**TECHNICAL BROCHURE**
BPHV R3

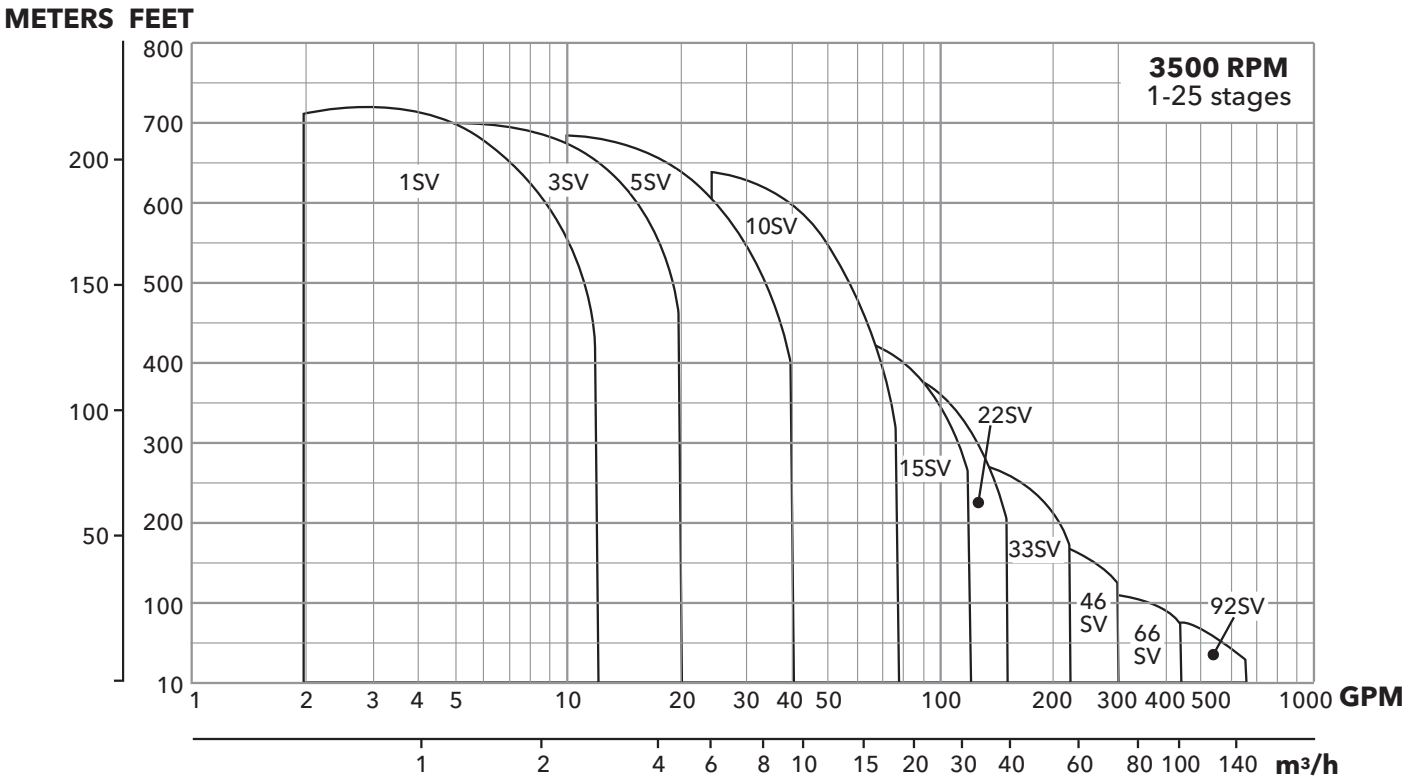
# Packaged e-SV Hydrovar Series

VARIABLE SPEED WATER BOOSTER WITH E-SV
VERTICAL MULTISTAGE PUMP AND FUSED DISCONNECT

GOULDS WATER TECHNOLOGY
a xylem brand

**CONTENTS**

## PACKAGED HYDROVAR / e-SV COVERAGE CHART




**NOTE:** Refer to e-SV Technical Brochure and/or the selection software for final e-SV pump selection.


(Available soon)

"Packaged Pumping System"

## MAIN COMPONENTS

of constant pressure variable speed system

- One multistage vertical **pump**, Goulds Water Technology e-SV series.
- **Hydrovar**® pump mounted variable speed drive
- **Pressure transducer** for constant pressure control, connected to the Hydrovar drive.
- **NEMA 4X** fused disconnect panel with corrosion resistant durable plastic; external on/off switch with lockout/ tagout. Panel is bracket mounted directly to pump.
- **Electrical panel** for control and protection, with casing made of plastic material, NEMA 4X, equipped with:
  – fast acting fuses. The panel is mounted on the electric pump using a bracket.

**The pump package comes pre-assembled** and tested, complete with operating instructions and panel wiring diagram.

**1)** Vertical multi-stage stainless pump

**2)** TEFC standard NEMA 2-pole motor

**3)** NEMA 4X fused disconnect panel

**4)** Hydrovar® variable speed controller

**5)** cUL flexible liquid tight conduit/wiring

**6)** Pressure transducer (sensor) with cable

**7)** Outdoor use

## MARKETS AND APPLICATIONS

**Booster Sets**

### MARKETS SERVED
MUNICIPAL, COMMERCIAL, INDUSTRIAL

### APPLICATIONS
- Water network supply in condominiums, offices, hotels, shopping centers, factories, water treatment, process control.
- Water supply to agricultural water networks (e.g. irrigation).
- Variable flow / demand applications requiring constant pressure control.

### SPECIFICATIONS

- **Flow rate** up to 600 GPM
- **Head** up to 1,040' TDH
- Supply voltage:
  1Ø, 230V ± 10% up to 3 HP
  3Ø, 460V ± 10% for 3 – 15 HP
- Output voltage:
  3Ø, 230V up to 3 HP
  3Ø, 460V 3 – 15 HP
- Input Frequency: 50 or 60 Hz
- External control voltage:
  0-5 VDC; 0-10 VDC; 0-20 mA
- Protection class
  - panel: NEMA 4X
  - drive: NEMA 4 up to 15 HP
  - outdoor use
- Maximum HP: 15 HP
- Soft motor start
- **Vertical design pump**:
  e-SV series (motor insulation class, F, TEFC enclosure)
- Maximum operating pressure:
  360 PSI
- Maximum temperature of pumped liquid: 180° F

## MARKETS AND APPLICATIONS

***(continued)***

### WATER SUPPLY AND PRESSURE BOOSTING

- Pressure boosting in buildings, hotels, residential complexes
- Pressure booster stations, supply of water networks
- Booster packages

### WATER TREATMENT

- Ultrafiltration systems
- Reverse osmosis systems
- Water softeners and de-mineralization
- Distillation systems
- Filtration

### LIGHT INDUSTRY

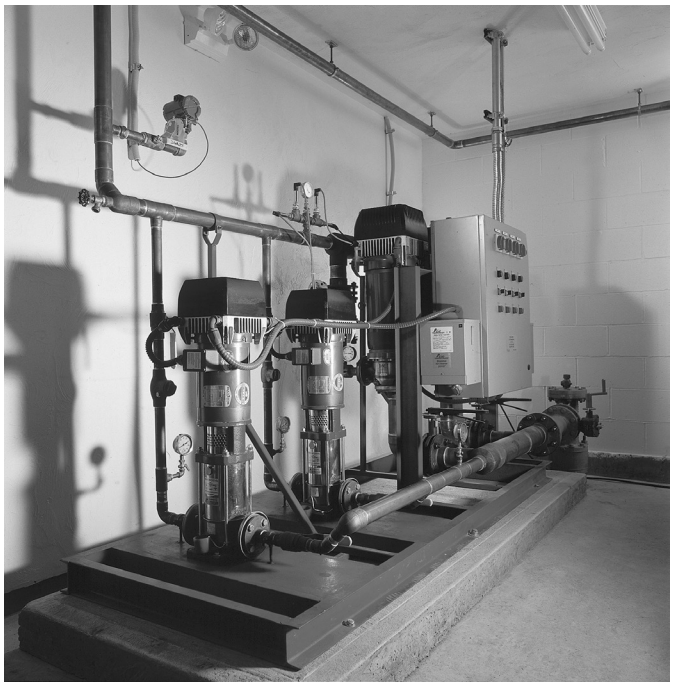
- Washing and cleaning plants (washing and degreasing of mechanical parts, car and truck wash tunnels, washing of electronic industry circuits)
- Commercial washers
- Firefighting system pumps

### IRRIGATION AND AGRICULTURE

- Greenhouses
- Humidifiers
- Sprinkler irrigation

### HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

- Cooling towers and systems
- Temperature control systems
- Refrigerators
- Induction heating
- Heat exchangers
- Boilers
- Water recirculation and heating



## MARKETS AND APPLICATIONS *(continued)*

MUNICIPAL, AGRICULTURAL, LIGHT INDUSTRY, WATER TREATMENT, HEATING AND AIR CONDITIONING

### APPLICATIONS

- Handling of water, free of suspended solids, in the municipal, industrial and agricultural markets
- Pressure boosting and water supply systems
- Fire fighting jockey pumps
- Irrigation systems
- Wash systems
- Water treatment plants: reverse osmosis
- Handling of moderately aggressive liquids, demineralized water, water and glycol, etc.
- Circulation of hot and cold water for heating, cooling and conditioning systems
- Boiler feed

### SPECIFICATIONS

#### PUMP

The e-SV pump is a non-self priming vertical multistage pump coupled to a standard motor.
The liquid end, located between the upper cover and the pump casing, is held in place by tie rods.
The pump casing is available with different configurations and connection types.

