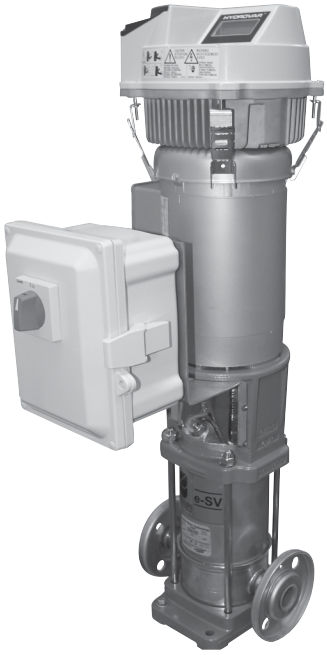
GOULDS WATER TECHNOLOGY
xylem

Technical Brochure
BPHV R9



Packaged e-SV HYDROVAR® Series

Variable speed water booster with e-SV Series vertical multistage pump and fused disconnect

xylem
Let's Solve Water

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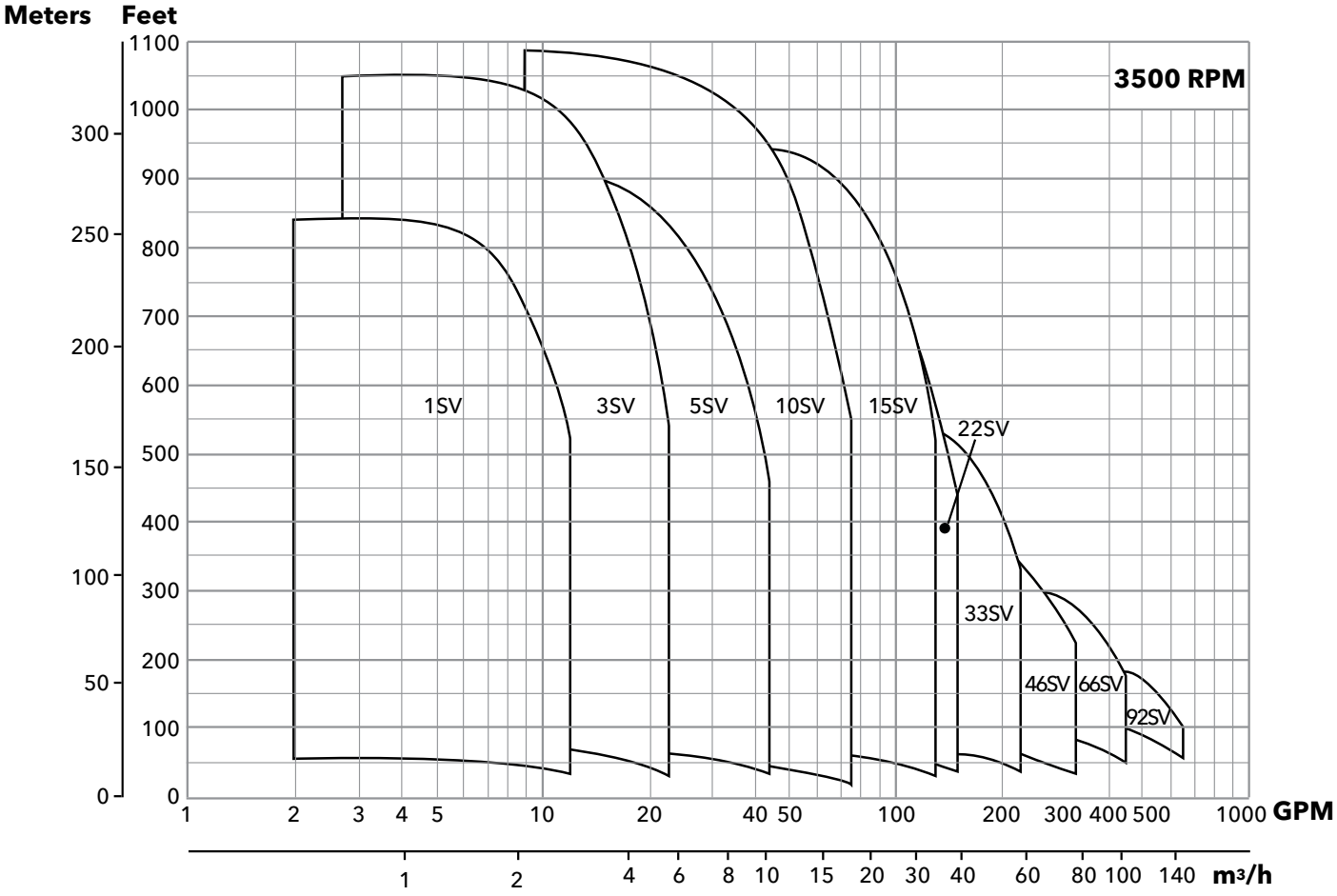
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Packaged HYDROVAR Series / e-SV Series coverage chart



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

Main components

(constant pressure variable speed system)

- One multistage vertical pump , Goulds Water Technology e-SV Series.
- **HYDROVAR**® pump mounted variable speed drive, NEMA 1 enclosure
- **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.Includes fast acting fuses.
- UL Package listing
- Factory tested and assembled. Pre-programmed, wired, and electrically tested.

