

CRT, CRTE

Vertical multistage centrifugal pumps in titanium
60 Hz



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1. Product data

Introduction

The CRT and CRTE pumps are non-self-priming, vertical multistage centrifugal pumps. The pumps are available with Grundfos standard motors (CRT pumps) or frequency-controlled motors (CRTE pumps). Reliable and cost efficient CRT and CRTE pumps handle a variety of liquids from sea water to sodium hypochlorite. In CRT and CRTE pumps, all components in contact with the pumped liquid are constructed of titanium.

Excellent corrosion resistance

Titanium is widely used for many industrial applications due to its high resistance to corrosion.

Titanium is unaffected by corrosive attacks by salt water or marine atmospheres. It also has exceptional resistance to a wide range of acids, alkalies, natural water and industrial chemicals.

The corrosion resistance of titanium is due to a stable, protective and strongly adherent oxide film that forms instantly on the metal when a fresh surface is exposed to air or moisture.



GR7369

Fig. 1 CRT pumps

Applications

Reliable and cost-efficient, CRT and CRTE pumps handle a variety of liquids from sea water to sodium hypochlorite.

CRT and CRTE pumps are suitable for these types of applications:

Marine environment

- Ballast pumps
- washing/cleaning.

Pulp and paper industries

- Bleaching solutions

Offshore industries and refineries

- Fire fighting
- cooling
- metal-finishing industries (electroplating)
- copper chloride etching
- ammonium chloride etching.

Power generation plants

- FGD (Flue Gas Desulphurization)

Food processing, brewing and pharmaceutical industries

- CIP (Cleaning In Place)
- disinfection.

Desalination industries

- Reverse osmosis
- distillation.

Chemical processing industries

- Chlorine and chlorates
- organic acids
- oxidizing acids (nitric acid, chromic acid)
- chloride-containing salts (ferric chloride)
- inhibited reducing acids.

Other

- Fish farming
- aquariums
- water parks.

Features and benefits

Pump

The pump consists of a base and a pump head. The chamber stack and the outer sleeve are secured between the pump head and the base by means of staybolts. The base has inlet and outlet ports on the same level (in-line).

All pumps are equipped with a maintenance-free mechanical shaft seal.

Motors

Grundfos standard motors -ML and Baldor® motors

CRT pumps are fitted with Grundfos specified motors. The motors are all heavy-duty 2-pole, energy efficient NEMA frame, C-face motors.

MLE frequency-controlled motors

CRTE pumps are fitted with totally enclosed, fan-cooled, 2-pole MLE frequency-controlled motors.

Permanent magnet motors

From 0.5 Hp to 2.0 Hp Grundfos offers CRTE pumps fitted with single-phase MLE motors (1 x 200-240 V).

From 1.5 Hp to 7.5 Hp Grundfos offers CRTE pumps fitted with three-phase MLE motors (3 x 200-240 V).

From 1.0 Hp to 15 Hp Grundfos offers CRTE pumps fitted with three-phase MLE motors (3 x 440-480 V).

Asynchronous motors

From 20 Hp to 30 Hp Grundfos offers CRTE pumps fitted with three-phase MLE motors (3 x 460-480 V).

Electrical data

Mounting designation	NEMA
Insulation class	F/B/H
Efficiency class*	Energy efficient Premium efficiency - on request for 15 Hp and above
Enclosure class	TEFC - Totally Enclosed Fan Cooled
60 Hz Standard voltages	1 x 115/208-230 V 3 x 208-230/460 V 3 x 575 V
Approvals	

* 1-10 Hp ML motors are premium efficient as standard.

Optional motors

The Grundfos standard range of motors covers a wide variety of application demands. However, for special applications or operating conditions, custom-built motor solutions can be provided.

For special applications or operating conditions, Grundfos offers custom-built motors such as:

- explosion proof motors
- motors with anti-condensation heating units
- low-noise motors
- premium efficiency motors
- motors with thermal protection.

Motor protection

Single-phase Grundfos specified motors have built-in thermal overload switches (up to 7.5 Hp).

Three-phase motors must be connected to motor starters in accordance with local regulations.

Single- and three-phase MLE motors have built-in thermal protection.

Terminal box positions

As standard the terminal box is mounted on the inlet side of the pump.

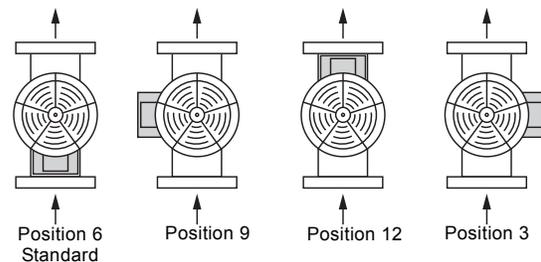


Fig. 2 CRT and CRTE, terminal box positions

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MLE 0.5 to 15 Hp permanent magnet motors

Supply voltage:

- 0.5 to 2 Hp (1 x 200-240 V)
- 1.5 to 7.5 Hp (3 x 200-240 V)
- 1 to 15 Hp (3 x 440-480 V)

Advanced functional module (FM 300)

The FM 300 is the standard functional module in all MLE motors 0.5 to 15 Hp.

The module has a number of inputs and outputs enabling the motor to be used in advanced applications where many inputs and outputs are required.

The FM 300 has these connections:

- three analog inputs
- one analog output
- two dedicated digital inputs
- two configurable digital inputs or open-collector outputs
- Grundfos Digital Sensor input and output
- two Pt100/1000 inputs
- two LiqTec sensor inputs
- two signal relay outputs
- GENIbus connection.

Connection terminals

CRTE pumps have a number of inputs and outputs enabling the pumps to be used in advanced applications where many inputs and outputs are required.

Functional module 300 has been selected as standard for CRTE pumps. See fig. 3.

As a precaution, the wires to be connected to the following connection groups must be separated from each other by reinforced insulation in their entire lengths.

Inputs and outputs

- Start/stop (digital input 1) (terminals 2 and 6)
- pressure sensor (analog input 1) (terminals 4 and 8)
- pressure switch (digital input 3) (terminals 10 and 6)
- external analog signal input (analog input 2) (terminals 7 and 23)
- GENIbus (terminals A, Y and B).

All inputs and outputs are internally separated from the power-conducting parts by reinforced insulation and galvanically separated from other circuits.

All control terminals are supplied by protective extra-low voltage (PELV), thus ensuring protection against electric shock.

Signal relay outputs

– Signal relay 1:

LIVE:

Power supply voltages up to 250 VAC can be connected to this output.

PELV:

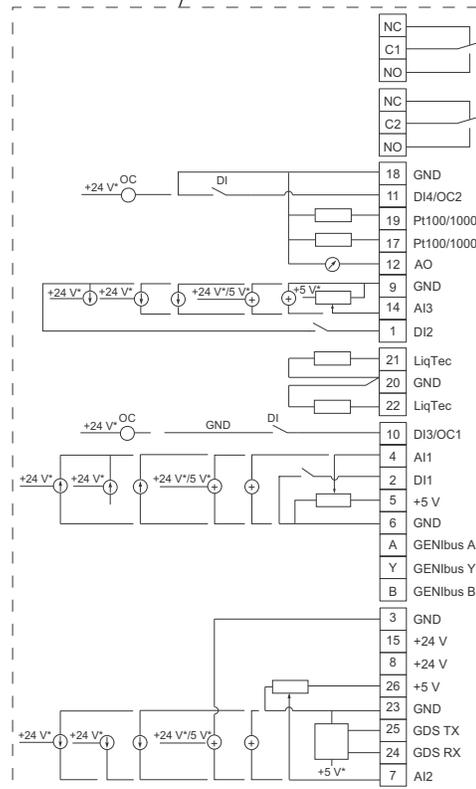
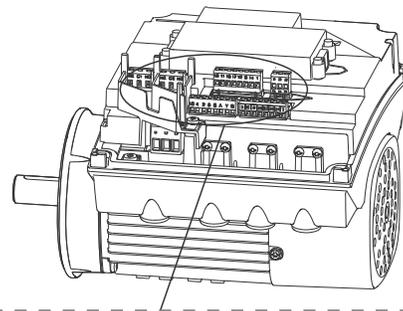
The output is galvanically separated from other circuits. Therefore, the supply voltage or protective extra-low voltage can be connected to the output as desired.

– Signal relay 2:

PELV:

The output is galvanically separated from other circuits. Therefore, the supply voltage or protective extra-low voltage can be connected to the output as desired.

Power supply (terminals N, PE, L or L1, L2, L3, PE)



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Fig. 3 Connection terminals, FM 300 functional module

MLE 20 to 30 Hp asynchronous motors

Supply voltage:

20 to 30 Hp (3 x 460-480 V)

Advanced I/O module

The advanced I/O module is the standard functional module in these MLE motors.

The module has a number of inputs and outputs enabling the motor to be used in advanced applications where many inputs and outputs are required.

The Advanced I/O module has these connections:

- start/stop terminals
- three digital inputs
- one setpoint input
- one sensor input (feedback sensor)
- one sensor 2 input
- one analog output
- two Pt100 inputs
- two signal relay outputs
- GENIbus connection.

Connection terminals

As a precaution, the wires to be connected to the following connection groups must be separated from each other by reinforced insulation in their entire lengths.

Inputs and outputs

- Start/stop (terminals 2 and 3)
- digital inputs (terminals 1 and 9, 10 and 9, 11 and 9)
- sensor input 2 (terminals 14 and 15)
- Pt100 sensor inputs (terminals 17, 18, 19 and 20)
- setpoint input (terminals 4, 5 and 6)
- sensor input (terminals 7 and 8)
- GENIbus (terminals B, Y and A).

All inputs are internally separated from the power-conducting parts by reinforced insulation and galvanically separated from other circuits.

All control terminals are supplied with protective extra-low voltage (PELV), thus ensuring protection against electric shock.

Output (relay signal, terminals NC, C, NO)

The output is galvanically separated from other circuits.

Therefore, the supply voltage or protective extra-low voltage can be connected to the output as desired.

- Analog output (terminal 12 and 13).

Power supply (terminals L1, L2, L3)

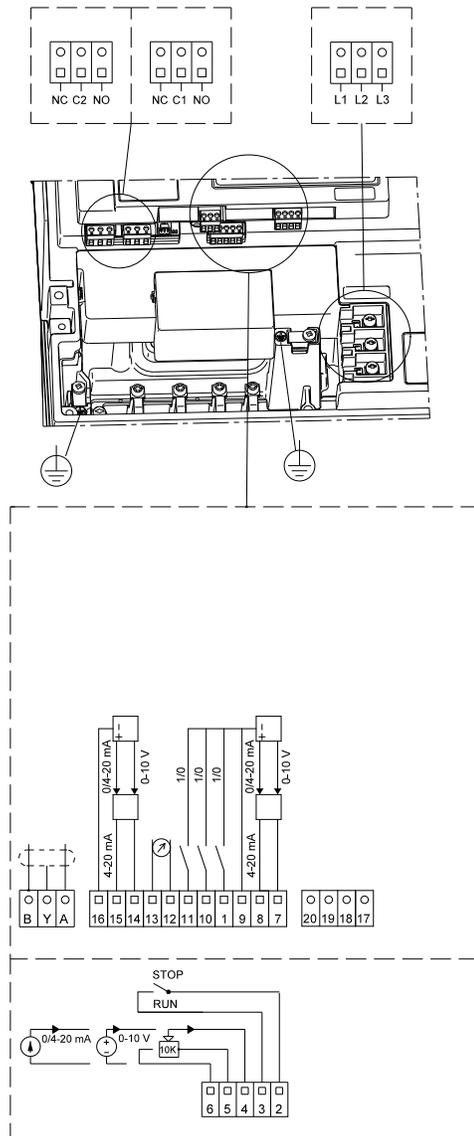


Fig. 4 Connection terminals, Advanced I/O module

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Terminal box positions

As standard, the terminal box is fitted on the inlet side of the pump.

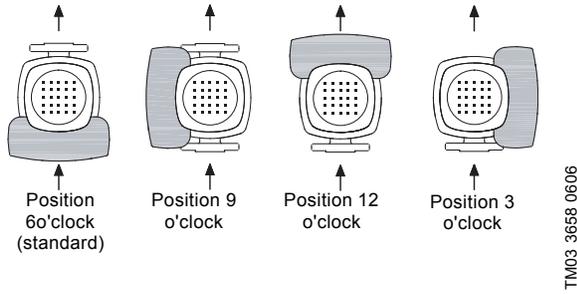


Fig. 5 Terminal box positions

Ambient temperature

MLE motor power [Hp]	Motor make	Voltage [V]	Max. ambient temp. [°F (°C)]	Max. altitude above sea level [ft (m)]
0.5 to 2	MLE	1 x 200-240	122 (50)	
1 to 15	MLE	3 x 440-480	122 (50)	3280 (1000)
1.5 to 7.5	MLE	3 x 200-240	104 (40)	
20 to 30	MLE	3 x 460-480	104 (40)	

If the ambient temperature exceeds the above maximum ambient temperatures or the pump is installed at an altitude exceeding 3280 ft (1000 m), the motor must not be fully loaded due to the risk of overheating. Overheating may result from excessive ambient temperatures or high altitudes.

In such cases, it may be necessary to use a motor with a higher rated output.

Viscosity

The pumping of liquids with densities or kinematic viscosities higher than those of water will cause a considerable pressure drop, a drop in the hydraulic performance and a rise in the power consumption. In such situations, fit the pump with a larger motor. If in doubt, contact Grundfos.

Installation altitude

Installation altitude is the height above sea level of the installation site. Motors installed up to 3280 ft (1000 m) above sea level can be loaded 100 %.

Motors installed more than 3280 ft (1000 m) above sea level must not be fully loaded due to the low density and consequently low cooling effect of the air.

MLE permanent magnet motors

- 0.5 to 2 Hp (1 x 200-240 V)
- 1.5 to 7.5 Hp (3 x 200-240 V)
- 1 to 15 Hp (3 x 440-480 V)

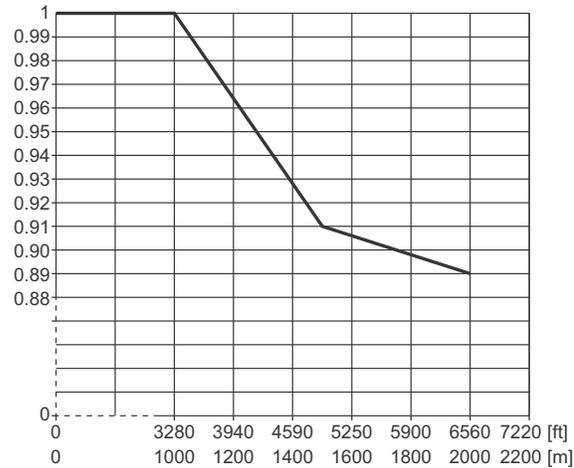


Fig. 6 Derating of motor output (P2) in relation to altitude above sea level

MLE asynchronous motors

- 20 to 30 Hp (3 x 460-480 V)

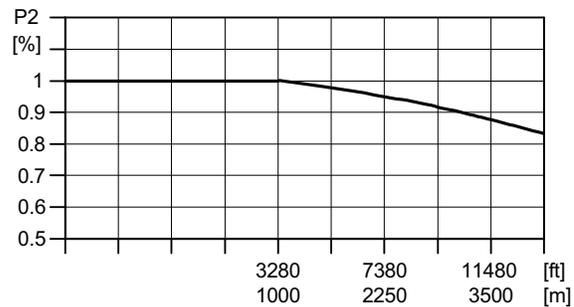


Fig. 7 Derating of motor output (P2) in relation to altitude above sea level

2. MLE technical data

Grundfos MLE motors are equipped with NEMA standard C-face flanges.

Grundfos MLE motors are recognized under the Component Recognition Program of Underwriters Laboratories Inc. for the United States and Canada.

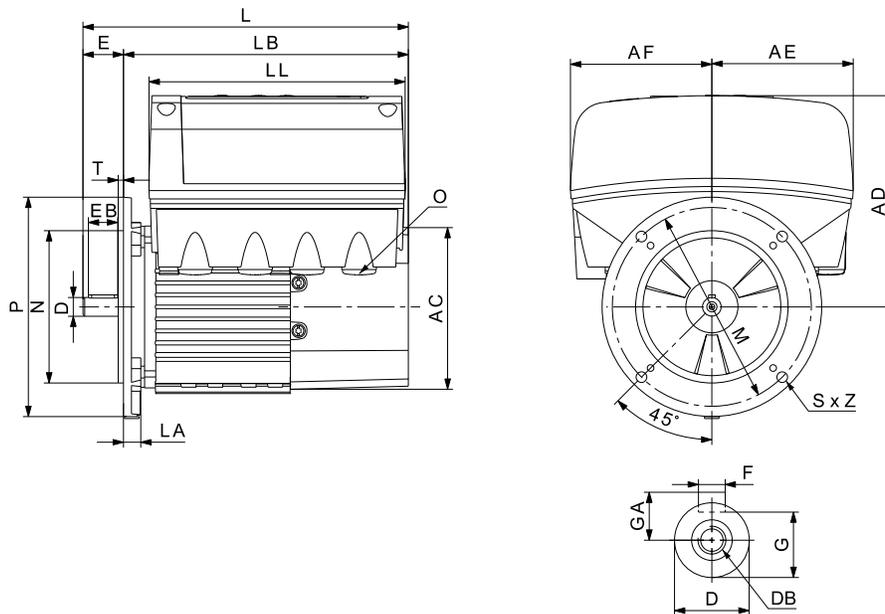
MLE motors are equipped with a reinforced bearing system with locked bearings at the drive end, either a deep-groove ball bearing or an angular-contact bearing depending on the motor model.

This ensures an even uptake of the load in order to maximize the lifetime of the bearings, which are guaranteed for a minimum of 18,000 hours service life. At the non-drive end, the motors are fitted with bearings with axial clearance in order to meet production tolerances while allowing for thermal expansion during motor operation. This ensures trouble-free operation and long life.

See MLE motor data with dimensions on pages 8-11. See electrical data for MLE motors on page 46.

