

# bioPULSE™ MBR Biological Treatment Equipment System Operation Manual

for

# North Reading Middle / Senior High School

May 2014

**A CLARCOR Company** 

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# SECTION 1: WASTEWATER TREATMENT SYSTEM DESCRIPTION & DESIGN CALCULATIONS



# WASTEWATER TREATMENT SYSTEM PROCESS DESIGN CALCULATIONS

#### SITE: NORTH READING HIGH AND MIDDLE SCHOOL - North Reading, MA

A bioprocessH2O supplied treatment system is proposed to treat the wastewater discharged from the North Reading High and Middle Schools. The system shall be capable of treating the daily wastewater flow with the following maximum influent characteristics.

<u>Raw Influent</u>	<u>Effluent</u>
17,500	17,500
10	-
6.5-8.5	6.5-8.5
450	<30
350	<30
160	-
140	<2
160	<10
TNTC	<100
	Raw Influent         17,500         10         6.5-8.5         450         350         160         140         160         TNTC

The following unit processes are proposed to meet the effluent requirements:

- 1) (2) 9,000 gallon concrete trash traps (duty/standby)
- 2) (1) 1 ,000 gallon flow equalization tank assembly
- 3) (1) 2 mm automated mechanical bar screen assembly
- 4) (1) 5,000 gallon pre anoxic reactor
- 5) (1) 4,400 gallon aerobic reactor
- 6) (1) 2,500 gallon tertiary anoxic reactor
- 7) (1) ultra filtration (UF) membrane skid assembly
- 8) (2) ultraviolet (UV) disinfection units (final effluent disinfection and permeate recycle)
- 9) (1) final dosing tank (for leach field)
- 10) Chemical feed assemblies as required (alkalinity, carbon and membrane cleaning)

#### **BIOLOGICAL TREATMENT PLANT PROCESS DESCRIPTION**

#### Trash Traps:

Two (2) 9,000 gallon concrete trash traps operated in parallel and in a duty/standby mode shall receive wastewater from the collection system and shall be used to remove large non biodegradable solids and floatables from the influent waste stream.

#### Equalization:

Wastewater shall overflow by gravity from the from the trash traps into the 9,000 gallon flow equalization tank . The following equipment shall be included in this tank: (2) submersible grinder pumps with slide rails, associated piping, level sensors, controls and appurtenances. The two alternating submersible pumps shall transfer wastewater to the mechanical bar screen and subsequently to the biological treatment reactors over 24 hours. The equalization pumps shall alternate on a run time basis. If one pump fails, the remaining pump will take over the failed pump's cycle and an audio/visual alarm will be energized.

#### Mechanical Bar Screen:

Wastewater shall be pumped from the equalization tank through an automated mechanical bar screen assembly prior to the biological treatment reactors. Wastewater shall pass through the 2 millimeter screening apertures and a raking mechanism shall remove the collected solids from the screen bars and transport them to a screenings collection basket.

#### Membrane Bioreactor (MBR) Biological Reactors:

Biological treatment shall consist of a suspended growth MBR system utilizing a 5,000 gallon pre anoxic tank, a 4,400 gallon aerobic tank, a 2,500 gallon post anoxic tank and a UF membrane filtration skid assembly.

The screened wastewater shall be combined with recycled nitrified effluent and mixed liquor suspended solids (MLSS) in the 5,000 gallon pre-anoxic zone. In the absence of dissolved oxygen, nitrate-N is reduced to nitrogen gas via denitrification. An influent BOD5:Total Kjeldahl Nitrogen (TKN) concentration of 3:1 or greater is typically required to achieve and maximize denitrification rates in the pre anoxic zone. Due to the high influent nitrogen concentrations and the anticipated periods of low flow, the design incorporates chemical feed equipment that will automate external carbon (Micro C) addition to the pre-anoxic reactor. An oxidation reduction potential (ORP) sensor and PLC based control logic shall be employed to monitor and control the addition of Micro C to the pre-anoxic reactor. A submersible mechanical mixer assembly shall be used to mix the tank contents.

BOD oxidation and nitrification shall be accomplished within the 4,400 gallon aeration tank. The oxygen and mixing requirements of the MLSS shall be satisfied using a positive displacement blower (duty/standby configuration) and a fine bubble diffuser assembly. A submersible pump shall be used to recycle nitrate-N and MLSS to the pre anoxic reactor. The pump shall be

controlled using a variable frequency drive (VFD) and timer so that the recycle rate can be varied between 0-6Q.

The 2,500 gallon post-anoxic reactor shall denitrify remaining nitrate-N that is contained in the aerobic reactor effluent. By this point in the process, little COD remains in the system and in order to satisfy the carbon requirements of the heterotrophic bacteria responsible for denitrification, an external carbon source shall be added to the post anoxic zone. The design incorporates chemical feed equipment that will automate external carbon (Micro C) addition to the reactor. An oxidation reduction potential (ORP) sensor and PLC based control logic shall be employed to monitor and control Micro C addition. A submersible mixer assembly shall be used to mix the tank contents.

The proposed Pentair X-FLOW Airlift BioPULSE<sup>™</sup> membrane is an external tubular membrane system that has been successfully used in numerous applications throughout the world. The Airlift membrane system is a modification of the conventional cross-flow system in which the Airlift membranes are configured in a vertical configuration. This allows the MLSS cross flow velocity to be maintained by a circulation pump and membrane air scour by applying compressed air into the bottom of each membrane module. The air provides high turbulence at the membrane surface to maintain system flux and results in low energy consumption, due to a reduction in the membrane recirculation pump size. Permeate production shall be regulated using a VFD driven permeate pump in combination with a flow transmitter and level sensor in the biological reactors. The permeate shall be used to complete the automated backwash cycles. This treatment application shall require a total of (3) membrane modules that will provide a total membrane surface area of 1,065 ft<sup>2</sup> and result in a net flux (permeate production) in excess of the design flow of 17,500 gpd.

The membrane circulation pump shall transfer MLSS and effluent from the post anoxic reactor to the bottom of the membrane modules at a rate of approximately 300 gpm. Permeate shall be directed to the permeate collection tank at approximately 12 gpm and the remainder of the recirculated stream shall flow by gravity to the aeration basin. Air at approximately 18 scfm shall be constantly supplied to the bottom of each membrane module during the filtration process (6 cfm per membrane module).

The BioPULSE membrane system skid shall include the following equipment:

- a. Three (3) BioPULSE membrane modules equipped with a circulation pump, a permeate pump and a backwash pump, all the necessary valves and instrumentation and an electrical control system.
- b. One (1) Positive displacement or regenerative airlift blower.
- c. One (1) Chemical addition module designed to automatically provide chemically enhanced backwash (CEB) cycles.
- d. Electrical Controls Fully automated PLC based control system.





Figure 1: Typical External bioPULSE Membrane Skid

Figure 2: Airlift Membrane Module

# **BIOLOGICAL TREATMENT PLANT PROCESS DESIGN**

#### Aquifas Computer Modeling and Simulation:

The biological reactor that includes the suspended growth anoxic and aerobic zones were modeled and designed using the Aquifas computer modeling software. In addition to a presentation of the modeling results, common kinetic parameters and sizing calculations are presented to demonstrate that the biological reactors are sized based upon proven engineering principles and guidelines for the design of the activated sludge processes.

The computer model predicts the performance each biological reactor based upon biological growth and decay kinetic coefficients and rates of the microorganisms responsible for wastewater treatment (i.e. heterotrophic organisms for anoxic and aerobic treatment and the nitrifying organisms). In addition the model calculates the key design parameters for the activated sludge process (MLSS concentration, MCRT, sludge production, wasting rates, chemical requirements, etc.).

The Aquifas model has been commonly used around the world and over the past 15 years to successfully design conventional activated sludge, MBR treatment systems and fixed film biological reactors. The model has been verified through numerous pilot and full scale applications. The following is additional information regarding the development of the Aquifas modeling software from the website (www.aquifas.com):

"This Unified Model for biofilm and activated sludge systems has been developed and published over a period of 15 years. The effort included contributions by Dipankar Sen, Clifford Randall, Rip Copithorn, various media and membrane manufacturers. The bench scale pilot studies with media to develop the semi-empirical and biofilm diffusional models were conducted at Virginia Tech, Blacksburg, VA, with a team which included Pramod Mitta and Keith Jensen. Full-scale installation and testing of processes and models were conducted in collaboration with operators and plants at Annapolis, MD (fixed bed IFAS) and Fairfield, CT (moving bed IFAS). Subsequently, the equations for the semi-empirical model and the parameters were published by these authors at WEFTEC 1996, in <u>http://www.e-wef.org</u> Investigation of Hybrid Systems for Enhanced Nutrient Control ISBN 1893664066 and ASCE http://cedb.asce.org Jour Env Engr Vol 131 (11) Nov 2005; additional improvements were presented in papers at WEFTEC 2005, 06, Nutrient 2007 (Session 12), WEFTEC 2007 and WEF http://www.waterpractice.org\_Water Practice Vol 1 (5) 2007 ; http://www.wer.org Water Environment Research Vol 80 (5) 2008. Both the semiempirical and biofilm diffusional models were verified in full scale using data from the IFAS plant at Broomfield Colorado (2006-08). The activated sludge and membrane components were developed in parallel in collaboration with manufacturers and plants (Redlands, CA). The application of the model to membrane systems is presented at WEF Membrane 2008."

# Reactor Volumes and Hydraulic Retention Times (HRT's):

The biological treatment system sizing is based on the design criteria listed on page one of this document. The BOD5, TKN and nitrate-N removal rates (kinetic coefficients) are based upon proven kinetic coefficients at 20 °C. The pollutant removal rates for this design are corrected for a minimum wastewater temperature of 10 °C using the Van't Hoff-Arrhenius relationship and incorporating the applicable coefficient, (theta). Verification of the selected removal and kinetic coefficients are confirmed by the data and references included in this document.

Compartment / Total Volume (gallons)	Hydraulic Retention Time (hours)
1 – pre anoxic (5,000)	6.9
2 – aerobic (4,400)	6.0
4 – post anoxic (2,500)	3.4

Table 1: Biological Reactor Volumes and Hydraulic Retention Times

#### Table 2: Key Biological Reactor Design Parameters (from the Aquifas model)

Parameter Description	Parameter Values (units)
Minimum Wastewater Temperature	10 (C)
Total Reactor Volume	11,900 (gallons) <sup>1</sup>
MLSS (required for treatment)	8,000 (mg/L)

MLVSS	7,000 (mg/L)
Solids Retention Time	<u>&gt;</u> 20.0 (days)
Nitrate-N Recycle	4Q (see note 2)

Notes: 1) Aerobic + Anoxic tank volumes.

2) Nitrate recycle is adjustable between 0-6Q.

#### Table 3: Biological Reactor Effluent Quality (predicted from the Aquifas model)

Parameter	Concentration (mg/L)
Soluble BOD	<2
TSS (after membrane filtration)	<1
TKN	<3
Ammonia-N	<1
Nitrate-N+Nitrite-N	<3
Total Nitrogen	<6

Note that as the system SRT increases, the anoxic and aerobic reactor MLSS concentration will increase, which will increase the treatment capacity of the treatment plant. The membrane system shall be capable of operating at an MLSS concentration up to ~12,000 mg/L, therefore there is a factor of safety of 1.5 incorporated into this design based on the Aquifas modeling results. And based on a MLSS operating range between 8000 mg/L-12,000 mg/L, 4,000 mg/L of solids can be accumulated between wasting cycles. This equates to a nominal storage capacity of 397 pounds of dry solids that can be accumulated between sludge pumping cycles. This is based on a total anoxic and aerobic reactor volume of 11,900 gallons.

MLSS storage capacity: [(4000 mg/L/1,000,000) x 11,900 gal x 8.34] = 397 lbs

At an accumulation rate of 33.2 lb solids/day (calculation provided below), sludge wasting will be required approximately every 12 days: (397 lb / 33.2 lb/day) days = **12.0 days** 

#### EMPIRICAL DESIGN PARAMETERS FOR THE ACTIVATED SLUDGE PROCESS

In addition to the Aquifas modeling results, common kinetic parameters and sizing calculations are presented to demonstrate that the biological reactors are sized based upon proven engineering principles and guidelines for the design of the activated sludge processes. The following calculations assume that the nominal MLVSS and MLSS concentrations are 8750 mg/L and 10,000 mg/L respectively. Additionally, the MCRT shall be greater than or equal to 20 days at the nominal MLSS concentration.

# Pollutant Loadings:

**BOD5:**  $(17,500 \text{ gpd x } 8.34 \text{ lbs./gal x } 450 \text{ mg/L}) = 65.7 \text{ lbs. of BOD}_5/\text{day} 1x10^6$ 

**TKN:** Note that approximately 13.5 mg/L TKN will be removed with the microorganisms (sludge) that achieve BOD5 removal and denitrification. This is based on the fact that (0.12 grams of N/g TSS) are contained in each gram of active biomass (Metcalf & Eddy).

# TKN removed by microorganisms that achieve BOD removal:

Nsyn =  $[Y(S_o-S_e)F_N / (1+b(SRT)overall)] + (X_e)F_N$ = [(0.5(450-5)0.12) / (1+0.05(20))] + [(1)0.12]= 13.5 mg/L

Where;

- Nsyn = Influent TKN used in the synthesis of biomass (mg/L)
- Y = Biological cell yield of heterotrophic organisms (0.5 gVSS/gBOD)
- F<sub>N</sub> = Fraction of nitrogen in VSS (12%)
- S<sub>o</sub> and S<sub>e</sub> = Influent and effluent BOD concentration (mg/L)
- b = endogenous decay coefficient for heterotrophic bacteria = 0.05/day
- X<sub>e</sub> = Effluent VSS concentration (1 mg/L)

Therefore;

= 
$$(17,500 \text{ gpd x } 8.34 \text{ lbs./gal x } 146.5 \text{ mg/L})$$
 = 21.4 lbs. TKN/day  $1x10^{6}$ 

# Food to Microorganism Ratio (F/M) in for suspended growth in aeration tank:

- = BOD (lbs./day) / MLVSS (lbs./day)
- = 65.7 (lbs./day) / [8,750 mg/L \* 8.34 \*.0119 MG]
- = 0.076

Based on the F/M ratio and the MCRT ( $\geq$ 20 days at nominal MLSS) the suspended growth aeration tank being proposed for this project best approximates a complete mix activated sludge process designed for complete nitrification as listed in Metcalf & Eddy, Third Edition, 1991 (Table 10-5).

# Confirmation that the 4,400 gallon aerobic basin is sized appropriately to achieve full nitrification:

# Known Values:

- Nominal MLVSS = 8,750 mg/L
- Nominal MLSS = 10,000 mg/L
- Minimum Dissolved Oxygen (DO) = 2.0 mg/L
- pH = ~7.0 (automated alkalinity dosing shall be provided)
- Influent ammonia-N to reactor = ~150 mg/L (this takes into account the nitrogen uptake by the system microorganisms during anoxic/aerobic treatment).

*From WEF - Biological and Chemical Systems for Nutrient Removal - 1998: (Coefficients Corrected for 10C);* 

- $K_{DO}$  = half saturation constant for DO = 1.0 mg/L
- $K_{NS}$  = half saturation constant for NH4-N =  $10^{(0.051*T)-1.14}$  = 0.23 mg/L
- k<sub>NS</sub> = maximum substrate (NH4-N) utilization rate = 1.57/day (10C)
- b<sub>NS</sub> = endogenous decay coefficient for Nitrosomonas = 0.04/day
- Y = nitrifier (Nitrosomonas) yield = 0.15 gVSS/g NH4-N
- To calculate that maximum nitrifier growth rate (umax);
  - $\circ = 0.47e^{0.098(T-15)}[DO/(K_{DO}+DO)]*[1-0.833(7.2-pH)]$
  - $\circ = 0.47e^{0.098(10-15)}[2/(1+2)]*[1-0.833(7.2-7.0)]$
  - o = 0.34/day
- To calculate the minimum overall biological (anoxic+aerobic) SRT for nitrification;
  - $\circ$  1/SRT<sub>min</sub>= [umax (NH4-N)<sub>in</sub>] / [K<sub>NS</sub>+(NH4-N)<sub>in</sub>] b<sub>NS</sub>
  - $\circ$  1/SRT<sub>min</sub>= [[0.34\*140] / [0.23+140]] 0.04
  - $\circ$  SRT<sub>min</sub> to achieve nitrification = 3.3 days

The overall SRT for the supplied anoxic and aerobic zones shall be >20 days, therefore this equation predicts that nitrification shall occur by the MLVSS at a wastewater temperature of 10C.

- To calculate the approximate effluent ammonia-N concentration the following equation can be used;
  - $\circ$  (NH4-N)<sub>e</sub> = K<sub>NS</sub>[1+ b<sub>NS</sub>(SRT)] / [SRT[Y k<sub>NS</sub> b<sub>NS</sub>] 1]
  - o = 0.23[1+0.04(20)] / [20[0.15 (1.57) 0.04] 1]
  - o = 0.14 mg/L

This calculation demonstrates that complete nitrification is predicted to be accomplished by the MLVSS within the aerobic zone.

# Aeration Requirements:

Two (duty and standby) positive displacement air blowers and a fine bubble aeration assembly shall be used to transfer dissolved oxygen to the wastewater and provide mixing in the aerobic reactor. Based upon the design criteria listed on page one of this document, approximately 8.2 lbs. of oxygen/hour (197 lbs/day) are required for efficient treatment of the wastewater based on the summer and winter seasons (calculations shown below). This oxygen requirement is derived using actual and standard oxygen requirement (AOR and SOR) calculations for wastewater treatment based on the fact that 1.5 lbs. and 4.6 lbs. of oxygen are required to oxidize each pound of BOD5 and ammonium respectively.

The air required to provide the necessary oxygen transfer can be determined by the following equations:

Mass of air (lbs./day) = (lbs. oxygen/day - SOR) / (.232\*OTE) = (675) / (.232\*0.119) = 24,449 lbs/day

Volume of air (SCFM) = ((Mass of air) / (air density)) / (1440 minutes/day) = (24,449) / (.075) / (1440) = **226 SCFM** 

Where OTE is defined as the oxygen transfer efficiency and has been conservatively documented to be 1.9%/ft (@ 1.9% and 6.25 ft diffuser submergence = 11.9%) for fine bubble diffusers. The air density is approximately  $0.075 \text{ lbs/ft}^3$ . According to this equation, 226 SCFM @ 4.5 psig of air are required to transfer oxygen to the wastewater to satisfy the respiration needs of the biomass.

Two (2) 10 HP positive displacement blowers (duty/standby), each capable of providing 247 SCFM @ 4.5 psig shall be provided to maintain 2.0 mg/L residual DO. The blowers shall be controlled with VFD's and a PLC based DO control loop. In the following calculations a conservative value of 1.5 lb/O2/lb BOD-day is used as a safety factor.

- Actual Oxygen Rate (AOR)
  - o = (1.5 lb O2/ lb BOD/day) + (4.6 lb O2/ NH3-N lb/day)
    - = [(1.5)(65.7) +(4.6)(21.4)] lb/day O2
    - = (98.6 + 98.4) lb/day O2
    - = 197.0 lbs/day O2
- Standard Oxygen Rate (SOR)

 $= AOR / (Alpha) ((Beta * C_{walt} * D_c) - C_l) * Theta^{(T_w - 20)} (C20 * Dc)$   $= 197/(0.4) ((0.95 * 7.25 * 1.06) - 2.0) * 1.024^{(32-20)} (9.09 * 1.06)$  = 197/.292 = 675 lbs O2/day

• Where:

0	Alpha = 0.4	Cwalt = 7.25 (based on 200' elevation)
	Beta = 0.95	Dc = 1.06 (based on 6.25' submergence)
	Theta = 1.024	$C_1$ residual DO = 2 mg/L
	Temp (T <sub>s</sub> ) = 32 deg. C	C20 = 9.09
	Elevation = <200 ft.MSL	

#### Alkalinity Addition:

Because nitrification requires approximately 7.1 mg alkalinity as  $CaCO_3/mg NH_4-N$  oxidized, the concentration of alkalinity in the wastewater is not clearly or easily defined and may vary depending on chemical composition of the wastewater, an automated chemical feed shall be incorporated into the design.

Nitrification will consume 7.14 mg alkalinity per mg TKN nitrified and denitrification recovers 3.57 mg alkalinity per mg NO3-N reduced. Since the treatment plant is designed for complete nitrification and denitrification, the system will gain ½ the alkalinity lost to nitrification.

- <u>Alkalinity lost during Nitrification:</u> (147 mg TKN nitrified) x 7.14 mg alkalinity = 1,050 mg/L alkalinity as CaCO3.
- <u>Alkalinity gained during denitrification:</u> (147 mg/L NO3-N denitrified) x 3.57 mg alkalinity = 525 mg/L alkalinity as CaCO3.
- With an influent alkalinity concentration of 300 mg/L, the total alkalinity required shall be:

1,050 mg/L - (300 mg/L + 525 mg/L) = 225 mg/L alkalinity required as CaCO3 = 32.8 lbs alkalinity/day.

50% sodium hydroxide (NaOH) shall be used as the external alkalinity source. NaOH provides 1.25 mg/L alkalinity per mg/L added, therefore the NaOH required: = (32.8 lbs/day / 50%) / 12.8 lb/gal = 5.1 gallons/day of NaOH

A pH controller shall be provided for automatic addition and prevent overfeeding of NaOH.

Denitrification:

It was noted that ~13.5 mg/L of nitrogen shall be removed with the microorganisms that achieve BOD5 removal and denitrification, therefore the overall nitrate-N loading rate to the pre and post anoxic reactors shall be <150 mg/L.

# Pounds of Nitrate-N/day available for denitrification:

= (17,500 gpd x 8.34 lbs./gal x 150 mg/L) = 21.9 lbs. nitrate-N/day  $1 \times 10^{6} \qquad (9,943 \text{ grams/day})$ 

# Pre Anoxic Zone Denitrification:

Pre denitrification is accomplished by employing the Modified Ludzack Ettinger (MLE) process by recirculating nitrified effluent from the aeration tank to the pre anoxic zone. The MLE process is generally designed to achieve up to 70% total-N removal (Metcalf & Eddy, 1991). The influent raw wastewater and MicroC shall be utilized as the organic carbon source to complete the denitrification reaction. The nitrate-N removal rate can be determined by calculating the COD uptake in the anoxic zone based on known kinetic coefficients (Monod expressions) for heterotrophic organisms that shall complete the denitrification reaction. The COD substrate removal can then be related to the rate of nitrate-N removal which is based on the growth rate of the heterotrophic organisms (USEPA, *Nitrogen Control Manual* 1993).

# Known Values (for the pre and post anoxic zones):

- Influent nitrate-N to reactor = 150 mg/L
- MLVSS (nominal) = 8,750 mg/L
- HRT in pre-anoxic zone = 6.8 hours
- HRT in post anoxic zone = 3.4 hours
- S = readily biodegradable COD in anoxic zones (mg/L)
- K<sub>s</sub> = COD half saturation coefficient = 60 mg/L COD (Aquifas model)
- q<sub>s1</sub> = substrate removal rate @ 20C = 5 g COD/g MLVSS/day USEPA, *Nitrogen Control*
- q<sub>s</sub> = maximum substrate removal (g COD/g MLVSS/day)
- q<sub>d</sub> = nitrate removal rate (g NO3-N/g MLVSS/day)
- Y = biomass yield = 0.45 (g biomass/g COD removed)
- B = endogenous decay coefficient for heterotrophic microorganisms (0.04)
- $q_s = q_{s1}[(S/(K_s+S)] = COD removal rate (g COD/g MLVSS/day)$ 
  - o 5[(450/(60+450)] = 4.4 COD removal rate (g COD/g MLVSS/day)
  - Corrected for  $10C = (1.03)^{(10-20)*}4.4 = 3.3$  (g COD/g MLVSS/day)
- $q_d = [1-1.42(Y)] (q_{s1}/2.86) + (1.42/2.86)b$ 
  - o = [1-1.42(0.45)] (3.3/2.86) + (1.42/2.86)0.04
    - $\circ$  = 0.44 g NO3-N/g MLVSS/day

Therefore, the MLVSS contained in the pre-anoxic zone; [5,000 (gallons)\*8,750 mg/L MLVSS\*8.34] / 1E6 \*454 (g/lb) =165,653 g MLVSS And;

165,653 g MLVSS \* 0.44 g NO3-N/g MLVSS = 72,887 grams NO3-N capable of being reduced by the MLVSS in the pre-anoxic zones. Since the mass of nitrate-N capable of denitrification is significantly greater than the mass of nitrate-N available in the system, (9,943 g NO3-N/day), then up to 70% nitrate removal can be accomplished through the MLE process. In practice the MLE process is capable of achieving approximately 65-70% nitrate-N removal utilizing a recycle rate of 3-4\*Q (Metcalf & Eddy, Third Edition 1991). That would leave approximately 2,983 grams (45 mg/L) of NO3-N for tertiary denitrification in the post anoxic zone.

# Post Anoxic Zone Denitrification:

The post anoxic reactor shall be capable of reducing the effluent nitrate-N to <2 mg/L. Micro C shall be used as the external carbon source;

- q<sub>s1</sub> = q<sub>s</sub>[(S/(K<sub>s</sub>+S)] = COD removal rate (g COD/g MLVSS/day)
  - o 3.3[(135/(60+135)] = 2.3 COD removal rate (g COD/g MLVSS/day)
  - Corrected for  $10C = (1.03)^{(10-20)*}2.3 = 1.7$
- $q_d = [1-1.42(Y)] (q_{s1}/2.86) + (1.42/2.86)b$  $\odot = [1-1.42(0.45)] (1.7/2.86) + (1.42/2.86)0.04$ 
  - $\circ$  = 0.24 g NO3-N/g MLVSS/day

Therefore, the MLVSS contained in the post-anoxic zone;

[2,500 (gallons)\*8,750 mg/L MLVSS\*8.34] / 1E6 \*454 (g/lb) =82,826 g MLVSS

# And;

82,826 g MLVSS \* 0.24 g NO3-N/g MLVSS = 19,878 grams NO3-N capable of being removed by the MLVSS in the post-anoxic zones. That would allow complete denitrification since a maximum of 2,983 grams of NO3-N would flow to the post anoxic zone/day.

# Micro C (Carbon) Addition:

Micro C shall be added to the anoxic tanks as the external carbon source to achieve denitrification. The feed rate will be governed by the nitrate-N + nitrite-N and oxygen concentrations in the anoxic reactors. The following equation from Metcalf and Eddy is utilized to calculate the total volume of methanol and Micro C that is to be added to the pre and post anoxic tanks. This formula is based on utilizing methanol for the carbon source and the assumption that the quantity of Micro C required shall be approximately 1.5 times the amount of methanol (based on field experience and EOS Environmental).

•  $C_m = 2.47N_o + 1.53N_1 + 0.87D_o$ 

Where:

 $C_m$  = required methanol concentration, mg/L  $N_o$  = nitrate-N concentration, mg/L (assumes 45% denitrification will occur using the influent BOD as the carbon source)  $N_1$  = nitrite-N nitrogen concentration, mg/L  $D_o$  = dissolved oxygen concentration, mg/L

 $C_m = 2.47(40 \text{ mg/L}) + 1.53(5 \text{ mg/L}) + 0.87(2 \text{ mg/L}) = 108 \text{ mg/L}$ Methanol lb/day = 108 mg/L x 0.0175 MGD x 8.34 = 15.7 lb/day

GPD Methanol = 15.7 lb/day / 6.6 lb/gal = 2.4 gallonsGPD Mirco C = 2.4\*1.5 = 3.6 gallons

An ORP controller will be provided for automatic addition of Micro C to ensure the proper carbon dose to complete the anoxic reaction.

# Sludge Production Estimation:

Sludge production is difficult to estimate as there are many variables such as the amount of TSS that will be removed by the primary treatment system and how much of this TSS will be biodegradable. The sludge will be withdrawn in bulk fashion as the system MLSS reaches a maximum operating concentration of 12,000 mg/L. The following calculations are based on formulas presented in Metcalf & Eddy, Third Edition - 1991.

• Solids Production due to MLVSS

 $P_{x,vss} = Y_{obs} (Q)(S_o - S)(1 \text{ kg} / 10^3 \text{ g})$ 

# Where:

 $P_{x,vss}$  = Net wasted activated sludge

- Y<sub>obs</sub> = Observed yield, g VSS/g substrate removal (.5 g VSS/g BOD removed)
- $Q = Influent flow m^3/day$
- S<sub>o</sub> = Influent substrate concentration, mg/L
- S = Effluent substrate concentration, mg/L

# Assumptions:

- 1) TSS post trash trap and mechanical bar screen is 120 mg/L (60 mg/L is volatile)
- 2)  $17,500 \text{ GPD} = 66.2 \text{ m}^3/\text{d}$
- 3) 1 lb = 2.2 kg

4) BOD Post Screen is 340 mg/L (assumes 25% BOD reduction through primary treatment – for purposes of sludge generation only)

 $P_{x,vss} = .5(66.2)(340-5)*(1 \text{ kg} / 10^3 \text{ g})= 11.1 \text{ kg/d} = 24.4 \text{ lbs/d VSS}$ 

• Solids Production due to Inorganic Solids

 $I_s = Q (TSS - VSS)(1 \text{ kg} / 10^6 \text{ mg})(1000 \text{ L/ m}^3)$ 

Where:

I<sub>s</sub> = Inorganic solids(kg/d) Q = Influent flow M<sup>3</sup>/d TSS = Total Suspended Solids (mg/L) VSS = Volatile Suspended Solids (mg/L)

 $I_s = 66.2 (120 \text{mg/L} - 60 \text{mg/L})(1 \text{ kg} / 10^3 \text{ g}) = 4.0 \text{ kg/d} = 8.8 \text{ lb/d}$ 

Total Solids per Day = 24.4 + 8.8 = 33.2 lb/d

# SECTION 3: FUNCTIONAL DESCRIPTION

November 2013

# 2.1 INTRODUCTION

The following control description is for the North Reading Middle/Senior High School wastewater treatment plant. The control panel shall be modular construction using a NEMA 12 multi-door cabinet with forced ventilation. Basic control of the system is possible through the OIT, this means starting, stopping and resetting/acknowledging of alarms. Field devices such as pumps, blowers and actuated valves can be controlled from the OIT (i.e. a valve can be put in manual mode and the operator can open or close this valve).

The control panel shall include the following major components / features.

- Hoffman or equal enclosure / Floor mount with bottom cutout
- Allen Bradley compact logix processor
- Allen Bradley Panel View Plus CE version 6, 10" color
- All VFD's to have line reactors
- 3 phase monitor
- All pumps and blowers to have HOA switches. Manual position shall bypass the PLC. For VFD driven equipment potentiometers shall also be provided.
- An emergency stop (mushroom type button) shall be provided.
- Allowance shall be made for screen generation for each system described below. Screens will include animated screen showing operating status of equipment, tank levels, flows, pressures etc as well as set up screens.
- Alarm History and Alarm List screen is required
- Data logging of certain parameters is required

# 2.2 DELETED

# 2.3 EQ SYSTEM

The EQ system includes the following components:

- 2 @ 2 HP submersible pumps with thermal and moisture protection, 480V, VFD. (P-0211, P-0212)
- 1 @ Submersible level sensor, loop powered 24 VDC (LS-0221)
- 1 @ Mag flow meter. 120 v power requirement with self powered 4-20 ma output. (FM-0222)
- 1 @ Motorized fine screen, ¼ HP, DOL (SC-0251)
- 1 @ normally open float switch, 24V (LS-0223)

The EQ system serves as a buffer to allow a relatively constant flow to be fed to the treatment process. The system includes a 20,000 gallon tank, two (one operating/one standby) EQ transfer pumps, submersible level sensor (to monitor tank level), magnetic flow meter (to monitor EQ transfer pump flow into the treatment process), motorized fine screen and a float switch installed in the fine screen box.

The EQ transfer pumps are controlled by VFD's in order to provide automatic flow control. There are two programmable set points for flow based on the level in the EQ tank (set points 2 and 3). The flow set points are set by the operator on the EQ System Set-Up Screen. There are three level set points which can be set on the EQ System set-up screen. The set points are in units of % full. Set point 1 is not adjustable thru the EQ set up screen; this set point will be hard coded in the program. Set points 2,3 and 4 can be changed thru the EQ system set up screen. The set points are used as shown on the table below.

Set Point 1	Permissive set point. No pumps will run unless the level is above this set point. This set point is password protected on screen.
Set point 2	Run Duty Pump at set flow, Runs until level drops to Set Point 1
Set point 3	Run Duty pump at higher flow until level reaches set point 2
Set point 4 Alarm	High Level alarm callout.

Each pump will include an HOA switch. If the HOA switch for the pump/pumps is in the auto position the duty pump will operate as outlined above. When the pump is operating in auto the following interlocks will be active;

- Float switch in fine screen must be open
- Fine screen must be available (i.e. no faults, HOA in auto)
- Post anoxic tank level must be below high level set point 5 for the EQ pumps to operate in auto. If the post anoxic tank level reaches the high level set point 5 the EQ pumps will be prevented from operating in auto until the post anoxic tank level drops to a "release' set point (set point 4) as described in the Post Anoxic Tank section later in this document.
- Post anoxic tank float switch LS-0623 must be open in order for the EQ pumps to operate in auto. If LS-0623 closes the EQ pumps will be prohibited from operating, this is a latches fault and will require an operator fault reset.

If the HOA is in the hand position the pump will operate independent of the PLC, speed of the pump when the HOA is in the hand position will be controlled by a potentiometer mounted on the panel door. When the HOA is in the hand position the pump will operate continuously and the thermal and moisture detection circuits will not be active and the level sensor will not have any influence on the pump (since these items communicate to the PLC thru I/O).

If both pumps are in auto and the duty pump faults the standby pump will automatically assume the duty position until the duty pump fault is cleared.

Duty/Standby rotation times (set in hours) are settable on the EQ set up screen.

There will be one (¼ HP) Motorized Fine Screen installed which receives flow from the EQ Transfer Pumps. Any time an EQ Transfer Pump is called to run (in auto) the Fine Screen will also run (assuming the HOA switch for the fine screen is in the auto position). When the bar screen is operated with the HOA in the hand position the PLC will be bypassed.

# 2.3.1 FAULTS FOR EQ SYSTEM

1.	EQ Tank High Level – not latched	Notification only
2.	EQ Pump #1 Thermal fault	Switch to standby pump
3.	EQ Pump #2 Thermal fault	Switch to standby pump
4.	EQ Pump #1 VFD fault or VFD failed to start	Switch to standby pump
5.	EQ Pump #2 VFD fault or VFD failed to start	Switch to standby pump
6.	EQ Pump #1 Moisture fault	Switch to standby pump
7.	EQ Pump #2 Moisture fault	Switch to standby pump
8.	Invalid EQ tank level sensor signal	Inhibit EQ pumps
9.	Invalid EQ pump flow meter signal	Inhibit EQ pumps
10.	EQ pump flow failure	Inhibit EQ Pumps
11.	Fine Screen Overload fault	Inhibit EQ pumps
12.	Fine Screen Not Ready	Inhibit EQ pumps
13.	Fine Screen High Level – not latched	Inhibit EQ Pumps

All Alarms will be stored on the Alarm History Screen. All alarms are latched with exception of the High Level and will need to be **RESET**. All alarms will initiate a callout.

# 2.3.2 THE FOLLOWING OIT SCREENS ARE REQUIRED FOR EQ SYSTEM

- Set up screen
- Operating screen showing EQ tank level, status of pumps and screen, flow rate of pumps

# 2.4 ODOR CONTROL SYSTEM

The odor control system includes the following;

#### 1 @ 2 HP blower, 480 V, DOL (B-1251)

The odor control blower can be operated in auto mode or manual mode. When the HOA is in the auto position the blower can be set to operate on a time on/time off basis. The time on/time off setting will be set on the odor control set up screen. If the time off is set to "0" the blower will operate continuously. When the HOA switch is in the hand position the blower will operate continuously and the PLC will be bypassed.

# 2.4.1 FAULTS FOR ODOR CONTROL SYSTEM

1.	Odor Control Blower Overload Fault	Notification only	
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Alarm will be stored on the Alarm History Screen. The alarm is latched and will need to be **RESET**. All screens include a **RESET** button. The alarm will NOT initiate a callout.

# 2.4.2 THE FOLLOWING OIT SCREENS ARE REQUIRED FOR ODOR CONTROL SYSTEM

- Set up screen
- Operating screen showing status of blower

# 2.5 PRE-ANOXIC TANK

The pre-anoxic tank system includes the following;

- 2.3 HP pre-anoxic submersible mixer with thermal and moisture protection, 480 V, DOL (MI-0351)
- ORP controller and metering pump (ORP-0321)

Wastewater from the fine screen flows by gravity to the pre-anoxic tank. The pre-anoxic tank will provide an anoxic (no free oxygen) environment for denitrification to take place. In order for the denitrification process to function properly the tank contents must be kept fully mixed. In addition, an ample source of carbon (food) must be available for the denitrifying biology.

A (2.3 HP) submersible mixer will provide mixing for the pre-anoxic tank. The mixer will include an HOA switch. When the HOA is in the auto position the mixer can be set to operate on a time on/time off basis. The time on/time off setting will be set on the pre-anoxic tank set up screen. If the time off is set to "0" the mixer will operate continuously. When the HOA is in the hand position the mixer will operate continuously and the thermal and moisture detection circuits will not be active.

The Pre Anoxic mixer must be in auto for the UF system to run in auto.

An independent ORP controller will monitor and adjust the ORP level in the pre-anoxic tank. ORP will be adjusted by the ORP controller which will control a carbon chemical feed pump. The controller will send a 4-20 ma signal to the PLC for monitoring and data logging purposes. High and low ORP alarm points can be set on the pre anoxic set up screen.

# 2.5.1 FAULTS FOR PRE-ANOXIC TANK

1.	Pre-Anoxic Mixing Pump Overload fault	Go to Idle B mode
2.	Pre-Anoxic Mixer Thermal fault	Go to Idle B mode
З.	Pre-Anoxic Mixer Moisture fault	Go to Idle B mode
4.	ORP High Level	Notification only
5.	ORP Low level	Notification only

6.	ORP-20-1 signal invalid	Notification only
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All Alarms will be stored on the Alarm History Screen. All alarms are latched and will need to be **RESET**. All alarms will initiate a callout.

# 2.5.2 THE FOLLOWING OIT SCREENS ARE REQUIRED FOR PRE-ANOXIC TANK

- Set up screen
- Operating screen showing pre-anoxic tank ORP level and status of mixer

# 2.6 AREATION TANK

The aeration tank system will include the following;

- 2 @ 10 HP blowers, 480 V, VFD (BL-0451, BL-0452)
- 2 @ 1/10 HP blower enclosure exhaust fans, 480 V, DOL (VF-0453, VF-0454)
- 1 @ 2.3 HP aeration tank mixer, 480 V, DOL (MI-0456)
- 1 @ 2.7 HP denitrification pump, 480 V, DOL (P-0511)
- 1 @ Dissolved Oxygen Meter, 120 v power requirement with self powered 4-20 ma output (DO-0422)
- 1 @ pH controller (120 v power requirement with self-powered 4-20 ma output and metering pump 120 v), (PH-0421)
- 1 @ Mag flow meter. 120 v power requirement with self-powered 4-20 ma output, (FM-0521)

Mixed liquor from the pre-anoxic tank will flow by gravity to the aeration tank. The aeration tank will provide an aerobic environment for Biological Oxygen Demand (BOD) reduction and nitrification. In order for the BOD reduction and nitrification process to function properly the tank contents must be well mixed, aerated and pH controlled.

There are two modes of operation (full auto and semi auto) that can be run when the blower HOA switches are placed in the auto position. The modes are set via the blower set up screen.

In "semi auto" mode the blowers will operate at a constant speed as set by the operator on the set up screen. In this mode the aeration tank mixer will not operate regardless of the DO level in the aeration tank.

In the "fully auto" mode the aeration tank will be monitored for Dissolved Oxygen (D.O.) Level by an independent D.O. meter which will report to the PLC. The D.O. level in the aeration tank will be controlled via PI control loop that will raise or lower the aeration blower speed in order to maintain the desired D.O. set point. The D.O. set point will be set by the operator thru the OIT screen. There are three D.O. set points that the operator is required to set for the control system;

- Desired D.O. level
- High D.O. level
- Low D.O. level

The "Desired D.O." set point is the set point that the blower will be controlled to. If the blower is to operate at the minimum speed and the D.O. level exceeds the "High D.O." set point the blower will be stopped and the aeration tank mixing pump will start. Once the actual D.O. level falls below the "Low D.O." set point the mixing pump will stop and the blower will be returned to service. If the D.O. level remains below the Low D.O. level set point for more than 10 minutes when the blower is operating an alarm will be sent. If the mixer faults while running or is faulted when requested to run an alarm will be sent and the duty blower will be permitted to operate.

Whenever a blower starts (regardless of the HOA position) the blower enclosure exhaust fan will also start. If the blower HOA is in auto and the blower shuts down (normal or fault) the blower enclosure exhaust fan will operate for 15 minutes. If the HOA is in hand and the blower is shut down the blower enclosure fan will stop with the blower.

If the blower HOA is in auto and the blower enclosure fan is "not ready" (i.e. HOA not in auto, fan faulted etc) the blower will not be permitted to start.

Each Blower will have an HOA switch and potentiometer. The mixer will have an HOA switch. In order for the blowers to operate in auto the mixer HOA needs to be in auto.

If both blowers are in auto and the duty blower faults the standby blower will automatically assume the duty position until the duty blower fault is cleared.

If the blower system is in the fully auto mode and the DO signal becomes invalid the operating blower will be controlled to a preset speed (DO Meter Failure Default Speed Setting), this is settable on the blower set up screen. In addition the membrane system will perform a Group B fault routine.

Duty/Standby rotation times (set in hours) are settable on the Aeration Tank set up screen.

If the blower HOA switch is placed in the hand position, the blower will operate independent of the PLC. Speed of the blower when the HOA is in the hand position will be controlled by a potentiometer located on the panel door.

If the mixer HOA is placed in the hand position, the mixer will operate continuously and the thermal and moisture detection circuits will not be active.

An independent pH controller will monitor and control the pH level in the Aeration tank. pH will be adjusted by an independent controller which will control a caustic chemical feed pump. The controller will send a 4-20 ma signal to the PLC for monitoring and data logging purposes.

The denitrification pump will have an HOA switch. When the HOA switch is placed in the auto position the pump will operate on a time on/time off basis settable on the set up screen. If the time is set to 0

the pump will operate continuously. When the pump is operated in hand it will operate continuously and the thermal and moisture detection circuits will not be active.

The denitrification pump must be in auto for the UF system to run in auto.

# 2.6.1 FAULTS FOR AERATION TANK – BLOWER SYSTEM

1.	Blower #1 VFD fault or VFD failed to start	Switch to standby blower
2.	Blower #2 VFD fault or VFD failed to start	Switch to standby blower
3.	Blower #1 Enclosure Fan OL	Switch to standby blower
4.	Blower #2 Enclosure Fan OL	Switch to standby blower
5.	Blower #1 Speed Feedback Signal Invalid	Switch to standby blower
6.	Blower #2 Speed Feedback Signal Invalid	Switch to standby blower
7.	DO signal invalid	Goes to Idle B & Blower goes to
		Default Speed Setting
8.	DO at low alarm (10 minutes below Low DO	Goes to Idle B
	set point with blower running)	
9.	Aeration Tank Mixer Overload fault	Notification only
10.	Aeration Tank Mixer Thermal fault	Notification only
11.	Aeration Tank Mixer Moisture fault	Notification only
12.	Denite Pump Overload fault	Goes to Idle B
13.	Denite Pump Thermal fault	Goes to Idle B
14.	Denite Pump Moisture fault	Goes to Idle B
15.	Denite Flow Meter signal invalid	Goes to Idle B
16.	Aeration Tank pH (below 6 or above 9)	Notification only
17.	Aeration Tank pH signal invalid	Notification only

All Alarms will be stored on the Alarm History Screen. All alarms are latched and will need to be **RESET**. All alarms will initiate a callout.

# 2.6.2 THE FOLLOWING OIT SCREENS ARE REQUIRED FOR AERATION TANK

- Set up screen
- Operating screen showing aeration tank D.O. and pH level, denite pump flow, status of aeration blowers, denite pump and mixer

# 2.7 POST ANOXIC TANK

The post-anoxic tank system includes the following;

- 2.3 HP post-anoxic submersible mixer with thermal and moisture protection, 480 V, DOL (P-0651)
- ORP controller and metering pump (120 v power requirement with self powered 4-20 ma output and metering pump 120 v), (ORP-0721)
- Submersible level sensor, 24 VDC loop powered (LS-0621)

• High Level Float Switch (LS-0623)

Wastewater from aeration tank flows by gravity to the post-anoxic tank. The post-anoxic tank will provide an anoxic (no free oxygen) environment for post denitrification to take place. In order for the denitrification process to function properly the tank contents must be kept fully mixed. In addition, an ample source of carbon (food) must be available for the denitrifying biology.

A (2.3 HP) submersible mixer will provide mixing for the post-anoxic tank. The mixer will include an HOA switch. When the HOA is in the auto position the mixer can be set to operate on a time on/time off basis. The time on/time off setting will be set on the post-anoxic tank set up screen. If the time off is set to "0" the mixer will operate continuously. When the HOA switch is in the hand position the mixer will operate continuously and the thermal and moisture detection circuits will not be active. The Post Anoxic mixer must be in auto for the UF system to run in auto.

An independent ORP controller will monitor and adjust the ORP level in the post-anoxic tank. ORP will be adjusted by the ORP controller which will control a carbon chemical feed pump. The controller will send a 4-20 ma signal to the PLC for monitoring and data logging purposes. High and low ORP alarm points can be set on the post anoxic set up screen.

A submersible level sensor will be installed in the post anoxic tank to monitor the level in the tank. The level information will be used in the control of the UF membrane system and will also be used to inhibit the EQ pump operation should a high level condition occur. If the level sensor signal is invalid (less than 4 ma) the membrane system will be prevented from running the permeate pump in auto mode.

Level sensor LS-0621 will be used in the control of the EQ pumps and membrane system. There are three level set points associated with the UF membrane system and two associated with the EQ Pump system as follows;

- SP1: Inhibit post anoxic tank mixer and UF feed pump This set point is password protected on screen.
- SP2: Filtration not required (permeate pump will not operate/stops)
- SP3: Filtration required (permeate pump will operate as required by UF control system)
- SP4: EQ Pump lockout release (EQ pump lockout will be removed following a high level)
- SP5: High level (alarm and EQ pump lockout)

The level set points can be adjusted on the UF Membrane set up screen.

# 2.7.1 FAULTS FOR POST ANOXIC TANK

1.	Post-Anoxic Mixer Overload fault	Group B fault
2.	Post-Anoxic Mixer Thermal fault	Group B fault
3.	Post-Anoxic Mixer Moisture fault	Group B fault
4.	ORP High Level	Notification only
5.	ORP Low level	Notification only
6.	ORP signal invalid	Notification only
7.	Ultra Sonic Level Sensor Invalid Signal	Group B fault
8.	Post Anoxic tank high level (above set point	Locks out EQ pumps- non latching,
	#5)	EQ pumps released when level drops
		to setpoint 4
9.	Post Anoxic tank high level (LS-0623 closed)	Locks out EQ pumps – Latched Fault
10.	Post Anoxic tank low level (below set point	Group C fault
	#1)	

All Alarms will be stored on the Alarm History Screen. All alarms are latched and will need to be **RESET**. All alarms will initiate a callout.

# 2.7.2 THE FOLLOWING OIT SCREENS ARE REQUIRED FOR POST ANOXIC TANK

- Set up screen
- Operating screen showing post-anoxic tank level, ORP level and status of mixer

# 2.8 UF MEMBRANE SYSTEM

The UF membrane system includes the following;

- 1 @ 4.7 HP membrane feed pump (P-0711), with thermal and moisture protection, 480v VFD
- 2 @ 5.0 HP backwash pumps (P-0911 & P-0912), 480V, VFD
- 2 @ 0.5 HP permeate pumps (P-0811 & P-0812), 480 v, VFD
- 1 @ 3 HP membrane blower (BL-0751), 480 v, DOL
- 1 @ 0.5 HP membrane sump pump (P-1011), 480v, DOL
- 3 @ Chemical metering pumps, (P-0913, P-0914, P-0915), 120 V, powered by MCP
- 1 @ UV unit (UV-0851), 120 V, 5 amps with self powered 4-20 ma output.
- 3 @ Mag flow meter (FM-0721, FM-0823, FM-0921), 120 v power requirement with self-powered 4-20 ma output
- 2 @ Pressure transmitters (PI-0722 & PI-0822), 24 VDC loop powered
- 1 @ Temperature transmitter (TE-0723), 24 VDC loop powered
- 1 @ Post Anoxic Level sensor (LS-0621), 24 VDC loop powered
- 1 @ Permeate Tank Level sensor (LS-0825), 24 VDC loop powered

- 3 @ Membrane Sump Float switches (LS-1021, LS-1022, LS-1023) 24 VDC
- 1 @ Turbidity meter (TM-0824), 120 v power requirement with self powered 4-20 ma output
- 1 @ Air flow switch (FS-0725), 24 VDC power with dry contact (to be used with a 24v input)
- 10 @ Pneumatically actuated valves (AV-0733, 0734, 0735, 0736, 0737, 0739, 0831, 0937, 0938, 0939) 24 VDC power to open, open &close contacts for position indication (24 VDC circuit)
- 1 @ Solenoid valve (SV-08312), 24 VDC (only open when permeate pump is operating in filtration mode)

Following biological treatment the biomass needs to be separated from the mixed liquor. An ultra filtration membrane system will be utilized to accomplish the biomass separation. The membrane system consists of a UF membrane skid, backwash skid, primary UV disinfection and permeate storage. The membrane system operation includes five major sequences of operation as briefly described below; a more detailed description of operation will follow.

# 2.8.1 FILTRATION

During filtration the UF system receives MLSS from the bioreactor by means of a circulation pump. The circulation pump is used to maintain a relatively constant flow of sludge from the bottom to the top of the membranes. The bottom air distribution system brings air in the water. Due to the driving force for air to go upwards, the sludge will be lifted up. Second benefit is the controlled membrane scrub by air under turbulent circumstances in each tubular membrane. The sludge is operating in "cross flow" mode from the bioreactor, past the membrane surface and returned to the bioreactor. The permeate production is controlled by a variable speed permeate extraction pump to realize a set permeate flow. Filtration periods are settable by the operator between 7 and 10 minutes.

# 2.8.1 BACKWASH

During operation solids will be retained and accumulate in the feed side (inside) of the tubular membranes. These solids must be periodically removed via backwash to maintain system performance. During backwash the membranes are cleaned with UF permeate by reversing flow from the outside to the inside. For this purpose a variable speed backwash pump is required. UF permeate will be used for backwash. During the backwash the sludge circulation and air lift will continue to run through the membrane to enhance solids removal and cleaning performance. Backwash waste will be returned to the biological reactor.

# 2.8.2 DRAIN / FLUSH

In the drain/flush sequence procedure the membrane modules are drained and backwashed, the drained sludge and backwash water will flow to the membrane sump. This backwash without backpressure on the feed side, works as a more effective backwash and drains down all collected solids inside the module, including eventual material caught at the front end of the module. Also the aerators and air supply lines will be flushed with UF permeate to prevent clogging. Normally a few times a day this drain clean is automatically executed. The drained sludge is returned to the reactor via the fine screen in front of the biological process. The draining sequence is also used as:

• Pre step for a CEB

- Following an expired Relax period
- Following certain faults or an emergency stop

# 2.8.2 CEB (Chemical Enhanced Backwash)

During a CEB the skid will be taken out of operation and will be cleaned. The procedure is fully automated and is particularly done in the low flow hours of the day (e.g. night), where full capacity is not required. Prior to beginning a CEB the filtration flow is stopped and a regular drain/flush sequence is performed. Cleaning chemicals (e.g. sodium hypochlorite, sodium hydroxide or citric acid) are then introduced into the membrane modules trough the permeate side (with the backwash pump running). The cleaning solution is pumped into the membrane modules at low flow using the backwash pump. Once the modules are completely filled they are allowed to soak for a period 30-240 minutes. After soaking the modules are flushed via another drain/flush sequence. Because a majority of the cleaning solution is discharged back into the bioreactor tank (via the fine screen). Two CEB routines are typically performed on the membrane system. CEB1 is typically performed with sodium hypochlorite at a concentration of 200 – 400 mg/l for disinfection, while CEB2 is typically performed using citric acid to ~ pH 3 to remove foulants and scaling. In certain circumstances caustic (sodium hydroxide) is added with the hypochlorite cleaning to raise the pH to 12. In most cases the two CEB routines are performed in succession.

# 2.8.5 RELAX / DRAIN - FILL

During extended no flow periods the skid will enter the idle-B mode. While in the idle-B mode the membrane feed pump and air scour blower remain operating, the permeate pump is off. A skid will enter the idle-B mode if the system is not calling for filtration. If the system remains in idle-B mode for a time greater than that set on the set up screen (Relax Time) the system will perform a Drain/Fill sequence. Once the Drain/Fill sequence is done the system will go to idle-A mode. A Drain/Fill consists of a "Drain/Flush" sequence as described above followed by filling of the modules with permeate until the membrane feed pressure transmitter reaches a preset pressure (hard coded). Following a Drain/Fill the system will be placed in Idle-A mode until filtration is required.

The above is a brief description of the membrane system operation. A more detailed control description follows later in this document.

Note, some of the sequences of operation contain common sequences of operation, for example; a typical Drain/Flush sequence is used during a CEB or following an Idle Mode-B if the system is not calling for filtration after a preset time.

# 2.8.6 UF MEMBRANE SYSTEM PROGRAM STRUCTURE

The program structure shall be constructed such that the above sequences of operations are "routines". In addition, the program structure shall include the following modes of operation. Idle (Idle-A or Idle-B)

• Stop

- Fault
- Run (filtration, backwash, Drain/Flush, relax, drain fill, CEB)

# 2.8.6a IDLE:

While in the idle-B mode the membrane feed pump and air scour blower remain operating, the permeate pump is off. A skid will enter the idle-B mode if the system is not calling for filtration. If the system remains in idle-B mode for a time greater than that set on the set up screen (Relax Time) the system will perform a Drain/Fill sequence. Once the Drain/Fill sequence is done the system will go to idle-A mode. A Drain/Fill consists of a "Drain/Flush" sequence as described above followed by filling of the modules with permeate until the membrane feed pressure transmitter reaches a preset pressure (hard coded). Following a Drain/Fill the system will be placed in Idle-A mode until filtration is required.

The system is available and waiting for a start command from the operator or the automatic program. If the system remains in idle-B mode for a time greater than that set on the set up screen (Relax Time) the system will perform a Drain/Fill sequence. A Drain/Fill consists of a "Drain/Flush" sequence as described above followed by filling of the modules with permeate until the membrane feed pressure transmitter reaches a preset pressure (hard coded). Following a Drain/Fill the system will be placed in Idle-A mode that commands the feed pump (P-0711) to operate at a reduced capacity bypassing the membranes in order to maintain recirculation from the post anoxic tank to the aeration tank. In this sub routine valve AV-0735 will open and valves AV-0733 & 0737 will close. Pump P-0711 will operate at a set flow (recirc. flow) as set on the set up screen. Air scour blower BL-0751 and air scour valve AV-0739 will also stop/close during the Idle-A mode. A start command causes a transition to the Run Mode.

# 2.8.6b RUN:

The system is active and one of the sequences is in progress. In this mode the feed pump does not utilize the bypass route.

# 2.8.6c STOP:

A stop command is initiated manually by the operator during an active program. When the stop command is given the system will perform a shut down procedure.

# 2.8.6d FAULT:

A fault condition will result in the system being shut down immediately; performing a programmed shut down or alarm notification only depending on the severity of the fault.

# 2.8.6e FORCING SEQUENCES:

The PLC program shall be constructed such that a particular sequence can be forced by the operator. In order for a forced sequence to take place the system must be in the following states as follows;

• Forced Filtration: System must be in Idle A or Idle B mode

- Forced Backwash: System must be in a Filtration sequence or Idle B mode
- Forced Drain Flush: System must be in a filtration sequence or Idle B mode
- Forced Drain-Fill: System must be in a filtration sequence or Idle B mode
  - Forced CEB: System must be in a filtration sequence or Idle B mode

When a sequence is forced the current operation will be interrupted then sequence will be executed. At the conclusion of the forced sequence the UF system act as follows based on what type of sequence was forced.

*Filtration:* At the end of a forced filtration sequence the system will either;

- 1) If the system is calling for filtration a backwash will be performed then the normal filtration sequence will begin.
- 2) If the system is not calling for filtration a backwash will be performed the system will enter Idle Mode B.

*Backwash:* At the end of a forced backwash sequence the system will either;

- 1) If the system is calling for filtration the system will enter filtration mode.
- 2) If the system is not calling for filtration the system will enter Idle Mode B.

# *NOTE:* A forced backwash sequence can only be performed if the system is currently in Idle B or Filtration Mode.

<u>Drain/Flush</u>: At the end of a forced Drain/Flush sequence the system will either;

- 1) If the system is calling for filtration the system will enter filtration mode at step 2
- 2) If the system is not calling for filtration the system will enter Idle Mode B. In this case filtration step 2 will take place first then in order for the proper valves to open/close then Idle Mode B will be entered (i.e. P-0711 and BL-0751 will start)

<u>CEB</u>: At the end of a forced CEB sequence the system will either;

- 1) If the system is calling for filtration CEB steps 16 and 17 will be performed
- 2) If the system is not calling for filtration when drain timer 3 is done CEB steps 18-22 will be performed (ultimately ending with the system in Idle A)

Drain/Fill: At the end of a forced Drain/Fill sequence the system will enter Idle Mode A

# 2.8.6f COUNTERS:

Counters will be utilized to determine when a Drain/Flush sequence and or a CEB sequence are required. Two counters will be utilized;

• A CEB Counter will count the number of backwashes performed between two CEB's. At the end of each filtration period the program will check the CEB counter first, if the counter is greater than the counter set point (set by the operator) the program will move to a CEB

sequence. Once the CEB is complete the CEB counter and Drain counter will be reset. If the CEB counter is less than the CEB counter set point the program will increment the CEB counter and will check the Drain Counter.

• The Drain Counter counts the number of backwashes performed between two Drain/Flush sequences. If the drain counter is greater than the drain counter set point a Drain/Flush sequence will take place. Once the Drain/Flush is complete the Drain Counter will be reset.

# 2.8.6g OPERATIONS:

The UF membrane system will operate based on the level in the Post Anoxic Tank, level sensor LS-0621. There are three level set points associated with the UF membrane system and two associated with the EQ Pump system as follows;

- SP1: Inhibit mixer and UF feed pump This set point is password protected on screen.
- SP2: Filtration not required (permeate pump will not operate/stops)
- SP3: Filtration required (permeate pump will operate as required by UF control system)
- SP4: EQ Pump lockout release (EQ pump lockout will be removed following a high level)
- SP5: High level (alarm and EQ pump lockout)

The level set points can be adjusted on the UF Membrane set up screen.

Backwash Counters will be utilized to determine if a CEB or a Drain/Flush sequence is required. The following description of operations will utilize sequence charts to aide in the operation sequence description.

# 2.8.6h FILTRATION SEQUENCE:

See Appendix "A"

# 2.8.6i FILTRATION SEQUENCE DESCRIPTION:

#### <u>Step 1:</u>

Referring to the sequence chart above the filtration sequence begins with step 1A or 1B. If the system is in Idle A (bypass mode) the program will move from step 1A to step 2. If the system is in Idle B (normal feed path with air scour blower running) the program will move from step 1B to step 4. In order for the program to progress a step the equipment listed on the chart must be in the state indicated and be available for automatic operation (i.e. no active faults and equipment HOA's (if applicable) in the auto position).

# Step 2.1 (assuming system was in Idle A):

If the system is calling for filtration (i.e. LS-0621 indicates level has risen above SP2) the following will occur; P-0711 will ramp to a stop.

Once stopped the following valves will open/close.

- AV-0733 (Feed Valve) will open
- AV-0739 (Air Scour Valve) will open
- AV-0737 (Return Valve) will open
- AV-0735 (Bypass Valve) will close

When Valve AV-0739 is called to open Air scour blower BL-0751 will start.

# NOTE: If system was in Idle mode B the program will go directly to step 4 when filtration is required as P-0711, BL-0751 are running and valves AV-0733, AV-0737 are open and AV-0735 is closed already. De-aeration is not active.

# <u>Step 3.1:</u>

Once the valves are open the following will occur;

- Feed pump P-0711 will start and ramp to a preset flow as set on the set up screen. Flow meter FM-0721 will monitor the feed flow.
- Start 5 second timer for sensing air flow

# <u>Step 3.2:</u>

Assuming FS-0725 does indicates flow within 5 seconds of BL-0751 starting, level sensor LS-0724 will determine whether de-aeration valve AV-0736 will open or remain closed. IF FS-0725 does not indicate flow within 5 seconds of BL-0751 starting, a group D fault will occur.

# <u>Step 3.3:</u>

If LS-0724 detects air (contact closed) AV-0736 will open. A timer will start (settable on the setup screen 1-5 minutes). If LS-0724 does not detect liquid before the timer times out, the system will go into a group B fault. If LS-0724 detects liquid in the line (contact open) AV-0736 will remain closed and the program will proceed to the next step.

# <u>Step 4.1:</u>

Permeate valve AV-0831 and turbidity valve SV-08312 will open,

# <u>Step 4.2:</u>

Once open the duty permeate pump (P-0811 or P-0812) will start and ramp to a preset flow as set on the set up screen. Flow meter FM-0823 will monitor the permeate flow. A 0-60 second

time delay (settable on set up screen – turbidity meter delay timer) will start once the permeate pump is started.

When the time delay is done the turbidity value will be active, if the value is greater than the set point value (turbidity level set point) a group D fault will occur.

# <u>Step 5.1:</u>

Once the permeate timer has expired P-0811 will stop,

# <u>Step 5.2:</u>

Or the level in the post anoxic tank drops to level Set Point 2, P-0811 will stop

#### <u>Step 6.1:</u>

Once stopped valves and AV-0831 and SV-08312 will close.

#### <u>Step 6.2:</u>

Once AV-0831 is closed the permeate timer will be reset, the filtration sequence will end and the backwash sequence will begin.

#### <u>Step 7.1:</u>

Completed proceed to backwash.

#### <u>Step 7.2:</u>

Not completed go to idle B

*NOTE:* If the level in the post anoxic tank drops to level Set Point 2 pump P-0811 will stop, once stopped valve AV-0831 will close and the system will go to Idle mode B, the permeate timer will also stop but it will not be reset. The permeate timer is only reset by the following:

- If the timer expires on a normal filtration cycle
- Following a Drain/Flush
- Following a Drain/Fill
- Following a CEB
- Following a reset from a fault.

NOTE: UV unit (UV-0851) must be available in order for the filtration sequence to start/run. If the relax timer expires and the system moves to Idle-A mode (following a Drain/Fill) the UV unit will be shut off. When filtration is requested the UV unit will be turned back on at step 2. The UV Unit will ONLY be active during filtration and backwash sequences.

# Stop Mode

If a stop command is given by the operator (by pushing the stop button) the system will shut down as follows:

- P-0811 will stop
- BL-0751 will stop and simultaneously close AV-0739
- P-0711 will stop
- Once pumps are stopped valves AV-0733, AV-0737 and AV-0831 will close
- All other automatic valves and pumps are assumed to be closed/stopped.
- UV-0851 will be shut down.
- A warning flag (sludge flag)will be displayed on the OIT to alert the operator that there is standing sludge in the membranes
- In order to bring the system back on line the reset button must be pushed, this will cause the system to go to Idle B mode (assuming no fault conditions exist and the required equipment is available for service).

# 2.8.6j BACKWASH SEQUENCE:

See Appendix "A"

# 2.8.6k BACKWASH SEQUENCE DESCRIPTION:

# <u>Step 1:</u>

Referring to the sequence chart above the system will enter the backwash sequence at the end of a filtration sequence (i.e. permeate timer expires). The backwash sequence begins with step 2. In order for the program to move to the next step the equipment listed on the chart must be in the state indicated and be available for automatic operation (i.e. no active faults and equipment HOA's (if applicable) in the auto position).

# <u>Step 2:</u>

If the permeate timer is expired the program will check the backwash counters for CEB and Drain/Flush. If either counter is greater than the set point a CEB or Drain/Flush will occur in place of a backwash. If the counters are less than the set points the backwash sequence will begin, the following valves will open: AV-0937

# *NOTE:* The UF system feed and air scour are already active at this time therefore the following valves should already be open. AV-0733, AV-0739, AV-0737

<u>Step 3:</u>
Once the valves are open the duty backwash pump (P-0911 or 0912) will start and ramp to a preset backwash flow as set on the set up screen.

#### <u>Step 4.1:</u>

Once the backwash flow has been attained valve AV-0938 will open.

#### <u>Step 4.2:</u>

Once open valve AV-0937 will close.

#### <u>Step 4.3:</u>

Once closed the backwash timer will begin. The value for the backwash timer is settable on the set up screen (5-30 seconds).

#### <u>Step 5.1:</u>

Once the backwash timer has expired the backwash pump will stop.

#### <u>Step 5.2:</u>

Once stopped valve AV-0938 will close. The backwash counters for CEB and Drain/Flush will be incremented.

#### <u>Step 6.1:</u>

Once AV-0938 is closed the system will return to the filtration sequence at step 3 if the system is calling for filtration.

#### <u>Step 6.2:</u>

If the system is not calling for filtration the system will return to Idle B mode.

#### Stop Mode:

If a stop command is given by the operator (by pushing the stop button) while the unit is in a backwash sequence the system will shut down as follows.

- P-0911 or 0912 will stop.
- AV-0937 and/or 0938 will close.
- BL-0751 will stop and simultaneously close AV-0739
- P-0711 will stop.
- Once the pumps are stopped valves AV-0733, AV-0737, AV-0937 and or 0938 will close
- UV-0851 will be shut down.

- All other automatic valves and pumps are assumed to be closed/stopped.
- A warning flag (sludge flag) will be displayed on the OIT to alert the operator that there is standing sludge in the membranes.
- In order to bring the system back on line the reset button must be pushed, this will cause the system to go to Idle B mode (assuming no fault conditions exist and the required equipment is available for service).

#### 2.8.61 DRAIN / FLUSH SEQUENCE:

See Appendix "A"

#### 2.8.6m DRAIN / FLUSH SEQUENCE DESCRIPTION:

#### <u>Step 1:</u>

Referring to the sequence chart above the system will enter the Drain/Flush sequence at the end of a filtration sequence (i.e. permeate timer expires). The Drain/Flush sequence begins with step 2. In order for the program to move to the next step the equipment listed on the chart must be in the state indicated and be available for automatic operation (i.e. no active faults and equipment HOA's (if applicable) in the auto position).

#### <u>Step 2.1:</u>

If the permeate timer is expired the program will check the backwash counters for CEB and Drain/Flush. If either counter is greater than the set point a CEB or Drain/Flush will occur. The CEB counter is checked first if the CEB counter is greater than the set point a CEB will occur, if the CEB counter is less than the set point the Drain/Flush counter will be checked. If the Drain/Flush counter is greater than the set point a Drain/Flush will occur, if the counter is less than the set point a Drain/Flush will occur, if the counter is less than the set point a Drain/Flush will occur, if the counter is less than the set point a backwash will occur. For this sequence description it has been assumed that the CEB counter is less than the set point but the Drain/Flush counter is greater than the Drain/Flush set point therefore a Drain Flush sequence will be performed. The following will occur in step 2.

- Feed Pump (P-0711) will stop.
- Air Scour Blower (BL0751) will stop and simultaneously close AV-0739.

#### <u>Step 2.2:</u>

Once P-0711 is stopped Feed Valve (AV-0733) will close.

Backwash Bypass Valve (AV-0937) will open.

#### <u>Step 2.3:</u>

Once AV-0733 is closed Drain Valve (AV-0734) will open.

#### <u>Step 3:</u>

Once the valves have reached their commanded positions and the feed pump and air scour blower are off Drain Timer 1 will begin (this is settable on the set up screen 0-30 seconds).

#### <u>Step 4.1:</u>

Once drain timer 1 is done the duty backwash pump (P-0911 or 0912) will start and ramp to preset flow (backwash flow as set on the set up screen).

#### <u>Step 4.2:</u>

Once backwash flow is attained valves AV-0938 will open.

#### <u>Step 4.3:</u>

Once open AV-0937 will close.

#### <u>Step 4.4:</u>

Once closed the Drain timer 2 will begin (drain timer2 time is settable on the set up screen 0-60 seconds).

#### <u>Step 4.5:</u>

Concurrent with the backwash pump starting de-aeration valve AV-0736 will open if LS-0724 senses no water in the line, AV-0736 will stay open until LS-0724 senses water.

#### <u>Step 5.1:</u>

Once drain timer 2 is done aerator flush valve AV-0939 will open (backwash pump continues to operate at set flow).

#### <u>Step 5.2:</u>

Once AV-0939 is open Drain Timer 3 starts.

#### <u>Step 6.1:</u>

When Drain Timer 3 is done the following will occur:

• Backwash pump will stop.

#### <u>Step 6.2:</u>

Once stopped the following valves will close:

- AV-0938 will close
- AV-0939 will close

• AV-0734 will close

De-aeration valve (AV-0736) will close (if open).

#### NOTE: If the de-aeration valve is still open at the end of drain timer 3 an alarm will occur.

#### <u>Step 7.1:</u>

Once the valves are closed the system will return to the filtration sequence at step 3 if the system is calling for filtration. **The Drain/Flush counter will be reset.** 

#### <u>Step 7.2:</u>

If the system is not calling for filtration the system will return to filtration step 1B (Idle mode). **The Drain/Flush counter will be reset.** 

#### <u>Stop Mode:</u>

If a stop command is given by the operator (by pushing the stop button) while the unit is in a Drain/Flush sequence the system will shut down as follows.

- P-0911 or 0912 will stop (if running)
- Once the pump is stopped all valves will close
- UV-0 will be shut down.
- A warning flag (sludge flag)will be displayed on the OIT to alert the operator that there is or may be standing sludge in the membranes
- In order to bring the system back on line the reset button must be pushed, this will cause the system to go to filtration step 2 (this will open/close the valves accordingly, assuming no fault conditions exist and the required equipment is available for service). Once the valves are in the correct position the system will move to Idle Mode B.

#### 2.8.6n CEB (CHEMICAL ENHANCED BACKWASH):

Prior to beginning a CEB the filtration flow is stopped and a regular drain/flush sequence is performed. Cleaning chemicals (e.g. sodium hypochlorite, sodium hydroxide or citric acid) are then introduced into the membrane modules through the permeate side (with the backwash pump). The cleaning solution is pumped into the membrane modules at low flow using the backwash pump. Once the modules are completely filled they are allowed to soak for a period 30-240 minutes. After soaking the modules are flushed via another drain/flush sequence. Because a majority of the cleaning solution is consumed during soaking and because the cleaning solution volume is small, the spent solution is discharged back into the bioreactor tank (via the fine screen). Two CEB routines are typically performed on the membrane system. CEB-A is typically performed with sodium hypochlorite at a concentration of 200 - 400 mg/l for disinfection, while CEB-B is typically performed using citric acid to ~pH 3 to remove foulants and scaling. In certain circumstances caustic (sodium hydroxide) is added with the hypochlorite cleaning to raise the pH to 12. In most cases the two CEB routines are performed in succession.

#### 2.8.60 CEB SEQUENCE:

See Appendix "A"

#### 2.8.6p CEB SEQUENCE DESCRIPTION:

<u>Step 1:</u>

Referring to the sequence chart above the system will enter the CEB sequence at the end of a filtration sequence (i.e. permeate timer expires). The CEB sequence begins with step 2. In order for the program to move to the next step the equipment listed on the chart must be in the state indicated and be available for automatic operation (i.e. no active faults and equipment HOA's (if applicable) in the auto position).

#### <u>Step 2:</u>

If the permeate timer is expired the program will check the backwash counters for CEB and Drain/Flush. If either counter is greater than the set point a CEB or Drain/Flush will occur. The CEB counter is checked first if the CEB counter is greater than the set point a CEB will occur, if the CEB counter is less than the set point the Drain/Flush counter will be checked. If the Drain/Flush counter is greater than the set point a Drain/Flush will occur, if the counter is less than the set point a Drain/Flush will occur, if the counter is less than the set point a Drain/Flush will occur, if the counter is less than the set point a backwash will occur. For this sequence description it has been assumed that the CEB counter is greater than the set point therefore a CEB sequence will be performed. **Once the CEB sequence is done the CEB counter and Drain/Flush counter will be reset**. The following will occur in step 2.

#### <u>Step 2.1:</u>

Feed Pump (P-0711) will stop.

Air Scour Blower (BL-0751) will stop and Air Scour Valve (AV-0739) will close.

#### Step 2.2:

Once P-0711 is stopped Feed Valve (AV-0733) will close.

Backwash Bypass Valve (AV-0937) will open.

#### Step 2.3:

Once AV-0733 is closed Drain Valve (AV-0734) will open.

UV-0851 will shut down.

Return valve AV-0737 stays open.

#### <u>Step 3:</u>

Once the valves have reached their commanded positions and the feed pump and air scour blower are off Timer 1 (Module Drain) will begin (this is settable on the set up screen 0 - 30 seconds)

#### <u>Step 4.1:</u>

Once Timer 1 (Module Drain) is done the duty backwash pump (P-0911 or 0912) will start and ramp to preset flow (backwash flow as set on the set up screen).

#### <u>Step 4.2:</u>

Once backwash flow is attained valves AV-0938 will open.

#### <u>Step 4.3:</u>

Once open AV-0937 will close.

#### <u>Step 4.4:</u>

Once closed Timer 2 (Module Flush) will start (drain timer 2 time is settable on the set up screen 0 - 60 seconds).

#### <u>Step 4.5:</u>

Concurrent with the backwash pump starting de-aeration valve AV-0736 will open if LS-0724 senses no water in the line, AV-0736 will stay open until LS-0724 senses water.

#### <u>Step 5.1:</u>

Once Timer 2 (Module Flush) is done aerator flush valve AV-0939 will open (backwash pump continues to operate at set flow).

#### <u>Step 5.2:</u>

Once AV-0939 is open Timer 3 (Aerator Flush) starts 0 – 30 seconds.

#### <u>Step 6.1:</u>

When Timer 3 (Aerator Flush) is done the following will occur;

- De-aeration valve will close (if open). Note, if the de-aeration valve is still open at the end of drain timer 3 an alarm will occur.
- Valve AV-0939 will close
- Backwash pump will reduce flow (dosing flow set point) to value set on set up screen.
- Chemical metering pump (P-0914) will start. Once metering pump P-0914 starts a dosing timer will start (dosing timer settable on set up screen 0 120 seconds).

#### <u>Step 6.2:</u>

After a hard coded time delay (which also starts once P-0914 starts, time delay will be initially set at 3 seconds) drain valve (AV-0734) will close.

# NOTE: Chemical metering pump P-0913 can be selected to operate with P-0914 (this is selectable on the CEB set up screen)

#### <u>Step 7:</u>

Once PI-0722 indicates membranes are full by reaching the Fill Pressure Setpoint (settable on the screen through Login) metering pump P-0914 will stop and a post dosing timer will begin once P-0914 stops (post dosing timer settable on set up screen 0-60 seconds).

# NOTE: During the time the chemical metering pumps are operating if the pH level is lower than 1 or greater than 11 and the time delay (pH out of range, 0-10 seconds) is done the chemical metering pumps will be stopped and an alarm be activated. If the pH falls within the acceptable range and the y are still being called to operate they will operate. This alarm will not stop the CEB process; it is to alert the operator that this condition occurred.

The backwash pump continues to run during the post dose.

#### <u>Step 9.1:</u>

Once the post dosing timer ends the following occurs (Post dosing timer should be settable from 0-5 seconds).

• Backwash pump P-0911 or 0912 will stop

#### <u>Step 9.2:</u>

Once backwash pump is stopped backwash valve (AV-0938) will close.

NOTE: If the pressure transmitter indicates the module is not full and the post dosing timer is complete an alarm will occur. This alarm is to alert the operator, no program action will be taken (dosing time/level alarm).

#### <u>Step 10.1:</u>

Once the backwash pump stops and backwash valve AV-0938 is closed the soak timer will start (soak timer settable on set up screen (0 - 24 hours).

Once the soak timer begins Valve AV-0737 will close and AV-0735 will open.

#### <u>Step 10.2:</u>

Once valves are in position pump P-0711 will start and ramp the Idle-A flow set point.

#### <u>Step 11.1:</u>

Once the soak timer is done the following will occur.

• P-0711 will stop

#### <u>Step 11.2:</u>

Once stopped

- valve AV-0735 will close and AV-0737 will open
- Backwash Bypass valve AV-0937 will open
- Drain valve AV-0734 will open

#### <u>Step 12:</u>

Once the valves have reached their commanded positions Timer 1 (Module Drain) will begin (this is settable on the set up screen).

#### <u>Step 13.1:</u>

Once Timer 1 (Module Drain) is done the duty backwash pump (P-0911 or 0912) will start and ramp to preset flow (backwash flow as set on the set up screen).

#### <u>Step 13.2:</u>

Once backwash flow is attained valves AV-0938 will open.

#### <u>Step 13.3:</u>

Once open AV-0937 will close.

#### <u>Step 13.4:</u>

Once closed Timer 2 (Module Flush) will start (drain timer2 time is settable on the set up screen 0-60 seconds).

#### <u>Step 13.5:</u>

Concurrent with the backwash pump starting de-aeration valve AV-0736 will open if LS-0724 senses no water in the line, AV-0736 will stay open until LS-0724 senses water.

#### <u>Step 14.1:</u>

Once Timer 2 (Module Flush) is done aerator flush valve AV-0939 will open (backwash pump continues to operate at set flow).

#### <u>Step 14.2:</u>

Once AV-0939 is open Timer 3 (Aerator Flush) starts.

#### <u>Step 14.4:</u>

Once Timer 3 (Aerator Flush) is done AV-0939 will close.

If CEB-B is not requested to follow CEB-A or if the CEB-B is complete move to step 16.

#### <u>Step 15.1:</u>

Once Timer 3 (Aerator Flush) is done AV-0939 will close.

If CEB-B is requested to follow CEB-A go to next step.

#### <u>Step 15.2:</u>

CEB-B is required. Repeat steps 6-15 for pump P-0915.

#### <u>Step 16.1:</u>

When Timer 3 (Aerator Flush) is done if the system is calling for filtration, precede the next step. If system is not calling for filtration proceed to step 18.

#### <u>Step 16.2:</u>

The CEB and Drain/Flush counter will be reset. Backwash pump will shut down

#### <u>Step 16.3:</u>

Once stopped the following valves will close:

- AV-0939 and AV-0938 will close
- AV-0734 will close
- De-aeration valve (AV-0736) will close (if open).

#### NOTE: If the de-aeration valve is still open at the end of drain timer 3, an alarm will occur.

#### <u>Step 17:</u>

Once the valves in step 16 are closed the system will move to step 2 in the filtration sequence. **CEB** done

#### <u>Step 18.1:</u>

If the system was not calling for filtration when drain timer 3 ended a fill will take place. In this event the following will occur:

- AV-0939 will close
- AV-0734 will close
- De-aeration valve (AV-0736) will close (if open). Note, if the de-aeration valve is still open at the end of drain timer 3 an alarm will occur.
- Backwash pump will ramp down to a reduced flow (Filling flow, settable on set up screen)
- Chemical metering pump P-0914 will start and run for a designated time (chemical addition time for fill, 0-10 seconds) settable on set up screen.
- The backwash pump is now operating at a reduced flow filling the membrane modules with chemical (hypochlorite) being added.

#### <u>Step 18.2:</u>

Pressure transmitter PI-0722 will sense when the modules are full, once this occurs the backwash pump (and P-0914 if still running) will stop.

#### <u>Step 19:</u>

Once the backwash pump is stopped backwash valve AV-0938 will close and Return valve AV-0737 will close. The **CEB and Drain/Flush** counter will be reset.

#### <u>Step 20:</u>

Once the valves are closed valve AV-0735 will open.

#### <u>Step 21:</u>

Once valve AV-0735 is open feed pump P-0711 will start and ramp to a preset flow (settable on set up screen / Idle A Flow ).

#### <u>Step 22:</u>

The fill sequence is done; the system is running in Idle-A mode.

#### 2.8.6q DRAIN / FILL:

During extended no flow periods the skid will enter the idle-B mode. While in the idle-B mode the membrane feed pump and air scour blower remain operating, the permeate pump is off. A skid will enter the idle-B mode if the system is not calling for filtration. If the system remains in idle-B mode for a time greater than that set on the set up screen (Relax Time) the system will perform a Drain/Fill sequence. Once the Drain/Fill sequence is done the system will go to idle-A mode. A Drain/Fill consists of a "Drain/Flush" sequence as described above followed by filling of the modules with permeate until the membrane feed pressure transmitter reaches a preset pressure (hard coded). Following a Drain/Fill the system will be placed in Idle-A mode until filtration is required.

NOTE: In addition to the Drain/Fill sequence described above a Modified Drain/Fill sequence will be used in the event of a TMP fault. The Modified Drain/Fill sequence is identical to the normal Drain/Fill sequence but the backwash flow rate will typically be set lower for the Modified Drain/Fill.

#### 2.8.6r DRAIN / FILL SEQUENCE:

See Appendix "A"

#### 2.8.6s DRAIN / FILL SEQUENCE DESCRIPTION:

#### <u>Step 1:</u>

Referring to the sequence chart above the system will enter the Drain/Fill sequence at the end of a filtration Idle-B time (i.e. Idle-B timer expires). The Drain/Fill sequence begins with step 2. In order for the program to move to the next step the equipment listed on the chart must be in the state indicated and be available for automatic operation (i.e. no active faults and equipment HOA's (if applicable) in the auto position).

#### <u>Step 2.1:</u>

If the Idle-B timer is expired the program will perform a Drain/Fill. The following will occur in step 2

- Feed Pump (P-0711) will stop
- Air Scour Blower (BL-0751) will stop and simultaneously close air scour valve AV-0739

#### <u>Step 2.2:</u>

Once P-0711 is stopped Feed Valve (AV-0733) will close.

- Backwash Bypass Valve (AV-0937) will open
- UV-0851 will shut down

#### <u>Step 2.3:</u>

Drain Valve (AV-0734) will open.

#### <u>Step 3:</u>

Once the valves have reached their commanded positions and the feed pump and air scour blower are off Drain Timer 1 will begin (this is settable on the set up screen).

#### <u>Step 4.1:</u>

Once drain timer 1 is done the duty backwash pump (P-0911 or 0912) will start and ramp to preset flow (backwash flow as set on the set up screen).

#### <u>Step 4.2:</u>

Once backwash flow is attained valves AV-0938 will open.

#### <u>Step 4.3:</u>

Once open AV-0937 will close.

#### <u>Step 4.4:</u>

Once closed Drain timer 2 will start (drain timer 2 time is settable on the set up screen 0-60 seconds).

#### <u>Step 4.5:</u>

Concurrent with the backwash pump starting de-aeration valve AV-0736 will open if LS-0724 senses no water in the line, AV-0736 will stay open until LS-0724 senses water.

#### <u>Step 5.1:</u>

Once drain timer 2 is done aerator flush valve AV-0939 will open (backwash pump continues to operate at set flow).

#### <u>Step 5.2:</u>

Once AV-0939 is open Drain Timer 3 starts.

#### <u>Step 6:</u>

When Drain Timer 3 is done the following will occur:

- Backwash pump will ramp down to a reduced flow (Filling flow, settable on set up screen)
- Chemical metering pump P-0914 will start and run for a designated time (chemical addition time for fill, 0-10 seconds) settable on set up screen.
- AV-0939 will close
- AV-0734 will close
- De-aeration valve (AV-0736) will close (if open).

#### NOTE: If the de-aeration valve is still open at the end of drain timer 3, an alarm will occur.

#### <u>Step 7.1:</u>

The backwash pump is operating at a reduced flow filling the membrane modules with chlorinated permeate. Pressure transmitter PI-0722 will sense when the modules are full.

#### <u>Step 7.2:</u>

Once this occurs the backwash pump (and P-0914 if still running) will stop.

#### <u>Step 8:</u>

Once the backwash pump is stopped backwash valve AV-0938 will close and Return valve AV-0737 will close. The **Drain/Flush** counter will be reset.

#### <u>Step 9:</u>

Once the valves are closed valve AV-0735 will open.

#### <u>Step 10:</u>

Once the valve AV-0735 is open feed pump P-0711 will start and ramp to a preset flow (settable on set up screen / Bypass Flow).

#### <u>Step 11:</u>

The Drain/Fill sequence is done, the system is running in Idle-A mode.

#### Stop Mode:

If a stop command is given by the operator (by pushing the stop button) while the unit is in a Drain/Fill sequence the system will shut down as follows.

- P-0911or 0912 will stop (if running).
- All Valves will close.
- A warning flag (sludge flag) will be displayed on the OIT to alert the operator that there is or may be standing sludge in the membranes.
- In order to bring the system back on line the reset button must be pushed, this will cause the system to go to Idle-B mode (assuming no fault conditions exist and the required equipment is available for service).

#### 2.8.6t UF MEMBRANE SUMP SYSTEM

A sump pump system will be used to collect and transfer the sludge/water that is drained from the UF membrane system during Drain/Flush, CEB and Drain/Fill sequences. The sump pump system will include a ½ HP pump and three normally open float switches. When the pump is in auto the float switches will control the pump as follows;

- LS-1021 (permissive float) will shut the pump off
- LS-1022 (run float) will start the pump as long as the permissive and run floats are closed.
- LS-1023 (high level float) will initiate a high level alarm, this is a Group B fault.

If the Fine Screen is in Auto and pump P-1011 is called to run, the fine screen will turn on while P-1011 is running.

Interlocks: If the fine screen float switch is closed the sump pump will be prevented from operating in auto until the fine screen float switch opens.

In manual control the pump will operate as directed by the operator regardless of float switch positions.

#### 2.8.6u UF MEMBRANE SYSTEM FAULTS

The following fault groups show the faults associated with the membrane system. If a fault occurs anytime the system is in operation a fault routine will be executed as described below.

#### Group A

- Feed valve (AV-0733) fault (failure to attain or maintain position)
- Drain valve (AV-0734) fault (failure to attain or maintain position)
- Return valve (AV-0737) fault (failure to attain or maintain position)
- Bypass valve (AV-0735) fault (failure to attain or maintain position)

#### <u>Group B</u>

- Pressure transmitter (PI-0822) fault (invalid signal, i.e. less than 4 ma)
- No backwash pumps available (P-0911 or 0912) (VFD fault, not in auto)
- Backwash pump fail to attain set point flow (within 15 seconds hard coded)
- Backwash bypass valve (AV-0937) fault (failure to attain or maintain position)
- Backwash valve (AV-0938) fault (failure to attain or maintain position)
- Flow meter (FM-0921) fault (invalid signal, i.e. less than 4 ma)
- Sump pump (P-1011) fault. Note, An alarm will occur when the pump faults but this fault will not cause a Group B fault routine to start until a Drain/Flush, CEB or Drain /Fill is requested
- Membrane Sump T-1041 high level
- Permeate Tank T-0841 low level (not sufficient water for backwash), hardcoded at 20% to start.
- Level sensor (LS-0825) fault (invalid signal, i.e. less than 4 ma)
- LS-0724 Does not detect liquid within time delay (settable on setup screen)
- CEB Requested Appropriate Chemical metering pump not in auto

#### <u>Group C</u>

- Feed pump (P-0711) fault (VFD fault)
- Feed pump (P-0711) fault (Thermal fault)
- Feed pump (P-0711) fault (Moisture fault)

- Feed pump (P-0711) VFD failed to start
- Flow meter (FM-0721) fault (invalid signal, i.e. less than 4 ma)
- Feed pump fail to attain set point flow (within 15 seconds hard coded)
- Post Anoxic Tank T-0641 Low Level (SP#1)

#### <u>Group D</u>

- Permeate pump fail to attain set point flow (within 15 seconds, hard coded). If standby permeate pump is available it will start and the filtration sequence will continue, if the standby is not available a Group D fault routine will be performed.
- No permeate pumps available (P-0811 or 0812) (VFD fault, not in auto). If the duty permeate pump faults the standby pump will automatically be started. If the standby is not available a Group D fault routine will be executed.
- Flow switch (FS-0725) fault (insufficient or no air flow)
- Air valve (AV-0739) fault (failure to attain or maintain position)
- Pressure transmitter (PI-0722) fault (invalid signal, i.e. less than 4 ma)
- De-aeration valve (AV-0736) fault (failure to attain or maintain position)
- Blower (BL-0751) fault
- Temperature (TE-0723) fault (invalid signal, i.e. less than 4 ma)
- Temperature (TE-0723) fault (temp above set point), hard coded high temp set point
- Turbidity above set point (as set on the set up screen)
- Turbidity meter (TM-0824) fault (invalid signal, i.e. less than 4 ma) (note, this fault has an ignore button)
- pH meter (pH-0821) fault (invalid signal, i.e. less than 4 ma) (note, only takes action if system is in CEB sequence, otherwise this condition is alarm only)
- Flow meter (FM-0823) fault (invalid signal, i.e. less than 4 ma)
- UV (UV-0851) fault (invalid signal, i.e. less than 4 ma)
- UV (UV-0851) not in auto

#### <u>Group E</u>

- Permeate valve (AV-0831) fault (failure to attain or maintain position)
- Aerator backflush valve (AV-0939) fault (failure to attain or maintain position)
- Low air pressure PS-1221

#### <u>Group F</u>

- Permeate pump (P-0811) VFD fault
- Permeate pump (P-0811) VFD failed to start
- Permeate pump (P-0812) VFD fault

- Permeate pump (P-0812) VFD failed to start
- Backwash pump (P-0911) VFD fault
- Backwash pump (P-0911) VFD failed to start
- Backwash pump (P-0912) VFD fault
- Backwash pump (P-0912) VFD fault to start
  - Note: If lead Backwash pump fails during any routine, the routine will shut down and then start from the beginning of the routine in which it faulted (Backwash, Drain Fill, Drain Flush, CEB). If the second Backwash pump fails a Group B fault will occur (No Bacwash pumps available)
- Membrane Sump pump motor overload (P-1011) A group B fault will accur if this is faulted and a drain/flush, CEB, or Drain/fill is requested
- Permeate pH meter signal invalid (pH-0821). Only causes a group D fault if the system is in a CEB sequence.
- De-aeration valve still open at the end of Timer 3 (Aerator Flush)
- pH high during a CEB sequence. Shut down chemical metering pump
- pH low during a CEB sequence. Shut down chemical metering pump
- CEB Dosing time / Level Alarm (Module full before dosing timer done)

#### <u>Group G</u>

- Filtration or Backwash TMP high. (see calculations section at the end of the UF Membrane System section)
- High pressure PI-0722, hard coded high pressure setpoint

NOTE: A group F fault will only cause an alarm dial out. If a permeate pump faults the standby permeate pump will assume the duty.

- **Group A** Fault routine will shut down the UF membrane system. A warning flag (sludge flag) will be displayed on the OIT to alert the operator that there is standing sludge in the membranes. (Group A faults are shutting down system)
- **Group B** Fault routine will stop the current sequence then place the system in Idle B mode (the Idle B to Idle A timer is disabled)
- **Group C** Fault routine will stop the current sequence then execute a Drain/Fill sequence. Once the Drain/Fill sequence is executed the UF membrane system will be placed in stop mode.
- **Group D** Fault routine will stop the current sequence then execute a Drain/Fill sequence. Once the Drain/Fill sequence is executed the system will run the sub routine for membrane feed bypass (Idle mode–A) as described previously.
- **Group E** Fault routine will stop current sequence; a warning flag (sludge flag) will be displayed on the OIT to alert the operator that there is standing sludge in the membranes. Once the

membrane system is shut down the system will run the sub routine for membrane feed bypass (Idle mode–A) as described previously.

#### NOTE: Valve AV-0735 (bypass valve) is a fail open valve.

**Group F** - There is no fault routine associated with a Group F fault.

Group G - Fault routine will stop the current sequence then execute a Modified Drain/Fill sequence. Once the Modified Drain/Fill sequence is executed the system will run the sub routine for membrane feed bypass (Idle mode–A) as described previously. The Modified Drain/Fill sequence is the same a normal Drain/Fill sequence with the difference being the backwash flow rate will be lower than normal (a modified drain/fill set-up screen is required, screen to have the same settable parameters as the normal drain/fill screen). The Modified Drain/Fill sequence will not advance the Drain/Fill counter.

Once the fault condition is addressed the system can be reset which will put the system into Idle-B mode.

#### 2.8.7 SET UP SCREENS

#### 2.8.7a FILTRATION

#### 2.8.7a.i ALARM SET POINTS

Item	Range	Fault Value
Turbidity Alarm SP	0-5 NTU	With bypass button on screen
Turbidity Alarm Timer SP	0-120 seconds	
TMP Alarm SP	15PSI Hardcoded	For all sequences
TMP Warning Filtration SP	0-15 PSI	Located on Alert Screen
TMP Warning Backwash SP	0-15 PSI	Located on Alert Screen
LS-0724 Time Delay	1-5 minutes	Located on Filtration Screen
Valve Fail to Attain Position	1-10 seconds	Located on Valve manual control screen

#### 2.8.7a.ii OPERATING VALUES

Item	Range	Set Point
Filtration Time	7-10 Minutes	
Level Set Point 1	0-100 percent full	Level set points based on level in post anoxic tank
Level Set Point 2	0-100 percent full	Level set points based on level in post anoxic tank
Level Set Point 3	0-100 percent full	Level set points based on level in post anoxic tank
Level Set Point 4	0-100 percent full	Level set points based on level in post anoxic tank
Level Set Point 5	0-100 percent full	Level set points based on level in post anoxic tank
Feed Pump Flow Set Point – Normal	0 – 400 GPM	
Feed Pump Flow Set Point – Idle A	0 – 100 GPM	
Permeate Flow Set Point	5-30 GPM	
Permeate Pump Duty Selection	Pump 1 or Pump 2	
Permeate Pump Duty Rotation	0-200 Hours	
Relax Timer	<b>1</b> -24 Hours	

#### 2.8.7b BACKWASH

### 2.8.7b.i OPERATING VALUES

Item	Range	Set Point
Backwash Timer	10-60 Seconds	
Backwash Pump Flow Set Point	85 – 175 GPM	
Backwash Pump Duty Selection	Pump 1 or Pump 2	
Backwash Pump Duty Rotation	0-200 Hours	

CEB Counter SP	0-15,000	
Drain/Flush Counter SP	0-1000	

### 2.8.7c DRAIN / FLUSH

#### 2.8.7b.i OPERATING VALUES

Item	Range	Set Point
Backwash Pump Flow Set Point	85 – 175 GPM	
Drain Timer 1 (Module Drain)	0-30 seconds	
Drain Timer 2 (Module Flush)	0-60 seconds	
Drain timer 3 (Aerator Flush)	0-30 seconds	

#### 2.8.7d CEB

#### 2.8.7d.i ALARM SET POINTS

Item	Range	Fault Value
pH Upper Limit CEB-A	7 – 14	
pH Lower Limit CEB-B	0 - 7	
2		I

#### 2.8.7d.ii OPERATING VALUES

Item	Range	Set Point
Backwash Pump Flow Set Point	85 – 175 GPM	
Dosing &Post Dosing BW Flow	70-90 GPM	
Idle-A Feed Pump Flow	0-100 GPM	
Drain Timer 1 (Module Drain)	0-30 seconds	
Drain Timer 2 (Module Flush)	0-60 seconds	
Drain timer 3 (Aerator Flush)	0-30 seconds	
Post Dose Timer	0-5 seconds	
Soak Timer	0-1,440 minutes	
Pressure Set Point (for module level indication)	3.5-6.0 PSI	Set point is 5.0 need to login to change
Chem Addition time for Fill	0-30 seconds	
pH out of Range Timer	0-10 seconds	

#### 2.8.7d.iii OPERATING COMBINATIONS

Item	Select One
CEB-A Only – w/ hypochlorite	
CEB-A Only- w/ hypochlorite & caustic	
CEB-A Only – w/ hypochlorite followed by CEB-B	
CEB-A Only- w/ hypochlorite & caustic followed by CEB-B	
CEB-B Only	

#### 2.8.7e DRAIN / FILL

#### 2.8.7e.i OPERATING VALUES

Item	Range	Set Point
Backwash Pump Flow	85 – 175 GPM	
Backwash Flow - Filling	70-90 GPM	
Drain Timer 1 (Module Drain)	0-30 seconds	
Drain Timer 2 (Module Flush)	0-60 seconds	
Drain timer 3 (Aerator Flush)	0-30 seconds	
Fill Timer	0-60 seconds	
Pressure Set Point (for module level indication)	3.5-4.5 PSI	
Idle-A Feed Pump Flow	0-100 GPM	

#### 2.9 MISCELLANEOUS CONTROL REQUIREMENTS

- If the duty permeate pump fails the standby permeate pump will automatically start and assume the duty. The filtration cycle will not be interrupted. A fault indication will occur for the faulted pump. If the faulted pump is returned to service (after the fault is cleared) and the duty rotation is calling for this pump as the duty pump it will be placed back in service.
- 2) If the duty backwash pump fails a Group B fault will occur
- 3) If level set point 5 (post anoxic high level) is reached the EQ pumps will be prevented from operating until the level in the tank drops below level set point 4.
- 4) If the level in the permeate tank (T-0841) rises above the high level set point (set point 6) the filtration sequence will be prevented from running until the level drops below the mid level set point (set point 5). Level sensor LS-0825 will monitor the level in permeate tank T-0841.
- 5) Turbidity feed valve (SV-08312) will open when the system is in filtration mode only.
- 6) A self contained air compressor will be used to supply air to the actuated valves. The compressor will be powered from an external source. A pressure switch will be installed on the air receiver and will monitor the pressure, if the pressure falls below a preset value the pressure switch will open signaling a low air pressure fault, this will cause a Group E fault routine to occur.

- 7) For the CEB and Drain/Flush counters a display is required on the OIT showing the status of the counters.
- 8) For a Turbidity meter fault an "Ignore" button will be provided. If a turbidity fault occurs and cannot be immediately rectified the operator can push the "Ignore" button which will allow the system to operate regardless of the turbidity value.
- 9) A set up screen will be provided to allow the time for "flow set point to be obtained" for the permeate and backwash pumps (0-30 seconds)
- 10) A set up screen will be provided to allow the time for "valve to attain position" (0-10 seconds), this is applicable for all AV valves.

#### 2.10 CALCULATIONS

The following calculations will be performed by the PLC, the calculated values will be displayed on the OIT.

#### 2.10.1 TMP

TMP is the pressure difference between the feed side of the membrane and the permeate side of the membrane. The permeate side pressure can never be greater than 14 PSIG above the feed side of the membrane.

$$TMP = [(PI - 50 - 1) - CF_1] - [(PI - 60 - 1) - CF_2]$$

CF<sub>1</sub> = 2.35 psi CF<sub>2</sub> = 1.73 psi

#### NOTE:

- 1) CF<sub>1</sub> and CF<sub>2</sub> are hard coded correction factors to correct the pressure readings to the middle of the membrane module.
- 2) TMP during a backwash, drain/flush, CEB or drain/fill will be a negative number.
- 3) The TMP value during filtration can never exceed 7 PSIG or a fault will occur.
- 4) The TMP during a backwash, drain/flush, CEB or drain/fill can never exceed -14 PSIG or a fault will occur.

#### 2.10.2 FLUX (FILTRATION)

Permeate Flux is a measurement of permeate flow per area of the membrane during filtration and is calculated as follows.

$$J=\frac{Q_P\times 1,440}{A}$$

Where:

J = Membrane Flux (GFD = gallons per square foot per day)

Q<sub>p</sub> = Permeate Flow (GPM = gallons per minute)

A = Membrane Area (Square Feet)

$$J = \frac{(FM - 60 - 1) \times 1,440}{710}$$

#### 2.10.3 FLUX (BACKWASH)

Backwash Flux is a measurement of permeate flow per area of the membrane during backwash and is calculated as follows.

$$J=\frac{Q_P\times 1,440}{A}$$

Where:

Q<sub>p</sub> = Backwash Flow (GPM = gallons per minute)

A = Membrane Area (Square Feet)

$$J = \frac{(FM - 823) \times 1,440}{710}$$

#### 2.10.4 TEMPERATURE CORRECTION FLUX - FILTRATION

Temperature Controlled Flux adjusts the flux value to a standard temperature of 20° C.

$$J_{@20}C = J \times TCF$$

Where:

 $J_{@ 20} C = Flux$  corrected to  $20^{\circ} C$ 

J = Flux @ Temp read by TI-50-1 converted to degrees C.

T = Feed Temperature (see note below)

TCF = Temperature Correction Factor = 1.022 <sup>(20-T)</sup>

NOTE: Feed temperature (as read by TI-60-1) needs to be converted to degrees C.

$$C = 0.55 \times [(TI - 60 - 1 - 32)]$$

#### 2.10.5 PERMEABILITY / SPECIFIC FLUX FILTRATION

Permeability or Specific Flux is a value that shows the relationship between the temperature corrected flux and TMP.

$$J_{SP} = \frac{J_{@20}}{TMP}$$

Where:

J<sub>SP</sub> = Specific Flux (GFD / psi)

 $J_{@ 20}$  = Flux corrected to 20<sup>o</sup> C

TMP = Trans Membrane Pressure (PSI)

#### 2.11 REQUIRED OIT SCREENS FOR UF MEMBRANE SYSTEM

- Set up screens
- Operating screens showing all operating parameters for UF membrane system

#### 2.11.1 PERMEATE TANKS

The permeate system includes the following items.

- 1 @ 0.5 HP UV recirculation pumps (P-0813), 480 V, DOL
- 1 @ UV unit (UV-0852), 120 V, 5 amps with self powered 4-20 ma output.
- 1 @ Level sensor (LS-0825), 24 VDC loop powered. This level switch is accounted for in UF membrane system but shown here also.

The permeate tank T-0841 will be used to collect permeate from the UF membrane system. As described in the UF membrane section of this document the backwash pumps utilize the permeate water in these tanks for backwash, flush and fill water. Tank T-0841 has a level sensor (LS-0825) which is used in the UF membrane control as described above. T-0841 is fitted with a UV recirculation system as described below.

#### Permeate Tank T-0841 Level Set points

Tank is scaled from 0-80" and set points are in % full.

Set point 1: This set point will inhibit the operation of P-0813 and UV-0852.

- Set point 2: This set point will release the inhibit on P-0813 and UV-0852.
- Set point 3: This set point will inhibit the BW pumps (P-0911 and P-0912) from operating; this is a Group B UF system fault.

Set point 4: This set point will release the BW pump inhibit.

Set point 5: This set point will release the permeate pump inhibit

Set point 6: This set point will inhibit the permeate pumps (P-0811 and P-0812)

#### 2.11.2 T-0841 UV RECIRCULATION SYSTEM

The UV recirculation skid for tank T-0841 includes a UV recirculation pump and UV unit. When the skid is placed in auto the following will occur if the level in T-0841 is above a hard coded value.

- Pump P-0813 will start
- UV-0852 will be energized

If the level in T-0841 is below the hard coded level set point a fault will occur which will cause the UV pump to stop (if the equipment was not operating it would be prevented from doing so).

#### 2.11.3 T-0841 UV RECIRCULATION SYSTEM FAULTS

1.	UV Recirc. Pump Motor Overload	Turns off UV unit
2	UV (UV-0852) fault (invalid signal, i.e. less than 4 ma)	Notification only
3	UV (UV-0852) fault (UV not in auto)	Notification only

#### 2.13 EFFLUENT DOSING SYSTEM

2 @ 2.7 HP submersible pumps (P-1111 and P-1112) with thermal and moisture protection, 480 V, VFD

1 @ Submersible level sensor (LS-1121), loop powered 24 VDC

2 @ Mag flow meter (FM-1125 and FM-1127). 120 v power requirement with self powered 4-20 ma output.

1 @ Dual channel pH meter (pH -1126 and pH-1128). 120 v power requirement with two self powered 4-20 ma outputs.

The pH meter signal outputs are for monitoring the pH level of the discharge from each pump. The information will be used for monitoring and alarming purposes (see faults below).

The dosing system is comprised of two pumping systems that operate on a flow set point control. Level sensor LS-1121 will determine when pump/pumps are to operate. When a pump is called to operate it will operate at a pre set flow as set on the set up screen. There are four level set points (SP1, SP2, SP3 and SP4)

- SP1 This is the permissive level, no pumps can operate unless the level in the tank is above this level.
- SP2 The duty pump will run when the level reaches this set point level.
- SP3 The lag pump will run when the level reaches this set point level.
- SP4 This is a high level set point, if the level reaches this set point level an alarm will occur. An interlock will also be active that will prevent the UF system from operating until the level drops below SP3.

When a pump is called to operate it will ramp to the pre set flow (as set on the set up screen). The pump will operate until the level in the tank drops below SP1. The pumps will alternate lead and lag status every pumping cycle. If the lead pump fails the lag pump will become the lead pump.

#### 2.13.1 FAULTS FOR EFFLUENT DOSING SYSTEM

- P-1111 VFD fault (if this pump was lead P-1112 becomes lead)
- P-1112 VFD fault (if this pump was lead P-1111 becomes lead)
- P-1111 failure to attain flow within a set time (if P-1111 was lead P-1112 becomes lead)
- P-1112 failure to attain flow within a set time (if P-1112 was lead P-1111 becomes lead)
- Flow meter (FM-1125) fault (invalid signal, i.e. less than 4 ma) (if P-1111 was lead P-1112 becomes lead)
- Flow meter (FM-1127) fault (invalid signal, i.e. less than 4 ma) (if P-1112 was lead P-1111 becomes lead)
- pH meter (pH-1126) fault (invalid signal, i.e. less than 4 ma) (if P-1111 was lead P-1112 becomes lead)
- pH meter (pH-1128) fault (invalid signal, i.e. less than 4 ma) (if P-1112 was lead P-1111 becomes lead)
- pH-1126 out of range (range set on set up screen) (if P-1111 was lead P-1112 becomes lead)
- pH-1128 out of range (range set on set up screen) (if P-1112 was lead P-1111 becomes lead)
- Level sensor (LS-1121) fault (invalid signal, i.e. less than 4 ma) (Both pumps will be inhibited from operating)
- Tank (T-1141) high level (inhibits UF permeate pump, callout only)

Item	Value
T-1141 – SP 1	% full
T-1141 – SP 2	% full
T-1141 – SP 3	% full
T-1141 – SP 4	% full
Flow Set Point (P-1111)	50 - 200 GPM
Flow Set Point (P-1112)	50 - 200 GPM
Time to Attain Flow (either pump)	5 – 30 seconds
pH Range	6.5 - 8.5

#### 2.13.2 SET UP SCREENS FOR EFFLUENT DOSING SYSTEM

#### 2.14 POWER FAILURE

An emergency generator (by others) is installed to provide power to the WWTP during power outages. An automatic transfer switch (with a delayed neutral, by others) is installed to automatically start the generator and transfer the load to the generator in the event of a power loss. The transfer switch contains a set of dry contacts, which are wired to the PLC to indicate whether the system is receiving power from the mains or the generator. In addition, the generator control panel contains a fault contact and a running contact. Upon power being restored to the system by the generator the PLC will restart equipment that was in manual mode and also allow any equipment that is in auto mode to start. An uninterrupted power supply (UPS) will be used to maintain the PLC memory and power to the auto dialer.

When a power failure occurs and power is restored either by the main power becoming available or the emergency generator starting, the system will be brought back on line in a step start method which will prevent all the equipment from starting at once. Any equipment that may have been operating in manual mode or equipment that is not controlled by the PLC will be powered as soon as power is available. For equipment that was in auto prior to the power loss this equipment will be started in a structured sequence. The structured sequence is as follows.

- Misc 120 volt loads
- Aeration Blowers
- Pre & Post Anoxic Mixers and Denite Pump
- UV Recirc. Pump and UV's
- UF Membrane System
- Dosing Pumps
- EQ pumps and Fine Screen
- Odor Control Blower

#### 2.15 ALARMS CHANNEL ASSIGNMENTS

A 16 channel auto dialer will be installed (Sensaphone Express II). All of the plant faults will be grouped such that each channel includes a group of equipment. Groups are defined as follows.

Alarm Channel Callouts		
Channel 1	All EQ System Faults and Bar Screen Faults	
Channel 2	Pre-Anoxic Mixer and Pre-Anoxic ORP Faults	
Channel 3	Aeration Mixer, Denite Pump, Aeration Blowers, D.O., pH Faults	
Channel 4	Post Anoxic Mixer, ORP, Level Sensor Faults	
Channel 5	UF Membrane System "A" Faults	
Channel 6	UF Membrane System "B" Faults	
Channel 7	UF Membrane System "C" Faults	
Channel 8	UF Membrane System "D" Faults	
Channel 9	UF Membrane System "E" Faults	
Channel 10	UF Membrane System "F" Faults	
Channel 11	UV -0851, UV-0852, UV Recirc Pump P-0813	
Channel 12	Final pH, Flow Monitoring and Level Sensor System Faults	
Channel 13	Final Effluent Dosing Pump P-1111 Fault	
Channel 14	Final Effluent Dosing Pump P-1112 Fault	
Channel 15	Generator Fault <b>and or</b> On Emergency Power	
Channel 16	Odor Control Faults	

#### 2.16 DATA LOGGING

Item	Instrument Number	<b>Recording/Trending Interval</b>
UF Backwash Flow	FM-0921	1 seconds
UF Backwash Flux	Calculated	1 seconds
UF Backwash TMP	Calculated	1 seconds
Influent Flow	FM-0222	15 seconds
Pre Anoxic ORP	AC-0321	15 minutes
Aeration Tank pH	DO-0422	15 minutes
Aeration Tank D.O.	pH-0421	15 minutes
Denite Return Flow	FM-0521	15 minutes
Post Anoxic ORP	AC-0321	15 minutes
UF Feed Pump Flow	FM-0721	5 minutes
UF TMP	Calculated	5 minutes
UF Flux	Calculated	5 minutes
UF Permeability	Calculated	5 minutes
UV Transmittance	UV-0851	5 minutes
UV Transmittance	UV-0852	5 minutes
Final Effluent Flow	FM-1125	5 minutes
Final Effluent Flow	FM-1127	5 minutes
Final Effluent pH	pH-1126	5 minutes
Final Effluent pH	pH-1128	5 minutes

The following items require data logging.

#### Note: All pumps, Blowers and Screen Motor run times to be data logged and also displayed on OIT

#### 2.17 EQUIPMENT LIST

See Appendix "A"

#### 2.18 APPENDIX "A"

Valve Sequencing Charts:

- 1. Filtration
- 2. Backwash
- 3. Drain / Flush
- 4. CEB Sequence
- 5. Drain / Fill

Equipment List:

FILTRATION SEQUE	NCE CHART																
	Step	1A	1B	2.1	2.2	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7.1	7.2
Function		Idle A	Idle B	Start Filtration stop P-0711	P-0711 stopped set valves	Valves set start P- 0711, start timer for sensing air flow	Flow sensed check for Air in line	Air sensed in line, open AV- 0736 & start timer	Liquid sensed in line, Open permeate valve.	position, Start permeate pump. Start Turbidity Timer	Turbidity timer done, turbidity value active	Permeate timer done stop pump	Post Anoxic Tank level dropped stop pump	Pump stopped, due to permeate timer done, close valves	Pump stopped due to level dropping, close valves	Valves closed, End Filtration, go to backwash	Valves closed, End Filtration, go to Idle B
Equipment Identification	P&ID #																
Feed Pump	P-0711	RUN	RUN	OFF	OFF	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN
Permeate Pump	P-0811 or P-0812	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	RUN	RUN	OFF	OFF	OFF	OFF	OFF	OFF
Backwash Pump	P-0911 or P-0912	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Air Scour Blower	BL-0751	OFF	RUN	OFF	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN
Feed Valve	AV-0733	CLOSE	OPEN	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
Drain Valve	AV-0734	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Bypass Valve	AV-0735	OPEN	CLOSE	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
De-Aeration Valve	AV-0736	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Return Valve	AV-0737	CLOSE	OPEN	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
Air Scour Valve	AV-0739	CLOSE	OPEN	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
Permeate Valve	AV-0831	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE
Turbidity Valve	SV-08312	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE
Backwash Bypass Valve	AV-0937	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Backwash Valve	AV-0938	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Aerator Flush Valve	AV-0939	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
UV unit	UV-0851	OFF	OFF	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN
Control Loops																	
UF Backwash Control																	
UF Feed Flow Control		ACTIVE	ACTIVE			ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE
UF Air Scour Control			ACTIVE			ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE
UF Permeate Control										ACTIVE	ACTIVE						
UF De-Aeration Control								ACTIVE									
Special Step Conditions																	
De-Aeration OK																	
Backwash Flow Attained																	
Backwash Time Elapsed																	

## **APPENDIX "A"**

# **BACKWASH SEQUENCE CHART**

BACKWASH SEQUENCE CHART													
	Step		2.1	3.1	4.1	4.2	4.3	5.1	5.2	6.1	6.2		
					running		۵\/_0937	Backwash	stonned	Backwash			
			Start	Valve	and Flow		closed.	timer	Close AV-	complete.	Backwash		
			Backwash,	open, start	attained,	AV-0938	start	done, Stop	0938	retrn to	complete,		
		Filtration	Open AV-	Backwash	open AV-	open, close	backwash	backwash	increment	Filtration	go to Idle		
Function		Step 7	0937	pump	0938	AV-0937	timer	pump	counters	step 3	mode B		
Equipment Identification	P&ID #												
Feed Pump	P-0711	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN		
Permeate Pump	P-0811 or P-0812	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF		
Backwash Pump	P-0911 or P-0912	OFF	OFF	RUN	RUN	RUN	RUN	OFF	OFF	OFF	OFF		
Air Scour Blower	BL-0751	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN		
Feed Valve	AV-0733	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN		
Drain Valve	AV-0734	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE		
Bypass Valve	AV-0735	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE		
De-Aeration Valve	AV-0736	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE		
Return Valve	AV-0737	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN		
Air Scour Valve	AV-0739	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN		
Permeate Valve	AV-0831	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE		
Turbidity Valve	SV-08312	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE		
Backwash Bypass Valve	AV-0937	CLOSE	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE		
Backwash Valve	AV-0938	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE		
Aerator Flush Valve	AV-0939	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE		
UV unit	UV-0851	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON		
Control Loops													
UF Backwash Control				ACTIVE	ACTIVE	ACTIVE	ACTIVE						
UF Feed Flow Control		ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE		
UF Air Scour Control		ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE		
UF Permeate Control													
UF De-Aeration Control													
Special Step Conditions													
De-Aeration OK													
Backwash Flow Attained													
Backwash Time Elapsed													

ORAIN / FLUSH SEQUENCE CHART																	
	Step		2.1	2.2	2.3	3.1	4.1	4.2	4.3	4.4	4.5	5.1	5.2	6.1	6.2	7.1	7.2
Function		Filtration Step 7	Start Drain sequence, stop P- 0711 & BL-0751 and close AV-0739	Pump stopped, open AV- 0937 & close AV- 0733	Once AV- 0733 is closed, open AV- 0734	Start Drain Timer 1	Drain timer 1 done, start backwash pump	Backwash flow attained open AV-0938	AV-0938 open, close AV-0937	AV-0937 closed, start drain timer 2	Check for air in line and open AV-0736 if necessary	Drain timer 2 done, open AV-0939	AV-0939 is open, start drain timer 3	Drain timer 3 done, stop backwash pump	Backwash pump stopped, close AV-0734, AV- 0938, AV- 0939, AV- 0736	Valves closed, filtration required, go to filtration step 2	Valves closed, filtration not required, go to Idle mode B
Equipment Identification	P&ID #																
Feed Pump	P-0711	RUN	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Permeate Pump	P-0811 or P-0812	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Backwash Pump	P-0911 or P-0912	OFF	OFF	OFF	OFF	OFF	RUN	RUN	RUN	RUN	RUN	RUN	RUN	OFF	OFF	OFF	OFF
Air Scour Blower	BL-0751	RUN	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Feed Valve	AV-0733	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Drain Valve	AV-0734	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE
Bypass Valve	AV-0735	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
De-Aeration Valve	AV-0736	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CLOSE	CLOSE	CLOSE
Return Valve	AV-0737	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
Air Scour Valve	AV-0739	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Permeate Valve	AV-0831	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Turbidity Valve	SV-08312	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Backwash Bypass Valve	AV-0937	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Backwash Valve	AV-0938	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE
Aerator Flush Valve	AV-0939	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE
UV unit	UV-0851	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Control Loops																	
UF Backwash Control							ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE				1
UF Feed Flow Control		ACTIVE															
UF Air Scour Control		ACTIVE															
UF Permeate Control																	1
UF De-Aeration Control																	
Special Step Conditions																	
De-Aeration OK																	
Backwash Flow Attained																	
Backwash Time Elapsed																	

EB SEQUENCE CHART																						
	Step		2.1	2.2	2.3	3.1	4.1	4.2	4.3	4.4	4.5	5.1	5.2	6.1	6.2	7.1	9.1	9.2	10.1	10.2	11.1	11.2
Function		Filtration Step 7	Start Drain sequence, stop P- 0711 & BL-0751 and close AV-0739	Pump stopped, open AV- 0937 & close AV- 0733	Once AV- 0733 is closed, open AV- 0734	Start Module Drain Timer	Module Drain Timer done, start backwash pump	Backwash flow attained open AV-0938	AV-0938 open, close AV-0937	AV-0937 closed, start Module Flush timer	Check for air in line and open AV- 0736 if necessary	Module Flush timer done, open AV-0939	AV-0939 open, start Aerator Flush Timer	Aerator Flush Timer done. Close AV-0736, & AV-0939, Reduce flow, Start Chemical metering pump/pumps	Close Drain valve AV-0734	Membrane full, Stop Dosing Pump, start post dosing timer.	Post dosing timer done, Stop Backwash pump	Pump stopped, close backwash valve AV-0938	Backwash pump stopped and AV-0938 is closed, Start soak timer. Close AV-0737 & Open AV-0735	Valves in position start P-0711 and ramp to Idle A flow SP	Soak timer done, Stop P 0711	Pump Stopped, OpenAV- 0734, AV- 0737 & AV- 0937 Close AV- 0735
Equipment Identification	P&ID #																					
Eged Pump	P_0711	RUN	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	RUN	OFF	OFF
Permeste Pump	P-0811 or P-0812		011	011	055	055	011	011	055	055	011	011	055	055	011	011	055	055	055	OFF	055	055
	P-0011 or P-0012	011	011	011	055	055	PLIN	PLIN	PLIN	PLIN	PLIN	PLIN	PLIN	PLIN	PLIN	PLIN	011	055	055	011	011	OFF
Air Scour Blower	BL-0751	RUN	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
KOH Metering Pump	P_0913	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF			OFF	OFF	OFF	OFF	OFF	OFF	OFF
CEB-A Metering Pump	P_0914	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF			OFF	OFF	OFF	OFF	OFF	OFF	OFF
CEB-B Metering Pump	P-0915	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF			OFF	OFF	OFF	OFF	OFF	OFF	OFF
Eed Valve	AV-0733	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Drain Valve	AV-0734	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE		CLOSE	CLOSE	CLOSE	CLOSE	OPEN
Bypass Valve	AV-0735	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	CLOSE
De-Aeration Valve	AV-0736	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE								CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Return Valve	AV-0737	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	OPEN
Air Scour Valve	AV-0739	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Permeate Valve	AV-0831	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Turbidity Valve	SV-08312	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Backwash Bypass Valve	AV-0937	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN
Backwash Valve	AV-0938	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Aerator Flush Valve	AV-0939	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
UV unit	UV-0851	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Control Loops																						
UF Backwash Control							ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE						
UF Feed Flow Control		ACTIVE																				
UF Air Scour Control		ACTIVE																				
UF Permeate Control																						
UF De-Aeration Control																						
Special Step Conditions																						
De-Aeration OK																						
Backwash Flow Attained																						
Backwash Time Elapsed																						

12.1	13.1	13.2	13.3	13.4	13.5	14.1	14.2	14.4	15.1	15.2	16.1	16.2	16.3	17.1	18.1	18.2	19.1	20	21	22.1
											Aerator Flush	System is calling			Eiltration not					
	Module Drain							Aerator Flush Timer Done	Aerator Flush	CEB A	and CEB complete	for filtration. shut down backwash			required, close AV-0939, AV-					
Valves in	Timer done	<u>Flaw</u>	AV 0028	Once AV-0937	Ain concord in	Madula Fluch	AV-0939	CEB-B	Timer Done If	completed,	check if	pump and reset	pump stopped,		0734. Reduce	Pi-0722 will sense	Pump stopped,		Value and start	
Module Drain	backwash	attained,	open, close	start Module	line, open AV-	- Timer done,	Aerator Flush	Go to step	required start	CEB B, Go to	calling for	Drain/Flush	0939, AV-0938	Valves closed Go	start P-0914, start	are full, stop	Reset both	Valve closed,	P-0711, ramp to	CEB done, switch
Timer	pump	open AV-0938	AV-0937	Flush Timer	0736	open AV-0939	Timer	16.1	now.	step 6	filtration	counter	and AV-0734	to Filtration step 2	chem fill timer	backwash pump	counters	open AV-0735	Idle A Flow SP	to idle mode A
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	RUN	RUN
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
OFF	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	OFF	OFF	OFF	RUN	OFF	OFF	OFF	OFF	OFF
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	CONTROLLED	OFF	OFF	OFF	OFF	OFF
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN
CLOSE	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE
CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF
	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE				ACTIVE					
																			ACTIVE	ACTIVE

DRAIN / FILL SEQUENCE CHART																				
	Step		2.1	2.2	2.3	3.1	4.1	4.2	4.3	4.4	4.5	5.1	5.2	6.1	7.1	7.2	8	9	10	11.1
			Start Drain sequence,	Pump										Aerator Flush Timer done. Close AV-0734.	Valves in	Membrane	Pump stopped.			
			stop P-	stopped.	Once AV-		Module Drain				Check for air			AV-0736. & AV-	position.	full.	close AV-0938			
			0711 &	open AV-	0733 is	Start	Timer done,			AV-0937	in line and		AV-0939	0939, Reduce	check	Stop	& AV-0737.			The drain fill
			BL-0751	0937 &	closed,	Module	start	Backwash	AV-0938	closed, start	open AV-	Module Flush	open, start	flow, Start	pressure	Backwash	Reset the	Valves closed,		sequence is
			and close	close AV-	open AV-	Drain	backwash	flow attained	open, close	Module Flush	0736 if	timer done,	Aerator Flush	Chemical	sensor for full	pump and	drain flush	Open AV-	Valve open,	done. System
Function		Idle B	AV-0739	0733	0734	Timer	pump	open AV-0938	AV-0937	timer	necessary	open AV-0939	Timer	metering P-0914	module	Dosing Pump	counter	0735	Start P-0711.	is in Idle A
Equipment Identification	P&ID #																			
Feed Pump	P-0711	RUN	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	RUN	OFF
Permeate Pump	P-0811 or P-0812	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Backwash Pump	P-0911 or P-0912	OFF	OFF	OFF	OFF	OFF	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN	OFF	OFF	OFF	OFF	OFF
Air Scour Blower	BL-0751	RUN	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
KOH Metering Pump	P-0913	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
CEB-A Metering Pump	P-0914	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	CONTROLLED	CONTROLLED	OFF	OFF	OFF	OFF	OFF
CEB-B Metering Pump	P-0915	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Feed Valve	AV-0733	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Drain Valve	AV-0734	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Bypass Valve	AV-0735	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN
De-Aeration Valve	AV-0736	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CONTROLLED	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Return Valve	AV-0737	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE
Air Scour Valve	AV-0739	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	**	CLOSE
Permeate Valve	AV-0831	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Turbidity Valve	SV-08312	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Backwash Bypass Valve	AV-0937	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
Backwash Valve	AV-0938	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE
Aerator Flush Valve	AV-0939	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
UV unit	UV-0851	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF
Control Loops																				
UF Backwash Control							ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE					
UF Feed Flow Control		ACTIVE																		
UF Air Scour Control		ACTIVE																		
UF Permeate Control																				
UF De-Aeration Control																				
Special Step Conditions																				
De-Aeration OK																				
Backwash Flow Attained																				
Backwash Time Elapsed																				

Itom Description	0.00	Description	ELA	μр	Electrical
	PAID	Description	FLA	пр	Electrical
Screen					
Influent Fine Screen	SC-0251	Ovivo Model FS600S-2mm	0.12 amps	0.75 hp	3 Ø 60 Hz 480 V
Pumps					
EO Pump #1	P-0211	Keen Model: KG2-23		2.00 hp	3 Ø 60 Hz 480 V
EO Pump #2	P-0212	Keen Model: KG2-23		2.00 hp	3 Ø 60 Hz 480 V
EQ Fullp #2	F-0212		1.00	2.00 mp	3 Ø 00 112 480 V
Denitrification Pump	P-0511	ABS Model: XFP 80C VX.3 -PE22/4	4.60 amps	3.00 np	3 Ø 60 Hz 480 V
Membrane Recirc. Pump	P-0711	ABS Model: XFP 100C CB1.4 PE 35/4		4.70 hp	3Ø 60 Hz 480 V
Permeate Pump #1	P-0811	Goulds Model: 1ST2C5A2		0.50 hp	3 Ø 60 Hz 480 V
Permeste Pump #2	P.0812	Goulds Model: 15T2C5A2		0.50 hp	2 0 60 H7 480 V
	F-0812			0.30 hp	30 00112 480 0
Backwash Pump #1	P-0911	Goulds Model: 25SH4J55C0		5.00 hp	3Ø 60 Hz 480 V
Backwash Pump #2	P-0912	Goulds Model: 25SH4J55C0		5.00 hp	3Ø 60 Hz 480 V
UF System Sump Pump	P-1011	Goulds Model: WE0534H	1.70 amps	0.50 hp	3 Ø 60 Hz 480 V
Permeate Tank (T. 08/1) LIV Pecirc Pump	P.0912	Goulds Model: 15T2C5A2	1.00 amps	0.50 hp	2 0 60 H7 480 V
	F-0813		1.00 amps	0.50 mp	30 00112 480 0
Final Effluent Pump #1	P-1111	ABS Model: XFP 80C CB1.2-PE20/6		2.70 hp	3Ø 60 Hz 480 V
Final Effluent Pump #2	P-1112	ABS Model: XFP 80C CB1.2-PE20/6		2.70 hp	3Ø 60 Hz 480 V
UF Membrane Acid CEB Metering Pump	P-0913	Walchem Model: LKN57A-VC	6.20 amps	0.33 hp	1Ø 60 Hz 120 V
LIE Membrane (NaOCI) CER Metering Pump	P-0014	Walchem Model: EHESSE1.VC	1.20 amps		1 Ø 60 Hz 120 V
	F-0314		1.20 amps		10 00112 120 0
UF Membrane (NaOH) CEB Metering Pump	P-0915	Walchem Model: EHE56E1-VE	1.20 amps		1Ø 60 Hz 120 V
Pre-Anoxic Tank Carbon Metering Pump	P-0311	Walchem Model: EWB31F1-VC M	1.20 amps		1Ø 60 Hz 120 V
Post Anoxic Tank Carbon Metering Pump	P-0712	Walchem Model: EWB31E1-VC M	1.20 amps		1Ø 60 Hz 120 V
Agration Tank Caustic Matering Dump	D 0411	Walcham Madel: EWR21E1 VE M	1.20 amps		1 0 60 47 120 1
	P-0411		1.20 amps		10 00 HZ 120 V
Blowers / Compressors					
Aeration Blower #1	BL-0451	Kaeser Model: CB131C		10.00 hp	3Ø 60 Hz 480 V
Aeration Blower #1 Ventilation Fan	VF-0453		0.39 amns	0.16 hn	3 Ø 60 Hz 480 V
Agratian Player #2		Kasser Medel: CP121C	5.55 Grip5	10.00 hm	2 0 60 11- 490 14
Aeration Blower #2	BL-0452	KAESEI IVIUUEI: CBISIC		10.00 np	5 00 HZ 480 V
Aeration Blower #2 Ventilation Fan	VF-0454		0.39 amps	0.16 hp	3Ø 60 Hz 480 V
Membrane Air Scour Blower	BL-0751	Becker Model: DX 4.40K	5.00 amps	2.90 hp	3Ø 60 Hz 480 V
Process Air Compressor	CMP-1251	Speedaire Model: ATW29	15.00 amos	5.00 hn	1 Ø 60 Hz 120 V
	00 1201		15.00 011155	5.00 mp	10 00112 120 0
Pressure Switch	PS-1221	Omega Pressure Switch: 3-100 psi			
Odor Control					
Odor Control #1	BL-1251	TEXP Fan AF-10-R11527-6	3.00 amps	2.00 hp	3Ø 60 Hz 480 V
Automatic Valvos					
Membrane Feed AV	AV-0733	6" Pneumatically Actuated Jomar Butterfly Valve PVC Sch80 w/ 24v solenoid & limit switch			24 V
Membrane Drain AV	AV-0734	6" Pneumatically Actuated Jomar Butterfly Valve PVC Sch80 w/ 24v solenoid & limit switch			24 V
Membrane Bypass Valve	AV-0735	3" Butterfly Valve w/ Pnuematic Actuator			
Do Agration AV/#1	AV 0726	2" Desumatically Actuated Jomar Butterfly Value DVC Sch20 w/ 24y calenoid & limit switch			24.1/
De-Aeration AV #1	AV-0750	2 Priedmatically Actuated Jonar Butterny valve PVC Schoo wy 24v solenoid & initi switch			24 V
UF Membrane Return Valve	AV-0737	8" Butterfly Valve w/Pnuematic Actuator			
Air Scour AV	AV-0739	1 1/2" Pneumatically Actuated Jomar Ball Valve Stainless w/ 24v solenoid & limit switch			24 V
Permeate AV	AV-0831	2" Pneumatically Actuated Jomar Butterfly Valve PVC Sch80 w/ 24v solenoid & limit switch			24 V
	AV 0027	2" Putterflu Value w/ Pruematia Actuator			
BW Bypass valve	AV-0937	3 Butterny valve w/ Phuematic Actuator			
Backwash AV	AV-0938	4" Pneumatically Actuated Jomar Butterfly Valve PVC Sch80 w/ 24v solenoid & limit switch			24 V
Air Scour to Permeate AV	AV-0939	1 1/2 " Pneumatically Actuated Jomar Ball Valve Stainless w/ 24v solenoid & limit switch			24 V
Instrumentation					
Mansharana Curra Flagt Curitale #1	16 1021	Concern Neuropelly Open Flact Switch Madel 2000 P0 51 51 40			2414
Membrane Sump Float Switch #1	LS-1021	Conery Normally Open Float Switch Model 2900-B8-S1-C1-40			24 V
Membrane Sump Float Switch #2	LS-1022	Conery Normally Open Float Switch Model 2900-B8-S1-C1-40			24 V
Membrane Sump Float Switch #3	LS-1023	Conery Normally Open Float Switch Model 2900-B8-S1-C1-40			24 V
Post Anoxic Tank High Level Float Switch	15-0631	Copery Normally Open Float Switch Model 2900-88-51-C1-40			24 V
50 Lovel Concern	16 0001	Manual Carles DBLTD & DBLTV			241
EQ Level Sensor	LS-0221	Miecola Series PBL12 & PBL1X			24 V
Post Anoxic Tank Level Sensor	LS-0621	Mecoid Series PBLT2 & PBL TX			24 V
Permeate / Backwash Tank Level Sensor	LS-0825	Dwyer Industrial Pressure Transmitter 626-07-CH-P1-E5-S1 (0-15 psi)			24 V
Final Effluent Tank Level Sensor	LS-1121	Mecoid Series PBLT2 & PBL TX			24 V
	10 1121	Vibey Medel (SV4.01.0C N.C			24 V
De-Aeration vibrating Level Switch	LS-0724				24 V
EQ Flow Meter	FM-0222	2" Siemens MAG 5100W Flow Meter w/ MAG 5000 Transmitter (7ME6580-2YJ14-2LA2)			1Ø 60 Hz 120 V
Membrane Feed Flow Meter #1	FM-0721	6" Siemens MAG 5100W Flow Meter w/ MAG 5000 Transmitter (7ME6580-4HJ14-2LA2)			1Ø 60 Hz 120 V
Permeate Flow Meter #1	FM-0823	2" Siemens MAG 5100W Flow Meter w/ MAG 5000 Transmitter (7ME6580-2YI14-2LA2)			1Ø 60 Hz 120 V
Backwash Skid Elow Motor	EM 0021	4" Siemens MAG 5100W Flow Meter w/ MAG 5000 Transmitter (7MEGE90 2T11 / 2LA2)			1 0 60 47 120 1
	TWI-0321				10 00112 120 V
Denitrification Flow Meter	FM-0521	3" Siemens MAG 5100W Flow Meter w/ MAG 5000 Transmitter (7ME6580-3MJ14-2LA2)			10 60 Hz 120 V
Dosing Pump #1 Flow Meter	FM-1125	4" Siemens MAG 5100W Flow Meter w/ MAG 5000 Transmitter (7ME6580-3TJ14-2LA2)			1Ø 60 Hz 120 V
Dosing Pump #2 Flow Meter	FM-1127	4" Siemens MAG 5100W Flow Meter w/ MAG 5000 Transmitter (7ME6580-3TJ14-2LA2)			1Ø 60 Hz 120 V
Aeration Tank & Membrane nH Controller	AIC 0421	Walchem WDP/20-5-2-N-II nH Controller			1 0 60 47 120 1
	AIC-0421				10 00 HZ 120 V
Aeration Tank pH Probe	PH-0421	waicnem WEL-PHF-2-1 Probe			
Membrane pH Probe	PH-0821	Walchem WEL-PHF-2-1 Probe			
Pre & Post Anoxic ORP Controller	AIC-0321	Walchem WDP 420-5-2-5-U pH Controller			1Ø 60 Hz 120 V
Pro Anovic OPP Proho	OPD 0221	Walchem WEL MVE 2.1			
POST ANOXIC UKP Probe	OKP-0721	waicnem WEL-MIVE-2-1			
Effluent pH Controller	AI-1126	Walchem WDP410-5-2-N-U pH Controller			
Effluent pH Probe #1	PH-1126	Sensorex S656CD Electrode w/ S675 12" Insertion Assembly & Walchem Preamp 190783			
Effluent nH Probe #2	DH 1120	Sensorey S656CD Electrode w/ S675 12" Insertion Assembly 9: Walsham Prozent 100793			
	11-1128	Sensorex 303000 Electrode w/ 3073 12 Thise tron Assembly & Walchem Preamp 190783			1 d co
Dissolved Oxygen Controller	AIC422	Hach - Part#: LXV404.99.00552 SC200 Controller, AC-DC, 2 DIG			тØ 60 Hz 120 V
Dissolved Oxygen Probe	DO-0422	Hach - Part#: 9020000 ASSY, Probe, LDO Model 2, 10M			
Membrane Feed Pressure Transmitter #1	PI-0722	Mercoid Model 3200G-2-FM-1-1-LCD (Scaled 0 to 30 PSI)			24 V
Permeate Pressure Transmitter #1	PI_0822	Mercaid Madel 3200G-1-FM-1-1-I CD (Scaled -10 to 20 PSI)			24.1
	FC 07				24 V
Iviembrane Air Flow Switch	+5-0/25	KODOIG IVIODEI KAL-8115 Thermal air flow switch			24 V
Membrane Feed Temperature Transmitter #1	TE-0723	Dwyer TTW-106 (6" probe length) w/ TE-TNS-N064N-14 thermowell (6" length, 1/2" NPT)			24 V
Turbidity Meter #1	TM-0824a	HF Scientific MicroTol Online Turbidity Analyzer Model #20053			1Ø 60 Hz 120 V
Turbidity Meter Solenoid Valve #1	SV-08312	ASCO Solenoid Valve Model 8262G007 (stainless steel 1/4" NPT 24\/)		72	24.14
	00012			,,,,	24 V
Item Description	P&ID	Description	FLA	HP	Electrical
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Anoxic/Aeration Mixing					
Pre-Anoxic Mixer	MI-0351	ABS Model RW3021 – 2.3HP	4.00 amps	2.30 hp	3Ø 60 Hz 480 V
Post Anoxic Mixer	MI-0651	ABS Model RW3021 – 2.3HP	4.00 amps	2.30 hp	3Ø 60 Hz 480 V
Aeration Tank Mixer	MI-0451	ABS Model RW3021 – 2.3HP	4.00 amps	2.30 hp	3Ø 60 Hz 480 V
Aeration System					
Aeration Tank Aeration System	AE-0451	EDI Model Flexair 84P Magnum			
UV Disinfection					
UF System UV Unit	UV-0851	Aqua Azul Ultraviolent Disinfection Equipment - Model IVM-15-HO	3.00 amps		1Ø 60 Hz 120 V
Permeate Tank UV Unit	UV-0852	Aqua Azul Ultraviolent Disinfection Equipment - Model IVM-15-HO	3.00 amps		1Ø 60 Hz 120 V
Control Panel					
Main Control Panel		Control Panel			

## SECTION 3: PRE-COMMISIONING SYSTEM CLEANING / FLUSHING RECOMENDATIONS

The following steps are recommended for the cleaning / flushing procedure.

- 1. Prior to cleaning the trash traps the site contractor should verify that the gravity sewer system (lines and manholes) are free of dirt, mud and miscellaneous debris, if any of these items are found to exist the gravity sewer system should be flushed and cleaned.
- 2. The EQ piping from the fine screen back to the EQ tank should be blown clean with air to remove PVC shavings and miscellaneous debris.
- 3. Once the gravity sewer system is clean and the EQ pump discharge lines have been blown down the trash traps and EQ tank should be swept clean. Once clean, the EQ tank can be filled with clean water which will be used for commissioning the plant.
- 4. It is recommended that all pipe runs be blown out with compressed air before they are terminated on each end. The purpose is to remove PVC pipe shavings and other debris that may have entered the piping system during construction. Failure to carry out this step could result in plastic shavings and or miscellaneous debris entering the process tanks which may prove difficult if not impossible to remove once the tanks are filled with water. This debris could cause damage to the membrane systems and cause nuisance clogging of the UV systems and pumps.
- 5. All process tanks (anoxic, aeration, permeate and final effluent) should be inspected for cleanliness and swept/vacuumed cleaned if debris is present, once this is complete the process tanks can be filled with clean water. Prior to filling the tanks with clean water all isolation valves for pumps, UV skids, UF skids etc. should be closed to prevent water from entering this equipment (equipment vendor should be present at the time the equipment is filled with water).

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## SECTION 4: START UP PROCEDURES

#### 4.1 PRE-INSTALLATION STORAGE CONDITIONS

The membranes can be stored in their original packaging for a maximum of 9 months after date of shipment from manufacturer. During the initial storage period before installation they must be kept between 1.7°C - 15°C (35°F - 40°F). The membranes should be stored inside and protected from direct sunlight, rain, moisture, freezing conditions, and dust.

#### 4.1.1 CHECK LIST PRIOR TO COMMISSIONING

NOTE: Prior to filling the system with clean water the following items should be verified with the installation contractors.

- *Review P&ID's to verify system is constructed as designed.*
- Verify that all piping is installed and properly supported and all pipe joints are secure.
- Verify all electrical wires are run and terminated.
- Verify that all control circuits have been loop tested.
- Verify the tanks have been cleaned (i.e. no loose debris, dirt etc.).
- Verify that all process pipes are free of debris (i.e. PVC shavings, foreign debris etc.).
- Verify that there is sufficient clean water (<1 NTU) to fill the appropriate tanks in order to complete commissioning.
- Verify that a suitable point of discharge exists for any water that may need to be discharged from the system.

#### 4.1.2 PRE- COMMISIONING – CHECK LIST

See appendix in this section of the manual.

#### 4.2 COMMISIONING (WITH "DUMMY" MEMBRANES INSTALLED)

It is recommended that dummy modules be used for the upfront commissioning tasks which include of flushing the piping system and setting the membrane feed pump PID control loops. Failure to use dummy modules could result in damage to the membranes from foreign debris and or water hammer due to erratic pump or valve control.

#### 4.2.1 CHECK LIST PRIOR TO MEMBRANE INSTALLATION

Once the contractor has verified that all tanks and piping are debris free commissioning with dummy modules can begin.

#### NOTE: Debris left in the system in result in membrane failure and reduce pumping capacities!

Prior to running any automatic sequences the following items will be checked/performed.

- Set pump ramping and deceleration speeds.
- Verify instrument scaling of 4-20 ma signals.
- Verify valve limit switches are working for both open and closed valve positions.
- Verify mufflers on the automatic valves are operating properly to control the speed of opening and closing.
- Verify alarm timers for valve to reach position are working properly.
- Verify sequencing of valves in automatic mode for all sequences.
- Verify readings that are to be data logged.
- Power failure procedures and structured startup when power returns.
- Set minimum tank levels for pumps to operate and verify they work.
- Verify instrument air supply switch fault is working.

Commissioning with dummy modules will include testing the following sequences:

- Filtration
- Backwash
- Drain/Flush
- CEB (chemically enhanced Backwash)
- Relax/Drain Fill
- Idle A
- Idle B

Testing for each sequence should include:

- Verify correct sequence operation.
- Verify all counters are working and the system reacts appropriately when counter set points are reached.
- Test all potential faults for each sequence being tested and verify that the system reacts properly.

### 4.2.2 COMMISIONING (WITHOUT MEMBRANES INSTALLED) – CHECK LIST

See appendix in this section of the manual.

#### 4.2.3 MEMBRANE MANUFACTURE COMMISIONING – CHECK LIST

See appendix in this section of the manual.

#### 4.3 COMMISIONING (WITH MEMBRANES INSTALLED)

Once testing of the system with dummy modules is complete the membrane modules can be installed. Once the membranes are installed the system should be filled with water, membranes should never be left in an empty system as they may dry and become damaged. When initially filling the membranes with water open the appropriate valves, make sure the permeate valve and de-aeration valves are open. Allow the system to fill up slowly by gravity. Do not turn any pumps on until the membranes have filled with water completely.

Once the membranes are full run the membrane recirculation pump in manual to slowly flush the preservatives from the membrane. Take care to always start the pump up slowly and ramp the pump down slowly. Recirculate water thru the membranes for 5 minutes then stop the recirculation pump and close all valves.

At this time the system should be placed in auto mode and the following sequences shall be tested.

- Filtration
- Backwash
- Drain/Flush
- CEB (chemically enhanced Backwash)
- Relax/Drain Fill
- Idle A
- Idle B

Testing for each of these sequences should include:

- Verify pump PID flow controls and ramping speeds.
- Verify correct sequence operation.
- Verify all counters are working and the system reacts appropriately when counter set points are reached.
- Test all potential faults for each sequence being tested and verify that the system reacts properly.
- Verify all calculations performed by the PLC are correct (i.e. TMP, Flux, Permeability etc.).

Once this testing has been completed, run the system in automatic mode and monitor. This may require a pump to return permeate to the process tanks. Take caution that any tank that handles process water should be thoroughly cleaned. Once the system has run in automatic mode and all sequences have been triggered automatically by the PLC, the membranes should be cleaned. Determine how long the membranes are going to be out of service and then refer to the shutdown procedures for the membranes to determine appropriate cleaning procedure.

### 4.3.1 COMMISIONING (WITH MEMBRANES INSTALLED) – CHECK LIST

See appendix in this section of the manual.

#### 4.4 PROCESS GUIDELINES

The wastewater treatment system at the North Reading High and Middle Schools Is designed to treat 17,500 gallons per day at 10°C - 15°C (50°F - 59°F). The design parameters for the Airlift UF system are as follows:

- Recirculation flow 400 GPM per train
- Membrane airflow 6 CFM per membrane
- Design Flux 17.6 GFD
  - *Permeate flow = 17.4 GPM per train*
- Filtration TMP Range 1.5 4.5 PSI
- BW Flux 177 GFD
  - *BW Flow = 180 GPM*
- BW TMP Range 7 14 PSI

- BW Timing
  - Occurs every 5-10 min for 10-20 seconds at a time
- Membrane Drain occurs approximately 4-5 times per day
- Membrane CIP occurs approximately every 4 weeks
- pH Range:
  - o 6.5-7.5 within system
  - $\circ$  1 12 during a cleaning

NOTE: These values are guidelines and operational values will vary greatly depending on how the system is run. System set-points on the OIT should be set by operator to optimize system performance based on actual flow characteristics in to the plant.

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## **PRE-COMISSIONING - CHECK LIST**

ITEM NO.	PRE-COMMISSION TASK	YES	NO	N/A	COMMENTS/REMARKS
1	Has the UF plant been built according to the final P&ID?				
2	Has the UF plant been built according to the final technical drawings?				
3	Is the UF plant mechanically complete? Piping is installed, properly supported & leak-free?				
4	Is the UF plant electrically complete? (including I/O loop test and pump rotation checks)				
5	Has the control software been finished satisfactory?				
6	Has the data trending/monitoring been set up?				
7	Will enough clean water (< 1 NTU) be available for testing and flushing?				
8	Is there a suitable point of discharge that exists for any water that may need to be discharged?				
9	Have the proper strainers been installed?				
10	Have all tanks, equipment and piping been cleaned and pressure/leak tested?				
11	Have all chemical dosing sets been cleaned and pressure/leak tested?				

#### **COMMISSIONER SIGNATURE**

DATE

(PRINT NAME)



#### COMMISIONING (WITH "DUMMY" MEMBRANES INSTALLED) - CHECK LIST

	-				
ITEM NO.	TASK	YES	NO	N/A	COMMENTS/REMARKS
1	Have you verified with the contractor that all tanks/piping/equipment are debris free?				
2	Have all instruments been calibrated and scaled to the proper 4-20 ma signals?				
3	Have the orientation of all manual valves been check?				
4	Have you manually actuated each valve to verify limit switches/speed mufflers are operating properly?				
5	Have you verified that alarm timers for valves to reach position are working properly?				
6	Have you verified proper valve sequencing in automatic mode for all phases of operation?				
7	Have you verified that air supply pressure switch fault is working properly?				
8	Have minimum tank levels been set with clean water for pump operation? Do the pumps work?				
9	Have the pump ramping and decel speeds been set?				
10	Have power failure procedures and structure start-up when power returns been tested?				
	For each sequence, verify correct sequence operation? (Check)				
	FiltrationRelax/Drain Fill				
	BackwashIdle Mode A				
11	Drain/FlushIdle Mode B				
	CEB (Chemically Enhanced Backwash)				
	For each sequence, verify all counters are working & the system reacts appropriately when counter set points are reached				
	FiltrationRelax/Drain Fill				
	Backwash Idle Mode A				
12	Drain/Flush Idle Mode B				
	CEB (Chemically Enhanced Backwash)				
	For each sequence, have all potential faults been tested and verified that the system reacts properly				
	Filtration Relax/Drain Fill				
	Backwash Idle Mode A				
13	Drain/Flush Idle Mode B				
	CEB (Chemically Enhanced Backwash)				
14	Are the required chemicals in the correct concentration available?				
15	Have the CEB's been checked for the right pH and/or chemical soak concentrations?				
16	Has a continuous-run test been performed satisfactorily?				

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**Technical Bulletin** 

Process commissioning checklist AirLift systems



#### **Related documents**

Doc. No.	Originator	Description
-	Pentair	Standard Process Control Philosophy Skid / Megablock

#### List of abbreviations

Abbreviation	Description
BPD	Basic Process design
BW	Backwash
CEB	Chemical Enhanced Backwash
CIP	Cleaning in place
FAT	Factory acceptance test
РСР	Process Control Philosophy
PLC	Programmable logic controller
ТМР	Trans membrane pressure
UF	Ultrafiltration
UPS	Uninterrupted power supply

#### Glossary

Term / name	Description
Airflow Integrity Test	Procedure for testing integrity of an UF unit and locating individual compromised membrane
	housings within the UF unit, by pressurizing the feed side of the UF unit with air and measuring the
	displaced water flow leaving the permeate side of the UF unit.
Backwash	Reversing the filter flow and using a small portion of the permeate to remove the fouling from the
	membrane.
Membrane	Polymeric material with the capability of separating a solute (e.g. water) from insoluble matter (e.g.
	bacteria)
Membrane housing	Tube containing one or more membrane modules
Membrane element	Replaceable element containing a set of membranes
Permeate	The filtered water leaving the UF system
UF unit	Independently operable UF system, consisting of one or more membrane housing with membranes,
	which is fed with (pre-treated) feed water.



#### Contents

1	Introdu	uction	
2	Phase A	A – Pre- commissioning	5
3	Phase E	B – Wet testing without membranes	7
4	Phase C	C – Membrane loading	
5	Phase [	D – Process startup	
	Annex I	Comments phase A	
	Annex II	Comments phase B	
	Annex III	Comments phase C	
	Annex IV	Comments phase D	



## 1 Introduction

In this document a general overview of the standard commissioning is shown. This document can be used as a guidance to go from one step to the next step in the commissioning.

Each step in the commissioning has a checklist that can be used to check the progress of that certain step.

In general the commissioning period is split up in several periods:

- Pre-commissioning: A check to see if the construction phase of the plant is completed and to check if all conditions are met to be able to start the commissioning.
- Wet test without membranes: All automatic programs including all program steps, alarms, settings etcetera are checked. Dummies or old modules are used to be able to test
- Membrane loading: Loading of the membranes in the skid
- Startup: Finalize settings on pumps, record settings etcetera, startup bioreactor.

The above is a general overview of the commissioning period, if specific situations require adjustments to this sequence care must be taken not to damage the new membranes or other process equipment.





# 2 Phase A – Pre- commissioning

(Comments can be included in Annex I)

Item	Check	
A1	Has the UF plant been built according to th	e final P&ID?
	Yes	
	No	Not applicable
A2	Has the UF plant been built according to the final technical drawings?	
	Yes	
	No	Not applicable
A3	Is the UF plant mechanically complete?	
	Yes	
	No	Not applicable
A4	Is the UF plant electrically complete? (inclu	ding I/O loop tests and rotation checks)
	Yes	_
	No	Not applicable
A5	Has the software FAT been finished satisfac	:tory?
		Not applicable
A6	Has the data trending/ monitoring been se	t up?
		Not applicable
A7	Will enough clean water (< 1 NTO) be availa	able for testing and flushing (phase B and C)?
	Vec. enough with the use of a recycle	$(\Box$ Recycle installed and ready to use)
<u> </u>	Ls a sufficient amount of blind flanges avail	Not applicable
70		
Δ9	Have provisions been made to divert the pr	ermeate flow during membrane flushing?
1.5		
		Not applicable
A10	Is information given on surge analysis?	
	Yes	
	No	Not applicable
A11	Has the permeate discharge a (tendency to	) siphoning?
Yes, see measures taken in Annex I		



Item	Check	
	No [	Not applicable
A12	Has the concentrate discharge a (tendency to)	siphoning?
	Yes, see measures taken in Annex I	
		Not applicable
A13	Have the backwash and chemical dosing pump	strainers been installed?
	Yes	
	No	Not applicable
A14	Have all tanks, equipment and piping been clea	aned and pressure/leak tested?
	Yes	
	No [	Not applicable
A15	Have all chemical dosing sets been cleaned and pressure/leak tested?	
	Yes	
	No [	Not applicable



# **3** Phase B – Wet testing without membranes

(Comments can be included in Annex II)

Item	Check	
B1	Checks in Pre-treatment unit	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B2	Checks in Bioreactor unit	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B3	Checks in Filtration program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B4	Checks in (Stream-)Backwash program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B5	Checks in Drain program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B6	Checks in CEB Sodium hypochlorite program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B7	Checks in CEB citric acid program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	



Item	Check	
B8	Checks in Relaxation program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B9	Checks in Drain(-fill) program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B10	Checks in Fault routine A program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B11	Checks in Fault routine B program	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B12	Checks in Draintank unit	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B13	Checks in Dosing set NaOCl unit	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B14	Checks in Dosing set CA unit	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	



Item	Check	
B15	Checks in permeate tank unit	
	Program sequence	Start conditions
	Control loops	Stop conditions
	Calculations	Fault conditions
	Availability conditions	
B16	Have controls / equipment been set-up to a	void pressure shocks and flow surges during
	operation?	
	Yes	
	No	Not applicable
B17	Are the required chemicals in the correct co	ncentration available?
	Yes	
	No No	Not applicable
B18	Have all instruments been calibrated (chemi	cal dosing sets, I/O's etc)?
	Yes	
	No No	Not applicable
B19	Have the CEB's been checked for the right p	H and/or chemical soak concentrations
	Yes	
	□ No	Not applicable
B20	Have continuous-run test been performed s	atisfactorily
	Yes	
	No	Not applicable



# 4 Phase C – Membrane loading

(Comments can be included in Annex III)

Item	Check				
C1	Has the UF plant been (re)checked on cleanness before membrane module assembly (Especially				
	permeate and backwash side) Is the feed (from bioreactor) free of dirt?				
	Yes				
	No Not applicable				
C2	Is there clean water available to store the membranes after flushing?				
	Yes				
	No Not applicable				
C3	Are membranes, facilities (people etc.) and required tools available?				
	Yes				
	No Not applicable				
C4	Have the membrane module positions been recorded?				
	Yes, see Membrane module load record sheet (Annex IV of membrane module assembly)				
	No				
	Not applicable				
C5	Has membrane flushing been executed according to the X-flow flushing procedure ?				
	Yes				
	No Not applicable				
C6	Has the permeate and backwash side of the UF plant been disinfected after membrane flushing?				
	Yes				
No Not applicable					



# 5 Phase D – Process startup

(Comments can be included in Annex IV)

Item	Check					
D1	Are the PID controllers adjusted to the process conditions after startup / seeding					
	Yes					
	No	Not applicable				
D2	Is the UF permeate quality within specification	ons?				
	Yes					
	No	Not applicable				
D3	Have all parameter settings been recorded?					
	Skid	Pre-treatment				
	Filtration	Bioreactor				
	🗌 (Stream-)Backwash	Drain tank				
	Drain	Dosing set NaOCI				
	CEB NaOCI	Dosing set CA				
	CEB CA	Permeate tank				
	Relaxation					
	Drain(-fill)					
	Fault routine A					
	Fault routine B					
D4	Is the UF feed water quality and the MLSS from the bioreactor within specifications?					
	Yes					
	No	Not applicable				





## Annex I Comments phase A

Note	Comments
A1	
A2	
A3	
A4	
A5	
A6	
/ 10	
Δ7	
48	
70	
٨٩	
AJ	
A10	
AIU	



A11	
A12	
A13	
A14	
A15	



## Annex II

## Comments phase B

Mate	
Note	Comments
B1	
B2	
D2	
DD	
B4	
B5	
BO	
B7	
27	
B8	
89	
B10	



B11	
B12	
B13	
B14	
B15	
B16	
B17	
B18	
B19	
B20	



# Annex III Comments phase C

Note	Comments
C1	
C2	
C3	
C4	
C5	
C6	



# Annex IV Comments phase D

Note	Comments
D1	
D2	
D3	
D4	



## **COMMISIONING (WITH MEMBRANES INSTALLED) - CHECK LIST**

ITEM NO.	TASK	YES	NO	N/A	COMMENTS/REMARKS
1	Has the UF plant been re-checked on cleanness? Is the feed from bioreactor debris/dirt free?				
2	Is there clean water available to store the membranes after flushing?				
3	Are membranes, facilities (people etc.) and required tools available?				
4	Have the membranes been installed properly, hardware tightened and positions been recorded?				
5	Has membrane hushing been executed according to BioprocessH2O/X-Flow procedure?				
6	Has the nermeate and backwash side of the LIE plant been disinfected after membrane flushing?				
	has the permetate and backwash side of the or plant been disinceted area memorane hashing.				
7	Are the PID controllers adjusted to the process conditions after startup/seeding?	1			
8	For each sequence, verify correct sequence operation? (Check)     Filtration   Relax/Drain Fill     Backwash   Idle Mode A     Drain/Flush   Idle Mode B     CEB (Chemically Enhanced Backwash)   Idle system reacts appropriately when counter set points are reached?				
9	FiltrationRelax/Drain Fill BackwashIdle Mode A CEB (Chemically Enhanced Backwash)				
10	For each sequence, have all potential faults regarding membranes been tested and verified that the system reacts properly     Filtration   Relax/Drain Fill     Backwash   Idle Mode A     Drain/Flush   Idle Mode B     CEB (Chemically Enhanced Backwash)   Certain Comparison of the system comparison of t				
11	Have all parameter settings been recorded? Verify all calculations performed by PLC are correct (TMP, Flux, etc.)				
12	Have you run the system in automatic mode to verify that system is working properly?				
13	Determine how long membranes will be out of service. Have you performed proper membrane storage/cleaning procedure?				

COMMISSIONER SIGNATURE

DATE

(PRINT NAME)

## SECTION 5: MAINTENANCE

Refer to following lists for Operational Check Lists and Preventative Maintenance Schedules. Daily logs need to be established and maintained with information required from check lists and schedules for the process guarantee and equipment warranties to be valid. THIS PAGE INTENTIONALLY LEFT BLANK



### WASTEWATER TREATMENT PLANT - OPERATIONS CHECK LIST

NOTE: The following operation and maintenance schedules need to be followed and recorded in order for the process guarantee and equipment warranty to be valid.						
TASK DESCRIPTION	FREQUENCY	NORMAL / ABNORMAL				
Faults						
Any faults present - List faults and times	Daily					
Note corrective action taken						
Record temperature of Motors and Gearboxes						
Fine Screen Motor	Daily					
Permeate Pump #1	Daily					
Permeate Pump #2	Daily					
Airlift blower	Daily					
Aeration Blower #1	Daily					
Aeration Blower Fan #1	Daily					
Aeration Blower #2	Daily					
Aeration Blower Fan #2	Daily					
Backwash pump #1	Daily					
Backwash pump #2	Daily					
UV recirc pump	Daily					
Odor Control Blower	Daily					
Oil Levels - Confirm Oil level / are leaks visible						
Air Compressor	Daily					
Aeration Blower #1	Daily					
Aeration Blower #2	Daily					
Citric Acid Pump	Daily					
Hatches	Duity					
Inspect inside each hatch	Daily					
Note any abnormal conditions	Daily					
Verify Eloats are clean and have free range of motion	Daily					
Screen	Dully					
Open Screen batch to verify screen is working effectively						
ie. Screens are not clogged, solids are being brought to the screen basket	Daily					
Tin float to verify EQ numn interlock takes place	Daily					
Ensure float is clean and has free range of motion						
ch Brobos						
Verify nH value with standard and calibrate if value shifts more than 0.1	Daily					
	Dully					
Remove Prohe and clean	Weekly					
	WEEKIY					
Drain turbidimeter, clean incide of housing, verify reading against standard	Weekly					
Prossure Transmitters	Weekiy					
Fluch dianhragm	Weekly					
Chemicals	Weekiy					
Record level in the chemical containers	Weekly					
Sodium Hypochlorite	Weekty					
Sodium Hydroxide						
Record gauge reading on nulcation Damoner	Daily					
Verify chemical metering numps are nrimed	Daily					
Note any visible leaks in metering pumps and associated nining/tubing	Daily					
Trach Trans	Daily					
Visually inspect inside batch. Note any abnormalities	Weekly					
FO Tank	VVCENIY					
Record Liquid Level	Daily					
Varify liquid level	Daily					
vering inquire even in tank visually and commin level transmitter reduing	Daily					
Necord Flow setnoint	Daily					
Record Flow Setpoint						
	ві-ууеекіу					
rie-Alluxiu Idlik	Dailt	105				
visually inspect inside natch, note any adhormalities.	Dally					

Verify mixing of tank contents	Daily	
Verify ORP probe calibration against a standard. If reading is off by more than 0.1, calibrate the unit.	Weekly	
Record ORP.	Daily	
Aeration Tank		
Confirm that mixing patterns are consistent.	Daily	
Manually trip the high level float to ensure float is in working order and alarm is called for.	Weekly	
Remove and clean DO Probe.	Weekly	
Verify ph probe calibration against a standard. If reading is off by more than 0.1, calibrate the unit.	Weekly	
Record pH.	Daily	
Record DO	Daily	
Dentrification		
Record Denitrification flow	Daily	
Record Totalized Denitrification flow	Daily	
Post-Anoxic Tank		
Visually inspect inside hatch. Note any abnormalities.	Daily	
Verify mixing of tank contents	Daily	
Verify ORP probe calibration against a standard. If reading is off by more than 0.1, calibrate the unit.	Weekly	
Record ORP.	Daily	
Aeration Blowers		
Record:		
Discharge Pressure	Daily	
Тетр	Daily	
Inlet Pressure	Daily	
Percent that the operating blower is running	Daily	
Ensure relief valves are working.	Weekly	
Membrane Skid		
Verify ph probe calibration against a standard. If reading is off by more than 0.1, calibrate the unit.		
Record:		
ph	Weekly	
Temperature	Daily	
Turbidity	Daily	
Concentrate Feed Pressure	Daily	
Permeate Pressure	Daily	
ТМР	Daily	
Flux	Daily	
Permeability	Daily	
Recirc flow meter reading	Daily	
Flush Pressure Transmitter diaphragm	Daily	
Permeate flow totalizer	Daily	
Visual leak inspection	Daily	
Ensure air release valve is functioning	Daily	
Backwash Skid		
Record UV intensity	Daily	
Record UV output in Percent	Daily	
Record Level in Permeate Tank	Daily	
Visual verification of Permeate Tank level readout	Daily	
Force Backwash and record:	Daily	
тмр	Daily	
Flow	Daily	
Lab Test Permeate for ammonia and nitrates	Twice a Month	
Test strip Permeate for ammonia and nitrates	Daily	
Odor Control		
Record Gauge Reading	Daily	
Air Compressor		
Record air pressure in line to pneumatic valves	Daily	
Drain receiver tank of condensate	Daily	
Drain filter/regulator	Daily	
Membrane Sump		
Manually trip high level float to ensure it is working.	Weekly	
Final Effluent Dosing Pump System	,	
Record Liquid Level	Daily	
Verify liquid level in tank visually and confirm level transmitter reading	, Daily	
Record totalized flow	Daily	
Record Flow setpoint	, Daily	
Verify ph probe calibration against a standard. If reading is off by more than 0.1. calibrate the unit.	, Weeklv	
Record pH.	, Daily	106



#### WASTEWATER TREATMENT PLANT - PREVENTIVE MAINTENANCE LIST

ITEM	MAINTENANCE TASK	FREQUENCY	
Hardware Connections	Check all bolt connections. Re-torgue as required.	6 Months	
Submersible Pumps	Pull, wash and inspect pump. Check seal chamber oil for water intrusion.	6 Months	
EQ	Jog Idle Unit	1 Month	
Denitrification	Check Seal Water/Glycol Mixture for Contamination - Top off if clean	12 Months	
Membrane Feed Pump	Check Mechanical Seals when oil is contaminated or if the seal failure indicating light is on	As Needed	
Membrane Drain Sump Pump	Inspect Cable for chafing, cuts or abrasions	3 Months	
	Inspect Impeller/Wear Plate/Wear Rings for any wear	As Needed, If Performance Has Decreased	
	Inspect Lifting chains	3 Months	
	Record Amp Draw	6 Months	
	Megger the motor with 500 MEGOHM meter. If reading is less than .5, than the motor should be		
	serviced.	6 Months	
	NOTE: Disconnect submersible motor cables at junction box prior to megging motor.		
Influent Screen	Refer to manufacturer's recommendations in IO&M (Section 12c)	Refer to Manual	
Mixers	Cleaning and inspection of the power and control circuit cables	1 Month	
Pre-Anoxic	Check the current consumption at the ampere meter	1 Month	
Aeration	Cleaning and inspection of the shackles and the lifting equipment	3 Months	
Post Anoxic	Insulation resistance check.	6 Months	
	Functional testing of the monitoring device	6 Months	
	Checking of the tightening torques of the screws and nuts	1 Year	
EDI Aeration System	Inspect aeration grid diffusers, supports brackets, nuts and bolts.	E Vegre	
	Replace and tighten as needed	5 fears	
Probes	When a calibration can not be performed to bring the reading within 0.1 replace the probe.	As Needed	
Aeration Blowers	Refer to manufacturer's recommendations in IO&M (Section 12a)	Refer to Manual	
Membrane blower	Check/clean air filter	Once a Month	
Membranes	Ensure Permeabilities are kept within desired range. Clean membranes as needed.		
	If membranes are going to be down for prolonged period of time fill membranes with	As Needed , If Performance Has Decreased	
	1% solution of sodium metabisulfite. Refresh chemicals every month.		
Backwash pumps	Grease motor bearings.	6 Months	
	Caution - Take care not to over-grease.		
UV unit	Refer to manufacturer's recommendations in IO&M (Section 17)	Refer to Manual	
Air Compressor	Inspect air filter element; replace as needed.	Weekly	
	Change oil	3 Months	
	Check for air leaks	Weekly	
	Replace air filter	12 Months	
	Check belt tension. Tighten and replace as needed.	Weekly	
Citric Acid LKN Chemical Metering pump	Replace Oil	12 Months	
	Check diaphragm; replace as needed.	6 Months	

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## SECTION 11: FINAL AS-BUILT DRAWINGS

- a. EW2.01 EW2.01b Power Water Treatment Plan
- b. RW3.1 WWTP Equipment & Piping Layout Plan
- c. RW4.1 Process Pipe Stub Up Schedule
- d. RW8.1 Inside WWTP Underground Tankage Details
- e. RW10.1 Process & I.D. Legend
- f. RW11.1 RW12.1 Process & I.D. Plan
- g. RW13.1 WWTP Equipment Details Rev1
- h. RW14.1 WWTP Equipment Details Rev1
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			PO Conduit	Dimonsio	80V)			Description	Wiring and Ground (	Conduit Cor	nduit	Dimensions off	Flevation	Remarks
Description	Wiring and Ground	Conduit	Stub Up	Wall A	Wall B	elevation	Remarks	Beschption		Stu	-02A S	Vall A         Wall B           tub up in MCP (24 V) section		including
			P-0211A	Stub up in MCP (4	480 V) section			EQ Pump #1 and #2 Moisture / Therma	als 8#14	1" C  -	-02B	34'- 5½"	Through WWTP wall - to be run at elevation required by electrical code	To Junction Box (adjacent to Riser)
Powerto FO pump #1	3 # 12 & 1 # 126	3/4" C	P-0211B		34'- 9½"	elevation required by electrical code		EQ Pump #1 Moisture / Thermals	4#14	1-1/2" C  -0	0211A 0211B			From Junction Box (adjacent to Riser) Through EQ pump wall
			P-0211C				To Junction Box (adjacent to Riser)	EQ Pump #2 Moisture /Thermals	4#14	1-1/2" C  -0	0212A 0212B			From Junction Box (adjacent to Riser) Through EQ pump wall
		1-1/2"C	P-0211D P-0211E				From Junction Box (adjacent to Riser)       Through EQ pump wall		18/2 TWSH	3/4" C  -0	0221A S 0221B	tub up in MCP (24 V) section 34'- 1½"	Through WWTP wall - to be run at	
			P-0212A	Stub up in MCP (4	480 V) section			EQ Level Sensor		-(  -(	0221C		élevátión required by éléctrical code	To Junction Box (adjacent to Riser)
		3/4" C	P-0212B		35'- 1½"	Through WWTP wall - to be run at elevation required by electrical code			18/2 TWSH	3/4" C  -C	02210 0221E 0222A St	ub up in MCP (120 V) section		Through EQ pump wall
Power to EQ Pump #2	3 # 12 & 1 # 12G		P-0212C				To Junction Box (adjacent to Riser)	Influent Flow Meter Power	2#14;1#14G	3/4" C P-(	0222B 3	9'- 1¼" 24'- 1½" tub up in MCP (24 V) section		
		1-1/2"C	P-0212D				From Junction Box (adjacent to Riser)	Influent Flow Meter signal	18/2 Twsh	3/4" C I-C	0222B 3 0251A S	8'- 11¼" 24'- 1½" tub up in MCP (24 V) section		
	3 # 14 & 1 # 14G	3///" C	P-0211E P-0251A	Stub up in MCP (4	480 V) section		through EQ pump wall	Aeration Mixer, Pre Anoxic Mixer,	2 # 15	3/4" C  -0	0251B 3 -03A S	6'- 10%" 24'- 8%" tub up in MCP (24 V) section		Moisture thermals are in same cord as
	5#14 & I # 140	5/4 C	P-0252B	37'- 4½"	24'- 5½" 480.V) section			and Denite pump moisture thermals	1 @ 18/5 TW/SH	1-1/2  - 3/4" C  -C	-03B 2 0321A	4'- 4¼" 28'- 5½" 0'- 3" 27'- 10½"		power for mixers and pump
<sup>o</sup> re - Anoxic Mixer	Cable from motor to be pulled through this conduit	1-1/2" C	P-0351A	25'- 2¼"	section	85.24'	Conduit to run on top of tank and either below				0321B 2 0321C 2	5'- ¼'' 28'- 2¼" 5'- ¼'' 28'- ¼"		
	2#10.0.1 #105	111.0	P-0451A	Stub up in MCP (4	480 V) section		or through hatch side wall	Pre Anoxic ORP Probe to Pre-Amp	pull string	3/4" C I-C	0321D 2	6'- %"	85.24'	Conduit to run on top of tank and either below or through hatch side wall
Aeration Blower #1	3#10&1#100	I C	P-0451B	18'- 7¼"	28'- 3½"			Controller to Aeration pH Pre-amp	1 @ 18/5 TWSH	3/4° C  -0	0421A 0421B 2 0421C 2	0'- 3'         28- ½'           5'- ¼''         28'- 6¼''           5'- ¼''         28'- 4¼''		
Aeration Blower Enclosure Fan #1	3 # 14 & 1 # 14G	3/4" C	P-0453B	18'- 4¼"	28'- 3½"			Aeration pH Probe to Pre-Amp	pull string	3/4" C	04210 2 0421D 2	1'- 8¼"	85.24'	Conduit to run on top of tank and either below or through hatch side wall
Aeration Blower #2	3 # 10 & 1 # 10G	1" C	P-0452A P-0452B	Stub up in MCP (4	480 V) section			DO meter power	2#14;1#146	3/4" C P-(	0422A St 0422B 2	ub up in MCP (120 V) section 0'- 7%" 35'- 4%"		From MCP
Aeration Blower Enclosure Fan #2	3 # 14 & 1 # 14G	3/4" C	P-0454A	Stub up in MCP {	480 V) section			DO Meter to MCP 4-20 ma	18/2 twsh	3/4" C  -0	0422A S 0422B 2	tub up in MCP (24 V) section 0'- 4¼" 35'- 4¼"		
			P-0454B P-0511A	12'- 2¾" Stub up in MCP (4	28'- 3½" 480 V) section			Do probe to DO meter	pull string	3/4" C  -0	0422C 2 0422D 2	0'- 1¼" 35'- 4¾" 0'- 1¼"	85.24	Conduit to run on top of tank and either
Jenite Pump	3 # 12 & 1 # 12G	1-1/2" C	P-0511B	24'- 5½"		85.24'	Conduit to run on top of tank and either below	Denite Flow meter Power 120V	2#14;1#14G	3/4" C P-(	0521A St 0521B 7	ub up in MCP (120 V) section 9'- 7%" 20'- 612"		verow or through natch side wall
	Cable from motor to be		P-0551A	Stub up in MCP (4	480 V) section			Denite Flow Meter Signal	18/2 Twsh	3/4" C I-0	0521A S 0521B 3			
Aeration Tank Mixer	pulled through this conduit	1-1/2" C	P-0551B	23'- 7"		85.24'	Conduit to run on top of tank and either below or through hatch side wall	Post Anoxic Level Sensor	18/2 TWSH	3/4" C	0621A S	tub up in MCP (24 V) section	6C 7A1	Conduit to run on top of tank and either
	3 # 12 & 1 # 12G	3/4" C	P-0651A	Stub up in MCP (4	480 V) section					-(  -(	0621C	0'- 3'' 17'- 11½'' 17'- 8½''	ð5.24 <sup>-</sup>	below or through hatch side wall
<sup>2</sup> ost Anoxic Tank Mixer	Cable from motor to be		P-0651B	0'- 3"	15 - 4%" 15 - 7%"						0621D 0622A	20'- 4'' 0'- 3'' 17'- 5½"	85.24'	Conduit to run on top of tank and either
	pulled through this conduit	1-1/2" C	P-0651D	11'- 2½"		85.24'	Conduit to run on top of tank and either below or through hatch side wall	Post Anoxic URP Probe to Pre-Amp	puii string	3/4°C	0622B 1	1'- 8%" ub up in MCP (1201/) contion		uerow or through hatch side wall
	3 # 12 & 1 # 12G	3/4" C	P-0711A	Stub up in MCP (4	480 V) section			Airlfit skid 120V power Juncion Box	4#14;2#14G;3#16G	1" C P	-07B 2	2'- ¼" 14'- 1½" tub up in MCP (24 V) section		
Vembrane Recirc Pump	Cable from material ha		P-0711B P-0711C	0'- 3" 0'- 3"	15'- 1¼" 14'- 10¼"			Airlift Skīd FM-0721	TWSH 18/2 TWSH	3" C  -	-07B 2	0'- 7¾" 14'- 1½"		
	Cable from motor to be pulled through this conduit	1-1/2" C	P-0711D	10'- 8¼"		85.24'	Conduit to run on top of tank and either below	FM-0823 AV-0733	18/2 TWSH 6 @ 16 ; 1 @ 16g					
Airlift Blower	3#12&1#12G	3/4" C	P-0751A	Stub up in MCP (4	480 V) section			AV-0734 AV-0735	6@16;1@16g 6@16;1@16g					
			P-0751B P-0811A	13'- 8¼" Stub up in MCP (4	14'- 2¼" 480 V) section			AV-0736 AV-0737	6 @ 16 ; 1 @ 16g 6 @ 16 ; 1 @ 16g					
Permeate Pump #1	3 # 12 & 1 # 12G	3/4" C	P-0811B	21'- 3¼"	10'- 9½"			AV-0739 PI-0722	6 @ 16; 1 @ 16g 18/2 TWSH					
Permeate Pump #2	3 # 12 & 1 # 12G	3/4" C	P-0812A P-0812B	Stub up in MCP (4 21'- 6¼"	480 V) section 10'- 9½''			PI-0822 AV-0831	18/2 TWSH 6 @ 16 ; 1 @ 16g					
UV Recirc Pump	3 # 12 & 1 # 12G	3/4" C	P-0813A	Stub up in MCP (4	480 V) section			TE-0723 FS-0725	18/2 TWSH 4@16; 1 @ 16 g					
Backwach Pump #1	3 # 17 & 1 # 17G	3/4" C	P-0813B P-0911A	Stub up in MCP (4	480 V) section			TM-0824 Turbidity Meter	2 @ 16; 1 @ 16g; 18/2 TWSH 4@16; 1 @ 16g; 18/2 TWSH					
	5#1201#125	3,4 0	P-0911B	33'- 9"	3'- 8½" 480 V) section			AV-0938	6@16;1@16g 6@16;1@16g					
<sub>/</sub> ackwash Pump #2	3 # 12 & 1 # 12G	3/4" C	P-0912B	35'- 9"	3'- 51⁄2"			UF skid ph-0821 Pre-amp to controller	r 1@18/5TWSH	3/4" C  -0	0821A 0821B 1	0'- 3" 28'- 4½" 7'- 11" 10'- 9½"		
	3 # 12 & 1 # 12G	1" C	P-1011A P-1011B	Stub up in MCP (4 31'- 11"	480 V) section 15'- 7½"			UV-0851 Power	2@14;1@14g	3/4" C P-0	0851A St 0851B 3	ub up in MCP (120 V) section 1'- 4½" 11'- 6½"		
Vembrane Drain Sump Pump	Cable from motor to be	1-1/2" C	P-1011C	30'- 5"	15'- 7½"		Conduit to run on ton of tank and oither holow	UV-0851 Signal	18/2 TWSH	3/4" C  -0	0851A S 0851B 3	tub up in MCP (24 V) section 1'- 4%" 11'- 9%"		
	pulled through this conduit		P-1011D	28'- 8½"		85.24'	or through hatch side wall	UV-0852 Power	2 @ 14; 1 @ 14g	3/4" C P-0	0852A St 0852B 3	7'- 4½" 17'- 8¼"		
Dosing Pump #1 MCP to Junction box			P-1111A		480 V) section	Through W/M/TR wall to be run at		UV-0852 Signal	18/2 TWSH	3/4" C  -C	0852B 3 0825A S	7'- 4½" 18'- ½" tub up in MCP (24 V) section		
adjacent to Dosing tank riser	3 # 12 & 1 # 12G	1-1/2"C	P-1111B	8'- 7"		elevation required by electrical code			18/2 TWSH	3/4" C  -C	0825B 3 -09A St	1'- 4¼" 12'- ½" ub up in MCP (120 V) section		
Desing Dump #1 from junction how	Coble from meter to be		P-1111C				Located adjacent to Dosing Tank Riser		6@ 16 : 1 @ 166 : 1 @ 18/2 TM/S	3/4 C P	-098 3 -09A S	5'- 9" 6'- 2¼" tub up in MCP (24 V) section		
adjacent to Dosing tank riser to the pur	pulled through this conduit	1-1/2"C	P-1111E	Ch. l	496.2.1		Through Dosing Tank Wall	FM-0921	18/2 TWSH		-09B 3	5'- 9" 6'- 9¾"		
Dosing Dump #2 MCB to lungtion both			P-1112A	Stub up in MCP (4	480 V) section			AV-0937 Membrane Sump Floats	ა @ 16 ; 1 @ 16g 6 @ 16 ; 3 @ 16G	1"C	-10A S	tub up in MCP (24 V) section		
adjacent to Dosing tank riser	3 # 12 & 1 # 12G	1-1/2"C	P-1112B	8'- 11"		elevation required by electrical code		Membrane Sump Pump 1 + 2 moisture/thermals	18/2 TWSH	3/4" C I-1	1011B 3	15-7%"           1'-8"         15'-7%"		
			P-1112C				Located adjacent to Dosing Tank Riser	Mambrana Comp Floor 12 2005	7.0.15.1.0.10-	3/49.0	1021B 2	7'- 0" 14'- 5½"	ar = 11	Conduit to run on top of tank and either
Dosing Pump #2 from junction box adjacent to Dosing tank riser to the pum	cable from motor to be pulled through this conduit	1-1/2"C	P-1112D P-1112E				Located adjacent to Dosing Tank Riser Through Dosing Tank Wall	ivientorane sump Floats LS-1021	د به ۲۵ ; ۲ (۵۰ ۲۵ <sup>β</sup>	i-1 به المراجع ال-1	1021C 3	1- 2 15'- 7½" 9'- ½"	85.24	below or through hatch side wall
Odor Control Blower	3 # 12 & 1 # 12G	3/4" C	P-1251A	Stub up in MCP (4	480 V) section			Membrane Sump Floats LS-1022	2 @ 16 ; <b>1</b> @ 16g	3/4" C  -1	1022B 2 1022C 3	6'- 10" 14'- 5%" 0'- 11" 15'- 7%"	85.24	Conduit to run on top of tank and either
	1	1	12310		JL - J/4	1	J		+ +	-1  -1	1022D 2 1023B 7	8'- 11¼" 6'- 8" 14'- 5%"		Service of through flatch side Wall
								Membrane Sump Floats LS-1023	2 @ 16 ; 1 @ 16g	3/4" C  -1	1023C 3	0'- 8" 15'- 7½"	85.24	Conduit to run on top of tank and either below or through hatch side wall
								Dosing Pump		-1	1023D 2 -11A S	8'- 10" tub up in MCP (24 V) section		
								1 + 2 moisture/thermals and LS-1121 to junction box adjacent to riser	2 8 # 14 ; 1 @ 18/2 TWSH	1-1/2" C	-11B -11C	8'- 3" 0'- 3"		To Junction Box (adjacent to Riser)
								Ultrasonic Level Sensor LS-1121	18/2 TWSH	3/4"  -1	1121D 1121E			From Junction Box (adjacent to Riser) Through Dosing tank wall
			onduit	Chemical Line	es ins off			FM-1125 power	2@16;1@16g	3/4" C P-1	1125A St 1125B	ub up in MCP (120 V) section 9'- 5"2'- 3"		-
Description	Tubing	Conduit S	tub Up	Wall A	Wall B	Elevation	Remarks	FM-1125 signal	18/2 TWSH	3/4" C  -1	1125A S 1125B	tub up in MCP (24 V) section 9'- 3" 2'- 3"		
rbon To Pre-Anoxic 1/	2" poly line	1-1/2" C	CH-1A	0'- 3''	24'- 9½"		Conduit to run on top of tank and either	FM-1127 power	2 @ 16 ; 1 @ 16g	3/4" C P-1	1127A St 1127B 1	ub up in MCP (120 V) section S'- 5" 0'- 3"		
			СН-1В	27'- 7%" 0'- 2"	221 01/1	85.24'	below or through hatch side wall	FM-1127 signəl	18/2 TWSH	3/4" C  -1	112/A \$ 1127B 1 11260 00	tub up in MCP (24 V) section           5'- 3"           0'- 3"           up in MCP (120 V)*'		
ustic To Aeration 1/	2" poly line	1-1/2" C	CH-2B	21'- ¼"	26 - 3/2	85.24'	Conduit to run on top of tank and either	PH-1126 Power	2 @ 16 ; 1 @ 16g	3/4" C P-1	ST 	1'- 10¼" 0'- 3" tub up in MCP (24 V) section		
			CH-3A	0'- 3''	23'- 9½"		below or through hatch side wall	PH-1126 Signal	2 @ 18/2 TW5H	3/4" C  -1	1126A 1 2-14A St	1'- 8¼" 0'- 3" ub up in MCP (120 V) section		
rbon to Post-Anoxic 1/	2" poly line	1-1/2" C	СН-ЗВ		18'- 11½"	85.24'	Conduit to run on top of tank and either	CHEM FEED POWER	4@12;6@14;3@12G	1-1/2"C	P-14B	0'- 3'' 27'- 2½"		
B Chem #1	nyc sch 80 line		CH-4A	0'- 3''	25'- 9½"		below or through hatch side wall	Aeration Tank ph Controller Pre-Anoxic carbon Feed metering pun	2#12;1#125					
	pvc scri ou iine		CH-4B	20'- 11¼"	13 <sup>1</sup> - 11½" 21 <sup>1</sup> - 9½"			Aeration Tank Caustic Metering Pump Post Anoxic Carbon Metering pump	2 <b># 12</b> ; 1 <b>#</b> 12 G					
B Chem #2 1/	2" poly line	1-1/2" C	CH-5B	19'- 2''	21 - 9½ 10'- 9½"			CEB pump #1 Power CEB pump #2 Power	2#14;1#14G 2#14:1#14G					
B Chem #3 1/	2" Poly line	1-1/2" C	CH-6A CH-6B	0'- 3'' 18'- 11''	20'- 9½" 10'- 9½"			CEB pump #3 Power CHEM FEED SIGNAL	2 # 14 ; 1 # 14 G 4 @ 18/2 TW5H ; 6 @ 15	1-1/2" I-	-14A 5	tub up in MCP (24 V) section		
I	I	I		Air Lines	/*			ORP controller to MCP 4-20	2 @ 18/2 twsh		- 148	0'- 3" 27'- 5½"		
Description	Tubing	Conduit C	onduit tub Up	Dimensio Wall A	ns off Wall B			Ph Controller to MCP 4-20 CEB pump #1 Pulse from MCP	2 @ 18/2 Twsh 2 @ 16					
			A-1A	18'- 2¼"	0'- 3''			CEB pump #2 Pulse from MCP	2@10					
line to UF skid 3/	8" Poly line	1-1/2" C 🔶	Λ 1 0	121 =1/1	101 01/1			CEB pump #3 Pulse from MCP	2 @ 10	- I -	-154	tub up in MCP (24 V) section		





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# **CRITICAL NOTE:** FINAL OFFSETS FOR ELECTRICAL CONDUITS & PROCESS PIPING WILL BE ESTABLISHED AFTER THE FOUNDATION WALL IS POURED IN PLACE AND AS BUILT LOCATIONS ARE PROVIDED TO THE DESIGN ENGINEER. FINAL OFFSETS TO BE VERIFIED IN WRITING BY DESIGN ENGINEER BEFORE ANY INSTALLATION OF ANY CONDUITS OR PROCESS PIPING.

