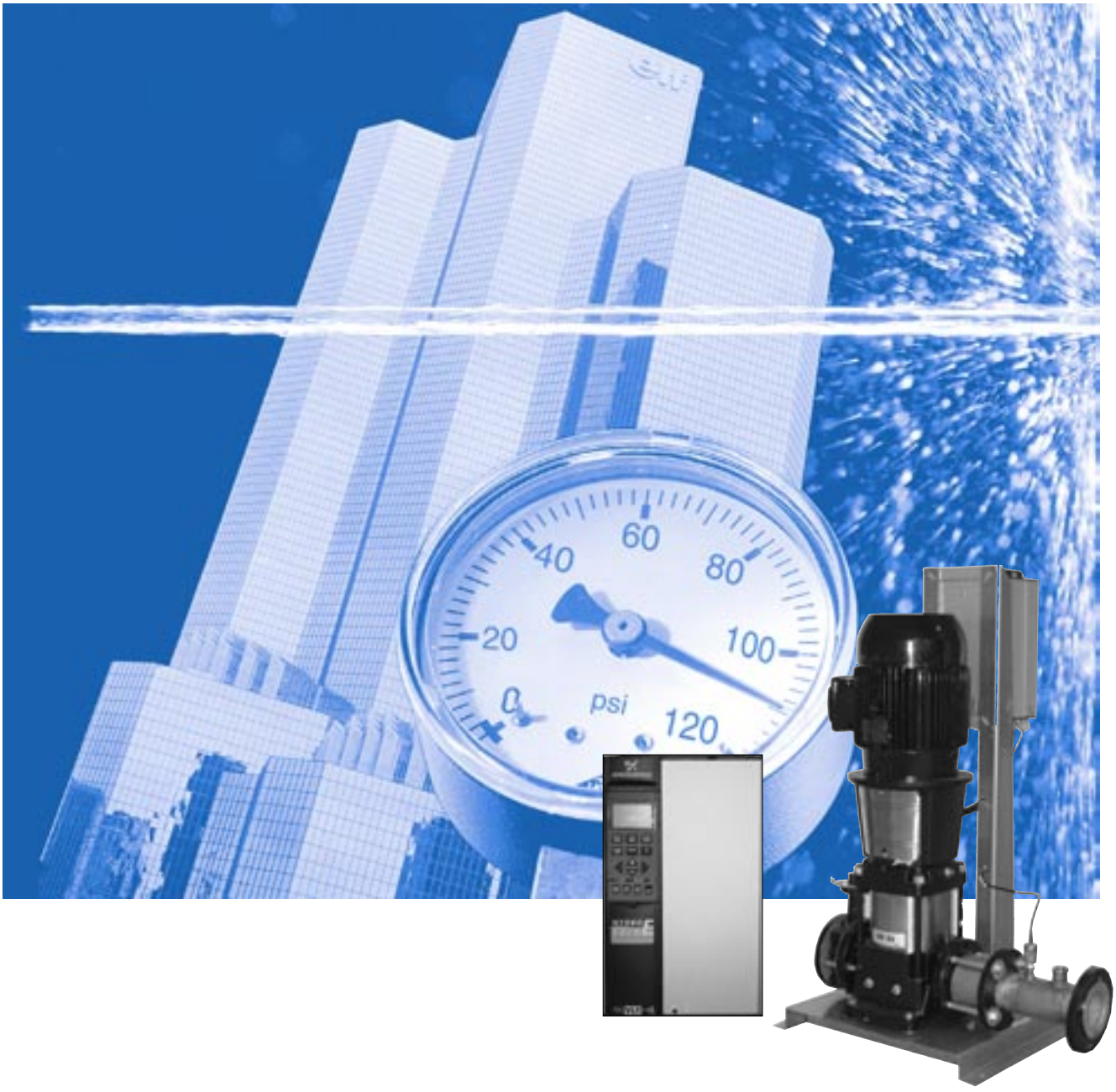
Hydro Solo-E

Grundfos Hydro Solo-E booster sets
60 Hz



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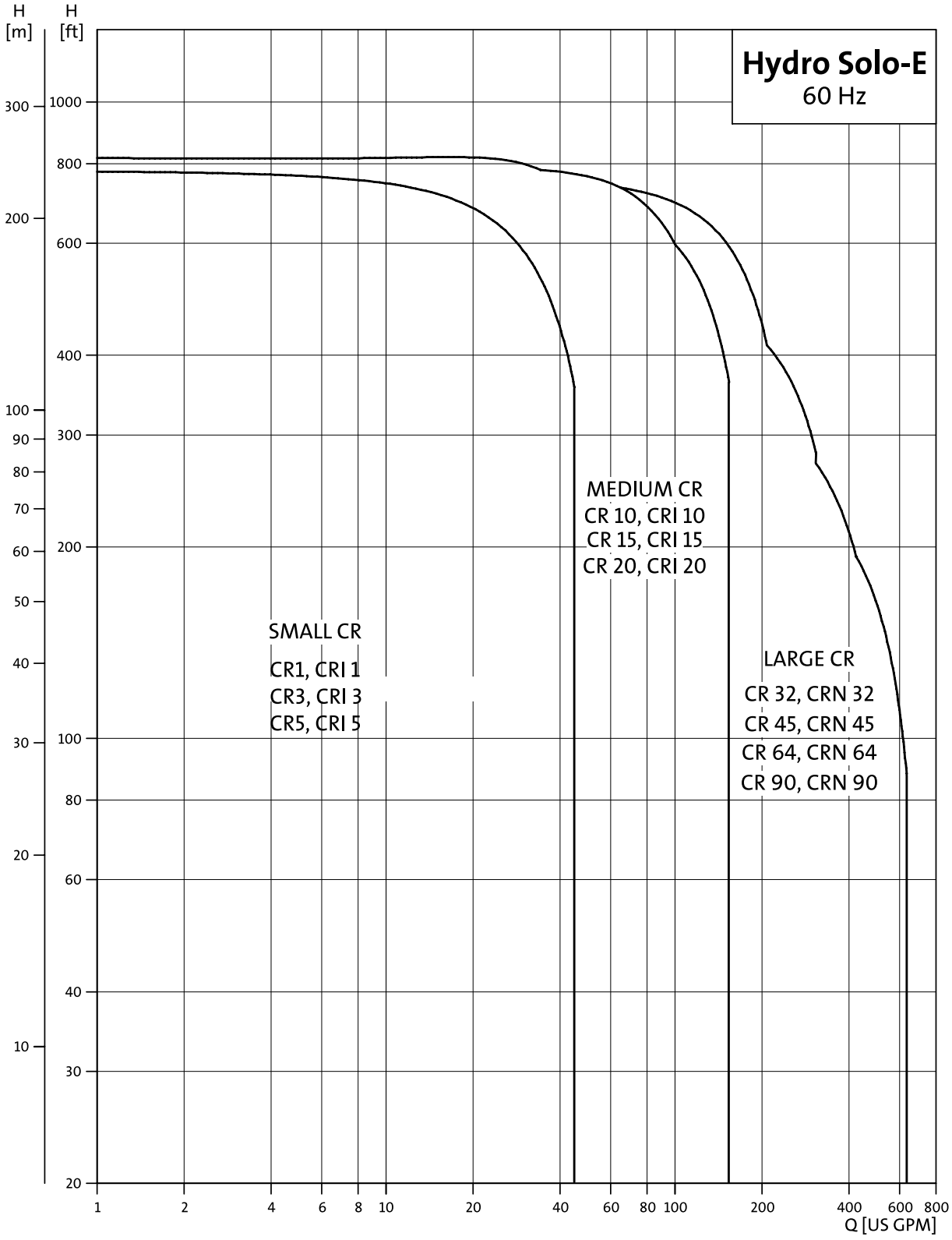
Performance Range



Hydro Solo-E

Grundfos Hydro Solo-E single pump booster system consists of one speed-controlled CR pump fitted with isolating valves, check valve, discharge manifold, pressure transducer, pressure gauge and diaphragm tank.

The Hydro Solo-E booster set is ready for operation once the diaphragm tank is connected to discharge manifold.

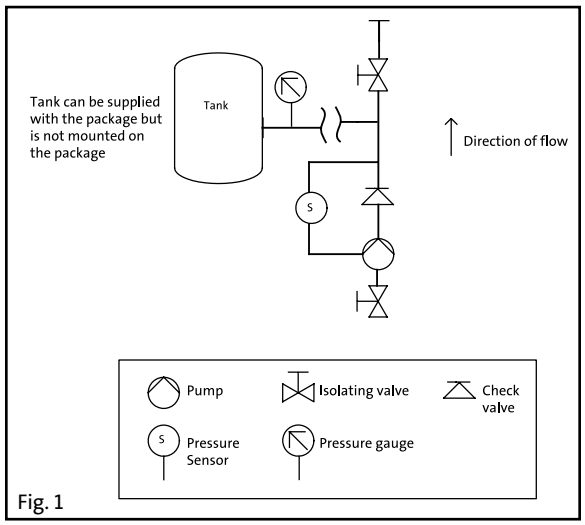


Fig. 1

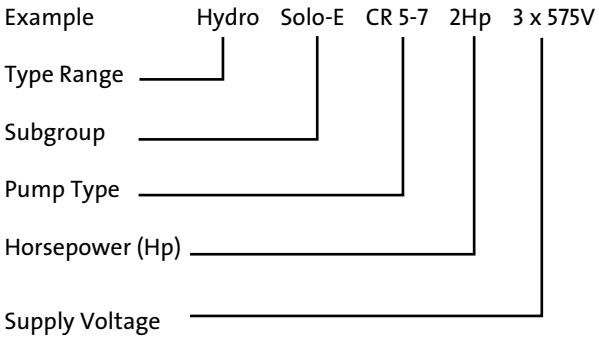
Operating Conditions

Liquid Temperature

Small and Medium CR	: -4 to + 250° F
Large CR	: -22 to + 250° F

Ambient Temperature : + 104° F

Nomenclature



Minimum inlet pressure (Net positive Suction head)

The minimum inlet pressure, H, in feet head required to avoid cavitation in the pump is calculated as follows:

H = pb x 10.2 – NPSHR – Hf – Hv – Hs

Pb = Barometric pressure in psi.
Barometric pressure can be set to 1, if req.

NPSHR = Net Positive Suction required in feet head . NPSHR can be read from the NPSH curve at the maximum capacity at which the pump will run.

Hf = Friction loss in suction pipe in feet head.

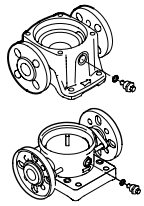
Hv = Vapour pressure in feet head.

Hs = Safety margin of min. 2 feet head.

Maximum Inlet Pressure

CR(E), CRI(E) 1	
1-2 - 1-25	145 psi
1-27	218 psi
CR(E), CRI(E) 3	
3-2 - 3-15	145 psi
3-17 - 3-25	218 psi
CR(E), CRI(E) 5	
5-2 - 5-9	145 psi
5-10 - 5-24	218 psi
CR(E), CRI(E) 10	
10-1 - 10-5	116 psi
10-6 - 10-17	145 psi
CR(E), CRI(E) 15	
15-1 - 15-2	116 psi
15-3 - 15-12	145 psi
CR(E), CRI(E) 20	
20-1	116 psi
20-2 - 20-10	145 psi
CR, CRN 32	
32-1-1 - 32-2	58 psi
32-3-2 - 32-6	145 psi
32-7-2 - 32-8	218 psi
CR, CRN 45	
45-1-1 - 45-1	58 psi
45-2-2 - 45-3	145 psi
45-4	218 psi
CR, CRN 64	
64-1-1	58 psi
64-1 - 64-2-1	145 psi
64-2 - 64-3-2	218 psi
CR, CRN 90	
90-1-1 - 90-1	145 psi
90-2-1	218 psi

Maximum operating pressure and temperature range

		ANSI 	
		Max. permissible operating pressure	Liquid temperature range
CR(E), CRI(E) 1		362 psi	-4 °F to 248 °F
CR(E), CRI(E) 3		362 psi	-4 °F to 248 °F
CR(E), CRI(E) 5		362 psi	-4 °F to 248 °F
CR(E), CRI(E) 10-1	- CR,CRI 10-17	362 psi	-4 °F to 248 °F
CR, CRI 15-1	- CR,CRI 15-12	362 psi	-4 °F to 248 °F
CR, CRI 20-1	- CR,CRI 20-10	362 psi	-4 °F to 248 °F
CR, CRN 32-1-1	- CR,CRN 32-5	232 psi	-22 °F to 248 °F
CR, CRN 32-6-2	- CR,CRN 32-8	362 psi	-22 °F to 248 °F
CR, CRN 32-9-2	- CR,CRN 32-11-2	435 psi	-22 °F to 248 °F
CR, CRN 45-1-1	- CR,CRN 45-6	232 psi	-22 °F to 248 °F
CRN 45-7-2	- CR,CRN 45-8-1	435 psi	-22 °F to 248 °F
CR, CRN 64-1-1	- CR,CRN 64-3	232 psi	-22 °F to 248 °F
CR, CRN 64-4-2	- CR,CRN 64-5-2	362 psi	-22 °F to 248 °F
CR, CRN 90-1-1	- CR,CRN 90-3	232 psi	-22 °F to 248 °F
CR, CRN 90-4-2	- CR,CRN 90-4-1	362 psi	-22 °F to 248 °F