MLE permanent magnet motors 0.5 to 2 Hp

(2-pole) 1 phase, 60 Hz, 200-240 V



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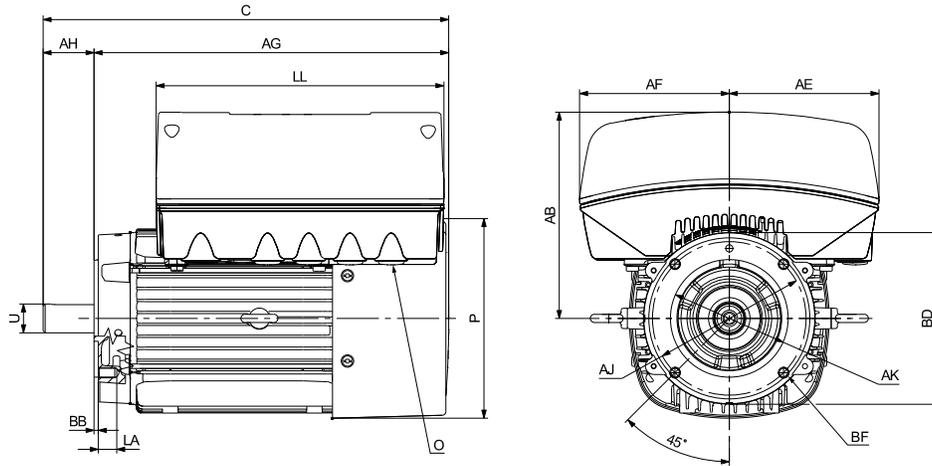
2-pole dimensional data

Power [Hp]	NEMA frame	Stator housing [inches (mm)]							Shaft end [inches (mm)]	
		AC	AD	AF	L	LB	LL	D	E	
0.50	56C									
0.75		4.80	6.22	4.17	10.55	8.46	7.56	0.63	2.06(52.3)	
1.00		(122)	(158)	(106)	(268)	(215)	(192)	(15.9)		
1.50										
2.00		4.80	6.22	4.17	11.34	9.25	7.56	0.63	2.06	
		(122)	(158)	(106)	(288)	(235)	(192)	(15.9)	(52.3)	

Power [Hp]	NEMA Frame	Flange [inches (mm)]						Cable entries [mm]	
		LA	M	N	P	S	T	O	
0.50	56C								
0.75		0.63	5.87	4.50	6.50	3/8"	0.16	1/2" NPT (4)	
1.00		(16)	(149.2)	(114.3)	(165)		(4)		
1.50									
2.00		1.42	5.87	4.50	6.50	3/8"	0.16	1/2" NPT (4)	
		(36)	(149.2)	(114.3)	(165)		(4)		

MLE permanent magnet motors 1 to 15 Hp

(2-pole) 3 phase, 60 Hz, 440-480 V



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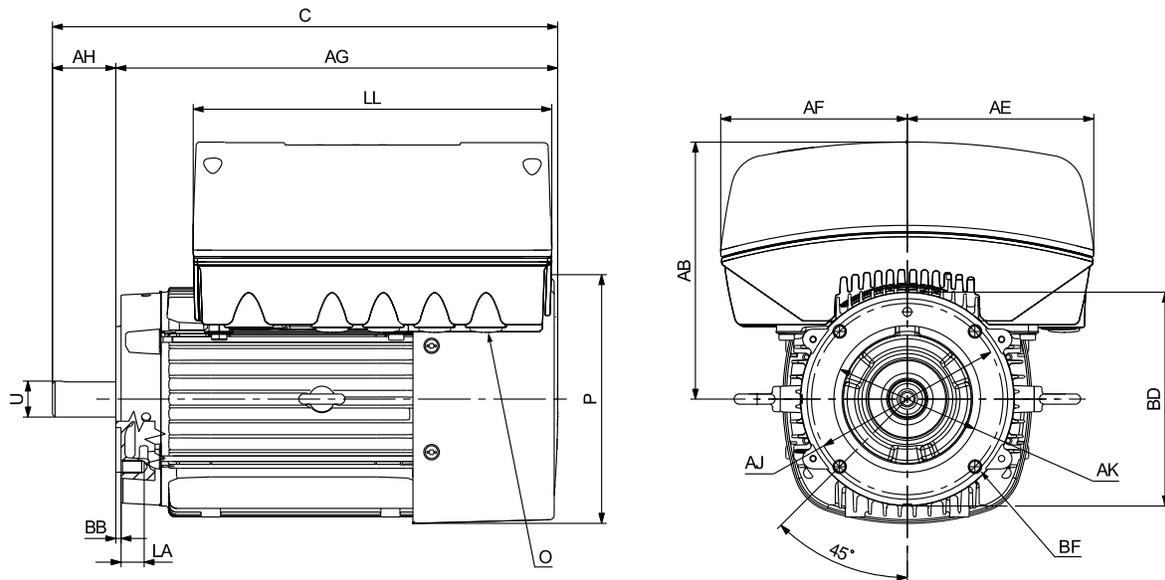
Dimensional data

Power [Hp]	NEMA frame	Stator housing [inches (mm)]							Shaft end [inches (mm)]	
		P	AB	AE	AF	C	AG	LL	U	AH
1	56C	4.80 (122)	6.22 (158)	5.28 (134)	5.28 (134)	12.13 (308)	10.04 (255)	9.13 (232)	0.63 (15.9)	2.06 (52.3)
1.5		4.80 (122)	6.22 (158)	5.28 (134)	5.28 (134)	12.13 (308)	10.04 (255)	9.13 (232)	0.63 (15.9)	2.06 (52.3)
2		4.80 (122)	6.22 (158)	5.28 (134)	5.28 (134)	12.91 (328)	10.83 (275)	9.13 (232)	0.63 (15.9)	2.06 (52.3)
3	182TC	4.80 (122)	6.22 (158)	5.28 (134)	5.28 (134)	13.46 (342)	10.83 (275)	9.13 (232)	1.13 (28.6)	2.62 (66.6)
5		7.53 (191.3)	7.91 (201)	5.73 (145.5)	5.73 (145.5)	15.89 (403.6)	13.15 (334)	11.02 (280)	1.13 (28.6)	2.74 (69.6)
7.5	213TC	7.53 (191.3)	7.91 (201)	5.73 (145.5)	5.73 (145.5)	17.75 (450.9)	14.37 (365)	11.02 (280)	1.37 (34.9)	3.38 (85.9)
10		10.04 (254.9)	9.33 (237)	6.81 (173)	6.81 (173)	18.70 (474.9)	15.31 (389)	12.48 (317)	1.37 (34.9)	3.38 (85.9)
15	254TC	10.04 (254.9)	9.33 (237)	6.81 (173)	6.81 (173)	19.74 (501.3)	15.98 (406)	12.48 (317)	1.63 (41.3)	3.75 (95.3)

Power [Hp]	NEMA frame	Flange [inches (mm)]						Cable entries [mm]
		LA	AJ	AK	BD	BF	BB	O
1	56C	0.63 (16)	5.87 (149.2)	4.50 (114.3)	6.50 (165)	3/8"	0.16 (4)	1/2" NPT (4)
1.5		0.63 (16)	5.87 (149.2)	4.50 (114.3)	6.50 (165)	3/8"	0.16 (4)	1/2" NPT (4)
2		1.42 (36)	5.87 (149.2)	4.50 (114.3)	6.50 (165)	3/8"	0.16 (4)	1/2" NPT (4)
3	182TC	0.51 (13)	7.25 (184.2)	-	8.50 (215.9)	1/2"	-	1/2" NPT (4)
5		0.75 (19)	7.25 (184.5)	8.50 (215.9)	8.50 (215.9)	1/2" - 13	0.25 (6.35)	1/2" NPT (5)
7.5	213TC	0.75 (19)	7.25 (184.15)	8.50 (215.9)	8.50 (215.9)	1/2" - 13	0.25 (6.35)	1/2" NPT (5)
10		0.79 (20)	7.25 (184.15)	8.50 (215.9)	8.68 (220.5)	1/2" - 13	0.25 (6.35)	3/4" NPT (1) & 1/2" NPT (5)
15	254TC	0.79 (20)	7.25 (184.15)	8.50 (215.9)	8.68 (220.5)	1/2" - 13	0.25 (6.35)	3/4" NPT (1) & 1/2" NPT (5)

MLE permanent magnet motors 1.5 to 7.5 Hp

1.5 to 7.5 Hp (2-pole) 3 phase, 60 Hz, 200-240 V



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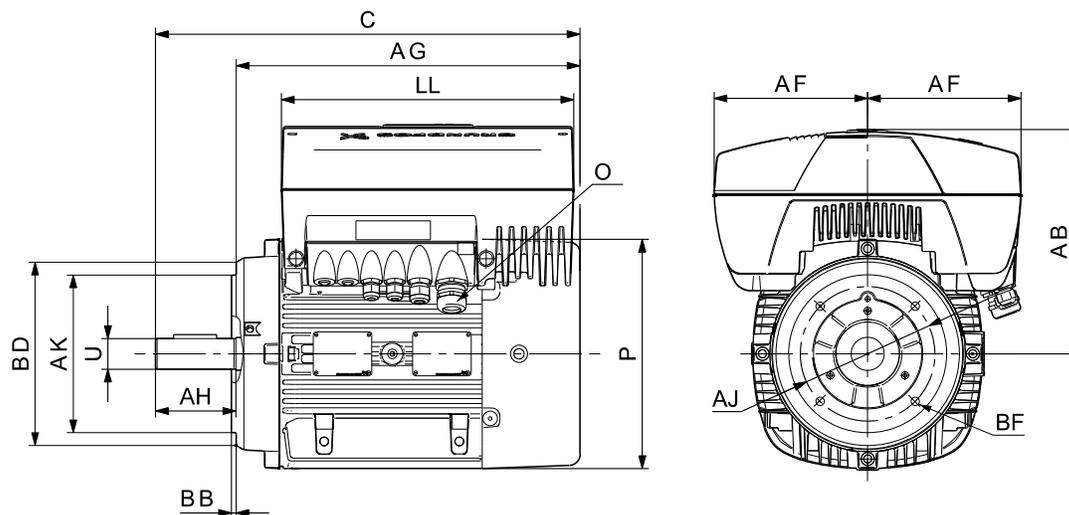
Dimensional data

Power [Hp]	NEMA frame	Stator housing [inches (mm)]							Shaft end [inches (mm)]	
		P	AB	AE	AF	C	AG	LL	U	AH
1.5	56C	4.80 (122)	6.22 (158)	5.28 (134)	5.28 (134)	12.13 (308)	10.04 (255)	9.13 (232)	0.63 (15.9)	2.06 (52.3)
2		7.53 (191.3)	7.91 (201)	5.73 (145.5)	5.73 (145.5)	15.89 (408)	13.15 (334)	11.02 (280)	1.13 (28.6)	2.74 (69.6)
3	182TC	7.53 (191.3)	7.91 (201)	5.73 (145.5)	5.73 (145.5)	15.89 (408)	13.15 (334)	11.02 (280)	1.13 (28.6)	2.74 (69.6)
5		10.04 (254.9)	9.33 (237)	6.81 (173)	6.81 (173)	18.70 (476)	15.31 (389)	12.48 (317)	1.37 (34.9)	3.38 (85.9)
7.5	213TC									

Power [Hp]	NEMA frame	Flange [inches (mm)]						Cable entries [mm]
		LA	AJ	AK	BD	BF	BB	O
1.5	56C	0.63 (16)	5.87 (149.2)	4.5 (114.3)	6.50 (165)	3/8 "	0.16 (4)	1/2" NPT (4)
2		0.75 (19)	7.25 (184.15)	8.50 (215.9)	8.50 (215.9)	1/2"-13	0.25 (6.35)	1/2" NPT (5)
3	182TC	0.75 (19)	7.25 (184.15)	8.50 (215.9)	8.50 (215.9)	1/2"-13	0.25 (6.35)	1/2" NPT (5)
5		0.79 (20)	7.25 (184.15)	8.50 (215.9)	8.68 (220.5)	1/2"-13	0.25 (6.35)	3/4" NPT (1) & 1/2" NPT (5)
7.5	213TC							

MLE asynchronous motors 20 to 30 Hp

(2-pole) 3 phase, 60 Hz, 460-480 V



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Dimensional data

Power [Hp]	Nema frame	Stator housing [inches (mm)]							Shaft end [inches]	
		P	AB	AF	AF	C	AG	LL	U	AH
20	256TC	13.39 (340)	12.13 (308)	8.27 (210)	8.27 (210)	22.56 (573)	18.78 (477)	15.75 (400)	1.62 (41)	3.75 (95)
25	284TC	13.39 (340)	12.13 (308)	8.27 (210)	8.27 (210)	24.53 (623)	22.72 (577)	15.75 (400)	1.62 (41)	3.75 (95)
30	286TC	13.39 (340)	12.13 (308)	8.27 (210)	8.27 (210)	24.53 (623)	22.72 (577)	15.75 (400)	1.62 (41)	3.75 (95)

Power [Hp]	Nema frame	Flange [inches (mm)]					Cable entries [mm]
		AJ	AK	BD	BF	BB	O
20	256TC	7.25 (184)	8.50 (216)	9.88 (251)	1/2"	0.26 (7)	1 x M40 + 1 x M20 + 2 x M16 + 2 x knock out M16
25	284TC	9.00 (229)	10.50 (267)	10.75 (273)	1/2"	0.32 (8)	1 x M40 + 1 x M20 + 2 x M16 + 2 x knock out M16
30	286TC	9.00 (229)	10.50 (267)	10.75 (273)	1/2"	0.32 (8)	1 x M40 + 1 x M20 + 2 x M16 + 2 x knock out M16

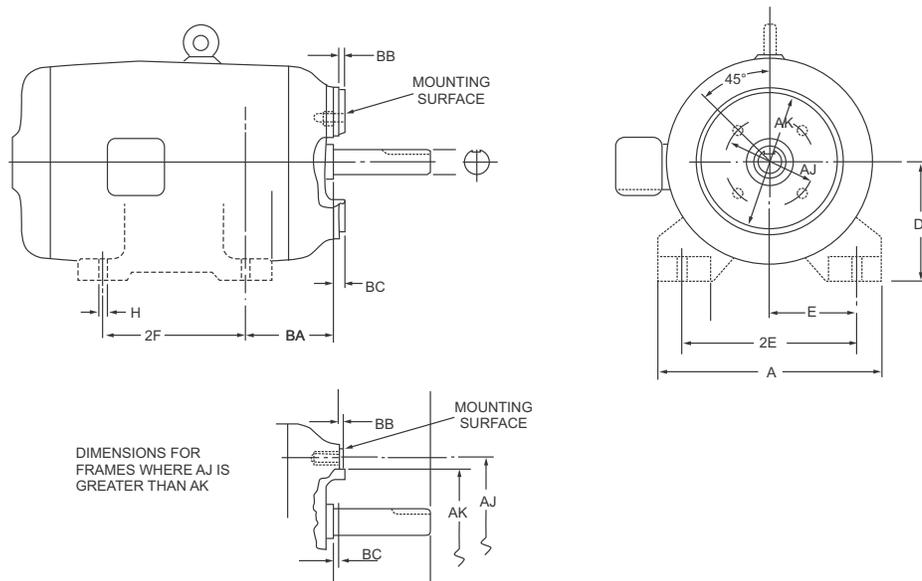
MLE motors for CRTE

(C-Face mounting with foot)



GR9035

Dimensional sketch



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Dimensional data

Power [Hp]	Phase	NEMA frame size	Foot dimensions [inches]							
			A	D	E	2E	2F	BA + BC	H	
1-phase, 2-pole MLE motor with foot										
0.5	1	56C	6.00	3.50	2.44	4.88	3.00	2.56	0.34	
0.75	1	56C	6.00	3.50	2.44	4.88	3.00	2.56	0.34	
1	1	56C	6.00	3.50	2.44	4.88	3.00	2.56	0.34	
1.5	1	56C	6.00	3.50	2.44	4.88	3.00	2.56	0.34	
2	1	56C	6.00	3.50	2.44	4.88	3.00	2.56	0.34	
3-phase, 2-pole MLE motor with foot										
1	3	56C	6.00	3.50	2.44	4.88	3.00	2.56	0.34	
1.5	3	56C	6.00	3.50	2.44	4.88	3.00	2.56	0.34	
2	3	56C	6.00	3.50	2.44	4.88	3.00	2.56	0.34	
3	3	182TC	8.90	4.50	3.75	7.50	4.50	2.87	0.41	
5	3	184TC	8.90	4.50	3.75	7.50	5.50	2.87	0.41	
7.5	3	215TC	9.96	5.25	4.25	8.50	7.00	3.75	0.41	
10	3	215TC	9.60	5.25	4.25	8.50	7.00	3.75	0.41	
15	3	254TC	11.30	6.25	5.00	10.00	8.25	4.50	0.53	
20	3	256TC	11.30	6.25	5.00	10.00	10.00	4.50	0.53	
25	3	284TSC	12.30	7.00	5.50	11.00	9.50	5.00	0.53	
30	3	286TSC	12.30	7.00	5.50	11.00	11.00	5.00	0.53	

3. Control of E-pumps

CRTE pumps are the ideal choice for a number of applications characterized by a demand for variable flow at constant pressure. The pumps are suited for water supply systems and pressure boosting as well as for industrial applications.

Depending on the application, the pumps offer energy savings, increased comfort and improved processing.

E-pumps in the service of industry

The industry uses a large number of pumps in many different applications. Demands on pumps in terms of pump performance and mode of operation make speed control a must in many applications.

E-pumps are ideal for and often used in the situations listed below.

Constant pressure

- Water supply
- washing and cleaning systems
- distribution from waterworks
- humidifying systems
- water treatment systems
- process boosting systems, etc.

Example: Within industrial water supply, E-pumps with integrated pressure sensor are used to ensure a constant pressure in the piping system. From the sensor, the E-pump receives inputs about changes of pressure as a result of changes in the consumption. The E-pump responds to the input by adjusting the speed until the pressure is equalized. The constant pressure is stabilized once more on the basis of the preset setpoint.

Constant temperature

- Air-conditioning systems in industrial plants
- industrial cooling systems
- industrial freezing systems
- casting and molding tools, etc.

Example: In industrial freezing systems, E-pumps with temperature sensor increase comfort and lower operating costs compared with pumps without a temperature sensor.

An E-pump continuously adapts its performance to the changing demands reflected in the differences in temperature of the liquid circulating in the freezing system. Thus, the lower the demand for cooling, the smaller the quantity of liquid circulated in the system and vice versa.

Constant level

- Boiler feed systems
- condensate systems
- sprinkler irrigation systems
- chemical industry, etc.

Example: In a steam boiler, it is important to be able to monitor and control pump operation to maintain a constant level of water in the boiler.

By using an E-pump with level sensor in the boiler, it is possible to maintain a constant water level.

A constant water level ensures optimum and cost-efficient operation as a result of a stable steam production.

Dosing applications

- Chemical industry, i.e. control of pH values
- petrochemical industry
- paint industry
- degreasing systems
- bleaching systems, etc.

Example: In the petrochemical industry, E-pumps with pressure sensor are used as dosing pumps.

The E-pumps help to ensure that the correct mixture ratio is achieved when more liquids are combined.

E-pumps functioning as dosing pumps improve processing and offer energy savings.

E-pumps in commercial building services

Commercial building services use E-pumps to maintain a constant pressure or a constant temperature based on a variable flow.

Constant pressure

Water supply in high-rise buildings, such as office buildings and hotels.

Example: E-pumps with pressure sensor are used for water supply in high-rise buildings to ensure a constant pressure even at the highest draw-off point.

As the consumption pattern and thus the pressure change during the day, the E-pump continuously adapts its performance until the pressure is equalized.

Constant temperature

- Air-conditioning systems in hotels, schools, etc.
- building cooling systems, etc.

Example: E-pumps are an excellent choice for buildings where a constant temperature is essential. E-pumps keep the temperature constant in air-conditioned, high-rise glass buildings, irrespective of the seasonal fluctuations of the outdoor temperature and various heat impacts inside the building.

Control options

It is possible to communicate with CRE, CRIE, CRNE pumps via the following platforms:

- control panel on the pump
- Grundfos GO Remote
- central management system.

The purpose of controlling an E-pump is to monitor and control the pressure, temperature, flow rate and liquid level of the system.

Control panel on the pump

The control panel on the E-pump terminal box makes it possible to change the setpoint settings manually.

MLE permanent magnet motors

0.5 to 2 Hp (1 x 200-240 V)

1.5 to 7.5 Hp (3 x 200-240 V)

1 to 15 Hp (3 x 440-480 V)

The operating condition of the pump is indicated by the Grundfos Eye on the control panel. See fig. 8.

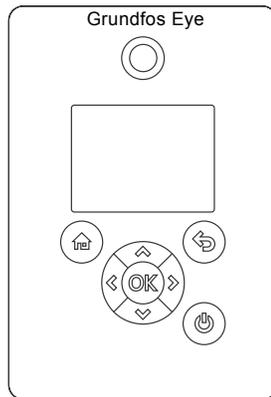


Fig. 8 Control panel on CRE pump

MLE asynchronous motors

20 to 30 Hp (3 x 460-480 V)

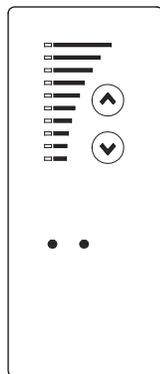


Fig. 9 Control panel on CRE pump

Grundfos GO Remote

The pump is designed for wireless radio or infrared communication with the Grundfos GO Remote.

Grundfos GO Remote enables the setting of functions and gives access to status overviews, technical product information and actual operating parameters.

Grundfos GO Remote offers three different mobile interfaces (MI).

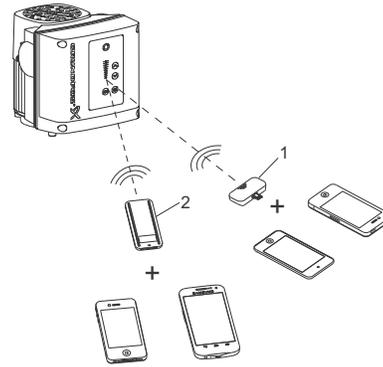


Fig. 10 Grundfos GO Remote communicating with the pump via radio or infrared connection (IR)

Pos.	Description
1	Grundfos MI 204: Add-on module enabling radio or infrared communication. You can use MI 204 in conjunction with an Apple iPhone or iPod with Lightning connector, e.g., fifth generation or later iPhone or iPod. MI 204 is also available together with an Apple iPod touch and a cover.
2	Grundfos MI 301: Separate module enabling radio or infrared communication. You can use MI 301 in conjunction with an Android or an iOS-based smart device with Bluetooth connection.