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# **GENERAL NOTES:**

1. MARKINGS SUCH AS CH-4A, DL-9, DS-4 ETC. ARE DESIGNATIONS FOR PROCESS PIPING STUB UPS. SEE SHEET RW 4.1 FOR DIMENSIONAL OFFSETS, DESCRIPTION, PIPE SIZES AND **INVERTS**.

2. ALL PROCESS PIPING INSIDE WWTP UNLESS INDICATED OTHERWISE SHALL BE SCH 80 PVC.

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GRAPHIC SCALE 3/8"=1'



	Item		PIPE	PIPE	C	Dimens	ions C	)ff		
	No.	Description	SIZE	Stub Up	Wa	A	Wc	ıll B	- INV. Elevation	
	1	Air Line to Diffusers	6"	AI-1	14'-	10½"	21'-	- 3¾"		
-	2	Bar screen to Pre-Anoxic Tank	4"	BS-1	33'-	63/4"	23'-	- 81/2"		
	3	Backwash line	4"	BW-1	38'-	4"	5'-	- 6½"		
	4	Backwash line	4"	BW-2	23'-	91/2"	11'-	- 41/2"		
	5	Citric Acid Chemical Feed Line	1"	CH-4A	25'-	93/4"	-`0	- 3"		
	6	Citric Acid Chemical Feed Line	1"	CH-4B	20'-	111/4"	13'-	- 11/2"		
	7	De-aeration Line	2"	DA-1	19'-	71/4"	17'-	- 11/4"		
	8	Aeration Tank to Denite Sump	4" D.I.	DE-1	18'-	1 1 3/4"			77.51	
	9	Aeration Tank to Denite Sump	4" D.I.	DE-2	21'-	5"			77.51'	
	10	Dosing pump #1 through Dosing tank	4"	DL-1	Refere	nce Dra	u wing CP6	5		
	11	Dosing pump #2 effluent through wall	4"	DL-10			2'-	- 5"	80.76' (field adjusted)	
	12	 Dosing pump #2 through Dosing tank	4"	DL-2	Refere	nce Dra	u wing CP6	<u> </u>		
	13		4"	DL-3	14'-	4"			80.76' (field adjusted)	
	14	Dosina pump #2 through building wall	4"	DI - 4	10'-	4"			80.76' (field adjusted)	
-	15	Dosing pump #1 stub up to flow meter	<u> </u>	DI - 5	14'-	<u> </u>	<u> </u>	- 81/, "		
	1.6	Dosing pump #2 stub up to flow meter	Δ.''		16'-	<u> </u>	<u> </u>	- 81/, "		
	17	Dosing number $\pi^2$ side op to now meter $\pi^2$	т л"		10'_	Δ"				
-	1.2	Dosing pump #2	4 / "		10 	4	0,	81/. "		
	10	Desing pump $#1$ offluent through well	<u></u> 4 л "			<del>' +</del> 		5"	80.76' (field adjusted)	
-	19	Dosing pump #1 entuent inrough wait	4 7 ''					- 0	ov.76 (neid dajusied)	
_	20	Denife Sump to Pre-Anoxic Tank	) "			71/ "	32 -	$-6\frac{1}{2}$	83.38	
		Denite Sump to Pre-Anoxic Tank	3 	DS-2	28 -	$\frac{7}{7}$	32 -			
_	22	Denite Sump to Pre-Anoxic Tank	3	DS-3	30 -	$\frac{1}{2}$	32 -	- 6½		
	23	Denite Sump to Pre-Anoxic Tank	3	DS-4	30 -	/ 1/2			83.34	
	24	EQ Transfer Pump #1	2	EQ-1	Refere	nce Dra	wing CP1	1		
	25	EQ Transfer Pump #2	2"	EQ-2	Refere	nce Dra	wing CP1	1		
	26	Combined EQ Flow	2"	EQ-3			23'-	- 8½"	81.00' (field adjusted)	
	27	Combined EQ Flow	2"	EQ-4	39'-	11/4"	23'-	- 8½"		
	28	Membrane Drain Line	8"	MD-1	23'-	8"	12'-	- 3¾"		
	29	Membrane Drain line through sump wall	8"	MD-2			11'-	- 10¼"	83.08'	
	30	Membrane Recirc to UF Skid	6"	MR-1	9'-	5"			83.67	
	31	Membrane Recirc to UF Skid	6"	MR-2	11'-	5¼"	12'-	- 3¾"		
	32	Membrane Recirc to Aeration Tank	8"	MR-3	18'-	71/2"	17'-	- 93⁄4"		
	33	Membrane Sump	2"	MS-1			11'-	- 1 3/4"	83.58'	
	34	Membrane Sump to Bar Screen	2"	MS-2	37`-	10¾"	22'-	- 5½"		
	35	Odor Control through EQ tank wall	4"	OC-1	Refere	nce Dra	wing CP1	11		
	36	Odor Control Through WWTP wall	6"	OC-10			31'-	- 8½"	Above 93.75' (field determined)	
	37	Odor Control Through WWTP wall	4"	0C-2			27'-	- 10½"	81.00' (field adj. sloped to FET)	
	38	Odor Control Stub—up from From EQ tank	4"	0C-3	37'-	3¼"	27'-	- 10½"		
	39	Odor Control from Pre Anoxic Tank	4"	0C-4	11'-	1 1 3⁄4"			84.09'	
	40	Odor Control stub up from Pre Anoxic Tank	4"	0C-5	35'-	11/4"	29'-	- 5¾"		
	41	Odor Control Vent from membrane sump to Pre Anoxic Tank	4"	0C-6	26'-	11/2"			84.09'	
	42	Odor Control Vent from membrane sump to Pre Anoxic Tank	4"	0C-7	23'-	41/2"			84.09'	
	43	Odor Control in to Aeration tank from Denite Tank	4"	0C-8			32'-	- 6½"	84.09'	
	44	Odor Control at Denite sump to Aeration tank	4"	0C-9	9'-	53/4"			84.09'	
	45	Permeate Line	2"	PL-1	21'-	111/4"	7'-	- 111/2"		
	46	Permeate Line to UV	2"	PL-2	30'-	4"	7'-	- 111/2"		
	47	Permeate Line from Permeate Tank	4"	PL-3	40'-	8"	12'-	- 6¼"		
	48	Permeate Line through WWTP wall to Dosing Tank	4"	PL-4	40'-	8"				
	49	Permeate Line through Dosing Tank Wall	4"	PL-5	Refere	nce Dra	u wina CPF	_ <b>I</b> б	1	
	50	Turbidity drain line	1 72	ΤM — 1 Λ	22'-	91%"		- 81/, "		
$\vdash$	51	Turbidity drain line through geration tank wall	SÇH10		22	a1/, "		<i>V</i> 74	84.26'	
-	50	Vant from Aaratian Tank				<u>372</u> л 1/ "			84.00'	
		Vent Freize geratiere tereti	4 , "			4 '/4 Λ''	<u> </u>	01/ "	04.03	
	55	veni rrom aeration tank	4			4		- 0 1/4		
	54	Aeration lank vent through wall		IVF-3	1 17'-	14		1	I Above 95 /5 (field determined)	,





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AIR DRYER

POSITIVE DISPLACEMENT PUMP P-

FLOWMETER

DISPLACEMENT-TYPE FLOW TOTALIZING

DEVICE FX-ORIFICE PLATE & FLANGE

CALIBRATION

PULSATION DAMPENER PD-

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IN S	S T	RU	ME	EN	ΤI	D [	EN	ΤI	FΙ	СА	ΤI	ΟN			
DEVICE WEASURED OR NITIATING VARIABLE	PRIMARY ELEMENT	TRANSMITTER	INDICATING TRANSMITTER	INDICATOR	RECORDER	CONTROLLER (NOTE 2)	INDICATING CONTROLLER (NOTE 2)	RECORDING CONTROLLER	SWITCH (NOTE 2)	INDICATING SWITCH (NOTE 2)	TRANSDUCER, RELAY, TRIGGER, COMPUTATION	ALARM (NOTE 2)	GLASS, VIEWING DEVICE	COMPUTATION/ INFORMATION TRANSFER	PILOT LIGHT (NOTE 2)
ANALYSIS (NOTE 1)	AE	AT	AIT	AI	AR	AC	AIC	ARC	AS	AIS	AY	AA		AY	AL
ANALYSIS RATIO				AFI	AFR	AFC	AFIC	AFRC			AFY	AFA			AFL
ANALYSIS SCAN	Aje	AJT	Ajit	AJI	Ajr	AJC	AGIC	AJRC	AJS	AJIS	AJY	AJA		AJY	
ANALYSIS INSTANTANEOUS (MOMENTARY)	AME					AMC			AMS		AMY	AMA			
CONDUCTIVITY/RESISTIVITY	CE	СТ	CIT	CI	CR	CC	CIC	CRC	CS	CIS	CY	CA		CY	CL
CONDUCTIVITY RATIO				CFI	CFR	CFC	CFIC	CFRC			CFY	CFA			CFL
VOLTAGE				EI	ER	EC	EIC		ES	EIS	ΕY	EA			EL
FLOW RATE	FE	FT	FIT	FI	FR	FC	FIC	FRC	FS	FIS	FY	FA	FG	FY	FL
FLOW RATIO				FFI	FFR	FFC	FFIC	FFRC			FFY	FFA			FFL
FLOW QUANTITY				FQI					FQS	FQIS		FQA			FQL
HAND (MANUAL)						нс	HIC		HS	HIS	HY				
CURRENT		IT		=	IR				IS	HS	IY	IA			IL
POWER				JI	JR				JS	JIS	JY	AL			JL
пМе				KI		KC			KS	KIS	KY	KA		KY	KL
TIME QUANTITY				KQI					KQS	KQIS		KQA			KQL
LEVEL	LE	LT	LIT	LI	LR	LC	LIC	LRC	LS	LIS	LY	LA	LG	LY	LL
MOTOR (ELECTRICAL)				MI								MA			ML
PRESSURE/VACUUM	PE	PT	PIT	ΡI	PR	PC	PIC	PRC	PS	PIS	ΡY	PA		PY	PL
PRESSURE DIFFERENTIAL	PDE	PDT	PDIT	PDI	PDR	PDC	PDIC	PDRC	PD5	PDI5	PDY	PDA		PDY	PDI
RADIATION	RE	RT	RIT	RI	RR	RC	RIC	RRC	RS	RIS	RY	RA			RL
SPEED/FREQUENCY	SE	ST	SIT	SI	SR	SC	SIC	SRC	SS	SIS	SY	SA		SY	SL
RATE OF SPEED CHANGE				SKI		SKC					SKY				
FEMPERATURE	TE	Π	TIT	TI	TR	TC	TIC	TRC	TS	TI5	ΤY	TA		TY	TL
remperature differential	TDE	TDT	TDIT	TDI	TDR	TDC	TDIC	TDRC	TDS	TDIS	TDY	TDY		TDY	TDL
VIBRATION	VE	VΤ	VIT	VI	VR				VS	VIS	٧Y	VA		VY	VL
MULTIVARIABLE	UE	UT	UIT	UI	UR				US	UIS	UY	UA		UY	UL
POSITION				ZI		ZC	ZIC		ZS	ZIS	ZY	ZA		ZY	ZL
EVENT/STATUS						YC			YS			YA		YY	YL
NOTES															

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EX.

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1. THE DESCRIPTION OF AN ANALYTICAL VARIABLE FUNCTION (pH, SIO<sub>3</sub>, O<sub>2</sub>, ETC.) SHALL BE SHOWN OUTSIDE THE INSTRUMENT. EXAMPLE: pН

2. ADD THE SUFFIX L (LOW), LL (LOW-LOW) H (HIGH), HH (HIGH-HIGH), HL (HIGH-LOW), AS REQUIRED. PSL FAL EXAMPLE:

LINE SYMBOLS & MISC. INSTRUMENTATION LINES



FO	FAIL OPEN
I/P	ELECTRIC ANALOG TO
	PNEUMATIC SIGNAL CONVERTE
IAS	INSTRUMENT AIR SUPPLY
SP	SET POINT
NC	NORMALLY CLOSED

NO NORMALLY OPEN MCC MOTOR CONTROL CENTER

5

- MAG MAGNETIC
- MFV MULTI FUNCTION VALVE (COMBINATION RELIEF & BACK PRESSURE VALVE FOR METERING PUMPS)

6

BPV BACK PRESSURE VALVE

YY SOLENOID FOR PNEUMATIC

CONTROL OF AUTOMATIC VALVE

HCV HAND CONTROL VALVE

HV HAND VALVE

7

SV SAMPLE VALVE

# • P-PUMP

4







9	8	7	6	5	4





9 | 8 | 7 | 6 | 5 | 4



# SECTION 12a: AERATION BLOWERS

# P&I, D Item # BL-0451, BL-0452

Unit Details:	Kaeser Aeration Blower
	COM-PAK Model CB131C
	10Hp, 3Ø/60Hz/460V
	265 SCFM @ 4.5 psig

Manufacturer: Kaeser Compressors 40 Norfolk, Avenue South Easton, MA 02375 Phone: (508)-238-3228 Fax: (508)-238-3808 www.us.kaeser.com

Local Distributor/Contact:

Kaeser Compressors 40 Norfolk, Avenue South Easton, MA 02375 Phone: (508)-238-3228 Fax: (508)-238-3808 www.us.kaeser.com

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# Kaeser Com-paK Installation Data Sheet

# CB111C/CB131C

Package	Blower	Horsepower
CB111C	Omega 24P	7.5,10,15,20,25
CB131C	Omega 41P	7.5 <mark>10,</mark> 15,20,25,30,40



### Electrical Data Drive Motor

						wye-delta st	arting (2-wir	e per phase)	direct on	direct online (1-wire per phase)				
Нр	Vo <b>l</b> tage (3ph/60Hz)	FLA +/ <del>-</del> 10%	Nominal Eff	Insulation Class	Enclosure Type	Jumper Connection	Disconnect Fuse	Wire Size (75°C or higher)	Jumper Connection	Disconnect Fuse	Wire Size (75°C or higher)			
	208	18.4				YY -> ΔΔ	25 AMP	14 AWG	ΔΔ	30 AMP	10 AWG			
7.5	230	17.6	89.9	F	TEFC	YY -> ΔΔ	25 AMP	14 AWG	ΔΔ	30 AMP	10 AWG			
	460	8.8				Y -> ∆	10 AMP	14 AWG	Δ	15 AMP	14 AWG			
	208	25				YY -> ΔΔ	35 AMP	14 AWG	ΔΔ	40 AMP	8 AWG			
10	230	23	90.8	F	TEFC	YY -> ΔΔ	30 AMP	14 AWG	ΔΔ	35 AMP	8 AWG			
	460	11.5				Y -> ∆	20 AMP	14 AWG	Δ	20 AMP	12 AWG			
	208	37				YY -> ΔΔ	50 AMP	10 AWG	ΔΔ	60 AMP	4 AWG			
15	230	35	91.0	F	TEFC	YY -> ΔΔ	50 AMP	10 AWG	ΔΔ	50 AMP	6 AWG			
	460	17.6				Y -> ∆	30 AMP	14 AWG	Δ	35 AMP	8 AWG			
	208	50			TEFC	ΥΥ	70 AMP	8 AWG	ΔΔ	80 AMP	3 AWG			
20	230	48	91.0	F		YY -> ΔΔ	70 AMP	8 AWG	ΔΔ	80 AMP	3 AWG			
	460	24				Y -> ∆	35 AMP	14 AWG	Δ	40 AMP	8 AWG			
	208	60				YY -> ΔΔ	100 AMP	4 AWG	ΔΔ	125 AMP	2 AWG			
25	230	56	91.7	F	TEFC	YY -> ΔΔ	90 AMP	6 AWG	ΔΔ	110 AMP	2 AWG			
	460	28				Y -> ∆	45 AMP	10 AWG	Δ	50 AMP	6 AWG			
	208	72				YY -> ΔΔ	100 AMP	4 AWG	ΔΔ	125 AMP	1/0 AWG			
30	230	67	91.7	F	TEFC	ΥΥ <b>-</b> > ΔΔ	90 AMP	6 AWG	ΔΔ	110 AMP	1 AWG			
	460	33.5				Y -> ∆	45 AMP	10 AWG	Δ	50 AMP	6 AWG			
	208	100				ΥΥ <b>-</b> > ΔΔ	150 AMP	4 AWG	ΔΔ	175 AMP	1/0 AWG			
40	230	92	92.4	F	TEFC	ΥΥ -> ΔΔ	125 AMP	4 AWG	ΔΔ	150 AMP	1/0 AWG			
	460	46				Υ -> Δ	60 AMP 8 AWG		Δ	80 AMP	3 AWG			

Notes: 1. Disconnect fuses should be of dual element time delay design.

2. Breaker should be suitable for a heavy duty starting load and of inverse time delay design that complies to regulations outlined in NEC 430.52

3. Fuse and wire sizes determined in accordance to NEC 240.6, 430.52 and tables 250.122, 430.248, 430.250, 430.252.

Enclos	sure Fan I	Data						
Power	Voltage (60Hz)	Phase (60Hz)	Current Draw	Jumper Connection	Quantity	Enclosure Type	Fan Type	Flow
120W	115	1	3.80	Capacitor	1	TEFC	Axial	1188 CFM
120W	230	1	1.10	Capacitor	1	TEFC	Axial	1294 CFM
120W	208	3	0.92	Δ	1	TEFC	Axial	1294 CFM
120W	230	3	0.68	Δ	1	TEFC	Axial	1188 CFM
120W	460	3	0.37	Y	1	TEFC	Axial	1188 CFM
140W	575	3	0.36	Ý	1	TEFC	Axial	1294 CFM

Notes: 1.) Nominal power in Watts.

2.) Current in A (+/- 10%).

3.) Default fan selection is 230/460V. If other voltage is required, it must be noted at time of order.

4.) Fan requires separate power supply.

5.) Fan should run at the same time as main motor. If fan is able to run for 15 minutes after machine is turned off, it will improve thermal conditions inside enclosure.

# CB111C/CB131C

Oil System Data (CB111C)	
Drive End Capacity	0.15 quarts
Gear End Capacity	0.13 quarts
Oil Type (Synthetic)	SB 220
Oil System Data (CB131C)	
Drive End Capacity	0.25 quarts
Gear End Canacity	0.30 quarts
Ocal Life Capacity	0.00 quarto
Oil Type (Synthetic)	SB 220



Dack	ackage Connections (without weather bood)									
I acr	Cable	Entry					Weig	ht (Ib)		
Нр	Drive Motor	Fan Motor	Length (in.) L	Width (in.) W	Height <sup>*</sup> (in.) H	Floor (sq ft)	CB111C	CB131C	Size (in.)	Туре
7.5	3 x 1" NPT						827	882	3	Tube
10	3 x 1" NPT						849	904	3	Tube
15	3 x 1" NPT			45 3/8	51	12	882	937	3	Tube
20	3 x 1-1/4" NPT	2 × M16	38 3/8				893	948	3	Tube
25	3 x 1" NPT						981	1036	3	Tube
30	3 x 1" NPT						xx	1047	3	Tube
40	2 x 2" NPT & 1 x 1/2"						xx	1235	3	Tube





# CB111C/CB131C

Ventilation of Blower Room									
Air Inlet Opening	1	2.5 sq. ft							
Cooling Fan Capacity (forced ventilation)	2	1,500 CFM							
Max Heat Rejection	3	14,000 BTU / HR							

Ventilation values based on 190 CFM @ 15 PSIG  $\Delta$ P, 20Hp and ambient inlet. Max. room temp. = 104°F and cooling air temp = 95°F. Discharge piping length = 5 ft.



It is recommended to extract the exhaust air from the upper third of the room as this is where the heat collects. The room ventilation openings should be arranged that the current of cooling air flowing through the room passes over the blower inlet and exhaust ports and, if possible, should leave no stagnant air in the room. (A thermal short circuit must be avoided, i.e. discharged cooling air must not find its way to the cooling air inlet.)

The blower must not be positioned so near to a wall that the inflow of cooling air is obstructed.

Pipework should be insulated against heat emission.

If the blower station is located in the middle of a large hall its exhaust air can be extracted by means of a duct positioned above the exhaust port (illustrated in broken lines).



- RECOMMENDATIONS BLOWERS -



Customer: BioProcessH20

### **INPUT DATA:**

### Prepared By: Kaeser-Geary

PAGE 1

Operating mode:	Gauge pressure		Flow medium : Dry Air	
Kind of package:	Com-paK Plus	on frequency control	Specific heat constant $\kappa$ : 1.40	
Inlet temperature:	95 °F	Specific	weight at standard conditions :0.0760	lb/ ft³
Inlet pressure:	14.7 psia		Pressure difference: 4.5	psig
Inlet flow:	257 icfm			
			Discharge pessure: 19.2	psia

# Technical data:

Package:	<b>CB 131C</b>			BI	owe C	er speed (60H onnection AN	z): 3310  SI:3"	rpm	
Motor power:	10.0	hp		%	of n	naximum spee	ed: 66		
Operating voltage:	460V/	60Hz			Blo	wer: OMEGA	41P		
Performance da	ta: r	nin. frequ	lency		D	esign point	t	max. fr	equency
Frequency:		18.0				56.2		60.0	Hz
Speed:		990				3100		3310	rpm
Inlet air flow Q1*:		56				257		279	icfm
Inlet air flow Q1 (sta Standard conditions	andard): s 14.7psia, 68°F an	53 id 0 % RH				244		265	scfm
Discharge temperat	ure*:	174				151		149	°F
Blower shaft power	*.	2.5				7.1		7.6	bhp
Motor shaft power :								8.6	bhp
			withou	t sour	nd e	enclosure	with sou	ind enclos	ure
Sound pressure lev	el**:	at fmax			85	dB(A)		700	lB(A)
Sound pressure lev	el**:	at 60 Hz	2		85	dB(A)		700	dB(A)
Sound power level*	*.	at 60 Hz	2	1	000	dB(A)		86 0	lB(A)
Dimension [inches] Estimated Weight	(L x W x H)	:	34x ca.	40 50	x 7	44 Ibs	39x ca.	46 X 904	51 Ibs
IGBT Frequency c	ontrolled						46	0V ±5%	60 Hz

Standard motor with impulse peak resistance in accordance with IEC 60034-1 for operation with a IGBT frequency converter.

\* Performance data to DIN ISO 1217, PART 1, ANNEX C

\*\* Measured to DIN EN ISO 2151, figures ± 3 dB(A), with sound isolated pipework.

Motor shaft power includes belt losses in addition to dirty filter losses of 0.6 psig (40 mbar)

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### OMEGA/OMEGA PLUS ROTARY BLOWERS 06/18/12

PAGE 2

- RECOMMENDATIONS BLOWERS -

Customer: BioProcessH20 Prepared By: Kaeser-Geary Kind of package: Com-paK Plus on frequency control Operating mode: Gauge pressure Inlet temperature: 95 °F Valve set 7.5 psig pressure: Inlet pressure: 14.7 psia Input inlet flow: 257 icfm Package: **CB 131C** Blower: OMEGA 41P Blower speed (60Hz): 3310 rpm Motor power: 10.0 hp Connection ANSI: 3" Operating voltage: 460V/60Hz % of maximum speed: 66 Nameplate data:\*\* related to 14.7 psi and 68°F Pressure difference  $\Delta p$ : 5.8 psig Discharge pressure p2 \*: 20.5 psia \*Discharge pressure related to max. pressure difference \*\* At direct connection to power Inlet flow Q1: 273 icfm supply without converter Related to inlet conditions NOTE: ACCESSORIES SHOWN ARE INTENDED FOR AIR USE ONLY. Accessories: yes no yes no Χ Unloaded start up valve: AFE15 Sound enclosure: Χ Check plate: 3" Suction from ambient: Х Х  $\square$ Suction from pipe:  $\square$ Χ Instrument/ sensor: Optional for package with sound enclosure Sound enclosure for outdor installation: Χ Temperature gauge with switch point: Χ X Pressure gauge: Χ Filter differential pressure switch: oil level sensor X Frequency converter (FC): speed monitor Χ Frequency converter (FC) by customer: Χ Kaeser FC type OFC: Χ Blowoff valve, pressure gauge, filter with maintenance Standard equipment with s. encl.: 1x 2" indicator Standard equipment without s. encl.: 1x 2" Blowoff valve, filter with maintenance indicator

# **Comments for project:**

		/ -			
Rota	ary Blower	Package			
Gauge press	ure application	n Com-paK	( Plus		
		on freque	ency control		
Fo	r an oil-free convevir	na medium	•		
with CE Declaration of incorporation	within the meaning o	f Machinery Dire	ective 2006/ 42 EG, an	nex II B	
Gas handled			Dry Air		
Design point					
Inlet pressure (pressure-absol	ute)		14.7	psia	
Inlet temperature			95	°F	
Pressure difference			4.5	psig	
Discharge pressure (pressure-	absolute)		19.2	psia	
Control range	min. frequency	Design poi	nt max. frequ	iency	
Frequency	18.0	56.2	60.0	Hz	
Blower speed	990	3100	3310	rpm	
Effective inlet air flow Q 1	56	257	279	icfm	
Inlet air flow Q 1 Standard Standard conditions 14.7 psia. 68 °F and	53 d 0 % RH	244	265	scfm	
Discharge temperature	174	151	149	°F	
Blower shaft power	2.5	7.1	7.6	bhp	
Motor rated power			10.0	hp	
Motor protection			TEFC		
Motor voltage/ -frequency			460V ± 5 %	60 Hz	
Typ of cooling			air, conveo	ction	
Connection size			3"		
	without sound e	<u>nclosure</u>	with sound enclos	sure	
Dimension (L x W* x H)	34x 40 x	44 inches	39 x 46 x 5 <sup>,</sup>	l inches	
Estimated Weight	ca. 50	7 lbs	ca. 904	lbs	
Estimated noise level to DIN EN ISO	<sup>2151</sup> at 60 Hz	85 dB(A)	at 60 Hz 70	dB(A)	
	f max	85 dB(A)	f max 70	dB(A)	

# TECHNICAL PROPOSAL



Com-nak Plus CB 131C

More air flow with less energy

/**41P** 

OMEGA BLOWERS

Date: 06/18/12

Prepared By:Kaeser-GearyProject Reference:No. ReadingCustomer:BioProcessH20

Location:MA

**KAESER** 

V 7.2 AD VERSION 14/01/11 T1

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Kaeser Compressors, Inc. P.O. Box 946 Fredericksburg, VA 22408 Tel.: (540) 898-5500 FAX.: -5520

This data's apply to operation with IGBT frequency controller!

SIEN	<b>NENS</b>																				
						┢					Kondens-	Vehant				μ	×	lemmka	isten / te	minal box	
Nr.	MLFB	Optionen	Maßbild	Bauform	НИ	ε	<b>ר</b>	₽.	ບ ບ	2A schmierung	h löcher	vibrat. Klasse	warme Klasse	Lage	ъ В	ehäuse	Тур	тах.	тах.	Kontakt terminal sc	<b>bolzen</b> / rew thread
Kaeser	MIFB	options	dimension	typ of	fram	8	-	<u></u>	Ú L	c regreasing	drain	vibrat.	insulation	haarir	-	omer	time	>em	>em	Anzahl/	Größe/
No.:		SIIDINO	sheet	construction	size	=	,	<u>-</u>	33	2A device	holes	class	class	חכמוו			iype	1197.	ша <b>х</b> .	number	size
						kg	kgm²	$\left  \right $						AS	BS	àG/Alu		mm²	Ø		
894991.0	1LE10231CA162AB4-Z	M10+H04+Y84	5_510_81320_00_5 03.pdf	IMB3 AK oben / top	132M	57 0	,03143	55 4	11 yé	- <u>S</u>		٨	F/B	6208 2ZC3	62.08 2ZC3	Alu	TB1H10	9	21	12	M4

Anschluß	connection					12x				
Standard	standard					UL+CSA				
Code	letter			Σ						ĺ
ΚТ	КT	ပ္		40						
MA	T <sub>start</sub>	%		270						
Mĸ	T <sub>break</sub>	%		420						
MN	Trated	шN		20,2						
cos <sub>phi</sub>	cos <sub>phi</sub>			0,91						
eff <sub>Pn</sub>	eff 4/4-load	%		90,2						
eff <sub>0,75Pn</sub>	eff 3/4-load	%		91,0						
eff <sub>0,5Pn</sub>	eff 1/2-load	%		90,8						
I <sub>A</sub> / I <sub>N</sub>	ILR / Irated	%		960						
ISF	Isr	A		13						ľ
ľ	Irated	٨		11,5						Ì
n <sub>N</sub>	n <sub>rated</sub>	min <sup>-1</sup>		3555						
D	∍	÷		+/- 10%						
٩	Urated	>		460D						Ī
f	frequency	ΡZ		60						
Servicefaktor	servicefactor	SF		1,15						
P <sub>N</sub>	Prated	kW		7,5						
Wirkungsgradklasse	efficiency-class			 IE3						
MLFB	motor type					1LE10231CA162AB4-Z				
Kaeser-Nr.:	Kaeser-No.:					894991.0			 1:	3:

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# Installation manual

# Rotary blower

**CB C pr** No.: 9\_9480 04 USE

/KKW/BCBCP 1.04 en 01 SBA-GEBLAESE



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1.1 Using this document

# 1 Regarding this Document

# 1.1 Using this document

This operating or installation manual is part of the machine. It describes the machine as it was at the time of first delivery after manufacture.

- ► Keep the operating or installation manual in a safe place throughout the life of the machine.
- > Pass the operating or installation manual on to the next owner/user.
- ► Ensure that all amendments received are entered in the operating or installation manual.
- Enter details from the machine nameplate and individual items of equipment in the table in chapter 2.

# 1.2 Further documents

Additional documents for the safe operation of the machine are included with this installation instruction:

- Customer-specific design data sheets
- Motor manual.

Missing documents can be requested from KAESER.

- ➤ Make sure all documents are complete and observe the instructions contained in them.
- ➤ Make sure you provide the data from the nameplate when ordering documents.

# 1.3 Copyright

This operating or installation manual is protected by copyright. Any queries regarding the use or duplication of this documentation should be referred to KAESER. Correct use of information will be fully supported.

# 1.4 Symbols and labels

### 1.4.1 Warning notices

Warnings indicate risks potentially resulting in personal injury, if the measures shown are not taken.

Warning notices indicate three levels of danger signified by the signal word.

- DANGER
- WARNING
- CAUTION

# 1. **A DANGER** The type and source of the imminent danger is shown here! The possible consequences of ignoring a warning are shown here. The signal word "DANGER" indicates that death or severe injury can result from ignoring the warning.

> The measures required to protect yourself from danger are shown here.



1.4 Symbols and labels

2. Warnings must always be read thoroughly and carefully observed.

Signal term	Meaning	Consequences of non-compliance
DANGER	Warns of an imminent danger	Will result in death or severe injury
WARNING	Warns of a potentially imminent danger	May result in death or severe injury
CAUTION	Warns of a potentially dangerous situation	May result in a moderate physical injury

Tab. 1 Danger levels and their definition

### 1.4.2 Potential damage warnings

Contrary to the warnings shown above, damage warnings do not indicate a potential personal injury.

Damage warnings have only one danger level identified with this signal term:

- NOTE
- 1. **NOTICE** The type and source of the imminent danger is shown here! Potential effects when ignoring the warning are indicated here.
  - > The protective measures against the damages are shown here.
- 2. Carefully read and fully comply with warnings against damages.

### 1.4.3 Other alerts and their symbols



This symbol indicates particular important information.

operating or installation manual are explained in chapter 2.3.





Information referring to potential problems are identified by a question mark.

The cause is identified in the help text ...

... as is a remedy.

This symbol refers to important information or measures concerning environmental protection.

Further information Further subjects are introduced here.

# 2 Technical Data



2.1 Nameplate

# 2 Technical Data

# 2.1 Nameplate

The machine's nameplate provides the model designation and important technical information. The nameplate is attached to the machine stand and at the left sidewall of the sound enclosure (Option H12).

The nameplate data relates to Standard intake state of 14.7 psi and 68 °F.

► Enter here the nameplate data as a reference:

Feature	Value
Rotary blowers	
Part No.	
Serial No.	
Year of manufacture	
Delivery at p <sub>max</sub>	
Max. final pressure (a)	
Max. pressure differential	
Rated motor power	
Block speed	

Tab. 2 Nameplate

# 2.2 Design data

Design data agreed with KAESER is given in the customer-specific data sheet. Data sheets are given in chapter 13.7.

Further information Design diagrams are given in chapter 13.3.

# 2.3 Option codes

The table contains a list of possible options.

► Enter options fitted to your machine here for reference.

Option	Option code	Available?
Pressure switch	C9	
Speed monitor	C10	
Unloaded start valve	C11	
Temperature gauge switch	C13	
Pressure transducer	C14	
Unloaded start valve with regulating valve	C18	
Thermostat	C19	
Pressure gauge	C20	


2.4 Weight

2

Option	Option code	Available?
Under frequency control	C32	
Filter maintenance indicator	F4	
Filter pressure differential switch	F5	
Check valve	G1	
Auxiliary heating	H2	
Outdoor installation	H3	
Intake from pipe network	H11	
Sound enclosure	H12	

### Tab. 3 Option codes

# 2.4 Weight

The machine weight shown applies to the standard design including drive motor. The actual weight depends on individual equipment and accessories.

### Machine without sound enclosure

	Weight [lb] *				
Motor power [hp]	CB 111 C pr	CB 131 C pr			
7.5	430	485			
10	452	507			
15	485	540			
20	496	551			
25	584	639			
30		650			
40		838			
* Approximate values and	tual weighte ean vary depending on th	a motor manufacturor			

\* Approximate values, actual weights can vary depending on the motor manufacturer

Tab. 4 Machine weight without sound enclosure

### Machine with sound enclosure

	Weight [lb] *				
Motor power [hp]	CB 111 C pr	CB 131 C pr			
7.5	827	882			
10	849	904			
15	882	937			
20	893	948			
25	981	1036			
30		1047			
* Approximate values, actual weights can vary depending on the motor manufacturer					



# 2.5 Motors and power

2

	Weight [lb] *			
Motor power [hp]	CB 111 C pr	CB 131 C pr		
40		1235		
* Approximate values, actual weights can vary depending on the motor manufacturer				

Tab. 5 Machine weight with sound enclosure

# 2.5 Motors and power

### Drive motor

Feature	Value
Rated power* [hp]	7.5 – 40
Rated speed [rpm] (60 Hz)	3600
Enclosure protection	IP 55
* see drive motor nameplate	·

#### Tab. 6 Drive motor

KAESER is not liable for a machine delivered without drive motor or the customer ordering the drive motor.

# 2.6 Temperature

	CB 111 C pr	CB 131 C pr	<b>—</b>
Maximum block dis- charge temperature [°F]	320	320	_
Maximum temperature differential [K] *	115	115	—
*			

\* Discharge temperature minus inlet temperature

Tab. 7 Temperature

# 2.7 Recommended oil

The oil to be recommended depends on the operating conditions.

OMEGA FLUID	
SB-220	FGB-220
Synthetic oil	Synthetic oil
Suitable for all applications, except food processing.	Specifically for applications where the compressed air comes into contact with food products.
	OMEGA FLUID SB–220 Synthetic oil Suitable for all applications, except food processing.

\* Special measures are required for oil temperatures >248 °F. Consult KAESER for advice on this subject.

Ê



	OMEGA FLUID				
	SB-220	FGB-220			
Oil temperature [°F]	14 – +248*	23 – +230			
* Special measures subject.	are required for oil temperatures >24	8 °F. Consult KAESER for advice on this			

#### Tab. 8 Recommended oil

2

Further information The type of oil with which the block is to be filled is marked near the filling port. Information on ordering oil is found in chapter 11.2.

#### 2.8 Lubricating oil charge

The block oil chambers are filled with oil at the factory.

#### Guide value

Lubricating oil charge [qt] ±15 %	CB 111 C pr	CB 131 C pr
Drive-end	0.16	0.26
Gear-end	0.14	0.32

Lubricating oil charge Tab. 9

#### Ambient and intake conditions 2.9

The following conditions must be maintained:

- No saliferous atmosphere in the immediate vicinity of the machine.
- The air must be free of chemicals or explosive substances.

	CB 111 C pr	CB 131 C pr	
Permissible temperature [°F]	23 – 104	23 – 104	
Machine with connected auxiliary heating Options H2, H12)	5 – 104	5 – 104	_
Permissible temperature [°F]			
Relative humidity [%]	0 - 80	0 – 80	
Maximum altitude AMSL* [ft]	3280	3280	
*For deviations in altitude of ter 13.7.	of installation, see the cu	istomer-specific design o	data sheets in chap-

Tab. 10 Ambient and intake conditions

Further information The wiring diagram for option H2 in chapter 13.5 contains further details of the power supply connection.



For other ambient and intake conditions, please consult the manufacturer.

# 2.10 Sound pressure level/sound power level

Operating state LOAD under the following conditions:

- Nominal speed
- Nominal flow rate
- Nominal pressure

Measuring condition according to DIN EN ISO 2151 and basic standard ISO 9614-2:

- Measurement distance: 3 ft
- Tolerance: ±3 dB(A)
- Sound insulated pipeline

Further information The sound pressure level and sound power level values for your machine are provided in the customer-specific design data sheet in chapter 13.7.

These values refer to the design condition. They do not apply to the control range with frequency converter.

## 2.11 Power supply

#### **Basic requirements**

The machine is designed for an electrical supply according to National Electric Code (NEC) NEC– 670, particularly NFPA 79, edition 2007, section 4.3. In the absence of any user-specified alternatives, the limits given in these standards must be adhered to. Consult manufacturer for any other specific power supply.

#### Three-phase

Do **NOT** operate package on any unsymmetrical power supply. Also do **NOT** operate package on power supplies like, for example, a three-phase (open) delta or three-phase star with non-grounded neutral.

The machine requires a symmetrical three-phase power supply transformer with a WYE configuration output as shown in Figure 1 and Figure 2. In a symmetrical three phase supply the phase angles and voltages are all the same.

Other power supplies are not suitable.



03-S0235







Fig. 2 Three-phase star (wye); 3 wire; grounded neutral

Further information Please contact authorized KAESER Service representative for options. The electrical diagram 13.4 contains further specifications for electrical connection.

# 2.12 Power supply specifications

The following multi-strand copper core wires are given according to 2012 NEC 310.15, Table 310.16 for 104 °F ambient temperature.

If other local conditions prevail, like for example high temperature, the cross section should be checked and adjusted according to 2011 NEC 110.14©, 220.3,310.15, Table 310.16, 430.6, 430.22, 430.24 and other local codes.

Dual element time delay fuses are selected according to 2011 NEC 240.6,430.52 and Tables 430.52, 430.248 and 430.250.

We strongly suggest using a separate copper conductor for the equipment GROUNDING. NEC Table 250.122 will point out the "minimum size", however, we recommend a ground conductor the same size as the power leads, if local codes allow.

### 2.12.1 Power supply details

Rated power supply: 230V ±10% / 3ph / 60Hz

Motor power [hp]		7.5	10	15	20	25	30	40
Rated current ±10%	, [A]	17.4	22.8	34.0	46.8	57.0	66.0	93.0
Direct-online start-	Backup fuse [A]	30	40	50	80	90	110	150
ing	Supply cable [AWG]	1x 4x10	1x 4x8	1x 4x6	1x 4x3	1x 4x2	2x 4x6	2x 4x4
Star-delta starting	Backup fuse [A]	20	25	40	60	70	80	110
	Supply cable [AWG]	2x 4x14	2x 4x14	2x 4x10	2x 4x8	2x 4x6	2x 4x6	2x 4x4

Tab. 11 Power supply details 230V/3ph/60Hz

#### Rated power supply: 380V ±10% / 3ph / 60Hz

Motor power [kW]		7.5	10	15	20	25	30	40
Rated current ±10	% [A]	10.7	13.9	21.3	29.1	33.9	40.6	56.0
Direct-online	Backup fuse [A]	25	35	35	50	63	63	80
starting	Supply cable [AWG]	4x14	4x14	4x12	4x10	4x8	4x8	4x6



2.13 Options

2

Motor power [kW]		7.5	10	15	20	25	30	40
Star-delta start-	Backup fuse [A]	16	20	25	35	50	50	63
ing	Supply cable [AWG]	2x 4x14	2x 4x14	2x 4x14	2x 4x14	2x 4x14	2x 4x12	2x 4x10

### Tab. 12 Power supply details 380V/3ph/60Hz

#### Rated power supply: 460V ±10% / 3ph / 60Hz

Motor power [kW]		7.5	10	15	20	25	30	40
Rated current ±10	% [A]	8.7	11.4	17.0	23.4	29.0	33.0	47.0
Direct-online	Backup fuse [A]	15	20	25	40	50	50	80
starting	Supply cable [AWG]	4x14	4x14	4x10	4x8	4x6	4x6	4x3
Star-delta starting	Backup fuse [A]	10	15	20	30	35	40	60
	Supply cable [AWG]	2x 4x14	2x 4x14	2x 4x14	2x 4x14	2x 4x12	2x 4x10	2x 4x8

Tab. 13 Power supply details 460V/3ph/60Hz

#### Rated power supply: 575V ±10% / 3ph / 60Hz

Motor power [kW]		7.5	10	15	20	25	30	40
Rated current ±10	% [A]	7.0	9.1	13.6	18.7	23.0	26.4	37.0
Direct-online	Backup fuse [A]	10	15	20	30	40	45	60
starting	Supply cable [AWG]	4x14	4x14	4x12	4x10	4x8	4x8	4x4
Star-delta start-	Backup fuse [A]	6	10	15	20	25	30	45
ing	Supply cable [AWG]	2x 4x14	2x 4x14	2x 4x14	2x 4x14	2x 4x14	2x 4x14	2x 4x10

Tab. 14 Power supply details 575V/3ph/60Hz

# 2.13 Options

Technical data for the options available for your machine are given in the following.

# 2.13.1 Option C9

### Pressure switch

Feature		Data
Max. contact load at 250 V [A]	Inductive load	0.5
	Resistive load	1.0



Feature	Data
Protection (with cover, electrical connection upwards)	IP 54

Tab. 15 Pressure switch (option C9)

Further information The wiring diagram for option C9 in chapter 13.5 contains further details of the power supply connection.

# 2.13.2 Option C10 Speed monitor

Sensor

Feature	Data
Rated switching distance Sn [in]	76 – 102
Installation conditions	Not flush
Output function	DC PNP/NPN
Degree of protection	IP 67

### Tab. 16 Speed monitor (Option C10)

#### Sensor

Feature	Data
Rated voltage [V]	110 – 240 AC/DC (50 – 60 Hz) / 27 DC (typ. 24 DC)
Contact load capacity	6 A (250 V AC); B300, R300
Power consumption [VA]	5
Start override [s]	0.5 – 15
Ambient temperature [°F]	-4 – +158
Degree of protection - enclosure/terminals	IP 40 / IP 20
Connection	16 terminals up to 2.5 mm <sup>2</sup> (AWG 14)

Tab. 17 Speed monitor sensor (Option C10)

### Sensor setting

Feature	Data
Start override time [s]	5
Switching point [Imp/min] (basic value)	20
Hysteresis [%]	5
Switching function	II



2.13 Options

2

Feature	Data
Switching point multiplier	100

Tab. 18 Speed monitor sensor setting (Option C10)

Further information The wiring diagram for Option C10 in chapter 13.5 contains further details of the power supply connection.

# 2.13.3 Option C11 Unloaded start valve (AFE)

Model	AFE 15
Permissible pressure [psi]	0 – 29
Maximum delivery [cfm]	530
Nominal width (ISO 228–1)	G 2 A

Tab. 19 Unloaded start valve (Option C11)

# 2.13.4 Option C13 Temperature gauge switch

Feature		Data
Switching capacity at 250 V(AC) [A] Single pole micro-switch with changeover contact	Inductive load	1.5
	Resistive load	5.0
Switching differential of the scale	e range [%]	<3
Switching point tolerance [%] (of the scale range related to the cut-out point at rising tempera- ture)		±5
Minimum voltage [V] [AC] Minimum current [mA] (Switching safety)		24 20
Enclosure protection	Front	IP 53
	Rear	IP 54

Tab. 20Temperature gauge switch (Option C13)

Further information The wiring diagram for Option C13 in chapter 13.5 contains further details of the power supply connection.

# 2.13.5 Option C14 Pressure sensor

Feature	Data
Output signal [mA]	4 – 20
Parasitic energy [V]	U <sub>B</sub> = DC 10 – 30



Feature	Data
Permissible apparent resistance [Ohm]	R <sub>A</sub> = (U <sub>B</sub> [V] – 10 V) / 0.02 A
Enclosure protection	IP 65

Tab. 21 Pressure sensor (option C14)

# 2.13.6 Option C18 Unloaded start valve with regulating valve (AFR)

Model	AFR 10
Permissible pressure [psi]	0 – 29
Maximum delivery [cfm]	353
Maximum pressure differ- ential [psi]	13.8
Regulating range [psi]	2.9 – 13.8
Nominal width (ISO 228–1)	G 2 A
Control line connection (ISO 228–1)	R 1/8 A

Tab. 22 Unloaded start valve with regulating valve (Option C18)

### 2.13.7 Option C19, H12 Thermostat

Feature	Data
Snap switch with change-over contact	1–pole
Switching capacity NC contact (1–2)	AC 230 V / 2.5 A / cosφ=0.6 AC 230 V / 16 A / cosφ=1 DC 230 V / 0.25 A
Switching capacity NO contact (1-4)	AC 230 V / 2.5 A / cosφ=0.6 AC 230 V / 6.3 A / cosφ=1 DC 230 V / 0.25 A
Switching differential scale starting position [%]	6
Switching differential scale end position [%]	1.5
Enclosure protection	IP 54

Tab. 23 Thermostat (Option C19)

Further information The wiring diagram for Option C19 in chapter 13.5 contains further details of the power supply connection.

Further information The wiring diagram for option C14 in chapter 13.5 contains further details of the power supply connection.



# 2.13.8 Option C20 Pressure gauge

Feature	Data
Indicator range [psi]	0 – 23.2

Tab. 24 Pressure gauge (option C20)

# 2.13.9 Option F4 Filter maintenance indicator

Feature	Data
Indicator range [psi]	0 – 0.94

Tab. 25Filter maintenance indicator (option F4)

# 2.13.10 Option F5

### Filter pressure differential switch

Feature	Data	
Pressure differential, adjustable [psi]	0.04 – 0.73	
Voltage [V]	(AC) eff., min. 10	
	(AC) max. 250	
	(DC) min. 12	
	(DC) max. 48	
Rated current [A]	(AC) 10	
Switching current	(AC) eff., min. 20 mA	
	(AC) max. 6 A, cosφ = 1.0	
	(AC) max. 3 A, cosφ = 0.6	
	(DC) min. 20 mA	
	(DC) max. 1 A	
Enclosure protection	IP 54	

Tab. 26 Filter pressure differential switch (Option F5)

Further information The wiring diagram for Option F5 in chapter 13.5 contains further details of the power supply connection.

## 2.13.11 Option G1 Check valve

Nominal pipe size	Max. pressure and back pres- sure [psi]	Max. torque [lbf.ft]
DN 100	21.8	59
—		—

Tab. 27 Check valve torque (option G1)



## 2.13.12 Option H2, H12 Auxiliary heating

Rated voltage [V]	110–265	
Heating capacity [hp]	0.2	
Number of radiators	1	

Tab. 28Auxiliary heating (Option H2)

#### Thermostat

Feature	Data
Snap switch with change-over contact	1–pole
Switching capacity NC contact (1–2)	AC 230 V / 2.5 A / cosφ=0.6 AC 230 V / 16 A / cosφ=1 DC 230 V / 0.25 A
Switching capacity NO contact (1-4)	AC 230 V / 2.5 A / cosφ=0.6 AC 230 V / 6.3 A / cosφ=1 DC 230 V / 0.25 A
Switching differential scale starting position [%]	6
Switching differential scale end position [%]	1.5
Enclosure protection	IP 54

- Tab. 29 Thermostatic auxiliary heating (Option H2)
- Further information The wiring diagram for Option H2 in chapter 13.5 contains further details of the power supply connection.

### 2.13.13 Option H3, H12 Outdoor installation

The dimensional drawings in chapter 13.2 includes dimensions of a weather protection roof.

### 2.13.14 Option H11 Piped inlet

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The dimensional drawings in chapter 13.2 include connection dimensions.

# 2.13.15 Option H12 Ventilator fan (sound enclosure)

KAESER installs fans supplied by various manufacturers. The manufacturer is indicated on the fan's nameplate.

Set overload protection devices to 1.1 times nominal value.

Further information The wiring diagram for Option H12 in chapter 13.5 contains further details for the power supply connection.



2.13 Options

### 2.13.15.1 Manufacturer SODECA

#### Delivery

2

Feature	Value
Delivery [cfm]	1295

Tab. 30 Delivery for SODECA fan (Option H12)

#### Power supply details

Three-phase, 60 Hz

Rated voltage [V]	Δ–208/Y– 360	Δ–220/Y– 380	Δ–230/Y– 400	Y–460	Y–575
Rated power ±10% [hp]	0.16	0.16	0.16	0.16	0.19
Current draw ±10% [A]	0.92/0.53	0.83/0.48	0.68	0.37	0.32
Enclosure protection	IP 55	IP 55	IP 55	IP 55	IP 55

Tab. 31 Power supply details for SODECA fan: 3ph/60Hz (Option H12)

### Single-phase, 60 Hz - 1/N/PE

Rated voltage [V]	115	230
Rated power ±10% [hp]	0.24	0.16
Current draw ±10% [A]	3.80	1.10
Enclosure protection	IP 55	IP 55

Tab. 32 Power supply details for SODECA fan: 1ph/60Hz (Option H12)

#### 2.13.15.2 Manufacturer EBM

#### Fan air delivery

Feature	Value
Delivery [cfm]	1059 – 1177

Tab. 33Delivery for EBM fan (Option H12)

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The fan's nameplate indicates the minimum value for the power consumption. The following tables show the maximum value for the power consumption.

### Power supply details

#### Three-phase, 60 Hz

Rated voltage [V]	Δ–208/Y–360	Δ-220/Y-380	Δ-230/Y-400	Y-460
Power consumption ±10% [hp]	0.17	0.19	0.19	0.21
Current draw ±10% [A]	0.43/0.25	0.43/0.25	0.45/0.26	0.26



Rated voltage [V]	Δ–208/Υ–360	∆–220/Y–380	Δ-230/Y-400	Y-460	
Enclosure protection	IP 44	IP 44	IP 44	IP 44	

Tab. 34 Power supply details for EBM fan: 3ph/60Hz (Option H12)

### Single-phase, 60 Hz

Rated voltage [V]	115	230
Power consumption ±10% [hp]	0.21	0.20
Current draw ±10% [A]	1.51	0.71
Enclosure protection	IP 44	IP 44

Tab. 35Power supply details for EBM fan: 1ph/60Hz (Option H12)

Safety and Responsibility



3.1 Basic instructions

# 3 Safety and Responsibility

# 3.1 Basic instructions

3

The machine is manufactured to the latest engineering standards and acknowledged safety regulations. Nevertheless, dangers can arise through its operation:

- danger to life and limb of the operator or third parties,
- damages to the machine and other material assets.

### **A** DANGER

Disregard of these instructions can result in serious injury.

- Read the operating and installation instruction carefully and take note of the contents for safe machine operation.
- Use this machine only if it is in a technically perfect condition and only for the purpose for which it is intended; and observe all safety measures and the instructions in the operating or installation manual!
- Immediately rectify (have rectified) any faults that could be detrimental to safety!

# 3.2 Specified use

The machine is designed exclusively for the generation of overpressure in a commercial or industrial environment where air (in the following "compressed air") as delivery medium is approved for use. Any other use is considered incorrect. The manufacturer is not liable for any damages that may result from incorrect use. The user alone is liable for any risks incurred.

- ► Comply with the specifications listed in this installation manual.
- Operate the machine only within its performance limits and under the permitted ambient conditions.
- > Do not use compressed air for breathing purposes unless it is specifically treated.
- ➤ Do not use compressed air for any application that will bring it into direct contact with food products unless it is specifically treated.
- ► Operate the blower block only with inlet and outlet ports connected.
- Intake of solid particles >0.004 inch is not permitted.

# 3.3 Improper use

- ➤ Never direct compressed air at persons or animals.
- Use hot cooling air for heating purposes only if there is no risk to the health of humans or animals. If necessary, hot cooling air should be treated by suitable means.
- > Do not allow the machine to take in toxic, acidic, flammable of explosive gases or vapors.
- Do not operate the machine in areas in which specific requirements with regard to explosion protection are in force.



# 3.4 User's responsibilities

The machine is delivered in a state in which it cannot be activated. The user must equip the machine with a motor starter of >3 hp and a current draw of >10 A, with a lockable main switch and appropriate fusing. The machine must also be equipped with a motor overload protection switch and an emergency stop switch before being commissioned in accordance with applicable local regulations.

### 3.4.1 Observe statutory and universally accepted regulations

This includes, for example, nationally implemented European directives and/or applicable national legislation, safety and accident prevention regulations.

 Observe relevant statutory and accepted regulations during installation, operation and maintenance of the machine.

### 3.4.2 Determining personnel

Suitable personnel are experts who, by virtue of their training, knowledge and experience as well as their knowledge of relevant regulations can assess the work to be done and recognize the possible dangers involved.

Authorised operators possess the following qualifications:

- are of legal age,
- are conversant with and adhere to the safety instructions and sections of the installation manual relevant to operation,
- have received adequate training and authorization to operate electrical and compressed air devices.

Authorised installation and maintenance personnel have the following qualifications:

- are of legal age,
- have read, are conversant with and adhere to the safety instructions and sections of the installation manual applicable to installation and maintenance,
- are fully conversant with the safety concepts and regulations of electrical and compressed air engineering,
- are able to recognize the possible dangers of electrical and compressed air devices and take appropriate measures to safeguard persons and property,
- have received adequate training in and authorization for the safe installation and maintenance of this machine.
- Ensure that personnel entrusted with operation, installation and maintenance are qualified and authorised to carry out their tasks.

# 3.5 Dangers

#### **Basic instructions**

The following describes the various forms of danger that can occur during machine operation. Basic safety instructions are found in this operating or installation manual at the beginning of each chapter in the section entitled 'Safety'.

Warning instructions are found before a potentially dangerous task.



3.5 Dangers

3

## 3.5.1 Safely dealing with sources of danger

The following describes the various forms of danger that can occur during machine operation.

#### Electricity

Touching voltage-carrying components can result in electric shocks, burns, or death.

- Allow only qualified and authorized electricians or trained personnel under the supervision of a qualified and authorized electrician to carry out work on electrical equipment according to electrical engineering regulations.
- Before commissioning or recommissioning the machine, the user must ensure adequate protection against electric shock from direct or indirect contact.
- Before beginning any work on electrical equipment: Switch off and lock out the power supply disconnecting device and verify the absence of any voltage.
- Switch off any external power sources.
   These could be connections to floating relay contacts or the electrical machine heating, for example.
- Use fuses corresponding to machine power.
- > Check regularly that all electrical connections are tight and in proper condition.

#### Forces of compression

Compressed air is contained energy. Uncontrolled release of this energy can cause serious injury or death. The following information concerns work on components that could be under pressure.

- Close shut-off valves or otherwise isolate the machine from the distribution network to ensure that no compressed air can flow back into the machine.
- > Depressurize all pressurized components and enclosures.
- Allow no person or thing to remain near the blowoff valve during machine operation. In the event of operating pressure being exceeded, hot gas is blown off at high velocity and the valve tension rod is blown upward with great force.
- Do not carry out welding, heat treatment, or mechanical modifications on pressurized components, as this influences the component's resistance to pressure. The safety of the machine is then no longer ensured.

#### Compressed air quality

The composition of the compressed air must be suitable for the actual application in order to preclude health and life-threatening dangers.

- ➤ Never directly inhale compressed air.
- ➤ Use appropriate systems for air treatment before using the compressed air from this machine as breathing air and/or for the processing of food products.
- Use food-grade lubricating oil whenever compressed air is to come into contact with food products.

#### Spring forces

Springs under tension or compression store energy. Uncontrolled release of this energy can cause serious injury or death.

Check valves, blowoff valves, and unloaded start valves are under powerful spring loading.

Do not open or dismantle any valves.



3.5 Dangers

3

#### **Rotating components**

Touching the the fan wheel or the belt drive while the machine is switched on can result in serious injury.

- > Do not open the enclosure while the machine is activated.
- Switch off and lock out the power supply disconnecting device and verify the absence of any voltage.
- Wear close-fitting clothes and a hair net if necessary.
- > Ensure that all covers and safety guards are in place and secured before restarting.

#### Temperature

High temperatures are generated during compression. Touching hot components may cause injuries.

Avoid contact with hot components.

Some examples of hot components are:

- Blower block
- Silencer
- Oil and compressed air lines
- Coolers
- Motors
- Machine heaters
- Wear protective clothing.
- If welding is carried out on or near the machine, take adequate measures to prevent sparks or heat from igniting oil vapors or parts of the machine.

#### Noise

The enclosure (Option H12) absorbs the machine noise to a tolerable level. This function will be effective only if the enclosure is closed.

Wear hearing protection if necessary.
 The blowoff valve blowing off can be particularly loud.

#### **Operating fluids/materials**

The used operating fluids and materials can cause adverse health effects. Suitable safety measures must be taken in order to prevent injuries.

- Strictly forbid fire, open flame, and smoking.
- ► Follow safety regulations when dealing with oils, lubricants, and chemical substances.
- Avoid contact with skin and eyes.
- ► Do not inhale oil mist and vapors.
- > Do not eat or drink while handling lubricants.
- Keep suitable fire extinguishing agents ready for use.
- Use only KAESER approved operating materials.

#### Unsuitable spare parts

Unsuitable spare parts compromise the safety of the machine.

➤ Use only spare parts approved by the manufacturer for use in this machine.





3.5 Dangers

3

➤ Use only genuine KAESER replacement parts on pressure bearing parts.

#### Conversion or modification of the machine

Modifications, additions to, and conversions of the machine or the controller can result in unpredictable dangers.

- > Do not convert or modify the machine!
- Obtain written approval by the manufacturer prior to any technical modification or expansion of the machine, the controller, or the control programs.

#### Extending or modifying the compressor station

If sized appropriately, safety relief valves reliably prevent an impermissible rise in pressure. New dangers may arise if you modify or extend the blower air station.

- If an air distribution network is to be extended or changed: Check the capacity of the blow-off valves before installing any new machines.
- Blow-off valves of insufficient capacity must be replaced by valves with higher capacity.

### 3.5.2 Organizational measures

- > Designate personnel and their responsibilities.
- > Give clear instructions on reporting faults and damage to the machine.
- ► Give instructions on fire reporting and fire-fighting measures.

#### 3.5.3 Safe machine operation

Information on conduct that will help in handling the machine safely is given here.

#### Transporting

- > Use suitable lifting gear that conforms to local safety regulations.
- > Allow transportation only by personnel trained in the safe movement of loads.
- > Attach lifting gear only to suitable lifting points.
- > Note the center of gravity to avoid danger of the load tipping over.
- Make sure the danger zone is clear of personnel.

#### Installation

- > Make sure no power is applied when electrical connections are made.
- Only use only electrical cables that are suitable and approved for the surroundings and electrical loads applied.
- ► Never dismantle compressed air pipes until they are fully vented.
- Only use pressure lines that are suitable and approved for the maximum working pressure and the intended medium.
- > Do not allow connection pipes to be placed under mechanical stress.
- > Do not step onto machine components to climb up the machine.

#### Positioning

CB C pr

Installation manual Rotary blower

► Install the machine in a suitable compressor room.



3.6 Danger areas

3

- If installed outdoors, the machine must be protected from frost, direct sunlight, dust, rain and splashing water.
- Do not operate in areas in which specific requirements regarding explosion protection are in force.
- Ensure adequate ventilation.
- Ensure that required ambient conditions are maintained with regard to:
  - Ambient temperature and humidity
  - clean inlet air with no damaging contaminants,
  - explosive or chemically unstable gases or vapors,
  - acid/alkaline forming substances, particularly ammonia, chlorine or hydrogen sulfide.
- > Do not position the machine in warm cooling outlet air from other machines.
- Ensure accessibility so that all work on the machine can be carried out without danger or hindrance.

#### Operation

- Carry out regular inspections:
  - for visual damage,
  - Of safety devices

#### Maintenance

- Make sure the machine is disconnected from electrical power and vented before commencing any work.
- > Maintenance may not commence before the machine has cooled down.
- ➤ Wear close-fitting, flame-resistant clothing. Wear protective clothing as necessary.
- ➤ Pay particular attention to cleanliness during all maintenance and repair work. Cover components and openings with clean cloths, paper or tape to keep them clean.
- Do not leave any loose components, tools or cleaning rags on or in the machine.
- Components removed from the machine can still be dangerous.
   Do not attempt to open or destroy any components taken from the machine.

#### De-commissioning, storage, disposal

- Drain out fluids and dispose of according to environmental regulations. These include, for example, lubricating oil.
- > Dispose of the machine in accordance with local environmental regulations.

# 3.6 Danger areas

The table gives information on areas dangerous to personnel. Only authorized personnel may enter these areas.

Function	Danger area	Authorized personnel
Transporting	Within a 10 ft radius of the machine.	Installation personnel for transport- ing preparation. No personnel during transporting.
	Beneath the lifted machine.	No personnel!





# 3.7 Safety devices

Function	Danger area	Authorized personnel
Installation	Within the machine. Within 3 ft radius of the machine and its pow- er supply cables.	Installation personnel
Operation	Within a 3 ft radius of the machine.	Operating personnel
Maintenance	Within the machine. Within a 3 ft radius of the machine.	Maintenance personnel

#### Tab. 36 Danger areas

3

# 3.7 Safety devices

Various safety devices ensure safe working with the machine.

- ► Do not change, bypass or disable safety devices.
- ► Check safety devices for correct function regularly.
- ► Do not remove or obliterate labels and notices.
- ► Ensure that labels and notices are clearly legible.

Further information More information on safety devices is contained in chapter 4, section 4.4.

# 3.8 Safety signs

The diagram shows the positions of safety signs on the machine. The table 37 lists the various safety signs used and their meanings.



Fig. 3 Position of the safety signs at the machine





Fig. 4 Position of the safety signs, Option H2 (standstill heating)

Item	Symbol	Meaning
3		Rotating rotors. Risk of serious lacerations or even severing of extremities (fingers) from rotating components.
		<ul> <li>Switch off and lock out the power isolating devices and check that no voltage is present before opening any machine enclosure or guard.</li> </ul>
6		Hot gas!
		Burning, from contact with hot gasses.
		<ul> <li>Do not enter danger zone.</li> </ul>
		<ul> <li>Wear long-sleeved garments (not synthetics such as polyester) and protective gloves.</li> </ul>
8		Danger of fatal injury from touching electrically live components!
	<u>/</u>	<ul> <li>Switch off and lock out the supply disconnecting device and check that no volt- age is present.</li> </ul>
10		Severe injury could result from touching the v-belt drive while it is rotating.
		<ul> <li>Isolate completely from the power supply (all conductors) and ensure the supply cannot be switched on again (lock off).</li> </ul>
11		Injury and/or contamination can result from breathing compressed air! Contamination of food can result from using untreated compressed air for food proc- essing!
		<ul> <li>Never breathe untreated compressed air.</li> </ul>
		<ul> <li>Air from this compressor must meet OSHA 29CFR1910.134 and FDA 21CFR178.3570 standards, if used for breathing or food processing. Use proper compressed air treatment.</li> </ul>
13		Hot surface can cause burns!
		➤ Let the machine cool down.
		<ul> <li>Wear long-sleeved garments (not synthetics such as polyester) and protective gloves.</li> </ul>
16		Wrong lubricating oil level can cause machine defects or rising oil consumption (oil content for pure air)!
		<ul> <li>Check the oil level regularly and top up as necessary.</li> </ul>
23		Serious injury or death can result from loosening or opening component that is un- der pressure and heavily spring loaded!
		<ul> <li>Do not open or dismantle the valve.</li> </ul>
		<ul> <li>Call for authorized KAESER Service representative if a fault occurs.</li> </ul>



3.9 In emergency

3

Item	Symbol	Meaning
24		<ul> <li>Serious injury or death can result from loosening or opening component under pressure!</li> <li>De-pressurize all pressurized components and enclosures.</li> <li>Secure that machine keeps de-pressurized.</li> <li>Check that machine is de-pressurized.</li> </ul>
25		<ul> <li>Ear damage and burns can result from loud noise and/or oil mist when the blowoff valve opens!</li> <li>Wear ear protection and protective cloths.</li> <li>Close all maintenance doors and cover panels.</li> </ul>
38		<ul> <li>Wear hearing protection.</li> <li>➤ Noise from running machine (without sound enclosure).</li> <li>➤ Loud noise if any part of the sound enclosure is open while the machine is running.</li> </ul>

Tab. 37 Safety signs

# 3.9 In emergency

## 3.9.1 Correct fire fighting

Suitable extinguishing agents

- Foam
- Carbon dioxide
- Sand or dirt

Unsuitable or unsafe extinguishing agents

- Strong jet of water
- 1. Keep calm.
- 2. Give the alarm.
- 3. Switch off the power supply disconnecting device, if possible.
- 4. Move to safety.
  - Warn persons in danger.
  - Help incapacitated persons.
  - Close the doors.
- 5. Try to extinguish the fire if you have the skill to do so.

### 3.9.2 Remove lubricating oil from the skin.

- Eye contact: Rinse eyes thoroughly with lukewarm water and seek medical assistance.
- Skin contact: Wash off immediately.



# 3.10 Environmental protection

- Store and dispose of operating materials and replaced parts in accordance with local environmental protection regulations.
- Observe national regulations.
   This applies particularly to parts contaminated with lubricating oil.



► Do not allow lubricating oil to escape to the environment or into the sewage system.

# 3.11 Warranty

This operating or installation manual does not contain an independent warranty commitment. Our general terms and conditions of business apply with regard to warranty.

A condition of our warranty is that the machine is used for the purpose for which it is intended under the conditions specified.

Due to the multitude of applications for which the machine is suitable, the user is obliged to determine its suitability for his specific application.

Furthermore, we do not assume any warranty obligation for damages caused by:

- the use of unsuitable parts or operating materials,
- un-authorized modifications,
- incorrect maintenance,
- incorrect repair.

Correct maintenance and repair includes the use of genuine KAESER spare parts and operating materials.

> Obtain confirmation from KAESER that your specific operating conditions are suitable.



**Design and Function** 



4.1 Outline of the machine

#### **Design and Function** 4

- 4.1 Outline of the machine
- 4.1.1 Machine



- Fig. 5
  - Inlet silencer 2
  - 3 Blower block
  - Outlet silencer 4
  - (5) Display (option)

#### 4.1.2 **Blower block**

- Blowoff valve 7
- 8 Unloaded start valve (option)
- 9 Filter maintenance indicator (option)



- 1 Gear-end oil inlet
  - Side gas drainage (closed)
- 23 Flange connection (both sides)
- <u>(</u>4) Drive-end oil inlet
- 5 Drive-end oil drain

- 6 Drive shaft
- 7 Drive-end oil sight glass
- 8 Gear-end oil sight glass
- 9 Gear-end oil drain
- 10 Connection for measuring instrument (both sides)



#### 4.2 **Functional Description**

4.2.1 Machine



U	Drive motor	
2	Inlet silencer	

Outlet silencer

The motor 1 drives the block 3 via belts.

Air is drawn into the inlet silencer (2) and through a filter where it is cleaned.

The air is then compressed in the block and transported vertically into the outlet silencer [4].

(4)

#### 4.2.2 Principle of compression



Fig. 8 Principle of compression

A pair or rotors with intermeshing lobes turn in opposite directions within a casing. The rotors are synchronized by timing gears on one end. Air in the block inlet is trapped between the rotor lobes and the casing and moved round to the discharge port.

As there is no contact between the rotors themselves and the casing, oil film lubrication is not required.

#### 4.2.3 Blowoff valve

The blow-off valve protects the system from excessive pressure. It is factory set.

Design and Function



4.3 Options



- Fig. 9 Blowoff valve dimensions
  - 1 Pressure line connection

NPT ["]	A [in]	B [in]	C [in]
2.0	7.1	3.0	3.3

Tab. 38 Blowoff valve dimensions

# 4.2.4 Compensator

The compensator functions as follows:

- Inlet and outlet connections to silencers and accessories,
- Isolates the machine vibrations from the air pipeline.



#### Fig. 10 Compensator

- 1 Flange
- 2 Compensator hose
- 3 Hose clamp

# 4.3 Options

The options available for your machine are described below.



optiono

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The options included are listed in the KAESER order confirmation.

## 4.3.1 Option C9 Pressure switch

The pressure switch sends a signal when the set pressure is exceeded.



The pressure switch is factory set according to the customer's specification. In other cases it must be set according to the application.



### Fig. 11 Pressure switch

- 1 Switching point adjusting screw
- 2 Switching differential adjusting screw
- 3 Screw sealed with a protective coating

The switching point can be adjusted by the screw 1 while the machine is running. Fine adjustment and switching differential is set with the adjusting screw [2].

<u>0</u>][

The screw (3) is sealed with a protective coating. It is not to be adjusted.

# 4.3.2 Option C10 Speed monitor

The speed monitor measures the rotational speed of the block rotors.

# 4.3.3 Option C11 Unloaded start valve

The unloaded start value prevents the machine starting against a load in the star-delta phase. The value closes when the motor starter switches from star (Y) to delta ( $\Delta$ ).





4.3 Options







The unloaded start valve is factory set.

#### 4.3.3.1 Function



#### Fig. 13 Diagram of the unloaded start valve

Adjusting screw

(1) Air network

- (4)
- Diaphragm chamber Valve cone

3 Nozzle

(2)

(5)

When the machine is shut down the valve cone  $\overline{(5)}$  is open.

When the machine is started, air passes through the blow-off aperture to atmosphere.

Screwing in the adjusting screw [2] reduces the gap between the valve cone [5] and its seating so that it closes at a lower flow rate.

(1.45 psi pressure is needed in the network to close the valve cone (5)

Back pressure acts through the nozzle (3) on the diaphragm chamber (4) to close the valve cone. The closing time is influenced by the adjusting screw [2] changing the position of the valve cone.

Changing the closing time with the adjusting screw:

- Clockwise shorter closing time
- Counterclockwise longer closing time

#### 4.3.4 Option C13 Temperature gauge switch

The gauge shows the temperature in the block discharge port and has a floating relay changeover contact that can be set to switch at a selected temperature.



<u>0</u>][

4.3 Options

The switching point is factory set to 293 °F.



Fig. 14 Location of the temperature gauge

- (A) Machine with sound enclosure
- B Machine without sound enclosure
- 1 Temperature gauge

#### 4.3.4.1 Setting instructions

The switching point can be adjusted by means of the screw beneath the protective cover on the front plate.

Possible adjustment for working conditions on site:

- Block discharge temperature lower than 293 °F
  - If the average block discharge temperature is significantly lower than 293 °F, the gauge switching point can be adjusted down.
     The recommended switching point is the average block discharge temperature plus 27°F.
- Block discharge temperature higher than 293 °F
  - If the average block discharge temperature is near to or higher than 293 °F, adjust the switching point upward.
     The maximum permissible value is 311 °F.

# 4.3.5 Option C14

### Pressure sensor

The sensor measures the actual block discharge pressure.

Design and Function



4.3 Options



Fig. 15 Pressure sensor

## 4.3.6 Option C18 Unloaded start valve with regulating valve

The unloaded start valve with regulating valve is a medium-controlled valve with the following functions:

- Unloaded starting
- Pressure regulating during operation



Fig. 16 Unloaded start valve with regulating valve

### 4.3.6.1 Function



Fig. 17 Diagram of the unloaded start valve with regulating valve

- 1 Adjusting screw
- 2 Control air regulator
- 3 Valve cone
- Air network

- 5 Valve cone6 Diaphragm chamber
- 7 Nozzle
- 8 Adjusting screw



Options

4.3

#### Unloaded starting

When the machine is stopped the valve cone (5) is open and valve cone (3) closed. When the machine is started, air flows over the valve cone (5) and is blown off to atmosphere. The pressure build-up in the air network (4) is transmitted through the hollow spindle and nozzle (7) into the upper diaphragm chamber (6). The resulting pressure on the diaphragm closes the valve cone (5).

Changing the closing time:

The value closing time can be adjusted by changing the nozzle 7 and turning the adjusting screw 8.

- Clockwise shorter closing time
- Counterclockwise longer closing time

The unloaded start function only works if the pressure in the air network ④ reaches at least 1.45 psi.

#### **Overflow regulation**



The control air regulator is set to atmospheric pressure.

After starting, the network pressure and the pressure on the control air regulator (2) rises. As soon as the set network pressure is reached the valve cone (3) opens. Pressure in the upper diaphragm chamber (6) bleeds off to atmosphere and the valve cone (5) opens.

The set network pressure is kept constant.

Changing the pressure setting

Remove the rubber cap from the control regulator to change network pressure. Undo the locknut and adjust the screw with a screwdriver.

- Clockwise lower pressure
- Counterclockwise higher pressure

Lock the screw in position after adjusting and replace the rubber cap.

## 4.3.7 Option C19, H12 Thermostat

The thermostat controls the temperature within the sound enclosure. It consists of a temperature sensor with a floating relay change-over contact.



The switching point is factory set to 140 °F.



Fig. 18 Thermostat



Options

# 4.3.8 Option C20 Pressure gauge

4.3

The pressure gauge shows the pressure in the blower block discharge port.



Fig. 19 Location of the pressure gauge

- A Machine with sound enclosure
- B Machine without sound enclosure
- 1 Pressure gauge

# 4.3.9 Option F4 Filter maintenance indicator

The maintenance indicator shows when the filter needs maintenance. When the filter becomes clogged and flow resistance rises to a set point, the maintenance signal is given.

# 4.3.10 Option F5 Filter pressure differential switch

The filter pressure differential switch monitors contamination of the intake filter.

The switch is triggered by pressure differential. Falling below or rising above the set value causes the current flow to switch on, switch off or changeover according to how the switch is wired.







4.3 Options

#### 4.3.10.1 Pressure connection diagram



Fig. 21 Pressure connection to the filter pressure differential switch

- (1) Low pressure connection
- 2 Higher pressure connection
- Inlet silencer
   Filter

#### 4.3.10.2 Switching function



#### Fig. 22 Filter pressure differential switch function

Switching with rising pressure:

- 1 NC opens
- 2 NO closes

Switching with falling pressure:

- 1 NC closes
- 2 NO opens

# 4.3.11 Option G1 Check valve

The check valve prevents reversal of the normal air flow direction. The valve is closed when the machine is at standstill. The fixing screws are sealed with Omnifit FD 20.



4.3 Options



#### Fig. 23 Check valve

- 1 Housing
- 2 Closing mechanism
- 3 Gasket

# 4.3.12 Option H2, H12 Auxiliary heating

The auxiliary heating has the following functions:

- Prevents condensation forming on the machine in climates of high humidity.
- Pre-warms the machine when ambient temperatures are below 23 °F.

The heating is designed to raise the machine temperature by about 59 °F.

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The thermostat switching point is factory set to 41 °F.



- Fig. 24 Auxiliary heating
  - 1 Radiator
  - 2 Thermostat
  - 3 Terminal box



## 4.3.13 Option H3, H12 Outdoor installation

Sound enclosures (Option H12) on machines for outdoor installation are provided with a weather protection roof.

### 4.3.14 Option H11 Piped inlet

Air is drawn into the block through the inlet silencer.

## 4.3.15 Option H12 Sound enclosure

4.3.15.1 Overview



Fig. 25 Sound enclosure overview

- 1 Side panel
- 2 Intake air inlet
- 3 Pressure line connection
- Frame
- 5 Back plate

- 6 Cooling air inlet7 Removable panels
- 8 Display (option)
- 9 Cooling air outlet

The sound enclosure has a removable access panel (7). Latches are released by a key supplied with the machine.

The sound enclosure has several functions when it is closed:

- Sound insulation
- Protection against contact with components
- Airflow control

The sound enclosure is not suitable for the following uses:

- Persons walking, standing or sitting on the machine.
- Use as resting place or storage of any kind of load.



4.4 Safety devices

#### 4.3.15.2 Functional Description



Fig. 26 Function of the sound enclosure (schematic diagram)

2 Intake air inlet

3 Compressed air outlet

Cooling air inlet

9 Cooling air outlet

The motor fan draws cooling air through the inlet 6 to cool the motor and blower within the sound enclosure.

(6)

Cooling air flow is supplemented by an extractor within the enclosure. Warm air is blown out to protect the machine from overheating.

Air to be compressed is drawn in through a separate air inlet 2. This ensures that only air at ambient temperature is compressed.

# 4.4 Safety devices

The following safety devices are provided and may not be modified in any way.

- Blow-off valve: The blow-off valve protects the machine from excessive pressure build up. It is factory set.
- Covers over moving parts and electrical connections. These protect against accidental contact.
- Sound enclosure (Option H12): The sound enclosure prevents excessive noise emission.
- Drive motor with 3 PTC thermistors: They protect the motor against overheating in connection with the user's protection cut-out.


Safety

# 5 Installation and Operating Conditions

# 5.1 Safety

5 5.1

- ► Strictly forbid fire, open flame and smoking.
- If welding is carried out on or near the machine, take adequate measures to prevent sparks or heat from igniting oil vapors or parts of the machine.
- The machine is not explosion protected.
   Do not operate in areas in which specific requirements regarding explosion protection are in force.
- ► Ensure that required ambient conditions are maintained with regard to:
  - Ambient temperature and humidity
  - clean inlet air with no damaging contaminants,
  - explosive or chemically unstable gases or vapors,
  - acid/alkaline forming substances, particularly ammonia, chlorine or hydrogen sulfide.
- ► Keep suitable fire extinguishing agents ready for use.

# 5.2 Installation conditions

### 5.2.1 Determining location and clearances

The machine is intended for installation in an appropriate machine room. Information on distances from walls and ventilation is given below.



The distances quoted are recommended distances and ensure unhindered access to all machine parts.

> Please consult KAESER if you cannot comply with these recommendations.

Precondition The floor must be level, firm and capable of bearing the weight of the machine. No special foundation is necessary.







5.2 Installation conditions



Fig. 27 Recommended machine placement and dimensions [in]

Α	32	E	71
B	4	1	Exhaust fan
С	4	2	Air inlet aperture
D	24		

- 1. NOTICE Ambient temperature too low! Frozen condensate and highly viscous lubricating oil can cause damage when starting the machine.
  - ► Ensure that the temperature of the machine is at least +37°F before starting.
  - > Heat the machine room adequately or install an auxiliary heater.
- 2. If installed outdoors, protect the machine against frost, direct sunlight, dust and rain.
- 3. Secure the machine so it cannot slide on the floor.
- 4. Ensure accessibility so that all work on the machine can be carried out without danger or hindrance.

#### 5.2.2 Ensuring adequate ventilation

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If the ventilation is insufficient, a partial vacuum can be created in the room.

- Ensure that the volume of air flowing into the machine room is at least equivalent to that being ≻ removed from it by the machine and exhaust fan.
- Make sure that the machine and exhaust fan can only operate when the inlet aperture is actually open.
- Keep the inlet and exhaust apertures free of obstructions so that the cooling air can flow freely through the room.



5.3 Outdoor installation

# 5.3 Option H3, H12 Outdoor installation

5

When the machine is installed outdoors, the sound enclosure in the cover roof area (weather protection roof) and the instruments are protected against direct sunlight, rain and, snow.

► Consult KAESER for advice on this subject.



Installation

6.1 Safety

# 6 Installation

# 6.1 Safety

6

Follow the instructions below for safe installation. Warning instructions are located before a potentially dangerous task.

#### **Basic safety instructions**

- 1. Follow the instructions in chapter 3 'Safety and Responsibility'.
- 2. Installation work may only be carried out by authorized personnel.
- 3. Before activating ensure that:
  - No personnel are working on the machine,
  - All access doors and panels are closed and secure.

#### Working on live components

- 1. Work on electrical equipment may only be carried out by authorized electricians.
- 2. Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- 3. Check that there is no voltage on floating relay contacts.

#### Working on pressure system

- 1. Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- 2. Close shut-off valves or otherwise isolate the machine from the compressed air network to ensure that no compressed air can flow back into the machine.
- 3. De-pressurize all pressurized components and enclosures.
- 4. Do not open or dismantle any valves.

#### Working on the drive system

- 1. Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- 2. Replace and secure all enclosure panels before starting the machine.

Further information Details of authorized personnel are found in chapter 3.4.2.

Details of dangers and their avoidance are found in chapter 3.5.

# 6.2 Reporting transport damage

- 1. Check the machine for visible and hidden transport damage.
- 2. Inform the carrier and the manufacturer in writing of any damage without delay.



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# 6.3 Anchoring the machine

The machine may be anchored to the floor. Suitable fixings are delivered with the machine.

➤ Use appropriate fixing bolts to anchor the machine without stress.

Further information Details of the fixing holes are contained in the dimensional drawing in chapter 13.2.

# 6.4 Making the compressed air connection

Precondition The machine is factory assembled up to the point of connection to the discharge silencer. The air main is at atmospheric pressure.

### A WARNING

Serious injury or death can result from loosening or opening components under pressure.

Vent all pressurized components and chambers completely.

If the system is such that there is a tendency for air / gas under pressure to flow back to the machine when it is stopped, a non-return device must be installed to allow for unloaded starting of the machine.

- ► Consult KAESER on a suitable check valve and expert installation.
- 1. A flexible connector (compensator) must be used to connect to the users pipeline.
- 2. Support the weight of the piping so that its weight does not fall on connecting components.

### 6.5 Remove transport securing devices

Remove the transport securing devices after the machine has been installed.



Fig. 28 Removing the transport securing devices

- 1 Screw
- 2 Spacer
- 1. Remove sound enclosure access panel.
- 2. Undo the screws 1.
- 3. Remove the spacers 2.



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6.6 Connecting the power supply

# 6.6 Connecting the power supply

Precondition The supply isolating device is switched off, the device is locked off, the absence of any voltage has been verified.

- 1. The power supply must only be connected by authorized installation personnel or an authorized electrician.
- Carry out protection measures as stipulated in relevant regulations (e.g IEC 364 or DIN VDE 0100) and in national accident prevention regulations (BGV A3 in Germany). In addition, observe the regulations of the local electricity supplier.
- 3. Select supply cable conductor diameters and fusing in accordance with local regulations.
- 4. The user must provide the machine with a lockable power supply disconnecting device. This could be, for example, a load disconnect switch with fused input. If a circuit breaker is used it must be suitable for the motor starting characteristics.
- 5. Connect the drive motor to the mains power supply in accordance with the electrical diagrams.
- 6. The user's safety devices must be correctly connected to the machine's electrical system by a qualified person.
- 7. If the machine is driven by a frequency converter, observe also the specifications provided in the documentation for this unit.
- 8. **A DANGER** Danger of fatal injury from electric shock!
  - Switch off and lock out the power supply disconnecting device and check that no voltage is
    present.
  - When working on the frequency converter, wait at least 5 minutes for dangerous voltages to subside.
- 9. Connect the machine to the power supply.

### 6.6.1 Notes to the operation with frequency converter

If the machine is delivered by KAESER including the frequency converter, the regulation behaviour and operating mode of the frequency converter will be preset.

► Adapt and optimize the actual properties to the customer system on-site.



### Installation

6

6.7 Safety devices installed by the user

- 1. Comply with the following provisions if you operate machines with a frequency converter:
  - Operate the machine only within its performance limits and under the permitted ambient conditions.
  - The frequency converter must be suitable for the operation of a working machine with constant torque. Models with squared torque may not be used.
  - When operating with a frequency converter, the drive motor must be ≥100 hp with currentisolated bearings.
  - The speed change should be approx. 5 Hz per second. This value applies also for the starting ramp from standstill to reaching minimum frequency. Deviating settings, either slower or faster, may be possible after verification by KAESER Service.
  - The frequency converter may be switched onto a motor in standstill only, in order to avoid malfunctions.
  - Upon deactivation of the frequency converter, it must be impossible to reactive it until after complete machine standstill.
  - For safety-technical reasons, an automatic restart of the machine is not permitted and must be fully deactivated when parameterizing the frequency converter.
  - The maximum conductor length between output frequency converter and drive motor is 100 ft. Longer conductors may be possible upon verification by the KAESER Service.
  - Only screened conductors may be used to connect the machine for an EMC compliant connection and machine operation.
    - Do not twist the braided screen of these conductors. The braided screen must be generously spread two-sided across the earth potential.
    - Use only shield clamps or EMC-compliant screwed cable glands.
    - This also applies to other connecting cables, such as the thermistor sensors (PTC) of the drive motor.
- 2. Consult with KAESER to determine an appropriate frequency converter.

### 6.6.2 Connecting the drive motor

- Precondition The supply isolating device is switched off, the device is locked off, the absence of any voltage has been verified.
  - 1. Determine the cable diameters and fusing according to the operation conditions.
  - 2. Connect the drive motor according to the wiring diagram.

Further informationSee chapter 2.12 for guidelines on cable diameters and fusing.See electrical diagram in chapter 13.4.

# 6.7 Safety devices installed by the user

- ➤ The user must install the necessary safety devices.
  - Three PTC thermistor Relay should be installed by the user to protect against drive motor overheating or overloading.
  - A motor overload protection switch/overload relay (if not included with the deliverables) must be installed to monitor maximum current draw(s).
  - EMERGENCY OFF command device for immediate shut-down of the machine.



6.8 Options

6

- ► The user must monitor the following parameters:
  - Permissible final pressure
  - Maximum block discharge temperature
- ➤ Consult KAESER for advice on this subject.

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Blow-off valves and check valves are not regulating means in case of overpressure. The activation of the blow-off valve constitutes an impermissible operating state requiring immediate remedial measures.

# 6.8 Options

All options are mechanically installed/mounted. The electrical connections and evaluations are the customer's responsibility.

➤ Instructions on individual options should be followed.

# 6.8.1 Option C9 Connecting the pressure switch

Connecting the pressure switch

Further information See chapter 13.5.1.

### 6.8.2 Option C10 Connecting the speed monitor

The sensor and transmitter are mechanically installed.

A speed monitor sensor is supplied separately when ordered individually. Install in the user's control cabinet and wire up.

Further information See chapter 2.13.2 for the sensor settings. The wiring diagram for the speed monitor is found in chapter 13.5.2.

## 6.8.3 Option C13 Connecting the temperature gauge switch

► Connect the temperature gauge switch.

Further information See electrical diagram in chapter 13.5.3.

### 6.8.4 Option C14 Connecting the pressure sensor

Connecting the pressure sensor

Further information See chapter 13.5.4.



### 6.8.5 Option C19 Connecting the thermostat

➤ Connect the thermostat.

Further information See electrical diagram in chapter 13.5.5.

### 6.8.6 Option F5

### Connecting the filter pressure differential switch

Connect the filter pressure differential switch.

Further information See electrical diagram in chapter 13.5.6.

### 6.8.7 Option H2 Connecting the auxiliary heater

► Connect the auxiliary heater in the terminal box.

Further information See electrical diagram in chapter 13.5.7.

### 6.8.8 Option H11 Connecting the suction line

If suction is to be from a pipeline, the inlet silencer is connected using a compensator.

#### Precondition The compressed air system is vented completely to atmospheric pressure.

- Secure the pipeline securely before the compensator.
- Connect to the compressed air network.

Further information Dimensional drawings for the pipeline connection is given in chapter 13.2.

### 6.8.9 Option H12 Sound enclosure

#### 6.8.9.1 Electrical connections

Subsequent work enables the access to the electrical connections of drive motor, extractor motor and accessories.

- 1. 4 Open the sash fastener at the service panel.
- 2. Remove the service panel.
- 3. Make the electrical connections.
- 4. Insert service panel.
- 5. 4 Close the sash fastener.

#### 6.8.9.2 Connecting the extractor

The extractor motor has a terminal box for direct supply connection.

The drive motor and the extractor motor must run simultaneously.

Ensure correct direction of rotation when connecting the extractor motor. The extractor must blow air out of the sound enclosure.



### 6.8 Options

6

The extractor should run on for approx. 15 minutes after machine shut down to avoid temperature peaks inside the sound enclosure.

Precondition The supply isolating device is switched off, the device is locked off, the absence of any voltage has been verified.

- 1. Select sufficient cable length.
- 2. Connect cables to the terminal box without mechanical stress.
- 3. Connect the protective earth.

Further information See electrical diagram in chapter 13.5.8.

AESER7Initial Start-upMPRESSORS7.1Safety

# 7 Initial Start-up

# 7.1 Safety

Here you will find instructions for safe commissioning of the machine. Warning instructions are located before a potentially dangerous task.

#### **Basic safety instructions**

- 1. Follow the instructions in chapter 3 'Safety and responsibility'.
- 2. Have the initial start-up carried out by authorized installation personnel only.
- 3. Before activating ensure that:
  - No personnel are working on the machine,
  - All access doors and panels are closed and secure.

#### Working on live components

- 1. Work on electrical equipment may only be carried out by authorized electricians.
- 2. Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- 3. Check that there is no voltage on floating relay contacts.

#### Working on pressure system

- 1. Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- 2. Close shut-off valves or otherwise isolate the machine from the compressed air network to ensure that no compressed air can flow back into the machine.
- 3. De-pressurise all pressurized components and enclosures.
- 4. Do not open or dismantle any valves.

#### Working on the drive system

- 1. Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- 2. Replace and secure all enclosure panels before starting the machine.

Further information Details of authorized personnel are found in chapter 3.4.2.

Details of dangers and their avoidance are found in chapter 3.5.

# 7.2 Checking installation and operating conditions

➤ Check and confirm all the items in the checklist before commissioning the machine.

To be checked		See chapter	Confirmed?
>	Have all packing materials, tool and transport securing means been removed from the machine?	-	
>	Are the operators fully familiar with safety regulations?	-	



7

7.3 Instructions to be observed before commissioning or re-commissioning

To be checked	See chapter	Confirmed?
Have all the positioning conditions been complied with?	5	
Has the automatic machine shut-down by the user's safety devices in the event of a fault been realized?	6.7	
Are the power supply cable conductor diameters and fuse ratings ad- equate?	2.12	
Has the drive motor connection been checked?	6.6	
<ul> <li>Has the extractor connection (sound enclosure) been checked? (Option H12)</li> </ul>	6.8.9	
Has the direction of rotation of drive motor and extractor fan been checked?	7.4	
<ul> <li>Have all electrical connections been checked for tightness? (Repeat inspection after 50 operating hours following commission- ing.)</li> </ul>	-	
<ul> <li>Is there adequate lubricating oil in the drive-end and gear-end of the block?</li> <li>(level in the center of the sight glass)</li> </ul>	10.4	
Has the connection to the compressed air network been made with a hose or compensator?	6.4	
<ul> <li>Has the belt tension been checked? (The check must be repeated after 24 operating hours)</li> </ul>	10.8	
Has the block drive shaft been turned by hand to check that it turns freely?	-	
Is the machine anchored to the floor without stress?	6.3	
<ul> <li>Are all sound enclosure panels in place and secured? (Option H12)</li> </ul>	4.3.15	

 Tab. 39
 Installation conditions checklist

# 7.3 Instructions to be observed before commissioning or re-commissioning

Incorrect or improper commissioning can cause injury to persons and damage to the machine.

 Commissioning may only be carried out by authorized installation and service personnel who have been trained on this machine.

#### Special measures for re-commissioning after storage

Storage period longer than	Action
12 months	<ul> <li>Change the lubricating oil.</li> <li>Have the motor bearings checked by an authorized KAESER Service Technician.</li> </ul>



## 7.4 Checking the direction of rotation

Storage period longer than	Action
36 months	<ul> <li>Have the overall technical condition checked by an authorized KAESER Service Technician.</li> </ul>

Tab. 40Re-commissioning after storage

# 7.4 Checking the direction of rotation

### 7.4.1 Drive motor

If the block rotors turn in the wrong direction the direction of airflow through the machine will also be wrong.

The drive shaft must rotate counter-clockwise when viewed from the end of the shaft.

- NOTICE Wrong direction of rotation! The machine can be damaged by ingesting foreign bodies or excessive vacuum force.
   Ensuring the correct direction of rotation.
- 2. Remove the inlet silencer filter maintenance cover on the inlet silencer or inlet filter and/or remove the inlet check valve.
- 3. Verify the direction of phase rotation with a phase sequence meter.
- 4. If the direction of rotation is incorrect, interchange the phases L1 and L2.

You do not have a phase sequence meter?

- ► Switch the machine on and off again after 1 second.
- Compare the direction of rotation of the motor with the arrows on the belt guard and the block casing.
- > If the direction of rotation is incorrect, interchange the phases L1 and L2.

### 7.4.2 Option H12 Extractor fan(s)

 $\begin{picture}{c} \end{picture} \end{pict$ 

An arrow is also to be found on the ventilator to indicate its correct direction of rotation. The extractor must blow air out of the sound enclosure.

► If the direction of rotation is incorrect, interchange the phases L1 and L2.





8.1 Switching on and off

# 8 Operation

# 8.1 Switching on and off

Switching on and off follows to a large extent the procedure established for the equipment provided for this. The equipment is provided by the user and not part of the scope of supply of the machine unless ordered as an option.



Make sure the machine is technically sound before switching on.
 If the machine has a sound enclosure, a check must be made that the extractor is fully functional.

### 8.1.1 Switching on

Precondition Maximum permissible number of starts per hour: 6 times. Switch the machine on only from standstill. If there is back pressure, an unloaded start must be ensured.

- 1. **A WARNING** Possible serious injury from compressed air!.
  - ► Make sure that no one is working on the machine.
- 2. Switch on at the user's control cabinet.

### 8.1.2 Switching off

► Switch off at the user's control cabinet.

Further information Information on the function of the user's control cabinet should be taken from the cabinet manufacturer's documentation.

# 8.2 Switching off in an emergency

The machine is not equipped with an emergency stop device. Such a device must be provided by the user unless it is part of an ordered option.

> Ensure the machine can be stopped immediately in an emergency.

# 8.3 Option H12 Checking the ventilator function

### NOTICE

Overheating inside the sound enclosure!

- A failure of the ventilator can result in a breakdown of the blower block or other components.
- If the ventilator stops, immediately provide an alternative flow of cooling air through the sound enclosure.
- Check that air is actually being blown out of the enclosure cooling air outlet, e.g. by holding a sheet of paper in front of the outlet.



# Operation

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### 8.3 Checking the ventilator function

While complying with the definition of specified use, it is possible to operate the machine with an access panel removed.

► Wear hearing protection when the machine is running.

Further information KAESER Service will advise on suitable measures.





9.1 Basic instructions

# 9 Fault Recognition and Rectification

# 9.1 Basic instructions

The following tables are intended to assist in locating faults.

- 1. Do not attempt fault rectification measures other than those given in this manual.
- In all other cases, have the fault rectified by an authorized KAESER Service Technician.

# 9.2 Faults

Fault	Possible cause	Action
Unusual noise when running.	Too much backlash in the tim- ing gears.	Call KAESER Service.
	Too much play in the rotor bearings.	Call KAESER Service.
	Rotors not synchronized.	Keep to the pressure differen- tial and speed as specified. Call KAESER Service.
Block runs too hot.	Pressure differential too great.	Check and correct pressure dif- ferential.
	Clogged inlet filter reducing air intake volume.	Clean the inlet filter.
	Rotor clearance too large.	Call KAESER Service.
Oil leaks from the gas drain.	Oil level too high.	Drain off oil until the correct lev- el is reached.
Oil leaking from around the drive shaft.	Shaft seal defective.	Call KAESER Service.
Reduced air inlet flow.	Rotor clearance to large be- cause of wear.	Call KAESER Service.
	Intake resistance too high.	Clean the inlet filter.
Black film on the oil sight	Oil not changed at the correct	Change the lubricating oil.
glasses.	interval.	Clean or renew the sight glass.
	Insufficient oil.	Change the lubricating oil.
		Clean or renew the sight glass.
	Oil overheated.	Call KAESER Service.
	Block overloaded.	Call KAESER Service.
Water in the oil.	Condensate build-up by pro- longed storage and high humid- ity.	Change the lubricating oil.
Blowoff valve activates.	Inadmissible operating state; operating pressure too high.	Bring the machine to a permis- sible operational state or shut down.



Fault	Possible cause	Action
PTC relay trips out.	Operating pressure too high.	Check and correct pressure dif- ferential.

#### Tab. 41 Alarms and remedies

# 9.3 Options

This section provides remedies for technical faults concerning the machine's optional equipment.

### 9.3.1 Option H12 Sound enclosure faults

Fault	Possible cause	Action
Overheating inside the sound enclosure!	Fan defective or turning in the wrong direction.	Check connection. Call KAESER Service.
	Flow of cooling air blocked.	Check and clean cooling air apertures. Check the cooling air inlet tem- perature.
	Drive motor overloaded.	Check operating conditions.

Tab. 42 Faults and remedies (option H12)

### 9.3.2 Option C14 Faulty pressure sensor

Fault	Possible cause	Action
No output signal.	No power supply, broken wire.	Check power supply and wires.
	Pressure transducer incorrectly connected.	Check power supply and wires.
	No input pressure.	Check pressure feed.
	Electronic defect from power supply voltage surge or exter- nal voltage.	Call KAESER Service.
Output signal does not respond to pressure changes.	Input channel blocked.	Clean the input channel and throttle screw, being careful not to damage the delicate dia- phragm.
	Electronic defect from power supply voltage surge or exter- nal voltage.	Call KAESER Service.
	Pressure transducer defective from mechanical overloading.	Call KAESER Service.



# 9 Fault Recognition and Rectification

9.3 Options

Fault	Possible cause	Action
Output signal too high and not responding to pressure changes.	Electronic defect from power supply voltage surge or exter- nal voltage.	Call KAESER Service.

Tab. 43 Faults and remedies (option C14)

10 Maintenance

DRS 10.1 Safety

# 10 Maintenance

# 10.1 Safety

Follow the instructions below to ensure safe machine maintenance. Warning instructions are located before a potentially dangerous task.

#### **Basic safety instructions**

- 1. Follow the instructions in chapter 3 'Safety and responsibility'.
- 2. Allow maintenance work to be performed by authorized personnel only.
- 3. Before activating ensure that:
  - No personnel are working on the machine,
  - All access doors and panels are closed and secure.

#### Working on live components

- 1. Work on electrical equipment may only be carried out by authorized electricians.
- 2. Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- 3. Check that there is no voltage on floating relay contacts.

#### Working on pressure system

- 1. Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- 2. Close shut-off valves or otherwise isolate the machine from the compressed air network to ensure that no compressed air can flow back into the machine.
- 3. De-pressurise all pressurized components and enclosures.
- 4. Do not open or dismantle any valves.

#### Working on the drive system

- Switch off and lock out the power supply disconnecting device and verify the absence of voltage.
- ► Replace and secure all enclosure panels before starting the machine.

Further information Details of authorized personnel are found in chapter 3.4.2.

Details of dangers and their avoidance are found in chapter 3.5.

# 10.2 Maintenance schedule

### 10.2.1 Logging maintenance work

- The maintenance intervals given are those recommended for average operating conditions.
- Maintenance tasks should be carried out more frequently where operating conditions are unfavorable (e.g. dusty atmosphere) or when the equipment is in constant use.
- Adjust the maintenance intervals with regard to local installation and operating conditions.





### 10.2 Maintenance schedule

► Keep a log of all maintenance and service work.

This enables the frequency of individual maintenance tasks and deviations from our recommendations to be determined.

## 10.2.2 Regular maintenance tasks

The table below lists maintenance tasks required.



When operating conditions are unfavorable (e.g. dusty ambient) or when the equipment is in constant use, maintenance tasks must be carried out more frequently (shorter intervals).

 Carry out maintenance tasks punctually, taking ambient and operating conditions into consideration.

Interval	Maintenance task	See chapter
24 h after commissioning	Check belt tension.	10.8
50 h after commissioning	Check all screwed electrical connections and tighten if necessary.	-
500 h after commission- ing	Change the lubricating oil.	10.6
Up to 500 h	Check the oil level.	10.4
Or monthly	Check belt tension.	10.8
	Check the air filter.	10.7
Up to 3 000 h At least annually	Change the air filter element.	10.7
Up to 6 000 h* At least annually	Change the lubricating oil.	10.6
Annually	Check the blow-off valve.	10.10
	Check all screwed electrical connections and tighten if necessary.	-
Up to 12 000 h At the latest every 3 years.	Replace the drive belt.	10.8
As needed	Check rotors for contamination.	10.11

h = operating hours

\*The intervals for lubricating oil changes at high thermal stresses must be shortened and can be determined upon analyses of the oil.

#### Tab. 44 Regular maintenance tasks

### 10.2.3 Regular service tasks

The table below lists necessary service tasks.

> Only an authorised KAESER Service Technician should carry out service work.

Further information A prepared list is provided in chapter 10.12.



### 10.3 Sound enclosure

 Have service tasks carried out punctually taking ambient and operating conditions into account.

Interval	Service task
Up to 12 000 h at the latest every 3 years.	Permanently greased motor bearings: Have the bearings checked.
Up to 12 000 h at the latest every 3 years.	Ventilator motor (Option H12): Have the bearings checked.
Up to 36 000 h at the latest every 8 years.	Have hose lines checked.
h = operating hours	

Tab. 45 Regular service tasks

# 10.3 Option H12 Sound enclosure



### Fig. 29 Sound enclosure

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- 1 Removable panels
- ► Lift off panels 1 for maintenance work.

Latches are released by a key supplied with the machine.

# 10.4 Checking the oil level

The true oil level can be seen in the oil sight glass only when the machine is stopped.

The gear-end and drive-end oil chambers are not connected.







### 10.5 Replenishing oil

### A WARNING

Danger of burns from hot components!

Wear long-sleeved clothing and gloves.



Fig. 30 Checking the oil level

- 1. Check the oil level in the sight glasses on both ends of the block.
- 2. Replenish the lubricating oil as soon as the level has fallen as follows:
  - CB 111 C pr up to 0.2 in. below the sight glass middle
  - CB 131 C pr up to 0.3 in. below the sight glass middle

### 10.5 Replenishing oil

Labels giving the oil type for topping up are to be found on the blower block and belt guard.



The machine must be isolated from the compressed air network and completely vented before undertaking any work on the pressure system.

#### Precondition

n The power supply disconnecting device is switched off

The disconnecting device is locked in the off position. The oil level has settled.

#### NOTICE

Unsuitable oil can damage the block.

- > Never mix different types of oil.
- Never top up with a different type of oil to that already used in the block.

#### A WARNING

Installation manual Rotary blower

CB C pr

Danger of burns from hot components and oil!

Wear long-sleeved clothing and gloves.

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10 Maintenance

Changing the oil

10.6





- 1. Slowly remove the plug 1 and/or 2.
- 2. Top up until the level is at the marking on the sight glass (3) and/or (4).
- 3. Screw in the plugs.
- 4. Visually check for leaks.

# 10.6 Changing the oil

The machine must be isolated from the compressed air network and completely vented before undertaking any work on the pressure system.

The oil should be changed with the block temperature at 130°F to ensure the oil flows freely.

Drain the oil thoroughly from the blower block:

- gear-end
- drive-end

Material Lubricating oil

Oil receptacle

### **WARNING**

Danger of burns from hot components and oil!

> Wear long-sleeved clothing and gloves.

10 Maintenance



10.7 Air filter maintenance



- 2. Take out the oil filler plugs 1 and 2 (Fig. 31).
- 3. Take off the caps 1 and 2 and open the oil drain taps 3 and 4.
- 4. Drain the lubricating oil.

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Dispose of the old oil in accordance with local environmental protection regulations.

#### Filling with fresh oil

- 1. Fill with fresh oil.
- 2. Allow the oil drain taps to remain open until fresh oil begins to run out (bleeding the oil drain lines).
- 3. Check the oil level in both sight glasses (Fig. 31) and top up as necessary.
- 4. Close the oil drain taps 3 and 4.
- 5. Screw on the caps 1 and 2.
- 6. Replace and tighten the oil filler plugs.
- 7. Visually check for leaks.

# 10.7 Air filter maintenance

The air filter protects the supplied pressure system from dirt entering.

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- The use of an unsuitable air filter can permit dirt to enter the pressure system and cause damage to the machine.
- The air filter cannot be cleaned.



### 10.7 Air filter maintenance

Material Spares Precondition The supply disconnecting device is switched off, the device is locked off, the absence of voltage has been verified. The machine has cooled down.

# 10.7.1 Option F4 Filter maintenance indicator

The maintenance indicator shows when the filter needs maintenance. When the filter becomes clogged and flow resistance rises to a set point, the maintenance signal is given.

#### Machine without sound enclosure



Fig. 33 Filter maintenance indicator

- (1) Signal ring
- 2 Reset button
- 1. Change the air filter when the signal ring (1) shows red.
- 2. Unlatch the signal ring by pressing the reset button 2.

#### Option H12 Machine with sound enclosure



Fig. 34 Filter maintenance indicator (sound enclosure)

- 1 Indicator range
- 2 Reset button





### 10.8 Drive belt maintenance

- 1. Replace the filter when the maintenance indicator reads more than 50 %.
- 2. Reset to the indication range 1 by pressing the reset button 2.

### 10.7.2 Changing the air filter



10-B0750

#### Fig. 35 Changing the air filter

- 1 Cover
- 1 Inlet silencer
- 3 Air filter
- 1. Open the snap fastener on the inlet silencer cover 2.
- 2. Take off the cover 1.
- 3. Loosen the Velcro strip and remove the air filter 3.
- 4. Clean all parts and sealing surfaces.
- 5. Place the new filter in the inlet silencer and secure with the Velcro strip.
- 6. Secure the silencer cover.

### 10.8 Drive belt maintenance

Material Spare parts (if required)

Precondition The supply disconnecting device is switched off, the device is locked off, the absence of voltage has been verified.

The machine has cooled down.

### A WARNING

Touching the moving drive belt may result in severe bruising or even loss of limb or extremities.

 Switch off and lock out the power supply isolating device and verify the absence of voltage.



10.8 Drive belt maintenance



- Fig. 36 Drive belt maintenance
  - 1 Marker pin (the illustration shows that belt tensioning is required)
  - 2 Nut
  - 3 Nut

#### Checking the belt tension and adjustment

The tensioning device uses spring force to apply correct tension to the belts.

Adjust the tension when the marker pin reaches the top end of the elongated hole.

- 1. Loosen the locking nut 2.
- 2. Use the adjusting nut (3) to adjust the spring tension until the marker pin reaches the lower end of the elongated hole.
- 3. Tighten the locking nut 2.

#### Visually check for damages.

- 1. **A CAUTION** Danger of pinching between belt and pulley!
  - ► Work carefully.
- 2. Turn the pulley by hand so that the entire belt can be inspected for damage.
- 3. Change the belt immediately if any damage is found.
- <u>)</u>[

When individual belts fail in multiple-groove drives, all belts must be replaced.

#### Changing the belt

- 1. Remove the belt guard.
- 2. Loosen the locking nut 3.
- 3. Turn the adjusting nut (2) to loosen the tension on the belts until they can be removed from the pulley.
- 4. Install the new set of belts and use the adjusting nut (2) to adjust the tension until the marker pin reaches the lower end of the elongated hole.
- 5. Tighten the locking nut 3.
- 6. Replace the belt guard.
- 7. Check the tension after the new belts have been in operation for 50 hours.



### 10.9 Motor maintenance

### 10.9.1 Permanently greased motor bearings

The motor bearings are greased for life. Re-greasing is not necessary.
Have the motor bearings checked by an authorized KAESER Service.

Further information For further information to the motor, please consult the motor manual.

### 10.9.2 Option H12 Sound enclosure extractor motor

The motor bearings are greased for life. Re-greasing is not necessary.

➤ Have the motor bearings checked by an authorized KAESER Service representative.

# 10.10 Checking the blowoff valve

Free movement of the blowoff valve tension rod is checked by hand or with a lifting device.

Precondition The machine is switched off. The machine is fully vented to atmosphere.



Fig. 37 Checking the blowoff valve

- 1 Opening lever
- 2 Tension rod

Check for free movement of the tension rod 2 by pulling vertically on the opening lever 1.

The valve opens as soon as maximum working pressure is exceeded.

- Never operate the machine without a properly functioning blowoff valve.
- Do not adjust the blowoff valve.
- Replace a defective blowoff valve.

### 10.11 Checking rotors for contamination

If there is dust in the conveyed medium, this can build up inside the block.



The machine must be isolated from the compressed air network and completely vented before undertaking any work on the pressure system.



# 10 Maintenance

10.11 Checking rotors for contamination

Precondition The power supply isolating device is switched off, the device is locked off, a check has been made that no voltage is present. The machine has cooled down.

# A WARNING

Danger of burns from hot components!

► Wear long-sleeved clothing and gloves.

# **A**CAUTION

Rotating rotors.

Danger of squashing or severing.

- Switch off and lock out the power supply isolating device and check that no voltage is present.
- 1. Disconnect the flange connections and look for contamination inside the block.
- 2. If necessary, have the block cleaned by an authorized KAESER Service Technician.







10.12 Document maintenance and service work.

# 10.12 Document maintenance and service work.

Machine number:

> Enter maintenance and service work carried out in the list.

Date	Maintenance task carried out	Operating hours	Signature

Tab. 46 Logged maintenance tasks



# 11 Spares, Operating Materials, Service

### 11.1 Note the nameplate

The nameplate contains all information to identify your machine. This information is essential to us in order to provide you with optimal service.

> Please give the information from the nameplate with every inquiry and order for spares.

# 11.2 Ordering spares and operating fluids/materials

KAESER spares and operating fluids/materials have the same characteristics as the originals. They are specifically selected for use in KAESER machines.

#### A WARNING

There is risk of personal injury or damage to the machine resulting from the use of unsuitable spares or operating fluids/materials.

Non-Kaeser parts and operating fluids/materials may be unsuitable or of poor quality and can damage the machine or impair its proper function.

Personal injury may result from machine damage.

- Use only original KAESER parts and operating fluids/materials.
- Have an authorized KAESER Service Technician carry out regular maintenance.

#### Machine

Name	Quantity	Number
Shaft sealing ring	1	4052
Air filter	1	1250
Sealing ring	1	1252
Drive belts (set)	1	1800

Tab. 47 Consumable parts

#### Lubricating oil

Name	Quantity [qt]	Material number
OMEGA FLUID SB 220	1	831057.00010
	5	831057.0
OMEGA FLUID FGB 220	1	892702.00020
	5	892702.00010

Tab. 48 Lubricating oil overview

# 11.3 KAESER AIR SERVICE

KAESER AIR SERVICE offers:

- authorized KAESER service representatives with KAESER factory training,
- increased operational reliability ensured by preventive maintenance,



#### 11.4 Service addresses

- energy savings achieved by avoidance of pressure losses,
- optimum conditions for operation of the compressed air system,
- the security of genuine KAESER spare parts,
- increased legal certainty as all regulations are kept to.
- > Why not sign a KAESER AIR SERVICE maintenance agreement!

#### Result Your advantage:

lower costs and higher compressed air availability.

### 11.4 Service addresses

Addresses of all KAESER agents worldwide are provided at the end of this operating or installation instruction.

# 11.5 Declaration of Contamination

Every company (user) is responsible for the health and safety of its employees. This extends to personnel who carry out servicing work at the user or service contractor.

A Declaration of Contamination must be filled out and signed whenever maintenance or repair work is to be carried out on the machine.

#### Shipping the machine

- Precondition Correct preparation of the machine for shipment.
  - 1. Drain the lubricating oil.
  - 2. Seal all openings.
  - 3. Remove filter elements.
  - 4. Use appropriate packing.
  - 5. Ship in a suitable container.
  - 6. Fix a copy of the Declaration of Contamination to the **outside** of the packing.

Further information A Declaration of Contamination form is given in chapter 13.6.

12.1 De-commissioning

# 12 Decommissioning, Storage and Transport

# 12.1 De-commissioning

De-commissioning is necessary, for example, under the following circumstances:

- the machine is temporarily not needed,
- the machine is to be moved to another location,
- The machine is to be scrapped.

#### Temporary de-commissioning

Precondition The machine can be started at regular intervals.

Run the machine once a week for at least 30 minutes at operating temperature to ensure corrosion protection.

#### Long-term de-commissioning

- Precondition The power supply isolating device is switched off, it is locked off, a check has been made that no voltage is present on the machine. Machine fully vented (no pressure).
  - 1. Allow the machine to cool down completely.
  - 2. Disconnect all air and electrical connections.
  - 3. Spray the machine inside and out with a preservative to prevent corrosion.

Further information Details of preservatives are found in chapter 12.4.

# 12.2 Packing

A wooden crate is required for overland transport to protect the machine from mechanical damage. Consult KAESER Service for advice concerning sea or air transport.

Material Plastic sheeting

Wooden transport crate

- Precondition The machine is decommissioned. Machine is dry and cooled down.
  - ► Wrap the machine in plastic sheeting.

# 12.3 Transporting

### 12.3.1 Safety

The weight determines the means of transport.

Precondition Transport only by pallet truck, forklift truck or lifting gear by personnel trained in the safe transportation of loads.



#### 12.3 Transporting

► Make sure the danger area is clear of personnel.

Further information Details of weights are found in chapter 2.4.

### 12.3.2 Transporting with a pallet truck

► The machine must not collide with anything.

#### Machine with sound enclosure

> Drive the pallet truck fully beneath the machine and transport with care.

#### Machine without sound enclosure

- Use a steel lever bar to lift the machine ca. 2.4 in. one side at a time and place it on wooden blocks.
- > Drive the pallet truck fully beneath the machine and transport with care.
- Carry the wooden blocks with the machine to the new location.
- Lower the machine onto the blocks.
- ► Use the lever to lift the machine and remove the blocks.

### 12.3.3 Transport with a forklift truck



Fig. 38 Transport with a forklift truck

> Drive the forks completely under the machine or pallet and lift carefully.

### 12.3.4 Transport with a crane

Suitable lifting gear ensures correct transportation. The lifting slings must be fed under the machine. The slings may not press on the sides of the machine cabinet.

Examples of unsuitable fixing points:

- Pipe sockets
- Flanges
- Attached accessories
- Rain protection covers

#### Precondition The lifting gear complies with local safety regulations.

No pressure should bear on the sides of the machine cabinet.



12.4 Storage



- Fig. 39 Transport with a crane
  - 1 Lifting gear
  - 2 Slings
  - 1. **NOTICE** The machine can be damaged by incorrect attachment of the lifting gear!
    - Do not attach the lifting gear to any of the machine components.
    - > The manufacturer can advise on the use of suitable lifting gear.
  - 2. Use the lifting gear correctly and lift the machine carefully.

## 12.4 Storage

Moisture can lead to corrosion, particularly on the surfaces of the blower block. Storage temperature must not fall below -22 °F.



Advice can be obtained from KAESER on storage and recommissioning.

#### NOTICE

Moisture and frost can damage the machine!

> Prevent ingress of moisture and formation of condensation.

### **A** CAUTION

Rotating piston!

Danger of squashing or severing of limbs.

- Do not reach into the interior of the block.
- ➤ Store the machine in a dry, frost-proof room.
- Protect the flange connections, drive shaft and delivery space of the block by spraying with appropriate an conservation oil, e.g., ANTICORIT OHK.
- Seal off the inlet and discharge ports to prevent entry of dirt.
- ► Each month, manually turn the motor shaft by about 30°.
- Change the lubricating oil annually.

#### After lengthy storage

- ➤ Remove the preservative from the flow chamber with cleaning solvent.
- Observe the procedures for assembly and initial start-up.

# 12 Decommissioning, Storage and Transport

12.5 Disposal

- ► Change the lubricating oil.
- ➤ Re-grease the bearings if they are not of the permanently greased type.

# 12.5 Disposal

When disposing of a machine, drain out all liquids and remove old filters.

Precondition The machine is decommissioned.

- 1. Completely drain the oil from the machine.
- 2. Remove old filters.
- 3. Hand the machine over to an authorized disposal expert.

 Components contaminated with oil must be disposed of in accordance with local environmental protection regulations.


13.1 Pipeline and instrument flow diagram (P+I diagram)



## 13.1 Pipeline and instrument flow diagram (P+I diagram)





## 13.1 Pipeline and instrument flow diagram (P+I diagram)







13.2 Dimensional drawing

## 13.2 Dimensional drawing



### 13.2 Dimensional drawing













No.: 9\_9480 04 USE

Installation manual Rotary blower CB C pr



С

## 13 Annex

### 13.3 Design diagrams

## 13.3 Design diagrams

° ∏ The diagrams relate to the blower block.

	CB 111 C pr	CB 131 C pr	
Blower block diagram	OMEGA 24 PLUS	OMEGA 41 PLUS	

Tab. 49 Blower block diagram (machine layout)

The following data can be found in the diagrams:

	Diagram legend
A	Pressure Performance 14.7 psia and 68 °F
В	Blower speed [rpm]
С	Blower shaft power [hp]
D	Inlet airflow [cfm]
E	Temperature rise [°F]

Tab. 50 Diagram legend





13.3 Design diagrams



Diagramm O24P

Stand: 01.2010



## 13.3 Design diagrams



Diagramm O41P

Stand: 01.2010





## 13.4 Electrical diagrams

## 13.4.1 Drive motor electrical diagram

The connection diagram is a common diagram for the mains voltage and frequency.



#### 13.4 **Electrical diagrams**



Sternschaltung

Für eine Sternschaltung müssen die Klemmen W2, U2, V2 zusammengeschlossen und die Stellen U1, V1 und W1 gespeist werden. Der Phasenstrom und die Phasenspannung:

 $I_{ph} = I_n \qquad U_{ph} = U_n \ / \ \sqrt{3} \\ wobei \ I_n \ der \ Netzstrom \ und \ U_n \ die \ Netzspannung \ ist.$ 





W1 Y-Schaltung

Uph



#### Dreieckschaltung

För eine Dreieckschaftung muss das Ende der Phase an den Beginn der nächsten Phase angeschlossen werden. Der Phasenstrom I<sub>ph</sub> und die Phasenspannung U<sub>ph</sub> sind:  $\begin{aligned} \mathbf{I}_{ph} &= \mathbf{I}_n / \sqrt{3} \\ \mathbf{U}_{ph} &= \mathbf{U}_n \end{aligned}$ 

wobei  $I_n$  der Netzstrom und  $U_n$  die Netzspannung ist.



Stern Drejeck Anlauf



Delta connection

Connecting the end of each winding to the beginning of the next winding a delta connection is obtained. The phase current  $I_{ph}$  and the phase voltage $U_{ph}$  are the following:  $I_{ph} = I_n / \sqrt{3}$  $U_{ph} = U_n$ 

Connecting together the W2, U2, V2 terminals (star point) and connecting to the mains the U1, V1, W1 terminals a star connection is obtained. The phase current lph and the phase voltageUph are the following:

where  $I''_n$  the line current and  $U_n$  ist the line voltage.

v1

 $I_{ph} = I_n$   $U_{ph} = U_n / \sqrt{3}$ where  $I_n$  the line current and  $U_n$  ist the line voltage

U1



#### Star-Delta starting:

The star-delta starting is an easy way to reduce the starting current and starting toraue.

Motors can be started with star-delta starting method whenever the supply voltage correspond to the rated voltage of the motors in delta connections.

valVTBLLETB\_GERA\_00011\_02D\_Sa

Der Stern-Dreieck-Anlauf ist die einfachste Art, den Strom und das Anlaufdreh-moment zu reduzieren. Die Motoren, deren Nennspannung

bei Dreieckschaltung der Netzspannung entspricht, können mit der Stern-Dreieck-Methode angelassen werden.

V2

υ,







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13.4 Electrical diagrams



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12-Lead Motoren	Spannung	Voltage	200 V / 50 Hz	230 V / 50 Hz	380 V / 50 Hz	400 V / 50 Hz	420 V / 50 Hz	200 V / 60 Hz	208 V / 60 Hz	220 V / 60 Hz	230 V / 60 Hz	420 V / 60 Hz	440 V / 60 Hz	460 V / 60 Hz	480 V / 60 Hz	\\gera02\data1\Technik\DATEN\GEBLAE

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13Annex13.4Electrical diagrams

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## 13.5 Electrical diagrams for options

Electrical diagrams for the options available for your machine are given in the following.

### 13.5.1 Option C9

### Pressure switch wiring diagram



- Fig. 40 Pressure switch wiring diagram
  - 1 Supply
  - 2 Break contact
  - 3 Make contact

### 13.5.2 Option C10 Speed monitor wiring diagram

### Sensor / evaluation device



Fig. 41 Speed monitor wiring diagram

## 13.5.3 Option C13

### Temperature gauge switch wiring diagram



Fig. 42 Temperature gauge switch wiring diagram

13-B0732



## 13.5.4 Option C14 Pressure sensor connections



- Fig. 43 Pressure sensor connections
  - A Power supply
  - B Evaluation/display

## 13.5.5 Option C19 Thermostat wiring diagram



Fig. 44 Thermostat wiring diagram



## 13.5.6 Option F5 Filter pressure differential switch wiring diagram



Fig. 45 Filter pressure differential switch wiring diagram

## 13.5.7 Option H2

Auxiliary heater wiring diagram

Installation manual Rotary blower

CB C pr





## 13.5 Electrical diagrams for options

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## 13.5 Electrical diagrams for options





### 13.5.8 Option H12 Sound enclosure fan motor wiring plan

The connection diagram for the fan motor is a common diagram for the mains voltage and frequency.

### 13.5.8.1 Three-phase motor connection



Fig. 46 Extractor motor star-delta connection

#### Mains frequency: 60 Hz

Extractor model:

- Δ-208 V / Y-360 V
- Δ-220 V / Y-380 V
- ∆-230 V
- Y-460 V
- Y-575 V

### 13.5.8.2 Single-phase motor connection



Fig. 47 Extractor motor 1-phase diagram

### Mains frequency: 60 Hz

Fan model:

- 230 V
- 115 V

## 13.6 Declaration concerning contamination



13.6 Declaration concerning contamination



## Declaration of Decontamination of Blowers, Vacuum Pumps, Compressors, and Components

A completed Declaration of Decontamination form is required prior to shipping any equipment to Kaeser Compressors, Inc. for inspection and/or repair work. A separate Declaration form is required for each item to be sent to us. Items will not be accepted without prior submittal of these forms and Kaeser's authorization to return the equipment. Equipment that has been exposed to microbiological, explosive, or radioactive substances will not be accepted. Equipment that has been exposed to any hazardous materials must be thoroughly decontaminated prior to shipping to Kaeser Compressors. This Declaration may only be filled out and signed by an authorized and qualified representative of the ordering party (sender of equipment).

#### **Customer and Equipment Information:**

Company Name:		Telephone/ Extension:	
Shipping Address:		Fax:	
Contact:		Email Address:	
Model		EMR Number:	
Numbers:			
Part Number:		Serial Number:	
Arrangement:			
Reason for Return:	Warranty Repair—completed warranty clai   Non-warranty Repair   Other: (Please specify):	m form must be at tion	tached
Purchase Order N	umber for Inspection or Repair:		
Service Notificatio	n Number:		
Symptoms of fault	:		
How long was the operated?	equipment	What type of used?	oil was
What application equipment used for	was the pr?		

#### Equipment Condition:

Has this equipment been exposed (internally or externally) to any of the following hazards:

Please answer all questions b	y selecting (Yes/No) as applicable a	nd by providing details below:
Carcinogenic 🗌 yes 🗌 no	Biological hazard 🗌 yes 🗌 no	
Corrosive 🗌 yes 🗌 no	Explosive 🗌 yes 🗌 no	Equipment and components which have been
Flammable 🗌 yes 🗌 no	Radioactive 🗌 yes 🗌 no	substances will not be accepted.
Toxic 🗌 yes 🗌 no		
Other	harmful substances 🗌 yes 🔲 no	

Page 1 of 2

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### 13.6 Declaration concerning contamination

List all substances, gases, and by-pro-	ducts which came into contact with the e	quipment: (inter	rnally or externally)
Product name manufacturer*	Chemical name or symbol*	CAS Nur	nber(s)
*Attach MSDS sheets for all hazardo details.	ous substances and use second page of	of this form if n	ecessary to provide additional
If the equipment has been exposed	to any hazardous materials, deconta not accept any contaminated equip	mination MUS ment.	T be carried out. Kaeser will
This equipment has been thorough hazardous residues:	nly cleaned and decontaminated and	l contains no	□Yes □No
What method has been used to clean/	decontaminate the equipment?		

#### Preparation of equipment for shipping

Once the Declaration of Decontamination has been reviewed by Kaeser Compressors, Inc., you will be notified if the equipment can be returned.

Prior to shipping the equipment:

- All service fluids must be drained (if the unit is being returned for warranty consideration, include an oil sample)
- All openings must be sealed (airtight)
- The equipment must be packaged to prevent damage during shipment. (If the packaging in which the unit is received is not suitable to prevent damage for the return shipment, the unit will be repackaged. Please be advised that if this is necessary, there will be a charge for the additional packaging materials and labor. Shipments from Kaeser Compressors, Inc. will be collect or third party billing.)
- Include a copy of the Declaration of Decontamination with the packing list

#### Legally Binding Declaration

We herby declare the information given in this declaration is accurate and complete and I, as the undersigned, am qualified and authorized to make this declaration. For equipment that was exposed to hazardous substances, we certify that the equipment has been thoroughly decontaminated eliminating all potential hazards. We are aware that by providing false or incomplete information, we are directly liable for any injuries or damages suffered by third parties, particularly Kaeser employees involved in handling and/or repairing the equipment. We agree to hold Kaeser Compressors, Inc. free of any claims from third parties related to hazardous substances in or on this equipment including injuries, damages, improper shipment, or exposure.

If we choose not to have Kaeser Compressors, Inc. repair the unit, we agree to advise Kaeser within 60 days after receiving the repair quote to either return or scrap the unit. Units left over 60 days become property of Kaeser Compressors Inc.

Signature:		Print Name:	
Title:		Date:	
Company:			
Fo	r Blowers, please complete and return to: Kaeser Compressors, Inc. tention: Omega Service Center Fax (901)-795-4885	For	all other products, please complete and return to: Kaeser Compressors, Inc. ention: After Sales Service Department Fax (540) 898-5520

Page 2 of 2

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## WARRANTY CLAIM FORM

NOTE: THIS FORM MUST BE COMPLETED AND RETURNED WITHIN THIRTY (30) DAYS OF UNIT REPAIR. DEFECTIVE PARTS OVER \$300.00 MUST BE RETURNED (PREPAID) WITH THE COMPLETED WARRANTY FORM. PARTS UNDER \$300.00 MUST BE HELD FOR 90 DAYS. PLACE A TAG ON EACH PART RETURNED, WITH THE PART NUMBER AND CLAIM NUMBER CLEARLY MARKED.

	REPLACEMENT INV	OICE #		_ SAP C	DRDER/ DIST WC	] REPLACEME	NT PARTS CLAIM
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	TEMP RANGE (min to		<b>_</b>	000			
	UNIT ENVIRONMEN			JOD			
	LUBRICANT TYPE:		DA	TE OF LAS			
. [	FAILURE OCURRED	AT STARTUP: 🔲 YES 🥅 NO					
	DESCRIPTION OF F	AILURE: PLEASE BE SPECIFIC (A	TTACH A		L PAGES IF NEED	ED)	
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A							
	CUSTOMER SATISF	IED: 📃 YES 📃 NO					
	IF NOT, WHAT MUST	F BE DONE TO SATISFY CUSTOM	1ER:				
	PARTS RETURNED	1					
Е	PART NUMBER	DESCRIPTION		QTY	LIST PRICE/EA.	DISC%	TOTAL NET
AR							
ш							
					PA	RTS TOTAL	
	PARTS RETURNED	TO KAESER COMPRESSORS, INC	C.: 📃 YES	🔲 NO;	DATE RETU	JRNED	
	NOTE:PARTS RE	TURNED TO KAESER COMPRESSORS, INC	C. MUST BE I		PACKAGED TO PREVE	NT DAMAGE DURI	NG SHIPMENT.
	EXPENSES:	PLACE A TAG ON EACH PART T	HAT INCLUD	ES PARI NU	WBER AND CLAIM NU	WBER.	
	LABOR:	HOURS AT	-		\$/HOUR	TOTAL:	
	TRAVEL:	HOURS AT			\$/HOUR	TOTAL:	
	MILEAGE:	MILES AT	-		\$/MILE	TOTAL:	
		—				_	
						_	
	TOTAL AMOUNT RE	QUESTED ON THIS CLAIM:					
						—	
	AUTHORIZED NAME		JAIE		SIGNATURE		Marranty Claim Form 5/0 Jan 2007
					SER	VIGEN//F-190501-USA-	wananty Gaim Form 5/2, Jan 2007



13.7 Customer-specific design data



13.7 Customer-specific design data

## SECTION12b: MEMBRANE AERATION BLOWER

### P&ID: Item #: BL-0751

Unit Details:Becker Rotary Vane Compressor and MotorModel DX 4.40K2.9 Hp, 3Ø/60Hz/460V28 SCFM @ 15 psig

Becker X Series Replacement Vanes Part Number: 90139700007

Manufacturer:	Gebr. Becker GmbH
	Hölker Feld 29-31
	D-42279 Wuppertal
	Phone: +49 (0) 202 697-0
	Fax: +49 (0) 202 660855

Local Distributor/Contact:

Becker Pumps Corp. 100 East Ascot Lane Cuyahoga Falls, Ohio 44223-3768 Phone: (330) 928-9966 Fax: (330) 928-7065 www.beckerpumps.com

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# 20,000 Hour/3 Year Vane Life – Guaranteed!



# **DX** 4.10 – 4.40K Series

## 100% OIL-LESS COMPRESSORS





**ISO 9001 Certified** CE Compliant

100% Oil-less (dry operation)

- Continuous duty rated
- Maximum Pressure 15 PSIG
- Direct drive—no belts; no gears
- Low energy consumption
- TEFC motor
- Integral pressure regulating valve
- Integral 4-micron inlet filter
- Vibration isolators
- Quiet and cool operation
- 20,000 hr/3-yr graphite composite vanes



Engineering Vacuum and Pressure Solutions that are Like a Breath of Fresh Air

Becker Pumps Corp. • 100 East Ascot Lane • Cuyahoga Falls, Ohio 44223-3768 Ph. (330) 928-9966 • (888) 633-1083 • FAX: (330) 928-7065 • e-mail: info@beckerpumps.com • beckerpumps.com 247



DX 4.25 K + DX 4.40 K

Drehschieber-Verdichter, trockenlaufend, luftgekühlt, für x-tra Betriebsstunden	DX 4.10
Rotary vane compressors, oil-free, air-cooled, for x-tra operating hours	DX 4.16
Compresseurs à palettes, fonctionnant à sec, refroidis par air, pour les heures de travail x-tra	DX 4.25 K
Compressori a palette, funzionanti a secco, raffreddati ad aria, per x-tra ore operative	DX 4.40 K





Φ





Druckregulierventil Pressure regulating valve Vanne de réglage pression Valvola regolazione pressione

	m <sup>3</sup>	³/h	ba	ar			k١	N			dB	( <b>A)</b> <sup>2)</sup>	kg
	(ma	ax.)	(max.	rel.1)		3~	-		1~	-			
	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz		50 Hz	60 Hz	1 M	50 Hz	60 Hz	
DX 4.10	10	12	+1,0	+1,0	0,37	0,45	Ī	0,37	0,44	5	60	62	16,0
DX 4.16	16	19	+1,0	+1,0	0,55	0,70	2	0,55	0,66	6	62	64	23,5
DX 4.25 K	25	30	+1,0	+1,0	1,10	1,30	3	1,10	<u> </u>	7	65	67	36,5
DX 4.40 K	40	48	+1,0	+1,0	1,85	2,20	4	1,70	- <sup>3)</sup>	8	67	70	46,0

							• • •		1,00	2,20								10		0,0
	1 2 3 4	0,37 / 0,55 / 1,10 / 1,85 /	7 0,45 kW 7 0,70 kW 7 1,30 kW 7 2,20 kW	/ • 50 H / • 50 H / • 50 H / • 50 H	Hz: 175- Hz: 175- Hz: 190- Hz: 190-	260/300 260/300 255/330 255/330	-450 V -450 V -440 V -440 V	1420 1420 1420 1420	min <sup>-1</sup> 2 min <sup>-1</sup> 3 min <sup>-1</sup> 4 min <sup>-1</sup> 8	,30/1,30 ,80/2,20 ,8-5,5/2 ,1-9,5/4	A • 60 A • 60 ,8-3,2 A ,7-5,5 A	0 Hz: 20 0 Hz: 20 A • 60 H A • 60 H	2-300/3 2-300/3 1z: 190-: 1z: 190-:	50-520 50-520 290/330 290/330	V 170 V 170 )-500 V )-500 V	0 min <sup>-1</sup> 0 min <sup>-1</sup> 1690 r 1660 r	2,35/1, 3,90/2, nin <sup>-1</sup> 6 nin <sup>-1</sup> 1	36 A 25 A ,20-4,9/ 0,0-8,5/	3,6-2,8 <i>1</i> 5,8-4,97	4 4
M   5   0,37 / 0,44 kW   50 Hz: 230 V ±10%   1380 min <sup>-1</sup> 3,0 A • 60 Hz: 230 V ±10%   1630 min <sup>-1</sup> 3,4 A • 12 μF / 400 V     1   0,55 / 0,66 kW   50 Hz: 230 V ±10%   1360 min <sup>-1</sup> 4,6 A • 60 Hz: 230 V ±10%   1600 min <sup>-1</sup> 5,2 A • 20 μF / 450 V     1   -   kW • 50 Hz: 230 V ± 5%   1350 min <sup>-1</sup> 7,6 A • 30 μF / 400 V   1600 min <sup>-1</sup> 5,2 A • 20 μF / 450 V     1,10 / -   kW • 50 Hz: 230 V ± 5%   1350 min <sup>-1</sup> 7,6 A • 30 μF / 400 V   1300 min <sup>-1</sup> 5,2 A • 20 μF / 450 V																				
$\stackrel{mm}{\longleftrightarrow}$		а	b	е	e1	f	f1	g	g1	g2	h	h1	h2	h3	i	k	k1	o	o1	q
DX 4.10		160	112	-	35	200	142	206	90	90	107	176	195	-	106	387	429	-	257	123
DX 4.16		202	125	-	35	242	155	231	102,5	102,5	113	186	211	-	73	416	452	-	291,5	151,5
DX 4.25 K		220	190	130	-	260	238	328	125	173	140	227	260	290	130	505	545	54,8	-	178
DX 4.40 K		220	208	130	-	260	238	328	125	173	140	227	260	290	178	585	625	54,8	-	245

1) bar relativ • bar relative • bar relatif • bar relativo → bar absolut (absolute • absolu • assoluto) = 1 + (±x bar rel.)

2) bei mittlerer Belastung, beide Seiten abgeleitet • at medium load, both sides derived • à régime moyen, les deux côtés dérivés • a medio regime, entrambi i lati derivati : DIN EN ISO 2151 + DIN EN ISO 3744 (KpA = 3 dB(A))

3) auf Anfrage • on request • sur demande • su richiesta

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1) bar absolut • bar absolut • bar absolu • bar assoluto 2) bar relativ • bar relative • bar relatif • bar relativo

Bezugsdaten (Atmosphäre) • Reference (atmosphere) • Référence (atmosphère) • Rifermento (atmosfera) : 1000 mbar, 20°C

Mögliche Abweichung • Allowable tolerance • Variation possibile • Variazione possibile :  $\pm 10~\%$ 

2

+1



- Betriebsanleitung Operating Instructions Instructions de service Istruzioni d'uso Handleiding Instrucciones para el manejo Manual de instruções Naudojimosi instrukcija Kasutusjuhend Lietošanas instrukcija Oδηγίες χρήσης 取扱説明書 사용설명서
- Driftsinstruks Driftsinstruktioner Käyttöohje Driftsvejledning Instrukcja obsługi Kezelési útmutató Návod k obsluze Navodilo za uporabo Návod na obsluhu El Kitabi Инструкция по эксплуатации 使用说明书



2006/42/EG



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1.	Warning Notio	ce				
	High Voltage Only qualified staff may work on electronic components			High Voltage according to ANSI American, National StandardsInstitute		Qualified Staff Marked operations may only be executed by qualified electricians
	Automatic Start-Up When servicing the device must be turned off			Hot Surface will cause burns. Let device cool down before maintenance		Note Ignoring notices will cause severe damage to the pump
2.	Interdiction					
	Pump works without oil Avoid absorption of oil fumes	C		Marked areas may not be subject to weight		Liquids may not be conveyed
	Explosive substances may not be conveyed			Flammable Substances may not be conveyed		Toxic Substances may not be conveyed
	Assembly Incorrect fitting position					
3.	Rules					
	Wear protective goggles			Wear protective gloves		Wear protective ear- muffs Sound level information e.g. 85 dB (A)
4.	Advice					
<b>≢</b> ©	Active principle Rotary vane pump Only air may be conveyed			Active principle side channel fan only air may be conveyed		Maintenance Regularly execute the marked procedures
	Storing / Assembly Protect pump from humidity	max 800r		Assembly Characteristic data is valid up to 800m above sea level	<b>●</b>	Further Information (optional Data) - name plate - Internet
VACUUM	Specification Vacuum pump	PRES		Specification Compressor		Safety valve
	Factory-made <b>Revol-</b> ving field clockwise as pre-requisite for pump attachment	E-orr		Switch interval Not more than 10x per hour		Arrange <b>Motor-circuit</b> switch
	Blow out marked areas with air pressure	300	0 h	Maintenance interval Observe minimum gate valve measurement every 3.000 hours		Filter Maintenance Service according to dust accumulation exchange old cartridge dispose old





Ersatzteilliste Spare parts list Liste de pièces de rechange Listino pezzi di ricambio Lista de piezas de recambio Lista de piezas sobresselentes Reservedelenlijst Reservedelsliste Reservedelslista Reservedelsliste Varaosaluettelo Wykaz części zamiennych Seznam náhradních dílů Tartalékalkatrész lista Kartáλογος ανταλλακτικών Перечень запасных частей 备用零件目录 スペアパーツリスト



Wartu Maint Entre Manu Mante	ing enance tien tenzior enimier	e ne nto		
	Pos.	Menge <sup>2)</sup> Quantity Quantité Quantità Cantidad	Bestell-Nr. Ident No. No. Identification No. Identificazione No. de pedido	Bezeichnung Description Designation Designazione Descripcion
<b>1 4</b>	0.4		004000 00007	0.1.1

		Quantité Quantità Cantidad	No. Identification No. Identificazione No. de pedido	Designation Designazione Descripcion
5K	24	SATZ (KIT)	901399 00007	Schieber, Rotor Vane, Palette, Empujador
4.2	72	1	909505 01000	Filterpatrone, Filter cartridge, Cartouche Filtrante. Cartuccia filtro. Cartucho de filtro
ХQ	74	1	909529 00000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filtro
NO:	24	SATZ (KIT)	901397 00007	Schieber, Rotor Vane, Palette, Empujador
4.4	72	1	909505 01000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filtro
Ď	74	1	909529 00000	Filterpatrone, Filter cartridge, Cartouche Filtrante, Cartuccia filtro, Cartucho de filtro

P

2) erforderliche Bestellmenge / necessary order quantity / quantité nécessaire / quantità di ordinazione necessari / cantidad necesario

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Index	Pos.	Bestell Nr.	Beschreibung
	15	020000 50300	KOLBEN
X	16	016800 16500	SPANNSCHEIBE
10	17	911012 00000	STAR TOLERANZEING
	18	949203 00000	ZAHNSCHEIBE
4	19	945320 00000	INNENSECHSKANTSCHRAUBE
×	21	000100 27500	GEHÄUSE
<b>C</b>	22	951806 00000	SPANNHÜLSE
_	23	945320 00000	INNENSECHSKANTSCHRAUBE
	24	901399 00007	SCHIEBER, KOHLE (SATZ)
	25	952009 00000	SPANNHÜLSE
	28	000701 27600	SEITENDECKEL
	29	945373 00000	INNENSECHSKANTSCHRAUBE
	30	008900 16500	DICHTUNG
	33	560200 27500	KÜHLER
	34	005700 27600	DICHTUNG
	35	945325 00000	INNENSECHSKANTSCHRAUBE
	46	502300 16400	VENTILATOR
	48	947713 00000	PASSFEDER
	49	949454 00000	UNTERLEGSCHEIBE
	50	901804 00000	WELLENENDSCHRAUBE
	61	004803 27600	FILTERDECKEL
	67	009000 16300	ANPRESSFEDER
	72	909505 01000	FILTERPATRONE C 75/2 (1x) 1)
	74	909529 00000	FILTERPATRONE C 78/6 - OPTIONAL
	76	945373 00000	INNENSECHSKANTSCHRAUBE
	77	948021 00000	DICHTRING
	83	006800 27500	GERÄTEHAUBE
	84	742609 01000	SCHLAUCH
	85	951920 00000	GUMMIFORMTEIL
	88	006803 27600	FRONTHAUBE
	89	741365 00000	GUMMIPUFFER
	90	945318 00000	INNENSECHSKANTSCHRAUBE
	91	951922 00000	GUMMIFORMTEIL
	92	964108 00000	KANTENSCHUTZ
	94	015100 27600	FUSS
	95	951921 00000	GUMMIFORMTEIL
	96	068000 27600	DISTANZSTÜCK
	97	945328 00000	INNENSECHSKANTSCHRAUBE
	98	949451 00000	UNTERLEGSCHEIBE
	101	833903 99597	VENTILTELLER
	102	951906 00000	KABELTÜLLE
	103	068002 16500	DISTANZROHR
	104	548800 16300	RINGSCHRAUBE
	125	728003 99611	DRUCKREGULIERVENTIL
	126	943132 00000	DÜSE
	130	951225 00000	VERSCHLUSS-SCHRAUBE

Index	Pos.	Bestell Nr.	Beschreibung
×	15	020000 50400	KOLBEN
0	16	016800 16500	SPANNSCHEIBE
4	1/	911008 00000	STAR TOLERANZRING
4	18	949203 00000	ZAHNSCHEIBE
~	19	945320 00000	
8	22	045222 00000	
	23	943322 00000	SCHIEBER KOHLE (SATZ)
	25	952009 00000	SPANNHÜLSE
	28	000701 27600	SEITENDECKEI
	29	945374 00000	INNENSECHSKANTSCHRAUBE
	30	008900 16500	DICHTUNG
	33	560200 27600	DRUCKLUFTKÜHLER
	34	005700 27600	DICHTUNG
	35	945325 00000	INNENSECHSKANTSCHRAUBE
	46	902300 27600	VENTILATOR
	48	947713 00000	PASSFEDER
	49	949454 00000	UNTERLEGSCHEIBE
	50	901804 00000	WELLENENDSCHRAUBE
	61	004803 27600	FILTERDECKEL
	67	009000 16300	ANPRESSFEDER
	72	909505 01000	FILTERPATRONE C 75/2 (1x) 1
	74	909529 00000	FILTERPATRONE C 78/6 - OPTIONAL
	76	945373 00000	NNENSECHSKANTSCHRAUBE
	02	948021 00000	
	84	742609 01000	
	85	951920 00000	GUMMEORMTEIL
	88	006803 27600	ERONTHAUBE
	89	741365 00000	GUMMIPUEEER
	90	945318 00000	INNENSECHSKANTSCHRAUBE
	91	951922 00000	GUMMIFORMTEIL
	92	964108 00000	KANTENSCHUTZ
	94	015100 27600	FUSS
	95	951921 00000	GUMMIFORMTEIL
	96	068000 27600	DISTANZSTÜCK
	97	945328 00000	INNENSECHSKANTSCHRAUBE
	98	949451 00000	UNTERLEGSCHEIBE
	101	833903 99597	VENTILTELLER
	102	951906 00000	KABELTULLE
	103	068002 16500	DISTANZROHR
	104	548800 16300	RINGSCHRAUBE
	125	728003 99611	DRUCKREGULIERVENTIL
	120	943133 00000	VEBSCHILLSS SCHBALIBE
	150	551223 00000	VERSURLUSS-SURRAUBE

#### 1) erforderliche Bestellmenge / Wartung

DX 4.40K	(1~) /5	Ausfuhrung - Einphasenwechselstrom Ausführung mit erhöhter Leistung - Motor 2,2/3kW
	e Positio	nen zum Standardgerät - siehe Anhang (Zeichnungsrückseite)
Anweichend		(merennangerat erener innang (merennangeraenee)

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1) erforderliche Bestellmenge / Wartung

TIONAL

DX 4.25K (1~) Ausführung - Einphasenwechselstrom Abweichende Positionen zum Standardgerät - siehe Anhang (Zeichnungsrückseite)

Pos.	Ident No.	Description
15	020000 50200	POTOP
10	016900 16500	
17	911012 00000	
19	949203 00000	TOOTHED SPRING WASHER
10	945320 00000	SOCKET HEAD SCREW
21	000100 27500	PUMP BODY
22	951806 00000	LOCATING PEG
23	945320 00000	SOCKET HEAD SCREW
24	901399 00007	CARBON VANES (KIT)
25	952009 00000	LOCATING PEG
28	000701 27600	
29	945373 00000	SOCKET HEAD SCREW
30	008900 16500	GASKET
33	560200 27500	COOLER
34	005700 27600	GASKET
35	945325 00000	SOCKET HEAD SCREW
46	502300 16400	FAN
48	947713 00000	KEY
49	949454 00000	WASHER
50	901804 00000	SHAFT END BOLD
61	004803 27600	FILTER COVER
67	009000 16300	LEAF SPRING
72	909505 01000	FILTER CARTRIDGE C 75/2 (1x) 1)
74	909529 00000	FILTER CARTRIDGE C 78/6 - OPTIONAL
76	945373 00000	SOCKET HEAD SCREW
77	948021 00000	SEALING RING
83	006800 27500	PROTECTING HOOD
84	742609 01000	TUBE FLEXIBLE
85	951920 00000	RUBBER ELEMENT
88	006803 27600	PROTECTING HOOD
89	741365 00000	RUBBER BUFFER
90	945318 00000	SUCKET HEAD SCREW
91	951922 00000	
92	964106 00000	EDGE PROTECTION
94	0101002/600	
90	931921 00000	
90	045338 00000	SPAUING GULLAR
31	940320 00000	WAQUED
101	833003 00507	VALVE DISC
102	951906 00000	RUBBER BUSHING
102	068002 16500	SPACER TUBE
104	548800 16300	RING SCREW
125	728003 99611	PRESSURE REGUL VALVE
126	943132 00000	NOZZI F
	010102 00000	

Index	Pos.	Ident No.	Description
	15	020000 50400	ROTOR
ž	16	016800 16500	CLAMPING DISC
4	17	911008 00000	STAR-TOLERANCE-RING
<u> </u>	18	949203 00000	TOOTHED SPRING WASHER
	19	945320 00000	SOCKET HEAD SCREW
×	21	000100 27600	PUMP BODY
	23	945322 00000	SOCKET HEAD SCREW
	24	901397 00007	CARBON VANES (KIT)
	25	952009 00000	LOCATING PEG
	28	000701 27600	LID
	29	945374 00000	SOCKET HEAD SCREW
	30	008900 16500	GASKET
	33	560200 27600	COOLER
	34	005700 27600	GASKET
	35	945325 00000	SUCKET HEAD SCREW
	40	902300 27600	FAN
	40	947713 00000	
	49	901804 00000	SHAFT END BOLD
	61	004803 27600	EILTER COVER
	67	009000 16300	
	72	909505 01000	ELITER CARTRIDGE C 75/2 (1x) 1)
	74	909529 00000	FILTER CARTRIDGE C 78/6 - OPTIONAL
	76	945373 00000	SOCKET HEAD SCREW
	77	948021 00000	SEALING RING
	83	006800 27600	PROTECTING HOOD
	84	742609 01000	TUBE FLEXIBLE
	85	951920 00000	RUBBER ELEMENT
	88	006803 27600	PROTECTING HOOD
	89	741365 00000	RUBBER BUFFER
	90	945318 00000	SOCKET HEAD SCREW
	91	951922 00000	RUBBER ELEMENT
	92	964108 00000	EDGE PROTECTION
	94	015100 27600	FOOT
	95	951921 00000	RUBBER ELEMENT
	96	068000 27600	SPACING COLLAR
	97	945328 00000	SOCKET HEAD SCREW
	98	949451 00000	WASHER
	101	833903 99597	VALVE DISC
	102	931906 00000	RUBBER BUSHING
	103	549900 16200	SPACER TUBE
	104	728003 00611	DESSURE DECUL VALVE
	120	943133 00000	
	120	951225 00000	LOCKING SCREW
	130	331223 00000	LUGNING SUNEW

#### 1) necessary order quantity / maintenance



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1) necessary order quantity / maintenance

andard appliance see appendix (back of drawing)	
	andard appliance see appendix (back of drawing)

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Index	Pos.	No. Identification	Designation
	45	000000 50000	
×	15	020000 50300	
- S	10	010000 10000	
n,	10	911012 00000	DENT DISOUE
4	10	949203 00000	
×	21	000100 27500	
6	21	00010027500	
	22	945320 00000	
	23	901399 00007	PALETTE DE CHARBON (KIT)
	25	952009 00000	
	28	000701 27600	COUVERCLE
	20	945373 00000	VIS HEXAGONALE INTERNE
	30	008900 16500	JOINT
	33	560200 27500	REEROIDISSEUR
	34	005700 27600	JOINT
	35	945325 00000	VIS HEXAGONALE INTERNE
	46	502300 16400	VENTILATEUR
	48	947713 00000	CLAVETTE
	49	949454 00000	RONDELLE
	50	901804 00000	VIS BOUT D'ARBRE
	61	004803 27600	COUVERCLE DU FILTRE
	67	009000 16300	RESSORT-JAME
	72	909505 01000	CARTOUCHE FILTRANTE C 75/2 (1x) 1)
	74	909529 00000	CARTOUCHE FILTRANTE C 78/6 - EN OPTION
	76	945373 00000	VIS HEXAGONALE INTERNE
	77	948021 00000	JOINT
	83	006800 27500	CARTER PROTECTEUR
	84	742609 01000	TUBE FLEXIBLE
	85	951920 00000	ELEMENT EN CAOUTCHOUC
	88	006803 27600	CARTER PROTECTEUR
	89	741365 00000	AMORTISSEUR EN CAOUTCHOUC
	90	945318 00000	VIS HEXAGONALE INTERNE
	91	951922 00000	ELEMENT EN CAOUTCHOUC
	92	964108 00000	PROTECTION D'ARETE
	94	015100 27600	PIED
	95	951921 00000	ELEMENT EN CAOUTCHOUC
	96	068000 27600	DONILLE D'ECARMENT
	97	945328 00000	VIS HEXAGONALE INTERNE
	98	949451 00000	RONDELLE
	101	833903 99597	PLATEAU DE SOUPAPE
	102	951906 00000	PROTECTION EN CAOUTCHOUC
	103	068002 16500	TUBE D'ECARTEMENT
	104	548800 16300	PITON
	125	728003 99611	SOUPAPE REGLAGE PRESSION
	126	943132 00000	GIULEUK
	130	951225 00000	BOUCHON

	Dee	No. Identification	
Index	Pos.	No. Identification	Designation
¥	15	020000 50400	PISTON
0	16	016800 16500	DISQUE DE SERRAGE
4	17	911008 00000	BAGUE STAR
4	18	949203 00000	DENT DISQUE
	19	945320 00000	VIS HEXAGONALE INTERNE
×	21	000100 27600	CORP DE POMPE
	23	945322 00000	VIS HEXAGONALE INTERNE
	24	901397 00007	PALETTE DE CHARBON (KIT)
	25	952009 00000	DOVILLE DE ETRAGE
	28	000701 27600	COUVERCLE
	29	945374 00000	VIS HEXAGONALE INTERNE
	30	008900 16500	JOINT
	33	560200 27600	REFROIDISSEUR
	34	005700 27600	JOINT
	35	945325 00000	VIS HEXAGONALE INTERNE
	46	902300 27600	VENTILATEUR
	48	947713 00000	CLAVETTE
	49	949454 00000	RONDELLE
	50	901804 00000	VIS BOUT D'ARBRE
	61	004803 27600	COUVERCLE DU FILTRE
	67	009000 16300	RESSORT-JAME
	72	909505 01000	CARTOUCHE FILTRANTE C 75/2 (1x) 1)
	74	909529 00000	CARTOUCHE FILTRANTE C 78/6 - EN OPTION
	76	945373 00000	VIS HEXAGONALE INTERNE
	77	948021 00000	JOINT
	83	006800 27600	CARTER PROTECTEUR
	84	742609 01000	TUBE FLEXIBLE
	85	951920 00000	ELEMENT EN CAOUTCHOUC
	88	006803 27600	CARTER PROTECTEUR
	89	741365 00000	AMORTISSEUR EN CAOUTCHOUC
	90	945318 00000	VIS HEXAGONALE INTERNE
	91	951922 00000	ELEMENT EN CAOUTCHOUC
	92	964108 00000	PROTECTION D'ARETE
	94	015100 27600	PIED
	95	951921 00000	ELEMENT EN CAOUTCHOUC
	96	068000 27600	DONILLE D'ECARMENT
	97	945328 00000	VIS HEXAGONALE INTERNE
	98	949451 00000	RONDELLE
	101	833903 99597	PLATEAU DE SOUPAPE
	102	951906 00000	PROTECTION EN CAOUTCHOUC
	103	068002 16500	TUBE D'ECARTEMENT
	104	548800 16300	PITON
	125	728003 99611	SOUPAPE REGLAGE PRESSION
	126	943133 00000	GICLEUR
	130	951225 00000	BOUCHON

#### 1) quantité nécessaire / entretien

DA 4.23N	(1~)	abrication - Ao monophase

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#### 1) quantité nécessaire / entretien

DX 4.40K	(1~) /5	Fabrication - AC monophase Fabrication avec moteur 2,2 / 3 kW
Articles dive	raonto vi	a à via de l'annersitatandard, vair annevo (dec du deccin / du nten)
Articles uive	igents vi	s-a-vis de l'apparen standard, von annexe (dos du dessin / du plan)

Index	Pos.	No. Identificazione	Designazione
	15	020000 50300	ROTORE
X	16	016800 16500	DISCO DI FISSAGGIO
22	17	911012 00000	STAR-ANNELLO TOLLERANZA
1	18	949203 00000	DISCOADENTE
4	19	945320 00000	VITE ESAGONALE INTERNA
×	21	000100 27500	CARCASSA
	22	951806 00000	SPINE DI RISCONTRO
_	23	945320 00000	VITE ESAGONALE INTERNA
	24	901399 00007	PALETTE DI CHARBONE (KIT)
	25	952009 00000	SPINE DI RISCONTRO
	28	000701 27600	COPERCHIO
	29	945373 00000	VITE ESAGONALE INTERNA
	30	008900 16500	GUARNIZIONE
	33	560200 27500	RAFFREDDATORE
	34	005700 27600	GUARNIZIONE
	35	945325 00000	VITE ESAGONALE INTERNA
	46	502300 16400	VENTILATORE
	48	947713 00000	CHIAVETTA
	49	949454 00000	RONDELLA
	50	901804 00000	VITE DI CHIUSURA ALBERO
	61	004803 27600	COPERCHIO FILTRO
	67	009000 16300	MOLLA
	72	909505 01000	CARTUCCIA FILTRO C 75/2 (1x) 1)
	74	909529 00000	CARTUCCIA FILTRO C 78/6 - OPTIONALE
	76	945373 00000	VITE ESAGONALE INTERNA
	77	948021 00000	ANELLO GUARNIZIONE
	83	006800 27500	CARTER DI PROTEZIONE
	84	742609 01000	TUBO FLESSIBILE
	85	951920 00000	ELEMENTO IN GOMMA
	88	006803 27600	CARTER DI PROTEZIONE
	89	741365 00000	AMMORTIZZATORE IN GOMMA
	90	945318 00000	VITE ESAGONALE INTERNA
	91	951922 00000	ELEMENTO IN GOMMA
	92	964108 00000	LISTELLO DI PROTEZIONE
	94	015100 27600	PIEDE
	95	951921 00000	ELEMENTO IN GOMMA
	96	068000 27600	BOCCOLA DISTANZIATRICE
	97	945328 00000	VITE ESAGUNALE INTERNA
	98	949451 00000	RUNDELLA
	101	833903 99597	
	102	951906 00000	TUDO DISTANZA
	103	000002 10000	CANCIO
	104	346800 16300 728002 00611	
	120	120003 99011	VALVULA REGULAZIUNE PRESS.
	120	943132 00000	
	130	991229 00000	VILE DI GRIUSUKA

Index	Pos.	No. Identificazione	Designazione
	15	020000 50400	ROTORE
ž	16	016800 16500	DISCO DI FISSAGGIO
4	17	911008 00000	STAR-ANNELLO TOLLERANZA
	18	949203 00000	DISCO A DENTE
V	19	945320 00000	VITE ESAGONALE INTERNA
$\times$	21	000100 27600	CARCASSA
Δ	23	945322 00000	VITE ESAGONALE INTERNA
	24	901397 00007	PALETTE DI CHARBONE (KIT)
	25	952009 00000	SPINE DI RISCONTRO
	28	000701 27600	COPERCHIO
	29	945374 00000	VITE ESAGONALE INTERNA
	30	008900 16500	GUARNIZIONE
	33	560200 27600	RADIATORE
	34	005700 27600	
	33	945325 00000	
	40	902300 27600	
	40	949454 00000	
	50	901804 00000	VITE DI CHIUSURA ALBERO
	61	004803 27600	COPERCHIO EILTRO
	67	009000 16300	MOLLA
	72	909505 01000	CARTUCCIA FILTRO C 75/2 (1x) 1)
	74	909529 00000	CARTUCCIA FILTRO C 78/6 - OPTIONALE
	76	945373 00000	VITE ESAGONALE INTERNA
	77	948021 00000	ANELLO GUARNIZIONE
	83	006800 27600	CARTER DI PROTEZIONE
	84	742609 01000	TUBO FLESSIBILE
	85	951920 00000	ELEMENTO IN GOMMA
	88	006803 27600	CARTER DI PROTEZIONE
	89	741365 00000	AMMORTIZZATORE IN GOMMA
	90	945318 00000	VITE ESAGONALE INTERNA
	91	951922 00000	ELEMENTO IN GOMMA
	92	964108 00000	LISTELLO DI PROTEZIONE
	94	015100 27600	PIEDE
	95	951921 00000	ELEMENTO IN GOMMA
	90	045329 00000	
	97	949451 00000	
	101	833903 99597	
	102	951906 00000	PROTEZIONE IN GOMMA
	103	068002 16500	TUBO DISTANZA
	104	548800 16300	GANCIO
	125	728003 99611	VALVOLA REGULAZIONE PRESS.
	126	943133 00000	UGELLO
	130	951225 00000	VITE DI CHIUSURA

#### 1) quantità di ordinazione necessari / manutenzione

DX 4.40K	(1~) /5	Modello - AC monofase Modello con motore 2 2/3kW
	10	

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1) quantità di ordinazione necessari / manutenzione

DX 4.25K (1~) Modello - AC monofase

Index	Pos.	No. De pedido	Descripción
	45	020000 50200	ÉMPOLO
×	10	020000 30300	
សួ	17	010000 10000	
	18	949203 00000	
4	10	945320 00000	
×	21	000100 27500	CARCASA
<b>n</b>	22	951806 00000	CASQUILLO TENSOR
	23	945320 00000	
	24	901399 00007	EMPUJADOR DE CARBÓN (KIT)
	25	952009 00000	CASQUILLO TENSOR
	28	000701 27600	TAPA LATERAL
	29	945373 00000	TORNILLO HEXAGONAL INTERIOR
	30	008900 16500	JUNTA
	33	560200 27500	REFRIGERADOR
	34	005700 27600	JUNTA
	35	945325 00000	TORNILLO HEXAGONAL INTERIOR
	46	502300 16400	VENTILADOR
	48	947713 00000	LENGÜETA DE AJUSTE
	49	949454 00000	ARANDELA
	50	901804 00000	TORNILLO TERMINAL DE ÁRBOL
	61	004803 27600	TAPA DE FILTRO
	67	009000 16300	MUELLE DE PRESIÓN
	72	909505 01000	CARTUCHO DE FILTRO C 75/2 (1x) 1)
	74	909529 00000	CARTUCHO DE FILTRO C 78/6 - OPCIONAL
	76	945373 00000	TORNILLO HEXAGONAL INTERIOR
	77	948021 00000	ANILLO DE JUNTA
	83	006800 27500	CAPERUZA DE APARATO
	84	742609 01000	MANGUERA
	85	951920 00000	PIEZA DE ORMA DE GOMA
	88	006803 27600	CAPERUZA DE APARATO
	89	741365 00000	AMORTIGUADOR DE GOMA
	90	945318 00000	TORNILLO HEXAGONAL INTERIOR
	91	951922 00000	PIEZA DE ORMA DE GOMA
	92	964108 00000	PROTECCIÓN DE CANTOS
	94	015100 27600	PIE
	95	951921 00000	PIEZA DE ORMA DE GOMA
	96	068000 27600	PIEZA DISTANCIADORA
	97	945328 00000	TORNILLO HEXAGONAL INTERIOR
	98	949451 00000	ARANDELA
	101	833903 99597	PLATILLO DE VÁLVULA
	102	951906 00000	BOQUILLA DE CABLE
	103	068002 16500	TUBO DISTANCIADOR
	104	548800 16300	TORNILLO DE CANCAMO
	125	728003 99611	VALVULA REGULADORA DE PRESIÓN
	126	943132 00000	TOBERA
	130	951225 00000	TORNILLO DE CIERRE

Index			
$\sim$	15	020000 50400	ÉMBOLO
5	16	016800 16500	ARANDELA TENSORA
4	17	911008 00000	ANILLO DE TOLERANCIA STAR
2	18	949203 00000	POLEA DENTADA
N	19	945320 00000	TORNILLO HEXAGONAL INTERIOR
×	21	000100 27600	CARCASA
	23	945322 00000	TORNILLO HEXAGONAL INTERIOR
	24	901397 00007	EMPUJADOR DE CARBÓN (KIT)
	25	952009 00000	CASQUILLO TENSOR
	28	000701 27600	TAPA LATERAL
	29	945374 00000	TORNILLO HEXAGONAL INTERIOR
	30	008900 16500	JUNTA
	33	560200 27600	REFRIGERADOR DE AIRE COMPRIMIDO
	34	005700 27600	JUNIA
	35	945325 00000	TORNILLO HEXAGONAL INTERIOR
	40	902300 27000	
	40	940454 00000	
	49	901804 00000	
	61	004803 27600	
	67	009000 16300	MUELLE DE PRESIÓN
	72	909505 01000	CARTUCHO DE EILTRO C 75/2 (1x) 1)
	74	909529 00000	CARTUCHO DE FILTRO C 78/6 - OPCIONAL
	76	945373 00000	TORNILLO HEXAGONAL INTERIOR
	77	948021 00000	ANILLO DE JUNTA
	83	006800 27600	CAPERUZA DE APARATO
	84	742609 01000	MANGUERA
	85	951920 00000	PIEZA DE ORMA DE GOMA
	88	006803 27600	CAPERUZA DE APARATO
	89	741365 00000	AMORTIGUADOR DE GOMA
	90	945318 00000	TORNILLO HEXAGONAL INTERIOR
	91	951922 00000	PIEZA DE ORMA DE GOMA
	92	964108 00000	PROTECCION DE CANTOS
	94	015100 27600	
	95	951921 00000	PIEZA DE ORMA DE GOMA
	90	045229 00000	
	97	949451 00000	ARANDELA
	101	833903 99597	
	102	951906 00000	BOOULLADE CABLE
	103	068002 16500	TUBO DISTANCIADOR
	104	548800 16300	TORNILLO DE CÁNCAMO
	125	728003 99611	VÁLVULA REGULADORA DE PRESIÓN
	126	943133 00000	TOBERA
	130	951225 00000	TORNILLO DE CIERRE

Descripción

Pos. No. De pedido

DX 4.40K	(1~)	Versión - AC monofásica		
	/5	Versión con motor de 2,2/3kW		
Para posiciones que derivan del aparato standard véase apéndice (lado trasero del plano)				

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1) cantidad necesario / mantenimiento

CIONAL

DX 4.25K (1~) Versión - AC monofásica
Para posiciones que derivan del aparato standard véase apéndice (lado trasero del plano)

# BECKER





optional en option	Variante(n) Modifications Variantes	Pos <sup>2)</sup>	Bestell Nr. / Ident No. / No. Identification / No. Identificazione / No. De pedido		Beschreibung / Description / Designation / Designazione / Desripcion			
optionale opcional			$\bullet$					
DX 4.25K (1~) DX 4.40K (1~) DX 4.40K/ <b>XX</b>	DX 4.25K (1~)	8 12 13 83 94	964233 00000 948766 00000 742002 30000 006802 27500 015101 27600	<del>006800 27500</del> <del>015100 27600</del>	WINKEL / BRACKET / COUDES / GOMITO / ÁNGULO BLINDNIET / BLIND RIVET / RIVET AVEUGLIE / RIVETTO CIECO / REMACHE CIEGO KABEL / CABLE / CABLE / CAVO / CABLE HAUBE / PROTECTING HOOD / CARTER PROTECTEUR / CARTER DI PROTEZIONE / CAPERUZA FUSS / FOOT / PIED / PIEDE / PIE			
	DX 4.40K <b>(1~)</b>	8 12 13 83 94	964233 00000 948766 00000 742002 30000 006804 27600 015101 27600	<del>006800 27600</del> <del>015100 27600</del>	WINKEL / BRACKET / COUDES / GOMITO / ÁNGULO BLINDNIET / BLIND RIVET / RIVET AVEUGLIE / RIVETTO CIECO / REMACHE CIEGO KABEL / CABLE / CADLE / CAVO / CABLE HAUBE / PROTECTING HOOD / CARTER PROTECTEUR / CARTER DI PROTEZIONE / CAPERUZA FUSS / FOOT / PIED / PIEDE / PIE			
	DX 4.40K/5	27	903237 00000		DICHTUNG / GASKET / JOINT / GUARNIZIONE / JUNTA			
	2) variantenabhängige	Bauteile	/ variant-dependent	components / compo	sants variante-dependantes / componenti variante-dispendenti / componentes variante-dependientes			
standard					www.bockor.international.com			
		www.becker-international.com						

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#### SECTION 12c: AUTOMATIC FINE BAR SCREEN

#### P&ID: Item #: SC-0251

Unit Details:	FS600S – 2mm Bar Screen with 304SS screen box with removable screen baskets.
Manufacturer:	Comminutor Service Co., Ltd. 7 <sup>th</sup> FL Shinjuku Kokusai Bldg. No. 6-6-3. Nishi-shinjuku, Shinjuku-ku.
	Tokyo-160, Japan
	Phone: JAPAN 3-3342-6797/7
	Fax: JAPAN 3-3342-6798

Local Distributor/Contact:

Ovivo 2404 Rutland Dr. Austin, Texas 78758 Phone: (512) 834-6007 Fax: (512) 834-6039 www.ovivowater.com THIS PAGE INTENTIONALLY LEFT BLANK

### **OPERATIONAL & MAINTENANCE MANUAL**

### JOB NO. CAW208

## North Reading High School Portsmouth, RI

FS-600S Fine Screen Enclosure

Bioprocess H2O, LLC Customer

> Prepared by: Ovivo USA, LLC P.O. Box 9069 Austin, Texas 78766 (512) 834-6000

December 17, 2013

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Equipment Description	2
Product Information	3
Equipment Drawings	4

# Section 1

Special Instructions

Warranty

Material Specifications

**Protective Coatings** 

#### SPECIAL INSTRUCTIONS ON RECEIVING EQUIPMENT

Upon receiving equipment, Ovivo recommends that each item be thoroughly inspected, counted, and properly stored. Any items marked as shipped on the Shipping List which are missing or in poor condition should be brought to the attention of Ovivo immediately. The freight company should be notified immediately of any crates, boxes, or equipment damaged in transit.

Short shipments and back orders are clearly indicated on the Shipping List. These items will be shipped as soon as possible.

For convenience, the mark number on each item corresponds to the Item Number where it is shown on the Shipping List.

The Shipping List is sorted by the Item Number. The Item Number is sequential by the first number encountered, reading left to right (typical database sequencing).

For example, the below Item Numbers would appear in this order:

516-1 516-33 595-1 595-10 595-11 595-115 595-12 595-130 595-2 595-233 595-24 CAW27-1-01 CAW27-1-02

In the event of an improper shipment, please contact:

**Ovivo USA, LLC** 2404 Rutland Drive Austin, Texas 78758 (512) 834-6000

#### VERY IMPORTANT INFORMATION

Regarding the format used in the Instruction Manual, information of particular importance is highlighted by the use of words "NOTE", "CAUTION", and "WARNING", each having significance listed below:

- **NOTE:** Information of particular importance related to equipment operation.
- **<u>CAUTION</u>**: Lack of observance of this information can result in equipment malfunction or damage.

# **WARNING:** LACK OF OBSERVANCE OF THIS INFORMATION CAN RESULT IN A HAZARD TO PERSONNEL AND EQUIPMENT.

#### THE ENTIRE CONTENTS OF THIS MANUAL SHOULD BE THROUGHLY REVIEWED AND UNDERSTOOD PRIOR TO INSTALLING AND OPERATING THE EQUIPMENT.

#### SPECIAL INSTRUCTION ON PAINTING

<u>NOTE:</u> Mask-off and protect all drive components before sand-blasting adjacent structures.

Equipment painted with prime coats only should get additional coats within one month after receipt to protect the surface under field conditions. Primer paints do not act as a finish coat. They are not 100% moisture proof. Ovivo cannot accept responsibility for corrosion of material that has not received additional coats in the field.

#### SPECIAL INSTRUCTIONS ON ORDERING SPARE OR REPAIR PARTS

If spare or repair mechanical parts are needed, the Item Number from the Shipping list will be required for ordering.

If electrical parts are required, provide all pertinent data: voltage, amperage, wattage, cycle, speed, power factor, or other information given on a nameplate or in the IOM Manual.

Submit a written purchase order signed by your authorized agent so that we will know whom to contact should further clarification of the order be necessary. Indicate the item information, quantity of each item, ship-to address, method of delivery, and invoicing instructions.

#### SPECIAL INSTRUCTION ON INSPECTION OF INSTALLED EQUIPMENT

Ovivo can supply a letter to the Consulting Engineer and/or Owner stating that the equipment is installed per our instructions only if the inspection of the equipment can be conducted when the basins are empty and all equipment is accessible.

Ovivo included the conditions of Field Service in our proposal. Any time in excess of the stated hours, included as part of our proposal, which is required to complete the inspection will be billed to the Contractor at the rates indicated therein.

Failure to have the equipment installation inspected by an Ovivo representative will result in loss of equipment warranty.

#### SPECIAL INSTRUCTIONS ON BOLT TIGHTENING

Any erection or machine bolt must be properly torqued if it is to function satisfactorily. Structural steel erection bolts must have enough clamping force to develop the full strength of friction type connections. A machine bolt must be tightened to a sufficiently high preload so that any dynamic loading it endures is small in comparison to the preload. Loose or improperly tightened bolts fail in fatigue from the repeated stress due to dynamic loading. Keep in mind that, regardless of the safety designed into the bolted connection, the proper preload can only be developed during installation.

Most of the tightening torque for a bolt is required to overcome friction. Since friction is dependent upon lubrication, finish, cleanliness, etc., we hesitate to recommend a particular torque for a given size bolt. We strongly urge that the following simple test, using representative bolts, be performed:

Using a torque wrench, slowly and steadily tighten the fastener. As it is tightened, the torque increases at a rather uniform rate. When the yield point of the fastener is reached, torque will level off. Note this torque reading. This test should be performed on several fasteners to obtain a good average. The test bolts must be discarded.

The minimum tightening torque should be 75% of the established average yield torque. Care must be taken to repeat the test if any change is made in fastener lubrication, finish, fit, etc.

Erection bolts should be tightened from 1/4 to 2/3 of a turn past a snug position. A snug position is taken to be the maximum torque that can be applied by an average man using a wrench with a 10'' handle.

OVIVO DOES NOT RECOMMEND THE USE OF IMPACT WRENCHES AS THEY CAN CAUSE FASTENERS TO SEIZE, AND CAN CAUSE DAMAGE TO COATINGS. ONLY HAND TOOLS SHOULD BE USED FOR ASSEMBLY OF EQUIPMENT.

#### SPECIAL INSTRUCTION FOR ROTATING MACHINERY

Certain types of equipment such as blowers, pumps, and gear drives are subject to bearing damage during extended storage. It is advisable to hand rotate this type of equipment once a week during storage and before start-up.

Any rotating machinery that does not move freely should be brought to the attention of Ovivo immediately.

Before placing rotating machinery in operation, bearing and other moving parts should be cleansed of the original lubricants and lubricated in accordance with detailed maintenance instruction included in this manual.

#### SPECIAL INSTRUCTIONS ON LUBRICATION

Before operation, drain condensate, grease bearings, clear breathers and vents, and fill gear boxes with recommended oil.

DO NOT OVERFILL gear boxes. Do not over grease bearings or couplings on high - speed machinery. Force spent grease from bearing cavities.

# OPERATION WITHOUT LUBRICATION IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS WILL VOID OVIVO WARRANTY.

Refer to these instructions or call the Ovivo Field Service Department (512) 834-6000 for correct procedures.

#### SPECIAL INSTRUCTIONS FOR MECHANICAL PIPE COUPLINGS

Clean pipe ends thoroughly, particularly in the area where the gasket will seat and far enough from the end to prevent interference with the couplings.

Mark pipe ends so that it can be ascertained the pipe is inserted far enough into the coupling. The marks can be used for centering the coupling. The marks should be a minimum of one-half the sleeve (body) length, plus two inches.

Place flange over each pipe end.

Gaskets should be cleaned and inspected for damage in shipment. Lubricate gaskets and pipe ends with soapy water. Anti-freeze should be added in freezing weather.

Place gasket on each pipe end. Tapered end should be toward pipe end.

Be certain sleeve (body) is clean, particularly flares, where gasket will seat. Slip sleeve over pipe end.

Telephone: 512.834.6000 Facsimile: 512.834.6039



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Bring other pipe into position and center sleeve to make certain proper pipe entrance is obtained.

Bring gaskets and flanges into position.

Insert bolts, assemble nuts, and tighten to a minimum of 35 ft\*lbs for 7/16" and 1/2" bolts, and 75 ft\*lbs for 5/8" bolts.

#### SPECIAL INSTRUCTIONS FOR RECEIVING HOT-DIPPED GALVANIZED EQUIPMENT

Equipment which has been hot-dipped galvanized (HDG) after fabrication should be thoroughly inspected for galvanized defects and carefully stored.

Incoming articles should be inspected for warpage, distortion, bent members, cracked or discolored galvanizing, projections, interior threads that have not been cleaned, and shipping damage. Notify Ovivo immediately of any defects that may complicate assembly or deter acceptance.

To prevent the formation of wet storage stain, galvanized equipment should be kept under cover, in dry and well ventilated conditions. Where outdoor stacking is necessary, the material should be raised from the ground and articles separated with wood spacing strips to allow free circulation of air.

UNDER NO CIRCUMSTANCE SHOULD GALVANIZED EQUIPMENT BE STORED IN DIRECT CONTACT WITH MUD OR DAMP GROUND.

#### SPECIAL INSTRUCTIONS FOR STORAGE OF FLOOR GRATING

To prevent damage, floor grating should be stored on flat surfaces, with no items of equipment stored on top of it. Adhere to all other precautions for HDG equipment.

#### SPECIAL INSTRUCTIONS FOR THREADED PIPE FITTINGS

A quality liquid thread sealer (pipe dope) should be applied liberally to all NPT (tapered) threaded pipe fittings before they are installed.

#### SPECIAL INSTRUCTIONS FOR STAINLESS STEEL FASTENERS

Load bearing fasteners made from premium materials such as Type 304 and 316 stainless steel require lubrication before tightening. Ovivo recommends a liberal application of anti-seize lubricant to prevent galling.



Equipment or parts manufactured by **Ovivo USA, LLC** ("SELLER"), is backed by the following warranty:

Solely for the benefit of the original user, SELLER warrants that new equipment and parts manufactured by it and provided to the original user (collectively, "Products") shall be free from defects in material and workmanship for the period of one (1) year from the date of Owner acceptance not to exceed eighteen (18) months from the date of shipment by Seller (the "Warranty Period").

If any of SELLER'S Products fail to comply with the foregoing warranty, SELLER shall do one of the following:

- (a) repair or replace free of charge to original user, EX WORKS SELLER'S factories or other location that SELLER designates, any Product or parts thereof returned to SELLER, which examination shall show to have failed under normal use and service operation by the original user within the Warranty Period; provided, that if it would be impracticable for the Product or part thereof to be returned to SELLER, SELLER will send a representative to the original user's job site to inspect the Product. If it is determined after inspection that SELLER is liable under this warranty to repair or replace the Product or part thereof, SELLER shall bear the transportation cost of (i) returning the Product to SELLER for inspection or sending its representative to the job site, and (ii) returning the repaired or replaced Products to the original user; however, if it is determined after inspection that SELLER is not liable under this warranty, SELLER'S customer or the original user shall pay those costs; or
- (b) at SELLER'S sole option, refund all or part of the purchase price allocable to the defective Product, or parts thereof.

For SELLER to be liable with respect to this warranty, the original user must make its claims to SELLER with respect to this warranty in writing no later than thirty (30) days after the original user discovers the basis for its warranty claim and in no event more than thirty (30) days after the expiration of the Warranty Period.