1) Vertical multistage stainless pump

2) TEFC NEMA 2-pole motor

3) NEMA 4X fused disconnect panel

4) HYDROVAR variable speed controller

5) Pressure transducer (sensor) with cable



"Packaged pumping system"

Markets and applications

Booster sets

Markets served
Municipal, commercial and 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 725 GPM

• **Head** up to 1,080' TDH

• **Input supply:**
1Ø Input 208/230 volt 2 and 3 HP
3Ø Input 208/230 volt 2 and 3 HP
3Ø Input 460 volt 2 - 5 HP
(208 – 240V ± 10%, 15 – 70 Hz)
(380 – 460V ± 10%, 15 – 70 Hz)

• **Output voltage:**
3Ø, 230V 2 – 3 HP
3Ø, 460V 2 – 5 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: NEMA1 up to 30 HP

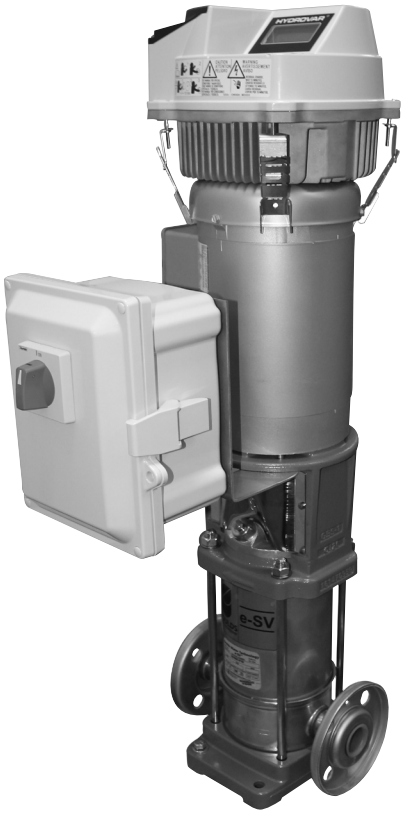
• **Maximum HP:** 5 HP

• **Soft motor start**

• **Vertical design pump**:
e-SV series (motor insulation class, F, TEFC enclosure)

• **Maximum operating pressure:** 360 PSI

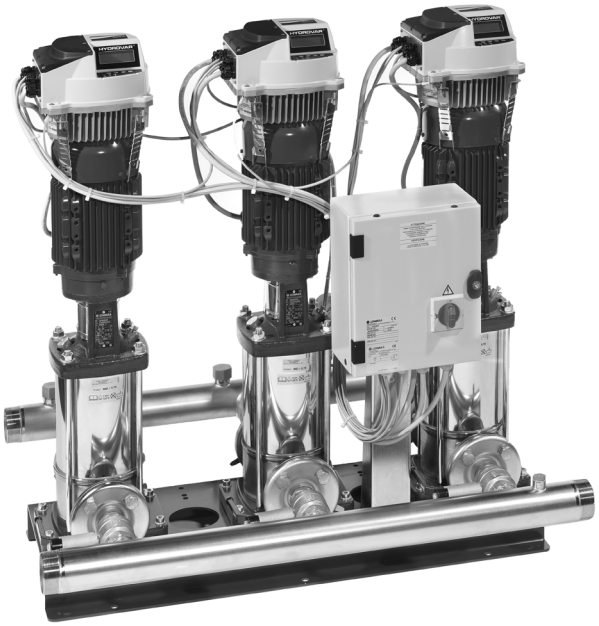
• **Maximum temperature of pumped liquid:** 250°F



Markets and applications (continued)

Water supply and pressure boosting

- Pressure boosting in buildings, hotels and residential complexes
- Pressure booster stations and 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 and washing of electronic industry circuits)
- Commercial washers
- Fire fighting system pumps

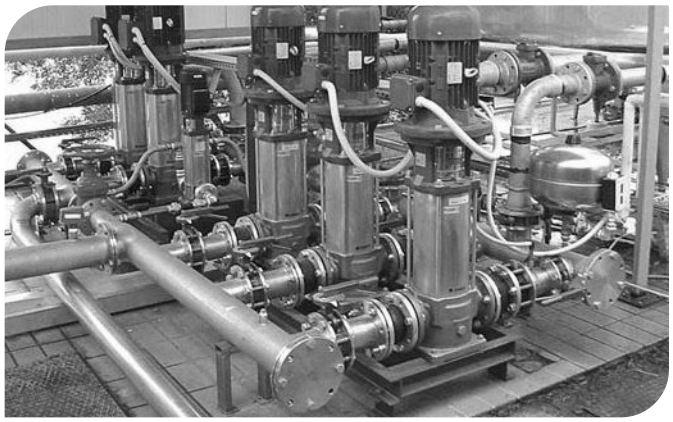


Irrigation and agriculture

- 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

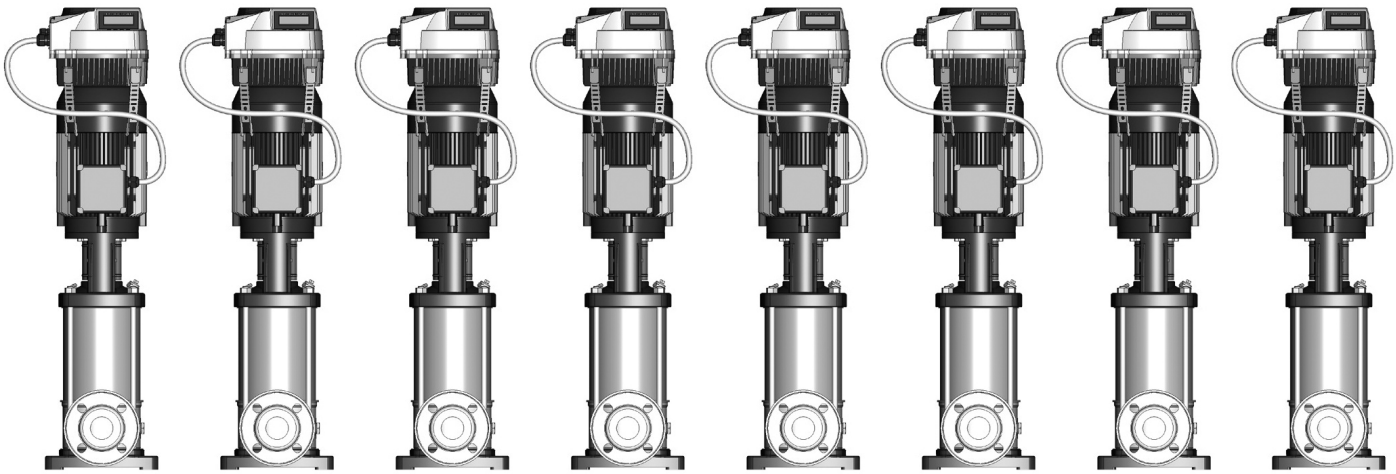
- Handling of water, free of suspended solids, in the municipal, industrial and agricultural markets
- Pressure boosting and water supply systems
- Fire fighting jockey pumps
- Irrigation systems
- Wash systems
- Water treatment plants: reverse osmosis
- Handling of moderately aggressive liquids, demineralized 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 multi-stage 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).