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Central management system

Communication with the E-pump is possible even if the operator is not present near the E-pump. Communication is enabled by connecting the E-pump to a central management system. This allows the operator to monitor the pump and to change control modes and setpoint settings.

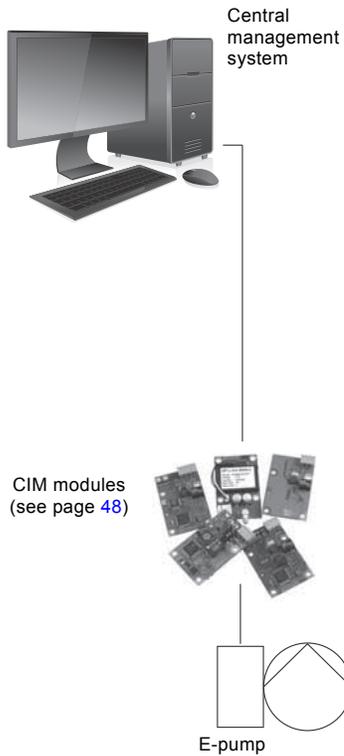


Fig. 11 Structure of a central management system

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Control modes for E-pumps

Grundfos CRTE pumps are available in two variants:

- CRTE with integrated pressure sensor
- CRTE without sensor.

CRTE with integrated pressure sensor

Use CRTE pumps with integrated pressure sensor in applications where you want to control the pressure after the pump, irrespective of the flow. For further information, see section [Control of E-pumps](#) on page 13.

Signals of pressure changes in the piping system are transmitted continuously from the sensor to the pump. The pump responds to the signals by adjusting its performance up or down to compensate for the pressure difference between the actual and the desired pressure. As this adjustment is a continuous process, a constant pressure is maintained in the piping system.



Fig. 12 CRTE pumps

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A CRTE pump with integrated pressure sensor facilitates installation and commissioning. CRTE pumps with integrated pressure sensor can be set to either of these control modes:

- constant pressure (factory setting)
- constant curve.

In constant-pressure mode, the pump maintains a preset pressure after the pump, irrespective of the flow. See fig. 13.

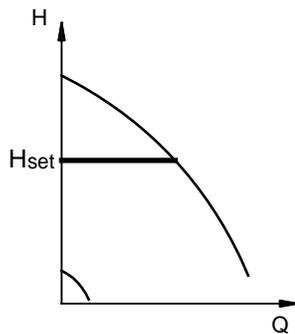


Fig. 13 Constant-pressure mode

In constant-curve mode, the pump is not controlled. It can be set to pump according to a preset pump characteristic curve within the range from min. curve to max. curve. See fig. 14.

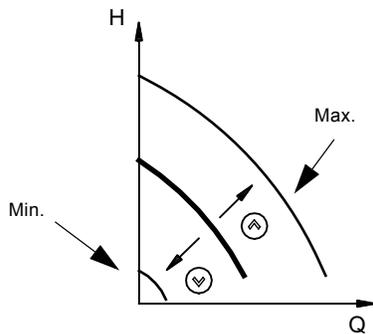


Fig. 14 Constant-curve mode

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CRTE without sensor

CRTE pumps without sensor are suitable in these situations:

- Uncontrolled operation is required.
- The sensor has been retrofitted in order to control the flow, temperature, differential temperature, liquid level, pH value, etc. at some arbitrary point in the system.

MLE permanent magnet motors

0.5 to 2 Hp (1 x 200-240 V)

1.5 to 7.5 Hp (3 x 200-240 V)

1 to 15 Hp (3 x 440-480 V)

These CRTE pumps without sensor can be set to either of these control modes:

- constant pressure
- constant differential pressure
- constant temperature
- constant differential temperature
- constant flow rate
- constant level
- constant curve
- constant other value.

MLE asynchronous motors

20 to 30 Hp (3 x 460-480 V)

These CRTE pumps without sensor can be set to either of these control modes:

- controlled operation
- uncontrolled operation (factory setting).

In controlled operating mode, the pump adjusts its performance to the desired setpoint. See fig. 15.

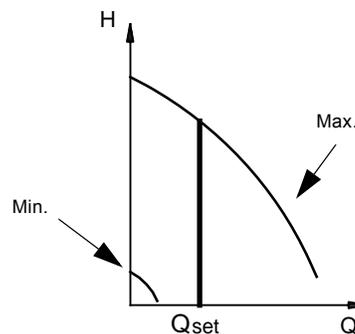


Fig. 15 Constant-flow mode

In uncontrolled operating mode, the pump operates according to a preset pump characteristic curve. See fig. 14.

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4. Advanced use of MLE motors

Introduction

Grundfos MLE motors have many features for the advanced user.

Grundfos three-phase MLE motors have features such as bearing monitoring, standstill heating, stop function, signal relays, analog sensors and limit exceeded. These features give a unique opportunity to customize the E-pumps.

PC Tool E-products gives access to most of the settings available in the products, as well as the possibility of logging and viewing data.

All of these features are described below.

Bearing monitoring

Bearing monitoring is a built-in function indicating the time to relubricate or replace the bearings of the MLE motor. The relubrication feature is only available for three-phase pumps of 15 to 30 Hp.

Purpose and benefits

The purpose of this function is to give an indication to the user when it is time to relubricate or replace the motor bearings. This is important information for maintenance planning.

Bearing monitoring provides these benefits:

- The bearing can be relubricated at the right time according to the manufacturer's recommendations.
- Maximum life of the motor bearings is obtained.
- Maintenance intervals are based on the operating conditions of the bearings.
- No worn-down or damaged bearings, and consequently no costly down-time, due to overseen maintenance.

Description

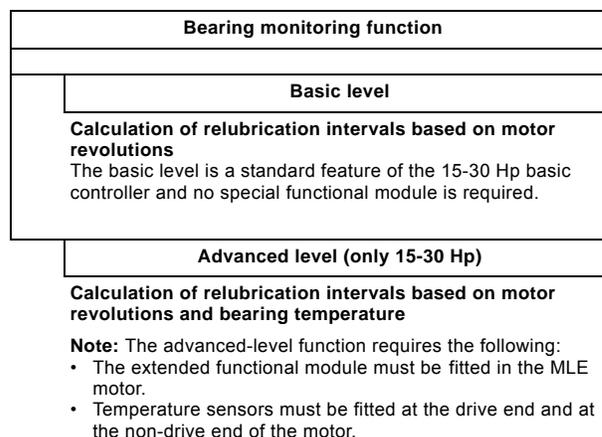
When the bearing monitoring function determines that it is time to relubricate the bearings, the user will receive a warning via PC Tool E-products, a bus or a relay.

When the bearings have been relubricated, a certain number of times, the warning function will inform the user that it is time to replace the bearings.

The number of relubrications before bearing replacement is set up by Grundfos.

Technical description

The bearing monitoring function is available on two levels for calculating the relubrication interval, basic and advanced:



Standstill heating

Standstill heating is a feature ensuring that even during standstill periods the motor windings have a certain minimum temperature.

Purpose and benefits

The purpose of this function is to make the MLE motor more suitable for outdoor installation. During standstill periods, there is a need to keep the motor temperature higher than the ambient temperature to avoid condensation in and on the motor.

Traditionally this issue has been solved by using an anti-condensation heater on the stator coil heads. Now Grundfos provides this feature by means of a special function within the MLE motor and terminal box.

The MLE motor has standstill heating included. An external heater on the stator coil is not necessary.

Applications

This function is especially suitable in outdoor applications and at installation sites with fluctuating temperatures.

Description

The working principle is that AC voltage is applied to the motor windings. The applied AC voltage will ensure that sufficient heat is generated to avoid condensation in the motor. The terminal box is kept warm and dry by the heat generated via the power supply. However, it is a condition that the terminal box is not exposed to open air. It must be provided with a suitable cover to protect it from rain.

Outdoor installation

According to UL 778 and C22.2 No 108-14, pumps that are intended for outdoor use must be marked enclosure type 3, and the product must be tested at a rated surface temperature down to -31 °F (-35 °C). The MLE enclosure is approved for type 3 or 4 and a rated surface temperature down to 32 °F (0 °C), and thus only for indoor use in UL 778 and C22.2 No 108-14 pump applications. See the installation and operating instructions for additional details.

Stop function

The stop function ensures that the pump is stopped at low or no flow. The function is also called low-flow stop function.

Purpose and benefits

The purpose of the stop function is to stop the pump when low flow is detected.

The stop function provides these benefits:

- The energy consumption is optimized, and the system efficiency is improved.
- Unnecessary heating of the pumped liquid which damages pumps is avoided
- Wear of the shaft seals is reduced.
- Noise from operation is reduced.

Applications

The stop function is used in systems with periodically low or no consumption thus preventing the pump from running against a closed valve.

Operating conditions for the stop function

A pressure sensor, a non-return valve and a diaphragm tank are required for the stop function to operate properly.

Note: The non-return valve must always be installed before the pressure sensor. See fig. 16 and fig. 17.

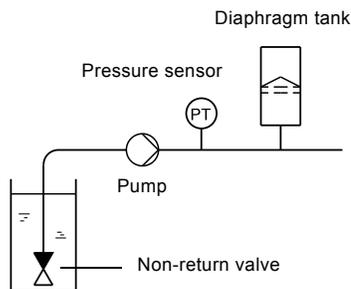


Fig. 16 Position of the non-return valve and pressure sensor in system with suction lift operation

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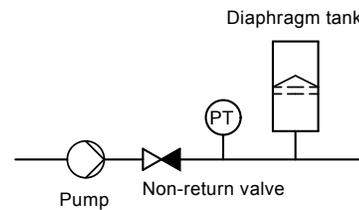


Fig. 17 Position of the non-return valve and pressure sensor in system with positive inlet pressure

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When low flow is detected, the pump is in start/stop operation. If there is flow, the pump will continue operating according to the setpoint. See fig. 18.

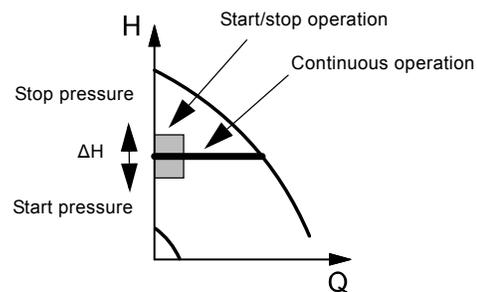


Fig. 18 Constant pressure with stop function. Difference between start and stop pressures (ΔH)

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Diaphragm tank

The stop function requires a diaphragm tank of a certain minimum size. The tank must be installed near the pump outlet, and the precharge air pressure must be 0.7 x setpoint.

Recommended diaphragm tank size:

Rated flow rate of pump [gpm (m ³ h)]	CRE pump	Typical diaphragm tank size [gal (liter)]
0-26 (0 - 5.9)	1s, 1, 3	2 (7.6)
27-105 (6.1 - 23.8)	5, 10, 15	4.4 (16.7)
106-176 (24.2 - 40)	20, 32	14 (53.0)
177-308 (40.2 - 70.0)	45	34 (128.7)
309-440 (70.2 - 99.9)	64, 90	62 (234.7)
441-750 (100-170)	120, 150	86 (325.5)

If a diaphragm tank of the above size is installed in the system, additional adjustment is unnecessary. If the tank installed is too small, the pump will start and stop often. Tank size will influence at which flow rate the system will go into start/stop operation.

Description

The low-flow stop function can operate in two different ways:

- by means of an integrated low-flow detection function
- by means of an external flow switch connected to the digital input.

Low-flow detection function

- The low-flow detection function will check the flow regularly by reducing the speed for a short time. A small change in pressure or no change in pressure means that there is low flow.

Low-flow detection with flow switch

- When a flow switch detects low flow, the digital input will be activated.

Contact Grundfos for further information.

Dry-running protection

This function protects the pump against dry running. When lack of inlet pressure or water shortage is detected, the pump will be stopped before being damaged.

Lack of inlet pressure or water shortage can be detected with a switch connected to a digital input configured to dry-running protection.

The use of a digital input requires an accessory, such as:

- a Grundfos Liqtec® dry-running switch (for more information on LiqTec, see section [Accessories](#) on page 90)
- a pressure switch installed on the inlet side of the pump
- a float switch installed on the inlet side of the pump.

The pump cannot restart as long as the digital input is activated.

Temperature sensors 1 and 2

One or two Pt100 temperature sensors may be connected to the input terminals 17, 18, 19, and 20.

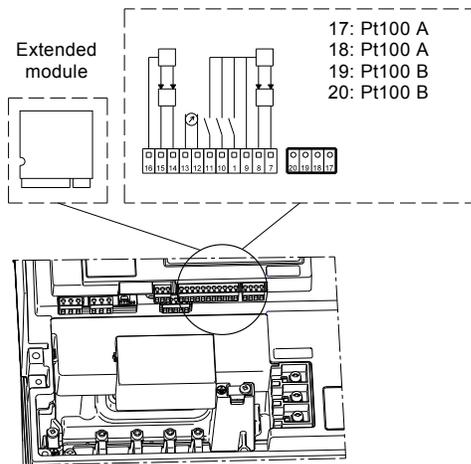


Fig. 19 Temperature sensor connections in the extended functional module

Purpose and benefits

The temperature sensor inputs 1 and 2 provide these benefits:

- The temperature sensor inputs can be used as input to the limit exceeded functions 1 and 2.
- In combination with the bearing monitoring function, the temperature sensors provide optimum monitoring of the motor bearings.
- A bearing warning or a bearing alarm can be indicated as the motor bearing temperature is measured.
- Status readings of the measured temperatures are available via Grundfos GO, PC Tool E-products and a bus.
- The function has a built-in signal fault detection if the temperature sensors fail or a conductor is broken.

Applications

The temperature inputs can be used in all applications where temperatures in the system or in the motor need to be monitored.

Note: The temperature sensor inputs are available on all MLE motors.

Description

The temperature sensor inputs enable several functions.

- The temperature sensor inputs 1 and 2 can be used as input to the limit exceeded functions 1 and 2. If a limit is exceeded, this will be indicated. The indication will be in the form of outputs (relay) or alarms/warnings set up or defined in the limit exceeded functions 1 and 2.

The temperature sensor inputs 1 and 2 can be set up to measure bearing temperature. The measured values of temperature sensor 1 and 2 are used in the calculation of relubrication intervals. Additionally, the measured value can activate the indication of a bearing warning or a bearing alarm. In case of high bearing temperature, a warning or an alarm can be logged and force the pump to stop.

Signal relays

Signal relays are used to give an output indication of the current operational status of the MLE. The signal relay is a potential free contact (also called a dry contact). The output signals are typically transmitted to external control systems.

Purpose and benefits

The signal relays offer these features:

- The signal relays can be remotely (via bus) or internally controlled.
- The signal relays can be set up to indicate several types of operational status.
- A relay delay can be defined to avoid activating the relay in case of periodic failures.

Applications

Signal relays can be used in all applications involving a need to read out the operational status to e.g. a control room or to a superior control system.

Description

The signal relays can be set up with these three parameters:

- relay control
- relay setup
- relay delay.

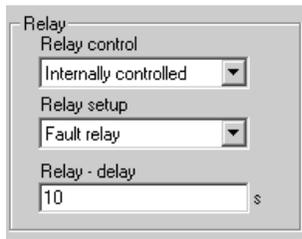


Fig. 20 Signal relay parameters for 0.5 - 10 Hp pumps

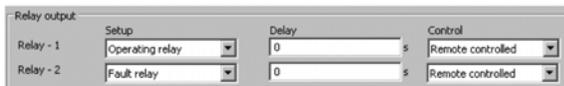


Fig. 21 Signal relay parameters for 15-30 Hp pumps

Relay control

The relay time is 0 seconds, and the signal relay is internally controlled.

The advanced relay control can only be set via PC Tool E-products.

Relay control has these two setting options:

- **Internally controlled**
The relay is internally controlled by the variable frequency drive software according to the setup of the relay [Ready, Fault, Operation].
- **Remotely controlled**
The relay is controlled via commands from the GENibus.

Analog sensor inputs 1 and 2

The analog sensor inputs 1 and 2 are standardized inputs for measuring all types of analog parameters.

Sensor input 1 is the only sensor input set up for closed-loop operation. The input will be used as the sensor feedback input.

Sensor input 2 is referred to as the secondary sensor.

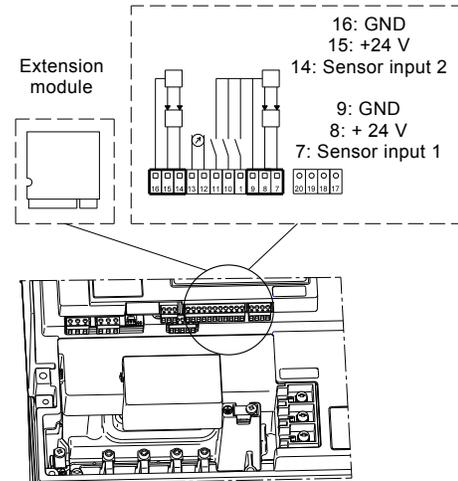


Fig. 22 Sensor inputs 1 and 2 connections

Purpose and benefits

The analog sensor inputs 1 and 2 provide these benefits:

- Sensor input 1 can be feedback input for the built-in PI controller.
- It is possible to monitor secondary parameters in the process, e.g. flow or liquid temperature.
- The secondary sensor can be set up as a redundant sensor.
- The sensors can give input to the limit exceeded functions 1 and 2.
- Status readings of the inputs are available via Grundfos GO and PC Tool E-products.

Applications

Analog sensor inputs 1 and 2 can be used in applications with a need for monitoring essential parameters.

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Description

The analog sensors 1 and 2 enable several functions.

- When the secondary sensor is set up as an input to the limit exceeded functions 1 and 2, defined outputs or warnings or alarms can be given when system parameters are outside the defined system limits.
- Connecting a flow sensor.
When sensor input 2 is set up with a flow sensor, the measured value can be used as input to the proportional-pressure function. The flow displayed in Grundfos GO will be the measured flow instead of the estimated flow.
The flow measurement can also be used in the low-flow stop function to detect low flow instead of estimating the flow rate by lowering the speed of the pump.
- Sensor reading via Grundfos GO and PC Tool E-products.
When sensors are set up, the user can get a status reading via Grundfos GO and PC Tool E-products.

Analog output

Analog output

The analog output (0-10 mA) can be set via PC Tool E-products to one of these indications:

- feedback value
- speed
- frequency
- motor current
- external setpoint input
- limit exceeded.

The analog output is default set to not active.

Feedback value

The output signal is a function of the actual feedback sensor.

Speed

The output signal is a function of the actual pump speed.

Frequency

The output signal is a function of the actual frequency.

Motor current

The output signal is a function of the actual motor current.

External setpoint input

The output signal is a function of the external setpoint input.

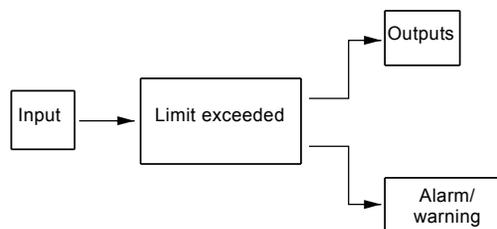
Limit exceeded

The output signal indicates whether the limit is exceeded:

- Minimum output = limit is not exceeded.
- Maximum output = limit is exceeded.

Limit exceeded 1 and 2

Limit exceeded is a monitoring function monitoring one or two values or inputs. The function enables different **inputs** to activate various **outputs** and **alarms/warnings** when the signal input has exceeded pre-determined limits.



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Fig. 23 Example of a limit exceeded sequence

Purpose and benefits

The purpose of this function is to monitor parameters which are central for the application. This will enable the controller to react to possible, abnormal operating conditions. This makes the E-pump a more important and integrated part of a system, and it can thus replace other existing monitoring units.

The liquid temperature can be monitored, and thus the E-pump can ensure that the system temperature does not exceed a maximum permissible level.