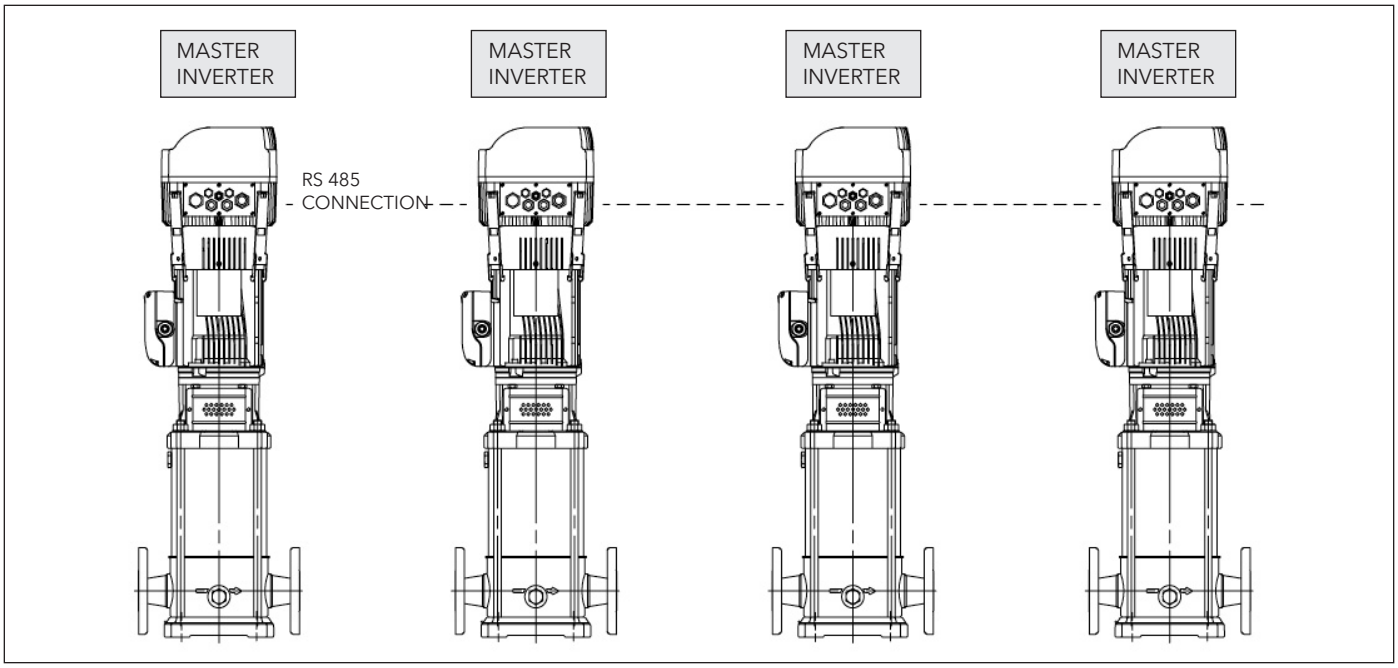
- Delivery: up to 600 GPM
- Head: up to 1200 feet
- Temperature of pumped liquid: -20°F to 250°F (-30°C to 120°C) standard version
- Maximum operating pressure
  – with oval flanges: 230 PSI (15 bar)
  – with round flanges or Victaulic: 360 PSI (25 bar)
  – SV33, 46: 230, 360 or 575 PSI (16, 25 or 40 bar)*
  – SV 66, 92: 230 or 360 PSI (16 or 25 bar)*
- Direction of rotation: clockwise looking at the pump from the top down (marked with an arrow on the adapter and on the coupling).

#### MOTOR

- Standard NEMA TC Frame motors totally enclosed fan cooled.
- Efficiency is 75.5% or higher, Class "F" insulation
- 3500 RPM nominal
- Standard voltage:
  - Single phase version: 115-208/230 V, 60 Hz up to 3 HP or 208-230 V for 5 HP
  - Three phase version, 2 pole: 208-230/460 V, 60 Hz up to 75 HP

* Based on pump staging

## APPLICATION EXAMPLE – MULTI-PUMP "CASCADE"




With the "master" version of the Hyrdrovar, it is possible to connect up to 8 Hydrovar controller pumps together in parallel. Complete lead/lag and auto alternation.

## CHARACTERISTICS OF THE e-SV SERIES PUMP USED IN BOOSTER PACKAGE

### 1SV – 22SV e-SV VERTICAL MULTI-STAGE PUMPS

- High hydraulic efficiency for significant energy savings.
- Multistage centrifugal vertical electric pumps. All metal parts in contact with pumped liquid are made of 304/316 stainless steel.
- A version: round flanges, in-line discharge and suction ports, AISI 304
- B version: ANSI flanges, in-line discharge and suction ports, AISI 316
- Reduced axial thrusts enable the use of **standard motors** that are easily found on the market.
- Standard Baldor, NEMA motors
- Easy maintenance. No special tools required for assembly or disassembly.
- **ANSI/NSF 61 certified by CSA for potable drinking water.**

### 33SV – 125SV e-SV MULTI-STAGE PUMPS

- Vertical multistage centrifugal pump with impellers, diffusers and outer sleeve made entirely of stainless steel, and with pump casing and upper head made of cast iron in the standard version.
- High hydraulic efficiency for significant energy savings.
- Innovative axial load compensation system on pumps with higher head. This ensures reduced axial thrusts and enables the use of standard motors that are easily found on the market.
- Standard NEMA Baldor® motors.
- Mechanical seal can easily be replaced without disassembling the motor from the pump.
- Mechanical sturdiness and easy maintenance. No special tools required for assembly or disassembly.
- **ANSI/NSF 61 certified by CSA for potable drinking water.**

### REFERENCE STANDARDS

- cUL Listed as pumping packaged unit, 42UC (available soon)
- VFD (Hydrovar) UL recognized
- Baldor motor UL recognized
- Pumps meet ANSI/NSF 61 certification by CSA for potable drinking water
- Pumps meet ANSI/UL778 standards
- Control/disconnect meet UL508A standards

## MAIN CHARACTERISTICS OF FREQUENCY CONVERTERS USED IN THE PACKAGED BOOSTER SETS

The booster uses a **Hydrovar**® variable frequency drive, an automatic device that adjusts the speed of the electric pump in order to maintain **constant pressure** in the system.

Converters with power up to 15 HP are **mounted directly on to the motor**. The pressure is measured by a **pressure transmitter** which uses a standard **4..20 mA** current signal. The system pressure value can be read on the converter's display. A simple user interface allows you to set the desired pressure value for optimal adjustment, as well as to **view the operating data**, such as the hours of operation and any alarms triggered. Included diagnostic menu to view temperature, current and voltage values facilitates diagnostics and failure analisys. Indicator lights signal power status, pump running and malfunctions.


Modular Hydrovar, Bare Unit

A **password** is required to access sensitive settings that allow you to **program the Hydrovar** in order to adapt it to any control requirements, such as **flow resistance compensation**, **external control**, periodic testing and so on. When more than one pump is used, the converters exchange information with each other through an **RS485 serial line** which can connect up to 8 Hydrovar devices plus one external unit for remote control. The Pump-link and Pump-watcher dedicated systems, connected to the Hydrovar®, enable remote control through a traditional telephone line or mobile telephony. A serial port available as standard up to 15 HP allows you to control the Hydrovar® converters from a Modbus® field serial bus line.

Packaged Hydrovar with e-SV Pump

The converter is equipped with two **potential-free relays** which can be used for **remote signalling** of pump running and malfunction status, plus a programmable voltage **analogue output** for signalling the frequency or pressure. Standard version with two sensor inputs for implementing of two actual values signals within one system (min/max, difference) or for a second sensor for safety reasons. Specific digital **inputs** are used for protection against **water failure**, **motor overtemperature**, as well as for external enable signal and remote control. The converter also incorporates a dry running protection function via an adjustable **minimum pressure** threshold.

FCC Class A filter standard for Hydrovar three-phase power supply.
E.g. Industrial areas, technical areas of any building fed from a dedicated transformer are examples of environment locations.

FCC Class B filter standard for Hydrovar single-phase power supply.
E.g. Houses, apartments, commercial premises or offices in a residential building are examples of environment locations.

Further information is available in the Hydrovar manual.