Product range*

MODELS	HP	ELECTRICAL DATA				MATERIAL OPTIONS**			PRESSURE TRANSDUCER [psi]
		1 x 230V	3 x 208-230V	3 x 460V	3 x 575V	CR	CRI	CRN	
CR 1									
CR 1-5	1/2	•				•	•		0 - 145
CR 1-7	3/4	•				•	•		0 - 145
CR 1-10	1	•				•	•		0 - 145
CR 1-13	1 1/2	•				•	•		0 - 232
CR 1-19	2		•	•	•	•	•		0 - 362
CR 1-27	3		•	•	•	•	•		0 - 362
CR 3									
CR 3-3	1/2	•				•	•		0 - 145
CR 3-6	1	•				•	•		0 - 145
CR 3-9	1 1/2	•				•	•		0 - 145
CR 3-12	2		•	•	•	•	•		0 - 232
CR 3-15	3		•	•	•	•	•		0 - 232
CR 3-19	3		•	•	•	•	•		0 - 362
CR 3-25	5		•	•	•	•	•		0 - 362
CR 5									
CR 5-3	1	•				•	•		0 - 145
CR 5-5	1 1/2	•				•	•		0 - 145
CR 5-7	2		•	•	•	•	•		0 - 145
CR 5-10	3		•	•	•	•	•		0 - 232
CR 5-16	5		•	•	•	•	•		0 - 362
CR 5-24	7 1/2		•	•	•	•	•		0 - 362

* Standard available models, consult factory for other models.

** CR - Cast iron pump, 304 SS fittings (Standard)
CRI - All 304 SS pump and fittings
CRN - 316 SS pump, 304 SS fittings

Product range*

MODELS	HP	ELECTRICAL DATA				MATERIAL OPTIONS**			PRESSURE TRANSDUCER [psi]
		1 x 230V	3 x 208-230V	3 x 460V	3 x 575V	CR	CRI	CRN	
CR 10									
CR 10-1	1	•				•	•		0 - 145
CR 10-2	1 1/2	•				•	•		0 - 145
CR 10-4	3		•	•	•	•	•		0 - 145
CR 10-7	5		•	•	•	•	•		0 - 232
CR 10-10	7 1/2		•	•	•	•	•		0 - 232
CR 10-14	10		•	•	•	•	•		0 - 362
CR 10-17	15		•	•	•	•	•		0 - 362
CR 15									
CR 15-1	2		•	•	•	•	•		0 - 145
CR 15-3	5		•	•	•	•	•		0 - 145
CR 15-4	7 1/2		•	•	•	•	•		0 - 145
CR 15-6	10		•	•	•	•	•		0 - 232
CR 15-8	15		•	•	•	•	•		0 - 232
CR 15-10	20		•	•	•	•	•		0 - 362
CR 15-12	25		•	•	•	•	•		0 - 362
CR 20									
CR 20-1	3		•	•	•	•	•		0 - 145
CR 20-2	5		•	•	•	•	•		0 - 145
CR 20-3	7 1/2		•	•	•	•	•		0 - 145
CR 20-4	10		•	•	•	•	•		0 - 232
CR 20-6	15		•	•	•	•	•		0 - 232
CR 20-8	20		•	•	•	•	•		0 - 362
CR 20-10	25		•	•	•	•	•		0 - 362

* Standard available models, consult factory for other models.

** CR - Cast iron pump, 304 SS fittings (Standard)
CRI - All 304 SS pump and fittings
CRN - 316 SS pump, 304 SS fittings

Product range*

MODELS	HP	ELECTRICAL DATA				MATERIAL OPTIONS**			PRESSURE TRANSDUCER [psi]
		1 x 230V	3 x 208-230V	3 x 460V	3 x 575V	CR	CRI	CRN	
CR 32									
CR 32-1	5		•	•	•	•		•	0 - 145
CR 32-2	7 1/2		•	•	•	•		•	0 - 145
CR 32-3-2	10		•	•	•	•		•	0 - 145
CR 32-4	15		•	•	•	•		•	0 - 232
CR 32-5	20		•	•	•	•		•	0 - 232
CR 32-7-2	25		•	•	•	•		•	0 - 362
CR 32-8	30		•	•	•	•		•	0 - 362
CR 45									
CR 45-1	7 1/2		•	•	•	•		•	0 - 145
CR 45-2	15		•	•	•	•		•	0 - 145
CR 45-3-2	20		•	•	•	•		•	0 - 232
CR 45-3	25		•	•	•	•		•	0 - 232
CR 45-4	30		•	•	•	•		•	0 - 232
CR 64									
CR 64-1-1	7 1/2		•	•	•	•		•	0 - 145
CR 64-2-2	15		•	•	•	•		•	0 - 145
CR 64-2-1	20		•	•	•	•		•	0 - 145
CR 64-2	25		•	•	•	•		•	0 - 145
CR 64-3-2	30		•	•	•	•		•	0 - 145
CR 90									
CR 90-1	15		•	•	•	•		•	0 - 145
CR 90-2-2	25		•	•	•	•		•	0 - 145
CR 90-2-1	30		•	•	•	•		•	0 - 145

* Standard available models, consult factory for other models.

** CR - Cast iron pump, 304 SS fittings (Standard)
CRI - All 304 SS pump and fittings
CRN - 316 SS pump, 304 SS fittings

Construction

Pos.	Description	Qty.
1	CR(E) Pump	1
2	Diaphragm Tank	1
3	Pressure Gauge	1
4	Isolating Valves	2
5	Discharge Manifold	1
6	Pressure Transducer	1
7	Check Valve	1
8	Base	1
9	VFD Mounting Bracket	1
10	Variable Frequency Drive	1

On the discharge side of the pump is fitted a stainless steel discharge pipe, a check valve, an isolating valve, a pressure transducer.

A pressure gauge is also present in the system to measure the discharge pressure.

A frequency controlled motor (Grundfos MLE motor) drives the CR pump for 1 phase 230V (1/2-1 1/2 Hp) and 3 phase 460V (2-10 Hp) versions of Hydro Solo-E booster sets.

All other 3 phase versions of Hydro Solo-E booster sets come with a CR pump driven by an externally mounted Variable Frequency Drive (VFD).

Installation

A Hydro Solo-E booster set must be installed in a well ventilated room to ensure sufficient cooling for the pump. Hydro Solo-E is not suitable for outdoor installation.

The booster set should be placed with sufficient clearance around it.

3 phase versions must have a disconnect ON/OFF switch for the supply voltage, which is not provided as a standard item with the unit.

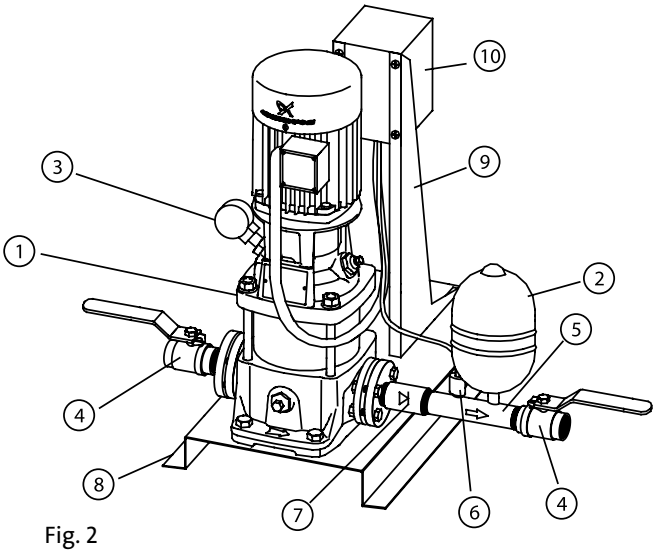


Fig. 2

The main components of the Hydro Solo-E include the pump, motor and the Variable Frequency Drive.

Pump

A Hydro Solo-E system consists of a CR pump which is a non-self-priming, vertical multistage centrifugal pump. The pumps are available with a Grundfos standard motor (CR pumps) or a frequency-controlled motor (CRE pumps).
All pumps are equipped with a maintenance-free cartridge mechanical shaft seal.

Motor

Grundfos standard motors - With external VFD
3 x 208-230V, 3 x 460V (15-30Hp), 3 x 575V
CR, CRI and CRN in a Hydro Solo-E system pumps are fitted with a Grundfos specified motor. The motors are all heavy-duty 2-pole, NEMA C-frame.

Frequency-controlled motors - MLE motors (integrated VFD)
1 x 230V and 3 x 460V (2-10Hp)
CRE and CRIE pumps in a Hydro Solo-E system are fitted with a totally enclosed, fan-cooled, 2-pole frequency-controlled motor.

Electrical Data

Grundfos Standard Motor 3 phase

Mounting designation	NEMA
Insulation class	F
Efficiency class	Standard efficiency Energy efficient / NRC - on request Premium efficiency - on request
Enclosure class	ODP - Open Drip Proof TEFC - Totally Enclosed Fan Cooled
60 Hz Standard voltages	3 x 208-230/460V 3 x 575V
Approvals	The motors are rated for:

Frequency Controlled motors MLE motors - 1 phase and 3 phase

Mounting designation	NEMA
Enclosure class	TEFC - Totally Enclosed Fan Cooled (IP55)
60 Hz Standard voltages	1 x 230V 3 x 460V
Approvals	The motors are rated for:

Overview of the External Variable Frequency Drive (VFD)

Benefits

- Eliminates control valves and problematic pressure storage tanks
- Harmonic distortion protection built in
- Lower energy consumption
- Less pump noise
- Easy to set up and operate
- Comprehensive protection of drive, motor and pump equipment
- Reduced maintenance
- Eliminates current in-rushes on the AC line
- Protection from extreme voltage and temperature conditions

Feature Highlights

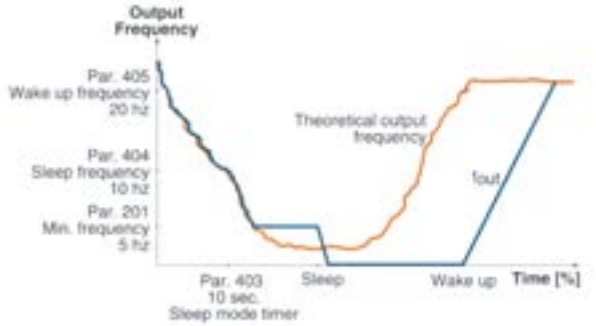
- Sleep mode automatically stops and starts the drive as determined by user-programmed levels at low demand – saves additional energy and reduces wear on drive and pump components.
- Electronic Thermal Relay provides motor overload protection
- AEO (Automatic Energy Optimizer) reduces energy consumption and audible motor noise
- Fast response time for control inputs
- Standard protection features include phase-to-phase short; phase-to-ground short; input and output protection
- Built-in DC link inductors reduce harmonics
- Built in H-O-A (Hand-Off-Auto) switch function on keypad
- Alarm, Warning and On LEDs indicate drive status

Built in Protection to Maximize System Reliability

- Programmable No Flow protection (option)
- Motor and drive overheating
- Power surges
- Loss of Phase
- Ground fault
- Overvoltage
- Over-current
- Under-voltage
- ETR (Electronic Thermal Relay)

Sleep mode with Torque Boost

Sleep Mode monitors the input signal determining the output frequency of the drive and thus the system's flow/pressure. When the signal has decreased to the point that the output frequency (motor's speed), has become inefficient and the resulting flow/pressure is negligible, Sleep Mode automatically turns the output off to save energy. Once the unit senses that the system has reached a point where the motor-driven pump will be effective, Sleep Mode "wakes up" the drive and operation resumes.



Versatile Data Display

The four line, alphanumeric, backlit LCD display is easy to read from any angle, with three lines of 20 characters and one line of eight double-sized characters. Up to four measurements can be shown continuously on the top two lines of the display.

The LCP keypad may be removed for secure, tamper-proof operation. The drives status light operates independent of keypad. The operational status on the drive include a green "ON", yellow "WARNING", and red "ALARM" LED.

The LCP keypad can be remotely mounted up to 10 feet by using one of the optional NEMA 1 or NEMA 12 remote mounting kits.

H-O-A Manual or Automatic Control

The variable frequency drive's keypad separates the H-O-A (Hand-Off-Auto) functions for easy, logical control of the drive. Local control is easily accomplished by simply pressing the HAND START key and controlling the drive's speed using the + and – keys. Activating the Remote/Auto button enables remote operation via the control terminals.