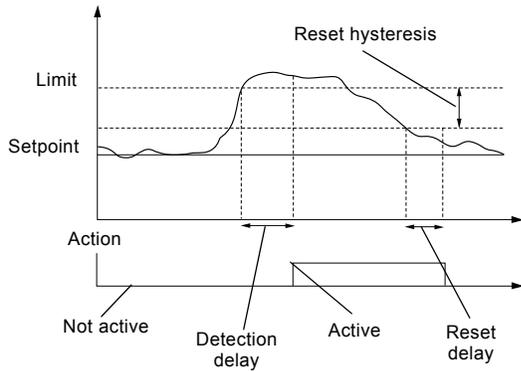
The minimum inlet pressure can be monitored, and thus the E-pump can prevent damage caused by a cavitation or dry run.

Applications

The limit exceeded function is typically used for monitoring secondary parameters in the systems.

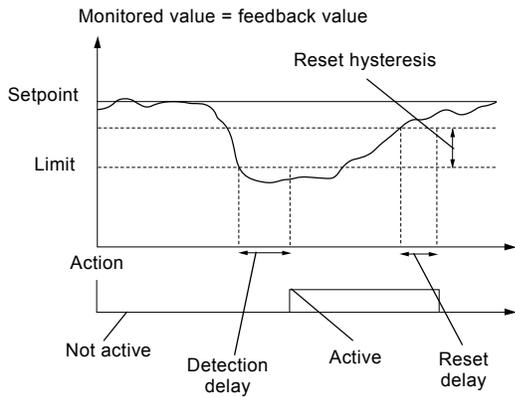
Description

The figures below show two examples of setpoint monitoring by means of the limit exceeded function.



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Fig. 24 Limit exceeded sequence with the limit type "max. limit", for example monitoring of bearing temperature



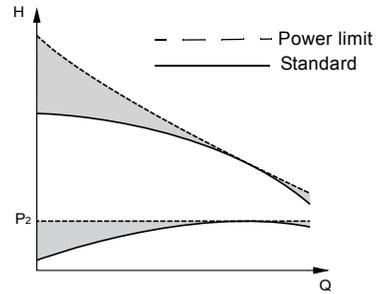
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Fig. 25 Limit exceeded sequence with the limit type "min. limit"

When the limit is exceeded, the signal input crosses the limit as an increasing or decreasing value, and the function can be set to cover both situations.

Pump operating at power limit

When a pump is operating at the power limit, the MLE motor will deliver an output corresponding to the maximum load stated on the nameplate. The maximum load will never be exceeded. See fig. 26.



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Fig. 26 Curves of a standard E-pump and a pump operating at power limit

Purpose and benefits

When using a standard pump at a low flow, the power consumption will drop and the motor will have excess power available.

By setting the CRE pump to operate at a higher speed, the excess power can be used to provide a higher pressure. The power limit function will make sure that the motor load never exceeds its maximum by decreasing the speed until the motor is at its power limit.

In cases where an undersized motor is used with standard speed, the power limit function will still reduce the speed and protect the motor against overload at high flow. The solution offers the following benefits:

- reduced motor size
- reduced pump size.

Figure 27 shows that a pump operating at low flow rates and relatively high pressures (1) can be fitted with an undersize motor with a rated power that matches this operating range. At higher flow rates and relatively lower pressures (2), the motor will reduce its speed when the power limit is exceeded and follow a steeper curve corresponding to the power available.

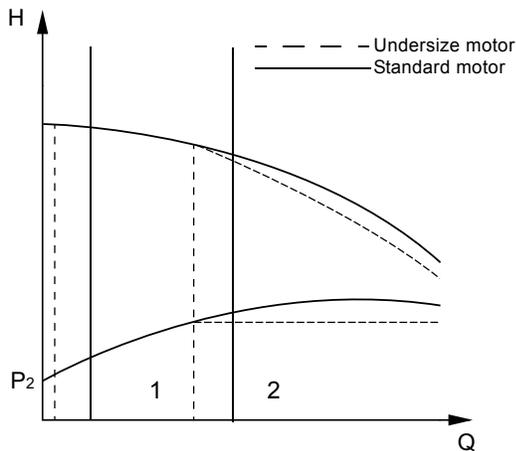
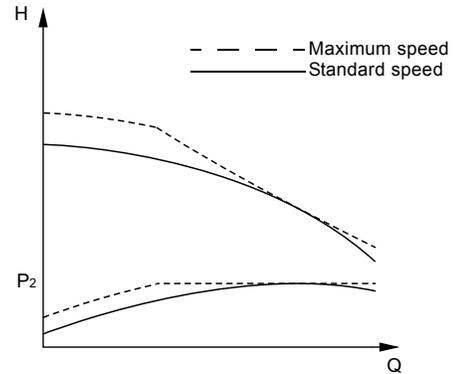


Fig. 27 Standard performance curve compared to a curve for a pump fitted with an undersize MLE motor.

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The MLE motor can be set to a higher speed than a standard motor, enabling the pump to deliver more pressure. The pump will operate at this higher speed until the pump reaches the flow rate where the motor is loaded to its full rated power. If the flow is increased further, the motor will reduce its speed so as not to exceed its rated power.

Using this function can, in some instances, enable the use of a smaller pump to reach the desired duty point compared to a pump running with standard maximum speed. See fig. 28.



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Fig. 28 Standard performance curve (60 Hz) compared to a performance curve for a pump running at maximum speed

Applications

The power limit function is primarily used in applications where the motor size is dimensioned to be as small as possible to reduce size or cost. It is also used in applications demanding a high maximum speed to achieve a high pressure at a low flow rate. In both cases, the motor is protected by the power limit function at a higher flow rate where a lower speed is needed to prevent the motor from overloading.

Examples of applications:

- Washing and cleaning
- Boiler feed.

Setup

The power limit is always active in CRE pumps to protect the motor against overload. Pumps with undersize motor and pumps with higher maximum speed are available as factory-configured products.

Note: Running the pump at over-synchronous speed will affect the NPSH value, thus requiring a sufficient inlet pressure to avoid cavitation.

The sound pressure level emitted from the pump and motor may increase at higher speeds.

Furthermore, the differential pressure over the chambers must be taken into consideration.

Stabilizing unstable pump curves

When the pump curve has a shape where it intersects the system curve in two points (A and B) with identical pressure but at different flow rates, the pump curve is defined as unstable. See fig. 29. This is especially problematic in systems with a flat system characteristic as it prevents the pump from being controlled to a flow rate which is lower than the flow rate at point B.

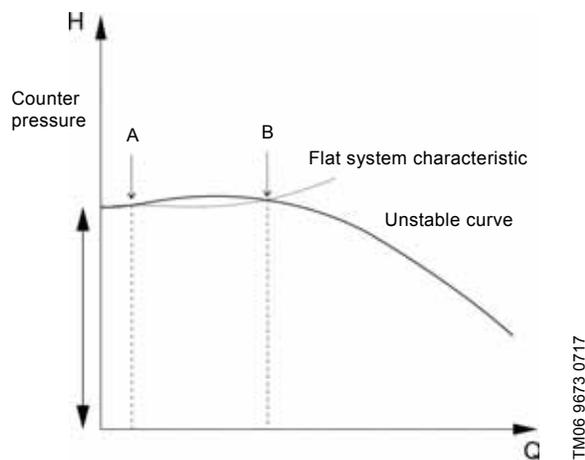
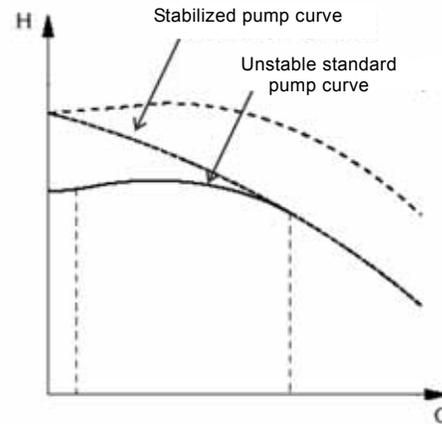


Fig. 29 Unstable pump curve

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The E-motor can stabilize an unstable pump curve in the low-flow rate area by changing to a higher speed. Figure 30 illustrates how the pump curve is straightened out in this area. As the flow rate increases, the E-motor gradually reduces the speed to normal speed and the pump performance will follow the standard pump curve.



TM06 9671 0717

Fig. 30 Pump curve with a stabilized operating range

Purpose and benefits

The purpose of stabilizing an unstable pump is to enable normal control throughout the entire operating range. Thus fully stable operation is achieved, even in the low-flow rate range. This enables the use of modern high-efficiency pumps in applications where this would otherwise not be possible.

Applications

As mentioned, unstable operation may occur in applications with a high counter pressure and a flat system characteristic.

Examples of applications:

- pumping of water to a water tower
- boiler feed.

Note: The sound pressure level emitted from the pump and motor may increase at higher speeds.

Setup

This function is available in factory-configured products.

5. Application examples

Differential pressure in a circulation system

Circulation systems (closed systems) are well-suited for speed-controlled pump solutions.

It is an advantage that circulation systems with variable system characteristic are fitted with a differential-pressure-controlled circulator pump. See fig. 31.

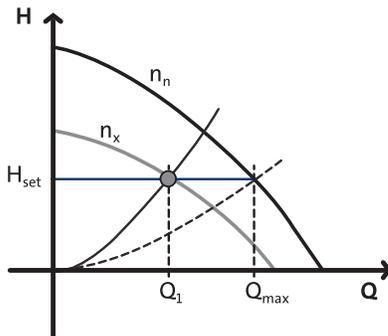
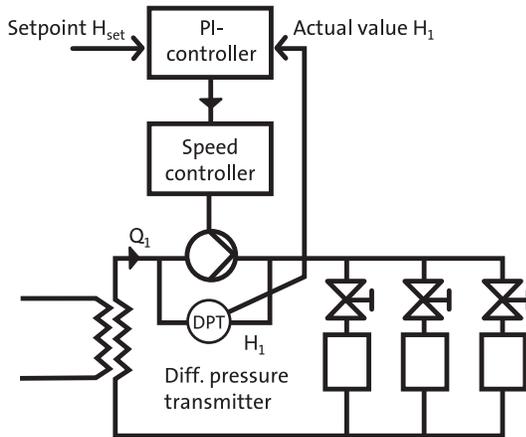


Fig. 31 Constant differential-pressure control

Figure 31 shows a heating system consisting of a heat exchanger where the circulated water is heated and delivered to three radiators by a speed-controlled pump. A control valve is connected in series at each radiator to control the flow according to the heat requirement.

The pump is controlled according to a constant differential pressure measured across the pump. This means that the pump system offers constant differential pressure in the Q range of 0 to Q_{max} , represented by the horizontal line in fig. 31.

Constant differential pressure

The differential pressure of the pump is kept constant, independently of the flow rate. See fig. 32.

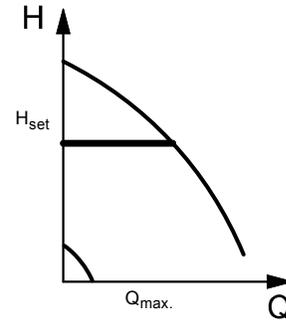


Fig. 32 Constant differential pressure, pump

The pump is controlled according to a constant differential pressure measured across the pump. This means that the pump system offers constant differential pressure in the Q-range of 0 to Q_{max} , represented by the horizontal line in the QH diagram.

Proportional differential pressure

The differential pressure of the pump is reduced at falling flow rate and increased at rising flow rate. See fig. 33.

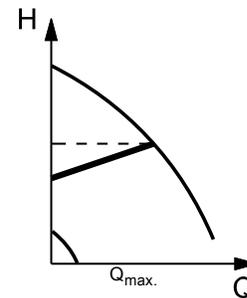


Fig. 33 Proportional differential pressure

The pump is controlled according to a differential pressure measured across the pump. This means that the pump system offers a proportional differential pressure in the Q-range of 0 to Q_{max} , represented by the sloping line in the QH diagram.

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TM03 8475 1607

Proportional differential pressure, parabolic curve (proportional differential pressure available on CRE-DP (differential pressure) only)

Setting via PC Tool.

The proportional differential pressure can be selected with one of these flow dependencies:

- linear (setting via PC Tool).
- parabolic (setting via PC Tool).

When the flow dependency is selected as parabolic, the differential pressure of the pump will be reduced with a parabolic curve at falling flow rate and increased at rising flow rate. See fig. 34.

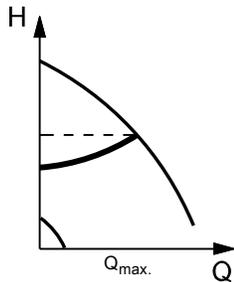


Fig. 34 Proportional differential pressure, parabolic curve

The pump is controlled according to a differential pressure measured across the pump. This means that the pump system offers a flow-compensated differential pressure in the Q-range of 0 to Q_{max} , represented by the parabolic curve in the QH diagram.

Constant differential pressure

The setpoint range is between 12.5 % to 100 % of maximum head.

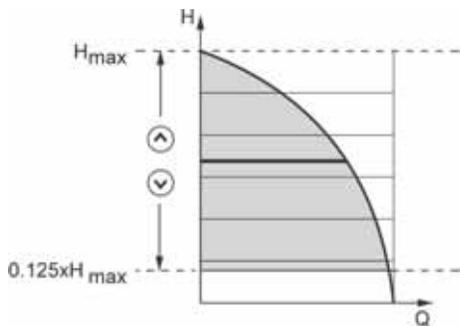


Fig. 35 Constant differential pressure

Proportional differential pressure

The setpoint range is between 25 % to 90 % of maximum head.

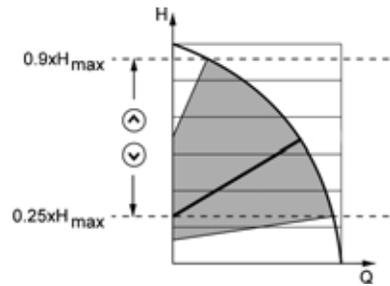


Fig. 36 Proportional differential pressure

To compensate for this excessive system pressure, the proportional-pressure function automatically adapts the setpoint to the actual flow rate.

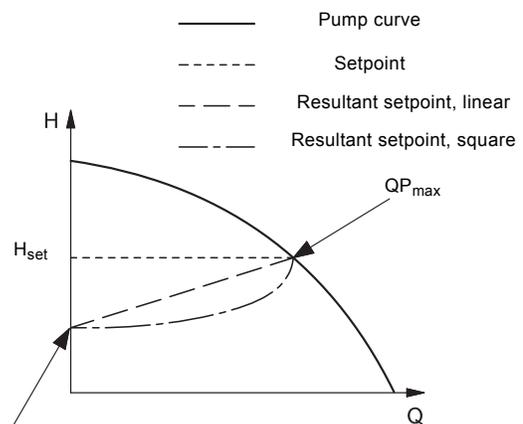


Fig. 37 Proportional-pressure control

The factory-fitted differential-pressure sensor is a variant. Contact Grundfos for additional details.

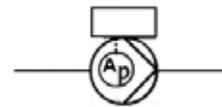
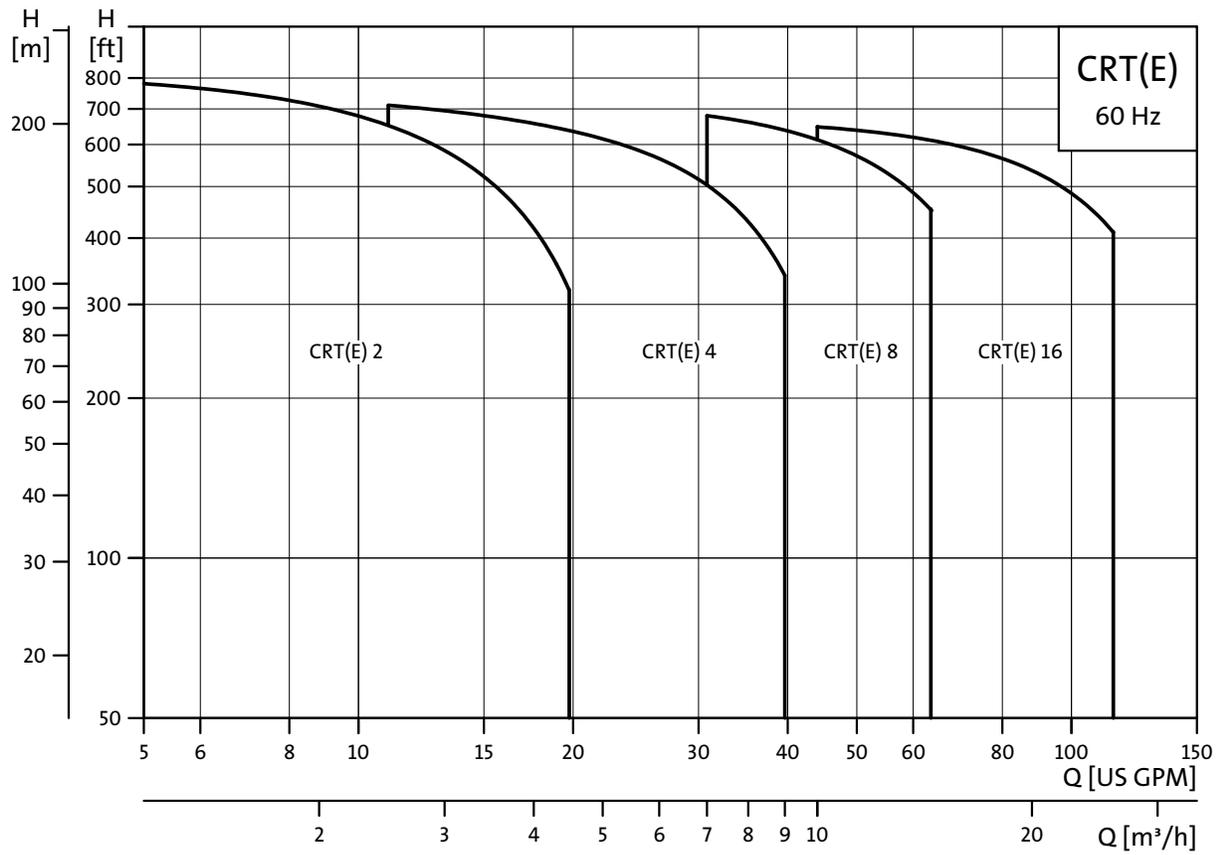


Fig. 38 Proportional pressure

Performance range

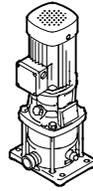
CRT(E)



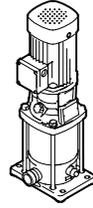
TM02 8328 4903

Product range

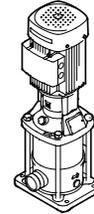
CRT(E)



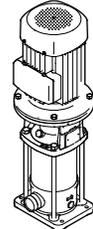
TM02 7184 2703



TM02 7331 3203



TM02 7185 2703



TM02 7195 2803

Description	CRT(E) 2	CRT(E) 4	CRT(E) 8	CRT(E) 16
Range				
Nominal flow rate [US gpm (m ³ h)]	13 (2.9)	30 (6.8)	50 (11.3)	80 (18.1)
Max. operating pressure [psi (bar)]	362 (25)	362 (25)	362 (25)	362 (25)
Temperature range [°F (°C)]	-4 to +248 (-20 to +120)			
Maximum efficiency [%]	48	59	64	70
Flow range [US gpm (m ³ h)]	1.3 to 20 (0.3 to 4.5)	3 to 40 (0.7 to 9.0)	5 to 64 (1.1 to 14.5)	8 to 114 (1.8 to 25.9)
Motor power range [Hp]	0.5 to 5	0.5 to 7.5	0.75 to 15	5 to 25
Pipework connection				
PJE (victaulic type) coupling	1.25"	1.25"	2"	2"
ANSI flange adapter - on request	-	-	2"	2"