In addition to any other limitation or disclaimer with respect to this warranty, SELLER shall have no liability with respect to any of the following:

- (i) failure of the Products, or damages to them, due to the negligence or willful misconduct of SELLER's customer or the original user, abuse or improper storage, installation, application or maintenance (as specified in any manuals or written instructions that SELLER provides to the original user);
- (ii) any Products that have been altered or repaired in any way without SELLER'S prior written authorization;
- (iii) the costs of dismantling and reinstallation of the Products;
- (iv) any Products damaged while in transit or otherwise by accident;
- (v) decomposition of Products by chemical action, erosion or corrosion or wear to Products caused by abrasive materials or due to conditions of temperature, moisture and dirt; or
- (vi) claims with respect to parts that are consumable and normally replaced during maintenance such as filter media, filter drainage belts and the like, except where such parts are not performing to SELLER'S estimate of normal service life, in which case, SELLER shall only be liable for the pro rata cost of replacement of those parts based on SELLER'S estimate of what the remaining service life of those parts should have been; provided, that failure of those parts did not result from any of the matters listed in clauses (i) through (v) above.

With regard to third-party parts, equipment, accessories or components not of SELLER's design, SELLER'S liability shall be limited solely to the assignment of available third-party warranties.

It is the responsibility of SELLER'S customer or the original user to hire or retain engineers and other experts to determine the suitability of the Product for the original user's use. SELLER shall not be liable for the design or suitability of any Products for any particular use (except to the extent that a warranty or guarantee with respect to such a matter is expressly set forth in a written document executed by an authorized representative of SELLER). In making interpretations of data, SELLER'S employees will give its customer the benefit of their reasonable professional judgment as to the correct interpretation, but SELLER cannot and does not guarantee the accuracy or correctness of these interpretations (except to the extent that a warranty or guarantee with respect to such a matter is expressly set forth in a written document executed by an authorized representative of SELLER).

SELLER'S quoted price for the Products is based upon this warranty. Any increase in warranty obligation may be subject to an increase in price.

THE PARTIES AGREE THAT ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY, WHETHER WRITTEN, ORAL OR STATUTORY, ARE EXCLUDED TO THE FULLEST EXTENT PERMISSIBLE BY LAW. ALL WARRANTIES AND OBLIGATIONS OF SELLER SHALL TERMINATE IF: (1) SELLER'S CUSTOMER OR ORIGINAL USER FAILS TO PERFORM ITS OBLIGATIONS UNDER THIS OR ANY OTHER AGREEMENT BETWEEN THE PARTIES; OR (2) SELLER'S CUSTOMER AND THE ORIGINAL USER FAIL TO PAY ANY CHARGES OTHERWISE DUE SELLER.

SELLER shall not be liable for any indirect, special, punitive, exemplary or consequential damages, including damages for lost production, plant shut-down, service interruptions, increased expense of operation, increased costs of power supply, loss of use of capital, lost revenue, lost product, lost profit or lost business opportunities, from any cause whatsoever, including the negligence of any person or entity.

### **Material Specifications**

#### A. Fasteners

Structural erection bolts, nuts and washers	Type 303/304 stainless steel
B. Fine Screen	
Fabricated enclosure	Type 304 stainless steel
Screen frame	Type 304 stainless steel
Screen rakes	Polycarbonate
Screen bars	Rynite

### C. Welding

All fillet and butt weld joints of pipe, fittings and structural steel shapes shall conform to the specifications of the American Welding Society.

# **Protective Coatings**

1. All non-ferrous surfaces, including stainless steel and plastic items of equipment, shall not be painted.

# Section 2

Equipment Description

### **Equipment Description**

One (1) Ovivo fine screening system. Scope of supply includes:

- 1- FS-600S automatic fine screen, 2 mm openings, Rynite bars, polycarbonate rakes, stainless steel chain, UHMW bearings and 460V-60Hz-3ph non-explosion-proof motor.
- 1- Enclosure for screen, 304SS construction, with 4" flanged inlet, 4" plain end pipe outlet, screenings basket, float switch bracket, and hinged lid.
- 1- Float switch to initiate screen operation when accumulated trash is clogging the screen.
- 1- Spare 460V-60Hz-3ph non-explosion-proof motor is included.

**ENVIROQUI** 

# **Automatic Fine Opening Bar Screen**



- Simple operation, non-corrosive materials of construction, maintenance free
- Standard openings: 1, 2, 2.5, 5, 9 and 14mm
- Can be installed in a stainless steel box or in concrete channels
- Built-in seals allow installation in new and existing channels
- All non-corrosive components:
   Screen frame is type 304 stainless steel
- De-watering of screenings occurs automatically as material is removed up the screen
- All weather proof drive unit

# **APPLICATIONS**

- Membranes
- Screening domestic waste
- Screening industrial wastes such as food and beverage processing
- Scum separation

<b>_</b>	

ModelFlow range 100 gpm to 1,050 gpmFS(up to 16" wide)ModelFlow range 220 gpm to 4,000 gpmFM(up to 32" wide)ModelElow range 570 gpm to 14,400 gpmFL(up to 55" wide)





Enviroquip a division of Eimco Water Technologies LLC 2404 Rutland Drive Austin, TX 78758 USA www.glv.com

Tel: 512.834.6000 Fax: 512.834.6039







Model FS-600S

- 25w waterproof geared motor is coupled directly to the screen
- 3/60/220v or 460v power
- It is lightweight
- Easy to handle
- Maintenance free
- Two Year Warranty



Model FS-600S in 304 SS Box



Dimensions															
Model	FS-600S				FS-800S				FS-1100S						
Clear Openings (mm)	2	-2.5	5	•	-14	2	2.5	5	9	14	2	2.5	5	2	14
Max Flow Rate (gpm)	150	180	250	320	400	300	330	450	600	750	450	500	100	850	1050
Weight (lbs.)			33					49					88		
A		1'	-10 1/2	2"		2'-10 1/4"				3'-8 1/4"					
В			9"			9"				9"					
С			1'- 5"			2'-2"				2'-9 1/2"					
D	11 1/4"			1'-7 1/4"			2'-3								
E	1'-1 3/4"			1'-8"			2'- 1 1/2"								
F	1'-6 3/4"			2'-3 1/8"			2'-9 5/8"								

#### ENVIROQUIP AUTOMATIC FINE SCREEN

#### **OPERATION**

Screen operation is controlled by a level float switch. The level switch or meter initiates and terminates the screen operation as flow enters or drains out of the channel. When the level is low the switch is tripped to terminate screen operation. A timer is activated allowing the screen to continue operating up to 60 seconds prior to shutting off. When the level is high the switch initiates the run mode of the bar screen.

#### MAINTENANCE

Life expectancy of all components is 30,000 hours. As an example, if the screen is operated for 10 hours each 24 hour period that is a life expectancy of over 8 years. Maximum life expectancy can be obtained by keeping the screen clean and in good working condition. A thorough washdown of screen components including the gearmotor is recommended each month. No other routine maintenance is required. Enviroquip fine screens are simple construction and all components that require replacement are bolted on making replacement relatively easy. On smaller screens, the whole screen can be removed from the screen box or channel and placed on plywood or concrete to make parts replacement easier. There should be enough slack in the power chord to allow this removal without unwiring the motor from the control panel or junction box.

ALWAYS DISCONNECT POWER TO THE GEARMOTOR PRIOR TO REPLACING ANY SCREEN COMPONENTS.

CARE SHOULD BE TAKEN WHEN RE-INSTALLING ANY OF THE FASTENERS. ALMOST ALL THE CONNECTIONS HAVE TAPPED HOLES IN THE FRAME. THE FRAME IS THIN GAUGE STAINLESS STEEL AND THERE ARE ONLY A FEW THREADS. THEY STRIP OUT VERY EASILY IF TOO MUCH TORQUE IS APPLIED. SOCKETS REQUIRED ARE 10MM, 13MM AND 24MM.

#### SCREEN COMPONENTS

Gearmotor – totally enclosed non-ventilated design, TENV. Does not require periodic greasing or oil change. Keep unit clean, grime and other materials allowed to build up will reduce the life of the coating and the drive. The gearmotor can be washed without harming the unit. The best maintenance routine would include washing the gearmotor with a sponge and mild detergent every few months. After shutting off power to the control panel, unwire the gearmotor from the terminals in the panel and pull the cable out of the panel. Be sure to note the individual wire terminal locations. The gearmotor is replaced by removing four screws and sliding the motor shaft and keystock out of the drive shaft. Apply a light coating of bearing grease to the shaft and keystock before installing the new gearmotor shaft. Slide the gearmotor shaft and keystock into the drive shaft and attach to the mounting plate with four screws. Feed the gearmotor power cable into the panel and wire to the proper terminals.

# THESE GEARMOTORS CANNOT BE REBUILT. THEY MUST BE REPLACED.

Lower Bearings - solid lube bearings made from UHMW. Grease applied at initial assembly. Periodic greasing is not required unless the unit has to disassembled for some reason. Apply light coating of grease to the bearings upon reassembly being careful to use a minimum of grease. Over greasing will not allow the bearings to seat against the frame. Grease can be LUBRI-PLATE, Molith 2 (molybdenum based) or equal.

Upper Bearings – there is a UHMW solid sleeve bearing on the motor side and a roller bearing on the opposite side. Roller bearing consists of two spring clips that hold the cap over the end of the shaft, a lock collar with two set screws and (2) 13MM HHMB that attach the bearing body to the frame. The seal fits thru a hole in the frame from the inside out and can only be replaced by removing the upper shaft. The lock collar has a cam type fit. Rotate it as you slide it on the shaft. Fill bearing cap with grease.

Grease seals – There is a grease seal between the flow path and the upper and lower bearings. They slide on the shaft from the inside out. Removal/installation require removing the shafts.

Frame – all 304SS construction. Only maintenance is to keep as clean as possible. This will slow frame deterioration associated with highly corrosive substances; low ph, acidic wastewater. When maintenance is required on any item take the time to clean the frame thoroughly with a sponge and mild detergent. Dispose of all cleaning materials.

Bars –Trapezoidal 304SS bars will wear with time and to insure it does not happen to quickly make sure the rakes are engaging the screen and moving up the screen parallel to the bars. Once again keeping the bars clean will insure maximum life. The bars are replaced by removing the lower front cover and also the clamp bar behind cover. The bars will then lift out individually. The bars are notched near the bottom to position them. A notched spacer plate at the bottom sets the proper bar spacing.

Rakes – rakes are high impact polycarbonate. They will wear faster than the bars.

Chain guides - chain guides are UHMW strips attached to a stainless steel angle bolted to the frame. On older units the fasteners holding the strips in place are

positioned below the cross members that hold the two frames together. Most of the screen has to be removed to access and remove them. On new models the fasteners are not hidden behind the cross members. They can be changed in about 5 minutes.

Rubber side seals and backing plates – the neoprene side seals and plastic backing plates will last longer than any other component but will deteriorate over time. They are the least expensive and are the easiest parts to replace. You may want to want to make your replacement seals and backing plates.

Float switch – low-level float switch should be positioned as close to the bottom of the box as possible. High-level float switch (if provided) should be positioned as shown on the equipment drawings. Observe float location and inspect wires for any wear points at three month intervals. Replace if necessary.

# Section 3

Product Information

#### Ø001/001

#### '07 09/27 THU 13:39 FAX 0426872375 コミューターサーヒンスKK コミニューターサービス スカラベセンター 2007年 9月27日 14時39分

NO. 3592 P. 3/3

Page 6

# <u>INSPECTION REPORT OF GEAR MOTOR</u> (ギアモータ出行株式成成本)

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Anja Aichi Japan

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T. Kato

M. Futamura

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# TEST REPORT OF GEAR MOTOR (ギアモートル出版成成者)

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HISSEI COAPORATION	Oate of Inspection	Tesled by	Approved by
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CONERY PART # 2900-B2-S2-15'

DESIGNED FOR ACCURATE LIQUID LEVEL CONTROL IN MANY APPLICATIONS INCLUDING SEWAGE ENVIRONMENTS. THE FLOAT SWITCH CAN BE UTILIZED TO SIGNIFY SPECIFIC

THE CONTACTS ARE OPEN (OR OFF) IN THE HANGING POSITION. AS THE FLOAT RISES 1" (5°) ABOVE HORIZONTAL, THE CONTACTS BECOME CLOSED AND ACTUATE (TURN ON) THE SWITCH. THIS FLOAT IS GENERALLY USED IN PUMP DOWN

THE CONTACTS ARE CLOSED (OR ON) IN THE HANGING POSITION. AS THE FLOAT RISES 1" (5°) ABOVE HORIZONTAL, THE CONTACTS BECOME OPEN AND ACTUATE

A VARIATION OF THE PREVIOUSLY LISTED SWITCHES. THIS FLOAT SWITCH CAN BE WIRED TO OPERATE AS EITHER (BUT NOT BOTH) A NORMALLY OPEN OR NORMALLY

2900 SERIES MERCURY FLOAT SWITCHES ARE DESIGNED TO OPERATE UNDER THE

	CONDUCTOR CORD – PHYSICAL	-	CHLORINATED POLY ETHYLENE.
15	ELECTRICAL FOR N/O OR N/C SWITCH	-	18 AWG 2, TYPE SJOOW-300 VOLT.
	ELECTRICAL FOR SPDT SWITCH	-	18 AWG 3, TYPE SJOOW-300 VOLT.

#### FLOAT SPECIFICATIONS

DURABLE POLYPROPYLENE MATERIAL CONSTRUCTION. SOLID POLYURETHANE FOAM INTERIOR. LEAK PROOF, SHOCK PROOF, AND IMPACT RESISTANT. RESISTANT TO SEWAGE AND WASTEWATER APPLICATIONS. FOR USE WITH INTRINSICALLY SAFE CIRCUITS.

#### CORD WEIGHT

ZINC PLATED CAST IRON - 1.22 LBS. SPLIT WEIGHT DESIGN ALLOWS FOR EASY ADJUSTMENT. DESIGN ALLOWS FOR SECURE AND PERMANENT ATTACHMENT TO CORD.



CONERY MFG INC info@conervmfa.com **1380 ENTERPRISE PARKWAY** PH (419) 289-1444

ASHLAND, OH 44805 FAX (419) 281-0366




## Section 4

Equipment Drawings



### GENERAL NOTES:

- 1. SCREEN VOLTAGE: 460V-3PH-60HZ (NON-EXPLOSION PROOF DRIVE).
- 2. SCREEN RAKES: POLYCARBONATE, BARS: RYNITE
- 3. AUTOMATIC SCREEN OPENINGS: 2 MM
- 4. DIMENSIONS AND PIPE SIZES TO BE VERIFIED.
- 5. ENCLOSURE MATERIAL: TYPE 304SS.
- 6. LID COVER PROVIDED FOR THE ENCLOSURE.
- 7. HEAT TRACING NOT PROVIDED.
- 8. ALL HARDWARE AND ANCHORAGE: TYPE 304SS.

### FOR RECORD ONLY NOT FOR CONSTRUCTION



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### SECTION 12d: ODOR CONTROL BLOWER (SYSTEM)

### P&ID: Item #: BL-1251

Unit Details:	General Carbon Odor Control System
	Model ES-42-1
	2Hp, 3Ø/60Hz/460V

Manufacturer: General Carbon Corporation 33 Patterson Street Paterson, NJ 07501 Phone: (973) 523-2223 Fax: (973) 523-1494 www.generalcarbon.com

Local Distributor/Contact:

General Carbon Corporation 33 Patterson Street Paterson, NJ 07501 Phone: (973) 523-2223 Fax: (973) 523-1494 www.generalcarbon.com THIS PAGE INTENTIONALLY LEFT BLANK

### "CLEANING THE WORLD WITH ACTIVATED CARBON"



## <u>ES – SERIES</u>

ACTIVATED CARBON ODOR CONTROL SYSTEMS simple solutions for odor control

GENERAL CARBON ES SYSTEMS provide a simple, cost effective solution for odor control problems and air treatment applications. The adsorber is constructed from linear polyethylene for corrosion and weather resistance as well as durability. All fittings are welded to the tank. On vessels up to 50 inches, the top is removable for easy carbon service. Larger vessels have a 20 inch manway for access.

### Other features are:

- \* High quality virgin or impregnated carbons
- \* Magnehelic gauge and condensate drain
- \* Aluminum fan with locking damper
- \* Standard TEFC motor at your voltage
- \* System mounted on structural steel skid
- \* Stainless Steel carbon bed ground rod
- \* Optional operating and instrumentation packages available upon request

GENERAL CARBO	ON CORPORATION

		<u>C</u>	<u>arbon</u>  bs)	<u>Recommended</u>		<u>Syster</u>	n Dimer	<u>nsions</u>
<u>Model</u>	<u>Dia.</u>	IPH	<u>C-40</u>	Flow: CFM	<u>I/O</u>	<u>Length</u>	<u>Width</u>	<u>Height</u>
ES-24	24″	330	265	95-190	4"/4"	60″	24″	66″
ES-30	30″	515	410	175-370	6"/6"	66″	30″	66″
ES-39	39″	875	700	250-500	6"/6"	72″	36″	66″
ES-42	<mark>42″</mark>	1010	800	<mark>390-610</mark>	<mark>8″/8″</mark>	84″	<mark>42″</mark>	78″
ES-50	50″	1440	1150	410-820	8″/8″	98″	48″	84″

### 33 Paterson Street, Paterson, New Jersey 07501 Tel: 973 523 2223 Fax: 973 523 1494 www.generalcarbon.com email:sales@generalcarbon.com

**AVAILABLE OPTIONS:** We offer a complete selection of NEMA rated motors and controls that are prewired and skid mounted. All fans are ordered to your flow rate and static pressure requirements. Additional options include Hydrogen Sulfide monitor, custom instrumentation including alarms warning devices and automation, explosion proof components, carbon sample ports, FRP fans, FRP equipment skid, exhaust stack and rain hood. **General Carbon Corporation** can recommend and provide special impregnated carbons to enhance control of problem chemicals. When the media needs replacing we will be glad to provide a service quote. We maintain our own fleet of modern equipment and trained technicians that are able to complete any change-out service quickly and safely. Please call for a price quote.



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GC C-40

pelletized activated carbon

**GC C-40** is a virgin activated carbon. Derived from bituminous coal, it is pelletized in form. Its high activity and surface area make it ideal for most vapor phase applications. The uniformity of its shape makes it particularly attractive in applications where low-pressure drop is a consideration.

### **Specifications**

Particle Size - (Diameter), mm:	4.0
(Length), mm:	6.0
Mean Particle Diameter, mm:	4.7
CCI₄ Activity, %:	60 (min)
lodine No., mg/g:	1000 (min)
Surface Area, m²/g:	1000 (min)
Hardness, %:	95 (min)
Moisture, % (as packaged):	3 (max)
Typical Density, lbs./cu.ft.:	28-32
g/cc:	0.44-0.52

\*Standard packaging is in 55 lb. vinyl bags. Other packaging is available upon request.

### Caution!

Wet activated carbon removes oxygen from air causing a severe hazard to workers inside carbon vessels. Confined space/low oxygen procedures should be put in place before any entry is made. Such procedures should comply with all applicable Local, State and Federal guidelines.

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2933 Symmes Road Fairfield, OH 45014 Ph. 513-874-2400 Fax 513-870-6249

### Representative Information

Eric Wilts P: 201 251 6466 ewilts@optonline.net

> Air Systems Engineering 231 Greenwood Ave Midland Park, NJ 07432

Date: 09-20-11

Performance Requ	uirements	5	Selection					
Actual Volume	577 Cu Ft / Min		Model and Size	AF-10-R11527-6				
			Impeller Diameter	11.56	Inches			
Static Pressure	7.000	Inches W.G.	Impeller Material	Aluminum				
lax Design Temperature	200	Degrees F						
Inlet Conditi	ons							
<del>-</del> .			Density	0.0723	Lb / Cu Ft			
Operating Temperature	80	Degrees F	Volume	584	Cu Ft / Min			
specific Gravity	1.000		Static Pressure	7.16	Inches W.C			
Altitude	500	Feet	Power @ Condition	1.28	Horsepowe			
nlet Pressure	0.000	Inches W.G.	Power @ 0.075 Lb / Cu Ft	1.32	Horsepowe			
ensity at Static Pressure	0.0723	Lb / Cu Ft	Fan Speed	3500	RPM			
Selected Direct Dr	ive Speed	ł	Impeller Tip Speed	10595	Ft / Min			
			Static Efficiency	51	%			
speed	3500	RPM	Outlet Velocity	5589	Ft / Min			
			% of Max Fan Speed	92	%			
			Max Fan Speed	3800	RPM			
			Recommended Motor	1-1/2	Horsepowe			
Sound Dat Sound Power Levels @	ta 0 10E-12 \	Watts						
Frequency	LW dB		The sound power level ratings are show	wn in decibels,				
63	89		referred to 10E-12 watts calculated per	AMCA Standard				
125	90		301.Values shown are for inlet Lwi sou	nd power levels fo	r			
250	96		installation Type B, free inlet, ducted o	utlet. Ratings do	not			
500	99		include the effects of duct end correction	on.				
1000	94							
2000	90		dbA value shown was obtained in insta	Ilation Type B tes	ts			
4000	85		conducted in the AFC Laboratory. dbA value obtained for					
8000	79		your installation may be different. dbA	level shown is for				
			comparative purposes only.					
Estimated DBA ( 88	@ 5 Feet							

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## ES – 42 Odor Control System for Activated Carbon

## **Operation & Maintenance Manual**

SECTION	<u>PAGE</u>
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## Handling and Storage

- 1. Before proceeding with assembly read and understand these instructions.
- 2. Inspect all equipment when it is received. Notify the carrier and General Carbon Corp. of any damage that occurred during shipment. No material or equipment may be returned without our prior written consent. Our written reply, if granted, will contain return shipping instructions for you to follow.
- 3. When unloading or moving equipment, take care to prevent injury to personnel and damage to the equipment.
  - a. If the equipment is on a skid, moving by lift points provided on the skid using a crane, sling and spreader bar is the recommended method for moving the unit. Only apply vertical force at the lift points.
  - b. If only a fork truck is available, the forks <u>MUST</u> span the full length of the skid and that the skid is secured to the truck to prevent the equipment from "sliding" off the forks.
- 4. <u>STORAGE:</u> If equipment will be stored before installation.
  - a. Store in clean, dry and safe area.
  - b. Protect from direct sunlight. Use a reflective covering and arrange it in such a manner that air is allowed to circulate around the equipment in order to protect it from excessive heat and moisture.
  - c. Cover flanges and couplings in order to prevent accumulations of dirt and moisture in the unit.
  - d. Periodically rotate shafts on equipment like fans and motors in order to circulate the bearing lubricant to protect bearings from premature failure.

### Page 2

## **Installation**

- The vessel must be located on a level surface able to support the operating weight of the equipment and which uniformly supports the base of the skid. The mounting surface must be free of debris in order to prevent warping of the skid and/or damage to the vessel's bottom. Bottom support should also extend beyond the outline of the vessel by at least twelve (12) inches in order to provide enough strength for anchoring.
- Grout or shim under skid hold down flanges to prevent applying uneven stress that might "twist" the skid or stress the vessel when the anchor bolts are tightened. If the unit has NO skid and vessel is to be bolted directly to a concrete pad, tighten mounting bolts AFTER carbon has been loaded into the vessel. Be careful not to over tighten mounting bolts through Poly brackets.
- 3. Carbon should not be added until the entire system has been installed and checked for proper operation.

If impregnated carbon is used, it <u>MUST NOT</u> be added until the system can be run uninterrupted for five (5) days straight. This is because airflow through the carbon is required to remove heat buildup from chemical reactions. IF AIRFLOW IS STOPPED WITHIN THE FIRST FIVE DAYS OF OPERATION WITH IMPREGNATED CARBON, <u>A BED FIRE CAN RESULT</u>. Regular non-impregnated carbon has a much lower tendency to start fires and does NOT need the air flow.

The following items must be examined before start up.

- a. Exhaust duct and components as well as all instruments and electrical connections must be in place and operating properly.
- b. Check to see that fan motor and impeller are rotating in the proper direction and not hitting anything.
- c. Start the fan with the damper <u>half closed</u>. When the fan is up to speed, adjust the fan damper to provide discharge pressure equivalent to the static pressure loss of the carbon bed (designed air flow should result). Check motor amperage. If there is no damper on the system, disregard this instruction.

<u>CAUTION</u>: Fans require the most horsepower when they are allowed to move as much air as possible. Large fans are frequently designed to rely on system static pressure loss to restrict the airflow through the fan. In such a system, running the fan disconnected from the system may cause a greater horsepower requirement than the rating of the motor. This can overload the motor and cause motor failure. DO NOT RUN THE FAN WITHOUT A LOAD.

### Page 3

- 4. Check system for excessive vibration and air leaks.
- 5. Carbon may be added to the vessel at this point. Follow the procedure outlined below. **SEE CARBON WARNING BELOW**
- 6. CARBON INSTALLATION.
  - a. Remove the vessel cover.
  - b. Place the polypropylene screen and tension ring over the carbon support grate. This prevents the carbon from falling through the bed support. If there are multiple sections of screen, they must overlap adjacent sections by one-third to one-half of their width. The screen must be long enough to run up the vessel wall 4" to 6" around the entire inside circumference of the vessel. The screen should go between the vessel wall and the tension ring and can fold back onto the grate or be attached to the wall with duct tape. The screen does NOT have to be stretched tight.
  - c. After the screen is properly positioned, bucket small amounts of carbon on top of the screen to hold it in place. After bottom is covered, larger amounts of carbon can be added from drums or supersacks. Use a rake or board to level the bed surface. Follow the precautions on the MSDS and use safety equipment to protect yourself from harm. Minimum equipment should include dust respirator, goggles, and chemical resistant gloves.
- 7. After the complete carbon charge has been loaded, close the adsorber and start up the unit according to the section on "System Start-up".

IF YOU ARE USING IMPREGNATED CARBON - Once loaded, air flow through a system with fresh carbon MUST start immediately and continue for at least 5 consecutive days. Fresh impregnated carbon is very reactive and generates a large amount of heat when treating contaminated air. Air flow through the carbon bed removes the heat generated by chemical reactions. If the air flow is stopped, heat producing reactions continue and bed temperature will continue to rise. The amount of heat generated can exceed the ignition point of the carbon.

### FIRE CAN RESULT

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## **Principle Of Operation**

Activated carbon works by the process of adsorption. Adsorption is when one material adheres to the surface of another material by means of physical and/or chemical attraction between the materials. Activated carbon is full of holes. This network of connected pores inside the carbon gives it a large surface area (approx. 1000 sq M per gm of carbon). Organic odor molecules from the air are attracted to the internal carbon surface. These contaminates accumulate on carbon's interior surface until an equilibrium level is reached between the concentration on the carbon surface and the concentration left in the air. The lower the residual concentration required in the air stream, the greater the relative amount of carbon required to achieve that level.

The capacity of activated carbon to adsorb a compound depends on several factors including air temperature, the chemicals boiling point, molecular weight, and concentration in the air stream. The mass transfer zone (MTZ) is the area in the bed where adsorption takes place. The chemicals concentration and air flow rate change the size of the MTZ. The lead edge of the MTZ has no contamination while the trailing edge is completely saturated (to the level of contamination in the inlet air). As the MTZ moves through the carbon bed and approaches the end of the bed, breakthrough occurs. The carbon becomes saturated with adsorbate and the chemical can be detected in the exhaust. When the outlet concentration exceeds a specified limit the bed is spent. The carbon must then be replaced. Samples of the carbon drawn from various levels of the bed can be tested for their remaining capacity and used to predict the remaining bed life. In this way, bed replacement can be scheduled in advance of the actual need and avoid timing problems.

Activated carbon can be impregnated with chemicals to enhance its ability to control problem contaminates. Control of acid gases such as Hydrogen Sulfide and Mercaptans is greatly enhanced by impregnation with a caustic compound. General Carbon IPH carbon is treated with Potassium Hydroxide (KOH) for this purpose. The KOH gives carbon the ability to chemically neutralize acidic gases and increase the volume of air able to be treated by the carbon. Caustic carbon bed life can be partially renewed by the process of in situ "regeneration". This procedure soaks the carbon in a caustic solution that dissolves accumulated sulfur and renews the caustic impregnate. This process is not recommended by General Carbon Corp. because only a limited amount of life can be restored to the carbon.

Catalytic carbon is the newest carbon to control H2S. The surface of this carbon has been enhanced during manufacture to catalytically react the H2S forming elemental Sulfur on the surface of the carbon. Catalytic carbon provides the highest amount of "loading" of H2S while giving greater safety in operation and handling of the media than caustic carbon.

## **Use And Care Of Activated Carbon**

For odor control applications, granular activated carbon that has been manufactured from coconut shell or bituminous coal is used. In some cases the carbon has also been impregnated with caustic or other inorganic materials in order to enhance its capacity for various compounds. Important physical and chemical properties of the activated carbon that is used in this application will appear elsewhere in this manual.

Activated carbon should be stored in a cool, dry, well ventilated area. While temporary outdoor storage is possible, indoor storage is recommended. Exposure to direct sunlight should be avoided. Storage of open carbon containers (especially if the plastic liner has been opened) should also be avoided since the exposed carbon will begin to adsorb vapors from the air.

Contact with skin, eyes, or mucous membranes should be avoided, especially when using caustic impregnated carbon (IPH). Dust as well as the carbon itself can be irritating. Protective clothing <u>MUST</u> be worn when handling the carbon. This includes use of chemical-resistant rubber gloves, full face shield, and dust mask. A material safety data sheet is located at the back of this manual for further information.

Static electrical charges can accumulate when adsorption tanks are fabricated from non-conductive materials such as FRP, PP and PE. In order to prevent electrical shock or an ignition hazard, the treatment system must be well grounded. A grounding lug is located on our metal skids and Poly vessels and all General Carbon FRP fans contain a conductive layer to dissipate static charges. Optional, additional bed grounding probes are available for extra security.

Care is required to avoid a rapid rise in bed temperatures and subsequent ignition of the carbon. Such fire hazards are usually the result of the following conditions;

1. High heat of adsorption given off by the carbon treating very concentrated vapors through the carbon bed.

2. Accumulated heat of reaction caused by oxidation of vapors during the use of impregnated carbon (IPH).

Fires hazard can be minimized by use of the following:

- 1. Dilute concentrated vapors with outside air or inert gas.
- 2. Humidify the inlet air stream using water vapor to help carry away heat that is generated.
- 3. Maintain proper air flow and distribution to prevent localized heating effects and insure adequate heat dissipation from carbon bed.
- 4. Never shut down a carbon bed of GC-IPH (caustic impregnated carbon) that has been in use for less than one month. If a long shut down is expected, remove all carbon regardless of time in use.

**<u>CAUTION</u>**: Although dry in appearance, activated carbon contains 11-15% moisture by weight. Wet carbon can rapidly adsorb free oxygen from the air. Any entry of carbon vessels should follow all guidelines for confined space entry and/or depleted oxygen supply areas as established by OSHA and other state, local and federal agencies.

## System Start-Up

- 1. Partially close the fan damper, if present, to restrict the air flow. Restricted air flow is required on larger systems to prevent carbon bed fluidization by large capacity fans.
- 2. Start the fan and adjust to the proper air flow. Flow rate can be adjusted by setting the system static pressure (2.3-2.5"wc). The damper (if present) is used to accomplish this.
- 3. Record initial conditions in log book.
- Note: If you are starting the system up after "in situ" regeneration or after adding fresh carbon, be sure to continue operation for a minimum of 120 continuous (uninterrupted) hours to age the carbon. Do not interrupt the airflow during that time.

If airflow is stopped, fire can result when using GC-IPH carbon.

## System Shut Down

- 1. Turn off the fan and close all dampers to isolate the vessel.
- 2. If the system is to be down for more than a few days, the vessel must be completely sealed to prevent any air flow. This will prevent problems caused by reactions of adsorbed products that may foul the carbon or generate dangerous amounts of heat.

## **Operating Log**

General Carbon Corp. recommends that you maintain a record of operating data in order to facilitate troubleshooting and to ensure that proper maintenance is done at regular intervals. The frequency of these observations will vary according to the application, but the maximum interval should be no greater than one week. Data should include the following information:

1.	Date
2.	Air Flow Rate and / or Differential Pressure
3.	Observations and Comments - should record all events of
	unusual or out-of-the-ordinary occurrence.

## **Maintenance**

The only short term maintenance requirement is to look at the unit every week to see that it is operating in a normal manner. Things to check are uncharacteristic noises, fan motor sounding okay and not hot, unusual vibration, high/low static pressure and new odors to the area. In the cooler months, the condensate drain valve should be opened to drain accumulated water.

Carbon samples can be collected on a quarterly basis. General Carbon Corp. can test the samples to determine the condition of the carbon. Sample ports are optional on all vessels, as is a "hatch card"  $H_2S$  indicator gauge. A "grain thief" is used to remove carbon samples at different bed depths to see where "breakthrough" has occurred.

A specialized  $H_2S$  indicator gauge can be used to determine when breakthrough occurs. This gauge uses a treated "hatch card" that changes color in the presence of  $H_2S$ . Connected to a sample port located part way through the bed, it visually shows when breakthrough has gotten to the port location and that a change out will be needed shortly. Other indicators are available for a limited number of compounds.

## **Troubleshooting**

- 1. Low Air Flow Rate.
  - a. Fan Speed Too Low probably due to loose belt, wrong size drive sheaves, three-phase motor missing power leg. Correct drive problem.
  - b. System Pressure Too High probably due to obstruction such as narrow ducting, closed damper, fouled screen or carbon, or foreign object in air pathway. May be other system changes (such as additional duct or equipment) that increase static pressure losses. Remove obstruction or change fan to accept higher load.
- 2. High Differential Pressure.
  - a. Fouled Carbon/Screen due to accumulation of dust, moisture, or other material on the carbon or the screen. Requires chemical or mechanical cleaning.
  - b. High Air Rate due to improper sizing or control of fan. Adjust to design rate.
- 3. Carbon Bed Problems.
  - a. Top of carbon bed does not remain level probably due to high surge of air when first starting fan. Follow instructions regarding partial closing of inlet damper for start-up.
  - b. Loss of Carbon probably due to fluidization because of too high air rate. Reduce air rate or install bed limiter (screen) on top of the carbon bed.
- 4. Poor Removal Efficiency
  - a. Needs Regenerating/Replacement due to exhaustion of carbon capacity. Have carbon samples tested to determine whether regeneration or replacement is recommended.
  - Insufficient Bed Depth due to loss of carbon or failure of design. Replace lost carbon and correct situation causing the loss. Reevaluate design basis to ensure that it is adequate for existing conditions.

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## **MSDS & Misc. Information**

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### SECTION 12e.1: MEMBRANE BACKWASH PUMPS

### P&ID: Item #: P-0911, P-0912

- Unit Details: Goulds Model 25SH4J55C0 5Hp, 3Ø/60Hz/460V 180 GPM @ 55' TDH
- Manufacturer: Goulds Pumps, ITT Industries 2881 East Bayard Street Seneca Falls, NY 13148 Phone: (315) 568-7123 www.goulds.com

Local Distributor/Contact:

Industrial Pump Sales & Service, Inc. 37 William S. Canning Blvd. Tiverton, RI 02878 Phone: (800) 323-6532 or (401) 624-2977 Fax: (401) 624-3373 www.ipspump.com THIS PAGE INTENTIONALLY LEFT BLANK



### **Commercial Water**

# **Goulds Pumps**

G&L Series SSH Products Product Number Crossover Effective September 1, 2006

Supersedes all list prices of prior dates. Prices and specifications are subject to change without notice.

Revised September 11, 2006



Goulds Pumps is a brand of ITT Residential and Commercial Water

www.goulds.com

Engineered for life

### SSH, M-GROUP NUMBERING SYSTEM

24 SH 1 G 1 2 A 0

#### For units built after September 1, 2006 F

P&ID's: P-0911, P-0912

## **MECHANICAL SEAL and O-RING** 0 = Standard

For Optional Mechanical Seal modify catalog order no. with Seal code listed below. For frame mounted units use seal option for 254 frame size.

Type 21 Mechanical Seal													
Seal				Motal	Part No.								
Seal	Rotary	Stationary	Elastomers	Nieldi	180-210	250-360	List F	Price					
Code	-	-		Parts	Frames	Frames	Adder						
0	Carbon	Sil-Carbide	Viton		10K27	10K45	No Adder	No Adder					
2 Carbon		Sil-Carbide	EPR	<mark>316 S.S.</mark>	10K19	10K20	\$25.00	\$30.00					
5	Sil-Carbide	Sil-Carbide	Viton		10K64	10K65	100.00	100.00					

IMPELLER OPTION CODE... For Optional Impeller Diameters modify catalog order no. with Impeller code listed below. Selection must be within motor service factor @ curve end.

	Pump Size								
Impeller	22SH *	23SH *	24SH	25SH	27SH *	28SH *			
Code	21⁄2 x 3 - 8	3 x 4 - 8	1½ x 2½ - 10	2 x 2 <sup>1</sup> / <sub>2</sub> - 10	21⁄2 x 3 - 10	3 x 4 - 10			
	Diameter	Diameter	Diameter	Diameter	Diameter	Diameter			
А	91⁄16	91⁄16	97/8	97⁄8	103⁄8	105⁄8			
В	83⁄4	8 <sup>11</sup> ⁄16	9½	9½	9 <sup>15</sup> /16	10¼			
C	8½	87/16	<u>93⁄16</u>	91/8	9 <sup>9</sup> ⁄16	9 <sup>13</sup> ⁄16			
D	81⁄4	81⁄16	81/8	8 <sup>13</sup> ⁄16	91⁄4	97⁄16			
E	71/8	7 <sup>1</sup> 1⁄16	8%16	<b>8</b> <sup>3</sup> ⁄16	8¾	9½16			
F	7½	7½	81⁄4	7 <sup>15</sup> ⁄16		8 <sup>1</sup> 1⁄16			
G	71⁄8	71⁄8		711/16					
Н	611/16	67/8							
J	61/2	6½							
K	•72	6							
		51%							
4 = ODP Premi <b>VOLTAGE RATI</b> 1 = 115/208-23 2 = 115/230 3 = 230 <b>HP RATING</b> E = 1 HP F = $1\frac{1}{2}$ HP G = 2 HP H = 3 HP	um Eff. NG 5 = 230/46 5 = 208-23 6 = 460 U = 5 HP K = 7½ HP L = 10 HP M = 15 HP	0 7 = 57 0/460 9 = 20 B = 19 N = 20 P = 25 Q = 30 R = 40	5 8-230 0/380-415 HP S = HP T = HP U = HP V =	50 HP 60 HP 75 HP 100 HP		For frame mounted pu substitute th letters "FRM:			
<b>DRIVER: Phase</b> , 1 = 1 Ph, 60 Hz 2 = 3 Ph, 60 Hz 3 = 1 Ph, 60 Hz (4 = 3 Ph, 60 Hz 5 = 1 Ph, 50 Hz 6 = 3 Ph, 50 Hz	(Hertz/RPM 2, 3500 RPM 2, 3500 RPM 2, 1750 RPM 2, 1750 RPM 2, 2900 RPM 2, 2900 RPM								
 MATERIAL SH = Stainless	steel								
 PUMP SIZE 22 = 2½ x 3 - 8 23 = 3 x 4 - 8 24 = 1½ x 2½ 25 = 2 x 2½ - 1 27 = 2½ x 3 - 10 28 = 3 x 4 - 10	3 - 10 0 0		<b>Note:</b> Not a seal options Please check * <b>Impellers</b> a	Il combinations are available fo with G&L pum are cast Stainle	of motor, impe or every pump m ps on non-catal <b>ss Steel</b>	ller and nodel. oged numbers.			

### Performance Curves – 60 Hz, 1750 RPM Curvas de Funcionamiento – 60 Hz, 1750 RPM



Optional Impeller, Impulsor Opcional										
Impeller Code, Código del Impulsor	Dia., Diá.	Standard HP Rating, Estándar HP Potencia								
А	91/8"	5								
В	<b>9</b> ½	5								
С	<b>9</b> <sup>3</sup> / <sub>16</sub>	3								
D	81/8	3								
E	8%16	3								
F	81⁄4	2								

**NOTE:** Pump will pass a sphere to  $\frac{5}{16}$ " diameter.

**NOTA:** La bomba pasará una esfera a <sup>5</sup>/<sub>16</sub>" diámetro.

### 180 gpm



### **GOULDS PUMPS** Commercial Water

## Membrane Backwash Pump Goulds 25SH4J55D0

180 gpm



### SSH Close Coupled – Dimensions and Weights SSH Acople Cerrado – Dimensiones y Pesos

(All dimensions in inches and weights in lbs. Do not use for construction purposes.)

(Todas las dimensiones en pulgadas y pesos en libras. No usar para propósitos de construcción.)



	Dimensions "L" Determined by Pump and Motor, Dimensiones "L" Determinadas por la Bomba y el Motor																				
Pump	Pump Size, Tamaño de	mp Size, maño de Suction*, Bomba Succión*	Suction*,	Suction*, Succión*	Discharge*,	harge*, Max., Max., DD X Y (lbs.), carga*		Motor Frame Size, Tamaño del Armazón del Motor													
la Bo	іа вотра		Destarga	ga Máx.	Máx. Máx.				(libras)	140	180	210	250	280	320	360					
24SH	1½ x 2 ½-10	214	11/2	341/2	67/6	65%			75	101/2						—					
25SH	<mark>2 x 2½-10</mark>	<b>2</b> 72	2		078	078	8 <sup>15</sup> /16	1	75		<mark>11½</mark>			7.							
22SH	21⁄2 x 3-8	2	214	<mark>36</mark>	61/8	51/8		4	72	_		<mark>12<sup>1</sup>/8</mark>	13	<mark>//8</mark>	<mark>14<sup>3</sup>/8</mark>	<mark>15</mark>					
27SH	21⁄2 x 3-10		Z 72		674	C7/ C5/	<i>C</i> 7/	67/	C7/ C5/	7/ 65/	67/ 65/	0154 -		84	—	_					
23SH	3 x 4-8	4	2	72	078	078	3 716	E	86	11½	12 <sup>1</sup> /8	1236	1.4	74	1 5 3 4	16					
28SH	3 x 4-10		د	/د	7⁵⁄8	73/8	11½		98	—	_	1,578	14	78	1,578	10					

\* For use with ANSI class 150 mating flanges.

\* Para usar con bridas que casan ANSI clase 150.

### NOTES:

- 1. Pumps shipped in vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten  $\frac{y_8}{16}$  – 16 bolts to 12 ft./lbs.,  $\frac{y_{16}}{14}$  – 14 bolts to 20 ft./lbs.,  $\frac{y_2}{13}$  – 13 bolts to 35 ft./lbs.
- 2. Motor dimensions may vary with motor manufacturer.
- 3. Not for construction purposes.

### Dimensions Determined by JM Motor Frame, Dimensiones Determinadas por el Armazón del Motor JM

Frame, Armazón	Α	AB Max.	В	D	E	F	G	Н	P Max., <i>P Máx.</i>				
145JM	61/2	51⁄4	6	31/2	23⁄4	21/2	1⁄8	11/32	<b>7</b> <sup>3</sup> /16				
182JM	<b>Q</b> 1/ <sub>6</sub>	576	61/2	<b>A</b> 16	23/.	21/4	340		<b>Q</b> 1/ <sub>0</sub>				
184JM	072	<mark>. 78</mark>	072	472	<b>374</b>	<b>7</b> 3/,	716	13/22	072				
213JM	01/	73/6	0	51/.	<b>A</b> 17.	<mark>~ /4</mark>	765	/32	10346				
215JM	372	1 78	0	J74	474	31/2	/32		10716				
254JM	111/.	111/.	111/4	111/	111/4	0	113/	<b>G</b> 1/.	E	41/8			101/
256JM	1174	5	1174	074		5	17.	17/32	1374				
284JM	121/	121/	121/	7	E1/.	43/4	74		10				
286JM	1Z 74	IZ 74	IZ 74	/	572	51/2			15				
324JM	1.4	101/	1.4	0	<b>6</b> 1/.	51⁄4	54.0		16154				
326JM	14	1574	14	0	074	6	716	214.	10.716				
364TCZ	173/.	1516	1516	0	7	55%	1	- 732	10				
365TCZ	1794	1378	1572	3		61/8			19				

364TCZ and 365TCZ frames are built with 326JM shaft extensions.

Dimensions may vary with manufacturer.

Los armazones 364TCZ y 365TCZ se construyen con extensiones del eje 326JM. Las dimensiones puede que varien con los fabricantes.

### NOTAS:

- Las bombas se transportarán en descarga vertical como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar <sup>3</sup>/<sub>8</sub> – 16 tornillos a 12 pies/libras, <sup>7</sup>/<sub>16</sub> – 14 tornillos a 20 pies/libras, <sup>1</sup>/<sub>2</sub> – 13 tornillos a 35 pies/libras.
- 2. TODAS las dimensiones en pulgadas.
- 3. No para propósitos de construcción.

#### Motor Frame Selections, Selecciones del Armazón del Motor

Frame, Armazón	Motor Horsepower, Potencia del Motor						Wt
	3500 RPM		1750 RPM				Max.,
	3 PH, Trifásicos		1 PH, Monofásicos		3 PH, Trifásicos		Peso
	ODP	TEFC	ODP	TEFC	ODP	TEFC	wiax.
145JM	-	-	-	-	2	2	57
182JM	-	-	2	2, 3	3	3	77
<mark>184JM</mark>	_	_	<mark>3</mark>	_	<mark>5</mark>	<mark>-5</mark>	<mark>97</mark>
213JM	10	-	5	-	71/2	71/2	141
215JM	15	10	-	-	10	10	155
254JM	20	15	-	-	15	15	265
256JM	25	20	-	-	20	20	320
284JM	30	25	-	-	25	25	419
286JM	40	30	-	-	-	-	422
324JM	50	40	-	-	-	-	562
326JM	60	50	_	_	_	_	625
364TCZ	75	60	_	_	_	_	775
365TCZ	100	75, 100	-	-	-	-	905

364TCZ and 365TCZ frames are built with 326JM shaft extensions. Los armazones 364TCZ y 365TCZ se construyen con extensiones del eje 326JM.

### **GOULDS PUMPS** Commercial Water

321





# **Goulds Pumps** G&L SERIES SSH-C and SSH-F

Installation, Operation and Maintenance Instructions





Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

Engineered for life

### Table of Contents

### **Owner's Information**

Please fill in data from your pump nameplate. Warranty information is on page 15.

Pump Model: \_\_\_\_\_

Serial Number:\_\_\_\_\_

Dealer: \_\_\_\_

Dealer's Phone Number:

Date of Purchase: \_\_\_\_\_

Installation Date: \_\_\_\_

### SAFETY INSTRUCTIONS



NOTICE: INSPECT UNIT FOR DAMAGE AND REPORT ALL DAMAGE TO THE CARRIER OR DEALER IMMEDIATELY.

### 1. Important Instructions

- 1. Inspect unit for damage. Report damage to carrier immediately.
- 2. Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per National and Local electrical codes. Install an all-leg disconnect switch near pump.



ALWAYS DISCONNECT ELECTRICAL POWER WHEN HANDLING PUMP OR CONTROLS.

- 3. Motors must be wired for proper voltage (check nameplate). Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.
- 4. Single-Phase: Thermal protection for single-phase units is sometimes built-in (Check nameplate). If no built-in protection is provided, use a contactor with proper overload. Fusing is permissible if properly fused.
- 5. Three-Phase: Provide three-leg protection with proper size magnetic starter and thermal overloads.
- Maximum Liquid Temperatures: 212°F (100°C) with standard seal. 250°F (120°C) with optional high-temperature seal.
- 7. Maximum allowable operating pressure: 230 PSI (15 bars).
- 8. Maximum number of starts per hour: 20, evenly distributed.
- **9.** Regular Inspection and Maintenance will increase service life. Base schedule on operating time.

### 2. Installation

1. Close-coupled units may be installed inclined or vertical.

**A CAUTION** DO NOT INSTALL WITH MOTOR BELOW PUMP. CONDENSATION WILL BUILD UP IN MOTOR.

- **2.** Locate pump as near liquid source as possible (below level of liquid for automatic operation).
- 3. Protect from freezing or floods.
- 4. Allow adequate space for servicing and ventilation.
- 5. For close-coupled pumps, the foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration. Tighten motor hold-down bolts before connecting piping to pump.
- 6. For frame-mounted pumps, permanent and solid foundation is required for smooth operation. Bedplate must be grouted to a foundation with solid footing.
- 7. Place unit in position on wedges located at four points (Two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit, bringing coupling halves into reasonable alignment. Level or plumb suction and discharge flanges.
- 8. Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming if necessary.
- **9.** Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before further tightening foundation bolts.
- 10. All piping must be supported independently of the pump, and must "line-up" naturally. Never draw piping into place by forcing the pump suction and discharge connections!
- 11. Angular alignment of the flanges can best be accomplished using calipers at bolt locations (See illustration).

3



- **12.** On frame-mounted units, tighten foundation, pump and driver hold-down bolts before connecting piping to pump.
- 13. Avoid unnecessary fittings. Select sizes to keep friction losses low.
- 14. After completing piping, rotate unit by hand to check for binding. Note: A screwdriver slot or flats are provided in end of motor shaft.

### 3. Alignment

- 1. No field alignment is necessary on close-coupled pumps.
- **2.** Even though the pump-motor unit may have a factory alignment, in transit this alignment could be disturbed and must be checked prior to running.
- **3.** Check the tightness of all hold-down bolts before checking the alignment.
- 4. If re-alignment is necessary, always move the motor. Shim as required.
- 5. Final alignment is achieved when parallel and angular requirements are achieved with both pump and motor hold down bolts tight.

### ALWAYS RECHECK BOTH ALIGNMENTS AFTER MAKING ADJUSTMENTS.

- 6. Parallel misalignment exists when the shafts are not concentric. Place dial indicator on one hub and rotate this hub 360° while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005" or less.
- 7. Angular misalignment exists when the shafts are not parallel. Place dial indicator on one hub and rotate this hub 360° while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005" or less.

### 4. Suction Piping

- 1. Low static lift and short, direct suction piping is desired. For suction lift over 15 feet, consult pump performance curve for *Net Positive Suction Head Required*.
- **2.** Suction pipe size must be at least equal to suction connection of pump.
- 3. If larger pipe is used, an eccentric pipe reducer (with straight side up) must be used at the pump.
- 4. Installation with pump below source of supply:
  4.1. Install isolation valve in piping for inspection and maintenance.

- 4.2. Do not use suction isolation valve to throttle pump!
- 5. Installation with pump above source of supply:
  - 5.1. To avoid air pockets, no part of piping should be higher than pump suction connection. Slope piping upwards from liquid source.
  - 5.2. All joints must be airtight.
  - **5.3.** Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.
  - 5.4. Suction strainer open area must be at least triple the pipe area.
- 6. Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump.

### 5. Discharge Piping

- 1. Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or inspection of pump or check valve.
- **2.** If reducer is required, place between check valve and-pump.

### 6. Rotation



Hazardous Machinery

DO NOT PLACE HANDS IN PUMP WHILE CHECKING MOTOR ROTATION. TO DO SO WILL CAUSE SEVERE PERSONAL INJURY.

- 1. Pumps are right-hand rotation (Clockwise when viewed from the driver end). Switch power on and off. Observe shaft rotation. On frame-mounted units, check rotation before coupling pump to motor.
- **2.** Single-Phase: Refer to wiring diagram on motor if rotation must be changed.
- **3.** Three-Phase: Interchange any two power supply leads to change rotation.

### 7. Operation

**1.** Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

```
A CAUTION PUMPED LIQUID PROVIDES
LUBRICATION. IF PUMP IS RUN
DRY, ROTATING PARTS WILL SEIZE
AND MECHANICAL SEAL WILL BE
DAMAGED.
```

- 2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. Check coupling alignment.
- **3.** Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.
## 8. Maintenance

AWARNING Hazardous voltage

## FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING ANY MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.

- 1. Bearings are located in and are part of the motor. For lubrication procedure, refer to manufacturer's instructions.
- 2. On frame-mounted units, regrease at 2,000 hours use or after 3 months. Use #2 Sodium or Lithium grease and fill until grease comes out of the relief fitting.

## 9. Disassembly

- 1. Always turn power off.
- 2. Drain system. Flush if necessary.
- 3. Remove motor hold-down bolts on close-coupled or disconnect coupling and remove spacer.
- 4. Remove casing bolts and pump hold-down bolts.
- 5. Remove motor and rotating element from casing.
- 6. Unscrew impeller bolt with a socket wrench. Do not insert screwdriver between impeller vanes to prevent rotation. It may be necessary to use a strap wrench around the impeller if impacting the socket wrench will not loosen the impeller bolt.
- 7. Remove impeller o-ring.
- 8. Insert two pry bars (180° apart) between impeller and seal housing. Pry off impeller.
- 9. Remove shaft sleeve, seal spring, cupwasher, seal rotary and impeller key.
- 10. Remove seal housing.
- 11. Place seal housing on flat surface. Press out stationary seal parts.
- **12.** Remove deflector from shaft on frame-mounted units.
- **13.** Remove bolts holding bearing cover to frame and remove bearing cover (frame-mount).
- 14. Remove lip seals from bearing frame and bearing cover (frame-mount).
- **15.** Remove shaft and bearings from frame (framemount).
- 16. Remove bearing retaining ring (frame-mount).
- 17. Use bearing puller or arbor press to remove ball bearings (frame-mount).
- **18.** Remove wear ring if excessively worn. Use pry bar and/or vicegrips.

## 10. Reassembly

- 1. All parts should be cleaned before assembly.
- **2.** Refer to parts list to identify required replacement items.
- **3.** Reassembly is the reverse of the disassembly procedure.
- 4. Replace lip seals if worn or damaged (frame-mount only).
- 5. Replace ball bearings if loose, rough or noisy when rotated (frame-mount only).
- 6. Check shaft for maximum runout of .005" TIR. Bearing seats and lip seal areas must be smooth and free of scratches or grooves. Replace if necessary (framemount only).
- 7. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.
- 8. If wear ring is being replaced, do not use lubricants on the metal-to-metal fit when pressing in the replacement.
- **9.** If the impeller is removed, as for example to effect a mechanical seal change, this procedure must be followed: Old impeller bolt and impeller o-ring cannot be reused.
- **10.** Install the mechanical seal stationary seat in the seal housing, using soapy water as a lubricant to ease insertion.
- 11. S-Group Install the mechanical seal spring retainer, spring and rotary assembly on the shaft sleeve using soapy water to lubricate. Slide the shaft sleeve over the pump shaft, be sure that a new shaft sleeve o-ring is used.
- NOTE: THE SHAFT SLEEVE O-RING AND IMPEL-LER WASHER O-RING ARE ALMOST IDENTICAL IN DIAMETER. BE SURE TO USE THE SQUARE CROSS-SECTION O-RING IN THE IMPELLER WASHER. THE ROUND CROSS-SECTION O-RING IS USED IN THE SHAFT SLEEVE.
- 11. M-Group Install the mechanical seal spring and rotary on the shaft sleeve using soapy water to lubricate. Slide the shaft sleeve over the pump shaft. Be sure that a new shaft sleeve o-ring is used. Place the mechanical seal spring retainer over the impeller hub.
- 12. Place the impeller key into the shaft keyway and slide the impeller in place. Install the impeller stud and impeller washer. Be sure that a new impeller o-ring is used. Tighten S-Group (<sup>3</sup>/<sub>8</sub>" thread) to 17 lb.ft. and M-Group (<sup>1</sup>/<sub>2</sub>" thread) to 38 lb.ft.
- 13. Replace casing bolts and tighten in a crossing sequence to the torque values indicated below.

S-Group – 25 lb.-ft. (35 N-m)

- M-Group 37 lb.-ft. (50 N-m)
- 14. Check reassembled unit for binding by rotating shaft with appropriate tool from motor end.
- **15.** If rubbing exists, loosen casing bolts and proceed with tightening sequence again.

## 11. Troubleshooting

- 1. Motor does not start, and no noise or vibration occurs:
  - 1.1. Power supply not connected.
  - 1.2. Fuses or protection device tripped or defective.
  - 1.3. Loose or broken electrical connections.
- 2. Motor will not start, but generates noise and vibration: 2.1. Motor not wired as directed on diagram.
  - **2.2.** Shaft locked due to mechanical obstructions in motor or pump.
  - 2.3. Low voltage or phase loss on three phase supply.
- 3. Pump does not deliver rated capacity:
  - **3.1.** Pump not filled and primed.
  - 3.2. Pump has lost prime due to leaks in suction line.
  - 3.3. Direction of rotation incorrect. See Rotation.
  - **3.4.** Head required is higher than that originally specified. (Valve may be partially closed.)
  - 3.5. Foot valve clogged.
  - **3.6.** Suction lift too high.
  - 3.7. Suction pipe diameter too small.
- 4. Protection trips as unit starts:
  - **4.1.** Phase loss on three-phase supply.
  - **4.2.** Protection device may be defective.
  - 4.3. Loose or broken electrical connections.
  - 4.4. Check motor resistance and insulation to ground.
- 5. Protection device trips too often:
  - 5.1. Protection may be set to a value lower than motor full load.
  - 5.2. Phase loss due to faulty contacts or supply cable.
  - 5.3. Liquid is viscous or its specific gravity is too high.
  - **5.4.** Rubbing occurs between rotating and stationary parts.

- 6. Shaft spins with difficulty:
  - **6.1.** Check for obstructions in the motor or the pump.
  - **6.2.** Rubbing occurs between rotating and stationary parts.
  - 6.3. Check bearings for proper conditions.
- 7. Pump vibrates, runs noisily, and flow rate is uneven:
  - 7.1. Pump runs beyond rated capacity.
  - 7.2. Pump or piping not properly secured.
  - 7.3. Suction lift too high.
  - 7.4. Suction pipe diameter too small.
  - 7.5. Cavitation caused by insufficient liquid supply or excessive suction losses.
  - **7.6.** Impeller blockage.
- 8. When stopped, unit turns slowly in the reverse direction:
  - 8.1. Leaks on air locks in suction pipe.
  - 8.2. Partial blockage in check valve.
- **9.** In pressure boosting applications, the unit starts and stops too often:
  - 9.1. Pressure switch settings are incorrect.
  - 9.2. Tank size may be incorrect.
- **10.** In pressure boosting applications, the unit does not stop:
  - 10.1. Pressure switch maximum setting is higher than was specified.
  - 10.2. Direction of rotation incorrect. See Rotation.

# SSH-C Components



## **MATERIALS OF CONSTRUCTION**

Description	Material
Casing	
Impeller	
Wear Ring	AISI TYPE 316L
Seal Housing	Stainless Steel
Socket Head Cap Screw	
(Casing to Adapter)	
Drain Plug — 3/8 NPT	AISI TYPE 316 SS
Shaft Sleeve	316 SS
Impeller Key	Steel
Impeller Stud	Steel
Impeller Washer	316 SS
Adapter	Cast Iron ASTM A48CL20
Hex Head Cap Screw (Adapter to Motor)	Steel
O-ring, impeller	BUNA-N
O-ring, shaft sleeve	BUNA-N
O-Ring	BUNA-N
	Carbon/Ceramic
Mechanical Seal Part No. 10K13	Buna Elastomers
	316 SS Metal Parts
Spring Retainer	AISI Type 316 SS
	DescriptionCasing Impeller Wear Ring Seal Housing 

## **OPTIONAL MECHANICAL SEALS**

	John Crane Type 21 Mechanical Seals												
ltem	Part No.      Rotary      Stationary      Elaster        10K19      Ni-Resist      Elaster				Metal Parts	Intended Duty							
	10K19		Ni-Resist	EPR		Hi-Temperature							
383	10K25	Carbon Ni-Resist Viton		Viton	316	Chemical							
Options	10K27	Carboli	Tungsten Carbide	EPR	SS	Hi-Temperature Mild Abrasive							

SSH-F Components



## **MATERIALS OF CONSTRUCTION**

I	tem	Description	Material
	100 101 103 184 370	Casing Impeller Wear Ring Seal Housing Socket Head Cap Screw	AISI TYPE 316L Stainless Steel
S	408	Drain plug – ¾ NPT	AISI TYPE 316 SS
Jent	126	Shaft Sleeve	316 SS
Iodu	178	Impeller Key	Steel
Con	422	Impeller Stud	Steel
pu	199	Impeller Washer	316 SS
np E	412A	O-ring, impeller	BUNA-N
Pur	412F	O-ring, shaft sleeve	BUNA-N
	513	O-Ring	BUNA-N
	383	Mechanical Seal Standard Part No. 10K13	Carbon/Ceramic BUNA-N Elastomers 316 SS Metal Parts
	383A	Spring Retainer	AISI Type 316SS
	108 228 134	Adapter Bearing Frame Bearing Cover	Cast Iron ASTM A48 CL20
ower End Components	122 168 112 136 370B 370C	Pump Shaft Ball Bearing (Inboard) Ball Bearing (Outboard) Retaining Ring Hex Head Cap Screw (Adapter to Bearing Frame) Hex Head Cap Screw (Bearing Frame to Cover)	Steel
٩	333A	Lip Seal	BUNA-N
	193	Grease Fitting	Steel
	123	V-Ring Deflector	BUNA-N

## **OPTIONAL MECHANICAL SEALS**

	John Crane Type 21 Mechanical Seals														
Item	Part No.	Rotary	Stationary	Elastomers	Metal Parts	Intended Duty									
	10K19		Ni-Resist	EPR		Hi-Temperature									
383	10K25	Carbon	Ni-Resist	Viton	316	Chemical									
Options	10K27	Carbon	Tungsten Carbide	EPR	SS	Hi-Temperature Mild Abrasive									

#### Channel Steel Bedplate, Clockwise Rotation Viewed from Drive End;

Fundación de Acero, Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor; Plaque de base profilée en U et rotation en sens horaire (vue de l'extrémité du moteur)



Dimensions and weights vary with manufacturers. Dimensions in inches and weights in lbs.

"HP" Dimensions at motor end only.

\* "HD" Dimension for 254T/256T motor frame on 1 x 2-10 only is 11"; A ¾" motor shim and a 1¾" bearing frame shim are required.

Dimensiones y pesos varían con los fabricantes. Dimensiones en pulgadas y pesos en libras.

Dimensiones "HP" sólo en el extremo del motor. \* La dimensión "HP" sólo en el extremo del motor. 25/17/2567 de 1 x 2 - 10 es sólo 11": se requieren una quéa del motor de  $\frac{3}{2}$ " y una qui

\* La dimensión "HD" para el bastidor del motor 254T/256T de 1 x 2 - 10 es sólo 11"; se requieren una cuña del motor de <sup>3</sup>/<sub>4</sub>" y una cuña del bastidor de apoyo de 1<sup>3</sup>/<sub>4</sub>". ODP = carcasse abritée (à ouvertures de ventilation protégées) ; TEFC = carcasse fermée autoventilée.

\*Dimensions HP à l'extrémité du moteur seulement. La dimension HD pour la carcasse 254T ou 256T, version 1X2-10 seulement, est de 11 po ; une cale de moteur de <sup>3</sup>/<sub>4</sub> po et une cale de galier de 1<sup>3</sup>/<sub>4</sub> po sont requises.

# SSH S-Group Close Coupled – Dimensions and Weights, SSH Acople Cerrado – Dimensiones y Pesos, Dimensions et poids – SSH montée sur moteur, groupe S

(All dimensions in inches and weights in lbs. Do not use for construction purposes.) (Todas las dimensiones en pulgadas y pesos en libras. No usar para propósitos de construcción.)



Dimensions "L" Determined by Pump and Motor, Dimensiones "L" Determinadas por la Bomba y el Motor, Dimensions L – pompe et moteur																		
I E I	Pump, Bomba, Pompe	150 lb. Brida de Bride, 15 Suct.	150 lb. Flange, Brida de 150 lib., Bride, 150 lb/po <sup>2</sup> CP        Bride, 150 lb/po <sup>2</sup> CP        Suct.      Disch.      Máx        Succ.      Desc.      C		DC Max., DC Máx.,	DD	DD X Y Carcasse de n			ame Size, azón del M le moteur	lotor,	Wt. (Ibs.), Pesos (libras),						
		Aspir.	Refoul.	max.	max.				143/145	Poids								
9SH	1x2-6			253/	5	43/4	63%	21/	05/	101/.	111/.	_	24					
10SH	1x2-8	2	1	1	1	1	1	2378	5%	5%	71/8	2/8	378	1074	1174		32	
11SH	1 x 2 - 10			271/8	6%	65%	81/8	4	101/2	111/8	121/8	123/8	54					
4SH	11/2 x 21/2 - 6		114	251/2	5	43/4	63%	31/4	93/4	10¾	113%	—	25					
7SH	11/2 x 21/2 - 8	214	172		5%	5%	71/8						34					
5SH	2 x 2 <sup>1</sup> / <sub>2</sub> -6	21/2 -	21/2	2	2		2		777	5 4	43/4	63%		101/4	111/	121/	173/	25
8SH	2 x 2 <sup>1</sup> / <sub>2</sub> -8		2	211/8	211/8 6	6 /3/	715/	4	101/2	1178	1278	1278	36					
6SH	$2^{1}/_{2} \times 3 = 6$		21/2	]	0	474	/ 716						27					

① For use with ANSI class 150 mating flanges. Para usar con bridas que casan ANSI clase 150. À utiliser avec des contre-brides ANSI, classe 150.

# Dimensions Determined by JM Motor Frame, Dimensiones Determinadas por el Armazón del Motor JM,

Dimensions – carcasse de moteur JM

JM Frame, JM Armazón, Carcasse	A	AB	В	D	E	F	G	H Dia., H Diám., H (diam.)	P Max., P Máx., P max.	Motor Wt. (lbs.) Peso Motor (lib.), Poids du moteur
143JM	61/2	51/.	6	21/	<b>7</b> 3/.	2	17	11/	65/	41
145JM	072	J74	0	572	Z /4	21/2	/8	/32	078	57
182JM	01/	E7/	61/	A17	<b>D</b> 3/	21/4	37		77/	77
184JM	<b>0</b> 72	D'/8	072	472	574	23/	716		178	97
213JM	01/	73/	0	E1/	A17	Z 74	7/	1 732	05/	122
215JM	972	178	ŏ	J 74	474	31/2	732		95/8	155
254TCZ	1117.	0	91/2	<b>G</b> 1/.	E	41/8	17.	177	1114	265
256TCZ	1174	9	113⁄4	074	5	5	74	/32	1172	320

## NOTE:

- 1. Pumps shipped in vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten  $\frac{3}{2} 16$  bolts to 12 ft./lbs.,  $\frac{7}{16} 14$  bolts to 20 ft./lbs.
- ALL dimensions in inches.
  Motor dimensions may vary with motor manufacturer.
- 4. Not for construction purposes.

#### NOTA:

- Las bombas se transportarán en descarga vertical como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar <sup>3</sup>/<sub>6</sub> − 16 tornillos a 12 pies/libras, <sup>7</sup>/<sub>16</sub> − 14 tornillos a 20 pies/libras.
- 2. TODAS las dimensiones en pulgadas.
- 3. Las dimensiones puede que varíen con
- los fabricantes.
- 4. No para propósitos de construcción.

#### NOTA :

- L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis <sup>3</sup>/<sub>6</sub> - 16 à 12 lbf-pi et <sup>7</sup>/<sub>16</sub> - 14 à 20 lbf-pi.
- 2. Les dimensions sont en pouces, et le poids, en livres.
- 3. Les dimensions et le poids du moteur peuvent varier
- selon le fabricant.
  - Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.

## Motor Frame Selections, Selecciones del Armazón del Motor, Choix de carcasses de moteur

Motor	Motor Horsepower, Potencia del Motor, Puissance (hp)												
Frame,	3500 RP	M, 3500 F	RPM, 3 50	00 tr/min	1750 RPM, 1750 RPM, 1750 tr/min								
del Motor,	1Ø, Mor 1	ofásicos Ø	3Ø, Tri 3	fásicos Ø	1Ø, Mor 1	ofásicos Ø	3Ø, Trifásicos 3 Ø						
Carcasse	ODP	TEFC	ODP	TEFC	ODP	TEFC	ODP	TEFC					
143JM	-	-	-	-	-	-	1	1					
145JM	2	2	2-3	2	1-11/2	1-11/2	11/2-2	11/2-2					
182JM	3	3	5	3	2	2-3	3	3					
184JM	5	5	71/2	5	3	-	5	5					
213JM	71/2	-	10	71/2	5	-	71/2	71/2					
215JM	10	-	15	10-15	-	-	-	-					
254TCZ	-	-	20	-	-	-	-	-					
256TCZ	_	_	25	20-25	_	_	_	_					

ODP = carcasse abritée (à ouvertures de ventilation protégées) ;

TEFC = carcasse fermée autoventilée.



**Dimensions and Weights – Bare Pump Only,** Dimensiones y Pesos – Solamente Bomba, Dimensions et poids – pompe nue seulement

	Pump,	150 lk Brida c Bride,	o. Flange, le 150 lib., 150 lb/po²	DC Max., DC		CP Max., CP	1	x	v	Wt. (lbs.),
	вотра, Ротре	Suction Succión ① Aspir.	Discharge Descarga ① Refoul.	Máx., DC max.	DD	Máx., CP max.	L	X	Ŷ	(libras), Poids
9SH	1 x 2 - 6			5	43/4	163/	75/	6¾	31/	56
10SH	1 x 2 - 8	2	1	5%	5¾	1074	1 /8	71/8	J78	64
11SH	1 x 2 - 10			61/8	61/8	17%16	81/2	81/8	4	86
4SH	1½ x 2½ – 6		116	5	43/4	16%16	73⁄4	6¾	31⁄4	56
7SH	11/2 x 21/2 - 8	216	172	51/8	53/8			71/		64
5SH	2 x 2 <sup>1</sup> / <sub>2</sub> - 6	2/2	2	5	43/4	175/	<b>Q</b> 1/2	1 /8	1	57
8SH	2 x 2 <sup>1</sup> / <sub>2</sub> - 8			6	53/.	$ 1/?_{16} $	0 72	63/	4	66
6SH	2 <sup>1</sup> / <sub>2</sub> x 3 - 6	3	21/2	0	J <sup>-74</sup>			078		57

① For use with ANSI class 150 mating flanges. Para usar con bridas que casan ANSI clase 150. À utiliser avec des contre-brides ANSI, classe 150.

# NOTE:

- 1. Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten 3/8 -16 bolts to 12 ft./lbs.,  $\frac{7}{16} - 14$ bolts to 20 ft./lbs.
- 2.ALL dimensions in inches.
- 3. Not for construction purposes.

## NOTA:

- 1. Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar <sup>3</sup>/<sub>8</sub> – 16 tornillos a 12 pies/libras, <sup>7</sup>/<sub>16</sub> – 14 tornillos a 20 pies/libras.
- 2. TODAS las dimensiones en pulgadas.
- 3. No para propósitos de construcción.

### NOTA :

- 1. L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis <sup>3</sup>/<sub>8</sub> – 16 à 12 lbf·pi et <sup>7</sup>/<sub>16</sub> – 14 à 20 lbf·pi.
- 2. Les dimensions sont en pouces, et le poids, en livres.
- 3. Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.

### Channel Steel Bedplate, Clockwise Rotation Viewed from Drive End;

Fundación de Acero, Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor; Plaque de base profilée en U et rotation en sens horaire (vue de l'extrémité du moteur)



## Dimensions and Weights – Determined by Pump, Dimensiones y Pesos – Determinados por la Bomba, Dimensions et poids – pompe

Pump, Bomba, Pompe	Pump Size, Tamaño de Ia Bomba, Dimensions	① Suction Succión Aspir.	① Discharge Descarga Refoul.	СР	DC Max., DC Máx., DC max.	DD	L	x	Y	Wt. (Ibs.), Peso (Iibras), Poids
24SH	1½ x 2½-10	216	11/2		67/6	65/6				125
25SH	2 x 2 <sup>1</sup> / <sub>2</sub> -10	2/2	2	22	078	078	101%	8 <sup>15</sup> ⁄16	1	125
22SH	2½ x 3-8	3	216	25	61/8	51/8	1078		4	125
27SH	2½ x 3-10	5	2/2		67/6	65/6		Q15/4 c		134
23SH	3 x 4-8	4	3	24	0/8	078	111/6	/16	5	136
28SH	3 x 4-10	4	5	24	75/8	73/8	1178	11 <sup>1</sup> /8	5	148

① For use with ANSI class 150 mating flanges. Para usar con bridas que casan ANSI clase 150.

À utiliser avec des contre-brides ANSI, classe 150.

### Available Motor and Bedplate Dimensions and Weights, Pesos y Dimensiones Disponibles de la Fundación y del Motor, Dimensions et poids - moteur et plaque de base

## NOTE:

- 1. Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position and tighten  $\frac{3}{8} 16$  bolts to 12 ft./lbs.
- ALL dimensions in inches.
  Not for construction purposes.

## NOTA:

- Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar <sup>3</sup>/<sub>8</sub> – 16 tornillos a 12 pies/libras.
- 2. TODAS las dimensiones en pulgadas.
- 3. No para propósitos de construcción.

#### NOTA :

- L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis <sup>3</sup>/<sub>8</sub> - 16 à 12 lbf pi.
- 2. Les dimensions sont en pouces, et le poids, en livres.
- 3. Les dimensions et le poids du moteur peuvent varier selon le fabricant.
- Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.

Motor Frame, Armazón	HP @ 35 hp à 3 5	HP @ 3500 RPM, hp à 3 500 tr/min      HP @ 1750 hp à 1 750			– T-Fram – carc. T s	e Only eulem.	AB Max.,	C Max.,	P Max.,	Wt. Max.,	Bedplate Data, Datos de la Fundación, Plaque de base						
del Motor, Carcasse	Three Trifásic	Phase, :os, 3 Ø	Single Monofás	Phase, icos, 1 Ø	Three Phase, Trifásicos, 3 Ø		AB Máx., AB	C Máx., C	P Máx., P	Peso Máx., Poids	HA	HB	HD	HE	HF	HG	Wt. (lbs.), Peso (libras)
de moteur	ODP	TEFC	ODP	TEFC	ODP	TEFC	max.	max.	max.	max.							Poids
184T			3 or <i>ou</i> 5	3	5	5	51/8	18 <sup>1</sup> /8	71/8	95							
213T					<b>7</b> ½	<b>7</b> <sup>1</sup> / <sub>2</sub>		18		116							
215T	15				10	10	73/8	19 <sup>1</sup> /8	9%	136	13	42	10¼	5¼	38 <sup>1</sup> /2	4	111
254T	20	15			15	15	016	215/8	12	266							
256T	25	20			20	20	572	233/8	1.5	264							
284TS/T	30	25			25	25	1.75%	247/8	15	392	15	11	1016	53/4	4016	216	124
286TS/T	40	30					1278	265/8	1.5	422	IJ	44	1072	J74	4072	572	124
324TS/T	50	40					1 414	283/4	1734	592			10				
326TS/T	60	50					1478	30 <sup>1</sup> /4	1778	634	10	10	ΙZ	71/.	1116	л	102
364TS/T	75	60					1 5 1 4	315⁄8	107/	834	10	40	10	//4	4472	4	100
365TS/T	100	75					1078	325/8	1078	1000			13				
405TS/T		100					18	361/8	205/8	1060	22	56	14	71⁄4	521/2	4	214

Dimensions and weights vary with manufacturers. Dimensions in inches and weights in lbs.

Dimensiones y pesos varían con los fabricantes. Dimensiones en pulgadas y pesos en libras.

ODP = carcasse abritée (à ouvertures de ventilation protégées) ; TEFC = carcasse fermée autoventilée.

## SSH M-Group Close Coupled - Dimensions and Weights, SSH Acople Cerrado - Dimensiones y Pesos, Dimensions et poids – SSH montée sur moteur, groupe M

(All dimensions in inches and weights in lbs. Do not use for construction purposes.) (Todas las dimensiones en pulgadas y pesos en libras. No usar para propósitos de construcción.)



Dimens	Dimensions "L" Determined by Pump and Motor, Dimensiones "L" Determinadas por la Bomba y el Motor, Dimensions L – pompe et moteur															
Pump, Bomba,	Pump Size, Tamaño de la Bomba	① Suction	① Discharge	CP Max., CP Máx	DC Max., DC Máx	DD	x	Y	Wt. (lbs.), Peso		Tam	Moto año del Carca	or Fram Armaz sse de	e Size, ón del N moteur	/lotor,	
Pompe	Dimensions	Aspir.	Refoul.	CP max.	DC max.				(libras), Poids	140	180	210	250	280	320	360
24SH	1½ x 2 ½-10	216	11/2	341/2	67/6	65%			75	101/2						-
25SH	2 x 2 <sup>1</sup> ⁄2-10	272	2		078	078	815/16	1	75		111/8	4.217		.7.	4.427	
22SH	2½ x 3-8	2	214	36	61⁄8	51/8		-	72	-		12 1/8	13	5'/8	14%	15
27SH	2 <sup>1</sup> / <sub>2</sub> x 3-10		272		676	656	0154.c		84	-	-					
23SH	3 x 4-8	Д	3	37	078	078	3 716	5	86	11½	12 <sup>1</sup> /8	133%	14	17/6	153/2	16
28SH	3 x 4-10			51	75⁄8	73//8	1111/8		98	-	-	1378		170	1378	.0

① For use with ANSI class 150 mating flanges. Para usar con bridas que casan ANSI clase 150. À utiliser avec des contre-brides ANSI,

classe 150.

- NOTES:
- 1. Pumps shipped in vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, and tighten  $\frac{3}{8}$  – 16 bolts to 12 ft./lbs., 7/16-14 bolts to 20 ft./lbs.,
- 1/2-13 bolts to 35 ft./lbs. 2. Motor dimensions may vary with motor manufacturer.
- 3. Not for construction purposes.

#### NOTAS:

. Las bombas se transportarán en descarga vertical como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar 3/8 - 16 tornillos a 12 pies/libras, 7/16 - 14 tornillos a 20 pies/libras, 1/2 - 13 tornillos a 35 pies/libras.

2. TODAS las dimensiones en pulgadas.

#### **Dimensions Determined by JM Motor Frame,** Dimensiones Determinadas por el Armazón del Motor JM, Dimensions – carcasse de moteur JM

Frame, Armazón, Carcasse	A	AB Max., <i>AB</i> max.	В	D	E	F	G	Н	P Max., P Máx., P max.
145JM	61/2	51/4	6	31/2	23/4	21/2	1/8	11/32	<b>7</b> <sup>3</sup> /16
182JM	<b>Q</b> 16	576	616	116	23/	21/4	340		016
184JM	072	J78	072	472	574	73/.	716	13.6-2	072
213JM	016	734	0	E1/.	417.	Z-74	7/22	-732	1034
215JM	972	778	0	574	474	31/2	732		10716
254JM	1 1 1 /.	0	1137.	G1/.	E	4 <sup>1</sup> /8			1.21/.
256JM	1174	9	1174	074	5	5	17.	17.6.0	1574
284JM	1.21/.	1.21/.	1.21/.	7	E16	43/4	74		15
286JM	TZ 74	TZ 74	IZ 74	/	572	51/2			15
324JM	11	121/	1./	0	61/4	5 <sup>1</sup> /4	540		16154
326JM	14	1574	14	0	074	5½	/16	2162	10 716
364TCZ	1 73/	1516	1516	0	7	55⁄8	1	/32	10
365TCZ	1774	1,578	1372	3	/	61/8			19

364TCZ and 365TCZ frames are built with 326JM shaft extensions. Dimensions may vary with manufacturer.;

Los armazones 364TCZ y 365TCZ se construyen con extensiones del eje 326JM. Las dimensiones puede que varíen con los fabricantes.;

Les carcasses 364TCZ et 365TCZ possèdent la rallonge d'arbre de la 326JM.

3. No para propósitos de construcción. **Motor Frame Selections,** 

## Selecciones del Armazón del Motor, Choix de carcasses de moteur

Frame,	Motor 3500 RPM,	Horsepow 3500 tr/min	rer, Potencia del Motor, Puissance (hp) 1750 RPM, 1750 tr/min				
Armazón,	3 PH, Trifa	ásicos, 3 Ø	1 PH, Mond	ofásicos, 1 Ø	isicos, 3Ø	Máx.,	
Carcasse	ODP	TEFC	ODP	TEFC	ODP	TEFC	max.
145JM	-	-	-	_	2	2	57
182JM	-	-	2	2, 3	3	3	77
184JM	-	-	3	-	5	5	97
213JM	10	-	5	-	71/2	71/2	141
215JM	15	10	-	-	10	10	155
254JM	20	15	-	-	15	15	265
256JM	25	20	-	_	20	20	320
284JM	30	25	-	-	25	25	419
286JM	40	30	-	-	-	_	422
324JM	50	40	-	_	_	-	562
326JM	60	50	-	_	_	_	625
364TCZ	75	60	-	_	_	_	775
365TCZ	100	75, 100	_	_	_	_	905

364TCZ and 365TCZ frames are built with 326JM shaft extensions. Los armazones 364TCZ y 365TCZ se construyen con extensiones del eje 326JM. Los armazones 364TCZ y 365TCZ se construyen con extensiones del cjc 52.5.... ODP = carcasse abritée (à ouvertures de ventilation protégées) ; TEFC = carcasse fermée autoventilée. Les carcasses 364TCZ et 365TCZ possèdent la rallonge d'arbre de la 326JM, 13

NOTA : 1. l'orifice de refoulement est orienté vers le haut.

- Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis 3/8 - 16 à 12 lbf·pi, 7/16 - 14 à 20 lbf·pi et 1/2 - 13 à 35 lbf·pi.
- 2. Les dimensions sont en pouces, et le poids, en livres. 3. Les dimensions et le poids du moteur peuvent varier
- selon le fabricant. 4. Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.



Dimensions and Weights – Bare Pump Only, Dimensiones y Pesos – Solamente Bomba Dimensions et poids – pompe nue seulement

Pump, Bomba, Pompe	Pump Size, Tamaño de Ia Bomba, Dimensions	① Suction Succión Aspir.	① Discharge Descarga Refoul.	СР	DC Max., DC Máx., DC max.	DD	L	x	Y	Wt. (lbs.), Peso (libras), Poids
24SH	1½ x 2½-10	<b>7</b> 1/2	11/2		67/6	65%				125
25SH	2 x 2 <sup>1</sup> / <sub>2</sub> -10	2/2	2	22	078	078	1016	8 <sup>15</sup> ⁄16	1	125
22SH	21⁄2 x 3-8	2	21/2	25	61/8	51/8	1072		-	125
27SH	21⁄2 x 3-10	J	2/2		67/6	65%		9 <sup>15</sup> ⁄16		134
23SH	3 x 4-8	Λ	3	24	078	078	111/2		5	136
28SH	3 x 4-10	+	J	24	75⁄8	73/8	111/2	11½	J .	148

 For use with ANSI class 150 mating flanges. Para usar con bridas que casan ANSI clase 150. À utiliser avec des contre-brides ANSI, classe 150.

#### NOTES:

- 1. Pumps will be shipped with top vertical discharge as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten  $\frac{3}{8}$ -16 bolts to 12 ft./lbs.
- 2. Motor dimensions may vary with motor manufacturer.
- 3. Not for construction purposes.

#### NOTAS:

- Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y apretar <sup>3</sup>/<sub>8</sub> – 16 tornillos a 12 pies/libras.
- 2. TODAS las dimensiones en pulgadas.
- 3. No para propósitos de construcción.

### NOTA :

- L'orifice de refoulement est orienté vers le haut. Pour l'orienter autrement, enlever les vis de fixation du corps de pompe, placer l'orifice dans le sens voulu, puis reposer et serrer les vis <sup>3</sup>/<sub>8</sub> – 16 à 12 lbf·pi.
- 2. Les dimensions sont en pouces, et le poids, en livres.
- 3. Les dimensions et le poids du moteur peuvent varier selon le fabricant.
- Ne pas utiliser les dimensions pour la construction si elles ne sont pas certifiées à cette effet.

# **Commercial Water**

## GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps. Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized GouldsPumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

#### The warranty excludes:

Ў ІТТ

(a) Labor, transportation and related costs incurred by the dealer;

- (b) Reinstallation costs of repaired equipment;
- (c) Reinstallation costs of replacement equipment;
- (d) Consequential damages of any kind; and,
- (e) Reimbursement for loss caused by interruption of service.
- For purposes of this warranty, the following terms have these definitions:
- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
- (3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

#### THIS WARRANTY EXTENDS TO THE DEALER ONLY.



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Engineered for life

# SECTION 12e.2: DENITRIFICATION PUMP

## P&ID: Item #: P-0511

Unit Details: ABS Series XFP Sewage Pump ABS Model#: XFP 80C VX.3 -PE22/4 3.0Hp, 3Ø/60Hz/460V 75 GPM @ 15' TDH

Manufacturer: ABS Pumps, Inc. 140 Pond View Drive Meriden, CT 06450 Phone: (203) 238-2700 Fax: (203) 238-0738 www.absgroup.com

Local Distributor/Contact:

ABS Pumps, Inc. 140 Pond View Drive Meriden, CT 06450 Phone: (203) 238-2700 Fax: (203) 238-0738 www.absgroup.com

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Tough, reliable, submersible pumps, with Premium Efficiency motors from 2.4 to 40.2 hp. For the pumping of wastewater and sewage from buildings and sites in private, commercial, industrial and municipal areas.

#### Features

- The water-pressure-tight, encapsulated, flood-proof motor and the pump section form a compact, robust, modular construction.
   NEMA Class A temperature rise.
- Premium Efficiency Motors in accordance with IEC 60034-30 level IE3\* with testing in accordance with IEC60034-2-1.
- Continuously rated motor in submerged and non-submerged applications.
- Double SiC-SiC mechanical seals. All seals are independent of rotation direction and resistant to temperature shock.
- □ Anti-wicking cable plug solution (80C 150E), or
- water-pressure-sealed connection chamber (100G 201G). Hydraulic options of Contrablock and Contrablock Plus impellers for high efficiency, or vortex impellers for maximum
- solids handling.
- mum 50,000 hrs. (80C 150E), and 1000,000 hrs. (100G 201G). □ Stainless steel shaft. Designed with high safety factor to prevent
- fatigue fracture.
- Temperature monitoring using bi-metallic thermal sensors in the stator windings that open at 140 °C (284 °F).
- Seal monitoring by a moisture probe (DI) in the seal chamber (80C - 150E), or dry chamber (100G - 201G), which signals an inspection alert if there is leakage at the shaft seals.
- □ Smooth outer design to reduce rag build-up.
- □ Stainless steel lifting hoop.
- □ 3", 4", 6" and 8" radial slot ANSI flange discharge.
- Maximum allowable temperature of the medium for continuous operation is 104 °F.
- Decomposition Maximum submergence depth of 65 ft.
- Available in explosion-proof version in accordance with international standards FM / CSA.

\* See Technical Data table



#### Performance fields with Contrablock impeller



<sup>\*\*</sup> Minimum flow rate Q



#### Motor

Premium Efficiency IE3\* motor.

60 Hz single-phase 230 V through 3.8 hp, and three-phase 460 V through 40.2 hp.

Squirrel-cage motor as 2-pole (3400 rpm), 4-pole (1750), 6-pole (1180) and 8-pole (870).

Protection type IP 68, with stator insulation Class H.

Starting: DOL (direct on line).

Motors with other operating voltages and frequencies are also available (DOL and YD).

Identification Code: e.g. XFP 80C CB1.3 PE22/4-C-60 Hydraulics:

XFP Product range	XFP
8 Discharge outlet DN (cm)	8
0Hydraulic type	0
C Volute opening (dia. ins)	C
CB Impeller type: CB = Contrablock, VX = vortex	VX
1 Number of impeller vanes	1
3 Impeller size	3
Motor:	
PE Premium Efficiency	· PE
22 Motor power P <sub>2</sub> x 10 hp	22
4 Number of poles	. 4
C Volute opening (dia. ins)	<b>C</b>
60 Frequency	,60

#### Performance fields with vortex impeller



Please use the ABSEL program as the only valid selection tool

## **Technical Data**

XFP	Motor	IEC rating	Impeller size	Rated voltage	Motor (kW)	<b>power*</b> (hp)	Rated current	Speed	Cable size	Weight**
				(V)	<b>P</b> <sub>1</sub>	P <sub>2</sub>	(A)	(rpm)		(lbs)
80C-CB1	PE 28/4 PE 35/4 PE 20/6	IE3 IE3 IE1	5 4 1, 2, 4	460 3~ 460 3~ 460 3~	3.1 3.9 2.4	3.8 4.7 2.7	5.2 6.2 4.2	1750 1750 1180	SOOW 14/7 SOOW 14/7 SOOW 14/7	215 / n.a. 221 / n.a. 221 / n.a.
	PE 28/4W PE 20/6W	IE3 IE1	5 1. 2. 4	230 1~ 230 1~	3.6 2.6	3.8 2.7	16.9 12.0	1750 1180	SOOW 10/7 SOOW 14/7	215 / n.a. 221 / n.a.
80C-VX	PE 22/4	IE3	2, 3, <mark>4</mark>	<mark>460 3~</mark>	2.5	<mark>3.0</mark>	4.6	1750	S00W 14/7	215 / n.a.
	PE 35/4	IE3	1	460 3~	3.9	4.7	6.2	1750 1750	SOOW 14/7	220 / n.a.
	PE 28/4W	IE3	3, 4 2	230 1~	2.3 3.6	2.4 3.8	16.9	1750	SOOW 12/7 SOOW 10/7	211 / n.a. 215 / n.a.
80E-CB1	PE125/2	IE3	4,5	460 3~	13.7	16.8	21.3	3400	AWM 8/4+16/3	381 / n.a.
81E-VX	PE 80/2	IE3	4	460 3~	8.9	10.7	13.3	3400	SOOW 12/7	300 / n.a.
	PE 125/2	IE3	1, 2, 3	460 3~	13.7	16.8	21.3	3400	AWM 8/4+16/3	336 / n.a.
100C-CB1	PE 28/4	IE3	5	460 3~ 460 3-	3.1	3.8	5.2	1750 1750	SOOW 14/7	235 / n.a. 240 / n.a
	PE 20/6	IF1	124	460 3~ 460 3~	24	4.7	4.2	1180	SOOW 14/7	240 / n.a. 240 / n.a
	PE 28/4W	IE3	5	230 1~	3.6	3.8	16.9	1750	SOOW 10/7	235 / n.a.
	PE 20/6W	IE1	1, 2, 4	230 1~	2.6	2.7	12.0	1180	SOOW 14/7	240 / n.a.
100C-VX	PE 22/4	IE3	3, 4, 5	460 3~	2.5	3.0	4.6	1750	SOOW 14/7	208 / n.a.
	PE 28/4	IE3	2	460 3~	3.1	3.8	5.2	1750	SUUW 14/7	259 / n.a.
	PE 33/4 PE 18/4W	IE3 IE3	4	480 3~ 230 1~	23	4.7	0.2 10.5	1750	SOOW 10/7	203/n.a.
	PE 28/4W	IE3	2, 3	230 1~	3.6	3.8	16.9	1750	SOOW 10/7	259 / n.a.
100E-CB1	PE 75/4	IE3	4,5	460 3~	8.2	10.1	13.8	1750	SOOW 12/7	390 / n.a.
	PE 90/4	IE3	2, 3, 4	460 3~	9.8	12.1	15.8	1750	SOOW 12/7	416/n.a.
	PE 103/4 PE 35/6	IE3 IE2	1, 2, 3 2, 3, 4, 5	460 3~ 460 3~	4.0	4.7	6.3	1180	SOOW 10/7 SOOW 14/7	349 / n.a.
100E-VX	PE 45/4	IE3	5	460 3~	5.0	6.0	8.2	1750	S00W 14/7	357 / n.a.
	PE 75/4	IE3	4	460 3~	8.2	10.1	13.8	1750	SOOW 12/7	364 / n.a.
	PE 90/4	IE3	3	460 3~	9.8	12.1	15.8	1750	SOOW 12/7	364 / n.a.
100C CP1	DE 120/4	1E3	0	460 3~	11.4	14.1	17.7	1750	SUUW 10/7	3907 h.a.
1000-001	PE 130/4 PE 185/4	IE3 IE3	6	460 3~ 460 3~	14.0	24.8	32.3	1750	AWM 8/4+16/3	763 / 885
	PE 210/4	IE3	4	460 3~	22.4	28.2	35.4	1750	AWM 8/4+16/3	763 / 885
	PE 250/4	IE3	4	460 3~	26.7	33.5	40.8	1750	AWM 4/4+16/3	792/1015
	PE 90/6	IE3	4, 5	460 3~	10.0	12.1	18.8	1180	SOOW 10/7	721 / 865
101G-CB1	PE 185/2 PE 200/2	IE3	4 3	460 3~ 460 3~	20.0	24.8 26.8	28.4	3400 3400	AWM 8/4+16/3	629/796
	PE 300/2	IE3	2, 1	460 3~	32.5	40.2	45.8	3400	AWM 4/4+16/3	651 / 821
150E-CB1	PE45/4	IE3	7	460 3~	5.0	6.0	8.2	1750	SOOW 14/7	369 / n.a.
	PE75/4	IE3	5,6	460 3~	8.2	10.1	13.8	1750	SOOW 12/7	410/n.a.
	PE90/4	IE3	4,5	460 3~	9.8	12.1	15.8	1750	SOOW 12/7	410 / n.a.
	PE105/4 PE35/6	IE3 IE2	4 4 5 6	460 3~ 460 3~	11.4	14.1	17.7	1750 1180	SOOW 10/7 SOOW 16/7	435/n.a. 369/n.a
150G-CB1	PE 130/4	IE3	8	460.3~	14 0	17.4	23.2	1750	AWM 8/4+16/3	735 / 925
	PE 185/4	IE3	6	460 3~	19.8	24.8	32.3	1750	AWM 8/4+16/3	765 / 981
	PE 210/4	IE3	4	460 3~	22.4	28.2	35.4	1750	AWM 8/4+16/3	765 / 981
	PE 110/6	IE3	2,3, 4	460 3~	12.0	14.8	21.1	1180	AWM 8/4+16/3	735 / 964
200G-CB1	PE 90/6 PE 110/6	IE3 IE3	3, 4 1, 2	460 3~ 460 3~	10.0 12.0	12.1 14.8	18.8 21.1	1180 1180	SOOW 10/7 AWM 8/4+16/3	805 / 1018 805 / 1018
201G-CB2	PE 130/6	IE3	6	460 3~	14.2	17.4	23.7	1180	AWM 8/4+16/3	845 / 982
	PE 160/6	IE3	4	460 3~ 460 2	17.5 21 5	21.5	28.4	1180	AWM 8/4+16/3	865/1004
	PE 120/8	IE3	∠ 1, 2	460 3~ 460 3~	∠1.5 13.5	20.0 16.1	23.7	870	AWM 8/4+16/3	851/993

 $^{*}P_{1}$  = power at mains. P<sub>2</sub> = power at motor shaft. \*\*Without / with cooling jacket; includes 33 ft of cable.

Data for alternative voltages available on request.

## **Standard and Options**

Description	Standard	Option
Mains voltage	230 V 1~, 460 V 3~	208 V 1~, 208, 220, 380, 600, 220/380, 380/660 V 3~
Voltage tolerance	± 10%	-
Motor efficiency	Premium Eff. IE3*	-
Insulation class	Н	-
Start-up	Direct on line	Star delta
Approvals	FM / CSA	-
Mechanical seal (at medium side)	SiC-SiC	-
Mechanical seal (at motor side)	SiC-SiC	-
0-rings	NBR	-
Cables	CSA	EMC
Cable length (ft)	49	33, 66, 99, 131, 164
Protective coating	2k Epoxy 120 µm	2k Epoxy 400 μm
Provision for lifting hoist	Lifting hoop	
Cooling	Self-cooling (80C - 150E); by the medium (100G - 201G)	Closed cooling (100G - 201G)
Installation	Wet well	Dry well** or transportable
* C T		

See Technical Data table \*\* Except XFP 80E and 81E

## Monitoring

Description		Standard	Option
Motor	Bi-metallic switch in windings	Х	-
(temperature)	PTC thermistor in windings	-	Х
Seals	Moisture sensor (DI) in oil chamber (80C - 150E)	Х	-
(leakage)	Moisture sensor (DI) in dry chamber (100G - 201G)	Х	-
	Moisture sensor (DI) in connection chamber (100G - 201G)	-	Х
Bearings	PTC thermistor (100G - 201G)	-	Х
(temperature)	PT 100 (100G - 201G)	-	Х

## Materials

Motor	Material
Motor housing	Cast iron EN-GJL-250
Motor shaft	Stainless steel 1.4021
Fasteners	Stainless steel 1.4401
Lifting hoop	Stainless steel 1.4401
Hydraulics	Material
Volute	Cast iron EN-GJL-250
Impeller	Cast iron EN-GJL-250
Bottom plate	Cast iron EN-GJL-250

## Material comparison

Europe	USA					
EN-GJL-250	ASTM A48; Class 40B					
1.4021	ASTM / AISI 420					
1.4401	ASTM / AISI 316					

#### Accessories

	Description	Size	XFP	Part no.
Fixed installation - wet well with ABS Automatic Coupling System	<b>Pedestal*</b> (cast iron ASTM A48; Class 40B) 90° cast bend (single guide rail) - DIN flange connection	<mark>3")</mark> 4" 4" (high-head) 6" 8"	<mark>80C</mark> - 81E 100C - 100G 101G 150E & 150G 201G	62320649 62320652 62325019 62320655 62320658
	90° cast bend (single guide rail) - plug/clamp connection	3" (pipe Ø3½") 4" (pipe Ø4¼") 4" high head (pipe Ø4¼") 4" (pipe Ø4½") 6" (pipe Ø6¼")	80C - 81E 100C - 100G 101G 100C - 100G 150E & 150G	62320650 62320653 62325020 62320654 62320656
	90º cast bend (twin guide rail) - DIN flange connection	3" 4" 6" 8"	80C - 81E 100C - 101G 150E & 150G 201G	62325029 62325030 62325031 62325032
	<b>Pedestal bracket fasteners</b> single guide rail version (galvanised steel)		80C - 81E 100C - 101G 150E & 150G 201G	62610632 62610633 62610635 62610883
	single guide rail version (stainless steel)		80C - 81E 100C - 101G 150E & 150G 201G	62610899 62610637 62610639 62610862
	twin guide rail version (galvanised steel)		80C - 81E 100C - 101G 150E & 150G 201G	62615053 62615054 62615055 62615056
	<b>Pedestal base anchor bolts</b> single and twin guide rail (galvanised steel)		80C - 101G 150E & 150G 201G	62610775 62610784 62610785
Fixed installation - dry well, (horizontal)	<b>Pump Support Kit</b> (ASTM A48; Class 40B) head and volute supports with fixing bolts and vibration damper		80C 80C**, 100C 81E*** 100E 150E 101G 100G, 150G, 201G	61825032 61825033 61825038 61825030 61825031 61825036 61825037
(vertical)	Ground Support Stand		80C 81E*** 100C 100E 150E 101G 100G, 150G, 201G	61355014 61355020 61355015 61355021 61355022 61355024 61355023
Transportable	Ground Support Stand		80C, 100C 80E & 81E 100E 150E 101G 100G, 150G, 201G	61355016 61355017 61355018 61355019 61355026 61355025
General	Cathodic Protection (Zinc anodes)		80C - 201G	13905000

\*Guide rail not included \*\*Vortex version of pumps (VX) \*\*\* Only with PE 80/2 motor





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ABSEL 32 1.7.2 / 2007-02-07



# XFP 80C VX 60HZ

70 GPM @ 15 Feet - 3 HP (3-Inch Discharge)

### XFP

ABS EffeX XFP range of submersible pumps (PE1 to PE3) are supplied for reliable and economic pumping of clear water. polluted water and heavily polluted sewage containing solids, faecal slurry and sludge in commercial, industrial and municipal application. Driven by Premium Efficiency IE3 motor in according with IEC 60034-30, exceeding CEMEP EFF 1. Motor insulation according to Class H, temperature rise according to Class A. Explosion proof as standard, ATEX, FM and CSA. Continuously rated motor suitable for wet and dry installation as standard.(PE1 and PE2) PE3 has the option of internal closed loop cooling system for dry installation. Equipped with temperature and moisture sensors as standard. Standard sewage hydraulic with Contrablock plus gives enhanced levels of blockage resistance and excellent rag handling with large free solids passage of 75 mm minimum. 50Hz Capacity up to 750 m3/h Head, max. 74 m 60Hz Capacity up to 3500 US g.p.m. Head, max. 330ft Type: XFP 80C VX 60HZ Technical data Delivery rate : 77.4 US g.p.m. Delivery head : 18.3 ft Hydr. efficiency : 23.5 % Total efficiency : 20 % Shaft power : 1.53 hp Speed : 1760 rpm Impeller type : Vortex impeller Motor output : 2.95 hp Voltage : 460 V Frequency : 60 Hz Suction outlet : DN80 **Discharge** outlet : DN80

abs
We know how water works

Rated power 2.95 hp

70 GPM @ 15 Feet - 3 HP (3-Inch Discharge)

Service factor

Motor performance curve PE22/4-C-60HZ

Nominal speed 1760 rpm

Frequency 60 Hz

P [hp]

Number of poles

4

Rated voltage 460 V Date 2012-09-19

				M/Mn	
1.2				1/1-2	7.2
1.1				1/In	6.6
1					6
				n/ns	
0.9			= -	 eff	5.4
0.8					4.8
				cos	
0.7	/			P1	4.2
0.6				P2	3.6
0.5					3
0.4					2.4
0.3					1.8
					1.2
0.1					0.6
				s	

Loading	No load	25 %	50 %	75 %	100 %	125 %
 P1 [hp]	0.332	1.019	1.743	2.503	3.289	4.113
P2 [hp]	0	0.7376	1.475	2.213	2.95	3.688
I [A]	3.14	3.332	3.637	4.043	4.548	5.16
eff [%]	0	72.41	84.61	88.42	89.69	89.66
cos	0.09897	0.2862	0.4487	0.5793	0.6768	0.746
n [rpm]	1800	1794	1784	1773	1762	1749
M [lbf ft]	0	2.159	4.343	6.555	8.795	11.07
s [%]	0.0002205	0.3322	0.8911	1.498	2.112	2.833
Tolerance accor	rding to VDE 0530 T	1 12.84 for rated p	ower			
Starting current	Starting torque	Moment of	of inertia			

22 A

24.3 lbf ft

0.0712 lb ft<sup>2</sup>

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	Masshiatt VED OAC V	V Naccinetallation	No: AN_M 22 600 00
	Massolatt XFP OUL-V.	Drawn: 11.08.10 / D.Whelan	
	Dimension sheet WEI -	Issue Date: 11.08.2010	
ang			Technical changes reserved
		nstallation novee	Con riserva di modifiche Con reserva de modificaciones
			Sous reśerve de modification
50 Hz			
Typ Gewict Type Weigh Tipo Poids Peso (lbs)		Part No. Y(mm) DN 80 6 232 0649	
PE 15/4 211.0		6 232 0650 Ø 90	
PE 22/4 215.0			
PE 29/4 220.0			
Typ      Gewich        Type      Peids        Tipo      Poids        PE      18/4      211.0        PE      22/4      215.0        PE      28/4      215.0        PE      35/4      220.0	+ 2.8 2.8 - 2.8 - - - - - - - - - - - - -	28"×56"(two 28"×28"(one 3.3 3.5 9.8 2" 6.6	DUMPS) min. Schacht?ffnung min. Sump opening Dimensioni min. botola min. apertura del pozo Largeur min. du puisard
Ø0.71 (8x) Class	7.9 6.3 800 800 800 800 800 800 800 800 800 80		6.6 7'9 0 9

7.2

3" Class 125 ANSI

**346** 





P&ID#: P-0511 XFP 80C VX.3 -PE22/4



Installation, Operating and Maintenance Instructions (CA)

www.absgroup.com



# ABS submersible sewage pump XFP

PE1	PE2	PE3	
80C-CB1	80E-CB1	100G-CB1	201G-CB2
80C-VX	81E-VX	101G-CB1	
81C-VX	100E-CB1	101G-VX	
100C-CB1	100E-VX	150G-CB1	
100C-VX	150E-CB1	200G-CB1	

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ABS reserves the right to alter specifications due to technical developments

# abs

ABS submersible sewage pump XFP 80C - 201G

# Symbols and notices used in this booklet:

Presence of dangerous voltage.



Non-compliance may result in personal injury.

Hot surface - danger of burn injury.

Danger of an explosion occurring.

ATTENTION! Non-observance may result in damage to the unit or negatively affect its performance.

**NOTE:** Important information for particular attention.

# 1 General

## 1.1 Application areas

The following guidelines must be observed when setting the lowest switch off point for XFP pumps:

- When switching on and operating the pump, the hydraulic section of dry installation pumps must always be filled with water.
- The minimum submergence allowed for specific pumps can be found on the dimension installation sheets available from your local ABS representative.

XFP pumps have been designed for economic and reliable pumping in commercial, industrial and municipal installations and are suitable for pumping of the following liquids:

- clear and wastewater, and for sewage containing solids and fibrous material
- faecal matter

In combination with the ABS automatic coupling system, the below ground level wet installation is a particularly economical and environmentally friendly solution. The pumps are also suitable for horizontal or vertical dry installation (except XFP 80E-CB1-PE125/2 and XFP 81E-VX-PE125/2).

# ATTENTION! The maximum allowable temperature of the medium pumped is 104 °F

# 1.2 Explosion-proof Approvals

Explosion-proof as standard, in accordance with international standards FM and CSA.

# 1.2.1 Use of explosion-proof pumps in explosive zones.

- 1. Explosion-proof submersible pumps may only be operated with the thermal sensing system connected.
- 2. If ball type float switches are used, these must be connected to an intrinsically safe electrical circuit "Protection type EX (i)" in accordance with VDE 0165.
- 3. Dismantling and repair of submersible explosion-proof motors may only be carried out by approved personnel in specially approved work shops.
- 4. In the event that the pump is to be operated in explosive atmospheres using a variable speed drive, please contact your local ABS representative for technical advice regarding the various Approvals and Standards concerning thermal overload protection.

## 1.3 Technical data

Maximum noise level  $\leq$  70 dB. This may be exceeded in certain circumstances.

Detailed technical information is available in the technical data sheet ABS submersible sewage pump XFP 80C - 201G which can be downloaded from www.absgroup.com > Downloads.

## 1.3.1 Nameplate

We recommend that you record the data from the nameplate on the pump in the corresponding form below, and maintain it as a source of reference for the ordering of spare parts, repeat orders and general queries.

Always state the pump type, item no. and serial no. in all communications.

## Standard nameplate

abs	ABS USA 140 Pond View Drive Meriden CT 06450 Tel 203-238-2700 www.cardo.com		FM APPROVED Explosion Proof		LR51412 CL.I, DIV.1, GR.C+D	
Тур						
Nr	Sn			xx/xxxx		
UN		IN			Ph	Hz
P1:		P2:				RPM
Cos φ	NEMA A	IEC60	034-30	IE		≬≬ IP68
Qmax		Hmax	[		Ølmp	
DN Hmin Wt. See Instruction Manual for sensor connection and cable replacement. Use with approved motor control that matches motor input full load amps. Utiliser un demarreur approvue covenant au courant a pleine charge du moteur. DO NOT REMOVE COVER WHILE CIRCUIT IS ALIVE.				nally Protected ER. TEMP. T3C.		

Legend		
Тур	Pump type	
Nr	Item No.	
Sn	Serial No.	
xx/xxxx	Production date (Week/Year)	
U <sub>N</sub>	Rated voltage	V
I <sub>N</sub>	Rated current	A
Ph	Number of phases	
Hz	Frequency	Hz
P1	Rated input power	kW
P2	Rated output power	hp
RPM	Speed	rpm
Cos φ	Power factor	pf
NEMA	Temperature rise	Class
Qmax	Max. Flow	gpm
Hmax	Max. Head	ft
Ø Imp.	Impeller diameter	ins
DN	Discharge diameter	ins



## 1.4 General design features

XFP is a submersible sewage and wastewater pump with a Premium Efficiency motor.

The water-pressure-tight, encapsulated, flood-proof motor and the pump section form a compact, robust, modular construction.

## 1.4.1 Design features PE1 & PE2



- 1 Pressure release screw
- 2 10-pole terminal block
- 3 Moisture sensor (DI)
- 4 Seal chamber
- 5 Seal chamber drain plug/ pressure test point
- 6 Venting plug

- 7 Stainless steel lifting hoop
- 8 Upper bearing single row
- 9 Motor with thermal sensors
- 10 Stainless steel shaft
- 11 Motor chamber
- 12 Lower bearing double row
- 13 Bearing housing
- 14 Mechanical seals
- 15 Seal holding plate
- 16 Motor chamber drain plug/ pressure test point
- 17 Impeller Contrablock version
- 18 Bottom plate adjustment screw

## 1.4.2 Design features PE3 (version with cooling jacket)



- 1 Stainless steel lifting hoop
- 2 Lid assembly
- 3 Cable gland
- 4 Upper bearing single row
- 5 Coolant fill plug
- 6 Cooling jacket
- 7 Motor housing
- 8 Lower bearing housing
- 9 Lower bearing double row

- 10 Seal holding plate
- 11 Mechanical seals
- 12 Venting plug
- 13 Terminal block\*
- 14 Pressure test point
- 15 Upper bearing housing
- 16 Motor with thermal sensors
- 17 Stainless steel shaft
- 18 Moisture sensor (DI)

- 19 Dry chamber
- 20 Coolant impeller
- 21 Flow deflector
- 22 Coolant drain plug / pressure test point
- 23 Seal chamber
- 24 Impeller Contrablock version
- 25 Bottom plate adjustment screw
- \* Fitted to bearing housing when two cables connected.



## 2 Safety

The general and specific health and safety guidelines are described in detail in the ABS Products Safety Instructions booklet. If anything is not clear or you have any questions as to safety make certain to contact the manufacturer ABS.

## 3 Transport and Storage

## 3.1 Transport

During transport, care should be taken that the pump is not dropped or thrown. The pumps of the XFP series are fitted with a lifting hoop to which a chain and shackle may be attached for transport or for suspension of the pump.



The pump must be raised only by the lifting hoop and never by the power cable.



Take note of the weight of the entire unit. The hoist and chain must be adequately dimensioned for that weight and must comply with the current valid safety regulations.

All relevant safety regulations as well as general good technical practice must be complied with.

## 3.2 Storage

- 1. During long periods of storage the pump should be protected from moisture and extremes of cold or heat.
- 2. To prevent the mechanical seals from sticking it is recommended that occasionally the impeller is rotated by hand.
- 3. If the pump is being taken out of service the oil should be changed before storage.
- 4. After storage the pump should be inspected for damage, the oil level should be checked, and the impeller checked to ensure it rotates freely.

## 3.2.1 Moisture protection of motor connection cable

The motor connection cables are protected against the ingress of moisture along the cable by having the ends sealed at the factory with protective covers.

## ATTENTION! The ends of the cables should never be immersed in water as the protective covers only provide protection against water spray or similar (IP44) and are not a water tight seal. The covers should only be removed immediately prior to connecting the pumps electrically.

During storage or installation, prior to the laying and connection of the power cable, particular attention should be given to the prevention of water damage in locations which could flood.

## ATTENTION! If there is a possibility of water ingress then the cable should be secured so that the end is above the maximum possible flood level. Take care not to damage the cable or its insulation when doing this.

#### 4 Mounting and Installation

4

The regulations covering the use of pumps in sewage applications, together with all regulations involving the use of explosion-proof motors, should be observed. The cable ducting to the control panel should be sealed off in a gas-tight manner by the use of a foaming material after the cable and control circuits have been pulled through. In particular the safety regulations covering work in enclosed areas in sewage plants should be observed together with general good technical practice.

For the XFP transportable version, arrange the cable run so that the cables will not be kinked or nipped. Connect the discharge pipe and cable (see section "Electrical Connection"). Place the pump on a firm surface which will prevent it from overturning or burrowing down. The pump can also be bolted down to the base or suspended slightly by the lifting handle. Hoses, pipes and valves must be sized to suit the pump performance.

#### 4.1 Installation examples

#### Submerged in concrete sump 4.1.1



- 1 Sump cover
- 2 Venting line
- 3 Sump cover
- 4 Sleeve for cable ducting to the control panel as well as for aeration and venting
- 5 Chain

- 6 Inflow line 7
- Ball-type float switch 8
- Submersible pump
- 9 Concrete sump
- 10 Pedestal

- Guide rail 11
- 12 **Discharge** line
- 13 Non-return valve
- 14 Gate valve
- 15 Power cable to motor



## 4.1.2 Dry-installed

Horizontal



# ATTENTION! The oil-filled version of PE1 and PE2 pumps, and the cooling jacket version of PE3 pumps, are required for dry installations.



Under continuous running conditions the pump motor housing may become hot. To avoid burn injury allow to cool down before handling.

## 4.2 Discharge Line

The discharge line must be installed in compliance with the relevant regulations.

This applies in particular to the following:

- The discharge line should be fitted with a backwash loop (180° bend) located above the backwash level and should then flow by gravity into the collection line or sewer.
- The discharge line should not be connected to a down pipe.
- No other inflows or discharge lines should be connected to this discharge line.

## ATTENTION! The discharge line should be installed so that it is not affected by frost.

## 5

## Electrical Connection



Before commissioning, an expert should check that one of the necessary electrical protective devices is available. Earthing, neutral, earth leakage circuit breakers, etc. must comply with the regulations of the local electricity supply authority and a qualified person should check that these are in perfect order.

## ATTENTION! The power supply system on site must comply with VDE or other local regulations with regard to cross-sectional area and maximum voltage drop. The voltage stated on the nameplate of the pump must correspond to that of the mains.

The power supply cable must be protected by an adequately dimensioned slow-blow fuse corresponding to the rated power of the pump.



The incoming power supply as well as the connection of the pump itself to the terminals on the control panel must comply with the circuit diagram of the control panel as well as the motor connection diagrams and must be carried out by a qualified person.

All relevant safety regulations as well as general good technical practice must be complied with.

## ATTENTION! For use in the open air, the following VDE regulations apply:

Submersible pumps used outdoors must be fitted with a power cable of at least 33 feet length.

For pumps intended to be used in outdoor fountains, garden ponds and similar places, the pump is to be supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA.

## Please consult your electrician.

## 5.1 Temperature monitoring

Thermal sensors in the stator windings protect the motor from overheating.

XFP motors are fitted with bimetallic thermal sensors in the stator as standard, or as an option with a PTC thermistor.

## 5.2 Seal monitoring

XFP pumps are supplied as standard with a moisture sensor (DI), to detect and alert to the ingress of water into the motor and seal chambers (PE1 & PE2), or motor and dry chambers (PE3).

# NOTE! Running the pump with the thermal and/or moisture sensors disconnected will invalidate related warranty claims.



1

ABS submersible sewage pump XFP 80C - 201G

#### 5.3 **Wiring Diagrams**

U1 V1 W1 F1 F0 Di PE =

4 5 3 2

\_6





\_1) \_

2



Explosion-proof pumps may only be used in explosive zones with the thermal sensors connected (leads F0 & F1).

		2 3 PE ▼ 		(U1 W1 R S 			
60 Hz	1	2	3		4	<mark>.</mark>	5
20/6 <mark>22/4</mark> 28/4 35/4	D63,D68, D79,D80	-			D66,D62 <mark>,D7</mark>	7 <mark>,</mark> D85	-
45/2	D63,D79, D80	D64,D81	-		D66,D62,D7	7,D85,D86	
18/4W 28/4W 20/6W*	-	-			-		W60, W62
35/6 45/4 56/4 75/4 90/4 105/4 80/2 125/2	D63,D79, D80	D64,D81	-		D66,D62,D7	7,D85,D86	-
120/8 90/6 110/6 130/6		D64,D79	D63,D80,D81		D66,D62,D7	7,D85,D86	
160/6			D63,D64,D79	,D80,D81			1
200/6		-	D64,D79				
130/4	-	D64,D79	D63,D80,D81				-
150/4 185/4			D63,D64,D79	,D80,D81	D66,D62,D7	7,D85,D86	
210/4 250/4 185/2 200/2 300/2		-	D64,D79				
<b>D62</b> = 23	30 V 3~, DO	L D68 = 3	80 V 3~, Y∆	<b>D81</b> = 22	0 V 3~, YΔ	<b>W60</b> = 230	V 1~
<b>D63</b> = 22	20 V 3~, DO	L D77 = 4	<mark>460 ∨ 3~, DOL</mark> <b>D85</b> = 60		0 V 3~, DOL	<b>W62</b> = 208	V 1~
<b>D64</b> = 38	<b>D64</b> = 380 ∨ 3~, Y∆ <b>D79</b> = 3			<b>D86</b> = 46	0 V 3~, DOL		
<b>D66</b> = 20	08 V 3~, DO	L D80 = 2	20 V 3~, DOL				

abs

ABS submersible sewage pump XFP 80C - 201G

# 6 Commissioning

Before commissioning, the pump should be checked and a functional test carried out. Particular attention should be paid to the following:

- Have the electrical connections been carried out in accordance with regulations?
- Have the thermal sensors been connected?
- Is the seal monitoring device correctly installed?
- Is the motor overload switch correctly set?
- Does the pump sit correctly on the pedestal?
- Is the direction of rotation of the pump correct even if run via an emergency generator?
- Are the switching ON and switching OFF levels set correctly?
- Are the level control switches functioning correctly?
- Are the required gate valves (where fitted) open?
- Do the non-return valves (where fitted) function easily?

# 6.1 Types of operation and frequency of starting

All pumps of the XFP series have been designed for continuous operation S1 when either submerged or dry-installed.

## 6.2 Checking direction of rotation

When three phase units are being commissioned for the first time, and also when used on a new site, the direction of rotation must be carefully checked by a qualified person.



When checking the direction of rotation, the pump should be secured in such a manner that no danger to personnel is caused by the rotating impeller or by the resulting air flow. Do not place your hand into the hydraulic system!



When checking the direction of rotation, or when starting the unit, pay attention to the **START REACTION**. This can be very powerful and cause the pump to jerk in the opposite direction to the direction of rotation.

ATTENTION: When viewed from above, the direction of rotation is correct if the impeller rotates in a clockwise manner.



NOTE: The start reaction is anti-clockwise.

ATTENTION: If a number of pumps are connected to a single control panel then each unit must be individually checked.

ATTENTION: The mains supply to the control panel should have a clockwise rotation. If the leads are connected in accordance with the circuit diagram and lead designations, the direction of rotation will be correct.



## 6.3 Changing direction of rotation

The direction of rotation should only be altered by a qualified person.

If the direction of rotation is incorrect then this is altered by changing over two phases of the power supply cable in the control panel. The direction of rotation should then be rechecked.

## 7 Maintenance



Before commencing any maintenance work the pump should be completely disconnected from the mains by a qualified person and care should be taken that it cannot be inadvertently switched back on.

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When carrying out any repair or maintenance work, the safety regulations covering work in enclosed areas of sewage installations as well as good general technical pratices should be followed.



Under continuous running conditions the pump motor housing can become very hot. To prevent burn injury allow to cool down before handling.

ATTENTION!

The maintenance instructions given here are not designed for "do-it-yourself" repairs as special technical knowledge is required.

## 7.1 General maintenance instructions

ABS submersible pumps are reliable quality products, each being subjected to careful final inspection. Lubricated-for-life ball bearings, together with monitoring devices, ensure optimum pump reliability provided that the pump has been connected and operated in accordance with the operating instructions. However, should a malfunction occur, do not improvise, but ask your ABS Customer Service Department for assistance. This applies particularly if the pump is continually switched off by the current overload in the control panel, by the thermal sensors of the thermo-control system, or by the seal monitoring system (DI).

Regular inspection and care is recommended to ensure a long service life. Service intervals vary for XFP pumps depending on installation and application. For recommended service interval details contact your local ABS Service Centre. A maintenance contract with our Service Department will guarantee the best technical service.

When carrying out repairs, only original spare parts supplied by the manufacturer should be used. ABS warranty conditions are only valid provided that any repair work has been carried out in an ABS approved workshop and where original ABS spare parts have been used.

# 7.3 Lubricant changing (PE1 & PE2)

The seal chamber between the motor and the hydraulic section has been filled with oil at manufacture.

An oil change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or motor chamber.
- · After repair work that requires draining of the oil.
- If the pump is being taken out of service the oil should be changed before storage.

## 7.3.1 Instructions on how to drain and f II the seal chamber

1. Loosen the plug screw (a) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to

contain any possible spray of oil as the pump de-pressurises.

Place the pump in a horizontal position, sitting on its discharge flange, with the motor housing supported from underneath.
 To prevent the pump from toppling over ensure it is supported

 $\triangle$ 

to lie flat on its discharge flange.

- 3. Position an adequate container to receive the waste oil.
- 4. Remove the plug screw and seal ring (a) from the drain hole.
- 5. After the oil is fully drained lay the pump flat, and rotate so that the drain hole is positioned to the top.

When in this position the pump must be held by hand, or supported at both sides, to prevent it from toppling over.

- 6. Select the required volume of oil from the quantities table (p.17) and slowly pour into the drain hole.
- 7. Refit the plug screw and seal ring.





DRAIN

FILL



## 7.4 Lubricant changing (PE3 - version without cooling jacket)

The seal chamber between the motor and the hydraulic section has been filled with glycol at manufacture. The water and propylene glycol is frost resisting down to 5 °F.

A glycol change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or dry chamber.
- After repair work that requires draining of the glycol.
- If the pump is being taken out of service the glycol should be changed before storage.
- In the case of extreme ambient temperatures below -15 °C / 5 °F (e.g. during transport, storage, or if the pump is out of duty) the cooling liquid must be drained. Otherwise the pump may be damaged.

## 7.4.1 Instructions on how to drain and f II the seal chamber

1. Loosen the plug screw (a) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to contain any possible spray of glycol as the pump de-pressurises.

- Secure a hoist to the lifting hoop. Lay the pump on its side and rotate until the drain plug is underneath.
  Note: because there is insufficient space to place a waste container underneath the drain plug the waste must be drained into a sump.
- 3. Remove the plug screw and seal ring (a) from the drain hole.
- 4. After the glycol is fully drained, place the pump in a horizontal position sitting on its discharge flange with the motor housing supported from underneath.

To prevent the pump from toppling over ensure it is supported to lie flat on its discharge flange.

6. Refit the plug screw and seal ring.

5. Select the required volume of glycol from the quantities table (p.17) and slowly pour into the drain hole.



(a) Drain plug

DRAIN

FILL


### 7.5 Coolant changing (PE3 - version with cooling jacket)

The cooling system (seal chamber and cooling jacket) has been filled with glycol at manufacture. The water and propylene glycol is frost resisting down to 5 °F.

A glycol change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or dry chamber.
- After repair work that requires draining of the glycol.
- If the pump is being taken out of service the glycol should be changed before storage.
- In the case of extreme ambient temperatures below -15 °C / 5 °F (e.g. during transport, storage, or if the pump is out of duty) the cooling liquid must be drained. Otherwise the pump may be damaged.

### 7.5.1 Instructions on how to drain and f II the cooling system

1. Loosen the plug screw (a) or (b) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to contain any possible spray of glycol as the pump de-pressurises.

2. Secure a hoist to the lifting hoop. Tilt the pump to 45° with the drain plug underneath.

**Note:** because there is insufficient space to place a waste container underneath the drain plug by the completion of step 5, the waste must be drained into a sump.

- 3. Remove the plug screw and seal ring (a) from the drain hole.
- 4. Glycol will empty from the cooling jacket chamber.
- 5. When the flow stops, continue to gradually tilt the pump until horizontal. This will drain the remaining glycol from the seal chamber.

**Note:** draining the glycol entirely with the pump in a horizontal position would result in some glycol being retained in the cooling jacket.

- 6. After the glycol is fully drained raise the pump into its upright position and refit the plug screw and seal ring (a).
- 7. Remove the plug screw and seal ring (b) from the fill hole.
- 8. Select the required volume of glycol from the quantities table and slowly pour into the fill hole.
- 9. Refit the plug screw and seal ring (b).



(a) Drain (b) Fill





### 7.6 Oil and glycol quantities (litres)

	Motor	Lubricant		Coolant	
XFP		(without cooling jacket)		(with cooling jacket)	
		Oil	Water and propylene glycol	Water and propylene glycol	
PE 1	PE45/2 PE22/4 PE28/4 PE35/4 PE18/4W PE28/4W PE20/6 PE20/6W	<mark>0.43</mark>	-	-	
PE 2	PE80/2 PE125/2 PE45/4 PE56/4 PE75/4 PE90/4 PE105/4 PE35/6	0.68	-	_	
PE3	PE185/2 PE200/2 PE300/2 PE130/4 PE150/4 PE185/4 PE210/4 PE90/6 PE110/6 PE130/6 PE160/6 PE120/8 PE250/4 PE2200/6	-	8.0	16.5	
	PE200/6			18.0	

Volume ratio: 86% oil or water/propylene glycol : 14% air

### Specif cation:

Lubricant: white mineral oil VG8 FP153C or 70% water/30% glycol Coolant: 70% water/30% glycol

### 7.7 Bottom plate adjustment

At manufacture, the bottom plate is fitted to the volute with the correct clearance gap set between the impeller and the bottom plate (for optimum performance max 0.2 mm).

### 7.7.1 Instructions on how to adjust the bottom plate

To reset the clearance gap following wear:

(Note: when adjusting PE3 pumps, steps 1, 2 and 3 do not apply)

- 1. Check the position of the alignment notch (e) in the fixing lug to determine if the bottom plate is in the factory pre-set position or if the clearance gap has been previously adjusted. If previously adjusted proceed to Step 4.
- 2. Remove the three screws (c) securing the bottom plate to the volute. Attention: if, due to corrosion, the bottom plate does not release freely from the volute, DO NOT force it free by tightening the adjusting grub screws (d) against the fixing lugs on the volute as this could damage the lugs on the bottom plate beyond repair! In that case, first remove the volute from the motor housing by releasing the three securing screws (f) and then remove the bottom plate by tapping it free from inside the volute using a mallet and block of wood.
- 3. Rotate the bottom plate anti-clockwise through 45° from the pre-set position (a) to the secondary alignment position (b) and refit the securing screws.
- 4. Loosen the adjusting grub screws (d) and tighten the securing screws in the bottom plate evenly until the impeller will lightly, but freely, rub against the bottom plate when rotated by hand.
- 5. Tighten the grub screws fully to secure the bottom plate in position (max. 33 Nm).









### 7.8 Bearings and Mechanical Seals

XFP pumps are fitted with lubricated-for-life ball bearings. Shaft sealing is by means of double mechanical seals.

### ATTENTION: Once removed, bearings and seals must not be re-used, and must be replaced in an approved workshop with genuine ABS spare parts.

### 7.9 Changing the power cable (PE1 & PE2)

To facilitate quick and easy changing or repair of the power cable, the connection between the cable and motor is by means of an integrated 10-pole terminal block.



To be carried out only by a qualified person, in strict adherence to relevant safety regulations.

### 7.10 Cleaning

If the pump is used for transportable applications, then in order to avoid deposits of dirt and encrustation it should be cleaned after each usage by pumping clear water. In the case of fixed installation, we recommend that the functioning of the automatic level control system be checked regularly. By switching the selection switch (switch setting "HAND") the sump will be emptied. If deposits of dirt are visible on the floats then these should be cleaned. After cleaning, the pump should be rinsed out with clear water and a number of automatic pumping cycles carried out.

### 7.11 Venting of the volute

After lowering the pump into a sump full of water, an air lock may occur in the volute and cause pumping problems. To clear the air lock, raise the pump in the medium and then lower it again. If necessary, repeat this venting procedure.

We strongly recommend that dry-installed XFP pumps are vented back into the sump by means of the (drilled and tapped) hole provided in the volute.

### 8 Troubleshooting Guide

Fault	Cause	Fix
Pump does not run	Moisture sensor shutdown.	Check for loose or damaged oil plug, or locate and replace faulty mechanical seal / damaged o-rings. Change oil. <sup>1)</sup>
	Level control override.	Check for float switch that is faulty or tangled and held in OFF position in sump.
	Impeller jammed.	Inspect and remove jammed object. Check gap between impeller and bottom plate and adjust if necessary.
	Gate valve closed, non-return valve blocked.	Open gate valve, clean blockage from non-return valve.
Pump switching on/off intermittently	Temperature sensor shutdown.	Motor will restart automatically when pump cools down. Check thermal relay settings in control panel. Check for impeller blockage. If none of above, a service inspection is required. <sup>1)</sup>
Low head or flow	Wrong direction of rotation.	Change rotation by interchanging two phases of the power supply cable.
	Gap too wide between impeller and bottom plate	Reduce gap (see page 13).
	Gate valve partially open.	Open valve fully.
Excessive noise or vibration	Defective bearing.	Replace bearing. <sup>1)</sup>
	Clogged impeller.	Remove and clean hydraulics.
	Wrong direction of rotation.	Change rotation by interchanging two phases of the power supply cable.
High voltage	Water inside motor.	Replace stator. <sup>1)</sup>
test failure	Stator insulation damaged.	Replace stator. <sup>1)</sup>
	Power cable or lead damaged.	Replace power cable. <sup>1)</sup>
Ohms test failure	Stator failure.	Repair/replace stator. <sup>1)</sup>



Before commencing any inspection or repair work the pump should be completely disconnected from the mains by a qualified person and care should be taken that it cannot be inadvertently switched back on.

<sup>1)</sup> Pump must be taken to approved workshop.

SERVICE LOG				
Pump Type:		Serial No:		
Date	Hours of Operation	Comments	Sign	

# **SERVICE LOG**

Date	Hours of Operation	Comments	Sign

# **SERVICE LOG**

Date	Hours of Operation	Comments	Sign





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### SECTION 12e.3: EQUALIZATION TANK TRANSFER PUMPS

### P&ID: Item #: P-0211, P-0212

Unit Details: Keen Grinder Pump Model KG2-23, KL1 Lift Out Rail System and lifting chain 2Hp, 3Ø/60Hz/460V 30 GPM @ 25' TDH

Manufacturer: Keen Pump Co. 471 E. State Route 250 East Ashland, Ohio 44805 Phone: (419) 207-9400 Fax: (419) 207-8031 www.keenpump.com

Local Distributor/Contact:

Eastern Reliability P.O. Box 68 Fairhaven, MA 02719 Phone: (508) 992-9189 www.easternreliability.com THIS PAGE INTENTIONALLY LEFT BLANK



# KG2-23

# 2HP Dual Seal Grinder Pump, Three-Phase

The light purr The rail s The free purr

The KEEN PUMP **KG2-23** series centrifugal grinder pumps easily handle residential, light commercial or industrial sanitary waste, reducing it to a fine slurry. The **KG2-23** pump is designed for use in pressure sewer applications or any piping network.

The **KG2-23** grinder pump retrofits into many existing competitor pump installations. The **KG2-23** pump operates with the same control panel and installation piping / rail system.

The recessed vortex impeller design of the **KG2-23** grinder pump provides troublefree, non-overloading operation over the entire performance curve. The **KG2-23** pump produces capacities to 43 gpm with heads to 106 feet.

The **KG2-23** series pump features:

- Interchangeable into Competitor Installations
- Dual Silicon-Carbide Shaft Seals
- Pressed-In Motor with Internal Overload Protection
- 3-Bearing Shaft Support
- Internal Moisture Detection
- Strong 2hp Motor, Voltage (208/230/460)



# Features and Benefits

### 1. Watertight Cable Entrance

Agency-approved, watertight strain relief cord grip with compression grommet protects outer cord jacket. Epoxy-filled inner cord cap provides anti-wicking moisture protection to the motor even if powercable is cut or damaged.

### 2. Modular Pump Design

Commonality of parts across the Keen product line minimizes the amount of parts required for servicing. Heavy-duty ASTM A48, Class 30 cast iron components.

### 3. Strong Motor

Powerful high-torque motor for reliable pump operation. Pressed stator securely holds motor and efficiently transfers heat. Class F insulation with overload protection in oil-filled chamber for cool operation and long motor life.

### 4. 3-Bearing Support

Motor / Pump shaft securely held with upper and lower ball bearing plus additional sleeve bearing in lower seal chamber. Long 50,000 hour B-10 bearing life.

### 5. Double Mechanical Seal Protection

Dual silicon carbide mechanical shaft seals provide twice the moisture protection for the motor. Dual seals are housed in a secondary oil-filled seal chamber. Tougher silicon carbide seals better handle sand, grit and abrasive materials.

### 6. Moisture Detection

Seal leak probe signals alarm in control panel for scheduled maintenance.

### 7. Non-Overloading Hydraulic Design

The recessed centrifugal impeller allows 100% performance curve operation from shut-off to maximum flow without damage to the pump or system. The recessed vortex impeller is out of the passageway of fluid flow, eliminating concerns of blockage or wear.

### 8. Proven Grinder Assembly

Hardened (Rockwell 56-60) stainless steel grinder assembly has 30+ years proven field experience. The reversible grinder ring and grinder impeller effectively reduce solids into a fine slurry, easily passable in a piping system without concerns of clogging. Highly efficient 16,600 cuts/second.

### 9. Easy Piping Connection

Removable 1-1/4"NPT connection flange for simple and easy connection to discharge piping.

### 10. Accessories

Stainless steel lifting handle included. Anti-vibration rubber mounting feet optional.





471E State Route 250 East · Ashland, Ohio 44805 419.207.9400 fax 419.207.8031 www.keenpump.com 374





# **KEEN PUMP**

### 2 HP Grinder Pumps

KG2-23

### **Performance Specifications**

<u>Pump Model</u> – Pump shall be of the centrifugal type, KG2-23, with an integrally built-in grinder unit and submersible type motor. The grinder unit shall be capable of macerating all material in normal domestic and commercial sewage, including reasonable amounts of foreign objects such as sanitary napkins, disposable diapers, thin rubber, small wood, plastic and the like to a fine slurry that will easily pass through the pump and 1-1/4" NPT discharge.

<u>Operating Conditions</u> – The pump shall have a capacity of \_\_\_\_\_ GPM at a total head of \_\_\_\_\_ Feet, and shall use a motor rated at 2 HP and 3450 RPM.

**Pump Impeller** – Ductile iron and threaded on a stainless steel shaft. The impeller shall be of the recessed vortex type to provide an unobstructed passage through the volute for the ground solids.

<u>**Grinder Construction**</u> – Both grinder impellers and shredding ring shall be of 440C stainless steel hardened to 56-60 Rockwell C. The grinder assembly shall consist of a grinder impeller and shredding ring mounted directly below the volute passage. The grinder impeller is threaded to a stainless steel shaft, locked with a screw and washer. The shredding ring shall be pressed into the cast iron volute for easy removal. All grinding of solids shall be from the action of the grinder impeller against the shredding ring. There shall be 16,600 cuts / second.

<u>Seals</u> – Type 21, dual mechanical seal construction mounted in tandem, shall protect the motor. Primary seal shall be silicon / carbide. Secondary seal shall be silicon / carbide. The seal face shall be lapped to a flatness of one light band. An electrode shall be mounted in the seal chamber to detect water entering the chamber through the lower seal. Water in the chamber shall cause a red light to turn on at the control box. This signal shall not stop the motor, but shall act as a warning only, indicating service is required.

<u>Motor</u> – The pump motor shall be of the submersible type, rated 2 HP, 3450 RPM. The motor shall be for 60 Hz, either 208, 230 or 460 volt, three-phase operation. Major motor operating temperature must not exceed Class B ratings.

The stator winding shall be of the open type with Class F insulation. The stator shall be pressed into the cast iron motor housing. Winding housing shall be filled with clean, high dielectric oil that lubricates bearings and seals, transferring heat from windings and rotor to the outer cast housing. Air-filled motors, which do not have the superior heat dissipating capabilities of oil-filled motors, shall not be considered equal.

The motor shall have two heavy-duty ball bearings and one sleeve bearing to support the pump shaft, taking radial and thrust loadings. Ball bearings shall be designed for a minimum 50,000 hours B-10 life. The stator shall be pressed into the motor housing. The common motor pump and grinder shaft shall be of 416 SST, threaded to take the pump and grinder impeller.

Three-phase motors contain temperature sensors with (2) two wires for attachment to the control panel.

<u>Power Cord</u> – The motor power cord shall be 12 Ga. SJOW/SJOWA or SOOW. The cable jacket shall be sealed at the motor entrance by means of a rubber compression washer and compression nut. An epoxy filled cord cap seals the outer cable jacket and individual leads to prevent water from entering the motor housing. Individual conductor strands shall be soldered within the epoxy seal.

# **KL18 KL2** <u>Lift-Out Rail</u> System





- **KL2: 2" NPT Pump Connection**
- 2" NPT Vertical Discharge
- <sup>3</sup>/<sub>4</sub>" or 1" Stainless Steel Guide Rails
- \* Stress-Free Rail System
- **Durable Cast Iron Base and Lift-Out Flange**
- **Stainless Steel Pump Adapter**
- Stainless Steel Guide Plate

The base elbow provides guick and easy installation and removal of most vertical discharge:

- $\neq$  **KL** - 1 or 2 HP Grinder Pumps
- ≠ KL2 - 2" Sewage Pumps

Quick connect stainless steel pump adapters.

- **≠** Thread adapter to pump
- ≠ Bolt adapter to lift-out elbow

Taper base arms support lift-out elbow and pump.

- ≠ Positive, tight, o-ring sealing face
- $\neq$  Automatic sealing, pulls mating faces together
- $\neq$  Carries 100% pump loading, no stress on rails





# **KL1 & KL2**

### KL1: 1-1/4" NPT Pump Connection

**KL2: 2" NPT Pump Connection** 

2" NPT Vertical Discharge

3/4" Stainless Steel Guide Rails

**Stress-Free Rail System** 

Durable Cast Iron Base And Lift-Out Flange

**Stainless Steel Pump Adapter** 

**Stainless Steel Guide Plate** 

# KL1-CV Lift-Out Rail System

\*



- 1-1/4" NPT Pump Connection
- 2" NPT Vertical Discharge
- <sup>3</sup>⁄<sub>4</sub>" or 1" Stainless Steel Guide Rails
- \* Stress-Free Rail System
- \* Durable Cast Iron Base and Lift-Out Flange
  - Stainless Steel Pump Adapter
- Stainless Steel Guide Plate

The base elbow provides quick and easy installation and removal of most vertical discharge:

**KL1-CV** - - - 1 or 2 HP Grinder Pumps

### Quick connect stainless steel pump adapters.

- **≠** Thread adapter to pump
- **≠** Bolt adapter to lift-out elbow

Taper base arms support lift-out elbow and pump.

- ≠ Positive, tight, o-ring sealing face
- ≠ Automatic sealing, pulls mating faces together
- ≠ Carries 100% pump loading, no stress on rails





471 E State Route 250 East, Ashland, Ohio 44805 PH: 419-207-9400 FX: 419-207-8031

# INSTALLATION AND SERVICE INSTRUCTIONS AND REPAIR PARTS LIST FOR 2HP & 2.5HP CENTRIFUGAL SUBMERSIBLE GRINDER SEWAGE PUMPS



# MODELS: 2hp "K(F/H)G2" & 2.5hp Series

# KG2-115

• 115 Volt, 1- Phase, Internal Capacitor Kit

# K(H)G2-21C Series

• 200 / 230 Volt, 1- Phase, Internal Capacitor Kit

## K(H)G2-21 Series

• 200 / 230 Volt, 1- Phase, External Capacitor Kit

# K(H)G2-23 Series

• 200 / 230 / 460 Volt, 3- Phase

# **KFG2-21 Series**

• 200 / 230 Volt, 1- Phase, External Capacitor Kit

## **KFG2-23 Series**

• 200 / 230 / 460 Volt, 3- Phase

# KHG25-21 Series (2.5hp)

• 200 / 230 Volt, 1-Phase, External Capacitor Kit

# KHG25-23 Series (2.5hp)

• 200 / 230 / 460 Volt, 3- Phase

# KHHG25-21 Series (2.5hp)

• 200 / 230 Volt, 1-Phase, External Capacitor Kit

# KHHG25-23 Series (2.5hp)

### • 200 / 230 / 460 Volt, 3- Phase Read all instructions in this manual before operating pump. Most accidents can be avoided by using COMMON SENSE.

Please Read This Before Installing Or Operating Pump. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols:

IMPORTANT! Warns about hazards that can result



in personal injury or Indicates factors concerned with assembly, installation, operation, or maintenance which could result in damage to the machine or equipment if

ignored.

CAUTION I Warns about hazards that can or will cause minor personal injury or property damage if ignored. Used with symbols below.

WARNING ! Warns about hazards that can or will cause serious personal injury, death, or major property damage if ignored. Used with symbols below.





Extremely hot - Severe burnes can occur on contact. Hazardous fluids can Hazard-

ous pressure, eruptions or ex-

plosions could cause personal injury or property damage.

Biohazard can cause serious personal injury.



Rotating machinery Amoutation or severe laceration can result



Hazardous voltage can shock, burn or cause deeth.

Only qualified personnel should install, operate and repair pump. Any wiring of pumps should be performed by a qualified electrician.



WARNING ! - To reduce risk of electrical shock, pumps and control panels must be properly grounded in accordance with the National Electric Code (NEC) or the Canadian Electrical Code (CEC) and all applicable state, province, local codes and ordinances.

WARNING! - To reduce risk of electrical shock, always disconnect the pump from the power source before handling or servicing. Lock out power and tag.

Prevent large articles of clothing, large amounts of chemicals, other materials or substances such as are uncommon in domestic sewage from entering the system.

During power black-outs, minimize water consumption at the home(s) to prevent sewage from backing up into the house.

Always keep the shut-off valve completely open when system is in operation (unless advised otherwise by the proper authorities). Before removing the pump from the basin, be sure to close the shut-off valve. (This prevents backflow from the pressure sewer.)

Keep the control panel locked or confined to prevent unauthorized access to it.

If the pump is idle for long periods of time, it is advisable to start the pump occasionally by adding water to the basin.



CAUTION! Pumps build up heat and pressure during operation-allow time for pumps to cool before handling or servicing.



WARNING! - DO NOT pump hazardous materiais (flammable, caustic, etc.) unless the pump is specifically designed and designated to handle them.

Do not block or restrict discharge hose, as discharge hose may whip under pressure.



connected.

WARNING! - Keep clear of suction and discharge openings. DO NOT insert fingers in pump with power

Make sure lifting handles are securely fastened each time before lifting. Do not operate pump without safety devices in place Always replace safety devices that have been removed during service or repair.

Do not exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat.

Secure the pump in its operating position so it can not tip over, fall or slide.

Cable should be protected at all times to avoid punctures, cut, bruises and abrasions - inspect frequently.

Never handle connected power cords with wet hands.



To reduce risk of electrical shock, all wiring and junction connections should be made per the NEC or CEC and applicable state or province and local codes.



Submersible Pumps are not approved for use in swimming pools, recreational water installations, decorative fountains or any installation where human contact with the pumped fluid is common.

Do not remove cord and strain relief. Do not connect conduit to pump.



Products Returned Must Be Cleaned, Sanitized, Or Decontaminated As Necessary Prior To Shipment, To Insure That Employees Will Not Be Exposed To Health Hazards In Handling Said Material. All Applicable Laws And Regulations Shall Apply.



Bronze/brass and bronze/brass fitted pumps may contain lead levels higher than considered safe for potable water systems. Various government agencies have determined that leaded copper alloys should not be used in potable water applications. For non-leaded copper alloy materials of construction, please contact factory.



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KEEN PUMP is not responsible for losses, injury or death resulting from a failure to observe these safety precautions, misuse, abuse or misapplication of pumps or equipment.

### WARNING!

# THE PUMP MUST BE WIRED BY A QUALIFIED ELECTRICIAN, USING AN APPROVED STARTER BOX AND SWITCHING DEVICE.

On 3 phase pumps only, "Motor Protection" must be provided by the installer. All 3 phase pumps must be installed with magnetic starters having 3 leg overload protection in accordance with the NEC (National Electric Code). For duplex installations, both pump motors must have separate overload protection.

Pumps with seal leak detectors must be connected to the proper control circuitry.

### DANGER!

HAZARDOUS MOVING PARTS. To reduce risk of injury, disconnect power before servicing. Never put fingers near grinder impeller or in pump inlet when pump cord is connected or pump is operating.

For use with maximum 140 degrees F liquid.

### DANGER!

In the initial installation, before sewage is admitted to the basin, there is no danger on entering the basin. AFTER SEWAGE HAS BEEN IN THE BASIN, THERE IS DANGER. Sewage water produces methane and hydrogen sulfide gasses, both of which are highly poisonous. A breathing device may be required. Never enter the basin unless cover is open and outside blower is used to force fresh air into the basin. Also the worker in the basin must wear a harness attached to the surface so he can be pulled out in case of asphyxiation. NEVER WORK ALONE!

### WARNING!

Do not exceed working load limit of lifting chain, cable or rope. Do not use lifting chain, cable or rope where failure could result in loss of life.

Examine all lifting devices, chain, cable or rope for damage before and after each lift. Do not use any lifting devices that are not rated for and designed to lift the weights involved with these pumps. DO NOT LIFT PUMP BY POWER CORD.

Do not install or remove pump with person(s) in the basin.

This pump is designed to handle materials which could cause illness or disease through direct exposure. Wear and use protective clothing when working on the pump or piping.

### WARNING !

Any wiring to be done on pumps should be done by a qualified electrician.

NEVER operate a pump with a power cord that has frayed or brittle insulation.

NEVER let cords or plugs lay in water.

NEVER handle connected power cords with wet hands.

NEVER be in contact with the liquid being pumped while pump cord is connected to electrical supply.

Only qualified personnel should install, operate or repair pump.

- Explosives
- Flammable Material
- Lubricating Oil and/or Grease
- Chemicals, Solvents, etc.
- Gasoline
- Any Petroleum Product

Regulatory agencies advise that the following items should not be introduced into any sewer:

- Glass
- Metal
- Diapers
- Clothing, socks, rags, etc.
- Plastic objects (toys, utensils, etc.)
- Sanitary napkins or tampons

DO NOT pump without safety devices in place.

For hazardous locations, use pumps listed and classified for such locations.

DO NOT use non-explosion rated pumps in locations considered hazardous in accordance with the National Electric Code, ANSI/NFPA 70-1993.

#### IMPORTANT!

KEEN PUMP is not responsible for losses, injury or death resulting from failure to observe these safety precautions.

## **SPECIFICATIONS**

# K(H)G2-23 & KFG2-23 2HP, 200/230/460 Volt, 3-Phase





230	DHM	
WHITE	BLACK	3.1
WHITE	RED	3.1
BLACK	RED	3.1
460		
WHITE	BLACK	12,4
WHITE	RED	12.4
BLACK	RED	12.4

# **PUMP SPECIFICATIONS**

DISCHARGE	1-1/4" NPT, Vertical 120 degrees F (Continuous) 140 degrees F. (Intermittent)				
MOTOR HOUSING CORD CAP VOLUTE SEAL PLATE	Cast Iron, ASTM A-48, Class 30 Cast Iron, ASTM A-48, Class 30 Cast Iron, ASTM A-48, Class 30 Cast Iron, ASTM A-48, Class 30				
IMPELLER	. Ductile Iron, A 12 vane, Vorte	STM A-48, ex with Pun	Class 35B np-out Vanes, Dynan	nically Balanced	
SHREDDING RING	. Hardened 440 56-60 Rockwe	C Stainless II C	s Steel		
GRINDER IMPELLER	Hardened 4400 56-60 Rockwe	C Stainless II C	Steel		
SHAFT	. 416 Stainless	Steel			
SHAFT SEAL	. Mechanical	Main (Me Carbide – Silicon– S	otor) Rotating Face tationary Face	Secondary (Pump) Carbide – Rotating Face Silicon – Stationary Face	
	Buna-N - Elast 300 Series Stai	tomer inless Stee	I - Hardware		
BEARING (UPPER) BEARING (LOWER)	Single Row, Ba Single Row, Ba	all, Oil Lubr all, Oil Lubr	icated ricated		
HARDWARE O-RINGS	. 300 Series Sta . Buna-N	inless Stee	91		
CORD	. 12 AWG, Type	SJOW or S	SOOW		
	20' Length Sta	ndard. Oth	er Lengths Available	).	
CORD ENTRY	Triple Sealed D Compression G Epoxy Potted – Butt Connector	esign Frommet – Inner Con – Inner Wi	Outer Jacket Seal ductor Seal ire Strand Wicking B	lockage	
MOTOR (SINGLE PHASE)	2 HP, 3450 RPI Dual voltage, 2	V, 60 Hz 00 / 230 vol	lts		
	Includes Overlo Oil Filled, Class	oad Protect s F	tion in the Motor.		
	Capacitor Star	t / Capacito	or Run Run Canacitor		
KG2-115 K(H)G2-21C	200 mfd. 125 V/	AC	70 mfd. 250 VAC		
K(H)G2-21, KFG2-21 KH(H)G25-21	216 mfd, 250 V/ 300 mfd, 250 V/	AC AC	20 mfd, 370 VAC 30 mfd, 370 VAC		
MOTOR (THREE PHASE)	. 2 HP, 3450 RP Tri-voltage, 200 On-Winding te in control pan Oil Filled, Clas	M, 60 Hz 0 / 230 / 460 emperature el s F	0 volts sensor, requires ter	nperature sensor circuitry	
OPTIONAL EQUIPMENT	. Seal Materials Additional Cal Impeller Trims	ble Length	S		

# Installation

### USAGE:

The 2 HP & 2.5 HP grinder pumps are for pumping domestic sewage. One pump can handle the sewage from a maximum of 2 homes.

These pumps are not to be used for pumping commercial or industrial sewage from factories, schools, motels, apartments, etc..

This pump is intended to grind and pump all normal sewage for home use. It will handle reasonable quantities of disposable diapers, sanitary napkins, paper towels, rubber material, wood, cigarette butts, string, plastic and other material not normally found in sewage.

### CAUTION!

Pump is not to be disassembled in the field except at certified service stations or at the factory. Warranty is void if pump is taken apart for any reason other than to replace grinder impeller and grinder ring, which is covered in these instructions.

### PACKAGING

Each pump is packaged with 30 feet of power cord in a carton that is marked with the Model Number. Longer cords are available – consult factory.

### **INSPECTING PUMP**

Before making any piping or electrical connections, check pump for any shipping damage. Turn grinder impeller to be sure it is free. DO NOT TURN IMPELLER WITH FINGERS AS EDGES ARE SHARP. Use allen wrench in the impeller screw to turn the impeller.

### CAUTION!

No persons should be in the basin when pump is lowered into position! DO NOT lift pump in a manner where failure could result in loss of life.

After pump is installed in basin, NEVER WORK ON MOTOR OR GRINDER UNIT WITHOUT DISCONNECTING MOTOR LEAD WIRES FROM CONTROL PANEL. DO NOT RELY UPON OPENING THE CIRCUIT BREAKER ONLY!

### ELECTRICAL:

### MOTOR OVERLOAD PROTECTION

Single phase motors are provided with an on-winding thermal overload switch. If motor overloads or overheats for any reason, the switch opens, stopping motor. As soon as the motor cools to normal temperature, the switch automatically closes and restarts motor.

### MOISTURE DETECTION

All 2 HP, dual seal grinder pumps with external start kit or 3-phase, contain an electrode for detecting water within the unit. The electrode is housed within the secondary seal chamber, isolated from the motor chamber. If the electrode detects water within the oil-filled housing, it will close the circuit to the red alarm light in the control panel, indicating the pump must be serviced before the upper seal fails.

### **MOTOR POWER CORDS**

Pump models with seal leak detector, single phase use a 12AWG-5C cord, three phase use a 12AWG-4C cord. The three power conductors are BLACK, WHITE and RED. The ORANGE conductor connects to the seal leak probe and GREEN conductor connects to the ground screw inside the cord cap.

For single phase, BLACK is "Common" WHITE is "Run" RED is "Start".

### CONTROL POWER CORD (3-PHASE) All pump models use an 18AWG-4C cord.

The BLACK & WHITE are thermal detection. ORANGE is moisture detection. The GREEN wire is for ground connection.

### **IMPORTANT!**

Ground wires must be connected in the control box to grounding bar, which is connected to a good suitable ground. MOTOR IS NOT SAFE UNLESS PROPERLY GROUNDED.

IMPELLER ROTATION: When looking at the bottom of the pump and through the inlet of the volute, rotation of the impeller is COUNTER-CLOCKWISE.

# TROUBLESHOOTING

The troubles listed below are potential problems involving the pump. Other troubles can occur from faulty control box operation. Consult control box instructions for troubleshooting list involving the control box.

PROBLEM	PROBABLE CAUSE
Pump will not run.	Tripped breaker, blown fuse, poor electrical connection, interruption of power, improper power supply.
	On single phase pumps, electronic start switch or capacitors blown. Overload in motor tripped.
	Solid material lodged in pump inlet.
Pump runs, but does not pump liquid from basin.	Pump impeller may be air locked. Start and stop pump several times to purge air. Check to ensure vent hole in volute is open and clean. Lower "OFF" float may be set too low, allowing air into pump. Pump inlet or valves in discharge pipe may be clogged. Discharge valve may be closed.
Pump hums, but does not run.	Incorrect voltage.
	Pump inlet plugged. Cutter jammed or loose on shaft, worn or damaged.
Pump delivers low volume	Low voltage.
of water.	Discharge restricted.
	Check valve stuck closed or installed backwards. Pump motor damaged / worn.
	Pump may be air locked.
	Cutter loose or jammed on shaft, worn or damaged.
Pump is noisy.	Grinder impeller may be rubbing against grinder ring due to misalignment, bent shaft or object stuck in impeller. Grinder assembly may be partially clogged. Pump cavitation due to low discharge pressure.
Pump cycles frequently.	Check valve stuck closed or installed backwards.
	Ground water entering basin. Fixtures are leaking.
Pump will not turn off.	Float switch defective or movement restricted.
	H-O-A switch in panel is in "HAND" position. Pump may be air locked.
	Excessive inflow / pump not sized for the application.
Grease and solids accumulated in basin and	Pump "ON" switch may be set too high. Debris may have accumulated around lower float weight causing pump
will not pump out.	to turn off too soon. Clean debris away from weight and cord.
Red light illuminated at control box.	Moisture detection in double seal pumps indicating service is required. Lower seal has failed. Secondary seal still functioning.
Circuit breaker trips.	Electrical short to ground. Check troubleshooting in control panel before pulling pump.
	Check all electrical cords for damage. Pull pump and take resistance readings of motor to determine if problem is in the pump or control box.

### **REPLACING GRINDER IMPELLER AND SHREDDING RING**

Note: This is the only disassembly operation permitted in the field.

All other repairs must be performed at an authorized service center or the factory.

### STANDARD TOOLS REQUIRED:

- Standard socket wrench set.
- Standard set of open end wrenches.
- Hammer.
- Vise grip pliers.
- Allen head socket set.
- Screwdrivers.
- Wire brush.

CAUTION – Disconnect all power and control wires to motor at the control panel before starting the disassembly operations. Do not rely upon opening the circuit breaker only.

**IMPORTANT – Pump should be sanitized with bleach before starting work.** 

Pump should be thoroughly cleaned of trash and deposits before starting disassembly operations.

Wear protective gloves and clothing.

Always use a rag on the impeller when turning to prevent cutting hands on the sharp edges of the shredding ring.

### DISASSEMBLY OF SHREDDING RING AND GRINDER IMPELLER

- 1. Hold the grinder impeller by prying against the impeller cutting bar and remove the allen head cap screw from the end of the shaft.
- 2. Use a large screwdriver in the slot end of the shaft and tap (counterclockwise) on one of the large cutter vanes with a hammer. Tap in a counterclockwise direction (thread is right hand).
- 3. If the impeller removes easily, clean and replace if worn.
- 4. Make sure the pump impeller has not loosened when the grinder impeller was removed. This can be checked on reassembly of grinder impeller and shredding ring. The tips of the impeller cutter vanes should extend 1/8" below the bottom of the shredding ring. If the distance is greater, the pump impeller has loosened. If the distance is less, the shredding ring is not properly seated.
- 5. After the volute case has been removed, insert screwdriver in slot end of shaft and tap hammer against the outer vane of the ductile iron pump impeller (clockwise) to ensure it is threaded tight against shoulder on shaft.
- 6. Use large screwdriver to tap stainless steel cutter ring from cast iron volute.
- 7. Clean all threads with a wire brush and file smooth any nicked threads. Use NEVER-SEEZE or other graphite compound on threads before replacing grinder impeller.
- 8. Make sure allen head cap screw in bottom of pump shaft is tight. Make sure the impeller turns freely by hand after reassembly. Some drag will be present due to the shaft seals. There should not be any binding or tight spots when turning the grinder impeller.

# "K(H)G2-23" & "KFG2-23"



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# <u>"K(H)G2-23" & "KFG2-23"</u>

REF. NO.	DESCRIPTION	QTY.	PART NUMBER
1	Assy, Cord Cap, 2HP Grinder for Cablesub 147, 20 ft. length cord.	1	KG2099-147
2	Screw, Cap, 1/2-13UNC x 1" LG, SST	2	CS1/2X1SS
3	Screw, Cap, 5/16-18UNC x 1-3/4" LG, SST	4	CS5/16X1-3/4SS
4	Bearing, Upper Ball	1	KG2003
5	O-Ring, Buna-N, Motor, Cord Cap, Brg. Hsg.	4	KG2010
6	Bearing Plate, Upper, Cast Iron	1	KG2004
7	Assembly, Housing & Stator, 200/230/460V, 3 phase	1	KG2098
8	Rotor and shaft assembly 2 hp, 1 and 3 phase	1	KGX2096
9	Bearing, Ball, 2hp LOWER, 3-7.5hp UPPER	1	KG2009
10	Screw, Cap, 5/16-18UNC x 1-1/4" LG, SST	6	CS5/16X1-1/4SS
11	Housing, Lower Bearing, Cast Iron	1	KG2011
12	Seal, Shaft, Lower and Upper, Sil. Carbide	2	KG2172
13	RETAINING RING, Black- Finish Steel, EXTERNAL	1	KG2089
14	Sensor, Moisture	1	KG2029
15	Plug, 1/4" NPT pipe, SST	3	PLUG1/4
16	Screw, Cap, 5/16-18UNC x 1-3/8" LG, SST	4	CS5/16X1-3/8SS
17	Seal Plate, Lower, Cast Iron	1	KG2014
18	Screw, Allen HD, 5/16-18UNC x 1" LG, SST	4	SCS5/16X1SS
19	Volute Case, Cast Iron	1	KG2015
20	Square ring, Buna N, Volute	1	KG2016
21	Impeller, Cast Iron (KG2-23)	1	KG2018-01
21	Impeller, Cast Iron (KHG2-23)	1	KG2018-04
21	Impeller, Cast Iron (KFG2-23)	1	KG2018-02
22	Impeller, Grinding, SST (K(H)G2-23)	1	KG2019
22	Impeller, Grinding, SST (KFG2-23)	1	KG2114
23	Ring, Grinder, SST (KG2-23)	1	KG2020
23	Ring, Grinder, SST (KHG2-23)	1	KG2072
23	Ring, Grinder, SST (KFG2-23)	1	KG2115
24	Screw, Allen HD, 1/4-20UNC x 5/8" LG, SST	1	SCS1/4X5/8SS
25	Disc Retainer Ring, 2hp grinder impeller, 304 SST	1	KG2024
26	Leg Kit, 304 SST/Buna-N (3 Legs)	1	KG2021
27	Nut, Hex, 1/2-13UNC, SST	3	NUT1/2SS
28	O-Ring, 2hp volute adapter, Buna-N	1	KG2025
29	Adapter, 1-1/4" NPT Discharge	1	KG2026
30	Handle, Lifting, SST	1	KG2017
31	Screw, Cap, 1/4-20UNC x 1" LG, SST	3	CS1/4X1SS
32	Flange, Grinder ring, Cast iron	1	KG2063
33	Oil	68 oz	OIL-55
34	Spring, Disc/Wave steel	1	KG2118
35	RETAINING RING, Black- Finish Steel, INTERNAL	1	KG2119
36	Washer, Flat 5/16", 300 series SST	2	WASH5/16SS
37	Pre-insulated Crimp Wire Connector	7	WC2-10
38	Wire Assembly for KG2029 Moisture Sensor	1	KG2029-W1





# **Limited Warranty**

Keen Pump co. Inc.

During the time periods and subject to the conditions hereinafter set forth, Keen Pump will repair or replace to the original user or consumer, any portion of your new Keen product which proves defective due to defective materials or workmanship of Keen Pump. Contact your closest authorized Keen Pump representative or distributor for warranty service. At all times, Keen Pump shall have and possess the sole right and option to determine whether to repair or replace defective equipment, parts or components. Damage caused by acts of GOD or conditions beyond the control of Keen Pump is not covered by this warranty.

### WARRANTY PERIOD:

36 months from date of installation / 36 months from date of manufacture, which-ever occurs first. Start-up reports may be required to support warranty claims. Warranty effective only if Keen Pump supplied or authorized control panels are used. Single phase pumps must utilize Keen Pump supplied start components.

### THIS WARRANTY WILL NOT APPLY:

- (1) To defects or malfunctions resulting from failure to properly install, operate or maintain the product in accordance with printed instructions provided.
- (2) To failures resulting from abuse, accident or negligence.
- (3) To normal maintenance services and the parts used in conjunction with such service.
- (4) To products which are not installed in accordance with applicable local codes, ordinances and good trade practices.
- (5) The product is used for purposes other than for what it was designed and manufactured.
- (6) If 3 phase motors are installed on a single phase power supply using a phase converter or if 3 phase power is supplied by only two transformers, making an open Delta system.

### WARRANTY EXCLUSIONS:

Keen Pump specifically disclaims the implied warranties of merchantability and fitness for a particular purpose after the termination of the warranty period set forth herein. No warranties or representations at any time made by any representatives of Keen Pump shall vary or expand the provision hereof.

### LIABILITY LIMITATION:

In no event shall Keen Pump be liable or responsible for consequential, incidental or special damages resulting from or related in any manner to any Keen Pump product or parts thereof. Personal injury and/or property damage may result from improper installation. Keen Pump disclaims all liability, including liability under this warranty, for improper installation. Keen Pump recommends following the instructions in the installation manual. When in doubt, consult a professional. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

### LABOR, ETC, COSTS:

Keen Pump shall in no event be responsible or liable for the cost of field labor or other charges incurred by any customer in removing and/or reaffixing any Keen Pump product, part or component thereof.

### **RETURNED OR REPLACED COMPONENTS:**

Any item to be replaced under this Warranty must be returned to Keen Pump, or such other place as Keen Pump may designate, freight prepaid.

This warranty gives you specific legal rights and other rights which may vary from state to state.

In the absence of suitable proof of this purchase date, the effective date of this warranty will be based upon the date of manufacture. Example: 0105 = Month-Year = January, 2005

P/N O&M-2HPGRINDER



471 E State Route 250 East, Ashland, Ohio 44805 PH: 419-207-9400 FX: 419-207-8031

# INSTALLATION AND SERVICE INSTRUCTIONS FOR 2HP SUBMERSIBLE GRINDER PUMPS SIMPLEX & DUPLEX BASIN PACKAGE W/ RAILS



"SIMPLEX" FIBERGLASS SYSTEM

"DUPLEX" CONCRETE SYSTEM

### **Safety Instructions**

### Read all instructions in this manual before operating pump.

Please Read This Before Installing Or Operating Pump. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols:



IMPORTANT! Warns about hazards that can result in personal injury or Indicates factors concerned with assembly, installation, operation, or maintenance which

could result in damage to the machine or equipment if ored.

ignored.

CAUTION ! Warns about hazards that can or will cause minor personal injury or property damage if ignored. Used with symbols below.

WARNING I Warns about hazards that can or will cause serious personal injury, death, or major property damage if ignored, Used with symbols below.







Hazardeus fluids can Hazardous pressure, eruptions or explosions could cause personal

burnes can occur on contact.

Extremely hot - Severe

Rotating machinery Amputation or severe laceration can result



Hazardous voltage can shock, burn or cause death.

injury or property damage.

Only qualified personnel should install, operate and repair pump. Any wiring of pumps should be performed by a qualified electrician.



WARNING 1 - To reduce risk of electrical shock, pumps and control panels must be properly grounded in accordance with the National Electric Code (NEC) or the Canadian Electrical Code (CEC) and all applicable state, province, local codes and ordinances.

WARNING! - To reduce risk of electrical shock, always disconnect the pump from the power source before handling or servicing. Lock out power and tag.

Prevent large articles of clothing, large amounts of chemicals, other materials or substances such as are uncommon in domestic sewage from entering the system.

During power black-outs, minimize water consumption at the home(s) to prevent sewage from backing up into the house.

Always keep the shut-off valve completely open when system is in operation (unless advised otherwise by the proper authorities). Before removing the pump from the basin, be sure to close the shut-off valve. (This prevents backflow from the pressure sewer.)

Keep the control panel locked or confined to prevent unauthorized access to it.

If the pump is idle for long periods of time, it is advisable to start the pump occasionally by adding water to the basin.



CAUTION! Pumps build up heat and pressure during operation-allow time for pumps to cool before handling or servicing.

### Most accidents can be avoided by using COMMON SENSE.

KEEN PUMP is not responsible for losses, injury or death resulting from a failure to observe these safety precautions, misuse, abuse or misapplication of pumps or equipment.



Do not block or restrict discharge hose, as discharge hose may whip under pressure.



WARNING! - DO NOT wear loose clothing that may become entangled in the impeller or other moving parts.

WARNING! - Keep clear of suction and discharge openings. DO NOT insert fingers in pump with power connected.

Make sure lifting handles are securely fastened each time before lifting. Do not operate pump without safety devices in place. Always replace safety devices that have been removed during service or repair.

Do not exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat.

Secure the pump in its operating position so it can not tip over, fall or slide.

Cable should be protected at all times to avoid punctures, cut, bruises and abrasions - inspect frequently.

Never handle connected power cords with wet hands.



To reduce risk of electrical shock, all wiring and junction connections should be made per the NEC or CEC and applicable state or province and local codes. Requirements may vary depending on usage and location.



Submersible Pumps are not approved for use in swimming pools, recreational water installations, decorative fountains or any installation where human contact with the pumped fluid is common.

Do not remove cord and strain relief. Do not connect conduit to pump.



Products Returned Must Be Cleaned, Sanitized, Or Decontaminated As Necessary Prior To Shipment, To Insure That Employees Will Not Be Exposed To Health Hazards in Handling Said Material. All Applicable Laws And Regulations Shall Apply.

Bronze/brass and bronze/brass fitted pumps may contain lead levels higher than considered safe for patable water systems. Various government agencies have determined that leaded copper alloys should not be used in potable water applications. For non-leaded copper alloy materials of construction, please contact factory.

### Safety Instructions (cont'd)

#### WARNING ! WARNING! THE PUMP MUST BE WIRED BY A QUALIFIED ELECTRICIAN, USING AN APPROVED STARTER BOX AND SWITCHING DEVICE. On 3 phase pumps only, "Motor Protection" must be provided by the installer. All 3 phase pumps must be installed with magnetic starters having 3 leg overload protection in accordance with the NEC (National Electric Code). For duplex installations, both pump motors must have separate overload protection. wet hands. Pumps with seal leak detectors must be connected to the proper control circuitry. electrical supply. **DANGER!** HAZARDOUS MOVING PARTS. To reduce risk of injury, disconnect power before servicing. Never or repair pump. put fingers near grinder impeller or in pump inlet when pump cord is connected or pump is operating. \*\*\*\*\*\*\*\* USE AND CARE \*\*\*\* For use with maximum 140 degrees F liquid. DANGER ! **Explosives** • In the initial installation, before sewage is Flammable Material admitted to the basin, there is no danger on entering the basin. AFTER SEWAGE HAS BEEN IN THE BASIN, THERE IS DANGER. Sewage water produces methane and hydrogen sulfide Gasoline gasses, both of which are highly poisonous. A breathing device may be required. Never enter the basin unless cover is open and outside blower is used to force fresh air into the basin. Also the worker in the basin must wear a harness attached to the surface so he can be Glass pulled out in case of asphyxiation. Metal **NEVER WORK ALONE !** Diapers WARNING !

Do not exceed working load limit of lifting chain, cable or rope. Do not use lifting chain, cable or rope where failure could result in loss of life.

Examine all lifting devices, chain, cable or rope for damage before and after each lift. Do not use any lifting devices that are not rated for and designed to lift the weights involved with these pumps. DO NOT LIFT PUMP BY POWER CORD.

Do not install or remove pump with person(s) in the basin.

This pump is designed to handle materials which could cause illness or disease through direct exposure. Wear and use protective clothing when working on the pump or piping.

Any wiring to be done on pumps should be done by a gualified electrician.

NEVER operate a pump with a power cord that has frayed or brittle insulation.

NEVER let cords or plugs lay in water.

NEVER handle connected power cords with

NEVER be in contact with the liquid being pumped while pump cord is connected to

Only gualified personnel should install, operate

### 

DO NOT pump hazardous material not recommended for pump. NEVER introduce:

- Lubricating Oil and/or Grease
- Chemicals, Solvents, etc.
- **Any Petroleum Product**

Regulatory agencies advise that the following items should not be introduced into any sewer:

- Clothing, socks, rags, etc.
- Plastic objects (toys, utensils, etc.) •
- Sanitary napkins or tampons

DO NOT pump without safety devices in place.

For hazardous locations, use pumps listed and classified for such locations.

DO NOT use non-explosion rated pumps in locations considered hazardous in accordance with the National Electric Code, ANSI/NFPA 70-1993.

### IMPORTANT !

KEEN PUMP is not responsible for losses, injury or death resulting from failure to observe these safety precautions.
# **BASIN HANDLING**

Although the exterior surfaces of our fiberglass reinforced plastic (FRP) sump and sewage basins are designed to withstand normal handling, they can be damaged during transportation and installation. Basins must not be dropped, dragged, or handled with sharp objects and with the exception of the minimal movement involved in a visual inspection, should not be rolled.

If the basin or its shell is damaged, installation should be suspended until Keen Pump Co. or its agent can make a determination of the extent of damage. Any repairs must be first authorized in writing by Keen Pump Co. and then be done in accordance with Keen Pump Co. instructions.

#### UNLOADING, LIFTING, AND LOWERING

The proper way of moving a basin is by lifting it, using chains or cables with the optional lifting lugs (not more than 30\* included angle) or by using a non-marring sling around the basin. Before any attempt is made to move a basin, it should be established that all of the equipment and accessories have sufficient capacity and reach to lift and lower the basins without dragging and/or dropping. Basins should be maneuvered with guide ropes attached to the sides.

*WARNING* !! Under NO circumstances are the use of chains or cables around the basin shell permitted.

#### STORAGE

Basins should be stored in a secure, controlled area where the potential for accidental damage or vandalism will be minimized. The storage area should be free from sharp objects, rocks and any other foreign solutions or materials that could cause damage to the basins. Chock the basins until they are needed for installation and if windy conditions are possible, secure the basins with non-marring restraints of a size and number adequate for securing the basin.

#### PRE-INSTALLATION INSPECTION

Basins, vales, equipment, and piping materials should be physically and visually inspected before installation. Adherence to the project's specifications should also be confirmed before installation. If the basin or any of its internal components are damaged, installation should be suspended until a determination of the extent of damage can be made by Keen Pump Co. or its agent. Any repairs must be first authorized in writing by Keen Pump Co. and then be done in accordance with Keen Pump Co. instructions.

# **EXCAVATION**

The excavation should provide adequate space for the basin, piping, and other buried equipment and for the replacement and compaction of backfill materials particularly around the basin walls. The size, shape and wall slope of the excavation should be determined by soil conditions, depth of excavation, shoring requirements, and if workers are required to enter the excavation, safety considerations and federal, sate, county, and municipal regulations.

#### WARNING !! Locate all overhead and underground utilities before excavating

#### LOCATION OF EXCAVATING

Excavation for an underground basin should be made with due care to avoid undermining foundations of existing structures and contact with underground utilities. In the absence of building codes or regulations, maintain a minimum distance of five feet plus a slope or 45\* from the bottom of the compacted sub-base to the bottom of the adjacent structures, foundations, footings, and property lines (as shown in the attached illustration). Additional distances may be required to assure that any loading carried or created by the foundations and supports cannot be transferred to the basins.

#### HANDLING OF EXCAVATED MATERIALS

Excavated materials, which cannot be removed from the jobsite, should be carefully stored as far from the edge of the basin excavation as possible. Unless approved for use as backfill, excavation materials should be securely stored separate from the approved backfill materials.

#### WORK AREA SAFETY

Safe installation procedures shall be the sole responsibility of the basin installer. Work safety requirements are defined in U.S. Department of Labor 29 CFR part 1926, subpart P, Excavations.

# BACKFILLING

Careful selection, placement, and compaction of approved backfill material is critical to a successful basin installation. Among the common problems associated with basin leaks and premature failures are:

- Use of incorrect backfill material
- Inadequate or improper placement or compaction
- Rocks, clods, or debris left in the excavation or basin
- Voids under or around the perimeter of the basin
- Failure to prevent the migration of backfill materials

#### PLACEMENT OF BASIN

The bottom of the basin excavation should be covered with suitably with graded, leveled, and compacted backfill material to a depth of at least 12 inches (compacted sub-base). If a concrete hold-down/anti-flotation pad is required, this bedding can be reduced to a depth of at least 6 inches. The carefully lower the basin into the excavation and centered on the compacted backfill or concrete pad (see attached).

WARNING !! Placement of a basin on a concrete pad or compacted sub-base smaller than the total basin bottom area or on intermediate supports (saddles) will cause uneven distribution of loads. This may contribute to structural failure, and is never permitted.

#### **BACKFILL MATERIAL**

Backfill material should be clean, well granulated, free flowing, non-corrosive, and inert. It should be free of ice, snow, debris, rock, or organic material, all of which could damage the tank and interfere with the compaction of the backfill material. The largest particles should not be larger than 3/4". Not more than 3% (by weight) should pass through a # 8 sieve, and the backfill material should conform to ASTM C-33, Paragraph 9.1 requirements. Approved backfill materials include:

- Pea Gravel, naturally rounded particles with a minimum diameter of 1/8" and a maximum diameter of 3/4".
- Crushed rock, washed and free-flowing angular particles between 1/8" and 1/2" in size.

#### PLACEMENT AND COMPACTION OF BACKFILL

Compaction of backfill materials should be adequate to ensure the support of the tank, and to prevent movement or settlement. Backfill materials should be placed in 12" lifts and compacted to a minimum soil modulus of 700 pounds per square inch (psi)

#### SUPPORTING PIPING, EOUIPMENT AND ACCESSORIES

Support for piping, equipment and other accessories must be provided during backfilling. Using the basin to support piping, equipment, cribbing, bracing, or blocking is never permitted. During backfilling, temporary supporting materials must be carefully installed and removed to prevent damage to the basin, piping, or equipment.

**WARNING** !! Using the basin to support any loading carried or created by piping, equipment, cribbing, bracing, or blocking is never permitted.

<u>ANCHORAGE</u> When basin installations are located in areas subject to high water tables or flooding, provisions should be made to prevent the basins, either empty or filled, from floating. The buoyancy force to be offset is determined primarily by the volume of the basin. The principle offsetting factors include:

- Backfill materials
- Concrete hold-down pad
- Friction between the tank, backfill materials and the surrounding soil

#### METHODS OF ANCHORAGE

All methods of anchoring basins use the weight of the backfill materials to offset the buoyancy forces. The use of supplemental mechanical anchoring methods (a concrete hold-down pad) increases the amount of backfill ballast, which is mechanically, attached to the basin. The recommended method of attachment is to pour concrete grout over the basin's anti-floatation flange and concrete grout over the basin's anti-floatation flange and concrete hold-down pad (see attached illustration)

#### **ANCHORAGE REQUIREMENTS**

Requirements of anchorage, thickness of concrete hold-down pads, as well as the size of anchors and reinforcement must be calculated for each installation based on the environmental conditions of that specific installation.

*WARNING !!* Use "submerged" material weights when calculating anchorage requirements. Example: weight of concrete (150 ponds per cubic foot) minus the weight of the water (62.4 pounds per cubic foot) equals a "submerged" weight of 87.6 pounds per cubic foot.

	CONCRETE BALLAST REFERENCE GUIDE
Basin Diameter	Cubic feet Concrete required per foot of basin depth
24"	2
30"	3.5
36"	5
48"	8.5
NOTE: If basin is in	nstalled in dry ground without surface water, 1/3 of above values may be
used. If basin is left	t in open hole without backfilling for several days, full amount of concrete
should be used, due	e to possible flash rain storms.



# **SPECIFICATIONS For fiberglass basin package:**

NOTE: Pump, lift-out check valve, floats, inlet fitting and control panel are shipped separately.

BASIN - Fiberglass construction w/ cover flange and bottom anti-flotation collar

COVER - Solid Fiberglass, or aluminum with access hatch

**DISCHARGE PIPE** – 1-1/4" PVC, Schedule 80, or as req'd.

**DISCHARGE HUB** – 1-1/4" NPT SST (Simplex), 1-1/4", 1-1/2" or 2"NPT SST (Duplex)

**RAIL SYSTEM** – Keen Pump KL1 or KL1-CV (Check valve), Cast iron, painted KL1-CV includes ball check valve – Qty. 2 req'd for duplex

RAIL BRACKETS - Upper support and liftout yoke SST

LIFTING APPARATUS - 3/16" Stainless steel chain w/ 1/4" shackles

SHUT-OFF VALVE - 1-1/4" Ball Valve, PVC, True Union, Blocked, or 1-1/4" Gate valve, brass

**INLET FITTING** – 4" or 6" Adaptaflex hub (Sch. 40 Pipe), or as req'd.

JUNCTION BOX – Fiberglass box designed to NEMA 6P standard, includes cord fittings and inlet hub

CONDUIT HUB - 1-1/2" or 2" NPT Plastic

LEVEL CONTROLS - Narrow angle, control duty, mercury, normally open floats, or as req'd.

LEVEL CONTROL BRACKET - SST w/ plastic cord bushing

HARDWARE – 300 Series SST

# STEPS TO INSTALL A KEEN FACTORY-BUILT BASIN PACKAGE

- 1. **BASIN INSTALLATION:** The basin is supplied with a standard inlet fitting for connecting a schedule 40 plastic pipe (4.50" OD) incoming sewer (from house). Other inlet types or sizes are optional. Please confirm that you have the pipe that matches the inlet fitting before continuing.
- 2. AFTER EXCAVATING the hole for basin (per above instructions), the basin should be plumb. Fill the basin with water to the invert (bottom of inlet pipe) to prevent basin from shifting as concrete is being poured for ballast.
- **3. INLET PIPE:** If installing the standard 4" inlet fitting, a standard 5" diameter pilot hole-saw is required. If installing the 6" inlet fitting, a standard 7" diameter pilot hole-saw is required. The minimum invert level (bottom of inlet pipe) required is 36" (3'-0") from bottom of basin. After drilling hole, remove rough edges of fiberglass coat with resin if available. Place inlet fitting through hole on outside wall of basin. Cut and chamfer inlet pipe. Lubricate pipe and inlet fitting with soapy water. Insert inlet pipe into fitting and protrude through basin wall. Pipe must protrude a minimum of 1" past inlet fitting.
- 4. DISCHARGE PIPE: The use of schedule 40 pvc, HDPE (DR), and SDR pipe is recommended. The standard Keen flange connection is 1-1/4" NPT for all simplex basin packages, and 1-1/2" NPT for all duplex basin packages. IT IS STRONGLY RECOMMENDED TO INSTALL A REDUNDANT CHECK VALVE between the Keen basin and the street main on all installations.
- **5. BACKFILL** using the previous illustration and instructions.
- 6. VENTING: It is unnecessary to vent a Keen Pump basin package as long as the house vent stack is properly vented to the rooftop. A separate 2" mushroom vent is optional and can be included to attach to basin cover if required.
- 7. INSTALL PUMP AND LIFTOUT: (See illustration to attach lift-out to pump volute). Remove (2) two 5/16" bolts from pump volute adapter. Separate threaded pump adapter from volute. Install adapter onto 1-1/4" pipe/lift-out assembly. Reinstall adapter and pipe assembly onto pump. Attach lift cable/chain to pump lift bail. Pump is now ready to install into basin.



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- **8. POSITION PUMP** so the guide rails are located in the slots of the guide plate. Slowly lower the pump down the guide rails to the base. Retain pump cables so they do not drop into the basin. The tapered arms in the base will automatically seal and pull the mating faces together when lowered into place.
- 9. FLOATS: A typical simplex system with control panel will consist of (3) three float control switches (Off, On and High Water Alarm). A typical duplex system will consist of (4) four float control switches (Off, Lead Pump On, Lag Pump On, and High Water Alarm). A system with an automatic pump will be equipped with (2) two float switches (On-Off, and High Water Alarm). All floats will be attached to float bracket, which is installed near the top of the basin. Each float cord will have a cord bushing that fits into the float bracket. The recommended float settings are as follows for KEEN 2hp pump models: (Note all settings are activation levels). NO PUMP ON/OFF FLOAT SWITCH SHOULD BE SET THAT WILL EXCEED 10 STARTS PER HOUR PER PUMP.

## (3) FLOAT OPERATION SIMPLEX:

- 12" from basin bottom to "OFF" setting KG2/KHG2/KFG2 (Minimum)
- 18" from basin bottom to "OFF" setting KHHG2/KHHG2H (Min.)
- 24" from basin bottom to "ON" setting KG2/KHG2/KFG2 (Min.)
- 30" from basin bottom to "ON" setting KHHG2/KHHG2H (Min.)
- 30" from basin bottom to "HWA" setting KG2/KHG2/KFG2 (Min.)
- 36" from basin bottom to "HWA" setting KHHG2/KHHG2H (Min.)