Application example – multi-pump “cascade”



With the “master” version of the HYDROVAR, 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 a booster package

1SV – 22SV e-SV Series vertical multistage 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 – 92SV e-SV Series multistage 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

- UL QCZJ package listing
- VFD (HYDROVAR) UL recognized
- Baldor motor UL recognized
- **Pumps meet ANSI/NSF 61 certification by CSA for potable drinking water**
- Control/disconnect meet UL508A standards

Main characteristics of frequency converters used in the packaged booster sets

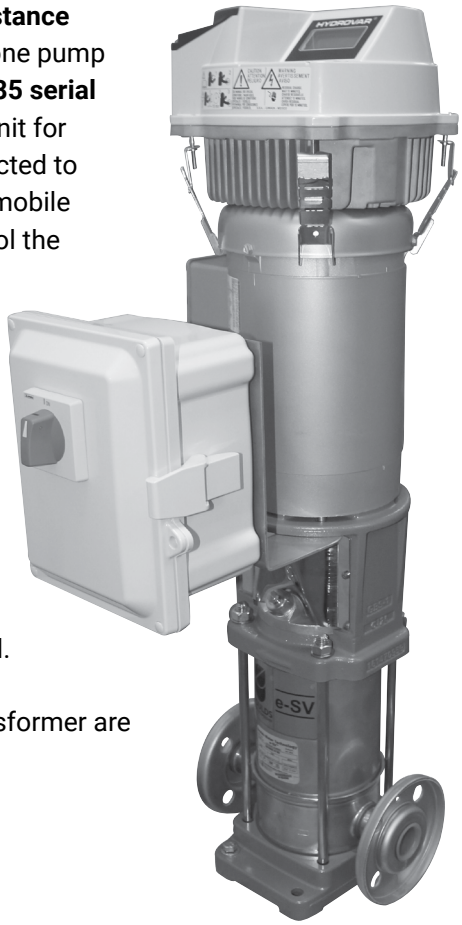
The booster uses a **HYDROVAR®** variable frequency drive, an automatic device that adjusts the speed of the electric pump in order to maintain **constant pressure** in the system.



Modular HYDROVAR, bare unit

Converters with power up to 30 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.

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 eight (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 signaling** 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.

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.

Further information is available in the HYDROVAR IOM.

HYDROVAR specifications

HYDROVAR VFD							TEFC motor	
Model	Input		HP	NEMA class	Max input current (A)	Max output current (A)	Power supply (voltage/phase)	HP
	Voltage (V)	Phase						
10073L1AAUST	208-240	1	2	1	11.6	7.5	230/3	2
10073L2AAUST			3		15.1	10		3
10073L5AAUST	208-240	3	2		7	7.5		2
10073L6AAUST			3		9.1	10		3
10073LCAAUST	380-460		2		3.9	4.1	460/3	2
10073LDAAUST			3		5.3	5.7		3
10073LFAAUST			5		10.1	10		5

Electrical panels (Packaged HYDROVAR Series)

The Packaged HYDROVAR Series comes with a **fused disconnect** on which are installed automatic **line protection fast acting fuses** for each drive. Class J or Class KTK, 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**.

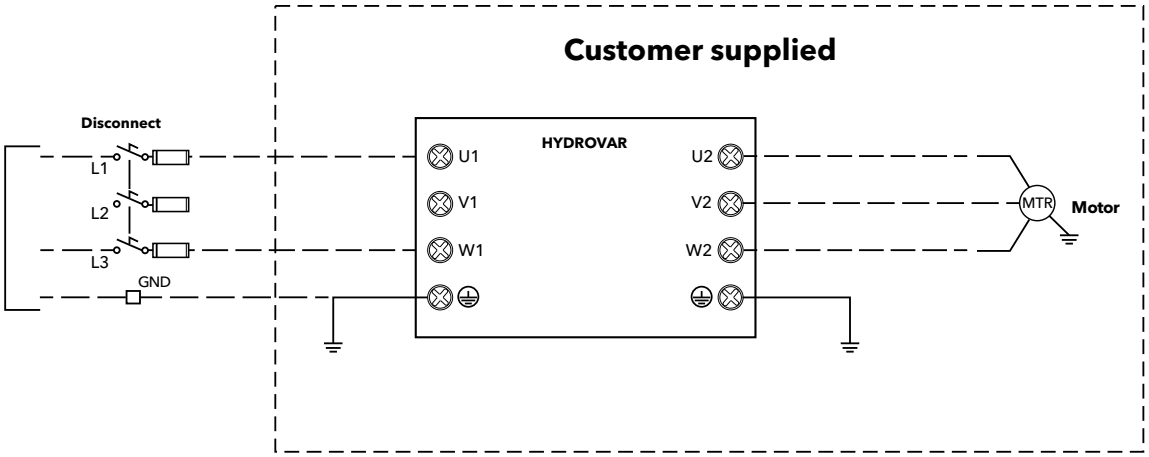
The fused disconnect is rated for UL508A.