Fieldbus Options

Fieldbus option cards are designed to give unprecedented flexibility and command over a variable speed drive controlled system. The options perform as an integrated part of the drive, giving access to all parameters relevant to the application. The options include :

- Profibus DP/FMS : Profibus is an open, non-proprietary fieldbus standard complying with EN 50170
- Modbus RTU : Modbus RTU (Remote Terminal Unit) is the language used by all Modicon controllers. This protocol defines a message structure that controller will recognize and use, regardless of the type of networks over which they communicate.
- DeviceNet : DeviceNet is a low cost alternative to expensive hardwire communication links for connecting industrial automation devices to a network.

Enclosure Options*

The standard enclosure for the external variable frequency drives is a Protected Chassis (IP 20) which allows quick access to terminals and greater heat tolerance.

The enclosure options include :

- NEMA 1 (IP 20) Enclosures
- NEMA 12 (IP 54) Enclosures

* Not available for all models. Consult factory for details

RFI Filter (option)

The switching of an adjustable frequency drive's power components causes voltage and current deviations in the voltage and current of the AC line. These deviations contain elements of high frequencies that may disturb equipment sharing the power line and may radiate to nearby equipment which can be affected. RFI (Radio Frequency Interference) filters, when properly used, prevent interference currents from transmitting back onto the AC power lines.

RFI Filters do not come as a standard item in the external variable frequency drives of the Hydro Solo-E. RFI Filters are offered as an option.

Please note that RFI filter option has to be built into the drive at time of purchase and cannot be retrofitted in the field. All RFI options are factory installed and are UL/cUL listed.

RFI filter option (with 1A Filter) is available in 230 and 460 VAC units only.

Overview of MLE with Integral Frequency Drive

Standard Protections in the frequency controlled MLE motors:

- Thermal protection
- Over current protection
- Over/under voltage protection

Control options of MLE-driven pumps

Communication with MLE-driven pumps is possible by means of

- a central management system,
- remote control (Grundfos R100) or
- a control panel.

Central management system

Communication with the variable speed pump is possible even though the operator is not present near the pump. Communication is enabled by having connected the pump to a central management system allowing the operator to monitor and change control modes and set-point settings of the E-pump.

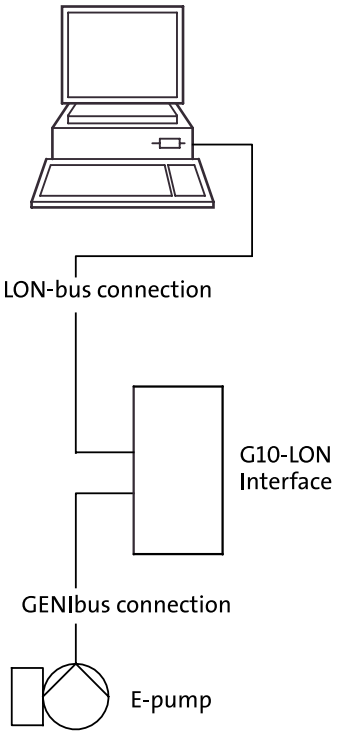


Fig 4. Structure of a central management system

Remote control

The R100 remote control produced by Grundfos is available as an accessory.
The operator communicates with the E-pump by pointing the IR-signal transmitter at the control panel of the E-pump terminal box.

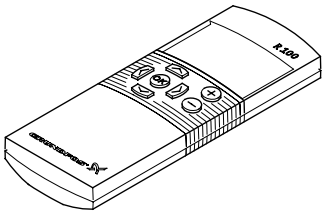


Fig. 5 R100 remote control

On the R100 display it is possible to monitor and change control modes and settings of the E-pump.

Control panel

The control panel of the E-pump terminal box makes it possible to change the set-point settings manually.

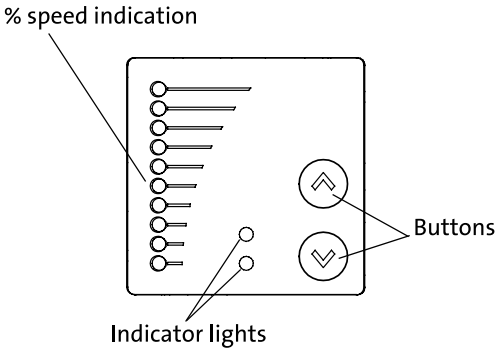
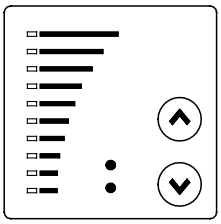
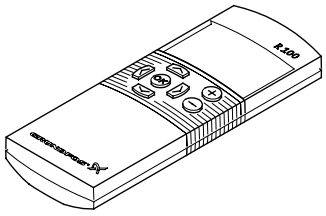
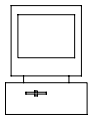
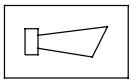
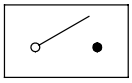


Fig. 6 Control panel on CRE pump

Overview of functions MLE

Pumps/functions		Hydro Solo-E
	Setting via control panel:	
	Setpoint	•
	Start/stop	•
	Max. curve	•
	Reading via control panel:	
	Setpoint	•
	Operating indication	•
	Fault indication	•
	Setting via R100:	
	Setpoint	•
	Start/stop	•
	Max. curve	•
	Control mode	•
	PI-controller	•
	Signal relay	•
	Operating range	•
	Stop function	•
	Reading via R100	
	Setpoint	•
	Operating indication	•
	Pump status	•
	Connection to building management system	The pumps have inputs for bus communication. The pumps can be controlled and monitored via these inputs from a building management system or other external control systems.
	External signals:	
	Inputs:	
	Sensor	Fitted
	External fault	•
	Outputs	
	Signal relay	•

Mechanical installation

The pipes connected to the booster set must be of adequate size. To avoid resonance, expansion joints should be fitted both in the discharge and suction pipes.

The booster set should be tightened up prior to start-up.
It is always advisable to fit pipe hangers both on the suction and discharge side, as shown. The system should be positioned on an even and solid surface, e.g. a concrete floor or foundation. If the booster set is not fitted with vibration dampers, it must be bolted to the floor or foundation.

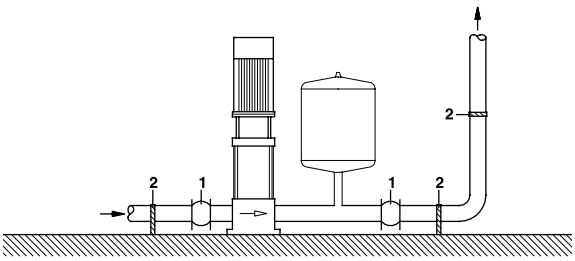


Fig. 3 Mechanical installation

1. Expansion joints
2. Pipe hangers

Expansion joints and pipe hangers shown are not included in a standard booster set.

Diaphragm tank (supplied separately)

The diaphragm tank is pre-charged to correct pressure. If the set point is altered, a new pre-charge pressure should be calculated to obtain optimal duty:

Calculation of pre-charge pressure:

• Pre-charge pressure = 0.7 x setpoint

The diaphragm tank's pre-charge pressure must be measured in a pressureless system.

Curve conditions

The following curves are subject to the following guidelines:

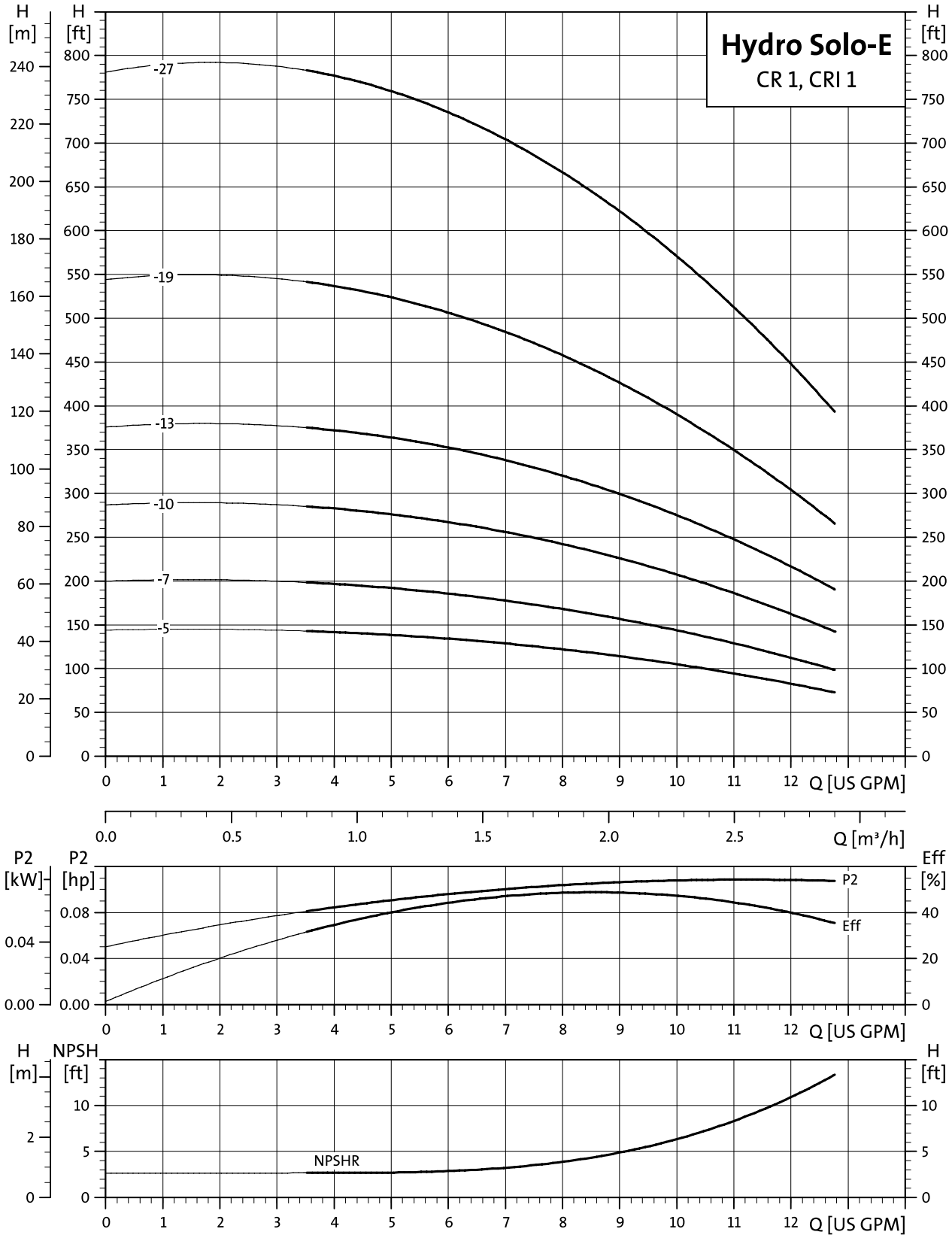
- Performance measurement is made with water at a temperature of 68°F.
- The motors used for measurements are standard (ODP, TEFC or MLE) motors.
- The curves describe the pump mean values at a rated motor speed of 3450 RPM
- The curves should not be used as guaranteed curves. Certified Test curves available.
- Due to risk of overheating the pumps should not be used at a flow below minimum flow rate.
- The curves apply to a kinematic viscosity of 1 mm^2/s (1 cSt).