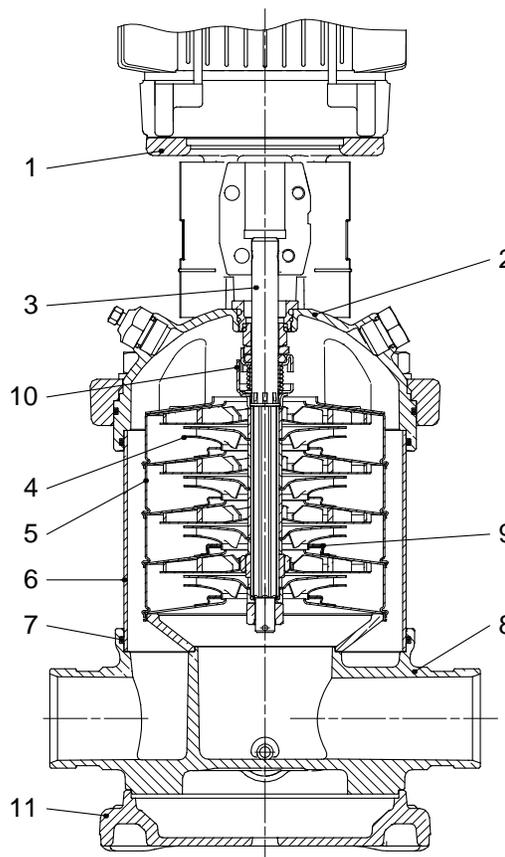
Identification

Type key

Example	CR T E 16 - 3 A - P - A - E AUUE
Pump range	E
Version with vital parts in titanium	T
Pump with integrated frequency control	A
Nominal flow rate [m ³ /h]	16
Number of impellers	3
Code for pump version	P
Code for pipework connection	A
Code for materials, excl. plastic and rubber parts (A = basic version)	A
Code for neck ring material	E
Code for shaft seal and plastic/rubber parts, excl. neck ring	AUUE

Construction

Sectional drawing



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Materials

Pos.	Description	Materials	AISI/ASTM	EN/DIN
1	Pump head	Stainless steel	1.4308	CF 8 (eq. to AISI 304)
2	Pump head cover	Titanium (cast)	Grade 5	- NA -
3	Shaft	Titanium	Grade 5	3.7165
4	Impeller	Titanium	Grade 1	3.7025
5	Intermediate chamber	Titanium	Grade 1	3.7025
6	Outer sleeve	Titanium	Grade 1	3.7035
7	O-ring for outer sleeve	EPDM or FKM		
8	Base	Titanium (cast)	Grade 5	- NA -
9	Neck ring	PTFE		
10	Shaft seal	AUUE/AUUV ¹⁾		
11	Base plate	Stainless steel	1.4408	CF 8M (eq. to AISI 316)
	Rubber parts in pump	Same as in shaft seal EPDM/FKM		
	Bearing rings	Silicon carbide		
	Plugs	Titanium	Grade 2	3.7165
	Staybolts	Stainless steel	AISI 431	
	Strap (CRT 8/16)	Titanium	Grade 2	3.7035

6. Operation

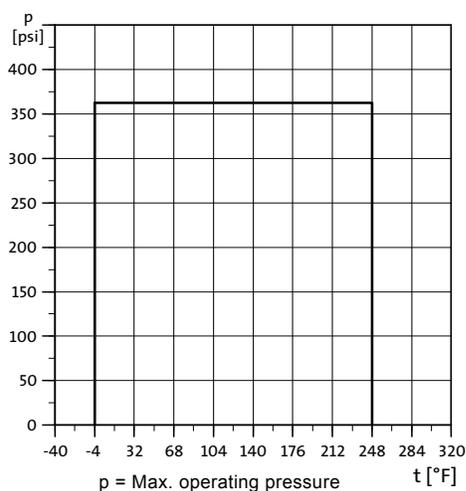
Operating conditions

Temperatures and pressures

Description	Operating conditions
Liquid temperature	EPDM: -4 °F to +248 °F (-20 °C to +120 °C)
	FKM: -4 °F to +194 °F (-20 °C to 90 °C)
Ambient temperature	Maximum +104 °F (40 °C)
Minimum inlet pressure	According to the NPSH _R curve + a safety margin of minimum 2 ft (0.6 m)

Operating pressure

Maximum operating pressure



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Fig. 39 Operating pressure and temperature limits

Note: Liquid temperatures above +194 °F (90 °C) may involve the risk of periodic noise from the shaft seal.

Inlet pressure

Maximum inlet pressure

The following table shows the maximum permissible inlet pressure. However, the actual inlet pressure + pressure against a closed valve must always be lower than the maximum permissible operating pressure.

60 Hz		
CRT(E) 2-2	→ 2-6	145 psi (10 bar)
CRT(E) 2-7	→ 2-18	217 psi (15 bar)
CRT(E) 4-1	→ 4-7	145 psi (10 bar)
CRT(E) 4-8	→ 4-16	217 psi (15 bar)
CRT(E) 8-1	→ 8-16	145 psi (10 bar)
CRT(E) 16-2	→ 16-12	145 psi (10 bar)

Pumped liquids

CRT, CRTE pumps are intended for pumping thin, non-explosive liquids, not containing solid particles or fibers. The liquid must not attack the pump materials chemically.

When pumping liquids with a density and/or viscosity higher than that of water, motors with correspondingly higher outputs must be used, if required.

CRT pumps can be used for liquid transfer, circulation and pressure boosting.

Corrosion resistance for CRT(E)

Media	Conc. [%]	Temp. [°F (°C)]	Seal face		Bearing
			Binderless tungsten carbide (AUUx)	Silicon carbide (AQQx)	Silicon carbide
Demineralized water		248 (120)	•		•
Ground water		248 (120)	•		•
Brackish water		248 (120)	•		•
Seawater		176 (80)	•		•
Sulfuric acid	3	140 (60)		•**	•
Phosphoric acid	30	95 (35)	•		•
	10	140 (60)	•		•
Formic acid	50	176 (80)		•**	•
Citric acid	50	212 (100)	•		•
Oxalic acid	5	68 (20)	•		•
Inorganic salts (including FeCl ₃)				•**	•
Sodium hydroxide	10	212 (100)	•		•
	50	140 (60)	•		•
Potassium hydroxide	50	68 (20)	•		•
Calcium hydroxide	saturated	212 (100)	•		•
Ammonium hydroxide	28	212 (100)	•		•
Alcohols (except for methanol*), aldehydes, ketones			•		•

* Titanium is susceptible to stress corrosion cracking (SSC) in methanol and should not be used with methanol.

** Available on request.

7. Selection

Selection of pumps

Selection of pumps should be based on

- The duty point of the pump (see section 1)
- Sizing data such as pressure loss as a result of height differences, friction loss in the pipework, pump efficiency etc. (see section 2)
- Pump materials (see section 3)
- Pump connections (see section 4)
- Shaft seal (see section 5).

Duty point of the pump

From a duty point it is possible to select a pump on the basis of the curve charts. See section [How to read the curve charts](#) on page 35.

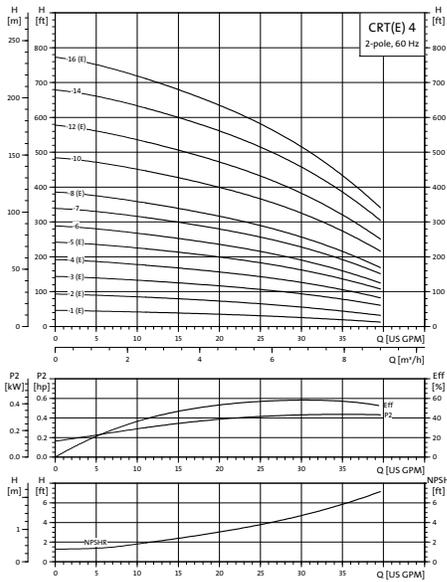


Fig. 40 Example of a curve chart

Sizing data

When sizing a pump the following must be taken into account (see fig. 43).

- Required flow and pressure at the point of use.
- Pressure loss as a result of height differences (H_{geo}).
- Friction loss in the pipework (H_f).
- Best efficiency at the estimated duty point.
- NPSH value.

It may be necessary to account for pressure loss in connection with long pipes, bends or valves, etc.

For calculation of the NPSH value, see "Minimum inlet pressure - NPSH" page 34.

Efficiency

Before determining the point of best efficiency, the operation pattern of the pump needs to be identified. If the pump is expected to operate at the same duty point, then select a CRT(E) pump which is operating at a duty point corresponding with the best efficiency of the pump.

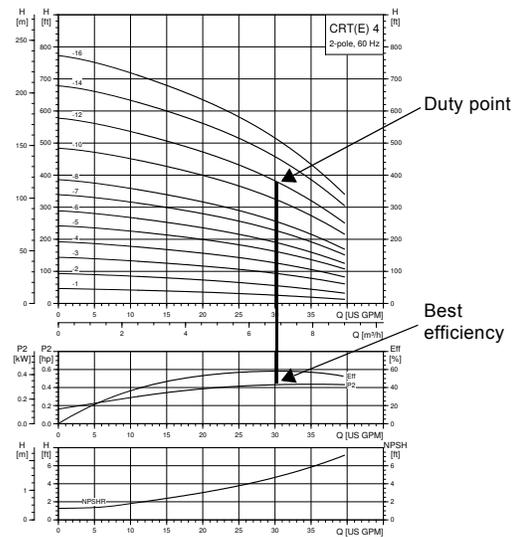


Fig. 41 Example of a CRT(E) pump's duty point

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TM02 8331 3504

As the pump is sized on the basis of the highest possible flow, it is important to always have the duty point to the right of the optimum efficiency point (see fig. 42, range with check mark). This must be considered in order to keep efficiency high when the flow drops.

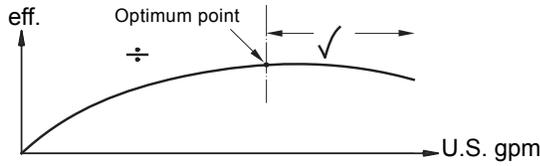


Fig. 42 Best efficiency

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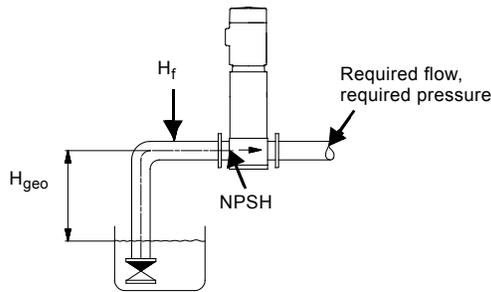


Fig. 43 Sizing data

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Typically, E-pumps are used in applications characterized by a variable flow. Consequently, it is not possible to select a pump that is constantly operating at optimum efficiency.

In order to achieve optimum operating economy, the pump should be selected on the basis of the following criteria:

- The max. required duty point should be as close as possible to the QH curve of the pump.
- The required duty point should be positioned so that P_2 is close to the max. point of the 100 % curve.

Between the min. and max. performance curve E-pumps have an infinite number of performance curves each representing a specific speed. Therefore it may not be possible to select a duty point close to the 100 % curve.

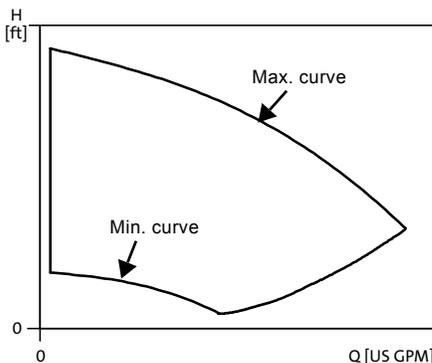


Fig. 44 Min. and max. performance curves

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In situations where it is not possible to select a duty point close to the 100 % curve the affinity equations to the right can be used. The head (H), the flow (Q) and the input power (P) are all the appropriate variables for the motor speed (n).

Note:

The approximated formulas apply on the condition that the system characteristic remains unchanged for n_n and n_x and that it is based on the formula $H = k \times Q^2$, where k is a constant.

The power equation implies that the pump efficiency is unchanged at the two speeds. In practice this is not quite correct.

Finally, it is worth noting that the efficiencies of the frequency converter and the motor must be taken into account if a precise calculation of the power saving resulting from a reduction of the pump speed is wanted.

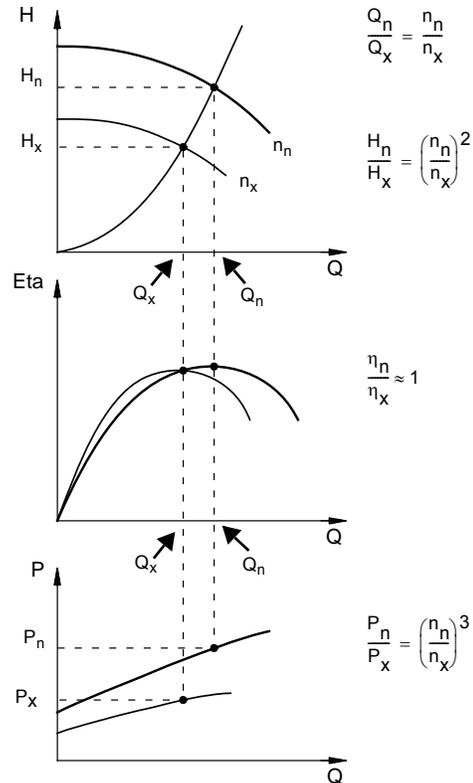


Fig. 45 Affinity equations

Legend

- H_n Rated head in feet
- H_x Current head in feet
- Q_n Rated flow rate in US gpm
- Q_{x0} Current flow rate in US gpm
- n_n Rated motor speed in min^{-1} ($n_n = 3500 \text{ min}^{-1}$)
- n_x Current motor speed in min^{-1}
- η_n Rated efficiency in %
- η_x Current efficiency in %

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Pump material

The material variant should be selected based of the liquid to be pumped.

Connection

Selection of pump connection depends on the rated pressure and pipework. To meet any requirement the CRT(E) pumps offer the following connections:

- PJE coupling - see fig. 47
- ANSI adapter (CRT 8 and CRT 16 only - sold separately)

Shaft seal

As standard, the CRT(E) range is fitted with a Grundfos type A shaft seal suitable for the most common applications, see fig. 48.

In service situations Grundfos type A shaft seals can be replaced without dismantling the pump head.

The following three key parameters must be taken into account, when selecting the shaft seal:

- Type of pumped liquid
- liquid temperature
- maximum pressure.

Inlet pressure and operating pressure

The limit values stated on page 30 must not be exceeded as regards:

- maximum inlet pressure and
- maximum operating pressure.

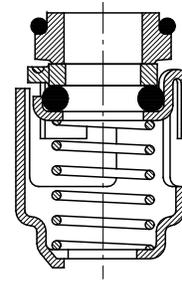


Fig. 48 Shaft seal

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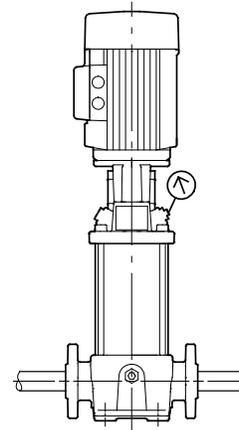


Fig. 49 Inlet and operating pressure

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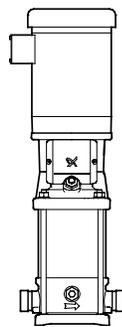


Fig. 46 CRT pump

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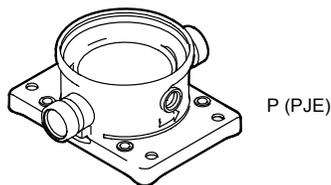


Fig. 47 Pump connections

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Minimum inlet pressure - NPSH

Calculation of the inlet pressure "H" is recommended when:

- the liquid temperature is high
- the flow is significantly higher than the rated flow
- water is drawn from depths
- water is drawn through long pipes
- inlet conditions are poor.

To avoid cavitation, make sure that there is a minimum pressure on the inlet side of the pump. The maximum suction lift "H" in feet can be calculated as follows:

$$H = p_b - \text{NPSH} - H_f - H_v - H_s$$

p_b = Barometric pressure in feet absolute.
(Barometric pressure can be set to 33.9 ft at sea level). In closed systems, p_b indicates the system pressure in feet.

NPSH = Net Positive Suction Head in feet.
(To be read from the NPSH curve at the highest flow rate the pump will be delivering).

H_f = Friction loss in suction pipe in feet.
(At the highest flow rate the pump will be delivering.)

H_v = Vapor pressure in feet.
(To be read from the vapor pressure scale. " H_v " depends on the liquid temperature " T_m ".)

H_s = Safety margin = minimum 2.0 feet.

If the "H" calculated is positive, the pump can operate at a suction lift of maximum "H" feet of head.

If the "H" calculated is negative, an inlet pressure of minimum "H" feet is required.

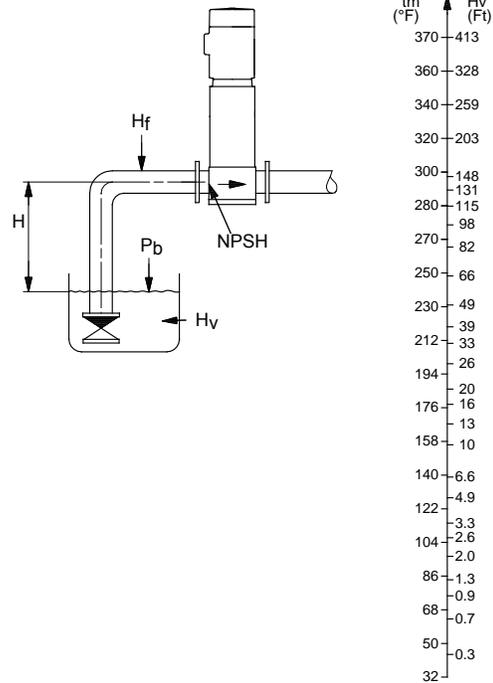


Fig. 50 Minimum inlet pressure - NPSH

Note: In order to avoid cavitation, never select a pump with a duty point that lies too far to the right on the NPSH curve.

Always check the NPSH value of the pump at the highest possible flow rate.