Fused disconnect box

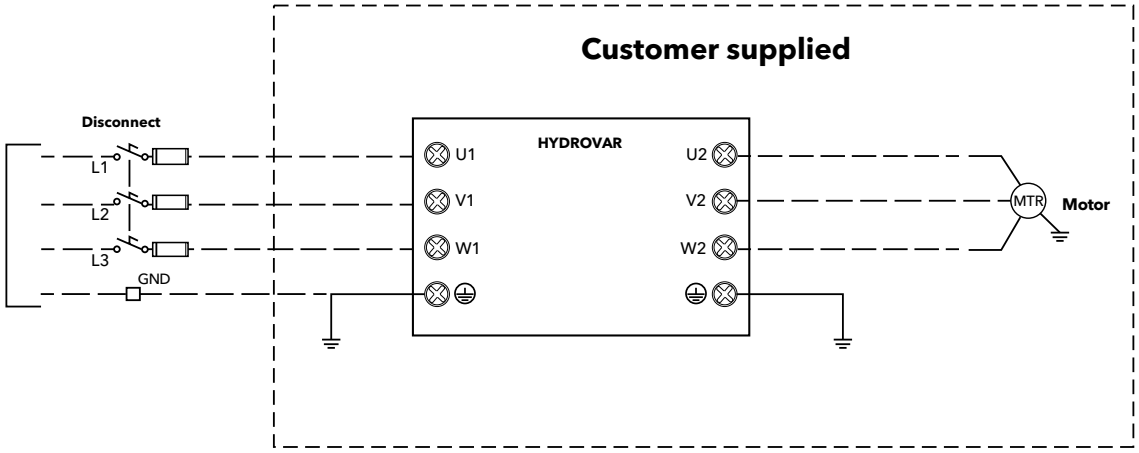
Single-phase

Customer supplied voltage



Three-phase

Customer supplied voltage



Disconnect part number	Input voltage	NEMA rating HP/ Amps	Wire AWG disconnect to VFD	Tightening torque	Fuse brand	Amp rating	Fuse part number	Max voltage
HFD512C1-2	230V/1PH	2HP/12A	14	18 lb-in	Bussmann	20	KTK-R-20	600V
HFD512E1-2	230V/1PH	3HP/17A	14	18 lb-in	Bussmann	30	KTK-R-30	600V
HFD532C1-1	230V/3PH	2HP/6.8A	14	18 lb-in	Bussmann	15	KTK-R-15	600V
HFD532E1-1	230V/3PH	3HP/9.6A	14	18 lb-in	Bussmann	15	KTK-R-15	600V
HFD534A1-2	460V/3PH	2HP/ 3.4A 3HP/4.8A	14	18 lb-in	Bussmann	10	KTK-R-10	600V
HFD534B1-2	460V/3PH	5HP/7.6A	14	18 lb-in	Bussmann	15	KTK-R-15	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.

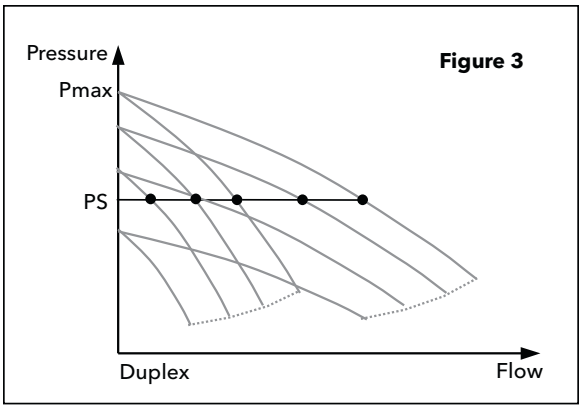


Figure 3

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 variable speed drive starts per hr up to 10 HP. Maximum 40 variable speed drive starts per hr above 10 HP.
Sound emission	See table

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

Typical acoustic performance TEFC / Super-e motors

	PWL (dBA)	
NEMA frame size	**3600 RPM**	**1800 RPM**
56	70	67
180		
210		
250	76	70
280	79	75

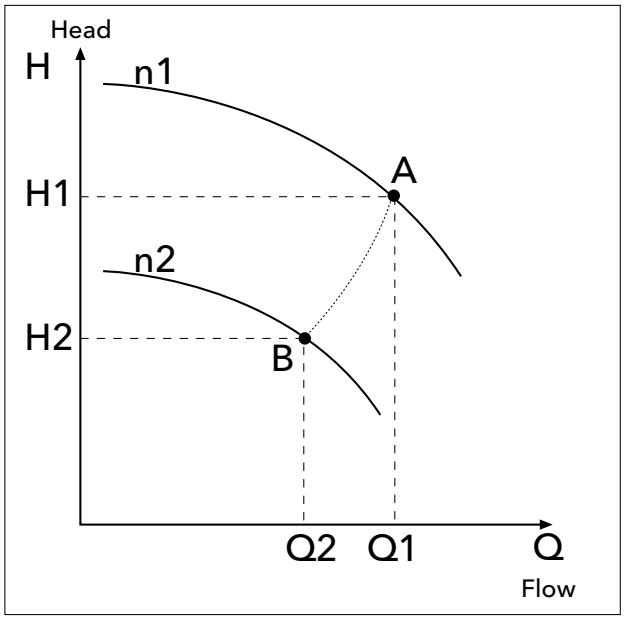
Performance with varying speed for centrifugal pumps

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.