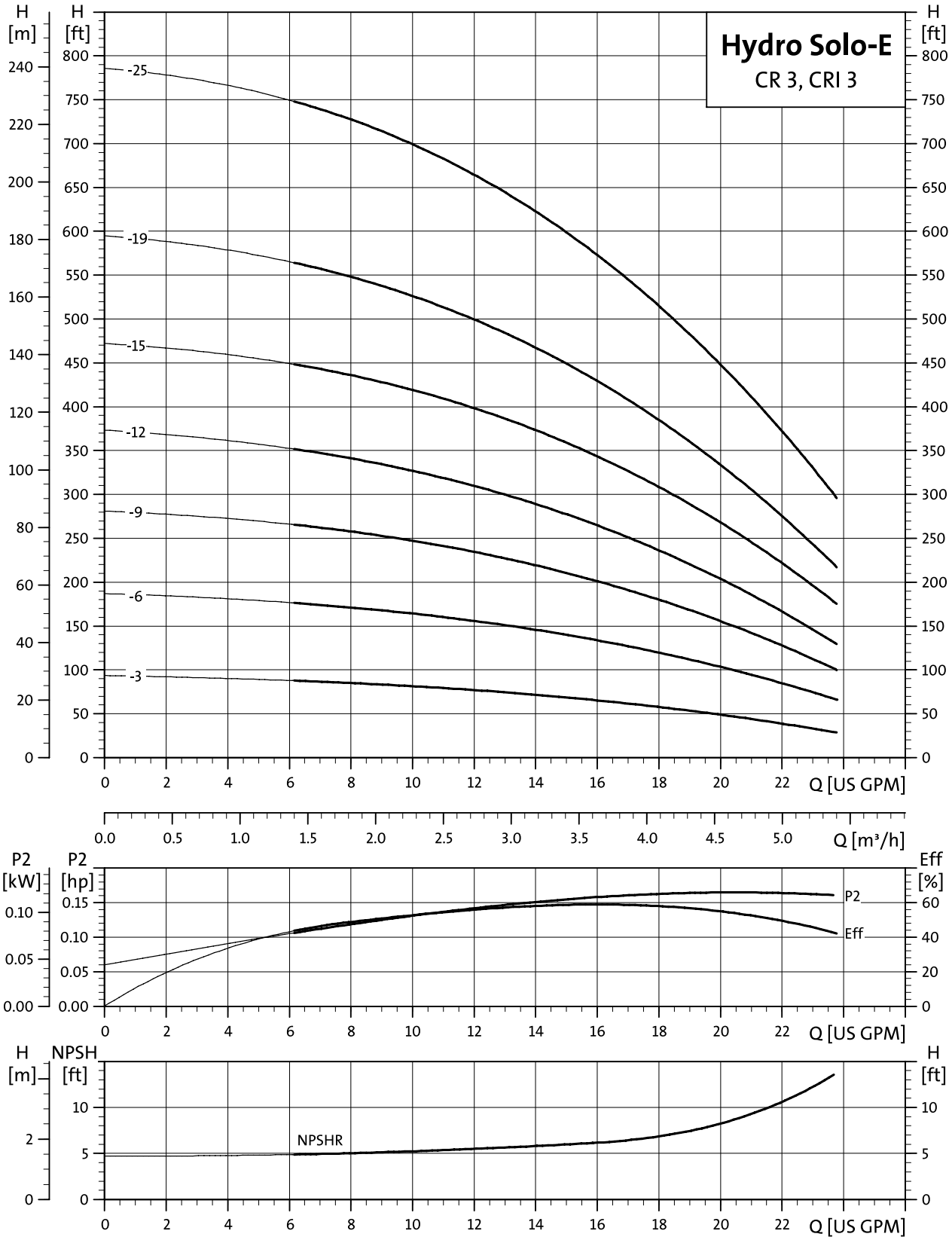
Electrical connection

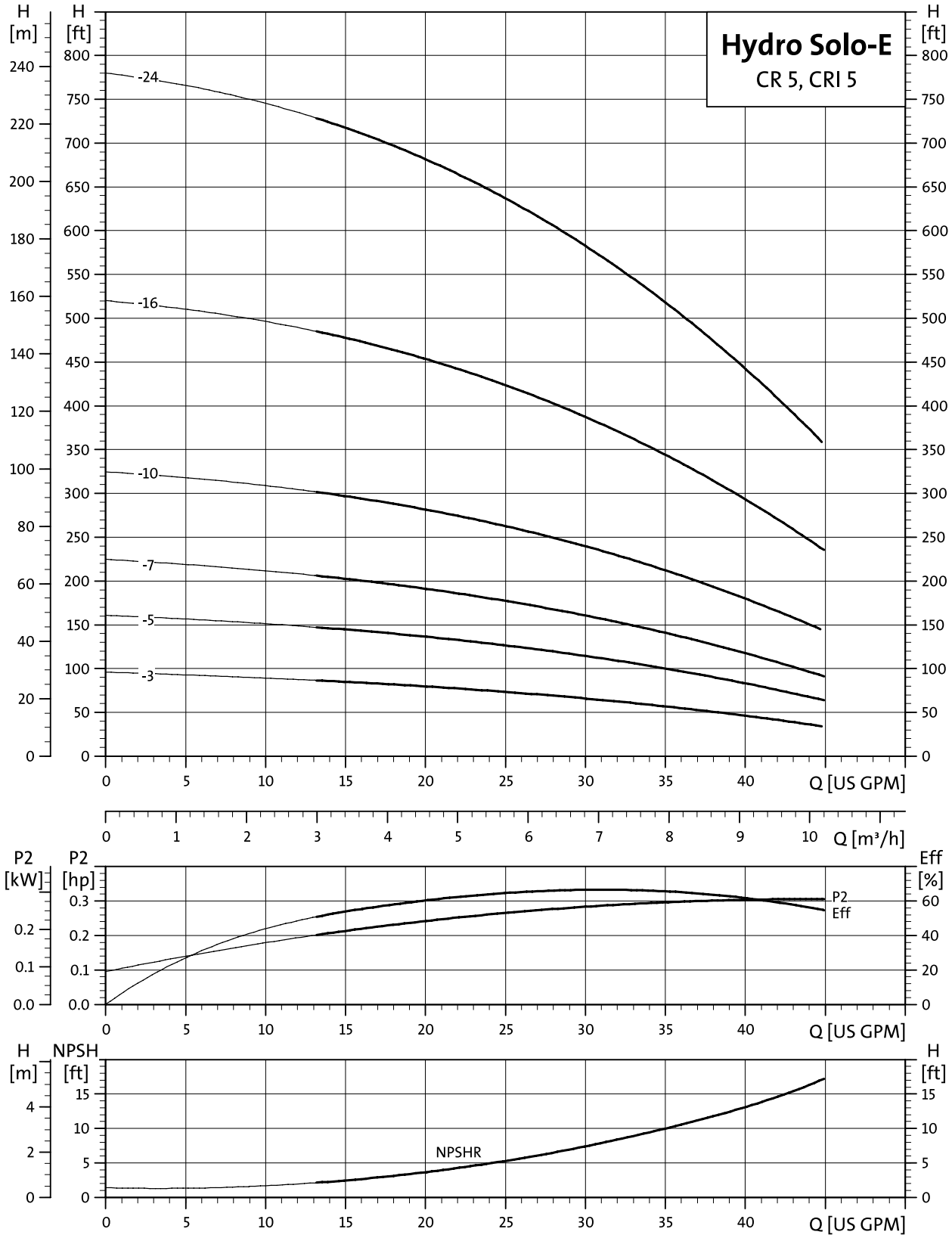
The electrical connection and protection should be carried out in accordance with local regulations.

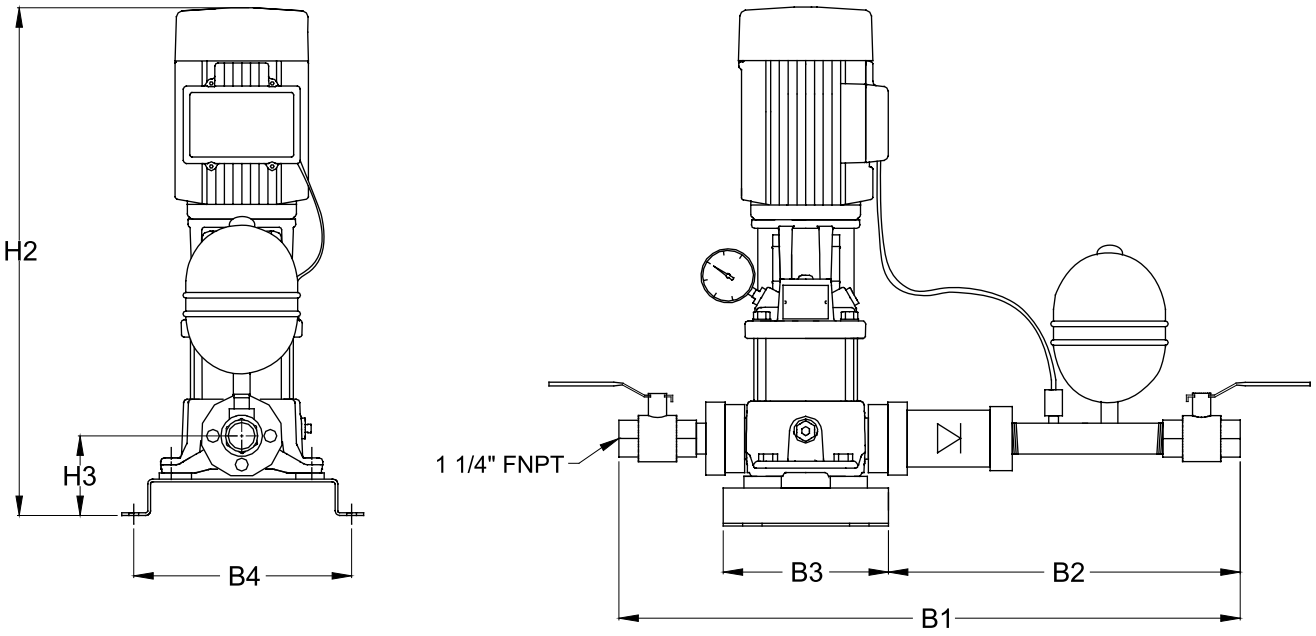
- The system with a CR pump and a VFD must be connected to an external main switch, which is not included as a standard item with the package.
- The system with a CRE pump (with an MLE motor) must always be correctly grounded.*
- The pump requires no external motor protection. The VFD and the MLE motor incorporates various types of protection.

*See MLE Instructions and Operating Manual for proper grounding instructions.

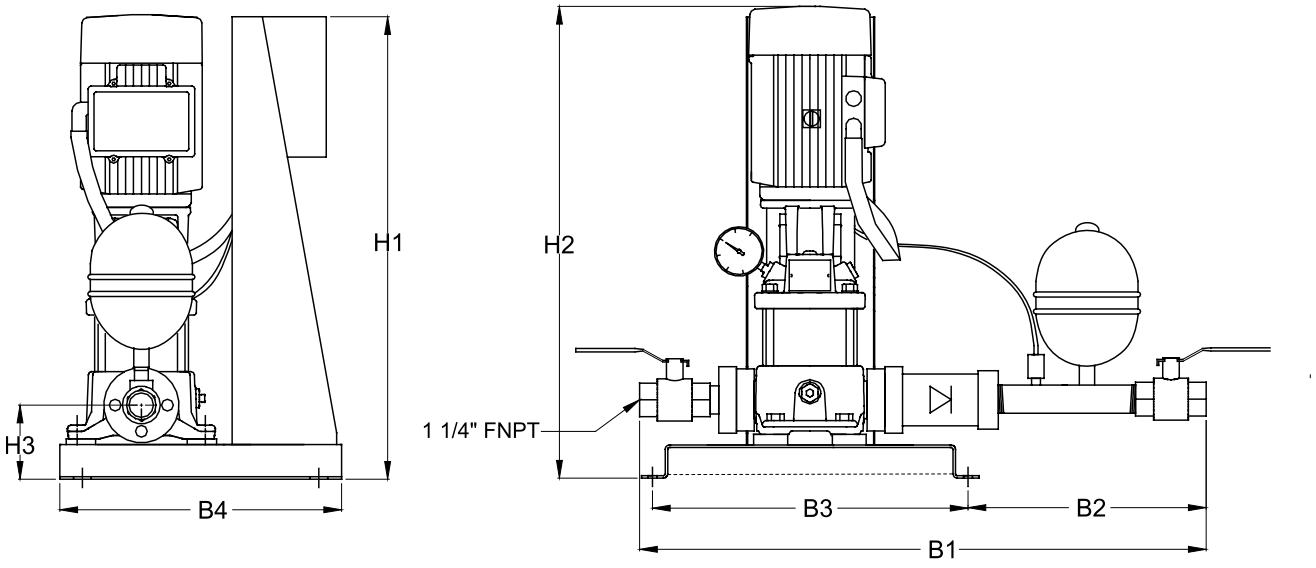

Hydro Solo-E
CR 1, CRI 1
H [m]
H [ft]
-27
-19
-13
-10
-7
-5
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
P2
Eff
Eff [%]
H [m]
NPSH [ft]
NPSHR
H [ft]


Hydro Solo-E
CR 3, CRI 3
H [m]
H [ft]
-25
-19
-15
-12
-9
-6
-3
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
P2
Eff
H [m]
NPSH [ft]
NPSHR


Hydro Solo-E
CR 5, CRI 5
H [m]
H [ft]
-24
-16
-10
-7
-5
-3
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
P2
Eff
H [m]
NPSH [ft]
NPSHR