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How to read the curve charts

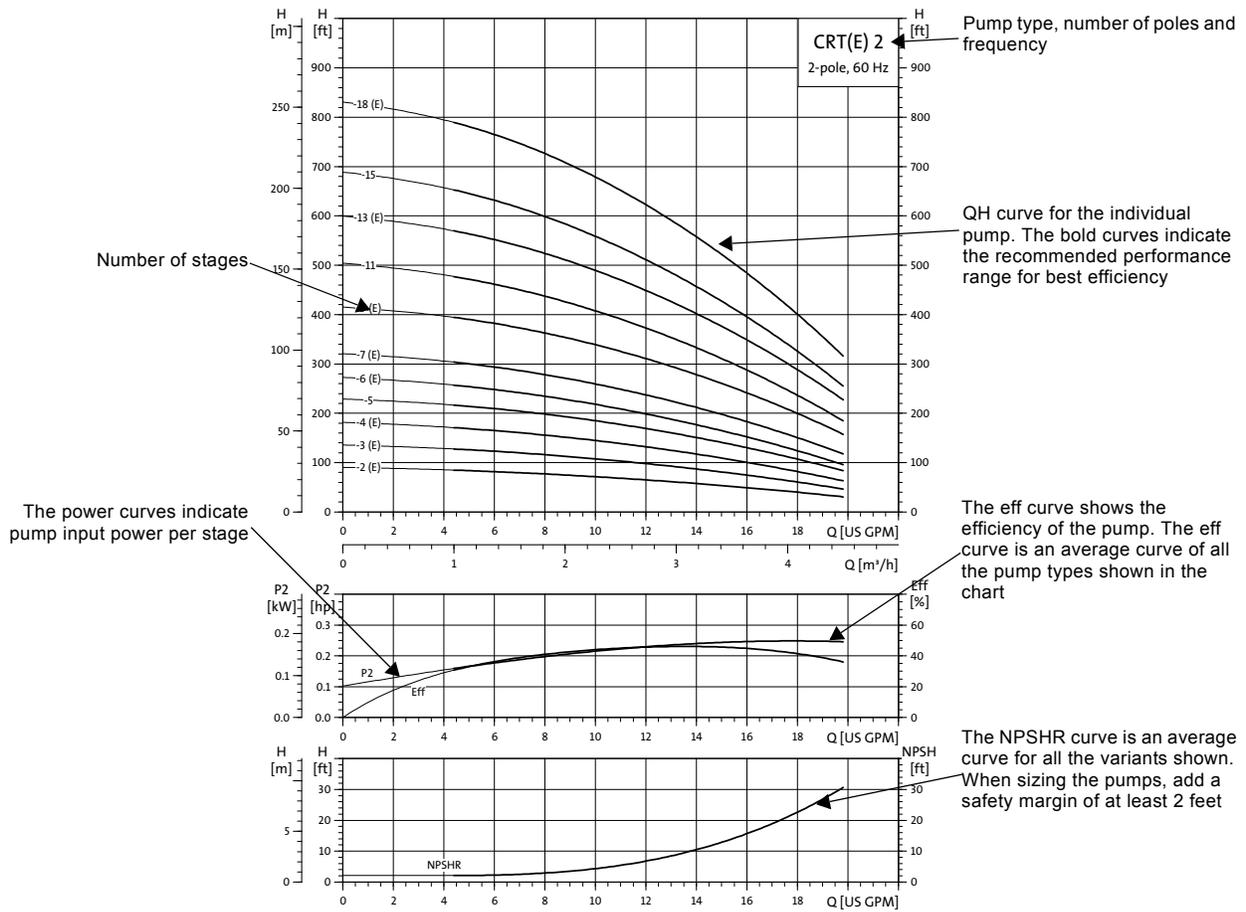


Fig. 51 How to read the curve charts

Guidelines to performance curves

The guidelines below apply to the curves shown on the following pages:

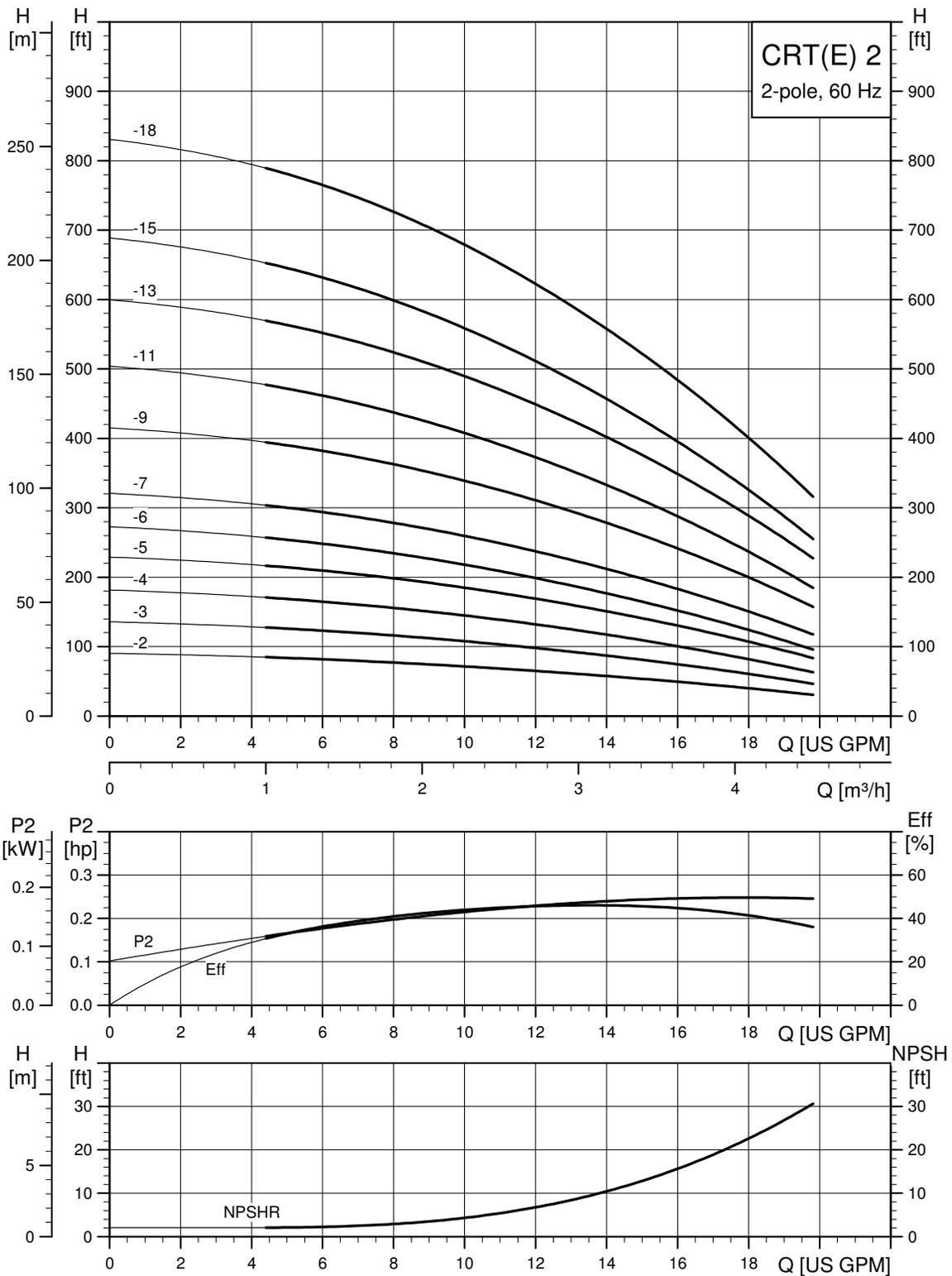
1. The motors used for the measurements are standard motors (TEFC or MLE).
2. Measurements have been made with airless water at a temperature of 68 °F (20 °C).
3. The curves apply to a kinematic viscosity of $\mu = 1 \text{ mm}^2/\text{s}$ (1 cSt).
4. Due to the risk of overheating, the pumps should not be used at a flow below the minimum flow rate.

The QH curves apply to actual speed with the motor types mentioned at 60 Hz.

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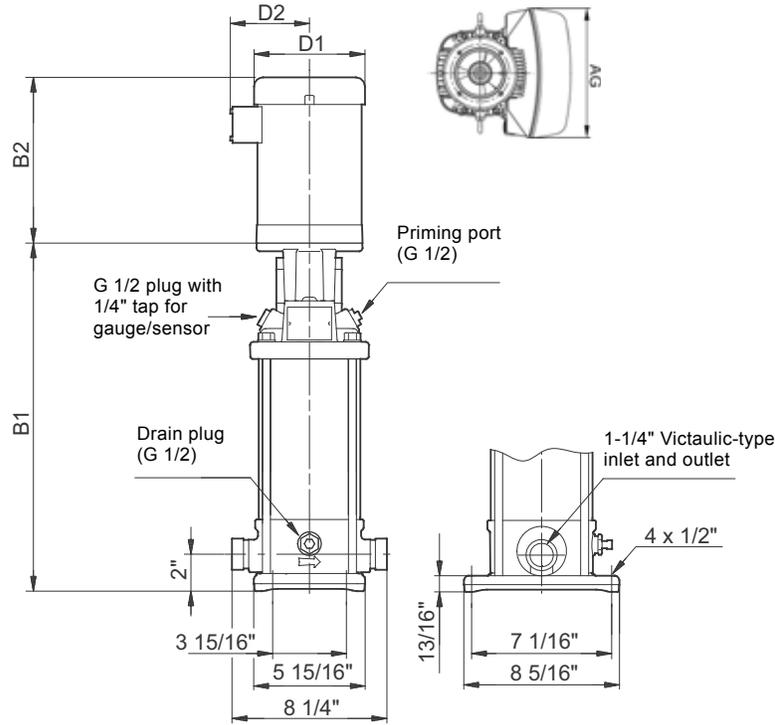
8. Performance curves and technical data

CRT, CRTE 2



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Dimensional sketches



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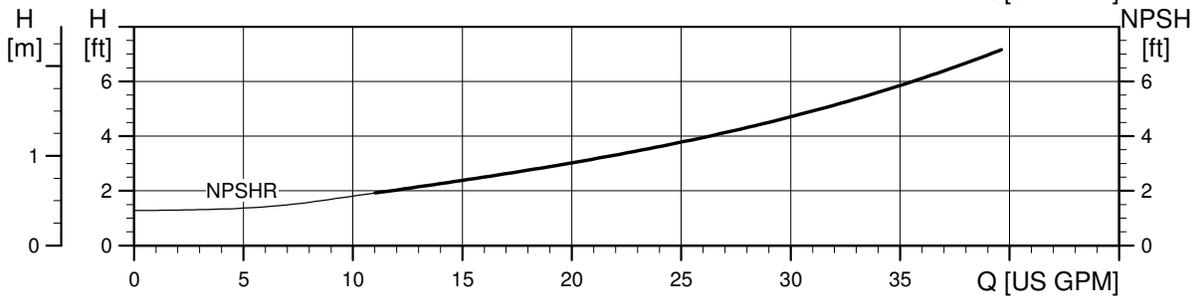
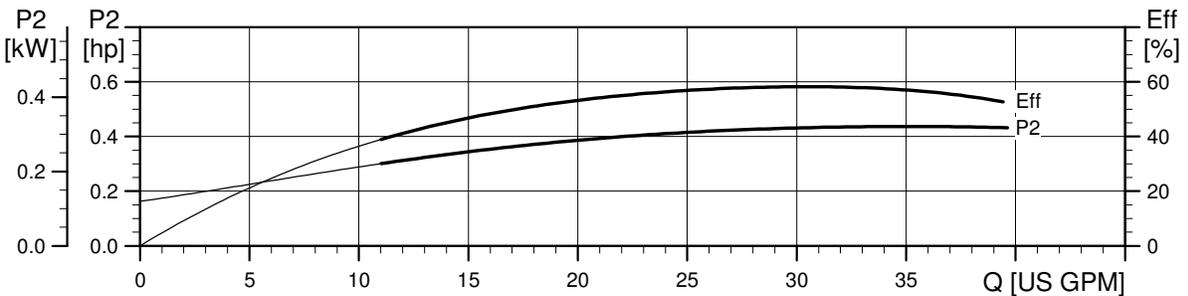
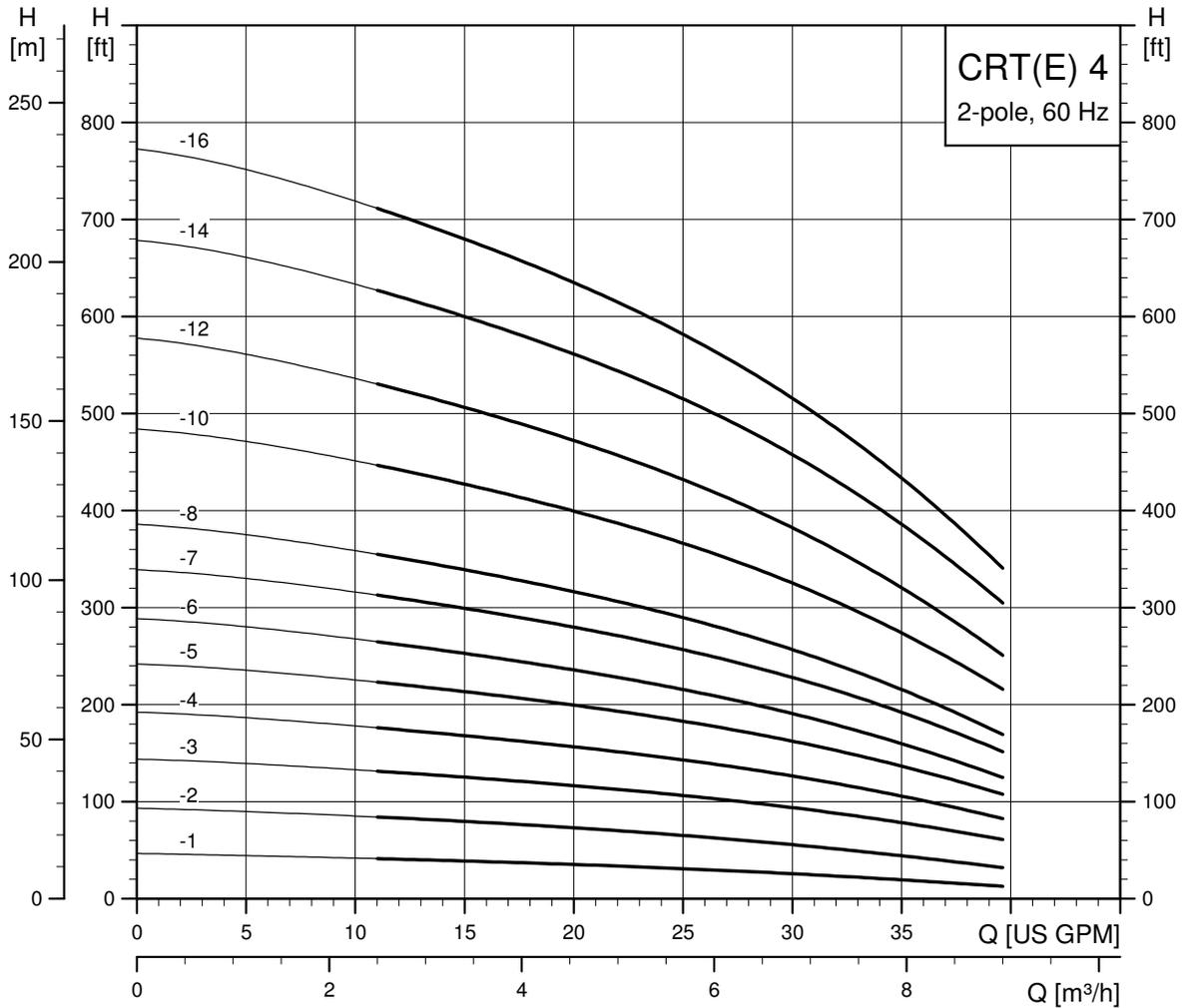
Dimensions and weights

Pump type	Hp	Ph	Voltage	Frame size	CRT TEFC					CRTE MLE				
					B1	TEFC D1	D2	B1+B2	Ship wt. [lb]	D1	D2	AG	B1+B2	Ship wt. [lb]
					Dimensions [inches]					Dimensions [inches]				
CRT 2-2	0.5	1	115/208-230	56C	9.96	6.19	5.18	19.25	53	4.80	6.22	8.34	18.42	*
		3	208-230/460	56C	9.96	5.55	4.57	17.40	48	-	-	-	-	-
CRT 2-3	0.75	1	115/208-230	56C	9.96	6.19	5.18	19.87	59	4.80	6.22	8.34	18.42	*
		3	208-230/460	56C	9.96	5.55	4.57	17.40	49	-	-	-	-	-
CRT 2-4	1.0	1	115-230	56C	11.61	7.19	5.73	22.80	70	4.80	6.22	8.34	20.07	*
		3	208-230/460	56C	11.61	5.55	4.57	19.05	50	4.80	6.22	10.56	21.65	*
CRT 2-5	1.5	1	115/208-230	56C	11.61	7.19	5.73	23.29	79	4.80	6.22	8.34	20.07	*
		3	208-230/460	56C	11.61	5.55	4.57	20.23	52	4.80	6.22	10.56	21.65	*
CRT 2-6	1.5	1	115/208-230	56C	13.03	7.19	5.73	24.71	80	4.80	6.22	8.34	21.49	*
		3	208-230/460	56C	13.03	5.55	4.57	21.65	53	4.80	6.22	10.56	23.07	*
CRT 2-7	2.0	1	115-230	56C	13.66	7.19	5.73	26.22	84	4.80	6.22	8.34	22.91	*
		3	208-230/460	56C	13.66	7.01	4.33	24.88	75	4.80	6.22	10.56	24.49	*
CRT 2-9	3.0	1	115/208-230	182TC	16.50	8.60	6.87	31.15	108	-	-	-	-	-
		3	208-230/460	182TC	16.50	7.01	4.33	29.73	87	4.80	6.22	10.56	27.33	*
CRT 2-11	3.0	1	115/208-230	182TC	16.50	8.60	6.87	31.15	110	-	-	-	-	-
		3	208-230/460	182TC	16.50	7.01	4.33	29.73	89	4.80	6.22	10.56	27.33	*
CRT 2-13	3.0	1	115/208-230	182TC	19.53	8.60	6.87	34.18	112	-	-	-	-	-
		3	208-230/460	182TC	19.53	7.01	4.33	32.76	91	4.80	6.22	10.56	30.36	*
CRT(E) 2-15	5.0	1	208-230	182TC	19.53	10.62	7.46	35.05	149	-	-	-	-	-
		3	208-230/460	182TC	19.53	8.66	5.28	35.04	147	7.53	7.91	11.46	32.68	*
CRT(E)2-18	5.0	1	208-230	182TC	21.65	10.62	7.46	37.17	153	-	-	-	-	-
		3	208-230/460	182TC	21.65	8.66	5.28	37.16	151	7.53	7.91	11.46	34.80	*

Dimensions shown for 3-phase MLE motors are for 460 V versions. See page 10 for 200-240 V, 3-phase dimensions.

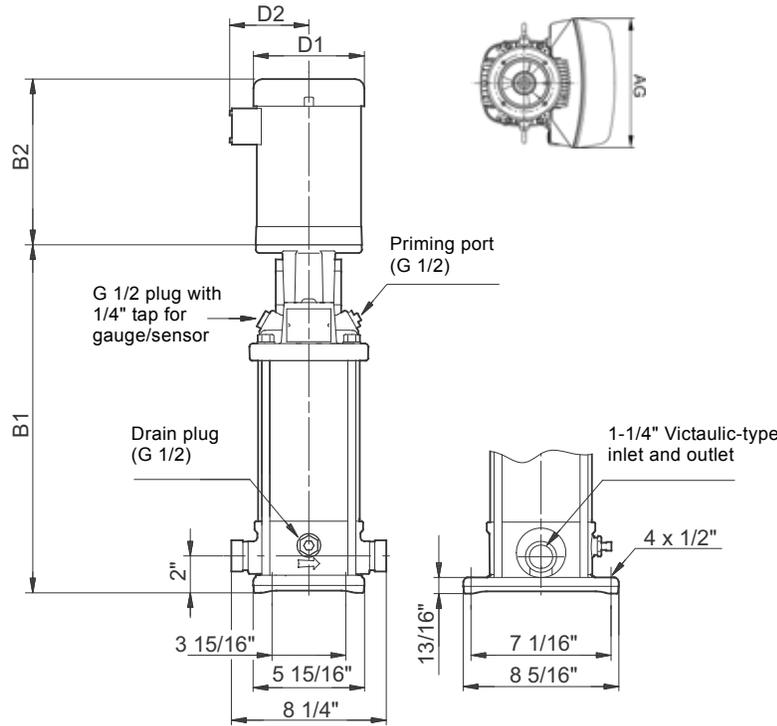
* Contact factory for weights.