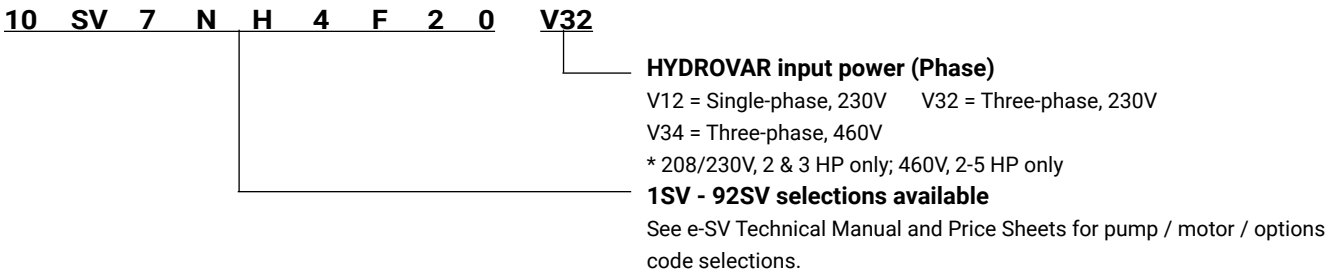
For peak performance, variable speed booster sets need **smaller tanks** compared to traditional systems. Generally speaking, a tank with a capacity of just 20% of the nominal capacity of a single pump, expressed in gallons per minute, is required. Example: If my pump is sized for 100 GPM, then we would 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 Series 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 Series/e-SV example product code



HV - HYDROVAR Variable Speed Drive

M - Master drive (full control and communications)

3 - 3-phase input power

4 - 460 Volt input 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 Series technical brochures and other appropriate technical documentation 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 HYDROVAR 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) Add option suffix V12, V32 or V34 to the pump order number to complet the packge.

   Example: Add V12 for 230 volt 1-phase HYDROVAR input power supply

   Add V34 for 460 volt 3-phase HYDROVAR input power supply

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 Packaged 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 Series options

	Suffix	Package description
Addition of Package HYDROVAR	V12	HYDROVAR 1PH 208-240V - 2HP
		HYDROVAR 1PH 208-240V - 3HP
	V32	HYDROVAR 3PH 208-240V - 2HP
		HYDROVAR 3PH 208-240V - 3HP
	V34	HYDROVAR 3PH 380-460V - 2HP
		HYDROVAR 3PH 380-460V - 3HP
		HYDROVAR 3PH 380-460V - 5HP

- 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, Class KTK 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 30 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 HYDROVAR Kits are only to used with three-phase TEFC motors

Kit includes HYDROVAR master drive, fused disconnect with bracket, wiring and conduit

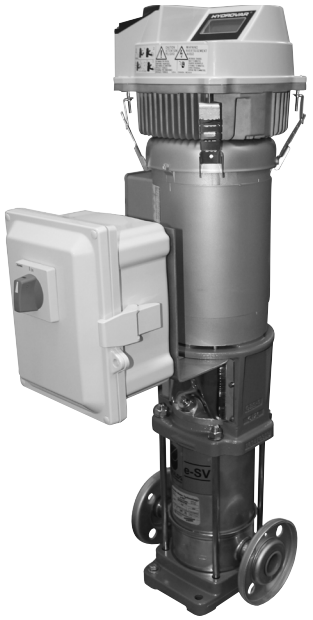
1-22SV

Model	Rated output (HP)	Input voltage (V)	Input phase	Max Input current (A)	Max output current (A)	Description
10073L1AAUST1KIT	2	208-240	1	11.6	7.5	HYDROVAR Kit 2HP 1/208-240V
10073L2AAUST1KIT	3			15.1	10	HYDROVAR Kit 3HP 1/208-240V
10073L5AAUST1KIT	2	208-240	3	7	7.5	HYDROVAR Kit 2HP 3/208-240V
10073L6AAUST1KIT	3			9.1	10	HYDROVAR Kit 3HP 3/208-240V
10073LCAAUST1KIT	2	380-460		3.9	4.1	HYDROVAR Kit 2HP 3/380-460V
10073LDAAUST1KIT	3			5.3	5.7	HYDROVAR Kit 3HP 3/380-460V
10073LFAAUST1KIT	5			10.1	10	HYDROVAR Kit 5HP 3/380-460V

33-125SV

Model	Rated output (HP)	Input voltage (V)	Input phase	Max Input current (A)	Max output current (A)	Description
10073LFAAUST2KIT	5	380-460	**3**	10.1	10	HYDROVAR Kit 5HP 3/380-460V

- 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	Maximum HP draw	Motor selection using HYDROVAR (1.0 SF)		Shutoff TDH (feet)	Shutoff TDH (psi)	Shutoff TDH (bar)	Casing / Sleeve pressure rating (standard assy.)	Pump flange rating
		Rated HP	NEMA motor frame TEFC					
30	3.45	5.00	184TC	860	372	25.7	40 bar (580 psi)	Class 250 / 300
29	3.34		184TC	835	362	24.9	25 bar (362 psi)	
28	3.22		184TC	810	351	24.2		
27	3.11		184TC	780	338	23.3		
26	2.99	3.00	56C	750	325	22.4		
25	2.88		56C	720	312	21.5		
24	2.76		56C	695	301	20.7		
23	2.67		56C	665	288	19.8		
22	2.53		56C	635	275	18.9		
21	2.42		56C	610	264	18.2		
20	2.3		56C	580	251	17.3		
19	2.19		56C	550	238	16.4		
18	2.07		56C	520	225	15.5		
17	1.96	2.00	56C	485	210	14.5		
16	1.84		56C	455	197	13.6		
15	1.73		56C	425	184	12.7		
14	1.61		56C	400	173	11.9		
13	1.50	1.50	56C	375	162	11.2		
12	1.38		56C	345	149	10.3		
11	1.27		56C	315	136	9.4		
10	1.15		56C	290	126	8.7		
9	1.04		56C	255	110	7.6		
8	0.92	1.00	56C	230	100	6.9		
7	0.81		56C	200	87	6		
6	0.69	0.75	56C	175	76	5.2		
5	0.58		56C	145	63	4.3		
4	0.46	0.50	56C	115	50	3.4		
3	0.35		56C	85	37	2.5		
2	0.23		56C	60	26	1.8		