## (2) FLOAT OPERATION SIMPLEX:

- 12" from basin bottom to "OFF" setting KG2/KHG2/KFG2 (Min.)
- 18" from basin bottom to "OFF" setting KHHG2/KHHG2H (Min.)
- 24" from basin bottom to "ON" setting KG2/KHG2/KFG2 (Min.)
- 30" from basin bottom to "ON" setting KHHG2/KHHG2H (Min.)
- 30" from basin bottom to "HWA" setting KG2/KHG2/KFG2 (Min.)
- 36" from basin bottom to "HWA" setting KHHG2/KHHG2H (Min.)

# (4) FLOAT OPERATION DUPLEX:

- 12" from basin bottom to "OFF" setting KG2/KHG2/KFG2 (Min.)
- 18" from basin bottom to "OFF" setting KHHG2/KHHG2H (Min.)
- 24" from basin bottom to "LEAD PUMP ON" setting KG2/KHG2/KFG2 (Min.)
- 30" from basin bottom to "LEAD PUMP ON" setting KHHG2/KHHG2H (Min.)
- 30" from basin bottom to "LAG PUMP ON" setting KG2/KHG2/KFG2 (Min.)
- 36" from basin bottom to "LAG PUMP ON" setting KHHG2/KHHG2H (Min.)
- 32" from basin bottom to "HWA" setting KG2/KHG2/KFG2 (Min.)
- 38" from basin bottom to "HWA" setting KHHG2/KHHG2H (Min.)
- **10. JUNCTION BOX/ELECTRICAL CONNECTION:** Connect level control and pump power cords to junction box. Make certain that all compression fittings are tight. Install control panel. Run wires to control panel through conduit and connect cords coming into control panel. Mark or trace each incoming wire so that it can be connected to proper cord.

# **STARTING PUMPS**

- 1. Open shutoff valves on discharge piping.
- 2. Set pump switches at control panel to "auto" position and turn on power. Fill basin with water until controls start pump. Allow pump to operate until level drops, stopping pump.
- 3. If system is duplex, turn both pump switches to "off" and fill basin above upper control. Turn both pump switches to "auto" position. Both pumps should run and pump basin down to lower control.
- 4. Leave both switches in "auto" position and pump is ready for automatic operation.
- 5. A small weep hole may need to be drilled in the pump volute case or discharge pipe to prevent air-lock, so some water will flow from this hole when pump is operating.

## TROUBLESHOOTING

- 1. Pump runs but does not deliver water.
  - a. May be air-locked. Lift pump and reseat onto discharge base.
  - b. Discharge shutoff valve may be closed.
  - c. If pump is 3-phase, may be running in wrong direction. Pump should be checked before installing in basin for proper rotation. ROTATION: Counterclockwise when looking into pump inlet.

CAUTION: KEEP HANDS AND FINGERS AWAY FROM GRINDER IMPELLER WHEN MAKING THIS CHECK. If 3-phase rotation is wrong, interchange any two line leads at the control panel to reverse motor. CAUTION: BE SURE CONNECTED POWER AGREES WITH DATA ON PUMP NAMEPLATE.

- 2. Liftout base flange leaks
  - a. O-ring or gasket cut
  - b. Trash may be caught under flange. Lift out and reseat. It may be necessary to run pump lifted out of base elbow to flush away trash.

3. Proper setting of level controls. Controls should be set so that pump stops when level is minimum 6 inches above pump inlet. If controls are set too high, trash and grease may accumulate on the surface and may cause clogging.

CAUTION: NEVER WORK ON PUMPS OR CONTROLS UNLESS POWER IS TURNED OFF. IF PUMP IS REMOTE FROM CONTROL PANEL, DISCONNECT WIRES TO PUMPS TO BE CERTAIN POWER CANNOT BE TURNED ON. THIS MEANS ALL WIRES INCLUDING CONTROL WIRES. NEVER PUT HANDS NEAR GRINDER IMPELLER ON ANY RUN CHECKS.

# STEPS TO INSTALL A KEEN SYSTEM IN CONCRETE BASIN

- 1. Clean basin bottom thoroughly before installing the rail system components.
- 2. Bolt discharge base elbow in place on basin bottom. See typical layout dimensions on following pages or consult factory.
- 3. Install discharge piping from base elbow complete through basin wall. Cement in place.
- 4. Keen recommends mounting guide rails to access cover hatch frame. Mount upper rail support onto hatch cover frame per typical layout as follows or consult factory.
- 5. Install <sup>3</sup>/<sub>4</sub>" or 1" guide rails. Schedule 40 stainless steel is recommended. To get proper length, upper rail support must be installed prior to trimming rail pipes. Align rail pipes plumb by using a level in two directions on pipe.
- 6. Mount level control bracket as shown on typical layout as follows. Set float control heights per instruction above or as required by engineer. Consult factory for special settings required.
- 7. If control panel is remotely mounted, attach conduit pipe through basin wall and cement in place. See typical layout as follows for placement of conduit.
- 8. Be certain all inlet and discharge piping is properly connected before backfilling.
- **9. INSTALL PUMP AND LIFTOUT:** (See illustration above to attach lift-out flange from the Keen "KL1[CV]" to pump volute). Attach lift cable/chain to pump lift bail. Pump is now ready to install into basin.

# TYPICAL INSTALLATIONS AND DIMENSIONS ON PROCEEDING PAGES

- 1. KG2 grinder pump with KL1 liftout dimensions
- 2. KG2 grinder pump with KL1CV liftout dimensions
- **3. KHHG2H high head grinder pump with KL1CV liftout dimensions**
- 4. Fiberglass basin assembly, 24" Diameter simplex
- 5. Fiberglass basin assembly, 48" Diameter duplex
- 6. Concrete basin assembly, 30" Diameter simplex w/ stud and hatch layout
- 7. Concrete basin assembly, 48" Diameter duplex w/ stud and hatch layout

# NOTE: CONSULT FACTORY IF DIMENSIONS OR LAYOUTS REQUIRED ARE NOT INCLUDED WITH THIS MANUAL.



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# SECTION 12e.4: MEMBRANE RECIRCULATION PUMP

# P&ID: Item #: P-0711

Unit Details: ABS Series XFP Sewage Pump ABS Model#: XFP 100C CB1.4 PE35/4 4.7Hp, 3Ø/60Hz/460V 400 GPM @ 28' TDH

Manufacturer: ABS Pumps, Inc. 140 Pond View Drive Meriden, CT 06450 Phone: (203) 238-2700 Fax: (203) 238-0738 www.absgroup.com

Local Distributor/Contact:

ABS Pumps, Inc. 140 Pond View Drive Meriden, CT 06450 Phone: (203) 238-2700 Fax: (203) 238-0738 www.absgroup.com THIS PAGE INTENTIONALLY LEFT BLANK

Tough, reliable, submersible pumps, with Premium Efficiency motors from 2.4 to 40.2 hp. For the pumping of wastewater and sewage from buildings and sites in private, commercial, industrial and municipal areas.

#### Features

- The water-pressure-tight, encapsulated, flood-proof motor and the pump section form a compact, robust, modular construction.
   NEMA Class A temperature rise.
- Premium Efficiency Motors in accordance with IEC 60034-30 level IE3\* with testing in accordance with IEC60034-2-1.
- Continuously rated motor in submerged and non-submerged applications.
- Double SiC-SiC mechanical seals. All seals are independent of rotation direction and resistant to temperature shock.
- □ Anti-wicking cable plug solution (80C 150E), or
- water-pressure-sealed connection chamber (100G 201G). Hydraulic options of Contrablock and Contrablock Plus impellers for high efficiency, or vortex impellers for maximum
- solids handling.
- mum 50,000 hrs. (80C 150E), and 1000,000 hrs. (100G 201G). □ Stainless steel shaft. Designed with high safety factor to prevent
- fatigue fracture.
- Temperature monitoring using bi-metallic thermal sensors in the stator windings that open at 140 °C (284 °F).
- Seal monitoring by a moisture probe (DI) in the seal chamber (80C - 150E), or dry chamber (100G - 201G), which signals an inspection alert if there is leakage at the shaft seals.
- □ Smooth outer design to reduce rag build-up.
- □ Stainless steel lifting hoop.
- $\square$  3", 4", 6" and 8" radial slot ANSI flange discharge.
- Maximum allowable temperature of the medium for continuous operation is 104 °F.
- De Maximum submergence depth of 65 ft.
- Available in explosion-proof version in accordance with international standards FM / CSA.

\* See Technical Data table

P&ID#: P-0711 XFP 100C CB1.4 PE35/4-C-60



Performance fields with Contrablock impeller



#### Motor

Premium Efficiency IE3\* motor.

60 Hz single-phase 230 V through 3.8 hp, and three-phase 460 V through 40.2 hp.

Squirrel-cage motor as 2-pole (3400 rpm), 4-pole (1750), 6-pole (1180) and 8-pole (870).

Protection type IP 68, with stator insulation Class H.

Starting: DOL (direct on line).

Motors with other operating voltages and frequencies are also available (DOL and YD).

Identification Code: e.g. XFP 80C CB1.3 PE22/4-C-60 Hydraulics:

,		
XFP Product range		- XFP
8 Discharge outl	let DN (cm)	. 10
0Hydraulic type		.0
C Volute opening	g (dia. ins)	C
CB Impeller type:	CB = Contrablock, VX = vortex	CB
1 Number of imp	peller vanes	. 1
3 Impeller size		4
Motor:		
PE Premium Effic	iency	. PE
22 Motor power F	P₂ x 10 hp	. 35
4 Number of pol	.es	_ 4
C Volute opening	g (dia. ins)	C
60 Frequency	~ 	. 60
1 2		

#### Performance fields with vortex impeller



Please use the ABSEL program as the only valid selection tool

<sup>\*\*</sup> Minimum flow rate Q

XFP	Motor	IEC rating	Impeller size	Rated	Motor	power*	Rated	Speed	Cable	Weight**
		runng	SILC	(V)	P <sub>1</sub>	<b>P</b> <sub>2</sub>	(A)	(rpm)	5120	(lbs)
80C-CB1	PE 28/4	IE3	5	460 3~	3.1	3.8	5.2	1750	S00W 14/7	215 / n.a.
	PE 35/4	IE3	4	460 3~	3.9	4.7	6.2	1750	S00W 14/7	221 / n.a.
	PE 20/6	IE1	1, 2, 4	460 3~	2.4	2.7	4.2	1180	S00W 14/7	221 / n.a.
	PE 28/4W	IE3	5	230 1~	3.6	3.8	16.9	1750	S00W 10/7	215 / n.a.
	PE 20/6W	IE1	1, 2, 4	230 1~	2.6	2.7	12.0	1180	S00W 14/7	221 / n.a.
80C-VX	PE 22/4	IE3	2, 3, 4	460 3~	2.5	3.0	4.6	1750	SOOW 14/7	215 / n.a.
	PE 35/4	IE3	1	460 3~	3.9	4.7	6.2	1750	SOOW 14/7	220 / n.a.
	PE 18/4W	IE3	3, 4	230 1~	2.3	2.4	10.5	1750	SOOW 12/7	211 / n.a.
	PE 28/4W	IE3	2	230 1~	3.6	3.8	16.9	1750	SOOW 10/7	215 / n.a.
80E-CB1	PE125/2	IE3	4,5	460 3~	13.7	16.8	21.3	3400	AWM 8/4+16/3	381 / n.a.
81E-VX	PE 80/2	IE3	4	460 3~	8.9	10.7	13.3	3400	SOOW 12/7	300 / n.a.
	PE 125/2	IE3	1, 2, 3	460 3~	13.7	16.8	21.3	3400	AWM 8/4+16/3	336 / n.a.
(100C-CB1)	PE 28/4	IE3	5	460 3~	3.1	3.8	5.2	1750	SOOW 14/7	235 / n.a.
	PE 35/4	<mark>IE3</mark>	<mark>4</mark>	<mark>460 3~</mark>	<mark>3.9</mark>	<mark>4.7</mark>	<mark>6.2</mark>	<mark>1750</mark>	SOOW 14/7	<mark>240 / n.a.</mark>
	PE 20/6	IE1	1, 2, 4	460 3~	2.4	2.7	4.2	1180	SOOW 14/7	240 / n.a.
	PE 28/4W	IE3	5	230 1~	3.6	3.8	16.9	1750	SOOW 10/7	235 / n.a.
	PE 20/6W	IE1	1, 2, 4	230 1~	2.6	2.7	12.0	1180	SOOW 14/7	240 / n.a.
100C-VX	PE 22/4 PE 28/4 PE 35/4 PE 18/4W PE 28/4W	IE3 IE3 IE3 IE3 IE3 IE3	3, 4, 5 2 1 4 2, 3	460 3~ 460 3~ 460 3~ 230 1~ 230 1~	2.5 3.1 3.9 2.3 3.6	3.0 3.8 4.7 2.4 3.8	4.6 5.2 6.2 10.5 16.9	1750 1750 1750 1750 1750 1750	S00W 14/7 S00W 14/7 S00W 14/7 S00W 10/7 S00W 10/7	208 / n.a. 259 / n.a. 259 / n.a. 203 / n.a. 259 / n.a.
100E-CB1	PE 75/4	IE3	4, 5	460 3~	8.2	10.1	13.8	1750	SOOW 12/7	390 / n.a.
	PE 90/4	IE3	2, 3, 4	460 3~	9.8	12.1	15.8	1750	SOOW 12/7	416 / n.a.
	PE 105/4	IE3	1, 2, 3	460 3~	11.4	14.1	17.7	1750	SOOW 10/7	416 / n.a.
	PE 35/6	IE2	2, 3, 4, 5	460 3~	4.0	4.7	6.3	1180	SOOW 14/7	349 / n.a.
100E-VX	PE 45/4	IE3	5	460 3~	5.0	6.0	8.2	1750	SOOW 14/7	357 / n.a.
	PE 75/4	IE3	4	460 3~	8.2	10.1	13.8	1750	SOOW 12/7	364 / n.a.
	PE 90/4	IE3	3	460 3~	9.8	12.1	15.8	1750	SOOW 12/7	364 / n.a.
	PE 105/4	IE3	1, 2	460 3~	11.4	14.1	17.7	1750	SOOW 10/7	390 / n.a.
100G-CB1	PE 130/4 PE 185/4 PE 210/4 PE 250/4 PE 90/6	IE3 IE3 IE3 IE3 IE3	9 6 4 4 4,5	460 3~ 460 3~ 460 3~ 460 3~ 460 3~	14.0 19.8 22.4 26.7 10.0	17.4 24.8 28.2 33.5 12.1	23.2 32.3 35.4 40.8 18.8	1750 1750 1750 1750 1750 1180	AWM 8/4+16/3 AWM 8/4+16/3 AWM 8/4+16/3 AWM 4/4+16/3 SOOW 10/7	708 / 858 763 / 885 763 / 885 792 / 1015 721 / 865
101G-CB1	PE 185/2	IE3	4	460 3~	20.0	24.8	28.4	3400	AWM 8/4+16/3	629 / 796
	PE 200/2	IE3	3	460 3~	21.8	26.8	30.5	3400	AWM 8/4+16/3	629 / 796
	PE 300/2	IE3	2, 1	460 3~	32.5	40.2	45.8	3400	AWM 4/4+16/3	651 / 821
150E-CB1	PE45/4 PE75/4 PE90/4 PE105/4 PE35/6	IE3 IE3 IE3 IE3 IE2	7 5, 6 4, 5 4 4, 5, 6	460 3~ 460 3~ 460 3~ 460 3~ 460 3~	5.0 8.2 9.8 11.4 4.0	6.0 10.1 12.1 14.1 4.7	8.2 13.8 15.8 17.7 6.3	1750 1750 1750 1750 1750 1180	SOOW 14/7 SOOW 12/7 SOOW 12/7 SOOW 10/7 SOOW 14/7	369 / n.a. 410 / n.a. 410 / n.a. 435 / n.a. 369 / n.a.
150G-CB1	PE 130/4	IE3	8	460 3~	14.0	17.4	23.2	1750	AWM 8/4+16/3	735 / 925
	PE 185/4	IE3	6	460 3~	19.8	24.8	32.3	1750	AWM 8/4+16/3	765 / 981
	PE 210/4	IE3	4	460 3~	22.4	28.2	35.4	1750	AWM 8/4+16/3	765 / 981
	PE 110/6	IE3	2,3, 4	460 3~	12.0	14.8	21.1	1180	AWM 8/4+16/3	735 / 964
200G-CB1	PE 90/6	IE3	3, 4	460 3~	10.0	12.1	18.8	1180	SOOW 10/7	805 / 1018
	PE 110/6	IE3	1, 2	460 3~	12.0	14.8	21.1	1180	AWM 8/4+16/3	805 / 1018
201G-CB2	PE 130/6	IE3	6	460 3~	14.2	17.4	23.7	1180	AWM 8/4+16/3	845 / 982
	PE 160/6	IE3	4	460 3~	17.5	21.5	28.4	1180	AWM 8/4+16/3	865 / 1004
	PE 200/6	IE3	2	460 3~	21.5	26.8	32.7	1180	AWM 8/4+16/3	907 / 1047
	PE 120/8	IE3	1, 2	460 3~	13.5	16.1	23.7	870	AWM 8/4+16/3	851 / 993

**Technical Data** 

 $^{*}P_{1}$  = power at mains. P<sub>2</sub> = power at motor shaft. \*\*Without / with cooling jacket; includes 33 ft of cable.

Data for alternative voltages available on request.

#### **Standard and Options**

Description	Standard	Option
Mains voltage	230 V 1~, 460 V 3~	208 V 1~, 208, 220, 380, 600, 220/380, 380/660 V 3~
Voltage tolerance	± 10%	-
Motor efficiency	Premium Eff. IE3*	-
Insulation class	Н	-
Start-up	Direct on line	Star delta
Approvals	FM / CSA	-
Mechanical seal (at medium side)	SiC-SiC	-
Mechanical seal (at motor side)	SiC-SiC	-
0-rings	NBR	-
Cables	CSA	EMC
Cable length (ft)	49	33, 66, 99, 131, 164
Protective coating	2k Epoxy 120 µm	2k Epoxy 400 μm
Provision for lifting hoist	Lifting hoop	
Cooling	Self-cooling (80C - 150E); by the medium (100G - 201G)	Closed cooling (100G - 201G)
Installation	Wet well	Dry well** or transportable

See Technical Data table \*\* Except XFP 80E and 81E

#### Monitoring

Description		Standard	Option
Motor	Bi-metallic switch in windings	Х	-
(temperature)	PTC thermistor in windings	-	Х
Seals	Moisture sensor (DI) in oil chamber (80C - 150E)	Х	-
(leakage)	Moisture sensor (DI) in dry chamber (100G - 201G)	Х	-
	Moisture sensor (DI) in connection chamber (100G - 201G)	-	Х
Bearings	PTC thermistor (100G - 201G)	-	Х
(temperature)	PT 100 (100G - 201G)	-	Х

#### Materials

Motor	Material
Motor housing	Cast iron EN-GJL-250
Motor shaft	Stainless steel 1.4021
Fasteners	Stainless steel 1.4401
Lifting hoop	Stainless steel 1.4401
Hydraulics	Material
Volute	Cast iron EN-GJL-250
Impeller	Cast iron EN-GJL-250
Bottom plate	Cast iron EN-GJL-250

#### Material comparison

Europe	USA					
EN-GJL-250	ASTM A48; Class 40B					
1.4021	ASTM / AISI 420					
1.4401	ASTM / AISI 316					

#### Accessories

	Description	Size	XFP	Part no.
Fixed installation - wet well with ABS Automatic Coupling System	<b>Pedestal*</b> (cast iron ASTM A48; Class 40B) 90° cast bend (single guide rail) - DIN flange connection	3" 4" 4" (high-head) 6" 8"	80C - 81E 100C - 100G 101G 150E & 150G 201G	62320649 62320652 62325019 62320655 62320658
	90° cast bend (single guide rail) - plug/clamp connection	3" (pipe Ø3½") 4" (pipe Ø4¼") 4" high head (pipe Ø4¼") 4" (pipe Ø4½") 6" (pipe Ø6¼")	80C - 81E 100C - 100G 101G 100C - 100G 150E & 150G	62320650 62320653 62325020 62320654 62320656
	90° cast bend (twin guide rail) - DIN flange connection	3" 4" 6" 8"	80C - 81E 100C - 101G 150E & 150G 201G	62325029 62325030 62325031 62325032
	<b>Pedestal bracket fasteners</b> single guide rail version (galvanised steel)		80C - 81E 100C - 101G 150E & 150G 201G	62610632 62610633 62610635 62610883
	single guide rail version (stainless steel)		80C - 81E 100C - 101G 150E & 150G 201G	62610899 62610637 62610639 62610862
	twin guide rail version (galvanised steel)		80C - 81E 100C - 101G 150E & 150G 201G	62615053 62615054 62615055 62615056
	<b>Pedestal base anchor bolts</b> single and twin guide rail (galvanised steel)		80C - 101G 150E & 150G 201G	62610775 62610784 62610785
Fixed installation - dry well, (horizontal)	<b>Pump Support Kit</b> (ASTM A48; Class 40B) head and volute supports with fixing bolts and vibration damper		80C 80C**, 100C 81E*** 100E 150E 101G 100G, 150G, 201G	61825032 61825033 61825038 61825030 61825031 61825036 61825037
(vertical)	Ground Support Stand		80C 81E*** 100C 100E 150E 101G 100G, 150G, 201G	61355014 61355020 61355015 61355021 61355022 61355022 61355024 61355023
Transportable	Ground Support Stand		80C, 100C 80E & 81E 100E 150E 101G 100G, 150G, 201G	61355016 61355017 61355018 61355019 61355026 61355025
General	Cathodic Protection (Zinc anodes)		80C - 201G	13905000

\*Guide rail not included \*\*Vortex version of pumps (VX) \*\*\* Only with PE 80/2 motor





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ABSEL425 1.7.2 / 2007-02-07



# XFP100C CB1 60HZ

#### 400 GPM @ 28 Feet

#### XFP

ABS EffeX XFP range of submersible pumps (PE1 to PE3) are supplied for reliable and economic pumping of clear water, polluted water and heavily polluted sewage containing solids, faecal slurry and sludge in commercial, industrial and municipal application. Driven by Premium Efficiency IE3 motor in according with IEC 60034-30, exceeding CEMEP EFF 1. Motor insulation according to Class H, temperature rise according to Class A. Explosion proof as standard, ATEX, FM and CSA. Continuously rated motor suitable for wet and dry installation as standard.(PE1 and PE2) PE3 has the option of internal closed loop cooling system for dry installation. Equipped with temperature and moisture sensors as standard. Standard sewage hydraulic with Contrablock plus gives enhanced levels of blockage resistance and excellent rag handling with large free solids passage of 75 mm minimum.

#### 60Hz

Capacity up to 3500 US g.p.m. Head, max. 330ft

#### Type: XFP100C CB1 60HZ

i echnical data		
Delivery rate		: 409 US g.p.m.
Delivery head		: 29.3 ft
Hydr. efficiency		: 69.7 %
Total efficiency		: 62.7 %
Shaft power		: 4.36 hp
Speed		: 1730 rpm
Impeller type		: Contrabloc Plus impeller, 1 vane
Motor output		: 4.69 hp
Voltage		: 460 V
Frequency	: 60 Hz	
Suction outlet		: DN100
Discharge outlet		: DN100



Motor performance curve PE35/4-C-60HZ

Frequency 60 Hz

400 GPM @ 28 Fe	eet						
Rated power 4.69 hp	Service factor	Nominal spe 1730 rpm	eed	Number of poles 4	Rated 460 V	voltage	Date 2011-04-11
-[							B [hp]
1.4							13.3
1.3						∕M/Mn	12.3
						l/In	11.1
1.2							11.4
							10.5
··· '							10.0
							95
Ľ.						n/ns	
0.9			+				8.55
						eff	
0.8			- /			COS	7.6
0.7	/					P1	6.65
0.6						P2	5.7
	1						
0.5							4.75
-							
0.4							3.8
= /							
0.3							2.85
= /							
0.2							1.9
Ē							
0.1							0.95
						S	
0	20	40 6	60	80 100	12	0 <b>P2/P</b>	2n [%]
Loading	No load	25 %	50 %	75 %		100 %	125 %
	0.2657	1.242	0.507			E 242	6.600
P2 [hp]	0.2007	1.343	2.537	3.855		5.242 4.694	0.092 5.867
I [A]	3.102	3.475	4.082	5.005		6.212	7.559
eff [%]	0	87.35	92.49	91.31		89.53	87.67
cos	0.08017	0.3618	0.5818	0.721		0.7899	0.8285
n [rpm]	1800	1789	1772	1752		1731	1708
IVI [ITI TOI] s [%]	0 00233	3.440 0.6309	0.958	10.55		14.24	18.04
3 [ /0]	0.00233	0.0308	1.570	2.073		5.045	0.120
olerance accordi	ng to VDE 0530 T1	12.84 for rated pov	ver				
tarting current	Starting torque	Moment of i	inertia				
1.6 A	20.4 lbf ft	0.0712 lb	ft <sup>2</sup>				

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08/2011

ABS submersible sewage pump XFP 80C - 201G



Us Installation, Operating and Maintenance Instructions CA

www.absgroup.com



# ABS submersible sewage pump XFP

PE1	PE2	PE3	
80C-CB1	80E-CB1	100G-CB1	201G-CB2
80C-VX	81E-VX	101G-CB1	
81C-VX	100E-CB1	101G-VX	
100C-CB1	100E-VX	150G-CB1	
100C-VX	150E-CB1	200G-CB1	

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ABS reserves the right to alter specifications due to technical developments

# abs

ABS submersible sewage pump XFP 80C - 201G

# Symbols and notices used in this booklet:

Presence of dangerous voltage.



Non-compliance may result in personal injury.

Hot surface - danger of burn injury.

Danger of an explosion occurring.

ATTENTION! Non-observance may result in damage to the unit or negatively affect its performance.

**NOTE:** Important information for particular attention.

# 1 General

# 1.1 Application areas

The following guidelines must be observed when setting the lowest switch off point for XFP pumps:

- When switching on and operating the pump, the hydraulic section of dry installation pumps must always be filled with water.
- The minimum submergence allowed for specific pumps can be found on the dimension installation sheets available from your local ABS representative.

XFP pumps have been designed for economic and reliable pumping in commercial, industrial and municipal installations and are suitable for pumping of the following liquids:

- clear and wastewater, and for sewage containing solids and fibrous material
- faecal matter

In combination with the ABS automatic coupling system, the below ground level wet installation is a particularly economical and environmentally friendly solution. The pumps are also suitable for horizontal or vertical dry installation (except XFP 80E-CB1-PE125/2 and XFP 81E-VX-PE125/2).

# ATTENTION! The maximum allowable temperature of the medium pumped is 104 °F

# 1.2 Explosion-proof Approvals

Explosion-proof as standard, in accordance with international standards FM and CSA.

# 1.2.1 Use of explosion-proof pumps in explosive zones.

- 1. Explosion-proof submersible pumps may only be operated with the thermal sensing system connected.
- 2. If ball type float switches are used, these must be connected to an intrinsically safe electrical circuit "Protection type EX (i)" in accordance with VDE 0165.
- 3. Dismantling and repair of submersible explosion-proof motors may only be carried out by approved personnel in specially approved work shops.
- 4. In the event that the pump is to be operated in explosive atmospheres using a variable speed drive, please contact your local ABS representative for technical advice regarding the various Approvals and Standards concerning thermal overload protection.

#### 1.3 Technical data

Maximum noise level  $\leq$  70 dB. This may be exceeded in certain circumstances.

Detailed technical information is available in the technical data sheet ABS submersible sewage pump XFP 80C - 201G which can be downloaded from www.absgroup.com > Downloads.

## 1.3.1 Nameplate

We recommend that you record the data from the nameplate on the pump in the corresponding form below, and maintain it as a source of reference for the ordering of spare parts, repeat orders and general queries.

Always state the pump type, item no. and serial no. in all communications.

#### Standard nameplate

abs	ABS USA 140 Pond View Drive Meriden CT 06450 Tel 203-238-2700 www.cardo.com		FM APPROVED Explosion Proof		LR51412 CL.I, DIV.1, GR.C+D	
Тур						
Nr	Sn			xx/xxxx		
UN		IN			Ph	Hz
P1:		P2:				RPM
Cos φ	NEMA A	IEC60	034-30	IE		≬≬ IP68
Qmax	Hmax		Ølmp			
DN Hmin See Instruction Manual for sensor connection and cable replacement. Use with approved motor control that matches motor input full load amps. Utiliser un demarreur approuve covenant au courant a pleine charge du moteur. DO NOT REMOVE COVER WHILE CIRCUIT IS ALIVE.					Wt. Thermally Protected OPER. TEMP. T3C.	

Legend		
Тур	Pump type	
Nr	Item No.	
Sn	Serial No.	
xx/xxxx	Production date (Week/Year)	
U <sub>N</sub>	Rated voltage	V
I <sub>N</sub>	Rated current	A
Ph	Number of phases	
Hz	Frequency	Hz
P1	Rated input power	kW
P2	Rated output power	hp
RPM	Speed	rpm
Cos φ	Power factor	pf
NEMA	Temperature rise	Class
Qmax	Max. Flow	gpm
Hmax	Max. Head	ft
Ø Imp.	Impeller diameter	ins
DN	Discharge diameter	ins



#### 1.4 General design features

XFP is a submersible sewage and wastewater pump with a Premium Efficiency motor.

The water-pressure-tight, encapsulated, flood-proof motor and the pump section form a compact, robust, modular construction.

## 1.4.1 Design features PE1 & PE2



- 1 Pressure release screw
- 2 10-pole terminal block
- 3 Moisture sensor (DI)
- 4 Seal chamber
- 5 Seal chamber drain plug/ pressure test point
- 6 Venting plug

- 7 Stainless steel lifting hoop
- 8 Upper bearing single row
- 9 Motor with thermal sensors
- 10 Stainless steel shaft
- 11 Motor chamber
- 12 Lower bearing double row
- 13 Bearing housing
- 14 Mechanical seals
- 15 Seal holding plate
- 16 Motor chamber drain plug/ pressure test point
- 17 Impeller Contrablock version
- 18 Bottom plate adjustment screw

## 1.4.2 Design features PE3 (version with cooling jacket)



- 1 Stainless steel lifting hoop
- 2 Lid assembly
- 3 Cable gland
- 4 Upper bearing single row
- 5 Coolant fill plug
- 6 Cooling jacket
- 7 Motor housing
- 8 Lower bearing housing
- 9 Lower bearing double row

- 10 Seal holding plate
- 11 Mechanical seals
- 12 Venting plug
- 13 Terminal block\*
- 14 Pressure test point
- 15 Upper bearing housing
- 16 Motor with thermal sensors
- 17 Stainless steel shaft
- 18 Moisture sensor (DI)

- 19 Dry chamber
- 20 Coolant impeller
- 21 Flow deflector
- 22 Coolant drain plug / pressure test point
- 23 Seal chamber
- 24 Impeller Contrablock version
- 25 Bottom plate adjustment screw
- \* Fitted to bearing housing when two cables connected.



## 2 Safety

The general and specific health and safety guidelines are described in detail in the ABS Products Safety Instructions booklet. If anything is not clear or you have any questions as to safety make certain to contact the manufacturer ABS.

# 3 Transport and Storage

#### 3.1 Transport

During transport, care should be taken that the pump is not dropped or thrown. The pumps of the XFP series are fitted with a lifting hoop to which a chain and shackle may be attached for transport or for suspension of the pump.



The pump must be raised only by the lifting hoop and never by the power cable.



Take note of the weight of the entire unit. The hoist and chain must be adequately dimensioned for that weight and must comply with the current valid safety regulations.

All relevant safety regulations as well as general good technical practice must be complied with.

# 3.2 Storage

- 1. During long periods of storage the pump should be protected from moisture and extremes of cold or heat.
- 2. To prevent the mechanical seals from sticking it is recommended that occasionally the impeller is rotated by hand.
- 3. If the pump is being taken out of service the oil should be changed before storage.
- 4. After storage the pump should be inspected for damage, the oil level should be checked, and the impeller checked to ensure it rotates freely.

#### 3.2.1 Moisture protection of motor connection cable

The motor connection cables are protected against the ingress of moisture along the cable by having the ends sealed at the factory with protective covers.

#### ATTENTION! The ends of the cables should never be immersed in water as the protective covers only provide protection against water spray or similar (IP44) and are not a water tight seal. The covers should only be removed immediately prior to connecting the pumps electrically.

During storage or installation, prior to the laying and connection of the power cable, particular attention should be given to the prevention of water damage in locations which could flood.

#### ATTENTION! If there is a possibility of water ingress then the cable should be secured so that the end is above the maximum possible flood level. Take care not to damage the cable or its insulation when doing this.

# 4 Mounting and Installation

4

The regulations covering the use of pumps in sewage applications, together with all regulations involving the use of explosion-proof motors, should be observed. The cable ducting to the control panel should be sealed off in a gas-tight manner by the use of a foaming material after the cable and control circuits have been pulled through. In particular the safety regulations covering work in enclosed areas in sewage plants should be observed together with general good technical practice.

For the XFP transportable version, arrange the cable run so that the cables will not be kinked or nipped. Connect the discharge pipe and cable (see section "Electrical Connection"). Place the pump on a firm surface which will prevent it from overturning or burrowing down. The pump can also be bolted down to the base or suspended slightly by the lifting handle. Hoses, pipes and valves must be sized to suit the pump performance.

## 4.1 Installation examples

# 4.1.1 Submerged in concrete sump



- 1 Sump cover
- 2 Venting line
- 3 Sump cover
- 4 Sleeve for cable ducting to the control panel as well as for aeration and venting
- 5 Chain

- 6 Inflow line7 Ball-type float s
- 7 Ball-type float switch
- 8 Submersible pump
- 9 Concrete sump
- 10 Pedestal

- 11 Guide rail
- 12 Discharge line
- 13 Non-return valve
- 14 Gate valve
- 15 Power cable to motor



# 4.1.2 Dry-installed

Horizontal



# ATTENTION! The oil-filled version of PE1 and PE2 pumps, and the cooling jacket version of PE3 pumps, are required for dry installations.



Under continuous running conditions the pump motor housing may become hot. To avoid burn injury allow to cool down before handling.

# 4.2 Discharge Line

The discharge line must be installed in compliance with the relevant regulations.

This applies in particular to the following:

- The discharge line should be fitted with a backwash loop (180° bend) located above the backwash level and should then flow by gravity into the collection line or sewer.
- The discharge line should not be connected to a down pipe.
- No other inflows or discharge lines should be connected to this discharge line.

#### ATTENTION! The discharge line should be installed so that it is not affected by frost.

#### 5

#### Electrical Connection



Before commissioning, an expert should check that one of the necessary electrical protective devices is available. Earthing, neutral, earth leakage circuit breakers, etc. must comply with the regulations of the local electricity supply authority and a qualified person should check that these are in perfect order.

#### ATTENTION! The power supply system on site must comply with VDE or other local regulations with regard to cross-sectional area and maximum voltage drop. The voltage stated on the nameplate of the pump must correspond to that of the mains.

The power supply cable must be protected by an adequately dimensioned slow-blow fuse corresponding to the rated power of the pump.



The incoming power supply as well as the connection of the pump itself to the terminals on the control panel must comply with the circuit diagram of the control panel as well as the motor connection diagrams and must be carried out by a qualified person.

All relevant safety regulations as well as general good technical practice must be complied with.

#### ATTENTION! For use in the open air, the following VDE regulations apply:

Submersible pumps used outdoors must be fitted with a power cable of at least 33 feet length.

For pumps intended to be used in outdoor fountains, garden ponds and similar places, the pump is to be supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA.

#### Please consult your electrician.

#### 5.1 Temperature monitoring

Thermal sensors in the stator windings protect the motor from overheating.

XFP motors are fitted with bimetallic thermal sensors in the stator as standard, or as an option with a PTC thermistor.

## 5.2 Seal monitoring

XFP pumps are supplied as standard with a moisture sensor (DI), to detect and alert to the ingress of water into the motor and seal chambers (PE1 & PE2), or motor and dry chambers (PE3).

# NOTE! Running the pump with the thermal and/or moisture sensors disconnected will invalidate related warranty claims.



1

T1 T2 ТЗ

Luur

ABS submersible sewage pump XFP 80C - 201G

#### 5.3 **Wiring Diagrams**

U1 V1 W1 F1 F0 Di PE =

4 5 3 2

\_6

ş PÊ≛

ş 1



PĘ ₹

2 1 ş

1



Explosion-proof pumps may only be used in explosive zones with the thermal sensors connected (leads F0 & F1).

60 Hz	1	2	3		4		5		
20/6 22/4 28/4 <mark>35/4</mark>	D63,D68, D79,D80	-			D66,D62 <mark>,D7</mark>	7,D85	-		
45/2	D63,D79, D80	D64,D81	-		D66,D62,D7	7,D85,D86			
18/4W 28/4W 20/6W*	-	-			-		W60, W62		
35/6 45/4 56/4 75/4 90/4 105/4 80/2 125/2	D63,D79, D80	D64,D81	-		D66,D62,D7	7,D85,D86	-		
120/8 90/6 110/6 130/6		D64,D79	D63,D80,D81		D66,D62,D77,D85,D86				
160/6			D63,D64,D79,D80,D81						
200/6		-	D64,D79				-		
130/4	-	D64,D79	D63,D80,D81						
150/4 185/4	-		D63,D64,D79,D80,D81		D66,D62,D77,D85,D86				
210/4 250/4 185/2 200/2 300/2			D64,D79						
<b>D62</b> = 230 V 3~, DOL <b>D68</b> = 3			80 V 3~, YA <b>D81</b> = 22		0 V 3~, YΔ <b>W60</b> = 230		V 1~		
D63 = 220 V 3~, DOL		<mark>.60 V 3~, DOL</mark> D85 = 60		0 V 3~, DOL <b>W62</b> = 208		V 1~			
<b>D64</b> = 380 V 3~, Y∆ <b>D79</b> = 3			80 V 3~, YΔ <b>D86</b> = 46		0 V 3~, DOL				
D66 = 208 V 3~, DOL D80 = 220 V 3~, DOL									

\_1'

2

(U1 W1 V1)\* R S C I I I

abs

ABS submersible sewage pump XFP 80C - 201G

# 6 Commissioning

Before commissioning, the pump should be checked and a functional test carried out. Particular attention should be paid to the following:

- Have the electrical connections been carried out in accordance with regulations?
- Have the thermal sensors been connected?
- Is the seal monitoring device correctly installed?
- Is the motor overload switch correctly set?
- Does the pump sit correctly on the pedestal?
- Is the direction of rotation of the pump correct even if run via an emergency generator?
- Are the switching ON and switching OFF levels set correctly?
- Are the level control switches functioning correctly?
- Are the required gate valves (where fitted) open?
- Do the non-return valves (where fitted) function easily?

# 6.1 Types of operation and frequency of starting

All pumps of the XFP series have been designed for continuous operation S1 when either submerged or dry-installed.

## 6.2 Checking direction of rotation

When three phase units are being commissioned for the first time, and also when used on a new site, the direction of rotation must be carefully checked by a qualified person.



When checking the direction of rotation, the pump should be secured in such a manner that no danger to personnel is caused by the rotating impeller or by the resulting air flow. Do not place your hand into the hydraulic system!



When checking the direction of rotation, or when starting the unit, pay attention to the **START REACTION**. This can be very powerful and cause the pump to jerk in the opposite direction to the direction of rotation.

ATTENTION: When viewed from above, the direction of rotation is correct if the impeller rotates in a clockwise manner.



NOTE: The start reaction is anti-clockwise.

ATTENTION: If a number of pumps are connected to a single control panel then each unit must be individually checked.

ATTENTION: The mains supply to the control panel should have a clockwise rotation. If the leads are connected in accordance with the circuit diagram and lead designations, the direction of rotation will be correct.



# 6.3 Changing direction of rotation

The direction of rotation should only be altered by a qualified person.

If the direction of rotation is incorrect then this is altered by changing over two phases of the power supply cable in the control panel. The direction of rotation should then be rechecked.

## 7 Maintenance



Before commencing any maintenance work the pump should be completely disconnected from the mains by a qualified person and care should be taken that it cannot be inadvertently switched back on.

 $\wedge$ 

When carrying out any repair or maintenance work, the safety regulations covering work in enclosed areas of sewage installations as well as good general technical pratices should be followed.



Under continuous running conditions the pump motor housing can become very hot. To prevent burn injury allow to cool down before handling.

ATTENTION!

The maintenance instructions given here are not designed for "do-it-yourself" repairs as special technical knowledge is required.

# 7.1 General maintenance instructions

ABS submersible pumps are reliable quality products, each being subjected to careful final inspection. Lubricated-for-life ball bearings, together with monitoring devices, ensure optimum pump reliability provided that the pump has been connected and operated in accordance with the operating instructions. However, should a malfunction occur, do not improvise, but ask your ABS Customer Service Department for assistance. This applies particularly if the pump is continually switched off by the current overload in the control panel, by the thermal sensors of the thermo-control system, or by the seal monitoring system (DI).

Regular inspection and care is recommended to ensure a long service life. Service intervals vary for XFP pumps depending on installation and application. For recommended service interval details contact your local ABS Service Centre. A maintenance contract with our Service Department will guarantee the best technical service.

When carrying out repairs, only original spare parts supplied by the manufacturer should be used. ABS warranty conditions are only valid provided that any repair work has been carried out in an ABS approved workshop and where original ABS spare parts have been used.

#### 14 Installation, Operating and Maintenance Instructions (Original Instructions)

ABS submersible sewage pump XFP 80C - 201G



# 7.3 Lubricant changing (PE1 & PE2)

The seal chamber between the motor and the hydraulic section has been filled with oil at manufacture.

An oil change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or motor chamber.
- · After repair work that requires draining of the oil.
- If the pump is being taken out of service the oil should be changed before storage.

#### 7.3.1 Instructions on how to drain and f II the seal chamber

1. Loosen the plug screw (a) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to

contain any possible spray of oil as the pump de-pressurises.

2. Place the pump in a horizontal position, sitting on its discharge flange, with the motor housing supported from underneath.



To prevent the pump from toppling over ensure it is supported to lie flat on its discharge flange.

- 3. Position an adequate container to receive the waste oil.
- 4. Remove the plug screw and seal ring (a) from the drain hole.
- 5. After the oil is fully drained lay the pump flat, and rotate so that the drain hole is positioned to the top.

When in this position the pump must be held by hand, or supported at both sides, to prevent it from toppling over.

- 6. Select the required volume of oil from the quantities table (p.17) and slowly pour into the drain hole.
- 7. Refit the plug screw and seal ring.





DRAIN

FILL



# 7.4 Lubricant changing (PE3 - version without cooling jacket)

The seal chamber between the motor and the hydraulic section has been filled with glycol at manufacture. The water and propylene glycol is frost resisting down to 5 °F.

A glycol change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or dry chamber.
- After repair work that requires draining of the glycol.
- If the pump is being taken out of service the glycol should be changed before storage.
- In the case of extreme ambient temperatures below -15 °C / 5 °F (e.g. during transport, storage, or if the pump is out of duty) the cooling liquid must be drained. Otherwise the pump may be damaged.

## 7.4.1 Instructions on how to drain and f II the seal chamber

1. Loosen the plug screw (a) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to contain any possible spray of glycol as the pump de-pressurises.

- Secure a hoist to the lifting hoop. Lay the pump on its side and rotate until the drain plug is underneath.
  Note: because there is insufficient space to place a waste container underneath the drain plug the waste must be drained into a sump.
- 3. Remove the plug screw and seal ring (a) from the drain hole.
- 4. After the glycol is fully drained, place the pump in a horizontal position sitting on its discharge flange with the motor housing supported from underneath.
  - To prevent the pump from toppling over ensure it is supported to lie flat on its discharge flange.

6. Refit the plug screw and seal ring.

5. Select the required volume of glycol from the quantities table (p.17) and slowly pour into the drain hole.



(a) Drain plug

DRAIN

FILL


### 7.5 Coolant changing (PE3 - version with cooling jacket)

The cooling system (seal chamber and cooling jacket) has been filled with glycol at manufacture. The water and propylene glycol is frost resisting down to 5 °F.

A glycol change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or dry chamber.
- After repair work that requires draining of the glycol.
- If the pump is being taken out of service the glycol should be changed before storage.
- In the case of extreme ambient temperatures below -15 °C / 5 °F (e.g. during transport, storage, or if the pump is out of duty) the cooling liquid must be drained. Otherwise the pump may be damaged.

### 7.5.1 Instructions on how to drain and f II the cooling system

1. Loosen the plug screw (a) or (b) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to contain any possible spray of glycol as the pump de-pressurises.

2. Secure a hoist to the lifting hoop. Tilt the pump to 45° with the drain plug underneath.

**Note:** because there is insufficient space to place a waste container underneath the drain plug by the completion of step 5, the waste must be drained into a sump.

- 3. Remove the plug screw and seal ring (a) from the drain hole.
- 4. Glycol will empty from the cooling jacket chamber.
- 5. When the flow stops, continue to gradually tilt the pump until horizontal. This will drain the remaining glycol from the seal chamber.

**Note:** draining the glycol entirely with the pump in a horizontal position would result in some glycol being retained in the cooling jacket.

- 6. After the glycol is fully drained raise the pump into its upright position and refit the plug screw and seal ring (a).
- 7. Remove the plug screw and seal ring (b) from the fill hole.
- 8. Select the required volume of glycol from the quantities table and slowly pour into the fill hole.
- 9. Refit the plug screw and seal ring (b).



(a) Drain (b) Fill



DRAIN





### 7.6 Oil and glycol quantities (litres)

		Lubricant		Coolant	
XFP	Motor	(withou	t cooling jacket)	(with cooling jacket)	
		Oil	Water and propylene glycol	Water and propylene glycol	
PE 1	PE45/2 PE22/4 PE28/4 PE35/4 PE18/4W PE28/4W PE20/6 PE20/6W	<mark>0.43</mark>	-	-	
PE 2	PE80/2 PE125/2 PE45/4 PE56/4 PE75/4 PE90/4 PE105/4 PE35/6	0.68	-	_	
PE3	PE185/2 PE200/2 PE300/2 PE130/4 PE150/4 PE185/4 PE210/4 PE90/6 PE110/6 PE130/6 PE130/6 PE160/6 PE120/8 PE250/4 PE200/6	-	8.0	16.5	

Volume ratio: 86% oil or water/propylene glycol : 14% air

### Specif cation:

Lubricant: white mineral oil VG8 FP153C or 70% water/30% glycol Coolant: 70% water/30% glycol

### 7.7 Bottom plate adjustment

At manufacture, the bottom plate is fitted to the volute with the correct clearance gap set between the impeller and the bottom plate (for optimum performance max 0.2 mm).

### 7.7.1 Instructions on how to adjust the bottom plate

To reset the clearance gap following wear:

(Note: when adjusting PE3 pumps, steps 1, 2 and 3 do not apply)

- 1. Check the position of the alignment notch (e) in the fixing lug to determine if the bottom plate is in the factory pre-set position or if the clearance gap has been previously adjusted. If previously adjusted proceed to Step 4.
- 2. Remove the three screws (c) securing the bottom plate to the volute. Attention: if, due to corrosion, the bottom plate does not release freely from the volute, DO NOT force it free by tightening the adjusting grub screws (d) against the fixing lugs on the volute as this could damage the lugs on the bottom plate beyond repair! In that case, first remove the volute from the motor housing by releasing the three securing screws (f) and then remove the bottom plate by tapping it free from inside the volute using a mallet and block of wood.
- 3. Rotate the bottom plate anti-clockwise through 45° from the pre-set position (a) to the secondary alignment position (b) and refit the securing screws.
- 4. Loosen the adjusting grub screws (d) and tighten the securing screws in the bottom plate evenly until the impeller will lightly, but freely, rub against the bottom plate when rotated by hand.
- 5. Tighten the grub screws fully to secure the bottom plate in position (max. 33 Nm).









### 7.8 Bearings and Mechanical Seals

XFP pumps are fitted with lubricated-for-life ball bearings. Shaft sealing is by means of double mechanical seals.

### ATTENTION: Once removed, bearings and seals must not be re-used, and must be replaced in an approved workshop with genuine ABS spare parts.

### 7.9 Changing the power cable (PE1 & PE2)

To facilitate quick and easy changing or repair of the power cable, the connection between the cable and motor is by means of an integrated 10-pole terminal block.



To be carried out only by a qualified person, in strict adherence to relevant safety regulations.

### 7.10 Cleaning

If the pump is used for transportable applications, then in order to avoid deposits of dirt and encrustation it should be cleaned after each usage by pumping clear water. In the case of fixed installation, we recommend that the functioning of the automatic level control system be checked regularly. By switching the selection switch (switch setting "HAND") the sump will be emptied. If deposits of dirt are visible on the floats then these should be cleaned. After cleaning, the pump should be rinsed out with clear water and a number of automatic pumping cycles carried out.

### 7.11 Venting of the volute

After lowering the pump into a sump full of water, an air lock may occur in the volute and cause pumping problems. To clear the air lock, raise the pump in the medium and then lower it again. If necessary, repeat this venting procedure.

We strongly recommend that dry-installed XFP pumps are vented back into the sump by means of the (drilled and tapped) hole provided in the volute.

## 8 Troubleshooting Guide

Fault	Cause	Fix
Pump does not run	Moisture sensor shutdown.	Check for loose or damaged oil plug, or locate and replace faulty mechanical seal / damaged o-rings. Change oil. <sup>1)</sup>
	Level control override.	Check for float switch that is faulty or tangled and held in OFF position in sump.
	Impeller jammed.	Inspect and remove jammed object. Check gap between impeller and bottom plate and adjust if necessary.
	Gate valve closed, non-return valve blocked.	Open gate valve, clean blockage from non-return valve.
Pump switching on/off intermittently	Temperature sensor shutdown.	Motor will restart automatically when pump cools down. Check thermal relay settings in control panel. Check for impeller blockage. If none of above, a service inspection is required. <sup>1)</sup>
Low head or flow	Wrong direction of rotation.	Change rotation by interchanging two phases of the power supply cable.
	Gap too wide between impeller and bottom plate	Reduce gap (see page 13).
	Gate valve partially open.	Open valve fully.
Excessive noise or vibration	Defective bearing.	Replace bearing. <sup>1)</sup>
	Clogged impeller.	Remove and clean hydraulics.
	Wrong direction of rotation.	Change rotation by interchanging two phases of the power supply cable.
High voltage	Water inside motor.	Replace stator. <sup>1)</sup>
test failure	Stator insulation damaged.	Replace stator. <sup>1)</sup>
	Power cable or lead damaged.	Replace power cable. <sup>1)</sup>
Ohms test failure	Stator failure.	Repair/replace stator. <sup>1)</sup>



Before commencing any inspection or repair work the pump should be completely disconnected from the mains by a qualified person and care should be taken that it cannot be inadvertently switched back on.

<sup>1)</sup> Pump must be taken to approved workshop.

	SERVICE LOG		
Pump Type:		Serial No:	
Date	Hours of Operation	Comments	Sign





Cardo Production Wexford Ltd. Clonard Road, Wexford, Ireland Tel. +353 53 91 63 200 Fax +353 53 91 42335. www.absgroup.com

## SECTION 12e.5: MEMBRANE PERMEATE PUMPS

### P&ID: Item #: P-0811, P-0812

Unit Details: Goulds Model 1ST2C5A2 0.5Hp, 3Ø/60Hz/460V 20 GPM @ 25' TDH

Manufacturer: Goulds Pumps, ITT Industries 2881 East Bayard Street Seneca Falls, NY 13148 Phone: (315) 568-7123 www.goulds.com

Local Distributor/Contact:

Industrial Pump Sales & Service, Inc. 37 William S. Canning Blvd. Tiverton, RI 02878 Phone: (800) 323-6532 or (401) 624-2977 Fax: (401) 624-3373 www.ipspump.com THIS PAGE INTENTIONALLY LEFT BLANK





**Commercial Water** 

# Goulds Pumps

# G&L Series NPE

# 316L SS

NPE Series End Suction Centrifugal Pumps Bombas Centrífugas de Succión Final Serie NPE





Goulds Pumps is a brand of ITT Corporation. Goulds Pumps es una marca de fábrica de ITT Corporation. www.goulds.com

### A Full Range of Product Features Una Gama Total de Características del Producto

NPE Product Line Numbering System Línea de Producto NPE Sistema de Numeración

### **Superior Materials of**

**Construction:** Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

### **High Efficiency Impeller:**

Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

### **Casing and Adapter Features:**

Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

**Mechanical Seal:** Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

**Motors:** NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left. Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

#### Example Product Code, Ejemplo Código del Producto

### 1 ST 2 C 1 A 4 F **1ST2C5A2**

#### └─ Seal Vent/Flush Option, Opción de Sello Válvula/ChorroSeal Ven

— Mechanical Seal and O-ring

4 = Pre-engineered standard For optional mechanical seal modify catalog order no.

with seal code listed below.

#### Sello Mecánico y Anillo 'O' 4 = Estándar aprobado

Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

	John Crane Type 21 Mechanical Seal (⅔" seal), Sello Mecánico John Crane Tipo 21 (sello de ⅔")					
Seal Code, Código del Sello	Seal Code, Rotary, Stationary, Código Rotativo Estacionario del Sello			Metal Parts, Partes Metálicas	Part No., Pieza Número	
2	Carbon		EPR		10K18	
4	Carbon	Silicon	Viton	216.66	10K55	
5	Silicon	Carbide	EPR	310.22	10K81	
6	Carbide		Viton		10K62	

#### Impeller Option . . . No Adder Required

For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

#### Código del Impulsor Opcional

Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code,	Pump S	Pump Size, Tamaño de la Bomba			
Código del	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6		
Impulsor	Diameter	Diameter	Diameter		
K	-	61/8	-		
G	-	5 <sup>15</sup> / <sub>16</sub>	53/8		
Н	_	51/2	5		
A	<mark>61/8</mark>	51/4	43/4		
В	53/4	51/16	45/8		
C	53/16	41/8	43/8		
D	43/4	45/8	41/16		
E	47/16	41/4	35/8		
г	417	27/			

### - Driver, Conductor

2

3

4

	-		
=	1 PH, ODP	7 =	3 PH, XP
=	3 PH, ODP	8 =	575 V, XP
=	575 V, ODP	9 =	3 PH, TEFC
=	1 PH, TEFC		Premium Eff.
=	3 PH, TEFC	0 =	1 PH, XP

6 = 575 V, TEFC **HP Rating,** *HP Potencia*  $(C = \frac{1}{2} \text{ HP} \text{ E} = 1 \text{ HP} \text{ G} = 2 \text{ HP} \text{ J} = 5 \text{ HP} \text{ D} = \frac{3}{4} \text{ HP} \text{ F} = 1\frac{1}{2} \text{ HP} \text{ H} = 3 \text{ HP}$ 

mounted version, substitute the letters "FRM" in these positions. Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

For frame

#### 5 = 50 Hz, 4 pole, 1450 RPM — **Material**

### ST = Stainless steel, Acero inoxidable

Driver: Hertz/Pole/RPM,

1 = 60 Hz, 2 pole, 3500 RPM

2 = 60 Hz, 4 pole, 1750 RPM

3 = 60 Hz, 6 pole, 1150 RPM

4 = 50 Hz, 2 pole, 2900 RPM

Conductor: Hercios/Polo/RPM

Pump Size, Tamaño de la Bomba  $1 = 1 \times 1\frac{1}{4} - 6$   $2 = 1\frac{1}{4} \times 1\frac{1}{2} - 6$   $3 = 1\frac{1}{2} \times 2 - 6$ 

**GOULDS PUMPS** Commercial Water

### Performance Coverage (60 Hz) Alcance de Funcionamiento (60 Hz)



### NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on noncataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

#### NOTAS:

No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

### Performance Curves – 60 Hz, 1750 RPM Curvas de Funcionamiento – 60 Hz, 1750 RPM





**NOTE:** Although not recommended, the pump may pass a <sup>1</sup>/<sub>16</sub>" sphere. **NOTA:** Si bien no se recomienda, la bomba puede pasar una esfera de <sup>1</sup>/<sub>16</sub>".



Optional Impeller, Impulsor Opcional			
Ordering Code, Código de Pedido Dia.			
К	61⁄8″		
G	5 <sup>15</sup> ⁄16″		
Н	51⁄2		
А	51⁄4		
В	5 <sup>1</sup> / <sub>16</sub>		
С	41/8		
D	41/8		
E	41⁄4		
F	31/8		

**NOTE:** Although not recommended, the pump may pass a  $\frac{3}{16}$ " sphere.

**NOTA:** Si bien no se recomienda, la bomba puede pasar una esfera de  $\frac{3}{16}$ ".

### NPE Close Coupled Pump Major Components: Materials of Construction Bomba Cerrada Acoplada NPE Componentes Principales: Materiales de Construcción



ltem No., Parte No.	Description, Descripción	Materials, <i>Materiales</i>	
100	Casing; Carcasa		
101	Impeller; Impulsor	AISI 316L SS;	
108	Motor adapter; Adaptador del motor	AISI 316L	
108A	Motor adapter seal vent/flush; Sello válvula/chorro del adaptador del motor	Acero inoxidable	
123	Deflector; Deflector	BUNA-N	
184	Seal housing; Alojamiento del sello		
184 A Seal housing seal vent/flush; Sello válvula/chorro del alojamiento del sello		AISI 316L SS; AISI 316L Acero inovidable	
347	Guidevane; Difusor	Accio monuable	
349	Seal ring, guidevane; Anillo del sello, difusor	Viton	
370	Socket head screws, casing; Encajes cabezas de tornillos, carcasa	AISI 410 SS; AISI 410 Acero inoxidable	
371	Bolts, motor; Tornillos, motor	Plated steel; Acero chapeado	
383	Mechanical seal; Sello mecánico	**see chart, ver tabla	
408	Drain and vent plug, casing; Enchufes de drenaje y válvula, carcasa	AISI 316L SS; AISI 316L Acero inoxidable	
412B	O-ring, drain and vent plug; Anillo 'O', enchufe de drenaje y válvula	Viton (Standard, estándar)	
513	O-ring, casing; Anillo 'O', carcasa	EPK (Optional, Opcional)	
Motor <i>Motor</i>	NEMA standard, 56J flange; NEMA estándar, brida 56J		



<sup>1</sup>/<sub>2</sub>, <sup>3</sup>/<sub>4</sub> and 1 HP <sup>1</sup>/<sub>2</sub>, <sup>3</sup>/<sub>4</sub> y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.



### NPE Close Coupled – Dimensions, Weights and Specifications

ODP and TEFC 1<sup>1</sup>/<sub>2</sub>, 2 and 3 HP, ODP y TEFC 1<sup>1</sup>/<sub>2</sub>, 2 y 3 HP

### **Specifications**

### Capacities to:

75 GPM (283L/min) at 1750 RPM 150 GPM (550L/min) at 3500 RPM

Heads to: 39 feet (12 m) at 1750 RPM 150 feet (46 m) at 3500 RPM

### Working pressures to: 125 PSIG (9 bars)

**Maximum temperatures to:** 212°F (100°C) with standard seal or 250°F (121°C) with optional high temperature seal.

### Direction of rotation:

Clockwise when viewed from motor end.

### Motor specifications:

NEMA 56J frame, 1750 RPM, 1/2 HP. 3500 RPM 1/2 through 5 HP. Open drip-proof, totally enclosed fan-cooled or 2 HP explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/ 460 ODP, TEFC and EX PROOF. NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.















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# **Owner's Information**

Pump Model Number:					
Pump Serial Num	1				
Dealer:					
Dealer Phone No	.:				
Date of Purchase	:				
Date of Installation	Date of Installation:				
Current Readings at Startup:					
1 Ø	3 Ø	L1-2	L2-3	L3-1	
Amps:	Amps:				
Volts:	Volts:				

### SAFETY INSTRUCTIONS



Hazardous fluids can cause fire, burns or death.

### **DESCRIPTION & SPECIFICATIONS:**

The Models NPE (close-coupled) and NPE-F (framemounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

### 1. IMPORTANT:

- **1.1.** Inspect unit for damage. Report any damage to carrier/dealer immediately.
- **1.2.** Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per national and local electrical codes. Install an all-leg disconnect switch near pump.

# **ACAUTION** Always disconnect electrical power when handling pump or controls.

- **1.3.** Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.
- **1.4.** Always use horsepower-rated switches, contactor and starters.
- 1.5. Motor Protection
  - **1.5.1.** Single-phase: Thermal protection for singlephase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.
  - **1.5.2.** Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.
- 1.6. Maximum Operating Limits:

Liquid Temperature:	250° F (120° C)
Pressure:	125 PSI
Starts Per Hour:	20, evenly distributed

**1.7.** Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

### 2. INSTALLATION:

- 2.1. General
  - **2.1.1.** Locate pump as near liquid source as possible (below level of liquid for automatic operation).
  - 2.1.2. Protect from freezing or flooding.
  - **2.1.3.** Allow adequate space for servicing and ventilation.
  - **2.1.4.** All piping must be supported independently of the pump, and must "line-up" naturally.

**ACAUTION** Never draw piping into place by forcing the pump suction and discharge connections.

- **2.1.5.** Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.
- 2.2. Close-Coupled Units
  - **2.2.1.** Units may be installed horizontally, inclined or vertically.

# **A**CAUTION Do not install with motor below pump. Any leakage or condensation will affect the motor.

- **2.2.2.** Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.
- **2.2.3.** Tighten motor hold-down bolts before connecting piping to pump.
- **2.3.** Frame-Mounted Units
  - **2.3.1.** It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure 1.



### Figure 1

- **2.3.2.** Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.
- **2.3.3.** Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.
- **2.3.4.** Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.
- **2.3.5.** Tighten pump and motor hold-down bolts before connecting the piping to pump.

### **3. SUCTION PIPING:**

- 3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.
- **3.2.** Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.
- **3.3.** If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.
- 3.4. Installation with pump below source of supply
  - **3.4.1.** Install full flow isolation valve in piping for inspection and maintenance.

# **A** CAUTION Do not use suction isolation valve to throttle pump.

- 3.5. Installation with pump above source of supply
  - **3.5.1.** Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.
  - 3.5.2. All joints must be airtight.
  - **3.5.3.** Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.
  - **3.5.4.** Suction strainer open area must be at least triple the pipe area.

- **3.6.** Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figures 2-5.
- **3.7.** Use 3-4 wraps of Teflon tape to seal threaded connections.



### 4. DISCHARGE PIPING:

- **4.1.** Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.
- **4.2.** If an increaser is required, place between check valve and pump.
- **4.3.** Use 3-4 wraps of Teflon tape to seal threaded connections.

### 5. MOTOR-TO-PUMP SHAFT ALIGNMENT:

5.1. Close-Coupled Units

5.1.1. No field alignment necessary.

- 5.2. Frame-Mounted Units
  - **5.2.1.** Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Figure 6.



- **5.2.2.** Tighten all hold-down bolts before checking the alignment.
- **5.2.3.** If re-alignment is necessary, always move the motor. Shim as required.

- **5.2.4.** Parallel misalignment shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.
- **5.2.5.** Angular misalignment shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.
- **5.2.6.** Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

# **A**CAUTION Always recheck both alignments after making any adjustment.

- 6. ROTATION:
- **6.1.** Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:
  - 6.1.1. Single-phase motor: Non-reversible.
  - **6.1.2.** Three-phase motor: Interchange any two power supply leads.

### 7. OPERATION:

**7.1.** Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

**CAUTION** Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

### 8. MAINTENANCE:

- **8.1.** Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.
- 8.2. Frame-Mounted Units
  - 8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.
  - **8.2.2.** Follow motor and coupling manufacturers' lubrication instructions.
  - **8.2.3.** Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

### 9. DISASSEMBLY:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

- 9.1. Turn off power.
- 9.2. Drain system. Flush if necessary.
- **9.3.** Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

- 9.4. Disassembly of Liquid End
  - 9.4.1. Remove casing bolts (370).
  - **9.4.2.** Remove back pull-out assembly from casing (100).
  - 9.4.3. Remove impeller locknut (304).

**CAUTION** Do not insert screwdriver between impeller vanes to prevent rotation of closecoupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

- **9.4.4.** Remove impeller (101) by turning counterclockwise when looking at the front of the pump. Protect hand with rag or glove.
- **A**CAUTION Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.
  - **9.4.5.** With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.
  - **9.4.6.** Push out the mechanical seal stationary seat from the motor side of the seal housing.
- 9.5. Disassembly of Bearing Frame
  - 9.5.1. Remove bearing cover (109).
  - 9.5.2. Remove shaft assembly from frame (228).
  - **9.5.3.** Remove lip seals (138 and 139) from bearing frame and bearing cover if worn and are being replaced.
  - **9.5.5.** Use bearing puller or arbor press to remove ball bearings (112 and 168).

### **10. REASSEMBLY:**

- 10.1. All parts should be cleaned before assembly.
- **10.2.** Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.
- 10.3. Reassembly is the reverse of disassembly.

**10.3.1.** Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

- **10.4.** Observe the following when reassembling the bearing frame.
  - 10.4.1. Replace lip seals if worn or damaged.
  - **10.4.2.** Replace ball bearings if loose, rough or noisy when rotated.
  - **10.4.3.** Check shaft for runout. Maximum permissible is .002" T.I.R.
- **10.5.** Observe the following when reassembling the liquid-end.
  - 10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

- **10.5.2.** Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.
- 10.5.3. Inspect guidevane O-ring (349) and replace if worn.

**A CAUTION** Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.

- **10.6.** Check reassembled unit for binding. Correct as required.
- **10.7.** Tighten casing bolts in a star pattern to prevent Oring binding.

### **11. TROUBLE SHOOTING CHART:**

MOTOR NOT RUNNING: (See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED: (See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH: (See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION: (See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

### PROBABLE CAUSE:

- 1. Tripped thermal protector
- 2. Open circuit breaker
- 3. Blown fuse
- 4. Rotating parts binding
- 5. Motor wired improperly
- 6. Defective motor
- 7. Not primed
- 8. Discharge plugged or valve closed
- 9. Incorrect rotation
- 10. Foot valve too small, suction not submerged, inlet screen plugged
- 11. Low voltage
- 12. Phase loss (3-phase only)
- 13. Air or gasses in liquid
- 14. System head too high
- 15. NPSHA too low: Suction lift too high or suction losses excessive. Check with vacuum gauge.
- 16. Impeller worn or plugged
- 17. Incorrect impeller diameter
- 18. Head too low causing excessive flow rate
- 19. Viscosity or specific gravity too high
- 20. Worn bearings
- 21. Pump or piping loose
- 22. Pump and motor misaligned

### NPE STANDARD REPAIR PARTS LIST

ltem No.	Description	Materials of Construction	
100	Casing		
101	Impeller		
108A	Motor adapter with foot	AISI 316L	
108B	Motor adapter less foot	Stainless Steel	
108C	Motor adapter with foot and flush		
108D	Motor adapter less foot with flush		
123	Deflector	BUNA-N	
184A	Seal housing std.		
184B	Seal housing with seal flush	AISI 510L 5.5.	
240	Motor support	300 S.S.	
240	Rubber channel	Rubber	
304	Impeller locknut	AISI 316 S.S.	
347	Guidevane	AISI 316L S.S.	
		Viton (standard)	
349	Seal-Ring, guidevane	EPR	
		BUNA	
370	Socket head screw, casing	AISI 410 S.S.	
371	Bolts, motor	Steel/plated	
383	Mechanical seal		
408	Drain and vent plug, casing	AISI 316 S.S.	
		Viton (standard)	
412B	O-Ring, drain plugs	EPR	
		BUNA	
		Viton (standard)	
513	O-Ring, casing	EPR	
		BUNA	

## MECHANICAL SEAL APPLICATION CHART

Item 383 Mechanical Seal (5/8" seal)							
Rotary	Rotary Stationary Elastomers Metal Parts						
Carbon	· Sil-Carbide	EPR		10K18			
		Viton	31655	10K55			
Sil-Carbide		EPR		10K81			
		Viton		10K62			

**NOTE:** Close coupled units supplied with  $\frac{1}{2}$  HP 1750 RPM,  $\frac{1}{2}$  - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

**NOTE:** Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



# **Commercial Water**

### **GOULDS PUMPS LIMITED WARRANTY**

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

#### The warranty excludes:

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- (a) Labor, transportation and related costs incurred by the dealer;
- (b) Reinstallation costs of repaired equipment;
- (c) Reinstallation costs of replacement equipment;
- (d) Consequential damages of any kind; and,
- (e) Reimbursement for loss caused by interruption of service.

#### For purposes of this warranty, the following terms have these definitions:

- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
- "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, (3) corporation, limited liability company, association or other legal entity which may engage in any type of business.

### THIS WARRANTY EXTENDS TO THE DEALER ONLY.



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IM013 Revision Number 8 April, 2008 © 2008 ITT Corporation

# SECTION 12e.6: MEMBRANE DRAIN SUMP PUMP

### P&ID: Item #: P-1011

- Unit Details: Goulds Model WE0534H 0.5Hp, 3Ø/60Hz/460V 40 GPM @ 25' TDH
- Manufacturer: Goulds Pumps, ITT Industries 2881 East Bayard Street Seneca Falls, NY 13148 Phone: (315) 568-7123 www.goulds.com

Local Distributor/Contact:

Industrial Pump Sales & Service, Inc. 37 William S. Canning Blvd. Tiverton, RI 02878 Phone: (800) 323-6532 or (401) 624-2977 Fax: (401) 624-3373 www.ipspump.com THIS PAGE INTENTIONALLY LEFT BLANK





# **Goulds Pumps**

WE Series Model 3885 Submersible Effluent Pump

EXTENDED WARRANTY AVAILABLE FOR RESIDENTIAL APPLICATIONS.



P&ID #: P-1011 Goulds Model WE0534H

# **FEATURES**

- Impeller: Cast iron, semi-open, non-clog with pump-out vanes for mechanical seal protection. Balanced for smooth operation. Silicon bronze impeller available as an option.
- Casing: Cast iron volute type for maximum efficiency. 2" NPT discharge.
- Mechanical Seal: Silicon Carbide vs. Silicon Carbide sealing faces. Stainless steel metal parts, BUNA-N elastomers.
- Shaft: Corrosion-resistant, stainless steel. Threaded design. Locknut on all models to guard against component damage on accidental reverse rotation.
- **Fasteners:** 300 series stainless steel.
- Capable of running dry without damage to components.
- Designed for continuous operation when fully submerged.



Goulds Pumps is a brand of ITT Corporation.

www.goulds.com



### **APPLICATIONS**

Specifically designed for the following uses:

 Homes, Farms, Trailer Courts, Motels, Schools, Hospitals, Industry, Effluent Systems

### **SPECIFICATIONS**

### Pump

- Solids handling capabilities: <sup>3</sup>/<sub>4</sub>" maximum.
- Discharge size: 2" NPT.
- Capacities: up to 140 GPM.
- Total heads: up to 128 feet TDH.
- Temperature: 104°F (40°C) continuous, 140°F (60°C) intermittent.
- See order numbers on reverse side for specific HP, voltage, phase and RPM's available.

### MOTORS

- Fully submerged in high-grade turbine oil for lubrication and efficient heat transfer.
- Class B insulation on  $\frac{1}{3} 1\frac{1}{2}$  HP models.
- Class F insulation on 2 HP models.

### Single phase (60 Hz):

- Capacitor start motors for maximum starting torque.
- Built-in overload with automatic reset.
- SJTOW or STOW severe duty oil and water resistant power cords.

<sup>1</sup>/<sub>3</sub> - 1 HP models have NEMA three prong grounding plugs.

**GOULDS PUMPS** 

Wastewater

• 1<sup>1</sup>/<sub>2</sub> HP and larger units have bare lead cord ends.

### Three phase (60 Hz):

- Class 10 overload protection must be provided in separately ordered starter unit.
- STOW power cords all have bare lead cord ends.
- Designed for Continuous Operation: Pump ratings are within the motor manufacturer's recommended working limits, can be operated continuously without damage when fully submerged.
- Bearings: Upper and lower heavy duty ball bearing construction.
- Power Cable: Severe duty rated, oil and water resistant. Epoxy seal on motor end provides secondary moisture barrier in case of outer jacket damage and to prevent oil wicking. Standard cord is 20'. Optional lengths are available.
- O-ring: Assures positive sealing against contaminants and oil leakage.

### AGENCY LISTINGS



Tested to UL 778 and CSA 22.2 108 Standards By Canadian Standards Association File #LR38549 Goulds Pumps is ISO 9001 Registered.







# **GOULDS PUMPS** Wastewater

### MODELS

Number         Prior         Point         Prior         Diameter (in)         Amps         Code         Efficiency         Statt         Line-line         Cobes (in)         (hs)           WE031R1	Order					Impeller	Maximum	Locked Rotor	KVA	Full Load	Res	istance	Power	Weight	
WE031L WE032H WE032H WE0332M         15 208 20 20 20 WE033M         115 208 20 20 20 20 WE053H H 1 2 20 WE053H H 2 20 WE053H H 2 20 WE053H H 2 20 WE053H H 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Number	HP	Phase	Volts	RPM	Diameter (in.)	Amps	Amps	Code	Efficiency %	Start	Line-Line	Cable Size	(lbs.)	
VE0318, WE031M WE031M WE031M WE031M WE031M WE031M WE031M WE031M WE031M WE031M WE051H WE051H WE051H WE051H WE052H WE052H WE053BH WE052H WE053BH WE0532H WE053BH WE0532H M WE0532H M M M M M M M M M M M M M M M M M M M	WE0311L			115			10.7	30.0	М	54	11.9	1.7			
VE0314 WE031M WE031M WE031M WE031M WE051H WE051H WE051H WE051H WE051H WE051H WE051H WE053H M M 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	WE0318L			208			6.8	19.5	K	51	9.1	4.2			
	WE0312L	0.22		230	4750	F 20	4.9	14.1	L	53	14.5	8.0	4.672	50	
WE0318M WE0511M WE0518H WE0518H WE0532H M WE0532H M WE0532H M WE0532H M WE0532H M WE0532H M WE0532H M WE0532H M M M M M M M M M M M M M M M M M M M	WE0311M	0.33	0.33	115	1/50	5.38	10.7	30.0	М	54	11.9	1.7	16/3	56	
WE0312M         WE0314H         WE0511H         Z30         4.9         14.1         L         53         14.5         8.0           WE0511H         230         115         230         14.5         46.0         M         54         7.5         1.0         14/3         60           WE051H         230         460         K         68         9.7         2.0         16/3         60           WE052H         3         18.8         R         7.0         NA         5.8         16/3         60           WE052H         575         1.0         14/3         60         17.7         9.4         R         7.0         NA         5.8           WE052H         1.1         208         1.4         7.5         R         62         NA         3.23         14.5         46.0         M         54         7.5         1.0         14/4         60           WE0532H         1.1         208         14.5         46.0         M         54         7.5         1.0         14.3         60           WE0532H         220         1.1         7.3         34.5         M         3.8         3.8         16.0         16.3	WE0318M			208			6.8	19.5	K	51	9.1	4.2			
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WE0537Hn WE0712H WE0738H WE0738H WE0738H WE0738H WE0738H WE0738H WE0738H WE0738H WE0738H WE0737H         1         208 230 460         1.3         3.4         K         70         NA         25.2         NA         14/3         70           WE0732H WE0738H WE0738H WE0737H         1         208 230         200 230         11.0         31.0         K         668         9.7         2.4         14/3         70           WE073H WE0737H         75         3         460         5.4         15.7         K         668         NA         3.6.0           WE1018H WE1032H WE1032H WE1032H WE1037H         1         208 230         3450         14.40         59.0         K         688         9.3         1.1         14/4         70           WE1032H WE1032H WE1032H WE1532H WE1532H WE1532H WE1532H WE1532H WE1532H WE1532HH WE1533HH         200 3         230 460         17.5         59.0         K         68         9.3         1.1         14/4         80           WE1532H WE1532H WE1532H WE1533HH         1.5         200 3         16.6         40.6         K         79         NA         1.9         9.2         31.7			3	160	-		1.0	0.4		70	NA NA	2.0	14/4	60	
WE033Hh         1         208 230         1.3         7.3         K         622         NA         35.3         7           WE0712H WE0732H WE0732H WE0732H WE0732H WE0732H         1         208 230         200 460         10.0         27.5         J         655         12.2         2.7         14/3         70           WE0732H WE0732H WE0732H         77.5         K         68         9.7         2.4         14/3         70           WE0732H WE0732H WE0732H         75         200 460         230         460         10.0         27.7         7.9         K         68         NA         8.6           WE1038H WE1038H         1         208 230         3450         14.0         59.0         K         68         9.3         1.1         14/4         70           WE1038H WE1037H         1         200 230         3450         11.0         12.5         36.2         J         69         10.3         2.1         14/4         70           WE1037H         1         200 230         3450         11.1         1.5         14.44         11.5         11.5         11.4         14.44         11.4         14.44         11.4         11.4         11.4         11.4         1				400 575	1		1.0	9.4		70 62		25.2			
WE0712H WE0732H WE0732H WE0732H WE0732H WE0732H WE0737H         1         200 230 460         200 460         11.0 230         11.0 230         21.0 230         1 4.06         10.0 27.5         J 6.2         6.6 2.0 2.0.6         L 6.6         6.6 4.06         NA         5.7 5.4         12.2         2.7 2.7         14/3         70           WE0732H WE0737H WE1037H WE1032H WE1032H WE1032H WE1032H WE1032H WE1032H WE1032H WE15				2/2	1		11.0	7.5		62		20.5			
WE0712H WE073BH WE073BH WE073H         2.75         2.00 2.00         2.00 2.00         2.1.5         3         6.5         1.2.2         2.7.4         7.5         7.6         8.6         8.4         8.6         7.6         7.6         8.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.6         7.7         7.6         7.6         7.6         7.7         7.6         7.6         7.7 </td <td></td> <td></td> <td>1 200</td> <td></td> <td>10.0</td> <td>31.0</td> <td>K I</td> <td>08 CE</td> <td>9.7</td> <td>2.4</td> <td>14/3</td> <td>70</td>			1 200		10.0	31.0	K I	08 CE	9.7	2.4	14/3	70			
WE0738H WE0732H WE0737H         0.75 3         200 2400 3460         4.06         6.2         2.0.6         L         6.4         NA         5.7           WE0737H WE0737H         3         460         575         5.4         15.7         K         668         NA         8.6           WE0737H         575         2.2         9.9         L         78         NA         26.5           WE1012H WE1032H         1         200 3450         3450         12.5         36.2         J         69         10.3         2.1         14/3         70           WE1032H WE1032H         1         230         3450         4.44         3.5         12.1         L         79         NA         4.1         3.5         1.1         14/3         70           WE1032H WE1032H         1         200         4.44         3.5         12.1         L         79         NA         4.1         3.5         1.1         14/4         70           WE1532H WE1532H         1         200         230         460         75         7.5         59.0         K         68         9.3         1.1         14/4         80           WE1532H WE1532H         1.5         230	WE0712H			230	-		10.0	27.5	1	65	12.2	2.7			
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	VVE0738H	0.75		200	-	4.06	0.2	20.6	L	64	NA	5.7			
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	VVE0732H		3	230	-		5.4	15.7	K	68	NA	8.0	14/4	70	
WE0/3/H         I         S75         S75 </td <td>WE0734H</td> <td></td> <td></td> <td>460</td> <td>-</td> <td>2.7</td> <td>7.9</td> <td>K</td> <td>68</td> <td>NA</td> <td>34.2</td> <td></td>	WE0734H			460	-		2.7	7.9	K	68	NA	34.2			
WE1013H WE1012H WE1032H         1         208 230         3450         14.0         59.0         K         68         9.3         1.1         14/3         70           WE1012H WE1032H         1         200         3450         12.5         36.2         J         69         10.3         2.1         14/3         70           WE1032H WE1032H         3         460         70         24.1         L         79         NA         4.2           WE1037H         575         460         575         12.1         L         79         NA         46.2           WE1518H         1         230         17.5         59.0         K         68         9.3         1.1         14/3         80           WE1532H         3         230         15.7         50.0         H         68         11.3         1.6         14/3         80           WE1532H         3         230         460         575         10.6         40.6         K         79         NA         1.9         14/4         80           WE1532H         1.5         755         11.6         11.7         59.0         K         68         9.3         1.1         14/4	WE0737H	1 208 230 3450						2.2	9.9	L	/8	NA	26.5		
WE1012H WE1038H WE1032H         1         230 3450         3450         12.5         36.2         J         669         10.3         2.1         1         1           WE1032H WE1032H         1         3         230 460         230 460         230 460         7.0         24.1         L         79         NA         4.1         14/4         70           WE1037H         575         36.2         12.1         L         79         NA         4.1         14/4         70           WE1518H         755         2.8         9.9         L         78         NA         26.5           WE1538H         230         75         59.0         K         688         9.3         1.1         14/3         80           WE1532H         3.7         13.1         K         79         NA         1.9         14/4         80           WE1532H         4.66         15.9         K         78         NA         1.1         14/3         80           WE1532HH         1.5         230         4.66         15.9         K         78         NA         1.1         14/3         80           WE1532HH         230         3.3         1.1	WE1018H		1	208	2450		14.0	59.0	K	68	9.3	1.1	14/3	70	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	WE1012H			230	3450		12.5	36.2	J	69	10.3	2.1			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	WE1038H	1		200	-	4.44	8.1	37.6	M	//	NA	2.7			
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	WE1032H		3	230	-		/.0	24.1	L	/9	NA	4.1	14/4	70	
WE1037H         Image: S75         S75         S75         S75         S75         S75         S9.0         K         68         9.3         1.1         14/3         80           WE1512H         WE1532H         3         1         230         15.7         59.0         K         68         9.3         1.1         14/3         80           WE1532H         3         230         460         15.7         50.0         H         68         11.3         1.6         14/3         80           WE1532H         3         460         575         3.7         13.1         K         78         NA         2.9         14/4         80           WE1532H         1.5         230         460         15.9         K         78         NA         1.9         4.4         80           WE1532HH         1.5         230         17.5         59.0         K         68         9.3         1.1         4.4         80           WE1532HH         1.2         200         3.7         13.1         K         775         NA         1.9         4.4         80           WE1532HH         230         460         575         3.7 <t< td=""><td>WE1034H</td><td></td><td></td><td>460</td><td>-</td><td></td><td>3.5</td><td>12.1</td><td>L</td><td>79</td><td>NA</td><td>16.2</td><td></td><td></td></t<>	WE1034H			460	-		3.5	12.1	L	79	NA	16.2			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	WE1037H			575	-		2.8	9.9	L	78	NA	26.5			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	WE1518H		1	208			17.5	59.0	K	68	9.3	1.1	14/3	80	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	WE1512H			230			15.7	50.0	Н	68	11.3	1.6			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	WE1538H			200		4.56	10.6	40.6	K	79	NA	1.9			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	WE1532H		3	230			9.2	31.7	K	78	NA	2.9	14/4	80	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	WE1534H			460			4.6	15.9	K	78	NA	11.4	,.		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	WE1537H	1.5		575			3.7	13.1	K	75	NA	16.9			
WE1512HH WE1538HH WE1538HH WE1532HH WE1532HH WE1532HH WE1537HH         1         230         15.7         50.0         H         68         11.3         1.6         1.9         00           0         3         230 460         230         10.6         40.6         K         79         NA         1.9         14/4         80           WE1532HH WE1537HH         3         460         575         3.7         13.1         K         75         NA         11.4         80           WE2012H         1         230         18.0         49.6         F         78         NA         1.2         14/3         83	WE1518HH		1	208			17.5	59.0	K	68	9.3	1.1	14/3	80	
WE1538HH WE1532HH WE1532HH WE1532HH         200         5.50         10.6         40.6         K         79         NA         1.9         1.4/4         80           WE1532HH WE1537HH         3         460         575         466         15.9         K         78         NA         1.9         14/4         80           WE1537HH         575         575         3.7         13.1         K         75         NA         16.9         14/4         80           WE2012H         1         230         18.0         49.6         F         78         3.2         1.2         14/3         83           WE2038H         1         200         12.0         42.4         K         78         NA         1.7	WE1512HH			230			15.7	50.0	Н	68	11.3	1.6	1.175		
WE1532HH WE1533HH         3         230 460         9.2         31.7         K         78         NA         2.9         14/4         80           WE1537HH         575         460         15.9         K         78         NA         11.4         14/4         80           WE2012H         575         575         3.7         13.1         K         75         NA         16.9           WE2038H         200         18.0         49.6         F         78         3.2         1.2         14/3         83	WE1538HH			200		5 50	10.6	40.6	K	79	NA	1.9			
WE1534HH         460         4.6         15.9         K         78         NA         11.4         14/4         80           WE1537HH         575         3.7         13.1         K         75         NA         16.9         16         16.9	WE1532HH		2	230		5.50	9.2	31.7	K	78	NA	2.9	14/4	80	
WE1537HH         575         3.7         13.1         K         75         NA         16.9           WE2012H         1         230         18.0         49.6         F         78         3.2         1.2         14/3         83           WE2028H         200         12.0         42.4         K         78         NA         1.7	WE1534HH			460			4.6	15.9	K	78	NA	11.4	-,-,-		
WE2012H         1         230         18.0         49.6         F         78         3.2         1.2         14/3         83           WE2038H         200         12.0         42.4         K         78         NA         1.7	WE1537HH			575	]		3.7	13.1	K	75	NA	16.9			
WE2038H 200 12.0 42.4 K 79 NA 1.7	WE2012H		1	230	]		18.0	49.6	F	78	3.2	1.2	14/3	83	
VIL203011 200 12.0 42.4 N 70 INA 1.7	WE2038H			200			12.0	42.4	K	78	NA	1.7			
WE2032H 2 230 5.38 11.6 42.4 K 78 NA 1.7 14/4 03	WE2032H	2	2	230		5.38	11.6	42.4	K	78	NA	1.7	1.4/4	00	
WE2034H 5.8 21.2 K 78 NA 6.6 14/4 83	WE2034H		5	460			5.8	21.2	K	78	NA	6.6	14/4	60	
WE2037H 575 4.7 16.3 L 78 NA 10.5	WE2037H			575	]		4.7	16.3	L	78	NA	10.5			



## Wastewater

### **PERFORMANCE RATINGS** (gallons per minute)

0	rder Io.	WE03L	WE03M	WE05H	WE07H	WE10H	WE15H	WE05HH	WE15HH	WE20H
	HP	1/3	1/3	1/2	3/4	1	1½	1/2	1½	2
	RPM	1750	1750	3500	3500	3500	3500	3500	3500	3500
	5	86	-	-	-	—	—	-	—	-
	10	70	63	78	94	—	—	58	95	-
	15	52	52	70	90	103	128	53	93	138
	20	27	35	60	83	98	123	49	90	136
ter	25	5	15	48	76	94	117	45	87	133
Wa	30	-	-	35	67	88	110	40	83	130
of	35	-	-	22	57	82	103	35	80	126
eet	40	-	-	-	45	74	95	30	77	121
dΕ	45	-	-	-	35	64	86	25	74	116
lea	50	-	-	-	25	53	77	-	70	110
al F	55	-	-	-	-	40	67	-	66	103
Tot I	60	-	-	-	-	30	56	-	63	96
	65	-	-	-	-	20	45	-	58	89
	70	-	-	-	-	-	35	-	55	81
	75	-	-	-	-	_	25	-	51	74
	80	_	-	-	-	_	_	-	47	66
	90	-	-	-	-	_	-	-	37	49
	100	-	-	_	-	_	-	-	28	30

### COMPONENTS

Item No.	Description
1	Impeller
2	Casing
3	Mechanical Seal
4	Motor Shaft
5	Motor
6	Ball Bearings
7	Power Cable
8	Casing O-Ring



### DIMENSIONS

(All dimensions are in inches. Do not use for construction purposes.)



# GOULDS PUMPS

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**B3885 June, 2009** © 2008 ITT Corporation



# Wastewater

# CentriPro GUIDE RAII **SYSTEMS** AND DISCHARGE PIPE **ASSEMBLIES Stainless Steel** Mounting Hardware and Stand-off Brackets NOT provided by BioprocessH<sub>2</sub>O CentriPro®

CentriPro is a brand of ITT Corporation.

www.centripro.com

# Engineered for life

# MODELS A10-12 (1<sup>1</sup>/<sub>4</sub>"), A10-2015 (1<sup>1</sup>/<sub>2</sub>") AND A10-20 (2")

- Provide an easy means of removing pump from a wet-well by utilizing a quick disconnect and guide rail system.
- Connect directly to 1¼", 1½" or 2" vertical discharge Effluent, Wastewater and Grinder pumps.
- Adaptable to 1¼", 1½" and 2" threaded, horizontal discharge pumps by using a street elbow.
- Two piece 96" long fabricated SS rail assembly (2 easily coupled 48" long pieces for shipping convenience and ease of handling).
- Corrosion resistant design.

# **STANDARD GUIDE RAIL COMPONENTS**

- SS Guide rails, base, cross braces and pump brackets.
- **S** S Lifting cable, 96" long x  $\frac{3}{16}$ " cable.
- Brass quick disconnect with o-ring seal.
- Schedule 40 galvanized discharge pipe. Optional stainless steel pipe nipples are available (contact factory).
- Cast iron check valve with BUNA ball.
- SS Tee handle for shut-off valve is supplied (it is for use with the optional discharge pipe assemblies).





# System Components and Dimension Chart for A10-12, A10-2015 and A10-20

Item No.	Dimension	Descriptions and Quantities
1	<sup>3</sup> ⁄16" x 96" long	Stainless steel lifting cable
2	47" long	Stainless steel valve extension handle
3	11" min. – 14" max.	Adjustable stainless steel wall (support) brackets (qty. 2) includes (5) $3\%$ SS bolts, nuts and washers
4	1½" O.D.	Stainless steel guide rail tubing, 304 SS, 16 gauge
5	N/A	Stainless steel upper pump/guide bracket
6	1½" (A10-12) 2" (A10-2015 & A10-20)	11/4" Brass quick disconnect assembly, 2" Brass quick disconnect assembly
	1,4 ((10 12), 2 ((10 2013 a)(10 20)	Discharge is 36" up from base to discharge centerline
7	1¼" (A10-12), 2" (A10-2015 & A10-20)	Cast iron ball check valve and lower pump bracket assembly with BUNA ball and clean-out port
8	1¼" (A10-12), 1½" x 2" (A10-2015), 2" (A10-20)	Schedule 40 galvanized discharge pipe (SS discharge pipes are available as a special order option)
9	11" wide (2) 1/2" holes	Base or stud mounting plate
10	11 <sup>1</sup> / <sub>2</sub> " long, <sup>1</sup> / <sub>2</sub> " hole and <sup>1</sup> / <sub>2</sub> " x 1 <sup>1</sup> / <sub>2</sub> " slot	SS attachment brace – connects the (2) 48" guide rail halves, includes (2) $3\%$ SS bolts, nuts and washers
11	N/A	Plastic guide rail connectors (2) fit inside SS rails
12	181/2" – 19" spacing	Stainless steel intermediate braces (3) on upper rail assembly
13	41/2" - 51/2" end to C/L	Upper and lower cross brace dimensions from end of rail



**Stainless Steel Attachment Brace** 



**Stainless Steel Wall Bracket Assembly** 





Valve End of Shut-Off Valve Handle Mounting Hardware and Stand-off Brackets NOT provided by BioprocessH<sub>2</sub>O

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# **CENTRIPRO** Wastewater

# Order Numbers / Quantity Required

Slide Rail Order Number	Slide Rail Pump Discharge		Discharge Size (Inches)	Standard Discharge From Bottom	
A10-12	11⁄4"		1 <sup>1</sup> /4"	36"	
A10-2015	11/2"		2"	36"	
A10-20	2"		2"	36"	
Extension Kits I	nclude: Quantity	<u>ltem #</u>		0	
Stainless steel wall bracket	1	A			
<ul> <li>Guide rail connectors</li> </ul>	2	В	140		
• Stainless steel attachment b	race 1	С			
• Stainless steel rail extension	1	D			
• Stainless steel nuts, bolts ar	nd washers				
• Cable extension – not show	n A B 4EXT			View of Lower Guide Rail showing Brass Disconnect, Ball Check Valve/Lower Pump Bracket Assembly, Lifting Cable and Upper Pump Bracket.	
Order Number	Length				
A10-2012 EXT	12"				
A10-2024 EXT A10-2048 EXT	48"		B B		
			and the set	7	



# DISCHARGE PIPE ASSEMBLIES H12S, H20S, H12D, H20D

# Features

• Simplex discharge piping includes a union and a shut-off valve:

H12S (1<sup>1</sup>/<sub>4</sub>") discharge – use with A10-12; H2OS (2") discharge – use with A10-2015 or A10-20.

Duplex discharge piping includes (2) unions,
 (2) shut-off valves and a tee assembly; H12D (1<sup>1</sup>/<sub>4</sub>") discharge – use with A10-12; H20D (2") discharge – use with A10-2015 or A10-20.

Items in **bold** type are product Order Numbers.

All pipe and fitting galvanized steel. Contact factory for stainless steel option.

### Simplex Discharge Assemblies H12S and H20S

Assembled kits contain a brass gate valve, union and galvanized pipe nipples. Ready for connection to the appropriate guide rail assembly.

**Duplex Discharge Piping Assemblies H12D and H20D** Assembled kits contain (2) brass gate valves, (2) unions, a tee and (2) elbows. Ready for connection to the appropriate guide rail (2) assemblies.

Dimension	Discharge Piping Order Number (dimensions in inches)						
	H12S	H20S	H12D	H20D			
А	20	20	24	26			
В	12	12	12	12			
C	8	8	12	14			
D	NA	NA	14	18			
E	NA	NA	6	7			
F	5.5	8	5.5	8			

\* Stainless steel option available. Consult factory.



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Discharge Pipe	Rail System	Configuration
H12S	A10-12	Simplex
H12D	A10-12	Duplex
H20S	A10-15, 20	Simplex
H20D	A10-15, 20	Duplex



**Duplex Discharge Kit** 



Simplex Discharge Kit

BCPSSGR R4 November, 2007 © 2007 ITT Corporation

Wastewater



# **Goulds Pumps**

# Wastewater Pumps Dewatering, Effluent and Sewage

Installation, Operation and Maintainence Instructions

P&ID #: P-1011 Goulds Model WE0534H



Goulds Pumps is a brand of ITT Water Technology, Inc. - a subsidiary of ITT Industries, Inc.

www.goulds.com

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Optional Guide Rail or Lift-Out System	3
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Wiring and Grounding	4
Selecting and Wiring Pump Control Panels and Switches	
Installation	5
Operation	
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Insulation Resistance Readings	7
Engineering Data	
Troubleshooting	9
Typical Installations	
Limited Warranty	

# **Owner's Information**

Pump Model Nur	nber:					
Pump Serial Number:						
Control Model Number:						
Dealer:	Dealer:					
Dealer Phone No.						
Date of Purchase:Installation:						
Current Readings at Startup:						
1Ø	3Ø	L1-2	L2-3	L3-1		

10	50	L2 5	1.5 1
Amps:	Amps:	 	
Volts:	Volts:	 	
# SAFETY INSTRUCTIONS



MUST BE FOLLOWED. THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY

# MAINTAIN ALL SAFETY DECALS.

WORK ON THIS PUMP.

All electrical work must be performed by a qualified technician. Always follow the National Electrical Code (NEC), or the Canadian Electrical Code, as well as all local, state and provincial codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in electrical shock, fire hazard, personal injury or death, damaged equipment, provide unsatisfactory performance, and may void manufacturer's warranty.

**WARNING** Standard units are not designed for use in swimming pools, open bodies of water, hazardous liquids, or where flammable gases exist. These fluids and gases may be present in containment areas. Tank or wetwell must be vented per local codes.

Only pumps specifically Listed for Class 1, Division 1 are allowable in hazardous liquids and where flammable gases may exist. *See specific pump catalog bulletins or pump nameplate for all agency Listings*.

**WARNING** Disconnect and lockout electrical power before installing or servicing any electrical equipment. Many pumps are equipped with automatic thermal overload protection which may allow an overheated pump to restart unexpectedly.

**CAUTION** All three phase (3Ø) control panels for submersible pumps must provide Class 10, quick-trip, overload protection.

# PRE-INSTALLATION CHECKS

Open all cartons and inspect for shipping damage. Report any damage to your supplier or shipping carrier immediately.

**Important:** Always verify that the pump nameplate Amps, Voltage, Phase and HP ratings match your control panel and power supply.

Many of our sewage pumps are oil-filled. If there are any signs of oil leakage or if the unit has been stored for an extended period check the oil level in the motor dome and the seal housing, if so equipped.

Check the motor cover oil level through the pipe plug on top of the unit. The motor chamber oil should just cover the motor. Do not overfill, leave room for expansion!

To check the seal housing oil level, where used, lay the unit on its side with the fill plug at 12 o'clock. Remove the plug. The oil should be within <sup>1</sup>/<sub>2</sub>" (13mm) of the top. If low, refill with an ASTM 150 turbine oil. Replace the plug.

Oil is available in 5 gallon cans through our distributors. You can also source oil locally at motor repair shops. Typical oil brands are: Shell Turbo 32, Sunoco Sunvis 932, Texaco Regal R&O 32, Exxon Nuto 32 and Mobil DTE Light.

Check the strain relief nut on power cable strain assemblies. Power cables should be torqued to 75 in. lbs. for #16 cables and 80 in. lbs. for all other cable assemblies. Seal/heat sensor cables, where used, should be torqued to 75 in. lbs.

Warranty does not cover damage caused by connecting pumps and controls to an incorrect power source (voltage/phase supply).

Record the model numbers and serial numbers from the pumps and control panel on the front of this instruction manual for future reference. Give it to the owner or affix it to the control panel when finished with the installation.

# LIFTING OF PUMP



DO NOT LIFT, CARRY OR HANG PUMP BY THE ELECTRICAL CABLES. DAMAGE TO THE ELECTRICAL CABLES CAN CAUSE SHOCK, BURNS OR DEATH.

Lift the pump with an adequately sized chain or cable attached to the lifting eye bolt. **DO NOT** damage electrical and sensor cables while raising and lowering unit.

# OPTIONAL GUIDE RAIL OR LIFT-OUT SYSTEM

In many effluent and sewage basins or lift stations it is advisable to install the pump on a guide rail system or on a lift-out adapter to facilitate installation and removal for inspection and/or service. Most codes do not allow personnel to enter a wetwell without the correct protective equipment and training. Guide rails are designed to allow easy removal of the pump without the need for entry into the wetwell or need to disturb piping. The guide rail or liftout adapter should locate the pump opposite the influent opening preventing stagnate areas where solids can settle. The basin or pit must be capable of supporting the weight of the pump and guide rail. The pit floor must be flat.

#### NOTICE: FOLLOW THE INSTRUCTIONS THAT ARE PROVIDED WITH THE GUIDE RAIL ASSEMBLY.

# PIPING

Discharge piping should be no smaller than the pump discharge diameter and kept as short as possible, avoiding unnecessary fittings to minimize friction losses.

Install an adequately sized check valve matched to the solids handling capability of the pump to prevent fluid backflow. Backflow can allow the pump to "turbine" backwards and may cause premature seal and/or bearing wear. If the pump is turning backwards when it is called on to start the increased torque may cause damage to the pump motor and/or motor shaft and some single-phase pumps may actually run backwards.

Install an adequately sized gate valve AFTER the check valve for pump, plumbing and check valve maintenance.

Important – Before pump installation. Drill a <sup>3</sup>/<sub>16</sub>" (4.8mm) relief hole in the discharge pipe. It should be located within the wetwell, 2" (51mm) above the pump discharge but below the check valve. The relief hole allows any air to escape from the casing. Allowing liquid into the casing will insure that the pump can start when the liquid level rises. Unless a relief hole is provided, a bottom intake pump could "air lock" and will not pump water even though the impeller turns.

All piping must be adequately supported, so as not to impart any piping strain or loads on the pump.

The pit access cover must be of sufficient size to allow for inspection, maintenance and crane or hoist service.

# WIRING AND GROUNDING

Important notice: Read Safety Instructions before proceeding with any wiring.



Use only stranded copper wire to pump/motor and ground. The ground wire must be at least as large as the power supply wires. Wires should be color coded for ease of maintenance and troubleshooting.



Install wire and ground according to the National Electrical Code (NEC), or the Canadian Electrical Code, as well as all local, state and provincial codes.



Install an all leg disconnect switch where required by code.



Disconnect and lockout electrical power before performing any service or installation.



The electrical supply voltage and phase must match all equipment requirements. Incorrect voltage or phase can cause fire, motor and control damage, and voids the warranty.



All splices must be waterproof. If using splice kits follow manufacturer's instructions.

WARNING

Select the correct type and NEMA grade junction box for the application and location. The junction box must insure dry, safe wiring connections.

A WARNING
-----------

Seal all controls from gases present which may damage electrical components.

Hazardous
voltage

FAILURE TO PERMANENTLY GROUND THE PUMP, MOTOR AND **CONTROLS BEFORE CONNECTING** TO POWER CAN CAUSE SHOCK, **BURNS OR DEATH.** 

# SELECTING AND WIRING PUMP CONTROL PANELS AND SWITCHES

## FLOAT SWITCH TYPES

There are two basic float switch designs; single-action and wide-angle. Single-action switches operate over a range of 15° so they open and close quickly. Wide-angle floats operate over a 90° swing with the tether length between the float body and the pivot point controlling the On-Off range. The design determines how many floats are required with different systems or controls.

Floats may be normally open (NO) for pump down applications or to empty a tank. Normally closed (NC) switches are used to pump up or to fill a tank.

A single-action control switch may be used only with a control panel, never direct connected to a pump.

The wide-angle, pump down switches may be used as direct connected pump switches or as control switches.

## SETTING THE FLOAT SWITCHES

There are no absolute rules for where to set the float switches, it varies from job to job.

#### Suggested Rules to Follow:

All floats should be set below the Inlet pipe!

Off Float: Best: set so the water level is always above the top of the pump (motor dome). Next Best: set so the water level is not more than 6" below the top of the pump.

On Float: set so the volume of water between the On and Off floats allows pumps of  $1\frac{1}{2}$  HP and under to operate for 1 minute minimum. Two (2) HP and larger pumps should run a minimum of 2 minutes. Basin literature states the gallons of storage per inch of basin height.

Lag/Alarm Float(s): should be staggered above the Off and On floats. Try to use most of the available storage provided by the basin, save some space for reserve storage capacity. See Diagrams and Charts in Float Switch Chart Section.

#### PANEL WIRING DIAGRAMS

Our control panels are shipped with instructions and wiring diagrams. Use those instructions in conjunction with this IOM. Electrical installation should be performed only by qualified technicians. Any problem or questions pertaining to another brand control must be referred to that control supplier or manufacturer. Our technical people have no technical schematics or trouble shooting information for other companies' controls.

#### ALARMS

We recommend the installation of an alarm on all Wastewater pump installations. Many standard control panels come equipped with alarm circuits. If a control panel is not used, a stand alone high liquid level alarm is available. The alarm alerts the owner of a high liquid level in the system so they can contact the appropriate service personnel to investigate the situation. 471

#### SINGLE PHASE PUMPS

Single phase  $(1\emptyset)$  pumps may be operated using a piggyback or hard wired float switch, a contactor, or a Simplex or Duplex control panel. *See Figures 1, 2 and 5*.

All  $\frac{1}{3}$  and  $\frac{1}{2}$  HP, 115 or 230 volt pumps, and some  $\frac{3}{4}$  and 1 HP pumps, are supplied with plug style power cords. They may be plugged into piggyback float switches for simple installations. It is allowable to remove the plugs in order to hardwire or connect to a Simplex or Duplex controller. Removing the plug neither voids the warranty nor violates the agency Listings. *See Figure 5*.



A WARNING PLUG-CONNECTED UNITS MUST BE CONNECTED TO A PROPERLY GROUNDED, GROUNDING TYPE RECEPTACLE.

> ON NON-PLUG UNITS, DO NOT REMOVE CORD AND STRAIN RELIEF. DO NOT CONNECT CONDUIT TO PUMP.

Pumps with bare lead power cords can be hard-wired to a float switch, wired to a  $1\emptyset$  contactor, a Simplex controller or a Duplex controller. Always verify that the float switch is rated for the maximum run amperage, maximum starting amperage, and the HP rating on the pump. Single-phase wastewater pumps contain on-winding overloads, unless noted on the pump nameplate. *See Figures 1 and 2*.

# THREE PHASE PUMPS:

As a Minimum a 3Ø pump requires a 3 pole circuit breaker/fused circuit, an across the line magnetic starter rated for the pump HP, and ambient compensated Quick Trip Class 10 overloads.

**SINGLE AND THREE PHASE CONTROL PANELS:** Control panels are available as Simplex (controls 1 pump) or Duplex (controls 2 pumps). Our standard SES Series Panels are available with many standard features and can be built with our most popular options. We also custom build panels which offer many more design options than the SES panels. Custom control panels are available in many different configurations. Custom panel quote requests may be forwarded to Customer Service through any authorized distributor.

Our "SES" Duplex panels feature a solid-state printed circuit board design with standard high level alarm circuits. Other standard features are: an auxiliary dry alarm contact for signaling a remote alarm and float switch position indicator lights. Our 3Ø panels have built-in, adjustable, Class 10 overloads. The adjustable overloads on all our 3Ø panels mean less labor for the installer and no need to order specific overloads. Most SES panels are in stock for immediate delivery.

On pumps equipped with seal fail and/or heat (high temperature) sensors it is recommended that you use our control panel with the appropriate options. The pump sensors do not function without a seal fail relay or terminal connection in the control panel and a warning device such as a bell, horn or light.

**Seal Failure Circuit -** Some dual seal pumps are equipped with a standard, built-in seal failure circuit, which may also be called a moisture detection circuit. This circuit must be connected to a control panel with an optional seal fail relay. The panel must be special ordered with the seal fail relay and alarm. There are also stand alone seal fail panels such as the A4-3 or A4-4 available as standard items. The pumps can be identified by an extra control cable exiting the motor cover. The cable contains two wires, a black wire, connects to panel "terminal" going to "probe"; and a white wire, connects to the panel "terminal" going to the relay ground. Do not connect to the panel ground screw. Follow the wiring instructions supplied with the panel.

Heat Sensor and Seal Failure Circuit - Some pumps are equipped with a seal fail and normally closed, on-winding high temperature thermostats (heat sensors). The pumps have a control cable with four (4) leads, black (probe) and green (relay ground) for the seal fail circuit and red and white for the high temperature circuit. Connect the high temperature (heat sensor) circuit to the panel terminal strip as indicated on the panel drawing using the red and white wires. The high temperature panel circuit is also an optional item which you must specifically order when you order your control panel. The high temperature circuit is different from the Class 10 overloads which are always required on three phase pumps. *Follow the wiring instructions supplied with the panel*.

# INSTALLATION

Connect the pump(s) to the guide rail pump adapters or to the discharge piping. Slide rail bases should be anchored to the wetwell floor.

Complete all wiring per the control panel wiring diagrams and NEC, Canadian, state, provincial and/or local codes. This a good time to check for proper rotation of the motors/impellers.



#### DO NOT PLACE HANDS IN PUMP SUCTION WHILE CHECKING MOTOR ROTATION. TO DO SO WILL CAUSE SEVERE PERSONAL INJURY.

Always verify correct rotation. Correct rotation is indicated on the pump casing. Three phase motors are reversible. It is allowable to bump or jog the motor for a few seconds to check impeller rotation. It is easier to check rotation before installing the pump. Switch any two power leads to reverse rotation.

Lower the pump(s) into the wetwell.

Check to insure that the floats will operate freely and not contact the piping.

# OPERATION

Once the piping connections are made and checked you can run the pumps.

**Piggyback Switch Operation** – Plug the piggyback switch into a dedicated grounded outlet and then plug the pump into the switch. Test the pump by filling the wetwell until the pump goes On. If the pumps run but fail to pump, they are probably air locked, drill the relief holes per the instructions in the Piping Section.

Check the operating range to insure a minimum one minute run time and that the pump goes Off in the correct position.

Control Panel Operation – Fill the wetwell with clear water. 472

Use the pump H-O-A (Hand-Off-Automatic) switches in Hand to test the pumps. If they operate well in Hand proceed to test Automatic operation. If the pumps run but fail to pump, they are probably air locked, drill the relief holes per the instructions in the Piping Section.

Place Control Panel switch(es) in Automatic position and thoroughly test the operation of the ON, OFF, and Alarm floats by filling the wetwell with clear water. **Important:** Failure to provide a Neutral from the power supply to a  $1\emptyset$ , 230 volt Control Panel will not allow the panel control circuit to operate. The Neutral is necessary to complete the 115 volt control circuit.

Check voltage and amperage and record the data on the front of this manual for future reference. Compare the amperage readings to the pump nameplate maximum amperage. If higher than nameplate amperage investigate

# FLOAT SWITCH AND PANEL CHART

The purpose of this chart is to show the required switch quantities and the function of each switch in a typical wastewater system. The quantities required vary depending on the switch type, single-action or wide-angle. Switch quantities also vary by panel type: simplex with and without alarms, and duplex with alarms.

#### **Duplex Panels using single-action switches:**

#### Three Float Panel Wiring

SW1	Bottom	Pumps Off
SW2	Middle	1st Pump On
SW3	Тор	2nd Pump & Alarm On

#### Four Float Panel Wiring 2

SW1	Bottom	Pumps Off
SW2	2nd	1st Pump On
SW3	3rd	2nd Pump On
SW4	Тор	Alarm On

#### Duplex Panels using wide-angle switches:

#### Three Float Panel Wiring

SW1	Bottom	1st Pump On/Both Off
SW2	Тор	2nd Pump & Alarm On

#### Four Float Panel Wiring

SW1	Bottom	1st Pump On/Both Of
SW2	Middle	2nd Pump On
SW3	Тор	Alarm On

#### Simplex Panel using single-action switches:

#### Simplex Panel with Alarm ①

SW1	Bottom	Pump Off
SW2	Middle	Pump On
	SW3	Top Alarm On/Off

#### Simplex Panel with No Alarm

SW1	Bottom	Pump Off
SW2	Тор	Pump On

cause. Operating the pump off the curve, i.e. with too little head or with high or low voltage will increase amperage. The motor will operate properly with voltage not more than 10% above or below pump nameplate ratings. Performance within this range will not necessarily be the same as the published performance at the exact rated nameplate frequency and voltage. Correct the problem before proceeding. Three phase unbalance is also a possible cause. See Three Phase Power Unbalance and follow the instructions.

Reset the Alarm circuit, place pump switch(es) in the Automatic position and Control Switch in ON position. The system is now ready for automatic operation.

Explain the operation of the pumps, controls and alarms to the end user. Leave the paperwork with the owner or at the control panel if in a dry, secure location.

#### Simplex Panel using wide-angle switches:

#### Simplex Panel with Alarm

SW1	Bottom	Pump On/Off
SW2	Тор	Alarm On/Off

#### Simplex Panel with No Alarm



# THREE PHASE POWER UNBALANCE

A full three phase supply consisting of three individual transformers or one three phase transformer is recommended. "Open" delta or wye connections using only two transformers can be used, but are more likely to cause poor performance, overload tripping or early motor failure due to current unbalance.

Check the current in each of the three motor leads and calculate the current unbalance as explained below.

If the current unbalance is 2% or less, leave the leads as connected.

If the current unbalance is more than 2%, current readings should be checked on each leg using each of the three possible hook-ups. Roll the motor leads across the starter in the same direction to prevent motor reversal.

To calculate percent of current unbalance:

A. Add the three line amp values together.

- B. Divide the sum by three, yielding average current.
- C. Pick the amp value which is furthest from the average current (either high or low).
- D. Determine the difference between this amp value (furthest from average) and the average.
- E. Divide the difference by the average. Multiply the result by 100 to determine percent of unbalance.

Current unbalance should not exceed 5% at service factor load or 10% at rated input load. If the unbalance cannot be corrected by rolling leads, the source of the unbalance must be located and corrected. If, on the three possible hookups, the leg farthest from the average stays on the same power lead, most of the unbalance is coming from the power source.

Contact your local power company to resolve the imbalance.

		Hookup 1			Hookup	0 2		Hookup	o 3
Starter Terminals	L1	L2	L3	L1	L2	L3	L1	L2	L3
	$_{\top}^{\perp}$	$\downarrow$	$\frac{\perp}{\top}$		$\downarrow$	$\downarrow$	1 T	⊥ ⊤	$\downarrow$
Motor Leads	R	В	W	W	R	В	В	W	R
	T3	T1	T2	T2	Т3	T1	T1	T2	Т3

**Example:** 

T2-W = 50  amps	T1-B = 50  amps
T3-R = 48  amps	T2-W = 49 amps
T1-B = <u>52</u> amps	T3-R = <u>51</u> amps
Total = 150 amps	Total = 150 amps
$\div$ 3 = 50 amps	$\div$ 3 = 50 amps
-48 = 2 amps	-49 = 1 amps
$2 \div 50 = .04 \text{ or } 4\%$	$1 \div 50 = .02 \text{ or } 2\%$
	T2-W = 50  amps T3-R = 48  amps T1-B = 52  amps Total = 150  amps $\div 3 = 50 \text{ amps}$ - 48 = 2  amps $2 \div 50 = .04 \text{ or } 4\%$

# INSULATION RESISTANCE READINGS

Normal Ohm and Megohm Values between all leads and ground

Condition of Motor and Leads	Ohm Value	Megohm Value
A new motor (without drop cable).	20,000,000 (or more)	20 (or more)
A used motor which can be reinstalled in well.	10,000,000 (or more)	10 (or more)
Motor in well. Readings are for drop cable plus motor.		
New motor.	2,000,000 (or more)	2 (or more)
Motor in good condition.	500,000 - 2,000,000	.5 - 2
Insulation damage, locate and repair.	Less than 500,000	Less than .5

Insulation resistance varies very little with rating. Motors of all HP, voltage and phase ratings have similar values of insulation resistance.

Insulation resistance values above are based on readings taken with a megohmmeter with a 500V DC output. Readings may vary using a lower voltage ohmmeter, consult factory if readings are in question.

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# ENGINEERING DATA

Engineering data for specific models may be found in your catalog and on our website (address is on the cover).

Control panel wiring diagrams are shipped with the control panels. Please use the control panel drawings in conjunction with this instruction manual to complete the wiring.

	PUMP			
Minimum Submergence				
Continuous Duty	Fully Submerged			
Intermittent Duty	6" Below Top of Motor			

(	OPERATION					
		Maxim	um Fluid Temperature			
		Continuous Operation	104º F 40º C			
		Intermittent Operation	140º F 60º C			

Pumpmaster and Pumpmaster Plus -Hard Wired





Figure 4









Wide-Angle Float Switch







# TROUBLESHOOTING

A WARNING Hazardous voltage

## FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING ANY SERVICE CAN CAUSE SHOCK, BURNS OR DEATH.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
MOTOR NOT RUNNING	Motor thermal protector tripped.	Allow motor to cool. Insure minimum pump submergence. Clear debris from casing and impeller
"OPENS" repeatedly	Open circuit breaker or blown fuse.	Determine cause, call a qualified electrician.
DO NOT reset. Call	Pump impeller binding or jammed.	Check motor amp draw. If two or more times higher
qualified electrician.	1 1 0 ,	than listed on pump nameplate, impeller is locked,
a) Manual operation	Power cable is damaged.	motor bearings or shaft is damaged. Clear
	in control panel.	debris from casing and imperier, consult with dealer.
b) Automatic operation	No neutral wire	Resistance between power leads and ground should
b) Automatic operation	connected to control panel.	qualified electrician.
	Inadequate electrical connection in control panel.	Inspect control panel wiring. Call a qualified electrician.
<b>NOTE:</b> Check the pump in manual mode first to confirm operation. If pump	Defective liquid level switch.	With switch disconnected, check continuity while activating liquid level switch. Replace switch, as required.
control or wiring is at fault.	Insufficient liquid level to activate controls.	Allow liquid level to rise 3" to 4" (76 mm - 101 mm) above turn-on level.
see above.	Liquid level cords tangled.	Untangle cords and insure free operation.
PUMP WILL NOT TURN OFF	Liquid level cords tangled.	Untangle cords and insure free operation.
	Pump is air locked.	Shut off pump for approximately one minute, then restart. Repeat until air lock clears. If air locking persists in a system with a check valve, a $\frac{3}{16}$ " (4.8 mm) hole may be drilled in the discharge pipe approximately 2" (51 mm) above the discharge connection.
	Influent flow is matching pump's discharge capacity.	Larger pump may be required.
LITTLE OR NO LIQUID DELIVERED BY PUMP	Check valve installed backwards, plugged or stuck closed.	Check flow arrow on valve and check valve operation.
	Excessive system head.	Consult with dealer.
	Pump inlet plugged.	Inspect and clear as required.
	Improper voltage or wired incorrectly.	Check pump rotation, voltage and wiring. Consult with qualified electrician.
	Pump is air locked.	See recommended action, above.
	Impeller is worn or damaged.	Inspect impeller, replace as required.
	Liquid level controls defective or improperly positioned.	Inspect, readjust or replace as required.
PUMP CYCLES	Discharge check valve inoperative.	Inspect, repair or replace as required.
CONSTANTLY	Sewage containment area too small.	Consult with dealer.
	Liquid level controls defective or improperly positioned.	Inspect, readjust or replace as required.
	Influent excessive for this size pump.	Consult with dealer.



# Wastewater

#### **GOULDS PUMPS LIMITED WARRANTY**

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

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- (a) Labor, transportation and related costs incurred by the dealer;
- (b) Reinstallation costs of repaired equipment;
- (c) Reinstallation costs of replacement equipment;
- (d) Consequential damages of any kind; and,
- (e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
- (3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

#### THIS WARRANTY EXTENDS TO THE DEALER ONLY.



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#### IM107R03 March, 2006

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# Engineered for life

# SECTION 12e.7: PERMEATE TANK UV RECIRCULATION PUMP

# P&ID: Item #: P-0813

- Unit Details: Goulds Model 1ST2C5A2 0.5Hp, 3Ø/60Hz/460V 20 GPM @ 25' TDH
- Manufacturer: Goulds Pumps, ITT Industries 2881 East Bayard Street Seneca Falls, NY 13148 Phone: (315) 568-7123 www.goulds.com

Local Distributor/Contact:

Industrial Pump Sales & Service, Inc. 37 William S. Canning Blvd. Tiverton, RI 02878 Phone: (800) 323-6532 or (401) 624-2977 Fax: (401) 624-3373 www.ipspump.com THIS PAGE INTENTIONALLY LEFT BLANK





**Commercial Water** 

# Goulds Pumps

# G&L Series NPE

# 316L SS

NPE Series End Suction Centrifugal Pumps Bombas Centrífugas de Succión Final Serie NPE





Goulds Pumps is a brand of ITT Corporation. Goulds Pumps es una marca de fábrica de ITT Corporation. www.goulds.com

# Engineered for life

# A Full Range of Product Features Una Gama Total de Características del Producto

NPE Product Line Numbering System Línea de Producto NPE Sistema de Numeración

#### **Superior Materials of**

**Construction:** Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

#### **High Efficiency Impeller:**

Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

#### **Casing and Adapter Features:**

Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

**Mechanical Seal:** Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

**Motors:** NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left. Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

#### Example Product Code, Ejemplo Código del Producto

## 1 ST 2 C 1 A 4 F **1ST2C5A2**

#### Seal Vent/Flush Option, Opción de Sello Válvula/ChorroSeal Ven

— Mechanical Seal and O-ring

4 = Pre-engineered standard For optional mechanical seal modify catalog order no.

with seal code listed below.

#### Sello Mecánico y Anillo 'O' 4 = Estándar aprobado

Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

	John Crane Type 21 Mechanical Seal ( $\%$ " seal), Sello Mecánico John Crane Tipo 21 (sello de $\%$ ")				
Seal Code, Código del Sello	Rotary, Rotativo	Stationary, <i>Estacionari</i> o	Elastomers, <i>Elastómeros</i>	Metal Parts, Partes Metálicas	Part No., Pieza Número
2	Carbon		EPR		<mark>10K18</mark>
4	Carbon	Silicon	Viton	216.66	10K55
5	Silicon	Carbide	EPR	310.22	10K81
6	Carbide		Viton		10K62

#### Impeller Option . . . No Adder Required

For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

#### Código del Impulsor Opcional

Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code,	Pump Size, Tamaño de la Bomba			
Código del	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6	
Impulsor	Diameter	Diameter	Diameter	
K	-	61/8	-	
G	-	5 <sup>15</sup> / <sub>16</sub>	53/8	
Н	_	51/2	5	
A	<mark>61/8</mark>	51/4	43/4	
В	53/4	51/16	45/8	
C	53/16	41/8	43/8	
D	43/4	45/8	41/16	
E	47/16	41/4	35/8	
г	417	27/		

#### - Driver, Conductor

2

3

4

= 1 PH, ODP	7 = 3 PH, XP
= 3 PH, ODP	8 = 575 V, XP
= 575 V, ODP	9 = 3 PH, TEFC
= 1 PH, TEFC	Premium Eff.
= 3 PH, TEFC	0 = 1  PH, XP

6 = 575 V, TEFC **HP Rating,** *HP Potencia*  $(C = \frac{1}{2} \text{ HP} \text{ E} = 1 \text{ HP} \text{ G} = 2 \text{ HP} \text{ J} = 5 \text{ HP} \text{ D} = \frac{3}{4} \text{ HP} \text{ F} = 1\frac{1}{2} \text{ HP} \text{ H} = 3 \text{ HP}$ 

#### Driver: Hertz/Pole/RPM, Conductor: Hercios/Polo/RPM

1 = 60 Hz, 2 pole, 3500 RPM **2 = 60 Hz, 4 pole, 1750 RPM** 3 = 60 Hz, 6 pole, 1150 RPM 4 = 50 Hz, 2 pole, 2900 RPM 5 = 50 Hz, 4 pole, 1450 RPM For frame mounted version, substitute the letters "FRM" in these positions. Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

#### — Material

#### ST = Stainless steel, Acero inoxidable

**Pump Size,** Tamaño de la Bomba  $1 = 1 \times 1\frac{1}{4} - 6$   $2 = 1\frac{1}{4} \times 1\frac{1}{2} - 6$   $3 = 1\frac{1}{2} \times 2 - 6$ 

**GOULDS PUMPS** Commercial Water

# Performance Coverage (60 Hz) Alcance de Funcionamiento (60 Hz)



#### NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on noncataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

#### NOTAS:

No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

# Performance Curves – 60 Hz, 1750 RPM Curvas de Funcionamiento – 60 Hz, 1750 RPM





**NOTE:** Although not recommended, the pump may pass a <sup>1</sup>/<sub>16</sub>" sphere. **NOTA:** Si bien no se recomienda, la bomba puede pasar una esfera de <sup>1</sup>/<sub>16</sub>".

METERS METROS		FEET PIES	Model N RPM 175	<b>NPE / 2</b> 0 60 Hi	2 <b>ST Size (Tam</b> Z	<b>año) 1¼ x 1</b> ½	2 <b>-6</b>	NOTE: Not printed H-Q NOTA: No impreso en	recommend curve. Se recomien la curva H-Q	ed for operation   Ida para funciona !	beyond amiento superio	oral
AL DYNAMIC HEAD (CARGA DINAMICA TOTAL) H 중 전	ERS ROS 10 9 8 7 6 5	FEET 35 32.5 32.5 27.5 25 22.5 22.5 20 17.5 15	K 6 <sup>1</sup> %" DI G 5 <sup>15</sup> %6" H 5 <sup>1</sup> ⁄2" A 5 <sup>1</sup> ⁄4" B 5 <sup>1</sup> ⁄6" C 4 <sup>7</sup> %" D 4 <sup>5</sup> %" E 4 <sup>1</sup> ⁄4"					mpreso en 0' 15' 20 1 15' 20 1 1 1 1 1 1 1 1 58 1 1 1 58 1 1 1 1 1 58 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		Ŧ%		
TOT	4	12.5	F 37/8 <sup>n</sup>		- XX		$\langle  \rangle$	$\mathbf{S}\mathbf{S}$	X		<sup>8</sup> Hp	
	3	- 10						XX X		· . /3 /2		
	2	- 5					X	,		. 10		
		(	)	10	20	. 30	40	50	60	70	80	U.S. GPM
		(	)	2	4	6 8	10 CAPACITY <i>(CA</i>	12 PACIDAD) Q	14	16		m³∕hr

Optional Impeller, Impulsor Opcional				
Ordering Code, Código de Pedido	Dia.			
К	61⁄8″			
G	5 <sup>15</sup> ⁄16″			
Н	51⁄2			
А	51⁄4			
В	5 <sup>1</sup> / <sub>16</sub>			
С	41/8			
D	41%			
E	<b>4</b> ¼			
F	31/8			

**NOTE:** Although not recommended, the pump may pass a  $\frac{3}{16}$ " sphere.

**NOTA:** Si bien no se recomienda, la bomba puede pasar una esfera de <sup>3</sup>/<sub>16</sub>".

# NPE Close Coupled Pump Major Components: Materials of Construction Bomba Cerrada Acoplada NPE Componentes Principales: Materiales de Construcción



ltem No., Parte No.	Description, Descripción	Materials, <i>Materiales</i>
100	Casing; Carcasa	
101	Impeller; Impulsor	AISI 316L SS;
108	Motor adapter; Adaptador del motor	AISI 316L
108A	Motor adapter seal vent/flush; Sello válvula/chorro del adaptador del motor	Acero inoxidable
123	Deflector; Deflector	BUNA-N
184	Seal housing; Alojamiento del sello	
184 A Seal housing seal vent/flush; Sello válvula/chorro del alojamiento c		AISI 316L SS; AISI 316L Acero inoxidable
347	Guidevane; Difusor	Accio monuable
349	Seal ring, guidevane; Anillo del sello, difusor	Viton
370	Socket head screws, casing; Encajes cabezas de tornillos, carcasa	AISI 410 SS; AISI 410 Acero inoxidable
371	Bolts, motor; Tornillos, motor	Plated steel; Acero chapeado
383	Mechanical seal; Sello mecánico	**see chart, ver tabla
408	Drain and vent plug, casing; Enchufes de drenaje y válvula, carcasa	AISI 316L SS; AISI 316L Acero inoxidable
412B O-ring, drain and vent plug; Anillo 'O', enchufe de drenaje y válvula		Viton (Standard, estándar)
513	O-ring, casing; Anillo 'O', carcasa	EPK (Optional, Opcional)
Motor <i>Motor</i>	NEMA standard, 56J flange; NEMA estándar, brida 56J	



<sup>1</sup>/<sub>2</sub>, <sup>3</sup>/<sub>4</sub> and 1 HP <sup>1</sup>/<sub>2</sub>, <sup>3</sup>/<sub>4</sub> y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.



# NPE Close Coupled – Dimensions, Weights and Specifications

ODP and TEFC 1<sup>1</sup>/<sub>2</sub>, 2 and 3 HP, ODP y TEFC 1<sup>1</sup>/<sub>2</sub>, 2 y 3 HP

# **Specifications**

#### Capacities to:

75 GPM (283L/min) at 1750 RPM 150 GPM (550L/min) at 3500 RPM

Heads to: 39 feet (12 m) at 1750 RPM 150 feet (46 m) at 3500 RPM

#### Working pressures to: 125 PSIG (9 bars)

**Maximum temperatures to:** 212°F (100°C) with standard seal or 250°F (121°C) with optional high temperature seal.

# Direction of rotation:

Clockwise when viewed from motor end.

#### Motor specifications:

NEMA 56J frame, 1750 RPM, 1/2 HP. 3500 RPM 1/2 through 5 HP. Open drip-proof, totally enclosed fan-cooled or 2 HP explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/ 460 ODP, TEFC and EX PROOF. NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.





**Commercial Water** 

# **Goulds Pumps** P&ID #: P-0813 1ST2C5A2 **G&L SERIES** MODEL NPE/NPE-F Installation, Operation and Maintenance Instructions



Goulds Pumps is a brand of ITT Corporation.

www.goulds.com

# Engineered for life

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# **Owner's Information**

Pump Model Number:					
Pump Serial Num	1				
Dealer:					
Dealer Phone No	.:				
Date of Purchase	:				
Date of Installation	on:				
Current Readings at Startup:					
1 Ø	3 Ø	L1-2	L2-3	L3-1	
Amps:	Amps:				
Volts:	Volts:				

# SAFETY INSTRUCTIONS



Hazardous fluids can cause fire, burns or death.

## **DESCRIPTION & SPECIFICATIONS:**

The Models NPE (close-coupled) and NPE-F (framemounted) are end suction, single stage centrifugal pumps for general liquid transfer service, booster applications, etc. Liquid-end construction is all AISI Type 316 stainless steel, stamped and welded. Impellers are fully enclosed, non-trimable to intermediate diameters. Casings are fitted with a diffuser for efficiency and for negligible radial shaft loading.

Close-coupled units have NEMA 48J or 56J motors with C-face mounting and threaded shaft extension. Frame-mounted units can be coupled to motors through a spacer coupling, or belt driven.

# 1. IMPORTANT:

- **1.1.** Inspect unit for damage. Report any damage to carrier/dealer immediately.
- **1.2.** Electrical supply must be a separate branch circuit with fuses or circuit breakers, wire sizes, etc., per national and local electrical codes. Install an all-leg disconnect switch near pump.

# **ACAUTION** Always disconnect electrical power when handling pump or controls.

- **1.3.** Motors must be wired for proper voltage. Motor wiring diagram is on motor nameplate. Wire size must limit maximum voltage drop to 10% of nameplate voltage at motor terminals, or motor life and pump performance will be lowered.
- **1.4.** Always use horsepower-rated switches, contactor and starters.
- 1.5. Motor Protection
  - **1.5.1.** Single-phase: Thermal protection for singlephase units is sometimes built in (check nameplate). If no built-in protection is provided, use a contactor with a proper overload. Fusing is permissible.
  - **1.5.2.** Three-phase: Provide three-leg protection with properly sized magnetic starter and thermal overloads.
- 1.6. Maximum Operating Limits:

Liquid Temperature:	250° F (120° C)
Pressure:	125 PSI
Starts Per Hour:	20, evenly distributed

**1.7.** Regular inspection and maintenance will increase service life. Base schedule on operating time. Refer to Section 8.

# 2. INSTALLATION:

- 2.1. General
  - **2.1.1.** Locate pump as near liquid source as possible (below level of liquid for automatic operation).
  - 2.1.2. Protect from freezing or flooding.
  - **2.1.3.** Allow adequate space for servicing and ventilation.
  - **2.1.4.** All piping must be supported independently of the pump, and must "line-up" naturally.

**ACAUTION** Never draw piping into place by forcing the pump suction and discharge connections.

- **2.1.5.** Avoid unnecessary fittings. Select sizes to keep friction losses to a minimum.
- 2.2. Close-Coupled Units
  - **2.2.1.** Units may be installed horizontally, inclined or vertically.

# **A**CAUTION Do not install with motor below pump. Any leakage or condensation will affect the motor.

- **2.2.2.** Foundation must be flat and substantial to eliminate strain when tightening bolts. Use rubber mounts to minimize noise and vibration.
- **2.2.3.** Tighten motor hold-down bolts before connecting piping to pump.
- **2.3.** Frame-Mounted Units
  - **2.3.1.** It is recommended that the bedplate be grouted to a foundation with solid footing. Refer to Figure 1.



#### Figure 1

- **2.3.2.** Place unit in position on wedges located at four points (two below approximate center of driver and two below approximate center of pump). Adjust wedges to level unit. Level or plumb suction and discharge flanges.
- **2.3.3.** Make sure bedplate is not distorted and final coupling alignment can be made within the limits of movement of motor and by shimming, if necessary.
- **2.3.4.** Tighten foundation bolts finger tight and build dam around foundation. Pour grout under bedplate making sure the areas under pump and motor feet are filled solid. Allow grout to harden 48 hours before fully tightening foundation bolts.
- **2.3.5.** Tighten pump and motor hold-down bolts before connecting the piping to pump.

# **3. SUCTION PIPING:**

- 3.1. Low static suction lift and short, direct, suction piping is desired. For suction lift over 10 feet and liquid temperatures over 120 F, consult pump performance curve for Net Positive Suction Head Required.
- **3.2.** Suction pipe must be at least as large as the suction connection of the pump. Smaller size will degrade performance.
- **3.3.** If larger pipe is required, an eccentric pipe reducer (with straight side up) must be installed at the pump.
- 3.4. Installation with pump below source of supply
  - **3.4.1.** Install full flow isolation valve in piping for inspection and maintenance.

# **A** CAUTION Do not use suction isolation valve to throttle pump.

- 3.5. Installation with pump above source of supply
  - **3.5.1.** Avoid air pockets. No part of piping should be higher than pump suction connection. Slope piping upward from liquid source.
  - 3.5.2. All joints must be airtight.
  - **3.5.3.** Foot valve to be used only if necessary for priming, or to hold prime on intermittent service.
  - **3.5.4.** Suction strainer open area must be at least triple the pipe area.

- **3.6.** Size of inlet from liquid source, and minimum submergence over inlet, must be sufficient to prevent air entering pump through vortexing. See Figures 2-5.
- **3.7.** Use 3-4 wraps of Teflon tape to seal threaded connections.



# 4. DISCHARGE PIPING:

- **4.1.** Arrangement must include a check valve located between a gate valve and the pump. The gate valve is for regulation of capacity, or for inspection of the pump or check valve.
- **4.2.** If an increaser is required, place between check valve and pump.
- **4.3.** Use 3-4 wraps of Teflon tape to seal threaded connections.

# 5. MOTOR-TO-PUMP SHAFT ALIGNMENT:

- 5.1. Close-Coupled Units
  - 5.1.1. No field alignment necessary.
- 5.2. Frame-Mounted Units
  - **5.2.1.** Even though the pump-motor unit may have a factory alignment, this could be disturbed in transit and must be checked prior to running. See Figure 6.



- **5.2.2.** Tighten all hold-down bolts before checking the alignment.
- **5.2.3.** If re-alignment is necessary, always move the motor. Shim as required.

- **5.2.4.** Parallel misalignment shafts with axis parallel but not concentric. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the outside diameter of the other hub. Parallel alignment occurs when Total Indicator Reading is .005", or less.
- **5.2.5.** Angular misalignment shafts with axis concentric but not parallel. Place dial indicator on one hub and rotate this hub 360 degrees while taking readings on the face of the other hub. Angular alignment is achieved when Total Indicator Reading is .005", or less.
- **5.2.6.** Final alignment is achieved when parallel and angular requirements are satisfied with motor hold-down bolts tight.

# **A**CAUTION Always recheck both alignments after making any adjustment.

- 6. ROTATION:
- **6.1.** Correct rotation is right-hand (clockwise when viewed from the motor end). Switch power on and off quickly. Observe shaft rotation. To change rotation:
  - 6.1.1. Single-phase motor: Non-reversible.
  - **6.1.2.** Three-phase motor: Interchange any two power supply leads.

# 7. OPERATION:

**7.1.** Before starting, pump must be primed (free of air and suction pipe full of liquid) and discharge valve partially open.

**CAUTION** Pumped liquid provides lubrication. If pump is run dry, rotating parts will seize and mechanical seal will be damaged. Do not operate at or near zero flow. Energy imparted to the liquid is converted into heat. Liquid may flash to vapor. Rotating parts require liquid to prevent scoring or seizing.

7.2. Make complete check after unit is run under operating conditions and temperature has stabilized. Check for expansion of piping. On frame-mounted units coupling alignment may have changed due to the temperature differential between pump and motor. Recheck alignment.

# 8. MAINTENANCE:

- **8.1.** Close-Coupled Unit. Ball bearings are located in and are part of the motor. They are permanently lubricated. No greasing required.
- 8.2. Frame-Mounted Units
  - 8.2.1. Bearing frame should be regreased every 2,000 hours or 3 month interval, whichever occurs first. Use a #2 sodium or lithium based grease. Fill until grease comes out of relief fittings, or lip seals, then wipe off excess.
  - **8.2.2.** Follow motor and coupling manufacturers' lubrication instructions.
  - **8.2.3.** Alignment must be rechecked after any maintenance work involving any disturbance of the unit.

# 9. DISASSEMBLY:

Complete disassembly of the unit will be described. Proceed only as far as required to perform the maintenance work needed.

- 9.1. Turn off power.
- 9.2. Drain system. Flush if necessary.
- **9.3.** Close-Coupled Units: Remove motor hold-down bolts.

Frame-Mounted Units: Remove coupling, spacer, coupling guard and frame hold-down bolts.

- 9.4. Disassembly of Liquid End
  - 9.4.1. Remove casing bolts (370).
  - **9.4.2.** Remove back pull-out assembly from casing (100).
  - 9.4.3. Remove impeller locknut (304).

**CAUTION** Do not insert screwdriver between impeller vanes to prevent rotation of closecoupled units. Remove cap at opposite end of motor. A screwdriver slot or a pair of flats will be exposed. Using them will prevent impeller damage.

- **9.4.4.** Remove impeller (101) by turning counterclockwise when looking at the front of the pump. Protect hand with rag or glove.
- **A**CAUTION Failure to remove the impeller in a counter-clockwise direction may damage threading on the impeller, shaft or both.
  - **9.4.5.** With two pry bars 180 degrees apart and inserted between the seal housing (184) and the motor adapter (108), carefully separate the two parts. The mechanical seal rotary unit (383) should come off the shaft with the seal housing.
  - **9.4.6.** Push out the mechanical seal stationary seat from the motor side of the seal housing.
- 9.5. Disassembly of Bearing Frame
  - 9.5.1. Remove bearing cover (109).
  - 9.5.2. Remove shaft assembly from frame (228).
  - **9.5.3.** Remove lip seals (138 and 139) from bearing frame and bearing cover if worn and are being replaced.
  - **9.5.5.** Use bearing puller or arbor press to remove ball bearings (112 and 168).

## **10. REASSEMBLY:**

- 10.1. All parts should be cleaned before assembly.
- **10.2.** Refer to parts list to identify required replacement items. Specify pump index or catalog number when ordering parts.
- 10.3. Reassembly is the reverse of disassembly.

**10.3.1.** Impeller and impeller locknut assembled onto motor shaft with 10 ft-lbs of torque.

- **10.4.** Observe the following when reassembling the bearing frame.
  - 10.4.1. Replace lip seals if worn or damaged.
  - **10.4.2.** Replace ball bearings if loose, rough or noisy when rotated.
  - **10.4.3.** Check shaft for runout. Maximum permissible is .002" T.I.R.
- **10.5.** Observe the following when reassembling the liquid-end.
  - 10.5.1. All mechanical seal components must be in good condition or leakage may result. Replacement of complete seal assembly, whenever seal has been removed, is good standard practice.

It is permissible to use a light lubricant, such as glycerin, to facilitate assembly. Do not contaminate the mechanical seal faces with lubricant.

- **10.5.2.** Inspect casing O-ring (513) and replace if damaged. This O-ring may be lubricated with petroleum jelly to ease assembly.
- 10.5.3. Inspect guidevane O-ring (349) and replace if worn.

**A CAUTION** Do not lubricate guidevane O-ring (349). Insure it is not pinched by the impeller on reassembly.

- **10.6.** Check reassembled unit for binding. Correct as required.
- **10.7.** Tighten casing bolts in a star pattern to prevent Oring binding.

## **11. TROUBLE SHOOTING CHART:**

MOTOR NOT RUNNING: (See causes 1 thru 6)

LITTLE OR NO LIQUID DELIVERED: (See causes 7 thru 17)

POWER CONSUMPTION TOO HIGH: (See causes 4, 17, 18, 19, 22)

EXCESSIVE NOISE AND VIBRATION: (See causes 4, 6, 9, 13, 15, 16, 18, 20, 21, 22)

#### PROBABLE CAUSE:

- 1. Tripped thermal protector
- 2. Open circuit breaker
- 3. Blown fuse
- 4. Rotating parts binding
- 5. Motor wired improperly
- 6. Defective motor
- 7. Not primed
- 8. Discharge plugged or valve closed
- 9. Incorrect rotation
- 10. Foot valve too small, suction not submerged, inlet screen plugged
- 11. Low voltage
- 12. Phase loss (3-phase only)
- 13. Air or gasses in liquid
- 14. System head too high
- 15. NPSHA too low: Suction lift too high or suction losses excessive. Check with vacuum gauge.
- 16. Impeller worn or plugged
- 17. Incorrect impeller diameter
- 18. Head too low causing excessive flow rate
- 19. Viscosity or specific gravity too high
- 20. Worn bearings
- 21. Pump or piping loose
- 22. Pump and motor misaligned

# NPE STANDARD REPAIR PARTS LIST

ltem No.	Description	Materials of Construction
100	Casing	
101	Impeller	
108A	Motor adapter with foot	AISI 316L
108B	Motor adapter less foot	Stainless Steel
108C	Motor adapter with foot and flush	
108D	Motor adapter less foot with flush	
123	Deflector	BUNA-N
184A	Seal housing std.	
184B	Seal housing with seal flush	AISI 510L 5.5.
240	Motor support	300 S.S.
240	Rubber channel	Rubber
304	Impeller locknut	AISI 316 S.S.
347	Guidevane	AISI 316L S.S.
		Viton (standard)
349	Seal-Ring, guidevane	EPR
		BUNA
370	Socket head screw, casing	AISI 410 S.S.
371	Bolts, motor	Steel/plated
383	Mechanical seal	
408	Drain and vent plug, casing	AISI 316 S.S.
		Viton (standard)
412B	O-Ring, drain plugs	EPR
		BUNA
		Viton (standard)
513	O-Ring, casing	EPR
		BUNA

# MECHANICAL SEAL APPLICATION CHART

Item 383 Mechanical Seal (%" seal)						
Rotary	Part No.					
Carbon		EPR		10K18		
	Sil-Carbide	Viton	21655	10K55		
Sil-Carbido		EPR	51035	10K81		
Sil-Calblue		Viton		10K62		

**NOTE:** Close coupled units supplied with  $\frac{1}{2}$  HP 1750 RPM,  $\frac{1}{2}$  - 3 HP Explosion Proof or 5 HP motors, utilize motor adapter less foot and a footed motor.

**NOTE:** Frame mounted units (NPE-F) utilize the XS Power frame and motor adapter less foot. For repair parts for the power frame refer to the XS-Power frame repair parts page in the parts section of your catalog. To order the power frame complete order item 14L61.



# **Commercial Water**

#### **GOULDS PUMPS LIMITED WARRANTY**

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, which ever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

#### The warranty excludes:

Ў ІТТ

- (a) Labor, transportation and related costs incurred by the dealer;
- (b) Reinstallation costs of repaired equipment;
- (c) Reinstallation costs of replacement equipment;
- (d) Consequential damages of any kind; and,
- (e) Reimbursement for loss caused by interruption of service.

#### For purposes of this warranty, the following terms have these definitions:

- (1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
- (2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
- (3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

#### THIS WARRANTY EXTENDS TO THE DEALER ONLY.



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# SECTION 12e.8: EFFLUENT DOSING PUMPS

# P&ID: Item #: P-1111, P-1112

Unit Details: ABS Series XFP Submersible Sewage Pump ABS Model#: XFP 80C CB1.2- PE20/6 2.7Hp, 3Ø/60Hz/460V 200 GPM @ 21' TDH

Manufacturer: ABS Pumps, Inc. 140 Pond View Drive Meriden, CT 06450 Phone: (203) 238-2700 Fax: (203) 238-0738 www.absgroup.com

# Local Distributor/Contact:

ABS Pumps, Inc. 140 Pond View Drive Meriden, CT 06450 Phone: (203) 238-2700 Fax: (203) 238-0738 www.absgroup.com THIS PAGE INTENTIONALLY LEFT BLANK

# ABS submersible sewage pump XFP 80C - 201G

Tough, reliable, submersible pumps, with Premium Efficiency motors from 2.4 to 40.2 hp. For the pumping of wastewater and sewage from buildings and sites in private, commercial, industrial and municipal areas.

#### Features

- The water-pressure-tight, encapsulated, flood-proof motor and the pump section form a compact, robust, modular construction.
  NEMA Class A temperature rise.
- Premium Efficiency Motors in accordance with IEC 60034-30 level IE3\* with testing in accordance with IEC60034-2-1.
- Continuously rated motor in submerged and non-submerged applications.
- Double SiC-SiC mechanical seals. All seals are independent of rotation direction and resistant to temperature shock.
- □ Anti-wicking cable plug solution (80C 150E), or
- water-pressure-sealed connection chamber (100G 201G). Hydraulic options of Contrablock and Contrablock Plus impellers for high efficiency, or vortex impellers for maximum
- solids handling.
- mum 50,000 hrs. (80C 150E), and 1000,000 hrs. (100G 201G). □ Stainless steel shaft. Designed with high safety factor to prevent
- fatigue fracture.
- Temperature monitoring using bi-metallic thermal sensors in the stator windings that open at 140 °C (284 °F).
- Seal monitoring by a moisture probe (DI) in the seal chamber (80C - 150E), or dry chamber (100G - 201G), which signals an inspection alert if there is leakage at the shaft seals.
- □ Smooth outer design to reduce rag build-up.
- □ Stainless steel lifting hoop.
- □ 3", 4", 6" and 8" radial slot ANSI flange discharge.
- Maximum allowable temperature of the medium for continuous operation is 104 °F.
- De Maximum submergence depth of 65 ft.
- Available in explosion-proof version in accordance with international standards FM / CSA.

\* See Technical Data table

P&ID#: P-1111, P-1112 XFP 80C CB1.2 PE20/6-C-60

#### Performance fields with Contrablock impeller



<sup>\*\*</sup> Minimum flow rate Q



#### Motor

Premium Efficiency IE3\* motor.

60 Hz single-phase 230 V through 3.8 hp, and three-phase 460 V through 40.2 hp.

Squirrel-cage motor as 2-pole (3400 rpm), 4-pole (1750), 6-pole (1180) and 8-pole (870).

Protection type IP 68, with stator insulation Class H.

Starting: DOL (direct on line).

Motors with other operating voltages and frequencies are also available (DOL and YD).

Identification Code: e.g. XFP 80C CB1.3 PE22/4-C-60 Hydraulics:

XFP Product range	XFP
8 Discharge outlet DN (cm)	8
0Hydraulic type	0
C Volute opening (dia. ins)	С
CB Impeller type: CB = Contrablock, VX = vortex.	CB
1 Number of impeller vanes	1
3 Impeller size	2
Motor:	
PE Premium Efficiency	PE
22 Motor power $P_2 \times 10$ hp	20
4 Number of poles	6
C	.C
60 Frequency	60
,	

#### Performance fields with vortex impeller



Please use the ABSEL program as the only valid selection tool

#### **Technical Data**

XFP	Motor	IEC	Impeller	Rated	Motor	power*	Rated	Speed	Cable	Weight**
		rating	5120	(V)	<b>P</b> <sub>1</sub>	<b>P</b> <sub>2</sub>	[A]	(rpm)	5120	(lbs)
80C-CB1	PE 28/4	IE3	5	460 3~	3.1	3.8	5.2	1750	SOOW 14/7	215 / n.a.
	PE 35/4	IE3	4	460 3~	3.9	4.7	6.2	1750	SOOW 14/7	221 / n.a.
	PE 20/6	<mark>IE1</mark>	1, 2, <mark>4</mark>	460 3~	2.4	2.7	4.2	1180	SOOW 14/7	221 / n.a.
	PE 28/4W	IE3	5	230 1~	3.6	3.8	16.9	1750	SOOW 10/7	215 / n.a.
	PE 20/6W	IE1	1, 2, 4	230 1~	2.6	2.7	12.0	1180	SOOW 14/7	221 / n.a.
80C-VX	PE 22/4	IE3	2, 3, 4	460 3~	2.5	3.0	4.6	1750	SOOW 14/7	215 / n.a.
	PE 35/4	IE3	1	460 3~	3.9	4.7	6.2	1750	SOOW 14/7	220 / n.a.
	PE 18/4W	IE3	3, 4	230 1~	2.3	2.4	10.5	1750	SOOW 12/7	211 / n.a.
	PE 28/4W	IE3	2	230 1~	3.6	3.8	16.9	1750	SOOW 10/7	215 / n.a.
80E-CB1	PE125/2	IE3	4,5	460 3~	13.7	16.8	21.3	3400	AWM 8/4+16/3	381 / n.a.
81E-VX	PE 80/2	IE3	4	460 3~	8.9	10.7	13.3	3400	SOOW 12/7	300 / n.a.
	PE 125/2	IE3	1, 2, 3	460 3~	13.7	16.8	21.3	3400	AWM 8/4+16/3	336 / n.a.
100C-CB1	PE 28/4	IE3	5	460 3~	3.1	3.8	5.2	1750	SOOW 14/7	235 / n.a.
	PE 35/4	IE3	4	460 3~	3.9	4.7	6.2	1750	SOOW 14/7	240 / n.a.
	PE 20/6	IE1	1, 2, 4	460 3~	2.4	2.7	4.2	1180	SOOW 14/7	240 / n.a.
	PE 28/4W	IE3	5	230 1~	3.6	3.8	16.9	1750	SOOW 10/7	235 / n.a.
	PE 20/6W	IE1	1, 2, 4	230 1~	2.6	2.7	12.0	1180	SOOW 14/7	240 / n.a.
100C-VX	PE 22/4 PE 28/4 PE 35/4 PE 18/4W PE 28/4W	IE3 IE3 IE3 IE3 IE3 IE3	3, 4, 5 2 1 4 2, 3	460 3~ 460 3~ 460 3~ 230 1~ 230 1~	2.5 3.1 3.9 2.3 3.6	3.0 3.8 4.7 2.4 3.8	4.6 5.2 6.2 10.5 16.9	1750 1750 1750 1750 1750 1750	SOOW 14/7 SOOW 14/7 SOOW 14/7 SOOW 10/7 SOOW 10/7	208 / n.a. 259 / n.a. 259 / n.a. 203 / n.a. 259 / n.a.
100E-CB1	PE 75/4	IE3	4, 5	460 3~	8.2	10.1	13.8	1750	SOOW 12/7	390 / n.a.
	PE 90/4	IE3	2, 3, 4	460 3~	9.8	12.1	15.8	1750	SOOW 12/7	416 / n.a.
	PE 105/4	IE3	1, 2, 3	460 3~	11.4	14.1	17.7	1750	SOOW 10/7	416 / n.a.
	PE 35/6	IE2	2, 3, 4, 5	460 3~	4.0	4.7	6.3	1180	SOOW 14/7	349 / n.a.
100E-VX	PE 45/4 PE 75/4 PE 90/4 PE 105/4	IE3 IE3 IE3 IE3	5 4 3 1, 2	460 3~ 460 3~ 460 3~ 460 3~	5.0 8.2 9.8 11.4	6.0 10.1 12.1 14.1	8.2 13.8 15.8 17.7	1750 1750 1750 1750 1750	S00W 14/7 S00W 12/7 S00W 12/7 S00W 12/7	357 / n.a. 364 / n.a. 364 / n.a. 390 / n.a.
100G-CB1	PE 130/4 PE 185/4 PE 210/4 PE 250/4 PE 90/6	IE3 IE3 IE3 IE3 IE3	9 6 4 4 4, 5	460 3~ 460 3~ 460 3~ 460 3~ 460 3~	14.0 19.8 22.4 26.7 10.0	17.4 24.8 28.2 33.5 12.1	23.2 32.3 35.4 40.8 18.8	1750 1750 1750 1750 1750 1180	AWM 8/4+16/3 AWM 8/4+16/3 AWM 8/4+16/3 AWM 4/4+16/3 SOOW 10/7	708 / 858 763 / 885 763 / 885 792 / 1015 721 / 865
101G-CB1	PE 185/2	IE3	4	460 3~	20.0	24.8	28.4	3400	AWM 8/4+16/3	629 / 796
	PE 200/2	IE3	3	460 3~	21.8	26.8	30.5	3400	AWM 8/4+16/3	629 / 796
	PE 300/2	IE3	2, 1	460 3~	32.5	40.2	45.8	3400	AWM 4/4+16/3	651 / 821
150E-CB1	PE45/4 PE75/4 PE90/4 PE105/4 PE35/6	IE3 IE3 IE3 IE3 IE2	7 5, 6 4, 5 4 4, 5, 6	460 3~ 460 3~ 460 3~ 460 3~ 460 3~	5.0 8.2 9.8 11.4 4.0	6.0 10.1 12.1 14.1 4.7	8.2 13.8 15.8 17.7 6.3	1750 1750 1750 1750 1750 1180	SOOW 14/7 SOOW 12/7 SOOW 12/7 SOOW 10/7 SOOW 14/7	369 / n.a. 410 / n.a. 410 / n.a. 435 / n.a. 369 / n.a.
150G-CB1	PE 130/4	IE3	8	460 3~	14.0	17.4	23.2	1750	AWM 8/4+16/3	735 / 925
	PE 185/4	IE3	6	460 3~	19.8	24.8	32.3	1750	AWM 8/4+16/3	765 / 981
	PE 210/4	IE3	4	460 3~	22.4	28.2	35.4	1750	AWM 8/4+16/3	765 / 981
	PE 110/6	IE3	2,3, 4	460 3~	12.0	14.8	21.1	1180	AWM 8/4+16/3	735 / 964
200G-CB1	PE 90/6	IE3	3, 4	460 3~	10.0	12.1	18.8	1180	SOOW 10/7	805 / 1018
	PE 110/6	IE3	1, 2	460 3~	12.0	14.8	21.1	1180	AWM 8/4+16/3	805 / 1018
201G-CB2	PE 130/6	IE3	6	460 3~	14.2	17.4	23.7	1180	AWM 8/4+16/3	845 / 982
	PE 160/6	IE3	4	460 3~	17.5	21.5	28.4	1180	AWM 8/4+16/3	865 / 1004
	PE 200/6	IE3	2	460 3~	21.5	26.8	32.7	1180	AWM 8/4+16/3	907 / 1047
	PE 120/8	IE3	1, 2	460 3~	13.5	16.1	23.7	870	AWM 8/4+16/3	851 / 993

 $^{*}P_{1}$  = power at mains. P<sub>2</sub> = power at motor shaft. \*\*Without / with cooling jacket; includes 33 ft of cable.

Data for alternative voltages available on request.

## **Standard and Options**

Description	Standard	Option
Mains voltage	230 V 1~, 460 V 3~	208 V 1~, 208, 220, 380, 600, 220/380, 380/660 V 3~
Voltage tolerance	± 10%	-
Motor efficiency	Premium Eff. IE3*	-
Insulation class	Н	-
Start-up	Direct on line	Star delta
Approvals	FM / CSA	-
Mechanical seal (at medium side)	SiC-SiC	-
Mechanical seal (at motor side)	SiC-SiC	-
0-rings	NBR	-
Cables	CSA	EMC
Cable length (ft)	49	33, 66, 99, 131, 164
Protective coating	2k Epoxy 120 µm	2k Epoxy 400 μm
Provision for lifting hoist	Lifting hoop	
Cooling	Self-cooling (80C - 150E); by the medium (100G - 201G)	Closed cooling (100G - 201G)
Installation	Wet well	Dry well** or transportable

See Technical Data table \*\* Except XFP 80E and 81E

## Monitoring

Description		Standard	Option
Motor	Bi-metallic switch in windings	Х	-
(temperature)	PTC thermistor in windings	-	Х
Seals	Moisture sensor (DI) in oil chamber (80C - 150E)	Х	-
(leakage)	Moisture sensor (DI) in dry chamber (100G - 201G)	Х	-
	Moisture sensor (DI) in connection chamber (100G - 201G)	-	Х
Bearings	PTC thermistor (100G - 201G)	-	Х
(temperature)	PT 100 (100G - 201G)	-	Х

#### Materials

Motor	Material
Motor housing	Cast iron EN-GJL-250
Motor shaft	Stainless steel 1.4021
Fasteners	Stainless steel 1.4401
Lifting hoop	Stainless steel 1.4401
Hydraulics	Material
Volute	Cast iron EN-GJL-250
Impeller	Cast iron EN-GJL-250
Bottom plate	Cast iron EN-GJL-250

#### Material comparison

Europe	USA			
EN-GJL-250	ASTM A48; Class 40B			
1.4021	ASTM / AISI 420			
1.4401	ASTM / AISI 316			

#### Accessories

	Description	Size	YEP	Part no
Fixed installation - wet well with ABS Automatic Coupling System	<b>Pedestal*</b> (cast iron ASTM A48; Class 40B) 90° cast bend (single guide rail) - DIN flange connection	3" 4" 4" (high-head) 6" 8"	80C - 81E 100C - 100G 101G 150E & 150G 201G	62320649 62320652 62325019 62320655 62320658
	90° cast bend (single guide rail) - plug/clamp connection	3" (pipe Ø3½") 4" (pipe Ø4¼") 4" high head (pipe Ø4¼") 4" (pipe Ø4½") 6" (pipe Ø6¼")	80C - 81E 100C - 100G 101G 100C - 100G 150E & 150G	62320650 62320653 62325020 62320654 62320656
	90º cast bend (twin guide rail) - DIN flange connection	3" 4" 6" 8"	80C - 81E 100C - 101G 150E & 150G 201G	62325029 62325030 62325031 62325032
	<b>Pedestal bracket fasteners</b> single guide rail version (galvanised steel)		80C - 81E 100C - 101G 150E & 150G 201G	62610632 62610633 62610635 62610883
	single guide rail version (stainless steel)		80C - 81E 100C - 101G 150E & 150G 201G	62610899 62610637 62610639 62610862
	twin guide rail version (galvanised steel)		80C - 81E 100C - 101G 150E & 150G 201G	62615053 62615054 62615055 62615056
	<b>Pedestal base anchor bolts</b> single and twin guide rail (galvanised steel)		80C - 101G 150E & 150G 201G	62610775 62610784 62610785
Fixed installation - dry well, (horizontal)	<b>Pump Support Kit</b> (ASTM A48; Class 40B) head and volute supports with fixing bolts and vibration damper		80C 80C**, 100C 81E*** 100E 150E 101G 100G, 150G, 201G	61825032 61825033 61825038 61825030 61825031 61825036 61825037
(vertical)	Ground Support Stand		80C 81E*** 100C 100E 150E 101G 100G, 150G, 201G	61355014 61355020 61355015 61355021 61355022 61355024 61355023
Transportable	Ground Support Stand		80C, 100C 80E & 81E 100E 150E 101G 100G, 150G, 201G	61355016 61355017 61355018 61355019 61355026 61355025
General	Cathodic Protection (Zinc anodes)		80C - 201G	13905000

\*Guide rail not included \*\*Vortex version of pumps (VX) \*\*\* Only with PE 80/2 motor





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ABSEL TRD 1.7.2 / 2007-02-07



# XFP 80C CB1 60HZ

## 200 GPM @ 21 Feet

#### XFP

ABS EffeX XFP range of submersible pumps (PE1 to PE3) are supplied for reliable and economic pumping of clear water. polluted water and heavily polluted sewage containing solids, faecal slurry and sludge in commercial, industrial and municipal application. Driven by Premium Efficiency IE3 motor in according with IEC 60034-30, exceeding CEMEP EFF 1. Motor insulation according to Class H, temperature rise according to Class A. Explosion proof as standard, ATEX, FM and CSA. Continuously rated motor suitable for wet and dry installation as standard.(PE1 and PE2) PE3 has the option of internal closed loop cooling system for dry installation. Equipped with temperature and moisture sensors as standard. Standard sewage hydraulic with Contrablock plus gives enhanced levels of blockage resistance and excellent rag handling with large free solids passage of 75 mm minimum. 50Hz Capacity up to 750 m3/h Head, max. 74 m 60Hz Capacity up to 3500 US g.p.m. Head, max. 330ft Type: XFP 80C CB1 60HZ Technical data Delivery rate : 168 US g.p.m. Delivery head : 21.9 ft Hydr. efficiency : 56 % : 45.2 % Total efficiency Shaft power : 1.66 hp Speed : 1150 rpm Impeller type : Contrabloc Plus impeller, 1 vane Motor output : 2.68 hp Voltage : 460 V Frequency : 60 Hz Suction outlet : DN100 **Discharge** outlet : DN80





200 GPM @ 21 Feet

1.4

1.3

1.2

1.1

1

0.9

0.8

0.7

0.6

0.5

0.4

0.3

Service factor

Rated power 2.68 hp

Motor performance curve PE20/6-C-60HZ

Frequency 60 Hz

P [hp]

7.7

7.15

6.6

6.05

5.5

4.95

4.4

3.85

3.3

2.75

2.2

1.65

Nominal speed 1150 rpm Number of poles 6

Date 2012-09-19

Rated voltage 460 V

/M/Mn

∕l/In

-n/ns

eff

-cos P1

-P2

0.2						
0	20	40	60 80	100	120 <b>P2/P2</b> r	0 [%]
Loading	No load	25 %	50 %	75 %	100 %	125 %
P1 [hp]	0.3467	0.9834	1.7	2.449	3.211	4.112
P2 [hp]	0	0.6705	1.341	2.012	2.682	3.353
I [A]	2.701	2.794	3.112	3.588	4.206	4.999
eff [%]	0	68.18	78.9	82.14	83.52	81.53
cos	0.1201	0.3294	0.5112	0.6388	0.7146	0.7699
n [rpm]	1200	1187	1173	1162	1150	1128
M [lbf ft]	0	2.966	6.003	9.095	12.25	15.61
s [%]	0.005622	1.055	2.223	3.194	4.195	5.994
Tolerance acco	rding to VDE 0530 T	1 12.84 for rated p	ower			
Starting current 22.2 A	Starting torque 29.6 lbf ft	Moment 0 0.0712	of inertia b ft <sup>2</sup>			ADOE 503

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ABS submersible sewage pump XFP 80C - 201G



P&ID#: P-0511 XFP 80C CB1.4 PE20/6-C-60

08/2011 SU

) Installation, Operating and Maintenance Instructions (CA)

www.absgroup.com


### ABS submersible sewage pump XFP

PE1	PE2	PE3	
80C-CB1	80E-CB1	100G-CB1	201G-CB2
80C-VX	81E-VX	101G-CB1	
81C-VX	100E-CB1	101G-VX	
100C-CB1	100E-VX	150G-CB1	
100C-VX	150E-CB1	200G-CB1	

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ABS reserves the right to alter specifications due to technical developments

### Symbols and notices used in this booklet:

Presence of dangerous voltage.



Non-compliance may result in personal injury.



Hot surface - danger of burn injury.

Danger of an explosion occurring.

ATTENTION! Non-observance may result in damage to the unit or negatively affect its performance.

**NOTE:** Important information for particular attention.

### 1 General

### 1.1 Application areas

The following guidelines must be observed when setting the lowest switch off point for XFP pumps:

- When switching on and operating the pump, the hydraulic section of dry installation pumps must always be filled with water.
- The minimum submergence allowed for specific pumps can be found on the dimension installation sheets available from your local ABS representative.

XFP pumps have been designed for economic and reliable pumping in commercial, industrial and municipal installations and are suitable for pumping of the following liquids:

- clear and wastewater, and for sewage containing solids and fibrous material
- faecal matter

In combination with the ABS automatic coupling system, the below ground level wet installation is a particularly economical and environmentally friendly solution. The pumps are also suitable for horizontal or vertical dry installation (except XFP 80E-CB1-PE125/2 and XFP 81E-VX-PE125/2).

### ATTENTION! The maximum allowable temperature of the medium pumped is 104 °F

### 1.2 Explosion-proof Approvals

Explosion-proof as standard, in accordance with international standards FM and CSA.

### 1.2.1 Use of explosion-proof pumps in explosive zones.

- 1. Explosion-proof submersible pumps may only be operated with the thermal sensing system connected.
- 2. If ball type float switches are used, these must be connected to an intrinsically safe electrical circuit "Protection type EX (i)" in accordance with VDE 0165.
- 3. Dismantling and repair of submersible explosion-proof motors may only be carried out by approved personnel in specially approved work shops.
- 4. In the event that the pump is to be operated in explosive atmospheres using a variable speed drive, please contact your local ABS representative for technical advice regarding the various Approvals and Standards concerning thermal overload protection.

### 1.3 Technical data

Maximum noise level  $\leq$  70 dB. This may be exceeded in certain circumstances.

Detailed technical information is available in the technical data sheet ABS submersible sewage pump XFP 80C - 201G which can be downloaded from www.absgroup.com > Downloads.

### 1.3.1 Nameplate

We recommend that you record the data from the nameplate on the pump in the corresponding form below, and maintain it as a source of reference for the ordering of spare parts, repeat orders and general queries.

Always state the pump type, item no. and serial no. in all communications.

### Standard nameplate

abs	ABS USA 140 Pond View D Meriden CT 0645 Tel 203-238-2700 www.cardo.com	Prive i0 )	APPROV Explosio	> /ED on Proof	I CL.I, D	€ -R51412 IV.1, GR.C+D
Тур						
Nr		Sn			хх	/xxxx
UN		IN			Ph	Hz
P1:		P2:				RPM
Cos φ	NEMA A	IEC60	034-30	IE		≬≬ IP68
Qmax		Hmax	[		Ølmp	
DN Hmin See Instruction Manual for sensor connection and cable replacement. Use with approved motor control that matches motor input full load amps. Utiliser un demarreur approvue covenant au courant a pleine charge du moteur. DO NOT REMOVE COVER WHILE CIRCUIT IS ALIVE.					Wt. Therr OPP	nally Protected ER. TEMP. T3C.

Legend		
Тур	Pump type	
Nr	Item No.	
Sn	Serial No.	
xx/xxxx	Production date (Week/Year)	
U <sub>N</sub>	Rated voltage	V
I <sub>N</sub>	Rated current	A
Ph	Number of phases	
Hz	Frequency	Hz
P1	Rated input power	kW
P2	Rated output power	hp
RPM	Speed	rpm
Cos φ	Power factor	pf
NEMA	Temperature rise	Class
Qmax	Max. Flow	gpm
Hmax	Max. Head	ft
Ø Imp.	Impeller diameter	ins
DN	Discharge diameter	ins
-		



### 1.4 General design features

XFP is a submersible sewage and wastewater pump with a Premium Efficiency motor.

The water-pressure-tight, encapsulated, flood-proof motor and the pump section form a compact, robust, modular construction.

### 1.4.1 Design features PE1 & PE2



- 1 Pressure release screw
- 2 10-pole terminal block
- 3 Moisture sensor (DI)
- 4 Seal chamber
- 5 Seal chamber drain plug/ pressure test point
- 6 Venting plug

- 7 Stainless steel lifting hoop
- 8 Upper bearing single row
- 9 Motor with thermal sensors
- 10 Stainless steel shaft
- 11 Motor chamber
- 12 Lower bearing double row
- 13 Bearing housing
- 14 Mechanical seals
- 15 Seal holding plate
- 16 Motor chamber drain plug/ pressure test point
- 17 Impeller Contrablock version
- 18 Bottom plate adjustment screw

### 1.4.2 Design features PE3 (version with cooling jacket)



- 1 Stainless steel lifting hoop
- 2 Lid assembly
- 3 Cable gland
- 4 Upper bearing single row
- 5 Coolant fill plug
- 6 Cooling jacket
- 7 Motor housing
- 8 Lower bearing housing
- 9 Lower bearing double row

- 10 Seal holding plate
- 11 Mechanical seals
- 12 Venting plug
- 13 Terminal block\*
- 14 Pressure test point
- 15 Upper bearing housing
- 16 Motor with thermal sensors
- 17 Stainless steel shaft
- 18 Moisture sensor (DI)

- 19 Dry chamber
- 20 Coolant impeller
- 21 Flow deflector
- 22 Coolant drain plug / pressure test point
- 23 Seal chamber
- 24 Impeller Contrablock version
- 25 Bottom plate adjustment screw
- \* Fitted to bearing housing when two cables connected.



### 2 Safety

The general and specific health and safety guidelines are described in detail in the ABS Products Safety Instructions booklet. If anything is not clear or you have any questions as to safety make certain to contact the manufacturer ABS.

### 3 Transport and Storage

### 3.1 Transport

During transport, care should be taken that the pump is not dropped or thrown. The pumps of the XFP series are fitted with a lifting hoop to which a chain and shackle may be attached for transport or for suspension of the pump.



The pump must be raised only by the lifting hoop and never by the power cable.



Take note of the weight of the entire unit. The hoist and chain must be adequately dimensioned for that weight and must comply with the current valid safety regulations.

All relevant safety regulations as well as general good technical practice must be complied with.

### 3.2 Storage

- 1. During long periods of storage the pump should be protected from moisture and extremes of cold or heat.
- 2. To prevent the mechanical seals from sticking it is recommended that occasionally the impeller is rotated by hand.
- 3. If the pump is being taken out of service the oil should be changed before storage.
- 4. After storage the pump should be inspected for damage, the oil level should be checked, and the impeller checked to ensure it rotates freely.

### 3.2.1 Moisture protection of motor connection cable

The motor connection cables are protected against the ingress of moisture along the cable by having the ends sealed at the factory with protective covers.

### ATTENTION! The ends of the cables should never be immersed in water as the protective covers only provide protection against water spray or similar (IP44) and are not a water tight seal. The covers should only be removed immediately prior to connecting the pumps electrically.

During storage or installation, prior to the laying and connection of the power cable, particular attention should be given to the prevention of water damage in locations which could flood.

### ATTENTION! If there is a possibility of water ingress then the cable should be secured so that the end is above the maximum possible flood level. Take care not to damage the cable or its insulation when doing this.

### 4 Mounting and Installation

4

The regulations covering the use of pumps in sewage applications, together with all regulations involving the use of explosion-proof motors, should be observed. The cable ducting to the control panel should be sealed off in a gas-tight manner by the use of a foaming material after the cable and control circuits have been pulled through. In particular the safety regulations covering work in enclosed areas in sewage plants should be observed together with general good technical practice.

For the XFP transportable version, arrange the cable run so that the cables will not be kinked or nipped. Connect the discharge pipe and cable (see section "Electrical Connection"). Place the pump on a firm surface which will prevent it from overturning or burrowing down. The pump can also be bolted down to the base or suspended slightly by the lifting handle. Hoses, pipes and valves must be sized to suit the pump performance.

### 4.1 Installation examples

### 4.1.1 Submerged in concrete sump



- 1 Sump cover
- 2 Venting line
- 3 Sump cover
- 4 Sleeve for cable ducting to the control panel as well as for aeration and venting
- 5 Chain

- 6 Inflow line7 Ball-type float s
- 7 Ball-type float switch8 Submersible pump
- 9 Concrete sump
- 10 Pedestal

- 11 Guide rail
- 12 Discharge line
- 13 Non-return valve
- 14 Gate valve
- 15 Power cable to motor



### 4.1.2 Dry-installed

Horizontal



# ATTENTION! The oil-filled version of PE1 and PE2 pumps, and the cooling jacket version of PE3 pumps, are required for dry installations.



Under continuous running conditions the pump motor housing may become hot. To avoid burn injury allow to cool down before handling.

### 4.2 Discharge Line

The discharge line must be installed in compliance with the relevant regulations.

This applies in particular to the following:

- The discharge line should be fitted with a backwash loop (180° bend) located above the backwash level and should then flow by gravity into the collection line or sewer.
- The discharge line should not be connected to a down pipe.
- No other inflows or discharge lines should be connected to this discharge line.

### ATTENTION! The discharge line should be installed so that it is not affected by frost.

### 5

### Electrical Connection



Before commissioning, an expert should check that one of the necessary electrical protective devices is available. Earthing, neutral, earth leakage circuit breakers, etc. must comply with the regulations of the local electricity supply authority and a qualified person should check that these are in perfect order.

### ATTENTION! The power supply system on site must comply with VDE or other local regulations with regard to cross-sectional area and maximum voltage drop. The voltage stated on the nameplate of the pump must correspond to that of the mains.

The power supply cable must be protected by an adequately dimensioned slow-blow fuse corresponding to the rated power of the pump.



The incoming power supply as well as the connection of the pump itself to the terminals on the control panel must comply with the circuit diagram of the control panel as well as the motor connection diagrams and must be carried out by a qualified person.

All relevant safety regulations as well as general good technical practice must be complied with.

### ATTENTION! For use in the open air, the following VDE regulations apply:

Submersible pumps used outdoors must be fitted with a power cable of at least 33 feet length.

For pumps intended to be used in outdoor fountains, garden ponds and similar places, the pump is to be supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA.

### Please consult your electrician.

### 5.1 Temperature monitoring

Thermal sensors in the stator windings protect the motor from overheating.

XFP motors are fitted with bimetallic thermal sensors in the stator as standard, or as an option with a PTC thermistor.

### 5.2 Seal monitoring

XFP pumps are supplied as standard with a moisture sensor (DI), to detect and alert to the ingress of water into the motor and seal chambers (PE1 & PE2), or motor and dry chambers (PE3).

# NOTE! Running the pump with the thermal and/or moisture sensors disconnected will invalidate related warranty claims.



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ABS submersible sewage pump XFP 80C - 201G

U1 V1 W1

### 5.3 **Wiring Diagrams**

U1 V1 W1 F1 F0 Di PE =

4 5 3 2

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Explosion-proof pumps may only be used in explosive zones with the thermal sensors connected (leads F0 & F1).

U2 V2 W2 DI PE <del>▼</del>

	4 11 T2 T3 1 2 3 PE 4 5 5 4								
60 Hz	1	2	3		4	L)	5		
<mark>20/6</mark> 22/4 28/4 35/4	D63,D68, D79,D80	-			D66,D62 <mark>,D7</mark>	<mark>7,</mark> D85	-		
45/2	D63,D79, D80	D64,D81	-		D66,D62,D7	7,D85,D86			
18/4W 28/4W 20/6W*	-	-			-		W60, W62		
35/6 45/4 56/4 75/4 90/4 105/4 80/2 125/2	D63,D79, D80	D64,D81	-		D66,D62,D7	7,D85,D86	-		
120/8 90/6 110/6 130/6		D64,D79	D63,D80,D81		D66,D62,D7	7,D85,D86			
160/6		_	D63,D64,D79	,D80,D81					
200/6			D64,D79						
130/4	-	D64,D79	D63,D80,D81				-		
150/4 185/4			D63,D64,D79	,D80,D81	D66,D62,D7	7,D85,D86			
210/4 250/4 185/2 200/2 300/2		-	D64,D79						
<b>D62</b> = 23	30 V 3~, DO	L D68 = 3	80 V 3~, YΔ	<b>D81</b> = 22	0 V 3~, YΔ	<b>W60</b> = 230	V 1~		
<b>D63</b> = 22	20 V 3~, DO	L D77 = 4	60 V 3~, DOL	<b>D85</b> = 60	0 V 3~, DOL	<b>W62</b> = 208	V 1~		
<b>D64</b> = 38	30 V 3~, Y∆	<b>D79</b> = 3	80 V 3~, Y∆	<b>D86</b> = 46	0 V 3~, DOL				
<b>D66</b> = 20	08 V 3~, DO	L D80 = 2	20 V 3~, DOL						

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2

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ABS submersible sewage pump XFP 80C - 201G

## 6 Commissioning

Before commissioning, the pump should be checked and a functional test carried out. Particular attention should be paid to the following:

- Have the electrical connections been carried out in accordance with regulations?
- Have the thermal sensors been connected?
- Is the seal monitoring device correctly installed?
- Is the motor overload switch correctly set?
- Does the pump sit correctly on the pedestal?
- Is the direction of rotation of the pump correct even if run via an emergency generator?
- Are the switching ON and switching OFF levels set correctly?
- Are the level control switches functioning correctly?
- Are the required gate valves (where fitted) open?
- Do the non-return valves (where fitted) function easily?

### 6.1 Types of operation and frequency of starting

All pumps of the XFP series have been designed for continuous operation S1 when either submerged or dry-installed.

### 6.2 Checking direction of rotation

When three phase units are being commissioned for the first time, and also when used on a new site, the direction of rotation must be carefully checked by a qualified person.



When checking the direction of rotation, the pump should be secured in such a manner that no danger to personnel is caused by the rotating impeller or by the resulting air flow. Do not place your hand into the hydraulic system!



When checking the direction of rotation, or when starting the unit, pay attention to the **START REACTION**. This can be very powerful and cause the pump to jerk in the opposite direction to the direction of rotation.

ATTENTION: When viewed from above, the direction of rotation is correct if the impeller rotates in a clockwise manner.



NOTE: The start reaction is anti-clockwise.

ATTENTION: If a number of pumps are connected to a single control panel then each unit must be individually checked.

ATTENTION: The mains supply to the control panel should have a clockwise rotation. If the leads are connected in accordance with the circuit diagram and lead designations, the direction of rotation will be correct.



### 6.3 Changing direction of rotation

The direction of rotation should only be altered by a qualified person.

If the direction of rotation is incorrect then this is altered by changing over two phases of the power supply cable in the control panel. The direction of rotation should then be rechecked.

### 7 Maintenance



Before commencing any maintenance work the pump should be completely disconnected from the mains by a qualified person and care should be taken that it cannot be inadvertently switched back on.

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When carrying out any repair or maintenance work, the safety regulations covering work in enclosed areas of sewage installations as well as good general technical pratices should be followed.



Under continuous running conditions the pump motor housing can become very hot. To prevent burn injury allow to cool down before handling.

ATTENTION!

The maintenance instructions given here are not designed for "do-it-yourself" repairs as special technical knowledge is required.

### 7.1 General maintenance instructions

ABS submersible pumps are reliable quality products, each being subjected to careful final inspection. Lubricated-for-life ball bearings, together with monitoring devices, ensure optimum pump reliability provided that the pump has been connected and operated in accordance with the operating instructions. However, should a malfunction occur, do not improvise, but ask your ABS Customer Service Department for assistance. This applies particularly if the pump is continually switched off by the current overload in the control panel, by the thermal sensors of the thermo-control system, or by the seal monitoring system (DI).

Regular inspection and care is recommended to ensure a long service life. Service intervals vary for XFP pumps depending on installation and application. For recommended service interval details contact your local ABS Service Centre. A maintenance contract with our Service Department will guarantee the best technical service.

When carrying out repairs, only original spare parts supplied by the manufacturer should be used. ABS warranty conditions are only valid provided that any repair work has been carried out in an ABS approved workshop and where original ABS spare parts have been used.

### 7.3 Lubricant changing (PE1 & PE2)

The seal chamber between the motor and the hydraulic section has been filled with oil at manufacture.

An oil change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or motor chamber.
- · After repair work that requires draining of the oil.
- If the pump is being taken out of service the oil should be changed before storage.

### 7.3.1 Instructions on how to drain and f II the seal chamber

1. Loosen the plug screw (a) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to

contain any possible spray of oil as the pump de-pressurises.

Place the pump in a horizontal position, sitting on its discharge flange, with the motor housing supported from underneath.
 To prevent the pump from toppling over ensure it is supported

 $\triangle$ 

to lie flat on its discharge flange.

- 3. Position an adequate container to receive the waste oil.
- 4. Remove the plug screw and seal ring (a) from the drain hole.
- 5. After the oil is fully drained lay the pump flat, and rotate so that the drain hole is positioned to the top.

When in this position the pump must be held by hand, or supported at both sides, to prevent it from toppling over.

- 6. Select the required volume of oil from the quantities table (p.17) and slowly pour into the drain hole.
- 7. Refit the plug screw and seal ring.





DRAIN

FILL



### 7.4 Lubricant changing (PE3 - version without cooling jacket)

The seal chamber between the motor and the hydraulic section has been filled with glycol at manufacture. The water and propylene glycol is frost resisting down to 5 °F.

A glycol change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or dry chamber.
- After repair work that requires draining of the glycol.
- If the pump is being taken out of service the glycol should be changed before storage.
- In the case of extreme ambient temperatures below -15 °C / 5 °F (e.g. during transport, storage, or if the pump is out of duty) the cooling liquid must be drained. Otherwise the pump may be damaged.

### 7.4.1 Instructions on how to drain and f II the seal chamber

1. Loosen the plug screw (a) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to contain any possible spray of glycol as the pump de-pressurises.

- Secure a hoist to the lifting hoop. Lay the pump on its side and rotate until the drain plug is underneath.
   Note: because there is insufficient space to place a waste container underneath the drain plug the waste must be drained into a sump.
- 3. Remove the plug screw and seal ring (a) from the drain hole.
- 4. After the glycol is fully drained, place the pump in a horizontal position sitting on its discharge flange with the motor housing supported from underneath.
  - To prevent the pump from toppling over ensure it is supported to lie flat on its discharge flange.

6. Refit the plug screw and seal ring.

5. Select the required volume of glycol from the quantities table (p.17) and slowly pour into the drain hole.



(a) Drain plug

DRAIN

FILL



### 7.5 Coolant changing (PE3 - version with cooling jacket)

The cooling system (seal chamber and cooling jacket) has been filled with glycol at manufacture. The water and propylene glycol is frost resisting down to 5 °F.

A glycol change is only necessary:

- At specified service intervals (for details contact your local ABS Service Centre).
- If the DI moisture sensor detects an ingress of water into the seal chamber or dry chamber.
- After repair work that requires draining of the glycol.
- If the pump is being taken out of service the glycol should be changed before storage.
- In the case of extreme ambient temperatures below -15 °C / 5 °F (e.g. during transport, storage, or if the pump is out of duty) the cooling liquid must be drained. Otherwise the pump may be damaged.

### 7.5.1 Instructions on how to drain and f II the cooling system

1. Loosen the plug screw (a) or (b) enough to release any pressure that may have built-up, and re-tighten.

Before doing so, place a cloth over the plug screw to contain any possible spray of glycol as the pump de-pressurises.