## HYDROVAR SPECIFICATIONS

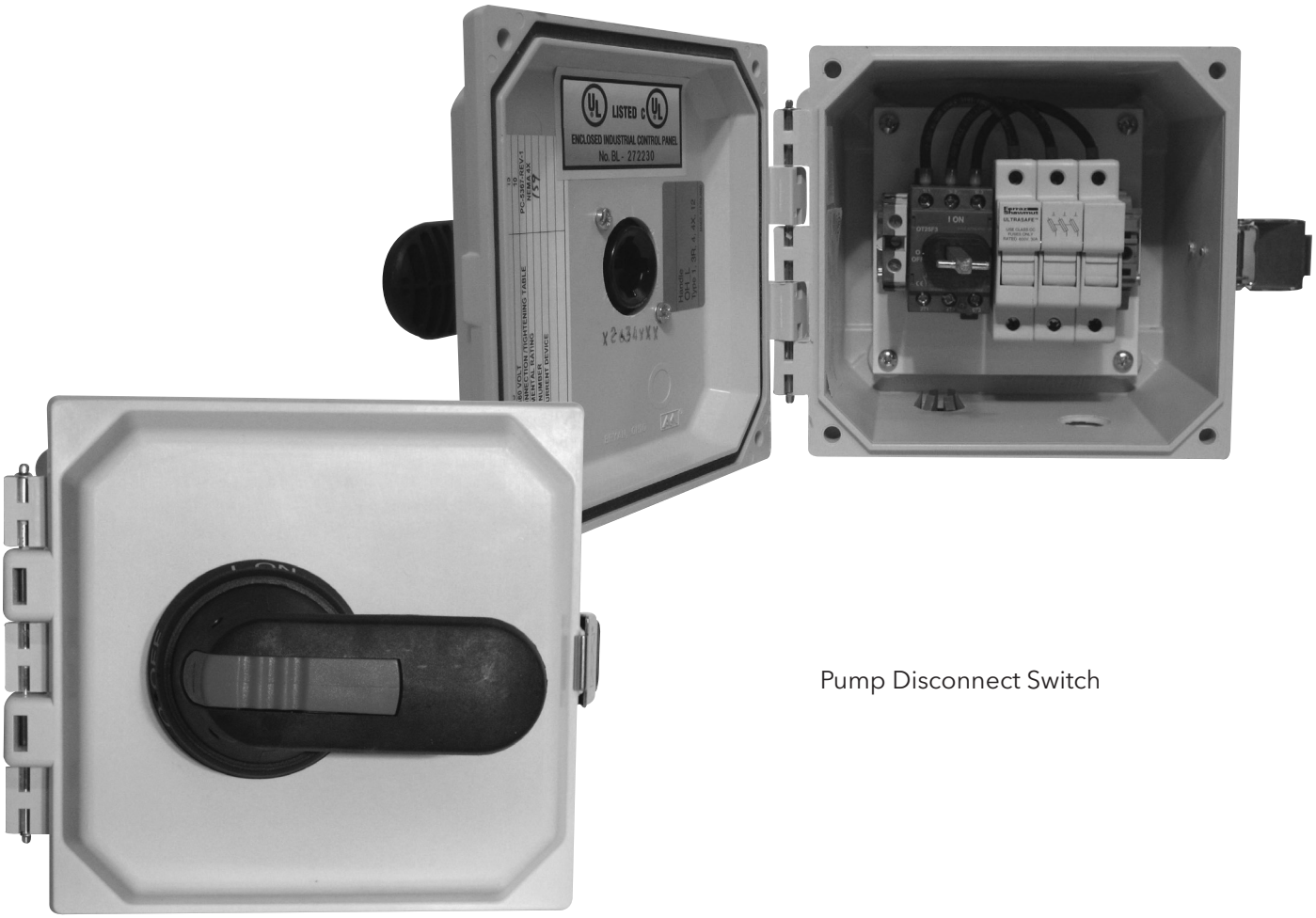
| Hydrovar VFD | | | | | Motor | |
|---|---|---|---|---|---|---|
| **HP** | **Model *** | **Power Supply (V)** | **NEMA Class** | **Install.** | **Power Supply (V)** | **HP** |
| 2 | HVM1202 | 1x230 | 4 | TEFC Motor | 3x230 | 2 |
| 3 | HVM1203 | 1x230 | 4 | TEFC Motor | 3x230 | 3 |
| 3 | HVM3403 | 3x460 | 4 | TEFC Motor | 3x460 | 3 |
| 5 | HVM3405 | 3x460 | 4 | TEFC Motor | 3x460 | 5 |
| 7½ | HVM3407 | 3x460 | 4 | TEFC Motor | 3x460 | 7½ |
| 10 | HVM3410 | 3x460 | 4 | TEFC Motor | 3x460 | 10 |
| 15 | HVM3415 | 3x460 | 4 | TEFC Motor | 3x460 | 15 |

## ELECTRICAL PANELS (Packaged Hydrovar® Series)

The Package comes with a **fused disconnect** on which are installed automatic **line protection fast acting fuses** for each drive. Class J, 600 volt.

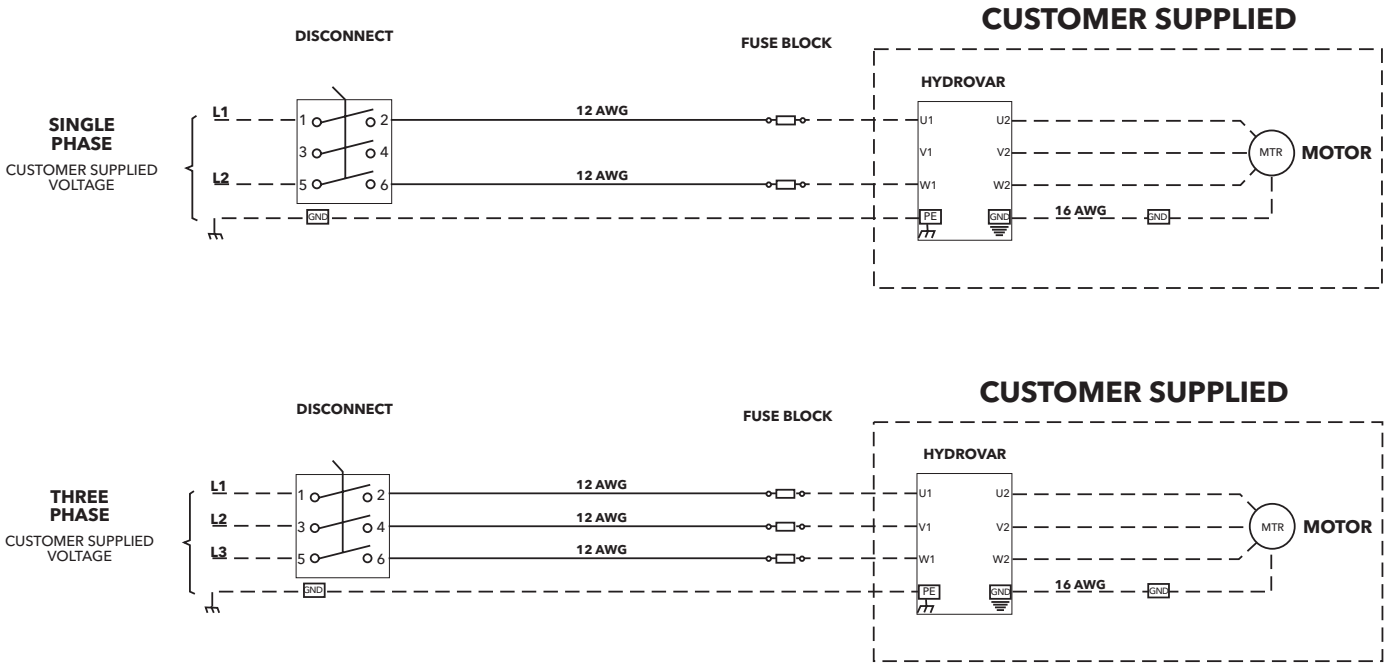
Single-pump Packages are supplied as standard with an electrical panel encased in NEMA 4X enclosure, with 2-pole or 3-pole (3 phase) up to 30 amps and featuring a **main switch**.

The fused disconnect is rated for UL508A.




Pump Disconnect Switch

## FUSED DISCONNECT BOX




| Disconnect Part Number | Input Voltage | Disconnect | HP / AMP Rating | Wire Range | Tightening Torque | Fuse Supplier | AMP Rating | Part Number | Voltage Rating |
|---|---|---|---|---|---|---|---|---|---|
| HFD512C1 | 230/1/60 | OT25F3 | 2 HP / 25A | #18-8AWG | 7 IN/LB | Bussman | 20 | KTK-R-20 | 600V |
| HFD512E1 | 230/1/60 | OT40F3 | 3 HP / 40A | #18-8AWG | 7 IN/LB | Bussman | 30 | KTK-R-30 | 600V |
| HFD534A1 | 460/3/60 | OT16F3 | 3 HP / 16A | #18-8AWG | 7 IN/LB | Bussman | 10 | KTK-R-10 | 600V |
| HFD534B1 | 460/3/60 | OT16F3 | 3 HP / 16A | #18-8AWG | 7 IN/LB | Bussman | 15 | KTK-R-15 | 600V |
| HFD534C1 | 460/3/60 | OT25F3 | 3 HP / 25A | #18-8AWG | 7 IN/LB | Bussman | 20 | KTK-R-20 | 600V |
| HFD534C2 | 460/3/60 | OT25F3 | 3 HP / 25A | #18-8AWG | 7 IN/LB | Bussman | 20 | KTK-R-20 | 600V |
| HFD534E2 | 460/3/60 | OT40F3 | 3 HP / 40A | #18-8AWG | 7 IN/LB | Bussman | 30 | KTK-R-30 | 600V |

**Note:** Recommended protection (not included with drive only). This fused disconnect is available as part of the Packaged Hydrovar, see price book.

## OPERATION DESCRIPTION

### PACKAGED HYDROVAR WITH PRESSURE TRANSDUCER CONTROL

The starting and stopping of the pumps are determined based on the pressure values set on the controller.
Each frequency converter is connected to a pressure transducer.
The controllers exchange information with each other and provide for cyclic changeover.

The figure shows the operating mode of a two-pump booster set (Typical Field Set).

- On demand, water is drawn from the tank.
- When the pressure drops belows the PS setting the first pump starts and the speed is adjusted to maintain a costant pressure as demand increases.
- If the water consumption increases and the pump reaches maximum speed, the second pump starts and the speed is adjusted to maintain constant pressure.
- When demand decreases, the speed is reduced until minimum speed is reached and one of the pumps are switched off.
- If consumption keeps decreasing the pump slows down, fills the tank and stops at the pressure setting.