Technical data – Pump hydraulics / Motor sizing

3SV 3500 RPM

No. of impellers	Maximum HP draw	Motor selection using HYDROVAR (1.0 SF)		Shutoff TDH (feet)	Shutoff TDH (psi)	Shutoff TDH (bar)	Casing / Sleeve pressure rating (standard assy.)	Pump flange rating
		Rated HP	NEMA Motor frame TEFC					
23	4.78	5.00	184TC	825	357	24.6	25 bar (362 psi)	Class 250 / 300
22	4.58		184TC	795	344	23.7		
21	4.37		184TC	760	329	22.7		
20	4.16		184TC	720	312	21.5		
19	3.95		184TC	680	294	20.3		
18	3.74		184TC	645	279	19.2		
17	3.54		184TC	610	264	18.2		
16	3.33		184TC	575	249	17.2		
15	3.12		184TC	540	234	16.1		
14	2.91	3.00	56C	500	217	14.9		
13	2.70		56C	465	201	13.9		
12	2.50		56C	430	186	12.8		
11	2.29		56C	395	171	11.8		
10	2.08		56C	360	156	10.7		
9	1.87	2.00	56C	320	139	9.5		
8	1.66		56C	285	123	8.5		
7	1.46	1.50	56C	250	108	7.5		
6	1.25		56C	215	93	6.4		
5	1.04		56C	180	78	5.4		
4	0.83	1.00	56C	145	63	4.3		
3	0.62	0.75	56C	105	45	3.1		
2	0.42	0.50	56C	70	30	2.1		

Technical data – Pump hydraulics / Motor sizing

5SV 3500 RPM

No. of impellers	Maximum HP draw	Motor selection using HYDROVAR (1.0 SF)		Shutoff TDH (feet)	Shutoff TDH (psi)	Shutoff TDH (bar)	Casing / Sleeve pressure rating (standard assy.)	Pump flange rating
		Rated HP	NEMA motor frame TEFC					
15	4.89	5.00	184TC	540	234	16.1	25 bar (362 psi)	Class 250 / 300
14	4.56		184TC	505	219	15.1		
13	4.24		184TC	470	204	14		
12	3.91		184TC	430	186	12.8		
11	3.59		184TC	395	171	11.8		
10	3.26		184TC	360	156	10.7		
9	2.93	3.00	56C	320	139	9.5		
8	2.61		56C	285	123	8.5		
7	2.28		56C	250	108	7.5		
6	1.96	2.00	56C	220	95	6.6		
5	1.63		56C	180	78	5.4		
4	1.3	1.50	56C	145	63	4.3		
3	0.98	1.00	56C	110	48	3.3		
2	0.65	0.75	56C	70	30	2.1		

10SV 3500 RPM

No. of impellers	Maximum HP draw	Motor selection using HYDROVAR (1.0 SF)		Shutoff TDH (feet)	Shutoff TDH (psi)	Shutoff TDH (bar)	Casing / Sleeve Pressure Rating (standard assy.)	Pump flange rating
		Rated HP	NEMA motor frame TEFC					
5	4.46	5.00	184TC	285	123	8.5	25 bar (362 psi)	Class 250 / 300
4	3.57		184TC	225	97	6.7		
3	2.68	3.00	56C	170	74	5.1		
2	1.78	2.00	56C	115	50	3.4		
1	0.89	1.00	56C	60	26	1.8		

15SV 3500 RPM

No. of impellers	Maximum HP draw	Motor selection using HYDROVAR (1.0 SF)		Shutoff TDH (feet)	Shutoff TDH (psi)	Shutoff TDH (bar)	Casing / Sleeve Pressure Rating (standard assy.)	Pump flange rating
		Rated HP	NEMA Motor Frame TEFC					
2	3.80	5.00	184TC	140	61	4.2	25 bar (362 psi)	Class 250 / 300
1	1.90	2.00	56C	70	30	2.1		

Technical data – Pump hydraulics / Motor sizing

22SV 3500 RPM

No. of impellers	Maximum HP draw	Motor selection using HYDROVAR (1.0 SF)		Shutoff TDH (feet)	Shutoff TDH (psi)	Shutoff TDH (bar)	Casing / Sleeve pressure rating (standard assy.)	Pump flange rating
		Rated HP	NEMA motor frame TEFC					
2	4.82	5.00	184TC	145	63	4.3	25 bar (362 psi)	Class 250 / 300
1	2.41	3.00	56C	70	30	2.1		