2. Secure a hoist to the lifting hoop. Tilt the pump to 45° with the drain plug underneath.

**Note:** because there is insufficient space to place a waste container underneath the drain plug by the completion of step 5, the waste must be drained into a sump.

- 3. Remove the plug screw and seal ring (a) from the drain hole.
- 4. Glycol will empty from the cooling jacket chamber.
- 5. When the flow stops, continue to gradually tilt the pump until horizontal. This will drain the remaining glycol from the seal chamber.

**Note:** draining the glycol entirely with the pump in a horizontal position would result in some glycol being retained in the cooling jacket.

- 6. After the glycol is fully drained raise the pump into its upright position and refit the plug screw and seal ring (a).
- 7. Remove the plug screw and seal ring (b) from the fill hole.
- 8. Select the required volume of glycol from the quantities table and slowly pour into the fill hole.
- 9. Refit the plug screw and seal ring (b).



(a) Drain (b) Fill





## 7.6 Oil and glycol quantities (litres)

		Lubricant		Coolant		
XFP	Motor	(withou	t cooling jacket)	(with cooling jacket)		
		Oil	Water and propylene glycol	Water and propylene glycol		
PE 1	PE45/2 PE22/4 PE28/4 PE35/4 PE18/4W PE28/4W PE20/6 PE20/6W	0.43	-	-		
PE 2	PE80/2 PE125/2 PE45/4 PE56/4 PE75/4 PE90/4 PE105/4 PE35/6	0.68	-	-		
PE3	PE185/2 PE200/2 PE300/2 PE130/4 PE150/4 PE185/4 PE210/4 PE90/6 PE110/6 PE130/6 PE160/6 PE120/8 PE250/4	-	8.0	16.5		

Volume ratio: 86% oil or water/propylene glycol : 14% air

### Specif cation:

Lubricant: white mineral oil VG8 FP153C or 70% water/30% glycol Coolant: 70% water/30% glycol

### 7.7 Bottom plate adjustment

At manufacture, the bottom plate is fitted to the volute with the correct clearance gap set between the impeller and the bottom plate (for optimum performance max 0.2 mm).

### 7.7.1 Instructions on how to adjust the bottom plate

To reset the clearance gap following wear:

(Note: when adjusting PE3 pumps, steps 1, 2 and 3 do not apply)

- 1. Check the position of the alignment notch (e) in the fixing lug to determine if the bottom plate is in the factory pre-set position or if the clearance gap has been previously adjusted. If previously adjusted proceed to Step 4.
- 2. Remove the three screws (c) securing the bottom plate to the volute. Attention: if, due to corrosion, the bottom plate does not release freely from the volute, DO NOT force it free by tightening the adjusting grub screws (d) against the fixing lugs on the volute as this could damage the lugs on the bottom plate beyond repair! In that case, first remove the volute from the motor housing by releasing the three securing screws (f) and then remove the bottom plate by tapping it free from inside the volute using a mallet and block of wood.
- 3. Rotate the bottom plate anti-clockwise through 45° from the pre-set position (a) to the secondary alignment position (b) and refit the securing screws.
- 4. Loosen the adjusting grub screws (d) and tighten the securing screws in the bottom plate evenly until the impeller will lightly, but freely, rub against the bottom plate when rotated by hand.
- 5. Tighten the grub screws fully to secure the bottom plate in position (max. 33 Nm).









### 7.8 Bearings and Mechanical Seals

XFP pumps are fitted with lubricated-for-life ball bearings. Shaft sealing is by means of double mechanical seals.

### ATTENTION: Once removed, bearings and seals must not be re-used, and must be replaced in an approved workshop with genuine ABS spare parts.

### 7.9 Changing the power cable (PE1 & PE2)

To facilitate quick and easy changing or repair of the power cable, the connection between the cable and motor is by means of an integrated 10-pole terminal block.



To be carried out only by a qualified person, in strict adherence to relevant safety regulations.

### 7.10 Cleaning

If the pump is used for transportable applications, then in order to avoid deposits of dirt and encrustation it should be cleaned after each usage by pumping clear water. In the case of fixed installation, we recommend that the functioning of the automatic level control system be checked regularly. By switching the selection switch (switch setting "HAND") the sump will be emptied. If deposits of dirt are visible on the floats then these should be cleaned. After cleaning, the pump should be rinsed out with clear water and a number of automatic pumping cycles carried out.

### 7.11 Venting of the volute

After lowering the pump into a sump full of water, an air lock may occur in the volute and cause pumping problems. To clear the air lock, raise the pump in the medium and then lower it again. If necessary, repeat this venting procedure.

We strongly recommend that dry-installed XFP pumps are vented back into the sump by means of the (drilled and tapped) hole provided in the volute.

## 8 Troubleshooting Guide

Fault	Cause	Fix			
Pump does not run	Moisture sensor shutdown.	Check for loose or damaged oil plug, or locate and replace faulty mechanical seal / damaged o-rings. Change oil. <sup>1)</sup>			
	Level control override.	Check for float switch that is faulty or tangled and held in OFF position in sump.			
	Impeller jammed.	Inspect and remove jammed object. Check gap between impeller and bottom plate and adjust if necessary.			
	Gate valve closed, non-return valve blocked.	Open gate valve, clean blockage from non-return valve.			
Pump switching on/off intermittently	Temperature sensor shutdown.	Motor will restart automatically when pump cools down. Check thermal relay settings in control panel. Check for impeller blockage. If none of above, a service inspection is required. <sup>1)</sup>			
Low head or flow	Wrong direction of rotation.	Change rotation by interchanging two phases of the power supply cable.			
	Gap too wide between impeller and bottom plate	Reduce gap (see page 13).			
	Gate valve partially open.	Open valve fully.			
Excessive noise or vibration	Defective bearing.	Replace bearing. <sup>1)</sup>			
	Clogged impeller.	Remove and clean hydraulics.			
	Wrong direction of rotation.	Change rotation by interchanging two phases of the power supply cable.			
High voltage	Water inside motor.	Replace stator. <sup>1)</sup>			
test failure	Stator insulation damaged.	Replace stator. <sup>1)</sup>			
	Power cable or lead damaged.	Replace power cable. <sup>1)</sup>			
Ohms test failure	Stator failure.	Repair/replace stator. <sup>1)</sup>			



Before commencing any inspection or repair work the pump should be completely disconnected from the mains by a qualified person and care should be taken that it cannot be inadvertently switched back on.

<sup>1)</sup> Pump must be taken to approved workshop.

	SERVICE LOG						
Pump Type:		Serial No:					
Date	Hours of Operation	Comments	Sign				





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## SECTION 12e9: METERING PUMPS & ACCESSORIES FOR PROCESS TREATMENT

Carbon Feed System Pre & Post Anoxic Tanks

P&ID: Item #: P-0311, P-0712

Unit Details: Walchem Series Metering Pumps EWB31F1-VC-M

**Caustic Feed pH System Aeration Tank** 

P&ID: Item #: P-0411

Unit Details: Walchem Series Metering Pumps EWB31F1-VE-M

**<u>UF Membrane Acid Pump</u>** 

P&ID: Item #: P-0913, PD-0951, BPV-09312, PSV-09310

Unit Details: P-0913 - Walchem Series Metering Pump LKN57A-VC PD-0951 - Sentry Pulsation Dampener C311ND-1 BPV-09312 - Walchem ECO Valve Model: BPR-1-PVC-N PSV-09310 - Walchem ECO Valve Model: BPR-1-PVC-N

<u>UF Membrane Acid Pump</u>

P&ID: Item #: P-0914, CIV-09314

Unit Details: P-0914- Walchem Series Metering Pump EHE56E1-VC (NaOCI)

> CIV-09314 - Walchem ½" Injection Valve E90007

## **<u>UF Membrane Caustic Pump</u>**

P&ID: Item #: P-0915, CIV-09315

Unit Details: P-0915 – Walchem Series Metering Pump EHE56E1-VE (NaOH)

> CIV-09315 - Walchem ½" Injection Valve E90008

Manufacturer:

Walchem 5 Boynton Rd. Holliston, MA 01746 Phone: (508)-429-1110 Fax: (508)-429-7433 www.walchem.com

Local Distributor / Contact: Maltz Sales 905 Turnpike St. Canton, MA 02021 Phone: (781)-821-4400 Fax: (781)-821-1314 www.maltzsales.com

# Metering Pumps

## **EHE Series**

The EHE is the workhorse of the E-Class metering pumps. EHE Series pumps have outputs up to 20 GPH (75 l/h) and pressure capabilities to 150 PSI (10 bar). Combining the EHE performance with a turndown ratio of 1800:1 yields one of the most versatile pumps in the water treatment industry today.

Superior mechanical design and quality manufacturing merge to create a pump better than the sum of its parts. The versatile control features enable the EHE to be integrated into virtually any chemical feed application. The 360 strokeper-minute operation results in high resolution chemical feed



and long service life. EHE pumps prime in seconds and hold prime reliably.

## Summary of Key Benefit

### High Speed Performance

E-Class pumps operate at 360 strokes-per-minute, providing high resolution chemical feed. Most competitive products operate at slower speeds, resulting in slug feeding, accelerated diaphragm wear and poor feed control.

### Engineered Longevity

All E-Class pumps feature dual bearing support. The armature and shaft are supported with a bearing on each end, which ensures proper axial movement, enabling the E-Class to operate at 360 SPM while extending the life of the diaphragm.

### Superior Check Valve Performance

Dual Check Valve Assemblies in both suction and discharge fittings feature precision ball guides and tapered seats. Precise machining and molding of parts limit valve ball travel, ensuring that balls fully seat and seal with every stroke. This superior check valve design guarantees fast priming and reliable performance.

### High Compression Ratio

The compression ratio of a metering pump is important because it affects the pump's ability to prime and vent. The compression ratio is raised when you reduce the dead volume of the pump head during operation. All E-Class pumps feature a very high compression ratio that ensures proper feed especially with off-gassing products (i.e. Sodium Hypochlorite).



# Specifications

Walchem and Iwaki have over 100 years of combined pump experience. This partnership has led to the design of the most innovative and comprehensive metering pump product line in the world, the E-Class Metering Pumps. E-Class features five great series: EZ, EW, EK, EHE, and EHF. The wide range of capabilities within the E-Class ensures that there's a model to fit any water treatment, food & beverage, agriculture, water conditioning, car wash, or other industrial chemical feed application.



### Powerful

A pump's maximum pressure rating times its maximum output at that pressure gives a relative measure of the pump's hydraulic output power, a "power index." The EHE36, with an output of 8.5 GPH at 105 PSI, yields a power index of 892.5. No other electronic metering pump in this range even comes close!

### Efficient

The EHE Series does its work extremely well. Hydraulic output is maximized by its economical use of electricity via excellent heat rejection, valves that positively and consistently seat and unique front-and-back support of the armature.

### Durable

Superior magnetic, electronic, thermal and hydraulic designs have been achieved in the EHE metering pump. The result is a pump that will perform longer at maximum duty than any other comparable pump.

### **Microprocessor-based Control Circuitry**

- Allows operator adjustment of pump speed and external input settings via 4-button keypad.
- Often used in flow proportional systems, such as with a flowmeter contactor. One input pulse can produce 1 to 999 pump strokes.
- Pump can be set to divide (accumulate) pulses by a factor of 1 to 999.
- Programmable 4-20mA input allows for user defined speed control band; user sets minimum and maximum pump speeds.











# Dimensions

### **Electrical Specifications**

### 50/60 Hz, single phase 115 VAC ±10% 230 VAC ±10%

48 Watt Avg 1.8 Amp Max. 0.8 Amp Max.

## Safety Certifications

The EHE series metering pumps are WQA tested and certified to NSF/ANSI Standard 61.



### Shipping Weight

23 lbs. (10.5 kg approximate)

### **Operating Conditions**

The EHE series metering pumps are tested by Intertek to UL and CSA standards.

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Ambient Temperature:32 to 122°F (0 to 50°C)Relative Humidity:30% to 90% non-condensingLiquid Temperature:32 to 104°F (0 to 40°C) for PVC based Liquid Ends<br/>32 to 140°F (0 to 60°C) for PP or PVDF based Liquid Ends

Pumps should always be shielded from direct exposure to the elements.

## Dimensions (EHE56 referenced)







### **Mounting Dimensions**

Units	R	S	Т	Х
inches	5.20"	4.50"	1.00"	0.28"
mm	132	114	25.4	7

Units	А	В	С	D	E	F	Н	J	L	W
inches	6.06	1.42	8.13	6.42	2.28	0.67	11.71	2.38	11.54	5.75
mm	154	36	206.5	163	58	17	297.5	60.5	293	146

## Ordering Information

Pump (	Capacity/ Pressure	Control Module	Voltage	Liquid End	Options

### **PUMP SERIES**

EH = Microprocessor control for all EHE models. Features manual speed control from 1 to 360 spm in 1 spm increments. External control from pulse signal with internal multiply and divide or from analog 4-20 mA signal.

### **CAPACITY/PRESSURE RATING**

See chart on this page

### **CONTROL MODULE**

E = For use on all EHE models, features external pulse capability. (pulse divide, pulse multiply, analog)

### VOLTAGE

1 = 115VAC, 50/60 Hz

2 = 230 VAC, 50/60 Hz



### OPTIONS

**LIQUID END** See chart on this page

- Blank = Standard 1/2" tube connection. No accessory valve.
- V = Standard 1/2" tube connection with back pressure/anti-syphon valve, except on FC models.
- T = 3/4" NPT (male) pipe thread connection (no MAVV)
- P = 3/4" NPT (male) connection with back pressure/ anti-syphon valve (no MAVV)

Note: Tube to piping connection material of construction will be the same as the liquid end.

All pumps also include a manual air vent valve with the exception of FC liquid ends and options P and T.

All pumps include one foot valve, one injection valve, 20 feet of polyethylene tubing and one ceramic weight with the exception of options P and T.

### Capacity/Pressure Rating

	Max Output Capacity		Max output per stroke	Max P	ressure	Power Index
Size	GPH	mL/min	mL	PSI	MPa	GPH x PSI
E31	5.5	340	0.94	150	1.0	825.0
E36	8.5	520	1.44	105	0.7	892.5
E46	12.0	750	2.08	60	0.4	720.0
<mark>E56</mark>	<mark>20.0</mark>	<mark>1250</mark>	<mark>3.47</mark>	<mark>30</mark>	<mark>0.2</mark>	600.0
E35-HV	4.0	252	1.05	50	0.35	200.0

### Liquid End Materials

	Liquid End	Pump Head & Fittings	Diaphragm	Valve Balls	Valve Seat	Valve Seals	Gasket	Tubing
	ΗV	PVC		CE/HC	PCTFE	FKM		N/A
	FC	PVDF		CE	PCTFE	PTFE		
	PC	GFRPP		CE	FKM	FKM		
	PE	GFRPP	PTFE	CE	EPDM	EPDM	PTFE	
•	VC	<b>PVC</b>	EPDM)	CE	FKM	FKM		PE
7	VE	<b>PVC</b>		CE	<b>EPDM</b>	EPDM		
	VF	PVC		PTFE	EPDM	EPDM		
	VM*	M-PVC		CE	FKM	FKM		

\* Note: VM liquid end available on E56 only

CE	Alumina ceramic	EPDM	Ethylene propylene diene monomer
FKM	Fluoroelastomer	GFRPP	Glass fiber reinforced polypropylene
PE	Polyethylene	PTFE	Polytetrafluoroethylene
PCTFE	Polychlorotrifluoroethylene	PVC	Polyvinylchloride (translucent)
PVDF	Polyvinylidenefluoride	HC	Hastelloy C276

### **ABOUT US**

Walchem integrates its advanced sensing, instrumentation, fluid pumping and communications technologies to deliver reliable and innovative solutions to the global water treatment market. Our in-house engineering is driven by quality, technology and innovation. For more information on the entire Walchem product line, visit: www.walchem.com





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EHE Series Metering Pumps

# EHE Series Electronic Metering Pump Instruction Manual

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### Notice

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Thank you for choosing a Walchem E Series metering pump. This instruction manual deals with the correct installation, operation, programming maintenance, and troubleshooting procedures for the EHE Series metering pumps. Please read through it carefully to ensure the optimum performance, safety and service of your pump.

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## **1.0 INTRODUCTION**

### 1.1 Safety and Caution Notes



Always wear protective clothing, eye protection and gloves before working on or near a metering pump. Follow all recommendations of the supplier of the solution being pumped. Refer to the MSDS from the solution supplier for additional precautions.

Walchem E Series metering pumps should NOT be installed where ambient temperatures exceed  $122^{\circ}F$  (50°C) or fall below  $32^{\circ}F$  (0°C). Pumps should always be shielded from direct exposure to the elements. Black UV resistant tubing should be used if the tubing is exposed to strong UV radiation (sunlight/lamps).



**WARNING Risk of electrical shock!** This pump is supplied with a grounding conductor and grounding-type attachment plug. To reduce the risk of electrical shock, be certain that it is connected only to a properly grounded, grounding type receptacle with ratings conforming to the data on the pump data plate. Prior to performing any maintenance on a pump, disconnect the pump from the electrical power source.



### **Plumbing Precautions**

All tubing must be securely attached to the fittings prior to starting the pump (see Section 2.3). Only use Walchem tubing with your pump. Tubing should be shielded to prevent possible injury in case of rupture or damage. UV resistant tubing should be used if the tubing is exposed to UV light. Always adhere to local plumbing codes and requirements. Be sure that the installation does not constitute a cross connection. Walchem is not responsible for improper installations. Prior to performing any maintenance on a pump, depressurize the discharge tubing.

If you are pumping downhill or into little or no system pressure, a back pressure/anti-siphon device must be installed to prevent over-pumping. Contact your Walchem distributor for additional information.



## **Solution Compatibility**

**CAUTION!** This pump has been tested by Underwriters Laboratories Inc. using water only. The suitability of this pump for use with liquids other than water is the responsibility of the user. For liquids other than water, select the best-suited liquid end material combination using a chemical compatibility chart or guidance from the solution supplier.

### 1.2 Principle of Operation

The E Series electronic metering pump consists of a pump unit, a drive unit, and a control unit. The drive unit is an electromagnetic solenoid. When the solenoid coil is energized by the control unit, the armature shaft moves forward due to the magnetic force of the solenoid. The shaft is attached to a PTFE faced diaphragm, which is part of the pump unit. The diaphragm is forced into the pump head cavity decreasing volume and increasing pressure which forces liquid in the pump head out through the discharge check valves. When the solenoid coil is de-energized, a spring returns the armature to its starting position. This action pulls the diaphragm out of the head cavity increasing volume and decreasing pressure then pushes liquid from the supply tank through the suction check valves to refill the pump head.

### 1.3 **Specifications**



### 1 **Pump Series**

EHE Electronic metering pump with external Analog and pulse control or manual speed control (adjustable to 360 strokes per minute). Manually adjustable stroke length. (Turndown ratio 1800:1)

### 2 **Capacity/Pressure Rating**

	Output Capacity				Output pe	er stroke	Maximum	Pressure	Conn Sizo (in)	
	(GF	PH)	(mL/	′min)	(mL)		Maximum	i lessure		
Size	min	max	min	max	min	max	(PSI)	(MPa)	Tubing O.D.	
E31	0.0031	5.5	0.189	340	0.189	0.94	150	1.0	1/2	
E36	0.0047	8.5	0.289	520	0.289	1.44	105	0.7	1/2	
E46	0.0067	12.0	0.417	750	0.417	2.08	60	0.4	1/2	
E56	0.0111	20.0	0.694	1250	0.694	3.47	30	0.2	1/2	
E35-HV	0.0033	4.0	0.21	252	0.21	1.05	50	0.35	3⁄4" NPTM	

### 3 **Control Module**

Ε

1

For use on all EHE models, features analog and external pulse control with pulse divide and multiply capability.

### 4 Voltage

115VAC, 50/60 Hz

2 230VAC, 50/60 Hz

### Liquid End 5

Eldara							
Liquid End Code	Liquid End Pump Head & Code Fittings		Valve Balls	Valve Seat	Valve Seals	Gasket	Tubing
HV	PVC	PTFE	CE/HC	PCTFE	FKM	PTFE	N/A
VC	PVC	PTFE	CE	FKM	FKM	PTFE	PE
VE	PVC	PTFE	CE	EPDM	EPDM	PTFE	PE
VF	PVC	PTFE	PTFE	EPDM	EPDM	PTFE	PE
PC	GFRPP	PTFE	CE	FKM	FKM	PTFE	PE
PE	GFRPP	PTFE	CE	EPDM	EPDM	PTFE	PE
FC	PVDF	PTFE	CE	PCTFE	PTFE	PTFE	PE
<b>VM</b> ⊕	M-PVC	PTFE	CE	FKM	PTFE	PTFE	PE
⊕ E56 Mo	del only	* Bonded to EF	DM				

E56 Model only

### Materials of Construction

CE	Alumina ceramic
EPDM	Ethylene propylene diene monomer
FKM	Fluoroelastomer
GFRPP	Glass fiber reinforced polypropylene
M-PVC	Machined polyvinylchloride
HC	Hastelloy C276 (spring in HV)

PCTFE	Polychlorotrifluoroethylene
PE	Polyethylene
PTFE	Polytetrafluoroethylene
PVC	Polyvinylchloride (translucent)
PVDF	Polyvinylidenefluoride

### 6 **Special Head Options**

Blank Standard 1/2" tube connection with tube style injection & foot valves, except HV (No accessories)

- V Standard 1/2" tube connection with back pressure/anti-siphon valve, tube style injection & foot valves.
- Т 3/4" NPT (male) pipe thread connection. No accessory valves. Ρ
- 3/4" NPT (male) pipe thread connection with back pressure/anti-siphon valve.

### Adjustment Range

Stroke length adjustment range Frequency adjustment range

### **Operating Conditions**

Ambient temperature Relative humidity Liquid temperature

### 1.4 Dimensions PVC & GFRPP Models







		Mode	el		A	В	С	D	E	F	G	Н	J	L	W
EHE	31 36	E1 E2	-VC -PC -VE	-PE -VF	6.06	1.05	7.76	6.42	2.28	0.67	9.49	10.95	3.15	11.18	5.75
EHE	46	E1 E2	-VC -PC -VE	-PE -VF	6.06	1.14	7.83	6.42	2.28	0.67	9.86	11.34	2.80	11.25	5.75
EHE	56	E1 E2	-VC -PC -VE	-PE -VF	6.06	1.42	8.13	6.42	2.28	0.67	10.10	11.57	2.38	11.55	5.75
EHE	56	E1 E2	-VM		6.06	1.42	8.13	6.42	2.28	0.67	10.10	11.57	2.38	11.55	5.75
Mounting Dimensions			R			S			Т			х			
EH	E all v	ariatior	าร		5.20			4.50			1.00		0.28		

20% to 100% Stroke Length 1 to 360 strokes per minute (1 to 240 strokes per minutes for –HV)

32 to 122°F (0 to 50°C)
30 to 90% non-condensing
32 to 104°F (0 to 40°C) for PVC based Liquid Ends
32 to 140°F (0 to 60°C) for PP or PVDF based Liquid Ends

FC and HV Models





		Model		Α	В	С	D	E	F	Н	J	L	W
EHE	31 36	E1 E2	-FC	6.06	1.05	7.76	6.42	0.65	0.67	9.69	3.15	9.53	5.75
EHE	46	E1 E2	-FC	6.06	1.14	7.83	6.42	0.75	0.67	10.00	2.80	9.72	5.75
EHE	56	E1 E2	-FC	6.06	1.42	8.13	6.42	0.85	0.67	10.45	2.38	10.12	5.75
EHE	35	E1 E2	-HV	6.06	1.05	7.76	6.42	1.00	0.67	9.80	3.03	9.90	5.75

Mounting Dimensions	R	S	Т	Х						
EHE all variations	5.20	4.50	1.00	0.28						
All dimonsions in inchos										

All dimensions in inches

### 2.1 Unpacking

Open the shipping carton and inspect contents for damage. If any items are missing or damaged contact your local distributor to arrange for replacement.



Pumps are pre-primed with water at the factory. If the application is not compatible with water, drain and dry before use. Be sure to remove caps from fittings before attaching tubing.

Head bolts may have loosened during storage or shipment. Be sure to check and tighten to 19 lb-in of torque, as necessary.

The electronics within the pump can be damaged by excessive surges in voltage. Do not install the pump near high-power electrical equipment that generates high surge voltages. Avoid branch circuits that also supply power to heavy or other equipment that could generate electrical interference. If necessary, install a surge suppression device (such as a varistor with a resistance greater than 2000A) or a noise-reducing transformer at the pump's power connection.



**WARNING:** Risk of electrical shock! *This pump is supplied with a grounding conductor and grounding-type attachment plug. To reduce the risk of electrical shock, be certain that it is connected only to a properly grounded, grounding type receptacle.* 

### 2.2 Location

Choose a location for the pump that is clean, dry, vibration –free, close to an electrical outlet, and allows convenient access to stroke length control, frequency control, and tubing connections. Avoid areas where ambient temperature exceeds 122°F (50°C) or falls below 32°F (0°C). Pumps should always be shielded from direct exposure to the elements. Black UV resistant tubing should be used if the tubing is exposed to strong UV radiation (sunlight/lamps).

This pump is cord connected and not intended for permanent mounting to a building structure. However, temporary mounting to stabilize the pump during operation may be necessary as long as tools are not required for the installation or removal of the pump.

Flooded suction (mounting the pump below the level of liquid in the supply tank) is strongly recommended, especially when pumping liquids that readily generate gas bubbles. Sodium hypochlorite and hydrogen peroxide are common examples of such liquids. (See Figure 1.)



If flooded suction mounting is not possible, a shelf adjacent to (but not directly above) the supply tank often works well (see Figure 2). The supply tank or cover can also be used if it has provisions for mounting a pump (see Figure 3). In any case, the total suction lift should not exceed 5 ft (1.5m). For extremely gaseous liquids such as Sodium Hypochlorite or Hydrogen Peroxide, pulling from an external manifold will significantly reduce gas bubbles to the suction side of the pump. This installation will typically solve most priming issues associated with these gaseous liquids. See Figure 4 for reference.



Figure 4 Flooded Suction for Gaseous Liquids
The EH-HV Series pumps require a flooded suction or pre-primed condition before operation. Flooded suction (mounting the pump below the level of liquid in the supply tank) is recommended for proper operation of high viscosity pumps. (See Figure 1) These pumps are not designed to be self-priming.

The pump is supplied with  $\frac{1}{2}$ " or  $\frac{3}{4}$ " (depending on model) NPT male suction and discharge connections. Mount the pump close to the supply tank and arrange the suction piping to be as short and straight as possible. Avoid piping installations where air may become trapped in the suction piping.



#### 2.3 Supply Tubing

The supply tubing run should be as short as possible. For flooded suction mounting, install a shut-off valve with an appropriate tubing connector at the tank outlet. Cut a length of tubing from the coil supplied and install between the shut-off valve and the pump inlet fitting. For suction lift applications, install a foot valve on one end of suction tubing and cut the tubing to a length such that the foot valve hangs vertically about 1 in (25mm) above the bottom of the tank. Avoid any loops in the tubing run that could form a vapor trap. Running the tubing through a length of rigid pipe will help to keep tubing straight (see Figure 3). Total vertical suction lift should be no more than 5ft. (1.5m).

Attach tubing as shown in Figure 5. First slide the coupling nut, small end first, onto the tubing. Then slide on the clamp ring so that the rounded edges face the end of the tubing. Next push the tubing onto the tubing adapter fitting. (Tips: Place tubing adapter fitting on a flat surface such as a table top and press tubing down on top of it *all the way to the lip* of the tubing adapter fitting. If the tubing is stiff from cold, dip the tubing end in hot tap water for a few minutes so it will slide on and flare out more easily. Slide clamp ring down until it tightens over the adapter fitting. Then slide coupling nut down as far as it will go. Insert this arrangement into the suction valve housing. With one hand holding tubing and applying slight downward pressure, tighten the coupling nut until secure.



**WARNING:** All fittings and coupling nuts should be tightened by hand. If necessary, small pliers may be used to make it snug. DO NOT use excessive force or large wrenches.



Figure 6 Tubing Connections

#### 2.4 Discharge Tubing

Cut a length of tubing long enough to go from the pump to the application (injection) point. Additional tubing can be ordered from your distributor. Avoid sharp bends or kinks in the tubing and protect the tubing from sharp edges that could chafe or cut it. If applicable, install the injection valve in 1/2" NPT thread at the injection point and connect the discharge tubing to the injection valve. Attach the tubing as described above in Section 2.3, Figure 5.

**Note:** Most pump models have an air vent valve with two connections on the discharge side of the pump head. The connection marked 'OUT' is the discharge connection plumbed to the injection point. The connection marked 'AIR' is the vent connection and tubing should be routed from this point back to the chemical solution (supply) tank or drum. Refer to Section 1.4 drawing.

#### 2.5 Installing Injection Check Valve

A fitting or tee with 1/2" NPTF threads and sufficient depth should be used to install the injection valve assembly. If required, trim off an amount of the extension tip until it fits your fitting or tee (see Figure 7). Attach the supplied tubing to the compression end: cut the tubing square, slide on the coupling nut, push the tubing to the bottom of the cone (use warm water to soften tubing as necessary), and hand tighten coupling nut.

The position of the injection check valve can be at any orientation as long as the spring is retained in the valve. DO NOT REMOVE THE SPRING. Be sure to check/replace the spring as needed.



**CAUTION:** Some chemicals may have reactions as they are injected into the main flow (ie. sulfuric acid may react with water causing excess heat). If that chemical is heavier than water, mount the injection valve as close as possible to vertical, injecting into the bottom of the pipe. This will keep the injection nozzle facing up and keep the heavier chemistry from draining into the pipe causing adverse reactions within the injection valve and pipe.

In addition to preventing backflow from pressurized lines, the injection valve will provide a limited amount of backpressure when pumping into open atmosphere type applications. However, the backpressure by the injection check valve is very low and can vary. Metering pump output is rated at maximum backpressure and, depending upon the application, may be higher if the back-pressure is lower than rated. Additionally, the valve does NOT act as an anti-siphon valve. If siphoning is a possibility, or if pumping downhill into open atmosphere (open tank), a separate backpressure/anti-siphon valve must be installed.

**NOTE:** Siphoning can also occur at the tip of the injection valve because of the high flow rate in the main pipe flowing past the small injection nozzle (venturi effect). In this case, an anti-siphon device must be installed to avoid over feeding or siphoning of chemistry into the line. Cutting the injector tip at an angle or to a different length will sometimes alleviate this problem.



Figure 7 Injection Check Valve Installation

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#### 3.0 OPERATION

#### 3.1 Priming

Install the pump as described in Section 2.0. With the pump plugged in but not pumping, set stroke length at 100% and frequency at 360 (use the  $\blacktriangle$  or  $\checkmark$  buttons as necessary to adjust the frequency). If the pump is equipped with a manual air vent valve, open the knob  $\frac{1}{2}$ -1 turn; otherwise disconnect the discharge tubing from the injection valve. Push the **START/STOP** button to start the pump. As soon as liquid enters the discharge tubing at the pump head, push the **START/STOP** button again to stop the pump. Close the air vent valve and/or reconnect the discharge tubing to the injection valve.

If the pump does not self-prime, remove the check valve housing on the discharge and suction sides to make sure the valve cartridges and gaskets are in correct positions (see Section 4.2). Remove and shake cartridges to make sure ball is loose inside. Wetting cartridges before re-installing will help in priming.

#### 3.2 Adjustment

The pump will operate best with the stroke length at 100%. If less than full output is required, set the frequency to the desired percentage of maximum.

Example: Model EHE31E1-VC has maximum output of 5.5 GPH at 360spm and 100%SL.

Desired output is 4.0 GPH.

 $4.0 \div 5.5 = 0.73$  or 73%. 73% of 360spm is 263spm.

Press the  $\blacktriangle$  or  $\triangledown$  buttons as necessary to set the frequency to 263spm.

If very low outputs are required, it will be necessary to also reduce the stroke length. (Minimum recommended stroke length is 20%.)

#### 3.3 Calibration

If the application requires the pump to be calibrated, prime and adjust the pump per directions above. Then connect a calibration column to the suction side of the pump and reprime the pump to eliminate any air.

Turn the pump on for one minute and read the amount of liquid pumped from the column. Adjust the frequency up or down as necessary and check the output again. When the desired output is reached, disconnect the calibration column and reconnect the suction tubing. (See Figure 8.)



Figure 8 Pump Calibration

#### 3.4 Control Unit Operation and Programming

The EHE Series metering pumps can be operated in either manual or external modes. The external mode can be controlled from a digital or analog external signal. An external stop function is available for remotely suspending operation of the pump and functions independent of the control mode.

#### Display/Keypad Overview





Notes:

- ni
- പ്
  - To change input operation between Digital or Analog, press the EXT and ▲ keys simultaneously. 4
- Toggle between DIG or ANA with the ▲ or ▼ keys and select the desired control method by pressing with the STOP/START key. This will also exit this menu.
  - the EXT key will move to this selection. On/Off is toggled with the ▲ or ▼ keys and the EXT key will Input Pulse Memory can be turned on/off in the DIG mode. While selecting DIG in step 4, pressing switch between multiply and divide. Press the STOP/START key to return to the WAIT Mode. Ω.
- To set the input operation values, press the EXT and  $\forall$  keys simultaneously from the WAIT Mode. The values are changed with the  $\triangle$  or  $\forall$  keys. The EXT key is used to toggle between MULT or DIV if set in DIG mode and will scroll through the (4) setpoints in ANA mode. <u>ن</u> 547

#### Manual Operation

(1) Power ON

When power is applied to the pump, the green indicator above ON lights up, the display momentarily shows the software version ("Vx.xE"), and the controller goes to whatever mode the pump was in when power was disconnected. If being powered for the first time, the stroke rate is then displayed, the "WAIT" is lit, and pump is then in the Wait Mode.

- (2) The stroke rate (spm) can be changed by pressing the ▲ or ▼ keys in either the Wait Mode or during operation. Press the ▲ to increase the stroke rate and the ▼ key to decrease the rate. Holding the keys down briefly will change the rate slowly, but holding them down for 3 seconds will change the rate rapidly. The default setting shipped from the factory is 360 spm.
- (3) Pressing the STOP/START key will start pump operation. The WAIT backlight disappears and the green ON indicator blinks off with every stroke.

(4) Pressing the STOP/START key again will stop pump operation and the WAIT will be backlit as the pump enters the WAIT Mode.



STOP

OVER

▼

ON ON

ØN

1

2

SET

START/STOP

WAIT

FXT

 $\bigcirc$ 

EXT



EH-E

Blinks

#### **External Operation**

#### ANALOG INPUT OPERATION

In analog mode the pump will accept a milliamp signal and produce a pump speed proportional to the signal level received. The input resistance of the analog signal is  $250\Omega$ . The pump's response can be fine-tuned by variable set points to meet system requirements.

(1) Power ON

When power is applied to the pump, the green indicator above ON lights up, the display momentarily shows the software version ("Vx.xE"), and the controller goes to whatever mode the pump was in when power was disconnected. If being powered for the first time, the stroke rate is then displayed, the "WAIT" is lit, and pump is then in the Wait Mode.

- (2) Selecting the mode of EXT operation: Press the EXT and the ▲ keys simultaneously. The WAIT backlight disappears, the SET backlight is lit, and the display shows "dIG" (if "ANA" is displayed, skip to step 3).
  - Change the mode by pressing the  $\checkmark$  key. Every time the  $\checkmark$  key is pressed, it toggles between the ANA and dIG modes. (Pump is shipped from the factory preset in the dIG mode)
- (3) Press the START/STOP key to confirm the Analog selection and return to the WAIT mode.

(4) Setting the Analog Input Set points: (NOTE: Pump is pre-set at factory with the Analog set points set at 4.0mA = 0 SPM and 20.0mA = 360 SPM. If these are the desired set points, skip steps 4-12 and move to step 13.) Press the EXT and ▼ keys simultaneously. The display will show the initial set point (default is A04.0) and the SET and 1 backlight will appear.



START/STOP



(5) Setting the Input Current (mA) of SET point 1: Use the ▲ and ▼ keys to set the input current (mA) of SET point
1. The value will increase with the ▲ key and decrease with ▼ the key. The numerical value will change slowly by 0.1mA if the keys are pressed briefly, but will increment rapidly if they are held for more than 3 seconds.

The allowable range is 0.0-20.0mA and the default setting from the factory is 4.0mA.

(6) Press the EXT key to confirm the current value of SET point 1 and move to the pump speed (SPM) setting of SET point 1. "P 0" will be the default setting (Pump speed=0spm) and the SET and 1 will remain backlit.













- (7) Setting the Stroke Rate of SET point 1: Set the stroke rate corresponding to the current setting of SET point 1 using the ▲ and ▼ keys. The allowable range is 0-360 spm and the default setting from the factory is 0 spm.
- (8) Press the EXT key to confirm the pump speed value of SET point 1 and move to the Current Input setting of Set point 2. The backlight behind SET will remain, but the light behind 1 will go off and 2 will become backlit. The default display will show A20.0.
- (9) Setting the Input Current (mA) of SET point 2: Use the ▲ and ▼ keys to set the input current (mA) of SET point
  2. Do NOT set the value equal to SET point 1 or an error (ERR1) will occur. The allowable range is 0.0-20.0mA and the default setting from the factory is 20.0mA.
- (10) Press the EXT key to confirm the current value of SET point 2 and move to the pump speed (SPM) setting of SET point 2."P360" will be the default setting (Pump speed=360spm) and the SET and 2 will remain backlit.

(11) Setting the Stroke Rate of SET point 2: Set the stroke rate corresponding to the current setting of SET point 2 using the ▲ and ▼ keys. The allowable range is 0-360 spm and the default setting from the factory is 360 spm.



(12) Press the STOP/START key to confirm the pump speed value of SET point 2 and move back to the WAIT mode. (Pressing the EXT key will move back to setting the current value of SET point 1 – step #4. Press the STOP/START key anytime to exit and go to the WAIT mode)



(13) Press the EXT button to start EXT pump operation. The WAIT backlight will go out, EXT will become backlit, and the ON lamp will begin to blink with every stroke. The pump will operate at the speed corresponding to the incoming current (mA) signal.

To stop the pump, press the STOP/START key once and the pump will enter the WAIT mode.

Pressing the EXT again will restart the pump in EXT mode. (see wiring section to ensure the analog wiring is correct)





The pump speed will now be determined by the level of the milliamp signal as shown in the graph. The stroke length can be adjusted manually to set the volume pumped per stroke.

#### **DIGITAL INPUT OPERATION**

In digital mode, the pump can accept a non-powered (dry contact) pulse signal from a flowmeter or other similar instrument. The pump can be set to <u>divide</u> pulses by a factor of 1 to 999; or in <u>multiply</u> mode, 1 input pulse can produce 1 to 999 pump strokes. The minimum pulse width for input pulses is 10 mSec.

(1) Power ON

When power is applied to the pump, the green indicator above ON lights up, the display momentarily shows the software version ("Vx.xE"), and the controller goes to whatever mode the pump was in when power was disconnected. If being powered for the first time, the stroke rate is then displayed, the "WAIT" is lit, and pump is then in the Wait Mode.

- (2) Selecting the mode of EXT operation: Press the EXT and the ▲ keys simultaneously. The WAIT backlight disappears, the SET backlight is lit, and the display shows "dIG" or "ANA" (if "dIG" is displayed, skip to step 3). Change the mode by pressing the ▼ key. Every time the ▼ key is pressed, it toggles between the ANA and dIG modes. (Pump is shipped from the factory preset in the dIG mode)
- (3) Move to the Pulse Input Memory menu: Press EXT while dIG is displayed and "/--OF" or "/--ON" will be displayed. "/--OF" is the default set at the factory as it is rarely needed or used.

Pulse Input Memory: As digital pulses come into the pump – whether the pump will operate faster than the pulses (MULT) or at a fraction of the speed (DIV) – internal memory can be set to store these pulses if they come in too fast for the pump to keep up. Once the incoming pulses slow or stop, the pump will work

off the excess pulses. The factory default settings are that the memory is OFF for the divide mode and ON for the multiply mode. A max. of 255 pulses can be stored.

**NOTE!** In the Multiply mode, stored pulses can cause the pump to run excessively after incoming pulses (usually indicating flow) have stopped. This could cause injection into a stagnant pipe.

- (4) Use the ▲ and ▼ keys to toggle the divide memory ON and OFF. These will change the display between "/--OF" and "/--ON".
- (5) Pressing the EXT key moves to the memory setting for the MULT mode. "X--ON" is the default setting. Pressing the ▲ and ▼ keys will toggle the display between "X--ON" and "X--OF".









(6) Press the EXT key to enter the memory selections and return to the "dIG" set menu.



(7) Press the START/STOP key to confirm the Digital Operation selection and return to the WAIT mode. The SET backlight will go out and the WAIT light will illuminate.









Input	EXAMPLE: Multiply by 5 Display = X 5
Pulses from instrument	
Output Pump strokes	

- (NOTE: Pump is pre-set at factory with both MULT or DIV set to 1. The default Digital mode is preset to DIV.)
  Press the EXT and ▼ keys simultaneously. The display will show "/ 1" (Dividing mode) and the SET backlight will appear.
- (9) Pressing the EXT key toggles the mode of operation between "/" (DIV) and "X" (MULT).

Once the desired mode of operation is displayed ("X 1" for MULT or "/ 1" for DIV), set the value needed to be multiplied or divided.

(10) Setting the Stroke Rate:

(8) Digital Input Selection:

Set the desired multiplier or divider value using the  $\blacktriangle$  and  $\blacktriangledown$  keys.

The allowable range is 1-999 and the default setting from the factory is 1.

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(11) Press the START/STOP key to confirm the operation mode and value settings. This will also return to the WAIT mode. The WAIT light will illuminate and the backlight behind SET will go out.

- (12) IMPORTANT: Changing the pump speed in the WAIT (or MAN) mode using the ▲ and ▼ keys sets the MAX operating speed the pump will operate in the Digital mode (MULT). This can be used to help moderate the pump output and reduce slug feeding. For example, if the pump is set to multiply by 10 and a max of 3 input pulses/min are expected from a flowmeter, instead of having the pump stroke 10 times in 2 seconds for each input pulse (pump set at 360SPM), the speed can be reduced to 40 SPM and the pump will take 15 seconds to evenly pump in the 10 strokes the pump will be operating 45 seconds out of 60 instead of 6 out of 60.
- (13) Press the EXT button to start EXT pump operation. The WAIT backlight will go out, EXT will become backlit, and the ON lamp will blink with every stroke. The pump will operate at the speed corresponding to the MULT or DIV setting of the incoming pulses. To stop the pump, press the STOP/START key once and the pump will enter the WAIT mode. Pressing the EXT again will restart the pump in EXT mode. (see wiring section to ensure the digital input wiring is correct)
- EXT WAIT EXT STOP OVER SET

1





START/STOP

 $\bigcirc$ 

#### **ALARM Indications**

 In ANALOG Input Operation, if the incoming current matching 360SPM (typically, 20mA=360SPM) is exceeded, the OVER will become backlit. The pump will continue to operate at 360SPM during this condition.



(2) While programming the Analog Input Setpoints, if the same value (current or SPM) is set for both Setpoint 1 and 2, "ERR 1" will be displayed for 3 seconds. It will return to the programming menu so the setpoints can be corrected.



(3) In DIGITAL Input Operation (Multiply or Divide modes), if the incoming pulses come in either during operation or exceed the pump doing 360SPM, the OVER will be come backlit. If the Pulse Input Memory is on, the pump will store the extra pulses (max. of 255 incoming pulses) and work them off as it can to catch up.



#### **Digital Mode**

#### Connecting a digital input device

Disconnect AC power to the pump. Remove the four screws from the terminal block cover and remove the cover. Remove the cord nut and bushing from the terminal block cover. Remove the terminal block from the connector. Slide the nut and bushing over the external control cable and insert the cable through the terminal block cover. Strip 1/4" insulation from conductors and connect the positive side to terminal 7 and the negative side to terminal 8. (See Figure 8 and the schematic, below.)



#### Connecting a digital input to multiple pumps in parallel



#### **Sensor Power**

The control circuit of the EHE series has the ability to provide 12 VDC at up to 10 mA to power a Hall effect sensor or similar device. Connect the sensor power leads to terminal 4 (positive) and terminal 8 (negative) of the terminal block.



**CAUTION:** Open loop signal voltage must not exceed 25 VDC. If the signal voltage is greater than 25 VDC, power down the signal source prior to connection.

#### Connecting an analog signal device

Disconnect AC power to the pump. Remove the four screws from the terminal block cover and remove the cover. Remove the cord nut and bushing from the terminal block cover. Remove the terminal block from the connector. Slide the nut and bushing over the external control cable and insert the cable through the terminal block cover. Strip 1/4" insulation from conductors and connect the positive side to terminal 5 and the negative side to terminal 8. (See Figure 8 and the schematic to the right.)



#### **STOP Function**

The EHE series pump also includes a **STOP** function that allows an external signal to stop the operation of the pump.

A switch or solid-state device capable of switching 5 VDC at 2 mA can be connected to terminals 6 (positive) and 8 (negative) of the terminal block. Closing this circuit temporarily interrupts pump operation. Opening this circuit resumes pump operation. If the pump is operating in external digital mode, any pulses received while the pump is stopped will be saved (up to a maximum of 255). When pump operation resumes, saved pulses will allow the pump to "catch up" by producing the correct number of pump strokes that should have occurred while it was stopped. The 'Over' indicator will light up if the pump receives pulses while in the 'Stopped' condition (see Figure 8 and the schematic below).



#### **3.6 AC Power Interruption**

If AC power is interrupted, the pump will power up as shown below:

State preceding power OFF	State following power ON
WAIT	WAIT
Run Manual	Run manual
Run external	Run external
Set EXTernal mode	WAIT
Set EXTernal values	WAIT



**CAUTION:** Before working on the pump, disconnect the power cord, depressurize the discharge tubing and drain or flush any residual liquid from the pump head and valves. Always wear protective gear when working around chemicals.

#### 4.1 Diaphragm Replacement

Disconnect AC power to the pump and disconnect the suction tubing and discharge tubing. Remove the four head bolts with a 4mm hex wrench. Turn the stroke length knob fully counter-clockwise. Unscrew the diaphragm and remove its retainer (small disk behind the diaphragm). **CAUTION**: *There may be small brass spacers between the retainer and the armature shaft. These spacers need to be re-used when replacing the diaphragm*. Install the new retainer and diaphragm on the shaft. Turn the diaphragm clockwise until it bottoms on the shaft. Use Caution when handling the diaphragm – the PTFE surface can be damaged by tools, nails, or any sharp objects. Replace the pump head and tighten the head bolts to a torque of 19 lb-in (2.16 N-m).

#### 4.2 Valve Replacement

Making sure the discharge side has been depressurized, remove the suction and discharge tubing. Remove the suction fitting, two valve cartridges\*, o-ring and gasket(s). Install the new o-ring, gasket(s) and valve cartridges. Be sure both valve seats are in the same orientation. Refer to Figure 9 below. Tighten the suction fitting. Similarly remove and replace the discharge valve cartridges, oring and gasket(s).

\*EHE35-HV, EHE46 and EHE56 series have one valve cartridge on the suction and discharge sides. Refer to Section 5.0 for exploded view drawing and parts list.



Figure 10 Valve Cartridge Orientation

#### 4.3 Tubing

Check ends of tubing for splits, cracks or thin spots. Examine the full length of tubing for damage due to chafing, abrasion, stress cracks, excessive temperature or exposure to ultraviolet light (direct sunlight or mercury vapor lamps). If any signs of deterioration exist, replace the entire length of tubing. It is a good idea to replace discharge tubing on a regular preventative maintenance schedule every 12 months.

## 5.0 EXPLODED VIEW AND PARTS GUIDE

#### 5.1 How to order parts for your metering pump.

Have your catalog or model number ready. This is found on the silver label on the side of the pump.

From the exploded view drawing, identify the item number of the part(s) to be ordered.

The item numbers are listed and include part number, description and size/material information.

Contact your Walchem distributor for further assistance.



#### 5.2 Accessories (Not shown)

Part No.	Description	Size	Liquid End Mtl
E90005	Valve, Injection 1/2	31, 36, 46	VC
E90006	Valve, Injection 1/2	31, 36, 46	VE, VF
E90007	Valve, Injection, 1/2	56	VC, VM
E90008	Valve, Injection, 1/2	56	VE, VF
E90009	Valve, Injection, 1/2	31, 36, 46	PC
E90010	Valve, Injection, 1/2	31, 36, 46	PE
E90011	Valve, Injection, 1/2	56	PC
E90012	Valve, Injection, 1/2	56	PE
E90022	Valve, Injection/Back Pressure, 1/2	31, 36, 46, 56	FC
E90068	Valve, Back Pressure/Anti-Siphon, 1/2	31, 36, 46, 56	VC, VE, VM, VF
E90069	Valve, Back Pressure/Anti-Siphon, 1/2	31, 36, 46, 56	PC, PE
E90018	Valve, Foot, 1/2	31, 36, 46, 56	PC
E90036	Valve, Foot, 1/2	31, 36, 46, 56	PE
E90016	Valve, Foot, 1/2	31, 36, 45, 56	VC
E90037	Valve, Foot, 1/2	31, 36, 46, 56	VE
E90193	Valve, Foot, 1/2	31, 36, 46, 56	VF
E90275	Valve, Foot, 1/2	31, 36, 46, 56	FC
E00001-00	Tubing, 1/2 OD LLDPE per foot	31, 36, 46, 56	All
E00001	Tubing, 1/2 OD LLDPE, 20 FT	31, 36, 46, 56	All
E00001-50	Tubing, 1/2 OD LLDPE, 50 FT	31, 36, 46, 56	All
E00001-100	Tubing, 1/2 OD LLDPE, 100 FT	31, 36, 46, 56	All
E00001-250	Tubing, 1/2 OD LLDPE, 250 FT	31, 36, 46, 56	All
E00001-500	Tubing, 1/2 OD LLDPE, 500 FT	31, 36, 46, 56	All
E00071	Weight, Ceramic	31, 36, 46, 56	All
*E00030	Fitting (NPT Valve Housing) 1/2" NPT, PVC	31, 36	VC, VE, VF
*E00031	Fitting (NPT Valve Housing) 1/2" NPT, PP	31, 36	PC, PE
*E00032	Fitting (NPT Valve Housing) 1/2" NPT, PVDF	31, 36	FC
*E00033	Fitting (NPT Valve Housing) 3/4" NPT, PVC	31, 36	VC, VE, VF
*E00034	Fitting (NPT Valve Housing) 3/4" NPT, PP	31, 36	PC, PE
*E00035	Fitting (NPT Valve Housing) 3/4" NPT, PVDF	31, 36	FC
*E00036	Fitting (NPT Valve Housing) 3/4" NPT, PVC	46	VC, VE, VF
*E00037	Fitting (NPT Valve Housing) 3/4" NPT, PP	46	PC, PE
*E00038	Fitting (NPT Valve Housing) 3/4" NPT, PVDF	46	FC
*E00039	Fitting (NPT Valve Housing) 3/4" NPT, PVC	56	VC, VE, VM, VF
*E00040	Fitting (NPT Valve Housing) 3/4" NPT, PP	56	PC, PE
*E00041	Fitting (NPT Valve Housing) 3/4" NPT, PVDF	56	FC

\* Fittings replace the Valve Housing (Item 3) and the complete Manual Air Vent Valve assembly (Item E) shown in exploded view.

5.3 EHE31, 36, 46 Liquid End Exploded View



## **Head Assembly** EHE 31, 36, 46

- С Head Assembly
- D Valve Cartridge
- Е Manual Air Vent Valve

See Page 31 for the assembly part numbers

Item	Part No	Description	Qty	Size	Liquid End Mtl
1	EH2101	Head, E31 PVC	1	31	VC, VE, VF
	EH2102	Head, E31 GFRPP	1	31	PC, PE
	EH2103	Head, E31 PVDF	1	31	FC
	EH1953	Head, E36 PVC	1	36	VC, VE, VF
	EH1962	Head, E36 GFRPP	1	36	PC, PE
	EH1967	Head, E36 PVDF	1	36	FC
	EH2109	Head, E46 PVC	1	46	VC, VE, VF
	EH2110	Head, E46 GFRPP	1	46	PC, PE
	EH2111	Head, E46 PVDF	1	46	FC
3	EH0619	Housing, Valve, 1/2 PVC	1	31,36	VC, VE, VF
	EH0675	Housing, Valve, 1/2 GFRPP	1	31,36	PC, PE
	EH0947	Housing, Valve, 1/2 PVDF	2	31,36	FC
	EH0640	Housing, Valve, 1/2 PVC	1	46	VC, VE, VF
	EH0679	Housing, Valve, 1/2 GFRPP	1	46	PC, PE
	EH0932	Housing, Valve, 1/2 PVDF	2	46	FC
4	EH0620	Nut, Coupling, 1/2 PVC	3	31,36,46	VC, VE, VF
	EH0676	Nut, Coupling, 1/2 GFRPP	3	31,36,46	PC, PE
	EH0933	Nut, Coupling, 1/2 PVDF	2	31,36,46	FC
5	EH0719	Adapter, ½, PVC	3	31,36,46	VC, VE, VF
	EH0734	Adapter, 1/2 GFRPP	3	31,36,46	PC, PE
	EH0938	Adapter, ½ PVDF	2	31,36,46	FC
6	EH0720	Clamp Ring, 1/2 SS	3(2)	31,36,46	All (FC)
*8	EH2105	Diaphragm, PTFE/EPDM	1	31	All
	EH2108	Diaphragm, PTFE/EPDM	1	36	All
	EH2113	Diaphragm, PTFE/EPDM	1	46	All
*9	EH0622	Retainer, Diaphragm	1	31	All
	EH0637	Retainer, Diaphragm	1	36	All
	EH0642	Retainer, Diaphragm	1	46	All
*11	EH0118	Guide, Valve 0.375 PVC	4	31,36	VC, VE, VF
	EH0332	Guide, Valve 0.375 GFRPP	4	31,36	PC, PE
	EH0352	Guide, Valve 0.375 PVDF	4	31,36	FC
	EH0643	Guide, Valve 0.500 PVC	2	46	VC, VE, VF
	EH0680	Guide, Valve 0.500 GFRPP	2	46	PC, PE
	EH0934	Guide, Valve 0.500 PVDF	2	46	FC
*12	EH0119	Seat, Valve 0.375 FKM	4	31, 36	VC, PC
	EH0623	Seat, Valve, 0.375 EPDM	4	31, 36	VE, PE, VF
	EH0593	Seat, Valve, 0.375 PCTFE	4	31, 36	FC
	EH0644	Seat, Valve, 0.500 FKM	2	46	VC, PC
	EH0645	Seat, Valve, 0.500 EPDM	2	46	VE, PE, VF
	EH0935	Seat, Valve, 0.500 PCTFE	2	46	FC
*13	EH0120	Ball, Valve, 0.375 CE	4	31, 36	VC, VE, PC, PE, FC
	E00062	Ball, Valve, 0.375, PTFE	4	31, 36	VF

EHE31	, 36,	46	Liq	uid	End	Parts	List
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em	D (N	<b>b</b>	ty	<b>.</b>	
± *13	Part No	Description Ball Valve 0.500 CE	2	Size	Liquid End Mtl
15	E110040	Ball Valve 0 500 PTFF	2	46	VE, VE, IC, IE, IC
*14	E00072	Gasket Valve 0.375 PTEE	2	31.36	VC VE PC PE VE
17	EH0354	Gasket Valve 0.375 PTEE	6	31, 36	FC
	EH0648	Gasket Valve 0.500 PTFF	4	46	VC VE PC PE VE
	EH0936	Gasket Valve 0.500 PTFF	6	46	FC
*15	EH0028	O-Ring P12 FKM	3	31 36 46	VC PC
10	EH0051	O-Ring, P12 FRM	3	31,36,46	VE PE VE
	EH0939	Gasket Adapter PTFE	2	31 36 46	FC
*17	EH0122	O-Ring P16 FKM	2	31 36	VC PC
	EH0127	O-Ring, P16 EPDM	2	31 36	VE PE VF
	EH0650	O-Ring 24 x 2.62 FKM	2	46	VC PC
	EH0649	O-Ring, 24 x 2.62 EPDM	2	46	VE. PE. VF
	EH0355	Gasket, Housing, PTFE	2	31.36	FC
	EH0941	Gasket, Housing, PTFE	2	46	FC
19	EH2106	Bolt, M5 x 40 316 SS	4/6	31,36,46	All
20	EH2011	Washer, M5 Flat, 316 SS	4/6	31,36,46	All
21	EH2012	Washer, M5 Lock, 316 SS	4/6	31,36,46	All
*22	EH0302	O-Ring, Knob, Seal	1	31,36,46	VC, PC
	EH0303	O-Ring, Knob, Seal	1	31,36,46	VE, PE, VF
*23	EH0300	O-Ring, Knob, Stop	1	31,36,46	VC, PC
	EH0301	O-Ring, Knob, Stop	1	30.35.45	VE, PE, VF
*24	EH1082	O-Ring, Fitting Seal	1	31, 36	VC, PC
	EH1084	O-Ring, Fitting Seal	1	31, 36	VE, PE, VF
	EH0122	O-Ring, Fitting Seal	1	46	VC, PC
	EH0127	O-Ring, Fitting Seal	1	46	VE, PE, VF
25	EH0299	Adjustment Knob	1	31,36,46	VC, VE, VF
	EH0321	Adjustment Knob	1	31, 36, 46	PC, PE
26	EH1662	Manual Air Vent Valve Body	1	31,36,46	VC, VE, VF
	EH1665	Manual Air Vent Valve Body	1	31,36,46	PC, PE
27	EH1078	Valve Housing MAVV	1	31, 36	VC, VE, VF
	EH1088	Valve Housing MAVV	1	31, 36	PC, PE
	EH1660	Valve Housing MAVV	1	46	VC, VE, VF
	EH1663	Valve Housing MAVV	1	46	PC, PE
28	EH1674	Lock Nut, MAVV	1	31, 36	VC, VE, VF
	EH1675	Lock Nut, MAVV	1	31, 36	PC, PE
	EH1661	Lock Nut, MAVV	1	46	VC, VE, VF
	EH1664	Lock Nut, MAVV	1	46	PC, PE
31	EH0653	Spacer, V.Housing, PVC	2	46	VC, VE, VF
	EH0683	Spacer, V.Housing, PP	2	46	PC, PE
	EH0940	Spacer, V.Housing, PVDF	2	46	FC
ZZ		Brass Spacers	Drive repla	e specific/l cing the di	Re-use when aphragm

\* Included in spare parts kit

#### 5.4 EHE 56 Liquid End Exploded View

E –



#### C Head Assembly EHE 56

- C Head Assembly D Valve Cartridge
- E Manual Air Vent Valve

See page 31 for the assembly part numbers

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### EHE 56 Liquid End Parts List

Item	Part No	Description	Qty	Size	Liquid End Mtl
1	EH2114	Head, E56 PVC	1	56	VC, VE, VF
	EH2115	Head, E56 GFRPP	1	56	PC, PE
	EH2118	Head, E56 PVC Machined	1	56	VM
	EH2116	Head, E56 PVDF	1	56	FC
3	EH0656	Housing, Valve, E56, PVC	2	56	VC, VE, VM, VF
	EH0685	Housing, Valve, E56, GFRPP	2	56	PC, PE
	EH0916	Housing, Valve, 1/2 PVDF	2	56	FC
4	EH0657	Nut, Coupling, E56, PVC	2	56	VC, VE, VM, VF
	EH0686	Nut, Coupling, E56, GFRPP	2	56	PC, PE
	EH0917	Nut, Coupling, E56, PVDF	2	56	FC
5	EH0730	Adapter, E56, 1/2, PVC	2	56	VC, VE, VM, VF
	EH0735	Adapter, E56, 1/2, GFRPP	2	56	PC, PE
	EH0923	Adapter, E56, PVDF	2	56	FC
6	EH0731	Clamp Ring, E56, 1/2, SS	2	56	All
*8	EH2119	Diaphragm, PTFE/EPDM	1	56	All
*9	EH0660	Retainer, Secondary, PPS	1	56	All
*10	EH0659	Retainer	1	56	All
*11	EH0661	Guide, Valve, .625, PVC	2	56	VC, VE, VM, VF
	EH0718	Guide, Valve, .625, GFRPP	2	56	PC, PE
4.1.0	EH0918	Guide, Valve, 0.625, PVDF	2	56	FC
*12	EH0662	Seat, Valve, .625, FKM	2	56	VC, VM, PC
	EH0663	Seat, Valve, .625, EPDM	2	56	VE, PE, VF
*12	EH0920	Pall Valve, 625 CE	2	56	VC VE VM DC DE EC
- 15	E110004	Ball Valve, 625 DTEE	2	56	VE, VE, VM, FC, FE, FC
*14	E00073	Gasket Valve 625 PTEE	2	56	VC VE VM PC PE VE
14	EH0921	Gasket Valve, 0.625 PTFE	4	56	FC
*15	EH0122	O-Ring P16 FKM	2	56	VC VM PC
10	EH0127	O-Ring, P16 EPDM	2	56	VE PE VF
	EH0924	Gasket, Adapter, PTFE	2	56	FC
*17	EH0667	O-Ring, 29.8 X 2.62, FKM	2	56	VC, VM, PC
	EH0668	O-Ring, 29.8 X 2.62, EPDM	2	56	VE, PE, VF
	EH0925	Gasket, Housing, PTFE	2	56	FC
19	EH2054	Bolt, M5 x 55 SHC, 316 SS	6	56	VC, VE, PC, PE, VF
	EH2121	Bolt, M5 x 75 SHC, 316 SS	6	56	VM
20	EH2011	Washer, M5 Flat, 316 SS	6	56	All
21	EH2012	Washer, M5 Lock, 316 SS	6	56	All
*22	EH0302	O-Ring, Knob, Seal	1	56	VC, PC
	EH0303	O-Ring, Knob, Seal	1	56	VE, PE
*23	EH0300	O-Ring, Knob, Stop	1	56	VC, PC
*24	EH0301	O-King, Knob, Stop	1	50	VE, PE
- 24	EH0122	O Ping, Fitting Seal	1	50	
25	EH0200	Adjustment Knob	1	56	VC VE
23	EH0321	Adjustment Knob	1	56	PC PF
26	EH1662	Manual Air Vent Valve Body	1	56	VC. VE
20	EH1665	Manual Air Vent Valve Body	1	56	PC. PE
27	EH1666	Valve Housing MAVV	1	56	VC, VE
	EH1667	Valve Housing MAVV	1	56	PC, PE
28	EH1661	Lock Nut, MAVV	1	56	VC, VE
	EH1664	Lock Nut, MAVV	1	56	PC, PE
29	EH0620	Coupling Nut	2	56	VC, VE
	EH0676	Coupling Nut	2	56	PC, PE
30	EH0720	Clamp Ring	2	56	VC, VE, PC, PE
31	EH0719	Adapter	2	56	VC, VE
	EH0734	Adapter	2	56	PC, PE
32	EH0028	O-Ring, Coupling Nut	2	56	VC, PC
	EH0051	O-Ring, Coupling Nut	2	56	VE, PE
ĽĽ		Brass Spacers	Ľ	prive specific	c/ re-use when replacing diaphragm
~	Included	i in spare parts kit			



]	Item	Part No	Description	Qty	Size
	1	EH1243	Head, HV, PVC	1	35
	3	E00036	Housing, Valve, 3/4" NPT, PVC	2	35
*	8	E90085	Diaphragm and Retainer	1	35
	8a	EH0636	Diaphragm, PTFE/EPDM	1	35
	8b	EH0637	Retainer, Diaphragm	1	35
	11	EH1246	Guide, Valve, .500, PVC	2	35
*	12	EH1247	Seat, Valve, 0.500, PCTFE	2	35
*	13	EH0646	Ball, Valve, 0.500, CE	2	35
*	14	EH0936	Gasket, Valve, 0.500, PTFE	4	35
*	15	EH1291	Spring, Valve, HC	2	35
*	17	EH0650	O-Ring, 24 X 2.62, FKM	2	35
	19	EH2054	Bolt, M5 X 55 SHC, 316SS	4	35
	20	EH2011	Washer, M5 Flat, 316SS	4	35
	21	EH2012	Washer, M5 Lock, 316SS	4	35
	ZZ		Spacers, Brass	Re-use	
*	Inclu	ded in spare pa	arts kit		

#### 5.6 Drive Control Components

Item	Part No.	Description	Qty
31	EH0700	Base, Pump, EHE	1
32	EH0697	Cover, Control Panel	1
33	EH1658	Gasket, EHE Pump Base	1
34	EH1071	Screw, M5 x 12, SS, PH	4
35	EH0696	Gasket, Terminal Block	1
36	EH0202	Grommet, Cord	3
37	EH0205	Nut, Strain Relief	3
38	EH0204	Cap, Strain Relief	2
39	EH0706	Box, Terminal, EHE	1
40	EH1036	Gasket, Terminal Box	1
41	EH0710	Screw, M3 x 50, SS, PH	1
42	EH0711	Screw, 5-10 SS PH Self Tap	2
43	EH0261	Gasket, M3 x 5 Bolt	1
44	EH1037	Screw, M3.5 x 10, SS, PH	2
45	EH1038	Screw, M3.5 x 25, SS, PH	2
46	EH0872	Gasket, Stroke Adjustment	1
47	EH0871	Knob, Stroke length Adj.	1
48	EH0873	Screw, M4 x 30 SS PH	1
49	EH0141	Cap, Stroke Length Adj Knob	1



А	Drive Unit
11	

#### B Control Unit

See page 31 for the spare part assembly part numbers.

#### 5.7 **Assembly Part Numbers**

Key letter from exploded view drawing, previous pages

- Drive Unit А
- В Control Module
- С Head Assembly
- D Valve Cartridge
- Manual Air Vent Valve Assembly Е



Liquid End

	A	[	В				Head A	C Assembly End Code			
Pump Model	Drive Unit Use P/N:	<b>Cont</b> ւ	<b>rol Module</b> Jse P/N:	vc	VE	VF	PC	PE	VM	FC	нν
EHE31E1-	HE31-1	EHC-E	11UPE (115V)	E31\/C	E31\/E	E31\/E	E31PC	E31DE		E31EC	
EHE31E2-	HE31-2	EHC-E2	23UPE (230V)	LUIVO	LOTVE	LOIVI	LOIT C	Lon L		Lon C	
EHE36E1-	HE36-1	EHC-E	11UPE (115V)	E36VC	E36VE	E36VE	E36PC	E36PE		E36EC	
EHE36E2-	HE36-2	EHC-E2	23UPE (230V)	20070	LOOVE	20001	2001 0	LOOFL		2001 0	
EHE46E1-	HE46-1	EHC-E	11UPE (115V)	E46VC	E46VE	E46VE	E46PC	FARDE		E46EC	
EHE46E2-	HE46-2	EHC-E2	23UPE (230V)	24070	LAOVE	24001				24010	
EHE56E1-	HE56-1	EHC-E11UPE (115V)		EFRIC	E56V/E	E56\/E	ESEDC	ESCOE	ESGVM	ESSEC	
EHE56E2-	HE56-2	EHC-E23UPE (230V)		LJOVC	LJOVL	23001	LJOPC	LJOFL	L30 V W	2001 0	
EHE35E1-	HE35-1	EHC-E11	UPE-HV (115V)								E35HV
EHE35E2-	HE35-2	EHC-E23	8UPE-HV (230V)								
			31, 36	E90052	E90071	E90313	E90056	E90073		E90316	
	D		46	E90074	E90075	E90314	E90077	E90078		E90317	
Valv	Valve Cartridge		56	E90079	E90080	E90315	E90082	E90083	E90079	E90318	
		31, 36	E90589	E90590	E90590	E90591	E90592				
E		46	E90366	E90367	E90367	E90368	E90369				
Manual A	Air Vent V ssembly	alve	56	E90370	E90371	E90371	E90372	E90373	E90370		

#### 5.8 **Spare Parts Kit**

The spare parts kit number is the Head Assembly part number with '-PK' at the end. (E31VC-PK, E31VE-PK, E31PC-PK, etc.)

Spare parts kit includes: diaphragm, retainer(s), valve guides, valve seats, valve balls, valve gaskets, o-rings and a hex wrench (head bolts are not included) (see the exploded view drawings for detail of parts in the spare parts kits)



**Caution:** Before working on the pump disconnect the power cord, depressurize the discharge tubing and drain or flush any residual liquid from the pump head and valves.

Problem	Possible Cause	Corrective Action
Pump does not start	Faulty wiring	Correct wiring
	Improper voltage	Connect to proper voltage source
	Electronic control unit is damaged	Replace control unit (Contact
		distributor or factory)
Pump does not prime	Pump stroke length is too short	Operate pump with stroke length set
		at 100% until primed. Then set the
		stroke length as needed to obtain
		desired output.
	Air in suction tubing	Reroute suction tubing to eliminate
		air trap
	Valve gasket is missing	Install valve gasket
	Valve set assembly direction is wrong.	Reassemble valve set
	Pump is air locked	Prime pump per instructions
Output fluctuates	Suction or discharge valve is clogged	Disassemble, inspect, clean
	with foreign matter	
	Air is trapped in pump	Prime pump per instructions
	Overfeeding	Install injection valve or back
		pressure valve. Check stroke length
		knob(@ 0%, pump should not pump)
	Diaphragm is damaged	Replace diaphragm
	Worn check valves	Replace valve cartridges
Liquid leaks	Fitting or coupling nut is loose	Tighten
	Pump head is loose	Tighten pump head bolts. Torque: 19
		lb-in (2.16 N-m)
	Diaphragm is damaged	Replace diaphragm
	O-ring or valve gasket missing.	Install o-ring or valve gasket

## 7.0 SERVICE POLICY

The EHE Series electronic metering pumps have a 2-year warranty. Contact your Walchem distributor for service.

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# Metering Pumps

## **EW Series**

EW Series electronic metering pumps offer superior dosing capability. The versatile control features enable the EW to be integrated into virtually any chemical feed application. Superb valve performance and advanced solenoid engineering combine to make a highly precise pump for the most demanding applications.

EW pumps have outputs to 6.7 GPH (25.2 l/h) and a maximum pressure of 250 PSI (17 bar). The high speed of operation results in high resolution chemical feed and long service life. Quiet and compact, EW pumps prime in seconds and hold prime reliably.



## **Summary of Key Benefit**

#### High Speed Performance

E-Class pumps operate at 360 strokes-per-minute, providing high resolution chemical feed. Most competitive products operate at slower speeds, resulting in slug feeding, accelerated diaphragm wear and poor feed control.

#### > Engineered Longevity

All E-Class pumps feature dual bearing support. The armature and shaft are supported with a bearing on each end, which ensures proper axial movement, enabling the E-Class to operate at 360 SPM while extending the life of the diaphragm.

#### Superior Check Valve Performance

Dual Check Valve Assemblies in both suction and discharge fittings feature precision ball guides and tapered seats. Precise machining and molding of parts limit valve ball travel, ensuring that balls fully seat and seal with every stroke. This superior check valve design guarantees fast priming and reliable performance.

#### > High Compression Ratio

The compression ratio of a metering pump is important because it affects the pump's ability to prime and vent. The compression ratio is raised when you reduce the dead volume of the pump head during operation. All E-Class pumps feature a very high compression ratio that ensures proper feed especially with off-gassing products (i.e. Sodium Hypochlorite).



## Features

#### **IP65 Construction**

The rugged Polyphenylene Oxide (PPO) enclosure is equipped with a durable clear cover to protect the membrane switches and stroke control of the pump, which are mounted opposite the liquid end. The display utilizes a high temperature LCD that provides extra protection from sunlight in outdoor applications.



#### **Control Features**

All EW Series pumps come equipped with pulse and stop input/output control.

- Feed Accuracy Powered by the E-Class 360 Stroke-Per-Minute technology, the EW has an incredible turndown ratio of 1800:1 ensuring precise feed control for any application.
- Pulse Output The EW pump is capable of sending a pulse out synchronous with pump operation to control a second pump or connect to a PLC or similar device.
- Stop Input/Output A stop input contact will stop the pump operation and close a stop output contact for alarm or remote notification. A red light visibly indicates a stopped condition.
- Pre-Stop Input An orange indicator light will give warning, but the pump will continue to operate.

In addition to the features found standard on the EW Series, pumps with the EW-Y control module feature:

- ➤ Analog Input Control Fixed or fully programmable response to mA input (4-20, 20-4, 0-20, 20-0) allows the input to be scaled to any desired slope.
- Pulse Input Control Pulse input with multiply and divide features (1-9999). 12VDC output power supply for Hall Effect water meters.
- Flow Display After calibration the EW will display the flow rate. As long as stroke length is constant, the pump will accurately display flow rate. In cases where the pump is being controlled externally with a pulse, the pump will display and count down remaining flow based on the pulse input. Coupled with the Posiflow<sup>®</sup> feed verification, the EW is equipped to ensure proper feed to your application.



Feed Verification - The EW is equipped with 3 pre-programmed modes for accepting our Posiflow<sup>®</sup> Feed Verification Sensor. The Posiflow<sup>®</sup> provides a pulse feedback to the pump to verify prime and proper feed. Depending on the mode, the user can program the pump to stop, continue operating and/or send an alarm based on the Posiflow<sup>®</sup> input.



- Quick-Prime Hold 2 keys down and pump runs at 100% of speed to prime quickly without adjusting application settings.
- Keypad Lock-Out Keypad functions can be locked out providing feed security, programming integrity and protection from unwanted adjustments.
- Easy Draw-Down Calibration In the calibration mode the user only needs to start and stop the pump, enter the drawdown volume and the pump calibrates volume-per-stroke.



## **Specifications**



**Relative Humidity:** 

Liquid Temperature:

to 85% PVC liquid ends: 32 to 104°F (0 to 40°C) PP, PVDF, SS liquid ends: 32 to 140°F (0 to 60°C) Below 32°F (0°C), pump is limited to 70% of maximum pressure. Liquid cannot freeze.

Pumps should always be shielded from direct exposure to the elements.

#### **Dimensions**





#### **Mounting Dimensions**

EW Model	R	S	Т	U	V	Х	Y	Z
11,16, 21	4 57"	<u>0 0 4"</u>	0.04"	0.45"	4 4 7 "	1 57"		0.70"
<mark>31</mark> , 36	<mark>4.57</mark>	<mark>3.94</mark>	0.24	3.13	4.17	1.37	0.59	0.79

all dimension in inches

EW Model	А	В	С	D	F	G	Н	J	K	L	М	Ν	W
11, 16, 21	9.92 <sup>1</sup>	1.46 <sup>1</sup>	2.24	0.77	ø <sup>1</sup> /4 x ø <sup>3</sup> /8	0.39	9.17	1.42	3.94	12.36 <sup>1</sup>	6.30 <sup>2</sup>	7.64 <sup>1</sup>	4.92
<mark>31,</mark> 36	<mark>10.12</mark>	<mark>1.50</mark>	<mark>2.24</mark>	<mark>0.93</mark>	ø <sup>3/</sup> 8 x ø <sup>1</sup> /2	<mark>0.39</mark>	<mark>9.17</mark>	0.71	<mark>3.94</mark>	<mark>12.56</mark>	7.17	<mark>8.43</mark>	<mark>4.92</mark>

Notes for EW11, 16, 21:

- 1. Addition of a Multifunction valve increases overall length by 0.37". Addition of an Auto Air Vent Valve increases overall length by 1.59"
- 2. Addition of a Multifunction Valve increases discharge height by 0.22". No change for the Auto Air Vent Valve.
- 3. Addition of a Multifunction Valve increases overall liquid end height by 1.16". No change for the Auto Air Vent Valve.

Intertek

# Ordering Information



#### PUMP SERIES

EW = IP65 electronic metering pump with external pulse control or manual speed control (adjustable to 360 strokes per minute) and manually adjustable stroke length. (Turndown ratio 1800:1)

#### **CAPACITY/PRESSURE RATING**

See chart on this page

#### **CONTROL MODULE**

- F = For use on all EW models, features digitally adjustable speed and external pulse input control, stop & pre-stop inputs.
- Y = For use on all EW models, features analog input, digital input w/multiply & divide, PosiFlow<sup>®</sup> input and alarm outputs.

#### VOLTAGE

1 = 115VAC, 50/60 Hz

2 = 230VAC, 50/60 Hz

#### **LIQUID END**

See chart on this page

#### **OPTIONS**

- A = Auto Air Vent Valve installed in place of manual air vent valve. Available for B11, B16, C16 and C21 sizes with -VC liquid ends only.
- M = Multifunction Valve is supplied in place of the manual air vent valve. Available for the 11, 16 and 21 size pumps with VC, VE, VF, PC, and PE liquid ends. Not available with the AAVV feature.
- H = High pressure pump configuration available with PC, PE liquid ends only. High pressure pump max. speed is 240 SPM.

#### CONNECTORS (SOLD SEPARATELY)

- E90494 4-Pin, Reverse Key Connector. Use for Stop/Pre-Stop inputs on EW/EW-Y.
- E90495 5-Pin Connector. Use for Pulse in and Outputs on EW. Use for digital or analog inputs on EW-Y. Supplied standard with EW-Y pumps.
- E90496 5-Pin, Reverse Key Connector. use for Posiflow® input on EW-Y.
- E90497 4-Pin Square Connector. Use for output connectors on EW-Y.

All pumps include a manual air vent valve with the exception of FC liquid ends. All pumps include one foot valve, one injection valve, 20 feet of polyethylene tubing and one ceramic weight with the exception of SH liquid ends.

#### Capacity/Pressure Rating

Size	Max Cap	Output bacity	Max output per stroke	Max P	ressure <sup>1</sup>	Connection Size (in) Tubing O.D.	
	GPH	mL/min	mL	PSI MPa			
B11	0.6	38	0.11	150	1.0	3/8	
B11-H	0.3	21	0.09	250	1.7	3/8 (suc) x 1/4 NPT (dis)	
B16	1.0	65	0.18	105	0.7	3/8	
B21	1.8	115	0.32	60	0.4	3/8	
<mark>B31</mark>	<mark>3.3</mark>	<mark>210</mark>	<mark>0.58</mark>	<mark>30</mark>	<mark>0.2</mark>	<mark>1/2</mark>	
C16	1.3	80	0.22	150	1.0	3/8	
C16-H	0.6	40	0.17	250	1.7	3/8 (suc) x 1/4 NPT (dis)	
C21	2.3	145	0.40	105	0.7	3/8	
C31	4.3	270	0.75	50	0.35	1/2	
C36 <sup>2</sup>	6.7	420	1.17	30	0.2	1/2	

Auto Air vent valve reduces maximum pressure approx. 35 PSI (0.2 MPa)

2 Output of the EWC36-TC/FC/SH is 6.3 GPH (400 ml/min)

#### **Liquid End Materials**

Liquid End	Pump Head & Fittings	Diaphragm	Valve Balls	Valve Seat	Valve Seals	Gasket	Tubing
PC	GFRPP		CE	FKM	FKM		
PE	GFRPP		CE	EPDM	EPDM		
VC	<b>PVC</b>		CE	FKM	FKM		
VE	<b>PVC</b>	PTFE	CE	<b>EPDM</b>	EPDM	DTEE	PE
VF	PVC	EPDM)	PTFE	EPDM	EPDM		
TC	PVDF		CE	FKM	FKM		
FC	PVDF		CE	PCTFE	PTFE		
SH	SS		HC	HC	PTFE		1/4" NPTF

EPDM

PTFE

PVC

HC

CE	Alumina ceramic
FKM	Fluoroelastomer
PE	Polyethylene
PCTFE	Polychlorotrifluoroethylene
	Polyvinylidenefluoride

Ethylene propylene diene monomer Glass fiber reinforced polypropylene GFRPP Polytetrafluoroethylene Polyvinylchloride (translucent) Hastelloy C276

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Walchem integrates its advanced sensing, instrumentation, fluid pumping and communications technologies to deliver reliable and innovative solutions to the global water treatment market. Our in-house engineering is driven by quality, technology and innovation. For more information on the entire Walchem product line, visit: www.walchem.com





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EW-F & EK Series Metering Pumps

# EW-F & EK Series Electronic Metering Pump Instruction Manual

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#### Notice

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Thank you for choosing a Walchem E-Class metering pump. This instruction manual deals with the correct installation, operation, maintenance and troubleshooting procedures for the EW and EK model metering pumps. Please read through it carefully to ensure the optimum performance, safety and service of your pump.

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## **1.0 INTRODUCTION**

#### 1.1 Safety and Caution Notes



Always wear protective clothing, eye protection and gloves before working on or near a metering pump. Follow all recommendations of the supplier of the solution being pumped. Refer to the MSDS from the solution supplier for additional precautions.

Walchem E-Class metering pumps should be installed where ambient temperatures do not exceed 122°F (50°C) or do not fall below 32°F (0°C). Pumps should always be shielded from direct exposure to the elements. Black UV resistant tubing should be used if the tubing is exposed to strong UV radiation (sunlight/lamps). The EK Series is specifically designed to withstand the elements and can be mounted directly outdoors within the temperature specifications. To protect and maintain the IP rating of the pump, the clear covers that protect the electronic controls MUST be left in a secured/tightened condition at all times other than during adjustment of the pump.



**WARNING Risk of electrical shock!** This pump is supplied with a grounding conductor and grounding-type attachment plug. To reduce the risk of electrical shock, be certain that it is connected only to a properly grounded, grounding type receptacle with ratings conforming to the data on the pump data plate. Prior to performing any maintenance on a pump, disconnect the pump from the electrical power source.



#### **Plumbing Precautions**

All tubing must be securely attached to the fittings prior to starting the pump (see Section 2.3). Only use Walchem tubing with your pump. Tubing should be shielded to prevent possible injury in case of rupture or damage. UV resistant tubing should be used if the tubing is exposed to UV light. Always adhere to local plumbing codes and requirements. Be sure that the installation does not constitute a cross connection. Walchem is not responsible for improper installations. Prior to performing any maintenance on a pump, depressurize the discharge tubing.

If you are pumping downhill or into little or no system pressure, a back pressure/anti-syphon device must be installed to prevent over-pumping. Contact your Walchem distributor for additional information.



#### **Solution Compatibility**

**CAUTION!** This pump has been evaluated for use with water only. The suitability of this pump for use with liquids other than water, such as acid and alkaline, is the responsibility of the user. For liquids other than water, select the best-suited liquid end material combination using a chemical compatibility chart.

#### 1.2 **Principle of Operation**

The E-Class electronic metering pumps consist of a pump unit, a drive unit, and a control unit. The drive unit is an electromagnetic solenoid. When the solenoid coil is energized by the control unit the armature shaft moves forward due to the magnetic force of the solenoid. The shaft is attached to a PTFE faced diaphragm which is part of the pump unit. The diaphragm is forced into the pump head cavity decreasing volume and increasing pressure which forces liquid in the pump head out through the discharge check valves. When the solenoid coil is deenergized, a spring returns the armature to its starting position. This action pulls the diaphragm out of the head cavity increasing volume and decreasing pressure. Atmospheric pressure then pushes liquid from the supply tank through the suction check valves to refill the pump head.

#### 1.3 Model Code



#### 1 Pump Series

- **EW** IP 65 electronic metering pump with external pulse control or manual speed control (adjustable to 360 strokes per minute) and manually adjustable stroke length. (Turndown ratio 1800:1.)
- **EK** IP 67 aggressive environment rated electronic metering pump with external pulse control or manual speed control (adjustable to 360 strokes per minute) and manually adjustable stroke length. (Turndown ratio 1800:1.)
- 2 **Capacity/Pressure Rating** (See Section 1.4 for detailed chart.)

#### 3 Control Module

- **F** For use on all EW models, features digitally adjustable speed and external pulse input control, stop & pre-stop inputs
- **R** For use on all EK models, features external pulse input control and stop input.

#### 4 Voltage

- **1** 115 VAC, 50/60 Hz
- **2** 230 VAC, 50/60 Hz
- **5 Liquid End** (See Section 1.4 for detailed chart.)

#### 6 Options

- A Auto Air Vent Valve is supplied in place of the manual air vent valve. Available for B11, B16, C16 and C21 sizes with -VC liquid ends only.
- M Multifunction Valve is supplied in place of the manual air vent valve. Available for the EW and EK 11-21 sized pumps with VC, VE, VF, PC, and PE liquid ends. Not available with the AAVV feature.
- **H** High Pressure pump configuration available with EW–PC and –PE liquid ends only. High Pressure pump maximum speed is 240 SPM.
#### **Specifications** 1.4

Electrical	1 50/60 Hz, single phase					
EWB/EKB	115 VAC±10%	0.8 Amp max.	20 watt avg.			
	230 VAC±10%	0.4 Amp max.	20 watt avg.			
EWC/EKC	115 VAC±10%	1.2 Amp max.	22 watt avg.			
	230 VAC±10%	0.6 Amp max.	22 watt avg.			
Onerating Condition	10					

## **Operating Conditions**

Ambient temperature	32°F to 122°F (0°C to 50°C)
Relative humidity	To 85% (EW) / 95% (EK) non-condensing
Liquid temperature	32° to 104°F (0 to 40°C) for PVC based liquid ends
	32° to 140°F (0 to 60°C) for PP, PVDF, SS based liquid ends
	Below 32°F (0°C), pump is limited to 70% of max. pressure. Liquid cannot freeze.

## Capacity/Pressure Rating

	Maximum Output Capacity		Output per Stroke (mL)		Maximum Pressure <sup>1</sup>		Connection Size (in)	
Size	(Gal/hr)	(mL/min)	Min.	Max.	PSI	MPa	Tubing O.D	
B11	0.6	38	0.03	0.11	150	1.0	3/8	
B11-H	0.3	21	0.02	0.09	250	1.7	3% (suc) x 1/4 NPT (dis)	
B16	1.0	65	0.04	0.18	105	0.7	3/8	
B21	1.8	115	0.07	0.32	60	0.4	3/8	
B31	3.3	210	0.12	0.58	30	0.2	1/2	
C16	1.3	80	0.05	0.22	150	1.0	3/8	
C16-H	0.6	40	0.03	0.17	250	1.7	3 (suc) x ¼ NPT (dis)	
C21	2.3	145	0.08	0.40	105	0.7	3/8	
C31	4.3	270	0.15	0.75	50	0.35	1/2	
C36 <sup>2</sup>	6.7	420	0.24	1.17	30	0.2	1/2	
1								

<sup>1</sup> Auto Air vent valve reduces maximum pressure approx. 35 PSI (0.2 MPa)
<sup>2</sup> Output of the EW/EKC36-TC/FC/SH is 6.3 GPH (400 ml/min)

## Adjustment Range

Stroke length adjustment range Frequency adjustment range

20% to 100% 0 to 360 strokes per minute

## Materials of Construction

Liquid End Code	Pump Head & Fittings	Dianhragm	Valve Balls	Valve Seat	Valve Seals	Gasket	Tubing	
PC	GERPP	Diaphragin	CF	FKM	FKM	Cusiter	rubing	
PE	GFRPP		CF	FPDM	FPDM			
VC	PVC		CE	FKM	FKM	-		
VE	PVC	PTFE	CE	EPDM	EPDM		PE	
VF	PVC	(bonded to	PTFE	EPDM	EPDM	PTFE		
тс	PVDF		CE	FKM	FKM			
FC	PVDF		CE	PCTFE	PTFE			
SH	SS		HC	HC	PTFE	-	1⁄4" NPTF	
CE	Alumina c	eramic		P	E Polye	ethylene		
EPD	M Ethylene	propylene diene	monomer	P	FFE Polyt	etrafluoroeth	ylene	
FKN		P	VC Polyv	vinylchloride	(translucent)			
GFR	<b>CPP</b> Glass fibe	er reinforced polypropylene			VDF Polyv	vinylideneflu	oride	
НС	Hastelloy	C276		S	S 316 stainless steel			

PCTFE Polychlorotrifluoroethylene

## 1.5 Dimensions



## EW-11,16 and 21 Models with thermoplastic liquid end materials









## EK-11,16 ands 21 Models with thermoplastic liquid end materials



EK-31 and 36 Models with thermoplastic liquid ends



# 2.0 INSTALLATION

## 2.1 Unpacking

Open the shipping carton and inspect contents for damage. If any items are missing or damaged contact your local distributor.

Pumps are pre-primed with water at the factory. If the application is not compatible with water, drain and dry before use. Be sure to remove caps from fittings before attaching tubing.



**CAUTION:** Head bolts may have loosened during storage or shipment. Be sure to check and tighten to 19 lb-in torque, if necessary.

## 2.2 Location

Choose a location for the pump which is clean, dry, vibration-free, close to an electrical outlet, and allows convenient access to stroke length control, frequency control, and tubing connections. Avoid areas where ambient temperature exceeds 122°F (50°C) or falls below 32°F (0°C). Pumps should always be shielded from direct exposure to the elements. Black UV resistant tubing should be used if the tubing is exposed to strong UV radiation (sunlight/lamps).

The EK Series is specifically designed to withstand the elements and can be mounted directly outdoors within the temperature specifications.

This pump is cord connected and not intended for permanent mounting to a building structure. However, temporary mounting to stabilize the pump during operation may be necessary as long as tools are not required for the installation or removal of the pump.

Flooded suction (mounting the pump below the level of liquid in the supply tank) is strongly recommended, especially when pumping liquids that readily generate gas bubbles. Sodium hypochlorite and hydrogen peroxide are common examples of such liquids. (See Figure 1.)

If flooded suction mounting is not possible, a shelf adjacent to (but not directly above) the supply tank often works well. (See Figure 2.) The supply tank or cover can also be used if it has provisions for mounting a pump. (See Figure 3.) In any case, the total suction lift should not exceed 5 ft (1.5m).





## 2.3 Supply Tubing

The supply tubing run should be as short as possible. For flooded suction mounting, install a shut-off valve with an appropriate tubing connector at the tank outlet. Cut a length of tubing from the coil supplied and install between the shut-off valve and the pump inlet fitting. For suction lift applications, slide on the ceramic weight, then install a foot valve on one end of suction tubing. Cut the tubing to a length such that the foot valve hangs vertically about 1 in (25mm) above the bottom of the tank. Avoid any loops in the tubing run that could form a vapor trap. Running the tubing through a length of pipe will help to keep tubing straight. Total vertical suction lift should be no more than 5ft. (1.5m). Reference Figure 4.

Attach tubing as shown in Figure 5. First slide the coupling nut, small end first, onto the tubing. Push the tubing over the valve housing tip *all the way to the valve housing shoulder*. (Tip: if the tubing is stiff from cold, dip the tubing end in hot tap water for a few minutes so it will slide on and flare out more easily. Push the coupling nut onto the threads. Apply some pressure on the coupling nut and tubing while tightening the nut, making sure the tubing has not backed off of the shoulder of the valve housing.



**WARNING:** All fittings and coupling nuts should be tightened by hand only. If necessary, a small tool may be used to make it snug. DO NOT use excessive force or large wrenches.

The coupling nut should not bottom out completely against the fitting. If this happens during connection, either the tubing has slid down the shoulder while tightening, or the tubing has been pinched. Remove the coupling nut, re-cut the tubing and re-connect.



**WARNING**: If there is any leakage around the coupling nut and it appears to have been installed correctly, DO NOT TIGHTEN the coupling further! Release pressure in the line, disconnect tubing, re-cut and re-connect. Tightening of misinstalled tubing may cause the tubing to pop off under pressure.



## 2.4 Discharge Tubing

Cut a length of tubing long enough to go from the pump to the application (injection) point. Additional tubing can be ordered from your distributor. Avoid sharp turns or bends and hot surfaces. Routing tubing through rigid pipe such as PVC pipe is recommended for long runs and/or as protective shielding against corrosive chemicals. If applicable, install the injection valve in 1/2" NPT thread at the injection point (see section 2.5) and connect the discharge tubing to the injection valve.

Attach tubing as described in section 2.3 and as shown in Figures 5 and 6. Note: Some models have an air vent valve with two outlet connections. The connection marked 'OUT' is the discharge side to the application point. (Fig 6).

Attach a second length of tubing to the air vent side marked ('AIR') and route back to the chemical solution tank or drum. On the larger pumps (31 & 36 sizes), the air vent valve connections are not marked, however, the discharge side is the vertical (UP) connection and the air vent connection is on the side of the valve.



Figure 6 Air Vent Valve Tubing

## 2.5 Installing Injection/BackPressure Valve

A fitting or tee with 3/8" or 1/2" NPTF threads and with sufficient depth will accept the injection valve assembly. If required, trim off an amount of the extension tip until it fits into the fitting or tee. (Fig. 7.)

The position of the injection/back pressure valve can be at any orientation as long as the spring is retained in the valve. DO NOT REMOVE THE SPRING. Be sure to check and replace the spring as needed. Attach the tubing following the same instructions in section 2.3, connecting the supply tubing.



**CAUTION:** Some chemicals may have reactions as they are injected into the main flow. For example, sulfuric acid may react with water causing excess heat. If the chemical is heavier than water, mount the injection valve as close as possible to vertical coming into the bottom of the pipe. This will keep the injection nozzle facing up and keep the heavier chemistry from draining into the pipe and causing adverse reactions within the injection valve and pipe.

In addition to preventing backflow from pressurized lines, the injection valve acts somewhat as a back pressure valve when pumping into open atmosphere type applications. However, the back pressure by the injection valve is very low and can vary. The output of the metering pumps is rated at maximum back pressure and will increase as back pressure decreases dependent on the specific installation. Additionally, the valve does NOT act as an anti-siphon valve. If siphoning is a possibility, or if pumping downhill into open atmosphere (open tank), a Walchem MultiFunction valve or a separate back pressure/anti-siphon valve must be installed.

Note: Siphoning can also occur at the tip of the injection valve because of the high flow rate in the main pipe flowing past the small injection nozzle (venturi effect). In this case, an antisiphon device must be installed to avoid over feeding or siphoning of chemistry.



## 2.6 Electrical



**WARNING Risk of electrical shock!** This pump is supplied with a grounding conductor and grounding-type attachment plug. To reduce the risk of electrical shock, be certain that it is connected only to a properly grounded, grounding type receptacle.



**CAUTION!** The electronics within the pump can be damaged by excessive surges in voltage. Do not install the pump near high-power electrical equipment that generate high surge voltages. Avoid branch circuits that also supply power to heavy or other equipment that could generate electrical interference. If necessary, install a surge suppression device (such as a varistor with a resistance greater than 2000A) or a noise reducing transformer at the pump's power connection.

# 3.0 OPERATION

## 3.1 Pump Operation & Programming

The EW an EK pumps have a digital display, two LED indicators and three pushbutton keys to change the pump speed and programming.



## A. Operation Overview





## **B.** Programming

Pressing the stop/start and up keys simultaneously will enter the program mode. The up and down keys scroll through the menus and choices and the stop/start key will exit back to the wait mode.

## **On-Time Menu**

The first item displayed will be the factory set choice of the External Input On-Time menu (T-5). There are three choices in this menu: T-5, T-20, and T-50 that can be scrolled through by repeatedly pressing the up key. These settings are time in milliseconds and correlate to the required minimum closure time of the external input signal for the pump to recognize it as a true signal. Selecting the smaller T-5 (5 msec) will allow shorter duration pulses to be recognized (typical for Hall Effect input), while the T-50 (50 msec) setting will help to reduce erroneous pulses from noise (as from a reed switch).

## **Stop Input NO/NC Selection**

Pressing the down key will move from the Eternal Input On-Time menu to the Stop menu and the initial factory setting is M-OF (input is normally open and contact closure will stop the pump). Pressing the up key will toggle between M-OF and M-ON. Setting the pump to M-ON means that the pump will be stopped continuously and a contact closure into the stop/start input will now start the pump and the pump will run as long as the contact is made.

Pressing the down key will again move back to the On-Time menu and pressing the stop/start key will go back to the wait mode.

## C. Pump Operation

## Manual and On/Off Control

The pumps can be operated manually by pressing the stop/start key from the wait mode. Once pressed, the pump will begin to operate at the stroke rate shown on the display. From here, the up and down keys can be used to change the stroke rate, and the stroke length knob can be adjusted down to further reduce the pump output.

Once adjusted/calibrated to the desired flow rate, the pump can be left in manual mode for on/off control via power (connecting/disconnecting AC power from an external source) or for on/off control via the stop/start input. Pressing the stop/start key will go back to the wait mode.

## External Control

Pressing the stop/start key and the down key simultaneously from the wait mode will set the pump to operate in external mode. In this mode, the pump will operate at a speed correlating to the frequency of digital inputs that it receives (see section 3.2 for wiring inputs). If used, the stop/start input will override the digital input signals.

If at any time in external mode the up and down keys are held down simultaneously, the pump will manually run at 360 SPM as long as the two keys are held down. This feature is useful for priming or the elimination of air trapped in the pump or tubing.

Pressing the stop/start key will disable external control and go back to the wait mode.

## 3.2 External Inputs & Outputs

The EW and EK pumps are capable of being controlled by an external pulse proportional input as well as being controlled by an external stop/start signal. Additionally, the EW pumps have two contact closure relay outputs – one output is ynchronous with the pump frequency and the other is tied to the external stop/start signal.

## A. EW Pumps and the 'F' control module

Two circular mini-DIN female connectors are used to make these connections. Figure 9 shows the mating connections on the back of the pump. Connector 1 is a 5-PIN standard-key connector (P/N E90495) and Connector 2 is a 4-PIN reverse-key connector (P/N E90494).



Figure 9

CONNE	CTOR 1:
PIN	FUNCTION
1	Voltage In (24VDC max)
2	<b>External Digital Input</b>
3	Out 2 (Synchronous with stroke)
4	Out 1 (Stop output)
5*	Common
<u>CONNE</u>	CTOR 2:
PIN	<b>FUNCTION</b>
1	Stop/Start Input
2	Pre-Stop Input
3	Not Used
4	Common

\*Note: The center pin is marked as '5' for easy identification purposes throughout the manual. Actual marking on the part may be any capital letter (mold cavity ID) or the number '5'.

## **External** Control

The external pulse input should not exceed 360 pulses per minute (6Hz) and the pump will output one stroke for every input pulse. The control signal can be a contact closure type switch (reed) with a max load of 1mA or a solid state device. If a solid state device is used, the external circuit should be capable of switching 5VDC at 1.2mA with an active duty cycle pulse width of 5ms to 100ms (actual closure time).

To connect the pulse input from an external device, wire PINs 2 and 5 from the contact closure. If using a solid state switching device, wire the connector ensuring that PIN 2 is positive (+) and PIN 5 is Common (-).

## Stop/Start and Pre-Stop Control

The EW pumps have two stop inputs. The Pre-Stop is an external input that changes the green STOP LED to orange to signal a "LOW" condition. This input does not control the pump. An external Stop/Start signal, however, not only turns the STOP LED to red, but also controls the pump. In this mode, AC power is applied continuously, but the pump operation is stopped (or started – see section on programming) by completing the circuit between PIN 1 and PIN 4 in Connector 2. Both the Pre-Stop and Stop/Start signals can be a contact closure type switch (reed) with a max load of 1mA or a solid state device. If a solid state device is used, the external circuit should be capable of switching 5VDC at 1.2mA with an active duty cycle pulse width of 5ms to 100ms (actual closure time).



3 (5 (1)

To connect the Pre-Stop input from an external device, wire PINs 2 and 4 from the contact closure. If using a solid state switching device, wire the connector ensuring that PIN 2 is positive (+) and PIN 4 is Common (-).

To connect the Stop/Start input from an external device, wire PINs 1 and 4 from the contact closure. If using a solid state switching device, wire the connector ensuring that PIN 1 is positive (+) and PIN 4 is Common (-).

## **Output Relays**

The EW pumps have two output relays (non-isolated PNP transistors with a  $330\Omega$  resistance) in Connector 1. Output 1 is tied to the Stop/Start input and will activate when a Stop/Start input connection is made. Output 2 activates synchronously with the pump stroke rate.

## **Contact Closure Type Outputs**

The EW circuit can make either the Stop/Start (Out 1) or the synchronous pulse (Out 2) function as contact closures, but ONLY ONE output can be used at a time. To use the synchronous pulse out, connect the positive side to PIN 1 and the negative side to PINS 3&5 (jumped together). To use the start/stop output, connect the positive side to PIN 1 and the negative side to PINS 4&5 (jumped together).



## Voltage Input Type Outputs (Non-Contact Closure)

PIN 1 will take a voltage in from an external source (max 24VDC). When this external voltage is present, then both relays will independently switch the input voltage. Both outputs can be used simultaneously. The figure to the left shows a schematic with the output relays configured to switch the powered input. This setup can only be used with voltage input type circuits (not contact closure types) such as those commonly found in a PLC.



## B. EK Pumps and the 'R' control module

One custom watertight connector is used for the digital input and stop/start connections on the EK pumps. There are no outputs on the EK pumps. The Connector Holder is keyed to fit into the pump only one direction. There is a set of painted alignment marks on the connector and connector holder that identify the correct orientation of the connector. Be sure to double check that the connector is installed properly into the connector assembly before installation onto the pump.



## **Digital** Control

The external pulse input should not exceed 360 pulses per minute (6Hz) and the pump will output one stroke for every input pulse. The control signal can be a contact closure type switch (reed) with a max load of 1mA or a solid state device. If a solid state device is used, the external circuit should be capable of switching 5VDC at 1.2mA with an active duty cycle pulse width of 5ms to 100ms (actual closure time).

To connect the pulse input from an external device, wire Terminal 4 and Terminal 6 from the contact closure. If using a solid state switching device, wire the connector ensuring that Terminal 4 is positive (+) and Terminal 6 is Common (-).



## Stop/Start Control

An external Stop/Start signal will turn the STOP LED to red and also control the pump. In this mode, AC power is applied continuously, but the pump operation is stopped (or started – see section on programming) by completing the circuit between Terminal 5 and Terminal 6. The Stop/Start signal can be a contact closure type switch (reed) with a max load of 1mA or a solid state device. If a solid state device is used, the external circuit should be capable of switching 5VDC at 1.2mA with an active duty cycle pulse width of 5ms to 100ms (actual closure time).



To connect the Stop/Start input from an external device, wire Terminals 5 and 6 from the contact closure. If using a solid state switching device, wire the connections ensuring that Terminal 5 is positive (+) and Terminal 6 is Common (-).

## 3.3 Adjustment

## A. EW Pumps using the 'F' Control Module

The pump will operate best keeping the stroke length at 100%. If less than full output is required, set the frequency to the approximate percentage of maximum desired. Example: Model EWB21F1-VC has maximum output of 1.8 GPH.

Desired output is 1.2 GPH.  $1.2 \div 1.8 = 0.667$  or 67%Using the UP and DOWN arrows, set the frequency of the pump to  $0.67 \times 360 = 241$  SPM.

For outputs less than 2% of maximum it will be necessary to also reduce the stroke length. (Minimum recommended stroke length is 20%.) It is good practice to change the frequency first, however, if low flows are required, a balanced turndown of speed and stroke length will yield the best results.

## B. EK Pumps using the 'R' Control Module

The pump will operate best keeping the stroke length at 100%. If less than full output is required, set the frequency to the approximate percentage of maximum desired. Example: Model EKC21R1-VC has maximum output of 4.3 GPH.

Desired output is 3.0 GPH.  $3.0 \div 4.3 = 0.7$  or 70% Using the UP and DOWN arrows, set the frequency of the pump to 0. 7 x 360 = 252 SPM.

For outputs less than 2% of maximum it will be necessary to also reduce the stroke length. (Minimum recommended stroke length is 20%.) It is good practice to change the frequency first, however, if low flows are required, a balanced turndown of speed and stroke length will yield the best results.

## 3.4 MultiFunction Valve Operation

The MultiFunction Valve is optional on select E-Class pumps and replaces the standard Manual Air Vent Valve when ordered. It integrates the air venting/bleeding functions with a back pressure and anti-siphon valve.

## **Air Vent / Bleed Function**

- 1. Open the air vent by turning the air vent adjustment knob counter-clockwise one to one and a half turns.
- 2. Operate the pump until all of the air is purged and only liquid is discharged from the air vent drain.
- 3. Turn the air vent adjustment knob clockwise until it bottoms out and will not turn further.

## **Back Pressure / Anti-Siphon Valve**

- 1. A spring-loaded diaphragm automatically adds 30PSI of back pressure to the discharge side of the pump when the air vent adjustment knob is closed.
- 2. If back pressure is not observed, the pressure release knob may be in the release position (the knob is resting in its 'up' location). If this is the case, turn the knob clockwise until it 'clicks' down (approximately <sup>1</sup>/<sub>4</sub> turn).
- 3. The diaphragm prevents siphoning of chemical through the pump.

## **Pressure Release**

- 1. Stop the pump operation.
- Turn the pressure release knob clockwise until it 'clicks' into the release or 'up' location (approximately <sup>1</sup>/<sub>4</sub> turn). If the knob is turned too far, it will 'click' again return to the back pressure or 'down' position. If this happens, keep turning the knob clockwise until it 'clicks' one time in the release ('up') position. Note: To avoid damage, do not turn the knob counterclockwise.
- 3. Turn the air vent adjustment knob counter-clockwise one or one and a half turns to release the pressure in the discharge tubing/piping through the air vent drain. The air vent drain should always be plumbed back to the supply tank or to safe disposal. Do not submerge the air vent drain tubing under chemical in the supply tank.



**CAUTION:** Confirm that liquid is discharged from the air vent drain. If the liquid is not discharged, the pressure may not be released. If this is the case, repeat the Pressure Release procedure.



## 3.5 Auto Air Vent Valve Operation

The Auto Air Vent Valve is an option on select EW and EK pumps and replaces the standard Manual Air Vent Valve when ordered. It is used primarily in applications where gassing is a problem and pumps can lose prime.

Unlike the Manual Air Vent Valve, the Auto Air Vent Valve constantly bleeds a controlled amount of volume out of the "Air" vent. Therefore, the "Air" vent should *always* be plumbed back to the source tank. During priming, the access knob does not have to be loosened as with a manual air vent valve as pressure is relieved through the vent. The Top Valve Guide assembly uses a bottom seat to ensure that air is not introduced into the discharge media and utilizes a precisely machined top seat that allows air to be quickly purged but limits the amount of liquid returned to the tank. A sleeve valve is used to maintain backpressure within the pump head, which helps speed the purging of air.



## 3.6 Priming

Install the pump as described in Section 2.0. With the pump turned on, set stroke length at 100% and frequency to 360 SPM. If the pump is equipped with an air vent valve, open the knob 1/2 turn. Liquid should move up through the suction tubing and into the pump head. When liquid starts running through the vent side tubing, close the air vent knob and continue with output adjustment described below. If the pump has no air vent valve, disconnect the discharge tubing from the injection valve. When liquid enters the discharge tubing at the pump head, stop the pump. Then reconnect the discharge tubing to the injection valve.

If the pump does not self prime, remove the check valve housing on discharge & suction sides to make sure valve cartridges and gaskets are in correct positions (see section 4.2 for correct orientation).

**Note:** Pumps with FC liquid ends may need assistance if dry priming due to the hard valve seat material.

## 3.7 Calibration



If exact output calibration is required, first prime and adjust the pump as above. Then connect a calibration column to the suction side of the pump. Turn the pump on for one minute and read the amount of liquid pumped from the column. Adjust the frequency up or down as necessary and check the output again. When the desired output is reached, disconnect the calibration column and reconnect the suction tubing. (See Figure 8.) Calibration must be performed with actual application equivalent back pressure for accurate results. Published flow rates are based on maximum pressures. Lower pressures may result in slightly higher flow rates.

Figure 8 Calibration

## 3.8 AC Power Interruption

If AC power is interrupted, the pump will power up as shown below:

State preceding power OFF	State following power ON
WAIT	WAIT
Run Manual	Run Manual
Run external	Run external

# 4.0 MAINTENANCE



**CAUTION:** Before working on the pump, disconnect the power cord, depressurize the discharge tubing and drain or flush any residual liquid from the pump head and valves. Always wear protective gear when working around chemicals.

## 4.1 Diaphragm Replacement

Disconnect AC power to the pump and disconnect the suction tubing, discharge tubing, and air vent tubing. Remove the four head bolts with a 4mm or 5mm hex wrench. Turn the stroke length knob fully counter-clockwise. Unscrew the diaphragm and remove its retainer (small disk behind the diaphragm).

## **CAUTION**: There may be small brass spacers between the retainer and the armature shaft. These spacers need to be reused when replacing the diaphragm.

Install the new retainer and diaphragm on the shaft. Turn the diaphragm clockwise until it bottoms on the shaft. Use caution when handling the diaphragm – the PTFE surface can be damaged by tools, nails, or any sharp objects. Replace the pump head and tighten the head bolts to a torque of 19 lb-in (2.16 N-m).

## 4.2 Valve Replacement

Remove the suction and discharge tubing making sure discharge side has been depressurized. Remove the suction fitting, two valve cartridges, o-ring and gasket(s). Install the new o-ring, gasket(s) and valve cartridges. Be sure both valve seats are in the same orientation. Refer to Figure below. Tighten the suction fitting. Similarly remove and replace the discharge valve cartridges, o-ring and gasket(s). For a more detailed drawing, refer to the Section 6.0.



## 4.3 Tubing

Check ends of tubing for splits, cracks, or thin spots. Examine the full length of tubing for damage due to chafing, abrasion, stress cracks, excessive temperature or exposure to ultraviolet light (direct sunlight or mercury vapor lamps). If any signs of deterioration exist, replace the entire length of tubing. It is a good idea to replace discharge tubing on a regular preventive maintenance schedule every 12 months.

# 5.0 EXPLODED VIEW & PARTS GUIDE

# PVC/GFRPP Liquid End Exploded View #1

For EW and EK pump model sizes 11, 16, and 21



## PVC/GFRPP Liquid End Exploded View #1

# Components

	Item	Part No	Description	Qty	Size	Liquid End Material
	1	EH2015	Head, Pump, EW/EKB11, PVC	1	11	VC, VE, VF, VCA
		EH2017	Head, Pump, EW/EKB11, GFRPP	1	11	PC, PE
		EH1950	Head, Pump, EW/EK/EZ16, PVC	1	16	VC, VE, VF, VCA
		EH1957	Head, Pump, EW/EK/EZ16, GFRPP	1	16	PC, PE
		EH1951	Head, Pump, EW/EK/EZ21, PVC	1	21	VC, VE, VF, VCA
		EH1958	Head, Pump, EW/EK/EZ21, GFRPP	1	21	PC, PE
	3	EH0400	Housing, Valve, 3/8 PVC	1	11, 16, 21	VC, VE, VF, VCA
		EH0418	Housing, Valve, 3/8 GFRPP	1	11, 16, 21	PC, PE
	4	EH0401	Nut, Coupling, 3/8 PVC	3	11, 16, 21	VC, VE, VF, VCA
		EH0419	Nut, Coupling, 3/8 GFRPP	3	11, 16, 21	PC, PE
	5	EH0294	Fitting, Air Vent, PVC	1	11, 16, 21	VC, VE, VF, VCA
		EH0315	Fitting, Air Vent, GFRPP	1	11, 16, 21	PC, PE
	6	EH0295	Nut, Lock, Air Vent, PVC	1	11, 16, 21	VC, VE, VF, VCA
		EH0316	Nut, Lock, Air Vent, GFRPP	1	11, 16, 21	PC, PE
*	8	EH1971	Diaphragm, EW/EK/EZ11	1	11	all
		EH1972	Diaphragm, EW/EK/EZ16	1	16	all
		EH1973	Diaphragm, EW/EK/EZ21	1	21	all
*	9	EH0059	Retainer, EW/EK/EZ11	1	11	all
		EH0083	Retainer, EW/EK/EZ16	1	16	all
	10	EH0067	Retainer, EW/EK/EZ21	1	21	all
	10	EH0402	Body, Manual Air Vent, PVC	1	11, 16, 21	VC, VE, VF
		EH0420	Body, Manual Air Vent, GFRPP	1	11, 16, 21	PC, PE
		EH0861	Body, Auto Air Vent, PVC	1	11, 16, 21	
		EH1406	Body, Multifunction Valve, PVC	1	11, 16, 21	DCM DEM
*	11	EH1407	Chida Value 0.188 DVC	1	11, 10, 21	PCM, PEM
	11	EH0000	Cuide, Valve, 0.188 PVC	4	11	DC DE
		EH0068	Guide, Valve, 0.188 OFKFF	4	16 21	VC VE VE VCA
		EH0325	Guide, Valve, 0.250 GERPP	4	16,21	PC PE
*	12	EH0061	Seat Valve 0.188 FKM	4 (5)	10, 21	$\frac{\Gamma C, \Gamma E}{VC, PC, (VCA)}$
	12	EH0048	Seat, Valve, 0.188 FPDM	4(3)	11	VE PE VE
		EH0069	Seat, Valve, 0.100 EFDM	4	16.21	VC PC
	-	EH0071	Seat, Valve, 0.250 FRM	4	16.21	VE PE VF
*	13	EH0025	Ball Valve 0 188 CE	4 (5)	11	VC VE PC PE (VCA)
	10	EH0084	Ball, Valve, 0.250 CE	4	16.21	VC, VE, PC, PE
		E00063	Ball, Valve 0.188 PTFE	4	11	VF
		E00064	Ball Valve 0.250 PTFE	4	16,21	VF
*	14	EH0026	Gasket, Valve, 0.188 & 0.250 PTFE	2	11, 16, 21	VC, VE, VF, VCA
		EH0580	Gasket, Valve, 0.188 & 0.250 PTFE	2	11, 16, 21	PC, PE
*	17	EH0027	O-Ring, S14 FKM	2	11, 16, 21	VC, PC, VCA
		EH0050	O-Ring, S14 EPDM	2	11, 16, 21	VE, PE, VF
	19	EH1986	Bolt, M4 x 35 w/PW & SW, 316SS	4	11, 16, 21	all
	21	E90374	Multifunction Valve Top Asm	1	11, 16, 21	all xxM ends
	22	EH1410	Screw, M4 x 35 w/PW & SW, 316SS	4	11, 16, 21	all xxM ends
	23	EH0299	Knob, Manual Air Vent Valve, PVC	1	11, 16, 21	VC, VE, VF
		EH0321	Knob, Manual Air Vent Valve, GFRPP	1	11, 16, 21	PC, PE
*	25	EH0300	O-Ring, P4 FKM	1	11, 16, 21	VC, PC, VCA
		EH0301	O-Ring, P4 EPDM	1	11, 16, 21	VE, PE, VF
*	26	EH0302	O-Ring, PIOA FKM	1	11, 16, 21	VC, PC, VCA
	- 27	EH0303	O-Ring, PTOA EPDM	1	11, 16, 21	VE, PE, VF
Ť	27	EH0304	O-Ring, P/ FKM	1	11, 16, 21	
	20	EH0305	O-King, P/ EPDM	1	11, 16, 21	VE, PE, VF
	20	EH0867	Fitting, Adapter, AAVV, PVC	1	11, 16, 21	VCA
	30	E10807 EH0774	Knob AAVV PVC	1	11, 10, 21	VCA
	31	E1107/4 EH0862	Guide Valve AAVV Titanium	1	11, 10, 21	
	31	E10802	Guide Valve AAVV HC276	1	11, 10, 21	VCA-H
	32	FH0775	Snacer AAVV PVC	1	11, 10, 21	VCA
*	33	EH0865	Tube Valve AAVV FKM	1	11 16 21	VCA
*	34	EH0776	O-Ring S12 FKM	1	11 16 21	VCA
	35	EH0866	Gasket, AAVV FKM	1	11, 16, 21	VCA
	77		Brass Snapers	Drive on	acific/Reuse when replace	ng dianhragm
			Diuss opacers	Drive spe	conternet actuate which replace	ng umpinagin

\* Included in spare parts kit

# **PVC/GFRPP Liquid End Exploded View #2** For EW and EK pump model sizes 31 and 36



Entire Head Assembly

Valve Cartridge Air Vent Valve

Part Numbers for these assemblies are on Page 30.

## PVC/GFRPP Liquid End Exploded View #2

## Components

Item	Part No	Description	Qty	Size	Liquid End Material	
1	EH1961 Head, Pump, EW/EK31, GFRPP		1	31	PC, PE	
	EH1960	Head, Pump, EW/EK31, PVC	1	31	VC, VE, VF	
	EH1962	Head, Pump, EW/EK36, GFRPP	1	36	PC, PE	
	EH1953	Head, Pump, EW/EK36, PVC	1	36	VC, VE, VF	
3	EH0405	Housing, Valve, 1/2 PVC	1	31, 36	VC, VE, VF	
	EH0421	Housing, Valve, 1/2 GFRPP	1	31, 36	PC, PE	
4	EH0406	Nut Coupling, 1/2 PVC	3	31, 36	VC, VE, VF	
	EH0422	Nut, Coupling, 1/2 GFRPP	3	31, 36	PC, PE	
5	EH1078	Fitting, Air Vent, PVC	1	31, 36	VC, VE, VF	
	EH1088	Fitting, Air Vent, GFRPP	1	31, 36	PC, PE	
6	EH1077	Nut, Lock, Air Vent, PVC	1	31, 36	VC, VE, VF	
	EH1087	Nut, Lock, Air Vent, GFRPP	1	31, 36	PC, PE	
* 8	EH1974	Diaphragm, EW/EK/EZ31	1	31	all	
	EH1975	Diaphragm, EW/EK/EZ36	1	36	all	
* 9	EH0087	Retainer, EW/EK/EZ31	1	31	all	
	EH0158	Retainer, EW/EK/EZ36	1	36	all	
10	EH1101	Body, Manual Air Vent, PVC	1	31, 36	VC, VE, VF	
	EH1099	Body, Manual Air Vent, GFRPP	1	31, 36	PC, PE	
* 11	EH0118	Guide, Valve, 0.375 PVC	4	31, 36	VC, VE, VF	
	EH0332	Guide, Valve, 0.375 GFRPP	4	31, 36	PC, PE	
* 12	EH0119	Seat, Valve, 0.375 FKM	4	30.35	VC, PC	
	EH0125	Seat, Valve, 0.375 EPDM	4	31, 36	VE, PE, VF	
* 13	EH0120	Ball, Valve, 0.375 CE	4	31, 36	VC, VE, PC, PE	
	E00062	Ball, Valve, 0.375 PTFE	4	31, 36	VF	
* 14	EH0121	Gasket, Valve, 0.375 PTFE	2	31, 36	VC, VE, PC, PE, VF	
* 15	EH1080	O-Ring, P-3, FKM	1	31, 36	VC, PC	
	EH1083	O-Ring, P-3, EPDM	1	31, 36	VE, PE, VF	
* 16	EH0029	O-Ring, P-6, FKM	1	31, 36	VC, PC	
	EH0052	O-Ring, P-6, EPDM	1	31, 36	VE, PE, VF	
* 17	EH0122	O-Ring, P16 FKM	2	31, 36	VC, PC	
	EH0127	O-Ring, P16 EPDM	2	31, 36	VE, PE, VF	
* 18	EH0027	O-Ring, S-14 FKM	1	31, 36	VC, PC	
	EH0050	O-Ring, S-14 EPDM	1	31, 36	VE, PE, VF	
19	EH1986	Bolt, M4 x 35 w/PW & SW, 316SS	4	31	all	
	EH1988	Bolt, M5 x 35 w/PW & SW, 316SS	4	36	all	
23	EH1079	Knob, Manual Air Vent, PVC	1	31, 36	VC, VE, VF	
	EH1089	Knob, Manual Air Vent, GFRPP	1	31, 36	PC, PE	
* 27	EH1082	O-Ring, P-11 FKM	1	31, 36	VC, PC	
	EH1084	O-Ring, P-11, EPDM	1	31, 36	VE, PE, VF	
ZZ	Brass Spacers		Drive specific/Reuse when replacing diaphragm			

\* Included in spare parts kit

**PVDF Liquid End Exploded View #3** For all PVDF EW and EK Pump Models



## PVDF Liquid End Exploded View #3

## Components

	•					
	Item	Part No	Description	Otv	Size	Liquid End Material
	1	FH2019	Head Pump FW/FKB11 PVDF	1	11	FCTC
		EH1970	Head Pump EW/EK16 PVDE	1	16	FC TC
		EH1065	Head Pump EW/EK21 PVDE	1	21	FC TC
		EU1066	Head Rump EW/EK21, I VDI	1	21	FC TC
		EH1967	Head Pump EW/EK36 PVDE	1	36	FC TC
	2	EII1907	Head, Fullip, EW/EK30, FVDF	2/1	11 16 21	FC, TC
	3	E110425	Housing, Valve, 5/8 FVDF	2/1	21.26	FC, TC
	4	EH0427	Nut Caughing 2/9 DVDE	2/1	31, 30	FC, IC
	4	EH0830	Nut, Coupling, 5/8 PVDF	2/3	11, 10, 21	FC, IC
	5	EH0857	Fitting Air Vert DVDF	2/3	31, 30	FC, IC
	3	EHI002	Fitting, Air Vent, PVDF	1	11, 10, 21	TC
	(	EH1093	Fitting, Air Vent, PVDF	1	31, 30	TC
	0	EH1047	Nut, Lock, Air Vent, PVDF	1	11, 10, 21	TC
*	0	EH1092	Nut, Lock, Air vent, PVDF	1	31, 30	<u>IC</u>
*	8	EH19/1	Diaphragm, EW/EK/EZ11	1		all
		EH1972	Diaphragm, EW/EK/EZ16	1	16	all
		EH19/3	Diaphragm, EW/EK/EZ21	1	21	all
		EH19/4	Diaphragm, EW/EK/EZ31	1	31	all
*		EH19/5	Diaphragm, EW/EK/EZ36	1	36	
Ŧ	9	EH0059	Retainer, EW/EK/EZ11	1	11	
		EH0083	Retainer, EW/EK/EZ16	1	16	
		EH0067	Retainer, EW/EK/EZ21	1	21	
		EH008/	Retainer, EW/EK/EZ31	1	31	
	10	EHUISS	Retainer, EW/EK/EZ36	1	30	
	10	EH1052	Body, Manual Air Vent, PVDF	1	11, 16, 21	
*	11	EHII00	Body, Manual Alf Vent, PVDF	1	51, 50	
	11	EH0340	Guide, Valve, 0.188 PVDF	4	11	FC
		EII1540	Cuide, Valve, 0.188 PVDF	4	11	IC EC TC
		EII1549	Cuide, Valve, 0.250 PVDF	4	21.26	FC, TC
*	12	EH1530	Sont Valve, 0.188 DCTEE	4	51, 50	FC, IC
-	12	EH1027	Seat, Valve, 0.186 FCTFE	4	16 21	FC
		EH0592	Seat, Valve, 0.250 FC IFE	4	21 26	FC
		EH0061	Seat, Valve, 0.575 FCTFE	4	11	
		E110001	Seat, Valve, 0.100 FKM	4	16 21	ТС
		EH0119	Seat, Valve, 0.250 FKM	4	31.36	TC
*	13	EH0025	Ball Valve 0.188 CE	4	11	FC TC
	15	EH0084	Ball Valve 0.250 CE	4	16.21	FC TC
		EH0120	Ball Valve 0.375 CE	4	31.36	FC TC
*	14	EH0342	Gasket Valve 0 188 & 0 250 PTFF	6	11 16 21	FC
	17	EH1553	Gasket, Valve, 0.188 & 0.250 PTFF	2	11, 16, 21	TC
		EH0354	Gasket, Valve, 0.375 PTFE	6	31.36	FC
		EH0121	Gasket Valve 0.375 PTFE	2	31.36	TC
*	15	EH1080	O-Ring P-3 FKM	1	31.36	TC
*	16	EH0029	O-Ring P-6 FKM	1	31.36	TC
*	17	EH0027	O-Ring S-14 FKM	2	11 16 21	TC
	17	EH0122	O-Ring P-16 FKM	2	31.36	TC
		EH0591	Gasket, V-Housing, 0,188/0,250 PTFE	2	11, 16, 21	FC
		EH0355	Gasket, V-Housing, 0.375 PTFE	2	31.36	FC
*	18	EH0027	O-Ring S-14 FKM	1	31.36	TC
	19	EH1986	Bolt, M4 x 35 w/PW & SW, 316SS	4	11, 16, 21, 31	FC. TC
		EH1988	Bolt, M5 x 35 w/PW & SW, 316SS	4	36	FC, TC
	23	EH1049	Knob, Air Vent Valve	1	11, 16, 21	FC, TC
		EH1094	Knob, Air Vent, 1/2, PVDF	1	31, 36	FC, TC
*	25	EH0300	O-Ring, P-4, FKM	1	11, 16, 21	TC
*	26	EH0302	O-Ring, P-10A, FKM	1	11, 16, 21	TC
*	27	EH0304	O-Ring, P-7, FKM	1	11, 16, 21	TC
		EH1082	O-Ring, P-11, FKM	1	31, 36	TC
	ZZ		Brass spacers	Drive specific/R	e-use when replacing diaph	nragm

\* Included in spare parts kit

# Stainless Steel Liquid End Exploded View #4 For all EW and EK Pump Models



## Components

- C				
	Item	Part No	Description	Qty
	1	EH2021	Head, Pump, EW/EKB11, 316 SS	1
		EH2022	Head, Pump, EW/EK21, 316 SS	1
		EH2023	Head, Pump, EW/EK31, 316 SS	1
		EH2024	Head, Pump, EW/EKC36, 316 SS	1
	3	EH0429	Housing, Valve, 0.188 & 0.250, 316 SS	1
		EH0433	Housing, Valve, 0.375, 316 SS	1
*	8	EH1971	Diaphragm, EW/EK11, PTFE/EPDM	1
		EH1973	Diaphragm, EW/EK21, PTFE/EPDM	1
		EH1974	Diaphragm, EW/EK31, PTFE/EPDM	1
		EH1975	Diaphragm, EW/EK36, PTFE/EPDM	1
*	9	EH0059	Retainer, Diaphragm, EW/EK11	1
		EH0067	Retainer, Diaphragm, EW/EK21	1
		EH0087	Retainer, Diaphragm, EW/EK31	1
		EH0158	Retainer, Diaphragm, EW/EK36	1
	11	EH0360	Guide, Valve, EW/EKB11, 316 SS	4
		EH1551	Guide, Valve, EW/EK211, 316 SS	4
		EH1552	Guide, Valve, EW/EKB31/36, 316 SS	4
	12	EH1554	Seat, Valve, EW/EK11, 316 SS	4
		EH1555	Seat, Valve, EW/EK21, 316 SS	4
		EH1556	Seat, Valve, EW/EK31/36, 316 SS	4
	13	EH0049	Ball, Valve, 0.188, HC	4
		EH0072	Ball, Valve, 0.250, HC	4
		EH0126	Ball, Valve, 0.375, HC	4
*	14	EH0362	Gasket, Valve Guide, EW/EK11/21 PTFE	2
		EH0380	Gasket, Valve Guide, EW/EK31/36, PTFE	2
	19	EH2089	Bolt, M4 x 45 316 SS, Hex Socket	4
		EH0290	Bolt, M5 x 45 316 SS, Hex Socket	4
	20	EH2000	Washer, Split, M4, 316 SS	4
		EH2012	Washer, Split, M5, 316 SS	4
	21	EH1999	Washer, Flat, M4, 316 SS	4
		EH2011	Washer, Flat, M5, 316 SS	4
*	28	EH0365	Gasket, Guide/MAVV, EW/EK11/21, PTFE	9
		EH0382	Gasket, Guide/MAVV, EW/EK31/36, PTFE	9
	37	EH1014	Knob, MAVV, EW/EK-SH, 316 SS	1
	38	EH1015	Nut, Loc, EW/EK-SH, 316 SS	1
*	39	EH1016	Seal, Ring, EW/EK-SH, 316 SS	1
*	40	EH1017	Seat, MAVV, EW/EK-SH, 316 SS	1
*	41	EH1018	Seat Ring, MAVV, EW/EK-SH, 316 SS	1
	51	EH1557	Body, MAVV, EW/EK11, 316 SS	1
		EH1558	Body, MAVV, EW/EK31/36, 316 SS	1
	53	EH1508	Fitting, MAVV, EW/EK11, 316 SS	1
		EH1510	Fitting, MAVV, EW/EK31/36. 316 SS	1
	54	EH1559	Nut. Lock. MAVV. EW/EW-SH. 316 SS	1
	55	EH1517	Connector, Air Vent, EW/EW-SH, ECTFE	1
*	Inchu	dad in spara	norta kit	-

Included in spare parts kit

# Accessories (Not Shown)

Part No.	Description	Size	Liquid End Material
E90494	Connector Assy, Stop Input, 4-pin-R	EW/EW-Y	all
E90495	Connector Assy, Ana/Dig Input, 5-pin	EW/EW-Y	all
E90496	Connector Assy, PosiFlow Input, 5-pin-R	EW/EW-Y	all
E90497	Connector Assy, Outputs, 4-pin-SQ	EW/EW-Y	all
E90665	Connector Assy, EK pump, Input	EK	all
E90001	Valve, Injection 3/8	11, 16, 21	VC
E90002	Valve, Injection 3/8	11, 16, 21	VE, VF
E90003	Valve, Injection, 3/8	11, 16, 21	PC
E90004	Valve, Injection, 3/8	11, 16, 21	PE
E90007	Valve, Injection, 1/2	31, 36	VC
E90008	Valve, Injection, 1/2	31, 36	VE, VF
E90011	Valve, Injection, 1/2	31, 36	PC
E90012	Valve, Injection, 1/2	31, 36	PE
E90238	Valve, Injection, 3/8	11, 16, 21	TC
E90020	Valve, Inj/Back Press, 3/8	11, 16, 21	FC
E90022	Valve, Inj/Back Press, 1/2	31, 36	TC, FC
E90013	Valve, Foot, 3/8	11, 16, 21	VC
E90015	Valve, Foot, 3/8	11, 16, 21	PC
E90016	Valve, Foot, 1/2	31, 36	VC
E90018	Valve, Foot, 1/2	31, 36	PC
E90034	Valve, Foot, 3/8	11, 16, 21	PE
E90035	Valve, Foot, 3/8	11, 16, 21	VE
E90036	Valve, Foot, 1/2	31, 36	PE
E90037	Valve, Foot, 1/2	31, 36	VE
E90193	Valve, Foot, 1/2	31, 36	VF
E90234	Valve, Foot, 3/8	11, 16, 21	VF
E90239	Valve, Foot, 1/2	31, 36	TC
E90240	Valve, Foot, 3/8	11, 16, 21	TC
E90241	Valve, Foot, 3/8	11, 16, 21	FC
E90275	Valve, Foot, 1/2	31, 36	FC
E00001-00	Tubing,1/2 OD LLDPE per foot	31, 36	all
E00001	Tubing,1/2 OD LLDPE, 20 FT	31, 36	all
E00001-50	Tubing,1/2 OD LLDPE, 50 FT	31, 36	all
E00001-100	Tubing,1/2 OD LLDPE, 100 FT	31, 36	all
E00001-250	Tubing,1/2 OD LLDPE, 250 FT	31, 36	all
E00001-500	Tubing,1/2 OD LLDPE, 500 FT	31, 36	all
E00002-00	Tubing, 3/8 OD LLDPE per foot	11, 16, 21	all
E00002	Tubing, 3/8 OD LLDPE, 20 FT	11, 16, 21	all
E00002-50	Tubing, 3/8 OD LLDPE, 50 FT	11, 16, 21	all
E00002-100	Tubing, 3/8 OD LLDPE, 100 FT	11, 16, 21	all
E00002-250	Tubing, 3/8 OD LLDPE, 250 FT	11, 16, 21	all
E00002-500	Tubing, 3/8 OD LLDPE, 500 FT	11, 16, 21	all
E00071	Weight, Ceramic	all	all



Pump Model <sup>®</sup>	A	B		C Head Assembly * (Spare Barto Kit)					
Model	Unit <sup>⊕</sup>	Module <sup>⊕</sup>	PC	PE	VC	VE		тс	FC
EWB11F1-	WB11-1	EWBF1	X11PC	X11PE	X11VC	X11VE	X11VF	X11TC	X11FC
EWB11F2-	WB11-2	EWBF2	(X11PC-PK)	(X11PE-PK)	(X11VC-PK)	(X11VE-PK)	(X11VF-PK)	(X11TC-PK)	(X11FC-PK)
EWB16F1-	WB16-1	EWBF1	X16PC	X16PE	X16VC	X16VE	X16VF	X16TC	X16FC
EWB16F2-	WB16-2	EWBF2	(X16PC-PK)	(X16PE-PK)	(X16VC-PK)	(X16VE-PK)	(X16VF-PK)	(X16TC-PK)	(X16FC-PK)
EWB21F1-	WB21-1	EWBF1	X21PC	X21PE	X21VC	X21VE	X21VF	X21TC	X21FC
EWB21F2-	WB21-2	EWBF2	(X21PC-PK)	(X21PE-PK)	(X21VC-PK)	(X21VE-PK)	(X21VF-PK)	(X21TC-PK)	(X21FC-PK)
EWB31F1-	WB31-1	EWB30F1	X31PC	X31PE	X31VC	X31VE	X31VF	X31TC	X31FC (X31FC-PK)
EWB31F2-	WB31-2	EWBF2	(X31PC-PK)	(X31PE-PK)	(X31VC-PK)	(X31VE-PK)	(X31VF-PK)	(X31TC-PK)	
EWC16F1-	WC16-1	EWCF1	X16PC	X16PE	X16VC	X16VE	X16VF	X16TC	X16FC
EWC16F2-	WC16-2	EWCF2	(X16PC-PK)	(X16PE-PK)	(X16VC-PK)	(X16VE-PK)	(X16VF-PK)	(X16TC-PK)	(X16FC-PK)
EWC21F1-	WC21-1	EWCF1	X21PC	X21PE (X21PE-PK)	X21VC (X21VC-PK)	X21VE (X21VE-PK)	X21VF (X21VF-PK)	X21TC	X21FC (X21FC-PK)
EWC21F2-	WC21-2	EWCF2	(X21PC-PK)					(X21TC-PK)	
EWC31F1-	WC31-1	EWCF1	X31PC	X31PE	X31VC (X31VC-PK)	X31VE (X31VE-PK)	X31VF (X31VF-PK)	X31TC (X31TC-PK)	X31FC (X31FC-PK)
EWC31F2-	WC31-2	EWCF2	(X31PC-PK)	(X31PE-PK)					
EWC36F1-	WC36-1	EWCF1	X36PC	X36PE	X36VC	X36VE	X36VF	X36TC	X36FC
EWC36F2-	WC36-2	EWCF2	(X36PC-PK)	(X36PE-PK)	(X36VC-PK)	(X36VE-PK)	(X36VF-PK)	(X36TC-PK)	(X36FC-PK)
	_	11	E90041	E90042	E90038	E90039	E90302	E90305	
		16, 21	E90048	E90049	E90045	E90046	E90303		
Valve Ca	artridge	31, 36	E90055	E90056	E90052	E90053	E90304		
E	:	11, 16, 21	E90026	E90027	E90024	E90025	E90025	E90308	
Manual / Valve As	Air Vent sembly	31, 36	E90248	E90249	E90246	E90247	E90247	E90250	
Automa Vent V	atic Air /alve	11, 16, 21			E90023				
MultiFu Valve As	nction sembly	11, 16, 21	E90364	E90365	E90362	E90363	E90363		

## Notes:

- \* The P/N in the block is the head assembly part number and the spare parts kit is shown underneath in parentheses. For head assemblies with a Multifunction Valve, add an "M" to the end of the part number. Parts kits for pumps with Multifunction valves are the same as pumps without the "M" option. For head assemblies or parts kits with the Auto Air Vent Valve, add "A" after the "VC" code in the number.
- For EK pump models, change the "W" to "K" and the "F" to "R". The EK drive and control units are only sold as an assembly only. Use the Drive Unit number but change the "W" to "K" and add an "R" before the voltage code (i.e. KB11-R1). For EW pumps using a "Y" Control Module, change the "F" in the model number or part number to a "Y" to determine the correct Control Module part number.



A Drive Unit B Control Module Part numbers for these

assemblies are on Page 30

Item	Part No.	Description	Series
1	EH1580	Screw, M5 x 55, SS PFH, Black	EW
2	EH1581	Screw, M5 x 47, SS PFH, Black	EW
3	EH1653	Hinge Pin, Spring, EW-F/Y Cover	EW
4	EH1646	Cover, Controller, Clear, EW-F/Y	EW
5	EH1648	Thumb Bolt, Captive, EW-F/Y, Cover	EW
6	EH1647	Gasket, Cover, EW-F/Y Controller, EPDM	EW
7	EH2427	Gasket, Controller-Drive. EW, EPDM	EW
8	EH1649	Knob, Stroke length, EW-F/Y	EW
9	EH1650	Label, EW-F/Y Stroke length knob	EW
10	EH1583	Cap, Mini din connector, EPDM	EW
11	EH1573	Gasket, Pump Head, EW/EK 11-21	EW, EK
	EH1574	Gasket, Pump Head, EW/EK 31	EW, EK
	EH1575	Gasket, Pump Head, EW/EK 36	EW, EK
12	EH1690	Spacer, Bracket, EW/EK/EZ-11	EW, EK
	EH1431	Spacer, Bracket, EW/EK/EZ-16	EW, EK
	EH1700	Spacer, Bracket, EW/EK/EZ-21	EW, EK
13	EH1410	Screw, M4 x 10, SS PFH, Black	EK
14	EH1375	Knob, Stroke length, EK-B	EK-B
	EH1584	Knob, Stroke length, EK-C	EK-C
15	EH1376	Screw, SL Knob, EK-B, M4 x 95	EK-B
	EH1586	Screw, SL Knob, EK-C, M4 x 75	EK-C
16	EH0141	Cap, Stroke length Adjustment Knob	EK
17	EH1372	Gasket, Cover, EK Controller, EPDM	EK
18	E90633	Cover Asm, EK Control Unit, (no bolts, w/gasket)	EK
	E90634	Cover Asm, EK Control Unit, (w/bolts & gasket)	EK
19	EH1374	Thumb Bolt, Captive, EK Cover	EK
20	EH1567	Gasket, Locknut, EK Input	EK
21	EH1565	Nut, Lock, Input connector, EK	EK

# 6.0 TROUBLESHOOTING

**CAUTION:** Before working on the pump, disconnect the power cord, depressurize the discharge tubing and drain or flush any residual liquid from the pump head and valves, using proper chemical handling techniques.

Problem	Possible Cause	Corrective Action
Pump does not start	Faulty wiring	Correct wiring
-	Improper voltage	Connect to proper voltage source
	Electronic control unit is damaged	Replace control unit (Contact distributor or factory)
Pump does not prime	Air in suction tubing	Reroute suction tubing to eliminate air trap
	Valve gasket is not installed	Install valve gasket
	Valve set assembly direction is wrong.	Reassemble valve set
	Pump is air locked	Open air vent valve
	Suction or discharge valve is clogged with foreign matter	Disassemble, inspect, clean
	Ball stuck to valve seat	Disassemble, inspect, clean
Output fluctuates	Suction or discharge valve is clogged with foreign matter	Disassemble, inspect, clean
	Air is trapped in pump	Open air vent valve
	Overfeeding	Install injection valve or back pressure valve
	Diaphragm is damaged	Replace diaphragm
Liquid leaks	Fitting or coupling nut is loose	Re-install (see section 2.3/2.4)
-	Pump head is loose	Tighten pump head bolts Torque: 19 lb-in (2.16 N-m)
	Diaphragm is damaged	Replace diaphragm
	O-ring or valve gasket missing	Install o-ring or valve gasket

# 7.0 SERVICE POLICY

The EW and EK Series electronic metering pumps have a 2-year limited warranty. Contact your Walchem distributor for service.

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# **Metering Pumps**

# **LK Series**

The LK Series metering pump is the largest in the high performance line of pumps from Walchem. The LK is a motor-driven, mechanically actuated diaphragm metering pump with a maximum capacity of 114 GPH (432 l/h) and a maximum pressure of 225 PSI (1.5 MPa).

The heart of the LK is a compact and very reliable dual-cam system drive and worm gear reducer. Roller bearings and oil bath lubrication ensure outstanding durability and wear resistance in continuous operation.

The LK Series is ideal for chemical feed applications in a wide range of fields, including water treatment, chemical process, agriculture, mining and paper.



## Liquid Ends

Summary of Key Benefit

Drive from the gear reduction unit is directly transferred to the diaphragm. This design is economical, yet retains a high degree of versatility. Liquid ends are available in PVC, PVDF and 316 SS for handling acids, bases, solvents, polymers and slurries.

## Stroke Adjustment

Accurate and reliable stroke setting is accomplished with a micrometer dial of the springback stroke adjustment mechanism. This lockable mechanism is adjustable from 10 to 100%.

# Drive

The LK utilizes a dual-cam system drive with a built-in worm gear type speed reducer. The aluminum bronze worm gear and the tapered roller bearing provide efficient transmission of motor power to the pump. This compact and rigid mechanism provides maximum wear resistance in continuous operation over long periods of time.

## Motors

All of the standard models employ totally enclosed fan-cooled motors which are vertically mounted to save space. A variety of motor options are available, including explosion-proof and DC variable speed motors for external control by a 4-20 mA input signal.



# Ordering Information

LKN	57	A -	- VC
Pump	Capacity	Motor	Liquid Eng

Materials

### **PUMP SERIES**

Series

LKN = LKN Series motor-driven metering pump with NEMA 42C motor mounting flange

## **CAPACITY/PRESSURE RATING**

See chart on this page

### **MOTOR CODE** (All 42C Face)

LIQUID END MATERIALS

Pressure

### A = 115/230V, 60 Hz, 1 Ph, 1/3 HP, 1725 RPM, TEFC

- B = 230/460V, 60 Hz, 3 Ph, 1/3 HP, 1725 RPM, TEFC
- C = 190/380/230/460V, 50/60 Hz, 3 Ph, 1/3 HP, 1450/1725 TEFC
- D = 90VDC, 1 Ph, 1/3 HP, 1750 RPM, TENV Variable Speed Motor, 115V Control
- E = 180VDC, 1 Ph, 1/3 HP, 1750 RPM, TENV Variable Speed Motor, 230V Control
- F = 230/460V, 60 Hz, 3 Ph, 1/3 HP, 1725 RPM, Explosion Proof Motor, Class 1, Div.1, Group C & D
- G = 230/460V, 60 Hz, 3 Ph, 1/3 HP, 1725 RPM, Inverter Duty Motor, TENV
- N = No motor option / used with special motor requirements

#### VC VH VS TC S6 Туре Viscosity & Strong Alkaline Application Acid slurries Acids Solvents PVC Pump head PVC PVC **PVDF** SS316 Valve ball CF HC HC/SS304 CF HC Valve seat Type 32 FKM EPDM SS304 FKM SS316 Type 45 to 57 PVC SS304 PVDF PVC SS316 FKM EPDM EPDM FKM O-ring Valve gasket PTFE PTFE PTFE PTFE PTFE PTFE + EPDM Diaphragm



Notes:

- 1. Walchem recommends the installation of a pressure relief valve and a pulsation dampener in the discharge line of the LK Series pumps. Contact your Walchem distributor for these and other control and accessory products from Walchem.
- 2. Maximum viscosity at rated output is 1000 cps for VS and S6, 500 cps for VH and 300 cps for VC and TC.
- 3. It is recommended that pumps be shielded from direct exposure to the elements.

## **Capacity and Pressure Rating**

	Capacity*		Max. Pressure PSI		Stroke Speed SPM		Connections	Weight Ibs***	
Model	LPH@ 50 Hz	GPH @ 60 Hz	PVC/ PVDF	SS	50 Hz	60 Hz	NPT	PVC/ PVDF	SS
LKN32	30	9.5	150	225	96	116	1/2"	50	61
LKN45	50	15.9	150	225	48	58	1/2"	55	70
LKN47	100	31.8	120	120	96	116	1/2"**	55	70
LKN55	168	53.4	75	75	48	58	1 "	59	81
LKN57	<mark>360</mark>	<mark>114.3</mark>	<mark>45</mark>	<mark>45</mark>	<mark>96</mark>	<mark>116</mark>	1"	<mark>59</mark>	<mark>81</mark>

Capacities listed are at max. pressure

\*\* LKN47 with VS liquid end has 1" NPT connections

\*\*\* Weights with standard motor



# **ABOUT US**

Walchem integrates its advanced sensing, instrumentation, fluid pumping and communications technologies to deliver reliable and innovative solutions to the global water treatment market. Our in-house engineering is driven by quality, technology and innovation. For more information on the entire Walchem product line, visit: www.walchem.com





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### 180186.M Aug 2013



LK Series Metering Pumps

# LK Series Metering Pump Instruction Manual

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# Notice

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P/N 180173.M July 2013

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Thank you for choosing a Walchem LK Series Metering Pump. This instruction manual deals with the correct installation, operation, maintenance and troubleshooting procedures for the LK metering pumps. Please read through it carefully to ensure the optimum performance, safety and service of your pump.

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### IMPORTANT INSTRUCTIONS

Important notes and statements about the safe operation and prevention of physical injury and/or property damage are included throughout this instruction manual.

## Always Observe These Safety Instructions!

### Safety Instructions to Prevent Personal Injury

In this manual, the following symbols and signs are used to clearly indicate safety instructions:



### Warning

Non-observance or misapplication of the contents of the "Warning" section could lead to a serious accident, including death or injury.



### Caution

Non-observance or misapplication of the contents of the "Caution" section could lead to serious physical injury to the user or serious damage to the product.

# . Warning

### (Always read and observe the following instructions to prevent personal injury.)

- **Damaged or deteriorated tools are very dangerous.** Use only qualified and suitable tools.
- Use protective gear. When disassembling, assembling, and conducting maintenance or when handling a dangerous type of liquid or a liquid of unknown property, be sure to wear safety gloves, a helmet, and protective shoes. In addition, when handling wet-end parts, always wear protective goggles, masks, etc.
- **Prevent death or injury from a falling pump.** Make sure the rope or chain used for lifting the pump is not accidentally cut or disconnected during installation. Make sure the rope or the chain used to lift the pump has sufficient strength for the pump load. Do not to stand underneath a lifted or suspended pump.
- Always turn off the power supply prior to servicing the pump. Make special provisions so that the power supply cannot be turned on while someone is working on the pump. In a noisy or poor visibility environment, display a sign near the power supply switch to notify others that someone is "WORKING" on the pump. Power mistakenly applied during maintenance may lead to personal injury.
- *Check and make sure that there is no one near the pump when switching on the power supply.* The pump is not equipped with an ON/OFF switch. Connecting the power cable or power plug supplies the power to the pump and starts the operation.
- *Run the pump at the specified power supply voltage on the nameplate only.* Fire or electric shock may result if the supply voltage is incorrect.
- *If pump operation is stopped due to a power failure or closure of discharge line*, turn off the power switch at once. After normal conditions are established, reapply power.

- **Do not use the pump for anything that it is not designed to do.** User's failure to observe this instruction exempts Walchem from any responsibility for personal injury or damage to the equipment or facility caused by the pump's misuse.
- When handling liquid with toxic or strong vapors, ventilate the working area well. In addition, the operator must wear protective gear (such as a safety mask, safety goggles, and protective gloves).
- Do not allow toxic substances such as lubricants, solvents, or similar substances to flow into the local sewage system or river systems. Do not drain hazardous liquids such as chemical solutions discharged out of the pump directly onto the ground. Instead, drain such liquids into an appropriate container. Observe the laws and regulations related to the application, handling, and processing of hazardous substances.

# (Always read and observe the following instructions to prevent personal injury.)

- *Wear gloves when working with rope or chain.* Working with bare hands may result in serious injury, since fingers are likely to be caught between the pump and the rope or chain when the rope or chain is under tension.
- *The pump is not designed to be used under water.* Install the pump in a clean, dry environment where the pump cannot become submerged. It is recommended that the pump be shielded from direct exposure to the elements.
- *Install a safety valve on the discharge line.* Installation of a pressure relief valve is highly recommended. Check local codes and regulations.
- *Do not close off the discharge or suction lines while the pump is operating.* The pump or piping may become damaged.

# 1 Operating Principle

The rotation of the motor is reduced by means of the worm and wheel. The rotary motion is converted to a reciprocating motion by the spring-back mechanism (including the worm wheel shaft, slider, spring, etc.). The reciprocating motion is transmitted to the diaphragm directly connected with the shaft, changing the volume inside the pump chamber. The variation in volume inside the pump chamber and the functioning of the valves in the pump head produce the pump operation. To adjust stroke length, the adjusting dial fixed on the control shaft is rotated to change the return of the slider.



#### 2 **Model Identification Guide** 57 LK Ν VC Α 2 3 1 4 1 LK Series motor-driven metering pump 2 N – NEMA 42C motor mounting flange 3 Capacity/Pressure Rating. Refer to specifications and outer dimensions below. 4 Motor Code: A = 115/230V, 60Hz, 1 ph, 1/3 HP, 1725 RPM, TEFC Frame 42C B = 230/460V, 60Hz, 3 ph, 1/3 HP, 1725 RPM, TEFC Frame 42C • . C = 190/380V//230/460V, 50/60Hz, 3 ph, 1/3 HP, 1450/1725 RPM, TEFC, Frame 42C D = 90VDC, 1 ph, 1/3 HP, 1750 RPM, TENV, Frame 42C Variable Speed Motor, 115V Control • • E = 180VDC, 1 ph, 1/3 HP, 1750 RPM, TENV, Frame 42C Variable Speed Motor, 230V Control F = 230/460V, 60Hz, 3 ph, 1/3 HP, 1725 RPM, Explosion Proof Motor: Class 1, Div 1, Group C & D G = 230/460, 60 Hz, 3 ph, 1/3 HP, 1725 RPM, Inverter Duty Motor, TENV, 42C

**5** Liquid End Code. Refer to the table below.

Material symbol		VC	VH	VS	TC	S6		
	Pump head		PVC	PVC	PVC	PVDF	316 SS	
	Valve ball		CE	HC	HC/304 SS	CE	HC	
÷	Valve seat	Type 32	FKM	EPDM	304 SS	FKM	316 SS	
bar		Type 45 to 57	PVC	PVC	304 SS	PVDF	316 SS	
	O ring		FKM	EPDM	EPDM	FKM	-	
	Valve gasket		PTFE					
	Diaphragm				PTFE + EPDN	<mark>/ </mark>		

CE: Alumina ceramic HC: Hastelloy C267

# **3** Specifications and Outer Dimensions

Model	Cap	oacity	Maximum Pressure PSI (MPa)		Stroke speed (spm)		Connection NPT		Viscosity
	50Hz (l/h)	60Hz (GPH)	PVC/PVDF	SS	50Hz	60Hz	PVC/PVDF	SS	cps
LKN32	30	9.5	150 (1)	225 (1.5)	96	116	1⁄2"	1⁄2"	N/0, 200
LKN45	50	15.9	150 (1)	225 (1.5)	48	58	1⁄2"	1⁄2"	TC: 300
LKN47	100	31.8	120 (0.8)	120 (0.8)	96	116	1⁄2" *	1⁄2"	VH: 500
LKN55	168	53.4	75 (0.5)	75 (0.5)	48	58	1"	1"	VS: 1000
LKN57	<mark>360</mark>	<mark>114.3</mark>	<mark>45 (0.3)</mark>	<mark>45 (0.3)</mark>	<mark>96</mark>	<mark>116</mark>	<mark>1"</mark>	<mark>1"</mark>	50: 1000

\* LKN47-VS has 1" NPT connections

### **Outer dimensions**

LKN32, 45, 47, 55, <mark>57</mark>, VC, VH, VS



Model	L	Α	С	E	F	J	K
LKN32, VC, VH, VS	10.88 (276)	12.125 (308)	3.88 (99)	4.063 (103)	4.688 (119)		
LKN45, 47, VC, VH, VS	10.94 (278)	12.00 (305)	3.94 (100)	4.00 (102)	4.75 (121)	<sup>1</sup> ∕2″ NP1	<mark>4 x ø0.35"</mark>
LKN47VS	10.94 (278)	10.125 (257)	3.94 (100)	3.06 (78)	4.75 (121)		<mark>(ø9)</mark>
LKN55, 57, VC, VH, VS	<mark>12.375</mark> (314)	<mark>12.25</mark> (311)	<mark>4.50</mark> (114)	<mark>4.125</mark> (105)	<mark>5.313</mark> (135)	1" NPT	







		۳.,	Part No.	Material	Part No.	Material	Part No.	Material		
1	Pump head	1	L0770	PVC	L0770	PVC	L1227	PVC		
*2	Ball	2	L0063	Alumina	L0062	Hastelloy	L0062	Hastelloy		
_	_	_	/	Ceramic		C		С		
*3	Valve guide	2	L0064	PVC	L0064	PVC	L0488	PVC		
*4	Valve seat	2	L0066	FKM	L0065	EPDM	L0489	SS304		
*5	Valve Gasket	2	L0068	PTFE	L0068	PTFE	L0068	PTFE		
6	Adapter	2	0072	PVC	L0072	PVC	L0072骨	PVC		
*7	O-ring	2	L0074	FKM	L0073	EPDM	L0073	EPDM		
*8	O-ring	2	L0016	FKM	L0015	EPDM	L0015	EPDM		

No.	Part	Qty	Part No.	Material
20	Hex head bolt	6	L0246	SS
21	Split washer	6	EH2012	SS
22	Plate washer	6	EH2011	SS
29	Reinforcing plate	1	L0771	Steel
*30	Diaphragm	1	L0080	PTFE + EPDM
*31	Retainer	1	L0081	SS304
50	Nut	2	L0022	PVC
51	Fitting	2	L1590	PVC

\* Parts included in the spare parts kit.

✤ L0506 (PVC) is used on the suction side.



No	Port	Part Qty	V	C		VN	VA VS		
NO.	Part		Part No.	Material	Part No.	Material	Part No.	Material	
1	Pump head	1	L1500	<b>PVC</b>	L1500	RVC	L1500	PVC	
*2	Ball	2	L0093	Alumina Ceramic	L0092	Hastelloy C	L0092	Hastelloy C	
*3	Valve guide	2	L0094	PVC	L0094	PVC	L0094	PVC	
*4	Valve seat	2	L0005	PVC	L0095	PVC	L0096	SS304	
*5	Valve Gasket	2	L0097	PTFE	L0097	PTFE	L0097	PTFE	
*7	O-ring	2	L0103	FKM	L0102	EPDM	L0102	EPDM	

No.	Part	Qty	Part No.	Material	Notes
20	Hex head bolt	8	L1166	SS	
22	Plate washer	8	L1610	SS	
29	Reinforcing plate	1	L1224	FC200	
*30	Diaphragm	1	L0109	PTFE + EPDM	
*31	Retainer	1	L0110	SS304	
50	Nut	2	L1596	PVC	
51	Fitting, 1/2" MPT	2	L1593	PVC	For LKN45/47-VC/VH and LKN45-VS
51	Fitting, 1"NPT	2	L1595	PVC	For LKN47-Vs only

### ■ LKN55, 57 VC, VH, VS



No	Dort	Otv	V	C		VH	VS	
NO.	Fait	QLY	Part No.	Material	Part No.	Material	Part No.	Material
1	Pump head	1	L1513	PVC	L1513	PVC	L1513	PVC
*2	Ball	2	L0151	Alumina Ceramic	L0150	Hastelloy C	L0150	Hastelloy C
*3	Valve guide	2	L0152	PVC	L0152	PVC	L0152	PVC
*4	Valve seat	2	L0153	PVC	L0153	PVC	L0154	SS304
*5	Valve Gasket	2	L0155	PTFE	L0155	PTFE	L0155	PTFE
*7	O-ring	2	L0161	FKM	L0160	EPDM	L0160	EPDM

No.	Part	Qty	Part No.	Material
20	Hex head bolt	8	L1168	SS
22	Plate washer	8	L1610	SS
29	Reinforcing plate	1	L1600	FC200
*30	Diaphragm	1	L0167	PTFE + EPDM
*31	Retainer	1	L0168	SS304
50	Nut	2	L1596	PVC
51	Fitting	2	L1595	PVC



No.	Part	Qty	Part No.	Material
1	Pump heag	1	L1204	SS316
*2	Ball	2	L0062	Hastelloy C
*3	Valve guide	2	L1205	SS316
*4	Valve seat	2	L1206	SS316
*5	Valve gasket A	4	L0244	PTFE
*6	Valve gasket B	2	L0245	PTFE
20	Hex head bolt	6	L0246	SS
21	Split washer	6	EH2012	SS
22	Plate washer	6	EH2011	SS
*30	Diaphragm	1	L0080	PTFE + EPDM
*31	Retainer plate	1	L0081	SS304
70	Fitting	2	L1592	SS316



No.	Part	Qty	Part No. for LKN45, 47	Part No. for LKN55, 57	Material
1	Pump head	1	L1209	L1212	SS316
*2	Ball	2	L0092	L0265	Hastelloy C
*3	Valve guide	2	L0826	L1213	SS316
*4	Valve seat	2	L0827	L1214	SS316
*5	Valve Gasket	6	L0257	L0269	PTFE
20	Bolt w/split washer	8	L1167	L1167	SS
22	Plate washer	8	L1610	L1610	SS
*30	Diaphragm 🦯	1	L0109	L0167	PTFE + EPDM
*31	Retainer plate	1	L0110	L0168	SS304
71	Fitting	2	L1594	L1599	SS316
80	Stud bolt	8	L1509	L1518	SS
81	Hex nyt	8	L0762	L1523	SS
82	Splitwasher	8	L1512	L0189	S S

LKN32 TC 50 51-8 6 5 31 30 3. 2 22 P 21 29 3 20 2 ۵ -6 8 -51 E) 80 100910 No. Part Qty Part No. Material L1226 **PVDF** Pump head 1 1 \*2 Ball 2 L0063 Ceramic \*3 Valve guide 2 L0332 PVDF

\* Parts included in the spare parts kit.

\*4

\*5

\*6

\*7

\*8

20

21

22

29

\*30

\*31

50

51

Valve seat

Adapter

O-ring

O-ring

Bolt

Nut/

Fitting

Valve Gasket

Split washer

Plate washer

Diaphragm

Retainer plate

Reinforcing plate

2

2

2

2

2

6

6

6

1

1

1

2

2

L0066

L0068

L0335

L0074

L0016

L0246

EH2012

EH2011

L0771

L0080

L0081

L1611

L1591

PVDF

PTFE

**PVDF** 

FKM

FKM

SS

SS

SS

SS41

PTFE + EPDM

SS304

**PVDF** 

**PVDF** 



No.	Part	Qty	Part No.	Material
1	Pump head	1	L1505	PVDF
*2	Ball	2	L0093	Ceramic
*3	Valve guide	2	L0347	PVDF
*4	Valve seat	2	L0348	PVDF
*5	Valve Gasket	2	L0097	PTFE
6	Adapter	2	L0350	RVDF
*7	O-ring	2	L0103	FKM
*8	O-ring	2	L0016	FKM
9	Nut	2	L1539	PVDF
20	Bolt w/split washer	8	L1166	SS304
22	Plate washer	8	L1610	SS
29	Reinforoing plate	1	L1224	SS41
*30	Diaphragm	1	L0109	PTFE + EPDM
*31	Retainer plate	1	L0110	SS304
50	Nut	2	L1611	PVDF
51	Fitting	2	L1591	PVDF



No.	Part	Qty	Part No.	Material
1	Pump head	1	L1521	PVDF
*2	Ball	2	L0151	Ceramic
*3	Valve guide	2	L0363	PVDF
*4	Valve seat	2	L0364	PVDF
*5	Valve Gasket	2	L0155	PTFE
*7	O-ring	2	L0161	FKM
20	Bolt 🚀/split washer	8	L1168	SS304
22	Plate washer	8	L1610	SS
29	Reinforcing plate	1	L1600	FC200
*30	Diaphragm	1	L0167	PTFE + SPDM
*31	Retainer plate	1	L0168	SS304
50	Nut	2	L1598	PVDF
51	Fitting	2	L1597	PVDF

# 5 Description on Main Unit and Label



Caution: Do not use any solvent when wiping the nameplate, labels or the pump main unit.

#### Handling Instructions 6

# Warning

Do not operate the pump with dangerous or hazardous mediums (such as explosive, combustible, flammable, or toxic substances).

## Caution

Read the following information prior to installation of the pump:

### Protective gear:

When operating the pump or working near it, always wear protective clothing, face guard, goggles, and gloves. Further precautionary measures must be taken depending upon the type of liquid used.

#### Pump repair:

Do not try to disassemble or repair the pump beyond the range specified in this instruction manual Contact the local distributor for further help.

1. Handle the pump carefully.

Impacts caused by dropping the pump on the floor or striking it may result in damage or faulty performance.

#### 2. Do not operate the pump under the following condition:

- where the temperature falls below 0°C
- where corrosive gas or explosive gas may be present
- exposed to splashing water
- where the ambient temperature is 40°C or above
- where the humidity is excessively high (Permissible humidity: 35~85%RH)
- places filled with or likely to be filled with explosive or corrosive atmosphere
- danger due to dust, fire, earthquake and/or any externally imposed shock

#### 3. Keep the pump away from fire.

To prevent fire and explosions, do not place dangerous or flammable substances near the pump.

- 4. Damaged pump or motor Do not operate a damaged pump due to the possibility of electric shock.
- 5. Pump modification Never attempt to modify the pump. This may cause a serious accident or damage.
- 6. No disassembly or repair

Users should not disassemble and repair the pump beyond the level given in the "Disassembly and Assembly" section of this manual.



Caution

The pump must be repaired by trained and qualified operators only. If in need of repair, stop operation and contact your supplier for service.

- Do not close the discharge or suction lines while in operation.
  Pump operation with valves closed increases the load onto the pump itself and will eventually damage the pump or piping.
- 8. Do not adjust the stroke length while the pump is not operating. Rotating the stroke adjustment dial while not in operation applies load onto the dial and will eventually damage the pump.
- 9. Allowable pressure limit Set the discharge pressure at or below the allowable pressure limit level indicated in the "Specifications" section.
- 10. Temperature/humidity fluctuation

Temperature fluctuation may not affect the performance of the pump itself. However, the liquid may change in terms of its viscosity, pressure, or corrosion resistance. Pay special attention to changes in liquid characteristics as a result of temperature fluctuation.

Liquid temperature range:	
Material symbol VC, VH, VS:	<mark>0~50°C</mark>
Material symbol S6, TC:	0~80°C
Ambient temperature range:	0~40°C
Humidity range:	35~85%RH

# 7 Installation

- 1. Installation position
  - Install the pump as close to the suction tank and as low as possible. Flooded suction is the ideal installation.
  - The suction lift ability depends upon the liquid properties, temperature, and length of the suction piping. For details of the setup, consult your distributor.
- 2. Indoor and outdoor use

The pump can be operated either indoors or outdoors. However, safety measures should be taken so as not to expose the motor and power distribution unit to flooding and it is always recommended that the pump be shielded from direct exposure to the elements (rain, snow, direct sun, etc.).

3. Installation site Select an installation site that is flat and free of vibrations caused by nearby machines. Sufficient space for maintenance should be provided.

#### ■ Lifting

Lift the pump horizontally so that the gear oil will not leak out of the pump drive unit.

#### Foundation preparation (before pump installation)

- 1. The area for anchoring the pump should be greater than the area of the pump base. If the anchoring area is too small, the base may be destroyed due to the concentrated load on it.
- 2. If pump operation is to be subject to vibration (resonation with the piping, for example), provide an expansion joint between the pump and the piping. Otherwise, the piping, gauge, etc., may be damaged.
- 3. Installation advice
  - Use anchor bolts to fasten the pump base firmly.
  - Install the pump horizontally.
  - Sufficient space is required to allow cool air from the motor fan to circulate.
  - Allow ample space around the pump for easy and efficient maintenance work.

## 8 Piping



#### Load of piping for LK-N

When plumbing the pump, support the piping and use an expansion joint so as not to apply a load onto the pump discharge/suction ports.

#### General precautions

- 1. All piping should be supported independently so that unnecessary weight and vibration are not transmitted directly to the pump. Expansion joint is recommended to avoid damaging the pump head especially.
- 2. The best piping arrangement for minimum pressure loss is achieved with straight runs and full bore piping containing as few bends and fittings as possible.

- 3. When handling a high or low temperature liquid, provide an expansion joint in the pipeline to allow for stress caused by thermal expansion and contraction.
- 4. When handling a slurry liquid, provide a drain plug at the bottom of the piping and do not make a "trap" in the piping system.
- 5. When handling a viscous, toxic or a liquid that easily crystallizes, install piping for cleaning.
- 6. Use adequate piping materials that can resist pressure and corrosion.
- 7. Clean the inside of pipes before installation. Remove the caps fitted on the pump inlet and outlet before installing piping. The caps are provided for preventing contamination by foreign matter.
- 8. A pressure relief safety valve and a pulsation dampener should be installed on the discharge line near the pump.

CAUTION! Operation without a pressure relief safety valve installed could result in catastrophic failure and a dangerous condition if the discharge line is closed for any reason during operation

#### Suction piping

- 1. Flooded suction is always recommended.
- 2. The diameter of the suction pipe should never be smaller than the size of the pump inlet.
- 3. The suction piping should be as short as possible. Excessive length may lead to flow restriction, cavitation and damage to the pump.
- 4. Air ingress from the joints in the piping system may cause pumping damage or inconsistent flow. Make sure the joints are well sealed.

#### Discharge piping

- 1. Install a pressure relief safety valve as close to the pump discharge as possible. Its setting pressure should not exceed the pressure permissible for the pump and pipes.
- 2. Maintain pipe diameter (match pump discharge size) through discharge point including all valves and injectors. At a minimum, match size through pressure relief valve to ensure safety and protect the pump.
- 3. Firmly connect and seal all the joints using proper pipe support (this includes flexible tubing as pulsation and tubing flex can stress pump head connection).
- 4. Install a pressure gauge on the discharge piping to verify actual pressure in discharge. The pressure gauge must be installed before any pipe reductions to measure an accurate pressure to the pump..
- 5. Install a pulsation dampener (air chamber or accumulator) in the discharge piping to prevent any fluctuation of pressure. Install the pulsation dampener in a position close to the pump discharge port. A pulsation dampener will significantly increase the life of the pump.

# 9 Wiring

#### Electrical connections

## WARNING

The electrical connection should be carried out by an authorized electrician in accordance with local regulations. Please make sure that the electrical data on the nameplate of the motor corresponds to the electrical supply on which it will be used. Motors must be connected to a motor protection switch.

- 1. Use an electromagnetic switch that conforms to the specifications (voltage, capacity, etc.) of the pump motor.
- 2. If using the pump outdoors, waterproof the wiring to protect the switches from rainwater.
- 3. Electromagnetic switches and push buttons should be installed at a reasonable distance from the pump.

# 10 Operating Instructions

- 1. Never operate the pump with the suction and discharge side valve closed. Otherwise, the inside of the pump or the piping will be damaged.
- 2. In the event of a service power failure, turn off the power switch immediately and close the discharge valve.
- 3. Maximum pump surface temperature (not motor) The max. pump surface temperature of each model is shown in the table. Arrange protective measures in accordance with the temperature levels.

Model	Liquid temp °C	Max. surface temp. at 40°C ambient temp °C
LKN32, 45,47,55, <mark>57 VC</mark> , VH, VS	<mark>50</mark>	45
LKN32, 45,47,55,57, 86	80	75

4. Sound generated by pump

The level of sound generated by LKN type of pump is 85 (dB). Arrange a muffling device to reduce the sound level if necessary. The procedure for sound measurement conforms to the EN 31201 (ISO11201).

#### Preparation for start-up

The following inspections should be made before the initial operation after installation and operation after a long period of inactivity.

- 1. Thoroughly clean the inside of the tank and pipe. Then, supply liquid.
- 2. Tighten the pump connections and the installation bolts on the base.
- 3. Check every part of the pump for defects, loosened bolts, oil leakage, etc.
- 4 Check the oil gauge to see if the drive unit is filled with the specified amount of oil.



5. Run the motor instantaneously to check for correct direction of motor rotation. The motor should run in the direction indicated with the arrow on the pump. If the direction is reversed, rewire the motor power wires in accordance with the wiring schematic on the motor nameplate.

#### Operation

1. Open the valves of the suction and discharge pipes.



- 2. Provide power to the motor.
- 3. Loosen the hex socket head bolt of the stroke length dial. Set the stroke length to 0% by turning the stroke length dial clockwise



- 4 Continue to run the pump for 30 minutes or longer to let it warm up. Check that no abnormality is found. This procedure is necessary only during the first operation, but when the ambient temperature is extremely low, continue no-load running until the oil temperature rises sufficiently because the motor may sometimes be overloaded a little due to an increase in the viscosity of oil in the drive unit.
- 5. Open an air vent valve to purge the discharge line of air.
- 6. Increase the stroke length up to 100% and continue to run the pump for 30 minutes or longer again.
- 7. Close the air vent valve gradually, watching the pressure gauge. The liquid will come into the discharge line and be discharged from the end of the pipe. Should the discharge pressure exceed the permissible pressure for the pump before the air vent valve is completely closed, check the piping system.
- 8. Check that the motor amperage does not exceed the rated value and that no abnormality is found.

#### Metering and Calibration

- 1. Operate the pump using the actual liquid and installation conditions.
- 2. Setting the stroke length at 100%, determine the discharge capacity per minute several times. If no noticeable variation is found after repeated measuring, the pump is working normally.
- 3. Measure the discharge capacity at two or three points of the stroke length. When a set point is changed, measure the discharge capacity after running one minute or longer.
- 4. Plot a pump calibration curve using the results of the above procedures. [Note] Our in-plant test data is based on pumping water at normal ambient temperature with a short piping system. Therefore, there will be a difference between the test data and the practical performance data.
- 5. The relationship between the amount of stroke length dial revolution and stroke length is shown in the following graphs.



Starting after the pump is stopped or out of use

- 1. When the pump is stopped for a short period of time (within a week), it can be re-started at its prescribed pressure and capacity.
- 2. When the pump has been out of use for a long period of time, operate the pump at zero pressure for a few minutes to lubricate it thoroughly. Do not start the pump at a prescribed pressure immediately.

#### Pulsation dampener

It is always recommended to install a pulsation dampener, i.e. diaphragm type accumulator, air chamber, etc. Because a metering pump is a reciprocating device, it produces pressure pulsations that the system sees in the form of acceleration, inertia, shock, noise, and reduced service life. When the piping is long, it is especially important to use a pulsation dampener for accurate metering.

ltem	Problem	Ref. No. for Cause/Countermeasure
Α	Discharge capacity is low.	1, 2, 4, 5, 6, 7, 8, 9, 11, 12
B	Discharge capacity is excessive.	3, 7, 9
С	Discharge capacity is unstable.	1, 2, 3, 4, 5, 7, 8, 11, 12
D	No liquid is discharged.	1, 2, 4, 7, 8, 11, 12
Е	Discharge pressure does not increase.	1, 2, 4, 8, 10, 11, 12
F	Pump will not prime.	1, 2, 4, 5, 6, 7, 8, 12
G	Liquid leaks.	5, 6
Н	Motor does not run.	15, 16, 17, 18, 19
Ι	Motor draws excessive amperage.	13, 15, 16, 17, 19
J	Excessive vibration and loud noise.	8, 12, 13, 15, 19
K	Oil leaks.	14
L	Gearbox temperature is excessive.	7, 13, 19

## 11 Troubleshooting

Ref.	Cause	Countermeasure
1	Foreign matter is clogging valve ball, valve seat and/or valve guide.	Disassemble and clean.
2	Valve seat and/or valve ball is worn.	Replace.
3	Differential pressure is inadequate.	Install a back-pressure valve in discharge line. (5 PSI is required as min. differential pressure.)
4	Air leaks into suction line.	Inspect suction pipes and connections. Re- tighten.
5	Defective valve gasket or O-ring	Replace.
6	Damage to diaphragm	Replace. Check the discharge pressure for foreign matter or crystallization in the pump chamber if it fails prematurely.
7	Pumping condition (liquid, temperature, pressure, piping, etc.) changes.	Renew pump performance data of the altered pumping condition after confirming that the pump is good.
8	Suction pipe or strainer is clogged.	Disassemble and clean.
9	Stroke length dial has moved.	Readjust and tighten lock bolt securely after confirming that no liquid is discharged at stroke length of 0%.

10	Dust is clogging mouth of pressure gauge or pressure gauge is defective.	Clean or replace.
11	Leak from safety valve	Readjust pressure setting or replace if it is defective.
12	Cavitation occurs due to insufficient NPSHr.	Examine suction conditions.
13	Lubricating oil of the drive unit is not correct.	Check that the correct oil has been used. Check the oil quantity and level. Replenish or replace if necessary.
14	Defective oil seal or O-ring	Replace.
15	Defective motor	Replace.
16	Wrong wiring or defective contact	Check wiring. Replace switch, etc. if necessary.

Ref.	Cause	Countermeasure
17	Voltage drop	Inspect cause and take countermeasures
		accordingly.
18	Blown fuse.	Inspect cause and take countermeasures
		accordingly.
19	Overload (excessive discharge pressure)	Check discharge line and take countermeasures
		to lower the pressure.

# 12 Maintenance and Inspection

- Daily inspection
  - 1. Check whether the pump operates smoothly and without any abnormal noise or vibration.
  - 2. Check the level of the liquid in the solution supply tank.
  - 3. Check the pump and piping for leakages.
  - 4. Check the drive unit for oil loss and leakage.
  - 5. Compare the discharge pressure and electric current measured during operation with the values indicated on the motor nameplate for verification of normal pump load.
    - Note that the values indicated on the pressure gauge vary in proportion to the specific gravity of the liquid. The valve to the pressure gauge must be opened only when measurement is carried out. It must be closed upon the completion of each measurement. If the valve remains open during pump operation, the meter mechanism in the gauge may be affected or damaged by noise or vibration.
  - 6. If a spare pump is available, activate it from time to time to keep it ready for use any time. Check to be sure there are no leaks from the pump before operating it. If leakage is detected, never try to operate the pump.
  - 7. Check to be sure the discharge pressure, discharge flow rate, and motor power supply voltage do not fluctuate during pump operation. If considerable fluctuation is observed, refer to the Troubleshooting section for corrective measures.

#### Periodic inspection

To ensure efficient and smooth operation of the pump, periodically inspect the pump and installation. When inspecting, overhauling, or if repair is necessary, stop the pump operation and contact the supplier as necessary.

The overhauling and repair work for Walchem pumps must be performed by qualified personnel who have been trained and certified by the pump supplier. User's failure to observe this instruction exempts Walchem from the responsibility for personal injury or damage to the equipment or facility that result from its misuse.

#### 1. Valve Unit

Check the valve balls, valve seats and valve guides every 6 months. If flaws or worn parts are found, replace them.

2. Diaphragm

Check the diaphragm every 6 months if the usage is fairly light. The life of the diaphragm depends on the characteristics, pressure, temperature, etc. of the liquid being pumped. If any deformation or crack is found, the diaphragm should be replaced with a new one.

3. Oil

Change the oil in the drive unit once a year. If emulsification of the oil is found during inspection, immediately change the oil. Remove the drain plug and drain the drive unit. Flush the inside with oil to clean it. Then, add new oil up to the specified level of the oil gauge. Ensure any replacement oil is SAE (80W-90) and must exceed API Service GL-4.

Model	Oil Qty	Recommended Oil
LKN	7.44oz	Esso (Exxon) GP80W-90, Shell Spirax/EP80,
	(220 mL)	Mobil Pegasus Gear Oil 80
		(Automobile Gear Oil SAE-80, API Grade GL-4),
		Castrol Hypoy Gear Oil

Contact your Walchem distributor if the oil listed above is unavailable. Use of incorrect oil may shorten the life-term of the gear unit.



#### **Spare Parts** 13

If downtime is critical, it is recommended to always maintain a stand-by pump and a spare parts kit if the pump is being used continuously.

Recommended Spare Parts	Estimated Service Life
Valve, Valve guide, Valve seat	12 months (life is dependent on the
	characteristics of liquid being pumped)
O-ring and Gasket	12 months (o-rings and gaskets shall be replaced at each disassembly)
Diaphragm	4,000 hrs (life is dependent on the discharge pressure, liquid, temperature, etc.)
Drive unit	3 years

Note: The above service life figures are only estimates and not a guarantee. Actual application will determine pump life.

#### **Disassembly and Assembly** 14

Refer to exploded view of the model corresponding to your pump. The views are shown in Section 4 - Exploded View and Parts List.

# Caution • Before disassembling/assembling the pump, to turn off the main power supply. Display a "WORKING" sign near the power switch to let other personnel know the situation. Accidental power ON initiated by an other person may result in an accident. The operator must take special precautions to prevent this situation.

- Prior to disassembly or assembly, close the suction valve and discharge valve fully.
- The piping and the pump often retain liquid. When working around a dangerous liquid, wear appropriate protection (goggles, rubber gloves, etc.) when disconnecting the pipes and decontaminating the pump.

#### Disassembly

1. Disassemble only after thoroughly decontaminating the pump by flushing and cleaning the piping and the inside of the pump.



### Warning

Wear protection (goggles, rubber gloves, etc.). Certain liquids are dangerous and may hurt your eyes and skin.

2. Remove the discharge and suction piping.



### Caution

Close the suction valve and discharge valve fully, prior to removing the discharge and suction piping.

#### • Valve

- Remove the suction and discharge fitting by loosening the nut (50).
   Remove the adapter (6) if any, and take out the valve (2), valve guide (3), valve seat (4), valve gasket (5) and O-ring (7). If the pump head is made of stainless steel, the valve assembly can be taken out by loosening the setting flange (54) or the nuts (81).
- 2. Check the valve and valve seat. If they are damaged or worn, replace with a new ones. It is highly recommended to replace the gasket and O-ring every time the liquid end is disassembled.

#### • Diaphragm

- 1. Loosen the hex head or socket head cap bolts (20).
- 2. Remove the pump head (1).
- Connect power supply and run the motor temporarily (without the liquid end).
   Set stroke length to 100%. Turn off when the diaphragm comes to the top dead center (when the diaphragm is most extended).
   Disconnect power supply.

## Caution

Do not touch any moving parts during operation.







Hex head bolt (20)

4. Remove the diaphragm from the pump shaft by turning the diaphragm counterclockwise with hand. If it is worn or deformed part in any way, replace it with a new one

5. Attach the new diaphragm firmly to the pump shaft by turning it clockwise by hand (hand tighten only, no tools). Confirm that the retainer (31) is sitting correctly around the diaphragm insert bolt and rests against the end of the pump shaft. If the position of the pump shaft moves during reassembly of the diaphragm, set it at top dead center, following the above procedure #3.



#### Assembly

The pump should be assembled by carrying out the steps of disassembly in reverse. Pay special attention to the following points:

#### • Valve

1. Replacement of o-ring and gasket

Replace the o-ring or gasket, with a new one. Additionally, ensure that the o-ring or gasket is not twisted or pinched between parts.

- \* The sealing section should be free of dust or scratches before installation.
- 2. Assemble the valve assembly by reversing the procedure, taking special care with the direction and position of the valve guide, valve seat and valve gasket.



### Caution

If the direction or position of the valve guide, valve ball, or valve seat is incorrect, the pump will not pump and/or may be damaged.

3. When installing the LKN32 fiiting/nut (VC, VH, or VS type), use a spanner wrench to hold the adapter (6) then fasten the nut (50) by hand.



#### • Diaphragm

1. Connect power supply and temporarily run the motor, moving the diaphragm to the bottom dead center where the diaphragm is fully drawn back. Turn off motor.

# Caution

Only attach the head when the diaphragm is at bottom dead center. Premature diaphragm failure may occur if this step is not observed.

Do not touch any moving parts during operation.

2. Fit the pump head (1) to the bracket of the drive unit with the hex head or socket head cap bolts (20). Tighten all the bolts securely and uniformly.

#### **Tighening torque for bolts (20)**

	LKN 32	LKN 45, 47	LKN 55, 57
VC, VH, VS, TC	27 in-lbs (3.0 Nm)	106 in-lbs (12.0 Nm)	106 in-lbs (12.0 Nm)
S6	44 in-lbs (5.0 Nm)	106 in-lbs (12.0 Nm)	106 in-lbs (12.0 Nm)

FIVE BOYNTON ROAD TEL: 508-429-1110 HOPPING BROOK PARK FAX: 508-429-7433 HOLLISTON, MA 01746 USA Web: www.walchem.com

### SECTION 12f: SUBMERSIBLE MIXERS

### P&ID Item #: MI-0351, MI-0451, MI-0651

Unit Details: ABS RW300 Series Submersible Mixer Model RW3021-A17/6 2.3 Hp 3Ø/60Hz/460V

Manufacturer: ABS Pumps, Inc. 140 Pond View Drive Meriden, CT 06450 Phone: (203) 238-2700 Fax: (203) 238-0738 www.absgroup.com

Local Distributor/Contact:

ABS Pumps, Inc. 140 Pond View Drive Meriden, CT 06450 Phone: (203) 238-2700 Fax: (203) 238-0738 www.absgroup.com THIS PAGE INTENTIONALLY LEFT BLANK

# ABS submersible mixer RW 300

The compact ABS submersible mixers have been designed for a wide range of applications. The units are suitable to achieve flow pattern in large tanks and open waters for mixing and stirring applications.

#### Construction

The submersible mixer is designed as a compact, water pressuretight unit including propeller and integrally casted installation bracket for the attachment on the square guide tube. Different versions with a bracket for vertical angle adjustment or a flow ring can be chosen.