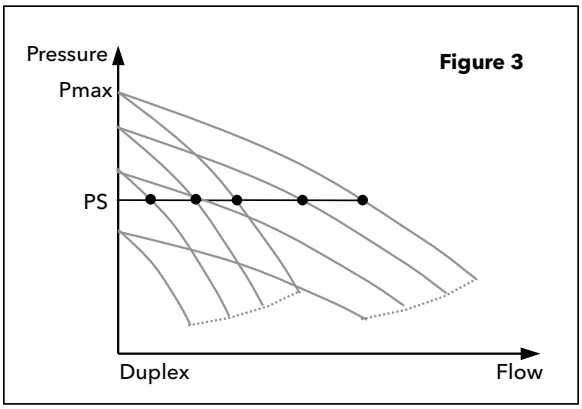


**Figure 3**

## OPERATING CHARACTERISTICS AND LIMITS

| | |
|---|---|
| Type of pumped liquids | Water containing no gas or corrosive and/or aggressive substances |
| Fluid temperature | Above 0° F to 180° F, pressure transducer limited |
| Ambient temperature | Above 0° F to 104° F, VFD/Display, keep away from direct sun |
| Maximum operating pressure | 360 PSI (Pump without transducer) |
| Minimum inlet pressure | According to NPSH curve and losses, with a minimum margin of 0.5 m |
| Maximum inlet pressure | The inlet pressure added to the pressure of the pump at zero flow must be lower than the maximum operating pressure of the set (suction and discharge). |
| Installation | Indoors/outdoors, protected from the direct sun. Away from heat sources. Maximum elevation 3300 feet ASL. Maximum humidity 50% without condensation. |
| Hourly starts | Maximum 60 up to 10 HP. Above 10 HP and up, maximum 40 starts per hour. Variable speed drive starts. |
| Sound emission | See table |

*** Note:** For higher temperature it is necessary to use special materials (only on request).

## NOISE EMISSION LEVELS

| 60 Hz 3500 RPM | | LpA (dB ±4) |
|---|---|---|
| **HP** | **NEMA Motor Frame** | **PHV** |
| 1 | 56 | < 70 |
| 2 | 56 | < 70 |
| 3 | 56 | < 70 |
| 5 | 145 | < 70 |
| 7½ | 182-184 | < 70 |
| 10 | 215 | 71 |
| 15 | 254 | 73 |

*** Note:** Adjusted from 50 Hz data, may vary.

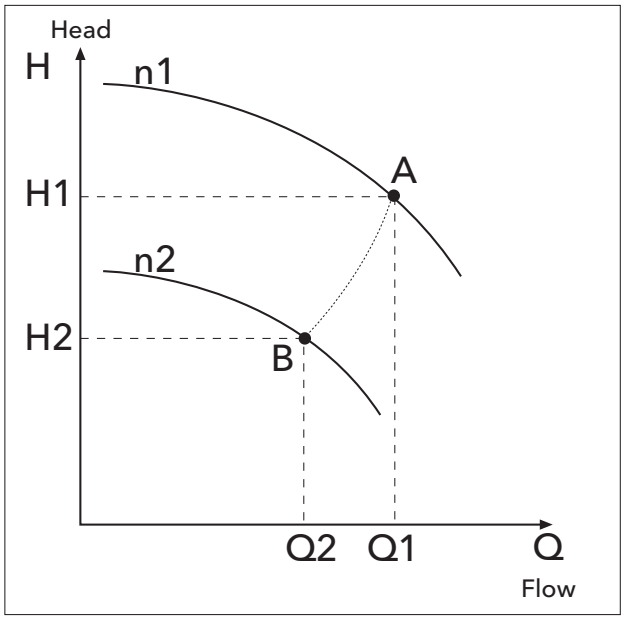
## PERFORMANCE WITH VARYING SPEED FOR CENTRIFUGAL PUMPS

Fitting the electric pump with a variable speed drive makes it possible to vary the pump rotation speed, normally according to the system pressure parameter. **Variations in electric pump speed** result in **modified performances** according to the equivalence relations, called affinity laws.

Flow Rate $\frac{Q1}{Q2} = \left[\frac{n1}{n2}\right]$

Head $\frac{H1}{H2} = \left[\frac{n1}{n2}\right]^2$

Power $\frac{P1}{P2} = \left[\frac{n1}{n2}\right]^3$




n1 = initial speed; n2= speed required.
Q1 = initial flow rate; Q2= flow rate required.
H1 = initial head; H2= head required.
P1 = initial power; P2= power required

**Frequency ratios** can be used instead of speed in practical applications, keeping 30 Hz as the bottom limit.

**Example :** 2-pole 50 Hz electric pump n1 =2900 (point A)
Flow rate (A) = 100 l/min; Head (A) = 50m
By reducing the frequency to 30 Hz the speed is reduced to approx. n2 = 1740 rpm (point B)
Flow rate (B) = 60 l/min; Head (B) = 18 m
The power of the new work point B is cut to about 22% of the initial power.

## SIZING THE DIAPHRAGM TANK IN SYSTEMS WITH SPEED VARIATION

**Variable speed** booster sets need **smaller tanks** compared to traditional systems. Generally speaking, a tank with a capacity of just 20% of the nominal capacity of a single pump, expressed in gallons per minute, is needed. The **gradual starting** of the pumps controlled by the drive reduces the need to limit the number of hourly starts; the main purpose of the tank is to compensate for small system losses, stabilize the pressure and make up for pressure variations caused by sudden demand (fast acting valves).

**Make the following calculation:**

Set made up of three electric pumps, each with a maximum flow rate of 100 GPM, for a total capacity of 300 GPM. The **volume** required for the tank is 20 gallons. This is total capacity, not drawdown. Mount downstream of the check valves in discharge manifold.

## SELECTING A PACKAGE

The first thing to do when selecting a package is to determine the quantity of water required and the pressure it must supply.

### Calculating the Flow Rate

The quantity of water called **water requirement** depends on the type of users, e.g. homes, offices, schools, as well as their number. The theoretic requirement is the total amount of water required by all the users. In actual fact, since it is very unlikely that there should be a simultaneous demand by all the users, the **real requirement** is lower than the theoretic one.

### Calculating the Head

The pressure required depends on the type of user. A number of factors must be taken into account, including the **height of the building**, the suction conditions and the flow resistance in the pipes.

### Selecting A Booster Set

According to the required flow rate and head values, it is possible to identify the most suitable size of e-SV pump. On two-pump sets the pumps normally act as **back-up for one another**. A single pump is normally sufficient to provide for average requirements, while in conditions of high demand the back up pump may be called in to assist. With the **cyclic changeover** function duty assignment is rotated to ensure both pumps remain active and with even running hours, so wear is uniform and the use factor is reduced for longer pump life. This system also ensures **continuity of operation** in case one of the pumps needs maintenance.The Hydrovar provides automatic lead/lag, alternation when programmed in multi-control and wired via RS485 communication terminals.

### Tank

Frequent demand or **small system losses** determine pressure variations that may be compensated for by using a **tank**. Correct selection of a diaphragm tank **reduces the number of pump starts** and, if it is installed near the booster set, helps reduce the effect of water hammer, or fast acting flush valves.

The booster sets are **ready** for installation of diaphragm tanks directly on the delivery manifold, and additional tanks can be connected to the unused end of the manifold.

**For peak performance, variable speed** booster sets need **smaller tanks** compared to traditional systems. Generally speaking, a tank with a capacity of just 20% of the nominal capacity of a single pump, expressed in gallons per minute, is required. Example: If my pump is sized for 100 GPM, then we would size a 20 gallon (total capacity) diaphragm tank.

Pre-charge the tank with air, 10-15 PSI below your system pressure. Charge dry tank without water pressure or before installing in system.

## PART NUMBERING / IDENTIFICATION CODES

### PACKAGED HYDROVAR VARIABLE SPEED e-SV PRODUCT LINE NUMBERING SYSTEM

The various versions are identified by a product code number on the pump label. The number is also the catalog number for the package. The meaning of each digit in the product code is shown below.

### Packaged Hydrovar/e-SV Example Product Code

**10 SV 7 F H 4 F 2 0 V3**

**Hydrovar Input Power (Phase)**
V1 = Single Phase V3 = Three Phase

**1SV - 92SV Selections Available**
See e-SV Technical Manual and Price Sheets for pump / motor / options code selections.

### Hydrovar Kit Example Product Code

**HV M 3 4 15 KIT**

**Hydrovar Kit Assembly:**
Drive, disconnect and transducer pre-wired package

**HP Rating:**
02 = 2 HP 03 = 3 HP 05 = 5 HP
07 = 7.5 HP 10 = 10 HP 15 = 15 HP

**Voltage:**
2 = 230V 4 = 460V

**Phase:**
1 = Single Phase (2 and 3 HP) 3 = Three Phase (3-15 HP)

**Type:**
M = Master (only)

**Series: HV**

HV - Hydrovar Variable Speed Drive

M - Master Drive (full control and communications)

3 - 3 Phase input power

4 - 460 Volt inut power

15 - Horsepower rating

KIT - Hydrovar Kit Assembly

**Note:** Packages and KITS will only be available with Master Drive Hydrovar. 300 PSI transducer is supplied as standard.
All e-SV motors will be TEFC 3-phase construction.

**CAUTION:** Optional 500 PSI transducer measures accurately to 400 PSI. Pump, flanges and other piping system components must also be rated for the maximum system pressure. See e-SV technical manual and other appropriate technical manuals to verify all equipment is rated to maximum system pressure.

## Building the order number for the Packaged e-SV Hydrovar System

1) The e-SV pump order number is built and priced using the e-SV Technical manual, selection software, and/or the price book.

   **Note:** The Order Number System is shown on page 5 in this book.

   All Packaged e-SV Hydrovars systems use three phase TEFC motors.

2) The Pump and motor option requirements are added to the order number from the same e-SV literature.

3) The option suffix V1 or V3 is added to pump order number to complete the package.

   **Example:** Add V1 for 230 volt 1 ph Hydrovar input power supplies
   Add V3 for 460 volt 3 ph Hydrovar input power supplies

4) The Packaged Price list adders are listed on page 6 in the e-SV Price book.

   **Note:** The Package Price adders are also listed in the Variable Speed Pumping System Controller's Price book.

5) The complete Package Hydrovar list price will be the addition of the e-SV pump, motor, options, and the Packaged list price adder.

Packages are shipped completely assembled and prewired.