CRT, CRTE 4



TM02 8331 0518

Dimensional sketches



TM02 2149 4604 - TM07 0758 0118

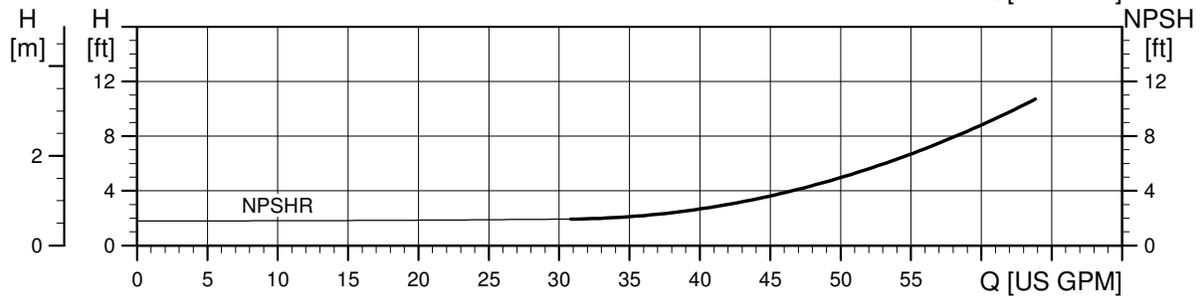
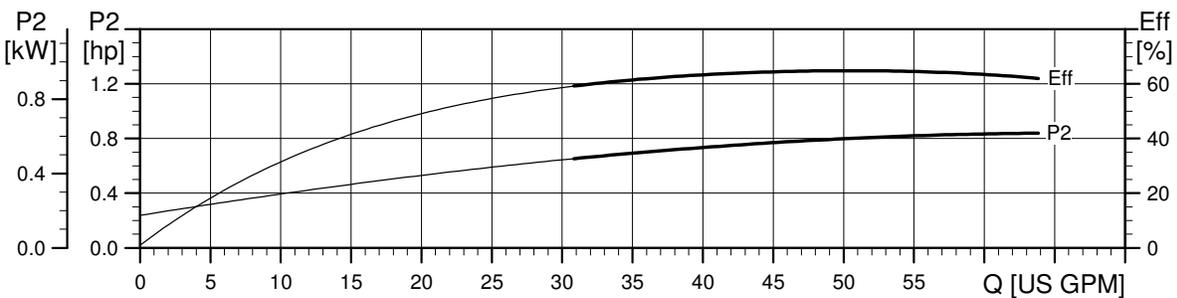
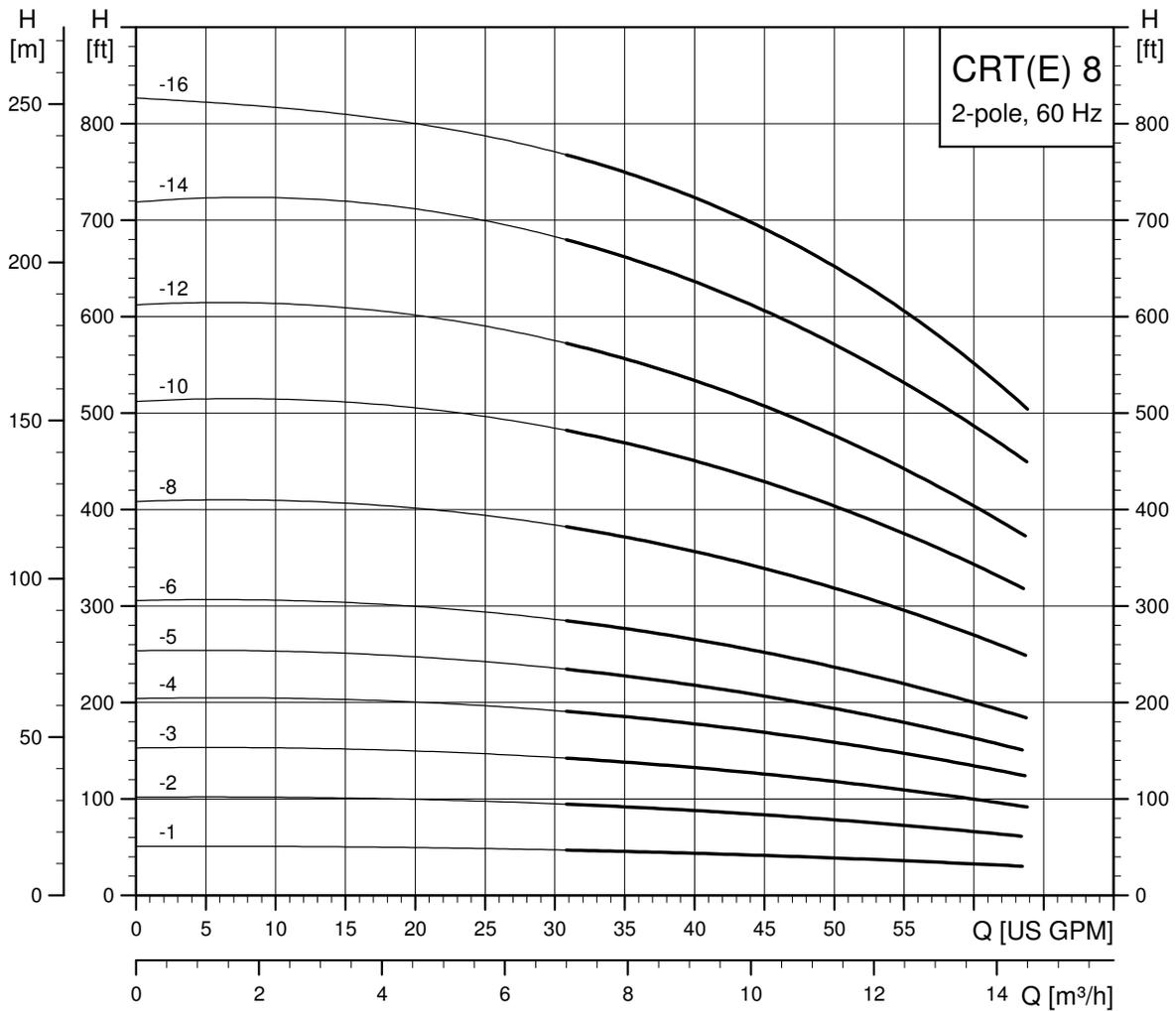
Dimensions and weights

Pump type	Hp	Ph	Voltage	Frame size	CRT TEFC					CRTE MLE				
					B1	D1	D2	B1+B2	Ship wt. [lb]	D1	D2	AG	B1+B2	Ship wt. [lb]
Dimensions [inches]														
CRT(E) 4-1	0.5	1	115/208-230	56C	9.96	6.19	5.18	19.25	57	4.80	6.22	8.34	18.42	*
		3	208-230/460	56C	9.96	5.55	4.57	17.40	52	-	-	-	-	-
CRT(E) 4-2	0.75	1	115/208-230	56C	9.96	6.19	5.18	19.87	64	4.80	6.22	8.34	18.42	*
		3	208-230/460	56C	9.96	5.55	4.57	17.40	54	-	-	-	-	-
CRT(E) 4-3	1.5	1	115/208-230	56C	11.26	7.19	5.73	22.94	84	4.80	6.22	8.34	19.72	*
		3	208-230/460	56C	11.26	5.55	4.57	19.88	57	4.80	6.22	10.56	21.30	*
CRT(E) 4-4	2.0	1	115-230	56C	12.95	7.19	5.73	25.51	89	4.80	6.22	8.34	22.20	*
		3	208-230/460	56C	12.95	7.01	4.33	24.17	80	4.80	6.22	10.56	23.78	*
CRT(E) 4-5	3.0	1	115/208-230	182TC	15.08	8.60	6.87	29.73	113	-	-	-	-	-
		3	208-230/460	182TC	15.08	7.01	4.33	28.31	92	4.80	6.22	10.56	25.91	*
CRT(E) 4-6	3.0	1	115/208-230	182TC	15.08	8.60	6.87	29.73	117	-	-	-	-	-
		3	208-230/460	182TC	15.08	7.01	4.33	28.31	96	4.80	6.22	10.56	25.91	*
CRT(E) 4-7	3.0	1	115/208-230	182TC	17.40	8.60	6.87	32.05	119	-	-	-	-	-
		3	208-230/460	182TC	17.40	7.01	4.33	30.63	98	4.80	6.22	10.56	28.23	*
CRT(E) 4-8	5.0	1	208-230	182TC	17.40	10.62	7.46	32.92	156	-	-	-	-	-
		3	208-230/460	182TC	17.40	8.66	5.28	32.91	154	7.53	7.91	11.46	30.55	*
CRT(E) 4-10	5.0	1	208-230	182TC	21.65	10.62	7.46	37.17	163	-	-	-	-	-
		3	208-230/460	182TC	21.65	8.66	5.28	37.16	161	7.53	7.91	11.46	34.80	*
CRT(E) 4-12	5.0	1	208-230	182TC	21.65	10.62	7.46	37.17	167	-	-	-	-	-
		3	208-230/460	182TC	21.65	8.66	5.28	37.16	165	7.53	7.91	11.46	34.80	*
CRT(E) 4-14	7.5	1	208-230	213TC	27.05	10.22	7.62	42.58	185	-	-	-	-	-
		3	208-230/460	213TC	27.05	8.66	5.28	42.56	173	7.53	7.91	11.46	41.42	*
CRT(E) 4-16	7.5	1	208-230	213TC	27.05	10.22	7.62	42.58	189	-	-	-	-	-
		3	208-230/460	213TC	27.05	8.66	5.28	42.56	177	7.53	7.91	11.46	41.42	*

Dimensions shown for 3-phase MLE motors are for 460 V versions. See page 10 for 200-240 V, 3-phase dimensions.

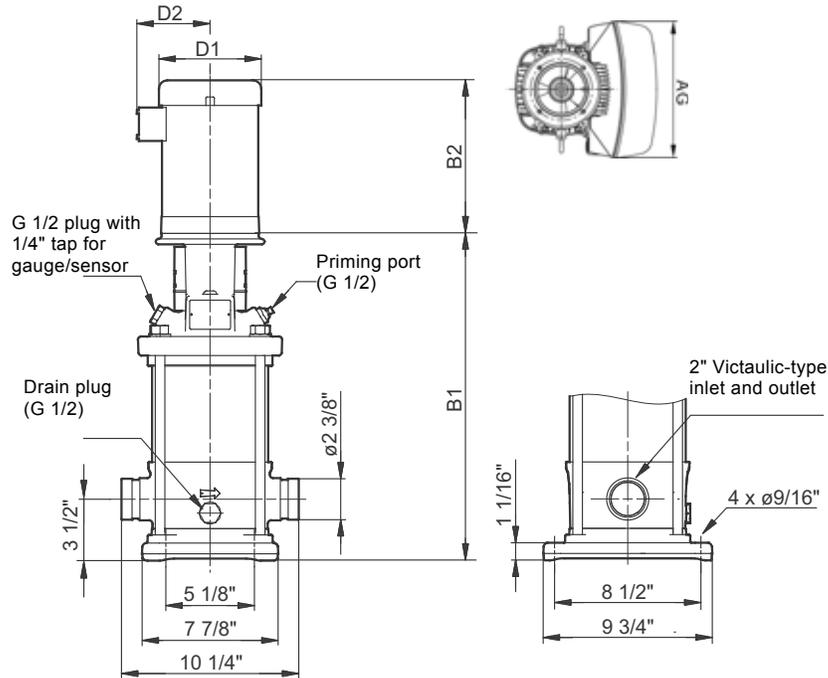
* Contact factory for weights.

CRT, CRTE 8



TM02 8332 0518

Dimensional sketches



TM07 0779 0518 - TM07 0758 0118

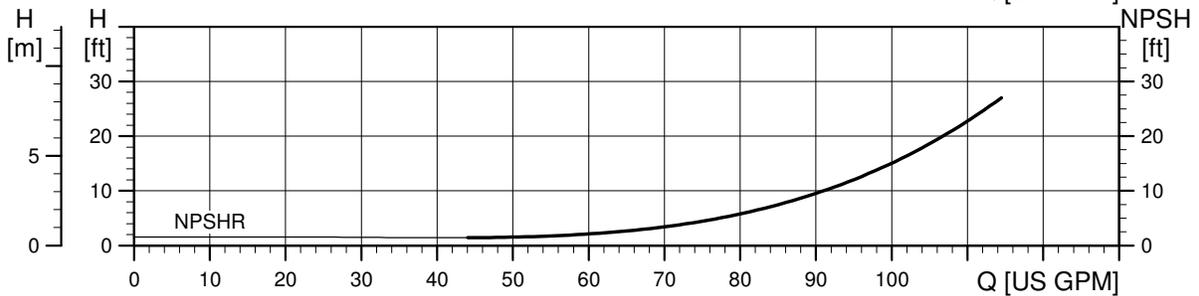
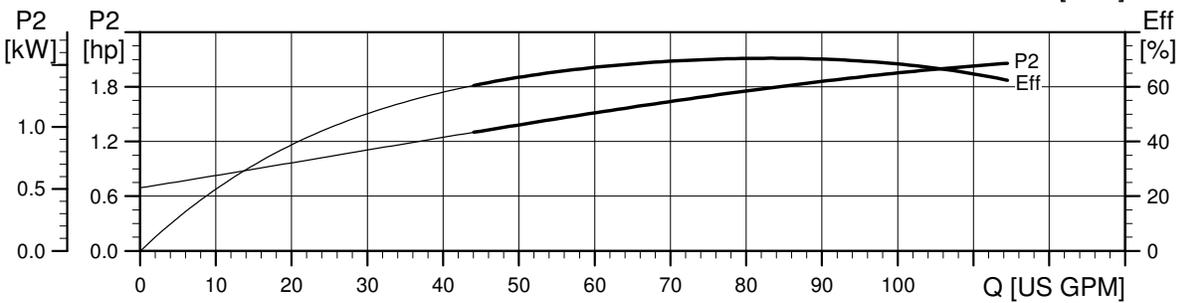
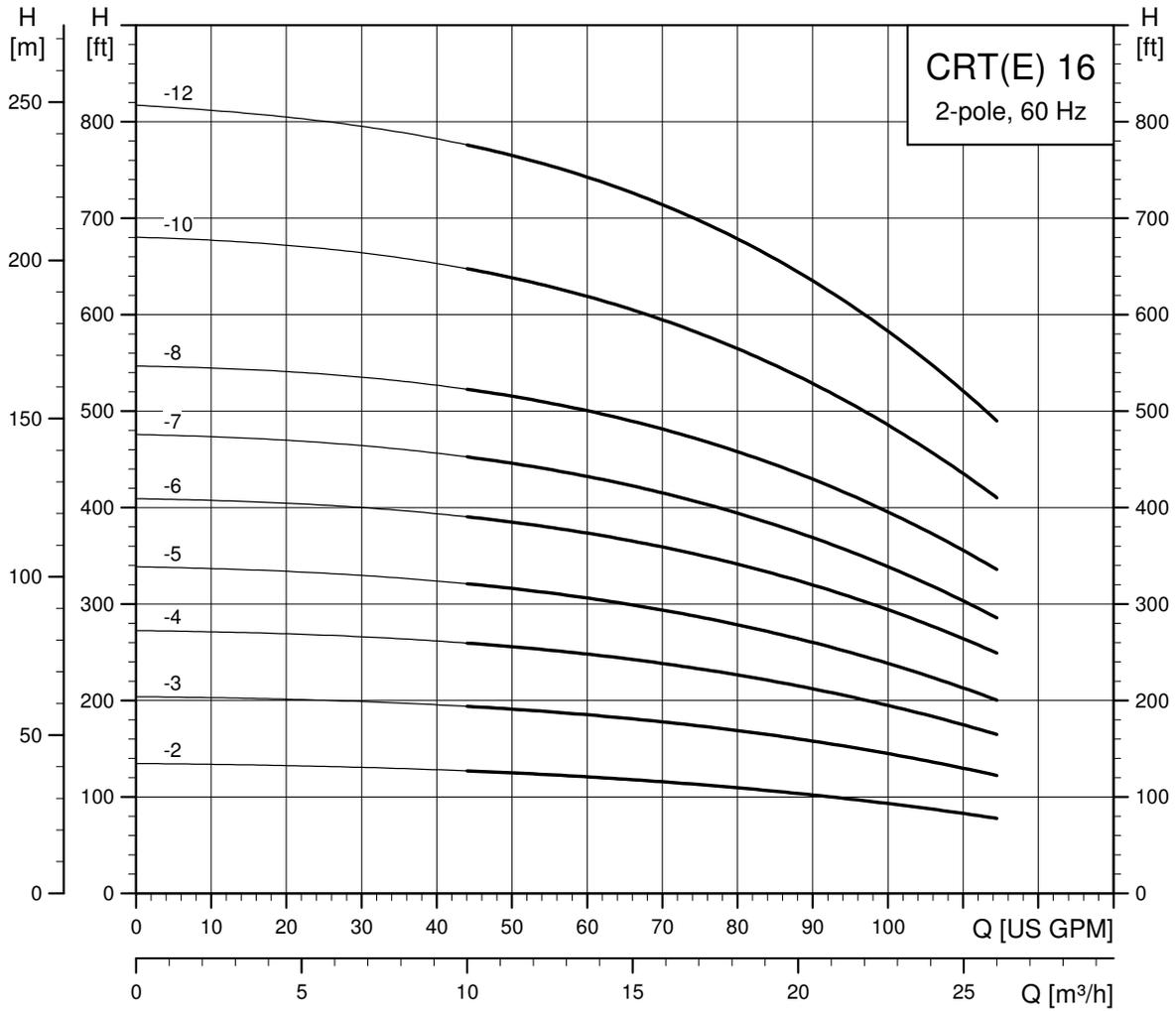
Dimensions and weights

Pump type	Hp	Ph	Voltage	Frame size	CRT TEFC					CRTE MLE				
					B1	D1	D2	B1+B2	Ship wt. [lb]	D1	D2	AG	B1+B2	Ship wt. [lb]
Dimensions [inches]														
CRT(E) 8-1	0.75	1	115/208-230	56C	14.06	6.19	5.18	23.97	75	4.80	6.22	8.34	22.52	*
		3	208-230/460	56C	14.06	5.55	4.57	21.50	65	-	-	-	-	-
CRT(E) 8-2	2.0	1	115-230	56C	14.69	7.19	5.73	27.25	100	4.80	6.22	8.34	23.94	*
		3	208-230/460	56C	14.69	7.01	4.33	25.91	91	4.80	6.22	10.56	14.69	-
CRT(E) 8-3	3.0	1	115/208-230	182TC	17.05	8.60	6.87	31.70	131	-	-	-	-	-
		3	208-230/460	182TC	17.05	7.01	4.33	30.28	110	4.80	6.22	10.56	27.88	*
CRT(E) 8-4	5.0	1	208-230	182TC	17.24	10.62	7.46	32.76	170	-	-	-	-	-
		3	208-230/460	182TC	17.24	8.66	5.28	32.75	168	7.53	7.91	11.46	30.39	*
CRT(E) 8-5	5.0	1	208-230	182TC	19.61	10.62	7.46	35.13	174	-	-	-	-	-
		3	208-230/460	182TC	19.61	8.66	5.28	35.12	172	7.53	7.91	11.46	32.76	*
CRT(E) 8-6	5.0	1	208-230	182TC	19.61	10.62	7.46	35.13	178	-	-	-	-	-
		3	208-230/460	182TC	19.61	8.66	5.28	35.12	176	7.53	7.91	11.46	32.76	*
CRT(E) 8-8	7.5	1	208-230	213TC	25.59	10.22	7.62	41.12	197	-	-	-	-	-
		3	208-230/460	213TC	25.59	8.66	5.28	41.10	185	7.53	7.91	11.46	39.96	*
CRT(E) 8-10	10	1	230	213TC	25.59	10.23	10.30	41.66	260	-	-	-	-	-
		3	208-230/460	213TC	25.59	8.66	5.28	41.10	193	10.04	9.33	13.62	40.90	*
CRT(E) 8-12	10	1	230	213TC	30.31	10.23	10.30	46.38	266	-	-	-	-	-
		3	208-230/460	213TC	30.31	8.66	5.28	45.82	199	10.04	9.33	13.62	45.62	*
CRT(E) 8-14	15	3	208-230/460	254TCZ	31.50	10.22	8.67	48.08	334	10.04	9.33	13.62	47.48	*
CRT(E) 8-16	15	3	208-230/460	254TCZ	35.59	10.22	8.67	52.17	342	10.04	9.33	13.62	51.57	*

Dimensions shown for 3-phase MLE motors are for 460 V versions. See page 10 for 200-240 V, 3-phase dimensions.

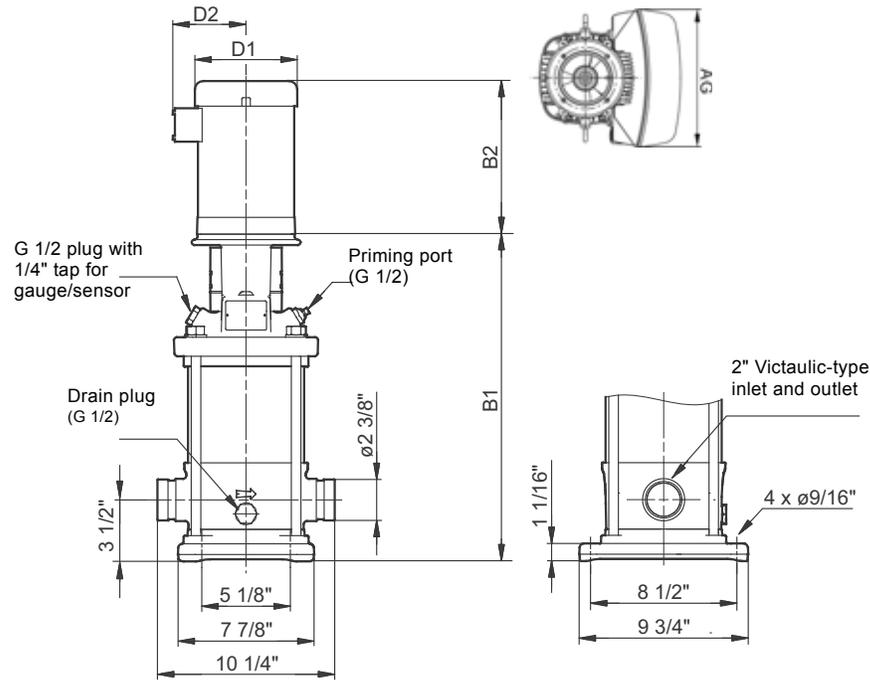
* Contact factory for weights.