The mixers are available in two standard material versions: **EC = cast iron version, CR = stainless steel version** 

#### Motor

Squirrel cage, 3-phase, 6-pole 60 Hz, insulation class F (155 °C/311 °F), max. submergence 20 m (66 ft).

#### Propeller

Technically optimized, axially operating 2- or 3-blade propellers with very good self-cleaning effect for vibration-free operation. The propellers are designed to achieve high thrusts and therefore a high flow capacity in axial direction.

#### Solids deflection ring

The patented solids deflection ring protects the mechanical seal from damage by ingress of solid or fibrous matter.

#### Bearings

All bearings are lubricated-for-life and maintenance-free, with a calculated life time of more than 100,000 h.

#### Shaft sealing

Mechanical seal: Silicon carbide / Silicon carbide. O-Rings / lip seals: NBR.

#### Seal monitoring

DI-system with a sensor in the oil chamber.

**Temperature monitoring:** TCS-Thermo-Control-System with thermal sensors in the stator which open at 140 °C (284 °F).

Cable: 10 m (32.8 ft) sewage resistant CSM material. Type: H07RN.

**Options:** Explosion-proof version, flow ring, seals in viton, cable protection sleeve, PTC or PT 100 in the stator.

**Accessories:** Lifting bracket, vertical angle adjustment, shock absorber, vortex shield.

**Weight:** Without flow ring: 48/51 kg (106/112 lbs). With flow ring: 54/57 kg (119/126 lbs).



# Mixer Model: RW3021-A17/6

P&ID #: MI-0351, MI-0451, MI-0651

lotor data	m	)
Motor	A 17/6	A 32/6
Rated power (kW)	1.7 (2.3 hp)	3.2 (4.3 hp)
Rated current at 460 V (A)	4.3	8.8
Speed (min <sup>-1</sup> )	1111	1097
Motor efficiency (%)	72	73
Power factor	0.69	0.69

#### Mixer performance table

Hydraulic	Mixer power	Motor
No.	$\mathbf{P}_{\scriptscriptstyle P}$ in kW (hp)	kW (hp)
3021	<mark>(1.1 (1.5)</mark> )	1.7 (2.3)
3022	1.5 (2.0)	1.7 (2.3)
3031	1.7 (2.3)	3.2 (4.3)
3032	2.6 (3.5)	3.2 (4.3)
3041*	0.9 (1.2)	1.7 (2.3)
3042*	1.1 (1.5)	1.7 (2.3)
3051*	1.4 (1.9)	3.2 (4.3)
3052*	2.1 (2.8)	3.2 (4.3)

\*with flow ring

N

#### Material comparison: Europe / USA

EN 1561; EN-GJL-250	ASTM A48; Class 35 B
EN 1563; EN-GJS-400-18	ASTM A536, 60-40-18
1.4021	ASTM / AISI 420
1.4401	ASTM / AISI 316
DIN 17 445; 1.4408	ASTM / AISI CF-8M
1.4460	ASTM / AISI 329
DIN 17 440; 1.4571	ASTM / AISI 316 Ti

#### Materials

	$(\cdots \cdots $	
Part	EC (cast iron)	CR (stainless steel)
Motor housing	EN-GJL-250, painted	1.4571 (AISI 316)
Sliding bracket	EN-GJL-250/EN-GJS-400-18 painted, polyamide	1.4408 / polyamide (CF-8M)
Motor shaft	1.4021 (AISI 420)	1.4401 (AISI 316)
Propeller	2 1.4460 (AISI 329)	1.4460 (AISI 329)
Fasteners	<b>5</b> 1.4401 (AISI 316)	1.4401 (AISI 316)





ELECTRICAL						RW30		
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#### MOTOR SPECIFICATIONS 60Hz, 3 PHASE

MOTOR DESIGN	NEMA design B, induction squirrel cage motor, air filled		
MOTOR TYPE	Enclosed submersible		
INSULATION CLASS	Class F, rated at 155° C (311° F), 40° C (104° F) ambient plus 115° C (207° F) rise		
MOTOR PROTECTION ABS DI-sealminder detects moisture in the oil chamber.			
	Bimetallic switches in each phase of the stator windings provide thermal protection.		
	Motor and cable protection shall conform to the latest N.E.C. standards - National Electric		
	Code, article 430.		
<b>BI METALLIC TEMP TRIP</b>	140° C ± 5° C (284° F ± 9° F)		
SERVICE FACTOR	1.10		
VOLTAGE TOLERANCE	± 5%		

### MOTOR DATA 60Hz, 3 PHASE

MIXER MOTOR SIZE	OUTPUT POWER BHP (KW)	VOLTS	FULL LOAD AMPS	LOCKED ROTOR AMPS	NEMA CODE LETTER	INPUT POWER KW	POLE/ SPEED (RPM)
<mark>A17/6</mark>	<mark>2.3 (1.7)</mark>	208 230 <mark>460</mark> 575	9.5 8.6 <mark>4.3</mark> 3.4	36.8 32.0 <mark>16.0</mark> 12.8	F F F	2.4 2.4 <mark>2.4</mark> 2.4	6 / 1150 6 / 1150 <mark>6 / 1150</mark> 6 / 1150
A32/6	4.3 (3.2)	208 230 460 575	19.5 17.6 8.8 7.0	78.2 68.0 34.0 27.2	H H H	4.4 4.4 4.4 4.4	6 / 1150 6 / 1150 6 / 1150 6 / 1150 6 / 1150

MOTOR		POWER FACTOR		MOTOR EFFICIENCY			
SIZE	100% FL	75% FL	50% FL	100% FL	75% FL	50% FL	
A17/6	0.69	0.59	0.47	72.0	71.1	66.0	
A32/6	0.69	0.60	0.47	72.7	72.2	68.6	

#### CABLE SPECIFICATIONS

			CABLE #1			CAB	BLE #2	
MOTOR	VOLTAGE	STARTING	CABLE	OD	OD	CABLE	OD	OD
SIZE		METHOD	TYPE	Inch	mm	TYPE	Inch	mm
<mark>A17/6</mark>	208V	DOL	7GX1.5	0.59	15.1			
	230V	DOL	7GX1.5	0.59	15.1	None	None	None
	<mark>460V</mark>	DOL	7GX1.5	<mark>0.59</mark>	<mark>15.1</mark>			
	575V	DOL	7GX1.5	0.59	15.1			
A32/6	208V	DOL	7GX2.5	0.72	18.3			
	230V	DOL	7GX2.5	0.72	18.3	None	None	None
	460V	DOL	7GX1.5	0.59	15.1			
	575V	DOL	7GX1.5	0.59	15.1			

Standard cable length is 30 ft (10 m)




# ABS submersible mixer RW ABS submersible recirculation pumps RCP ABS flow booster SB-KA



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# Installation and Operating Instructions

# For ABS submersible mixer,

ABS submersible recirculation pumps and ABS flow booster SB-KA

RW 300	RW 400	RW 650	RW 900
RW 400 LW	RW 550 DM	RW 650 LW	
RCP 250	RCP 400	RCP 500	RCP 800
SB 1236 KA	SB 1237 KA		

ABS reserves the right to alter specifications due to technical developments !



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# abs



# 1 General

# 1.1 Introduction

These **Installation and Operating Instructions** and the separate booklet **Safety Hints** contain basic instructions and safety hints which must be observed during transport, installation and commissioning. For this reason it is essential that they are read by the installing technician as well as by relevant skilled operators or users. They should also be always available where the unit is installed.



Safety Instructions which might cause danger to life in case of non-observance have been specifically highlighted with the general danger symbol.



The presence of a dangerous voltage is identified with this safety symbol.



This symbol indicates the danger of an explosion occurring.

ATTENTION Appears at safety hints, the non-observance of which could damage the unit or affect its functioning.

# NOTE Used for important pieces of information.

Illustrations code; e.g. (3/2). The first digit refers to the figure no. and the second digit to the position in that figure.

# 1.2 Correct usage of the products

The ABS products have been designed and built in accordance with the latest technology and taking into account the relevant safety regulations. However improper usage could cause a danger to life or limb of the user of a third party or cause damage or function impairment to the unit itself and other items of value.

The ABS units should only be used if they are in perfect technical condition taking into account all safety requirements and conscious of the need to avoid potentially dangers. The contents **of the installation and operating instructions and the safety hints** must be applied! Any other usage (abnormal usage) or usage beyond that specified will be considered as non-compliance.

The manufacturer/supplier will not accept any responsibility for damage due to this. The risk is borne by the user. In case of doubt the entire scope of the planned application must be approved by ABS.

In the case of any faults arising, the ABS units should immediately be taken out of use and secured. The fault should be immediately rectified or, if necessary, contact your ABS service centre.

# 1.3 Application restrictions of RW/RCP/SB-KA

The RW/RCP can be supplied both as standard versions and in explosion-proof execution (ATEX II 2Gk Ex d IIB T4) for 50 Hz or FM (NEC 500. Class I, Division 1. Group C&D. T3C) approval for 60 Hz.

Limitations: Fluid temperature maximum 40 °C/(104 °F)

Immersion depth maximum 20 m/(65 ft)

ATTENTION If cable length is less than 20 m/65 ft the max. immersion depth reduces accordingly. In special cases an immersion depth greater than 20 m/65 ft is possible. In order to do this you need the written approval from the manufacturer ABS.



Pumping of flammable or explosive liquids with these pumps is not allowed!

Only explosion-proof executions may be used in hazardous areas!

# For the operation of units as explosion-proof execution the following applies:

In hazardous areas care must be taken that during switching on and operation of the unit it is submerged or under water. Other types of operation e.g. snore operation or dry running are not allowed!

# ATTENTION RW/RCP with Ex d IIB T4 approval are not equipped with a DI in the oil chamber.

#### ATTENTION RW 400/650 and RCP 400/500 with FM approval (NEC 500) can be equipped (as an option) with a special DI in the oil chamber. Due to the design this is not possible in RW 900 and RCP 800.

#### For the operation of ex-RW/RCP applies:

It must be ensured that the motor of the ex-RW/RCP is always fully submerged during start-up and operation!

The temperature monitoring of the ex-RW/RCP has to be carried out by bimetallic temperature limiters or thermistors according to DIN 44 081-150 connected to a suitable release device which is certified in accordance with EC directive 94/9/EC.

#### For the operation of EX-RW/RCP with frequency inverter applies:

Motors must have direct thermal protection devices fitted. These consist of temperature sensors (PTC DIN 44081-150) embedded in the windings. These must be connected to a suitable release device which is certified in accordance with EC directive 94/9/EC.

Machines designated as ex machines may never, without exception, be operated using a mains frequency that is greater than the maximum of 50 or 60 Hz as indicated on the nameplate.

# 1.4 Application areas

# 1.4.1 Application areas RW

The ABS submersible mixers (RW 300 to 900) with a water pressure-tight encapsulated submersible motor are high-class quality products with the following range of applications:

- Mixing
- Stirring
- Agitation

in municipal treatment plants, in industry and in agriculture.

LW - Version with special propeller for use in agriculture, DM - Version (Drilling Mud) with special propeller for drilling mud.

# 1.4.2 Application areas RCP

The ABS submersible recirculation pumps RCP (250 to 800) are fitted with water pressure tight encapsulated motors and are quality products suitable for use in the following areas:

- Pumping and recirculation of active sludge in treatment plants with nitrogen removal (nitrification/denitrification).
- Pumping of rain and surface water.



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# 1.4.3 Application areas SB-KA

The SB-KA was developed to meet the specific requirements of those treatment processes in which the biomass is not freely floating in the wastewater as "flakes", but builds a "biofilm" that is bound to the surface by biofilm carriers. One of the successful processes of this nature is the "Moving Bed<sup>™</sup>" process of the company AnoxKaldnes.

# 1.5 Identification code



\*Propeller type: 1 = Mixing propeller (only without flow ring); 2 = 2-blade trust propeller; 3 = 3-blade trust propeller; 4 = 2-blade trust propeller with flow ring; 5 = 3-blade trust propeller with flow ring;

7 = 3- blade special propeller for biofilm carrier process

Figure 1 Identification code RW/RCP/SB-KA

# 1.6 Technical data

The maximum noise level of the units of this series is  $\leq$  70 dB(A). In some types of installation it is possible that the noise level of 70 dB(A) or the measured noise level will be exceeded.

# ATTENTION The maximum fluid temperature for continuous operation is 40 °C/104 °F for a submerged unit.

# 1.6.2 Technical data RW 60 Hz

F	ropelle	r	1	Motor (60 Hz/460 V)							Installation							
Mixer type	Propeller diameter	Speed	Version with flow ring	Motor type	Rated power input P	Rated power output P <sub>2</sub>	Starting: Direct (D.O.L)	Starting: Star/Delta	Rated current at 460 V	Starting current at 460 V	Cable type** (Ex-and standard)	Temperature monitoring	Seal monitoring	FM (NEC 500)	Guide tube 🗆 60	Guide tube 🛛 100	Total weight (without flow ring)	Total weight (with flow ring)
	[mm]	[1/min]			[kW]	[kW]			[A]	[A]							[kg]	[kg]
RW 3021	<mark>300</mark>	<mark>(1111</mark>	0	<mark>A 17/6</mark>	<mark>2.36</mark>	<mark>1.7</mark>	•		<mark>4.3</mark>	<mark>15.5</mark>	1	•	•	0	•		<mark>48</mark>	<mark>54</mark>
RW 3022	300	1111	0	A 17/6	2.36	1.7	•		4.3	15.5	1	•	•	0	•		48	54
RW 3031	300	1097	0	A 32/6	4.4	3.2	•		8.8	24.8	1	•	٠	0	•		51	57
RW 3032	300	1097	0	A 32/6	4.4	3.2	•		8.8	24.8	1	•	•	0	•		51	57
RW 4021	400	858	0	A 35/8	4.6	3.5	•		8.7	38	1	٠	٠	0	•	0	96	102
RW 4022	400	858	0	A 35/8	4.6	3.5	•		8.7	38	1	•	٠	0	•	0	96	102
RW 4023	400	858	0	A 35/8	4.6	3.5	•		8.7	38	1	•	•	0	•	0	96	102
RW 4024	400	841	0	A 46/8	6.0	4.6		•	10.3	38	2	•	•	0	•	0	96	102
RW 4031	400	841	0	A 46/8	6.0	4.6		•	10.3	38	2	•	٠	0	•	0	96	102
RW 6521	580	571	0	A 60/12	8.0	6.0		•	17.5	50	2	•	•	0		•	150	168
RW 6522	580	571	0	A 60/12	8.0	6.0		•	17.5	50	2	•	•	0		•	150	168
RW 6531	650	567	0	A 90/12	11.5	9.0		•	23.9	52	2	•	•	0		•	180	198
RW 6532	650	567	0	A 90/12	11.5	9.0		•	23.9	52	2	•	•	0		•	180	198
RW 6533	650	567	0	A 90/12	11.5	9.0		•	23.9	52	2	•	٠	0		•	180	198
RW 6534	650	569	0	A 120/12	15.3	12.0		•	31.4	88	3	•	•	0		•	200	218
RW 6535	650	569	0	A 120/12	15.3	12.0		•	31.4	88	3	•	•	0		•	200	218
RW 9032	900	238 <sup>1</sup>	0	A 130/4	15.3	13.0		•	21.8	109	2	•	•*	0		•	180	258
RW 9033	900	238 <sup>1</sup>	0	A 130/4	15.3	13.0		•	21.8	109	2	•	•*	0		•	180	258
RW 9034	900	238 <sup>1</sup>	0	A 130/4	15.3	13.0		•	21.8	109	2	•	•*	0		•	180	258
RW 9035	900	238 <sup>1</sup>	0	A 170/4	19.8	17.0		•	29.4	165	3	•	•*	0		•	185	263
RW 9033	900	285 <sup>2</sup>	0	A 170/4	19.8	17.0		•	29.4	165	3	•	•*	0		•	185	263
RW 9034	900	285 <sup>2</sup>	0	A 250/4	28.8	25.0		•	41.7	229	4	•	•*	0		•	210	288
RW 9035	900	285 <sup>2</sup>	0	A 250/4	28.8	25.0		•	41.7	229	4	•	•*	0		•	210	288

 $P_1$  = Power input ;  $P_2$  = Power output

1= Propeller speed with gear ratio i=7; 2= Propeller speed with gear ratio i=6

• = Standard ; • = Option; •\* = Moisture ingress monitor in connection chamber instead of oil chamber.

\*\*Cable type: 10 m cable with free cable ends as standard: 1 = 1 x 7G x 1.5; 2 = 1 x 10G x 1.5; 3 = 1 x 10 x G x 2.5; 4 = 2 x 4G x 4 + 2 x 0.75





# 1.7 Dimensions and weights

NOTE

abs

The weights of the units can be obtained from the nameplate of the unit or from the table in section 1.6 Technical Data.

# 1.7.1 Dimensions RW

Dimension	RW 300 A15/28 (50 Hz) A17/32 (60 Hz)	RW 400 A30/40 (50 Hz) A35/46 (60 Hz)	RW 650 A50 (50 Hz) A60 (60 Hz)	RW 650 A75 (50 Hz) A90 (60 Hz)	RW 650 A100 (50 Hz) A120 (60 Hz)	RW 900 A110/150 (50 Hz) A130/170 (60 Hz)	RW 900 A220 (50 Hz) A250 (60 Hz)
D <sub>1</sub>	ø 300	ø 400	ø 650	ø 650	ø 650	ø 900	ø 900
D <sub>2</sub>	ø 462	ø 560	ø 810	ø 810	ø 810	ø 1150	ø 1150
d <sub>1</sub>	ø 158	ø 222.5	ø 262.5	ø 262.5	ø 262.5	ø 222.5	ø 222.5
H □ 60	264	262	-	-	-	-	-
H 🗆 100	-	306	306	306	306	306	306
h <sub>1</sub>	700	700	1100	1100	1100	1500	1500
L <sub>1</sub> □ 60	610	665	-	-	-	-	-
L <sub>1</sub> □ 100	-	700	830	970	970	1150	1250
L <sub>2</sub> □ 60	610	685	-	-	-	-	-
L <sub>2</sub> □ 100	-	720	850	990	990	1170	1270
I <sub>1</sub>	725	795	925	1065	1065	1240	1340
I <sub>2</sub> □ 60	-	300	-	-	-	-	-
I <sub>2</sub> □ 100	-	300	400	630	530	-	-
X <sub>1</sub> □ 60	230	360	-	-	-	-	-
X <sub>1</sub> □ 100	-	280	320	420	400	470	500
X <sub>2</sub> □ 60	264	300	-	-	-	-	-
X <sub>2</sub> □ 100	-	310	330	430	410	520	550



Figure 2 Dimensions RW

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# 1.7.2 Dimensions RCP



Figure 4 RCP 400

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abs

# abs

RW 300/400/650/900 | RCP 250/400/500/800 | SB 1200 KA



Figure 5 RCP 500





#### 1.7.3 Dimensions SB-KA





Figure 7 Bracket: Version for fixed angle 0°

Figure 8 Bracket: Version for different angle adjustment

# 1.8 Nameplate

We recommend that you record the data from the original nameplate *Figure 9* so that you can refer to the data at any time.



Figure 9 Nameplates 42242500/0225/0227/0242

# Legend

- 1 Address
- 2 Model designation
- 3 Item no.
- 4 Serial no.
- 5 Order no.
- 6 Year of manufacture [month/year]
- 7 Free reserve field
- 8 Nominal voltage
- 9 Nominal current
- 10 Frequency
- 11 Nema Code Letter (only at 60 Hz, e.g. H)
- 12 Power (uptake) [unit flexible]
- 13 Power (delivery) [unit flexible]
- 14 Speed [unit flexible]

- 15 Impeller/propeller-ø [unit flexible]
- 16 Max. ambient temperature [unit flexible]
- 17 Max. immersion depth [unit flexible]
- 18 Nominal discharge diameter [unit flexible]
- 19 Nominal flow rate [unit flexible]
- 20 Nominal delivery head [unit flexible]
- 21 Min. delivery head [unit flexible]
- 22 Max. delivery head [unit flexible]
- 23 Sound level
- 24 Weight (without attached parts) [unit flexible]
- 25 Insulation class
- 26 Motor efficiency class
- 27 Direction of rotation of motor shaft

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NOTE In all communication please state type of the unit, item and serial number.

#### NOTE Additional country specific nameplates possible.

# 2 Safety

The general and specific health and safety hints are described in detail in the separate booklet **Safety Hints**. If anything is not clear or you have any questions as to safety make certain to contact the manufacturer ABS.

# 3 Transport and storage

### 3.1 Transport



The unit must never be raised by the power cable.

Depending on the version, the units are fitted with a lifting hoop/eyelet, to which a chain can be fastened by means of shackles to transportation, installation or removal.



Take note of the entire weight of the unit (see nameplate Figure 7). The hoist and chain must be adequately dimensioned for the weight of the unit and must comply with the current valid safety regulations as well as good technical practice must be observed.



The unit should be protected from rolling over!



The unit is prepared for transportation by placing it on an adequately strong, completely horizontal surface taking care that it cannot topple over.



Do not stay or work in the swivel area of a suspended load!



The lifting hook height must take into consideration the entire height of the unit as well as the length of the lifting chain.

# 3.2 Transport securing devices

#### 3.2.1 Motor connection cable moisture protection

The motor connection cables are protected against the ingress of moisture along the cable by having the ends sealed at the works with protective covers.

#### ATTENTION These protective covers should only be removed immediately prior to connecting the pumps electrically.

Particular attention is necessary during storage or installation of units in locations, which could fill with water prior to laying and connection of the power cable of the motor. Please note that the cable ends, even where fitted with protective sleeves, cannot be immersed in water.

ATTENTION These protective covers only provide protection against water spray or similar and are not a water tight seal. The ends of the cables should not be immersed in water, otherwise moisture could enter the connection chamber of the motor.

NOTE If there is a possibility of water ingress then the cables should be secured so that the ends are above the maximum possible flood level.



#### ATTENTION Take care not to damage the cable or its insulation when doing this!

### 3.3 Storage of the units

- ATTENTION The ABS products must be protected from weather influences such as UV from direct sunlight, high humidity, aggressive dust emissions, mechanical damage, frost etc. The ABS original packaging with the relevant transport securing devices (where used) ensures optimum protection of the unit. If the units are exposed to temperatures under 0 °C/32 °F check that there is no water in the hydraulics, cooling system, or other spaces. In the case of heavy frosts, the units and cable should not be moved if possible. When storing under extreme conditions, e.g. in tropical or desert conditions suitable additional protective steps should be taken. We would be glad to advise you further.
- NOTE ABS units do not generally require any particular maintenance during storage. After long storage periods (after approx. one year), the transportation locking device on the motor shaft (not with all versions) should be disassembled. By rotating the shaft several times by hand, new lubricating oil or, depending on the version, a small amount of coolant (which also serves to cool or lubricate the mechanical seals) is applied to the sealing surfaces, thus ensuring perfect operation of the mechanical seals. The bearings supporting the motor shaft are maintenance-free.

# 4 Product description

# 4.1 General description

- Hydraulically optimized propeller with high wear resistance.
- The motor shaft is supported in lubricated-for-life maintenance-free ball bearings.
- The shaft is sealed on the medium side by means of a high quality mechanical seal, which is independent of direction of rotation.
- Oil chamber filled with lubricating oil (oil change not necessary).

# Motor

- Three phase squirrel cage motor.
- Rated voltage: 400 V 3~ 50 Hz/460 V 3~ 60 Hz.
- Other voltages available on request.
- Insulation class F = 155 °C/311 °F, Protection type IP68.
- Medium temperature for continuous operation: + 40 °C/104 °F.

#### Motor monitoring

• All motors are fitted with temperature monitors, which switch off the motor in the case of excessive temperatures. The sensors must be correctly wired into the control panel.

#### Seal monitoring

• The DI-electrode carries out the seal monitoring function and signals the ingress of moisture by means of a special electronic device (option).

# **Operation with frequency inverters**

• All RW/RCP/SB-KA, when suitably selected, can be used with frequency inverters. Observe the EMC-Directive and the installation and operating instructions of the inverter manufacturer!

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# RW 300/400/650/900 | RCP 250/400/500/800 | SB 1200 KA

4.2 Structural design RW/SB-KA

# 4.2.1 RW 300/400/650



# Figure 10 RW 300/400/650

# 4.2.2 RW 900/SB-KA



Figure 11 RW 900/SB-KA

# Legend

- 1 Bracket
- 2 Cable inlet
- 3 Connection chamber
- 4 Sealing of the motor chamber
- 5 Stator
- 6 Bracket with shackle
- 7 Stainless steel covering (Option)
- 8 Mechanical seal
- 9 Propeller boss
- 10 Propeller
- 11 Shaft unit with rotor and bearings
- 12 SD ring
- 13 Gear

# 4.3 Rinsing system for mechanical seal (Option)

By connecting a water supply to the unit the mechanical seal can be washed out or rinsed while in operation. This can prevent injurious deposits and premature wear, e.g. due to chemical reactions.

By exchanging the motor cover the rinsing system can be fitted later to the unit.



Figure 12 Rinsing system for mechanical seal



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RW 300/400/650/900 | RCP 250/400/500/800 | SB 1200 KA



# 4.4 Structural design RCP

4.4.1 RCP 400/500



4.4.2 RCP 800



# Legend

- 1 Shaft unit with rotor and bearings
- 2 Mechanical seal
- 3 Inlet cone
- 4 Lifting hook
- 5 Motorhousing
- 6 Stator
- 7 Connection chamber
- 8 Cable inlet
- 9 Propeller
- 10 SD ring
- 11 DI-electrode (seal monitor)
- 12 Sealing of motor chamber
- 13 Gear

# 4.5 Operation with frequency inverters

The stator design and the insulation grade of the motors from ABS means that they suitable for usage with frequency inverters. It is however essential that the following conditions are met when the motors are used with frequency inverters:

- The guidelines for EMC (electromagnetic compatibility) are complied with.
- Explosion-proof motors must be equipped with thermistors (PTC temperature sensors).
- Machines designated as ex machines may never, without exception, be operated using a mains frequency that is greater than the maximum of 50 or 60 Hz as indicated on the nameplate.
- Machines that are not designated as ex machines may only be operated using the mains frequency indicated on the nameplate. Greater frequencies can be used but only after consulting with and receiving permission from the ABS manufacturing plant.
- For operation of ex-motors on frequency inverters special requirements in relation to the tripping times of the thermo control elements, must be observed.
- The lowest frequency must be set so that it is not falling below 25 Hz.
- The maximum frequency must be set so the rated power of the motor is not exceeded.

Modern frequency inverters are using higher wave frequencies and a steeper rise on the flanks of the voltage wave. This means that motors losses and motor noise is reduced. Unfortunately these inverter output signals cause higher voltage spikes in the stator. Experience has shown that, depending on rated voltage and the length of the cable between the inverter and the motor, these voltage spikes can adversely affect the life of the motor. In order to avoid this, inverters of this type must equipped with sinus filters when used in the critical zone *(see Figure 15)*. The sinus filter chosen must be suitable for the inverter with regard to rated voltage, inverter wave frequency, rated current of the inverter and maximum inverter output frequency.

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#### RW 300/400/650/900 | RCP 250/400/500/800 | SB 1200 KA



Figure 15 Critical/non critical area

# 5 Installation

The safety hints in the previous sections must be observed!

# 5.1 Installation RW/SB-KA



Care must be taken that the connection cables are positioned that they cannot be caught up in the propeller blades and that they are not subjected to tension.



The electrical connection is carried out in accordance with section 5.8 Electrical connection.

NOTE

We recommend that ABS installation accessories be used for the installation of the RW mixer, RCP recirculation pumps and SB flow booster.

# 5.2 Propeller assembly (only for RW 900 and SB-KA)

The propellers of the RW mixer RW 900/SB-KA are supplied separately and must be fitted on site in accordance with the instructions below.

# ATTENTION Take care that the orientation of the lock washers is correct (Figure 17 Correct fitting position of the securing washers) and that the prescribed tightening torque is used!

- 1. Lightly grease propeller boss and shaft end.
- 2. Push on propeller (16/6).
- 3. Fit O-Ring (16/5).
- 4. Insert propeller washer (16/2).
- 5. Fit O-Ring (16/4).
- 6. Fit lock washers (16/3) taking care that orientation is correct (see Figure 17 Correct fitting position of the Nord-Lock<sup>®</sup> securing washers).
- 7. Tighten socket head screw (16/1) with torque of 56 Nm.



Figure 16 Propeller assembly

# Legend

- 1 Socket head screw
- 2 Propeller washer
- 3 Lock washers
- 4 O-Ring
- 5 O-Ring
- 6 Propeller
- 7 Key (already fitted at factory)
- 8 Seal (already fitted at factory)

# 5.3 Tightening torque



Figure 17 (	Correct fitting	position of	of the	Nord-Lock®	securing	washers
-------------	-----------------	-------------	--------	------------	----------	---------

Tightening torque for ABS stainless steel screws A4-70:							
Thread	M6	M8	M10	M12	M16	M20	M24
Tightening torque	6.9 Nm	17 Nm	33 Nm	56 Nm	136 Nm	267 Nm	460 Nm

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RW 300/400/650/900 | RCP 250/400/500/800 | SB 1200 KA

#### 5.4 Installation examples RW/SB-KA

### 5.4.1 Installation example with existing accessories

We recommend that the closed bracket be used for this type of installation (See Figure 23 Closed bracket).



Figure 18 Installation example with exising accessories

# Legend

- 1 Hoist with winch and rope
- 2 Upper bracket with locking plate
- 3 Closed bracket
- 4 Bottom plate
- 5 Safety stop clamp
- 6 Swivelling square guide tube
- 7 Cable clamp with cable hook
- 8 Stop for vibration damper (option)



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# 5.4.2 Installation example with alternative fixing possibilities

We recommend that the open bracket be used for this type of installation (See Figure 23 Open bracket).



Figure 19 Installation example with alternative fixing possibilities

# Legend

- 1 Transportable lifting unit
- 2 Swivel handle
- 3 Socket (fixed installed)
- 4 Swivelling square guide tube
- 5 Swivelling wall mounted bracket
- 6 Open bracket
- 7 Cable clamp with cable hook
- 8 Rope block

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# 5.4.3 Installation example with fixed installation as flow booster

We recommend that the open bracket be used for this type of installation (See Figure 23 Open bracket).



Figure 20 Installation example with fixed installation as flow booster

# Legend

- 1 Rope block
- 2 Tube retainer
- 3 Cable clamp with cable hook
- 4 ABS lifting unit 5 kN
- 5 Square guide tube
- 6 Open bracket
- 7 Vibration damper
- 8 Tube connector
- 9 Bottom plate



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# 5.4.4 Installationsbeispiel SB-KA

We recommend that the open bracket be used for this type of installation (See Figure 23 Open bracket).



Figure 21 Installation example as flow booster for biofilm carriers.

# 5.4.5 Fixed installation with vibration damper

If the mixer is to be installed at a fixed point in the tank, then we recommend that the console with the vibration damper be used. In this case a further square tube must be used as a console at the guide tube. The vibration damper for the relevant mixer can be ordered, *see table below:* 

#### Vibration damper listing

Mixer	Part no.
RW 300	-
RW 400	6 162 0019
RW 650	6 162 0020 (A50/12, A 60/12). 6 162 0027 (A75/12, A 90/12, A100/12, A 120/12)
RW 900/SB-KA	Standard
RW 400/650	RW 900/SB-KA



Figure 22 Fixed installation with vibration damper



### 5.5 Brackets RW/SB-KA

Brackets which can be swivelled vertically (only optional) are available for both open and closed models of the brackets for all mixers of the series RW 300 to 900/SB-KA.



open



Figure 23 Open bracket/closed bracket

#### 5.5.1 Fitting of the open bracket with vertical swivelling (option)



Figure 24 Open bracket with vertical swivelling

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#### 30 Installation and Operating Instructions

RW 300/400/650/900 | RCP 250/400/500/800 | SB 1200 KA

# Legend

- 1 Bracket
- 2 Cladding
- 3 Threaded inserts
- 4 Hex bolts
- 5 Roller
- 6 Strap

- 7 Flat head screw
- 8 Tube
- 9 Washer
- 10 Hex nut
- 11 Socket head screw
- 12 Hinge bolt

# 5.5.2 Fitting of the closed bracket with vertical swivelling (option)



Figure 25 Closed bracket with vertical swivelling

# Legend

- 1 Bracket
- 2 Cladding
- 3 Roller
- 4 Bolt short
- 5 Linch pin
- 6 Strap

- 7 Bolt long
- 8 Washer
- 9 Hex nut
- 10 Threaded insert
- 11 Socket head screw

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abs

13 Linch pin



0551-0024

The mixer must be set up freely suspended with bracket fully mounted so that the bracket points vertically towards the ground (See Figure 26). When doing this the clamp of the mixer should be moved until the desired slope of the mixer is achieved (See Figure 26). This ensures that the mixer can slide up and down easily on the guide tube after it is fitted.



Figure 26 Setting up with fully mounted bracket

# 5.6 Guide tube lengths (square tube) RW/SB-KA

The table below shows the maximum lengths of the guide tubes - based on the maximum allowable bending 1/300 th. of the length of the guide tubes. These values have been determined in clean water of density 1000 kg/m<sup>3</sup> for the maximum trust of the most powerful mixer/flow booster in each series.



# 32 Installation and Operating Instructions

RW 300/400/650/900 | RCP 250/400/500/800 | SB 1200 KA

# 5.7 Installation RCP

# 5.7.1 Installation example with ABS lifting unit



Figure 27 Installation example with ABS lifting unit 5 kN

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### 5.7.2 Guide tube installation

The safety hints in the previous sections must be observed!

# ATTENTION

The discharge line and the required flange DIN EN 1092-1 PN6 should be installed on site before starting the installation of the guide tube. The DIN-flange should be installed so that none of the holes in the flange are on the axis line but are symmetrically on either side of it. Ensure that the DIN flange is securely fixed in the concrete.



Figure 28 Guide tube installation

• Place bracket (28/6) on the DIN-flange (28/9) and fasten using hex nuts (28/7) together with spring washers (28/8) and the special nuts (28/10).

# ATTENTION The flattened edge of the special nuts (28/10) must point towards the flange centre.

- Position the tube retainer (28/1) vertically over the bracket (28/6). Mount with the aid of the wall plugs (28/4) but do not tighten yet!
- Place the guide tube (28/5) alongside the conical section of the bracket (28/6) and determine the required length. To do this measure the upper edge of the tube retainer (28/1).
- Cut the guide tube (28/5) to the required length and place it on the conical portion of the bracket (28/6).
- Press the tube retainer (28/1) into the guide tube (28/5), so that no vertical play remains. Now tighten the hex screws (28/3) using the spring washers.

# 5.7.3 Securing and positioning of the motor connection cables of the RCP

The safety hints in the previous sections must be observed!



NOTE

# The cable holders described here are not supplied as part of the standard execution of the RCP.



Figure 29 Securing and positioning of the motor connection cables of the RCP

- Place the cable holder (29/2) with rubber sleeve (29/3) on the connection cable close to the RCP itself and tighten using hex screw (29/1).
- Connect the snap hook (29/4) to the cable holder (29/2) and attach to the wire rope or chain.



Care must be taken that the connection cables are positioned that they cannot be caught up in the propeller blades and that they are not subjected to tension.

- Assemble all other cable holders in a similar manner. The spacing can be increased as the distance from the RCP increases.
- Hang the connection cable into the cable hook using the strain relief (29/7).



The electrical connection is carried out in accordance with section 5.8 Electrical connection.



# 5.7.4 Lowering of the RCP along the guide tube



The safety hints in the previous sections must be observed!

The RCP together with the guide piece is connected into the guide tube as *shown in the Figure below* and lowered along it until it automatically sits in it's final position. When doing this carefully feed the power cable downwards at the same time.

# ATTENTION The power cable should be connected to the wire rope or chain in such a manner that it cannot become entangled in the propeller and that it is not subjected to any tension.

After lowering of the RCP the tension of the wire rope or the chain should be released.



Figure 30 RCP lowering/RCP connected





Before commissioning an expert should check that one of the necessary electrical protective devices is available. Earthing, neutral, earth leakage circuit breakers, etc. must comply with the regulations of the local electricity supply authority and a qualified person should check that these are in perfect order.

## ATTENTION The power supply system on site must comply with VDE or other local regulations with regard to cross-sectional area and maximum voltage drop. The voltage stated on the nameplate of the pump must correspond to that of the mains



The incoming power supply as well as the connection of the unit itself to the terminals on the control panel must comply with the circuit diagram of the control panel as well as the motor connection diagrams and must be carried out by a qualified person.

The power supply cable must be protected by an adequately dimensioned slow-blow fuse corresponding to the rated power of the unit.

In pump stations/tanks potential bonding must be carried out in accordance with VDE 0190 (Regulations for the installation of pipe lines, protective measures in power plants).

In the case of units supplied with a standard control panel this must be protected from dampness and installed above flood level by means of a correctly fitted CEE earthed socket.

ATTENTION The only method of starting allowed is that specified in chapter 1.6 Technical data or on the nameplate. If you want to use other starting methods please consult the manufacturer.

In the case a control panel is not supplied as standard the following applies: The unit must only be operated with a motor protection switch with overload relay and thermal sensors connected.





### 5.8.1 Standard connection diagrams. mains voltage 380 - 420 V at 50 Hz/460 V at 60 Hz



-003	50 Hz	60 Hz
055	A 15/6	A 17/6
	A 28/6	A 32/6
	A 30/8	A 35/8

Figure 31 One power cable with integrated control leads (internal connection in the motor only for M or A-motor < 3 kW)



Figure 32 One power cable with integrated control leads



Figure 33 Two power cables with integrated control leads

# 5.8.2 Lead designations

	ę.	33				
	L1	L2	L3	Join		n-700
North America	1	2	3	4 & 5 & 6	4 U2	5
ABS/Germany	U1	V1	W1	U2 & V2 & W2	3 W1 V1 2 W1 V1 2	
	D	irect starting in del	ta		34	ŧ,
	L1	L2	L3	-	W2 <b>/ 1</b> U1	002-00
North America	1; 6	2; 4	3; 5	-		>
ABS/Germany	U1; W2	V1; U2	W1; V2	-	$\begin{array}{c c} W1 & U2 \\ 3 & U2 \\ 5 & V2 & V1^2 \end{array}$	



The thermal monitoring circuit (F1) must be wired into the motor contactors in such a manner that a manual reset is required.

# ATTENTION The temperature limiting switches may only be operated as specified by the manufacturer (See following table).

Operating voltageAC/DC	500 V ~/101 V=
Rated voltage AC	250 V
Rated current <b>AC cos φ = 1.0</b>	2.5 A
Rated current <b>AC cos φ = 0.6</b>	1.6 A
Max. switching current at I <sub>N</sub>	5.0 A

# 5.8.3 Soft starter (Option)

For units > 15 kW we recommend the use of soft starter.

# ATTENTION The units must be connected DOL when used with soft starters.



Figure 34 Wiring diagram with soft starter (option)



Figure 35 Testing and adjustment of soft starter

#### Testing and adjustment of soft starter:

#### ATTENTION For the first test adjust the potentiometer in position C.

For further information consult the installation and operating instructions of the soft start manufacturer. These are supplied with the unit.

# Test:

• First test with potentiometer setting "C".

# Setting:

- Set to the lowest possible starting torque (within the adjustment range possible).
- Set to the longest possible starting time (within the adjustment range possible).

#### 5.8.4 Checking direction of rotation

When the units are being commissioned for the first time and also when used on a new site, the direction of rotation must be carefully checked by a qualified person.

The direction of rotation (propeller rotation) is correct if the propeller when viewed from the rear over the motor housing rotates in a clockwise manner (*See arrow*). This applies to all versions of the RW/RCP and SB-KA!



Figure 36 Checking direction of rotation



When checking the direction of rotation take care that no injury can be caused by the rotation of the propeller or the resulting airflow. Do not place a hand or other part of the body near the propeller or the hydraulics!


The direction of rotation should only be altered by a qualified person.

When carrying out the direction of rotation check as well as when starting the unit pay attention to the **Start reaction**. This can be very powerful.

## **NOTE** If a number of units are connected to a single control panel then each unit must be individually checked.

ATTENTION The mains supply in the control panel must have a clockwise sense of rotation. If the units are connected in accordance with the wiring diagram and the lead designations the direction of rotation will be correct.

#### 5.8.5 Changing direction of rotation



The safety hints in the previous sections must be observed!



Changing direction of rotation must only be carried out by a qualified person.

If the direction of rotation is incorrect then this is altered by changing over two phases of the power supply cable in the control panel. The direction of rotation should then be rechecked.

NOTE The direction of rotation measuring device monitors the direction of rotation of the mains supply or that of an emergency generator.





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0562-0039

#### 5.8.6 Connection of the seal monitoring unit to the control panel

The standard versions of the units are fitted as standard with DI seal monitors, which monitor the state of the sealing. In order to integrate the DI electrode into the control panel it is necessary to fit an ABS DI module and connect it in accordance with the wiring diagrams below.

#### ATTENTION If the DI-seal monitoring is activated the unit must be immediately taken out of service. Please contact your ABS service centre.



Figure 37 Electronic amplifier with signal lamp

Figure 38 Electronic amplifier with floating contact



Figure 39 Electronic amplifier with collective signalling

Electronic amplifier for 50 Hz		Electronic amplifier for 60 Hz		
110 V	(ArtNr./Part No.: 6 124 0113)	115 V	(ArtNr./Part No.: 6 124 0170)	
230 V	(ArtNr./Part No.: 6 124 0114)	230 V	(ArtNr./Part No.: 6 124 0171)	
400 V	(ArtNr./Part No.: 6 124 0115)	<mark>460 V</mark>	(ArtNr./Part No.: 6 124 0172)	
440 V	(ArtNr./Part No.: 6 124 0116)	575 V	(ArtNr./Part No.: 6 124 0173)	
		690 V	(ArtNr./Part No.: 6 124 0127)	

ATTENTION Maximum relay contact loading: 2 Ampere.

#### 6 Commisioning

The safety hints in the previous sections must be observed!

Before commissioning the unit should be checked and a functional test carried out. Particular attention should be paid to the following:

- Have the electrical connections been carried out in accordance with regulations?
- Have the thermal sensors/limiters been connected?
- Is the seal monitoring device (where fitted) correctly installed?
- Is the motor overload switch correctly set?
- Have the power and control circuit cables been correctly fitted?
- Has the motor connection cable been laid in such a manner that it cannot be caught up by the rotating body?
- Has the minimum submergence level been observed? (See Section 1.7 Dimensions and weights).

#### 6.1 Types of operation



B = Tank width; H = Water depth

Figure 40 Installation example with aeration

ATTENTION The illustration is only an example. For the correct installation please contact ABS.

ATTENTION Operation within the directly aerated area is not allowed!

ATTENTION The units must work fully submerged in the fluid. During operation no air should be drawn in by the propeller. Ensure that there is a smooth medium flow. The unit should not vibrate heavily when in operation.

#### Uneven flow formation and vibrations can occur if:

- Over active mixing in small tanks (only for RW/SB-KA).
- Prevention of free inflow or outflow in the area of the flow ring if fitted (only for RW). Changing the position or direction of the mixer may assist.
- Prevention of free inflow or outflow in the area of the guide cone (only for RCP).



#### 7 Maintenance

The safety hints in the previous sections must be observed!

In particular, the advice regarding maintenance in *paragraph 3.2* of the separate booklet Safety Instructions are to be observed.

#### 7.1 General maintenance hints



Before commencing any maintenance work the unit should be completely disconnected from the mains by a qualified person and care should be taken that it cannot be inadvertently switched back on.

NOTE

## The maintenance hints given here are not designed for "do-it-yourself" repairs as special technical knowledge is required.



Repair work on explosion-proof motors may only be carried out in approved workshops by approved personnel using original parts supplied by the manufacturer. Otherwise the ex-approvals no longer apply.

ABS units are reliable quality products each being subjected to careful final inspection. Lubricated-for-life ball bearings together with monitoring devices ensure optimum pump reliability provided that the unit has been connected and operated in accordance with the operating instructions.

Should, nevertheless, a malfunction occur, do not improvise but ask your ABS customer service department for assistance.

This applies particularly if the unit is continually switched off by the current overload in the control panel, by the thermal sensors/limiters of the thermo-control system or by the seal monitoring system (DI).

#### ATTENTION The lifting tools like chains and shackles should be visually checked in regular intervals (approx. every 3-month) for wear and corrosion. These parts should be replaced if required!

The ABS service organisation would be pleased to advise you on any applications you may have and to assist you in solving your aerating problems.

- NOTE The ABS warranty conditions are only valid provided that any repair work has been carried out in ABS approved workshops and where original ABS spare parts have been used.
- ATTENTION Regular checks are highly recommended and other checks are prescribed regulations after specific intervals. This ensures a long life time and trouble-free operation of the units (see section 7.2 Maintenance RW/RCP and SB-KA).

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#### 7.2 Maintenance RW/RCP and SB-KA



The safety hints in the previous sections must be observed!

Inspections carried through at regular intervals and preventive maintenance guarantee trouble-free operation. For this reason the complete unit should be cleaned thoroughly on a regular basis, maintained and inspected. For this purpose one has to take special care that all parts of the unit are in a good condition and that the operational security is guaranteed. The inspection period is determined by the type of usage of the units, but should however not exceed one year.

The maintenance and inspection work must be carried through corresponding to the subsequent inspection plan. The executed work must be documented in the attached inspection list. In case of non-observance the manufacturer's warranty does not apply!

#### 7.2.1 Faults

In addition to the maintenance and inspection tasks described in section 7.3 Inspection and maintenance intervals for RW/RCP and SB-KA an urgent check of the unit and installation should be carried out if heavy vibrations develop or uneven flow patterns occur.

#### Possible causes:

- Minimum liquid coverage of the propeller is not present.
- Aeration in the propeller area.
- Wrong direction of rotation of the propeller.
- Propeller is damaged.
- Restriction to the free inflow or outflow in the area of the RW flow ring.
- Restriction to the free inflow or outflow in the area of the RCP inflow cone.
- Parts of the Installation, such as bracket or coupling parts have become defective or become loose.

In these cases the unit should be immediately switched off and inspected. If no fault can be found or the fault remains after it has apparently been corrected the unit should be left switched off. The same applies also where the current overload in the control panel regularly trips, where the DI seal monitor or the temperature sensors in the stator are activated. We recommend that in such cases you contact the local ABS Service Centre.

#### 7.3 Inspection and maintenance intervals for RW/RCP and SB-KA

The safety hints in the previous sections must be observed!

PERIOD OF TIME:	Regulation: once a month
ACTIVITY:	Cleaning and inspection of the power and control circuit cables.
DESCRIPTION:	Once a month (more frequently - for example - in difficult application cases where the me- dium is heavily polluted with fibrous matter) the power and control circuit cables should be cleaned. In particular fibrous materials must be removed. Part of the regular maintenance is also the inspection of the motor cables. These must be checked for scratches, fissures, bub- bles or crushing.
MEASURE:	Damaged power and control circuit cables must be replaced in all cases. Please contact your local ABS Service Centre.

## abs

RW 300/400/650/900 | RCP 250/400/500/800 | SB 1200 KA

PERIOD OF TIME:	Recommendation: once a month
ACTIVITY:	Check the current consumption at the ampere meter.
DESCRIPTION:	With normal operation the current consumption is constant; occasional current fluctuations result from the constitution of the material being mixed.
MEASURE:	If the current consumption is too high for a longer period during normal operation please contact your local ABS Service Centre.
PERIOD OF TIME:	Regulation: every 3 months
ACTIVITY:	Cleaning and inspection of the shackles and the lifting equipment.
DESCRIPTION:	Lift the unit out of the tank and clean it. Lifting equipment like hoists, shackles, wire ropes and wire clamps etc. must undergo a visual examination at regular intervals for wear and corrosion.
MEASURE:	Worn or damaged parts should be replaced. Please contact your local ABS Service Centre.
ACTIVITY:	Inspection of the propeller and the SD ring (Solids-Deflection-Ring).
DESCRIPTION:	The propeller should be inspected carefully. The propeller might show spots of rupture and wear due to strongly abrasive or aggressive mixing material. In both cases the flow formation is reduced considerably and the propeller must be replaced. The solids-deflection-ring must also be checked. If wear of scoring is visible on the propeller boss these parts must be replaced as well.
MEASURE:	If you find out any cases of the damage described above please contact your local ABS Service Centre.
PERIOD OF TIME:	Recommendation: every 6 months
ACTIVITY:	Insulation resistance check.
DESCRIPTION:	Within the scope of the maintenance work the insulation resistance of the motor winding should be measured every 4,000 hours, and/or at least once a year. If the proper insulation resistance level is not reached, moisture might have got into the motor.
DESCRIPTION: MEASURE:	Within the scope of the maintenance work the insulation resistance of the motor winding should be measured every 4,000 hours, and/or at least once a year. If the proper insulation resistance level is not reached, moisture might have got into the motor. The unit must be taken out of operation and may not be started again. Please contact your local ABS Service Centre.
DESCRIPTION: MEASURE: ACTIVITY:	Within the scope of the maintenance work the insulation resistance of the motor winding should be measured every 4,000 hours, and/or at least once a year. If the proper insulation resistance level is not reached, moisture might have got into the motor. The unit must be taken out of operation and may not be started again. Please contact your local ABS Service Centre. Functional testing of the monitoring devices.
DESCRIPTION: MEASURE: ACTIVITY: DESCRIPTION:	<ul> <li>Within the scope of the maintenance work the insulation resistance of the motor winding should be measured every 4,000 hours, and/or at least once a year. If the proper insulation resistance level is not reached, moisture might have got into the motor.</li> <li>The unit must be taken out of operation and may not be started again. Please contact your local ABS Service Centre.</li> <li>Functional testing of the monitoring devices.</li> <li>In the scope of the maintenance measures functional testing of all monitoring devices must be carried through every 4,000 hours and/or at least once a year. For these functional tests the unit must have cooled down to the ambient temperature. The electrical connecting line of the monitoring device must be disconnected at the control box. These measurements must be carried through by means of an ohmmeter at the respective cable ends.</li> </ul>
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DESCRIPTION: MEASURE: ACTIVITY: DESCRIPTION: MEASURE: PERIOD OF TIME: ACTIVITY: DESCRIPTION:	Within the scope of the maintenance work the insulation resistance of the motor winding should be measured every 4,000 hours, and/or at least once a year. If the proper insulation resistance level is not reached, moisture might have got into the motor. The unit must be taken out of operation and may not be started again. Please contact your local ABS Service Centre. Functional testing of the monitoring devices. In the scope of the maintenance measures functional testing of all monitoring devices must be carried through every 4,000 hours and/or at least once a year. For these functional tests the unit must have cooled down to the ambient temperature. The electrical connecting line of the monitoring device must be disconnected at the control box. These measurements must be carried through by means of an ohmmeter at the respective cable ends. In any case of any functional problems on the monitoring devices please contact your local ABS Service Centre. <b>Recommendation: once a year</b> Checking of the tightening torques of the screws and nuts. For safety reasons we recommend that all screws are checked for their perfect positioning once a year.

1.	Manufacturer:	ABS Production Lohmar GmbH	
		Scheiderhöher Str. 30-38	
		D- 53797 Lohmar	
2.	Year of production:		
3.	Serial no.:		
4.	Туре:		
5.	Check before first operation:	on:	by:

Recurring checks (at least once a year)					
Date	Remarks	Operating hours	Signature		Repaired on/by

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Recurring checks (at least once a year)					
Date	Remarks	Operating hours	Signature		Repaired on/by

GB 0551-C





I ABS Production Lohmar GmbH I Scheiderhöher Straße 30-38. D-53797 Lohmar. Germany I I Tel. +49 22 46 900 0 I Fax +49 22 46 900 200 I www.absgroup.com I

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#### SECTION 12g: PROCESS AIR COMPRESSOR

P&ID: Item #: CMP-1251

Unit Details: Portable Air Compressor, Electric, Vertical Tank Type, Voltage 115/230, Amps AC 15.0, HP 2.0, Free Air CFM @ 90 PSI 5.50, Free Air CFM @ 125 PSI 4.9, Max. Pressure (PSI) 135, Tank (Gal.) 20

Manufacturer:

Speedaire www.grainger.com/speedaire

Local Distributor/Contact:

Grainger, Branch: 097 125 John Hancock Rd. Taunton, MA 02780-1055 Phone: (508) 880-0067 Fax: (508) 823-6391 www.grainger.com

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printed September 19, 2011



http://www.grainger.com/Grainger/wwg/itemDetails.shtml



http://www.grainger.com/Grainger/wwg/itemDetails.shtml

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

# Speedaire<sup>®</sup> Portable Air Compressors

For Warranty & 5ervice call 1-888-606-5587 Do Not Return To Branch

#### Description

Air compressor units are intended to provide compressed air to power pneumatic tools and to operate spray guns. The pumps supplied are oil lubricated. A small amount of oil carryover is present in the compressed air stream. Applications requiring air free of oil or water should have the appropriate filter installed. The air compressor unit must be mounted on a solid floor or solid ground. Any other use of these units will void the warranty and the manufacturer will not be responsible for problems or damages resulting from such misuse.

#### Safety Guidelines

This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols.

#### **A DANGER**

hazardous situation which, if not avoided, WILL result in death or serious injury.v

**A WARNING** 

Warning indicates indicates

Danger indicates

potentially hazardous situation which, if not avoided, COULD result in death or serious injury.



Caution indicates

potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.

NOTICE

**Notice indicates** *important* 

information, that if not followed, may cause damage to equipment.

**NOTE:** Information that requires special attention.

#### Unpacking

After unpacking the unit, inspect carefully for any damage that may have occurred during transit. Make sure to tighten fittings, bolts, etc., before putting unit into service.

**A WARNING** Do not operate tool if damaged during shipping, handling or use. Damage could result in bursting and cause injury or property damage.

#### **General Safety Information**

CALIFORNIA PROPOSITION 65

**AWARNING** This product or its power cord may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Wash hands after handling.

### A WARNING You can

dust when you cut, sand, drill or grind materials such as

wood, paint, metal, concrete, cement, or other masonry. This dust often contains chemicals known to cause cancer, birth defects, or other reproductive harm. Wear protective gear.



#### Breathable Air Warning

This compressor/pump is NOT equipped and should NOT be used "as is" to supply breathing quality air. For any application of air for human consumption, you must fit the air compressor/pump with suitable in-line safety and alarm equipment. This additional equipment is necessary to properly filter and purify the air to meet minimal specifications for Grade D breathing as described in **Compressed Gas Association Commodity Specification G 7.1** - 1966, OSHA 29 CFR 1910. 134, and/or Canadian Standards Associations (CSA).

DISCLAIMER OF WARRANTIES IN THE EVENT THE COMPRESSOR IS USED FOR THE PURPOSE OF BREATHING AIR APPLICATION AND PROPER IN-LINE SAFETY AND ALARM EQUIPMENT IS NOT SIMULTANEOUSLY USED, EXISTING WARRANTIES ARE VOID, AND DAYTON ELECTRIC MFG. CO. DISCLAIMS ANY LIABILITY WHATSOEVER FOR ANY LOSS, PERSONAL INJURY OR DAMAGE.

#### GENERAL SAFETY

Since the air compressor and other components (material pump, spray guns, filters, lubricators, hoses, etc.) used, make up a high pressure pumping system, the following safety precautions must be observed at all times: NGLIS

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Form 556007



## Speedaire<sup>®</sup> Portable Air Compressors

#### **General Safety Information** (Continued)

1. Read all manuals included with this product carefully. Be thoroughly familiar with the controls and the proper use of the equipment.



- Follow all local electrical and safety codes as well as the United States National Electrical Codes (NEC) and Occupational Safety and Health Act (OSHA).
- 3. Only persons well acquainted with these rules of safe operation should be allowed to use the compressor.
- Keep visitors away and NEVER allow children in the work area.
- 5. Wear safety glasses and use hearing protection when operating the pump or unit.



- 6. Do not stand on or use the pump or unit as a handhold.
- 7. Before each use, inspect compressed air system and electrical components for signs of damage, deterioration, weakness or leakage. Repair or replace defective items before using.
- 8. Check all fasteners at frequent intervals for proper tightness.

Motors, **WARNING** electrical equipment and controls can cause electrical arcs that will ignite a flammable gas or

vapor. Never operate or repair in or near a flammable gas or vapor. Never store flammable liquids or gases in the vicinity of the compressor.

#### Never A WARNING operate

compressor without a beltquard. Compressors can start automatically without



warning. Personal injury or property damage could occur from contact with moving parts.

9. Do not wear loose clothing or jewelry that will get caught in the moving parts of the unit.

#### **A** CAUTION

Compressor parts may be hot even if the unit is stopped.



- 10. Keep fingers away from a running compressor; fast moving and hot parts will cause injury and/or burns.
- 11. If the equipment should start to abnormally vibrate, STOP the engine/ motor and check immediately for the cause. Vibration is generally a warning of trouble.
- 12. To reduce fire hazard, keep engine/ motor exterior free of oil, solvent, or excessive grease.

An ASME code safety **AWARNING** relief valve with a setting no higher than 150 psi MUST be installed in the tank for this compressor. The ASME safety valve must have sufficient flow and pressure ratings to protect the pressurized components from bursting.

See compressor

#### **A** CAUTION

specification decal for maximum operating pressure. Do not operate with pressure switch or pilot valves set higher than the maximum operating pressure.

13. Never attempt to adjust safety valve. Keep safety valve free from paint and other accumulations.

#### Never **A** DANGER attempt

to repair or modify a tank! Welding, drilling or any other modification will weaken the

tank resulting in damage from rupture or explosion. Always replace worn or damaged tanks.

2

#### Drain liquid from **A WARNING** tank daily.

- 14. Tanks rust from moisture build-up, which weakens the tank. Make sure to drain tank regularly and inspect periodically for unsafe conditions such as rust formation and corrosion.
- 15. Fast moving air will stir up dust and debris which may be harmful. Release air slowly when draining moisture or depressurizing the compressor system.

#### SPRAYING PRECAUTIONS

Do not **AWARNING** sprav flammable materials in vicinity of open flame or near ignition sources including the compressor unit.



- Do not smoke when spraying paint, insecticides, or other flammable substances.
- 17. Use a face mask/respirator when spraying and spray in a well ventilated area to prevent health and fire hazards.



- 18. Do not direct paint or other sprayed material at the compressor. Locate compressor as far away from the spraying area as possible to minimize overspray accumulation on the compressor.
- 19. When spraying or cleaning with solvents or toxic chemicals, follow the instructions provided by the chemical manufacturer.

#### **A WARNING**

Disconnect, tag and lock out power source, then release all pressure from the system



before attempting to install, service, relocate or perform any maintenance.





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### **Cast Iron Series**

#### Introduction

Refer to Figure 1a and Figure 1b to locate the following items.

**Pressure Switch** - Auto/Off Switch. On some models there is no manual switch. The switch is permanently in the auto mode. In the AUTO position, the compressor shuts off automatically when tank pressure reaches the maximum preset pressure. In the OFF position, the compressor will not operate. This switch should be in the OFF position when connecting or disconnecting the power cord from the electrical outlet or when changing air tools.

When the pressure switch turns the motor off you will hear air leaking out of the pressure switch unloader valve for a short time. This releases the air pressure from the discharge tube and allows the compressor to restart easier.

**Regulator** - The regulator controls the amount of air pressure in the air hose. The air hose is attached at the outlet of the regulator.

**ASME Safety Valve -** This valve automatically releases air if the tank pressure exceeds the preset maximum.

**Discharge Tube** - This tube carries compressed air from the pump to the check valve. This tube becomes very hot during use.

**A WARNING** To avoid the risk of severe burns, never touch the discharge tube.

**Check Valve** - One-way valve that allows air to enter the tank, but prevents air in the tank from flowing back into the compressor pump.

Handle - Designed to move the compressor.



**Belt Guard** - Covers the belt, motor pulley and flywheel.

A WARNING Never

compressor without a beltguard. This unit can start automatically without warning. Personal injury or property damage could occur from contact with moving parts.



**Tank Drain Valve -** This valve is located on the bottom of the tank. Use this valve to drain moisture from the tank daily to reduce the risk of corrosion.

Reduce tank pressure below 10 psi, then drain moisture from tank daily to avoid tank corrosion. Drain moisture from tank(s) by opening the drain valve located underneath the tank.

Tank Pressure Gauge - Indicates amount of air pressure stored in tank.

Hose Pressure Gauge - Indicates amount of air pressure in hose used to operate tools. This pressure is increased or decreased by the regulator.



## <u>SPEEDAIRE</u>

## Speedaire<sup>®</sup> Portable Air Compressors

#### Assembly

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#### Horizontal Tank Units Only Handle

- 1. Remove the handle screw from the tank baseplate, if preinstalled.
- 2. Insert handle into both sides of tank baseplate. Squeeze handle to fit into special openings in baseplate (See Figure 2).



- 3. Place a short piece of wood against end of handle and tap with a mallet or hammer until the hole in the handle lines up with the hole in the baseplate.
- 4. Insert and tighten the handle screw into the hole in the baseplate and through the handle. Make sure the screw goes through the handle.

#### WHEEL ASSEMBLY

The items marked with an asterisk (\*) in Figure 3 were shipped loose with the unit. Assemble as follows:

 Insert shoulder bolt through wheel hub with the bolt head on the opposite side of the protruding hub section.



- For the 8 inch diameter wheels, insert the shoulder bolt in the lowest hole of the tank axle iron and tightly secure with locknut.
- For the 10 inch diameter wheels, insert the shoulder bolt in the upper hole in the tank axle iron and tightly secure with the locknut. Repeat this step on the opposite side.

When assembled, the tank must sit level or slope slightly towards the tank drain valve to allow tank to drain properly.

#### VERTICAL TANK UNITS ONLY

#### HANDLE ASSEMBLY

Insert four handle screws through holes in handle and tighten to tank baseplate (See Figure 4).





#### FOOT ASSEMBLY The items marked with an asterisk (\*) were shipped loose with the unit (See Figure 5).

- Tilt unit to allow access to front foot and secure properly to ensure unit does not tip over.
- 2. Insert bolt through foot and bracket. The foot should be on the lower side of bracket.
- 3. Tightly secure with the lock nut. Repeat on opposite side.

#### WHEEL ASSEMBLY

The items marked with an asterisk (\*) were shipped loose with the unit (See Figure 5).

- Insert shoulder bolt through wheel hub. The bolt hex head should be on the opposite side of protruding hub center.
- 2. Feed the shoulder bolt through the hole on the tank axle iron and tightly secure with the locknut. Repeat on the opposite side.



### **Cast Iron Series**

#### Assembly (Continued) **OIL DRAIN EXTENSION**

Some models include an oil drain extension and cap (found with the owner's manual). Install the oil drain extension and cap before adding oil to the pump. To avoid oil leaks, it is highly recommended to apply Teflon® tape or plumber's putty to the threads on each end of the oil drain extension. Screw the cap onto one end of the extension. Remove the oil drain plug from the base of the pump and install the oil drain extension (See Figure 6).



NOTE: If your model is equipped with an oil sight glass, add oil to the fill line (See Figure 6).

#### LUBRICATION

#### **A** CAUTION

operating compressor.

#### THIS UNIT CONTAINS **NO OIL! Follow** lubrication instructions before

Synthetic oil has proven to provide superior lubrication and is recommended for Speedaire air compressors. Use 10W30 100% synthetic oil such as Mobil 1 (Stock No. 4F743). Single viscosity, ISO100 (SAE 30) non-detergent compressor oil such as Mobil Rarus<sup>®</sup> (Stock No. 4ZF21), can also be used. Both are available at your local Grainger branch.

Do not use NOTICE petroleum based automotive oil which has shown to increase carbon deposits on the valves, resulting in more frequent service and reduced life.

Model	Oil Capacity (approx.)
3JR85, 4TW29	11 oz.
4B227, 4YN50	11 oz.
4B228	12 oz.

#### WIRING

Local electrical wiring codes differ from area to area. Source wiring, plug and protector must be rated for at least the amperage and voltage indicated on your motor nameplate, and meet all electrical codes for this minimum. Use a slow blow fuse type T or a circuit breaker.

#### **A** CAUTION

Overheating, short-circuiting and fire damage will result from inadequate wiring.

NOTE: 120 volt, 15 amp units can be operated on a 120 volt 15 amp circuit under the following conditions:

- 1. No other electrical appliances or lights are connected to the same branch circuit.
- 2. Voltage supply is normal.
- 3. Circuit is equipped with a 15 amp circuit breaker or a 15 amp slow blow fuse type T (For Canada use Type D).

If the above conditions cannot be met or if nuisance tripping of the current protection device occurs, it may be necessary to operate the compressor

from a 120 volt 20 amp circuit. Some models convert to 240 volt operation, see DUAL VOLTAGE MOTOR.

#### GROUNDING INSTRUCTIONS

1. This product must be grounded. In the event of an electric short circuit, grounding reduces the risk of electrical shock by providing an escape wire for the electric current. Unit is equipped with a cord that has a grounding prong. It will fit one of the common outlet types shown in Figure 7. If plug will not fit in the desired outlet, have the outlet replaced by a qualified electrician.





grounding plug can result in a

- adapter. 2. If repair or replacement of the cord or plug is necessary, do not connect the
  - grounding wire to either flat blade terminal. The wire with insu lation having an outer surface that is green with or without yellow stripes is the grounding wire.



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## Speedaire<sup>®</sup> Portable Air Compressors

#### Assembly (Continued)

3. Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if in doubt as to whether the product is properly grounded. Do not modify the plug provided; if it will not fit the outlet, have the proper outlet installed by a qualified electrician.

#### PLUGS AND RECEPTACLES

- If the plug on the electrical cord of the unit is unfamiliar to you or will not fit your particular receptacle, Figure 7 will help you understand why by illustrating the different plugs and the voltages they are to be used with.
- 2. Make sure that the product is connected to an outlet having the same configuration as the plug.
- The receptacles must be connected to circuits rated to carry at least the voltage and amperages shown.
- 4. NEVER have a receptacle replaced with one of a higher amperage before determining the change can be made according to all electrical codes affecting your particular area. The installation should be made by a qualified electrician. If the products must be reconnected for use on different types of circuits, the re-connection should be made by qualified personne!.

## DUAL VOLTAGE MOTORS (SOME MODELS)

Dual voltage motors may be connected for either 120 volts or 240 volts. By comparing the plug on the cord with the receptacles shown in Figure 8, you can determine for which voltage your compressor is factory wired. Also check motor decal to change from low voltage to high voltage.

**All wiring must be** performed by a qualified electrician.

To change connections for alternate voltage:

- 1. Disconnect cord from power source
- 2 . Remove motor terminal cover.
- 3 Find connection diagram on back side of the cover or on motor nameplate and reconnect to desired voltage as indicated on diagram.

**A WARNING** *If you do not understand this wiring diagram you must find a qualified electrician that does understand wiring diagrams.* 

4 . Change plug to match voltage and current requirements.

**A WARNING** When converting to an alternate voltage, be sure the green ground wire of the cord connects to the ground pin of the plug and to the metal body of the pressure switch.

#### **Operation**

#### START-UP

NOTICE

with oil before startup. See Lubrication section.

This compressor

**A CAUTION** Do not attach air tools to open end of the hose until start-up is completed and the unit checks OK.

- 1. Remove the dipstick breather and fill pump to the proper oil level. See Lubrication Section.
- 2. Turn regulator knob clockwise to open air flow.
- 3. Turn pressure switch lever or knob to OFF position and plug in power cord.

4. Turn pressure switch lever or knob to AUTO position and run unit for 30 minutes to break in the pump parts (See Figure 8).



- 5. Turn regulator knob fully counterclockwise. Compressor will build to maximum preset pressure and shut off.
- Turn regulator knob clockwise to cause air to bleed off. Compressor will restart at preset pressure.
- Turn pressure switch lever or knob to OFF position and unplug power cord. Slowly turn regulator knob clockwise to allow all air pressure to be released. Do not proceed to the next step until the tank pressure reaches zero (0).
- Attach hose, then add chuck or other tool to open end of hose. Plug in power cord. Turn pressure switch lever to AUTO position. When full pressure is reached turn regulator knob clockwise until desired outlet pressure is achieved.
- 9. After use, turn pressure switch lever or knob to the Off position.

### **Cast Iron Series**

#### **Operation (Continued)**

10. If compressor is not used for a long time period, bleed air from line and use drain valve to drain water from the tank. Then, follow the maintenance schedule.

**NOTE:** Electric models are equipped with a pressure switch that automatically turns the motor OFF when the tank pressure reaches a preset level. After air is used from the tank and drops to a preset low level, the pressure switch automatically turns the motor back on.

#### Maintenance

#### **A WARNING**



before attempting to install, service, relocate or perform any maintenance.

All repairs should be performed by an authorized service representative.

#### FOR EFFICIENT OPERATION:

Perform the following test to verify free operation of the safety valve weekly and follow maintenance schedule.

 Pull ring on safety valve and allow the ring to snap back to normal position (See Figure 9). This valve automatically releases air if the tank pressure exceeds the preset maximum.



**A** CAUTION A large amount of fast moving air will be released if the safety valve is actuated with air pressure in the tank.

A DANGER Do not attempt to tamper with this valve. This valve should be checked occasionally. If air leaks after the ring has been released, or the valve is stuck and cannot be actuated by the ring, the safety valve must be replaced.

2. With motor OFF and unplugged or locked out, clean debris from motor, flywheel, tank, air lines and pump cooling fins.

#### **DRIVE BELTS**

Belts will stretch in normal use. Properly adjusted, a 5-pound force applied to the belt between the motor pulley and the pump will deflect the belt about 1/2 inch (See Figure 10).



TO ADJUST A SECTION DRIVE BELT:

- 1. Remove belt guard.
- 2. Loosen the four fasteners holding the motor to the baseplate.
- Shift the motor in the proper direction. The belt must be properly aligned when adjustment is made.
- 4. Adjust flywheel or motor pulley so that the belt runs straight.
- If necessary, use a gear puller to move the pulley on the motor shaft. Tighten setscrew after pulley is positioned.
- 6. Attach beit guard.

#### STORAGE

- 1. When not in use, store hose and compressor in a cool dry place.
- 2. Drain tanks of moisture and disconnect hose. Hang hose with open ends down to allow any moisture to drain.
- Protect the electrical cord from possible damage by winding the cord loosely around the handle of the unit or coiling the cord up.



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## Speedaire<sup>®</sup> Portable Air Compressors

E N G L I S H

#### MOISTURE IN COMPRESSED AIR

Moisture in compressed air will form into droplets as it comes from an air compressor pump. When humidity is high or when a compressor is in continuous use for an extended period of time, this moisture will collect in the tank. When using a paint spray or sandblast gun, this water will be carried from the tank through the hose, and out of the gun as droplets mixed with the spray material.

**IMPORTANT:** This condensation will cause water spots in a paint job, especially when spraying other than water based paints. If sandblasting, it will cause the sand to cake and clog the gun, rendering it ineffective. A filter or air dryer in the air line, located as near to the gun as possible, will help eliminate moisture.

#### 

#### TORQUE REQUIREMENTS

Model	<b>Compressor Head Bolts</b>	Bearing Cap Bolts
3JR85		
4TW29		
4B227	175 in-lbs to 225 in-lbs	50 in-ibs to 120 in-lbs
4B228		
4B229		

#### **Troubleshooting Chart**

Symptom	Possible Cause(s)	Corrective Action
Low discharge pressure	1. Air demand exceeds pump capacity	1. Reduce air demand or use a compressor with more capacity
	2. Air leaks	<ol> <li>Listen for escaping air. Apply soap solution to all fittings and connections. Bubbles will appear at points of leakage. Tighten or replace leaking fittings or connections</li> </ol>
	3. Restricted air intake	3. Clean the air filter element
	4. Blown gaskets	4. Replace any gaskets proven faulty on inspection
	5. Leaking or damaged valves	<ol> <li>Remove head and inspect for valve breakage, misaligned valves, damaged valve seats, etc. Replace defective parts and reassemble</li> </ol>
		<b>A CAUTION</b> Install a new head gasket each time head is removed

## **Cast Iron Series**

Troubleshooting Chart (C	Continued)	
Symptom	Possible Cause(s)	Corrective Action
Pump overheating causes air filter to melt	<ol> <li>Insulating gasket between filter and head is missing</li> <li>Broken valves/blown gasket</li> </ol>	1. Install gasket 2. Replace valves or install new gasket
Excessive noise (knocking)	1. Loose motor or compressor pulley	<ol> <li>Loose motor or compressor pulleys are a very common cause of compressors knocking. Tighten pulley clamp boits and set-screws</li> </ol>
	2. Lack of oil in crankcase	<ol><li>Check for proper oil level; if low, check for possible damage to bearings. Dirty oil can cause excessive wear</li></ol>
	3. Worn connecting rod	3. Replace connecting rod. Maintain oil level and change oil more frequently
	4. Worn piston pin bores	<ol> <li>Remove piston assemblies from the compressor and inspect for excess wear. Replace excessively worn piston pin or pistons, as required. Maintain oil level and change oil more frequently</li> </ol>
	5. Piston hitting the valve plate	5. Remove the compressor head and valve plate and inspect for carbon deposits or other foreign matter on top of piston. Replace head and valve plate using new gasket. See Lubrication section for recommended oil
	6. Noisy check valve in	6. Replace
	compressor system	<b>A DANGER</b> Do not disassemble check valve with air pressure in tank
Large quanity of oil in the discharge air	1. Worn piston rings	<ol> <li>Replace with new rings. Maintain oil level and change oil more frequently</li> </ol>
<b>NOTE:</b> In an oil lubricated compressor there will always be	2. Compressor air intake restricted	2. Clean filter. Check for other restrictions in the intake system
a small amount of oil in the air stream.	3. Excessive oil in compressor 4. Wrong oil viscosity	3. Drain down to fuli level 4. Use Mobil 1® 10W-30
Water in discharge air/tank	Normal operation. The	1. Drain tank more often. At least daily
	amount of water increases with humid weather	2. Add a filter to reduce the amount of water in the air line
Motor hums and runs slowly or not at all	1. Use of extension cord	1. Do not use an extension cord. Use longer air hose with larger diameter
	2. Malfunctioning check	2. Replace check valve, unloader valve or pressure switch
	valve or unloader valve	A DANGER Do not disassemble check valve with air pressure in tank



**SPEEDAIRE** 

## Speedaire<sup>®</sup> Portable Air Compressors

H N G L I S H

Iroubleshooting Chart (Continued)
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Symptom	Possible Cause(s)	Corrective Action	
Motor hums and runs slowly or not at all (Continued)	3. Low voltage	<ol> <li>Check with voltmeter, check reset switch on motor. If reset switch trips repeatedly, find and correct the cause.</li> <li>See next item</li> </ol>	
	<ol> <li>Malfunctioning pressure switch - contacts will not close</li> </ol>	4. Repair or replace pressure switch	
Reset mechanism cuts out repeatedly or fuses blow	1. Too many devices on same circuit	1. Limit the circuit to the use of only the air compressor	
repeatedly	2. Incorrect fuse size or circuit breaker	2. Be sure that fuses or circuit breakers are rated properly	
	3. Malfunctioning check	3. Replace check valve	
	valve	<b>A DANGER</b> Do not disassemble check valve with air pressure in tank	
	4. Pressure switch set too high	4. Adjust or replace	
	5. Loose wiring	5. Check all electrical connections	
_	6. Malfunctioning motor	6. Replace motor	
Tank does not hold pressure	1. Worn check valve	1. Replace check valve	
when compressors off and the shut off valve is closed		<b>A DANGER</b> Do not disassemble check valve with air pressure in tank	
	<ol><li>Check all connections and fittings for leaks</li></ol>	2. Tighten	
	3. Check tank for cracks or pin holes	3. Replace tank. Never repair a damaged tank	
Pressure switch continuously blows air out the unloader valve	Malfunctioning check valve	Replace the check valve if the unloader valve bleeds off constantly	
		<b>A DANGER</b> Do not disassemble check valve with air pressure in tank	
Pressure switch does not release	Malfunctioning unloader	Replace the pressure switch if it does not release the	
air when the unit shuts off	valve on pressure switch	pressure for a short period of time when the unit shuts off         A DANGER         Do not disassemble pressure switch         with air pressure in tank	
Excessive vibration	1. Loose fasteners	1. Tighten	
	2. Belt needs replaced	2. Replace with correct size	
	3. Belt alignment	3. Align flywheel and pulley	



### Notes/Notas/Notes

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### Notes/Notas/Notes

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**Cast Iron Series** 

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

# Speedaire<sup>®</sup> Portable Air Compressors

*Refer to Form 551748 for General Operating and Safety Instructions For Warranty & Service call 1-888-606-5587 Do Not Return To Branch* 



Figure 1 – Model 3JR85E



Figure 2 – Model 4TW29C

#### **Specifications**

	Running	Number of	Free A	Air CFM		Bore	Stroke	Dime	nsions (ii	nches)	Mounting Working
Model	HP	Cylinders	@ 90 psi	@ Max psi	Tank Cap	(inches)	(inches)	L	w	н	Pressure
3JR85E	2	2	5.5	4.9	13 Gallons	2-3/4	2	28	18	27	135 psi
4TW29C	2	2	5.5	4.9	20 Gallons	2-3/4	2	31	21	38	135 psi

Printed in U.S.A. 04634 0410/042/VCPVP IN223907AV 4/10



## For Repair Parts, call 1-800-323-0620

#### 24 hours a day – 365 days a year

Please provide following information:

- Model number
- Serial number (if any)

- Part description and number as shown in parts list



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## Model 3JR85E

#### **Repair Parts List**

Ref. No.	Description	Part Number	Qty.
1	Tank		1
2	Drain valve	D-1403	1
3	Rubber foot	ST162600AV	2
4	5/16 inch - 18 Locknut	ST146001AV	10
5	Wheel	WA003900AV	2
6	Axle bolt	ST033400AV	2
7	Axle nut	ST033500AV	2
8	Handle	HL001801BH	1
9	Handle screw	ST073236AV	1
10	Pressure switch	CW209000AV	1
11	Strain relief	CW209500AV	1
12	Motor cord	EC012800AV	1
13	Strain relief screw	ST209800AV	1
14	Power cord	EC012601AV	1
15	ASME Safety valve	V-215105AV	1
16	1/4 inch Nipple	HF002401AV	2
17	Gauge	GA016300AV	2
18	Unloader	CW210001AV	1
19	Check valve	CV221502AJ	1
20	Ferrule	ST085200AV	1
21	Compression nut	ST033001AV	1
22	Discharge tube	VT035800AP	1
23	Push-in fitting	ST081301AV	1
24	Unloader tube	ST117801AV	1
25	Oil drain cap	ST149500AV	1
26	Oil drain extension	ST070350AV	1
27	Oil drain plug	ST022300AV	1
28 🔶	Pump	2WGX6	1
29	5/16 - 18 x 1-1/4 inch screw	ST016000AV	4
30	Compression assembly	ST018300AV	1
31	Belt guard (back)	BG217902AV	1
32	#10 - 24 x 5/16 inch Self-tapping screw	ST073277AV	3
33	Self-tapping screw 5 mm x 25 mm	ST073269AV	1
34	Flywheel	PU015900AJ	1
35	3/16 inch Key	KE000900AV	1
36	3/8 - 16 x 3/4 inch Setscrew	ST026200AV	1
37	Pulley	PU015200AV	1
38	1/4 - 20 x 1/2 inch Square head setscrew	ST012200AV	1
39	Beit	8T020400AV	1
40	Belt guard (front)	BG217800AV	1
41	Plascrew	ST058502AV	1
42	Electric Motor	MC0155025J	1
43	3/16 inch sq. x 1-1/4 inch Key	KE000903AV	2
44	5/16 inch - 18 Hex head screw	ST070692AV	4
45	5/16 inch Washer	ST011200AV	4
46	Regulator	RE206203AV	1
47	1/4 x 1/8 inch Reducer	ST071407AV	1
<u>48 </u>	Warning decals	DK747600AV	1

∆ ♦ Not shown

See compressor nameplate for exact model number when ordering pump repair parts.



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## For Repair Parts, call 1-800-323-0620

#### 24 hours a day – 365 days a year

- Please provide following information: Model number
- Serial number (if any)
- Part description and number as shown in parts list



### Model 4TW29C

#### **Repair Parts List**

No.         Deskription         Park Number Park Number Drain valve         Q1           1         Tank         AR065700CG         1           2         Drain valve         D-1403         1           1         Wheel         W004000AV         2           4         Axle bolt         \$1033400AV         2           5         Handle screw         \$1073273AV         4           6         Handle screw         \$1073273AV         4           7         Regulator         RE206203AV         1           8         Gauge         GA015505AV         1           9         14 inch Nipple         HF02401AV         1           1         Power cord         EC012601AV         1           13         Strain relief screw         \$1229800AV         1           14         Pressure switch         \$W209900AV         1           15         Unlaader         \$1010AAV         1           16         U/4 x18 inch Reducer         \$107147AV         1           17         Gauge         \$104147AV         1           16         U/4 x18 inch Reducer         \$1033001AV         1           17         Gauge         \$107147AV	Ref.			
1       Tank       AR065700CG       1         3       Wheel       D-1403       1         3       Wheel       WA004000AV       2         4       Axle bolt       \$1033400AV       2         5       Handle screw       \$1073273AV       4         6       Handle       \$1004000AV       1         7       Regulator       RE206203AV       1         9       14 Inch Nipple       \$1004000AV       1         9       14 Inch Nipple       \$1004000AV       1         9       14 Inch Nipple       \$1004000AV       1         10       ASME Safety Valve       \$215105AV       1         11       Proser cord       \$215105AV       1         12       Strain relief Screw       \$1209800AV       1         13       Strain relief Screw       \$1209800AV       1         14       Pressure switch       \$1209800AV       1         15       Inloader       \$109800AV       1         16       14/4 x1/8 inch Reducer       \$1071407AV       1         17       Gauge       \$6071407AV       1         14       Compression nut       \$1033001AV       1	No.	Description	Part Number	Qty.
2     Drain valve     D-1403     1       2     Axle bolt     ST0334000AV     2       3     Handle screw     ST033400AV     2       4     Axle bolt     ST033400AV     2       5     Handle screw     ST033400AV     2       6     Handle     HL00400AV     1       7     Regulator     RE206203AV     1       8     Gauge     GA015505AV     1       9     14 inch Nipple     HF002401AV     1       10     ASME Safety Valve     V-215105AV     1       11     Power cord     EC012601AV     1       12     Strain relief screw     ST029800AV     1       13     Strain relief screw     ST071407AV     1       14     Pressure switch     CW209500AV     1       15     Unloader     CW20900AV     1       16     U/4 x 1/8 inch Reducer     ST071407AV     1       17     Gauge     GA016300AV     1       18     Discharge tube     CV221502AV     1       20     Ferrule     ST033401AV     1       21     Check valve     CV221502AV     1       22     Push-in fitting     ST01301AV     1       24     #10 <t< td=""><td>1</td><td>Tank</td><td>AR065700CG</td><td>1</td></t<>	1	Tank	AR065700CG	1
3         Wheel         WA004000AV         2           4         Axle bolt         \$1033400AV         2           5         Handle screw         \$1073273AV         4           6         Handle         \$1004000AV         1           7         Regulator         \$20623AV         1           7         Regulator         \$20623AV         1           9         14 inch Nipple         \$1703273AV         4           10         ASME Safety Valve         \$215105AV         1           11         Power cord         \$20180AV         1           12         Strain relief facew         \$202980AV         1           13         Strain relief screw         \$120980AV         1           14         Pressure switch         \$202980AV         1           15         Unloader         \$107407AV         1           16         Tid X 18 inch Reducer         \$103300AV         1           17         Gauge         \$103200AV         1           18         Discharge tube         \$1044800AP         1           19         Compression nut         \$103300AV         1           20         Ferrule         \$103000AV         <	2	Drain valve	D-1403	1
4         Axle bolt         ST03200AV         2           6         Handle         HL004000AV         1           1         Regulator         RE206203AV         1           8         Gauge         GA01505AV         1           9         1/4 inch Nipple         HF002401AV         1           10         ASIME Safety Valve         V-215105AV         1           11         Power cord         EC012601AV         1           12         Strain relief         CW20950AV         1           13         Strain relief screw         ST03800AV         1           14         Mesure switch         CW20900AV         1           14         At 8 inch Reducer         ST071407AV         1           14         Strain relief screw         ST073800AV         1           14         Mesure switch         CW20900AV         1           14         Bischarge tube         CW1407AV         1           14         At 80 inch Reducer         ST0320AV         1           19         Compression nut         ST03820AV         1           21         Check valve         CV221502AI         1           22         Push-in fitting	3	Wheel	WA004000AV	2
5       Handle screw       ST03273AV       4         7       Regulator       RE206203AV       1         7       Regulator       RE206203AV       1         9       144 inch Nipple       H002401AV       1         10       ASME Safety Valve       V-215105AV       1         11       Power cord       EC012601AV       1         12       Strain relief screw       ST209800AV       1         13       Strain relief screw       ST209800AV       1         14       Pressure switch       CW20900AV       1         15       Unloader       CW210001AV       1         16       L/4 x 18 inch Reducer       ST071407AV       1         17       Gauge       GA016300AV       1         18       Discharge tube       VT048600AP       1         10       Compression nut       ST03301AV       1         21       Check valve       CV221502A       1         22       Push-in fitting       ST07327AV       3         23       Unloader tube       ST07327AV       1         24       Plascrew       ST07327AV       1         25       #10 - 24 - 576 inch Self tapping screw	4	Axle bolt	ST033400AV	2
6         Handle         HL04000AV         1           8         Gauge         GA01505AV         1           8         Gauge         GA01505AV         1           10         AKInch Nipple         HF002401AV         1           11         Power cord         EC012601AV         1           12         Strain relief         CM20950AV         1           13         Strain relief screw         ST209800AV         1           14         Pressure switch         CW219000AV         1           15         Unloader         CW219000AV         1           16         1/4 X16 inch Reducer         ST071407AV         1           17         Gauge         GA016300AV         1           18         Discharge tube         VT046600AV         1           19         Compression nut         ST038200AV         1           21         Check valve         CV221502AI         1           21         Push-in fitting         ST081301AV         1           23         Unloader tube         ST17802AV         1           24         Plascrew         ST03250AV         1           25         #10 - 24 - SF16 inch Self tapping screw	5	Handle screw	ST073273AV	4
7       Regulator       RE206203AV       1         9       14 inch Nipple       HF002401AV       1         9       14 inch Nipple       HF002401AV       1         11       Power cord       CW20500AV       1         12       Strain relief       CW20500AV       1         13       Strain relief screw       ST20800AV       1         14       Pressure switch       CW210001AV       1         15       Unitoader       CW210001AV       1         16       1/4 x 1/8 inch Reducer       ST01407AV       1         17       Gauge       GA016300AV       1         18       Discharge tube       VT046800AP       1         19       Compression nut       ST033001AV       1         20       Ferrule       ST033001AV       1         21       Check valve       CV221502AJ       1         22       Push-in fitting       ST013207AV       1         21       Check valve       ST073277AV       3         23       Self tapping screw 5 mm x 25 mm       ST07327AV       3         24       SH6 inch Self tapping screw       ST03259AV       1         27       Motor cord	6	Handle	HL004000AV	1
8         Gauge         GAUD         1           9         14 inch Nipple         HFI02401AV         1           10         ASME Safety Valve         V-211505AV         1           11         Power cord         EC012601AV         1           12         Strain relief         CW209500AV         1           13         Strain relief screw         ST20800AV         1           14         Pressure switch         CW209500AV         1           15         Unloader         CW209000AV         1           16         1/4 x 1/8 inch Reducer         ST071407AV         1           17         Gauge         GA016300AV         1           18         Discharge tube         VT046800AP         1           19         Compression nut         ST038001AV         1           21         Check valve         CV281301AV         1           22         Push-in fitting         ST083800AV         1           23         Unloader tube         ST013277AV         3           24         516 inch Self tapping screw         ST03277AV         3           25         FBIO - 24 - 576 inch Self tapping screw         ST03277AV         3           26 </td <td>7</td> <td>Regulator</td> <td>RE206203AV</td> <td>1</td>	7	Regulator	RE206203AV	1
9         14 inch Nipple         HF002401AV         1           0         ASME Safety Valve         V-215105AV         1           11         Power cord         EC012601AV         1           12         Strain relief         CW23600AV         1           13         Strain relief screw         ST209800AV         1           14         Pressure switch         CW210001AV         1           15         Unloader         CW210001AV         1           16         L/4 x 1/8 inch Reducer         ST07300AV         1           17         Gauge         GA016300AV         1           18         Discharge tube         VT045800AP         1           20         Ferrule         ST085200AV         1           21         Check valve         CV231001AV         1           22         Push-in fitting         ST081301AV         1           23         Unloader tube         ST1073269AV         1           24         Plascrew         ST073269AV         1           25         #10 - 24 - 5716 inch Self tapping screw         ST073269AV         1           26         Happing screw Smm 2 57073269AV         1         1           27	8	Gauge	GA015505AV	1
10     ASME Safety Valve     V-21505AV     1       12     Strain relief     CW209500AV     1       13     Strain relief screw     ST209800AV     1       14     Pressure switch     CW20900AV     1       15     Unloader     CW20900AV     1       16     1/4 x 1/8 inch Reducer     ST071407AV     1       17     Gauge     GA016300AV     1       18     Discharge tube     VT046800AP     1       19     Compression nut     ST083001AV     1       21     Ferrule     ST08200AV     1       22     Push-in fitting     ST0820AV     1       23     Unloader tube     CV221502AI     1       24     Plascrew     ST0820AV     1       25     #10 - 24 - 516 inch Self tapping screw     ST072277AV     3       26     Self tapping screw 5 mm x 25 mm     ST073227AV     3       26     Self tapping screw 5 mm x 25 mm     St073227AV     1       27     Beltguard (front)     B622200AV     1       28     Beltguard (fornt)     B6222200AV     1       39     Beltguard (fornt)     B6222200AV     1       39     Beltguard (fornt)     B6222200AV     1       31     Be	9	1/4 inch Nipple	HF002401AV	1
11       Power cord       EC012601AV       1         12       Strain relief screw       ST209800AV       1         13       Strain relief screw       ST209800AV       1         14       Pressure switch       CW209000AV       1         14       Pressure switch       CW210001AV       1         16       1/4 x 1/8 inch Reducer       ST07407AV       1         17       Gauge       GA016300AV       1         18       Discharge tube       VT046800AP       1         20       Ferrule       ST083200AV       1         21       Check valve       CV221502AI       1         22       Push-in fitting       ST081301AV       1         23       Unloader tube       ST17802AV       1         24       Placrew       ST073277AV       3         25       Fdt tapping screw       ST073277AV       3         26       Self tapping screw S mm 2       ST073277AV       3         27       Motor cord       ST15800AV       1         28       Rubber foot       ST15800AV       1         30       Beltguard (front)       BG22200AV       1         31       Beltguard (front) <td>10</td> <td>ASME Safety Valve</td> <td>V-215105AV</td> <td>1</td>	10	ASME Safety Valve	V-215105AV	1
12       Strain relief       CW209500AV       1         13       Strain relief screw       ST209800AV       1         14       Pressure switch       CW20900AV       1         15       Unloader       CW210001AV       1         15       Unloader       CW210001AV       1         16       1/4 X 1/8 inch Reducer       ST071407AV       1         17       Gauge       GA116300AV       1         18       Discharge tube       VT046800AP       1         19       Compression nut       ST033001AV       1         21       Check valve       CV221502AJ       1         21       Check valve       CV221502AJ       1         22       Push-in fitting       ST03802AV       1         23       Unloader tube       ST07327AV       3         24       Floi cuch Self tapping screw       ST07327AV       3         25       Floi 24- S16 inch Self tapping screw       ST03200AV       1         28       Rubber foot       ST158300AV       2         29       Beltguard (front)       BG222300AV       1         31       Belts       BT0300AV       1         32       PU015900AJ	11	Power cord	EC012601AV	1
13       Strain relief screw       ST209800AV       1         14       Presure switch       CW209000AV       1         14       Presure switch       CW210001AV       1         15       Unloader       ST001AV       1         16       1/4 x 1/8 inch Reducer       ST017407AV       1         17       Gauge       GA016300AV       1         18       Discharge tube       VT046800AP       1         20       Presteine       ST033001AV       1         21       Ccheck valve       CV21502A1       1         22       Push-in fitting       ST085200AV       1         21       Push-in fitting       ST081301AV       1         21       Push-in fitting       ST073277AV       3         23       #10-24 - 516 inch Self tapping screw       ST073267AV       1         24       Self tapping screw 5 mm x 25 mm       ST073267AV       1         27       Motor cord       EC012800AV       1         28       Betguard (front)       B6222200AV       1         29       Betguard (front)       B6222200AV       1         33       28 inch - 16 x 34 inch Setscrew       ST01280AV       1	12	Strain relief	CW209500AV	1
14     Pressure switch     CW209000AV     1       15     Unloader     CW209001AV     1       16     1/4 x 1/8 inch Reducer     ST071407AV     1       17     Gauge     GA016300AV     1       18     Discharge tube     VT046800AP     1       19     Compression nut     ST033001AV     1       21     Ferrule     ST082200AV     1       21     Check valve     CV221502AI     1       22     Push-in fitting     ST01702AV     1       23     Unloader tube     ST117802AV     1       24     Plascrew     ST073269AV     1       25     #10 - 24 - 5476 inch Self tapping screw     ST073269AV     1       28     Rubber foot     ST188300AV     2       29     Beltguard (front)     BG222200AV     1       31     Beltguard (front)     BG222200AV     1       32     Flowel     PU015200AV     1       33     38 inch - 16 x 34 inch Setscrew     ST026200AV     1       34     inch Key     PU015200AV     1       35     Pulley     PU015200AV     1       36     inch Aga anch Setscrew     ST012200AV     1       37     Motor Aga anch Setscrew     ST0180	13	Strain relief screw	ST209800AV	1
15       Unloader       CW210001AV       1         16       1/4 x 1/8 inch Reducer       ST071407AV       1         17       Gauge       GA016300AV       1         18       Discharge tube       VT046800AP       1         10       Compression nut       ST033001AV       1         20       Ferrule       ST085200AV       1         21       Check valve       CV221502A1       1         22       Push-in fitting       ST061301AV       1         23       Unloader tube       ST117802AV       1         24       Plascrew       ST053502AV       1         25       #10 - 24 - 576 inch Self tapping screw       ST073277AV       3         26       Self tapping screw       ST073269AV       1         27       Motor cord       EC012800AV       1         28       Rubber foot       ST153300AV       2         29       Beltguard (front)       B6222200AV       1         30       Beltguard (back)       BC22200AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015200AV       1         33       36 inch - 16 x 34 inch Setscre	14	Pressure switch	CW209000AV	1
16       1/4 x 1/8 inch Reducer       ST071407AV       1         17       Gauge       GA016300AV       1         18       Discharge tube       VT046800AP       1         19       Compression nut       ST033001AV       1         19       Ferrule       ST083001AV       1         21       Check valve       CV221502AJ       1         22       Push-in fitting       ST01301AV       1         23       Unloader tube       ST117802AV       1         24       Plascrew       ST073277AV       3         25       #10 - 24 - 576 inch Self tapping screw       ST073269AV       1         27       Motor cord       EC012800AV       1         28       Self tapping screw 5 mm x 25 mm       ST073269AV       1         29       Beltguard (front)       B6222200AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AV       1         33       34 inch - 16 x 34 inch 5etscrew       ST02200AV       1         33       Bit ch- 16 x 34 inch 5etscrew       ST01200AV       1         34       x36 inch - 18 Lex Aut       ST01400AV       1	15	Unloader	CW210001AV	1
17       Gauge       GA016300AV       1         18       Discharge tube       YT046800AP       1         19       Compression nut       ST033001AV       1         20       Ferrule       ST035200AV       1         21       Check valve       CV221502AJ       1         22       Push-in fitting       ST081301AV       1         23       Unloader tube       ST01302AV       1         24       Plaxcrew       ST035200AV       1         25       #10 - 24 - 516 inch Self tapping screw       ST05502AV       1         26       Self tapping screw 5 mm x 25 mm       ST073277AV       3         27       Motor cord       EC012800AV       1         28       Rubber foot       ST158300AV       2         29       Beltguard (front)       BG222200AV       1         30       Beltguard (back)       BG222200AV       1         31       Belt       BT03000AV       1         32       Flywheel       PU015900AJ       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       216 inch key       Electric motor       MC0159023J       1	16	1/4 x 1/8 inch Reducer	ST071407AV	1
18       Discharge tube       VT046800AP       1         19       Compression nut       ST033001AV       1         10       Ferrule       ST033001AV       1         21       Check valve       CV221502AJ       1         21       Push-in fitting       ST081301AV       1         23       Unloader tube       ST117802AV       1         24       Placrew       ST058502AV       1         25       #10 - 24 - 576 inch Self tapping screw       ST073269AV       1         26       Self tapping screw 5 mm x 25 mm       ST073269AV       1         27       Motor cord       EC02800AV       1         28       Rubber foot       ST158300AV       2         29       Belguard (front)       BG222200AV       1         30       Beltguard (forch)       BG222200AV       1         31       Beltguard (back)       BG222200AV       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       376 inch square head setscrew       ST012200AV       1         37       Key 216 inch square head setscrew       ST012	17	Gauge	GA016300AV	1
19       Compression nut       ST033001AV       1         20       Ferrule       ST035200AV       1         21       Check valve       CV21502AJ       1         22       Push-in fitting       ST081301AV       1         23       Unloader tube       ST081301AV       1         24       Plascrew       ST081301AV       1         25       #10 - 24 - 516 inch Self tapping screw       ST058502AV       1         25       #10 - 24 - 516 inch Self tapping screw       ST073269AV       1         26       Self tapping screw 5 mm x 25 mm       ST073269AV       1         27       Motor cord       EC012800AV       1         28       Belguard (front)       BG222200AV       1         30       Beltguard (back)       BG222200AV       1         31       Belt       BT013000AV       1         33       38 inch - 16 x 34 inch Setscrew       ST025200AV       1         34       346 inch Sq x 1-1/4 inch       KE009900AV       1         35       Pulley       PU015200AV       1         36       inch - 18 Locknut       ST04500AV       1         37       Key 316 inch sq x 1-1/4 inch       KE009903AV       <	18	Discharge tube	VT046800AP	1
20       Ferrule       5T085200AV       1         21       Check valve       CV221502AJ       1         22       Push-in fitting       ST081301AV       1         23       Unloader tube       ST073207AV       3         24       Plascrew       ST073277AV       3         25       #10 - 24 - 576 inch Self tapping screw       ST073269AV       1         27       Motor cord       EC012800AV       1         28       Self tapping screw 5 mm x 25 mm       ST073269AV       1         29       Beltguard (front)       BG222200AV       1         30       Beltguard (front)       BG222200AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         33       34 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       316 inch key       KE000900AV       1         34       316 inch key       KE000900AV       1         35       Pulley       Y12200AV       1         36       Inch - 18 x34 inch Setscrew       ST012200AV       1         37       Key 316 inch sq x 1-1/4 inch       KE000903AV       1	19	Compression nut	ST033001AV	1
21       Check valve       CV221502AJ       1         22       Push-in fitting       ST081301AV       1         23       Unloader tube       ST07820AV       1         24       Plascrew       ST073277AV       3         25       #10 - 24 - 516 inch Self tapping screw       ST073277AV       3         26       Self tapping screw 5 mm x 25 mm       ST073269AV       1         27       Motor cord       EC012800AV       1         28       Rubber foot       ST158300AV       2         29       Beltguard (front)       BG222200AV       1         30       Beltguard (back)       BG222200AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         33       346 inch - 16 x 3/4 inch Setscrew       ST02200AV       1         34       316 inch Key       KE000900AV       1         34       316 inch Key       V1015200AV       1         35       Pulley       V1015200AV       1         36       inch - 18 x 3/4 inch Setscrew       ST016200AV       1         37       Key 316 inch sq x 1-1/4 inch       KE000903AV       1      <	20	Ferrule	ST085200AV	1
22       Push-in fitting       ST081301AV       1         23       Unloader tube       ST117802AV       1         24       Plascrew       ST078202AV       1         25       #10 - 24 - 5/16 inch Self tapping screw       ST073269AV       1         25       #10 - 24 - 5/16 inch Self tapping screw       ST073269AV       1         26       Self tapping screw 5 mm x 25 mm       ST073269AV       1         27       Motor cord       EC012800AV       2         28       Rubber foot       ST158300AV       2         29       Beltguard (front)       B6222200AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       316 inch Key       KE000900AV       1         35       Pulley       KE000900AV       1         36       14 inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         37       Key 3716 inch sq x 1-1/4 inch       KE000903AV       1         38       Inch - 18 Locknut       ST018200AV       1         39       5716 inch - 18 Locknut	21	Check valve	CV221502AJ	1
23       Unloader tube       ST117802AV       1         24       Plascrew       ST058502AV       1         25       #10 - 24 - 576 inch Self tapping screw       ST073269AV       1         26       Self tapping screw 5 mm x 25 mm       ST073269AV       1         27       Motor cord       EC012800AV       1         28       Rubber foot       ST158300AV       2         29       Beltguard (front)       BG222200AV       1         30       Beltguard (back)       BG222200AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       316 inch Key       KE00090AV       1         35       Pulley       PU015200AV       1         36       Stof inch ag x 1-1/4 inch       KE00090AV       1         37       Key 316 inch ag x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC0155025J       1         39       5716 inch - 18 Locknut       ST016000AV       6         40       5716 inch - 18 Hex head screw       ST016000AV       1	22	Push-in fitting	ST081301AV	1
24       Plascrew       \$T058502AV       1         25       #10 - 24 - 5/16 inch Self tapping screw       \$T073277AV       3         26       Self tapping screw 5 mm x 25 mm       \$T073269AV       1         27       Motor cord       EC012800AV       1         28       Rubber foot       \$T158300AV       2         29       Beltguard (front)       BG222200AV       1         30       Beltguard (back)       BG222200AV       1         31       Belt       BT013000AV       1         33       38 inch - 16 x 34 inch Setscrew       \$T026200AV       1         33       38 inch - 16 x 34 inch Setscrew       \$T026200AV       1         34       316 inch Key       KE00900AV       1         35       Pulley       PU015200AV       1         36       Lift inch - 20 x 1/2 inch Square head setscrew       \$T012200AV       1         37       Key 316 inch sq x 1-1/4 inch       KE00903AV       1         38       Electric motor       MC0155025J       1         39       \$716 inch - 18 Locknut       \$T146001AV       6         40       516 inch - 18 Locknut       \$T01800AV       1         41       Compression assembly	23	Unloader tube	ST117802AV	1
25       #10 - 24 - 5/16 inch Self tapping screw       ST073277AV       3         26       Self tapping screw 5 mm x 25 mm       ST073269AV       1         27       Motor cord       EC012800AV       1         28       Rubber foot       ST158300AV       2         29       Beltguard (front)       BG222200AV       1         30       Beltguard (front)       BG222300AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         33       38 inch - 16 x 3/4 inch Setscrew       ST026200AV       1         34       316 inch Key       FU015200AV       1         34       316 inch square head setscrew       ST012200AV       1         35       Pulley       PU015200AV       1         36       Electric motor       MC015502SJ       1         37       Key 316 inch a ya 1-1/4 inch       ST00600AV       1         38       Electric motor       MC015502SJ       1         39       516 inch - 18 Locknut       ST018300AV       1         41       Compression assembly       ST018300AV       1         42       Pump       ZWGX6       1     <	24	Plascrew	ST058502AV	1
26       Self tapping screw 5 mm x 25 mm       ST073269AV       1         27       Motor cord       EC012800AV       1         28       Rubber foot       ST158300AV       2         29       Beltguard (front)       BG222200AV       1         30       Beltguard (back)       BG222200AV       1         31       Belt       BT013000AV       1         33       38 inch - 16 x 3/4 inch Setscrew       ST026200AV       1         34       316 inch Key       KE000900AV       1         35       Pulley       PU015200AV       1         36       inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         37       Key 316 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC0155025J       1         39       S/16 inch - 18 Locknut       ST016000AV       6         41       Compression assembly       ST018300AV       1         42       Pump       ZWGX6       1         43       Oil drain plug       ST02230AV       1         44       Oil drain cap       ST149500AV       1         45       Oil drain fubu       ST070350AV       1	25	#10 - 24 - 5/16 inch Self tapping screw	ST073277AV	3
27       Motor cord       EC012800AV       1         28       Rubber foot       ST158300AV       2         29       Beltguard (front)       BG222200AV       1         30       Beltguard (back)       BG222300AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       376 inch Key       KE000900AV       1         35       Pulley       PU015200AV       1         36       inch - 16 x 34 inch Setscrew       ST026200AV       1         37       Key 3/16 inch Setscrew       ST012200AV       1         38       Electric motor       KE000903AV       1         39       S716 inch - 18 Locknut       ST146001AV       6         40       S716 inch - 18 Hex head screw       ST018300AV       1         41       Compression assembly       ST018300AV       1         42       Pump       ZWGX6       1         43       Oil drain cap       ST070350AV       1         44       Oil drain cap       ST073250AV       1         45	26	Self tapping screw 5 mm x 25 mm	ST073269AV	1
28       Rubber foot       \$T158300AV       2         29       Beltguard (front)       BG22200AV       1         30       Beltguard (back)       BG222300AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         33       38 inch - 16 x 3/4 inch Setscrew       ST026200AV       1         34       3716 inch Key       KE000900AV       1         35       Pulley       PU015200AV       1         36       I.44 inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         37       Key 3/16 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       S/16 inch - 18 Locknut       ST146001AV       6         40       S/16 inch - 18 Hex head screw       ST01800AV       1         41       Compression assembly       ST018300AV       1         42       P Ump       ST022300AV       1         43       Oil drain extension tube       ST070350AV       1         44       Oil drain extension tube       ST0703224AV       1         45       Oil drain extension tube       ST070	27	Motor cord	EC012800AV	1
29       Beltguard (front)       BG222200AV       1         30       Beltguard (back)       BG222300AV       1         31       Belt       BT013000AV       1         31       Belt       BT013000AV       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       376 inch Key       ST026200AV       1         35       Pulley       PU015500AV       1         36       inch registration       ST026200AV       1         36       inch Key       KE000900AV       1         36       14 inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         37       Key 3/16 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       5/16 inch - 18 Locknut       ST016000AV       6         40       5/16 inch - 18 Locknut       ST016000AV       1         41       Compression assembly       ST012300AV       1         42       Pump       2WGX6       1         43       Oil drain plug       ST072320AV       1         44       Oil drain cap       ST073230AV       1	28	Rubber foot	ST158300AV	2
30       Beltguard (back)       BG222300AV       1         31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         32       S8 inch - 16 x 3/4 inch Setscrew       ST025200AV       1         34       3/16 inch Key       ST025200AV       1         34       3/16 inch Key       PU015200AV       1         35       Pulley       PU015200AV       1         36       I/4 inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         36       Electric motor       MC015502SJ       1         37       Keg 3/16 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       5/16 inch - 18 Locknut       ST016000AV       6         40       5/16 inch - 18 Hex head screw       ST016000AV       6         41       Compression assembly       ST018300AV       1         42       Pump       2WGX6       1         43       Oil drain plug       ST073250AV       1         44       Oil drain cap       ST011200AV       1         45       5/16 inch - 12 x 3/4 inch Self tapping screw       ST073257AV <td>29</td> <td>Beltquard (front)</td> <td>BG222200AV</td> <td>1</td>	29	Beltquard (front)	BG222200AV	1
31       Belt       BT013000AV       1         32       Flywheel       PU015900AJ       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       3716 inch Key       KE000900AV       1         35       Pulley       PU015200AV       1         36       1/4 inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         37       Key 3716 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       5716 inch - 18 Locknut       ST0146001AV       6         40       5716 inch - 18 Locknut       ST016000AV       1         40       5716 inch - 18 Hex head screw       ST016000AV       6         41       Compression assembly       ST018300AV       1         42       Pump       2WGX6       1         43       Oil drain plug       ST02300AV       1         45       Oil drain cap       ST070350AV       1         45       Oil drain extension tube       ST070350AV       1         46       5716 inch Nasher       ST0703350AV       1         47       5716 inch Washer       ST0703350AV	30	Beltguard (back)	BG222300AV	1
32       Flywheel       PU015900A1       1         33       38 inch - 16 x 34 inch Setscrew       ST026200AV       1         34       316 inch Key       KE000900AV       1         35       Pulley       PU015200AV       1         36 inch Key       ST012200AV       1         37       Key 316 inch Sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       5/16 inch - 18 Locknut       ST146001AV       6         41       Compression assembly       ST018300AV       1         42       Pump       2WGX6       1         43       Oil drain plug       ST018300AV       1         44       Oil drain plug       ST022300AV       1         45       Oil drain plug       ST01200AV       1         46       5/16 inch - 12 x 3/4 inch Self tapping screw       ST070330AV       1         47       5/16 inch Nipple       ST073275AV       4         48       1/4 inch Nipple       ST0733500AV       1         49       Axle nut       ST033500AV       1         49       Axle nut       ST033500AV       2         50       Re	31	Belt	BT013000AV	1
33 $3\%$ inch - 16 x 3/4 inch Setscrew $ST026200$ AV1343/16 inch KeyKE000900AV135PulleyPU015200AV1361/4 inch - 20 x 1/2 inch Square head setscrewST012200AV1361/4 inch - 20 x 1/2 inch Square head setscrewST012200AV137Key 3/16 inch sq x 1-1/4 inchKE000903AV138Electric motorMC015502SJ1395/16 inch - 18 LocknutST146001AV6405/16 inch - 18 Hex head screwST018300AV641Compression assemblyST018300AV142Pump2WGX6143Oil drain plugST022300AV144Oil drain capST149500AV145Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST073275AV4475/16 inch WasherST070350AV149Axle nutST033500AV249Axle nutST033500AV250Retainer—251Bolt—152A Warning decalsDK747600AV1	32	Flywheel	PU015900A1	1
34       3/16 inch Key       KE000900AV       1         35       Pulley       PU015200AV       1         36       1/4 inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         37       Key 3/16 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       5/16 inch - 18 Locknut       ST01800AV       6         40       5/16 inch - 18 Hex head screw       ST018300AV       1         41       Compression assembly       ST018300AV       1         42       Pump       2WGX6       1         43       Oil drain plug       ST022300AV       1         44       Oil drain cap       ST070350AV       1         45       Oil drain extension tube       ST073275AV       4         45       Oil drain extension tube       ST070324AV       1         47       5/16 inch Washer       ST070324AV       1         49       Axle nut       ST033500AV       2         50       Retainer       —       2         51       Bolt       —       1         52       A Warning decals       DK747600AV       1         5	33	3/8 inch - 16 x 3/4 inch Setscrew	ST026200AV	1
35       Pulley       PU015200AV       1         36       1/4 inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         37       Key 3/16 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       5/16 inch - 18 Locknut       ST146001AV       6         41       Compression assembly       ST018300AV       1         42       Pump       ST018300AV       1         42       Pump       ST018300AV       1         42       Pump       ST018300AV       1         43       Oil drain plug       ST022300AV       1         44       Oil drain plug       ST070350AV       1         45       Oil drain extension tube       ST070350AV       1         45       Oil drain extension tube       ST073275AV       4         46       S716 inch Washer       ST01200AV       5         47       S/16 inch self tapping screw       ST073250AV       1         48       1/4 inch Nipple       ST0733500AV       1         49       Axle nut       ST033500AV       2         50       Retainer       —       2	34	3/16 inch Key	KE000900AV	1
36       1/4 inch - 20 x 1/2 inch Square head setscrew       ST012200AV       1         37       Key 3/16 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       5/16 inch - 18 Locknut       ST146001AV       6         40       5/16 inch - 18 Hex head screw       ST016000AV       6         41       Compression assembly       ST018300AV       1         42	35	Pulley	PU015200AV	1
37       Key 3/16 inch sq x 1-1/4 inch       KE000903AV       1         38       Electric motor       MC015502SJ       1         39       5/16 inch - 18 Locknut       ST146001AV       6         40       5/16 inch - 18 Hex head screw       ST016000AV       6         41       Compression assembly       ST018300AV       1         42       Pump       2WGX6       1         43       Oil drain plug       ST022300AV       1         44       Oil drain cap       ST022300AV       1         45       Oil drain extension tube       ST070350AV       1         46       5/16 inch - 12 x 3/4 inch Self tapping screw       ST073275AV       4         47       5/16 inch Washer       ST070324AV       1         49       Axle nut       ST033500AV       1         49       Axle nut       ST033500AV       2         50       Retainer       —       2         51       Bolt       —       1         52       Marning decals       DK747600AV       1	36	1/4 inch - 20 x 1/2 inch Square head setscrew	ST012200AV	1
38Electric motorMC015502SJ1395/16 inch - 18 LocknutST146001AV6405/16 inch - 18 Hex head screwST016000AV641Compression assemblyST018300AV142Pump2WGX6143Oil drain plugST022300AV144Oil drain capST022300AV145Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST0703275AV4475/16 inch WasherST011200AV5481/4 inch NippleST070324AV149Axle nutST033500AV250Retainer—251Bolt—152Warning decalsDK747600AV1ANot shownHot shownHot shown	37	Key 3/16 inch sg x 1-1/4 inch	KE000903AV	1
395/16 inch - 18 LocknutST146001AV6405/16 inch - 18 Hex head screwST016000AV641Compression assemblyST018300AV142Pump2WGX6143Oil drain plugST022300AV144Oil drain capST049500AV145Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST073275AV4475/16 inch WasherST070324AV149Axle nutST070324AV149Axle nutST033500AV250Retainer—151Bolt—152Warning decalsDK747600AV1∆Not shownHot shownHot shown1	38	Electric motor	MC015502SJ	1
405/16 inch - 18 Hex head screwST016000AV641Compression assembly\$T018300AV142Pump2WGX6143Oil drain plugST022300AV144Oil drain capST022300AV145Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST070350AV1475/16 inch WasherST0703275AV4475/16 inch NippleST070324AV149Axle nutST033500AV250Retainer—251Bolt—152Warning decalsDK747600AV1∆Not shown1	39	5⁄16 inch - 18 Locknut	ST146001AV	6
41Compression assemblyST018300AV142Pump2WGX6143Oil drain plugST022300AV144Oil drain capST022300AV145Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST073275AV4475/16 inch WasherST071200AV5481/4 inch NippleST07324AV149Axle nutST033500AV250Retainer—251Bolt—152Warning decalsDK747600AV1∆Not shown11	40	5⁄16 inch - 18 Hex head screw	ST016000AV	6
42Pump2WGX6143Oil drain plugST022300AV144Oil drain capST149500AV145Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST073275AV4475/16 inch WasherST011200AV5481/4 inch NippleST070324AV149Axle nutST033500AV250Retainer—251Bolt—152Warning decalsDK747600AV1∆Not shown	41	Compression assembly	ST018300AV	
43Oil drain plugST022300AV144Oil drain capST149500AV145Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST073275AV4475/16 inch WasherST071200AV5481/4 inch NippleST070324AV149Axle nutST033500AV250Retainer—251Bolt—152Warning decalsDK747600AV1 $\Delta$ Not shown1	42 🔶	Pump	2WGX6	1
44Oil drain capST149500AV145Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST073275AV4475/16 inch WasherST071200AV5481/4 inch NippleST070324AV149Axle nutST033500AV250Retainer—251Bolt—152 $\Delta$ Warning decalsDK747600AV1 $\Delta$ Not shown3	43	Oil drain plug	ST022300AV	1
45Oil drain extension tubeST070350AV1465/16 inch - 12 x 3/4 inch Self tapping screwST073275AV4475/16 inch WasherST011200AV5481/4 inch NippleST070324AV149Axle nutST033500AV250Retainer—251Bolt—152 $\Delta$ Warning decalsDK747600AV1 $\Delta$ Not shown1	44	Oil drain cap	ST149500AV	1
465/16 inch - 12 x 3/4 inch Self tapping screwST073275AV4475/16 inch WasherST011200AV5481/4 inch NippleST070324AV149Axle nutST033500AV250Retainer—251Bolt—152 $\Delta$ Warning decalsDK747600AV1 $\Delta$ Not shown1	45	Oil drain extension tube	ST070350AV	1
47       5/16 inch Washer       ST011200AV       5         48       1/4 inch Nipple       ST070324AV       1         49       Axle nut       ST033500AV       2         50       Retainer       —       2         51       Bolt       —       1         52       A Warning decals       DK747600AV       1         Δ       Not shown       1	46	5/16 inch - 12 x 3/4 inch Self tapping screw	ST073275AV	4
48     1/4 inch Nipple     ST070324AV     1       49     Axle nut     ST033500AV     2       50     Retainer     —     2       51     Bolt     —     1       52     ∆     Warning decals     DK747600AV     1	47	5/16 inch Washer	ST011200AV	5
49     Axle nut     ST032500AV     2       50     Retainer     —     2       51     Bolt     —     1       52     ∆     Warning decals     DK747600AV     1	48	1/4 inch Nipple	ST070324AV	1
50         Retainer        2           51         Bolt        1           52         ∆         Warning decals        1           ∆         Not shown        1	49	Axle nut	ST033500AV	
51         Bolt        1           52         ▲ Warning decals         DK747600AV         1           △         Not shown         1         1	50	Retainer		2
52 △ Warning decals     DK747600AV     1       △ Not shown     1	51	Bolt		1
Δ Not shown	52 A	Warning decals	DK747600AV	, 1
	Δ	Not shown		• -

See compressor nameplate for exact model number when ordering pump repair parts.



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## For Repair Parts, call 1-800-323-0620

#### 24 hours a day - 365 days a year

- Please provide following information: Model number Serial number (if any)

- Part description and number as shown in parts list



Figure 5 – Repair Parts Illustration for Pump Model 2WGX6

## Pump Model 2WGX6

#### **Repair Parts List**

Ref.			
No.	Description	Part Number	Qty.
1	Crankcase	VT040300AG	1
2	Crankcase gasket	•	1
3	Breather	VH901100AV	1
	Cylinder	<u>VT</u> 040715AV	1
5	Cylinder gasket	•	1
6	Connecting rod and piston assembly with rings	VT020500AV	2
7	Piston ring set	VT911200AV	2
8	Ball bearing	ST084202AV	2
9	Crankshaft and bearings	VT040650AJ	1
10	O-ring	•	1
11	Oil seal	ST129700AV	1
12	Bearing cap assembly	VT040200AJ	1
13	M6 x 10 mm screw	*	4
14	Valve plate assembly	VT470800AJ	1
15	Valve plate molded seal	•	1
<u> 16                                   </u>	Cylinder head and fasteners	TQ900800AJ	1
17	Air filter assembly	VH901700AV	1
18	1/8 inch - 27 Oil drain plug	ST022300AV	1
19	Sight glass	ST191700AV	1
20	Air filter element	VH901800AV	1
REPAI	R PARTS KITS		
•	Gasket kit	4B252	1
*	Standard hardware item		

E N G L = S H

<u>SPEEDAIRE</u>

## Speedaire<sup>®</sup> Portable Air Compressors

#### LIMITED WARRANTY

**DAYTON ONE-YEAR LIMITED WARRANTY.** SPEEDAIRE® PORTABLER AIR OMPRESSORS AND PUMPS, MODELS COVERED IN THIS MANUAL, ARE WARRANTED BY DAYTON ELECTRIC MFG. CO. (DAYTON) TO THE ORIGINAL USER AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS UNDER NORMAL USE FOR ONE YEAR AFTER DATE OF PURCHASE. ANY PART WHICH IS DETERMINED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP AND RETURNED TO AN AUTHORIZED SERVICE LOCATION, AS DAYTON DESIGNATES, SHIPPING COSTS PREPAID, WILL BE, AS THE EXCLUSIVE REMEDY, REPAIRED OR REPLACED AT DAYTON'S OPTION. FOR LIMITED WARRANTY CLAIM PROCEDURES, SEE "PROMPT DISPOSITION" BELOW. THIS LIMITED WARRANTY GIVES PURCHASERS SPECIFIC LEGAL RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION.

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Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

**Prompt Disposition.** A good faith effort will be made for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714-4014 U.S.A.



#### SECTION 13a: PNEUMATICALLY ACTUATED VALVES

P&ID: Item #:

AV-0733, AV-0734, AV-0735, AV-0736, AV-0737, AV-0739, AV-0831, AV-0937, AV-0938, AV-0939

**Unit Details:** 

- AV-0733 UF Membrane Recirculation Feed Valve 6" Jomar Lug BFV, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)
- AV-0734 UF Membrane Drain Valve 6" Jomar Lug BFV, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)
- AV-0735 UF Membrane Drain Valve 3" Jomar Lug BFV, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)
- AV-0736 UF Membrane De-Aeration Valve 2" Jomar Lug BFV, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)
- AV-0737 UF Membrane Recirculation Return Valve 8" Jomar Lug BFV, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)

#### AV-0739 – UF Membrane Air Scour Valve 1 ½" Jomar Stainless Steel Ball Valve, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)

- AV-0831 UF Membrane Permeate Valve 2" Jomar Lug BFV, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)
- AV-0937 UF Membrane Backwash Bypass Valve 3" Jomar Lug BFV, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)
- AV-0938 Backwash Valve 4" Jomar Lug BFV, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)
- AV-0939 UF Membrane Air Scour Valve 1 1/2" Jomar Stainless Steel Ball Valve, Alpha Series AS-140-12 Spring Return Pneumatic Actuator, SM-200 Limit Switch, SV-120 Solenoid Valve (24 VAC option)

Manufacturer:

Jomar Valve 7243 Miller Drive Warren, MI 48092 Phone: (800) 325-5690 www.jomarvalve.com

Local Distributor/Contact:

Cranston Windustrial 150 Jefferson Blvd Warwick, RI 02888 Phone: (401) 941-8370 Fax: (401) 669-6250 www.cranstonwindustrial.com

## **Stainless Steel Ball Valve**



## 3 Piece 4 Bolt • Swing Out Body • Full Port • Threaded Connection 1000 WOG



T-SS-1000N-4B

#### Features

- Latch lock handle, may be locked in open or closed positions
- 29 in-HG vacuum rating
- Repair kit available
- 100% leak tested

#### 

- UL Listed 842 (49RO) (1/4" 2")
  - MHKZ Manual valves
- YQNZ Compressed gas shut-off valves
- YRBX Flammable liquid shut-off valves
- YRPV Gas shut-off valves
- YSDT LP gas shut-off valves
- YQAR Anhydrous ammonia shut-off valves
- MSS SP-110
- NACE Certified

#### Valve Seat Rating

#### 1000 WOG - 150 WSP





#### **Material Specifications**

No.	Part	Materials
1	Body	CF8M Stainless Steel
2	End Cap (2)	CF8M Stainless Steel
3	Ball	CF8M Stainless Steel
4	Seat (2)	Hostaflon <sup>®</sup> TFM 1600
5	Stem	316 Stainless Steel
6	Packing (2)	RPTFE
7	Stem Seal	Hostaflon <sup>®</sup> TFM 1600
8	Packing Gland	316 Stainless Steel
9	Body Seal (2)	Hostaflon <sup>®</sup> TFM 1600
10	Handle	304 Stainless Steel
11	Handle Nut	304 Stainless Steel
12	Lock Washer	304 Stainless Steel
13	Body Bolt (4)	304 Stainless Steel
14	Body Lock Washer (4)	304 Stainless Steel
15	Body Nut (4)	304 Stainless Steel

#### Dimensions

Part No.	Size	Α	В	С	D
500-301	1/4"	2.37	2.18	4.30	0.37
500-302	3/8"	2.37	2.18	4.30	0.37
500-303	1/2"	2.76	2.38	4.30	0.56
500-304	3/4"	3.03	2.87	5.81	0.81
500-305	1"	3.63	2.95	5.81	1.00
500-306	1-1/4"	4.14	3.66	7.44	1.25
500-307	1-1/2"	4.73	3.94	7.44	1.50
500-308	2"	5.43	4.25	7.81	1.97
500-310	3"	7.52	5.26	9.75	3.00
500-311	4"	8.54	6.57	11.88	3.93

**721** Note: Information subject to change without notice.


# SERIES 600/900 BUTTERFLY VALVE

#### **BEARINGS & SEALS**

- Low friction nylatron stem bearing for side-load support.
- Triple seal reduces external leakage.
- Upper and lower stem seals.

#### **BODY:**

- Extended neck accepts insulation.
- Meets API-609 and MSS SP-67 specifications.
- ISO Mounting Pad
- Epoxy Coated Ductile Iron body standard
- Retainer lip for dead end service
- Bi-Directional
- Suitable for dead end service

#### STEM:

- Positive stem retention for safety.
- Low tolerance square drive stem-to-disc connection for precise disc control.
- 410SS stem standard

#### DISC:

- Disc edge machined for low friction, tight seal and minimal seat wear.
- Streamlined design for maximum flow.
- Machined fit disc/stem.
- 316 SS standard (other materials available)

#### SEAT:

- Phenolic backed cartridge seat design for extended service life. Can be used for vacuum services.
- Seating area designed for low friction, tight seal.
- Molded-flange ribs for tight gasket sealing.
- Elastomer molded for primary stem sealing.
- EPDM, BUNA, PTFE and VITON in stock.



# Series 600 - Lug Type

# Ductile Iron Body, 316 SS, Lug Type Butterfly Valve

#### Description

Jomar butterfly valves are standard with epoxy coated, ductile iron bodies, and also phenolic backed cartridge type seats. Accompanied by precision machined 316SS disc, and 410SS stem, they offer lower operating torques, bubble tight shut-off, and extended seat life. Jomar butterfly valves are bi-directional and suited for dead end service. Jomar butterfly valves are standard with an extended neck, which makes them ideal for applications where insulation is required. Jomar butterfly valves are manufactured to ISO 5211 standards and have direct mount capabilities.

#### **Specifications**

Designed for commercial and industrial applications up to 225 PSI. Easily accepts actuator with ISO 5211 mounting flange.

- Available in EPDM, PTFE, Buna, or Viton seats
- Meets API 609 & MSS SP-67
- Seat to flange seal eliminates the need for flange gaskets
- Series 600 Lug bodies are bi-directional for dead end service:

With downstream flange, pressure ratings are 2"- 12" = 175psi, 14"- 24" = 150psi. With no downstream flange, bi-directional, dead end service rating is:

- 2"- 12"= 75psi, 14"- 24"= 50psi
- Epoxy coated finish
- Ideal for mounting pnuematic/electrical actuators
- Square stem for direct mount

#### Accessories

- 10 position locking lever handle
- Gear operators
- Electrical and pnuematic actuators

#### Warranty

The Company, for a period of one year from the date of shipment, warrants each product or system of its own manufacture to the original purchaser to be free from defects in material and workmanship under normal use, service and maintenance.



Architect/Engineer approval							
Job Name	Date						
Model Specified	Quantity						
Variations Specified							
Customer/Wholesaler							
Contractor							
Architect							

Note: Information subject to change without notice.



Jomar Automation 7243 Miller Drive Warren, MI 48092 Phone: 800-325-5690 Fax: 800-628-4194 www.jomarautomation.com

# Series 600 - Lug Type

# Ductile Iron Body, 316 SS, Lug Type Butterfly Valve



#### Description

Jomar Butterfly Valves come standard with phenolic backed cartridge type seats. Accompanied with precision machined 316 SS disc, offers low operating torque, bubble-tight shut-off and longer seat life.

#### **Dimensions in Inches**

Computer	Valve								
No.	Size A	В	C	D	Ε	F	G	Weight	CV
600-02DS_B	2″ 6.34	3.15	1.65	1.20	.35	2.07	1.97	8.38	135
600-0212DS_	B2-1/2″6.89	3.50	1.76	1.20	.35	2.54	1.97	9.26	220
600-03DS_B	3″ 7.13	3.74	1.78	1.20	.35	3.10	1.97	10.36	302
600-04DS_B	4″ 7.87	4.49	2.05	1.20	.43	4.10 2	2.76	19.84	600
600-05DS_B	5″ 8.39	5.00	2.14	1.20	.55	4.86 2	2.76	24.03	1022
600-06DS_B	6″ 8.90	5.47	2.20	1.20	.55	6.13 2	2.76	31.31	1579
600-08DS_B	8″ 10.24	6.89	2.39	1.77	.67	7.98 4	1.02	40.12	3136
600-10DS_B	10″ 11.50	7.99	2.58	1.77	.87	9.87 4	1.02	59.08	5340
600-12DS_B	12″ 13.27	9.53	3.03	1.77	.87	11.88 4	1.02	88.18	8250

Part Name	Material	Temperature F	Temperature C
	Buna-N (NBR)	+10 to 180	-12 to 82
	Buna-N, Food Grade	+10 to 180	-12 to 82
	EPDM	-30 to 250	-35 to 121
	EPDM, Food Grade	-30 to 225	-35 to 107
	EPDM, Heat-Resistant	+30 to 300	-2 to 150
Cost (Coft Cool)	Viton	+10 to 275	-12 to 135
Seat (Solt Seal)	Viton, High Temp	+10 to 400	-12 to 204
	Neoprene	+20 to 200	-7 to 93
	Hypalon	0 to 275	-18 to 135
	Silicon	-70 to 425	-57 to 218
	PTFE over EPDM	-20 to 250	-29 to 121
		1001 100	

			Flow in	Gpm @ :	IPSI P @	Various I	Disc Angle	s	
Size	10°	20°	30°	40°	50°	60°	70°	80°	Full 90°Open
2"	0.1	5	12	24	45	64	90	125	135
2.5"	0.2	8	20	37	65	98	144	204	220
3"	0.3	12	22	39	70	116	183	275	302
4"	0.5	17	36	78	139	230	364	546	600
5"	0.8	29	61	133	237	392	620	930	1022
6"	2	45	95	205	366	605	958	1437	1579
8"	3	89	188	408	727	1202	1903	2854	3136
10"	4	151	320	694	1237	2047	3240	4859	5340
12"	5	234	495	1072	1911	3162	5005	7505	8250
Note: Infor	mation s	piect to	chango	without r	otico				

2"

1 - 1/2

5/8 -11UNC

2-1/2'

1 - 1/2

5/8 -11UNC

3"

1 - 1/2

5/8 -11UNC

4"

1-3/4

5/8 -11UNC

5"

1-3/4

3/4 -10UNC

6"

2

3/4 -10UNC

Note: Information subject to change without notice.



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#### **Material Specification**

No.	Part Name	Materials
1	Body	Ductile Iron
2	Seat	EPDM / PTFE / BUNA / VITON
3	Lower Stem	410 Stainless Steel
4	Disc	316 Stainless Steel
5	Upper Stem	410 Stainless Steel
6	Locating Pin	Cast Steel
7	Bushing	PTFE
8	O-ring	EPDM
-		





DIAGONAL SQUARE HEAD 12"

2-1/2

7/8

-9UNC



8"

2

3/4 -10UNC

10"

2-1/4

7/8 -9UNC

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## Ductile Iron Body, 316 SS, Wafer Type Butterfly Valve

#### Description

Jomar butterfly valves are standard with epoxy coated, ductile iron bodies, and also phenolic backed cartridge type seats. Accompanied by precision machined 316SS disc, and 410SS stem, they offer lower operating torques, bubble tight shut-off, and extended seat life. Jomar butterfly valves are bi-directional and suited for dead end service. Jomar butterfly valves are standard with an extended neck, which makes them ideal for applications where insulation is required. Jomar butterfly valves are manufactured to ISO 5211 standards and have direct mount capabilities.

#### **Specifications**

Designed for commercial and industrial applications up to 225 PSI. Easily accepts actuator with ISO 5211 mounting flange.

- Available in EPDM, PTFE, Buna, or Viton seats
- Meets API 609 & MSS SP-67
- Seat to flange seal eliminates the need for flange gaskets
- Dead end service (single flange)
- Epoxy coated finish
- Ideal for mounting pnuematic/electrical actuators
- Square stem for direct mount

#### Accessories

- 10 position locking lever handle
- Gear operators
- Electrical and pnuematic actuators

#### Warranty

The Company, for a period of one year from the date of shipment, warrants each product or system of its own manufacture to the original purchaser to be free from defects in material and workmanship under normal use, service and maintenance.

9	53	

Wafer-EPDM

Architect/Engineer approval							
Job Name	Date						
Model Specified	Quantity						
Variations Specified							
Customer/Wholesaler							
Contractor							
Architect							

Note: Information subject to change without notice.



Jomar Automation 7243 Miller Drive Warren, MI 48092 Phone: 800-325-5690 Fax: 800-628-4194 www.jomarautomation.com

# Ductile Iron Body, 316 SS, Wafer Type Butterfly Valve



#### **Description**

**Jomar Butterfly Valves** come standard with phenolic backed cartridge type seats. Companied with precision machined 316 SS disc, offers low operating torque, bubble-tight shut-off and longer seat life. Jomar butterfly valves are bi-directional and suited for dead end service

#### **Dimensions in Inches**

Computer No.	Valve Size A	В	C	D	Е	F	G	Weiaht	cv
900-02DS_B	2″ 6.34	3.15	1.65	1.20	.35	2.07	1.97	5.50	135
900-0212DS_	B2-1/2"6.89	3.50	1.76	1.20	.35	2.54	1.97	7.00	220
900-03DS_B	3″ 7.13	3.74	1.78	1.20	.35	3.10	1.97	8.14	302
900-04DS_B	4″ 7.87	4.49	2.05	1.20	.43	4.10	2.76	10.08	600
900-05DS_B	5″ 8.39	5.00	2.14	1.20	.55	4.86	2.76	15.40	1022
900-06DS_B	6″ 8.90	5.47	2.20	1.20	.55	6.13	2.76	17.20	1579
900-08DS_B	8″ 10.24	6.89	2.39	1.77	.67	7.98	4.02	29.00	3136
900-10DS_B	10" 11.50	7.99	2.58	1.77	.87	9.87	4.02	42.20	5340
900-12DS_B	12″ 13.27	9.53	3.03	1.77	.87	11.88	4.02	71.50	8250

Part Name	Material	Temperature F	Temperature C	
	Buna-N (NBR)	+10 to 180	-12 to 82	
	Buna-N, Food Grade	+10 to 180	-12 to 82	
	EPDM	-30 to 250	-35 to 121	
	EPDM, Food Grade	-30 to 225	-35 to 107	
	EPDM, Heat-Resistant	+30 to 300	-2 to 150	
Cost (Coff Cool)	Viton	+10 to 275	-12 to 135	
Seal (Solt Seal)	Viton, High Temp	+10 to 400	-12 to 204	
	Neoprene	+20 to 200	-7 to 93	
	Hypalon	0 to 275	-18 to 135	
	Silicon	-70 to 425	-57 to 218	
	PTFE over EPDM	-20 to 250	-29 to 121	
	PURE PTFE	-100 to 400	-74 to 204	

#### **Material Specification**

No.	Part Name	Materials
1	Body	Ductile Iron
2	Seat	EPDM / PTFE / BUNA / VITON
3	Lower Stem	410 Stainless Steel
4	Disc	316 Stainless Steel
5	Upper Stem	410 Stainless Steel
6	Locating Pin	Cast Steel
7	Bushing	PTFE
8	O-ring	EPDM



			Flow in	Gpm @ 1	PSI P @	Various D	oisc Angle	s	
Size	10°	<b>20</b> °	<b>30</b> °	40°	50°	60°	70°	80°	Full 90°Open
2"	0.1	5	12	24	45	64	90	125	135
2.5"	0.2	8	20	37	65	98	144	204	220
3"	0.3	12	22	39	70	116	183	275	302
4"	0.5	17	36	78	139	230	364	546	600
5"	0.8	29	61	133	237	392	620	930	1022
6"	2	45	95	205	366	605	958	1437	1579
8"	3	89	188	408	727	1202	1903	2854	3136
10"	4	151	320	694	1237	2047	3240	4859	5340
12"	5	234	495	1072	1911	3162	5005	7505	8250

Note: Information subject to change without notice.



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## 10-Position, Lockable Lever Handle

#### Description

Lever Handles fit Jomar 600 series (Lug) and 900 series (Wafer) butterfly valves. Available in sizes 2" - 12".

#### **Dimensions in Inches**

Computer No.	Size	A	В	C	Weight	
BLH2-3	2"-3"	10.64	1.26	2.05	2.00	
BLH4	4″	10.64	1.26	2.05	2.00	
BLH5-6	5" - 6"	10.64	1.26	2.05	2.00	
BLH8	8″	14.18	1.77	2.96	4.30	
BLH10-12	10" - 12"	19.70	1.77	2.96	5.84	



Note: Information subject to change without notice.



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# **Worm Gear Actuator**

#### Description

Jomar worm gear actuators are designed to directly mount to Jomar 600 series (Lug) and 900 series (Wafer) butterfly valves. Allows easy operation during high line pressures.

#### **Dimensions in Inches**

Computer No.	Valve Size	А	в	C	D	Е	F	G	Weight
BG02-3	2"-3"	2.05	1.77	2.92	5.91	2.05	6.00	2.96	11.50
BG04	4″	2.05	1.77	2.92	5.91	2.05	6.00	2.96	11.50
BG05-6	5″-6″	2.05	1.77	2.92	5.91	2.05	6.00	2.96	11.50
BG08	8″	2.96	2.47	3.98	11.82	2.96	9.85	3.39	28.66
BG010	10″	2.96	2.47	3.98	11.82	2.96	9.85	3.39	28.66
BG012-14	12"-14"	3.19	3.15	4.65	11.82	3.19	8.94	3.27	33.00

#### Warranty

The Company, for a period of one year from the date of shipment, warrants each product or system of its own manufacture to the original purchaser to be free from defects in material and workmanship under rygrynal use, service and maintenance.



# AUTOMATION SERIES 600/900 BUTTERFLY VALVE IOM

### **BUTTERFLY VALVE INSTALLATION, OPERATION AND MAINTENANCE**

#### Installation Instructions

Jomar Series 600/900 Butterfly valves are of cartridge type seat design. They are designed for bidirectional dead end service for installation between 125# or 150# ANSI flanges. Gaskets are not required as the seat face itself serves as the sealing surface.

Before installation, close the valve firmly. Slide the valve between the mating flanges and hand tighten the bolts to a point where the valve is held firmly in place. Slowly rotate the handle to be sure that the disk swings freely.\*

After performing the above step, leave the valve in the open position and tighten the flange bolts. After completion of tightening the bolts, once again rotate the handle to ensure full range operation.

Jomar 600 Series Lug type butterfly valves are designed for bubble tight dead-end service and must be installed with the inlet tag facing upstream.

\* Refer to product sheet for proper bolt sizes.

#### Maintenance

No standard lubrication or maintenance is required. However, periodic rotation of the valve throughout its full range is recommended.

#### Valve Disassembly

1) After carefully following all safety precautions, remove the valve from the piping system

- 2) Remove the handle or gear operator
- 3) Remove retaining pins from the Upper and Lower stems
- 4) Remove upper stem by firmly pulling upwards
- 5) Remove lower stem by firmly pulling downwards

6) Carefully remove the disc from the seat taking care not to damage either part.

7) Remove the seat by pressing the seat outward toward the inlet side of the valve

8) Carefully inspect all component parts and replace if necessary.

#### Valve Assembly

Jomar butterfly valves are dry assembled, no silicone is used during the manufacturing process.

1) Clean all reusable parts

2) Apply soapy water solution on any lubricant compatible with seat material

3) Press seat into valve body, be sure that pressure is applied equally around the seat

4) Insert the disc into the seat cavity. Be sure the disc is installed correctly with broached end on top.

5) Apply any general purpose lubricant to the upper and lower stem.

Install the stems

- 7) Install retaining pins by tapping them in place
- 8) Install handle, gear operator or actuator

Open and close valve, check visually for proper assembly.



#### JOMAR ALPHA SERIES OPERATION AND INSTRUCTION MANUAL



#### **INTRODUCTION**

JOMAR Type A actuators are quarter-turn devices, simply meaning that the shaft rotates 90°.

JOMAR also offers Type A180 actuators that have 180° rotation.

Our standard stock actuators have a torque range of 73 in/lbs to 388,726 in/lbs, based on 80psig supply air pressure.

This wide torque range, along with standard ISO 5211 and Namur mounting, make Jomar Pneumatic Actuators the choice of professionals worldwide.

#### **MOUNTING ACTUATOR**

JOMAR actuators have a female output shaft, which meets DIN33337 and ISO5211, making direct mounting to any square stem valve possible. The output shaft is machined to an eight point star, which, either with or without an adapter can be mounted to any type of quarter turn valve or damper.

The JOMAR actuator can be mounted in any position, even upside down with affecting the operation.

The actuator is normally mounted with it's length parallel with the pipe, for space conscious installations.

Always ensure that the valve or damper is in the correct position, open or closed, before mounting the actuator.

# WARNING! NEVER REMOVE OR SERVICE AN ACTUATOR THAT HAS NOTBEEN PROPERLY DE-PRESSURIZED AND VENTED.Page 1

#### **STANDARD OPERATION**

JOMAR actuators rotate 90°, CCW as viewed from the top, to the open position. The opening rotation occurs when supply air is applied through Port A (left port), into the piston chambers.

This action is true of both double acting and spring return actuators.

In spring return actuators, when supply air pressure is removed, the springs then decompress, forcing the piston in the opposite (CW) direction, thereby closing the valve.

In double acting actuators, supply air must be removed from Port A and applied to Port B (right port), forcing the piston in the opposite (CW) direction, thus closing the valve.

#### MANUAL OPERATION

JOMAR actuators can be manually operated in the event of supply air pressure failure by using an appropriate wrench on the top portion of the output shaft. Declutchable manual overrides are also available, please contact Jomar Automation.

#### WARNING!

#### NEVER TRY TO MANUALLY OPERATE AN ACTUATOR WITHOUT FIRST VENTING ALL INTERNAL AIR PRESSURE BY REMOVING ALL AIR SUPPLY CONNECTIONS!

#### WARNING! SEVERE DAMAGE TO THE ACTUATOR CAN BE CAUSE BY MANUALLY OPERATING THE ACTUATOR WHILE STILL IN THE AUTOMATIC MODE.

Page 2

#### **LUBRICATION**

JOMAR actuators are factory lubricated and should require no further lubrication unless actuator is altered.

The use of clean, dry, air or gas is recommended.

Lubrication of the media is not required, however, it is recommended.

#### MINIMUM/ MAXIMUM SUPPLY PRESSURE

A minimum of 40 psig and a maximum of 120 psig, is required for normal operation of Spring Return actuators.

Double Acting actuators require a minimum of 15 psig, with a maximum of 120 psig for normal operation.

#### **SUPPLY AIR CONNECTIONS**

Remove the factory supplied dust plugs from the actuator.

Double Acting

Air supply lines must be installed to both Ports A and B. Port A: CCW rotation Port B: CW rotation

Spring Return

Air supply must be installed to Port A.

Solenoid Valves

Air must be supplied to the valve air inlet port. If using a JOMAR ASV Series solenoid valve, supply air to the center port.

#### MAINTENANCE

JOMAR actuators are factory lubricated and require only yearly inspection under normal operating conditions.

#### **STORAGE**

When not in use the actuator should be stored in a clean, dry place, and operated a minimum of twice a month. The air ports should be plugged to prevent any contamination.

#### RECOMMENDED SPARE PARTS

Although the actuator should not require service under normal operating conditions for at least 1 year, replacement part kits consisting of o-rings are available. Please contact JOMAR for pricing.

Spring sets are also available and sold in complete sets only. Please contact JOMAR for pricing.

#### **DISASSEMBLY OF ACTUATORS**

#### WARNING! DO NOT ATTEMPT TO DISASSEMBLE ANY ACTUATOR WITHOUT FIRST DISCONNECTING ALL AIR AND ELECTRICAL CONNECTIONS. KEEP FINGERS CLEAR OF ALL MOVING PARTS.

Disassembly or assembly of actuators should only be attempted by trained personnel.

Contact JOMAR before proceeding.

#### All warranties are void if actuator is disassembled without prior authorization.

#### TRAVEL STOP ADJUSTMENT.

JOMAR actuators have travel stops which can be adjusted **without** disassembling the actuator.

- 1. Remove lock nut.
- 2. Adjust travel stop with allen wrench, note that both sides must be adjusted equally.

3. Operate actuator to ensure proper adjustment.

- WARNING! KEEP FINGERS CLEAR OF ALL MOVING PARTS
- 4. Tighten lock nut on both travel stops.



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# Installation, Operation & Maintenance Manual

# **SM-200** Limit Switch



#### WARNING:

DISCONNECT ALL ELECTRICAL POWER CONNECTIONS TO AVOID ELECTRICAL SHOCK. DISCONNECT AND VENT ANY PNEUMATIC CONNECTIONS TO AVOID INJURY.





#### DESCRIPTION

- Jomar SM-200 limit switch is deigned for use with quarter turn pneumatic actuators.
- Visual dome indication: Red-Closed Yellow-Open
- NAMUR mounting
- Terminal strip: 8 position
- Enclosure: IP67
- Switches: SPDT
- Mounting: Standard bracket supplied

#### MOUNTING

- Verify that correct bracket has been supplied with limit switch.
- Align limit switch shaft with actuator shaft.
- Mount to actuator by tightening the appropriate size screws. (do not over tighten)

#### SWITCH ADJUSTMENT

- A multi-meter will be required to proceed.
- Attach leads from meter to appropriate terminals.
- Simply lift the green open position switch and place the cam in such a position that the switch will make and be verified by the reading of the impedance meter. Do the same with the red closed position cam.

#### **INDICATOR SETTING**

- Ensure dome indicator shows correct open or closed valve position.
- Dome can be adjusted by loosening the 4 screws on top of switch and rotating the dome indicator.
- When re-installing housing, do not over tighten screws.

#### WIRING

- Wiring should be completed by properly licensed electricians to avoid injury.
- Loosen 4 screws securing upper half of housing and remove.
- Terminals 1 through 6 are for mechanical switch wiring.
- Terminals 7 & 8 are for solenoid valve wiring.
- Refer to wiring diagram at left.

#### MAINTENANCE

• Only visual inspection is required to ensure proper operation of limit switch.

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### SV-120 SOLNOID VALVE INSTALLATION

Special care should be taken to ensure all foreign objects are removed from air supply piping before installation of solenoid valve.

Ensure adequate space is left for servicing or removal of solenoid valve.

Pipe sealant should be put on pipe thread, never on threads of solenoid valve. If PTFE tape is used, special care must be taken so that tape does not enter solenoid valve air paths.

The exhaust ports should be protected with breather mufflers or speed control valves so as to prevent foreign material from entering solenoid valve.

#### <u>Wiring</u>

WARNING: Wiring should be performed only by qualified electricians.

The SV-120 is a 120vac, 2- wire solenoid valve standard. Therefore only standard 2-wire, 120/60/1 wiring should be connected to the solenoid valve. (Optional voltages, 24vac, 24vdc, and 240vac can be ordered.)

Ensure valves are properly grounded.

#### Manual Override

The SV-120 is equipped with a manual override for use when power supply is interrupted, simply push the RED manual override button.

WARNING: Always remove power supply before servicing.

#### **SECTION 13b:** ACCESSORIES FOR PROCESS TREATMENT

#### P&ID: Item #: PSV-09310, BPV-09312

Unit Details: Press Relief Valve: Walchem ECO Valve Model: BPR-1-PVC-N

> Back Pressure Valve: Walchem ECO Valve Model: BPR-1-PVC-N

Manufacturer: Walchem Five Boynton Road Holliston, MA 01746 Phone: (508) 429-1110 Fax: (508) 429-7433 www.walchem.com Local Distributor/Contact: Maltz Sales 905 Turnpike Street Canton, MA 02021 Phone: (781) 821-4400 Fax: (781) 821-1314 www.maltzsales.com THIS PAGE INTENTIONALLY LEFT BLANK

01/2013 Rev. 2 180528.2

# **BPR Valve**

# **Instruction Manual**

Uses:

- Back Pressure valve
- Anti-Siphon valve
- Pressure Sustaining valve
- **Pressure Relief valve**

Please note:

This instruction manual provides detailed information and instructions that must be read, understood and followed to ensure that the equipment is installed, operated and serviced in an appropriate manner. Failure to do so before using may result in hazardous consequences and/or improper operation.



**IWAKI America Inc.** 

5 Boynton Road, Hopping Brook Park Holliston, MA 01746

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#### Introduction

The following instructions are to provide information on the Installation, operation and maintenance of BPR Valve, diaphragm style valves, manufactured by Walchem. The valves are designed to help improve the performance and safe operation of most positive displacement pumps.

Various materials of construction are available dependent on the requirements of the application and the type of fluids being transferred.

The valve(s) are factory set at 50 PSIG with a field adjustment range of 0-150 PSIG. Other factory set pressure ranges (within the range of the valve) is available upon request.

#### Features of BPR Valve:

- PVC, PP, CPVC (Corzan), PVDF and 316L S/S wetted construction
- PVC diaphragm with PVC valve bodies
- PTFE laminated to EPDM backer diaphragm standard on all other material
- Optional Viton or EPDM wetted diaphragm materials
- Only one elastomer is present in the wetted end
- Turn down handle limits pressure to 150 PSIG
- Locking adjustable pressure screw
- Color-coded caps indicate size at a glance
- Built-in gauge port on both sides of valve body (pre-drilled & threaded optional)
- Specially designed spring provides consistent pressure adjustments through the range (7-150 PSIG)
- BPR valve is available in several configurations to meet your needs, such as threaded, socket, flanged, union in DIN, BSPT and American Standard
- Built-in downstream manual air release, for ease of pump priming
- Built-in anti-siphon

#### Back Pressure Valve/Anti-siphon:

Diaphragm Back Pressure Valves serve two primary functions. The first is to provide a constant discharge pressure on the pump, which improves the performance, efficiency and consistency of the delivered volume. Secondly, the valve performs as an anti-siphon mechanism against positive or negative pressures in the downstream line. The valve is designed to allow for the venting of air into the downstream pipeline. This provides for easier priming of metering pumps that function under a suction lift. This is accomplished by a simple adjustment of the handle.

The valve comes complete with a gauge port located on both sides of the valve body; the ports are normally not drilled or tapped for a gauge connection. (See gauge installation instructions on page 5)

#### Caution:

The gauge port is solely for the installation of the gauge and must not be used for the bleeding or venting of the system. Improper operation of the valve and/or hazardous consequences could result. (See gauge installation instructions)

#### Back Pressure /Pressure Sustaining Valve: Reason for Selection and Use

Metering pumps having an atmospheric discharge system pressure or less than 20 psi will benefit from the installation of a back pressure control valve. Metering pumps in general require downstream back pressure to ensure smoother function of the discharge check assemblies, which enhances the accuracy of the discharge flow.

#### Pressure Relief Valves:

Diaphragm Pressure Relief Valves are designed to relieve excess line pressure that exceeds the set pressure of the valve. This protects the system piping from overpressure that could result in hazardous leakage and/or damage to the pump and other system components.

The Pressure Relief Valves are normally recommended to be set between 5 and 10 PSIG above the system operating pressure.

When BPR valves are used as a pressure relief valve it is a two port valve, thus designed for off line installations. This requires the valve to be installed on a tee branch of the discharge line of the pump for piping back to supply tank or feed side of pump.

The valve comes complete with a gauge port located on both sides of the valve body; the ports are normally not drilled or tapped for a gauge connection. (See gauge installation instructions on page 5)

#### Caution:

The gauge port is solely for the installation of the gauge and cannot be used for the bleeding or venting of the system. Improper operation and/or hazardous consequences could result. (See gauge installation instructions)

#### Pressure Relief Valves: Reason for Selection and Use

Most positive displacement pumps require the use of a pressure relief valve; it should always be installed on the downstream side of the pump to protect the system from over pressure which can cause pipe leakage and/or rupture. There should not be any type of valve located between the pump discharge or the pressure relief valve, for the pressure relief valve to function properly.

#### Installation and Maintenance of Back Pressure Valves:

Back pressure control valves are installed on the discharge line of the pump. The valve should be located as reasonable close as possible of the pump discharge to ensure check valve seating. When pumping to a process line without an injection valve, the back pressure valve should be installed as close as possible to the injection point to prevent siphoning.

When used in conjunction with a pressure relief valve, always locate the back pressure valve on the downstream side of the relief valve.

The valve is supplied from the factory pre-set at 50 psig. To increase the pressure setting, back off the lock nut located beneath the colour coded bonnet cap. Turn the Allan bolt using a 5/16" or #8 hex key clockwise to increase pressure setting or counter clockwise to reduce pressure setting. Approximately one (1) full turn of the handle is equal to 10 psig.

If maintenance is required on the valve:

- 1. Ensure that the value is *properly isolated* from the line, **not under pressure** and **properly flushed** of chemical before proceeding to disassembly.
- 2. Turn Allan bolt on the top of valve, counterclockwise until all spring pressure is released **before** proceeding to undo retaining nuts, to remove top of valve for diaphragm replacement.
- 3. All working components ie. diaphragm, spring can be accessed by removing the four retaining bolts located on the bottom of the valve (item # 9 of parts breakdown).
- 4. When replacing a PTFE coated diaphragm, ensure the PTFE coated side of the diaphragm is facing down when viewed from the top of the valve. The installed diaphragm also functions as the body seal. (Torque nuts to 40 inch pounds when reassembling)

#### Installation and Maintenance of Pressure Relief Valves:

Pressure relief values are installed on the discharge line of a pump and should be located as close as possible to the metering pump. The value is of a two port design and is required to be installed on a branch tee for piping back to the supply tank or feed side of the pump.

Never install shut-off/isolation valves between pump discharge and in-line pressure relief valves. When using in conjunction with a back pressure control valve, always install back pressure valve downstream of pressure relief valve. The relief port on the pressure relief valve should be piped back to the feed tank or suction side of the pump (see typical installation schematics).

#### Caution: The plastic valve bodies have standard threads, which are tapered. When installing pipe into the body, hand tighten only to avoid cracking.

#### Gauge Installation Instructions:

For the convenience of pressure setting and reading, there are two ports provided one on either side of the valve body. These ports are normally not drilled or tapped unless initially ordered that way. To drill and tap the ports it is recommended that you first disassembly the valve so as to not leave any foreign particles in the valve. You will require a 1/8" or 3.264 mm drill bit to drill out the centre point of the gauge port opening into the body of the valve. The port is already the correct diameter for the tapping of a ¼" or M10 thread. It is recommended that you use a regular tap then a bottoming tap to open the port up, this will allow for the proper number of gauge threads.

# Manual Air Release



DIAPHRAGIN POSITION AT 50 PM BACK PRESSURE The valve is shipped with a factory set pressure of 50 psig. The diagram to the left shows a cut away view of the position of the diaphragm on the seat.



AIR RELEASE POSITION WITH HANDLE BACKED OFF To adjust the valve to relieve air or gas downstream:

- 1. Back off lock nut located beneath the black cap.
- 2. Turn handle counter clockwise until approximately 1 inch of thread is exposed.
- 3. At this adjustment, the spring has relieved all tension from the diaphragm allowing air or gas to be vented downstream.

#### **Typical Installations**

The installations below are typical installation examples only. Consult your engineering department for the appropriate installation for your application or call the factory for advice





Example B: System arrangement for solenoid driven (above 150 psig) or motor driven pumps.





## Exploded View -- Back Pressure / Pressure Relief Valves

#### **Flow Rates**

Subject: Flow capacity through BPR VALVE, back pressure/pressure sustaining and pressure relief valves.

Under continuous flow conditions: @ **100 PSI** with ambient temperature water with the valve set@ 50PSIG.

¼" valve	17	USGPM
1/2" valve	19	USGPM
<sup>3</sup> ⁄4" valve	36	USGPM
1" valve	38	<b>USGPM</b>

Note: Capacities will increase with pressure. (If pressure is doubled, flow rate will approximately double)

For capacities of valves with pulsating flow use approximately 1/3 of the above given flow values.

#### **Temperature Correction Factors: Thermoplastics**

**Temperature Effects:** Thermoplastics and thermosets will decrease in tensile strength as the temperature increases: therefore, the working pressure must be reduced accordingly. The following factors will apply:

Opera Tempei	ating ratures		{Fact	{Factors}			
F	С	PVC	CPVC	PP	PVDF		
70	21	1.00	1.00	1.00	1.00		
80	27	1.00	1.00	1.00	1.00		
90	32	1.00	1.00	1.00	1.00		
100	38	.90	1.00	1.00	1.00		
110	43	.83	1.00	.91	1.00		
115	46	.75	1.00	.87	1.00		
120	49	.66	1.00	.83	1.00		
125	52	.58	.97	.79	1.00		
130	54	.50	.95	.75	1.00		
140	60	.33	.90	.66	1.00		
150	66	NR	.80	.60	.97		
160	71	NR	.70	.53	.93		
170	77	NR	.60	.43	.86		
180	82	NR	.50	.33	.80		
200	93	NR	.33	NR	.66		
210	99	NR	NR	NR	.60		
240	116	NR	NR	NR	.40		
280	138	NR	NR	NR	.16		

#### Example:

Maximum Pressure for PVDF valve at 280°F (138°C) Factor = 0.16 x 150psig = 24psig max. pressure Factor = 0.16 x 1034kPa = 165.44kPa max. pressure

The maximum pressure rating for valves regardless of size is 150 PSIG (1034 kPa) at 73° F (22°C)

NR = not recommended

The maufacturer takes no responsibility for the enclosed data.



	Norr	ninal ze	PVC, CPVC, PP & PVDF						
	NPS Inch	DN mm	ØD inch mm	h inch mm	H inch mm	L inch mm Thrd	L inch mm Soc	L inch mm Flg	L inch mm Unin
BPR-1	1	25	3.50 88.9	0.88 22.4	4.80 121.9	4.85 123.2	4.85 123.2	7.48 190.0	7,30 185.4
BPR-3	1/4	8	2.50 63.5	0.66 16.7	4.48 113.9	3.40 86.4	3.40 86.4	N/A	6.00 152.4
BPR-5	1/2	15	2.50 63.5	0.66	4.48 113.9	3.40 86.4	3.40 86.4	5.40 137.2	6.00 152.4
BPR-7	3/4	20	3.50 88.9	0.88 22.4	4.80 121.9	4.85 123.2	4.85 123.2	7.17	7.30

	Norr	inal zə	316L SS						
	NPS DN Inch mm		N ØD inch m mm		h H Inch Inch mm mm		L inch mm	L inch mm	
			-	_		Thrd	Soc	Flg	
BPR-1	1	25	3.50 88.9	0.86 21.8	5.10 129.5	3.50 88.9	3.50 88.9	7.66 194.6	
BPR-3	1/4	8	2.50 63.5	0.60	4.47 113.5	2.50 63.5	2.50 63.5	N/A	
BPR-5	1/2	15	2.50 63.5	0.60 15.2	4.72	2.50 63.5	2.50 63.5	6.15 136.2	
BPR-7	3/4	20	3.50 88.9	0.73 18.5	4.80 121.9	3.50 88.9	3.50 88.9	7.50 190.5	

### LIMITED WARRANTY

The Manufacturer warrants its products against defects in workmanship or materials for one (1) year under normal use.

The Manufacturer's obligations and liabilities under this warranty shall be limited to replacement of the product, or a refund of an amount not to exceed the purchase price of the product(s) to which such warranty claim is made. Repairs or replacements are made subject to our inspection of the returned product(s). The Manufacturer's decision of one of these alternatives shall be the buyer's exclusive remedy.

This warranty does not extend to damage by corrosion or other decomposition by chemical action. The Manufacturer does not warrant damages caused by (a) improper use of the product, (b) unauthorized modification or attachment to product, (c) misuse, abuse, accident or negligent handling or installation of product, or (d) alterations or repairs made by purchaser.

The materials of construction offered are recommendations only, subject in all cases to acceptance by purchaser. These recommendations do not constitute any guarantee against corrosion or decomposition, but are based on previous experience and best available information of the industry.

Statements and instructions set forth herein are based on the best information and practices known to The Manufacturer, but it should not be assumed that every acceptable safety procedure is contained herein. Of necessity The Manufacturer cannot guarantee that actions in accordance with such statements and instructions will result in the complete elimination of hazards and it assumes no liability for accidents that may occur.

Except as specifically provided herein, The Manufacturer makes no warranty, representations, promise or guarantee, either express or implied, statutory or otherwise, with respect to the product and technical information provided, including the products' quality, performance, merchantability, or fitness for a particular purpose.

In no event will The Manufacturer be liable for indirect, special, incidental, economic, covert or consequential damages arising out of the use or inability to use the product, including without limitation, damages or costs relating to the loss of profits, business and good will even if advised of the possibility of such damages. In no event shall The Manufacturer's liability exceed the amount paid by you for the product.

The warranty and remedies set forth herein are exclusive and in lieu of all others, oral or written, express or implied. No The Manufacturer dealer, distributor, agent or employee is authorized to make any modification or addition to this warranty. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

#### SECTION 13c: ACCESSORIES FOR PROCESS TREATMENT

P&ID: Item #: PD-0951,

Unit Details: Sentry Pulsation Dampener C311ND-1

Manufacturer: Walchem Five Boynton Road Holliston, MA 01746 Phone: (508) 429-1110 Fax: (508) 429-7433 <u>www.walchem.com</u>

Local Distributor/Contact: Maltz Sales 905 Turnpike Street Canton, MA 02021 Phone: (781) 821-4400 Fax: (781) 821-1314 www.maltzsales.com THIS PAGE INTENTIONALLY LEFT BLANK



MODEL #:	C311ND-1
AIR CONTROL:	CHARGE
BLADDER:	EPDM
CAPACITY:	85 CUBIC INCHES/1.4 LITERS
INLET:	1" FNPT
MAXIMUM PRESSURE:	150 PSI/10 BARS
NONWETTED HOUSING:	PVC
WETTED HOUSING:	PVC

#### DISCLAIMER

ALTHOUGH THE INFORMATION ON THIS SHEET IS BELIEVED TO HAVE BEEN ACCURATE WHEN THE SHEET WAS FIRST PREPARED, SOME INFORMATION ON THIS SHEET MAY NOT BE ENTIRELY ACCURATE NOW. PLEASE VERIFY MATERIAL COMPONENTS, DIMENSIONS, AND PRESSURE RATING ON THE CURRENT BROCHURE FOR THIS PRODUCT BY BLACOH FLUID CONTROL, INC. ("BLACOH") OR, IF NECESSARY, CONTACT BLACOH DIRECTLY. PRESSURE TOLERANCES, INCLUDING BUT NOT LIMITED TO, ON MODELS MADE OF PLASTIC, MAY BE REDUCED BY TEMPERATURE VARIATION AND BY THE COMPOSITION OF THE SUBSTANCE BEING PUMPED.

USE OF AN INCOMPATIBLE OR UNSUITABLE DAMPENER ON A PUMP MAY BE DANGEROUS TO PERSONS AND PROPERTY. BY WAY OF EXAMPLE BUT NOT LIMITATION, USE OF AN INCOMPATIBLE OR UNSUITABLE DAMPENER MAY RESULT IN EXPLOSIONS, LEAKAGE OF LIQUIDS OR GASES (WHICH MAY BE HAZARDOUS), OR MALFUNCTIONING EQUIPMENT.

THE USER IS SOLELY RESPONSIBLE FOR (AND BLACOH IS NOT RESPONSIBLE FOR) VERIFYING THE COMPATIBILITY AND SUITABILITY OF A PARTICULAR DAMPENER FOR A PARTICULAR PUMP AND APPLICATION. AS WELL AS DETERMINING WHETHER TESTING OF A DAMPENER IS ADVISABLE PRIOR TO USE IN A PARTICULAR APPLICATION.



#### BLACOH FLUID CONTROL, INC.

601 COLUMBIA AVE. • BLDG. D • RIVERSIDE • CA • 92507 • USA TEL: 800.603.7867 • 951.342.3100 • FAys 951.342.3101 SALES@BLACOH.COM • WWW.BLACOH.COM

# Installation, Operation and Maintenance Manual



# SENTRY

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#### MODEL SPECIFICATIONS & INSTALLATION INFORMATION

Model No.		Serial No.	Installation Date
1			
Body Material: Wetted / Non-wetted		Bladder/Bellows Material	Pump Area and Number
Purchased From	Contact	Phone	E-Mail

## The word "dampener", as used in this Manual, has the same meaning as Pulsation Dampener, Inlet Stabilizer, or Surge Suppressor.

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# SENTRY

### **SAFETY WARNINGS**

Dampeners should only be installed, operated and repaired by experienced and trained professional mechanics. Read and observe all instructions and safety warnings in this Manual before installing, operating or repairing dampeners.

#### SAFETY SYMBOLS

The following symbols indicate cautions, warnings and notes that must be observed for safe and satisfactory installation, operation and maintenance of dampener.



#### GENERAL SAFETY

() CAUTION!

- Observe all safety symbols in installation and operation instructions.
- The internal dampener pressure will equal the maximum fluid pressure of the system in which it is installed.
- DO NOT exceed maximum allowable working pressure (MAWP) specified on dampener serial tag or marked on dampener. If serial tag is missing, DO NOT use dampener without consulting distributor or factory for maximum pressure rating.
- Always make sure safety shutoff valves, regulators, pressure relief valves, gauges, etc. are working properly before starting system or assembly.
- Verify dampener model received against purchase order and shipper.
- Before starting a system or assembly make certain the discharge point of the piping system is clear and safe, and all persons have been warned to stand clear.
- DO NOT put your face or body near dampener when the system or assembly is operating, or dampener is pressurized.

- **DO NOT** operate a dampener that is leaking, damaged, corroded or otherwise unable to contain internal fluid, air or gas pressure.
- **DO NOT** pump incompatible fluids through dampener. Consult distributor or factory if you are not sure of the compatibility of system fluids with dampener materials.
- Dampeners are designed to operate with compressed air or clean dry Nitrogen only. Other compressed gases have not been tested and may be unsafe to use. DO NOT USE OXYGEN.
- Always shut off air supply, remove internal dampener pressure, and shut dampener isolation valve before performing dampener maintenance or repair.
- Remove all pressure from dampener AND pumping system before disassembly, removal or maintenance.
- Static spark can cause an explosion resulting in severe injury or death. Ground dampeners and pumping system when pumping flammable fluids or operating in flammable environments.
- NOTE: EC standard EN-13463-1 and EN-13463-5 (ATEX) require grounding (earthing) on dampeners when the potential for static sparking is present. A grounding point is located and marked on ATEX specific dampener models.

# SENTRY

#### EQUIPMENT MISUSE HAZARD

#### CAUTION!

#### **General Safety**

**DO NOT** misuse dampener, including but not limited to over-pressurization, modification of parts, using incompatible chemicals, or operating with worn or damaged parts. **DO NOT** use any gases other than compressed air or clean dry Nitrogen to charge dampener. **DO NOT USE OXYGEN.** Any misuse could result in serious bodily injury, death, fire, explosion or property damage.

#### **Over-Pressurization**

Never exceed the maximum pressure rating for the dampener model being used. Maximum allowable working pressure (MAWP) is specified on dampener serial tag or marked on dampener. Maximum allowable working pressure (MAWP) is rated at 70°F (21°C).

#### **Temperature Limits**

**DO NOT** exceed the operating temperature limits for the body and/or elastomer materials being used. Excessive temperature will result in dampener failure. For temperature limits, refer to the "Temperature Limits" section of the Manual. Temperature limits are stated at zero psi/bar.

#### Installation and Start-Up Hazards

Install dampener before charging or pressurizing. **DO NOT** start system or assembly without first charging or pressurizing dampener. Failure to charge may result in damage to the elastomeric bladder or PTFE bellows.

#### Temperature & Pressure Hazard

Temperature and pressure reduce the strength and chemical resistance of plastic, metal, elastomers and PTFE.

#### **Charging / Pressurization**

Charge or pressurize dampener with compressed air or clean dry Nitrogen only. **DO NOT USE OXYGEN.** 

#### Dampener Bladder/Bellows Failure

Dampeners utilize an elastomeric membrane (bladder) or PTFE bellows to separate system fluid from the air supply or gas charge. When failure occurs, system fluid may be expelled from the air valve. Always perform preventive maintenance and replace bladder/bellows before excessive wear occurs. O-rings for PTFE bellows cannot be re-used.

#### Maintenance Hazards

Never over-tighten fasteners. This may cause leakage of system fluid and damage to dampener body. Bolts on metal models should not be reused as re-torquing reduces bolt strength. AFTER MAINTENANCE OR RE-ASSEMBLY OF METAL MODELS, USE NEW FASTENERS AND TORQUE FASTENERS ACCORDING TO SPECIFICATION ON DAMPENER TAG.

#### **GENERAL** INFORMATION

For safe and satisfactory operation of dampener, read all safety warnings and caution statements, and this complete Manual before installation, startup, operation or maintenance.

MUST READ BEFORE INSTALLATION								
DO NOT use Oxygen to charge dampener. Use compressed air or clean dry Nitrogen only.	!	<b>Danger of static spark!</b> Grounding precautions must be considered when dampener is used in flammable or explosive environments.						
<b>DO NOT</b> exceed maximum allowable working pressure (MAWP) specified on dampener serial tag or marked on dampener.	!	ATEX Models must be grounded (earthed) before operation.						
Turn pump off and remove all pressure from system prior to dampener installation.	!	<b>DO NOT</b> operate a dampener that is leaking, damaged, corroded or otherwise unable to contain internal fluid, air or gas pressure.						
Always wear safety glasses and other appropriate safety equipment when installing, charging or repairing dampener.	!	Temperature, pressure and chemicals affect the strength of plastic, elastomer, and metal components.						
	!	Many plastics lose strength rapidly as temperature increases. Consult factory if in doubt.						





#### TEMPERATURE LIMITS

Operating temperatures are based on the maximum temperature of the wetted dampener components only. Non-wetted dampener components may have a lower temperature limit. Temperature and certain chemicals may reduce the maximum allowable working pressure (MAWP) of the dampener.

Elastomer Materials	Temperature Limits		Applications			
Aflas	0°F to +400°F	(-18°C to +204°C)	High temperature, petroleum based chemicals, strong acids and bases.			
Buna	+10°F to +180°F	(-12°C to +82°C)	Good flex life; use with petroleum, solvents and oil-based fluids.			
FDA Buna	+10°F to +180°F	(-12°C to +82°C)	FDA-approved food grade; similar characteristics of regular Buna.			
EPDM	-60°F to +280°F	(-51°C to +138°C)	Use in extreme cold; good chemical resistance with ketones, caustics.			
Hypalon	-20°F to +275°F	(-29°C to +135°C)	Excellent abrasion resistance; good in aggressive acid applications.			
Neoprene	0°F to +200°F	(-18°C to +93°C)	Good abrasion resistance and flex; use with moderate chemicals.			
PTFE	+40°F to +220°F	(+4°C to +104°C)	Bellows design; excellent flex life; use with highly aggressive fluids.			
Santoprene	-20°F to +225°F	(-29°C to +107°C)	Excellent choice as a low cost alternative for PTFE in many applications.			
FDA Silicone	-20°F to +300°F	(-29°C to +149°C)	FDA-approved food grade material; for use in food and pharmaceutical processing.			
Viton	-10°F to +350°F	(-23°C to +177°C)	Use in hot and aggressive fluids; good with aromatics, solvents, acids and oils.			

**CAUTION!** Plastic materials lose strength as temperature increases which reduces the maximum pressure sustainable by the material.

Non-Metallic Body Materials	Temperature Limits	Applications
PVC	See chart below.	Good general chemical resistance; looses strength quickly as temperature rises.
CPVC	+32°F to +180°F (0°C to +82°C)	Chlorinated PVC (CPVC) retains strength to higher temperatures.
Acetal*	+32°F to +175°F (0°C to +79°C)	Good flex life; low moisture sensitivity; high resistance to solvents and chemicals.
Noryl	+32°F to +220°F (0°C to +104°C)	Good resistance to acids and bases; good temperature stability.
Polypropylene*	+32°F to +175°F (0°C to +79°C)	Good general purpose plastic; broad chemical compatibility at medium temperatures.
PTFE	+40°F to +220°F (+4°C to +104°C)	Use with highly aggressive fluids.
PVDF	+10°F to +200°F (-12°C to +93°C)	Excellent resistance to most acids and bases; highest temperature plastic available.

Conductive Acetal and Conductive Polypropylene available.

CAUTION! PVC loses strength more rapidly than other plastic materials as temperature increases. Certain chemicals can also affect material strength reducing maximum pressure ratings. The chart below shows reduced maximum pressure ratings based on temperature for PVC only. Note that these are general guidelines only; selection of dampener materials must be determined by each individual application to avoid equipment damage and unsafe operation.

PVC Maximum Pressure Guidelines by Temperature									
Temperature	73.4°F	80°F	90°F	100°F	110°F	120°F	130°F		
	(23° C)	(27°C)	(32°C)	(38°C)	(43°C)	(48°C)	(54°C)		
Maximum	150 psi	142.5 psi	135 psi	112.5 psi	97.5 psi	90 psi	75 psi		
Pressure	(10.3 bar)	(9.8 bar)	(9 <b>.</b> 3 bar)	(7.6 bar)	(6.7 bar)	(6.2 bar)	(5 <b>.</b> 2 bar)		


# INSTALLATION & OPERATION INSTRUCTIONS: DAMPENER (CHARGEABLE MODEL)

DO NOT USE PLASTIC MODELS AS SURGE SUPPRESSORS AT QUICK CLOSING VALVES. USE METAL SURGE SUPPRESSORS FOR WATER HAMMER OR QUICK CLOSING VALVE APPLICATIONS. CONSULT FACTORY FOR OPTIONS.

(I) ATEX MODELS MUST BE GROUNDED (EARTHED) BEFORE OPERATION.

> Turn pump off and remove all pressure from system prior to dampener installation.

Remove all pressure from dampener AND pumping system before disassembly, removal or maintenance.

Use compressed air or clean dry Nitrogen to charge dampener. **DO NOT USE OXYGEN.** 

DO NOT exceed maximum allowable working pressure (MAWP) specified on dampener serial tag.

Always wear safety glasses and other appropriate safety equipment when installing, charging or repairing dampener.

READ ALL SAFETY WARNINGS AND INSTALLATION & OPERATION INSTRUCTIONS IN THE MANUAL BEFORE INSTALLATION.

, IMPORTANT! AFTER MAINTENANCE OR RE-ASSEMBLY OF METAL MODELS, USE NEW FASTENERS AND TORQUE FASTENERS ACCORDING TO SPECIFICATION ON DAMPENER TAG.

Before performing a system pressure test, dampener must be charged with 80% of system test pressure to avoid possible damage to bladder/bellows.

### READ BEFORE INSTALLATION

# **PRE-CHARGE NOTES**

READ BEFORE INSTALLATION

The following pre-charge notes are for plastic dampener models with a maximum pressure rating up to 150 psi (10.3 bar) and metal models with a maximum pressure rating up to 2000 psi (138 bar). NOTE: Dampener can be pre-charged with compressed air up to a maximum pressure of 150 psi (10.3 bar). If maximum pressure will exceed 150 psi (10.3 bar), dampener must be pre-charged with Nitrogen only. DO NOT USE OXYGEN.

Pre-charge pressure should be checked at least monthly as gas molecules will diffuse through elastomeric bladders, the speed of which depends on the elastomer material, temperature and pressure. Checks must occur when no system pressure is present or inaccurate readings will be recorded. If temperature is above 72°F (22°C) and/or pressure is over 300 psi (20.7 bar), checks should be performed more frequently. To prevent pre-charge loss through the fill valve, always replace the fill valve cap after charging. A proper gas charge is the key to dampener effectiveness and bladder/bellows life.

READ BEFORE INSTALLATION	INSTALLATION FOR PUMP	PEAD RECORE INSTALL
	DISCHARGE PULSATION	

## Step 1 — Installation Position

Install the dampener in-line, as close to the pump discharge as possible to absorb the pulse at its source and before any downstream equipment such as risers, valves, elbows, meters, or filters. Dampener installation should be no more than ten pipe diameters from pump discharge. If using a flexible connector on the discharge side of the pump between the pump and system piping, the dampener should be installed at the pump discharge manifold. The flexible connector should be attached to the dampener's tee and system piping (see FIGURE 1). Since pressure is equal in all directions, the dampener can be installed in a vertical, horizontal, or upside-down position. A vertical installation is recommended for better drainage of the dampener. Limitations for horizontal and upside-down mounting include high specific gravity, high viscosity, settling of solid material, or possible air entrapment, which could result in shortened bladder/bellows life and/or reduced dampening performance.

## Step 2 — Charging and Start-Up (see Pre-Charge Notes)

Chargeable models do not require an air line connection. Dampener can be pre-charged with compressed air up to a maximum pressure of 150 psi (10.3 bar). If maximum pressure will exceed 150 psi (10.3 bar), dampener must be pre-charged with Nitrogen only. Use a hand pump, Nitrogen tank or air compressor to charge dampener. **DO NOT USE OXYGEN.** Charging hose kits are available from BLACOH.

ATION



**Prior to starting the pump**, pre-charge the dampener to approximately 80% of expected system pressure and replace fill valve cap. **DO NOT USE OXYGEN.** The pre-charge pressure in the dampener must always be lower than pump discharge pressure. Generally, pulsation is most effectively minimized when the gas pre-charge is 80% of system pressure. Start the pump to generate system pressure. The dampener charge pressure may need to be adjusted up or down to be most effective in reducing pulsation. **NOTE:** The most effective method to set the proper dampener charge is to install a pressure gauge downstream of the dampener and adjust the dampener to minimize needle movement on the gauge.

Once system pressure is in contact with the bladder/bellows, the gas charge will be compressed to the system pressure and the dampener gauge will read the system pressure, not the initial charge pressure. Once working pressure is achieved, adjustment may be necessary. Gradually increase or decrease the gas charge in the dampener by bleeding or filling through the gas valve. Allow the system to respond to each adjustment (this may take a minute or two) before making further adjustments.

# READ BEFORE INSTALLATION FOR PUMP INLET READ BEFORE INSTALLATION

## Step 1 — Installation Position

Install the dampener in-line, as close to the pump inlet as possible and after any upstream equipment such as risers, valves, elbows, meters, or filters. Dampener installation should be no more than ten pipe diameters from pump inlet. If using a flexible connector on the inlet side of the pump between the system piping and pump, the dampener should be installed on a tee at the pump inlet manifold. The flexible connector should be attached to the dampener's tee and system piping (see FIGURE 1). A compound pressure gauge should be installed upstream of the dampener to aid in proper dampener adjustment.

## Step 2 — Charging and Start-Up (see Pre-Charge Notes)

Chargeable models do not require an air line connection. Dampener must be pre-charged with compressed air or Nitrogen, using a hand pump, Nitrogen tank/bottle, or compressor. **DO NOT USE OXYGEN.** Charging hose kits are available from BLACOH.

**A. Suction Lift/Dampener:** When using the dampener in a suction lift application no pre-charge is required. Start the pump to generate working pressure. As system pressure and vacuum is created, the acceleration head created with each suction stroke will compress the air trapped in the bladder/bellows.

**B. Positive Inlet Pressure:** Pre-charge the dampener with 50% of the static system pressure realized at the pump inlet. Start the pump to generate working pressure. Minor pressure adjustments may be required. Allow the system to respond to each adjustment (this may take a minute or two) before making further adjustments.





# INSTALLATION FOR SURGE / WATER HAMMER

**READ BEFORE INSTALLATION** 

## Step 1 — Installation Position

**READ BEFORE INSTALLATION** 

Install the dampener in-line, as close as possible to and before the device causing the water hammer pressure spike (see FIGURE 2). For example, if a quick closing valve is causing water hammer, install the dampener on a tee or elbow as close as possible upstream of the valve. Dampener installation should be no more than ten pipe diameters from the valve. It is advisable to install an isolation valve between the dampener inlet and the mounting tee so maintenance and pressure checks can be done while the system is operating.



## Step 2 — Charging and Start-Up (see Pre-Charge Notes)

Chargeable models do not require an air line connection. Dampener can be pre-charged with compressed air up to a maximum pressure of 150 psi (10.3 bar). If maximum pressure will exceed 150 psi (10.3 bar), dampener must be pre-charged with Nitrogen only. Use a hand pump, Nitrogen tank or air compressor to charge dampener. **DO NOT USE OXYGEN.** Charging hose kits are available from BLACOH.

The dampener must be pre-charged **after** installation but **prior to** system operation. The only method to get an accurate pressure charge in the dampener is to charge it prior to system start up or with a closed isolation valve at the dampener inlet. Pre-charge the dampener with 90% to 95% of expected system pressure. **DO NOT USE OXYGEN.** A fill valve similar to a Schrader type tire valve but designed for suppressors, is mounted to the top of the dampener. Replace fill valve cap after charging dampener and re-check dampener charge every month.



# MAINTENANCE & TROUBLESHOOTING GUIDE SENTRY PULSATION DAMPENERS

# **PREVENTATIVE MAINTENANCE**

SENTRY Pulsation Dampeners require very little maintenance. The rubber bladder or PTFE bellows is the only wear part of the unit.

Bladder replacement should be part of the system preventive maintenance program. Bladder life is a function of many variables. Normal life can be from a few months to several years depending upon usage, proper charge and dampener size, system design, and/or the harshness of the process fluid and application temperature.

SENTRY units used in conjunction with diaphragm pumps should have the rubber bladders replaced at least every second time the diaphragms in the pump are replaced. This does not apply to PTFE bellows. As with any pumping system, component wear is dependent upon many factors; therefore, this suggested maintenance program might need to be adjusted based upon specific applications.