## Packaged e-SV Hydrovar Options

| | Suffix | Hydrovar Package |
|---|---|---|
| **Addition of Hydrovar Package** | V1 | 2 HP 230 volt 1 ph |
| | | 3 HP 230 volt 1 ph |
| | V3 | 3 HP 460 volt 3 ph |
| | | 5 HP 460 volt 3 ph |
| | | 7½ HP 460 volt 3 ph |
| | | 10 HP 460 volt 3 ph |
| | | 15 HP 460 volt 3 ph |

- Hydrovar input power supply volts and phase are listed above.
- All Packaged e-SV Hydrovar systems use three phase TEFC TC frame Baldor motors.
- Master Hydrovar VSD is used on all packages.
- Fuse box contains class J or equal fast acting fuses.
- 300 PSI transducer is supplied as standard with package.
- Tanks, piping and valves sold separately.

## Packaged Hydrovar Kits

Packaged Hydrovar Kits are able to retrofit the e-SV, and other constant speed pumps in the field. Selections can be made for pumps up to 15 hp. The kits include the Hydrovar Master Drive, fused disconnect with bracket, wiring, conduit and 300 psi transducer. The Drive will be preporgramed for single pump use. All the components are UR listed. The Kit will be fully assembled, prewired and packaged.

### Building the Packaged Hydrovar Kit Order Number

Select Package Hydrovar Kit based on input power supply and existing pump motor HP

**Note:** The Order Number System is shown on page 5 in this book

All Packaged Hydrovars Kits are only to used with three phase TEFC motors

Kit includes Hydrovar Master Drive, fused disconnect with bracket, wiring and conduit

| Order Number | Volts | Phase | HP | Description |
|---|---|---|---|---|
| HVM1202KIT | 230 | 1 | 2 | Hydrovar Kit 2 HP 1/230V |
| HVM1203KIT | | | 3 | Hydrovar Kit 3 HP 1/230V |
| HVM3403KIT | 460 | 3 | 3 | Hydrovar Kit 3 HP 3/460V |
| HVM3405KIT | | | 5 | Hydrovar Kit 5 HP 3/460V |
| HMV3407KIT | | | 7½ | Hydrovar Kit 7 1/2 HP 3/460V |
| HMV3410KIT | | | 10 | Hydrovar Kit 10 HP 3/460V |
| HVM3415KIT | | | 15 | Hydrovar Kit 15 HP 3/460V |

- Hydrovar input power supply volts and phase are listed above
- All Packaged Hydrovar kits are be only used on three phase TEFC TC frame Baldor motors
- Master Hydrovar Drive is used on all kits
- Fuse box contains class J or equal fast acting fuses
- 300 psi transducer is supplied as standard with kit

## TECHNICAL DATA – PUMP HYDRAULICS / MOTOR SIZING

### 1SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 25 | 2.88 | 3.00 | 56C | | 3.00 | 56C | | 720 | 312 | 21.5 | 25 Bar (362 psi) | Class 250 / 300 |
| 24 | 2.76 | | | | | | | 695 | 301 | 20.7 | | |
| 23 | 2.67 | | | | | | | 665 | 288 | 19.8 | | |
| 22 | 2.53 | | | | | | | 635 | 275 | 18.9 | | |
| 21 | 2.42 | | | | | | | 610 | 264 | 18.2 | | |
| 20 | 2.30 | 2.00 | | | | | | 580 | 251 | 17.3 | | |
| 19 | 2.19 | | | | | | | 550 | 238 | 16.4 | | |
| 18 | 2.07 | | | | | | | 520 | 225 | 15.5 | | |
| 17 | 1.96 | | | | 2.00 | | | 485 | 210 | 14.5 | | |
| 16 | 1.84 | | | | | | | 455 | 197 | 13.6 | | |
| 15 | 1.73 | 1.50 | | | | | | 425 | 184 | 12.7 | | |
| 14 | 1.61 | | | | | | | 400 | 173 | 11.9 | | |
| 13 | 1.50 | 1.50 | | | 1.50 | | | 375 | 162 | 11.2 | | |
| 12 | 1.38 | | | | | | | 345 | 149 | 10.3 | | |
| 11 | 1.27 | | | | | | | 315 | 136 | 9.4 | | |
| 10 | 1.15 | 1.00 | | | | | | 290 | 126 | 8.7 | | |
| 9 | 1.04 | | | | | | | 255 | 110 | 7.6 | | |
| 8 | 0.92 | 0.75 | | | 1.00 | | | 230 | 100 | 6.9 | | |
| 7 | 0.81 | | | | | | | 200 | 87 | 6.0 | | |
| 6 | 0.69 | | | | 0.75 | | | 175 | 76 | 5.2 | | |
| 5 | 0.58 | 0.50 | | | | | | 145 | 63 | 4.3 | | |
| 4 | 0.46 | | | | 0.50 | | | 115 | 50 | 3.4 | | |
| 3 | 0.35 | | | | | | | 85 | 37 | 2.5 | | |
| 2 | 0.23 | | | | | | | 60 | 26 | 1.8 | | |

## TECHNICAL DATA – PUMP HYDRAULICS / MOTOR SIZING

### 3SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 20 | 4.16 | 5.00 | 182TC | 184TC | 5.00 | 182TC | 184TC | 720 | 312 | 21.5 | 25 Bar (362 psi) | Class 250 / 300 |
| 19 | 3.95 | | | | | | | 680 | 294 | 20.3 | | |
| 18 | 3.74 | | | | | | | 645 | 279 | 19.2 | | |
| 17 | 3.54 | | | | | | | 610 | 264 | 18.2 | | |
| 16 | 3.33 | 3.00 | 56C | | | | | 575 | 249 | 17.2 | | |
| 15 | 3.12 | | | | | | | 540 | 234 | 16.1 | | |
| 14 | 2.91 | | | | 3.00 | 56C | | 500 | 217 | 14.9 | | |
| 13 | 2.70 | | | | | | | 465 | 201 | 13.9 | | |
| 12 | 2.50 | | | | | | | 430 | 186 | 12.8 | | |
| 11 | 2.29 | 2.00 | | | | | | 395 | 171 | 11.8 | | |
| 10 | 2.08 | | | | | | | 360 | 156 | 10.7 | | |
| 9 | 1.87 | | | | 2.00 | | | 320 | 139 | 9.5 | | |
| 8 | 1.66 | 1.50 | | | | | | 285 | 123 | 8.5 | | |
| 7 | 1.46 | 1.50 | | | 1.50 | | | 250 | 108 | 7.5 | | |
| 6 | 1.25 | | | | | | | 215 | 93 | 6.4 | | |
| 5 | 1.04 | 1.00 | | | | | | 180 | 78 | 5.4 | | |
| 4 | 0.83 | 0.75 | | | 1.00 | | | 145 | 63 | 4.3 | | |
| 3 | 0.62 | 0.50 | | | 0.75 | | | 105 | 45 | 3.1 | | |
| 2 | 0.42 | | | | 0.50 | | | 70 | 30 | 2.1 | | |

### 5SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 20 | 6.52 | 7.50 | 184TC | | 7.50 | 184TC | | 715 | 310 | 21.3 | 25 Bar (362 psi) | Class 250 / 300 |
| 19 | 6.19 | | | | | | | 685 | 297 | 20.4 | | |
| 18 | 5.87 | | | | | | | 650 | 282 | 19.4 | | |
| 17 | 5.54 | 5.00 | 182TC | 184TC | | 182TC | 184TC | 615 | 266 | 18.4 | | |
| 16 | 5.22 | | | | | | | 575 | 249 | 17.2 | | |
| 15 | 4.89 | | | | 5.00 | | | 540 | 234 | 16.1 | | |
| 14 | 4.56 | | | | | | | 505 | 219 | 15.1 | | |
| 13 | 4.24 | | | | | | | 470 | 204 | 14.0 | | |
| 12 | 3.91 | | | | | | | 430 | 186 | 12.8 | | |
| 11 | 3.59 | | | | | | | 395 | 171 | 11.8 | | |
| 10 | 3.26 | 3.00 | 56C | | | 56C | | 360 | 156 | 10.7 | | |
| 9 | 2.93 | | | | 3.00 | | | 320 | 139 | 9.5 | | |
| 8 | 2.61 | | | | | | | 285 | 123 | 8.5 | | |
| 7 | 2.28 | 2.00 | | | | | | 250 | 108 | 7.5 | | |
| 6 | 1.96 | 2.00 | | | 2.00 | | | 220 | 95 | 6.6 | | |
| 5 | 1.63 | 1.50 | | | | | | 180 | 78 | 5.4 | | |
| 4 | 1.30 | | | | 1.50 | | | 145 | 63 | 4.3 | | |
| 3 | 0.98 | 1.00 | | | 1.00 | | | 110 | 48 | 3.3 | | |
| 2 | 0.65 | 0.75 | | | 0.75 | | | 70 | 30 | 2.1 | | |

## TECHNICAL DATA – PUMP HYDRAULICS / MOTOR SIZING

### 10SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 12 | 10.70 | 10.00 | 213TC | 215TC | 15.00 | 215TC | 254TC | 690 | 299 | 20.6 | 25 Bar (362 psi) | Class 250 / 300 |
| 11 | 9.81 | | | | 10.00 | 213TC | 215TC | 630 | 273 | 18.8 | | |
| 10 | 8.92 | | | | | | | 575 | 249 | 17.2 | | |
| 9 | 8.03 | 7.50 | 184TC | | | | | 520 | 225 | 15.5 | | |
| 8 | 7.14 | | | | 7.50 | 184TC | | 460 | 199 | 13.7 | | |
| 7 | 6.24 | | | | | | | 400 | 173 | 11.9 | | |
| 6 | 5.35 | 5.00 | 182TC | 184TC | | | | 340 | 147 | 10.1 | | |
| 5 | 4.46 | | | | 5.00 | 182TC | 184TC | 285 | 123 | 8.5 | | |
| 4 | 3.57 | | | | | | | 225 | 97 | 6.7 | | |
| 3 | 2.68 | 3.00 | 56C | | 3.00 | 56C | | 170 | 74 | 5.1 | | |
| 2 | 1.78 | 2.00 | | | 2.00 | | | 115 | 50 | 3.4 | | |
| 1 | 0.89 | 0.75 | | | 1.00 | | | 60 | 26 | 1.8 | | |