33SV 3500 RPM

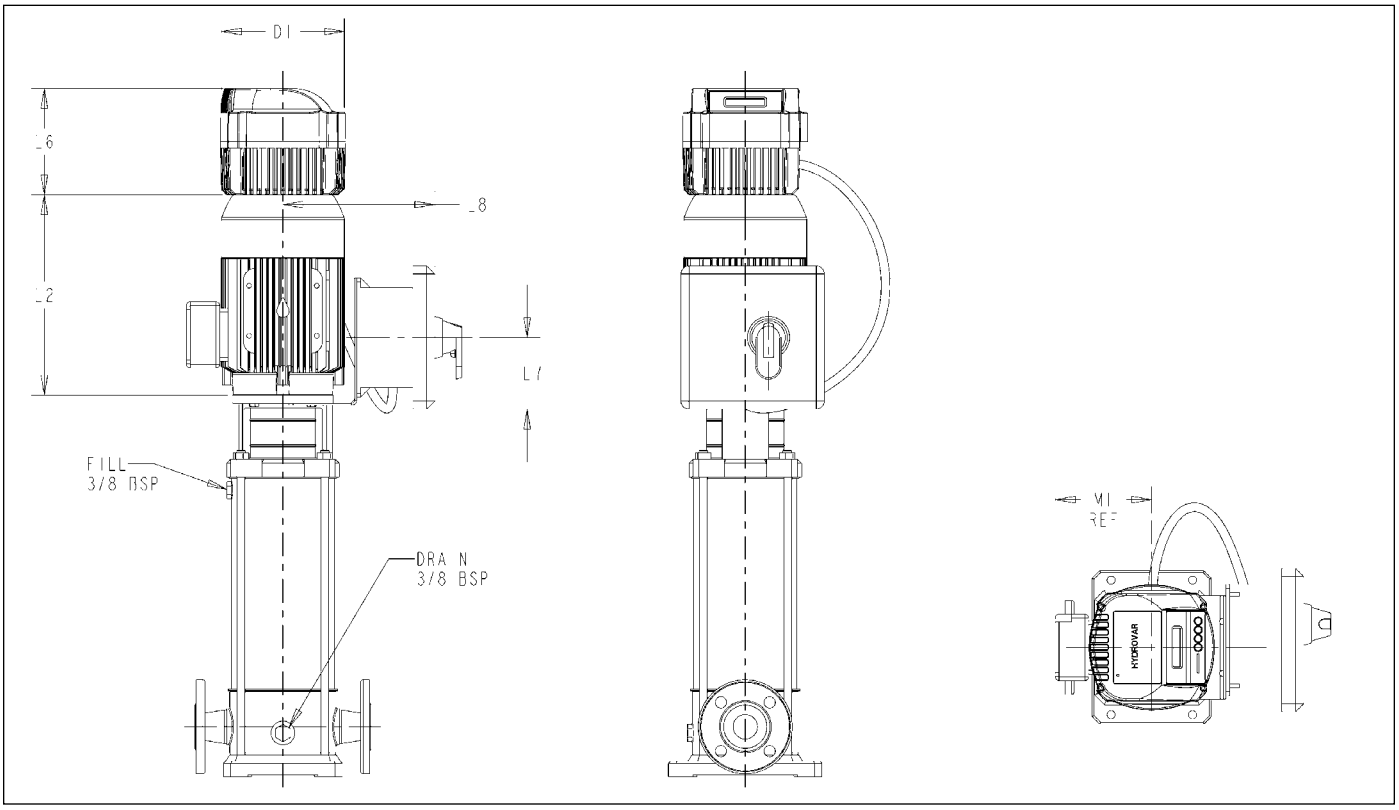
# of Impellers / # Reduced diameter	Maximum HP draw	Motor selection using HYDROVAR (1.0 SF)		Shutoff TDH (feet)	Shutoff TDH (psi)	Shutoff TDH (bar)	Casing / Sleeve pressure rating (standard assy.)	Stages requiring thrust balancing piston	Pump flange rating
		Rated HP	NEMA motor frame TEFC						
1/1	4	5	184TC	84	37	3	25 bar (362 psi)		Class 125 / 150

Motor data

HP	Phase	Voltage	FLA	Enclosure	Order no.	Frame size
2	3	208-230/460	6.2-5.8/2.9	TPE	V08A32E5BB2S	56C
		230/460	5/2.5		V08A32F5BB2S	
3		208-230/460	8.1-7.6/3.8		V09A32E5BB2S	
		230/460	7/3.5		V09A32F5BD2S	
5		208-230/460	13.2-12/6		V10A32E5BD2S	184TC
		230/460	11.2/5.6		V10A32F5BD2S	

NOTES:
Above data is for Baldor TC and TSC frame motors. Specifications subject to change without notice.

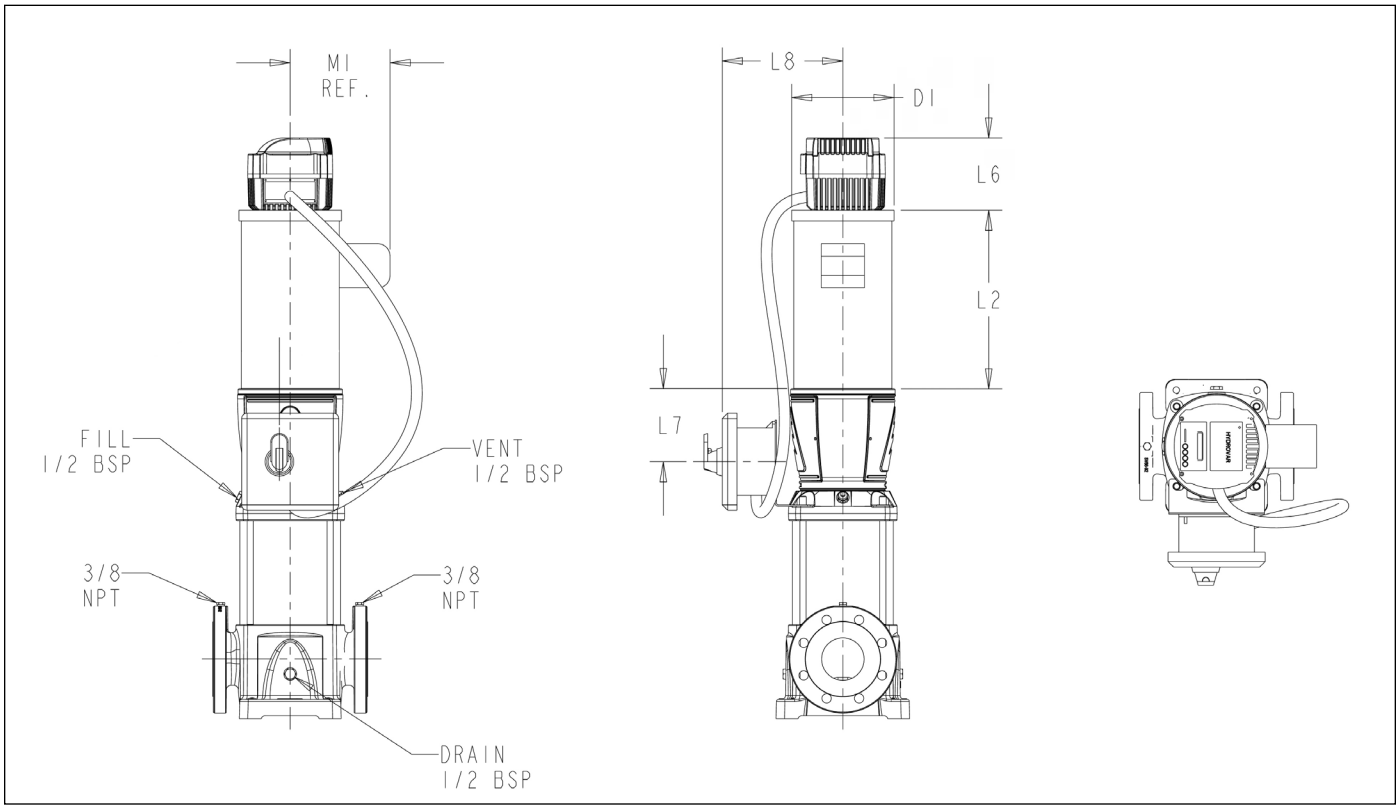
Packaged HYDROVAR Series — 1SV - 22SV dimensions