Periodic inspection of units should be as follows:

- 1. SENTRY housings and fasteners should be inspected for signs of over pressurization, stress, fatigue, corrosion, or UV attack. Housings and fasteners must be replaced at the first indication of deterioration.
- 2. Fastener tightness should be checked before initial start-up. Consult factory for torque specifications.
- 3. Fasteners on metal units should be replaced at each re-assembly.
- 4. Check the gas pre-charge in the unit while no system pressure is present. If system pressure is present, the gauge will display system pressure, NOT the pre-charge pressure.
- 5. Check the unit pressure gauge during operation. If the dampener is properly charged, the gauge needle should be fluctuating with each pump discharge stroke. Replace the gauge if needed.
- 6. Adjust the regulator on adjustable models to insure maximum dampening. Replace the self-relieving regulator if needed.

# **EFFECTIVE DAMPENING TIPS**

The primary factors that determine the level of dampening obtained with a SENTRY dampener are capacity, location, and the pressure charge.

**CAPACITY:** The dampener must be properly sized so that the volume of compressed gas inside is enough to absorb fluid shock, and also enough liquid volume capacity to accumulate the fluid pulse. A key element of effective dampening is the relationship of the gas charge to the fluid volume necessary for the pressure range required. An undersized dampener will result in insufficient dampening and can lead to excessive bladder wear and early failure.

The capacity of a pulsation dampener must be in the correct ratio to the volume per stroke of the pump and the number of pump heads. The larger the ratio is, the higher the level of dampening will be. For an Air Operated Diaphragm Pump the ratio between the dampener capacity and the pump stroke volume should be from 1.5:1 to 5:1, based upon the level of dampening required. For a metering pump the ratio is 10:1 to 30:1, based upon the level of dampening required.

LOCATION: Location is important because of wave frequency and fluid dynamics. Location directly effects dampener performance. The pulsation dampener should be installed as close as possible to the pump discharge and no further away than 10 pipe diameters. Installation should be on a tee in the fluid flow path. Do not install the dampener on a branch or riser. The farther away the dampener inlet is from the pump discharge, the less effective the unit will be.

A dampener installed on a riser or dead-end leg of pipe can actually increase pulsation. A pulse traveling toward the dampener has another pulse directly behind it. When the first pulse is reversed after contact with the dampener, it crashes into the next pulse disrupting the entire wave sequence. This action can change the system's fluid harmonics, which may lead to increased pulsation.

**CHARGE:** The compressed gas charge applied to any dampener will vary with each application and can have a significant effect on performance. To properly charge the unit, an accurate reading of the system fluid pressure is required. A pressure gauge should be installed on the system piping downstream from the unit. Any time the gas charge is equal to or greater than the system pressure, the dampener will not function properly. An over charged unit will force the internal bladder down, covering the inlet port – shutting off the dampener.

# TROUBLESHOOTING

# NO DAMPENING OR INSUFFICIENT DAMPENING EFFECT

- 1. Check the location of the dampener. Dampeners should be mounted within 10 pipe diameters of the pump discharge on a tee in the fluid flow path. The use of elbows and risers will decrease dampener performance.
- 2. Check the capacity of the dampener in relation to the pump stroke volume. An undersized dampener will decrease dampener performance and shorten bladder life.
- 3. Check the discharge head. Dampeners do perform better under a little discharge pressure (at least 5 psi). A slow stroking pump may not be filling the discharge pipe completely, creating zero discharge head between strokes. A slight discharge head can be created with a ball valve or back pressure valve.
- 4. Check for bladder failure. Replace bladder.
- 5. Check the dampener inlet fluid port for any blockage or restriction.

# LEAKING FLUID OR AIR

- 1. All plastic and PTFE components take an initial set after manufacture. The fasteners may need tightening. Consult factory for torque specifications.
- 2. Check the air controls and gauge threads for an airtight seal. Tighten if needed. Consult factory for torque specifications.
- 3. Check the ring flange or clamp band bolts for proper torque. Tighten if needed. Consult factory for torque specifications.
- 4. Check for a bladder rupture. Replace the bladder if it has failed.

# **BLADDER RUPTURE OR FAILURE**

**CAUTION:** IF A SYSTEM PRESSURE TEST IS TO BE PERFORMED, THE UNIT MUST BE CHARGED WITH 80% OF THE SYSTEM TEST PRESSURE PRIOR TO THE TEST. FAILURE TO CHARGE THE DAMPENER CAN CAUSE BLADDER FAILURE.

1. Chemical Attack

Swelling, hardening, and distortion are some of the indications of chemical attack. Check the chemical compatibility charts. Consult factory for assistance.

- 2. Cut Bladder Check for a sharp object that may have been introduced into the dampener through the pumped fluid.
- 3. Torn Bladder
  - Check for an insufficient air charge in the dampener. Properly charge the unit for the application.
  - Check for a transient high-pressure spike created by pump start up, pump shut down, vertical pipe runs, or a quick closing valve, all of which can destroy a bladder. A Surge Suppressor should be installed at the location where a pressure spike originates.
- 4. Excessive Bladder Wear
  - Check the size of the unit. An undersized unit does not have the capacity to absorb the volume of the pump stroke, forcing the bladder to be overworked.
  - Check the air charge in the unit. An undercharged unit will cause the bladder to rub excessively and wear against the body housing.



BLACOH FLUID CONTROL, INC. 601 COLUMBIA AVE. BLDG. D, RIVERSIDE, CA 92507 USA TEL: 800.603.7867 or 951.342.3100 Fax: 951.342.3101 e-mail: sales@blacoh.com web site: www.blacoh.com L-350 11/09/04

# SENTRY

# MANUFACTURER'S LIMITED WARRANTY & RETURN POLICY

## Standard Product Limited Warranty

Subject to the limitations set forth below, Blacoh Fluid Controls, Inc. ("Blacoh") warrants its products to be free from defects in material and workmanship under normal use, service, and maintenance in accord with Blacoh's published specifications for a period of two years from date of shipment by Blacoh (the "Warranty"). The EXCLUSIVE REMEDY for any product defect covered under this Warranty shall be one of the following, as determined by Blacoh in Blacoh's sole discretion: (a) refund of the purchase price; or (b) replacement or repair of the defective part or parts at Blacoh's facility. This Warranty will be null and void if the product is used in an inappropriate application or if the product has been altered, misapplied, improperly installed, or not properly inspected and maintained. To the maximum extent allowed by applicable law, Blacoh will not be responsible for nor have any liability for any "Damage," which means any of the following, whether the claim sounds in breach of contract, breach of warranty, tort, strict liability, implied contractual indemnity, or otherwise: (i) any damage, loss, or injury of any kind, or destruction, or death, whether or not caused by any defect in a Blacoh product and whether or not the Blacoh product is installed, used, operated, and/or maintained in accord with Blacoh instructions, to other products, machinery, buildings, property, or persons, and (ii) any costs, expenses, losses, or incidental, consequential, or special damages of any kind or nature, including but not limited to loss of profits, arising from or related to any Blacoh product, whether or not caused by any defect in a Blacoh product and whether or not the Blacoh product is installed, used, operated, and/or maintained in accord with Blacoh instructions. Damage resulting from chemical incompatibility or from over-pressurization of a product, whether from gas or fluid, is not covered under this Warranty, nor will Blacoh be responsible in any way for any such Damage. Because Blacoh does not determine and cannot anticipate or control the many different conditions under which its products may be used, Blacoh does not warranty the applicability, suitability, or fitness of any of its products for any particular use or purpose. Statements concerning the possible use of Blacoh products are not intended and shall not be interpreted as warranties of fitness for any specific use of such products. Each user of Blacoh products must conduct its own engineering analysis and tests to determine the suitability of each Blacoh product for the user's intended uses or purposes, including but not limited to chemical compatibility and pressurization, and any written or oral assistance from Blacoh in this regard does not relieve the user from exclusive responsibility for such engineering analysis and testing. Blacoh products are sold with only this limited Warranty, and each buyer assumes all responsibility for Damage (as defined above), including but not limited to, Damage arising from defects in Blacoh products and/or from the handling and use of Blacoh products whether used in accordance with Blacoh's directions or otherwise. Any products sold by Blacoh which are manufactured by and sold under the name of another company are NOT WARRANTED by Blacoh under the foregoing Warranty or otherwise. The buyer must rely exclusively on the product warranty, if any, given by such other company. Products manufactured by Blacoh as an original equipment manufacturer (OEM) to be sold by a customer under the customer's brand and name are warranted by Blacoh only under the above Warranty, and Blacoh shall have no liability whatsoever with respect to any representation or warranty given by such customer (or such customer's representatives, distributors, agents, employees, or independent contractors) to any of its buyers which is different in any respect whatsoever from the foregoing Warranty. EXCEPT FOR THE WARRANTY GIVEN ABOVE, WHICH IS SUBJECT TO THE ADDITIONAL LIMITATIONS STATED ABOVE, AND EXCEPT FOR THE ADDITIONAL LIMITED WARRANTY ON BLACOH'S PTFE BELLOWS STATED BELOW, BLACOH GIVES NO WARRANTY OF ANY NATURE WHATSOEVER, EXPRESS OR IMPLIED, WITH RESPECT TO ANY OF ITS PRODUCTS, INCLUDING WITHOUT LIMITATION NO WARRANTY OF MERCHANTABILITY AND NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. NO COURSE OF DEALING, USAGE OF TRADE, OR OTHER ORAL OR WRITTEN STATEMENTS SHALL MODIFY THE FOREGOING WARRANTY PROVISIONS AND LIMITATIONS IN ANY RESPECT WHATSOEVER. This Warranty shall be governed by and construed in accordance with the laws of the State of California.

## **PTFE Bellows Limited Warranty**

In addition to Blacoh's Standard Product Limited Warranty and subject to the limitations set forth below, Blacoh warrants that its PTFE Bellows equipment ("PTFE Bellows") on Blacoh's PTFE Bellows-fitted pulsation dampener will perform in accordance with Blacoh's written product description for three years from date of shipment ("PTFE Bellows Warranty"). This PTFE Bellows Warranty applies only to PTFE Bellows that are sized, charged, installed, used, operated, and maintained strictly in accordance with all installation, use, operation, and maintenance instructions provided by Blacoh, and failure to properly size, charge, install, use, operate, and maintain the PTFE Bellows (or failure to do any of them) shall make the PTFE Bellows Warranty null and void. This PTFE Bellows Warranty does not include applications where failure of performance is due to an unbalanced pressure load or a transient pressure spike (sometimes called a water hammer). The EXCLUSIVE REMEDY for breach of this PTFE Bellows Warranty is replacement of the PTFE Bellows at Blacoh's facility, and not any other equipment or parts whatsoever, and Blacoh will not be responsible for any Damage or any other loss of any kind, including but not limited to incidental, consequential, or special damages (including but not limited to loss of profits), in any way arising from failure of the PTFE Bellows to perform in accordance with Blacoh's written product description. This PTFE Bellows Warranty shall be governed and construed in accordance with the laws of the State of California.

# Warranty Claims

- Prior to returning any product to Blacoh based c Warranty, a Blacoh Return Request form must be determine if a Return Merchandise Authorization (R number does not constitute Blacoh's acknowledgme correct.
- 2. If an RMA number is issued by Blacoh, customer she specified on the RMA, freight prepaid.
- All products so returned to Blacoh based on a clair must be cleaned, sanitized and neutralized prior to that contains corrosive chemicals, organic cultures, might contaminate a breathable atmosphere or put a not comply will be returned at the expense of the cu pickup.
- 4. HAZMAT SHIPMENTS WILL BE REMOVED AND PF
- Receipt by Blacoh of a return does not constitute Warranty or PTFE Bellows Warranty.
- If Blacoh determines that a defect in workmanship entitled to a complete unit replacement. In the eve defective part or parts or refund the purchase price,

# New Product Returns

- If a customer wishes to return a new, unused Merchandise Authorization (RMA) number from Blac for possible credit.
- Product to be returned must be new, unused, and c of the return request. In addition the product mu Blacoh.
- 3. Product returns must be delivered, freight prepaid.

# SECTION 13d: TURBIDITY METER

Unit Details: ASCO Solenoid Valve 8262G007, Stainless Steel, ¼" NPT, 24V

Manufacturer:

ASCO Northeast 13000 Lincoln Drive West Suite 106 Marlton, NJ 08053 Phone: (856) 985-8700 Fax: (856) 985-5030 www.ascovalve.com

Local Distributor/Contact:

Cranston Windustrial 150 Jefferson Blvd Warwick, RI 02888 Phone: (401) 941-8370 Fax: (401) 669-6250 www.cranstonwindustrial.com THIS PAGE INTENTIONALLY LEFT BLANK



# Direct Acting **General Service Solenoid Valves**

Brass or Stainless Steel Bodies 1/8" to 3/8" NPT



# **Features**

- Reliable, proven design with high flows
- Small poppet valves for tight shutoff
- Wide range of elastomers for specialty service
- Mountable in any position
- Brass and stainless steel constructions

# Construction

Valve Parts in Contact with Fluids						
Body	Brass 303/304 Stainless Steel					
Seals and Discs	NBR or Cast UR					
Core Tube	305 Stainless Steel					
Core and Plugnut	430F Stainless Steel					
Springs	302 Stair	lless Steel				
Shading Coil	Copper	Silver				
Stem PA (Normally Open)						
Note: All 1/8" NPT Normally Open valves contain CA. All 1/4" NPT Normally Open valves contain PA.						

# Electrical

Standard	W	att Rati Cons	ng and Po sumption	)wer		Spare Coi	il Part No	
Coil and			AC		General	Purpose	Explosi	onproof
Class of Insulation	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	10.6	6.1	16	30	238210	238310	238214	238314
F	-	9.1	20	45	238210	-	238214	-
F	11.6	10.1	25	50	238610	238710	238614	238714
F	22.6	17.1	40	70	238610	238710	238614	238714

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering. Other voltages available when required.

# Solenoid Enclosures

Standard: Watertight, Types 1, 2, 3, 3S, 4, and 4X. **Optional:** Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9. (To order, add prefix "EF" to catalog number)

See Optional Features Section for other available options.





# **Nominal Ambient Temp. Ranges**

AC: 32°F to 125°F (0°C to 52°C) DC: 32°F to 104°F (0°C to 40°C) Refer to Engineering Section for details.

# Approvals

CSA certified. UL listed, as indicated. Normally Closed Valves FM approved. Meets applicable CE directives. Refer to Engineering Section for details.



# Specifications (English units)

			Operating Pressure Differential (psi)												Watt F	tating/		
			N	/lax. AC		N	lax. DC		Max. Tem	Fluid p. °F	Bra	ss Body		Stainless	s Steel Bo	ody	Class Insula	of Coil tion @
Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Air-Inert Gas	Water	Lt. Oil @ 300 SSU	Air-Inert Gas	Water	Lt. Oil @ 300 SSU	AC	DC	Catalog Number	Const. Ref.	UL ③ Listing	Catalog Number	Const. Ref.	UL ③ Listing	AC	DC
NORM	ALLY CL	OSED (C	losed whe	n de-ene	ergized),	NBR Disc												
1/8	3/64	.06	750	750	530	650	640	550	180	120	8262G001	1	О	8262G012	1	О	6.1/F	10.6/F
1/8	3/32	.20	275	290	130	150	140	145	180	120	8262G014	1	О	8262G015	1	О	6.1/F	10.6/F
1/8	1/8	.34	155	180	140	80	80	80	180	120	8262G002	1	О	8262G006	1	О	6.1/F	10.6/F
1/4	3/64	.06	750	750	500	500	500	500	180	120	8262G019	16	О	8262G080	11	О	6.1/F	10.6/F
1/4	3/64	.06	1500	1500	1100	475	475	450	140	140	8262G200 ①	17	•	-	-	-	10.1/F	11.6/F
1/4	3/64	.06	2200	2000	1100	-	-	-	140	140	-	-	-	8262G214 ①	12	•	10.1/F	-
1/4	3/32	.17	360	340	160	150	125	125	180	120	8262G020	16	О	8262G086	11	О	6.1/F	10.6/F
1/4	3/32	.17	500	500	280	-	-	-	180	-	8262G021	16	О	-	-	-	9.1/F	-
<mark>1/4</mark>	<mark>1/8</mark>	<mark>.35</mark>	<mark>140</mark>	<mark>165</mark>	<mark>90</mark>	<mark>65</mark>	<mark>60</mark>	<mark>60</mark>	<mark>180</mark>	<mark>120</mark>	8262G022	16	О	8262G007	<mark>11</mark>	0	<mark>6.1/F</mark>	10.6/F
1/4	1/8	.35	300	300	200	75	70	70	180	150	8262G232	17	О	-	-	-	10.1/F	11.6/F
1/4	5/32	.50	180	200	145	40	40	45	180	150	8262G202	4	О	8262G220	12	О	10.1/F	11.6/F
1/4	7/32	.72	90	100	100	25	25	25	180	150	8262G208	4	О	8262G226	12	О	10.1/F	11.6/F
1/4	7/32	.85	40	50	40	17	20	21	180	120	8262G013	2	О	8262G036	11	О	6.1/F	10.6/F
1/4	9/32	.88	60	75	60	18	15	18	180	150	8262G210	4	О	-	-	-	10.1/F	11.6/F
1/4	9/32	.88	90	100	90	25	20	22	180	150	8262G212	6	О	8262G230	13	О	17.1/F	22.6/F
1/4	9/32	.96	27	36	28	15	16	16	180	120	8262G090	2	О	8262G038	11	О	6.1/F	10.6/F
3/8	1/8	.35	160	150	90	65	60	60	180	120	8263G002	3	О	8263G330	3	О	6.1/F	10.6/F
3/8	5/32	.52	100	100	100	35	35	35	180	150	8263G200	5	О	8263G331	5	О	10.1/F	11.6/F
3/8	7/32	.72	100	100	100	25	25	25	180	150	8263G206	5	О	8263G332	5	О	17.1/F	11.6/F
3/8	9/32	.85	100	100	70	-	-	-	180	-	8263G210	7	О	8263G333	7	О	17.1/F	-
NORM	ALLY OF	PEN (Ope	n when de	-energiz	ed), NBR	Disc (exc	ept whe	re noted)	)	_								
1/8	1/16	.09	500	300	225	400	250	150	180	120	8262G091	8	•	8262G092	8	•	6.1/F	10.6/F
1/8	3/32	.15	275	200	150	190	110	110	180	120	8262G093	8	•	8262G094	8	•	6.1/F	10.6/F
1/8	1/8	.21	125	100	85	80	60	50	180	120	8262G031	8	•	8262G035	8	•	6.1/F	10.6/F
1/4	3/64	.06	750	700	700	500	500	500	140	140	8262G260 ①	9	•	8262G130 ①	14	•	10.1/F	11.6/F
1/4	3/32	.17	300	250	230	200	150	125	140	140	8262G261 ①	9	•	8262G134 ①	14	•	10.1/F	11.6/F
1/4	1/8	.35	130	110	100	80	60	60	180	150	8262G262	9	•	8262G138	14	•	10.1/F	11.6/F
1/4	5/32	.49	85	75	60	45	30	30	180	150	8262G263	4	•	8262G142	14	•	10.1/F	11.6/F
1/4	7/32	.83	45	45	40	25	20	20	180	150	8262G264	4	•	8262G148	14	•	10.1/F	11.6/F
1/4	9/32	.96	30	25	20	15	15	15	180	150	8262G265	4	•	8262G152	14	•	10.1/F	11.6/F
1 Cast	UR dis	c supplied	d as standa	ırd.														

O cast of the output of the data and a service, the rating for the 6.1/F solenoid is 8.1 watts.
 Safety Shutoff Valve; 

 General Purpose Valve. Refer to Engineering Section (Approvals) for details.



# Dimensions: inches (mm)



# Installation & Maintenance Instructions

**OPEN--FRAME, GENERAL PURPOSE, WATERTIGHT/EXPLOSIONPROOF SOLENOIDS** 

I&M No.V6583R9 (Section 1 of 2)

8016G/H

SERIES

# -SERVICE NOTICE-

ASCO<sup>®</sup> solenoid valves with design change letter "G" or "H" in the catalog number (example:  $8210\underline{G1}$ ) have an epoxy encapsulated ASCO<sup>®</sup> Red Hat II<sup>®</sup> solenoid. This solenoid replaces some of the solenoids with metal enclosures and open-frame constructions. Follow these installation and maintenance instructions if your valve or operator uses this solenoid.

# DESCRIPTION

Catalog numbers 8016G/H1 and 8016G/H2 are epoxy encapsulated pull-type solenoids. The green solenoid with lead wires and 1/2'' conduit connection is designed to meet Enclosure Type 1-General Purpose, Type 2-Dripproof, Types 3 and 3S – Raintight, and Types 4 and 4X – Watertight. The black solenoid on catalog numbers prefixed "EF" is designed to meet Enclosure Types 3 and 3S-Raintight, Types 4 and 4X – Watertight, Types 6 and 6P – Submersible, Type 7, Explosionproof Class I, Division 1, Groups A, B, C, & D and Type 9, - Dust - Ignitionproof Class II, Division 1, Groups E, F, & G. The Class II, Groups F & G Dust Locations designation is not applicable for solenoids or solenoid valves used for steam service or when a class "H" solenoid is used. See Temperature Limitations section for solenoid identification and nameplate/retainer for service. When installed just as a solenoid and not attached to an ASCO valve, the core has a 0.250-28 UNF-2B tapped hole, 0.38 minimum full thread.

# Series 8016G/H solenoids are available in:

- **Open-Frame Construction** 
  - The green solenoid may be supplied with 1/4'' spade, screw, or DIN terminals (Refer to Figure 4).
- Panel Mounted Construction

These solenoids are specifically designed to be panel mounted by the customer through a panel having a .062 to .093 maximum wall thickness. (Refer to Figure 3 and section on *Installation of Panel Mounted Solenoid*).

# **Optional Features For Type 1 – General Purpose Construction Only**

# Junction Box

This junction box construction meets Enclosure Types 2,3,3S,4, and 4X. Only solenoids with 1/4'' spade or screw terminals may have a junction box. The junction box provides a 1/2'' conduit connection, grounding and spade or screw terminal connections within the junction box (See Figure 5).

# • DIN Plug Connector Kit No. K236034

Use this kit only for solenoids with DIN terminals. The DIN plug connector kit provides a two pole with grounding contact DIN Type 43650 construction (See Figure 6).

## **OPERATION**

When the solenoid is energized, the core is drawn into the solenoid base sub-assembly. **IMPORTANT:** When the solenoid is de-energized, the initial return force for the core, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 2.77 lb (12.32 N) and 0.31 lb (1.38 N) for DC.

# **INSTALLATION**

Check nameplate for correct catalog number, service, and wattage. Check front of solenoid for voltage and frequency.

▲ WARNING: Electrical hazard from the accessibility of live parts. To prevent the possibility of death, serious injury or property damage, install the open − frame solenoid in an enclosure.

## FOR BLACK ENCLOSURE TYPES 7 AND 9 ONLY

▲ CAUTION: To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature of hazardous atmosphere is less than 165° C. On valves used for steam service or when a class "H" solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180°C. See nameplate/retainer for service.

**NOTE:** These solenoids have an internal non-resetable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or a shorted solenoid, etc. This unique feature is a standard feature only in solenoids with black explosionproof/dust-ignitionproof enclosures (Types 7 & 9).

# ASCO Valves ®

Page 1 of 6 (Section 1 of 2)

**A** CAUTION: To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601, and 8602 for strainers.

# **Temperature Limitations**

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature.

**NOTE:** For steam service, refer to *Wiring* section, *Junction Box* for temperature rating of supply wires.

Temperature Limitations For Series 8016G Solenoids for use on Valves Rated at 6.1, 8.1, 9.1, 10.6, or 11.1 Watts					
Watt Rating	Catalog Number Coil Prefix	Class of Insulation	Maximum ∜ Ambient Temp.		
6.1, 8.1, 9.1, & 11.1	None, FB, KF, KP, SF, SP, SC, & SD	F	125°F (51.7°C)		
6.1, 8.1, 9.1, & 11.1	HB, HT, KB, KH, SS, ST, SU, & ST	н	140°F (60°C)		
10.6	None, KF, SF, & SC	F	104°F (40°C)		
10.6	HT, KH, SU, & ST	н	104°F (40°C)		

†Minimum ambient temperature  $-40^{\circ}$ F ( $-40^{\circ}$  C).

Temperature Limitations for Series 8016H solenoids (Catalog Numbers 8262H & 8263H valves)							
	Wattage Ratings						
0		A	IC .	DC	Temperature		
Prefix	Coil Class	60 Hz	50 Hz		(°C)	(°F)	
EF, EV	FT	6.1	8.1	-	50		
EF, EV	FB	9.1	11.1	-	52	125	
	FT FB	6.1	8.1	-		131	
		9.1	11.1	-	55	101	
	НТ	1	-	10.6			
	HB	1	-	18.6	. ©	104	
EF, EV	HT	1	-	10.6	40	104	
EF, EV	HB	-	-	18.6			
	HT	6.1	8.1	-			
	HB	9.1	11.1	-	3	3	
EF, EV	НТ	6.1	8.1	-	60	140 <sup>°°</sup>	
EF, EV	HB	9.1	11.1	-			

①=EF, EV data applies to Explosionproof coils only.

② =DC solenoid valves can be operated at maximum ambient temperature of 55°C / 131° F with reduced pressure ratings. See valve I&M for maximum operating pressure differential ratings.

3=Steam service valves have a maximum ambient temperature of 55 °C / 131 ° F.

# Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub–assembly area.

# Wiring

Wiring must comply with local codes and the National Electrical Code. All solenoids supplied with lead wires are provided with a grounding wire which is green or green with yellow stripes and a 1/2'' conduit connection. To facilitate wiring, the solenoid may be rotated 360°. For the watertight and explosionproof solenoid, electrical fittings must be approved for use in the approved hazardous locations.

# **Additional Wiring Instructions For Optional Features:**

# • Open–Frame solenoid with 1/4" spade terminals

For solenoids supplied with screw terminal connections use #12-18 AWG stranded copper wire rated at 90°C or greater. Torque terminal block screws to  $10\pm2$  in–lbs  $[1,0\pm1,2$  Nm]. A tapped hole is provided in the solenoid for grounding, use a #10-32 machine screw. Torque grounding screw to 15-20 in–lbs [1,7-2,3 Nm]. On solenoids with screw terminals, the socket head screw holding the terminal block to the solenoid is the grounding screw. Torque the screw to 15-20 in–lbs [1,7-2,3 Nm]. with a 5/32'' hex key wrench.

# Junction Box

The junction box is used with spade or screw terminal solenoids only and is provided with a grounding screw and a 1/2'' conduit connection. Connect #12–18 AWG standard copper wire only to the screw terminals. Within the junction box use field wire that is rated 90°C or greater for connections. For steam service use 105°C rated wire up to 50 psi or use 125°C rated wire above 50 psi. After electrical hookup, replace cover gasket, cover, and screws. Tighten screws evenly in a crisscross manner.

# • DIN Plug Connector Kit No.K236-034

- 1. The open-frame solenoid is provided with DIN terminals to accommodate the DIN plug connector kit.
- 2. Remove center screw from plug connector. Using a small screwdriver, pry terminal block from connector cover.
- 3. Use #12-18 AWG stranded copper wire rated at 90°C or greater for connections. Strip wire leads back approximately 1/4"for installation in socket terminals. The use of wire-end sleeves is also recommended for these socket terminals. Maximum length of wire-end sleeves to be approximately 1/4". Tinning of the ends of the lead wires is not recommended.
- 4. Thread wire through gland nut, gland gasket, washer, and connector cover.

**NOTE:** Connector cover may be rotated in 90° increments from position shown for alternate positioning of cable entry.

- 5. Check DIN connector terminal block for electrical markings. Then make electrical hookup to terminal block according to markings on it. Snap terminal block into connector cover and install center screw.
- 6. Position connector gasket on solenoid and install plug connector. Torque center screw to 5±1 in-lbs [0,6±1,1 Nm].

**NOTE:** Alternating current (AC) and direct current (DC) solenoids are built differently and cannot be converted from one to the other by changing the coil.

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I&M No.V6583R9

# **Installation of Solenoid**

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid. The 3/4'' bonnet construction (Figure 1) must be disassembled for installation and installed with a special wrench adapter.

# Installation of Panel Mounted Solenoid (See Figure 3)

Disassemble solenoid following instruction under *Solenoid Replacement* then proceed.

# 3/4" Valve Bonnet Construction

- 1. Install retainer (convex side to solenoid) in 1.312 diameter mounting hole in customer panel.
- 2. Then position spring washer over plugnut/core tube sub-assembly.
- 3. Install plugnut/core tube sub-assembly through retainer in customer panel. Then replace solenoid, nameplate/retainer and red cap.

# 15/16" Valve Bonnet Construction

- 1. Install solenoid base sub-assembly through 0.69 diameter mounting hole in customer panel.
- 2. Position spring washer on opposite side of panel over solenoid base sub-assembly then replace.

# **Solenoid Temperature**

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is a safe operating temperature.

# MAINTENANCE

A WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.

# Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve.

# **Preventive Maintenance**

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- Periodic exercise of the valve should be considered if ambient or fluid conditions are such that corrosion, elastomer degradation, fluid contamination build up, or other conditions that could impede solenoid valve shifting are possible. The actual frequency of exercise necessary will depend on specific operating conditions. A successful operating history is the best indication of a proper interval between exercise cycles.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

# **Causes of Improper Operation**

- Faulty Control Circuit: Check the electrical system by energizing the solenoid. A metallic *click* signifies that the solenoid is operating. Absence of the *click* indicates loss of power supply. Check for loose or blown fuses, open-circuited or grounded solenoid, broken lead wires or splice connections.
- **Burned-Out Solenoid:** Check for open-circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- Low Voltage: Check voltage across the solenoid leads. Voltage must be at least 85% of rated voltage.

# Solenoid Replacement

1. On solenoids with lead wires disconnect conduit, coil leads, and grounding wire.

**NOTE:** Any optional parts attached to the old solenoid must be reinstalled on the new solenoid.

- 2. Disassemble solenoids with optional features as follows:
- Spade or Screw Terminals

Remove terminal connections, grounding screw, grounding wire, and terminal block (screw terminal type only).

**NOTE:** For screw terminals, the socket head screw holding the terminal block serves as a grounding screw.

• Junction Box

Remove conduit and socket head screw (use 5/32'' hex key wrench) from center of junction box. Disconnect junction box from solenoid.

Page 3 of 6 (Section 1 of 2)

# • DIN Plug Connector

Remove center screw from DIN plug connector. Disconnect DIN plug connector from adapter. Remove socket head screw (use 5/32" hex key wrench), DIN terminal adapter, and gasket from solenoid.

- 3. Snap off red cap from top of solenoid base sub-assembly.
- 4. Push down on solenoid. Then using a suitable screwdriver, insert blade in slot provided between solenoid and nameplate/retainer. Pry up slightly and push to remove. Then remove solenoid from solenoid base sub-assembly.
- 5. Reassemble using exploded views for parts identification and placement

# **Disassembly and Reassembly of Solenoids**

- 1. Remove solenoid, see Solenoid Replacement.
- 2. Remove spring washer from solenoid base sub assembly.
- 3. Unscrew solenoid base sub-assembly.

**NOTE:** Some solenoid constructions have a plugnut/core tube sub-assembly, bonnet gasket and bonnet in place of the solenoid base sub-assembly. To remove bonnet use special wrench adapter supplied in ASCO Rebuild Kit. For wrench adapter only, order ASCO Wrench Kit No.K218948.

- 4. The core is now accessible for cleaning or replacement.
- 5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
- 6. Reassemble using exploded views for identification and placement of parts.

# ORDERING INFORMATION FOR ASCO SOLENOIDS

When Ordering Solenoids for ASCO Solenoid Operators or Valves, order the number stamped on the solenoid. Also specify voltage and frequency.

Page 4 of 6 (Section 1 of 2)

I&M No.V6583R9

# Installation & Maintenance Instructions

OPEN--FRAME, GENERAL PURPOSE, WATERTIGHT/EXPLOSIONPROOF SOLENOIDS

I&M No.V6583R9 (Section 2 of 2)

8016G/H

# NOTICE: See Installation and Maintenance Instructions, I&M No. V6583R9– Section 1 of 2 for detailed instructions. Torque Chart



# ASCO Valves

# Page 5 of 6 (Section 2 of 2)

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SERIES

# Torque Chart



Page 6 of 6 (Section 2 of 2)

I&M No.V6583R9

# **Installation & Maintenance Instructions**

2-WAY DIRECT-ACTING SOLENOID VALVES **REVISION "H" & "R"** NORMALLY OPEN OR NORMALLY CLOSED OPERATION BRASS OR STAINLESS STEEL CONSTRUCTION - 1/8", 1/4", OR 3/8" PIPE THREADS

8262 8263

SERIES

I&M No.V9575R4 (Section 2 of 2)

NOTICE: See Installation and Maintenance Instructions, I&M No. V9575R4- Section 1 of 2 for detailed instructions.

# MAXIMUM OPERATING PRESSURE DIFFERENTIAL FOR DC VALVES ONLY

	Maximu	m Operatii	ng Press	ure Differ	ential For		
Catalog Numbers 8262H & 8263H DC Valves							
	At Maxi	mum 40°C An	nblent	At Maximum 55°C Ambient			
	Air-Inert Gas (PSI)	Water [PSI]	Oli [PSi] 300 ssu	Air-Inert Gas [PSI]	Water [PSI]	Oli [PSI] 300 ssu	
8262H001	750	640	550	750	600	500	
8262H002	130	110	95	120	100	90	
8262H006	130	110	95	120	100	90	
8262H007	130	110	90	120	100	85	
8262H011	295	210	205	285	200	195	
8262H012	750	640	550	750	600	500	
8262H013	38	33	31	35	30	28	
8262H014	235	160	160	215	150	145	
8262H015	235	160	160	215	150	145	
8262H016	165	130	130	155	120	120	
8262H019	750	640	550	750	600	500	
8262H020	235	160	160	215	150	145	
8262H021	295	210	205	285	200	195	
8262H022	130	110	90	120	100	85	
8262H023	165	130	120	155	120	115	
8262H036	38	33	31	35	30	28	
8262H038	27	23	21	24	22	20	
8262H079	965	745	720	920	700	675	
8262H080	750	640	550	750	600	500	
8262H086	235	160	160	215	150	145	
8262H089	1500	1500	1500	1500	1500	1500	
8262H090	27	23	21	24	22	20	
8262H096	750	620	565	700	565	530	
8262H099	1170	1145	945	1000	965	855	
8262H105	275	275	235	250	250	225	
8262H106	750	620	530	700	565	495	
8262H107	1500	1500	1500	1500	1500	1500	
8262H108	290	290	270	240	240	225	
8262H109	610	410	410	600	410	400	
8262H110	275	275	235	250	250	225	
8262H111	72	60	55	67	53	52	
8262H112	135	135	135	115	115	115	
8262H113	95	75	75	85	72	70	
8262H114	70	70	70	65	65	65	
8262H174	275	275	235	250	250	225	
8262H176	2000	2000	1725	1900	1900	1700	
8262H177	290	290	270	240	240	255	
82621178	610	410	410	600	410	400	

	Maximum Operating Pressure Differential For Catalog Numbers 8262H & 8263H DC Valves								
	At Maxi	mum 40°C A	mblent	At Maxin	num 55°C Ar	nbient			
	Air-Inert Gas [PSI]	Water [PSI]	Oil (PSI) 300 ssu	Air-Inert Gas [PSI]	Water [PSI]	Oil [PSI] 300 ssu			
8262H180	750	620	530	700	565	495			
8262H181	2000	2000	1725	1900	1900	1700			
8262H182	290	290	270	240	240	225			
8262H183	610	410	410	600	410	400			
8262H185	275	275	235	250	250	225			
8262H186	72	60	55	67	53	52			
8262H187	135	135	135	115	115	115			
8262H188	70	70	70	65	65	65			
8262H200	1170	1145	945	1000	965	855			
8262H202	65	63	63	55	54	54			
8262H208	35	35	35	30	30	30			
8262H210	25	25	22	22	22	20			
8262H212	53	50	47	48	46	44			
8262H214	1170	1145	945	1000	965	855			
8262H230	53	50	47	48	46	44			
8262H232	130	125	115	110	105	100			
8262H277	610	410	410	600	410	400			
8263H002	130	110	80	120	100	76			
8263H003	165	130	110	155	120	105			
8263H054	27	23	21	24	22	20			
8263H115	275	275	160	250	250	150			
8263H116	72	60	55	67	53	52			
8263H117	95	75	75	85	72	70			
8263H118	135	135	100	115	115	90			
8263H119	38	33	31	35	30	28			
8263H124	35	35	35	30	30	30			
8263H191	275	275	160	250	250	150			
8263H192	72	60	55	67	53	52			
8263H193	135	135	100	115	115	90			
8263H194	38	33	31	35	30	28			
8263H196	27	23	21	24	22	20			
8263H200	65	63	50	55	54	44			
8263H206	70	70	70	65	65	65			
8263H210	53	50	47	48	46	44			
8263H232	130	125	85	110	105	75			
8263H330	130	110	80	120	100	75			
8263H332	70	70	70	65	65	65			
8263H333	53	50	47	48	46	44			

## NOTES:

1. Suffix T (PTFE) valve maximum operating pressure differential is reduced by 25%.

2. Suffix MS valves are limited to maximum 750 PSI rating.

**ASCO Valves** 

Page 5 of 5 (Section 2 of 2)

# Installation & Maintenance Instructions

2-WAY DIRECT-ACTING SOLENOID VALVES REVISION "H" & "R"

NORMALLY OPEN OR NORMALLY CLOSED OPERATION

BRASS OR STAINLESS STEEL CONSTRUCTION - 1/8", 1/4", OR 3/8" PIPE THREADS

IMPORTANT: See separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Causes of Improper Operation, and Coll or Solenoid Replacement.

#### DESCRIPTION

Series 8262 and 8263 valves are 2-way direct-acting general service solenoid valves. Valves bodies are of rugged brass or stainless steel. Series 8262 or 8263 valves may be provided with a watertight/explosionproof solenoid enclosure.

#### **OPERATION**

Normally Open: Valve is open when solenoid is de-energized; closed when energized.

Normally Closed: Valve is closed when solcroid is de-energized; open when energized.

IMPORTANT: No minimum operating pressure required.

Manual Operation (Valves with Suffix MS)

Manual operator allows manual operation when desired or during an electrical power outage.

To engage manual operator, rotate stem on the side of the body clockwise until it hits a stop, approximately 90<sup>°</sup> from its original position. Do NOT rotate beyond stops. Do NOT apply excessive force beyond stops. Valve will now be in the same position as when the solenoid is energized. To disengage, rotates em counterclockwise until it hits a stop, approximately 90<sup>°</sup> from its original position. Do NOT rotate beyond stops. Do NOT apply excessive force beyond stops.

MS option is not available on normally closed valves that have a pressure rating greater than 750 PSL. MS option is not available on normally open valves.

A CAUTION: Do NOT rotate beyond 90° stops. Do NOT apply excessive force beyond stops. Rotating beyond the 90° stops could result in equipment damage.

CAUTION: For valve to operate electrically, manual operator stem must be fully rotated counterclockwise.

#### INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

Note: Inlet port will either be marked "1" or "IN". Outlet port will be marked "2" or "OUT". (see Figure 1)

#### Future Service Considerations.

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous,noncombustible fluid after disassembly and reassembly.

#### **Temperature Limitations**

For maximum valve ambient and fluid temperatures, refer to the following tables. Use catalog number, coil prefix, suffix, and watt rating on nameplate to identify the maximum ambient and fluid temperatures.

**ASCO Valves** •

NOTE: The following Temperature Limitations Tables do not apply to Magnetic Latch Valves: Catalog Numbers 8262A610 to 8262A627; 8263A615 to 8263A618, and 8263A624 to 8263A627. See separate Instruction Manual.

	. 5	1.1.4	Watt Ruting		-	Aax A	Taks	1.
Dels.	Cal	, h * 1		DC 3	Non	nuliy sed	her	Lury
	24	Right	50Hz	13.204	TC:	<b>L</b> ER	*C	19E
EF,EV	FT	6.1, 10.1	8.1, 10.1	1.00	50	1.25	52	125
EF,EV	FB	9.1, 17.1	11.1, 17.1	-	36	12.9	-	-
	FT	6.1, 10.1	8.1, 10.1	· · · · ·		124	55	131
	FB	9.1, 17.1	11,1, 17,1	-	55	131	-	-
	HT	-	1 2	10.6, 11.6				12
-	HB	-	1	22.6, 18.6	40	104	ee	1.91
EF,ÊV	HT			10.6, 11.6	0	Ø	22	191
EF,EV	HB	-		22.6, 18.6	-	194		-
-	HT	6.1, 10.1	8.1, 10.1				60	140
	HB	9.1, 17.1	11.1, 17.1	-		113	55	131
EF,EV	NT	6.1, 10.1	0.1, 10.1	-	60	140	60	140
EF,EV	HB	9.1, 17.1	11.1, 17.1	-		110	-	-
-	-	2	2	2	1.		60	140
uir A	owien	Tempera Catalog h	u Umital Isiliyate 82	lora for AC 82H IA & 83	anti KSH)	DC CA		106. A

Walne	1 Sec. 1	12.00	Vall Ratings	14.10 100	Max	Flued
Etalenter	Ches	A	C. I. I.	-	Tu	1. S
1500/4	- mana	BORE	SOHE	- me	°C .	
UR/None@					60	140
NOR ON	FT, FB.	6.1, 10.1,	8.1, 10.1,	10.6,	82 ©	180 ©
CRU	HI, HEG	9.1, 17.1,	11.1.	18.6,	-	-
U-Minie/A		2 11.1.2 22	22.6, 2	75	167	
EPDM/E		1.000		10.0	99 ©	210 ©
	FT	6.1, 10.1	8.1, 10.1		-	
	FB	1	11.1, 17.1	-		
	HT with EF/EV Prefix	6.1, 10.1	8.1, 10.1	10.6, 11.6	99 3	210 ①
FKM/V & PTFE/T	HE with EF/EV Prefix	9.1, 17.1	11.1, 17.1	18.6, 22.6		
	H	6.1, 10.1	8.1, 10.1	10.6, 11.6	121	250
	HBS	9.1, 17.1	11.1, 17.1	18.6, 22.8	0	0
	-	0	2	2	10	0

D=EF, EV data applies to Explosionproof coils only.

DC Normally closed solenoid valves can be operated at maximum ambient temperature of 55°C / 131° F with reduced pressure ratings. See page 5 of 5, Section 2 of 2 for maximum operating pressure differential.

 differential.
 Solenold colla with prefix EF & EV are limited to a maximum fluid temperature of 99°C/210°F.

(b) 106, 107, 104, 108, 107, 107, 108, 108, 108, 108, 107, 107, 108, 109, 109, 199, 199, 200, 214 and 8262H107, 181, 155, 161, 169, 169.
 (b) = Normally open 8262H & 8263H valves fitted with HB 17.1 watt AC colls have a maximum fluid temperature of 75°C(167°F)

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8263

1&M No.V9575R4

(Section 1 of 2)

#### Positioning

These valves are designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub-assembly area.

#### Mounting

Two (2) M5 threaded holes are provided in the valve body for mounting. (See Figure 1)

Optional mounting bracket can be obtained with valve as Suffix MB or separately as a kit.

#### Piping

Connect piping or tubing to valve according to markings on valve body. Inlet port will either be marked "1" or "IN". Outlet port will be marked "2" or "OUT". Wipe the pipe threads clean of cutting oils. Apply pipe compound spaningly to make pipe threads only. If applied to valve threads, the compound may enter the valve and cause operational difficulty. Avoid pipe strain by property supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

IMPORTANT: To protect the solenoid valve, install a strainer or filter mitable for the service involved, in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600 and 8601 for strainers.

#### MAINTENANCE

A WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before servicing the valve.

NOTE: It is not necessary to remove the valve from the pipeline for repairs.

#### Cleaning

All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean strainer or filter when cleaning the valve.

#### **Preventive Maintenance**

- Keep the medium flowing through the valve as free from dirt and foreign material as possible.
- Periodic exercise of the valve should be considered if ambient or fluid conditions are such that corrosion, elastomer degradation, fluid contamination build up, or other conditions that could impede solenoid valve shifting are possible. The actual frequency of exercise necessary will depend on specific operating conditions. A successful operating history is the best indication of a proper interval between exercise cycles.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

#### **Causes of Improper Operation**

- Incorrect Pressure: Check valve pressure, Pressure to valve must be within range specified on nameplate.
- Excessive Leakage: Disassemble valve (see Maintenance) and clean all parts. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

Page 2 of 5 (Section 1 of 2)

#### Valve Disassembly (see Figures 2, 3 & 4)

- 1. Disassemble valve using exploded views for identification of parts.
- 2. Remove solenoid, see separate instructions.
- Unscrewsolenoid base sub-assembly with wrench. Remove core assembly, core spring, and solenoid base gasket from valve body.
- For normally open construction (Figure 4) remove spring, and disc holder assembly.
- All parts are now accessible to clean or replace. If parts are worn or damaged, install a complete ASCO Rebuild Kit.

#### Valve Reassembly

- Use exploded views for identification, orientation and placement of parts.
- Lubricate all gaskets with DOW CORNING® 200 Compound lubricant or an equivalent high-grade silicone oil.
- For normally open construction (Figure 4), install disc holder assembly and disc holder spring.
- Replace solenoid base gasket, core assembly with core spring and solenoid base sub-assembly. Note: For core assemblies with internal type core springs, install wide end of core spring in core assembly first, closed end of core spring protrudes from top of core assembly. (see Figure 2)
- Torque solenoid base sub-assembly to 175 ± 25 in-lbs [19,8 ± 2,8 Nm].
- Install solenoid. See separate solenoid instructions. Then make electrical hookup to solenoid.

A WARNING: To prevent the possibility of death, serious injury or property damage, check valve for proper operation before returning to service. Also perform internal seat and external leakage tests with a nonhazardous, noncombustible fluid.

- 7. Restore line pressure and electrical power supply to valve.
- After maintenance is completed, operate the valve a few times to be sure of proper operation. A metallic *click* signifies the solenoid is operating.

#### ORDERING INFORMATION FOR ASCO REBUILD KITS

Parts marked with an asterisk (\*) in the exploded views in Figure 2 & 3 are supplied in Rebuild Kits. When Ordering Rebuild Kits for ASCO valves, order the Rebuild Kit number stamped on the valve nameplate. If the number of the kit is not visible, order by indicating the quantity of kits required, and the Catalog Number and Serial Number of the valve(s) for which they are intended.



1&M No.V9575R4

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Disassembly and Reassembly of Manual Operator (Refer to Figure 3)

- Position core assembly with core spring attached into base of manual operator body.
- 2. Insure retaining ring is properly located in valve body.
- Replace solenoid base gasket and solenoid base sub-assembly into valve body. Torque solenoid base sub-assembly to 175 ± 25 in-lbs [19,8 ± 2,8 Nm].
- Check manual operator for proper operation. Turn stem clockwise and counsterclockwise; stem should turn freely without binding.



Page 4 of 5 (Section 1 of 2)

1&M No.V9575R4







## GENERAL INSTALLATION AND MAINTENANCE INSTRUCTIONS

Note: These General Installation and Maintenance Instruc tions must be read in conjunction with the instruction Sheet for the specific product.

#### INSTALLATION

ASCO/JOUCOMATIC components are intended to be used only within the technical characteristics as specified on the nameplate. Changes to the equipment are only allowed after consulting the manufacturer or its representative. Before installation depressurize the piping system and clean internally.

The equipment may be mounted in any position if not otherwise indicated on the product by means of an arrow.

The flow direction and pipe connection of valves are indicated on the body.

The pipe connections have to be in accordance with the size indicated on the nameplate and fitted accordingly. Caution:

- Reducing the connections may cause improper operation or • malfunctioning.
- For the protection of the equipment install a strainer or filter suitable for the service involved in the inlet side as close to the product as possible.
- If tape, paste, spray or a similar lubricant is used when tightening, avoid particles entering the system.
- Use proper tools and locate wrenches as close as possible to the connection point.
- To avoid damage to the equipment, DO NOT OVERTIGHTEN pipe connections.
- Do not use valve or solenoid as a lever. The pipe connections should not apply any force, torque or
- strain to the oroduct.

#### **ELECTRICAL CONNECTION**

In case of electrical connections, they are only to be made by trained personnel and have to be in accordance with the local regulations and standards Caution:

- Turn off electrical power supply and de-energize the electrical • circuit and voltage carrying parts before starting work. All electrical screw terminals must be properly tightened ac-
- ٠ cording to the standards before putting into service. Dependent upon the voltage electrical components must be
- . provided with an earth connection and satisfy local regulations and standards

#### The equipment can have one of the following electrical terminals:

- Spade plug connections according to ISO-4400 or  $3 \times DIN-46244$  (when correctly installed this connection pro-
- vides IP-65 protection). Embedded screw terminals in metal enclosure with "Pg" cable .
- gland. Spade terminals (AMP type).
- · Flying leads or cables.

#### PUTTING INTO SERVICE

Before pressurizing the system, first carry-out an electrical test. In case of solenoid valves, energize the coil a few times and notice a metal click signifying the solenoid operation.

#### SERVICE

Most of the sciencid valves are equipped with coils for con-tinuous duty service. To prevent the possibility of personal or property damage do not touch the solenoid which can become hot under normal operation conditions.

#### SOUND EMISSION

The emission of sound depends on the application, medium and nature of the equipment used. The exact determination of the sound level can only be carried out by the user having the valve installed in his system.

#### MAINTENANCE

Maintenance of ASCO/JOUCOMATIC products is dependent on service conditions. Periodic cleaning is recommended, the timing of which will depend on the media and service conditions. During servicing, components should be examined for excessive wear. A complete set of internal parts is available as a spare parts or rebuild kit. If a problem occurs during installation/maintenance or in case of doubt please contact ASCO/JOUCOMATIC or authorised representatives.

A separate Declaration of Incorporation relating to EEC-Directive 89/392/EEC Annex II B is available on request. Please provide product identification number and serial numbers of products concerned.

The product complies with the essential requirements of the EMC Directive 89/336/EEC and amendments and the Low Voltage directives 73/23/EEC and 93/68/EEC. A separate Declaration of Conformity is available on request. Please provide product identification number and serial numbers of the products concerned.

50 Hanover Road Florham Park, New Jersey 07932 Tel. (973) 966–2000 Fax (973) 966 2628

AZCO. ASVO 1561 Columbia Highway Aiken, South Carolina 29801 Tel. (803) 641–9200 Fax (803) 641–9290



C E

INSTRUCTIONS GÉNÉRALES D'INSTALLATION ET D'ENTRETIEN

Nota : Ces instructions générales d'Installation et d'entretien complètent la notice spécifique du produit.

#### MONTAGE

Les composants ASCO/JOUCOMATIC sont concus pour les domaines de fonctionnement indiqués sur la plaque signalétique ou la documentation. Aucune modification ne peut être réalisée sur le matériel sans l'accord préalable du fabricant ou de son représentant. Avant de procéder au montage, dépressuriser les

canalisations et effectuer un nettoyage interne. A moins qu'une flèche ou la notice n'indique un sens de montage spécifique de la tête magnétique, le produit peut être monté dans n'importe quelle position.

Le sens de circulation du fluide est indiqué par repères sur le corps et dans la documentation.

La dimension des tuyauteries doit correspondre au raccordement indiqué sur le corps, l'étiquette ou la notice.

- Attention : Une restriction des tuyauteries peut entraîner des dysfonctionnements.
- Afin de protéger le matériel, installer une crépine ou un filtre ٠ adéquat en amont, aussi près que possible du produit.
- En cas d'utilisation de ruban, pâte, aérosol ou autre lubrifiant lors du serrage, veiller à ce qu'aucun corps étranger ne pénètre dans le circuit.
- Utiliser un outiliage approprié et placer les clés aussi près que possible du point de raccordement.
- Afin d'éviter toute détérioration, NE PAS TROP SERRER les raccords des tuvauteries.
- Ne pas se servir de la vanne ou de la tête magnétique comme • d'un levier.
- Les tubes de raccordement ne devront exercer aucun effort, ٠ couple ou contrainte sur le produit.

## **RACCORDEMENT ÉLECTRIQUE**

Le raccordement électrique doit être réalisé par un personnel qualifié et selon les normes et règlements locaux. Attention :

Avant toute intervention, couper l'alimentation électrique pour

٠

- mettre hors tension les composants. Toutes les bornes à vis doivent être serrées correctement
- avant la mise en service. Selon la tension, les composants électriques doivent être mis ٠ à la terre conformément aux normes et règlements locaux.

- Selon les cas, le raccordement électrique s'effectue par : Connecteur débrochable ISO4400 ou 3 x DIN46244 avec degré de protection IP65 lorsque le raccordement est correctement effectué.
- Bornes à vis solidaires du bobinage, sous boîtier métallique avec presse étoupe "Pg - -".
  Cosses (type AMP).
  Fils ou câbles solidaires de la bobine.

#### MISE EN SERVICE

Avant de mettre le circuit sous pression, effectuer un essai électrique. Dans le cas d'une électrovanne, mettre la bobine sous tension plusieurs fois et écouter le "clic" métallique qui signale le fonctionnement de la tête magnétique.

#### FONCTIONNEMENT

La plupart des électrovannes comportent des bobinages prévus pour mise sous tension permanente. Pour éviter toute brûlure, ne pas tpucher la tête magnétique qui, en fontionnement normal et en permanence sous tension, peut atteindre une température élevée.

#### BRUIT DE FONCTIONNEMENT

Le bruit de fonctionnement varie selon l'utilisation, le fluide et le type de matériel employé. L'utilisateur ne pourra déterminer avec récision le niveau sonore émis qu'après avoir monté le composant sur l'installation.

#### ENTRETIEN

L'entretien nécessaire aux produits ASCO/JOUCOMATIC varie avec leurs conditions d'utilisation. Il est souhaitable de procéder à un nettoyage périodique dont l'intervalle varie suivant la nature du fluide, les conditions de fonctionnement et le milieu ambiant. Lors de l'intervention, les composants doivent être examinés pour détecter toute usure excessive. Un ensemble de pièces internes est proposé en pièces de rechange pour procéder à la réfection. En cas de problème lors du montage/entretien ou en cas de doute, veuillez contacter ASCO/JOUCOMATIC ou ses représentants officiels

Conformément à la directive CEE 89/392/CEE Annexe II B, une Déclaration d'incorporation peut être fournie sur deman Veuillez nous indiquer le numéro d'accusé de réception (AR) et les références ou codes des produits concernée.

Ce produit est conforme aux prescriptions les plus impor de la directive CEM 89/336/CEE et amendements et aux directives basse tension 73/23/CEE et 94/68/CEE. Une déclaration de conformité peut être fournie sur simple dema nde. Veuillez nous indiquer le numéro d'accusé de réception (AR) ainsi que les numéros de série des produits concernés.

ASCA' SCIENTIFIC

Fax (973) 966 6461



(ASCO/JOUCOMATIC Produkte sind entsprechend der EG-Richtlinie 89/392/EWG gefertigt.

50 Hanover Road, Florham Park, New Jersey 07932 www.ascovalve.

Eine separate Herstelle rerklärung im Sinne der Richtlinie 89/392/ EWG Anhang IIB ist auf Anfrage erhältlich. Geben Sie bitte für die Produkte die Nummer der Auftragsbestätigung und die e an.

Dieses Produkt entspricht den grundlegenden Bestimmungen der EMV-Richtlinie 89/336/EWG, cinschi. Nachtrage, sowie den Niederspannungsrichtlinien 73/23/EWG u. 93/86/EWG. Bitte geben Sie die Auftragebestlitigungenummer und die Serienummern der betreffenden Produkte an.

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Page 1 of 2

ALLGEMEINE BETRIEBSANLEITUNG ACHTUNG: Diese Allgemeine Betriebsanleitung gilt in Zusam-

enhang mit der jeweiligen Betriebsanleitung für die spezielien Produkte.

#### EINBAU

Die ASCO/JOUCOMATIC-Komponenten dürfen nur innerhalb der auf den Typenschildern angegebenen Daten eingesetzt werden.Veränderungen an den Produkten sind nur nach Rück-sprache mit ASCO/JOUCOMATIC zulässig. Vor dem Einbau der Ventile muß das Rohrleitungssystem drucklos

geschaltet und innen gereinigt werden. Die Einbaulage der Produkte ist generell beliebig. Ausnahme:

Die mit einem Pfeil gekenzeichneten Produkte müssen ent-sprechend der Pfeilrichtung montiert werden. Die Durchflußrichtung und der Eingang von Ventilen sind

nnzeichnet

Die Rohranschlüsse sollten entsprechend den Größenangaben auf den Typenschildern mit handelsüblichen Verschraubungen durchgeführt werden. Dabei ist folgendes zu beachten:

- Eine Reduzierung der Anschlüsse kann zu Leistungs- und
- Funktionsminderungen führen. Zum Schutz der Ventile sollten Schmutzfänger oder Filter so
- dicht wie möglich in den Ventlleingang integriert werden. Bei Abdichtung am Gewinde ist darauf zu achten, daß kein ٠ Dichtungsmaterial in die Rohneitung oder das Ventil gelangt. Zur Montage darf nur geeignetes Werkzeug verwendet werden.
- Konische Verschraubungen sind sorgfältig anzuziehen. Es ist
- darauf zu achten, daß beim Anziehen das Gehäuse nicht. beschädigt wird. Spule und Führungsrohr von Ventilen dürfen nicht als Gegen-
- halter benutzt werden.
- Die Rohneitungsanschlüsse sollen fluchten und dürfen keine Spannungen auf das Ventil übertragen.

#### **ELEKTRISCHER ANSCHLUB**

Der elektrische Anschluß ist von Fachpersonal entsprechend den geltenden VDE- und CEE-Richtlinien auszuführen. Es ist Vor Beginn der Arbeiten ist sicherzusteilen, daß alle elektrischen

- Leitungen und Netzteile spannungslos geschaltet sind. Alle Anschlußklemmen sind nach Beendigung der Arbeiten
- vorschriftsmäßig entsprechend den geltenden Regeln anzuziehen. Je nach Spannungsbereich muß das Ventil nach den geltenden
- Regeln einen Schutzleiteranschluß erhalten.

Der Magnetantrieb kann je nach Bauart folgende Anschlüsse

- Anschluß für Gerätesteckdose nach DIN 43650 Form A/ISO 4400 oder 3x DIN 46244 (durch ordnungsgemäße Montage der Gerätesteckdose wird Schutzklasse IP 65 erreicht). Anschlüsse innerhalb eines Blechgehäuses mittels Schraub-
- klemmen. Kabeleinführung ins Gehäuse mit PG-Verschraubung. Offene Spulen mit Flachsteckern (AMP-Fahnen) oder mit

INBETRIEBNAHME

Vor Druckbeaufschlagung des Produktes sollte eine elektrische

Bei Ventitien Spannung an der Magnetspule mehrmals ein- und ausschalten. Es muß ein Klicken zu hören sein.

BETRIEB

Die meisten Ventile sind mit Spulen für Dauerbetrieb

ausgerüstet. Zur Vermeidung von Personen- und Sachschäden sollte jede Berührung mit dem Ventli vermieden werden, da die

GERÄUSCHEMISSION

Diese hängt sehr stark vom Anwendungsfall, den Betriebsdaten

und dem Medium, mit denen das Produkt beaufschlagt wird, ab.

Eine Aussage über die Geräuschemission des Produktes muß deshalb von demjenigen getroffen werden, der das Produkt

WARTUNG

Die Wartung hängt von den Einsatzbedigungen ab. In

entsprechenden Zeitabständen muß das Produkt geöffnet und

gereinigt werden. Für die Überholung der ASCO/JOUCOMATIC-

Produkte können Ersatzteilsätze geliefert werden. Treten Schwie-rigkeiten bei Einbau, Betrieb oder Wartung auf, sowie bei Unklarheiten, ist mit ASCO/JOUCOMATIC Rücksprache zu halten.

innerhalb einer Maschine in Betrieb nimmt.

Magnetspule bei längerem Betrleb sehr heiß werden kann.

eingegossenen Kabelenden.

Funktionsprüfung erfolgen:



### **INSTRUCCIONES GENERALES DE** INSTALACION Y MANTENIMIENTO

Nota: Estas instrucciones Generales de Instalación y imiento deben considerarse en conjunción con la Hoja de Instrucciones de cada producto.

#### INSTALACION

Los componentes ASCO/JOUCOMATIC sólo deben utilizarse dentro de las especificaciones técnicas que se especifican en su placa de características o catálogo. Los cambios en el equipo sólo estarán permitidos después de consultar al fabricante o a su representante. Antes de la instalación despresurice el sistema de tuberías y limpie internamente.

El equipo puede utilizarse en cualquier posición si no estuviera indicado lo contrario sobre el mismo mediante una flecha o en el catálogo.

En el cuerpo o en el catálogo se indican el sentido del fluido y la conexión de las válvulas a la tubería.

Las conexiones a la tubería deben corresponder al tamaño indicado en la placa de características la etiqueta o el catálogo y ajustarse adecuadamente.

- Precaución:
- · La reducción de las conexiones puede causar operaciones incorrectas o defectos de funcionamiento. Para la protección del equipo se debe instalar, en la parte de
- . la entrada y tan cerca como sea posible del producto, un filtro adecuado.
- Si se utilizara cinta, pasta, spray u otros lubricantes en el ajuste, se debe evitar que entren partículas en el producto. Se debe utilizar las herramientas adecuadas y colocar llaves
- e o des dunca las rectalmentas decuadas y colocal llaves inglesas lo mas cerca posible del punto de conexión.
   Para evitar daños al equipo, NO FORZAR las conexiones a la
- tubería.
- No utilizar la válvula o el solenoide como palanca. Las conexiones a la tubería no producirán ninguna fuerza, par o tensión sobre el producto.

#### **CONEXION ELECTRICA**

## Las conexiones eléctricas serán realizadas por personal cualificado y deberán adaptarse a las normas y regulaciones locales. Precaución:

- · Antes de comenzar el trabajo, desconecte el suministro de energía eléctrica y desenergice el circuito eléctrico y los elementos portadores de tensión.
- Todos los teminales eléctricos deben estar apretados adecuadamente según normas antes de su puesta en servicio. Según el voltaje, los componentes eléctricos deben disponer
- de una conexión a tierra y satisfacer las normas y regulaciones
- El equipo puede tener uno de los siguientes terminales eléctricos Conexiones desenchulables segun ISO 4400 o 3 x DIN-46244
- (cuando se instala correctamente esta conexión proporciona una protección IP-65).
- Terminales de tomillo con carcasa metálica con entrada de cable de conexión roscada "PG".
- Conector desenchufable (tipo AMP).
- Salida de cables.

#### PUESTA EN MARCHA

Se debe efectuar una prueba eléctrica antes de someter a presión el sistema. En el caso de las válvulas solenoides, se debe energizar varias veces la bobina v comprobar que se produce un sonido metálico que indica el funcionamiento del solenoide.

#### SERVICIO

La mayor parte de las válvulas solenoides se suministran con bobinas para un servicio continuo. Con el fin de evitar la posibilidad de daños personales o materiales no se debe tocar el solenoide, ya que puede haberse calentado en condiciones normales de trabajo.

#### **EMISION DE RUIDOS**

La emisión de ruidos depende de la aplicación, medio y naturaleza del equipo utilizado. Una determinación exacta del nivel de ruido sólamente se puede llevar a cabo por el usuario que disponga la válvula instalada en su sistema.

#### MANTENIMIENTO

El mantenimiento de los productos ASCO/JOUCOMATIC depende de las condiciones de servicio. Se recomienda una limpieza periódica, dependiendo de las condiciones del medio y del servicio. Durante el servicio, los componentes deben ser examinados por si hubieran desgastes excesivos. Se dispone de un juego completo de partes internas como recambio o kit de montaje. Si ocurriera un problema durante la instalación/mantenimiento o en caso de duda contactar con ASCO/JOUCOMATIC o representantes autorizados.

Se dispone, por separado y bajo demanda, de una Declaración de incorporación conforme a la Directiva CEE 89/392/EEC Anexo Il B. Rogamos que nos faciliten los códigos y números de acepta-ción de pedido correspondientes.

Este producto es conforme a las principales prescripciones Las productos CEM 69/336/CEE y altas enminante prescriteras baja tension 73/23/CEE y 94/38/CEE. SI io desea, podemos facilitarie una Declaración de Conformided por separado. Rogamos faciliten el número de confirmación de pedido y los números de serie de los respectivos productos.

ASCO Valve Canada

P.O. Box 160 (Airport Road) Brantford, Ontario N3T 5M8 Tel: (519) 758–2700 Fax: (519)758–5540

ASCOMATICA S.A. de C.V. ASCOMATICA S.A. 08 C.V. Bosques de Duraznos No. 65–1003A Fractionamiento Bosques de las Lomas Delegacion Miguel Hildago Mexico, D.F. CP11700 Tel: (52)–55–5596–7741 Fax: (52)–55–5596–7719

#### CE IT **ISTRUZIONI DI INSTALLAZIONE E**

# **DI MANUTENZIONE GENERALE**

Nota: Queste istruzioni devono essere lette in conglunzione con il manuale specifico dei prodotto.

#### INSTALLAZIONE

Le elettrovalvoie devono essere utilizzate esclusivamente rispettando le caratteristiche tecniche specificate sulla targhetta. Variazioni sulle valvole o sul piloti sono possinili solo dopo aver consultato il costruttore o i suoi rappresentanti. Prima dell'Installa-zione depressurizzare i tubi e pulire internamente.

Le elettrovalvole possone essere montate in tutte le posizioni. Diversamente, una freccia posta sulla valvola indica che deve essere montata in posizione verticale e diritta.

La direzione del flusso e' indicata sui corpo della valvola per mezzo di una freccia oppure con l'etichetta "IN", "1", "A", o "P".

I raccordi devono essere conformi alla misura indicata sulla targhetta apposta

Attenzione:

- Ridurre i raccordi puo' causare operazioni sbalgliate o . malfunzionamento.
- Per proteggere il componente installare, il più vicino possibile al lato ingresso, un filtro adatto al servizio.
- Se si usano nastro, pasta, sprav o lubrificanti simili durante il serraggio, evitare che delle particelle entrino nel corpo della valvola.
- Usare un'attrezzatura appropriate e utilizzare le chiavi solo sul corpo della valvola.
- Per evitare danni al corpo della valvola, NON SERRARE ECCESSIVAMENTE i tubi.
- Non usare la valvola o il pilota come una leva. I raccordi non devono esercitare pressione, torsione o
- sollecitazione sull'elettrovalvola.

#### ALLACCIAMENTO ELETTRICO

L'allacciamento elettrico deve essere effetuato esclu dal personale specializzato e deve essere conforme alle Norme locali. Attensione

- Prima di mettere in funzione togliere l'alimentazione elettrica. diseccitare il circulto elettrico e le parti sotto tension
- I morsetti elettrici devono essere correttamente avvitati, secondo le Norme, prima della messa in servizio.
- Le elettrovalvole devone essere provviste di morsetti di terra a seconda della tensione e delle Norme di sicurezza locali.

i piloti possono avere una delle sequenti caratteristiche elettrice: · Connettore ISO-4400 o 3 x DIN-46244 (se installato correttamente e' IP-65).

- Morsetteria racchiusa in custodia metallica. Entrata cavi con pressacavi tipo "PG".
- Bobina con attacchi FASTON (tipo AMP).
- Bobine con fili o cavo.
  - MESSA IN FUNZIONE

Prima di dare pressione alla valvoa, eseguire un test elettrico. Eccitare la bobina diverse volte fino a notare uno scatto metallico che dimostra il funzionamento del pilota.

#### SERVIZIO

Molte elettrovalvole sono provviste di bobine per funzionamento continuo. Per prevenire la possibilita' di danneggiare cose o persone, non toccare il pilota La custodia della bobina o dei pilota puo' scaldarsi anche in normali condizioni di funzionamento.

#### EMISSIONE SUONI

L'emissione di suoni dipende dall'applicazione e dal tipo di elettrovalvola. L'utente puo' stabilire esattamente il livello del suono solo dopo aver installato la valvola sul suo impianto.

#### MANUTENZIONE

Generalmente questi componenti non necessitano spesso di manutenzione. Comunque, in alcuni casi e' necessario fare attenzione a depositi o ad eccessiva usura. Questi componenti devono essere puliti periodicamente, il tempo che intercorre tra una pulizia e l'attra varia a sconda delle condizioni di funzionamento. Il ciclo di durata dei componenti dipende dalle condizioni di funzionamento. Incaso di usura e disponibile un set completo di

parti interne per per la revisione. Se si incontrano problemi durante l'Installazione e la manutenzione o se si hanno dei dubbi, consultare ASCO/JOUCOMATIC o i suoi rappresentanti.

L'utente puo'richiedere al costruttore una dichiarazione sepa-rate riguardante le Direttive EEC 89/392/EEC e 91/368/EEC (vedere allegato II B) fornendo il numero di serie e il riferimento dell'ordine relativo.

Questo prodotto soddisfa i requisiti essenziali della direttiva CEM 89/336/CEE nonche gli emendamenti e le directtive sulla bassa tensione 73/23/CEE e 93/68/CEE. Una Dichlarazione di Conformitá separata può essere ottenuta su richiesta. Si prega di fornira il numero della conferma dell'ordinativo ed i numeri di serie dei relativi prodotti.

ASCOTECH S.A. de C.V. Circuito Del Progreso No.27 Parque Industrial Progreso Mexicali, B.C. Mexico Tel: (011)-52-686-559-8504 Fax: (011)-52-686-559-8548



asca

JOUCOMATIC Form No. V6950R5

**ONDERHOUDSINSTRUKTIES** N.B.: Deze algemene instrukties t.a.v. installatie en onderhoud

moeten in acht worden genomen tezemen met de specifieke voorschriften van het produkt.

#### INSTALLATIE

ASCO/JOUCOMATIC produkten mogen uitsluitend toegepast worden binnen de op de naamplaat aangegeven specificaties. Wijzigingen, zowel elektrisch als mechanisch, zijn alleen toegestaar na overleg met de fabrikant of haar vertegenwoordiger. Voor het inbouwen dient het leidingssysteem druktoos gemaakt te worden en inwendig gereinigd.

De positie van de afsluiter is naar keuze te bepalen, behalve in die gevallen waarbij het tegendeel door pijlen wordt aangegeven. De doorstroomrichting wordt bij afsluiters aangegeven op het afe uiterbuis.

De pijpaansluiting moet overeenkomstig de naamplaatgegevens olaatsvinden.

- Hierbij moet men letten op: Een reductie van de aansluitingen kan tot prestatie- en funktiestoomis leiden.
- Ter bescherming van de interne delen wordt een filter in het leidingnet aanbevolen.
- Bij het gebruik van draadafdichtingspasta of tape mogen er geen deeltjes in het leidingwerk geraken.
- Men dient uitsluitend geschikt gereedschap voor de montage te gebruiken.
- Bij konische/tapse koppelingen moet met een zodanig koppel worden gewerkt dat het produkt niet wordt beschadigd.
- Het produkt, de behuizing of de spoel mag niet als hefboom
- worden gebruikt. De pijpaansluitingen mogen geen krachten of momenten op • het produkt overdragen.

#### ELEKTRISCHE AANSLUITING

In geval van elektrische aansluiting dient dit door vakkundig personeel te worden uitgevoerd volgens de door de plaatselijke overheid bepaalde richtlinen.

- Men dient in het bijzonder te letten op: Voordat men aan het werk begint moeten alle spannings-voerende delen spanningsloos worden gemaakt.
- Alle aansluitklemmen moeten na het beëindigen van het werk volgens de juiste normen worden aangedraaid.
- Al naar gelang het spanningsbereik, moet het produkt volgens de geldende normen van een aarding worden voorzien.

Het produkt kan de volgende aansluitingen hebben:

- Stekeraansluiting volgens ISO-4400 of 3x DIN-46244 (bij juiste montage wordt de dichtheidsklasse IP-65 verkregen). Anskulting binnen in het metalen huis d.m.v.schroefaansluiting. De kabeldoorvoer heeft een "PG" aansluiting. Spoelen met platte steker (AMP type).

IN GEBRUIK STELLEN

Voordat de druk aangesloten wordt dient een elektrische test te

worden uitgevoerd. Ingeval van magneetafsluiters, legt men meerdere malen spanning op de spoel aan waarbij een duidelijk

GEBRUIK

De meeste magneetafsluiters zijn uitgevoerd met spoelen voor continu gebruik. Omdat persoonlijke of zakelijke schade kan ontstaan bij sanraking dient men dit te vermijden, daar bij

langdurige inschakeling de spoel of het spoelhuis heet kan

GELUIDSEMISSIE

Dit hangt sterk af van de toepassing en het gebruikte medium. De

bepaling van het geluidsniveau kan pas uitgevoerd worden nadat het ventiel is ingebouwd.

ONDERHOUD

Het onderhoud aan de afsluiters is afhankelijk van de bedrijfs-

Het Ofdernoud aan de assurers is anternenje van de besinje-omstandigheden. In bepaalde gevallen moet men bedacht zijn op media welke sterke vervuiling binnen in het produkt kunnen veroorzaken. Men dient dan regelmatig inspecties uit te voeren door de afsluiter te openen en te reinigen. Indien ongewone slijtage optreedt dan zijn reserve onderdelensets beschikbaar om een inwendige revisie

uit te voeren. Ingeval problemen of onduidelijkheden tijdens montage, gebruik of onderhoud optreden dan dient men zich tot ASCO of haar vertegenwoordiger te wenden.

Een aparte fabrikanten verklaring van inbouw, in de zin van

na opgave van orderbevestigingsnummer en serienummer

Dit product voldoet aan de essentiele vereisten van de EMC

Richtilin 89/336/EEG en amendementen, net als aan de richtilinen 73/23/EEG en 93/69/EEG inzake laagspanning. Een afzonderlijke verklaring van overeenstemming is op verzoek

verkrijgbaar. Vermeld a.u.b. het nummer van de

opdrachtbevestiging en de serienummers van de betreffende

Form No. 6950R5

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EU-richtlijn 89/392/EEG aanhangsel IIB kan door de afne

verkregen worden.

50 Hanover Road, Florham Park, New Jersev 07932

produkten.

www.ascovalve.com

- - Losse of aangegoten kabels

klikken" hoorbaar moet zijn bij juist funktioneren.

# SECTION 14a: DE-AREATION LEVEL SWITCH

# P&ID: Item #: LS-0724

Unit Details: Vibex<sup>™</sup> Vibrating Level Switch, -40° to +212°F Application Temperature, 3/4" Connection, NPT Thread Type, M12 x 1, 4-Pin Connection with 6 ft. cable Model #: LSV1-01-06-N-C

# Manufacturer:

Flo Corp. / Flow Line Options 9009 S. Freeway Drive Suite #4 Macedonia, OH 44056 Phone: (877) 356-5463 Fax: (330) 468-0185 www.flowlineoptions.com

Local Distributor/Contact:

Flo Corp. / Flow Line Options 9009 S. Freeway Drive Suite #4 Macedonia, OH 44056 Phone: (877) 356-5463 Fax: (330) 468-0185 www.flowlineoptions.com

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Description

This universal vibrating level switch is an ideal instrument for accurate point level detection in liquids. Using vibrating fork technology, this device will detect the change in its natural resonant frequency (1.200 Hz) which is driven by an internal piezoceramic element inside the sensor. The frequency will change when the sensor is covered to a known point on the vibrating fork upon which the sensor will send a switching output. If the vibrating fork is not covered by liquid, its natural resonant frequency changes back and so does the state of the switching output. Typical applications include washing, filling, cooling and lubricating systems, sump level and bulk holding tank level control.

# Features & Benefits

- Simple, compact design
- Extremely reliable
- Setup without adjustment or calibration
- Independent of liquid properties and installation conditions •
- No moving parts, thus wear and maintenance free

# Specifications

Electrical Data	
Switching Output Type	Transistor (For connection to binary inputs of a PLC with an input resistance $<100k\Omega$ )
Supply Voltage	10 to 55 VDC
Load Current Max.	250mA (output is overload and permanently short-circuit protected)
Off-State Current (Load Off)	< 10uA
Voltage Drop	< 1V
Power Consumption Max	0.5W
Protection Class	II
Over-voltage Category	III
Connection Plug	M12x1, 4-Pin (See order code for adding the mating - M12 cable)
Measurement Performance Condition	ormance : Density 1g/cm <sup>3</sup> (0.036lbs/in <sup>3</sup> ) (water)
Hysteresis	0.08in (2mm) (With vertical installation)
Switching Point (Nominal)	Vertical Installation: 0.51in (13mm) above tip Of fork (indicated by a small notch on the outside of the fork paddles) Horizontal Installation: Center axis of the fork paddle (indicated by an elogated ridge on the outside of the fork paddles) Switching point is in any liquid definitely located on the fork paddle area

# **Specifications Continued**

Switching Delay	On: 0.5s / Off: 0.5s				
Application Conditions					
Dielectric Constant [ε <sub>r</sub> ]	No restriction (Suitable for all oils, ie: cutting, grinding and hydraulics oil; collant; erosion dielectric fluid; cleaning and degreasing agents; solvents; all liquid lubricants; water and water-based liquids)				
Conductivity	No restrictions				
Density	0.025 to 0.9lbs/in <sup>3</sup> (0.7 to 2.5g/cm <sup>3</sup> ) (Not suitable for substances with very low density, ie. propane)				
Dynamic Viscosity	0.1 to 10.000cP (0.1 to 10.000mPa s) (Not suitable for very viscous or adhesive substances)				
Solid Content in the Liquid	Max. 0.2in (5mm) diameter of solid particles contained in the liquid can be used in slurries				
Foam/Air Bubbles	Insensitive to foam and air bubbles				
Build-up	Avoid situations where a substance coats and dries on the fork, thus creating excessive build-up/caking on the fork or even bridge the fork (ie. dense paper slurries, bitumen)				
Application Temperature	F: -40° to + 212° or -40° to + 302° C: -40° to + 100° or -40° to +150°				
Ambient Temperaure	F: -40° to 158° C: -40° to 70°				
Temperature Shock	No restrictions				
Application Pressure	-14.5 to 938 PSI (-1 to 64 Bar)				
Mechanical Data					
Ingress Protection Rating	M12x 1 plug: IP66/IP67				
Connection Size	3/4" or 1"				
Thread Type	NPT (US) or G (Metric)				
Surface Finish [Ra]	1.26in <sup>-4</sup> (<3.2um)				
Material All Metal Parts	1.4404 (316L)				
Other Materials	Flat seal: Klingersil C -4400, Plastic End Cap: PEI				

Note: Please Consult Factory for Special Requirements



# **Ordering Information**

# FLO-CORP MODEL NUMBER BUILDER

For Assistance Call 877.FLO.LINE

Use the diagram below, working from left to right to construct your Flo-Corp Model Number. Simply match the category number to the corresponding box number.

## Example: LSV1-01-06N-N

Vibex™ Vibrating Level Switch, -40° to +212°F Application Temperature, 3/4" Connection, NPT Thread Type, M12 x 1, 4-Pin Connection Only



Ordering Notes: (1) Select the best configuration based on your requirements (2) Standard M12 cable is required for operation. For special lengths, please contact factory.

Specifications are subject to change without notice.



# Vibrating Level Switch OPERATING INSTRUCTIONS



787

# **Operating Instructions**

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# **Operating instructions**

# 1 For your safety

## 1.1 Authorised personnel

All operations described in this operating instruc tions manual must be carried out only by trained specialist personnel authorised by the plant oper ator.

During work on and with the device the required personal protection equipment must always be worn.

## 1.2 Appropriate use

Vibex is a sensor for level detection.

You can find detailed information on the application range of Vibex in chapter "Product description".

## 1.3 Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application -speci fic hazards , e.g. vessel over fill or damage to system components through incorrect mounting or adjustment.

## 1.4 General safety instructions

This is a high -tech instrument requiring the strict observance of standard regulations and guidelines . The user must take note of the safety instructions in this operating instructions manual , the countryspeci fic installation standards as well as all prevailing safety regulations and accident preven tion rules.

The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for trouble -free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the required occupational safety measures with the current valid rules and regulations and also take note of new regulations.

## 1.5 CE conformity

The protection goals of the EMC D irective 2004/ 108/EC (EMC) and the Low Voltage Directive 2006/95/EC (LVD) are fulfilled.

Conformity has been judged according to the following standards :

EMC : EN 61326 -1: 2006 (electrical instruments for control technology and laboratory use - EMC requirements)

- Emission : Class B
- Susceptibility: Industrial areas

LVD : EN 61010 -1: 2001 (safety regulations for electrical measurement, control and laboratory instruments - part 1: General requirements)

# 2 Product description

## 2.1 Configuration

S cope of delivery The scope of delivery encompasses :

- Vibex point level sensor
- Test magnet
- Operating instructions

## 2.2 Principle of operation

#### Area of application

Vibex is a point level sensor with tuning fork for level detection.

It is designed for industrial use in all areas of process technology and is used in liquids .

#### Fault monitoring

The electronics module of Vibex continuously monitors via frequency evaluation the following criteria:

- Strong corrosion or damage on the tuning fork
- Loss of vibration
- Line break to the piezo drive

If a malfunction is detected or in case of power failure, the electronics takes on a defined switching condition, i.e. the output transistor blocks or the contactless switch is open (safe condition).

#### Functional principle

The tuning fork is piezoelectrically energised and vibrates at its mechanical resonance frequency of approx. 1200 Hz. The piezos are fixed mechan - ically and are hence not subject to temperature shock limitations. The frequency changes when the tuning fork is covered by the medium. This change is detected by the integrated oscillator and converted into a switching command.

## 2.3 Storage and transport

#### Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test according to DIN EN 24180.

The packaging consists of cardboard. This material is environment-friendly and recyclable. Dispose of the packaging material via specialised recycling companies.

# 3 Mounting

## 3.1 General instructions

S witching point

In general, Vibex can be installed in any position. The instrument simply has be mounted in such a way that the tuning fork is at the height of the desired switching point.



Fig. 13: Vertical mounting

- 1 Switching point approx. 0.51" in water
- 2 S witching point with lower density
- 3 S witching point with higher density



Fig. 14: Horizontal mounting

1 S witching point

2 Switching point (recommended mounting position, particularly for adhesive products )

#### Moisture



Fig. 15: Measures against moisture penetration



#### Handling

Do not hold Vibex on the tuning fork. Bending the vibrating element will destroy the instrument.

## 3.2 Mounting instructions

#### Welded socket

Vibex has a defined thread outlet. This means that every Vibex is in the same position after being screwed in . Remove therefore the supplied flat seal from the thread of Vibex. This flat seal is not required when using a welded socket with front flush seal .

The welded socket has a marking (notch). For horizontal mounting, weld the socket with the notch facing upward or downward; in pipelines aligned with the direction of flow.



Fig. 16: Marking on the welded socket

1 Marking

#### Adhesive products

In case of horizontal mounting in adhesive and viscous products, the surfaces of the tuning fork should be vertical. The position of the tuning fork is indicated by a marking on the hexagon of Vibex. With this, you can check the position of the tuning fork when screwing it in.

In case of horizontal mounting in adhesive and viscous products, the tuning fork should protrude into the vessel to avoid buildup on the tuning fork.

#### Flows

To minimise flow resistance caused by the tuning fork, Vibex should be mounted in such a way that the surfaces of the blades are parallel to the product movement.

# 4 Connecting to power supply

## 4.1 Preparing the connection

Note safety instructions

Always keep in mind the following safety instruc - tions:

• Connect only in the complete absence of line voltage

## 4.2 Wiring plan

#### Contactless electronic switch

The instrument is used for direct control of relays, contactors, magnet valves, warning lights, horns etc. It must not be operated without intermediately connected load, because the electronic would be destroyed if connected directly to mains. It is not suitable for connection to low voltage PLC inputs. Domestic current is temporarily lowered below 1 mA after switching off the load so that contactors, whose holding current is lower than the constant domestic current of the electronics (3 mA), are reliably switched off.

For the plug version valve plug DIN 43650, standard cable with round wire cross -section can be used. Cable diameter 0.17... 0.28 in protection IP 65.



Fig. 17: Wiring plan, contactless electronic switch with valve plug DIN 43650

- 1 Max. level detection
- 2 Min. level detection
- P<sub>E</sub> Protective ground
- R<sub>L</sub> Load resistance (contactor, relay, etc.)

#### Transistor output

For connection to binary inputs of a PLC with an input resistance  $\,<\,100\,$  k $\Omega.$ 

If the input of the PLC is high-impedance , you have to connect a load resistor  $(R_{\rm L})$  with 100  $k\Omega$  according to the following illustrations in parallel to the input of the PLC .

For the plug version valve plug DIN 43650, standard cable with round wire cross -section can be used. Cable diameter 0.17... 0.28 in protection IP65

The M12 x 1 plug connection requires a complete confectioned cable with plug .



Fig. 18: Wiring plan, Transistor output with valve plug DIN 43650 1 Max. level detection

- 2 Min. level detection
- P<sub>A</sub> Potential equalisation
- $R_L$  Load resistor (contactor, relay etc. or external resistor 100 k $\Omega$ )



Fig. 19: Wiring plan (housing), transistor output with M12  $\times$  1 plug connection

- 1 Brown
- 2 White
- 3 Blue
- 4 Black
- $R_{\,L}$   $\,$  Load resistor (contactor, relay etc. or external resistor 100 kΩ)  $\,$

# 5 Set up

## 5.1 Indication of the switching status

The switching status of the electronics can be checked via the signal lamp integrated in the upper part of the housing.

## 5.2 Function test

KFA 100 has an integrated test switch which can be activated magnetically . Proceed as follows to test the instrument:

à Hold the test magnet (accessory ) to the magnet symbol on the instrument housing



Fig. 20: Function test

The test magnet changes the current switching condition of the instrument. You can check the change on the signal lamp . Please note that the connected instruments are activated during the test.



## Caution :

It is absolutely necessary that you remove the test magnet after the test from the instrument housing.



## 5.3 Functional chart

The following chart provides an overview of the switching conditions depending on the adjusted mode and level.

	Level	S witching status	C ontrol lamp
Mode max.		transistor con - ducts or S witch closed	G reen
Mode max.		transistor blocks or S witch open	R ed
Mode min.		transistor con - ducts or S witch closed	G reen
Mode min.		transistor blocks or S witch open	R ed
Failure	any	transistor blocks or S witch open	flashes red

# 6 Maintain

## 6.1 Maintenance

When used in the correct way , no special main - tenance is required in normal operation .

# 7 Dismounting

7.1 Dismounting steps

Warning :

Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel, high temperatures, corrosive or toxic products etc.

Take note of chapters "Mounting" and "Connecting to power supply" and carry out the listed steps in reverse order .

## 7.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the electronics to be easily separable.

#### WEEE directive 2002 /96 /EG

This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a speci alised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

C orrect disposal avoids negative effects to persons and environment and ensures recycling of useful raw materials.

Materials : see chapter "Technical data "

If you have no possibility to dispose of the old instrument professionally , please contact us con - cerning return and disposal .
#### Specifications

Electrical Data		
Switching Output Type         Transistor (For connection to binary inp of a PLC with an input resistance <100kg		
Supply Voltage	10 to 55 VDC	
Load Current Max.	250mA (output is overload and permanently short-circuit protected)	
Off-State Current (Load Off)	< 10uA	
Voltage Drop	< 1V	
Power Consumption Max	0.5W	
Protection Class		
Over-voltage Category	Ш	
Connection Plug	M12x1, 4-Pin (See order code for adding the mating - M12 cable)	
Measurement Performance (Reference Condition: Density 1g/cm <sup>3</sup> (0.036lbs/in <sup>3</sup> ) (water)		
Hysteresis	0.08in (2mm) (With vertical installation)	
Switching Point (Nominal)	Vertical Installation: 0.51in (13mm) above tip of fork (indicated by a small notch on the outside of the fork paddles) Horizontal Installation: Center axis of the fork paddle (indicated by an elogated ridge on the outside of the fork paddles) Switching point is in any liquid definitely located on the fork paddle area	

#### **Specifications Continued**

Switching Delay	On: 0.5s / Off: 0.5s		
Application Conditions			
Dielectric Constant [ε <sub>r</sub> ]	No restriction (Suitable for all oils, ie: cutting, grinding and hydraulics oil; collant; erosion dielectric fluid; cleaning and degreasing agents; solvents; all liquid lubricants; water and water-based liquids)		
Conductivity	No restrictions		
Density	0.025 to 0.9lbs/in <sup>3</sup> (0.7 to 2.5g/cm <sup>3</sup> ) (Not suitable for substances with very low density, ie. propane)		
Dynamic Viscosity	0.1 to 10.000cP (0.1 to 10.000mPa s) (Not suitable for very viscous or adhesive substances)		
Solid Content in the Liquid	Max. 0.2in (5mm) diameter of solid particles contained in the liquid can be used in slurries		
Foam/Air Bubbles	Insensitive to foam and air bubbles		
Build-up	Avoid situations where a substance coats and dries on the fork, thus creating excessive build-up/caking on the fork or even bridge the fork (ie. dense paper slurries, bitumen)		
Application Temperature	F: -40° to + 212° or -40° to + 302° C: -40° to + 100° or -40° to +150°		
Ambient Temperaure	F: -40° to 158° C: -40° to 70°		
Temperature Shock	No restrictions		
Application Pressure	-14.5 to 938 PSI (-1 to 64 Bar)		
Mechanical Data			
Ingress Protection Rating	M12x 1 plug: IP66/IP67		
Connection Size	3/4" or 1"		
Thread Type	NPT (US) or G (Metric)		
Surface Finish [Ra]	1.26in-4 (<3.2um)		
Material All Metal Parts	1.4404 (316L)		
Other Materials	Flat seal: Klingersil C -4400, Plastic End Cap: PEI		

Note: Please Consult Factory for Special Requirements

#### 8.2 Dimensions



Fig. 21: Vibex with M12 x 1 plug connection



Fig. 23: Vibex - High temp version with M12 x 1 plug connection



#### VIBEX™ WIRING DIAGRAM - LEVEL SWITCH TO AUX. RELAY

#### **Ordering Information**

#### FLO-CORP MODEL NUMBER BUILDER

For Assistance Call 877.FLO.LINE

Use the diagram below, working from left to right to construct your Flo-Corp Model Number. Simply match the category number to the corresponding box number.

#### Example: LSV1-01-06N-N

Vibex<sup>™</sup> Vibrating Level Switch, -40° to +212°F Application Temperature, 3/4" Connection, NPT Thread Type, M12 x 1, 4-Pin Connection Only



Ordering Notes:

(1) Select the best configuration based on your requirements

(2) Standard M12 cable is required for operation. For special lengths, please contact factory.

Specifications are subject to change without notice.

# SECTION 14b: DO ANALYZER-AREATION TANK

# P&ID: Item #: DO-0422

# **Unit Details:**

DO Analyzer:	Hach sc200 Universal Controller: 100-240 V AC with two digital sensor inputs and two 4- 20 mA outputs
	Useh Dissolved Owners LDO® Droke Medal 2

- DO Sensor: Hach Dissolved Oxygen LDO<sup>®</sup> Probe, Model 2
- Manufacturer: Hach Company P.O. Box 389 Loveland, CO 80539-0389 Phone: (800) 227-4224 Fax: (970) 669-2932 www.Hach.com

Local Distributor/Contact:

Hach Company P.O. Box 389 Loveland, CO 80539-0389 Phone: (800) 227-4224 Fax: (970) 669-2932 www.Hach.com THIS PAGE INTENTIONALLY LEFT BLANK

# sc200<sup>™</sup> UNIVERSAL CONTROLLER

#### **Applications**

- Drinking Water
- Wastewater
- Industrial Water
- Power



# One Controller for the Broadest Range of Sensors.

Choose from 30 digital and analog sensor families for up to 17 different parameters.

# **Maximum Versatility**

The sc200 controller allows the use of digital and analog sensors, either alone or in combination, to provide compatibility with Hach's broad range of sensors, eliminating the need for dedicated, parameter-specific controllers.

# **Ease of Use and Confidence in Results**

Large, high-resolution, transreflective display provides optimal viewing resolution in any lighting condition. Guided calibration procedures in 19 languages minimize complexity and reduce operator error. Password-protected SD card reader offers a simple solution for data download and transfer. Visual warning system provides critical alerts.

# **Wide Variety of Communication Options**

Utilize two to five analog outputs to transmit primary and secondary values for each sensor, or integrate Hach sensors and analyzers into MODBUS RS232/RS485, Profibus® DP, and HART networks.



Password protected SD card reader offers a simple solution for data download and transfer, and sc200 and digital sensor configuration file duplication and backup.



# **Controller Comparison**







	Previous Models				
Features	sc100 <sup>™</sup> Controller	GLI53 Controller	sc200™ Controller	Benefits	
Display	64 x 128 pixels 33 x 66 mm (1.3 x 2.6 in.)	64 x 128 pixels 33 x 66 mm (1.3 x 2.6 in.)	160 x 240 pixels 48 x 68 mm (1.89 x 2.67 in.) Transreflective	<ul> <li>Improved user interface— 50% bigger</li> <li>Easier to read in daylight and sunlight</li> </ul>	
Data Management	irDA Port/PDA Service Cable	N/A	SD Card Service Cable	<ul> <li>Simplifies data transfer</li> <li>Standardized accessories/ max compatibility</li> </ul>	
Sensor Inputs	2 Max Direct Digital Analog via External Gateway	2 Max Analog Depending on Parameter	2 Max Digital and/or Analog with Sensor Card	<ul> <li>Simplifies analog sensor connections</li> <li>Works with analog and digital sensors</li> </ul>	
Analog Inputs	N/A	N/A	1 Analog Input Signal Analog 4-20mA Card	<ul> <li>Enables non-sc analyzer monitoring</li> <li>Accepts mA signals from other analyzers for local display</li> <li>Consolidates analog mA signals to a digital output</li> </ul>	
4-20 mA Outputs	2 Standard	2 Standard	2 Standard Optional 3 Additional	<ul> <li>Total of five (5) 4-20 mA outputs allows multiple mA outputs per sensor input</li> </ul>	
Digital Communication	MODBUS RS232/RS485 Profibus DP V1.0	HART	MODBUS RS232/RS485 Profibus DP V1.0 HART 7.2	Unprecedented combination of sensor breadth and digital communication options	

# Choose from Hach's Broad Range of Digital and Analog Sensors

Parameter	Sensor	Digital or Analog
Ammonia	AMTAX™ sc, NH4D sc	•
Chlorine	CLF10 sc, CLT10 sc, 9184 sc	
Chlorine Dioxide	9185 sc	•
Conductivity	GLI 3400 Contacting, GLI 3700 Inductive	$\bigtriangleup$
Dissolved Oxygen	LDO™, 5740 sc	•
Dissolved Oxygen	5500	$\bigtriangleup$
Flow	U53, F53 Sensors	$\bigtriangleup$
Nitrate	NITRATAX™ sc, NO3D sc	•
Oil in Water	FP360 sc	•
Organics	UVAS sc	•
Ozone	9187 sc	•
pH/ORP	pHD	•
pH/ORP	pHD, pH Combination, LCP	$\bigtriangleup$
Phosphate	PHOSPHAX™ sc	•
Sludge Level	SONATAX™ sc	
Suspended Solids	SOLITAX™ sc, TSS sc	•
Turbidity	1720E, FT660 sc, SS7 sc, ULTRATURB sc, SOLITAX sc	
Ultra Pure Conductivity	8310, 8311, 8312, 8315, 8316, 8317 Contacting	$\bigtriangleup$
Ultra Pure pH/ORP	8362	$\bigtriangleup$

 $\bullet$  = Digital  $\triangle$  = Analog

Connect up to two of any of the sensors listed above, in any combination, to meet your application needs. The diagrams below demonstrate the potential configurations. Operation of analog sensors requires the controller to be equipped with the appropriate sensor module. Contact Hach Technical Support for help with selecting the appropriate module. 2 Channel Configurations

 $\bigtriangleup$ 

 $\triangle$ 

1 Channel Configurations



# sc200<sup>™</sup> Universal Controller

# **Specifications\***

5.7 in x 5.7 in x 7.1 in (144 mm x 144 mm x 181 mm)
Graphic dot matrix LCD with LE backlighting, transreflective
1.9 x 2.7 in. (48 mm x 68 mm)
240 x 160 pixels
3.75 lbs. (1.70 kg)
100 - 240 V AC, 24 V DC
50/60 Hz
-20 to 60 °C , 0 to 95% RH non-condensing
Two (Five with optional expansion module) to isolated current outputs, max 550 $\Omega$ , Accuracy $\pm$ 0.1% of FS (20mA) at 25 °C, $\pm$ 0.5% of FS over -20 °C to 60 range
Operational Mode: measurement or calculated value
Linear, Logarithmic, Bi-linear, Pl
2 password-protected levels
Wall, pole, and panel mounting
NEMA 4X/IP66
1/2 in NPT Conduit
Primary or secondary measurement, calculated value (dual channel only) or timer

5.7 in x 5.7 in x 7.1 in (144 mm x 144 mm x 181 mm)	F
Graphic dot matrix LCD with LED backlighting, transreflective	
1.9 x 2.7 in. (48 mm x 68 mm)	F
240 x 160 pixels	
3.75 lbs. (1.70 kg)	
100 - 240 V AC, 24 V DC	
	ľ
50/60 Hz	E
	(
-20 to 60 °C , 0 to 95% RH	
Two (Five with optional expansion module) to isolated current outputs, max 550 $\Omega$ , Accuracy: $\pm$ 0.1% of FS (20mA) at 25 °C, $\pm$ 0.5% of FS over -20 °C to 60 °C range	
Operational Mode: measurement or calculated value	
Linear, Logarithmic, Bi-linear, PID	
2 password-protected levels Wall, pole, and panel mounting	
NEMA 4X/IP66	

Relay Functions
Relays
Communication
Memory Backup
Certifications

Scheduler (Timer), Alarm, Feeder Control, Event Control, Pulse Width Modulation, Frequency Control, and Warning

Four electromechanical SPDT (Form C) contacts, 1200 W, 5 A

MODBUS RS232/RS485, PROFIBUS DPV1, or HART 7.2 optional

Flash memory

EMC

CE compliant for conducted and radiated emissions:

- CISPR 11 (Class A limits)

- EMC Immunity EN 61326-1 (Industrial limits)

Safety

cETLus safety mark for:

- General Locations per ANSI/UL 61010-1 & CAN/CSA C22.2. No. 61010-1
- Hazardous Location Class I, Division 2, Groups A,B,C & D (Zone 2, Group IIC) per FM 3600 / FM 3611 & CSA C22.2 No. 213 M1987 with approved options and appropriately rated Class I, Division 2 or Zone 2 sensors

cULus safety mark

- General Locations per UL 61010-1 & CAN/CSA C22.2. No. 61010-1

\*Subject to change without notice.

Δ

# **Dimensions**





# **Ordering Information**

#### sc200 for Hach Digital and Analog Sensors

LXV404.99.00552	sc200 controller, 2 channels, digital
LXV404.99.00502	sc200 controller, 1 channel, digital
LXV404.99.00102	sc200 controller, 1 channel, pH/DO
LXV404.99.00202	sc200 controller, 1 channel, Conductivity
LXV404.99.01552	sc200 controller, 2 channels, digital, Modbus RS232/RS485
LXV404.99.00112	sc200 controller, 2 channel, pH/DO

Note: Other Sensor combinations are available. Please contact Hach Technical Support or your Hach representative.

Note: Communication options (MODBUS, Profibus DPV1, and HART) are available. Please contact Hach Technical Support or your Hach representative.

### sc200 for Ultrapure Sensors

9500.99.00602	sc200 controller, 1 channel, ultrapure conductivity
9500.99.00702	sc200 controller, 1 channel, ultrapure pH
9500.99.00662	sc200 controller, 2 channel, ultrapure conductivity
9500.99.00772	sc200 controller, 2 channel, ultrapure pH

#### **Sensor and Communication Modules**

9012900	Analog pH/ORP and DO module for GLI Sensors
9013000	Analog Conductivity module for GLI Sensors
9012700	Flow module
9012800	4-20 mA Input Module
9525700	Analog pH/ORP Module for Polymetron Sensors
9525800	Analog Conductivity Module for Polymetron Sensors
9013200	Modbus 232/485 Module
9173900	Profibus DP Module
9328100	HART Module
9334600	4-20 mA Output Module (Provides 3 additional mA Outputs)

# Accessories

9220600	sc200 Weather and Sun Shield with UV Protection Screen
8809200	sc200 UV Protection Screen
9218200	SD card reader (USB) for connection to PC
9218100	4 GB SD card







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United States: Outside United States: **hach.com**  800-227-4224 tel970-669-2932 fax970-669-3050 tel970-461-3939 fax

orders@hach.com int@hach.com





DOC023.53.80040

# sc200 Controller

04/2013, Edition 5

**User Manual** 





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# Specifications

Specifications are subject to change without notice.

Specification	Details
Component description	Microprocessor-controlled and menu-driven controller that operates the sensor and displays measured values.
Operating temperature	-20 to 60 °C (-4 to 140 °F); 95% relative humidity, non-condensing with sensor load <7 W; -20 to 50 °C (-4 to 104 °F) with sensor load <28 W
Storage temperature	-20 to 70 °C (-4 to 158 °F); 95% relative humidity, non-condensing
Enclosure <sup>1</sup>	NEMA 4X/IP66 metal enclosure with a corrosion- resistant finish
Power requirements	AC powered controller: 100-240 VAC ±10%, 50/60 Hz; Power 50 VA with 7 W sensor/network module load, 100 VA with 28 W sensor/network module load (optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection).
	<b>24 VDC powered controller:</b> 24 VDC—15%, + 20%; Power 15 W with 7 W sensor/network module load, 40 W with 28 W sensor/network module load (optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection).
Altitude requirements	Standard 2000 m (6562 ft) ASL (Above Sea Level)
Pollution degree/Installation category	Polution Degree 2; Installation Category II
Outputs	Two analog (0-20 mA or 4-20 mA) outputs. Each analog output can be assigned to represent a measured parameter such as pH, temperature, flow or calculated values. Optional module supplies three additional analog outputs (5 total).

Specification	Details
Relays	Four SPDT, user-configured contacts, rated 250 VAC, 5 Amp resistive maximum for the AC powered controller and 24 VDC, 5A resistive maximum for the DC powered controller. Relays are designed for connection to AC Mains circuits (i.e., whenever the controller is operated with 115 - 240 VAC power) or DC circuits (i.e., whenever the controller is operated with 24 VDC power).
Dimensions	1/2 DIN—144 x 144 x 180.9 mm (5.7 x 5.7 x 7.12 in.)
Weight	1.7 kg (3.75 lb)
Compliance information <sup>2</sup>	CE approved (with all sensor types). Listed for use in general locations to UL and CSA safety standards by ETL (with all sensor types).
	Certain AC mains powered models are listed for use in general safety locations to UL and CSA safety standards by Underwriters Laboratories (with all sensor types).
Digital communication	Optional Modbus, RS232/RS485, Profibus DPV1 or HART network connection for data transmission
Data logging	Secure Digital Card (32 GB maximum) or special RS232 cable connector for data logging and performing software updates. The controller will keep approximately 20,000 data points per sensor.
Warranty	2 years

<sup>1</sup> Units that have the Underwriters Laboratories (UL) certification are intended for indoor use only and do not have a NEMA 4X/IP66 rating.

<sup>2</sup> DC powered units are not listed by UL.

# **General information**

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

### Safety information

#### NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

#### Use of hazard information

#### **A** DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

### A WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

# **A**CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

### NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

#### Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.



This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.



This symbol indicates that a risk of electrical shock and/or electrocution exists.



This symbol indicates the presence of devices sensitive to Electrostatic Discharge (ESD) and indicates that care must be taken to prevent damage with the equipment.



Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user.

#### Certification

# Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numèrique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

#### FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

**1.** The equipment may not cause harmful interference.

2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

- 1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
- 2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
- 3. Move the equipment away from the device receiving the interference.
- 4. Reposition the receiving antenna for the device receiving the interference.
- 5. Try combinations of the above.

#### **Product overview**

The controller displays sensor measurements and other data, can transmit analog and digital signals, and can interact with and control other devices through outputs and relays. Outputs, relays, sensors and sensor modules are configured and calibrated through the user interface on the front of the controller.

Figure 1 shows the product components. Components may vary according to controller configuration. Contact the manufacturer if parts are damaged or missing.

#### Figure 1 System components



1	Controller	4	Network module (optional)
2	Strain relief assembly (optional depending on controller version)	5	High-voltage barrier
3	Digital connection fitting (optional depending on controller version)	6	Sensor modules (optional)

#### Sensors and sensor modules

The controller accepts up to a maximum of two sensor modules or two digital sensors (depending on the controller configuration), along with one communication module. A single digital sensor and a single sensor module can be installed in combination. A variety of sensors can be wired to the sensor modules. Sensor wiring information is given in the specific sensor manuals and in the user instructions for specific modules.

#### Relays outputs and signals

The controller has four configurable relay switches and two analog outputs. An optional analog output module can increase the number of analog outputs to five.

#### **Device scans**

With two exceptions, the controller automatically scans for connected devices without user input when it is powered on. The first exception is when the controller is powered on for the first time before initial use. The second exception is after the controller configuration settings have been set to their default values and the controller is powered on. In both cases, the controller first displays the language, date and time edit screens. After the language, date and time entries are accepted, the controller performs a device scan. Refer to Connect a digital sc sensor on page 18 for instructions about how to scan for devices when the controller is already powered on.

#### **Controller enclosure**

The controller enclosure is NEMA 4X/IP66-rated and has a corrosionresistant finish designed to withstand corrosive environmental constituents such as salt spray and hydrogen sulfide. Protection against environmental damage is strongly recommended for outdoor use. **Note:** Units that have the Underwriters Laboratories (UL) certification are intended for indoor use only and do not have a NEMA 4X/IP66 rating.

#### **Controller mounting options**

The controller can be mounted to a panel, to a wall or to a vertical or horizontal pipe. A neoprene sealing gasket is included and can be used to reduce vibration. The gasket can be used as a template for panel mounting before the inner gasket component is separated.

# Installation

#### Mounting components and dimensions

#### A CAUTION

Personal injury hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

The controller can be installed on a surface, panel or pipe (horizontal or vertical). For mounting options and instructions, refer to Figure 2, Figure 3 on page 9, Figure 4 on page 10, Figure 5 on page 10 and Figure 6 on page 11.

For horizontal pipe mounts, the mounting feet (Figure 2) must be attached to the mounting bracket in a vertical position.

For both horizontal and vertical pipe mounts, attach the mounting bracket to the controller as shown in Figure 5 on page 10.

#### Figure 2 Mounting components



1	Mounting foot (2x)	6 Flat washer, ¼-inch ID (4x)	
2	Sealing gasket for panel mount, Neoprene	7 Lock washer, <sup>1</sup> / <sub>4</sub> -inch ID (4x)	
3	Bracket for wall and pipe mounting	8 M5 x 0.8 Keps hexnut (4x)	
4	Vibration isolation gasket for pipe mount	<ul> <li>Pan head screws, M5 x 0.8 x 100mm (4x) (Used for variable diameter pipe mount installations</li> </ul>	)
5	Vibration isolation washer for pipe mount (4x)	<b>10</b> Pan head screws, M5 x 0.8 x 15 mm (4x)	

#### **Controller mounting**

Figure 3 Surface mounting dimensions



#### Figure 4 Panel mounting dimensions



Figure 5 Pipe mounting (vertical pipe)



#### Figure 6 Top and bottom views



#### High-voltage barrier

High-voltage wiring for the controller is located behind the high-voltage barrier in the controller enclosure. The barrier must remain in place except when installing modules or when a qualified installation technician is wiring for power, alarms, outputs or relays. Do not remove the barrier while power is applied to the controller.

# Electrostatic discharge (ESD) considerations

#### NOTICE



Potential Instrument Damage. Delicate internal electronic components can be damaged by static electricity, resulting in degraded performance or eventual failure.

Refer to the steps in this procedure to prevent ESD damage to the instrument:

- Touch an earth-grounded metal surface such as the chassis of an instrument, a metal conduit or pipe to discharge static electricity from the body.
- Avoid excessive movement. Transport static-sensitive components in anti-static containers or packages.
- Wear a wrist strap connected by a wire to earth ground.
- Work in a static-safe area with anti-static floor pads and work bench pads.

### Wiring overview

Figure 7 shows an overview of the wiring connections inside the controller with the high voltage barrier removed. The left side of the figure shows the back side of the controller cover.

**Note:** Remove connector caps from the connectors before module installation.

Figure 7 Wiring connections overview



1 Service cable connection	4 Communication module connector (e.g., Modbus, Profibus, HART, optional 4-20 mA module, etc.)	7 Relay connections <sup>1</sup>
<b>2</b> 4-20 mA output <sup>1</sup>	5 AC and DC power connector <sup>1</sup>	8 Digital sensor connector <sup>1</sup>
3 Sensor module connector	6 Ground terminals	<b>9</b> Digital sensor connector <sup>1</sup>

<sup>1</sup> Terminals can be removed for improved access.

# Wiring for power



#### A WARNING

Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

#### A WARNING



Potential Electrocution Hazard. If this equipment is used outdoors or in potentially wet locations, a **Ground Fault Interrupt** device must be used for connecting the equipment to its mains power source.

## A DANGER

Electrocution Hazard. Do not connect AC power to a 24 VDC powered model.

## A WARNING



Potential Electrocution Hazard. A protective earth (PE) ground connection is required for both 100-240 VAC and 24 VDC wiring applications. Failure to connect a good PE ground connection can result in shock hazards and poor performance due to electromagnetic interferences. ALWAYS connect a good PE ground to the controller terminal.

# NOTICE

Install the device in a location and position that gives easy access to the disconnect device and its operation.

The controller can be purchased as either a 100-240 VAC powered model or a 24 VDC powered model. Follow the appropriate wiring instructions for the purchased model.

The controller can be wired for line power by hard-wiring in conduit or wiring to a power cord. Regardless of the wire used, the connections are made at the same terminals. A local disconnect designed to meet local electrical code is required and must be identified for all types of installation. In hard-wired applications, the power and safety ground service drops for the instrument must be 18 to 12 AWG.

#### Notes:

- The voltage barrier must be removed before making any electrical connections. After making all connections, replace the voltage barrier before closing the controller cover.
- A sealing type strain relief and a power cord less than 3 meters (10 feet) in length with three 18-gauge conductors (including a safety ground wire) can be used to maintain the NEMA 4X/IP66 environmental rating.
- Controllers can be ordered with AC power cords pre-installed. Additional power cords may also be ordered.
- The DC power source that supplies power to the 24 VDC powered controller must maintain voltage regulation within the specified 24 VDC-15% +20% voltage limits. The DC power source must also provide adequate protection against surges and line transients.

#### Wiring procedure

Refer to the illustrated steps that follow and Table 1 or Table 2 to wire the controller for power. Insert each wire into the appropriate terminal until the insulation is seated against the connector with no bare wire exposed. Tug gently after insertion to make sure that there is a secure connection. Seal any unused openings in the controller box with conduit opening sealing plugs.



Table 1	AC power	wiring	information	(AC	powered	models	only)
---------	----------	--------	-------------	-----	---------	--------	-------

Terminal	Description	Color—North America	Color—EU
1	Hot (L1)	Black	Brown
2	Neutral (N)	White	Blue
_	Protective Earth (PE) Ground lug	Green	Green with yellow stripe

Table 2 DC power wiring information (DC powered models only)

Terminal	Description	Color—North America	Color—EU
1	+24 VDC	Red	Red
2	24 VDC return	Black	Black
_	Protective Earth (PE) Ground lug	Green	Green with yellow stripe

# Alarms and relays

The controller is equipped with four unpowered, single pole relays rated 100-250 VAC, 50/60 Hz, 5 amp resistive maximum. Contacts are rated 250 VAC, 5 amp resistive maximum for the AC powered controller and 24 VDC, 5A resistive maximum for the DC powered controller. The relays are not rated for inductive loads.

# Wiring relays



Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

# A WARNING

AWARNING



Potential fire hazard. The relay contacts are rated 5A and are not fused. External loads connected to the relays must have current limiting devices provided to limit current to < 5 A.

# A WARNING



Potential fire hazard. Do not daisy-chain the common relay connections or jumper wire from the mains power connection inside the instrument.

# A WARNING



Potential electrocution hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP66 to route cables in to the instrument.

#### AC line (100-250 V) powered controllers

The wiring compartment is not designed for voltage connections in excess of 250 VAC.

#### 24 VDC powered controllers

### A WARNING



Potential electrocution hazard. AC mains powered controllers (115 V– 230 V) are designed for relay connections to AC mains circuits (i.e., voltages greater than 16 V-RMS, 22.6 V-PEAK or 35 VDC).

# A WARNING



Potential electrocution hazard. 24 V powered controllers are designed for relay connections to low voltage circuits (i.e., voltages less than 16 V-RMS, 22.6 V-PEAK or 35 VDC).

The 24 VDC controller relays are designed for the connection to low voltage circuits (i.e., voltages less than 30 V-RMS, 42.2 V-PEAK or 60 VDC). The wiring compartment is not designed for voltage connections above these levels.

The relay connector accepts 18–12 AWG wire (as determined by load application). Wire gauge less than 18 AWG is not recommended.

The Normally Open (NO) and Common (COM) relay contacts will be connected when an alarm or other condition is active. The Normally Closed (NC) and Common relay contacts will be connected when an alarm or other condition is inactive (unless the Fail Safe is set to Yes) or when power is removed from the controller.

Most relay connections use either the NO and COM terminals or the NC and COM terminals. The numbered installation steps show connection to the NO and COM terminals.



### Analog output connections

### A WARNING

Potential Electrocution Hazard. Always disconnect power to the instrument when making electrical connections.

#### **A**WARNING



Potential electrocution hazard. In order to maintain the NEMA/IP environmental ratings of the enclosure, use only conduit fittings and cable glands rated for at least NEMA 4X/IP66 to route cables in to the instrument.

Two isolated analog outputs (1 and 2) are provided (Figure 8). Such outputs are commonly used for analog signaling or to control other external devices.

Make wiring connections to the controller as shown in Figure 8 and Table 3.

**Note:** Figure 8 shows the back of the controller cover and not the inside of the main controller compartment.

Recorder wires	Circuit board position
Output 2–	4
Output 2+	3
Output 1–	2
Output 1+	1

#### Table 3 Output connections

- 1. Open the controller cover.
- 2. Feed the wires through the strain relief.
- 3. Adjust the wire as necessary and tighten the strain relief.
- 4. Make connections with twisted-pair shielded wire and connect the shield at the controlled component end or at the control loop end.
  - · Do not connect the shield at both ends of the cable.
  - Use of non-shielded cable may result in radio frequency emission or susceptibility levels higher than allowed.

- · Maximum loop resistance is 500 ohm.
- 5. Close the controller cover and tighten the cover screws.
- **6.** Configure outputs in the controller.

#### Figure 8 Analog output connections



### Connect a digital sc sensor

**Note:** To connect an analog sensor, refer to the instructions supplied in the module or sensor manual.

A digital sc sensor can be connected to the controller using the keyed quick-connect fitting (Figure 9). A digital sensor can be connected with the controller powered on or off.

When a sensor is connected with the controller powered on, the controller does not automatically perform a device scan. To make the controller perform a device scan, navigate to the Test/Maintenance menu and select Scan Devices. If a new device is found, the controller performs the installation process without further user action.

When a sensor is connected with the controller powered off, the controller will perform a device scan when it is powered on again. If a new device is found, the controller performs the installation process without further user action.

Retain the connector cap to seal the connector opening in case the sensor must be removed.

#### Figure 9 Digital sensor quick connect



### Connect the optional digital communication output

The manufacturer supports Modbus RS485, Modbus RS232, Profibus DPV1 and HART communication protocols. The optional digital output module is installed in the location indicated by item 4 in Figure 7 on page 12. Refer to the instructions supplied with the network module for more details.

For information about Modbus registers, go to http://www.hachlange.com or http://www.hach.com and search *Modbus registers* or go to any sc200 product page.

# Install a Secure Digital (SD) memory card

For instructions on how to install an SD card in the controller, refer to Figure 10. Information on how to use the SD memory card can be found in Using the secure digital memory (SD) card on page 36.

To remove an SD card, push down on the edge of the card and release, then pull the card up and out of the slot. After the card is removed, close the slot cover and tighten the cover screws.

#### Figure 10 SD card installation



# User interface and navigation

#### **User interface**

The keypad has four menu keys and four directional keys as shown in Figure 11. 825

#### Figure 11 Keypad and front panel overview



1	Instrument display	5	<b>BACK</b> key. Moves back one level in the menu structure.
2	Cover for secure digital memory card slot	6	<b>MENU</b> key. Moves to the Settings Menu from other screens and submenus.
3	<b>HOME</b> key. Moves to the Main Measurement screen from other screens and submenus.	7	Directional keys. Used to navigate through the menus, change settings, and increment or
4	ENTER key. Accepts input values, updates, or displayed menu options.		decrement digits.

Inputs and outputs are set up and configured through the front panel using the keypad and display screen. This user interface is used to set up and configure inputs and outputs, create log information and calculated values, and calibrate sensors. The SD interface can be used to save logs and update software.

#### **Reading and measurement screens**

When two sensors are connected, push the **HOME** key and then push the Right or Left arrows to toggle through the available measurement display options. A combination screen is the default display mode when two sensors are connected.

Push the **UP** or **DOWN** arrows to toggle the status bar at the bottom of the measurement display. The footer bar displays controller, sensor, or network card errors and warnings; sensor and network card process events; secondary measurements and outputs.

If a menu has more options than can be displayed at one time, a scroll bar will appear on the right side of the display. Push the **UP** or **DOWN** arrows to scroll through the available menu items.

#### Display

Figure 12 shows an example of the main measurement screen with a DO sensor connected to the controller.

The front panel display screen shows sensor measurement data, calibration and configuration settings, errors, warnings and other information.

#### Figure 12 Example of Main Measurement screen



1	Home screen icon	7 Date
2	Sensor name	8 Measurement parameter
3	SD Memory card icon	9 Analog output values, error and warning messages and secondary measurements.
4	Relay status indicator	10 Warning icon
5	Measurement value	11 Time
6	Measurement units or warning icon	12 Measurement name

#### Table 4 Icon descriptions

lcon	Description
Home screen	The icon may vary depending on the screen or menu being displayed. For example, if an SD card is installed, an SD card icon appears here when the user is in the SD Card Setup menu.
SD memory card	This icon appears only if an SD card is in the reader slot. When a user is in the SD Card Setup menu, this icon appears in the upper left corner.

#### Table 4 Icon descriptions (continued)

lcon	Description
Warning	A warning icon consists of an exclamation point within a triangle. Warning icons appear in the display footer along with a number that indicates the associated device.
	0=controller
	1=sensor 1
	2=sensor 2
	3=network card
Error	An error icon consists of an exclamation point within a circle. When an error occurs, the error icon and the measurement screen each flash again and again in the main display.

# System startup

When initially powered up, the Language, Date Format and Date/Time screens appear in order. After these options are set, the controller performs a device scan and displays the message **Scanning for devices. Please wait...** If a new device is found, the controller performs an installation process before displaying a main measurement screen.

If the scan finds previously installed devices without configuration changes, the main measurement screen of the device in the number one position appears immediately after the scan is complete.

If a device has been removed from the controller or is not found during the next power-cycled or menu-driven scan, the controller displays a **Device missing** message and prompts to delete the missing device.

If no sensor is connected to an installed analog module, the controller will indicate an error. If devices are connected but not found by the controller, refer to Troubleshooting on page 41.

#### Set the language, date and time for the first time

The controller displays the language, date and time edit screens when the controller is powered on for the first time, and when it is powered on after the configuration settings have been set to their default values.

After the language, date and time options are set for the first time, update the options as necessary through the sc200 setup menu.

1. In the Language screen, highlight a language in the options list and push the **ENTER** key. English is the default language for the controller.

The selected language is saved. The Date Format screen appears.

2. In the Date Format screen, highlight a format and push the ENTER key.

The date and time format is saved. Next, the Date /Time screen appears.

3. In the Date/Time screen, push the **RIGHT** or **LEFT** arrow keys to highlight a field, then push the **UP** and **DOWN** arrow keys to update the value in the field. Update the other fields as necessary.

#### 4. Push the ENTER key.

The changes are saved and the controller performs a start-up scan for devices. If connected devices are found, the controller displays the main measurement screen for the device in the number one position. If the controller fails to find connected devices, refer to Troubleshooting on page 41.

#### Adjust the display contrast

- 1. From the Settings Menu, select sc200 Setup.
- 2. Select Display Contrast.
- 3. Use the UP and DOWN arrow keys to adjust the contrast to a value between the minimum of +1 and the maximum of +9.

# Controller configuration information

General information about configuration options is listed in the table.

1. To navigate to the menu options, from the Settings Menu, select sc200 Setup.

Option	Description
Security setup	Sets the passcode preferences
Output setup	Configures the controller analog outputs

Option	Description
Relay setup	Configures the controller relays
Display contrast	Adjusts the contrast of the controller display
Set Date/Time	Sets the controller time and date
Datalog setup	Configures data logging options. (Available if Calculation has been setup. At least one sensor must be attached to enter a calculation.)
	<ul> <li>Set Mode—Snap shot, Average, Maximum, Minimum.</li> <li>Set Interval—5 sec, 30 sec, 1 min, 2 min, 5 min, 10 min, 15 min, 30 min</li> </ul>
Error Hold Mode	Hold Outputs—Holds outputs at last known value when controller loses communication with the sensor.
	Transfer Outputs—Switches to transfer mode when controller loses communication with the sensor. Outputs transfer to a pre-defined value.

Option	Description
Calculation	Lets the user calculate a value (i.e., the average DO readings from two basins) with readings that come from the different sensors that are connected to the sc200. To show the calculated value, go to the home screen, then push the <b>RIGHT</b> and <b>LEFT</b> arrows until "Calculation" is shown at the top of the screen. <b>Set Variable X</b> — Select the sensor that supplies the parameter that is used for the first variable.
	<b>Set Parameter X</b> — Select the parameter that is used for the first variable.
	<b>Set Variable Y</b> — Select the sensor that supplies the parameter that is used for the second variable.
	<b>Set Parameter Y</b> —Select the parameter that is used for the second variable.
	<b>Set Formula</b> —Select the equation that is used for the calculation. Options: None, X–Y, X+Y, X/Y, [X/Y] %, [X+Y]/2, X*Y, [X*Y]%/X.
	<b>Display Format</b> —Select the number of digits that are shown after the decimal point. Options: Auto, xxxx, xxxx.x, xxx.xx, xx.xxx, x. xxxx.
	<b>Set Units</b> —Select the measurement unit that is shown for the calculated value (up to 6 characters).
	<b>Set Parameter</b> —Select the parameter that is shown for the calculated value (up to 6 characters).
sc200 Information	<b>S/W VER:</b> —Displays the current version of controller software.
	<b>Bootloader VER:</b> —Displays the current Bootloader version. The Bootloader is a file that loads the main operating system for the controller.
	S/N:—Displays the controller serial number.
Edit name	Assigns a name to the controller
Discrete Input Setup	Configures the discrete inputs. Configuration is specific to the application. Discrete inputs are inputs that come from a PLC (programming logic controller) that require an on/off signal.
Language	Assigns the language used in the controller

2. Select an option and push ENTER to activate the menu item.

# Advanced operation

#### Security setup

#### Enable or disable the passcode

By default the passcode option is disabled and all configuration settings and calibrations can be changed. When the passcode function is enabled, access to Sensor calibration and Test/Maint menus requires a passcode.

To enable the passcode:

- 1. From the Settings Menu, select sc200 Setup and push the ENTER key.
- 2. Select Security Setup and push the ENTER key.
- 3. Select Set Passcode and push the ENTER key.
- 4. Select Disabled or Enabled and push the ENTER key. The passcode is enabled.
- Push the BACK key to return to the sc200 Setup Menu, or push the MENU key to return to the Settings Menu.

#### Edit the passcode

The passcode is factory set to SC200. The Edit Passcode menu option appears in the Security Setup menu only after the passcode feature is enabled and a valid passcode has been entered.

A passcode consists of up to six upper or lower-case alpha, numeric and special characters. Passcodes are case-sensitive.

To edit the passcode:

- 1. Make sure the passcode is enabled. Refer to Enable or disable the passcode on page 23 for information on how to enable the passcode.
- 2. From the Settings menu, select Security Setup and push ENTER.
- 3. Use the arrow keys to enter the current valid passcode and push ENTER.

The Edit Passcode option appears in the Security Setup menu.

4. Select Edit Pass Code and push ENTER.
The Edit Pass Code screen appears.

- 5. Use the arrow keys to edit the passcode and push ENTER. The new passcode is saved and the Security Setup menu appears. *Note:* All menus stay accessible until the HOME key is pushed or the controller is restarted.
- 6. Push the **HOME** key or perform a controller restart. The new passcode settings are saved, and the new passcode is required to enter the Security Setup, Datalog Setup and Test/Maint menus.

#### Configure a 4-20 mA input module

An analog module must be installed in the controller.

- 1. Determine what output the connected device is using (0-20 mA or 4-20 mA). This information will be used to set the scale.
- 2. Determine what the 20 mA value is equal to (e.g, 100 psi).
- Determine what the low end (0 or 4 mA) value is equal to (e.g., 10 psi). This information will be used to set the display range.
- 4. From the Settings Menu, select Sensor Setup.
- 5. Select Configure.
- 6. Update the options.
  - **a.** Highlight an option and push **ENTER**.
  - **b.** Make a selection or update the entries.
  - c. Push ENTER to save the changes.

Option	Description
Edit name	Edits the module name
Edit units	Edits the measurement units
Edit parameter	Edits the parameter name

Option	Description
Display range For the 0-20 mA scale:	Sets the values used for the selected scale (0-20 mA or 4-20 mA)
<ul><li>Set the 20 mA value</li><li>Set the 0 mA value</li></ul>	
For the 4-20 mA scale:	
<ul><li>Set the 20 mA value</li><li>Set the 4 mA value</li></ul>	
Signal average	Sets how often signals are averaged. Higher values produce a smoother signal but increase the time it takes for a signal to respond to a change in the process value.
Set resolution— X.XXX, XX.XX, XXX.X, XXXX	Sets the number of decimal places used in the display.
Select scale— 4-20 mA or 0-20 mA	Sets scale used for the 4-20 mA inpu
Data log interval—5 sec, 30 sec, 1 min, 2 min, 5 min, 10 min, 15 min, 30 min, 60 min	Sets how often data is logged to the internal controller memory.
Reset defaults—Push ENTER to	Resets configuration settings to the

For additional information, refer to the *sc200* 4–20 Analog Input Module User Manual.

#### Configure a 4-20 mA output module

The Network Setup option appears in the Settings Menu only if an analog output module or other network module such as Modbus or Profibus is installed in the controller.

Outputs for analog output modules are set at 4-20 mA. Outputs can be assigned to represent a measured parameter such as pH, temperature, flow or calculated values.

- 1. From the Settings menu, select Network Setup.
- 2. Select Edit Name and enter a name for the module. Push ENTER to save the name.
- 3. Select an output (A, B, C, D) and push ENTER.
  - a. Highlight an option and push ENTER.
  - **b.** Make a selection from the list or update the entries.
  - c. Push ENTER to save the changes.

Option	Description
Select Source	Selects the output to configure—None, sensor 1 name, sensor 2 name, calculation (if set up). For sensor output, Select Parameter sets the measurement options. When the measurement is autorange, Set Range sets the range.
Set Low Value	Sets the 4 mA value (default: 0.000). (Range and units depend on sensor)
Set High Value	Sets the 20 mA value (default: 1.000). (Range and units depend on sensor)
Set Transfer	Sets the transfer value. Range 3.0 to 25.0 mA (default 4.000).
Set Filter	Sets a time-average filter value of 0 (default) to 120 seconds.

For additional information, refer to the *sc200 4-20 Output Module User Manual*.

#### Configure the controller analog outputs

The controller analog outputs can be assigned to represent the measured parameter or secondary measurements such as temperature and calculations. To configure the options, highlight a menu option, push **ENTER** and select an option or update the entries. Push **ENTER** after an option is selected or the entries are updated.

- 1. From the Settings menu, select sc200 Setup.
- 2. Select Output Setup.

7.

- 3. Select Output 1 or Output 2.
- 4. Choose Select Source and select a source from the list. Typically the source is one of the sensors attached to the system. If an analog input card is installed, the analog input may be used as a source.
- From the Output Setup menu, choose Select Parameter and choose an option from the list. Parameters will vary depending on the type of sensors installed.
- **6.** From the Output Setup menu, select Set Function and choose a function. Further setup options will vary depending on which function is chosen.

Option	Description	
Linear	Signal is linearly dependent on the process value	
PID	Signal works as a PID (Proportional, Integral, Derivative) controller	
Logarithmic	Signal is represented logarithmically within the process variable range	
Bilinear	Signal is represented as two linear segments within the process variable range	
From the Output Setup menu, select Activation. Use the information in the table below the chosen function to configure the options.		

8. If Transfer is or will be selected as the Error Hold Mode, or if the Transfer will be used during calibration or other functions within the sensor menu, select Set Transfer from the Output Setup menu and enter the transfer value.

- **9.** From the Output Setup menu, select Set Filter and enter the filter value.
- **10.** From the Output Setup menu, select Scale and choose the scale (0-20 mA or 4-20 mA).

#### • Linear

Option	Description
Set low value	Sets the low endpoint of the process variable range
Set high value	Sets the high endpoint of the process variable range

#### • PID

Option	Description
Set mode (Auto or Manual)	Auto—the signal is automatically controlled by the algorithm within the analyzer using proportional, integral, and derivative inputs.
	Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase (Direct or Reverse)	The direction in which the signal responds to process change. Direct—signal increases as the process increases.
	Reverse—signal increases as process decreases.
Set setpoint	Creates a desired control point of process
Prop band	A function of the difference between the measured signal and the desired setpoint.
Integral	The period of time from the injection point of a reagent to contact with the measuring device.
Derivative	Used to compensate for the 2 <sup>nd</sup> order effects of the process. The majority of applications can be controlled without the use of the derivative setting.
Transit time	Stops all PID control for a selected period of time as the sample travels from the control pump to the measurement sensor.

#### Logarithmic

Option	Description
Set 50% value	Sets the value corresponding to 50% of the process variable range.
Set high value	Sets the upper value of the process variable range.

#### • Bilinear

Option	Description
Set low value	Sets the low endpoint value of the process variable range.
Set high value	Sets the high endpoint value of the process variable range.
Set knee point value	Sets the value at which the process variable range divides into another linear segment.
Set knee point current	Sets the value of the current at the knee point value.

#### Logarithmic output mode

Figure 13 shows in graph form the operation of the logarithmic output mode.

#### Figure 13 Logarithmic output



1	Output current axis	5	Minimum output current (0-4 mA)
2	Source value axis	6	50% output current
3	High value	7	Maximum output current (20 mA)
4	50% value		

#### Bilinear output mode

Figure 14 shows in graph form the operation of the bilinear output mode.



1	Output current axis	5	Low value
2	Source value axis	6	Minimum output current (0-4 mA)
3	High value	7	Knee point current
4	Knee point value	8	Maximum output current (20 mA)

#### **Configure relays**

The Normally Open (NO) and Common (COM) relay contacts will be connected when an alarm or other condition is active. The Normally Closed (NC) and Common relay contacts will be connected when an alarm or other condition is inactive (unless the Fail Safe is set to Yes), or when power is removed from the controller. To select a menu option, highlight the option and push **ENTER**.

- 1. From the sc200 Setup menu, select Relay Setup.
- 2. Select a relay from the list.

- 3. From the Relay Setup menu, choose Select Source and push **ENTER**. Normally, a source is one of the sensors attached to the system, but the controller can also function as a source. If an analog input module is installed, the source may be the analog input.
- 4. From the Relay Setup menu, select Set Parameter and choose from the list of parameters. The list of parameter options will vary with the type of attached sensor.
- 5. From the Relay Setup menu, select Set Function and choose from the list. Further setup will depend on the function chosen.

Option	Description
Scheduler Function (available if the controller is selected as the relay source)	Relay switches at certain times independently of any process value
Alarm Function	Relay activates when upper or lower alarm value is exceeded
Feeder Control Function	Relay indicates if a process value exceeds or falls below a setpoint
Event Control Function	Relay toggles if a process value reaches an upper or lower limit
Pulse Width Modulation (PWM) Control Function	Relay uses a Pulse Width Modulation control depending on a process value
Frequency control	Relay switches with a frequency depending on a process value
Warning	Relay indicates warning and error conditions in probes

- 6. From the Relay Setup menu, select Set Transfer and choose Active or Inactive.
- 7. From the Relay Setup menu, select Fail Safe and choose Yes or No.
- From the Relay Setup menu, select Activation. The activation options for the selected function appear. Use the information in the table below each function to update the options.
- 9. Test the relay function to make sure it is properly energizing the connected device. To do relay testing, go to the Setting menu, then select Test/Maint>Test Relay.

• Scheduler Function (refer to Figure 15)

Option	Description
Hold outputs	Holds outputs in the present ON or OFF state
Run days	Sets the weekday(s) that the relay operates. Options: Sunday, Monday, Tuesday., Wednesday, Thursday, Friday, Saturday
Start time	Sets the start time.
Interval	Sets the time between activation cycles (Default value: 5 min).
Duration	Sets the period of time the relay is energized (Default value: 30 sec).
Off delay	Sets the time for additional hold/output time after the relay has been turned off.

#### Figure 15 Scheduler function



#### • Alarm Function (refer to Figure 16)

0 seconds).

Option	Description
Low alarm	Sets the value where the relay will turn on in response to decreasing measured value. For example, if the low alarm is set for 1.0 and the measured value drops to 0.9, the relay activates.
High alarm	Sets the value where the relay will turn on in response to increasing measured value. For example, if the high alarm is set for 1.0 and the measured value increases to 1.1, the relay activates.
Low deadband	Sets the range where the relay remains on after the measured value increases above the low alarm value. For example, if the low alarm is set for 1.0 and the low deadband is set for 0.5, the relay remains on between 1.0 and 1.5. Default is 5% of the range.
High deadband	Sets the range where the relay remains on after the measured value decreases below the high alarm value. For example, if the high alarm is set for 4.0 and the high deadband is set for 0.5, the relay remains on between 3.5 and 4.0. Default is 5% of the range.
Off delay	Sets a time (0-300 seconds) to delay the relay from normally turning off (Default: 0 seconds).
On delay	Sets a delay time for the relay to turn on (Default:

8 6 0 1 High alarm 5 ON delay - - - - - -

2	High deadband	6	OFF delay
3	Low deadband	7	Time (x-axis)
4	Low alarm	8	Source (y-axis)

#### Figure 16 Alarm function

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#### • Feeder Control Function (refer to Figure 17 and Figure 18)

Option	Description
Phase	Defines the relay status if the process value exceeds the setpoint. High (default)—turns the relay on when the process value exceeds the setpoint.
	Low—turns the relay on when the process value falls below the setpoint.
Set setpoint	Sets the process value at which the relay toggles. The default value is different for each sensor.
Deadband	Sets the area for an amount of change necessary after the relay setpoint is reached in order to satisfy a condition.
Overfeed timer	Sets a time period for de-activating an active relay if the process setpoint cannot be reached. Once an overfeed alarm is present, it must be manually reset.
Off delay	Sets a delay time for the relay to turn off (default: 0 seconds).
On delay	Sets a delay time for the relay to turn on (default: 0 seconds).

#### Figure 17 Feeder control function



1	Deadband (Phase = Low)	6	Time (x-axis)
2	Deadband (Phase = High)	7	ON delay (phase set high)
3	Setpoint	8	OFF delay (phase set low)
4	OFF delay (phase set high)	9	Source (y-axis)
5	ON delay (phase set low)		



Figure 18 Feeder control function (Phase low, Overfeed timer)

1	Deadband	5	ON delay
2	Setpoint	6	OFF delay
3	Overfeed timer	7	Source (y-axis)
4	Time (x-axis)		

• Event Control Function (refer to Figure 19, Figure 20 and Figure 21)

Option	Description
Set setpoint	Sets the value where the relay will turn on.
Deadband	Sets a hysteresis so the relay will not swing unregulated when the process value converges to the setpoint.

Option	Description
OnMax timer	Sets the maximum time the relay can stay on independent from the measured value (default: + 0 min).
OffMax timer	Sets the maximum time the relay can stay off independent from the measured value (default: + 0 min).
OnMin timer	Sets the minimum time the relay can stay on independent from the measured value (default: + 0 min).
OffMin timer	Sets the minimum time the relay can stay off independent from the measured value (default: + 0 min).

32 English

#### Figure 19 Event control function (no delay)

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1 Source (y-axis)	5 Low alarm
2 High alarm	6 Time (x-axis)
3 Deadband	7 OnMax-time
4 Setpoint	8 OffMax-time

Figure 20 Event control function (OnMin timer, OffMin timer)



1	High alarm	5	Time (x-axis)
2	Deadband	6	OffMin timer
3	Setpoint	7	OnMin timer
4	Low alarm	8	Source (y-axis)



Figure 21 Event control function (ON/OFF delay)

1 High alarm	4 OFF delay
2 Low alarm	5 Time (x-axis)
3 ON delay	6 Source (y-axis)

• Pulse Width Modulation Control Function (refer to Figure 22)

Option	Description
Set mode	Auto—the relay output works as a PID controller. Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase	Reverses the leading sign of the control deviation for the PID controller (default: Reverse). The phase selects whether the relay will operate at the first part of a cycle (direct phase) or the second part (reverse phase).
Set setpoint	Creates a setpoint value.
Dead zone	The range above and below the setpoint. In this set range, the PID controller does not take action to change the Pulse Width Modulation On/Off Ratio output signal until the limits of the dead zone are reached.
Period	Sets the cycle duration of the PWM output signal (default: 5 seconds).
Min width	Sets the minimum PWM ratio (default: 1.0 second).
Max width	Sets the maximum PWM ratio (default: 4.0 seconds).
Prop band	Sets the proportional part of the PID controller. The proportional part of the controller supplies an output signal which is linearly dependent to the control deviation. The proportional part reacts on any changes at the input but starts to oscillate easily if the value is set high. The proportional part cannot completely compensate for disturbances.
Integral	Sets the integral part of the PID controller (default: 000 minutes). The integration part of the controller supplies an output signal. The output signal increases linearly if the control deviation is constant. The integration part responds slower than the proportional part and can completely compensate disturbances. The higher the integration part, the slower it responds. If the integration part is set too low, it starts to oscillate.

#### Figure 22 Pulse Width Modulation function (linear mode)



1 High alarm	5 Period
2 Deadband	6 Time (x-axis)
3 Setpoint	7 Phase
4 Low alarm	8 Selected source (y-axis)

#### • Frequency Control Function (refer to Figure 23)

Option	Description
Set mode	Auto—The relay works as a PID controller. Manual—the signal is controlled by the user through manual adjustment of the % change value. This option is shown as Manual Output after the manual set mode is selected.
Phase	Reverses the leading sign of the control deviation for the PID controller (default: Reverse). The phase selects whether the relay will operate at the first part of a cycle (direct phase) or the second part (reverse phase).
Set setpoint	Sets the process value which is controlled by the PID controller.
Dead zone	In this set range, the PID controller does not take action to change the output frequency until within the limits of the dead zone.
Pulse width	Sets the cycle duration (0-600 seconds) of the PWM output signal. (default: 0.5 seconds) The cycle duration is equal to the duty cycle of the output signal.
Minimum pulses	Sets the minimum number of pulses per minute at which the relay can operate. Range: 0.001–4.000 (default: 1.000)
Maximum pulses	Sets the maximum number of pulses per minute at which the relay can operate. Range: 0.001–60.000 (default: 04.000). This value cannot be set lower than Minimum Pulses value.
Prop band	Sets the proportional part of the PID controller. The proportional part of the controller supplies an output signal which is linearly dependent to the control deviation. The proportional part reacts on any changes at the input but starts to oscillate easily if the value is set high. The proportional part cannot fully compensate for disturbances.
Integral	Sets the derivative part of the PID controller (default: 000 minutes). The integration part of the controller generates an output signal. The output signal increases linearly if the control deviation is constant. The integration part responds slower than the proportional part and can fully compensate disturbances. The higher the integration part, the slower it responds. If the integration part is set too low, it starts to oscillate.
	840

#### Figure 23 Frequency control function



1 High limit	5 Cycle duration
2 Deadband	6 Time (x-axis)
3 Setpoint	7 Selected source (y-axis)
4 Low limit	

#### Warning Function

Option	Description
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Warning Sets the level for warning activation. Refer to the sensor manual for the numbers for individual warning messages.

#### Set up the discrete inputs

Use these inputs to switch closure inputs or logic level voltage inputs.

1. Press the MENU key.

- 2. Select sc200 Setup and push ENTER.
- 3. Select Discrete Input Setup and push ENTER.
- 4. Select the desired channel (Input 1, Input 2 or Input 3) and push ENTER.
- 5. Select a control logic option and push ENTER.

# Option Description Disable This channel is disabled and not used. On/High This channel is active when either the switch input is On (or closed), or the logic level voltage input is at a High level. Off/Low This channel is active when either the switch input is Off (or opened), or the logic level voltage input is at a Low level. 6. Select a warning option and push ENTER. Option Description

- Off An active discrete input does not trigger a device warning.
- On An active discrete input triggers a device warning.
- 7. Select an output mode option and push ENTER.

Option	Description
Active	Output level continues to represent operating conditions.
Hold	Output level is held static.
Transfer	Output level moves to a pre-configured value.

- 8. Select the sensors that will have their outputs (analog and relay) affected when one of the discrete inputs becomes active. Push ENTER.
- **9.** Use the arrows to select the On Delay value (the duration time delay between the discrete input activation and the configured response of the controller). Push **ENTER**.
- **10.** Use the arrows to select the Off Delay value (the duration time delay between the discrete input de-activation and the configured response of the controller). Push **ENTER**.

11. Repeat steps 4–10 for each desired channel.

12. If a discrete input needs to be changed after initially set up:

- a. Repeat steps 1–4 and an Input Settings menu appears with the following options:
  - Control Logic
  - Set Warning
  - Output Mode
  - On Delay
  - · Off Delay
- b. Select the desired option and push ENTER.
- **c.** Make the desired changes and push **ENTER** to save the changes and return to the Inputs Setting menu.

#### Set up a calculation

- 1. From the sc200 Setup menu, select Calculation and push **ENTER**. The calculation menu options appear.
- 2. Select a menu option and choose from the displayed list or update the entry. Refer to the table below for more information about each option.
- **3.** Push **ENTER** to save the selection or setting and return to the Calculation menu.
- 4. Push the HOME key, MENU key or the BACK key to exit to other menus.

Option	Description
Set variable X	Selects the sensor that corresponds to the variable set as "X"
Set parameter X	Selects the measurement type that corresponds to the variable set as "X"
Set variable Y	Selects the sensor that corresponds to the variable set as "Y" $% \left[ {\left[ {{{\mathbf{x}}_{i}} \right]_{i}} \right]_{i}} \right]$
Set parameter Y	Selects the measurement type that corresponds to the variable set as "Y"

Option	Description
Set formula	None, X-Y, X/Y, [X/Y]%, [X+Y]/2, X*Y, [X-Y]%/X
Display format	Sets the number of decimal places displayed in a calculation result
Set units	Sets the units of measurement
Set parameter	Assigns the name of the measurement

#### Set the datalog mode and interval

Datalog Setup is available if a calculation has been set up.

- 1. From the Settings menu, select sc200 Setup and push ENTER.
- 2. Select Datalog Setup and push ENTER.
- 3. Select Set Mode and push ENTER.
- 4. Select an option (Snap Shot, Average, Maximum, Minimum) and push ENTER.
- 5. From the Datalog Setup menu, select Set Interval and push ENTER.
- 6. Select an interval from the list and push ENTER.

#### Using the secure digital memory (SD) card

An SD card must be installed in the controller.

- The SD card can be used to update software and firmware and to download event and data logs. If the SD card is installed while the controller is in the Settings Menu, push the **HOME** key and then the **MENU** key to verify the option is visible. The SD icon will also be visible in the upper status bar of the main measurement screen when a card is installed.
- · Data log files on the SD card are available in XML and binary formats.
- DataCom is used to convert files from binary to CSV format. Refer to the DataCom manual for more information on how to use the application. For a copy of the DataCom manual, software updates or other downloadable resources, go to http://www.hach-lange.com or http://www.hach.com. Search DataCom or go to any sc200 product page.

## Updating software Notes:

- The controller does not automatically transfer information to or from an SD card.
- When the SD card is put in multiple controllers, each controller has a separate set of folders in the SD card memory. To make sure software updates are in the correct folder for the controller in use, it is best to use a separate dedicated SD card for each controller.
- 1. From the Settings Menu, select SD Card Setup and push the ENTER key.
- 2. Select Upgrade Software and push the ENTER key.

**Note:** If the Upgrade Software option does not appear, do the steps in Firmware updates with SD cards on page 38.

- Select a device from the list and push the ENTER key. The list of options includes the controller and all connected devices that have software placed in the appropriate folder on the SD card.
- 4. If more than one version of the upgrade software is available, select the version with the highest number and push the ENTER key.
- Push the ENTER key to begin the software transfer. The display will show "Transferring files. Please wait..." The percentage of completion appears in the bottom left corner of the display. The upgrade cannot be halted once it has begun.
  - When the transfer is successful, the display will show "Transfer complete" along with a prompt to push **ENTER** to restart the controller or to push the **BACK** key and exit to the SD Card Setup menu. Controller updates take effect when the controller is restarted. A restart is not necessary for sensor updates.
  - If the transfer is unsuccessful, the display will show "Transfer failed" and an error message. Press the **ENTER** key to acknowledge the warning and exit out of the menu. Error messages are different for each sensor. Refer to the applicable sensor manual.

## Saving data and event logs with SD cards Notes:

- Data and event logs can be downloaded to an SD card and viewed with any device capable of reading an SD card.
- Data logs store the measurement data at selected intervals in a packed binary format (.flg file).
- Event logs store a variety of events that occur on the devices such as configuration changes, alarms and warning conditions. Event logs are set up during the sensor or module configuration process. Event logs are stored in a CSV format.
- 1. From the Settings Menu, select SD Card Setup and push the ENTER key.
- 2. Select Save Logs and push the ENTER key.
- **3.** If more than one device appears on the screen, all devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Select the devices from which logs will be saved and push the **ENTER** key.
- 4. Select the time period from which logs are to be saved.

Option	Description		
Last Day	All logs from the last full 24 hours, starting from 12:00 a.m., and any additional time remaining on the current day		
Last Week	All logs from the last full week (7 days) starting from 12:00 a.m., and any additional time remaining on the current day		
Last Month	All logs from the last full month (30 days) starting from 12:00 a.m., and any additional time remaining on the current day		
All	Save all logs in memory		
New	All logs that are new since the last time logs were saved to the SD card		
Push the ENTER key to confirm the choice, and push the ENTER			

5. Push the ENTER key to confirm the choice, and push the ENTER key again to begin the file transfers.

- 6. Allow time for the files to transfer. The display will show Transferring files. Please wait... and the percentage of files transferred. If the transfer is successful, the display will show "Transfer complete." If the transfer is not successful, the display will show "Transfer failed."
- 7. Do one of the following:
  - a. Push the ENTER key to exit back to the SD Card Setup menu.
  - **b.** Push the **HOME** key to return to the measurement screen.
  - c. Push the **BACK** keys to return to the Settings Menu.

#### Access data and event log files on the SD card

A PC with an SD Card reader device or USB adapter is necessary to view the event and data logs kept on the SD Card. Excel 2003 or higher (for XML files) or the Data Com application (for binary flg files) is necessary to open the event and data logs.

Data logs have the following structure: Device Name, Device Serial Number, Device Identification, Data Log, Time Stamp.

Event logs have the following structure: Device Name, Device Serial Number, Device Identification, Event Log, Time Stamp.

To view data or event log files stored on the SD card:

- 1. Attach the card reader device to the PC (if necessary) and install the SD card that contains the files in the reader device.
- 2. In the SD card directory, open the HACH folder.
- 3. Select the Logs folder.
- 4. Select a device folder. The event and data log files in the folder are shown.
- 5. To view XML data log files:
  - a. Make sure the HachDatalog.xsl style sheet exists in the device folder.
  - **b.** Open the Excel application.
  - c. Go to File, Open.
  - d. Select the data log file.
  - e. In the Import XML dialog box, select Open the file with the following style sheet applied and select HachDatalog.xml.

- f. Click OK to view the data.
- 6. To view binary data log (.flg) files:
  - a. Make sure the device driver (.flg.drv) file exists in the device folder.
  - b. Open Data Com.
  - c. In the File Viewer section, click Open.
  - d. Select the data log file.

The data log file is shown in the box and a comma separated values (csv) file with the same file name is created. This csv file can be opened in Excel.

#### Firmware updates with SD cards

The latest firmware updates can be placed on an SD card. The SD card can then be used to update the controller or device firmware.

A PC and a USB card reader or other device capable of reading an SD card are necessary.

- 1. Find the zip file at http://www.hach-lange.com or http://www.hach.com and copy it to the PC.
- 2. Extract file(s) from the zip folder and save them to the SD card.
- Remove the SD card and update the controller and device firmware. Refer to Updating software on page 37.

#### Backup settings to an SD card

Saves the configuration of a device to the SD card.

- 1. Push the MENU key.
- 2. Select SD Card Setup and push ENTER.
- 3. Select Manage Configuration and push ENTER.
- 4. Select Backup Settings and push ENTER.
- Select the devices to be backed up. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push ENTER to begin the file transfers. If backup files already exist on the SD card, a confirmation window appears. Select

the devices again and push **ENTER**. Wait for the "Transfer complete" message.

6. Push ENTER again to return to the Manage Configuration menu.

#### Restore settings to the controller

This menu selection only appears if a (serial number-specific) backup file for the controller or one of the sensors connected to it exists on the SD Card. This menu selection loads the configuration of a specific device from the SD card to the same device (serial number-controlled function).

- 1. Push the MENU key.
- 2. Select SD Card Setup and push ENTER.
- 3. Select Manage Configuration and push ENTER.
- 4. Select Restore Settings and push ENTER.
- Select the device that will be restored. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push ENTER to begin the file transfers.
- 6. When the transfer is complete, push ENTER.
- 7. To have the settings take effect immediately, restart the controller. Push the **BACK** key to exit the Manage Configuration menu.

#### Transfer settings to another device

All device settings including calibration, sensor name, selected temperature and measurement units and data logging settings are transferred.

- 1. Push the MENU key.
- 2. Select SD Card Setup and push ENTER.
- 3. Select Manage Configuration and push ENTER.
- 4. Select Transfer Settings and push ENTER. Two options appear:
  - Retrieve Settings
  - Copy Settings

- 5. To retrieve settings from the controller (or a device connected to it) and put the settings on the SD card:
  - a. Select Retrieve Settings and push ENTER.
  - b. Select the devices that contain the information to be transferred. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push ENTER to begin the file transfers. Wait for the "Transfer complete" message.
  - c. If files already exist on the SD card, a confirmation window appears. Select the devices again and push ENTER. Wait for the "Transfer complete" message.
  - d. Push ENTER to return to the Manage Configuration menu.
- 6. To copy settings from the SD card to a controller (or a device connected to it):
  - a. Select Transfer Settings and push ENTER.
  - b. Select Copy Settings and push ENTER.
  - c. Select the devices on the SD card. All devices are selected by default. To deselect an item, highlight the selection and push the left arrow key. Push ENTER to begin the file transfers.
- 7. When the transfer is complete, push **ENTER** to restart the connected devices.
- 8. Push ENTER to restart the controller or push BACK to return to the Manage Configuration menu.

#### Using the service port

The service port is used to download data files from the controller and install new versions of controller and sensor firmware. To download data and update software, use the service port in combination with DataCom and a service cable (LZX887).

#### Using DataCom

When using the service port, it is necessary to use DataCom. DataCom is a PC Application Utility that downloads data log and event log files from the controller and installed sensors. Files are downloaded from the controller through the controller service port or they can be placed on a Secure Digital Memory (SD) card installed in the controller. In addition,

DataCom is used to upload software for the controller and sensors. The DataCom application must be installed on a PC to read the files.

Refer to the DataCom manual for more information on how to use the application. The DataCom manual, software updates and other downloadable resources are available at http://www.hach-lange.com or http://www.hach.com on any sc200 product page.

#### Update the display language

The display language can be changed through the Setup menu.

- 1. From the Settings Menu, select sc200 Setup and push ENTER.
- Select Language and push ENTER. The list of language options appears. English is the default language for the controller.
- 3. Highlight the language to be used for the controller and push **ENTER**.

The selected language is saved and is used for the controller display. The display returns to the sc200 Setup menu.

#### Update the date and time

- 1. From the Settings menu, select sc200 Setup and push ENTER.
- 2. Select Set Date/Time and push ENTER.
- 3. Select Date Format from the Set Date/Time screen and push ENTER.
- 4. Select a format and push ENTER.
- 5. Select Date/Time from the Set Date/Time screen and push ENTER.
- 6. Update the entries.
  - a. Use the right and left arrow keys to highlight a field.
  - **b.** Use the up and down arrow keys to change the values in the field and push **ENTER**.
  - **c.** At the end of the date field, push the right arrow to wrap down to the time fields.
  - d. Use the up and down and arrow keys to update the time fields.
- 7. Push ENTER to save the changes.

The controller returns to the Set Date/Time menu.

#### Maintenance

#### A DANGER



Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

#### **Cleaning the controller**

#### A DANGER



Always remove power from the controller before performing maintenance activities.

**Note:** Never use flammable or corrosive solvents to clean any part of the controller. Use of these solvents may degrade the environmental protection of the unit and may void the warranty.

- 1. Make sure the controller cover is securely closed.
- 2. Wipe the controller exterior with a cloth dampened with water, or with a mixture of water and mild detergent.

#### **Fuse replacement**

Fuses are not user-serviceable items. The need for fuse replacement in controllers indicates severe technical failure and is therefore considered to be a service activity. If a blown fuse is suspected, contact Technical Support.

#### **Battery replacement**

The lithium ion backup battery is not user replaceable. Contact technical support for replacement.

#### Troubleshooting

Problem	Resolution				
	Verify current output configuration.				
No current output	Test current output signal using the Test/Maintenance submenu. Input a current value and verify the output signal at the controller connections.				
	Contact Technical Support.				
	Verify current output configuration.				
Incorrect current output	Test current output signal using the Test/Maintenance submenu. Input a current value and verify the output signal at the controller connections. If the output is incorrect, perform an output calibration.				
	Make sure relay connections are secure.				
	If using an external power source, make sure the relay wiring is correct.				
	Make sure the relay configuration is correct.				
No relay activation	Test the relay activation through the Test/Maintenance menu. The relay should energize and de-energize as selected.				
	Make sure the controller is not in calibration mode and that the relay is not being held.				
	Reset the Overfeed Timer to make sure the timer has not expired.				

Problem	Resolution				
	Make sure the SD card is properly oriented. The copper traces should face toward the controller display.				
	Make sure the SD card is fully seated in the slot and the spring lock is engaged.				
Secure Digital Memory (SD) card not recognized by the controller	Make sure the SD card is properly formatted with a Fat 32 format. The MMC format is not supported. Follow the instructions of the card manufacturer to format the SD card on a PC.				
	Make sure the card is not larger than 32 GB.				
	Make sure an SD card is being used. Other types of cards (such as xSD, micro SD, mini SD) will not work properly.				
Information not saving, or not saving properly to the SD card.	Make sure the SD card is properly formatted with the FAT 32 format. The MMC format is not supported. Follow the instructions of the card manufacturer to format the SD card on a PC.				
	If the SD card has previously been in use, format the card with the Fat 32 format, install the card in the controller, and try downloading files.				
	Try a different SD card.				
SD card full	Read the SD card with a PC or other card reader device. Save important files and then delete some or all of the files on the SD card.				

Problem	Resolution	F	Problem		Resolution
	Make sure an appropriate folder is created by installing the SD card in the controller. An update folder will automatically be created.				If the sensor is an analog sensor and a corresponding module is installed in the controller, refer to the instructions supplied with the Network or Sensor Module
Controller cannot find software updates on the SD card.	Install the SD card on a PC and make sure the software files are located in the appropriate update folder.			Make sure the digital connector wiring harness is seated on the inside of the door assembly and that the wiring barness is not	
	If the same SD card is used with multiple			damaged.	
	separate folder on the system. Make sure the software updates are in the folder dedicated to the controller in use.	Sensor not recognized <b>Note:</b> Example of possible display message: ****		ized	If the digital sensor is connected to the controller with a digital termination box, user supplied junction box, digital extension cables, or a user-supplied extension cable, connect the sensor directly to the controller and perform a device scan. If the controller recognizes the sensor, check that all the wiring in the junction boxes or extension
	Adjust the display contrast			sible display	
Display is lit but shows no characters or characters are	Make sure protective film has been removed from display.				
faint of bidity.	Clean the outside of the controller, including the display screen				cables is correct.
	Make sure the AC power connections are properly terminated in the controller.				in the controller. Although two sensors are instanted ports are available, if a digital sensor and two analoo modules are installed, only two of the
Controller will not power up, or powers up intermittently	Make sure the power strip, line power, wall				three devices will be seen by the controller.
-					Contact Technical Support
	Make sure the module is properly installed.	Device Missing error message appears		or message	Perform a Device Scan from the Test/Maintenance menu.
-	Make sure the module selector switch is set				Power cycle the controller
Notwork or concer module not	to the proper number.				
recognized	Remove sensor module and install the module into the second analog slot. Apply power to the controller and allow the controller to perform a device scan.	Test and Maintenance menu           1. From the Settings Menu, select Test/Maint and push ENTER			
	Contact Technical Support		Option	Descri	ption

Option	Description		Option	Description		
Output cal <ul> <li>Output 1</li> <li>Output 2</li> </ul>	Lets the user calibrate the 4–20 mA outputs with a 250 ohm resistor in series to the mA output terminals. The settings for each output are adjusted until the correct value (4 mA or 20 mA) is supplied. Calibrate 4 mA output (Min: 0 Max: 25000) Calibrate 20 mA output (Min: 35000 Max: 65533)		Simulation (only displays if sensors or modules are connected)	After the sim value is entered, the controller outputs this value as if it was the value sent from the sensor. The simulation stops after the user exits the screen. Source- • <module 1=""> • <module 2=""></module></module>		
Hold outputs	Sets the value the controller sends to an external system for a defined period of time. After the time period, the instrument goes back to reporting real time values. Set activation—Launch or release Set Outmode—Hold Outputs (default) or Transfer Outputs Set Channels—All (default) or select from hardware list		Modbus stats	<ul> <li>Notice 22</li> <li>(Footer displays current source selection)</li> <li>Parameter—Source measurement type (footer displays current source selection)</li> <li>Sim value—Use arrow keys to change value (footer displays current source selection)</li> <li>Displays Error and Good count stats for selected port.</li> <li>Sensor port 1, 2, 3 or 4</li> </ul>		
Test output <ul> <li>Output 1</li> <li>Output 2</li> </ul>	Lets the user select a mA value that is sent by the controller for verification. Min: 0 mA (default +04.00) Max: 25.00 mA		System data	<ul> <li>Network port</li> <li>Service port</li> <li>Clear stats</li> </ul>		
Status	View status of all modules, sensors and relays.		voltage data.			
Test relay—A, B, C, D	Energize or De-energize the selected relay	w	Warning and error conditions			
Overfeed reset	Resets the Overfeed Timer.	Fo	Follow the steps below to acknowledge controller warnings.			
Reset default config	Resets the controller configuration settings to the default values (language, date and time, relay function and data output function).	1. 2.	<ol> <li>From the Settings menu, select Diagnostics and push ENTER.</li> <li>Select the device (controller, sensor, network card) with the war or error and push ENTER.</li> </ol>			
Restart sc200	Performs a controller restart	3. 4.	Select the warning, Select Yes and pus <i>Note: Errors cannot b</i>	error or event list and push ENTER. The ENTER to acknowledge the warning.		

**5.** For more information on a specific warning, error or event, refer to the device manual.

#### **Device scan information**

Display message	Action
Installing deviceplease wait	The controller has found a new device. No action is necessary. The controller automatically performs an installation process for the new device and displays the main measurement screen of the device installed in the number one position.
Device missing <device id=""></device>	<ul> <li>A previously installed device has been removed from the controller or is not detected.</li> <li>Push the Enter key to continue.</li> <li>Push the left arrow key to select or de-select a missing device.</li> <li>Push the Enter key to delete the missing device.</li> <li>The controller will display the main measurement screen for the device in the number one position.</li> <li>Note: This message also displays when a device is missing davice is deleted, the controller automatically installs the new device and displays Installing deviceplease wait. The controller the displays the main measurement screen for the device is deleted, the controller automatically installs the new device and displays Installing device please wait. The controller then displays the main measurement screen for the device installed in the number one position.</li> </ul>

#### **Replacement parts and accessories**

**Note:** Product and Article numbers may vary for some selling regions. Contact the appropriate distributor or refer to the company website for contact information.

Description	Item number
4 GB Secure Digital Memory (SD) card	9218100
Connector kit for digital sensor	9201000

Description	Item number
Controller installation kit	8806200
DataCom cable	LZX887
Mounting bracket inserts	9177900
Plug, conduit opening (set of 3)	5868700
Power cord kit, with strain relief, 125 VAC, U.S style plug	9202900
Power cord kit, with strain relief, 230 VAC, European-style plug	9203000
Screw driver	6134300
SD card reader	9218200
SD card cover kit for sc200 controller	9200900
Screws for controller installation kit	9177800
Cord grip kit (1)	9178000
Sealing washer for cord grip assembly	1033814
UV protection screen	8809200
Weather and sun shield w/ UV protection screen	9220600
Sensor and communication modules	
Conductivity module	9013000
Flow module	9012700
4-20 mA input module	9012800
pH and DO module	9012900
4-20 mA output module	9334600
HART network module kit	9328100
Modbus network module	9013200
Profibus network module	9173900
	850

Description	Item number
Profibus M12 connector kit	9178500
Profibus M12 socket (hard wire to quick connector adapter)	9178200
Profibus M12 T-splitter	9178400

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# Dissolved Oxygen: Hach LDO<sup>®</sup> Probe, Model 2

#### **Applications**

- Wastewater
- Industrial Water
- Drinking Water



# Take "No" for an answer when measuring dissolved oxygen with the next generation Hach LDO probe.

#### **No Calibration Required**

The Hach LDO probe is ready to work in your process right out of the box with no calibration required for the entire 2 year life of the sensor cap.

#### No Membranes to Replace

There is virtually no maintenance with Hach's breakthrough luminescent technology, as there are no membranes to replace, no electrolyte solution to replenish, and no anode or cathode to clean.

#### **No Missed Cleaning Cycles**

Customizable service indicators trigger a service message so that a cleaning cycle is never missed.

#### **No Drift**

A cutting-edge 3D calibration procedure at the factory makes oxygen measurement with the Hach LDO probe more accurate than ever before.

#### **No Complications**

A robust new design gives the Hach LDO enhanced durability and reduced size for easier handling.



#### Specifications\*

Measuring Range	0 - 20.00 ppm 0 - 20.0 mg/L 0 - 200% saturation	Sensor Immersion Depth	Pressure Limits at 34 m 345 kPa (112 ft.), 345 kPa (50 psi), maximum; accuracy may not be maintained at this depth
Accuracy	±0.1 ppm Below 5 ppm ±0.2 ppm Above 5 ppm	Transmission Distance	1000 m (3280 ft.) maximum when used with a termination box
	Temperature: ±0.2°C	Cable Length	10 m
Response Time	at 20°C: To 95% in less than 60 seconds	Wetted Materials	Sensor Cap: Acrylic; Probe Body: CPVC, Polyurethane, Viton, Noryl, 316 Stainless Steel
	To 90% in less than 40 seconds	Dimensions (D x I )	1.95  in  x 10.05  in  (49.53  mm  x)
Resolution	0.01 ppm (mg/L) / 0.1% saturation		255.27 mm)
Repeatability	±0.1 ppm (mg/L)	Weight	2.2 lbs. (1 kg)
Operating Temperature	0 to 50°C (32 to 122°F)	-	
Flow Rate	None required		*Subject to change without notice

#### **Principal of Operation**

The HACH LDO sensor is coated with a luminescent material. Blue light from an LED is transmitted to the sensor surface. The blue light excites the luminescent material. As the material relaxes it emits red light. The time for the red light to be emitted is measured. Between the flashes of blue light, a red LED is flashed on the sensor and used as an internal reference.

Increased oxygen in the sample decreases the time it takes for the red light to be emitted. The time measurements correlate to the oxygen concentration.



#### **Dimensions**



Installation / Mounting



Float Mount Kit



Pole Mount Kit



Union Mount Kit



Air Blast Cleaning System





#### **Ordering Information**

9020000	Dissolved Oxygen: Hach LDO <sup>®</sup> Probe	
9020000-UPGRADE	LDO Probe, Mounting Conversion Adapter	
9020000-SC200	LDO Probe, Mounting Conversion Adapter, sc200 controller with 2 channels	
Accessories		
5867000	Digital Termination Box	
5796000	Digital Extension Cable, 7.7 m (25 ft.)	
5796100	Digital Extension Cable, 15 m (50 ft.)	

5796200	Digital Extension Cable, 31 m (100 ft.)
6860000	High Output Air Blast Cleaning System, 115 Vac
6860100	High Output Air Blast Cleaning System, 230 Vac
9253500	Air Blast Hardware Components

#### **Replacement Parts**

LDO Model 2 Sensor Cap Replacement Kit

#### Mounting Kits

9253000	Pole Mount Kit, PVC
9253100	Ball Float Mount Kit, PVC
9257000	Union Mount Kit, PVC
9253400	Mounting Conversion Adapter, LDO Model 1 to LDO Model 2
7300800	1 NPT sc Sensors Flow Cell

#### Controllers

#### sc200 Digital Controllers

Sczoo Digital Contro		
LXV404.99.00552	sc200 controllers, 2 channels, digital	
LXV404.99.00542	sc200 controller, 2 channel, digital & mA input	
LXV404.99.00502	sc200 controller, 1 channel, digital	
LXV404.99.00512	sc200 controller, 2 channel, digital & pH/DO	
LXV404.99.00522	sc200 controller, 2 channel, digital & Conductivity	
LXV404.99.00532	sc200 controller, 2 channel, digital & Flow	
sc1000 Digital Controllers		
LXV402.99.00002	sc1000 Display Module	
LXV400.99.1R572	sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, 110-230V	
LXV400.99.1B572	sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, RS-485 (MODBUS), 110-230V	
LXV400.99.1F572	sc1000 Probe Module, 4 sensors, 4 mA Out, 4 mA In, 4 Relays, PROFIBUS DP, 110-230V	
LXV400.99.1R582	sc1000 Probe Module, 6 sensors, 4 mA Out, 4 mA In, 4 Relays, 110-230V	

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# **LDO Sensor**

12/2012, Edition 3



USER MANUAL MANUEL D'UTILISATION MANUAL DEL USUARIO MANUAL DO USUÁRIO 用户手册 ユーザーマニュアル 사용 설명서 859 <sup></sup><sup>(jio)</sup><sup>(ji)</sup>

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#### **Specifications**

Specifications are subject to change without notice.

Specification	Details
Wetted materials	Standard Probe, Standard Class 1-Div 2 Probe
	<ul> <li>CPVC, sensor end and cable end</li> <li>Polyurethane. over-molding on cable end and cable iacket</li> </ul>
	• 316 stainless steel body and screws
	Viton, O-ring     Noryl, nut on the cable end
	Standard Seawater Prohe Seawater Class 1-Div 2 Prohe
	CPVC sensor and and cable and
	<ul> <li>Polyurethane, over-molding on cable end and cable jacket</li> </ul>
	<ul> <li>PVC seawater body</li> <li>Seawater epoxy sealant</li> </ul>
	Noryl, nut on the cable end
IP classification	IP68
Wetted materials (sensor cap)	Acrylic
Measurement range (dissolved oxygen)	0 to 20 ppm (0 to 20 mg/L)
	0 to 200% saturation
Measurement accuracy (dissolved oxygen)	Below 5 ppm: ± 0.1 ppm
	Above 5 ppm: ± 0.2 ppm
Repeatability (dissolved oxygen)	0.1 ppm (mg/L)
Response time (dissolved oxygen)	T <sub>90</sub> <40 seconds
	T <sub>95</sub> <60 seconds
Resolution, sensor (dissolved oxygen)	0.01 ppm (mg/L); 0.1% saturation.
Measurement range (temperature)	0 to 50 °C (32 to 122 °F)
Measurement accuracy (temperature)	± 0.2 °C (± 0.36 °F)
Interferences	No interferences from the following: H <sub>2</sub> S, pH, K <sup>+</sup> , Na <sup>+</sup> , Mg <sup>2+</sup> , Ca <sup>2+</sup> , NH <sub>4</sub> <sup>+</sup> , Al <sup>3+</sup> , Pb <sup>2+</sup> , Cd <sup>2+</sup> , Zn <sup>2+</sup> , Cr (total), Fe <sup>2+</sup> , Fe <sup>3+</sup> , Mn <sup>2+</sup> , Cu <sup>2+</sup> , Ni <sup>2+</sup> , Co <sup>2+</sup> , CN <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>-2-</sup> , S <sup>2-</sup> , PO <sub>4</sub> <sup>-3-</sup> , Cl <sup>-</sup> , Anion Active Tensides, Crude Oils, Cl <sub>2</sub> < 4 ppm
Storage temperature	–20 to 70 °C (–4 to 158 °F)
Maximum temperature	0 to 50 °C (32 to 122 °F)

Specification	Details
Hazardous location classification (9020000-C1D2 sensor only)	Class I Division 2, Groups A–D, T4 / Class I, Zone 2 Group 2C, T4 Note: This product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).
Certifications (9020000-C1D2 sensor only)	ETL listed to ANSI/ISA, CSA and FM standards for use in hazardous location. Note: This product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).
Minimum flow rate	Not required
Calibration/verification	Air calibration: One point, 100% water-saturated air
	Sample calibration: Comparison with standard instrument
Probe immersion depth and pressure limits	Pressure Limits at 34 m (112 ft.), 345 kPa (50 psi) maximum; accuracy may not be maintained at this depth
Sensor cable	10 m (30 ft) integral cable with quick disconnect plug (all sensor types)
	Up to 100 m possible with extension cables (non-Class I, Division 2 sensor types only)
	Up to 1000 m with junction box (non-Class I, Division 2 sensor types only)
Probe weight	1.0 kg (2 lb, 3 oz)
Probe dimensions	Standard probe (diameter x length): 49.53 x 255.27 mm (1.95 x 10.05 in.)
	Seawater probe (diameter x length): 60.45 x 255.27 mm (2.38 x 10.05 in.)
Power requirements	12 VDC, 0.25 A, 3 W
Warranty	Probe: 3 years against manufacturing defects
	Sensor cap: 2 years against manufacturing defects

#### **General information**

In no event will the manufacturer be liable for direct, indirect, special, incidental or consequential damages resulting from any defect or omission in this manual. The manufacturer reserves the right to make changes in this manual and the products it describes at any time, without notice or obligation. Revised editions are found on the manufacturer's website.

#### Safety information

#### NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

#### Use of hazard information

#### **A** DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

#### A WARNING

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

#### A CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

#### NOTICE

Indicates a situation which, if not avoided, may cause damage to the instrument. Information that requires special emphasis.

#### Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

	This is the safety alert symbol. Obey all safety messages that follow this symbol to avoid potential injury. If on the instrument, refer to the instruction manual for operation or safety information.
	This symbol indicates the presence of a light source that may have the potential to cause minor eye injury. Obey all messages that follow this symbol to avoid potential eye injury.
	This symbol indicates the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.
X	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user. <b>Note:</b> For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.

#### Certification

#### Canadian Radio Interference-Causing Equipment Regulation, IECS-003, Class A:

Supporting test records reside with the manufacturer.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numèrique de classe A répond à toutes les exigences de la réglementation canadienne sur les équipements provoquant des interférences.

#### FCC Part 15, Class "A" Limits

Supporting test records reside with the manufacturer. The device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

- 1. The equipment may not cause harmful interference.
- 2. The equipment must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction

manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

- 1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
- 2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
- 3. Move the equipment away from the device receiving the interference.
- 4. Reposition the receiving antenna for the device receiving the interference.
- 5. Try combinations of the above.

#### **Product overview**

#### **A** DANGER



Chemical or biological hazards. If this instrument is used to monitor a treatment process and/or chemical feed system for which there are regulatory limits and monitoring requirements related to public health, public safety, food or beverage manufacture or processing, it is the responsibility of the user of this instrument to know and abide by any applicable regulation and to have sufficient and appropriate mechanisms in place for compliance with applicable regulations in the event of malfunction of the instrument.

This sensor is designed to work with a controller for data collection and operation. The sensor can be used with several controllers. Refer to the controller-specific user manual for more information.

The primary applications for this sensor are municipal and industrial wastewater applications. LDO sensor technology does not consume oxygen, and can measure DO concentration in low or no-flow applications. Refer to Figure 1.

#### Figure 1 LDO sensor



1 Sensor cap	3 1-inch NPT
2 Temperature sensor	4 Connector, quick-connect (standard)

#### LDO Sensor component list

Make sure that all components shown in Figure 2 have been received. If any items are missing or damaged, contact the manufacturer or a sales representative immediately. Refer to Figure 2.

#### Figure 2 Sensor component list



<sup>1</sup> Included user manual is not shown.

#### Installation

1

#### **WARNING**

Personal injury hazard. Only qualified personnel should conduct the tasks described in this section of the manual.

#### Validate the sensor type

#### **A** DANGER

Explosion hazard. Connect only peripheral components that are clearly marked as certified for Class 1, Division 2 Hazardous Locations.

#### NOTICE

The hazardous location certified version of this product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).

- 1. Go to the connector end of the cable.
- 2. Read the label on the connector end of the cable. For hazardous location certified sensors, the label will show "Rated: Class 1 Division 2".
- 3. Examine the connector.
  - Hazardous location certified sensors have a safety lock connector. Refer to Figure 3 on page 8.
  - Sensors that are not certified for hazardous locations have a quick-connect connector, without a safety lock.

#### Connect the sensor in a hazardous location

#### 🛦 D A N G E R



Explosion hazard. This equipment is suitable for use in non-hazardous locations or Class 1, Division 2, Groups A, B, C, D Hazardous Locations with specified sensors and options when installed per the Hazardous Location Installation Control Drawing. Always refer to the Control Drawing and applicable electrical code regulations for proper installation instructions.
### ADANGER



Explosion hazard. Do not connect or disconnect electrical components or circuits to the equipment unless power has been removed or the area is known to be non-hazardous.

### NOTICE

Use only a hazardous location certified sensor and cable lock in hazardous locations. The hazardous location certified version of this product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).

For more information, refer to Validate the sensor type on page 7.

- Remove the connector cap from the controller. Keep the connector cap to seal the connector opening when the sensor is removed.
- 2. Connect the sensor to the controller. Refer to the controller manual for more information.
- 3. Close the safety lock over the connector.
- 4. To remove the connector safety lock, use a small flat screwdriver. Refer to Figure 3.

### Figure 3 Connector safety lock



### Connect the sensor in a non-hazardous location

Refer to Figure 4 to connect an LDO sensor to an sc controller. Refer to the specific sc controller manual for hard-wiring instructions.

### Figure 4 Connect the LDO sensor (non-hazardous location sensor shown)



After the sensor is attached, scan for the sensor. Refer to Install the sensor on page 8.

### Install the sensor

There are two options to install the sensor:

- Connect the sensor while power to the controller is off. The controller will look for and install new sensors when it is turned on.
- Connect the sensor while power to the controller is on. Use the Scan Devices command to install the new sensor:

Option	Description	
sc200 controller	Go to MENU>TEST/MAINT>SCAN DEVICE	866

Option	Description
sc100 controller	Go to MENU>TEST/MAINT>SCAN SENSORS
sc1000 controller	Go to MENU>SYSTEM SETUP>DEVICE MANAGEMENT>SCANNING FOR NEW DEVICES

Refer to Connect the sensor in a non-hazardous location on page 8 for digital sensor connection.

### Sensor installation options

The installation and accessory options available for the LDO sensor are supplied with installation instructions in the hardware kit. Figure 5 shows several installation options. To order installation hardware, refer to Replacement parts and accessories on page 17.

### Figure 5 Installation options



## Operation

### User navigation

Refer to the controller documentation for keypad description and navigation information.

### Configure the sensor

Use the Configure menu to enter identification information for the sensor and to change options for data handling and storage.

For information about sensor installation, refer to Install the sensor on page 8. 867

Make sure that all of the Configuration menu values are correct for the application.

- 1. Go to MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE.
- 2. Select an option, ENTER. The list of available options is shown in the table below.

Option	Description
EDIT NAME	Changes the name that corresponds to the sensor on the top of the measure screen. The name is limited to 10 characters in any combination of letters, numbers, spaces or punctuation.
SET UNITS	TEMP–Sets the temperature units to °C (default) or °F.
	MEASURE–Set the measurement units in mg/L, ppm or % .
	ALT/PRESS–Set the altitude in m or ft, or set the atmospheric pressure units in mmHg or torr. (Default value = 0 ft)
ALT/PRESS	Enter the value of the altitude or atmospheric pressure. This value must be accurate to complete % saturation measurements and calibration in air. (Default = 0 ft).
SALINITY	Enter the salinity value. Salinity range: 0.00 to 250.00 parts per thousand (‰). Refer to Enter a salinity correction value on page 11 for more information. (Default value = 0)
SIGNAL AVERAGE	Set the time interval to average signal in seconds
CLEAN INTRVL	Set the time interval for manual sensor cleaning in days (Default value = 0 days. A value of 0 days disables the clean interval.)
RESET CLN INTRVL	Set the time interval to the last saved clean interval
LOG SETUP	Sets the time interval for data storage in the data log—0.5, 1, 2, 5, 10, 15 (default), 30, 60 minutes.
SET DEFAULTS	Restores the configurable default values for the sensor. Does not change the setting for slope or offset.

### Enter the atmospheric pressure value

The factory setting for atmospheric (air) pressure is 0 ft, or sea level. To change the default value, use the steps in this procedure. The adjustment for air pressure is entered as either elevation or as pressure units (preferred).

**Note:** Accurate air pressure is critical for saturated air calibration (Calibration with air on page 12). Use only absolute pressure, not adjusted. If the absolute air pressure is not known, use the correct elevation for the location.

- 1. Go to MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>SET UNITS>AIR PRESS/ALT UNITS.
- 2. Select one of the unit options listed:

Option	Description
ft	Feet—unit of measure for elevation
m	Meters-metric unit of measure for elevation
mmHg	Millimeters of mercury-metric unit of measure for absolute air pressure
torr	Unit of measure for absolute air pressure
0	

- Confirm the selection. The value entry screen will show the selected units.
- 4. Enter the value, then confirm.

### Enter a salinity correction value

Dissolved oxygen measurements in saline samples can show an apparent DO value that is very different from the actual DO value. To correct for the influence of dissolved salts in a sample, enter a salinity correction factor.

**Note:** If the presence or amount of salinity in the process is unknown, consult with the treatment facility engineering staff.

- 1. Use a conductivity meter to measure the conductivity of the sample in mS/cm at a reference temperature of 20 °C (68 °F).
- 2. Use Table 1 to estimate the salinity correction factor in parts per thousand (‰) saturation.

**Note:** The chloride ion concentration, in g/kg is equal to the chlorinity of the sample. Salinity is calculated with the formula: Salinity =  $1.80655 \times chlorinity$ .

Salinity can be calculated with the relationship in section 2520 B of *Standard Methods for the Examination of Water and Wastewater.*\*,

- 3. Go to MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>SALINITY.
- 4. Enter the salinity correction factor and confirm.

mS/cm	‰	mS/cm	‰	mS/cm	‰	mS/cm	‰
5	3	16	10	27	18	38	27
6	4	17	11	28	19	39	28
7	4	18	12	29	20	40	29
8	5	19	13	30	21	42	30
9	6	20	13	31	22	44	32
10	6	21	14	32	22	46	33
11	7	22	15	33	23	48	35
12	8	23	15	34	24	50	37
13	8	24	17	35	25	52	38
14	9	25	17	36	25	54	40
15	10	26	18	37	26		

 Table 1 Salinity saturation (‰) per conductivity value (mS/cm)

### Configure linear output on the controller

Linear outputs send probe data back to the facility PLC, SCADA or other data collection system.

1. Go to the controller output setup menu.

Option	Description
sc200	Go to MENU>SETTINGS>sc200 SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION.

Standard Methods for the Examiniation of Water and Wastewater, 20th Edition. Editors Lenore S. Clesceri, Arnold E. Greenberg and Andrew D. Eaton, p. 2-48-2-29 (1998). The relationship between Chlorinity and Oxygen Solubitity is provided in the same reference in 4500-O:I p. 4-131.