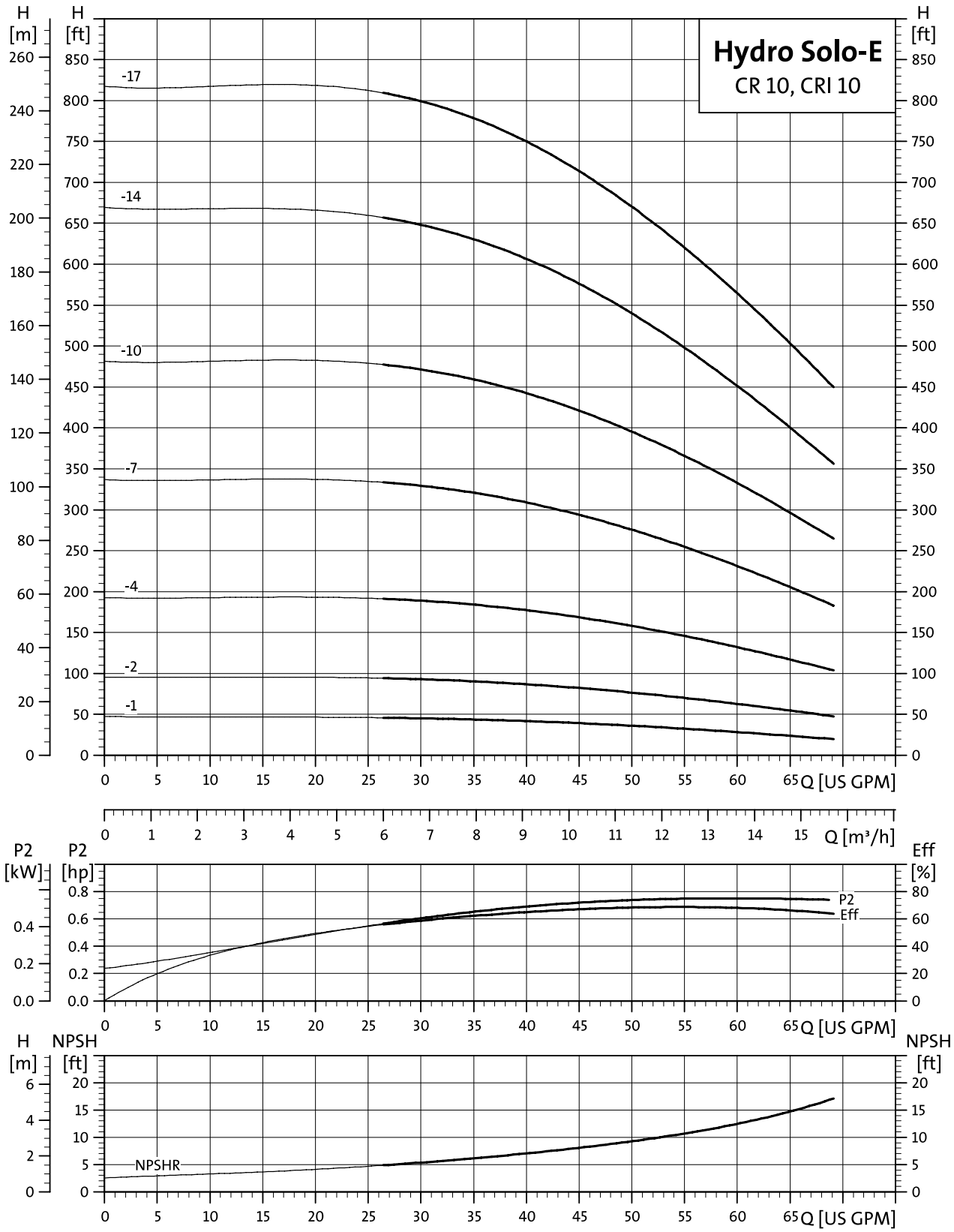
Hydro Solo-E CR(I)1, CR(I)3,CR(I)5 - 1 x 230V, 3 x 460V with Grundfos MLE motors

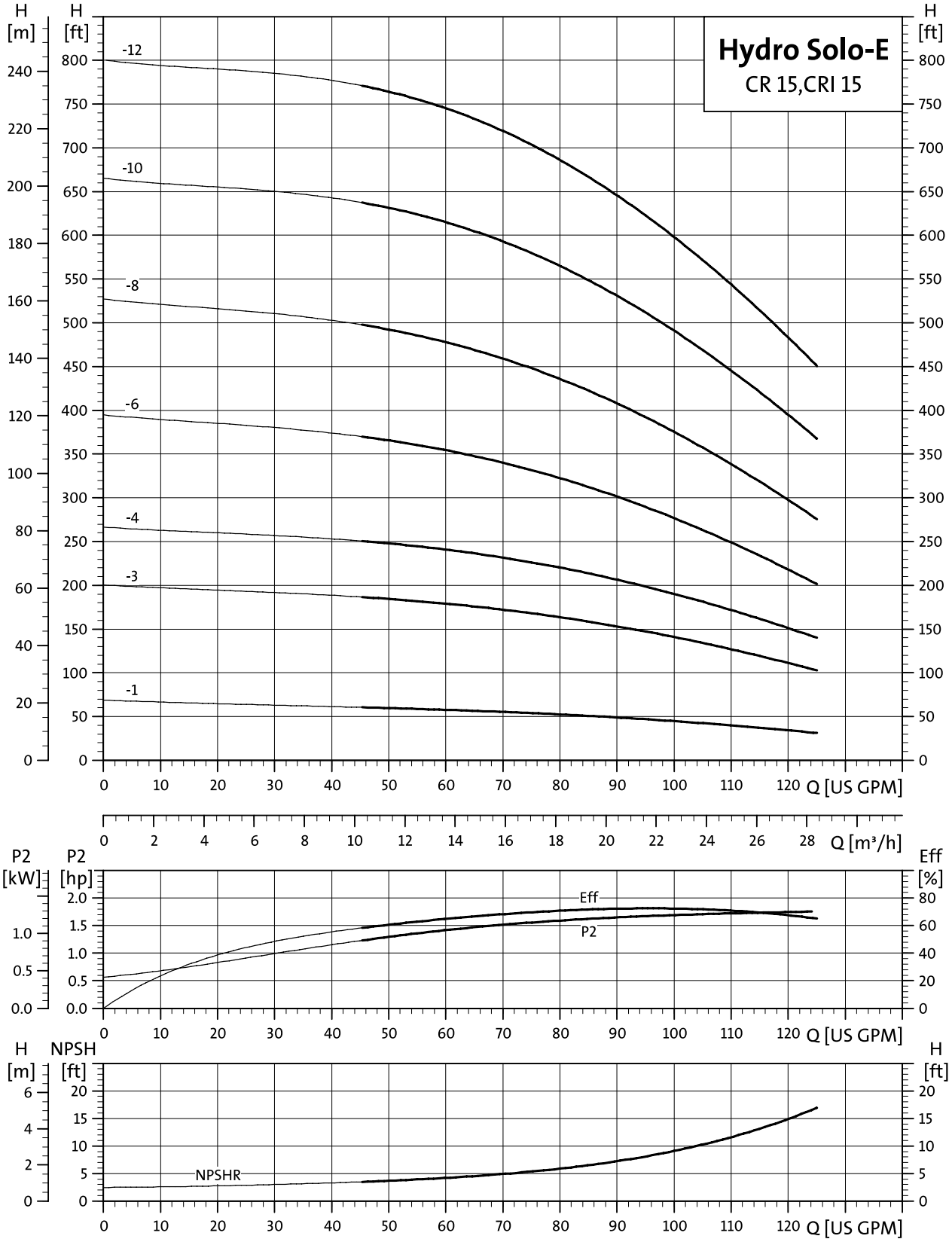


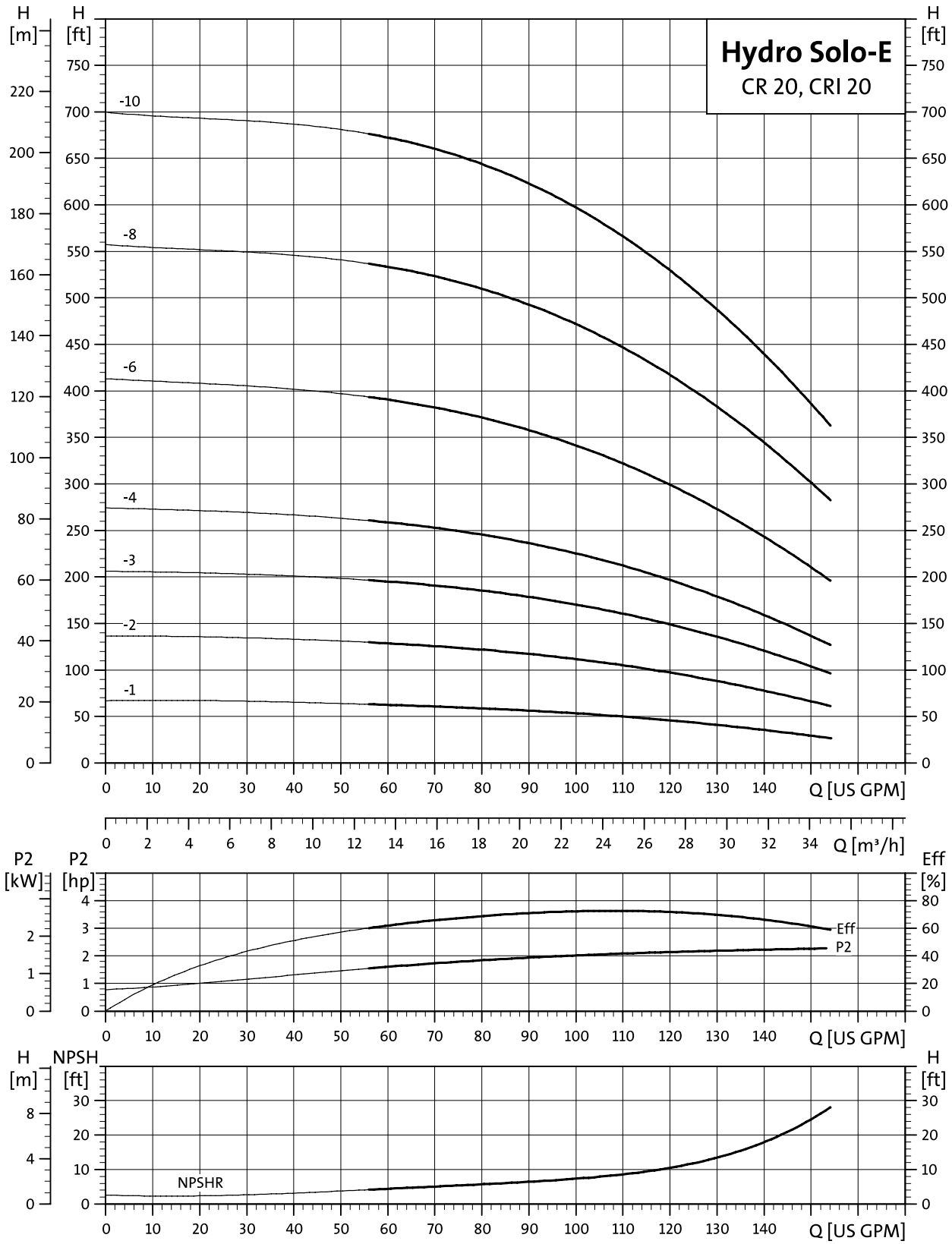
Hydro Solo-E CR(I)1, CR(I)3,CR(I)5- 3 x 208-230V, 3 X 575V with Variable Frequency Drive (VFD)