### 15SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 7 | 13.30 | 15.00 | 215TC | 254TC | 15.00 | 215TC | 254TC | 485 | 210 | 14.5 | 25 Bar (362 psi) | Class 250 / 300 |
| 6 | 11.40 | 10.00 | 213TC | 215TC | | | | 420 | 182 | 12.5 | | |
| 5 | 9.50 | | | | 10.00 | 213TC | 215TC | 345 | 149 | 10.3 | | |
| 4 | 7.60 | 7.50 | 184TC | 184TC | | | | 275 | 119 | 8.2 | | |
| 3 | 5.70 | 5.00 | 182TC | | 7.50 | 184TC | 184TC | 210 | 91 | 6.3 | | |
| 2 | 3.80 | | | | 5.00 | 182TC | | 140 | 61 | 4.2 | | |
| 1 | 1.90 | 2.00 | 56C | | 2.00 | 56C | | 70 | 30 | 2.1 | | |

### 22SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 6 | 14.46 | 15.00 | 215TC | 254TC | 15.00 | 215TC | 254TC | 440 | 191 | 13.1 | 25 Bar (362 psi) | Class 250 / 300 |
| 5 | 12.05 | | | | | | | 365 | 158 | 10.9 | | |
| 4 | 9.64 | 10.00 | 213TC | 215TC | 10.00 | 213TC | 215TC | 295 | 128 | 8.8 | | |
| 3 | 7.23 | 7.50 | 184TC | 184TC | 7.50 | 184TC | 184TC | 220 | 95 | 6.6 | | |
| 2 | 4.82 | 5.00 | 182TC | | 5.00 | 182TC | | 245 | 106 | 7.3 | | |
| 1 | 2.41 | 3.00 | 56C | | 3.00 | 56C | | 70 | 30 | 2.1 | | |

## TECHNICAL DATA – PUMP HYDRAULICS / MOTOR SIZING

### 33SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 3/1 | 14.70 | 15.00 | 215TC | 254TC | 15.00 | 215TC | 254TC | 310 | 133 | 9.0 | 25 Bar (362 psi) | Class 125 / 150 |
| 3/2 | 13.20 | | | | | | | 281 | 121 | 8.0 | | |
| 2 | 10.90 | 10 | | 215TC | | | | 225 | 97 | 7.0 | | |
| 2/1 | 9.40 | | | | 10 | | 215TC | 196 | 84 | 6.0 | | |
| 2/2 | 7.90 | 7.50 | 184TC | | | | | 167 | 72 | 5.0 | | |
| 1 | 5.40 | 5 | | | 7.5 | 184TC | | 113 | 49 | 3.0 | | |
| 1/1 | 4.00 | | | | 5.00 | | | 84 | 36 | 3.0 | | |

### 46SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 2/1 | 14.50 | 15.00 | 215TC | 254TC | 15 | 215TC | 254TC | 226 | 97 | 6.7 | 25 Bar (362 psi) | Class 125 / 150 |
| 2/2 | 12.80 | | | | | | | 200 | 86 | 6.0 | | |
| 1 | 8.50 | 10.00 | | 215TC | 10.00 | | 215TC | 127 | 55 | 3.8 | | |
| 1/1 | 6.70 | 7.50 | 184TC | | 7.50 | 184TC | | 102 | 44 | 3.0 | | |

### 66SV 3500 RPM

| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 1 | 12.20 | 15.00 | 215TC | 254TC | 15.00 | 215TC | 254TC | 142 | 61 | 4.2 | 25 Bar (362 psi) | Class 125 / 150 |
| 1/1 | 9.20 | 10.00 | | 215TC | 10.00 | | 215TC | 115 | 49 | 3.4 | | |

### 92SV 3500 RPM

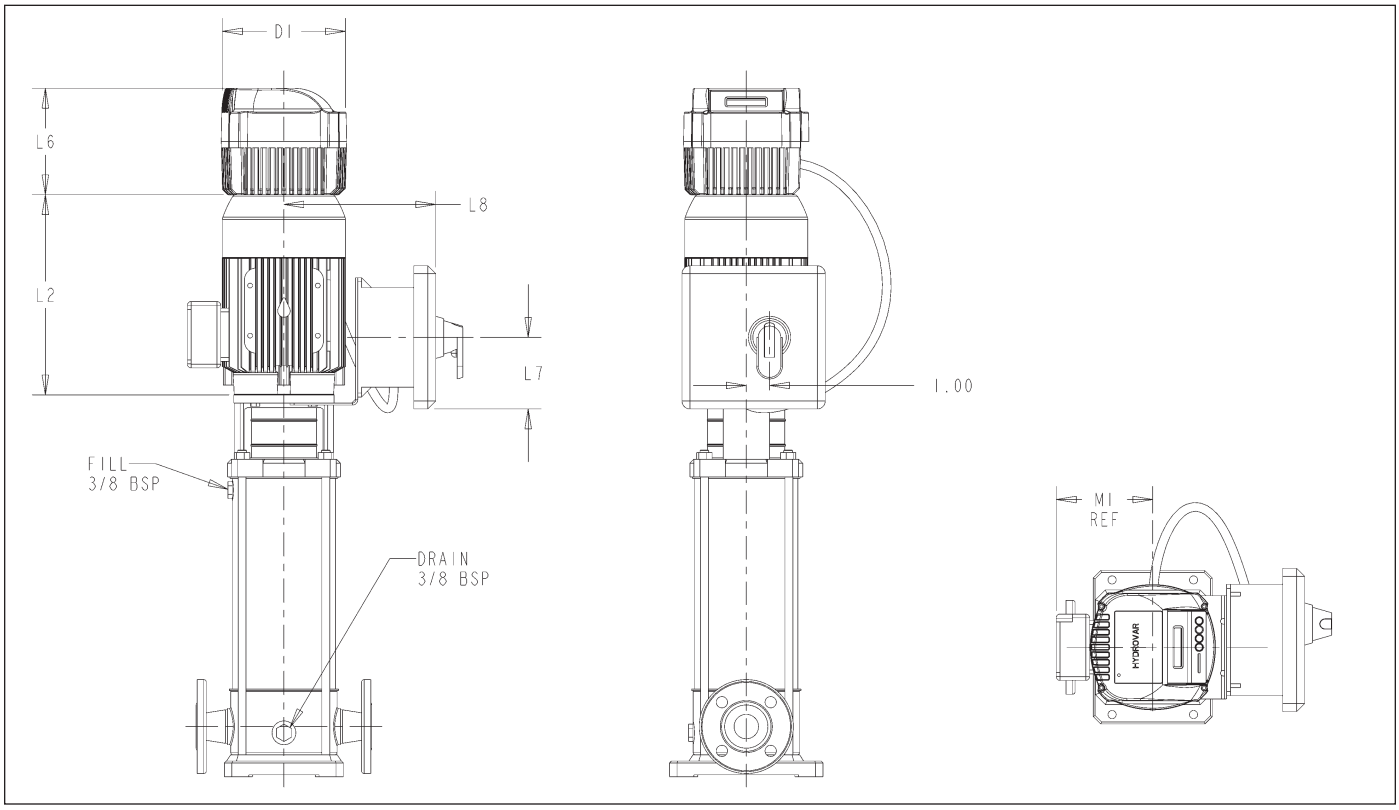
| No. of impellers | Maxi-mum HP draw | Motor Selection using SF | | | Motor Selection using Hydrovar ( 1.0 SF ) | | | Shut-off TDH (Feet) | Shut-off TDH (psi) | Shut-off TDH (Bar) | Casing / Sleeve Pressure rating (standard assy.) | Pump Flange Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated HP | NEMA MOTOR FRAME | | Rated HP | NEMA MOTOR FRAME | | | | | | |
| | | | ODP | TEFC | | ODP | TEFC | | | | | |
| 1/1 | 6.70 | 15.00 | 215TC | 254TC | 15.00 | 215TC | 254TC | 127 | 55 | 3.8 | 25 Bar (362 psi) | Class 125 / 150 |

## MOTOR DATA

| HP | Phase | Enclosure | Nameplate Voltage | NEMA Frame | Part Number | FLA | SFA | ① LRA | S.F. | Efficiency | Insulation Class |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 | TEFC | 208-230/460 | 56C | V08A32E2BB2S | 6.2-5.8/2.9 | 6.8-6.4/3.2 | 20.8 | 1.15 | 80.0% | B |
| | | PE-TEFC | 208-230/460 | 56C | V08A32E5BB2S | 5.3-5/2.5 | 5.9-5.6/2.8 | 25.9 | 1.15 | 85.5% | F |
| 3 | | TEFC | 208-230/460 | 56C | V09A32E2BB2S | 8.1-7.6/3.8 | 9.5-8.6/4.3 | 32.9 | 1.15 | 82.5% | F |
| | | PE-TEFC | 208-230/460 | 182TC | V09A32F5BD2S | 7.9-7.2/3.6 | 9.0-8.2/4.1 | 33.1 | 1.15 | 86.5% | F |
| 5 | | TEFC | 208-230/460 | 184TC | V10A32E2BD2S | 12.6-11.6/5.8 | 14.6-13.4/6.7 | 54 | 1.15 | 87.5% | F |
| | | PE-TEFC | 230/460 | 184TC | V10A32F5BD2S | 11.8/5.9 | 13.4/6.8 | 57.2 | 1.15 | 88.5% | F |
| 7.5 | | TEFC | 208-230/460 | 184TC | V11A32E2BD2S | 18.5-17.4/8.7 | 21.7-19.6/9.8 | 98.8 | 1.15 | 88.5% | F |
| | | PE-TEFC | 230/460 | 213TC | V11742APE | 17.8/8.9 | 20.2/10.1 | 83.4 | 1.15 | 91.0% | F |
| 10 | | TEFC | 208-230/460 | 215TC | V12A32E2BE2S | 25.7-24/12 | 30.5-27.6/13.8 | 81.8 | 1.15 | 89.5% | F |
| | | PE-TEFC | 230/460 | 215TC | V12A32F5BE2S | 23.8/11.9 | 27.6/13.7 | 112 | 1.15 | 91.0% | F |
| 15 | | TEFC | 208-230/460 | 254TC | V13A32E2BK2S | 37.5-34/17 | 43-39/19.5 | 152 | 1.15 | 90.2% | F |
| | | PE-TEFC | 208-230/460 | 254TC | V13742PE | 37-34.4/17.2 | 43.8-39.6/19.8 | 112 | 1.15 | 91.7% | F |

**NOTES:**
① Locked Rotor Amps are for high voltage only.
Above data is for Baldor® TC and TSC frame motors. Specifications subject to change without notice.