Motor frame (3 PH TEFC)	HP	HYDROVAR model	Disconnect box model	Dimensions (in)						Weight (lbs.)	
				L2	L6	L7	L8 (Ref.)	MI (Ref.)	DI Max.	HYDROVAR	Disconnect box
56C	2	A	A	10.79	6.7	4.69	11.5	5.74	8.07	12.35	3.6
	3			11.16							
184TC	5	A (460V/3Ph)	A (460V/3Ph)	13.93				8.05			
		B (230V/3Ph)	A (230V/3Ph)		7.29				10.43	23.15	
		B (230V/1Ph)	B (230V/1Ph)			5.69	12.5				8.2

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

Packaged HYDROVAR Series — 33SV - 92SV dimensions



Motor frame (3 PH TEFC)	HP	HYDROVAR model	Disconnect box model	Dimensions (in)						Weight (lbs.)	
				L2	L6	L7	L8 (Ref.)	MI (Ref.)	DI Max.	HYDROVAR	Disconnect box
184TC	5	A (460V/3Ph)	A (460V/3Ph)	13.93	6.7	4.69	11.5	8.05	8.07	12.35	3.6
		B (230V/3Ph)	A (230V/3Ph)		7.29				10.43	23.15	
		B (230V/1Ph)	B (230V/1Ph)			5.69	12.5				8.2

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.

A margin above the NPSHr is necessary in order to achieve the pump's published performance and an adequate service life.

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

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

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 (40ºF) 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	Specific gravity			Weight (lb/cubic ft)	Vapor pressure (psi Abs)
		(Cubic ft/lb)	@ 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 x 10^{-4}**	1,02 x 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 Solver

Xylem Solver is a pump selection software with multiple search options and helpful product information.

Xylem Solver allows any user to search by application, or product type without having detailed knowledge of Xylem products. It also has the ability to search via series or models across our whole portfolio. Solver platform has the ability to guide the user to the right product for their particular needs.

The search can be made by:

- Application
- Product type
- Duty point

Xylem Solver gives a detailed output:

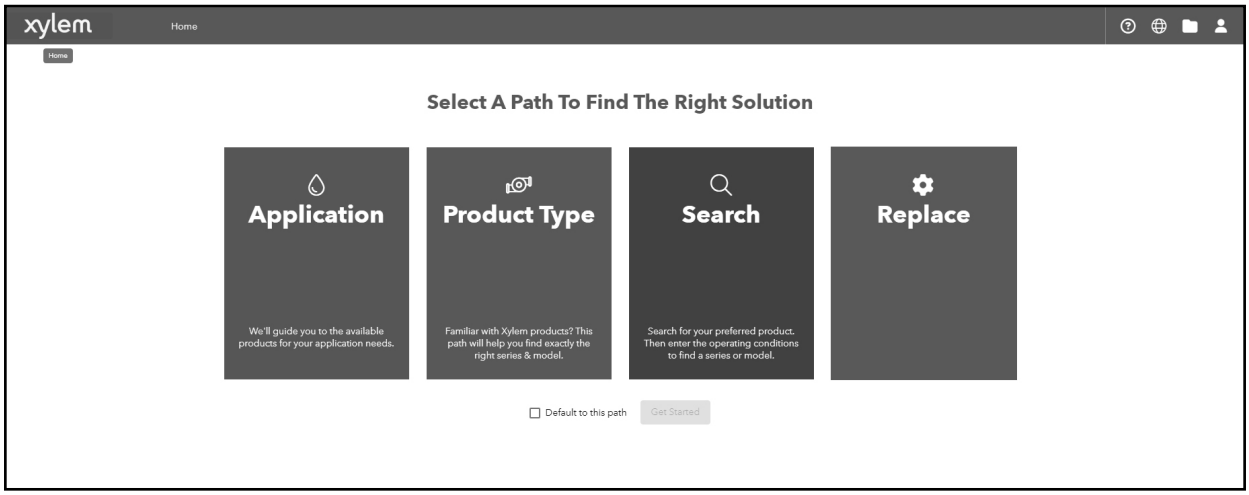
- List with search results
- Performance curves (flow, head, power, efficiency, NPSH)
- Motor data
- Dimensional drawings
- Technical documentation

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- Create and save projects
- Share projects with other Xylem Solver users

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Learn more about the e-SV Series Packaged HYDROVAR Series

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