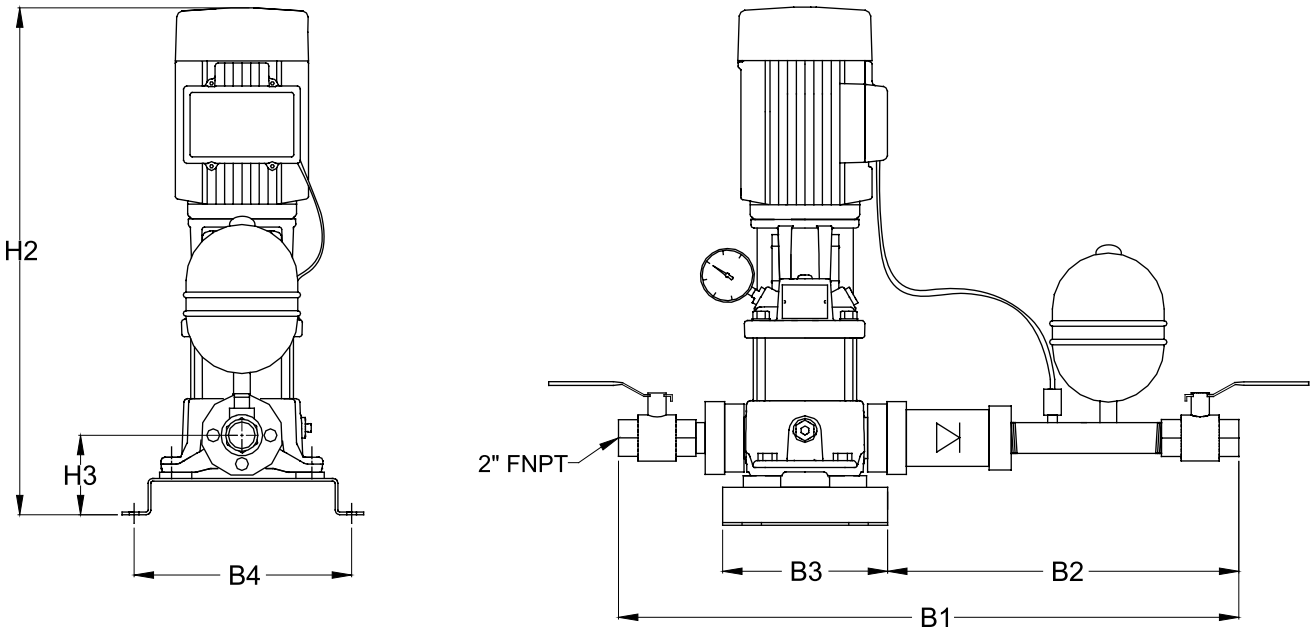
* Drawings not to scale

MODELS	HP	Supply Voltage				System connection	Dimensions (mm)							Weight (lbs)	Shipping Volume (ft^3)
		1 x 230V	3 x 208-230V	3 x 460V	3 x 575V		B1	B2	B3	B4	H1	H2	H3		
CR 1															
CR 1-5	1/2	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	606.1	148.9	112.6	22.7
CR 1-7	3/4	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	641	148.9	115.6	23.6
CR 1-10	1	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	736.2	148.9	124.6	26.0
CR 1-13	1 1/2	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	787.0	148.9	130.6	27.2
CR 1-19	2		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	935.8	148.9	193.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	956.0	148.9	179.1	31.5
CR 1-27	3		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	1139.1	148.9	268.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	956.0	148.9	233.1	31.5
CR 3															
CR 3-3	1/2	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	568.0	148.9	111.6	21.7
CR 3-6	1	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	663.2	148.9	117.6	24.1
CR 3-9	1- 1/2	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	717.2	148.9	126.6	25.5
CR 3-12	2		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	808.8	148.9	188.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	831.5	148.9	174.1	28.3
CR 3-15	3		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	923.2	148.9	255.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	961.7	148.9	222.1	31.6
CR 3-19	3		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	993.0	148.9	258.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	1031.5	148.9	225.1	33.3
CR 3-25	5		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	1126.4	148.9	272.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	1193.5	148.9	257.1	37.4
CR 5															
CR 5-3	1	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	637.8	148.9	116.6	23.5
CR 5-5	1 -1/2	•				1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	691.8	148.9	125.6	24.8
CR 5-7	2		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	783.4	148.9	192.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	806.1	148.9	173.1	27.7
CR 5-10	3		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	923.2	148.9	255.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	961.7	148.9	222.1	31.6
CR 5-16	5		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	1110.5	148.9	270.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	1177.6	148.9	255.1	37.0
CR 5-24	7-1/2		•		•	1 1/4'' FNPT	858.7	350.9	570.3	509.0	1140.0	1374.9	148.9	332.1	48.1
				•		1 1/4'' FNPT	858.7	501.7	203.2	304.8	-	1403.0	148.9	292.1	42.6

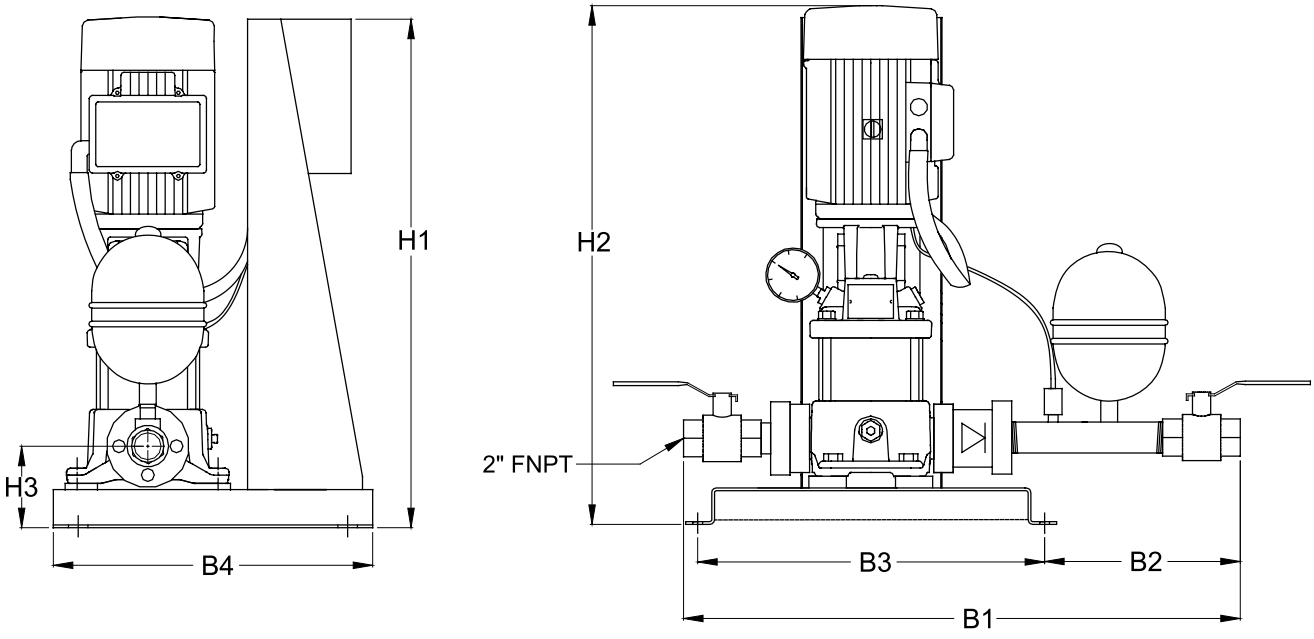

Hydro Solo-E
CR 10, CRI 10
H [m]
H [ft]
-17
-14
-10
-7
-4
-2
-1
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
P2
Eff
H [m]
NPSH [ft]
NPSHR


Hydro Solo-E
CR 15,CRI 15
H [m]
H [ft]
-12
-10
-8
-6
-4
-3
-1
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
Eff
P2
H [m]
NPSH [ft]
NPSHR
H [ft]


Hydro Solo-E
CR 20, CRI 20
H [m]
H [ft]
-10
-8
-6
-4
-3
-2
-1
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
Eff
P2
H [m]
NPSH [ft]
NPSHR



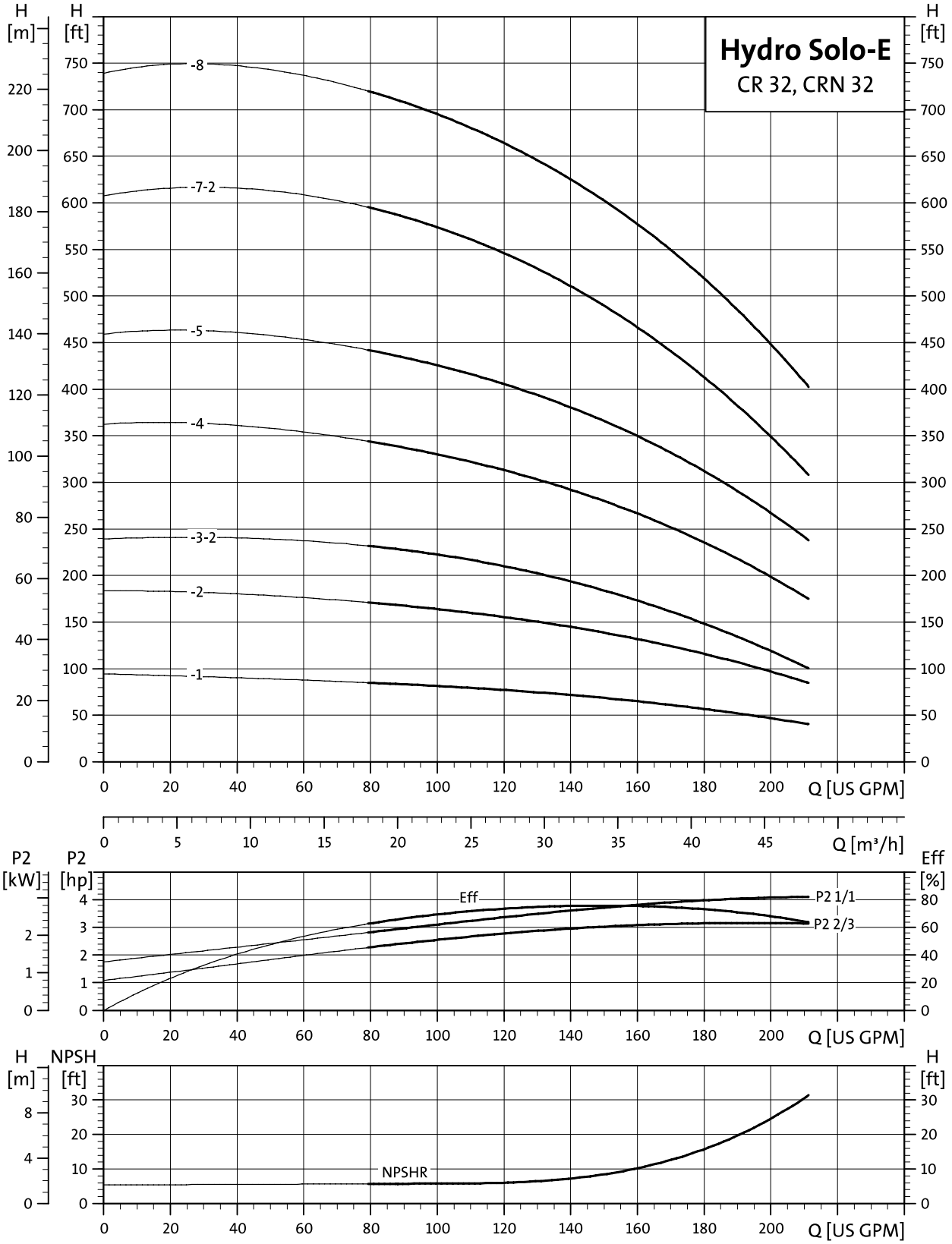
Hydro Solo-E CR(I)10- 1 x 230V, 2-10 Hp 3 x 460V with Grundfos MLE motor