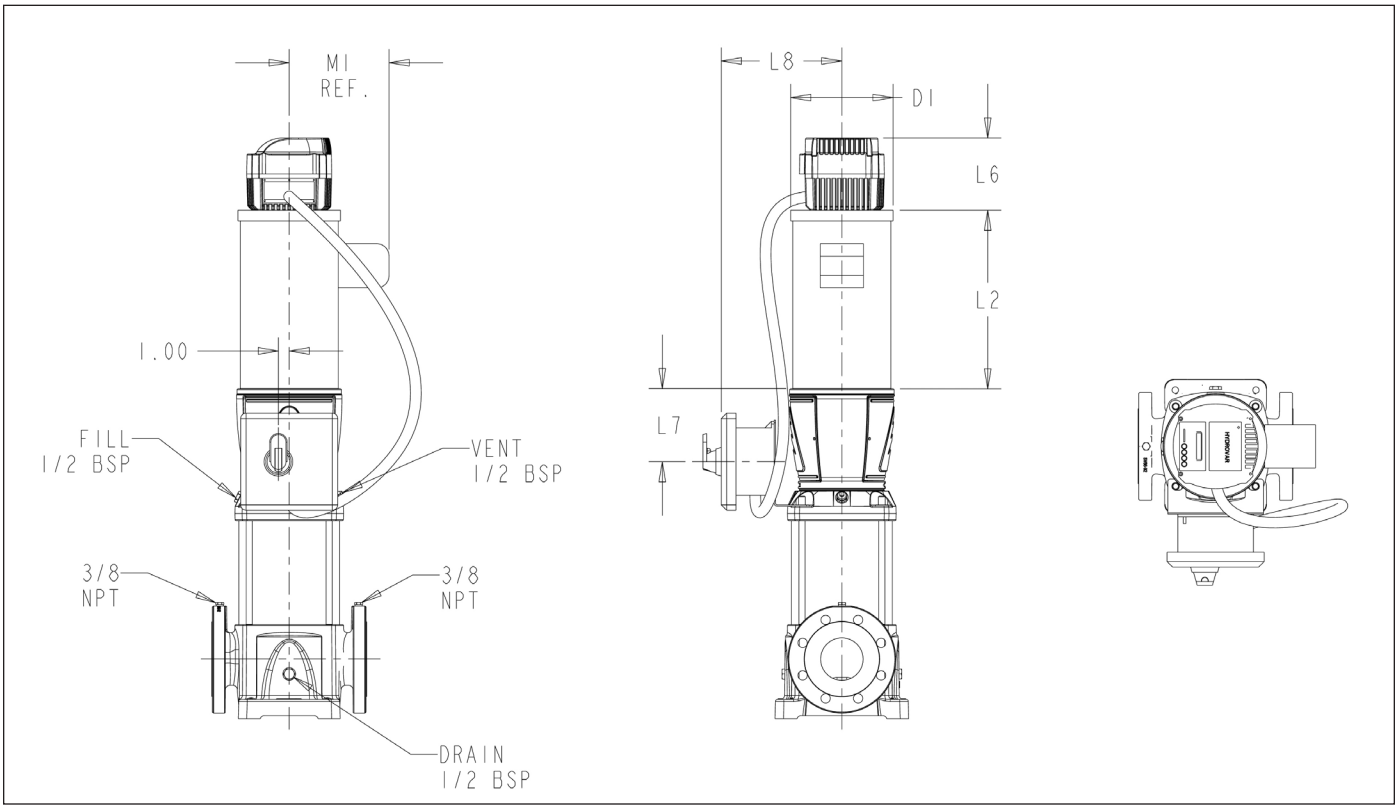
## PACKAGED HYDROVAR SERIES – 1SV - 22SV DIMENSIONS




| Frame (3 PH TEFC) | HP | Dimensions (in) | | | | | | Weight (lbs.) | |
|---|---|---|---|---|---|---|---|---|---|
| | | L2 | L6 | L7 | L8 | MI (Ref.) | DI Max. | Hydrovar | Disconnect Box |
| 56C | 2 | 11.17 | 6.70 | 3.50 | 11.60 | 5.23 | 7.19 | 10.15 | 2.5 |
| | 3 | 11.16 | | | | 5.74 | | | |
| 180TC | | 12.30 | | | 12.00 | 5.72 | | | |
| | 5 | 13.68 | | | | 6.87 | 8.50 | | |
| 213TC | 7.5 | 15.26 | | | | 8.05 | 10.28 | 17.71 | |
| 215TC | 10 | 16.39 | | | | | | | |
| 254TC | 15 | 19.83 | | | | | | | |

**NOTE:** See e-SV Technical Manual for Liquid-End Dimensions.

## PACKAGED HYDROVAR SERIES – 33SV - 92SV DIMENSIONS




| Frame (3 PH TEFC) | HP | Dimensions (in) | | | | | | Weight (lbs.) | |
|---|---|---|---|---|---|---|---|---|---|
| | | L2 | L6 | L7 | L8 | MI (Ref.) | DI Max. | Hydrovar | Disconnect Box |
| 56C | 3 | 11.16 | 6.70 | 3.50 | 11.60 | 5.74 | 7.19 | 10.15 | 2.5 |
| 180TC | | 12.30 | | | 12.00 | 5.72 | | | |
| | 5 | 13.68 | | | | 6.87 | 8.50 | | |
| 213TC | 7.5 | 15.26 | | | | 8.05 | 10.28 | 17.71 | |
| 215TC | 10 | 16.39 | | | | | | | |
| 254TC | 15 | 19.83 | | | | | | | |

**NOTE:** See e-SV Technical Manual for Liquid-End Dimensions.

**NPSH**

The minimum operating values that can be reached at the pump suction end are limited by the onset of cavitation.

Cavitation is the formation of vapor-filled cavities within liquids where the pressure is locally reduced to a critical value, or where the local pressure is equal to, or just below the vapor pressure of the liquid.

The vapor-filled cavities flow with the current and when they reach a higher pressure ares the vapor contained in the cavities condenses. The cavities collide, generating pressure waves that are transmitted to the walls. These, being subjected to stress cycles, gradually become deformed and yield due to fatigue. This phenomenon, characterized by a metallic noise produced by the hammering on the pipe walls, is called incipient cavitation.

The damage caused by cavitation may be magnified by electrochemical corrosion and a local rise in temperature due to the plastic deformation of the walls. The materials that offer the highest resistance to heat and corrosion are alloy steels, especially austenitic steel. The conditions that trigger cavitation may be assessed by calculating the total net suction head, referred to in technical literature with the acronym NPSH (Net Positive Suction Head).

The NPSH represents the total energy (expressed in feet) of the liquid measured at suction under conditions of incipient cavitation, excluding the vapor pressure (expressed in feet) that the liquid has at the pump inlet.

To find the static height (hz) at which to install the machine under safe conditions, the following formula must be verified:

$$\mathbf{h_p + h_z \geq (NPSHr + 2\ feet) + h_f + h_{pv}}$$

where:

**$h_p$** is the absolute pressure applied to the free liquid surface in the suction tank, expressed in feet of liquid; hp is the quotient between the barometric pressure and the specific weight of the liquid.

**$h_z$** is the suction lift between the pump axis and the free liquid surface in the suction tank, expressed in feet; hz is negative when the liquid level is lower than the pump axis.

**$h_f$** is the flow resistance in the suction line and its accessories, such as: fittings, foot valve, gate valve, elbows, etc.

**$h_{pv}$** is the vapor pressure of the liquid at the operating temperature, expressed in feet of the liquid. hpv is the quotient between the Pv vapor pressure and the liquid's specific weight.

**0.5** is the safety factor.

The maximum possible suction head for installation depends on the value of the atmospheric pressure (i.e. the elevation above sea level at which the pump is installed) and the temperature of the liquid.

To help the user, with reference to water temperature (40°F) and to the elevation above sea level, the following tables show the drop in hydraulic pressure head in relation to the elevation above sea level, and the suction loss in relation to temperature.

| **Water Temperature (°C)** | 68 | 104 | 140 | 176 | 194 | 230 | 248 |
|---|---|---|---|---|---|---|---|
| **Suction Loss (ft)** | -.7 | 2.3 | 6.6 | 16.4 | 24.3 | 50.5 | 70.5 |

| **Elevation Above Sea Level (ft)** | 1600 | 3300 | 4900 | 6500 | 8200 | 9800 |
|---|---|---|---|---|---|---|
| **Suction Loss (ft)** | 1.8 | 3.6 | 5.4 | 7.2 | 9.0 | 10.8 |

To reduce it to a minimum, especially in cases of high suction head (over 13 – 16 feet) or within the operating limits with high flow rates, we recommend using a suction line having a larger diameter than that of the pump's suction port. It is always a good idea to position the pump as close as possible to the liquid to be pumped.