Option	Description		
sc100	Go to MENU>SYSTEM SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION.		
sc1000	Go to MENU>SYSTEM SETUP>OUTPUT SETUP>[Select Output]>SET FUNCTION.		
Set the function for the controller.			

Option	Description	
sc200	LINEAR	
sc100	LINEAR CONTROL (Default value)	
sc1000	LINEAR CONTROL (Default value)	

### **Modbus registers**

2.

A list of Modbus registers is available for network communication. Refer to www.hach.com or www.hach-lange.com for more information.

### **Calibration for measurements**

The sensor is calibrated to specification at the factory. The manufacturer does not recommend calibration unless periodically required by regulatory agencies. If calibration is required, let the sensor come to equilibrium with the process before calibration. Do not calibrate the sensor at setup.

Table 2 shows options for calibration.

Table 2	Calibration	options
---------	-------------	---------

Option	Description		
AIR CAL	Recommended calibration method. This calibration modifies the slope.		
SAMPLE CAL	Calibration by comparison with a hand-held DO meter . This calibration modifies the offset		
RESET DFLT CAL	Resets the calibration gain (slope) and offset to the factory default: default gain=1.0; default offset=0.0		

### Calibration with air

### User notes:

- · Make sure that calibration bag has water inside.
- · Make sure that the seal between the calibration bag and the sensor body is tight.
- · Make sure that the sensor is dry when it is calibrated.
- · Make sure the air pressure/elevation setting is accurate for the calibration location.
- Allow enough time for the sensor temperature to stabilize to the temperature of the calibration bag location. A large difference in temperature between the process and the calibration location can take up to 15 minutes to stabilize.
- 1. Remove the sensor from the process. Use a wet cloth to clean the sensor.
- Put the entire sensor in a calibration bag with 25-50 mL of water. Make sure that the sensor cap is not in contact with the water inside the calibration bag and that no water drops are on the sensor cap (Figure 6).
- 3. Use a rubber band, tie or hand to create a tight seal around the sensor body.
- 4. Let the instrument stabilize for 15 minutes before calibration. Keep the calibration bag out of direct sunlight during stablization.
- 5. Make sure that the current absolute air pressure or elevation is configured correctly. Refer to Enter the atmospheric pressure value on page 10.

Note: The manufacturer recommends the use of absolute or actual air pressure as a best practice.

- 6. Go to MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>AIR CAL.
- 7. Select the option for the output signal during calibration:

Option	Description
Active	The instrument sends the current measured output value during the calibration procedure.
Hold	The sensor output value is held at the current measured value during the calibration procedure.
Transfer	A preset value is sent during calibration. Refer to the controller user manual to change the preset value.

- The controller will show "Move the probe to bag". Allow the value to stabilize. Push ENTER to accept the stable value. Alternately, let the calibration continue until the display shows "Complete".
- 9. When the sensor is calibrated, put the sensor into the process. Push ENTER.

### Figure 6 Air calibration procedure



If the value does not stabilize, the display will show "Unable to Calibrate" followed by an error message. Table 3 shows the error message and resolution for calibration problems.

Message	Description	Resolution
Cal fail, gain high	The calculated gain value is too high.	Repeat the calibration.
Cal fail, gain low	The calculated gain value is too low.	Repeat the calibration.
Cal fail, unstable	The value did not stabilize in the maximum allowed calibration time.	Repeat the calibration.

### Table 3 Air calibration error messages

### Sample CAL - calibration by comparison

This calibration method uses an alternate sensor attached to a hand-held meter.

- 1. Put the alternate sensor into the process. Put the second sensor as close as possible to the first sensor.
- 2. Wait for the DO value to stabilize .
- On the controller for the first sensor, go to MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>SAMPLE CAL.
- 4. Select the option for the output signal during calibration:

Option	Description
Active	The instrument sends the current measured output value during the calibration procedure.

Option	Description
Hold	The sensor output value is held at the current measured value during the calibration procedure.
Transfer	A preset value is sent during calibration. Refer to the controller user manual to change the preset value.
<u> </u>	

- 5. The controller will show:
  - · "Press ENTER when stabilized"
  - · The current dissolved oxygen measurement
  - · The current temperature measurement
- 6. When the measurement is stable, push ENTER. The display will show an entry screen.

Note: The measurement will usually stabilize in 2 to 3 minutes.

If the value does not stabilize, the display will show "Unable to Calibrate" followed by an error message. Table 4 shows the error message and resolution for calibration problems.

Table 4 Sample cal error message
----------------------------------

Message	Description	Resolution
Cal fail, offset high	The calculated offset value is too high.	Repeat the calibration.
Cal fail, offset low	The calculated offset value is too low.	Repeat the calibration.
Cal fail, unstable	The value did not stabilize in the maximum allowed calibration time.	Repeat the calibration.

### Exit the calibration procedure

1. During calibration, push the BACK key. Three options are shown:

Option	Description
ABORT	Stop the calibration. A new calibration must start from the beginning.
BACK TO CAL	Return to the current calibration.
LEAVE	Exit the calibration temporarily. Access to other menus is allowed while the calibration continues in the background. A calibration for a second sensor (if present) can be started. To return to the calibration, push the MENU key and select Sensor Setup, [Select Sensor].

2. Select one of the options. Confirm.

### **Reset calibration defaults**

Calibration settings can be reset to the factory defaults. Gain and offset values are set to 1.0 and 0.0, respectively.

- 1. Go to MENU>SENSOR SETUP>[Select Sensor]>CALIBRATE>RESET CAL DEFLT.
- 2. The display will show a confirmation message. Confirm to reset the sensor to the factory default calibration curve.

**A** DANGER

### Maintenance

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

### **A** DANGER



**Explosion hazard.** Do not connect or disconnect electrical components or circuits to the equipment unless power has been switched off or the area is known to be non-hazardous.

### **A** DANGER

**Explosion hazard**. Substitution of components may impair suitability for Class 1, Division 2. Do not replace any component unless power has been switched off and the area is known to be non-hazardous.

### NOTICE

The hazardous location certified version of this product does not fulfill the requirements of the 94/9/EC Directive (ATEX Directive).

### Maintenance schedule

The maintenance schedule shows minimum intervals for regular maintenance tasks. Perform maintenance tasks more frequently for applications that cause electrode fouling. *Note: Do not disassemble the probe for maintenance or cleaning.* 

Maintenance task	Recommended minimum frequency		
Clean the sensor	90 days		
Inspect the sensor for damage	90 days		
Calibrate the sensor	As recommended by regulatory agencies		

### Clean the sensor

Clean the exterior of the sensor with a soft, wet cloth.

**Note:** If the sensor cap must be removed for cleaning, do not expose the interior of the cap to direct sunlight for extended periods of time.

### Set or change the clean interval

Application conditions may need shorter or longer durations between manual sensor cleanings. The default clean interval is 0 days. To change the interval, refer to the steps in this procedure.

- 1. Go to MENU>SENSOR SETUP>[Select Sensor]>CONFIGURE>CLEAN INTRVL.
- 2. Change the shown value as needed. Confirm the change.
  - · To turn off the clean interval, set the value to '0'.

### Change the sensor cap

### 🛦 W A R N I N G



Potential explosion hazard. The sensor setup cap is not rated for hazardous location use.

Replacement sensor caps and setup caps are shipped with installation instructions. Refer to the included instructions to change the cap.

For best performance and accuracy, replace the sensor cap:

- Every two years
- · When routine inspection shows significant erosion of the sensor cap

## Troubleshooting

### Diagnostic and test menu

The diagnostic and test menu shows current and historical information about the LDO sensor. To access the diagnostic and test menu, go to MENU>SENSOR SETUP>[Select Sensor]>DIAG/TEST.

Refer to Table 5.

Option	Description		
SENSOR INFO	SOFTWARE VERS—Shows the installed software version		
	BOOT VERSION—Shows the installed boot version		
	DRIVER VERS—Shows the installed software driver version		
LOT CODE	Shows the sensor cap manufacturing lot		
SERIAL NUMBER	Sensor serial number		
GAIN CORR	Adjust the calibration gain value.		
	Range: 0.50 to 2.00		
OFFSET CORR	Adjust the calibration offset value (mg/L or ppm).		
	Range: -3.00 to +3.00		
PHASE DIAG	Shows the phase for total, red and blue wavelengths. Updates once per second.		
AMPL DIAG	Shows the amplitude for red and blue wavelengths. Updates once per second.		
DAYS TO CLEAN Shows the number of days until the next scheduled manual cleaning.			
SENSOR LIFE	Shows the number of days until the next scheduled sensor cap replacement		

### Table 5 DIAG/TEST menu

### **Error list**

If an error occurs, the reading on the measurement screen flashes. Output behavior is determined by controller settings. Refer to the controller manual for details. To show the current sensor errors, go to MENU>DIAGNOSTICS>[Select Sensor]>ERROR LIST. Refer to Table 6.

Table 6	Error	list for	the	LDO	sensor
---------	-------	----------	-----	-----	--------

Error	Possible cause	Resolution
RED AMPL LOW (Value is below 0.01) OR	The sensor cap is not installed, or is not installed correctly.	Remove the sensor cap and install it again.
BLUE AMPL LOW (Value is below 0.01)	The light path is blocked in the sensor cap.	Inspect the inside of the sensor cap and lens.
	The sensor is not operating correctly.	Make sure that the LED is flashing. Contact the manufacturer.

### Warning list

When the warning icon flashes (sc100 and sc200) or when the screen turns yellow (sc1000), a message is shown on the bottom of the measurement screen. On the sc1000, the screen turns

yellow to show a warning. To show the current sensor warnings, go to MENU> DIAGNOSTICS>[Select Sensor]>WARNING LIST. Refer to Table 7.

Warning	Definition	Resolution	
EE SETUP ERR	Storage is corrupt. The values have been set	Contact technical support.	
EE RSRVD ERR			
TEMP < 0 C	The process temperature is below 0 °C (32 °F)	Increase the process temperature or stop use until the process temperature is in the sensor specification range.	
TEMP > 50 C     The process temperature is above 50 °C (120 °F)		Decrease the process temperature or stop use until the process temperature is in the sensor specification range.	
RED AMPL LOW	Value falls below 0.03	Refer to Table 6 on page 16.	
RED AMPL HIGH Value is greater than 0.35		Call technical support.	
BLUE AMPL LOW Value is below 0.03		Refer to Table 6 on page 16.	
BLUE AMPL HIGH Value is greater than 0.35		Call technical support.	
CAP CODE FAULT	The sensor cap code has become corrupt. The code has been reset automatically to the default cap and lot codes.	Complete the sensor setup cap procedure. If no setup cap is available for the sensor cap, call technical support.	

### Table 7 Sensor warning list

### **Event list**

The Event list keeps a log of changes to how data is recorded by the sensor. To show sensor events, go to MENU>DIAGNOSTICS>[Select Sensor]>EVENT LIST. Refer to Table 8.

Event	Description
ALT/PRESSURE UNIT CHANGE	Atmospheric pressure or altitude units have changed.
ALT/PRESSURE CHANGE	The value for altitude or atmospheric pressure has changed.
TEMP UNIT CHANGE	The units for temperature have changed.
MEAS UNIT CHANGE	A new unit of measurement has changed.
SALINITY CHANGE	The value for salinity has changed.
SET DEFAULT	Sensor settings have been reset to the default values.
SENSOR SETUP CHANGE	The sensor setup has changed.
CLEAN INTERVAL TIMER CHANGE	The time between sensor cleaning has changed.
SENSOR CAP LIFE TIMER CHANGE	The time between sensor cap replacements has changed.

Table 8	Event	list for	the	sensor
1 0010 0	LVOIIL	1131 101		3611301

### **Replacement parts and accessories**

Use only replacement parts approved by the manufacturer. Use of non-approved parts may cause personal injury, damage to the instrument or equipment malfunction.

### **Replacement items**

Description	Item no. (US / EU)
LDO Probe, with one sensor cap and 2 calibration bags	9020000 / LXV416.99.20001
LDO Probe for seawater, with one sensor cap and two calibration bags	9020000-SW / —
LDO Probe for seawater hazardous locations, with one sensor cap and two calibration bags	9020000-C1D2-SW / —
LDO Probe for hazardous locations, with one sensor cap and 2 calibration bags	9020000-C1D2 / —
Sensor cap, replacement (includes the sensor setup cap, which is not rated for use in Class 1, Division 2 hazardous locations)	9021100 / 9021150

### Accessories

Description	Item no. (US / EU)
Sensor cable lock for hazardous locations	6139900 / —
Cable, sensor extension, Class 1, Division 2 Hazardous Location, 1 m (3.3 ft)	6122402 / —
Cable, sensor extension, Class 1, Division 2 Hazardous Location, 7m (23 ft)	5796002 / —
Cable, sensor extension, Class 1, Division 2 Hazardous Location, 15 m (49.21 ft)	5796102 / —
Cable, sensor extension, Class 1, Division 2 Hazardous Location, 31 m (101.71 ft)	5796202 / —
High output air blast cleaning system, 115 V (not rated for use in hazardous locations)	6860000 / 6860003.99.0001
High output air blast cleaning system, 230 V (not ATEX rated for use in hazardous locations)	6860100 / 6860103.99.0001
Calibration bag (1x)	5796600 / 5796600
Cable, sensor extension, non-hazardous location, 7.7 m (25 ft) <sup>1</sup>	US: 5796000, 7.7 m (25 ft)
	EU: LZX849, 10 m (33 ft)
Hardware kit for pipe mount (PVC)	9253000 / LZY714.99.21810
Hardware kit for float mount (PVC)	9253100 / LZX914.99.42200
Hardware kit for air blast mount	9253500 / LZY812
Hardware kit for chain mount (stainless steel)	— / LZX914.99.11200
Hardware kit for union mount	9257000 / 9257000
HQd meter with LDO rugged probe (not rated for use in hazardous locations)	8505200 / HQ40D.99.310.000

 $^1$   $\,$  15 m (49 ft) and 30 m (98 ft) also available

## SECTION 14c: FLOAT SWITCHES

### P&ID: Item #: LS-1021, LS-1022, LS-1023

Unit Details: Conery Model 2900-B8-S1-C1-40 Narrow Angle Non-Mercury Float Switches with 40 ft cable

Manufacturer: Conery Mfg., Inc. 1380 Enterprise Pkwy Ashland, OH 44805 Phone: (419)-289-1444 Fax: (419)-281-0366 www.conerymfg.com

Local Distributor/Contact:

Conery Mfg., Inc. 1380 Enterprise Pkwy Ashland, OH 44805 Phone: (419)-289-1444 Fax: (419)-281-0366 www.conerymfg.com THIS PAGE INTENTIONALLY LEFT BLANK



### NON-MERCURY FLOAT SWITCH - CONTROL DUTY 2900 MECHANICAL SERIES - NARROW ANGLE FLOAT SWITCH

### GENERAL

DESIGNED FOR ACCURATE LIQUID LEVEL CONTROL IN MANY APPLICATIONS INCLUDING POTABLE WATER OR SEWAGE ENVIRONMENTS. THE FLOAT SWITCH CAN BE UTILIZED TO SIGNIFY SPECIFIC WATER LEVELS OR FOR DIRECT ALARM ACTUATION.

### SWITCH VARIATIONS

NORMALLY OPEN (N/O) - GREEN SHELL

THE CONTACTS ARE OPEN (OR OFF) IN THE HANGING POSITION. AS THE FLOAT RISES 1" (5°) ABOVE HORIZONTAL, THE CONTACTS BECOME CLOSED AND ACTUATE (TURN ON) THE SWITCH. THIS FLOAT IS GENERALLY USED IN PUMP DOWN APPLICATIONS.

NORMALLY CLOSED (N/C) - GREEN/RED SHELL

THE CONTACTS ARE CLOSED (OR ON) IN THE HANGING POSITION. AS THE FLOAT RISES 1" (5°) ABOVE HORIZONTAL, THE CONTACTS BECOME OPEN AND ACTUATE (TURN OFF) THE SWITCH. THIS FLOAT IS GENERALLY USED IN PUMP UP APPLICATIONS.

SINGLE POLE, DOUBLE THROW (SPDT) - GREEN/BLUE SHELL

A VARIATION OF THE PREVIOUSLY LISTED SWITCHES. THIS FLOAT SWITCH CAN BE WIRED TO OPERATE AS EITHER (BUT NOT BOTH) A NORMALLY OPEN OR NORMALLY CLOSED SWITCH BASED ON THE USER'S NEED.

### SWITCH SPECIFICATIONS

2900 SERIES MECHANICAL FLOAT SWITCHES ARE DESIGNED TO OPERATE UNDER THE FOLLOWING PARAMETERS.

MINIMUM OPERATING TEMPERATURE	-	32 DEGREES F.
MAXIMUM OPERATING TEMPERATURE	-	170 DEGREES F.
ELECTRICAL RATING	-	10 AMP-120 VAC, 5 AMP-240 VAC
ACTUATION POINT	-	1" ABOVE / BELOW HORIZONTAL.

### POWER CORD SPECIFICATIONS

-	CHLORINATED POLY ETHYLENE
-	18 AWG 2, TYPE SJOOW - 300 V.
-	18 AWG 3, TYPE SJOOW - 300 V.
	- - -

### FLOAT SPECIFICATIONS

DURABLE POLYPROPYLENE MATERIAL CONSTRUCTION. SOLID POLYURETHANE FOAM INTERIOR. LEAK PROOF, SHOCK PROOF, AND IMPACT RESISTANT. RESISTANT TO SEWAGE AND WASTEWATER APPLICATIONS.

### CORD WEIGHT

ZINC PLATED CAST IRON - 1.22 LBS. SPLIT WEIGHT DESIGN ALLOWS FOR EASY ADJUSTMENT. DESIGN ALLOWS FOR SECURE AND PERMANENT ATTACHMENT TO CORD.



CONERY MFG INC info@conerymfg.com 1380 ENTERPRISE PKWY PH (419) 289-1444

ASHLAND, OH 44805 FAX (419) 281-0366





## CONERY MFG INC

### PRICE SHEET... 09/1/2011

1380 ENTERPRISE PARKWAY, ASHLAND, OHIO 44805

PH 419.289.1444 FX 419.281.0366 www.conerymfg.com

### FLOAT SWITCH PART NUMBER & PRICE WORKSHEET

INSTRUCTIONS: A... FILL IN THE SHADED BLANKS IN THE BOXES BELOW TO DETERMINE EXACT PART NUMBER

(PLEASE NOTE THAT MANY ABBREVIATIONS ARE USED - REFER TO CATALOG FOR COMPLETE DESCRIPTIONS) B... REFERENCE THE COST AMOUNTS BELOW EACH LETTER / NUMBER DESIGNATION TO BUILD THE EXACT PRICE

USING THE MULTIPLIER TABLE (BELOW & LEFT), DETERMINE THE QUANTITY DISCOUNT FOR NET PRICE.

2900-B8-S1-C1-40

STAINLESS FLOATS & VERTICAL FLOATS HAVE THEIR OWN CHARTS.

FLOAT SWITCH	BULB	SWITCH	PIGGYBACK	CORD	PACKAGING	CABLE LENGTH
ORIENTATION	TYPE	TYPE	PLUG	ASSEMBLY		(IN 5' INCREMENTS)
REQUIRED	REQUIRED	REQUIRED	(OPTIONAL)	(OPTIONAL)	(OPTIONAL)	REQUIRED
					, , , , , , , , , , , , , , , , , , ,	
2900	- B 8	- S 1 .	· P .	- C 1 .	· K	- 40
_,						15' STANDARD
				LL		
\$38.00 - <b>2900</b>	\$2.00 1	\$0.00 - 1	\$5.00 - 1	\$5.00 - 1	\$1.50 - <b>1</b>	(\$2.00) - <15'
NORMALLY OPEN	STD BULB - MERC	NARROW ANGLE	120V PLUG	CORD WEIGHT	IND BOXED	ANY TYPE FLOAT
\$38.00 - <b>2901</b>	\$2.00 <b>2</b>	\$13.00 - <b>2</b>	\$7.00 - 2	\$3.00 - <b>2</b>	\$1.00 - <b>2</b>	\$0.00 - <b>15'</b>
NORMALLY CLOSED	MINI BULB - MERC	NA - SPDT	240V PLUG	CLAMP - POLY	IND BAGGED	STANDARD
\$38.00 - <b>2902</b>	\$0.00 <b>3</b>	\$7.00 - <b>3</b>		\$4.00 - <b>3</b>		\$5.00 - <b>+ 5'</b>
SPDT	MECHANICAL BULB	NA - 600V	(PLUGS USABLE	CLAMP - STNLS		S1, S4, S14, 20 AMP
	\$12.00 <b>4</b>	<b>\$10.00 - 4</b>	ON WIDE ANGLE	\$4.00 - <b>31</b>		\$7.50 - <b>+ 5'</b>
	INT WTD BULB	WIDE ANGLE	FLOATS ONLY)	CLAMP - SM STNLS		S2, S5
	MERCURY	\$16.00 - <b>5</b>		\$3.00 - <b>4</b>		\$8.25 - <b>+ 5'</b>
	FOAM FILLED	WA - SPDT		RLS TIE STRAP		S3, S6
	\$12.00 <b>5</b>	\$21.50 - <b>6</b>		\$4.00 - 7		\$13.00 - <b>+5'</b>
	INT WTD BULB	WA-2HP MECH		FLOAT COLLAR		S7, S8, S9, S10, S11
	MERCURY	\$12.00 - <b>14</b>				
	AIR FILLED	WA - 60 DEGREE				
	\$10.00 <b>6</b>					
	INT WTD BULB					
	MECHANICAL					
			STAINLE	SS STEEL FLOAT SW		
	\$10.00 /		SWITCH		FLOAT SWITCH	SWIICH
			ITPE			
				REQUIRED	REQUIRED	(OPTIONAL)
			SE .			
			JF			
				20 STANDARD		(INA STAINDARD)
			6040 00	\$25.00 ± 10'	NO	NΛ
			<b>⊅∠10.00</b>	φ20.00 - T IV		
						\$14.00 VVA
				N		WIDE ANGLE



### SECTION 14d: MAGNETIC FLOW-METERS

P&ID: Item #: FM-0823, FM-0222

Unit Details: 2" Siemens MAG5100W flow tube w/ MAG5000 Transmitter - 7ME6580-2YJ14-2LA2

P&ID: Item #: FM-0521

Unit Details: 3" Siemens MAG5100W flow tube w/ MAG5000 Transmitter – 7ME6580-3MJ14-2LA2

P&ID: Item #: FM-1125, FM-1127, FM-0921

Unit Details: 4" Siemens MAG5100W flow tube w/ MAG5000 Transmitter – 7ME6580-3TJ14-2LA2

P&ID: Item #: FM-0721

Unit Details: 6" Siemens MAG5100W flow tube w/ MAG5000 Transmitter – 7ME6580-4HJ14-2LA2

Manufacturer: Siemens Energy & Automation, Inc. Process Silutions Division 1201 Sumneytown Pike P.O. Box 900 Spring House, PA 19477-0900 www.automation.siemens.com Local Distributor/Contact:

RITEC 26 Saginaw Drive Rochester, NY 14623 Phone: (585)-271-3170 Fax: (585)-271-5259 www.ritec.com

# SIEMENS

# SITRANS F M MAGFLO<sup>®</sup>

Electromagnetic flowmeters Sensor types MAG 1100, MAG 3100, MAG 5100 W Transmitter types MAG 5000, MAG 6000



Technical Documentation (handbooks, instructions, manuals etc.) on the complete product range SITRANS F can be found on the internet/intranet on the following links:

English: http://www4.ad.siemens.de/WW/view/en/10806951/133300

Order no.: FDK-521H0879

SFIDK.PS.027.W4.22 - A5E00253104

Siemens Flow Instruments range of electromagnetic flowmeters

							~~~~~
	MAG 1100	MAG 1100	MAG 31	00	MAG 3100 W	5	MAG 5100 W
		FOOD				_ ۶	-
			P	1	0-01	2	ALL A
	_11_	ALA	6 6		11 11	8	
			1	N.	0	2	- V
Size [inch]	1/40" - 4"	3/0" - 4"	1/0" - 78	2"	1" - 48"	ζ	1" - 48"
Connection	Flangeless	Weld-in adapter.	Flange	<u>,</u>	Flange	_ ₹	Flange
	(Wafer)	clamp adapter,		-		2	· ·····g·
Prossura [nsi]	600	thread adapter	1500		600	₽	600
Temperature [°F]	0 to 400	-20 to 300	-40 to 3	50	-20 to 200	_ع	-20 to 160
Liner	Zirconium oxide	Ceramic (Al <sub>2</sub> O <sub>3</sub> )	Neoprene, E	PDM,	Neoprene and	7	1" - 1½" &
	$(Z_r O_2)$	PFA	Teflon (PT	FE),	EPDM	۲ اع	14" - 48"
	PFA		Linatex			'  3	2" - 12"
	Distinum	Diotinum	AIGI 246	T:			mposite elastomer
Electrodes	Hastelloy C276	Hastelloy	Hastelloy	νC,	PE electrodes	_ ۶	PE electrodes
			Platinum/Iri Titaniur	dium, n		_ ۲	
			Tantalur	n,		3	
Enclosure			PE electro			<u></u>	
Ex-version	EEx [ia] [ib] IIB T4-T6		EEx e ia IIC	T3-T6		6	
Houzandous area	intrinsically safe		EEx d [ia] [ib] III	B T4-T6		۲	
Approvals			Intrinsically	sate	1 division 2	2	
Approvais				WRc,	NSF	- 3	WRC, NOF
<del>[</del>	M	AG 5000			MAG 60		
5							11
3					GEE .	2	
ξ	1	222 ·			1	100	12
5					- 100 M		
Outputs	1 cur	rent output			1 current c	output	
3	1digital output 1 relay output		3		1digital ou 1 relay ou	utput utput	
Flow direction	Uni/t	pidirectional			Uni/bidirec	tional	
Communication	C	Optional	1		Add-on mo	dules	
3		HART®		н	ART <sup>®</sup> , DeviceNet	t, Profi	bus DP,
Display		2 linos			Piolibus PA, C		ben
	20 0	characters			20 charac	cters	
Matazunaartainti	(optional	without display)		(optional without display)			
Enclosure	NEMA 2 N	FMA 4X NEMA 6		±0,25% 0.1.			MA 6
Custody transfer		PTB		PTB			
approval	(cc	old water)			OIMLR	75	
Ex-version	(EI	Ex ial IIC			UIML R		
Safety barrier 1	[						
Power supply	12-2	4 V AC/DC		12-24 V AC/DC			
Batch	(115	-230 V AC		)	115-230	VAC	
		neral nurnose			Ul c generali	nurno	20
	FM Clas	ss 1, division 2			FM Class 1, c	livisio	n 2
C	MAG	6000 Industry	<del>uu</del>		MAG 800	00 W	
	4	e l'			<b>E</b>		
	- 3	Carl			1	8	
		16			A H	A	0
					5	- 6	
Referto				Operating	nanuc	1	
	SFIDK.	PS.026.E1.02		SFIDK.PS.026.D2.02			

### SITRANS F M MAGFLO® Contents 1. Product introduction Product introduction ..... 1.1 1.2 Mode of operation ..... 2.1 Sensor MAG 1100 and MAG 1100 Ex...... 6 Specifications 2.2 2.3 Sensor MAG 5100 W 10 Transmitter MAG 5000 (1/4" to 48") 11 Transmitter MAG 6000 (1/4" to 78") 12 2.4 2.5.1 2.5.2 2.5.3 2.5.4 2.6 Meter uncertainty ..... 2.7 281 2.8.2 2.9 2 10 Sizing table (1/12" to 78") ..... 3. Product selection guidelines 3.1 3.2.1 3.2.2 Liner selection guide 18 3.2.3 Electrode selection guide ..... 3.3 3.4 3.5 3.6 3.7 4.1 Sensor MAG 1100 .. 25 4. Dimensions and weight 4.2 Sensor MAG 1100 FOOD ..... 26-27 4.3 44 4.5 5.1 Installation of sensor 5.2 5.3 Inlet protection MAG 3100 6.1 6 Installation of transmitter 6.2.1 6.2.2 6.2.3 6.2.4 Remote installation (Sensor end)..... 6.2.5 6.2.6 6.2.7 6.2.8 6.3 6.4 7. Electrical connection 7.1 7.2 7.2.1 7.2.3 Wall mount NEMA 2X enclosure 50 Rack mount with safety barrier NEMA 2 EEx (ia/ib) up to 12" 50 Wall mount with safety barrier NEMA 6 EEx (ia/ib) up to 12" 50 Wall mount with safety barrier NEMA 6 EEx (ia/ib) up to 12" 51 Rack mount NEMA 2 with cleaning unit 51 7.2.4 7.2.6 7.2.7 728 8. Start-up & programming 8.1 8.2 Menu build-up 8.2.1 8.3.1 Password ..... ..... 53 8.3.2 8.4.1 Basic settings ..... 56 842 8.4.3 8.4.4 Relay output ..... 845 8.4.6 8.4.7 Reset mode ..... 848 8.4.9 8.4.10 8.4.11 8.4.12 Language mode ..... 8.4.13 8.5.1 8.5.2 8.5.3 Batch Factory settings/available settings 65 Dimension dependent factory settings MAG 5000 and MAG 6000 66 Dimension dependent batch and pulse output settings 66 861 8.6.2 8.6.3 8.6.4 8.7.1 8.7.2 9. Service 9.1 Trouble shooting MAG 5000 and MAG 6000 71 Check list MAG sensor 72 9.2 9.3 9.4 10. Ordering 10.

# SITRANS F M MAGFLO® 1. Product introduction 1.1 SITRANS F M MAGFLO® electromagnetic flowmeters offer reliable, precise and inexpensive flow measurement on all electrically conductive liquids. Typical applications are found in all industries. E.g.:

- Water sector: Potable water, treatment of chemicals, waste water and sludge.
- Food sector: Dairy products, beer, wine, soft-drinks and fruit juices.
- Chemical sector: Detergents, pharmaceuticals, acids and alkalies.
  - Other sectors: HVAC, paper pulp and mining slurries.

SITRANS F M MAGFLO® electromagnetic flowmeters are characterised by simplicity:

- $\Rightarrow$  Simple to install
- $\Rightarrow$  Simple to commission
- $\Rightarrow$  Simple to operate
- ⇒ Simple to maintain

SITRANS F M MAGFLO<sup>®</sup> electromagnetic flowmeters are manufactured by Siemens Flow Instruments - one of the worlds leading makers of flowmeters.



All SITRANS F M MAGFLO<sup>®</sup> electromagnetic flowmeters feature a unique SENSORPROM<sup>®</sup> memory unit which stores sensor calibration data and transmitter settings for the lifetime of the product.





At commissioning the flowmeter commences measurement without any initial programming.

The factory settings matching the sensor are stored in the SENSORPROM<sup>®</sup> unit. Also customer specified settings are downloaded to the SENSORPROM<sup>®</sup> unit. Should the transmitter be replaced, the new transmitter will upload all previous settings and resume measurement without any need for reprogramming.

Furthermore, the "fingerprint" used in connection with the Siemens Flow Instruments Verificator is stored during the sensor calibration.

The Siemens Flow Instruments Verificator can verify the accuracy of the flowmeter while still installed years after the initial calibration.

### USM II "Plug & Play" add-on communication modules.

USM II - the **U**niversal **S**ignal **M**odule with "Plug & Play" simplicity makes it easy to access and integrate the flow measurement with almost any system. It ensures the flowmeter will be easy to upgrade to new communication platforms in the future, too.

### 1. Product introduction

1.2 Mode of operation

The flow measuring principle is based on Faraday's law of electromagnetic induction. The flowmeter consists of a sensor type MAG 1100, 3100 or 5100 W and a transmitter type MAG 5000 or 6000.



 $U_i$  = When an electrical conductor of length L is moved at velocity v, perpendicular to the lines of flux through a magnetic field of strength B, the voltage  $U_i$  is induced at the ends of the conductor

### U<sub>i</sub> = L x B x v

- U<sub>i</sub> = Induced voltage
- L = Conductor length = Inner pipe diameter =  $k_1$
- B = Magnetic field strength =  $k_2$
- v = Velocity of conductor (media)
- $k = k_1 \times k_2$

### Ui = k x v, the electrode signal is directly proportional to the fluid velocity

### SENSOR (Flow tube)

The sensor converts the flow into an electrical voltage  $(U_i)$  proportional to the velocity of the flow. The sensor is built up of a stainless steel pipe, 2 coils, electrodes, an isolating liner, housing and where applicable, connecting flanges.

### TRANSMITTER

The transmitter consists of a number of function blocks which convert the sensor voltage into flow readings.

### Power supply

2 different types of power supply are available. A 12 - 24 V AC/DC and a 115 - 230 V AC switch mode type.

**Coil current module** generates a pulsating magnetizing current that drives the coils in the sensor. The current is permanently monitored and corrected. Errors or cable faults are registered by the selfmonitoring circuit.

**Input circuit** amplifies the flow proportional signal from the electrodes. The input impedance is extremely high: >10<sup>14</sup>  $\Omega$  which allows flow measurements on fluids with conductivities as low as 1 mS/cm. Measuring errors due to cable capacitance are eliminated due to active cable screening.

**Digital signal processor** converts the analog flow signal to a digital signal and suppresses electrode noise through a digital filter. Inaccuracies in the transmitter as a result of long-term drift and temperature drift are monitored and continuously compensated for via the self-monitoring circuit. The analog to digital conversion takes place in an ultra low noise ASIC with 23 bit signal resolution. This has eliminated the need for range switching. The dynamic range of the transmitter is therefore unsurpassed with a turn down ratio of minimum 3000:1.

### **CAN** communication

The transmitter operates internal via an internal CAN communication bus. Signals are transferred to/from a signal conditioner to the display module, internal/external option modules and the dialog module.

### **Dialog module**

The display unit consists of a 3-line display and a 6-key keypad. The display shows a flow rate or a totalizer value as a primary reading.

**Output module** converts flow data to an analog, a digital and a relay output. The outputs are galvanically isolated and can be individually set to suit a particular application.

### SITRANS F M MAGFLO® 2. Specifications

### 2.4 Sensor MAG 5100 W

Specifications	
Specification	s
Specificatio	
Specificatio	<u></u>
Specificat	.≃
Specifica	÷
Specific	φ,
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Speci	fi
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Spe	Š
g	Ψ
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	Č.	<b>(E)</b>	6			
Туре		Sensor with flanges				
Design	Straight	Coned down 1 pipe size	Straight			
Nominal size inc	h 1" - 1½"	2" - 12"	14" - 48"			
Liner	Hard elastomer	Composite elastomer	Hard elastomer			
	(hard rubber) <sup>1</sup> )	(hard & soft rubber) <sup>1</sup> )	(hard rubber) <sup>1</sup> )			
Liner approvals	WRc, NSF	WRc, NSF WRc, NSF WRc, NSF				
Medium temperature		23 to 160°F <sup>2</sup> )				
Ambient temperature						
Remote transmitter		-40 to 212°F				
Compact transmitter		-5 to 122°F	1			
Operating pressure	0.15 to 580 psi	0.45 to 300 psi	0.15 to 200 psi			
Excitation frequency	15 Hz	2-2½": 15 Hz	3.75 Hz			
		3-6": 7.5 Hz				
		8-12": 3.75 Hz				
Enclosure rating Standar	NEMA 4X / 6 (3 ft. submersion for 30 min)					
Optio	n NE	NEMA 6P (30 ft. continuous submersion)				
Cable entries		4 Pg 13.5				
Mechanical load	18-1000 Hz rar	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36				
Test pressure		1.5 × nominal pressure				
Flanges						
EN 1092-1 Standar	d 600 psi	2-6": 200 psi	150 psi			
		8-12": 150 psi				
Optio	n	8-12": 200 psi	200 psi			
ANSI B16.5 Standar	d Class 150 lb	Class 150 lb	14"-24": Class 150 lb			
AWWA C-207 Standar			28"-48": Class D			
Pressure drop at 3 m/sec.	As straight pipe	Max. 0.35 psi	As straight pipe			
Electrodes		AISI 316 Ti (1.4571)				
PE/grounding electrodes Standar	d	AISI 316 Ti (1 4571)				
Measuring pipe/meter bog	AISI 304 (1.4301)	Composite elastomer	AISI 304 (1.4301)			
Flanges		Carbon steel				
Housing		Carbon steel				
Surface finish	Two component epoxy	Polyester powder coat	Two component epoxy			
	min. 150 microns	min. 100 microns	min. 150 microns			
Color		Siemens 700 light basic				
Approvals Conforms t	0	WRc, NSF				

Nitrile, NBR
 Peak temperature up to 194 °F in periods < 1 hour</li>

٦

Specifications

# 2.5.1 Transmitter MAG 5000 (1/12" to 48")

		Accuracy 0.5%			
Current	output				
	Active current	0-20 mA, 4-20 mA or 4-20 mA + alarm (Power supplied from flowmeter)			
	Load	< 800 ohm			
	Time constant	0.1-30 sec. adjustable			
Digital o	utput				
	Frequency	0-10 kHz, 50% duty cycle			
	Time constant	0.1-30 sec. adjustable			
	Active pulse	24 V DC, 30 mA, 1 K $\Omega$ < R <sub>load</sub> < 10 K $\Omega$ , short-circuit-protected (Power supplied from flowmeter)			
	Passive pulse	3-30 V DC, max, 110 mA, 200 $\Omega < R_{load} < 10 K\Omega$ (Powered from connected equipment)			
Relay	Time constant	Changeover relay, time constant same as current time constant			
	Load	42 V AC/2 A. 24 V DC/1A			
Digital in	nput	$11-30 \text{ V DC. R}_{i} = 4.4 \text{ K}\Omega$			
2.9.000	Activation time	50 msec			
	Current	$l_{11} v_{PC} = 2.5 \text{ mA} l_{20} v_{PC} = 7 \text{ mA}$			
Function	IS	Flowrate, 2 totalizers, low flow cut-off, empty pipe cut-off <sup>1</sup> ), flow direction, error system, operating time			
		uni/bidirectional flow limit switches, pulse output, control for cleaning unit			
Galvanic	isolation	All inputs and outputs are galvanically isolated			
Cut-off	Low flow	0-9.9% of maximum flow			
	Empty pipe	Detection of empty pipe, special cable required in separate mounted installation			
Totalizer		Two eight-digit counters for forward, net or reverse flow			
Display		Background illumination with alphanumerical text, $3 \times 20$ characters to indicate flowrate, totalized			
		values, settings and faults			
		Reverse flow indicated by negative sign			
	Time constant	Time constant as current output time constant			
Zero poi	nt adjustment	Automatic			
Electrode	e input impedance	$> 1 \times 10^{14} \Omega$			
Excitatio	n frequency	Sensor size depending pulsating DC current (125 mA)			
Ambient	temperature	Display version during operation: -5 to 120°F			
	••••••	Blind version during operation: -5 to 140°F			
		During storage: -40 to 160°F (Relative humidity max 95%)			
Custody	transfer approval	PTB			
MAG 500	о ст	(cold water)			
		6.221			
		99.19			
Commur	nication				
	Standard	Without serial communication			
	Optional	HART®			
Integral	mount				
	Enclosure material	Fiberglass-reinforced polyamide			
	Enclosure rating	NEMA 4X / 6 (3 ft. submersion for 30 min)			
	Mecanical load	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36			
Rack mo	ount				
	Enclosure material	Standard rack mount of aluminum/steel (DIN 41494)			
		Width: 4.75 inch			
		Height: 5.25 inch			
	Enclosure rating	NEMA 2			
	Mechanical load	Version: 1 G, 1-800 Hz sinusoidal in all directions to EN 60068-2-36			
EMC per	formance	Emission: EN 50081-1 (Light industry)			
		Immunity: EN 50082-2 (Industry)			
Power s	upply	115-230 V AC +10% to -15%, 50-60 Hz			
	,	11-30 V DC or 11-24 V AC			
Power c	onsumption	230 V AC: 9 VA			
		24 V DC: 9 W, $I_N$ = 380 mA, start-up peak current = 8 A (30 msec.)			
		12 V DC; 11 W, $I_N = 920$ mA start-up peak current = 4 A (250 msec.)			
Approva	ls	FM Class 1, division 2, ULc general purpose			
		· · · · · · · · · · · · · · · · · · ·			

1) Not remote Ex, not 1/12", 1/8"

### SITRANS F M MAGFLO<sup>®</sup> 2. Specifications

### 2.6 Meter uncertainty

### MAG 5000 or MAG 6000 used with MAG 3100 W or MAG 1100 PFA



### MAG 6000 used with MAG 3100, MAG 1100 Ceramic or MAG 5100 W



### Reference conditions (ISO 9104 and DIN/EN 29104)

	,
Temperature of medium	68°F ±9 F
Ambient temperature	68°F ±9 F
Supply voltage	Un ±1%
Warming-up time	30 min.
Incorporation in pipe section	Inlet section 10 * Nominal pipe size (sizes up to 48"),
	5 * Nominal pipe size (sizes up to 48")
	Outlet section 5 * Nominal pipe size (sizes up to 48"),
	3 * Nominal pipe size (sizes up to 48")
Flow conditions	Fully developed flow profile

### Additions in the event of deviations from reference conditions

Current output	As pulse output $\pm$ (0.1% of actual flow +0.05% FSO)	
Effect of ambient temperature	Display/frequency/pulse output: < ±0.003% / < ±0.0017°F	
	Current output: < ±0.005% / < ±0.0028°F	
Effect of supply voltage	< 0.005% of measuring value on 1% change	
Repeatability	$\pm 0.1\%$ of actual flow for V $\geq$ 1.5 ft./sec.	
	Conductivity $\geq$ 10 $\mu$ S/cm <sup>3</sup>	

### SITRANS F M MAGFLO<sup>®</sup>

2. Specifications

### 2.7 Output characteristics MAG 5000 and MAG 6000

Output characteristics	Bidirectio	nal mode	Unidirectional mode		
0-20 mA 4-20 mA	-100% Cut 100% Q		-100% Cot 100% C		
	-100% Cut 100% Q		-100% Cut 100% Q		
Frequency	F[Hz] F[Hz] F[max -100% Cut 100% Off		F[H2] 102.5% 100% - F[H2] Fmax - 100% Cut 100% Q		
Pulse output	External counter		Counter Cut Q		
Relay	Power down		Active		
Error relay	No error	44 45 9 6 555 46	Error	44 45 p. 1200 44 45 45 0. 1200 46	
Limit switch or	1 set point		2 set points		
direction switch	Output		Out	put 8	
	-100% 0	v v v v v v v v v v v v v v	100% 0 Set Point 1	Set Point 2	
	Low flow (Reverse flow)	44 45 0: Ziege 	Intermediate flow	44, 45 0; 1 5 15 15 46	
	High flow (Forward flow)		High flow/ Low flow	44 45 01 	
Batch on digital output			Hold Bacaeter 11000	t	
Batch on relay	Hold	44, 45 0, 17 	Batch	44 45 0 44 45 0 45 45 45	

### SITRANS F M MAGFLO<sup>®</sup> 2. Specifications

2.8.1
Sensor cables and
conductivity of medium
-



### Note

- For detection of empty pipe the min. conductivity must always be ≥ 20 µS/cm. and the max. length of electrode cable when remote mounted is 150 ft. Special shielded cables must be used.
- For remote mounting in Ex applications special cable cannot be used, empty pipe cannot be detected and the electrical conductivity must be ≥ 30 µS/cm.
- For remote mounted CT installations the max. cable length is 600 ft.
- For Ex installations with safety barriers, 75 ft of cable can be used in order to obtain ±0,25%, and 150 ft to obtain ±0.5%.

### Note

Empty pipe detection function not available with 1/12" & 1/8" sizes.

2.8.2					Coil cable Electrode cable					
Minimum accept data for	Basic data	No. o	f conductors		2	3				
cable		Min. s	qr. area		0.5 mm <sup>2</sup> /20 gage	0.2 mm <sup>2</sup> /22 gage				
		Shield			Yes	Yes				
		Max.	capacitance		N.A.	107 pF/ft.				
	Max. cable loop	temperature:	< 210°F	40 Ω	N.A.					
	resistance		< 390°F	6 Ω	N.A.					
2 9	Annliegtion									
HART <sup>®</sup> communication	Application		MAG 6000							
add-on module	Communication stan	مامعما	Doll 202 from		koving (f a k ) stands	5 0000 ord				
		aara	Bell 202 llequ		keying (I.S.K.) standa					
	Communication mod	es	Single loop     Multi drop	mode 15						
	Communicator		Iniuiti-urop	noue, 15	Slave devices	76				
	Communicator		Rosemount H	anu-neiu (	a communicator, type 275					
Cable specification			0							
Cable Specification			Communicati	ion mode	/ Single loop					
			$\geq 0.2 \text{ mm}^2/\text{AV}$	VG 24						
	Shleid	1.1'	Yes (Overall s	sniela)						
	Loop resistance	Min.	230 Ω							
	Cable conseitu	мах.	800 Ω							
	Cable capacity		$\leq 122 \text{ pr/n}.$							
	Cable length									
	Twisted pair		Tes							
	HART <sup>®</sup> is a registered	tradem	ark of the HA	RT Comr	nunication Foundat	ion.				
2 9					Standard appla	Special achie				
Cable specification						Special cable				
(Supplied by Siemens Flow	Basic data	Pagia data Nig. a								
Instruments)	Dasic udid	Sar a			3 1.5 mm <sup>2</sup> /18 dogo	0.25 mm <sup>2</sup> /22 daga				
/		Shiele	115a							
		Color			Brown blue black	Brown blue black				
		COULE		DIGWII, DIGG, DIACK	DIOWII, DIUC, DIACK					

Outside color

Ext. diameter

Isolation material

Flexible installation

Non flexible installation

Conductor

Capatance

Inductance

•

L/R

Amb. temperature

Cable parameter

Grey

0.3

Flexible CU

PVC

–23 to 160°F

-20 to 160°F

49.24 pF/ft.

0.178 μH/ft.

43.83 μH/Ω

Grey

0.32'

Flexible CU

PVC -23 to 160°F

–20 to 160°F

N.A.

N.A.

N.A.

### 3. Product selection guidelines





The table shows the relationship between flow velocity V, flow quantity Q and sensor dimension size.

### Guidelines for selection of sensor

Min. measuring range: 0-0.8 ft./sec. Max. measuring range: 0-33 ft./sec.

Normally the sensor is selected so that the nominal flow velocity is within the measuring range 1-15 ft./sec.

*Flow velocity calculation formula:* GPM = (Pipe I.D. inches)<sup>2</sup> x velocity (ft./sec.) x 2.448

V -	GPM x 0.408	or V =	MGD x 283.67			
v =	(Pipe I.D. inches) <sup>2</sup>	01 V =	(Pipe I.D. inches) <sup>2</sup>			

17

3.2.1 Minimum conductivity

3. Product selection guide	lines
----------------------------	-------

Applications		Min. conductivity
Integral/remote	DN 1/ <sub>12</sub> & 1/ <sub>8</sub>	30 µS/cm
	$DN \ge 1/4$	5 µS/cm (Please see 2.7.1 for further details)
With empty pipe detection		20 µS/cm (Please see 2.7.1 for further details)
Ex-installations		
(Remote mounted only)		30 $\mu$ S/cm (Please see 2.7.1 for further details)
District heating systems		
(Without DC cleaning unit)		250 μS/cm max. 150 ft.

### 3.2.2 Liner selection guide

selectio	linco
Product :	opino 1

Liner	Applications
Zirconium oxide Z <sub>r</sub> O <sub>2</sub>	General purpose, agressive chemicals
Ceramics Al <sub>2</sub> O <sub>3</sub>	General purpose, agressive chemicals
PFA	General purpose, dairy, food and beverage
Neoprene	General purpose, sewage
EPDM	Drinking water, sea water
PTFE	Agressive chemicals, paper and pulp, high temperature applications
Linatex®	Abrasive media and mining slurries
Ebonite	Drinking water

### 3.2.3 Electrode selection guide

Electrodes	Applications					
AISI 316 Ti	General purpose, water, sewage and district heating					
AISI 316 Ti Ceramic coated	High content of fibers, paper pulp					
Hastelloy C-276	Good chemical proporties, sea water					
Titanium	Chlorine, chlorite, nitric and chromic acids					
	Textile bleaching industry					
Tantalum	Almost any acid solution					
Platinum and platinum/irridium	The ultimate electrode material. Unaffected by most liquids					

### 3.3 Installation conditions



Reading and operating the flowmeter is possible under almost any installation conditions because the display can be oriented in relation to the sensor.

Installation conditions

3.3

(continued)

### 3. Product selection guidelines



To ensure optimum flow measurement, attention should be paid to the following: The sensor must always be completely full with liquid.

Avoid:

336275.10

- Installation at the highest point in the pipe system
- Installation in vertical pipes with free outlet •



### Installation in vertical pipes



Recommended flow direction: upwards. This minimizes the effect on the measurement of any gas/air bubbles in the liquid.

Installation in horizontal pipes

Measuring abrasive liquids and liquids containing particles



Inlet and outlet conditions



the right figure. This will position the electrodes at the top where there is possibility for air bubbles and at the bottom where there is possibility for mud, sludge, sand etc. Recommended installation is in a vertical/in-

The sensor must be mounted as shown in the left figure. Do not mount the sensor as shown in

clined pipe to minimize the wear and deposits in the sensor.

To achieve accurate flow measurement it is essential to have straight lengths of inlet and outlet pipes and a certain distance between pumps and valves.

It is also important to center the flowmeter in relation to pipe flanges and gaskets.

For accurate flow measurement, the sensor must be installed in a section of straight pipe, free of valves, elbows, tees, etc.

- Min. 5 x I.D. upstream •
- Min. 3 x I.D. downstream

### 3. Product selection guidelines

# Potential equalization (Grounding)





Product selection guidelines

### Installation in large pipes





The electrical potential of the liquid **must always** be equal to the electrical potential of the sensor. This can be achieved in different ways depending on the application:

- A. Built-in grounding electrodes. (MAG 3100 and MAG 3100 W).
- B. Direct metallic contact between sensor and fittings. (MAG 1100 FOOD).
- C. Wire jumper between sensor and adjacent flanges. (MAG 1100 and MAG 3100).
- D. Optional graphite gaskets on MAG 1100. (Standard for MAG 1100 High temperature).

Avoid a vacuum in the measuring pipe, since this can damage certain liners. See "Specifications", section 2.

The flowmeter can be installed between two reducers.

With an 8° reducer the following pressure drop curve applies. The curves are applicable to water.

### Example:

A flow velocity of 10 ft./sec. (V) in a sensor with a diameter reduction from 4" to 3"  $(d_1/d_2 = 0.8)$  gives a pressure drop of 0.04 psi.

### 3. Product selection guidelines

Integral mount/remote installation

### Ambient temp. <sup>°</sup>F <sup>120</sup> <sup>90</sup> <sup>90</sup> <sup>90</sup> <sup>120</sup> <sup>120</sup>

The sensor and transmitter can be installed either integral mount or remote.

With **integral mount** installation the temperature of medium must be according to the graph.

With **remote** installation, the cable length and type described under "Specifications", section 2 must be used.

### NEMA 6 submersible kit (option)



Horizontal installation



If the sensor is going to be buried or permanently submerged, the terminal box must be encapsulated with silicon dielectric gel. The optional kit has two components. Mix the two components well (without inducing air) and pour the contents into the terminal box. The material is a non-toxic, transparent, selfhealing gel which cures in approx. 24 hours. The gel can be penetrated with test instruments or be removed in case of cable replacement.

### Suggestions for the direct burial of MAG 3100 & MAG 5100 W sensors

If SITRANS F M MAGFLO 3100 or MAG 5100 W sensors are buried directly into the ground, we suggest the following precautions:

The SENSORPROM<sup>®</sup> unit should be removed from the terminal box on the sensor and relocated in the transmitter remote mounting prior to burying the sensor.

All the sensor data plate information and serial number should be recorded for each sensor prior to burying. This will ensure correct matching with the SENSORPROM<sup>®</sup> unit.

The sensor should be potted with the optional IP68 submersion kit and suitable coil and electrode cables should be used prior to burying.

The use of pea gravel, at least 12 inches all around the sensor, is recommended. This provides some drainage and prevents dirt from caking onto the sensor. It also helps locate the sensor should excavation be necessary.

Before covering the pea gravel with earth, we suggest the use of electrical cable identification tape laid above the gravel.

The sensor should not be subject to heavy vehicles applying excessive weight above the sensor or pipeline.

### SITRANS F M MAGFLO® 3. Product selection guidelines

3.4 **Cleaning unit**  The Siemens Flow Instruments cleaning unit can be used with MAG 5000 or 6000 in rack mount non CT versions.

The cleaning unit can be used in applications where the liner material and subsequently the electrodes may be coated with deposits. If the coating is electrically insulating, the electrode signal will be reduced. If the coating is electrically conductive, the electrode signal will be partly shortcircuited. In both cases the accuracy of the meter will decrease (dependent on the type and thickness of the coating).

### Note

The cleaning unit cannot be used for flammable or explosive media!

Theory of operation The cleaning unit cleans the electrodes electro-chemically by applying a voltage to the electrodes for approx. 60 sec. While cleaning, the transmitter stores and holds the latest measured flow reading on the display and also the signal outputs. After an additional pausing period of 60 sec. the flowmeter resumes normal measurement and the cleaning is now completed.

> The relay in the transmitter activates the cleaning cycle. In the relay output menu (under cleaning) the cleaning interval can be set between 1 hour and 24 hours.

> Cleaning should only take place with liquid in the pipe. This can be achieved via the empty pipe detection. It is therefore recommended to select "empty pipe detection" ON when using the cleaning unit.

> The cleaning sequence can also be controlled manually through the electrical input of the transmitter. Before this is done, ensure that the measuring pipe is full.

## AC-cleaning

(For non-conductive coatings)



AC-cleaning is used to remove fatty deposits on the electrodes. Fatty deposits are seen from Slaughter houses and in rare instances from wastewater applications and water applications with oil residuals. During the cleaning process, the surface of the electrodes get warmer, which tends to soften grease particles and the gas bubbles generated mechanically lift deposits away from the surface of the electrodes.



DC-cleaning is used to eliminate electrically conductive deposits in the measuring pipe influencing the measuring accuracy.

Particularly in district heating applications, an electrically conductive deposit (magnetite) may occur and short-circuit the electrode signal. In this case the accuracy of the meter decreases and the signal/ noise conditions of the meter become inferior. The problem only arises if the conductivity of the water is less than approx. 250 µS/cm.

During DC-cleaning, electrolysis takes place where the flow of electrons removes the particle deposits from the electrode area.

### Note

Do not use DC-cleaning on sensors with tantalum electrodes.

### DC-cleaning

(For conductive coatings)

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### SITRANS F M MAGFLO<sup>®</sup> 4. [

### 4. Dimensions and weight

### 4.3 Sensor MAG 5100 W Dimensions





	Nominal size		А		L									
					PN 10		PN 16		PN 40		Class 150		AWWA	
	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
	25	1"	187	7.4	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A
	40	1½"	197	7.8	N/A	N/A	N/A	N/A	200	7.9	200	7.9	N/A	N/A
P&ID: Item#: FM-0424	50	<mark>2"</mark>	<mark>188</mark>	<mark>7.4</mark>	N/A	N/A	200	<mark>7.9</mark>	N/A	N/A	<mark>200</mark>	<mark>7.9</mark>	N/A	N/A
	65	21⁄2"	194	7.6	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A
	80	3"	200	7.9	N/A	N/A	200	7.9	N/A	N/A	200	7.9	N/A	N/A
P&ID: Item#: FM-0224	100	<mark>4"</mark>	<mark>207</mark>	<mark>8.1</mark>	N/A	N/A	<mark>250</mark>	<mark>9.8</mark>	N/A	N/A	<mark>250</mark>	<mark>9.8</mark>	N/A	N/A
	125	5"	217	8.5	N/A	N/A	250	9.8	N/A	N/A	250	9.8	N/A	N/A
P&ID: Item#: FM-1122	150	<mark>6"</mark>	<mark>232</mark>	<mark>9.1</mark>	N/A	N/A	<mark>300</mark>	<mark>11.8</mark>	N/A	N/A	<mark>300</mark>	<mark>11.8</mark>	N/A	N/A
	200	8"	257	10.1	350	13.8	350	13.8	N/A	N/A	350	13.8	N/A	N/A
	250	10"	284	11.2	450	17.7	450	17.7	N/A	N/A	450	17.7	N/A	N/A
	300	12"	310	12.2	500	19.7	500	19.7	N/A	N/A	500	19.7	N/A	N/A
	350	14"	362	14.3	550	21.7	550	21.7	N/A	N/A	550	21.7	N/A	N/A
	400	16"	387	15.2	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A
	450	18"	418	16.5	600	23.6	600	23.6	N/A	N/A	600	23.6	N/A	N/A
	500	20"	443	17.4	625	24.6	625	24.6	N/A	N/A	680	26.8	N/A	N/A
	600	24"	494	19.4	750	29.5	750	29.5	N/A	N/A	820	32.3	N/A	N/A
	700	28"	544	21.4	875	34.4	875	34.4	N/A	N/A	N/A	N/A	875	34.4
	750	30"	571	22.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	937	36.9
	800	32"	606	23.9	1000	39.4	1000	39.4	N/A	N/A	N/A	N/A	1000	39.4
	900	36"	653	25.7	1125	44.3	1125	44.3	N/A	N/A	N/A	N/A	1125	44.3
	1000	40"	704	27.7	1250	49.2	1250	49.2	N/A	N/A	N/A	N/A	1250	49.2
		42"	704	27.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1250	49.2
	1100	44"	755	29.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1375	54.1
	1200	48"	810	31.9	1500	59.1	1500	59.1	N/A	N/A	N/A	N/A	1500	59.1

D = Outside diameter of flange, see flange tables
SITRANS F M MAGFLO <sup>®</sup>	4. Dimensions and weight
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MAG 5	100 W weight	Nominal size PN 10		PN	l 16	PN	40	Clas	s 150	AWWA			
		mm	inch	kgs	lbs	kgs	lbs	kgs	lbs	kgs	lbs	kgs	lbs
		25	1"	N/A	N/A	N/A	N/A	4	9	4	9	N/A	N/A
		40	1½"	N/A	N/A	N/A	N/A	7	15	6	13	N/A	N/A
	P&ID: Item#: FM-0424	50	<mark>2"</mark>	N/A	N/A	9	<mark>20</mark>	N/A	N/A	8	<mark>20</mark>	N/A	N/A
		65	21⁄2"	N/A	N/A	10.7	24	N/A	N/A	11	24	N/A	N/A
		80	3"	N/A	N/A	11.6	26	N/A	N/A	13	28	N/A	N/A
	P&ID: Item#: FM-0224	100	<mark>4"</mark>	N/A	N/A	<mark>15.2</mark>	<mark>33</mark>	N/A	N/A	<mark>19</mark>	<mark>41</mark>	N/A	N/A
		125	5"	N/A	N/A	20.4	45	N/A	N/A	24	52	N/A	N/A
	P&ID: Item#: FM-1122	150	<mark>6"</mark>	N/A	N/A	<mark>26</mark>	<mark>57</mark>	N/A	N/A	<mark>29</mark>	<mark>64</mark>	N/A	N/A
		200	8"	48	106	48	106	N/A	N/A	56	124	N/A	N/A
		250	10"	64	141	69	152	N/A	N/A	79	174	N/A	N/A
		300	12"	76	167	86	189	N/A	N/A	110	243	N/A	N/A
		350	14"	100	220	116	255	N/A	N/A	131	289	N/A	N/A
		400	16"	127	280	144	317	N/A	N/A	165	364	N/A	N/A
		450	18"	152	335	178	393	N/A	N/A	176	388	N/A	N/A
		500	20"	184	405	232	512	N/A	N/A	235	518	N/A	N/A
		600	24"	258	568	343	736	N/A	N/A	345	761	N/A	N/A
		700	28"	315	693	350	772	N/A	N/A	N/A	N/A	309	681
		750	30"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	480	1058
		800	32"	410	904	442	975	N/A	N/A	N/A	N/A	421	928
		900	36"	512	1129	550	1213	N/A	N/A	N/A	N/A	539	1188
		1000	40"	650	1433	732	1614	N/A	N/A	N/A	N/A	670	1477
			42"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	700	1544
		1100	44"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1100	2426
		1200	48"	990	2183	1106	2439	N/A	N/A	N/A	N/A	1030	2271

The effect of temperature on working pressure MAG 5100 W

Metric (Pressure in bar)								
Sizes 25 mm,	40 mm & :	> 300	mm					
Flange spec.	Flange	nge Temperature °C						
	rating	-5	10	50	90			
EN 1092-1	PN 10	10.0	10.0	9.7	9.4			
	PN 16	16.0	16.0	15.5	15.1			
	PN 40	40.0	40.0	38.7	37.7			
ANSI B16.45	150 lb	19.7	19.7	19.3	18.0			
AWWA C-207	Class D	10.3	10.3	10.3	10.3			
Sizes 50 mm t	o 300 mm	۱						
EN 1092-1	PN 10	10.0	10.0	10.0	8.2			
	PN 16	10.0	16.0	16.0	13.2			
	PN 40	10.0	40.0	40.0	32.9			
ANSI B16.45	150 lb	10.0	19.7	19.7	16.2			

Imperial (Pres	Imperial (Pressure in Psi)					
Sizes 1", 11/2",	& > 12"					
Flange spec.	Flange	Те	mpera	ture °	F	
	rating	25	50	125	200	
EN 1092-1	PN 10	145	145	141	136	
	PN 16	232	232	225	219	
	PN 40	580	580	561	547	
ANSI B16.45	150 lb	286	286	280	261	
AWWA C-207	Class D	150	150	150	150	
Sizes 2" to 12						
EN 1092-1	PN 10	145	145	145	119	
	PN 16	145	232	232	191	
	PN 40	145	580	580	477	
ANSI B16.45	150 lb	145	286	286	235	

#### 4. Dimensions and weight

#### Grounding/protection ring



Type C flanges for liners of neoprene, EPDM,  ${\sf Linatex}^{\tiny{(\!\!R )}}$  and ebonite. Type E flanges for liners of PTFE.

#### Note

MAG 3100 high temperature (PTFE) is always equipped with 2 pcs. type E grounding flanges.



#### SITRANS F M MAGFLO<sup>®</sup>

#### 6. Installation of transmitter



#### Turning the control pad



#### Step 1

Use a screw driver to remove the outer frame.

#### Step 2

Loosen the 4 screws retaining the control pad.

#### Step 3

Withdraw the control pad and turn it to the required orientation.

#### Step 4

Tighten the 4 screws until a mechanical stop is felt in order to obtain NEMA enclosure rating.

#### Step 5

Snap-lock the outer frame onto the control pad (click).

Turning the transmitter



The transmitter can be mounted in either direction as the arrow indicates without turning the terminal box.

The terminal box can be rotated  $\pm 90^{\circ}$  in order to optimize the viewing angle of the transmitter display/keypad:

Unscrew the four screws in the bottom of the terminal box. Turn the terminal box to the required position and retighten the screws firmly.

#### 6. Installation of transmitter

6.2.1 Add-on modules (MAG 6000 only)



# 6.2.2 Remote installation Sensor end



Fit and connect the electrode and coil cables as shown in chapter 7 "Electrical connections". The unshielded cable ends must be kept as short as possible.

The electrode cable and the coil cable must be two separate cables to prevent interference. Tighten the cable glands well to obtain optimum sealing.

The two cables can run in the same conduit.

## 6. Installation of transmitter

6.2.3 Remote installation *Wall mount* 

#### MAG 6000 & MAG 5000



#### Vertical pipe mounting



**Step 3** *(Wall mounting)* Mount wall bracket on a wall or in the back of a panel.

Mount the wall mounting on a vertical or horizontal pipe using an ordinary hose clamp or a duct strap.





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#### 6. Installation of transmitter

#### 6.2.3 Remote installation *Wall mount* (continued)







# Step 4 (Wall mounting)

Remove the SENSORPROM® unitfrom the sensor terminal box. Mount the SENSOR-PROM® unit in the wall mounting terminal box as shown. The text on the SENSOR-PROM® unit must face towards the wall bracket.

Mount an earth wire between PE on the connection board and bottom of connection box.

**Step 5** (Wall mounting) Mount the connection board in the terminal box. Fix the connection board with the two diagonal opposite screws.

Fit the coil, electrode, supply and output cables respectively and tighten the cable glands to obtain optimum sealing. Please see the wiring diagram in chapter 7 for the electrical connections.

#### **Step 6** (Wall mounting) Mount the transmitter on the terminal box.

Attention When remote mounted, power supply PE wire must be connected to PE terminal. Coil cable shield must be connected to SHIELD terminal. Use the supplied insulating tube to insulate the core shield.

#### Caution

Exposing the transmitter to direct sunlight may increase the operating temperature above its specified limit, and decrease display visibility

#### 7. Electrical connection SITRANS F M MAGFLO®



diagram (class 1 power supply).

#### **Mechanical counters**

When connecting a mechanical counter to terminals 57 and 58 (active output), a 1000 µF capacitor must be connected to the terminals 56 and 58. Capacitor + is connected to terminal 56.

#### Output cables

When using long cables in an electrically noisy environment we recommend using shielded cable in metal conduit. See page 15 for max. cable lengths.

#### **Electrode cables**

Dotted connections only to be used when using speical cable.

7.2 Wiring diagram for transmitter and sensor





#### Note

Mount a grounding wire to the PE on the connnection board to ensure sufficient grounding.

#### Cathodic protected piping

Integral mount installation: The transmitter must be supplied through an isolation transformer. The terminal "PE" must not be connected.

#### 7.2.2 Remote installation wall mount NEMA 6 enclosure

#### Sensor cables

- Unshielded cable ends must be as short as possible and the two cables must be kept separate. Cables must not be spliced.
- Terminals 81 and 84 are only connected when double shielded is used. See 2.7.1.
- Coil cable shield must be connected at both ends. Electrode cable shields must be connected at sensor side only.

#### Note

See 5.3 when using cathodic protection.



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## SITRANS F M MAGFLO<sup>®</sup> 7. Electrical connection

#### 7.2.3 Rack mount NEMA 2 enclosure



7.2.4 Wall mount NEMA 4X enclosure

lec.cor





7.2.5 Rack mount with safety barrier NEMA 2 EEx (ia/ib) up to 12"

#### SITRANS F M MAGFLO<sup>®</sup> 7. Electrical connection



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Elec.cor

# SITRANS F M MAGFLO<sup>®</sup> 8. Start-up & programming

8. Commissioning 8.1 Keypad and display layout								
Keypad	The keypad is used to program t	he flowmeter. The function of the keys is as follows:						
	TOP UP KEY	This key (hold 2 sec.) is used to switch between operator menu and setup menu. In the transmitter setup menu, a short press will cause a return to the previous menu.						
	FORWARD KEY	This key is used to step forward through the menus. It is the only key normally used by the operator.						
	BACKWARD KEY	This key is used to step backward through the menus.						
	CHANGE KEY	This key changes the settings or numerical values.						
	SELECT KEY	This key selects the figures to be changed.						
	LOCK/UNLOCK KEY	This key allows the operator to change settings, save changes and gives access to submenus.						
Display	The display is alphanumerical and indicates flow values, flowmeter settings and error messages. The upper line is for primary flow readings and will always show either flow rate, totalizer 1 or totalizer 2. The line is divided into 3 fields.							
	P: Primary field for numerical va U: Unit field	alue						
	The centre line is the title line (T) setup menu.	with individual information according to the selected operator or						
	The lowest line is the subtitle lin individual information independe	e (ST) which either will add information to the title line or keep nt of the title line.						
	F: The alarm field. <b>N</b> Two fla	ashing triangles will appear by a fault condition.						
	M: The mode field. The symbols	s indicate the following.						
	Communication mode	$\checkmark$ Basic settings $\checkmark$ Operator active						
	Y Service mode	→ Output						
	Operator menu	→ External input						
	Product identity	Sensor characteristics						
	🖽 Language mode	⊠ Reset mode						
	L: The lock field. Indicates the	function of the lock key.						
	Ready for change	Access to submenu						
	Value locked (saved)	RESET MODE: Zero setting of totalizers and initialization of setting						

8.2	
Menu	build-up

8.2.1

Password

The menu structure of a specific transmitter type is shown in a menu overview map. Details of how a specific parameter is set is shown in a menu detail map for the specific parameter. A detail map is valid for each type of transmitter if not indicated otherwise. The menu structure is valid for the title and subtitle line only. The upper line is for primary readings only and will always be active with either flowrate, totalizer 1 or totalizer 2.

The menu is built up in two parts. An **operator menu** and a **setup menu**.

#### **Operator menu**

The operator menu is for daily operation. The operator menu is customised in the operator menu setup. The transmitter always starts in operator menu No. 1. The page forward and page backward keys are used to step through the operator menus.

#### Setup menu

The setup menu is for start-up commissioning and service only.

Access to the setup menu is gained by pressing the top up key for 2 seconds. The setup menu operates in two modes:

- View mode
- Setup mode

View mode is a read only mode. The pre-selected settings can only be viewed.

Setup mode is a read and write mode. The pre-selected settings can be scanned and changed. Access to the setup mode is password protected. The factory set password is 1000 (see 8.6.1).

Access to a submenu in the set up menu is gained by the lock key. A short press on a top up key will bring you back to the previous menu. A long press (2 sec.) on the top up key will exit the setup menu and bring you back to operator menu No. 1.



#### The SETUP MENU can be operated in two different modes:

1. VIEW MODE (Read only)

#### 2. CHANGE MODE (Read and write mode)

Access view mode is gained by pressing the forward key when in the password menu.

Access to change mode is password protected. The password is factory set to 1000, but can be changed to any value between 1000 and 9999 in the change password menu.

The factory setting of 1000 can be re-established as follows:

- Switch off power suppply
- Press the TOP UP key and switch on the power supply
- Release the key after ROM and RAM tests are completed

The password is now reset to 1000.

#### 8.3.1 MAG 5000 and MAG 6000



#### 8.3.2 MAG 5000 CT and MAG 6000 CT



#### SITRANS F M MAGFLO<sup>®</sup> 8. Start-up & programming

#### Menu detail





Comma for flow rate, totalizer 1 and totalizer 2 can be individually positioned.

- open the respective window.
- ensure that the cursor is positioned below the comma. Use the SELECT KEY 🖳 .
- move the comma to the requested position. Use the CHANGE KEY 🔂 .

Units are changed by means of the CHANGE KEY 🔂 with the cursor placed below the unit selected. Select units (cursor moved) by means of the SELECT KEY 🖳 .

#### Totalizer 2 is not visible when batch is selected as digital output.

#### SITRANS F M MAGFLO® 8. Start-up & programming

#### Menu detail

8.4.2 **Outputs** 

Current output Proportional to flowrate (Terminal 31 and 32)



Current output gives the following mA, depending on what is selected as error level in basic settings. Fatal: 1.3 mA, permanent: 2 mA, warning: 3 mA

The current output must be turned off when not used.

# Pulse/volume (Terminal 56, 57, 58)



Error level Error number Direction/Limit

: Off Ð 0

0 - 255 

#### SITRANS F M MAGFLO® 8. Start-up & programming

#### Limit/direction



Limit switches are available for both digital as well as relay output.

Direction mode: 1 set point at 0% flow; hysteresis 5%.

If 2 set points must activate 2 separate outputs, a single set point has to be selected individually for digital as well as relay outputs.



#### Note

When batch function is on relay - the pulse/frequency output is not possible.



The relay output must always be used to operate the cleaning unit when a cleaning unit has been installed together with the transmitter. The relay output cannot be used for other purposes.



Batch control is available on MAG 6000 only.

#### 8.4.4 **Relay output**

Cleaning

Batch

digital output)

(MAG 6000 only) Non CT

Start-up & programming

**External input** 

Non CT versions only

8.4.5





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#### SITRANS F M MAGFLO<sup>®</sup> 8. Start-

8.4.8

Service mode



All previous settings are reinitialized when service mode is exited using the top up key 底 .

#### The error system

The error system is divided into an error pending list and a status log list. Time is displayed as days, minutes and hours since the error has occurred. The first 9 standing errors are stored in error pending. When an error is removed it is removed from error pending. The latest 9 errors are stored in the status log. When an error is removed it is still kept in status log. Errors in status log is stored for 180 days.

Error pending and status log are accessible when enabled in the operator menu.

#### SITRANS F M MAGFLO® 8. Start-up & programming

8.4.9

#### Menu setup



The upper line is always active and can never be deselected.

The two lower lines are for individual operator information. Information which the operator can scroll through with the forward key

- A closed lock key 🕑 in the operator menu setup, means that the menu is enabled when viewing the operator menu.
- An open lock key symbol 🕑, means that the menu is not available in the operator menu.

The middle line can either be used as a heading "Text line" for the lower line, or as a flow-reading. A flow reading can be individually selected for each menu.

The lower line may be used for an additional flow reading to the reading already available in the upper line.

#### SITRANS F M MAGFLO<sup>®</sup> 8. Start-up & programming



Software version of add-on module is only available if the add-on module has been installed.

8.4.11 Change password



If you have forgotten your password please refer to 8.2.1 on how to reset your password back to factory setting, 1000.

Menu detail

8.4.12 Language mode



Used to select language.

8. Start-up & programming



8.4.13 HART<sup>®</sup> communication MAG 5000 HART or as add-on module



#### SITRANS F M MAGFLO® 8. Start-up & programming

#### **Operator menu**

8.5.1 **Operator menu** Flow rate



The 1<sup>st</sup> display line is always active and shows the value enabled in the operator menu setup.

- Flow rate
- Totalizer 1
- Totalizer 2 •

The 2<sup>nd</sup> and 3<sup>rd</sup> display lines are individually set in the operator menu. The page forward key = steps through the enabled settings.

- Flow rate •
- Totalizer
- Totalizer reset •
- Batch control
- Batch cycle counter •
- Batch cycle counter reset
- Pipe size •
- Sensor type •
- Pending errors
- Status log •
- Tag No.

8.5.2 **Totalizer reset** 



A totalizer is reset by pressing the lock key when the corresponding totalizer reset window is open.



A batch can be started, paused or stopped from the operator menu, in addition to the externally operated batch control. The batch is controlled using the lock i and the top up keys. The lock key 🗃 :

- Starts the batch •
- Holds the batch (pause) when pressed during batching
- Restarts the batch to continue when pressed during a pause.

The top up key **k** resets a batch completely during a pause.

The accumulated number of performed batches can be viewed when enabled in the operator menu Batch cycle counter setup, please refer to 8.4.9.

The batch cycle counter is reset by pressing the lock key in the "batch cycle counter reset" menu. Batch cycle counter reset

Totalizer

8.5.3 Batch

(Only available on

MAG 6000)

#### 8. Start-up & programming

8.6.1 Factory settings/available settings

The transmitter is delivered with factory settings ready to measure the actual flow.

<b></b>		
Parameter	Factory settings	Available settings
Password		
Default value	1000	
Password	1000	1000 - 9999
Basic settings		
Flow direction	Positive	Positive, negative
Q <sub>max.</sub> (1+2)		3
- Volume units	Dim. dependent	m <sup>3</sup> , ml, l, kl, hl, Ml, ft <sup>3</sup> , in <sup>3</sup> , US G, US kG, US MG, UK G,
	<b></b>	UK MG, US BBL
- Tatal'		Dim. dependent Sec., min., nour, day
Iotalizer 1	Forward	Forward, reverse, net
- Totalizer i units	Dim. dependent	
Tatalizar 0	Deverse	DR G, UR MG, US BBL
Totalizer 2 unita	Reverse Dim dependent	
	Dim. dependent	
Low flow out off	1 5 0/	
Empty pipo	1.5 %	0 - 9.9 %
	Warning	Eatal permanent warning
	warning	r atai, permanent, warning
Current output	Off	On/off_uni-/bidirectional_0/4 - 20 mA
	Uni-directional	Uni-/bidirectional
- Eunction	$4_{-20}$ mA	$0.20 \text{ m}  4.20 \text{ m}  4.20 \text{ m}  \pm \text{ alarm}$
- Time constant	5 \$	0 1 - 30 s
	Pulse	Error direction/limit batch <sup>1</sup> ) frequency pulse error no
Bigital output		off
Relav output	Error	Error, direction/limit, cleaning, error No., off
Direction/limit switch	Off	1 set point/2 set points 100 - 100%
- Hvsteresis	5%	0.0 - 100%
Batch <sup>1)</sup>	Off	
- Batch quantity	0	Dim. dependent
- Batch compensation	0	-100 - 100 m <sup>3</sup>
- Batch counter	Down	Up/down
- Time constant	0.1 s	0.1 - 30 s
Frequency	Off	500 Hz, 1 kHz, 5 kHz, 10 kHz
- Time constant	5 s	0.1 - 30 s
Pulse	On	
<ul> <li>Pulse polarity</li> </ul>	Positive	Positive/negative
- Pulse width	66 ms	64 μs, 130 μs, 260 μs, 510 μs, 1.0 ms, 2.0 ms,
		4.1 ms, 8.2 ms, 16 ms, 33 ms, 66 ms, 130 ms,
		260 ms, 520 ms, 1.0 s, 2.1 s, 4.2 s.
- Volume/pulse	Dim. dependent	Dim. dependent
- Time constant	0.1 s	0.1 - 30 s
Electrode cleaning	Off	Off/cleaning
- Cleaning cycle time	24 h	1 - 240 h
External input		
External input	Off	Batch, reset totalizer, freeze output, forced output, off
- Batch		Start, hold/continue, stop, Q <sub>max.</sub> 2
Sensor characteristics		
Correction factor	1	0.85 - 2.00
Language	English	English, German, French, Danish, Swedish, Finnish,
_		Spanish, Russian, Italian, Portuguese and Polish
Operator menu		
Primary field	Flow rate	Flow rate, Totalizer 1, Totalizer 2
Title/subtitle line	Flow rate, Totalizer 1,	Flow rate, Flow rate %, Q <sub>max.</sub> , Totalizer 1, Totalizer 2,
	totalizer 2, totalizer 1	Totalizer 1 reset, Totalizer 2 reset, Batch start/
	reset, totalizer 2 reset,	paused/stop, Batch cycle counter, Batch cycle
	error pending	counter reset, Sensor size, Sensor type, Error
		pending, Status log, Tag No.

<sup>1)</sup> Batch is available on MAG 6000 only

# SITRANS F M MAGFLO® 8. Start-up & programming

8.6.2	9.6.2 Q <sub>max</sub>									
Dimension dependent			MAG 5	5100 W	MAG	1100,				
factory settings					3100, 3100 W			Volume/	Pulse	Totalizer
MAG 5000 and	[inches]	fac.set.	min.	max.	min.	max.	unit	pulse	unit	unit
MAG 6000 MAG 1100	1/12	0.13	-	-	0.01717	0.69	US GPM	1	US G	US G
	1/8	0.30	-	-	0.02817	1.12	US GPM	1	US G	US G
	1/4	1.5	-	-	0.11	4.4	US GPM	1	US G	US G
	3/8	4.0	-	-	0.31	12.4	US GPM	1	US G	US G
	1/2	10	-	-	0.7	28.0	US GPM	1	US G	US G
	1	25	-	-	1.9	77.8	US GPM	1	US G	US G
	1 <sup>1</sup> / <sub>2</sub>	60	-	-	5.3	198.1	US GPM	1	US G	US G
	2	100	-	-	7.9	308.2	US GPM	1	US G	US G
	21/2	160	-	-	13.2	523.9	US GPM	1	US G	US G
	3	250	-	-	20.3	792.5	US GPM	1	US G	US G
	4	400	-	-	31.3	1,241.6	US GPM	1	US G	US G
MAG 3100	1/2	10	-	-	0.7	28.0	US GPM	1	US G	US G
(ANSI #150, ANSI#300	1	25	1.9	77.8	1.9	77.8	US GPM	1	US G	USG
and AWWA flanges)	1 <sup>1</sup> / <sub>2</sub>	60	5.3	198.1	5.3	198.1	US GPM	1	US G	US G
	2	100	7.0	277.4	7.9	308.2	US GPM	1	US G	US G
	21/2	160	11.0	440.3	13.2	523.9	US GPM	1	US G	US G
	3	250	17.6	704.5	20.3	792.5	US GPM	1	US G	US MG
	4	400	27.7	1,100.7	31.3	1,241.6	US GPM	1	US G	US MG
	5	600	44.0	1,761.1	48.9	1,941.6	US GPM	1	USG	US MG
	6	900	70.4	2,773.8	70.4	2,800.2	US GPM	1	USG	US MG
	8	1,500	110.1	4,402.8	124.6	4,975.2	US GPM	1	USG	US MG
	10	2,500	1/6.1	7,044.5	194.6	7,779.8	US GPM	1	USG	USMG
	12	3,500	277.4	11,007.1	280.5	11,200.8	US GPM	1	USG	USMG
	14	4,500	381.3	15,247.0	381.3	15,247.0	US GPM	1	USG	USMG
	16	6,000	498.0	19.914.0	498.0	19,914.0	US GPM	1	USG	USMG
	18	7,500	630.5	25,206.2	630.5	25,206.2		1	056	USING
	20	9,500	1 1 2 0 5	31,119.2	1 1 2 0 5	31,119.2		1	056	USING
	24	13,500	1,120.5	44.012.0	1,120.5	44,012.0		10		
	20	16,500	1,525.1	70 022 7	1,525.1	00.990.9		10		
	30	21,000	1,751.0	70,022.7	1,751.0	70,022.7		10		
	36	30,000	2 5 2 2 8	100 833 7	2 5 2 2 8	100 833 7		10		
	40	37,000	2,022.0	124 485 7	2,022.0	124 485 7		10		
	40	37,000	3 112 8	124,405.7	3,112.0	124,400.7		10		
	44	45,000	3 765 7	150 625 3	3 765 7	150 625 3	US GPM	10	USG	USMG
	48	53,000	4.482.1	179.261.4	4.482.1	179,261 4	US GPM	10	USG	USMG
	54	73,000	-	-	6,100,1	243,991.8	US GPM	1000	USG	USMG
	60	84,000	-	-	7.002.7	280.095.0	US GPM	1000	USG	USMG
	66	95,000	-	-	7.967.4	318.685.9	US GPM	1000	USG	US MG
	72	120.000	-	-	10.083.8	403.334.8	US GPM	1000	USG	USMG
	78	140.000	-	-	12,449.0	497.947.2	US GPM	1000	USG	USMG
		. 10,000		1	,	1.01,011.2	000111	1000		00110

8.6.3
Dimension dependent
batch and pulse output
settings

	Volume/pulse or batch quantity					
	US G min.	US G max.				
1/12	0.0000095	24				
1/8	0.00000156	40				
1/4	0.0000634	164				
3/8	0.00001717	454				
1/2	0.0000388	1,019				
1	0.0000144	2,826				
11/2	0.000277	7,264				
2	0.000433	11,333				
21/2	0.000732	19,152				
3	0.00111	29,058				
4	0.00173	47,022				
5	0.0027	70,798				
6	0.0039	101,970				
8	0.0069	181,222				
10	0.0011	283,192				
12	0.016	407,881				
14	0.021	555,289				
16	0.028	725,152				
18	0.035	917,733				
20	0.043	1,133,034				
24	0.062	1,631,791				
28	0.085	2,220,894				
32	0.110	2,900,873				
36	0.140	3,671,199				
40	0.173	4,532,400				
48	0.249	6,526,635				
78	0.692	181,129,860				

#### SITRANS F M MAGFLO® 8. Start-up & programming

8.7.1 Error handling

#### Error system

- The transmitter system is equipped with an error and status log system with 4 groups of information. Information without a functional error involved
- Warnings which may cause malfunction in the application. The cause of the error may disappear on its own
- Permanent errors which may cause malfunction in the application. The error requires an operator
- Fatal error which is essential for the operation of the flowmeter

2 menus are available in service and operator menus for registration of information and errors

- Error pending •
- Status log

#### Error pending

The first 9 standing errors are stored in "error pending". When an error is removed it is removed from "error pending".

The acceptance level for "error pending" can be individually configured to a particular application. The acceptance level is set in the "basic settings" in the transmitter setup menu.

Acceptance levels

- Fatal error: Fatal errors are registered as errors
- Permanent errors: Permanent and fatal errors are registered as errors
- Warning (Default value): Warnings, permanent and fatal errors are registered as errors

The error information is displayed in the title and subtitle line. The title line will show the time since occurrence of error. The subtitle line will flash between an error text and a remedy text. The error text will indicate type of error (I, W, P or F), error No. and error text. The remedy text will inform the operator of the action to take to remove the error.



#### Status Log

Like "error pending" except that information, warnings, permanent and fatal errors is always stored in the "status log". The "status log" stores the latest 9 messages received/registered during the last 180 days.

#### Alarm field

The alarm field on the display will always flash with an error pending.

#### **Error output**

The digital and relay output can individually be activated error by error (error level). The relay output is default selected to error level. An output can also be selected to activate on a single error number. The alarm field, error output and error pending always operate together. The analog output turns to a 1 mA level when in the 4-20 mA mode.

#### **Operator menu**

Error pending and status log are as default enabled in the operator menu.

8.7.2 List of error numbers

#### 8. Start-up & programming

Error No.	Error text Remedy text	#Comment	Outputs status	Inp stat
1	I1 - Power on			
0	OK	Power on has happened	Active	Act
2	Applied	A new module has been applied to the system	Active	Act
3	13 - Add-on module			
	Install	An add-on module is defect or has been removed.	Active	Act
4	14 - Param corrected		Active	
7	OK	A less vital parameter in the transmitter has been re- placed by its default value	Active	Act
20	W20 - <i>Totalizer 1</i> Reset manually	During initialisation the check of the saved totalizer value has failed. It is not possible to rely on the saved totalizer value anymore. The totalizer value must be reset manually in order to rely on future readings	Active	Ac
20	W20 - <i>Totalizer</i> 2 Reset manually	During initialisation the check of the saved totalizer value has failed. It is not possible to rely on the saved totalizer value anymore. The totalizer value must be reset manually in order to rely on future readings	Active	Act
21	W21 - Pulse overflow			
	Adj. pulse settings	Actual flow is too big compared with pulse width and volume/pulse	Reduced pulse width	Ac
22	W22 - Batch timeout			
	Check installation	Duration of batching has exceeded a predefined max. time	Batch out- put on zero	Ac
23	W23 - Batch overrun			
	Check installation	Batch volume has exceeded a predefined maximum overrun volume	Batch out- put on zero	Ac
24	W24 - Batch neg. flow			
30	Check flow direction	Negative flow direction during batch	Active	Act
	Adj. Q <sub>max.</sub>	Flow is above Q <sub>max.</sub> settings	Max. 120 %	Ac
31	W31 - Empty pipe	Pipe is empty	Zero	Ac
40	P40 - SENSORPROM <sup>®</sup> Insert/change	SENSORPROM <sup>®</sup> unit not installed	Active	Ac
41	P41 - Parameter range Switch off and on	A parameter is out of range. The parameter could not be replaced by its default value. The error will dis- appear at the next power-on	Active	Ac
42	P42 - Current output Check cables	Current loop is disconnected or the loop resistance	Active	Ac
43	P43 - Internal error		7,0070	- 10
-	Switch off and on	Too many errors occured at the same time Some errors are not detected correctly	Active	Act
44	P44 - CT SENSORPROM®	SENSORPROM <sup>®</sup> unit has been used as CT version	Active	Ac
60	F60 - CAN comm. error		1	
	Transmitter/AOM	CAN bus communication error. An add-on module, the display module or the transmitter is defect	Zero	Inad
61	F61 - SENSORPROM® error			
	Replace	It is not possible to rely on the data in SENSOR- PROM <sup>®</sup> unit anymore	Active	Ac
62	F62 - SENSORPROM® ID			
	Replace	The SENSORPROM <sup>®</sup> unit ID does not comply with the product ID. The SENSORPROM <sup>®</sup> unit is from another type of product MASSEL O <sup>®</sup> SONOEL O <sup>®</sup> or c	Zoro	Inor
			200	
63		It is not possible to read from the SENSOPPOM®		
63	Replace	unit anymore	Active	Act
63	Replace F70 - Coil current	unit anymore.	Active	Act
63 70	F70 - Coil current Check cables	Coil excitation has failed	Active Active	Act Act

SITRANS F M MAGFLO®	9. Service
9. Service	Often problems with unstable/wrong measurements occur due to insufficient/wrong grounding or potential equalization. Please check connection. If OK, the SITRANS F M MAGFLO <sup>®</sup> transmitter can be checked as described under 9.1 and sensor under 9.3.
9.1 Transmitter check list	When checking SITRANS F M MAGFLO <sup>®</sup> installations for malfunction the easiest method to check the transmitter is to replace it with another MAG 5000/6000 transmitter with a similar power supply
	A replacement can easily be done as all settings are stored in and downloaded from the SENSORPROM <sup>®</sup> unit - no extra settings need to be made.

If no spare transmitter is available - then check transmitter according to check table.



## SITRANS F M MAGFLO<sup>®</sup> 9

9. Service

9.2	
Trouble shooting	
MAG 5000 and MAG	G 6000

Symptom	Output	Error	Cause	Remedy	
	signals	code			
Empty display	Minimum		1. No power supply	Power supply	
				Check MAG 5000/6000 for	
				bended pins on the connector	
			2. MAG 5000/6000 defective	Replace MAG 5000/6000	
No flow signal	Minimum		1. Current output disabled	Turn on current output	
			2. Digital output disabled	Turn on digital output	
			3. Reverse flow direction	Change direction	
		F70	Incorrect or no coil current	Check cables/connections	
		W31	Measuring pipe empty	Ensure that the measuring	
				pipe is full	
		F60	Internal error	Replace MAG 5000/6000	
	Undefined	P42	1. No load on current output	Check cables/connections	
		<b>D</b> 44	2. MAG 5000/6000 defective	Replace MAG 5000/6000	
		P41	Initializing error	Switch off MAG 5000/6000,	
Indiantes flow	Lindafinad		Managering pine anoth	Select empty pine out off	
with no flow	Underined		Empty pipe empty	Select empty pipe cut-oli	
in pipe			Empty pipe cut-on is OFF		
			Electrode connection missing/	Figure that electrode cable	
			electrode cable is insufficiently	is connected and sufficiently	
			screeped	screened	
Unstable	Linstable		1 Pulsating flow	Increase time constant	
flow signal	Unstable		2 Conductivity of medium		
			too low	Use special electrode cable	
			3 Electrical noise potential	Ensure sufficient potential	
			between medium and	equalization	
			sensor	oqualization	
			4. Air bubbles in medium	Ensure medium does not	
				contain air bubbles	
			5. High concentration of par-	Increase time constant	
			ticles or fibres		
Measuring error	Undefined		Incorrect installation	Check installation	
		P40	No SENSORPROM <sup>®</sup> unit	Install SENSORPROM <sup>®</sup> unit	
		P44	CT SENSORPROM <sup>®</sup> unit	Replace SENSORPROM <sup>®</sup> unit	
				or reset SENSORPROM <sup>®</sup> unit	
				with MAG CT transmitter	
		F61	Deficient SENSORPROM <sup>®</sup> unit	Replace SENSORPROM® unit	
		F62	Wrong type of SENSORPROM®	Replace SENSORPROM <sup>®</sup> unit	
			unit		
		F63	Deficient SENSORPROM <sup>®</sup> unit	Replace SENSORPROM <sup>®</sup> unit	
		F71	Loss of internal data	Replace MAG 5000/6000	
	Maximum	W30	Flow exceeds 100% of Q <sub>max.</sub>	Check Q <sub>max.</sub> (Basic Settings)	
		VV21	Pulse overflow		
			volume/pulse too small	Change volume/pulse	
Moncuring			Fuise width too large		
approx. 50%			connection	GHECK CADIES	
Loss of totalizer	ОК	W20	Initializing error	Reset totalizer manually	
data					
#####	OK		Totalizer roll over	Reset totalizer or increase	
Signs in display				totalizer unit	

9. Service

#### 9.3 Check list MAG sensor

#### ATTENTION!

If there is leakage from MAG 1100/3100/3100 W or MAG 5100 W and the unit has been used to measure inflammable/explosive liquids, there might be a risk of explosion when checking with a megger.

#### Disconnect all leads to MAG 1100/3100/3100 W or MAG 5100 W





#### 9.4 **Coil resistance table**

			Coil resis	tance			
	MAG 1100	MAG 3100		MAG 3100 W		MAG 5100 W	
Inches	Resistance	Resistance	Tolerance	Ohms	Tolerance	Ohms	Tolerance
<sup>1</sup> / <sub>12</sub>	104 Ω +/– 5	104			ξ		
1/8	104 Ω +/– 5	104			5		
1/4	98 Ω +/– 4	104			ξ		
3/8	98 Ω +/- 4	104			5		
$1/2^{1}$	98 Ω +/- 4	104			5		
1	98 Ω +/- 4	104	+/- 2	104	+/-2	104	+/- 2
$1^{1}/_{2}$	98 Ω +/- 4	92	+/- 2	92	+/- 2 🕻	92	+/- 2
2	98 Ω +/- 4	92	+/- 2	92	+/-2	124	+/- 4
$2^{1/2}$	98 Ω +/- 4	100	+/- 2	100	+/-2	127	+/- 4
3	98 Ω +/- 4	94	+/- 2	94	+/-2	126	+/- 4
4	98 Ω +/- 4	92	+/- 2	92	+/-2	125	+/- 4
5		92	+/- 2	92	+/-2 >	126	+/- 4
6		94	+/- 2	94	+/-2	116	+/- 4
8		90	+/- 2	90	+/-2	109	+/- 4
10		92	+/- 2	92	+/- 2	104	+/- 4
12		100	+/- 2	100	+/-2	108	+/- 4
14		112	+/- 2	112	+/-2	112	+/- 2
16		100	+/- 4	100	+/- 4 🕻	100	+/- 4
18		108	+/- 4	108	+/- 4	108	+/- 4
20		122	+/- 4	122	+/- 4 🕻	122	+/- 4
24		115	+/- 4	114	+/- 4 >	114	+/- 4
28		128	+/- 4	112	+/- 4 2	112	+/- 4
30		133			3		
32		128	+/- 4	127	+/- 4	127	+/- 4
36		131	+/- 4	93	+/- 4 >	93	+/- 4
40		131	+/- 4	103	+/- 4	103	+/- 4
44		126			7		
48		130	+/- 4	124	+/- 4	124	+/- 4
54		130			7		
60		124			3		
66		133			5		
72		133			3		
78		147			5		
			1		1 (	1	

1) On MAG 1100 1/2" produced as from May 1999 the coil resistance must be 86-other, 48/4 ohm

All resistance values are at 7  $^{\circ}\text{F}.$  The resistance changes proportionally 0.22 %/ $^{\circ}\text{F}.$ 

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are always welcomed.

Technical data subject to change without prior notice.

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# ...with the dedicated SITRANS F M program

#### Greater flexibility

- Wide product program
- Compact or remote installation using the same transmitter/sensor
- USM II communication platform for easy integration with all systems

#### Easier commisioning

- SENSORPROM enables instant measurement from the start of power-up
- User-configured settings automatically stored in the SENSORPROM

#### Easier operation and maintenance

- No moving parts
- Robust construction and materials
- Uniform user interface for all SITRANS F M products

#### Easier service

 Transmitter replacement requires no programming. SENSORPROM automatically updates all settings after initialization

#### Room for growth

- Plug and Play communication modules are available in a wide range of bus protocols
- Add-on communication modules allow future upgrades without investing in a new flowmeter

#### Diagnostics: Application and metering

- · Identification in clear text and error-log
- Error categories: function; warning; permanent and fatal errors
- Transmitter self-check including outputs
- Sensor check
- Overflow
- Empty pipe; partial filling; low conductivity; electrode fouling
- System verification with SITRANS F M Verificator

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You can start with a stand-alone installation today, secure in the knowledge that you can always integrate your system tomorrow.

- Confirm flowmeters are operating optimally and are properly utilized
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- Access real-time flow data
- Generate the highest yield by reducing waste and costs
- SIMATIC PDM software tool for the operation, configuration, parameterization, maintenance and diagnosis of intelligent field instruments based on the worldwide leading EDDL standard

PDM

SIMATIC PDM allows a wide variety of process devices to be configured using one software system and one uniform graphical user interface.

## Transmitter program What is right for you?



#### MAG 5000 and MAG 6000

The transmitters are specially designed to offer high performance, easy operation and reduced maintenance. MAG 5000 is the truly robust solution for all-around applications.

MAG 6000 is for the more demanding applications where higher accuracy and greater functionality is required.

The MAG 6000 offers bus communication modules and integrated batch functionalities.



#### MAG 6000 Industry

This transmitter is designed for the special demands in the process industry. The robust, full metal housing provides superb protection, even in the harshest industrial environments. Full input and output functionality is given even in the ATEX EEx d version.

Guaranteed performance – MAG 5000, MAG 6000 and MAG 6000 Industry

- Compact or remote installation
- Superior signal resolution for optimized turn-down ratio
- Digital Signal Processing with unlimited possibilities
- User-configurable operation menu with password protection
- Multiple functional output for process control
- Self-diagnostics for error detection and logging
- Batch control
- Multi-lingual display
- Custody transfer approved
- Optional electrode cleaning unit for special applications
- Add-on bus communication modules

Transmitter	MAG 5000 / MAG 5000 CT	MAG 6000 / MAG 6000 CT	MAG 6000 I	MAG 6000 l (Ex d)			
Enclosure	IP67 / NEMA 4X or IP20/6	6 / NEMA 2/4 Polyamide	IP67 / NEMA 4X die-cast aluminium				
Max measuring error	0.50 % of rate	0.25 % of rate	0.25 % of rate	0.25 % of rate			
Display		3-line alpha numeri	c LCD with backlight				
Inputs & outputs	1	digital input, 1 current output, 1 p	ulse/frequency output, 1 relay ou	tput			
Communication	HART	HART; Profibus P	A/DP; Modbus RTU	HART; Profibus PA			
Batch function	No	Yes	Yes	Yes			
Power supply	12–24 V AC/DC	/ 115–230 V AC	18–90 V DC / 115–230 AC	18–30 V DC / 115–230 V AC			
Approvals	FM/CSA Cla	ass 1, Div 2	FM/CSA Class 1, Div 2	ATEX II 2GD			
Custody transfer approval	Cold water pattern approval - MI-001, OIML R 49, PTB	Cold water pattern approval - MI-001, OIML R 49, DANAK TS 22.36.001, PTB. Heat meter pattern approval - OIML R 75. Hot water pattern approval - PTB. Other media than water - OIML R 117					

## Sensor program Sensible. Flexible. Reliable

#### MAG 1100

The flangeless wafer design meets all flange standards. The MAG 1100 is used in all industries where the corrosion-resistant stainless steel housing and the highly resistant liner and electrodes fit even the most extreme process media.

#### MAG 1100 F

Especially designed for the food & beverage and pharmaceutical industry, MAG 1100 F offers unique and flexible process connections. It meets all sanitary requirements and is 3A certified. Its performance is unaffected by suspended solids, viscosity and temperature challenges.

#### MAG 5100 WATER

A sensor for all water and wastewater applications. With its coned design, increased low-flow accuracy is achieved making it especially useful for leak detection. It is suitable for direct burial and constant flooding. MAG 5100 W complies with drinking water and custody transfer approvals.

#### MAG 3100 P

A sensor for process and chemical industries in the most common combinations with PFA/PTFE liner and Hastelloy electrodes. Especially designed to withstand harsh environments with strong chemicals, high temperature and pressure.

#### MAG 3100

This flexible and comprehensive sensor program offers a wide range of sizes. Liners and measuring electrodes capable of withstanding the most extreme processes are available. Fully welded construction provides a ruggedness that suits the toughest environments.



#### Flow measurement based on Faraday's law

The coils in the sensor generate a consistent magnetic field. The liquid flowing through the sensor induces a voltage proportional to the flow velocity.

Sensor	MAG 1100	MAG 1100 F	MAG 3100	MAG 3100 P	MAG 5100 W
Size DN	2–100 mm / <sup>1</sup> \ <sub>12</sub> "–4"	10–100 mm / ⊠"–4″	15–2000 mm / ½"–78"	DN 15-300 / 1/2"-12"	25–1200 mm / 1"–48"
Process temperature	-20–200 °C / 4–390 °F	-30–150 °C / -20–300 °F	-40–180 °C / -4–356 °F	-20–150 °C / -4–300 °F	<mark>-10–70 °C / 14–158 °F</mark>
Pressure rating max.	PN 40 / M	ax 580 psi	PN 100 / Max 1450 psi* / ANSI 150 & 300 / AWWA D / AS 2129 / AS 4087	PN 40 / Max 580 psi / ANSI 150	PN 10 & 16 / ANSI 150 / AWWA D / AS 4087
Liner material	Cera Pl	amic FA	Neoprene, EPDM, Ebonite, LINATEX, PTFE, NOVOLAK	PTFE PFA	NBR Hard Rubber, EPDM
Electrode material	Plati Haste	num Iloy C	AISI 316 Ti, Hastelloy C, Titanium, Tantalum,	Hastelloy C276	Hastelloy C276
Approvals	ATEX II 2GD	ATEX II 2GD, 3A, EHEDG design, FDA	ATEX II 2GD	ATEX II 2GD	Drinking Water WRAS; NSF/ANSI Standard 61; DVGW; Belgaqua; ACS
			FM/CSA Class 1, Div 2		
Custody transfer approvals	Cold water pattern approval - PTB. Heat meter pattern approval - OIML R 75 Hot water pattern approval - PTB Other media than water - OIML R 117	Cold water pattern approval - PTB. Hot water pattern approval - PTB. Other media than water - OIML R 117	Cold water pattern approval - DANAK TS 22.36.001, PTB. Heat meter pattern approval - OIML R 75. Hot water pattern approval - PTB. Other media than water - OIML R 117	Cold water pattern approval - DANAK TS 22.36.001, PTB. Heat meter pattern approval - OIML R 75. Hot water pattern approval - PTB. Other media than water - OIML R 117	Cold water pattern approval - MI-001, OIML R 49, PTB

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## Water and wastewater SITRANS F M for water processes



#### Cost-effective solution

## The MAG 5000 transmitter and MAG 5100 W sensor are the perfect match for a cost-effective solution.

- One solution for all your water and wastewater applications
- No moving parts ensures long-term performance
- NBR Hard Rubber liner guarantees consistent accuracy
- Highly resistant to a wide range of chemicals used in treatment plants
- Increased low-flow measurement for leak detection
- Sensor suitable for burial and constant flooding
- Drinking water approvals
- Complies with most international standards and approvals
- Built-in ground electrodes eliminate grounding straps on steel pipes and grounding rings on plastic pipes

#### Process optimization

MAG 6000 with the USM II add-on communication platform makes it easy to integrate SITRANS F M into your applications, thus ensuring a total integrated solution throughout the entire plant.

Realize the full benefits of automation

- Optimize management and process control
- Ensure correct dosing and product quality
- Minimize process time and consumption of high-cost chemicals

#### The Siemens product range provides sensors from 2 mm up to 2000 mm (from <sup>1</sup>/12" up to 78".)



## Additional products



## Continuous accuracy Verifiable confidence





#### Calibration

Validated calibration ensures accurate flow measurement. Every Siemens flowmeter is calibrated at facilities that are individually accredited in accordance with ISO / IEC 17025 by UKAS, DANAK and traceable to NIST. A calibration certificate is shipped with every Siemens sensor.

- High-accuracy rigs with better than 0.1% calibration uncertainty
- UKAS accredited calibration laboratory #0301
- Documentation for ISO 9001 and ISO 14001
   management system

Meter performance

Thanks to their reliable performance, electromagnetic flowmeters are those mostly recommended for measurement of conductive liquids.



## The best flowmeter for the job

Siemens offers the ultimate flexibility in its range of flowmeters. For a given task, we can often provide solutions based on two or three different technologies. The broadness of our range means we always find the best flowmeter for the job. Sensors and transmitters can be combined and adapted to meet any need in just about any industry. The overview makes it easy to select just the right SITRANS F M flowmeter solution for your application.

		MAG 5000	MAG 6000	MAG 6000 I	MAG 6000 I Ex d	MAG 3100 / 3100 HT	MAG 3100 P	MAG 5100	MAG 1100 F	MAG 1100 / 1100 HT	MAG 8000	TRANSMAG 2 / 911/E
	Abstraction	٠	٠	O		٠		٠			•	
×	Water treatment	٠	•	O		0	O	٠		٠		
ater 8	Distribution	٠	٠	•		0	O	٠			•	
, Wast	Revenue/billing	٠	٠			0	O	٠			•	
tewat	Wastewater treatment	٠	٠	O	0	0	O	٠		٠		
er	Re-use/filtration	٠	٠	O		0	O	٠				
	Irrigation		٠			•		•			•	
ç	Basic Chemicals	0	٠	٠	•	•	•	●		0		0
nemio	Fibers & Foils	0	٠	٠	•	•	•	0		٠		0
cal In	Speciality Chemicals		٠	0	٠	٠	٠	0		0		0
dusti	Fine Chemicals	0	•	0	•	•	•	0		٠		0
Ŷ	Bio Chemicals	0	•	٠	٠	•	•	٠		٠		0
an F	Food	•	•	O		0	O	٠	•	٠		
ood a d Pha	Dairy	٠	٠	O		٠	•	٠	•			
s Bev arma	Soft drink	•	٠						•	٠		
'erag ceuti	Beverages	٠	٠			•	•	٠	٠	٠		
e	Pharmaceutical	0	٠	•	٠	•	•		•	0		
N Cer Pult	Mining	0	•	•		•	•	٠		0		•
Nining nent a o & Pa	Cement	0				•	•	٠		0		•
), and Iper	Pulp & Paper	0	٠	•		•	•	٠		٠		•
Power and Utilities	District cooling and chillers	•	•	•	•	•	•	•		0	0	
<u>0</u>	Upstream	0	٠	•	0	•	•	٠		0		
۵ % I	Midstream	0	٠	•	0	•	•	٠		0		
as	Downstream	0	•	•	0	•	•	٠		0		

#### Unique features



#### Communication modules The USM II makes flowmeter networking installation and configuration easy. It is compatible with virtually every communication standard.



#### Touchpad Touch response keypad with LED light feedback for safe and easy operation.



#### SENSORPROM

During the calibration process, measurement parameters and "Fingerprint" data, are stored in the SENSORPROM memory:

- Sensor information and identification
- Calibration parameters
- Fingerprint parameters
- Default flowmeter settings



In-situ SITRANS F M Verification Your guarantee for continuous accurate measurement.

- Correct revenue metering
- Confidence in process and product quality
- As handover of new installations to
   ensure correct installation
- ISO 9001 and ISO 14001



## INSTRUCTIONS

### SITRANS F M MAGFLO<sup>®</sup> Electromagnetic flowmeter type MAG 5100 W

Siemens Flow Instruments SITRANS F M MAGFLO® electromagnetic flowmeters consist of a Introduction sensor and a transmitter. These instructions only describe the sensor installation. For further information on the transmitter installation, please refer to the SITRANS F M MAGFLO® handbook. **Dimensions and** MAG 5100 W, compact/separate weight 131(5.16) ■155(6.10)-4−155(6.10) 2 3696 PG 13.5 PG 13 5 Ł à Ш Í¢ ¢ ſ∉ Dimensions L. Nominal Α **PN 10 PN 16** PN 40 AWWA size Class 150 inch inch inch mm inch mm mm inch mm inch mm mm mm inch 25 200 N/A N/A 1" 187 7.4 N/A N/A N/A N/A 200 7.9 7.9 40 197 7.8 N/A N/A 200 7.9 200 7.9 N/A N/A 11/2 N/A N/A FM-0424 50 2" 188 7.4 N/A 7.9 N/A N/A 200 7.9 N/A N/A N/A 200 65 21/2 194 7.6 N/A N/A 200 7.9 N/A N/A 200 7.9 N/A N/A 80 3" 7.9 N/A 7.9 N/A N/A 7.9 200 N/A 200 200 N/A N/A FM-0224 100 207 8.1 N/A 9.8 N/A N/A 250 9.8 N/A N/A 4" N/A 250 125 8.5 N/A 250 9.8 N/A N/A 250 9.8 N/A 5' 217 N/A N/A FM-1122 150 9.1 N/A 300 11.8 N/A N/A 11.8 N/A N/A 6 232 N/A 300 200 8' 257 10.1 350 13.8 350 13.8 N/A N/A 350 13.8 N/A N/A 250 10' 284 11.2 450 17.7 450 17.7 N/A N/A 450 17.7 N/A N/A 300 12.2 500 19.7 19.7 N/A N/A 500 19.7 N/A N/A 12' 310 500 14.3 21.7 21.7 N/A N/A N/A N/A 350 14 362 550 550 550 21.7 400 16' 387 15.2 600 23.6 600 23.6 N/A N/A 600 23.6 N/A N/A 16.5 N/A N/A N/A 450 18' 418 600 23.6 600 23.6 N/A 600 23.6 500 17.4 24.6 N/A N/A 20 443 625 24.6 625 N/A 680 26.8 N/A 600 24' 494 19.4 750 29.5 750 29.5 N/A N/A 820 32.3 N/A N/A 700 28 544 21.4 875 34.4 875 34.4 N/A N/A N/A N/A 875 34.4 750 30' 571 22.5 N/A N/A N/A N/A N/A N/A N/A N/A 937 36.9 23.9 1000 N/A N/A N/A 800 32" 606 39.4 1000 39.4 N/A 1000 39.4 900 36 653 25.7 1125 44.3 1125 44.3 N/A N/A N/A N/A 1125 44.3 1000 40' 704 27.7 1250 49.2 1250 49.2 N/A N/A N/A N/A 1250 49.2 42' 704 27.7 N/A N/A N/A N/A N/A N/A N/A N/A 1250 49.2 44 755 29.7 N/A N/A 54.1 1100 N/A N/A N/A N/A N/A N/A 1375 1200 48" N/A N/A N/A 810 31.9 1500 59.1 1500 59.1 N/A 1500 59.1

Weight	Nomir	al size	PN	I 10	PN	116	PN	<b>4</b> 0	Clas	s 150	AW	/WA
	mm	inch	kgs	lbs	kgs	lbs	kgs	lbs	kgs	lbs	kgs	lbs
	25	1"	N/A	N/A	N/A	N/A	4	9	4	9	N/A	N/A
	40	1½"	N/A	N/A	N/A	N/A	7	15	6	13	N/A	N/A
FM-0424	<mark>50</mark>	<mark>2"</mark>	N/A	N/A	9	20	N/A	N/A	8	20	N/A	N/A
	65	21⁄2"	N/A	N/A	10.7	24	N/A	N/A	11	24	N/A	N/A
	80	3"	N/A	N/A	11.6	26	N/A	N/A	13	28	N/A	N/A
FM-0224	<mark>100</mark>	<mark>4"</mark>	N/A	N/A	<mark>15.2</mark>	<mark>33</mark>	N/A	N/A	<mark>19</mark>	<mark>41</mark>	N/A	N/A
	125	5"	N/A	N/A	20.4	45	N/A	N/A	24	52	N/A	N/A
FM-1122	<mark>150</mark>	<mark>6"</mark>	N/A	N/A	<mark>26</mark>	<mark>57</mark>	N/A	N/A	<mark>29</mark>	<mark>64</mark>	N/A	N/A
	200	8"	48	106	48	106	N/A	N/A	56	124	N/A	N/A
	250	10"	64	141	69	152	N/A	N/A	79	174	N/A	N/A
	300	12"	76	167	86	189	N/A	N/A	110	243	N/A	N/A
	350	14"	100	220	116	255	N/A	N/A	131	289	N/A	N/A
	400	16"	127	280	144	317	N/A	N/A	165	364	N/A	N/A
	450	18"	152	335	178	393	N/A	N/A	176	388	N/A	N/A
	500	20"	184	405	232	512	N/A	N/A	235	518	N/A	N/A
	600	24"	258	568	343	736	N/A	N/A	345	761	N/A	N/A
	700	28"	315	693	350	772	N/A	N/A	N/A	N/A	309	681
	750	30"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	480	1058
	800	32"	410	904	442	975	N/A	N/A	N/A	N/A	421	928
	900	36"	512	1129	550	1213	N/A	N/A	N/A	N/A	539	1188
	1000	40"	650	1433	732	1614	N/A	N/A	N/A	N/A	670	1477
		42"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	700	1544
	1100	44"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1100	2426
	1200	48"	990	2183	1106	2439	N/A	N/A	N/A	N/A	1030	2271

## The effect of temperature on working pressure

Metric (Pressures in bar)									
Sizes 25 mm, 40 mm & > 300 mm									
Flange spec.	Flange	Те	mpera	ture °(	0				
	rating	-5	10	50	90				
EN 1092-1	PN 10	10.0	10.0	9.7	9.4				
	PN 16	16.0	16.0	15.5	15.1				
	PN 40	40.0	40.0	38.7	37.7				
ANSI B16.45	150 lb	19.7	19.7	19.3	18.0				
AWWA C-207	Class D	10.3	10.3	10.3	10.3				
Sizes 50 mm to	o 300 mm								
EN 1092-1	PN 10	10.0	10.0	10.0	8.2				
	PN 16	10.0	16.0	16.0	13.2				
ANSI B16.45	150 lb	10.0	19.7	19.7	16.2				

Imperial (Pressures in Psi)									
Sizes 1", 1½", & > 12"									
Flange spec.	Flange	Те	mpera	ture °	F				
	rating	23	50	120	200				
EN 1092-1	PN 10	145	145	141	136				
	PN 16	232	232	225	219				
	PN 40	580	580	561	547				
ANSI B16.45	150 lb	286	286	280	261				
AWWA C-207	Class D	150	150	150	150				
Sizes 2" to 12"	1								
EN 1092-1	PN 10	145	145	145	119				
	PN 16	145	232	232	191				
ANSI B16.45	150 lb	145	286	286	235				

#### Installation, general



Reading and operating the flowmeter is possible under almost any installation conditions because the display can be oriented in relation to the sensor. To ensure optimum flow measurement attention should be paid to the following:

The sensor must always be completely full with liquid.

Therefore avoid:

836274.10

336275.10

- Installation at the highest point in the pipe system
- Installation in vertical pipes with free outlet

For partially filled pipes or pipes with downward flow and free outlet the flowmeter should be located in a U-tube.

#### Installation in vertical pipes

Recommended flow direction: upwards. This minimizes the effect on the measurement of any gas/air bubbles in the liquid.



#### SITRANS F M MAGFLO® Electromagnetic flowmeter type MAG 5100 W

## Installation, general

(continued)



#### **Potential equalisation**



Potential equalisation is carried out with the built-in earthing electrodes.

## Cathodic protected piping



Special attention must be given to systems with cathodic protection.

By compact mounting:

The transmitter must be supplied through an isolation transformer. The terminal "PE" must never be connected.

By remote mounting:

The screen must only be connected at the sensor end via a 1.5  $\mu$ F condensator. The screen must never be connected at both ends. *By isolated sensor:* 

If above mentioned connections are unacceptable the sensor must be isolated from the pipe work.

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## Maximum allowable torques



Standard bolts must be well lubricated and tightened evenly around the gasket. Leakage/damage to the flowmeter or piping may arise if bolts are overtightened.

	Nomir	nal size	PN	PN 10		PN 16		PN 40		Class 150		AWWA	
	mm	inch	Nm	f/lbs	Nm	f/lbs	Nm	f/lbs	Nm	f/lbs	Nm	f/lbs	
	25	1"	N/A	N/A	N/A	N/A	10	7	7	5	N/A	N/A	1
	40	11⁄2"	N/A	N/A	N/A	N/A	16	12	9	7	N/A	N/A	
FM-0424	<mark>50</mark>	<mark>2"</mark>	N/A	N/A	<mark>25</mark>	<mark>18</mark>	N/A	N/A	<mark>25</mark>	<mark>18</mark>	N/A	N/A	
	65	21⁄2"	N/A	N/A	25	18	N/A	N/A	25	18	N/A	N/A	
	80	3"	N/A	N/A	25	18	N/A	N/A	34	25	N/A	N/A	
FM-0224	100	<mark>4"</mark>	N/A	N/A	<mark>25</mark>	<mark>18</mark>	N/A	N/A	<mark>26</mark>	<mark>19</mark>	N/A	N/A	
	125	5"	N/A	N/A	29	21	N/A	N/A	42	31	N/A	N/A	
FM-1122	<mark>150</mark>	<mark>6"</mark>	N/A	N/A	<mark>50</mark>	<mark>37</mark>	N/A	N/A	<mark>57</mark>	<mark>42</mark>	N/A	N/A	
	200	8"	50	37	50	37	N/A	N/A	88	65	N/A	N/A	
	250	10"	50	37	82	61	N/A	N/A	99	73	N/A	N/A	
	300	12"	57	42	111	82	N/A	N/A	132	97	N/A	N/A	
	350	14"	60	44	120	89	N/A	N/A	225	166	N/A	N/A	
	400	16"	88	65	170	125	N/A	N/A	210	155	N/A	N/A	
	450	18"	92	68	170	125	N/A	N/A	220	162	N/A	N/A	
	500	20"	103	76	230	170	N/A	N/A	200	148	N/A	N/A	
	600	24"	161	119	350	258	N/A	N/A	280	207	N/A	N/A	
	700	28"	200	148	304	224	N/A	N/A	N/A	N/A	200	148	
	750	30"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	240	177	
	800	32"	274	202	386	285	N/A	N/A	N/A	N/A	260	192	
	900	36"	288	213	408	301	N/A	N/A	N/A	N/A	240	177	
	1000	40"	382	282	546	403	N/A	N/A	N/A	N/A	280	207	
		42"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	280	207	
	1100	44"	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	290	214	
	1200	48"	395	292	731	539	N/A	N/A	N/A	N/A	310	229	

#### **Torque calculations**

All values are theoretical and are calculated making the following assumptions:

1) All bolts are new and material selection is according to EN 1515-1 table 2

- 2) Gasket material not exceeding 75 shore A durometer is used between the flowmeter and mating flanges
- 3) All bolts are galvanized and adequately lubricated
- 4) The values are calculated for use with carbon steel flanges
- 5) Flowmeter and mating flanges are correctly aligned

Manufacturer's design and safety statement

- 1. Responsibility for the choice of lining and electrode materials with regard to their abrasion and corrosion resistance lies with the purchaser; the effect of any change in process medium during the operating life of the flowmeter should be taken into account. Incorrect selection of lining and/or electrode materials could lead to a failure of the flowmeter.
  - 2. Stresses and loading caused by earthquakes, traffic, high winds and fire damage not taken into account during flowmeter design.
  - 3. Do not install flowmeter such that it acts as a focus for pipeline stresses. External loadings not taken into account during flowmeter design.
  - 4. During operation do not exceed the pressure and/or temperature ratings indicated on the data label or in the installation instructions.
  - 5. It is recommended that all installations should include an appropriate safety valve and adequate means for draining/venting.
  - 6. Under the Pressure Equipment Directive this product is a pressure accessory, and not approved for use as a safety accessory, as defined by the Pressure Equipment Directive.
  - 7. Removal of the terminal box except by Siemens Flow Instruments or their approved agents will invalidate the PED conformity of the product.

In accordance with the Pressure Equipment Directive (97/23/EC).

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any are always welcomed.

Technical data subject to change without prior notice

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## SECTION 14e: ACCESSORIES FOR PROCESS TREATMENT

## Carbon Feed System Pre & Post Anoxic

P&ID: Item #: AIC-0321, ORP-0321, ORP-0721

Unit Details: Walchem Series WDP420-5-2-5 Dual Controller for:

Pre and Post Anoxic Tanks: pH probes

• Walchem Electrodes WEL MVF-2-1

Aeration Tank pH System & UF Membrane pH Monitoring

P&ID: Item #: AIC-0421, pH-0421, pH-0821

Unit Details: Walchem Series WDP420-5-2-N pH Controller for:

Aeration Tank: pH probes

• Walchem Electrodes WEL PHF-2-1

UF Membrane System pH probes

- Walchem Pre Amp 190783
- Sensorex BV1 Ball Valve
- S656CD Electrode
- S675 12" Insertion Assembly

<u>Effluent pH Monitoring</u>

P&ID: Item #: AI-1126, pH-1126, pH-1128

Unit Details: Walchem Series WDP410-5-2-N pH Monitor

• Walchem Pre Amp 19078

### Effluent ph probes

- Sensorex BV1 Ball Valve
- S656CD Electrode
- S675 12" Insertion Assembly

Manufacturers: Sensorex 11751 Markon Drive Garden Grove, CA 92841 Phone: (714) 895-4344 Fax: (714) 864-4839 <u>www.sensorex.com</u>

Walchem 5 Boynton Road Holliston, MA 01746 Phone: (508) 429-1110 Fax: (508) 429-7433 www.walchem.com Local Distributor/Contact: Maltz Sales 905 Turnpike Street Canton, MA 02021 Phone: (781) 821-4400 Fax: (781) 821-1314 www.maltzsales.com

# pH/ORP Controllers

## WPH/WDP400 Series

The WPH/WDP400 Series pH/ORP on-line process controllers are designed for a broad range of industrial, commercial, and municipal water treatment applications. WPH/WDP controllers are easily configured to accurately measure pH or mV (ORP) values from Walchem's WEL and WDS differential combination electrodes, or any conventional combination electrode.

A versatile output configuration allows you to program up to four outputs in a variety of control modes. Select from on/off mechanical relays or pulse proportional control for direct connection to metering pumps. The easyto-use menu format and pre-wired, pre-mounted panel system options make set-up and installation quick and simple.



Integrated datalogging is available to validate system performance. A USB memory stick is all that's needed to extract data and event logs that include

electrode measurements, temperature and relay status. Download log files from the USB stick to a PC at your convenience. It couldn't be easier!

## **Summary of Key Benefit**

### Dual Input Reduces Cost

Dual pH or ORP electrode inputs allow one controller to take the place of two, reducing cost and space requirements, and simplifying installation.

### Versatility for a Broad Range of Applications

Select from pH or ORP measurements and from five output options. Use *In-Range* to control a solenoid valve to dump a batch treatment tank when measurement value is within limits, or program for *Out-of-Range Alarm* in waste treatment applications when the measurement value is too high or low.

### Ideal for Harsh Environments

The NEMA 4X enclosure, combined with Walchem's WEL and WDS electrodes, provides a waterproof system with no BNC connectors exposed to wet or corrosive environments.

## > Built-in Safety Features

Programmable output limit timers prevent run-away chemical addition. Digital Interlock Input may be used from a flow switch or level input to prevent chemical addition based on a stagnant sample, or control of an empty batch tank.

## > Simple, Integrated Data Collection

Download stored data from the controller to a USB stick with the press of a button. Use the data to simply and easily validate system performance, document compliance, and reduce liability. The data and event logs show pH/ORP and temperature values, as well as accumulated chemical feed and relay activation times.





## Features

- >> WPH410 Series 4 control relays may be set as all high, all low or any combination. The control deadband is fully adjustable.
- >> WPH420 Series 2 pulse proportional control outputs may be set independently, enhanced by an adjustable minimum and maximum pulse per minute setting.
- WDP410 Series 4 powered relay outputs configurable for on/off control, alarms or automatic probe wash and 1 powered dedicated diagnostic alarm relay AI-1126
- WDP420 Series 2 pulse proportional control outputs, 2 dry contact relay outputs for on/off, alarm or automatic probe wash and 1 dedicated dry contact alarm relay AIC-0321, AIC-0421
- WDP440 Series 4 pulse proportional control outputs, and 1 dedicated dry contact diagnostic alarm relay



## **Standard Features**

#### >> pH or ORP Measurement

- Configurable via a software menu setting.
- Reduces inventory requirements.

#### Versatile relay configuration

- Control outputs can be set as high or low set points via keypad. Auxiliary outputs can be set as:
  - High alarm
  - Low alarm
  - In-range output
  - Out-of-range alarm
  - Probe wash

### Probe wash feature

 For applications that require frequent electrode cleaning, automatic probe wash stretches out reliable measurement life between maintenance interruptions.

#### 4-20mA Outputs

• Internally powered and fully isolated, for connection to WebAlert, PLC or other devices.

settings

#### Self diagnostics

• Software and electronics are constantly monitored without having to take the controller off-line.

#### Auto buffer recognition

• Software selectable for U.S. or European calibration standards.

#### Self test

Menu selectable self-test simulates pH and temperature signals, allowing for quick diagnostics of sensor or controller problems.

#### Differential pH



WDP and WPH Series controllers are a perfect match with Walchem's WEL pH/ORP sensors - offering an extremely reliable differential measurement technique immune to any possible ground loop problems. Together, they provide a true NEMA 4X system with no BNC connector exposed to wet or corrosive conditions. WEL pH/ORP electrodes are easily removed and replaced wtihout any tools.

## **USB** Features

Integrated datalogging collects analytical measurements at 10 minute intervals and captures all relay activations.





Easily create charts and graphs that demonstrate system performance



Identify system upsets faster by knowing exactly what happened and when







## Specifications





## 6.750° (171mm) (171mm) (195mm) (195mm) (195mm)



## Mechanical (controller)

Enclosure NEMA Rating Display Ambient Temperature Shipping weight Polycarbonate NEMA 4X (IP65) 2 x 16 character backlit liquid crystal 32 to 122°F (0 to 50°C) 22 lbs (10 kg) (approximately)



	Range	Resolution	Accuracy (Calibrated)	
pH/ORP	-2 to 16 pH ±1500 mV (ORP)	0.0015 pH units (.01 pH displayed) 92 μV (1mV displayed) (ORP)	± 0.01 pH ± 1 mV (ORP)	
Temperature	32 to 212°F (0 to 100°C)	±0.09°F (.05°C)	±0.9°F (0.5°C)	

#### Inputs

 Power
 100-240 VAC, 50/60 Hz, 8A

 Fuse: 1.0 ampere, 5 x 20 mm

 Signals
 One each for WPH, Two for WDP

 pH/ORP: ±1500 mV

**Measurement Performance** 

Temperature compensation (optional, pH only): Pt100 or Pt1000

Interlock (optional): Isolated, dry contact closure required (i.e. flow, level, etc.)

## WEL pH/ORP Electrode (optional)

Temperature Range
<b>Operating Pressure</b>
Materials of severations

50 to 158°F (10 to 70°C) 0 to 100 psi

Materials of constructionElectrode bodyCPVCElectrode referenceHDPEO-ringsFKMElectrodeGlass (pH) Platinum (ORP)Optional ground rodTitanium1" NPTM pipe submersion connection3/4" threaded NPTF tee in-line connection

#### Outputs Powered Belay

Powered Relays	Internally powered relays switching line voltage
	6A (resistive), 1/8 HP
	All relays are fused together as one group, total
	current for this group must not exceed 6A
Pulse Outputs	Opto-isolated, Solid state relay
	150 mA, 40 VDC Max.
	VLOWMAX = .13V @ 18 mA
Dry contact relays	6 A (resistive), 1/8 HP
	Dry contact relays are not fuse protected

	CTRL1	CTRL2	CTRL3	CTRL4	ALARM			
WPH410	Pow	ered	Dry					
WDP410		Powered						
WPH/DP420	Pulse Dry							
WDP440		Pulse Dry						

4 - 20 mA 1 or 2 (optional)

Internally powered Fully isolated 600 Ohm max resistive load Resolution .001% of span Accuracy ± 1% of reading

## Ordering Information

4 2 0	5	2	5	U
control	voltage	output	options	USB

#### CONTROL

WPH WDF

- 1 = WPH: 2 powered on/off relays & 2 on/off dry contact relays & 1 dry contact dedicated alarm WDP: 4 powered on/off relays & 1 powered dedicated alarm relay
- 2 = WPH & WDP: 2 pulse proportional relays & 2 on/off dry contact relays & 1 dry contact dedicated alarm
- 4 = WDP: 4 pulse proportional outputs & 1 dry contact dedicated alarm

#### VOLTAGE

- 1 = WPH/WDP410: 120 VAC, prewired, 6" pigtails to powered relays WPH/WDP420, WDP440: 20 ft. cables for E Class pumps
- 3 = WPH420: 120 VAC, prewired, 20 ft. cables with connectors for EW pumps
- 5 = Hardwired, cable glands

#### **OUTPUT**

- N = No data output
- 4 = Single isolated 4-20 mA output
- 2 =Two 4-20 mA outputs

#### WPH OPTIONS

- 1 = Prewired preamp with 10 ft. cable (electrode not included. Electrode should have BNC connector)
- 2 = Submersion flat pH electrode w/integral preamp (WEL-PHF-21)
- 3 = In-line flat pH electrode w/integral preamp (WEL-PHF-22) includes 3/4" NPTF mounting tee
- 4 = In-line flat pH electrode w/integral preamp (WEL-PHF-22) includes 3/4" flow switch manifold & 'U' adapter mounted on polypro panel
- 4T=In-line flat pH electrode with ATC and integral preamp (WEL-PHF-12), 3/4" flow switch manifold & 'U' adapter mounted on polypro panel
- 5= Submersion ORP electrode w/integral preamp (WEL-MVF-21)
- 6 = In-line ORP electrode w/integral preamp (WEL-MVF-22), includes 3/4" NPTF mounting tee
- 6R= In-line rod style ORP electrode w/integral preamp (WEL-MVR-22), includes 3/4" NPTF mounting tee
- 7 = In-line ORP electrode w/integral preamp (WEL-MVF-22), 3/4" flow switch manifold and 'U' adapter mounted on polypro panel
- 7R = In-line rod style ORP electrode w / integral preamp(WEL-MVR-22), 3/4" flow switch manifold and 'U' adapter mounted on polypro panel

#### WDP OPTIONS

- 2 = 2 WEL submersion style flat pH electrodes (without auto temp comp)
- 5 = 2 WEL submersion style ORP electrode
- 6 = 1 WEL submersion style flat pH electrode (without auto temp comp) & 1 WEL submersion ORP electrode
- 7 = 1 WEL in-line style flat pH electrode (without auto temp comp, tee included) & 1 WEL in-line ORP electrode (tee included)
- 8 = Flow switch manifold with 2 WEL in-line electrodes; 1 pH (without auto temp comp) & 1 ORP mounted on 19" x 24" polypropylene panel
- 8T=Identical to option #8 above, with auto temp comp

#### **USB FEATURES**

U = Integrated datalogging, event/reset logging, and configuration file import/export



WDH420-5-2-5-U: AIC-0321

WDH420-5-2-N-U: AIC-0421

WDH410-5-2-N-U: AI-1126

#### **Metering Pumps**

The E-Class is the most innovative and comprehensive metering pump product line in the world. Over 50 years of pump experience and a commitment to superior mechanical design has led to development of many industry firsts, including 360 stroke-per-minute technology, IP67 waterproof construction, and the world's highest capacity solenoid metering pumps.



#### WIND WebMaster® Industrial Water Controllers

Walchem's WebMaster Industrial (WIND) Controller sets a new standard for Industrial Water Treatment Controllers. WIND has a flexible multi-I/O platform, a wide range of analytical sensor measurement capabilities, and an extensive assortment of integrated communications and data handling features.

### **Agency Certifications**

UL ANSI/UL 61010-1:2004, 2nd Edition\* CAN/CSA C22.2 No.61010-1:2004 2nd Edition\* CE Safety

EN 61010-1:2001 2nd Edition\* CE EMC EN 61326-1:2006

Note: For EN61000-4-6 & EN61000-4-3 the controller met performance criteria B.

\*Class A equipment: Equipment suitable for use in establishments other than domestic, and those directly connected to a low voltage (100-240 VAC) power supply network which supplies buildings used for domestic purposes.



### **ABOUT US**

Walchem integrates its advanced sensing, instrumentation, fluid pumping and communications technologies to deliver reliable and innovative solutions to the global water treatment market. Our in-house engineering is driven by quality, technology and innovation. For more information on the entire Walchem product line, visit: www.walchem.com



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WPH/WDP pH/ORP Controllers

# WPH/WDP Series pH & ORP Controllers Instruction Manual

Five Boynton Road Hopping Brook Park Holliston, MA 01746 USA TEL: 508-429-1110 FAX: 508-429-7433 WEB: www.walchem.com

## Notice

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## **Statement of Limited Warranty**

WALCHEM warrants equipment of its manufacture, and bearing its identification to be free from defects in workmanship and material for a period of 24 months for electronics and 12 months for mechanical parts and electrodes from date of delivery from the factory or authorized distributor under normal use and service and otherwise when such equipment is used in accordance with instructions furnished by WALCHEM and for the purposes disclosed in writing at the time of purchase, if any. WALCHEM's liability under this warranty shall be limited to replacement or repair, F.O.B. Holliston, MA U.S.A. of any defective equipment or part which, having been returned to WALCHEM, transportation charges prepaid, has been inspected and determined by WALCHEM to be defective. Replaceable elastomeric parts and glass components are expendable and are not covered by any warranty.

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## **1.0 INTRODUCTION**

The Walchem WPH Series single sensor input and WDP Series dual sensor input controllers are wall mount pH/ORP controllers that are available in on/off or modulated pulse proportional versions. They are available with four on/off control relays (WPH410 or WDP410) with two modulated pulse proportional output and two dry contact relays (WPH420 or WDP420) or four modulated pulse proportional outputs (WDP440). A fifth output is used as a diagnostic alarm. One or two isolated 4-20 mA outputs are optional.

They are compatible with any amplified electrode. The choice of pH or ORP operation is selected through the keypad. Use of Antimony pH electrodes is acceptable. Automatic temperature compensation may be used via a Pt1000 or Pt100 input if pH operation is selected. The controller will prompt you to calibrate the electrode at the desired frequency. Automatic buffer recognition may be used in the calibration routine.

Our unique USB feature provides the ability to upgrade the software in the controller to the latest version.

An advanced USB capability option is available. The Configuration file feature allows you to save all the set points from a controller onto a USB flash disk, and then import them into another controller, making the programming of multiple controllers fast and easy. The data logging feature allows you to save the last 2 month's readings and events to a USB flash disk.

1

## 2.0 SPECIFICATIONS

### 2.1 Measurement Performance

-2 to 16 pH units pH Range pH Resolution 0.0015 pH units (0.01 pH displayed) pH Accuracy (Calibrated): ± .01 pH **ORP** Range -1500 to 1500 mV **ORP** Resolution 92 µV (1mV displayed) **ORP** Accuracy ±1 mV Temp Comp (optional): 100 or 1000 ohm platinum RTD **Temperature Range** 32-212°F (0-100°C) **Temperature Resolution** ±0.09°F (0.05°C)

### 2.2 Electrical: Input/Output

**Input Power** 

**Input Signals** 

Temperature Accuracy

100-240 VAC, 50/60 Hz, 8A Fuse: 1.0 ampere, 5 x 20 mm

 $\pm 0.9^{\circ}F (\pm 0.5^{\circ}C)$ 

lais	
pH/ORP Temp Comp (optional)	±1500 mV Pt100 or Pt1000 Isolated dry contact closure required (i.e., flow, level, etc.)
Powered Relays	Internally powered relays switching line voltage
	6 A (resistive), 1/8 HP

Outputs

	Powered Relays	Internally powered relays switching line voltage			
		6 A (resistiv	re), 1/8 HP		
		All relays a	re fused together a	s one group, total	current for this
		group must	not exceed 6A		
	Pulse Outputs	Opto-isolate	ed, Solid State Rel	ay	
		150mA, 40	VDC Max.		
		VLOWMA	X = .13V @. 18 m.	4	
	Dry contact relays	6 A (resistiv	ve), 1/8 HP		
		Dry contact	relays are not fuse	e protected	
	CTRL 1	CTRL2	CTRL 3	CTRL 4	ALARM
WPH410	Powered	Powered	Dry	Dry	Dry
WPH420	Pulse	Pulse	Dry	Dry	Dry
WDP410	Powered	Powered	Powered	Powered	Powered
WDP420	Pulse	Pulse	Dry	Dry	Dry
WDP440	Pulse	Pulse	Pulse	Pulse	Drv

*Note:* The Alarm relay is non-programmable. Refer to the Main Menu diagram for the list of error conditions that trigger the alarm relay.

4 - 20 mA 1 or 2 (optional)	Internally powered
	Fully isolated
	600 Ohm max resistive load
	Resolution .001% of span
	Accuracy $\pm 1\%$ of reading
pH/ORP Preamp Power	±5 VDC, 5 mA

#### Agency Approvals

UL	ANSI/UL 61010-1:2004, 2 <sup>nd</sup> Edition*
CAN/CSA	C22,2 No.61010-1:2004, 2 <sup>nd</sup> Edition*
CE Safety	EN 61010-1:2001 2 <sup>nd</sup> Edition *
CE EMC	EN 61326-1:2006

Note: For EN61000-4-6, EN61000-4-3 the controller met performance criteria B. \*Class A equipment: Equipment suitable for use in establishments other than domestic, and those directly connected to a low voltage (100-240 VAC) power supply network which supplies buildings used for domestic purposes.

## 2.3 Mechanical

Enclosure Material	Polycarbonate
NEMA Rating	NEMA 4X
Dimensions	8.5" x 6.5" x 5.5"
Display	2 x 16 character backlit liquid crystal
Operating Ambient Temp	32 – 122°F (0 – 50°C)
Storage Temperature	-20 – 180°F (-29 – 80°C)
Flow switch manifold temperature rating	140°F (60°C) max
Flow switch manifold pressure rating	150 psi
Flow switch manifold connections	<sup>3</sup> / <sub>4</sub> " NPTF

## 2.4 WPH/WDP Variables and their Limits

		Low Limit	High Limit
Sensor menu	Days Between Calibration	0 days (no reminder)	59 days
Temperature Menu		No variables	
<b>Control 1 -4 Menus</b> Dead E Minimum SPM Maximum SPM Sample Pe Time L	High or Low Set Point High or Low Alarm Point Band (Relay Outputs only) Proportional Band Rate (Pulse Outputs only) Rate (Pulse Outputs only) eriod (Relay Outputs only) imit (Relay Outputs only) Hold Time (Probe Wash)	-2 pH, -1500 mV -2 pH, -1500 mV 0 pH, 0 mV 0 pH, 0 mV 0 strokes/minute 10 strokes/minute 0:01 min:sec 0:01 min:sec 0 seconds	16 pH, 1500 mV 16 pH, 1500 mV 1.99 pH, 199 mV 6.99 pH, 999 mV 99 strokes/min 360 strokes/min 30:00 min:sec 499:59 min:sec (enabled) 0=unlimited (disabled) 99 seconds
	On Time (Probe Wash)	1 second	99 seconds
4-20 mA 1 and 2 Menus	4 & 20 mA Settings	-2 pH, -1500 mV	16 pH, 1500 mV
Access Code Menu	New Value	0	9999
Datalog Menu (Optional	))	No variables	
Config Menu (Optional)		No variables	
Upgrade Menu		No variables	

\*Note: The Alarm relay is non-programmable. Refer to the Main Menu diagram for the list of error conditions that trigger the alarm relay.

## 3.0 UNPACKING & INSTALLATION

### 3.1 Unpacking the unit

Inspect the contents of the carton. Please notify the carrier immediately if there are any signs of damage to the controller or its parts. Contact your distributor if any of the parts are missing. The carton should contain: a WPH/WDP series controller and instruction manual. Any options or accessories will be incorporated as ordered.

### 3.2 Mounting the electronic enclosure

The WPH/WDP series controller is supplied with mounting holes on the enclosure. It should be wall mounted with the display at eye level, on a vibration-free surface, utilizing all four mounting holes for maximum stability. Use M6 (1/4" diameter) fasteners that are appropriate for the substrate material of the wall. The enclosure is NEMA 4X rated. The maximum operating ambient temperature is 122°F (50°C); this should be considered if installation is in a high temperature location. The enclosure requires the following clearances:

Top:	2" (50 mm)
Left:	8" (203 mm)
Right:	4" (102 mm)
Bottom:	7" (178 mm)

### 3.3 Installation

Once the enclosure is mounted, the metering pumps or other control devices may be located at any distance from the controller. The electrode, once amplified, may be placed up to 1000 feet from the controller. Shielded cable with twisted pairs is required. Always route AC voltage wiring in conduit that is separated by 6 inches from low voltage DC signal lines (such as the electrode signal).

#### **Electrode Installation**

The WPH/WDP controllers are designed to work with most AMPLIFIED pH, ORP or ISE electrodes. When in doubt, follow the electrode manufacturer's instructions for installation.

If you have ordered your controller with an external preamplifier pre-wired to the controller, simply attach the electrode to the BNC connector on the preamplifier. If you are using automatic temperature compensation, wire the ATC element to the preamplifier as shown in figure 3.

If you have ordered the external preamplifier separately, see figure 3 for wiring instructions.

NOTE: The cable between the electrode and the preamplifier is carrying an extremely sensitive high impedance voltage signal. Never cut, splice or otherwise destroy the integrity of the cable or unstable readings and susceptibility to electrical noise will result.

Instructions for physically mounting the electrode into the process solution will vary greatly with the type of electrode and circumstances involved in your application. Here are some general guidelines to assist you. Refer to figure 1, Typical Installation.

The electrode should be installed such that the measuring surfaces will always stay wet. Many electrodes have to be installed vertically, with the measuring surfaces pointing down. Follow the manufacturer's recommendations if this is the case. If the electrode dries out, a slow response and short life will result.

For submersion applications, mount the electrode below the minimum solution level. If the tank will be completely emptied, plan on removing the electrode and storing it in tap water (NOT DI water) or pH 4 buffer solution while the tank is empty. If this is not desirable, a recirculation loop may be installed with the electrode mounted in-line. The WEL electrode cable is not waterproof and must be protected from moisture by connecting a pipe to the top of the electrode housing. The opposite end of the pipe should also be protected from moisture using a cable gland. When submerging the electrode, make sure the cable is protected by a length of pipe, sealed at the top using a cable gland.

For in-line applications, where the electrode is installed in a pipe, the electrode should be placed on the discharge side of the pump (under positive pressure). A "U" trap should be included so that if flow stops, the electrode is still immersed in the solution. If the flow through the pipe can not be shut down for cleaning and calibrating the electrode, install the electrode in a by-pass line with isolation valves to allow for electrode removal. The electrode should be installed in an area where there is good solution movement and where it will respond rapidly to chemical additions. The placement of the electrode relative to the placement of chemical replenishment, along with the quality of the mixing and replenishment flow rate, is critical to accurate control.

IMPORTANT: To avoid cracking the female pipe threads on the supplied plumbing parts, use no more than 3 wraps of Teflon tape and thread in the pipe FINGER tight plus 1/2 turn! *Do not use pipe dope to seal the threads of the flow switch because the clear plastic will crack!* 

Symbol	Publication	Description
	IEC 417, No.5019	Protective Conductor Terminal
	IEC 417, No. 5007	On (Supply)
$\bigcirc$	IEC 417, No. 5008	Off (Supply)
4	ISO 3864, No. B.3.6	Caution, risk of electric shock
	ISO 3864, No. B.3.1	Caution

### 3.4 Icon Definitions

## Installation with Submersion Electrode



Figure 1 Typical Installation

## 3.5 Electrical installation

The various standard wiring options are shown in figure 2. Your WPH/WDP series controller will arrive from the factory prewired or ready for hardwiring. Depending on your configuration of controller options, you may be required to hardwire some or all of the input/output devices. Refer to figures 3 and 4 for circuit board layout and wiring.

Note: when wiring the optional 4-20 mA output or a remote interlock switch, it is advisable to use stranded, twisted, shield pair wire between 22-26 AWG. Shield should be terminated at the controller ground stud (see figures 3 and 4).



## CAUTION

1. There are live circuits inside the controller even when the power switch on the front panel is in the OFF position! The front panel must never be opened before power to the controller is REMOVED!

If your controller is prewired, it is supplied with a 8 foot, 18 AWG power cord with USA style plug. A tool (#1 Phillips driver) is required to open the front panel.

- 2. When mounting the controller, make sure there is clear access to the disconnecting device!
- 3. The electrical installation of the controller must be done by trained personnel only and conform to all applicable National, State and Local codes!
- 4. Proper grounding of this product is required. Any attempt to bypass the grounding will compromise the safety of persons and property.
- 5. Operating this product in a manner not specified by Walchem may impair the protection provided by the equipment.



Figure 2a WPH410 Conduit Wiring







### Figure 2c WDP410 Conduit Wiring



Figure 2d WDP420 Conduit Wiring



Figure 2e WDP440 Conduit Wiring



Figure 3a WPH Inputs using WEL pH/ORP Electrode Housings



Figure 3b WPH Inputs using pH/ORP Electrode/External Preamplifiers



Figure 3c WDP Inputs using WEL pH/ORP Electrode Housings


Figure 3d WDP Inputs using pH/ORP Electrode/External Preamplifiers



Figure 4a WPH410 Outputs







Figure 4c WDP410 Outputs



Figure 4d WDP440 Outputs

## 4.0 FUNCTION OVERVIEW

#### 4.1 Front Panel



#### Figure 5 Front Panel

#### 4.2 Display

A summary screen is displayed while the WPH/WDP controller is on. If you have a single sensor (WPH), this display will show a bar graph of the pH/ORP relative to the set point, the numeric sensor reading, and current operating conditions. If you have two sensors (WDP), the bar graph will be replaced by the other sensor's reading.

Towards the center of the bar graph are the (S)'s, which represent the set points. The bar graph grows from the left hand side, and the point furthest to the right indicates where the process value is relative to the set points.

The bottom line of the summary screen displays the following potential status messages: Probe Error, Temp Sensor Err, Calibration Time, Output Timeout, High/Low Alarm, Range Alarm, In Range Output, Output On, Probe Wash, Probe Wash Hold, Normal and Interlock



#### **Figure 6 Summary Screens**

#### 4.3 Keypad

The keypad consists of 4 directional arrow keys and 4 function keys. The arrows are used to move the adjustment cursor and change settings, while the function keys are used to enter values, and navigate the various menu screens. The function keys are **ENTER**, **EXIT**, **NEXT**, and **PREV** (previous). **NEXT** and **PREV** scroll through the various menu choices. **ENTER** is used to enter a submenu and to enter a value. **EXIT** is used to back up one menu level. If you are at the main menu level, **EXIT** will return you to the Summary Display.



To change a value in a submenu, the left/right arrow keys move the cursor left and right to each digit or option that can be changed. The up/down arrows will change numeric values up or down, or scroll through option choices. Press **ENTER** only when you have finished making all of the changes for that menu screen.

#### 4.4 Access Code

The WPH/WDP series controller is shipped with the access code disabled. If you wish to enable it, see Section 5.9 for operation. With the access code enabled, any user can view parameter settings, but not change them. Note that this provides protection only against casual tampering. Use a lock on the cover latch if you need more protection.

#### 4.5 Startup

#### **Initial Startup**

After having mounted the enclosure and wired the unit, the controller is ready to be started.

Plug in the controller and turn on the power switch to supply power to the unit. The display will briefly show the model number and then revert to the normal summary display. Scroll through the menus and calibrate the pH/ORP reading, optional temperature, and set the control parameters detailed in Section 5, Operation.

To return to the summary display, press the **EXIT** key until you return to this screen. The controller will automatically return to this screen after 10 minutes.

#### Normal Startup

Startup is a simple process once your set points are in memory. Simply check your supply of chemicals, turn on the controller, calibrate it if necessary and it will start controlling.

#### 4.6 Shut Down

To shut the controller down, simply turn off the power. Programming remains in memory.

The electrode must be stored with the measuring surfaces wet. If an extended shutdown will result in the electrode dehydrating, it must be removed from its position in the process and stored in pH 4 buffer solution.

## 5.0 OPERATION

These units control continuously while power is applied. Programming is accomplished via the local keypad and display.

To view the top level menu, press any key. The menu structure is grouped by inputs and outputs. Each input has its own menu for calibration and unit selection as needed. Each output has its own setup menu including set points, timer values, direction of control, etc. as needed. After ten minutes of inactivity in the menu, the display will return to the summary display. Keep in mind that even while browsing through menus, the unit is still controlling.

#### 5.1 Main Menu

The exact configuration of your WPH/WDP controller determines which menus are available as you scroll through the settings. Certain menus are only available if you purchase certain options. All settings are grouped under the following main menu items.

Sensor	Sensor A and Sensor B menus appear if the 2 <sup>nd</sup> sensor input card is installed (WDP models)
Temperature	Temperature A and Temperature B menus appear if the 2 <sup>nd</sup> sensor input card is installed (WDP models)
Control 1	
Control 2	
Control 3	
Control 4	
Interlock A	Only appears if the 2 <sup>nd</sup> sensor input card is installed (WDP models)
Time	
4-20mA 1	Only if 4-20mA option installed
4-20mA 2	Only if 2nd 4-20mA option installed
Access Code	
Datalog	Only if advanced USB feature is in model code
Config	Only if advanced USB feature is in model code
Upgrade	-

The **NEXT** key travels forward through this list while the **PREV** key travels backwards through the list. Pressing **ENTER** will Enter the lower level menu that is currently displayed.



Figure 7 Main Menu

#### 5.2 Sensor Menu

The sensor menu provides the following settings: Calibration history (informational only), 2 point calibration, 1 point calibration, pH/ORP selection, and other calibration menus. Each is discussed in detail below. Refer to the Sensor Menu chart on the next page.

**Note**: If you are programming the unit for the first time, press the **PREV** key once, and set the "Sensor Type" menu first to choose standard pH, antimony pH, or ORP. Then press **PREV** three times to get to the "Use Buffer Rec" menu and choose whether you want to use automatic buffer recognition or not. Then press **ENTER**.

Calld	
	Displays the date of the last electrode calibration.
2 Pt Calibration	Press the <b>ENTER</b> key to perform a 2 point calibration of the electrode. Note: 2 point calibration instructions are given in the following order:
	pH electrodes, using Auto Buffer Recognition, pH electrodes, not using Auto Buffer Recognition, ORP electrodes (Auto Buffer Recognition not available)
2 Pt Calibration for pH	If using manual temperature compensation, the first display will be:
electrodes, using Auto Buffer Recognition	Cal Temp °F/C 68 Use the arrow keys to enter the actual temperature of the buffer solutions. If using automatic temperature compensation, this display will not appear. Press <b>ENTER</b> to continue.
	Rinse Electrode Remove the electrode from the process and rinse it off. Press ENTER to go to the next step.
	First Buffer
	This is a prompt to place the electrode in the first buffer. In a few seconds the controller will automatically go to the next step.
	1st Buffer 7.00
	The top line will show the temperature and the mV output from the electrode.
	The bottom line will read "1st Buffer" on the left hand side and either "??.??" or a pH value on the right hand side. If it reads a pH value, that means that it has recognized the buffer solution. Once the buffer value is recognized, it will stop flashing and the mV value will begin flashing. Once this has stabilized, it will stop flashing and go on to the next step.
	If it reads "????", that means it hasn't recognized the buffer solution because the mV output of the electrode is too far away from a standard buffer solution's theoretical mV value. If it can't recognize the buffer solution, the controller will beep and display "Unknown Buffer", and then display its best guess. Press <b>ENTER</b> to accept that guess, or change the value to the correct one using the arrow keys.
	If you press ENTER when it reads "??.??", the display will switch to "Buffer Override" and allow you to manually enter the buffer value.
	Rinse Electrode
	Remove the electrode from the first buffer solution and rinse it off with water. Press <b>ENTER</b> to continue.
	Second Buffer
	Place the electrode in the second buffer solution. The controller automatically advances.
	2nd Buffer 4.00
	The top line will display the temperature and mV readings, which will blink until they become stable. The bottom line will say "2nd Buffer" on the left hand side, either display the pH of the buffer solution or "?????" on the right hand side and will go to the next step or display "Unknown Buffer" as in 1st Buffer above.
	Cal Successful/Cal Failed
	If the electrode response is good, then the display will read "Cal Successful". If the mV output of the electrode did not change enough between the two buffer solutions, it will read "Cal Failed". A failure usually means that the electrode needs to be cleaned, or replaced. It will also display the % difference from the theoretical slope. A failure occurs if the slope is more than 80% different than theoretical. See Troubleshooting Section for "Probe Error" if calibration failed.

	Continue Y The controller will hold this display until you have replaced the electrode in the process, and press ENTER. Control will not begin until ENTER is pressed, or 10 minutes go by. If calibration failed control will begin using old calibration setpoints.
2 Pt Calibration for nH	If using manual temperature compensation, the first display will be:
electrodes, not using Auto Buffer Recognition	Cal Temp °F/C 68 Use the arrow keys to enter the actual temperature of the buffer solutions. If using automatic temperature compensation, this display will not appear. Press ENTER to continue.
	Rinse Electrode Remove the electrode from the process and rinse it off Press ENTER to go to the next step
	First Duffer
	This is a prompt to place the electrode in the first buffer. In a few seconds the controller will automatically go to the next step.
	1st Buffer 7.00
	The bottom line will display "1st Buffer" on the left hand side and "7.00" on the right hand side. Use the arrow keys to set the pH value of the 1st buffer, then press <b>ENTER</b> . The top line will now show the temperature and the mV input from the electrode. The mV will blink until the value is stable. The controller will automatically go onto the next step or you may press <b>ENTER</b> to go to the next step.
	Rinse Electrode
	Remove the electrode from the buffer and rinse it off. Press <b>ENTER</b> to go to the next step.
	Second Buffer
	This is a prompt to place the electrode in the second buffer. Again, in a few seconds the controller will automatically go to the next step.
	2nd Buffer 4.00
	The bottom line will display "2nd Buffer" on the left hand side and "4.00" on the right hand side. Use the arrow keys to set the pH value of the 2nd buffer, then press <b>ENTER</b> . The top line will now show the temperature and the mV input from the electrode. The mV will blink until the value is stable. The controller will automatically go onto the next step or you may press <b>ENTER</b> to go to the next step.
	The controller will go on to the next step once the mV signal is stable.
	Cal Successful/Cal Failed
	If the electrode response is good, then the display will read "Cal Successful". If the mV output of the electrode did not change enough between the two buffer solutions, it will read "Cal Failed". A failure usually means that the electrode needs to be cleaned, or replaced. It will also display the % difference from theoretical slope. A failure occurs if the slope is more than 80% different than theoretical.
	Continue Y
	The controller will hold this display until you replace the electrode in the process and press <b>ENTER</b> . Control will not begin until <b>ENTER</b> is pressed or 10 minutes go by.
2 Pt Calibration for ORP electrodes (no Auto	Rinse Electrode Remove the electrode from the process and rinse it off. Press ENTER to go to the next step.
Buffer Recognition	First Buffer
available)	This is a prompt to place the electrode in the first buffer. In a few seconds the controller will automatically go to the next step.
	Input XX mV The display will show the mV reading from the electrode. The entire number will blink until the reading is stable, then the display will change to:
	Buffer XX
	Now you can change the mV value of the buffer, by using the arrow keys and pressing <b>ENTER</b> .
	Rinse Electrode
	Remove the electrode from the buffer and rinse it off. Press <b>ENTER</b> to go to the next step.

	Second Buffer
	This is a prompt to place the electrode in the second buffer. Again, in a few seconds the controller will automatically go to the next step.
	Input XXX mV
	The display will show the mV reading from the electrode. The entire number will blink until the reading is stable, then the display will change to:
	Buffer XXX
	Now you can change the mV value of the buffer, by using the arrow keys and pressing <b>ENTER</b> .
	Cal Successful/Cal Failed
	If the electrode response is good, then the display will read "Cal Successful". If the mV output of the electrode did not change enough between the two buffer solutions, it will read "Cal Failed". A failure usually means that the electrode needs to be cleaned, or replaced.
	Continue Y
	The controller will hold this display until you replace the electrode in the process and press <b>ENTER</b> . Control will not begin until <b>ENTER</b> is pressed or 10 minutes go by.
1 Pt Calibration	Press <b>ENTER</b> to perform a 1 point calibration of the electrode. Note: 1 point calibration instructions are given in the following order: pH electrodes, using Auto Buffer Recognition pH electrodes, not using Auto Buffer Recognition ORP electrodes (Auto Buffer Recognition not available)
1 Pt Calibration for pH	If using manual temperature compensation, the first display will be:
Electrodes, using Auto	Cal Temp °F/C 68
Buffer Recognition	Use the arrow keys to enter the actual temperature of the buffer solutions. If using automatic temperature compensation, this display will not appear.
	Rinse Electrode
	Remove the electrode from the process and rinse it off. Press <b>ENTER</b> to go to the next step.
	First Buffer
	This is a prompt to place the electrode in the first buffer. In a few seconds the controller will automatically go to the next step.
	1st Buffer 4.00
	The top line will show the temperature and the mV output from the electrode. These values will blink until they become stable.
	The bottom line will read "1st Buffer" on the left hand side and either "?????" or a pH value on the right hand side. If it reads a pH value, that means that it has recognized the buffer solution. The controller will then go on to the next step.
	If it reads "??.??", that means it hasn't recognized the buffer solution because the mV output of the electrode is too far away from a standard buffer solution's theoretical mV value. If it can't recognize the buffer solution, the controller will beep and display "Unknown Buffer", and then display its best guess. Press <b>ENTER</b> to accept that guess, or change the value to the correct one using the arrow keys.
	If you press <b>ENTER</b> when it reads "??.??", the display will switch to "Buffer Override" and allow you to manually enter the buffer value.
	Cal Successful/Cal Failed
	If the electrode response is good, then the display will read "Cal Successful". If the controller can not calculate an acceptable slope from that mV reading, it will read "Cal Failed". A failure usually means that the electrode needs to be cleaned or replaced.
	Continue Y The controller will hold this display until you replace the electrode in the process and press ENTER. Control will not begin until ENTER is pressed or 10 minutes go by.

1 Pt Calibration for pH	If using manual temperature compensation, the first display will be:
electrodes, not using	Cal Temp °F/C 68
Auto Buffer Recognition	Use the arrow keys to enter the actual temperature of the buffer solutions. Press <b>ENTER</b> to go on to the next step. If using automatic temperature compensation, this display will not appear.
	Rinse Electrode
	Remove the electrode from the process and rinse it off. Press <b>ENTER</b> to go to the next step.
	First Buffer
	This is a prompt to place the electrode in the first buffer. In a few seconds the controller will automatically go to the next step.
	Buffer 4.00
	Use the arrow keys to change the value of the buffer being used, then press ENTER.
	1st Buffer 4.00
	The bottom line will display "1st Buffer" on the left hand side and "4.00" on the right hand side. Use the arrow keys to set the pH value of the 1st buffer, then press <b>ENTER</b> . The top line will now show the temperature and the mV input from the electrode. The mV will blink until the value is stable. The controller will automatically go onto the next step or you may press <b>ENTER</b> to go to the next step.
	Cal Successful/Cal Failed
	If the electrode response is good, then the display will read "Cal Successful". If the controller can not calculate an acceptable slope from that mV reading, it will read "Cal Failed". A failure usually means that the electrode needs to be cleaned or replaced.
	Continue Y
	The controller will hold this display until you replace the electrode in the process and press <b>ENTER</b> . Control will not begin until <b>ENTER</b> is pressed or 10 minutes go by.
1 Pt Calibration for ORP	Rinse Electrode
electrodes (no Auto	Remove the electrode from the process and rinse it off. Press <b>ENTER</b> to go to the next step.
Buffer Recognition	First Buffer
available)	This is a prompt to place the electrode in the first buffer. In a few seconds the controller will automatically go to the next step.
	Input 96 mV
	The display will show the mV reading from the electrode. The entire number will blink until the reading is stable, then the display will change to:
	Buffer 96
	Now you can change the mV value displayed to the known value of the buffer, by using the arrow keys and pressing <b>ENTER</b> .
	Cal Successful/Cal Failed
	If the electrode response is good, then the display will read "Cal Successful". If the controller can not calculate an acceptable slope from that mV reading, it will read "Cal Failed". A failure usually means that the electrode needs to be cleaned or replaced.
	Continue Y. The controller will hold this display until you replace the electrode in the process and press ENTER. Control will not begin until ENTER is pressed or 10 minutes go by.
Days Btwn Cal	Use the arrow keys to set the number of days that you would like to go by before recalibrating the electrode. The controller will prompt you to recalibrate when that time has expired. Setting the number of days to zero will disable this feature.
Use Buffer Rec	Use the Up and Down arrows to toggle between Y (yes) and N (no). If you choose to use automatic buffer recognition, then the controller will recognize which buffer solution the electrode has been placed in. If you choose not to, then you will have to enter the information manually during the 1 or 2 point calibration procedures. Press <b>ENTER</b> to accept the choice displayed.
Buffer Set	This menu will only appear if you have decided to use automatic buffer recognition. Press <b>ENTER</b> to change the type of buffers that will be used. Use the Up and Down arrows to toggle between US buffers (pH 4, 7 and 10) or DIN standard buffers (pH 1.09, 4.65, 6.79, 9.23 and 12.75.) then press <b>ENTER</b> to make your selection.

C	This many displays the mV from the electrode. It is useful for troublesheeting
Sensor mv	This menu displays the my from the electrode. It is useful for troubleshooting.
Self Test	Press <b>ENTER</b> to perform a self-test. If it says "FAIL" in the upper right hand corner, this indicates a problem with the controller which should be returned for repair. If it passes, and you have a problem calibrating, it is an electrode or preamp problem.
Sensor Type	Press <b>ENTER</b> to set up the controller to match the type of electrode to be used. Use the Up and Down arrows to toggle between standard pH, antimony pH, and ORP, then press <b>ENTER</b> to make your selection. The controller will warn you to check your set points because the units of measure have changed. Press any key to clear the warning messages.

Sensor Menu



Figure 8 Sensor Menu

#### 5.3 Temperature Menu (this menu does not appear if an ORP sensor has been selected)

The temperature menu contains the following settings: Calibrate and Units (if the Pt100 or Pt1000 sensor is detected when the unit is powered on) or Manual Temp and Units (if no Pt100 or Pt1000 sensor is detected at power-up). Refer to the Temperature Menu chart below.

Calibrate	To Calibrate the Temperature, use a thermometer to measure the fluid temperature and adjust the WPH controller to match. Once Calibrate is entered, the unit continuously displays temperature readings. Press the Up or Down arrow key to change the value displayed to match the thermometer. You must press ENTER to activate the new calibration. You must press the EXIT key to exit calibration.
Man Temp	This menu appears only if no temperature element is connected at power-up. Use the arrow keys to adjust the temperature displayed to match that of the water.
Units	You may choose to display temperature in °C or °F. Press ENTER and the Up or Down Arrow keys to change the temperature units for display.



# Legend



Menu wording that appears when °C units are selected.

Menu wording that appears when Automatic Temperature Compensation is selected.

Menu wording that appears when Manual Temperature Compensation is selected.

#### Figure 9 Temperature Menu

#### 5.4 Control 1 - 4 Menus (FOR ON/OFF CONTROLLERS)

The description of the menus for relay outputs will apply to Control 1 2, 3, and 4 for WPH410 and WDP410 models, and to control 3 and 4 for WPH420 and WDP420 models.

The Control 1 - 4 menus are separate from each other but operate in exactly the same way. Each menu provides the following independent settings: Set Point, Dead Band, Time Limit, Interlock, Output Mode, Assign Input, HOA, Set Point, Dead Band, and Time Limit. The Control menu will be indicated on the display by one of the following: (The 'A' indicates that the output is being controlled automatically.)

# NOTE: When programming the unit for the first time, go to the "Mode" menu to select how that output will operate. Making this assignment first will bring up the correct menus for the Mode you are using.

	Ctrl 1 A	OFF	Indicates that the output is currently OFF.
	Ctrl 1 A	10:00	Indicates the length of time that the output has been ON. In MIN:SEC until 99:59, then becomes HR:MIN.
	Ctrl 1 A	Intrick	Indicates that control has been suspended because the Interlock switch is Open
	Ctrl 1 A	TIMEOUT	Indicates that the output has been on longer than the Time Limit.
Mode		Press high s low s	the <b>ENTER</b> key to change the mode in which the output will operate. The relays may be a low set point, a set point, a low alarm, a high alarm, an out-of-range alarm, an in-range output, a probe wash or a high or et point time proportional output. Use the arrow keys to scroll through the choices.
		Low Press below availa	Set Point ENTER when this is displayed to select a low set point. The relay will close when the process value goes the set point value. The summary screen will display that the output is on. A time limit menu will be table, to prevent runaway control. An Interlock menu will be available to allow you to stop control.
		High Press above availa	Set Point ENTER when this is displayed to select a high set point. The relay will close when the process value goes the set point value. The summary screen will display that the output is on. A time limit menu will be able, to prevent runaway control. An Interlock menu will be available to allow you to stop control.
		Low Press below to pre	Alarm ENTER when this is displayed to select a low alarm. The relay will close when the process value goes the set point value. The summary screen will display "Low Alarm". A time limit menu will be available, event runaway control. An Interlock menu will be available to allow you to stop control.
		High Press above to pre	Alarm ENTER when this is displayed to select a high alarm. The relay will close when the process value goes the set point value. The summary screen will display "High Alarm". A time limit menu will be available, event runaway control. An Interlock menu will be available to allow you to stop control.
		Out Press value time I to sto	Range Alarm ENTER when this is displayed to select an out-of-range alarm. The relay will close when the process is either above or below the two set point values. The summary screen will display "Range Alarm". A imit menu will be available, to prevent runaway control. An Interlock menu will be available to allow you p control.
		In Ra Press betwee be ave	ENTER when this is displayed to select an in-range output. The relay will close when the process value is een the two set point values. The summary screen will display "In Range Output". A time limit menu will ailable, to prevent runaway control. An Interlock menu will be available to allow you to stop control.
		Prob Press valve availa	e Wash ENTER when this is displayed if you want to use the relay to interrupt control and activate a pump or to wash down the electrode. The summary screen will display "Probe Wash". A time limit menu will be able, to prevent runaway control. An Interlock menu will be available to allow you to stop control.

Mode	Time Prop Hi		
(Continued)	Press ENTER when this is displayed to use time proportional control with a high set point. In Time Proportional Mode, the farther away from the set point the system is, the longer the ON time. Refer to the drawings below for an illustration of Time Proportional Mode. A time limit menu will be available, to prevent runaway control. An Interlock menu will be available to allow you to stop control.		
	<b>Time Prop Lo</b> Press ENTER when this is displayed to use time proportional control with a low set point. In Time Proportional Mode, the farther away from the set point the system is, the longer the ON time. Refer to the drawings below for an illustration of Time Proportional Mode. A time limit menu will be available, to prevent runaway control. An Interlock menu will be available to allow you to stop control.		
Assign Input	Press <b>ENTER</b> to change the sensor signal which will be used to control the output. Use the arrow keys to toggle between "Sensor A" and "Sensor B". Press <b>ENTER</b> to accept the change.		
Low Set Point	Only appears if the Mode is Low Set Point or Time Prop Lo Press <b>ENTER</b> if you want the Control relay to close if the process goes below a certain value. The status screen message will be Output ON. This denotes a normal correction of the process value. If you want the status message to be Low Alarm, indicating a problem, choose an Output Mode of Low Alarm as described below.		
High Set Point	Only appears if the Mode is High Set Point or Time Prop Hi Press <b>ENTER</b> if you want the Control relay to close if the process above a certain value. The status screen message will be Output ON. This denotes a normal correction of the process value. If you want the status message to be High Alarm, indicating a problem, choose an Output Mode of High Alarm as described below.		
Low Alarm	Only appears if the Mode is Low Alarm, In Range or Out of Range Press <b>ENTER</b> if you want the Control relay to close if the process goes below a certain value. The status screen message will be Output ON. This denotes a normal correction of the process value. If you want the status message to be Low Alarm, indicating a problem, choose an Output Mode of Low Alarm as described below.		
High Alarm	Only appears if the Mode is High Alarm, In Range or Out of Range Press <b>ENTER</b> if you want the Control relay to close if the process above a certain value. The status screen message will be Output ON. This denotes a normal correction of the process value. If you want the status message to be High Alarm, indicating a problem, choose an Output Mode of High Alarm as described below.		
Dead Band	Use the arrow keys to set the desired dead band, then press <b>ENTER.</b> If the set point is pH 7.00, and the dead band is 0.05 pH units, then the relay will close at pH 7.00 and open 0.05 pH units away from 7.00.		
	HIGH SET POINT DEAD BAND mV		
	TIME		
	ZERO DEADBAND: NOT RECOMMENDED   HIGH SET   POINT   Pump On & Off rapidly, damaging relay		
	mV		
	TIME		

Proportional Band	This menu only appears if Time Proportional control mode is selected. The proportional band menu sets the deviation from set point at which the control output will be on for the entire		
Dunu	sampling period. The volume added at the worst case deviation can be calculated by multiplying the pump flow rate by the sample period time (for example, 1 gal per minute flow rate x 2 min sample period = 2 gal of chemical added). Then calculate the effect on the concentration of this addition (for example, if a 2 gal addition will raise the pH by 0.5 then the proportional band should be set to 0.5).		
	If the proportional band is set too low, then the controller could overshoot the set point. If it is set too high, then the controller may never be able to reach the set point.		
	Figures below show an example of Time Proportional Mode with the following program parameters:		
	Control Mode Time Prop Hi		
	Sample Period 10 minutes		
	High Set Point 7.00 pH		
	Proportional Band 1.00 pH		
	0% SETPOINT 7 8 PROPORTIONAL RAND		
	8.00		
	PROPORTIONAL		
	7.0 V DAND		
	CTRL ON OLITPUT OFF		
	PERIOD		
	In the example figures, the set point is 7.00 and the Proportional Band is 1.00. Note that when the pH goes above the set point, the control relay is ON for a short period of time. As the pH increases, the control relay is ON for a longer period of time. When the acid starts to affect the bath concentration and the pH is reduced, the control relay is ON for a shorter period of time. When the pH drops below the set point of 7.00, the control relay is OFF all the time.		
Sample Period	This menu only appears if Time Proportional control mode is selected.		
	It allows setting the sampling period from 0 to 30:00 minutes. This is the time that will elapse between checking the sensor input reading for deviation from set point. The Proportional Band setting and how far the current reading is from the set point will determine the amount of time that the relay remains on.		
	The sample period should be set to approximately 1½ times the amount of time that it takes for the sensor to react to an addition of chemical. This can be determined by making a manual addition of chemical using the HOA menu and timing how long it takes for the controller to react.		
	Setting the sample period too low will result in a second addition being made before the first is detected and you will overshoot the set point. Setting too high will delay the next addition to the point that the set point may never be reached.		
Time Limit	This menu only appears if the output mode has been selected as a Low Set Point, or a High Set Point.		
	Use the arrow keys to set the time limit (min:sec) for the output to be active, then press <b>ENTER</b> . If it is set for "0:00", no limit will be imposed, and the output could stay on forever.		

Reset Timer	This menu only appears if the output mode has been selected as a Low Set Point, or a High Set Point and the time limit has expired.
	Determine the reason that the output stayed on too long, and once the problem has been solved, press <b>ENTER</b> to reset the timer.
Probe Wash Sched	This menu only appears if the output mode has been selected as a Probe Wash. Press <b>ENTER</b> to program the probe wash schedule. The display will be "Event A 00:00 00". The first numbers are the time of day, in military time, when the probe wash will take place. The last two numbers are the time, in seconds, that the relay will be closed and the pump or valve attached to the relay will clean the probe. Use the arrow keys to change the time of day and the duration of the cleaning. When both values are set, press <b>ENTER</b> . If the electrode needs to be washed more than once a day, additional events may be accessed by pressing the NEXT key. Once all events are programmed, press <b>ENTE</b> .
Hold Time	This menu only appears if the output mode has been selected as a Probe Wash. Use the arrow keys to select the time delay in seconds between the probe wash ending and control beginning again. The hold time can be a maximum of 99 seconds. During the hold time, the summary display will indicate "Probe Wash Hold".
Interlock	Use the Up and Down arrows to toggle between Y(Yes) and N(No). Choosing Y means that the output will deactivate if the device attached to the controller is open. For example, if the electrode is installed in a recirculating pipe line, a flow switch that is closed if flow is sufficient and open if flow is insufficient may be installed in the line, so that if flow past the electrode stops, the controller will not pump in chemicals based on a stagnant sample. Similarly, a level switch may be attached to prevent control of an empty batch tank.
НОА	Use the Left and Right arrows to move between Hand, Off and Auto. In Hand (Manual) mode, the output will be turned on immediately for a maximum of 10 minutes. In the Off mode, the output will be turned off indefinitely. In the Auto mode, the output turns on and off in response to changes in the process value relative to the set point. The letter inside the block on the status screen indicates which mode the output is in.



Figure 10 Control 1 - 4 (On/Off ) Menu

#### 5.5 **Control 1 - 4 Menu (FOR PROPORTIONAL CONTROLLERS)**

The description of the menus for pulse outputs will apply to Control 1 2, 3, and 4 for WDP440 models, and to control 1 and 2 for WPH420 and WDP420 models.

The Control menus are separate from each other but operate in exactly the same way. Each menu provides the following independent settings: Set Point, Prop Band, Control Direction, Min SPM Rate, Max SPM Rate, Time Limit, Interlock and HOA. The top level menu status line may display the following messages: Off, Intrlck, Timeout or SPM. "Off" indicates that the output is off.

Ctrl 1 A	Intrlck	Indicates that the output would be on but is not because of a signal from a flow switch or level switch is stopping control.
Ctrl 1 A	Timeout	Indicates that the output has been on for longer than the maximum time programmed by
		the user.
Ctrl 1 A	SPM	Shows the stroke rate of the pump

Hi/LoSet Point	Use the arrow keys to adjust the display to read the desired set point value. Press <b>ENTER</b> to accept the change.				
Prop Band	Use the arrow keys to adjust how far away from the set point the process value must get before the pump is stroking at the maximum rate. For example, if the lower set point is 6.00 pH, and the proportional band is 0.5, then the pump will stroke at its maximum rate when the pH is 0.5 units away from the set point (at pH 5.5).				
	The following graph shows the effect of the various settings:				
	PROP BAND OF 0.5 0.5 0.5 MAX PROGRAMMED SPM CONTROL RANGE 0 5 6 7 8 9				
	LOWER UPPER SET PT SET PT				
	If the controller overshoots the set point, make the prop band larger. If the controller can't keep up with the additions, make the prop band value smaller, or increase the Max SPM rate value, or source a pump with a higher flow output.				
Control Dir	Press <b>ENTER</b> to change the direction of control, then use the Up and Down arrows to toggle between High Set Point and Low Set Point, and press <b>ENTER</b> to make your choice. A high set point will turn on the relay when the process value goes over the set point value (to add an acid, or reducing agent, or as a high alarm). A low set point will turn on the relay when the process value goes below the set point value (to add an alkali, or oxidizer, or as a low alarm). The further away from the set point the process value gets, the faster the pump will stroke.				
Min SPM Rate	Use the arrow keys to set the minimum stroke rate of the pump. If you want to stop when the set point has been reached, enter 0. If you need the pump to run at a certain rate regardless of the set point, enter that stroke rate. This may be useful in once-through control schemes.				
Max SPM Rate	Use the arrow keys to enter the maximum stroke rate of the pump. This may be the maximum that the pump is capable of, or it may be less if the pump is oversized for your application, but it can NOT be higher than the pump is capable of, or the pump will not stroke at all.				

Reset Timer	This menu only appears if the output mode has been selected as a Low Set Point, or a High Set Point and the time limit has expired. Determine the reason that the output stayed on too long, and once the problem has been solved, press <b>ENTER</b> to reset the timer.
Assign Input	Press <b>ENTER</b> to change the sensor signal which will be used to control the output. Use the arrow keys to toggle between "Sensor A" and "Sensor B". Press <b>ENTER</b> to accept the change.
Time Limit	Use the arrow keys to set the time limit (min:sec) for the output to be active, then press <b>ENTER</b> . If it is set for "0:00", no limit will be imposed, and the output could stay on forever.
Interlock	Use the Up and Down arrows to toggle between Y(Yes) and N(No). Choosing Y means that the output will deactivate if the device attached to the controller is open. For example, if the electrode is installed in a recirculating pipe line, a flow switch that is closed if flow is sufficient and open if flow is insufficient may be installed in the line, so that if flow past the electrode stops, the controller will not pump in chemicals based on a stagnant sample. Similarly, a level switch may be attached to prevent control of an empty batch tank.
НОА	Use the Left and Right arrows to move between Hand, Off and Auto. In Hand (Manual) mode, the output will be turned on immediately at the maximum programmed rate for a maximum of 10 minutes. In the Off mode, the output will be turned off indefinitely. In the Auto mode, the output turns on and off in response to changes in the process value relative to the set point. The letter inside the block on the status screen indicates which mode the output is in.



Figure 11 Control 1 - 4 (Proportional) Menu

#### 5.6 Interlock A Menu

This menu only appears in WDP models.

The Interlock A menu is used to assign an interlock device to the appropriate sensor. An interlock device is an external monitoring sensor like a flow or level switch that serves to deactivate control outputs when activated. For example, this could be used to prevent the controller from pumping chemicals based on a stagnant sample.

The WDP controller can support up to two interlock devices. Refer to Figure 3c and d for a wiring illustration. A typical setup would use one flow switch for sensor A and one for sensor B and they would function independently. This is the default setting and describes operation when **Sensor A Only** is selected in this menu.

However, in some applications it is desirable to have one interlock device assigned to both sensor A and B. For example, if you have both sensors mounted in the same sample stream, then a flow switch input could be used to disable control for both sensors. This describes the operation when **Sensor A and B** is selected in this menu. *Note: If this type of operation is desirable, the single interlock device must be connected to the Sensor A input as illustrated in Figures 3c and d.* 

To make a selection, press **ENTER** at the Interlock A menu. Use the UP or Down keys to toggle between **Sensor A Only** and **Sensor A + B**. Press **ENTER** again when the desired choice is displayed to change the selection. Press **EXIT** to return to the higher level menu.





# Operation

Press Enter key to enter menu. Press Exit key to exit menu. Blinking fields may be edited with the adjust arrows. Press Enter when modification is complete to return to Main Menu Level.

Figure 12 Interlock A Menu

### 5.7 4-20 mA 1 and 2 Menus (Optional)

These menus will only appear if the optional 4-20 mA output board(s) is installed. They are used to set the scale of the 4-20 mA output. It contains the following menu selections: Assign Inputs, 4 mA Point, 20 mA Point, and Calibrate.

Note: When programming the controller for the first time, first go to the Assign Inputs Menu, then program the other menus.

Assign Inputs	Press <b>ENTER</b> to assign the 4-20 mA output to a sensor input. Use the arrow keys to toggle between "pH/ORP" and "Temp." Press <b>ENTER</b> when the desired choice is displayed.	
4 mA Pt	Use the arrow keys to enter the process value (in either pH units, or mV if ORP) that you want to correspond to a 4 mA output from the controller.	
20 mA Pt	Use the arrow keys to enter the process value that you want to correspond to a 20 mA output from the controller.	
Calibrate	This menu is used to calibrate instruments connected to the mA output. The 4-20 mA output is extremely accurate and stable and therefore will never need calibration. This feature allows other devices to be calibrated at the 4 and 20 mA points. Press <b>ENTER</b> to start the calibration.	
Fixed 4 mA Out	The controller will output 4.00 mA. Adjust the chart recorder or data logger per its instruction so that the process value displayed is what is expected for a 4.00 mA input.	
Fixed 20 mA Out	As above, except that the controller will output 20.00 mA. The design of the 4-20 mA output is such that it should never need calibration. If the mA signal is not what it should be, call the factory for service.	



Figure 13 4-20 mA 1 and 2 Menus

#### 5.8 Time Menu

The time menu is used to set the date and time that the controller uses to schedule probe washing and calibration prompts. There is only one menu selection: Set Clock.

Set Clock	Press <b>ENTER</b> to set the clock. Use the arrow keys to change the year, date, and month, then press <b>ENTER</b> . Use the arrow keys again to set the day of the week and the time. Use military time (for example, 1:00 PM is
	13:00). Press <b>ENTER</b> to return to the top level clock menu.



Figure 14 Time Menu

#### 5.9 Access Code Menu

This menu determines whether the access code feature of the controller is enabled or disabled and allows you to customize the access code to your own value. The access code controls whether or not you are allowed to change the parameters in the controller. With the access code disabled, any user may change any parameter. With the access code enabled, any user can view any parameter, but cannot change them. Once an attempt is made to change a parameter, the display will prompt the user to enter the access code. If the correct access code is entered, the parameters can be changed. If the wrong access code is entered the parameters cannot be changed. Once the access code has been correctly entered, it will remain valid until there is a period of 10 minutes without a key being pressed. The access code menu will appear as shown below:

	DIC			
Access Code	DIS	indicates that the access code is disabled. No access code is required to change any setting.		
Access Code	REQ	Indicates that the access code is required to alter settings.		
Access Code	ОК	Indicates that the access code is required and has been entered correctly.		
Enable N / Y		the Up or Down arrow key to change the N to Y and press ENTER to enable the access code re. If the access code is enabled you must first enter the access code to disable it.		
New Value	Press betwo acces	ENTER to display the current access code value and use the arrow keys to change it to any value een 0 and 9999. If the access code has been enabled, you will be prompted to enter the current is code before being allowed to change it. You must remember the access code if you enable it.		
	The I	Factory default Access code is 1995.		
	If you change the access code and can't remember it follow this procedure:			
	1. Tu	1. Turn off power to the controller.		
	2. Wa	ait 10 seconds.		
	5. Pro 4 Re	ad the access code on the display		
	5. Re	lease the keys, and the access code will disappear.		

Access Code Menu

Any Top Display Access Code 0000 The Access Code prompt may appear at any screen in the entire menu structure if the current access code has not been entered by the user. Access code entries will be valid for 10 minutes from the most recent key press.



Enter any four digit code

Figure 15 Access Code Menu