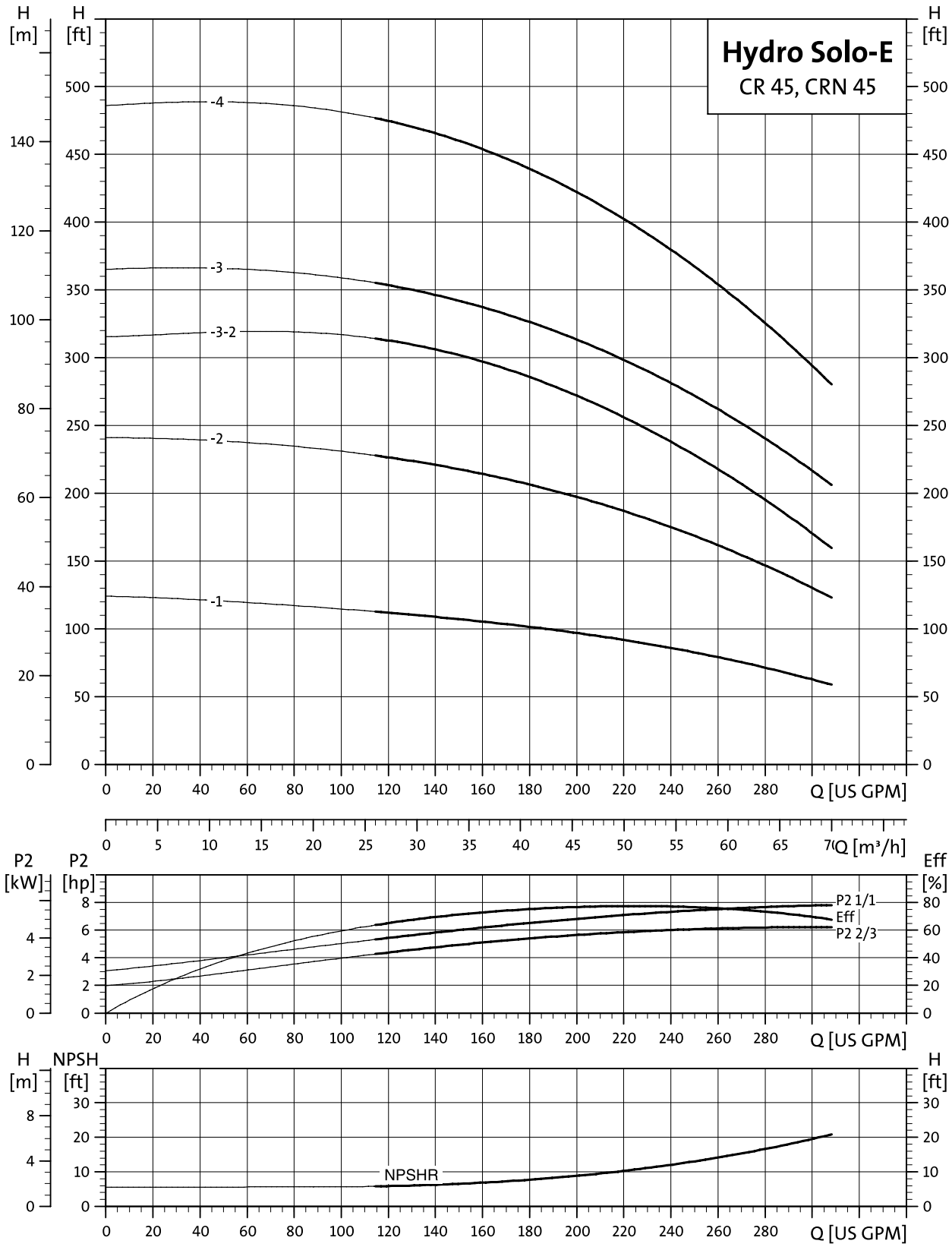


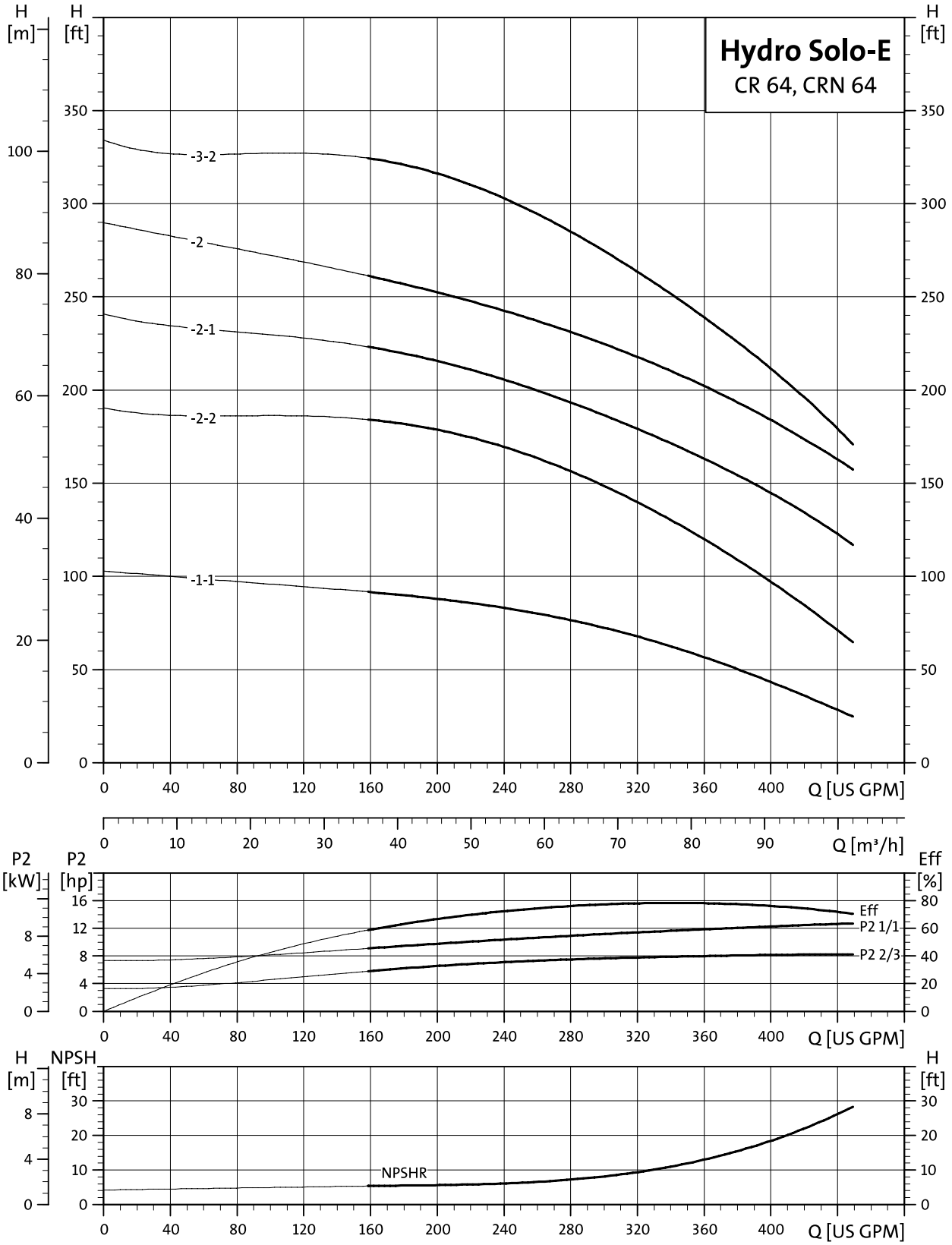
Hydro Solo-E CR(I)10, CR(I)15, CR(I)20 -3 x 208-230V, 15-30Hp 3 x 460V, 3 x 575 V with Variable Frequency Drive (VFD)

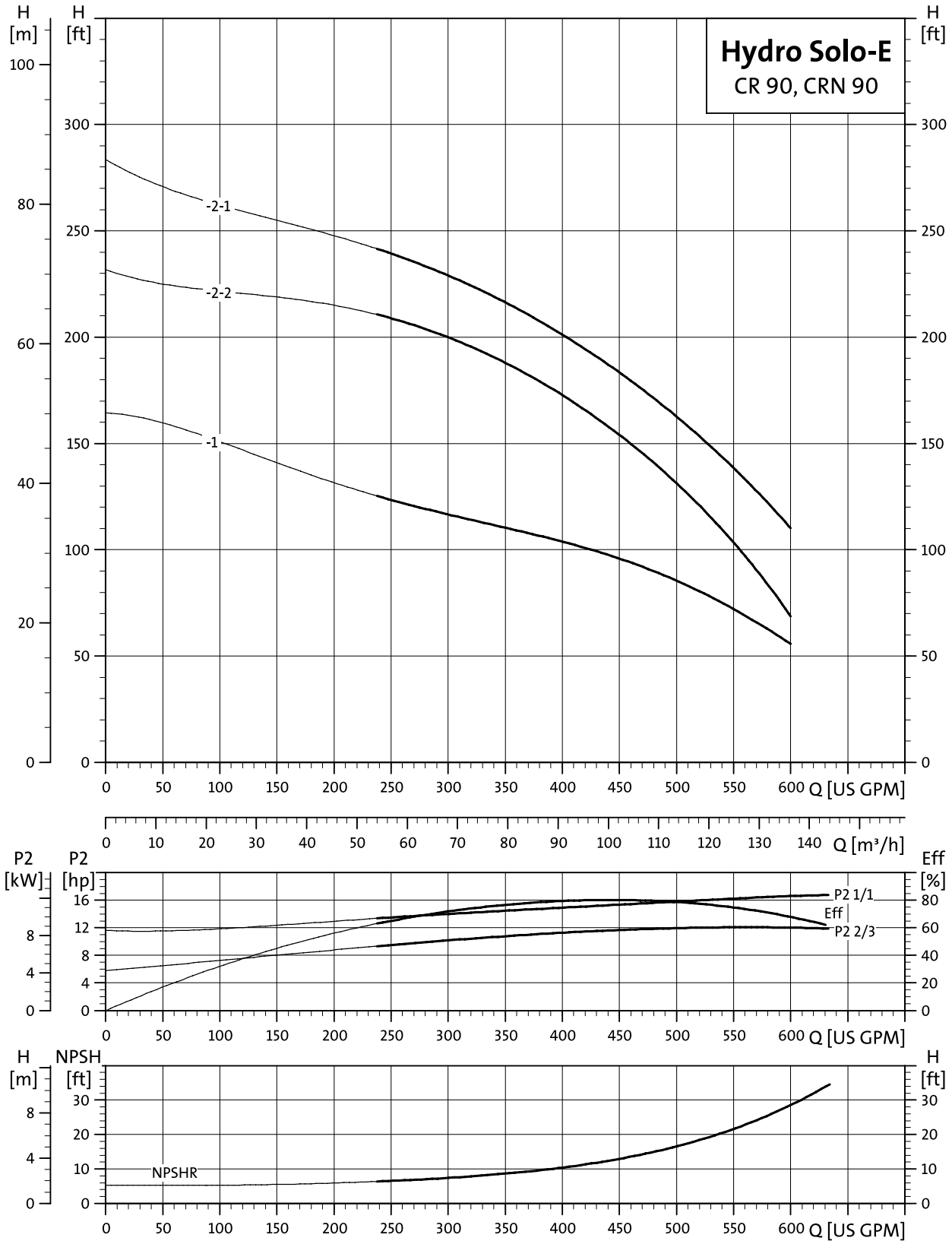
* Drawings not to scale

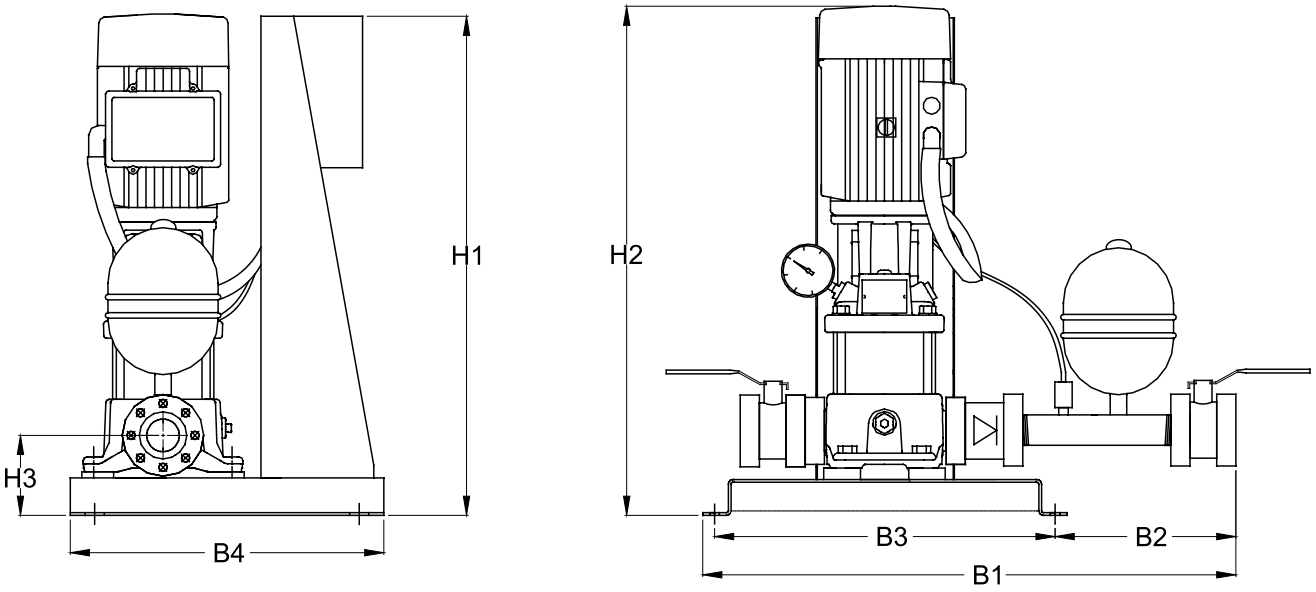
MODELS	HP	Supply Voltage				System connection	Dimensions (mm)							Weight (lbs)	Shipping Volume (ft^3)
		1 x230V	3 x 208-230V	3 x 460V	3 x 575V		B1	B2	B3	B4	H1	H2	H3		
CR 10															
CR 10-1	1	•				2" FNPT	875.1	514.2	203.2	304.8	-	622.3	161.6	191.5	23.5
CR 10-2	1 1/2	•				2" FNPT	875.1	514.2	203.2	304.8	-	622.3	161.6	210.5	23.5
CR 10-4	3		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	831.3	161.6	333.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		882.3	161.6	314.0	30.1
CR 10-7	5		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	945.6	161.6	340.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		1025.2	161.6	331.0	33.8
CR 10-10	7 1/2		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1083.0	161.6	399.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		1123.6	161.6	384.0	36.3
CR 10-14	10		•		•	2" FNPT	8875.1	363.4	570.3	509.0	1140.0	1251	161.6	410.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		1368.1	161.6	375.0	42.5
CR 10-17	15		•	•	•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1503.8	161.6	575.0	49.0
CR 15															
CR 15-1	2		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	748.6	161.6	266.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		783.9	161.6	252.0	27.6
CR 15-3	5		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	869.4	161.6	343.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		949.0	161.6	335.0	31.8
CR 15-4	7- 1/2		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	962.4	161.6	403.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		1002.9	161.6	386.0	33.2
CR 15-6	10		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1098.6	161.6	407.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		1091.8	161.6	368.0	35.5
CR 15-8	15		•	•	•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1322.9	161.6	570.0	49.0
CR 15-10	20		•	•	•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1455.8	161.6	709.0	49.0
CR 15-12	25		•	•	•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1553.9	161.6	715.0	49.0
CR 20															
CR 20-1	3		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	799.5	161.6	329.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		850.5	161.6	305.0	29.3
CR 20-2	5		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	824.9	161.6	341.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		904.5	161.6	335.0	30.7
CR 20-3	7-1/2		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	917.9	161.6	396.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		958.5	161.6	384.0	32.1
CR 20-4	10		•		•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1009.7	161.6	400.0	49.0
				•		2" FNPT	875.1	514.2	203.2	304.8		1002.9	161.6	361.0	33.2
CR 20-6	15		•	•	•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1234	161.6	561.0	49.0
CR 20-8	20		•	•	•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1366.9	161.6	702.0	49.0
CR 20-10	25		•	•	•	2" FNPT	875.1	363.4	570.3	509.0	1140.0	1461.9	161.6	706.0	49.0