## TECHNICAL DATA – WATER PROPERTY CHART

| Temp °F | Temp °C | Specific Volume (Cubic ft/lb) | Specific Gravity | | | Weight (lb/cubic ft) | Vapor Pressure (psi Abs) |
|---|---|---|---|---|---|---|---|
| | | | @ 39.2°F | @ 60°F | @ 68°F | | |
| 32 | 0.0 | 0.01602 | 1.000 | 1.001 | 1.002 | 62.42 | 0.088 |
| 35 | 1.7 | 0.01602 | 1.000 | 1.001 | 1.002 | 62.42 | 0.100 |
| 40 | 4.4 | 0.01602 | 1.000 | 1.001 | 1.002 | 62.42 | 0.122 |
| 50 | 10.0 | 0.01603 | 0.999 | 1.001 | 1.002 | 62.38 | 0.178 |
| 60 | 15.6 | 0.01604 | 0.999 | 1.000 | 1.001 | 62.34 | 0.256 |
| 70 | 21.1 | 0.01606 | 0.998 | 0.999 | 1.000 | 62.27 | 0.363 |
| 80 | 26.7 | 0.01608 | 0.996 | 0.998 | 0.999 | 62.19 | 0.507 |
| 90 | 32.2 | 0.0161 | 0.995 | 0.996 | 0.997 | 62.11 | 0.698 |
| 100 | 37.8 | 0.01613 | 0.993 | 0.994 | 0.995 | 62.00 | 0.949 |
| 120 | 48.9 | 0.0162 | 0.989 | 0.990 | 0.991 | 61.73 | 1.692 |
| 140 | 60.0 | 0.01629 | 0.983 | 0.985 | 0.986 | 61.39 | 2.889 |
| 160 | 71.1 | 0.01639 | 0.977 | 0.979 | 0.979 | 61.01 | 4.741 |
| 180 | 82.2 | 0.01651 | 0.970 | 0.972 | 0.973 | 60.57 | 7.510 |
| 200 | 93.3 | 0.01663 | 0.963 | 0.964 | 0.966 | 60.13 | 11.526 |
| 212 | 100.0 | 0.01672 | 0.958 | 0.959 | 0.960 | 59.81 | 14.696 |
| 220 | 104.4 | 0.01677 | 0.955 | 0.956 | 0.957 | 59.63 | 17.186 |
| 240 | 115.6 | 0.01692 | 0.947 | 0.948 | 0.949 | 59.10 | 24.97 |
| 260 | 126.7 | 0.01709 | 0.938 | 0.939 | 0.940 | 58.51 | 35.43 |
| 280 | 137.8 | 0.01726 | 0.928 | 0.929 | 0.930 | 58.00 | 49.20 |
| 300 | 148.9 | 0.01745 | 0.918 | 0.919 | 0.920 | 57.31 | 67.01 |
| 320 | 160.0 | 0.01756 | 0.908 | 0.909 | 0.910 | 56.66 | 89.66 |
| 340 | 171.1 | 0.01787 | 0.896 | 0.898 | 0.899 | 55.96 | 118.01 |
| 360 | 182.2 | 0.01811 | 0.885 | 0.886 | 0.887 | 55.22 | 153.04 |
| 380 | 193.3 | 0.01836 | 0.873 | 0.874 | 0.875 | 54.47 | 195.77 |
| 400 | 204.4 | 0.01864 | 0.859 | 0.860 | 0.862 | 53.65 | 247.31 |
| 420 | 215.6 | 0.01894 | 0.846 | 0.847 | 0.848 | 52.80 | 308.83 |
| 440 | 226.7 | 0.01926 | 0.832 | 0.833 | 0.834 | 51.92 | 381.59 |
| 460 | 237.8 | 0.0196 | 0.817 | 0.818 | 0.819 | 51.02 | 466.9 |
| 480 | 248.9 | 0.02 | 0.801 | 0.802 | 0.803 | 50.00 | 566.1 |
| 500 | 260.0 | 0.0204 | 0.785 | 0.786 | 0.787 | 49.02 | 680.8 |
| 520 | 271.1 | 0.0209 | 0.765 | 0.766 | 0.767 | 47.85 | 812.4 |
| 540 | 282.2 | 0.0215 | 0.746 | 0.747 | 0.748 | 46.51 | 962.5 |
| 560 | 293.3 | 0.0221 | 0.726 | 0.727 | 0.728 | 45.30 | 1133.1 |
| 580 | 304.4 | 0.0228 | 0.703 | 0.704 | 0.704 | 43.90 | 1325.8 |
| 600 | 315.6 | 0.0236 | 0.678 | 0.679 | 0.680 | 42.30 | 1542.9 |
| 620 | 326.7 | 0.0247 | 0.649 | 0.650 | 0.650 | 40.50 | 1786.6 |
| 640 | 337.8 | 0.026 | 0.617 | 0.618 | 0.618 | 38.50 | 2059.7 |
| 660 | 348.9 | 0.0278 | 0.577 | 0.577 | 0.578 | 36.00 | 2365.4 |
| 680 | 360.0 | 0.0305 | 0.525 | 0.526 | 0.527 | 32.80 | 2708.1 |
| 700 | 371.1 | 0.0369 | 0.434 | 0.435 | 0.435 | 27.10 | 3093.7 |

## VOLUMETRIC CAPACITY

| Litres per minute l/min | Cubic metres per hour $m^3/h$ | Cubic feet per hour $ft^3/h$ | Cubic feet per minute $ft^3/min$ | Imp. gal. per minute Imp. gal/min | US gal. per minute Us gal./min |
|---|---|---|---|---|---|
| 1,0000 | 0,0600 | 2,1189 | 0,0353 | 0,2200 | 0,2640 |
| 16,6670 | 1,0000 | 35,3147 | 0,5886 | 3,6660 | 4,4030 |
| 0,4720 | 0,0283 | 1,0000 | 0,0167 | 0,1040 | 0,1250 |
| 28,3170 | 1,6990 | 60,0000 | 1,0000 | 6,2290 | 7,4800 |
| 4,5460 | 0,2728 | 9,6326 | 0,1605 | 1,0000 | 1,2010 |
| 3,7850 | 0,2271 | 8,0209 | 0,1337 | 0,8330 | 1,0000 |
| 0,1100 | 0,0066 | 0,2339 | 0,0039 | 0,0240 | 0,0290 |

## PRESSURE AND HEAD

| Newtons per square metre $N/m^2$ | kilopascal kPa | bar bar | Pound force per square inch psi | metre of water m $H_2O$ | millimetre of mercury mm Hg |
|---|---|---|---|---|---|
| 1,0000 | 0,0010 | 1 x 105 | $1,45 \times 10^{-4}$ | $1,02 \times 10^{-4}$ | 0,0075 |
| 1000,0000 | 1,0000 | 0,0100 | 0,1450 | 0,1020 | 7,5000 |
| 100000,0000 | 100,0000 | 1,0000 | 14,5000 | 10,2000 | 750,1000 |
| 98067,0000 | 98,0700 | 0,9810 | 14,2200 | 10,0000 | 735,6000 |
| 6895,0000 | 6,8950 | 0,0690 | 1,0000 | 0,7030 | 51,7200 |
| 2984,0000 | 2,9840 | 0,0300 | 0,4330 | 0,3050 | 22,4200 |
| 9789,0000 | 9,7890 | 0,0980 | 1,4200 | 1,0000 | 73,4200 |
| 133,3000 | 0,1330 | 0,0013 | 0,0190 | 0,0140 | 1,0000 |
| 3386,0000 | 3,3860 | 0,0338 | 0,4910 | 0,3450 | 25,4000 |

## LENGTH

| millimetre mm | centimetre cm | metre m | inch in | foot ft | yard yd |
|---|---|---|---|---|---|
| 1,0000 | 0,1000 | 0,0010 | 0,0394 | 0,0033 | 0,0011 |
| 10,0000 | 1,0000 | 0,0100 | 0,3937 | 0,0328 | 0,0109 |
| 1000,0000 | 100,0000 | 1,0000 | 39,3701 | 3,2808 | 1,0936 |
| 25,4000 | 2,5400 | 0,0254 | 1,0000 | 0,0833 | 0,0278 |
| 304,8000 | 30,4800 | 0,3048 | 12,0000 | 1,0000 | 0,3333 |
| 914,4000 | 91,4400 | 0,9144 | 36,0000 | 3,0000 | 1,0000 |

## VOLUME

| cubic metre $m^3$ | litre litre | millilitre ml | imp. gallon imp. gal. | US gallon US gal. | cubic foot $ft^3$ |
|---|---|---|---|---|---|
| 1,0000 | 1000,0000 | 1 x 106 | 220,0000 | 264,2000 | 35,3147 |
| 0,0010 | 1,0000 | 1000,0000 | 0,2200 | 0,2642 | 0,0353 |
| 1 x 10-6 | 0,0010 | 1,0000 | 2,2 x 10-4 | 2,642 x 10-4 | 3,53 x 10-5 |
| 0,0045 | 4,5460 | 4546,0000 | 1,0000 | 1,2010 | 0,1605 |
| 0,0038 | 3,7850 | 3785,0000 | 0,8327 | 1,0000 | 0,1337 |
| 0,0283 | 28,3170 | 28317,0000 | 6,2288 | 7,4805 | 1,0000 |

# Xylem |'zīləm|

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