Hydro Solo-E
CR 32, CRN 32
H [m]
H [ft]
-8
-7-2
-5
-4
-3-2
-2
-1
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
Eff
P2 1/1
P2 2/3
NPSH [ft]
NPSHR


Hydro Solo-E
CR 45, CRN 45
H [m]
H [ft]
-4
-3
-3-2
-2
-1
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
P2 1/1
Eff
P2 2/3
H [m]
NPSH [ft]
NPSHR


Hydro Solo-E
CR 64, CRN 64
H [m]
H [ft]
-3-2
-2
-2-1
-2-2
-1-1
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
Eff
P2 1/1
P2 2/3
NPSH [ft]
NPSHR


Hydro Solo-E
CR 90, CRN 90
H [m]
H [ft]
-2-1
-2-2
-1
Q [US GPM]
Q [m³/h]
P2 [kW]
P2 [hp]
Eff [%]
P2 1/1
Eff
P2 2/3
NPSH [ft]
NPSHR



Hydro Solo-E CR(N)32, CR(N)45,CR(N)64,CR(N)90- 3 phase with Variable Frequency Drive (VFD)

* Drawings not to scale

MODELS	HP	Supply Voltage				System connection	Dimensions (mm)							Weight (lbs)	Shipping Volume (ft^3)
		1 x 230V	3 x 208-230V	3 x 460V	3 x 575V		B1	B2	B3	B4	H1	H2	H3		
CR 32															
CR 32-1	5		•	•	•	3" 150 LB ANSI	791.6	231.9	570.0	636.0	1140.0	894.8	164.9	571.5	52.6
CR 32-2	7 1/2		•	•	•	3" 150 LB ANSI	791.6	231.9	570.0	636.0	1140.0	1003.7	164.9	595.5	52.6
CR 32-3-2	10		•	•	•	3" 150 LB ANSI	791.6	231.9	570.0	636.0	1140.0	1120.8	164.9	650.5	52.6
CR 32-4	15		•	•	•	3" 150 LB ANSI	791.6	231.9	570.0	636.0	1140.0	1367.33	164.9	815.5	52.6
CR 32-5	20		•	•	•	3" 150 LB ANSI	791.6	231.9	570.0	636.0	1140.0	1481.2	164.9	966.5	52.6
CR 32-7-2	25		•	•	•	3" 300 LB ANSI	801.6	241.9	570.0	636.0	1140.0	1642.8	164.9	983.5	53.1
CR 32-8	30		•	•	•	3" 300 LB ANSI	801.6	241.9	570.0	636.0	1140.0	1753.9	164.9	1016.5	53.1
CR 45															
CR 45-1	7- 1/2		•	•	•	3" 150 LB ANSI	835.3	239.9	570.0	636.0	1140.0	984.6	199.9	661.5	54.7
CR 45-2	15		•	•	•	3" 150 LB ANSI	835.3	239.9	570.0	636.0	1140.0	1291.1	199.9	824.5	54.7
CR 45-3-2	20		•	•	•	3" 150 LB ANSI	835.3	239.9	570.0	636.0	1140.0	1414.5	199.9	971.5	54.7
CR 45-3	25		•	•	•	3" 150 LB ANSI	835.3	239.9	570.0	636.0	1140.0	1436.5	199.9	971.5	54.7
CR 45-4	30		•	•	•	3" 300 LB ANSI	845.3	249.9	570.0	636.0	1140.0	1553.8	199.9	996.5	55.2
CR 64															
CR 64-1-1	7- 1/2		•	•	•	4" 150 LB ANSI	851.3	255.9	570.0	636.0	1140.0	987.8	199.9	775.5	55.5
CR 64-2-2	15		•	•	•	4" 150 LB ANSI	851.3	255.9	570.0	636.0	1140.0	1297.5	199.9	939.50	55.5
CR 64-2-1	20		•	•	•	4" 150 LB ANSI	851.3	255.9	570.0	636.0	1140.0	1341.5	199.9	1077.5	55.5
CR 64-2	25		•	•	•	4" 150 LB ANSI	851.3	255.9	570.0	636.0	1140.0	1363.4	199.9	1077.5	55.5
CR 64-3-2	30		•	•	•	4" 150 LB ANSI	851.3	255.9	570.0	636.0	1140.0	1484.0	199.9	1102.5	55.5
CR 90															
CR 90-1	15		•	•	•	4" 150 LB ANSI	883.0	287.6	570.0	636.0	1140.0	1224.4	199.9	973.5	57.0
CR 90-2-2	25		•	•	•	4" 150 LB ANSI	883.0	287.6	570.0	636.0	1140.0	1382.5	199.9	1121.5	57.0
CR 90-2-1	30		•	•	•	4" 150 LB ANSI	883.0	287.6	570.0	636.0	1140.0	1420.5	199.9	1136.5	57.0

Tanks

Hydro Solo-E systems require a diaphragm tank to be connected on the discharge side of the system in order for the system to function properly. The recommended tank sizes and specifications are as follows :

Sizing

PUMP TYPE	STANDARD TANK SIZE (Gallons)	PRESSURE RATING (psi)
CR(I) 1	4.4	150
CR(I) 3	4.4	150
CR(I) 5	4.4	150
CR(I) 10	10.3	150
CR(I) 15	20.0	150
CR(I) 20	20.0	150
CR(N) 32	34.0	150
CR(N) 45	34.0	150
CR(N) 64	44.0	150
CR(N) 90	62.0	150

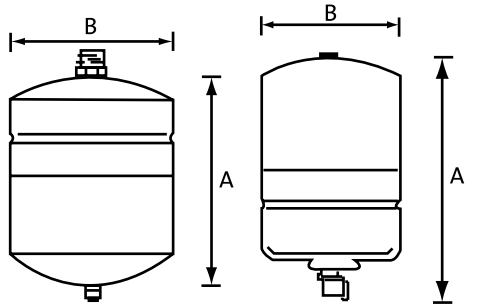
The diaphragm tanks are factory pre-charged to 70% of the setpoint to be maintained by the system.

The pre-charge pressure is calculated as :

- Pre-charge Pressure = 0.7 x setpoint

Specifications :

- Brass fitting Polypropylene Liner for corrosion resistance
- Maximum working pressure: 150 psig
- Maximum operating temperature: 200° F
- Standard Factory Precharge : 40 psig
- 4.4 Gallon tank has a brass connection
- 10.3 to 62 Gallon tanks have Stainless Steel Connection
- Diaphragm Material : Butyl
- Liner Material : Polypropylene
- Relief valve must be set at 150 psig for all tank models
- It is recommended to refill the tank with nitrogen



4.4 Gallon Tank 10.3 to 62 Gallon Tank

TANK VOLUME (Gallons)	Max. Accept. Factor	A Height (mm)	B Diameter(mm)	Tank connection
4.4	0.73	381	279	¾" NPTM
10.3	1.00	489	391	1" NPTF
20.0	0.57	802	391	1" NPTF
34.0	1.00	913	559	1 ¼" NPTF
44.0	0.77	913	559	1 ¼" NPTF
62.0	0.55	1186	559	1 ¼" NPTF

Specification

GRUNDFOS HYDRO SOLO-E PACKAGED WATER BOOSTER PUMP SYSTEM SPECIFICATION

JOB OR CUSTOMER:				
ENGINEER:				
CONTRACTOR:				
SUBMITTED BY:			DATE:	
APPROVED BY:			DATE:	
ORDER NO:			DATE:	
SPECIFICATION REF:				
MODEL DESCRIPTION:		PART NUMBER:	TAG NO.:	QTY.:
MAX. GPM:	DISCHARGE PRESSURE:	MIN. INLET PRESSURE:	VOLTS:	PHASE:

The packaged water booster pump system shall be a standard product of a single pump manufacturer. The manufacturer of the packaged pump system shall also be the manufacturer of the pumps. Non standard, "one of a kind" packaged pump systems shall not be considered equal. The packaged water booster pump system shall be Grundfos Model # Hydro Solo-E _____ or approved equal.

The complete packaged water booster pump system shall be certified and listed by UL for conformance to Canadian Standards. Systems that have only the sub-assemblies certified and listed by UL for conformance to Canadian Standards and/or UR and or cUR recognized components shall not be considered equal.

The packaged booster pump system shall use advanced variable frequency drive technology to maintain a constant pressure of _____ psi to a maximum flow of _____ gpm. Minimum supply pressure shall be _____ psi. Pump systems that use pump control valves or pressure reducing valves (PRVs) to maintain a constant water pressure shall not be considered equal.

The maximum duty point of the pump shall be _____ gpm @ _____ TDH. The pump efficiency shall be at least _____% at the duty point.

The system power shall be _____ volts, _____ phase.

The pump shall be Grundfos Model _____ or approved equal. The pump suction/discharge chamber, motor stool, and pump shaft couplings shall be constructed of _____ (cast iron/stainless steel). The impellers, pump shaft, diffuser chambers, outer discharge sleeve, impeller seal rings, and seal ring retainers shall be constructed of stainless steel.

The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement for models CR(I)20 and below. The pump impellers shall be secured to the shaft by a split cone and nut for size CR(N)32 and above. The shaft journal and chamber bearings shall be Silicon Carbide for model CR(I)20 and below. The shaft journal and chamber bearings shall be Tungsten Carbide and Bronze for model CR32 and above (Tungsten Carbide and Graflon® for CRN32 and above or as an option for CR32 and above). CR(I)20 and smaller pumps shall be equipped with a balanced cartridge style mechanical seal assembly with Silicon Carbide/Silicon Carbide seal faces mounted in stainless steel components. For CR32 and larger pumps, the shaft seal shall be of the balanced cartridge design also. CR32 and larger pumps may be ordered with Tungsten Carbide/Carbon, Tungsten Carbide, or the Grundfos "Hybrid" seal face design. The CR10 and larger pumps shall be designed so that the cartridge seal may be replaced without removing motors 15 HP and larger. All pipe fittings and base plate shall be constructed of stainless steel material.

The 3 phase motors shall be of TEFC design, NRC/EPACT rated for high efficiency. Other motor enclosures are available on request. The motors shall have a NEMA C face and shall operate at a nominal 3500 RPM with a minimum service factor of 1.15. Drive-end motor bearings shall be designed to absorb thrust and shall be adequately sized to ensure long motor life.

For systems with 3 phase supply, the system electronic component shall be a VLT or approved equal. The controller shall operate the pump based on a 0-10VDC/4-20mA input signal from the discharge side of the system, to maintain the design pressure while using minimum energy. As flow begins, the pump will start at low speed. As demand increases, the pump will speed up until it reaches full Frequency/Speed. When water demand is zero the pump shall go into sleep mode. The pump shall wake up on increase in demand in the system. The controller shall be capable of accepting a low suction pressure or other suction fault inputs to shut down the system.

The 1 phase motor shall be of pulse width modulated, integrated motor/variable frequency drive design; the motor and drive designed and built by a single manufacturer. The integrated motor/variable frequency drive combination shall be capable of operating the pump at varying RPMs to maintain the system design pressure with varying flows from 0 gpm to _____ gpm. The variable frequency drive enclosure shall include a PI controller, dry contact fault output relay contacts, analog and digital inputs. The motor shall detect/protect itself against under voltage, over voltage, overload, sensor signal fault and set-point signal fault. The motor/drive enclosure shall be rated IP55. The motor windings shall be class F rated.

Specification

The entire packaged pumping system shall be mounted on a 304 Stainless Steel fabricated skid. The control cabinet shall be mounted on a 304 Stainless Steel fabricated control stand attached to the system skid.

The suction and discharge manifolds shall be fabricated of 316 Stainless Steel. The discharge manifold shall include a stainless steel pressure transducer with a 4-20mA output. The pressure transducer shall be factory installed and wired. There will be a port to connect a diaphragm tank on the discharge manifold. There may be a suction manifold installed in the system for connecting pressure switch or pressure sensor to sense a low suction pressure or other suction fault inputs (this is optional with the system)

An isolation valve shall be installed on the suction of the pump and on the discharge manifold. A check valve shall be installed on the discharge end of each pump.

All systems shall be factory tested for performance and pressure. The system shall include a NON-ASME rated diaphragm type pressure tank sized by the manufacturer. Verified Factory Performance Tests and Witness Factory Performance Tests shall be options provided by the system manufacturer.

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