CRT, CRTE 16



TM02 8333 0518

Dimensional sketches



TM07 0779 0518 - TM07 0758 0118

Dimensions and weights

Pump type	Hp	Ph	Voltage	Frame size	CRT TEFC					CRTE MLE				
					Dimensions [inches]					Dimensions [inches]				
					B1	D1	D2	B1+B2	Ship wt. [lb]	D1	D2	AG	B1+B2	Ship wt. [lb]
CRT(E) 16-2	5.0	1	208-230	182TC	18.23	10.62	7.46	33.75	161	-	-	-	-	-
		3	208-230/460	182TC	18.23	8.66	5.28	33.74	159	7.53	7.91	11.46	31.38	*
CRT(E) 16-3	7.5	1	208-230	213TC	19.49	10.22	7.62	35.02	184	-	-	-	-	-
		3	208-230/460	213TC	19.49	8.66	5.28	35.00	172	7.53	7.91	11.46	33.86	*
CRT(E) 16-4	7.5	1	208-230	213TC	23.03	10.22	7.62	38.56	189	-	-	-	-	-
		3	208-230/460	213TC	23.03	8.66	5.28	38.54	177	7.53	7.91	11.46	37.40	*
CRT(E)16-5	10	1	230	213TC	23.03	10.23	10.30	39.10	249	-	-	-	-	-
		3	208-230/460	213TC	23.03	8.66	5.28	38.54	182	10.04	9.33	13.62	38.34	*
CRT(E) 16-6	15	3	208-230/460	254TCZ	27.76	10.22	8.67	44.34	307	10.04	9.33	13.62	43.74	*
CRT(E) 16-7	15	3	208-230/460	254TCZ	27.76	10.22	8.67	44.34	311	10.04	9.33	13.62	43.74	*
CRT(E) 16-8	15	3	208-230/460	254TCZ	33.07	10.22	8.67	49.65	316	10.04	9.33	13.62	49.05	*
CRT(E) 16-10	20	3	230/460	254TCZ	33.07	10.22	8.67	49.65	329	13.39	12.13	16.54	51.85	*
CRT(E) 16-12	25	3	230/460	284TSCZ	40.55	12.94	11.52	60.37	398	13.39	12.13	16.54	63.27	*

Dimensions shown for 3-phase MLE motors are for 460 V versions. See page 10 for 200-240 V, 3-phase dimensions.

* Contact factory for weights.

9. Electrical data

Standard motors

Motors used in the CR pump range are:

- Grundfos ML motors
- Grundfos specified **Baldor**® motors.

The information in the tables below applies to following motor types and sizes:

Type	Phase	Motor range [Hp]	Cooling method
ML	3	0.33 - 30	TEFC
	1	0.33 - 10	TEFC
Baldor	3	40 - 100	TEFC
	3	15 - 125	ODP

Grundfos CR pumps are supplied with heavy-duty 2-pole, NEMA energy efficient C-frame motors built or selected to our rigid specifications. All CR pump motors have heavy-duty bearings for maximum thrust requirements.

ODP motors

(Open Drip Proof, constant speed)

Hp	Ph	ODP frame	ODP S.F.	ODP voltage [V]	ODP motor eff. %	ODP insul. class	ODP KVA code	ODP full load current	ODP service factor current	ODP starting current
15	3	254TCZ	1.15	208-230/460	89.5	F	H	37-35 / 17.5	40-39.4 / 19.7	225-248 / 124
20	3	254TC	1.15	230/460	90.2	B	G	48/24	55/27.5	306/153
25	3	284TSCZ	1.15	208-230/460	91	B	G	64-59 / 29.5	74-67 / 33.5	335-374 / 187
30	3	284TSC	1.15	230/460	91	F	H	70/35	80/40	480/240
40	3	286TSCZ	1.15	230/460	91.7	F	F	94/47	108/54	542/271
50	3	324TSCZ	1.15	230/460	92.4	F	G	116/58	134/67	706/353
60	3	324TSCZ	1.15	230/460	93	B	G	132/66	152/76	844/422
75	3	364TSCZ	1.15	230/460	93	F	G	168/84	192/96	1110/555
100	3	365TSCZ	1.15	230/460	93	F	G	226/113	260/130	1380/690
125	3	405TSCZ	1.15	460	93.6	B	G	140	171	897

Baldor motor



TM02 7686 3803

It is not recommended that an off-the-shelf standard Baldor motor be used on a Grundfos pump. Ideally, the best motor choice would be the Grundfos specified motor.

Single-phase Grundfos specified motors up to 7.5 Hp have a built-in thermal overload switch.

Other motor types are available (i.e., Explosion proof, Mill and Chem duty, Premium Efficiency, etc.); consult local Grundfos company for more information.

Pumps supplied by Grundfos Canada are normally supplied with motors from other manufacturers. 575 volt motors meet NEMA energy efficiency standards. Dimensions and data will vary, contact local Grundfos company for more information.

All values are subject to change without notice.

TEFC motors

(Totally Enclosed Fan Cooled, constant speed)

Baldor motor



TM02 7696 3803

Grundfos ML motors



Gr7848sh



GR 7845



TM04 2512 2708

Hp	Ph	Frame	S.F.	Voltage [V]	Motor eff. [%]	Insul. class	KVA code	Full load current [A]	Service factor current [A]	Starting current [A]	Motor type
0.33	1	56C	1.35	115/230	55	B	K	6.0/3.0	7.6/3.8	28/14	Baldor
	3	56C	1.35	208-230/460	78.5	F	L	1.12-1.1/0.55	1.5-1.45/0.75	7.1-7.7/3.9	ML
0.5	1	56C	1.6	115/230	62	B	K	7.4/3.7	9.8/4.9	39/19.5	Baldor
	3	56C	1.25	208-230/460	78.5	F	K	1.64-1.55/0.78	2.0-1.9/0.95	9.7-10.1/5.1	ML
0.75	1	56C	1.25	115/230	66	B	K	9.6/4.8	11.4/5.7	56/28	Baldor
	3	56C	1.25	208-230/460	79	F	K	2.4-2.3/1.2	2.9-2.75/1.4	14.2-15/7.8	ML
1	1	56C	1.25	115/230	66	B	K	12/6.0	14.4/7.2	77/38.5	Baldor
	3	56C	1.25	208-230/460	80	F	J	3.25-3.35/1.68	4.0-3.9/1.95	19.2-21.8/10.9	ML
1.5	1	56C	1.3	115/208-230	71	B	K	17/9.5-8.6	20.4/11.3-10.2	106/58.6-53	Baldor
	3	56C	1.15	208-230/460	84	F	M	4.7-4.6/2.3	5.2-5.1/2.55	33.8-36.8/18.4	ML
2	1	56C	1.15	115/208-230	74	F	K	23/12.7-11.5	25.4/14.0-12.7	156/86-78	Baldor
	3	56C	1.15	208-230/460	85.5	F	G	5.7-5.4/2.7	6.55-6.1/3.05	46.2-48.6/24.3	ML
3	1	182TC	1.15	115/208-230	75	F	H	29/16-14.5	31.8/18-15.9	170/94-85	Baldor
	3	182TC	1.15	208-230/460	86.5	F	M	8.35-7.50/3.75	9.10-8.15/4.10	86.8-78.0/39.0	ML
5	1	213TCZ	1.15	208-230	80	F	J	24-22	27-25	188-170	Baldor
	3	182TC	1.15	208-230/460	88.5	F	L	14.1-13.1/7.29	16.2-15.0/8.4	207-193/107	ML
7.5	1	213TC	1.15	208-230	82	F	F	33.8-31	38.5-35.5	244-220	Baldor
	3	213TC	1.15	208-230/460	89.5	F	N	19.5-18.1/9.09	22.4-20.8/10.4	289-267/135	ML
10	1	213TC	1.15	230	85.5	F	F	40	46	284	Baldor
	3	215TC	1.15	208-230/460	90.2	F	K	26.5-24.6/12.4	29.0-27.0/13.6	261-243/123	ML
15	3	254TC	1.15	208-230/460	91	F	J	37.5-34/17	41.0-37.5/18.6	369-338/168	ML
20	3	254TC	1.15	208-230/460	91	F	K	50.5-46/23	55.5-50.5/25.5	450-410/207	ML
25	3	284TSC	1.15	230/460	91.7	F	J	62.0-56/28	68.0-61.5/31.0	510-462/233	ML
30	3	286TSC	1.15	230/460	91.7	F	H	74.0-67.0/33.5	81.5-73.5/37.0	595-537/271	ML
40	3	286TSC	1.15	230/460	91.7	F	G	88/44	102/51	614/307	Baldor
50	3	326TSC	1.15	230/460	93	F	G	110/55	128/64	746/393	Baldor
60	3	364TSC	1.15	230/460	93	F	G	134/67	154/77	918/459	Baldor
75	3	365TSC	1.15	230/460	93	F	G	166/83	188/94	1162/581	Baldor
100	3	405TSC	1.15	230/460	93.6	F	G	216/108	246/123	1422/711	Baldor

MLE motors



TM06 9830 0817

2 pole

Hp	Voltage [V]	Phase	NEMA frame size	Service Factor	Motor full load efficiency [%]	Full load current amps** [A]	Service factor current amps [A]	Power factor	Full load speed [rpm]	Sound pressure level [dB(A)]
0.5 ¹⁾	200-240	1	56C	1	84*	2.40 - 2.10	-	0.96	3400	58
0.75 ¹⁾	200-240	1	56C	1	85.3*	3.45 - 2.90	-	0.98	3400	58
1 ¹⁾	200-240	1	56C	1	85.2*	4.70 - 3.90	-	0.99	3400	58
1 ¹⁾	440-480	3	56C	1.25	86.4*	1.65	2.10	0.73	3480	58
1.5 ¹⁾	200-240	1	56C	1	86.9*	6.70 - 5.60	-	0.99	3400	58
1.5 ¹⁾	200-240	3	56C	1.15	89.3*	4.00 - 3.40	4.60 - 3.90	0.91	3480	55
1.5 ¹⁾	440-480	3	56C	1.15	89.6*	2.05	2.40	0.84	3480	58
2 ¹⁾	200-240	1	56C	1	87.4*	9.10 - 7.60	-	0.99	3400	64
2 ¹⁾	200-240	3	56C	1.00	88.90*	5.40 - 4.50	-	0.92	3480	55
2 ¹⁾	440-480	3	56C	1.15	89.4*	2.65	3.00	0.87	3480	64
3 ¹⁾	200-240	3	182TC	1.15	88.70*	7.90 - 6.60	9.10 - 7.60	0.94	3480	62
3 ¹⁾	440-480	3	182TC	1.15	90.7*	3.8	4.30	0.89	3480	64
5 ¹⁾	200-240	3	182TC	1.15	90.90*	13.2 - 10.9	14.90 - 12.40	0.94	3480	66
5 ¹⁾	440-480	3	182TC	1.15	92.5*	6.20 - 5.80	7.00 - 6.60	0.90	3500	60
7.5 ¹⁾	200-240	3	213TC	1.15	90.20*	20.0 - 16.6	23.0 - 19.3	0.94	3480	70
7.5 ¹⁾	440-480	3	213TC	1.15	92.4*	9.10 - 8.50	10.4 - 9.70	0.91	3500	60
10 ¹⁾	440-480	3	213TC	1.15	92.5*	12.4 - 11.5	14.2 - 13.0	0.91	3500	65
15 ¹⁾	440-480	3	254TC	1.15	93.2*	17.9 - 16.6	20.5 - 19.0	0.92	3500	65
20 ²⁾	460-480	3	256TC	1.15	91	24.00	27.50	0.89	3540	68
25 ²⁾	460-480	3	284TC	1.15	91.7	30.50	35.00	0.88	3540	70
30 ²⁾	460-480	3	286TC	1.15	91.7	36.50	42.00	0.88	3540	70

1) Permanent magnet motor

2) Asynchronous motor

* Efficiency of motor and VFD

** At 460 V for 460-480 V motors

10. Accessories

Remote controls

Grundfos GO Remote

Grundfos GO Remote is used for wireless infrared or radio communication with the pumps.

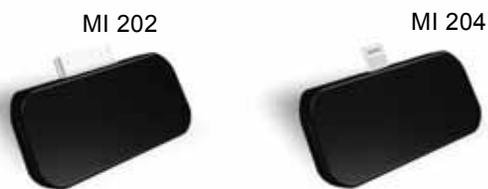
Various Grundfos GO Remote variants are available. The variants are described in the following.

MI 202 and MI 204

MI 202 and MI 204 are add-on modules with built-in infrared and radio communication. MI202 can be used in conjunction with an Apple iPhone or iPod with 30-pin connector and iOS. 5.0 or later, e.g. fourth generation iPhone or iPod.

MI 204 can be used in conjunction with an Apple iPhone or iPod with Lightning connector, e.g. fifth generation iPhone or iPod.

(MI 204 is also available together with an Apple iPod touch and a cover.)



TM05 3887 1612 - TM05 7704 1513

Fig. 52 MI 202 and MI 204

Supplied with the product:

- Grundfos MI 202 or MI 204
- sleeve
- quick guide
- charger cable.

MI 301

MI 301 is a module with built-in infrared and radio communication. MI 301 can be used in conjunction with Android or iOS-based smart devices with Bluetooth connection. MI 301 has a rechargeable Li-ion battery and must be charged separately.



TM05 3890 1712

Fig. 53 MI 301

Supplied with the product:

- Grundfos MI 301
- sleeve
- battery charger
- quick guide.

Product numbers

Grundfos GO Remote variant	Product number
Grundfos MI 202	98046376
Grundfos MI 204	98424092
Grundfos MI 204 including iPod touch	98612711
Grundfos MI 301	98046408

CIU communication interface units



GrA 6118

Fig. 54 Grundfos CIU communication interface unit

The CIU units enable communication of operating data, such as measured values and setpoints, between CRE, CRIE, CRNE pumps and a building management system. The CIU unit incorporates a 24-240 VAC/VDC power supply module and a CIM module. It can either be mounted on a DIN rail or on a wall.

We offer the following CIU units:

CIU 100

For communication via LonWorks.

CIU 150

For communication via PROFIBUS DP.

CIU 200

For communication via Modbus RTU.

CIU 250

For wireless communication via GSM/GPRS.

CIU 271

For communication via Grundfos Remote Management (GRM).

CIU 300

For communication via BACnet MS/TP.

Description	Fieldbus protocol	Product number
CIU 100	LonWorks	96753735
CIU 150	PROFIBUS DP	96753081
CIU 200	Modbus RTU	96753082
CIU 250*	GSM/GPRS	96787106
CIU 271*	GRM	96898819
CIU 300	BACnet MS/TP	Contact Grundfos

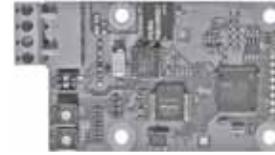
* Antenna are not included. See below.

Antennas for CIU 250 and 270

Description	Product number
Antenna for roof	97631956
Antenna for desk	97631957

For further information about data communication via CIU units and fieldbus protocols, see the CIU documentation available on www.grundfos.com (Grundfos Product Center).

CIM communication interface modules



GrA 6121

Fig. 55 Grundfos CIM communication interface module

The CIM modules enable communication of operating data, such as measured values and setpoints, between CRE, CRIE or CRNE pumps of 11-22 kW and a building management system. The CIM modules are add-on communication modules which are fitted in the terminal box of CRE, CRIE, CRNE pumps of 11-22 kW. **Note:** CIM modules must be fitted by authorised persons.

We offer the following CIM modules:

CIM 100

For communication via LonWorks.

CIM 150

For communication via PROFIBUS DP.

CIM 200

For communication via Modbus RTU.

CIM 250

For wireless communication via GSM/GPRS.

CIM 271

For communication via Grundfos Remote Management (GRM).

CIM 300

For communication via BACnet MS/TP.

Description	Fieldbus protocol	Product number
CIM 100	LonWorks	96824797
CIM 150	PROFIBUS DP	96824793
CIM 200	Modbus RTU	96824796
CIM 250*	GSM/GPRS	96824795
CIM 271*	GRM	96898815
CIM 300	BACnet MS/TP	Contact Grundfos

* Antenna not included. See below.

Antennas for CIM 250 and 270

Description	Product number
Antenna for roof	97631956
Antenna for desk	97631957

For further information about data communication via CIM modules and fieldbus protocols, see the CIM documentation available on www.grundfos.com (Grundfos Product Center).

Pipework connection

PJE couplings for CRT(E)

A set includes 1 coupling, 1 gasket, 1 pipe stub and bolts and nuts.

Pump type	Pipe stub	Pressure rating [psi (bar)]	Pipe work connection	Number of coupling sets needed	Material number	
					EPDM	FKM
CRT(E) 2 and CRT(E) 4	Threaded	1015 (70)	1.25" NPT	2	415522	91134571
	For welding	1015 (70)	1.25"	2	415521	415539
CRT(E) 8 and CRT(E) 16	Threaded	1015 (70)	2" NPT	2	336924	91134572
	For welding	1015 (70)	2"	2	425934	425952

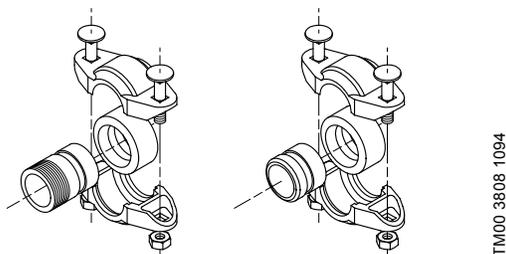


Fig. 56 PJE couplings

ANSI flange adapter for CRT(E)

For pipework connection, Grundfos can offer an ANSI flange adapter set.

A set includes one flange adapter and one gasket, two sets are normally required. The set does not include connection nuts and bolts. Four 5/8 x 3" bolts and nuts are required for each adapter set.

Pump type	Pipework connection	EPDM
CRT(E) 8, CRT(E) 16	ANSI 2" 150 lb	91122697

11. Variants

Lists of variants - on request

Although the Grundfos CRT(E) product range offers a number of pumps for different applications, customers require specific pump solutions to satisfy their needs.

To the side please find the range of options available for customizing the CRT(E) pumps to meet the customers' demands.

Contact Grundfos for further information or for requests other than the ones mentioned below.

Motors

Variant	Description
Explosion proof (including ATEX approved)	For operation in hazardous atmospheres, explosion-proof or dust-ignition-proof motors may be required.
Motors with anti-condensation heating unit	For operation in humid environments motors with built-in anti-condensation heating may be required.
Efficiency class	Premium efficiency
Integrated variable speed drive	All Grundfos CRT pumps 10 hp and below are available as standard with integrated variable speed drive (type MLE) motors.
Oversized motors	Ambient temperatures above +104 °F (+40 °C) or installation at altitudes of more than 3,300 ft (1005 m) above sea level require the use of oversized motors (i.e. derating).
4-pole motors	Grundfos offers standard motors fitted with 4-poles.
Different enclosure class	As standard, Grundfos can supply: <ul style="list-style-type: none"> • ODP: open drip-proof • TEFC: total-enclosed fan-cooled On request, we can supply: <ul style="list-style-type: none"> • Chemical processing/mill and chem duty • Washdown duty (Up through 10 hp only) • Other

Shaft seals

Variant	Description
Shaft seal with FKM or FFKM O-ring material	Shaft seals with FKM or FFKM o-ring material are recommended for applications where the pumped liquid may damage the standard O-ring material.
Shaft seal with SiC/SiC	Grundfos offers shaft seals with silicon carbide/silicon carbide (SiC/SiC).

Pumps

Variant	Description
Horizontally mounted pumps	For safety or height reasons, certain applications, for instance on ships, require the pumps to be mounted in the horizontal position. For easy installation the pumps are equipped with brackets that support motor and pump.
Pumps with bearing flange	The bearing flange is suitable for applications where the inlet pressure is higher than the recommended maximum pressure. The bearing flange increases the life of motor bearings. (Recommended for standard motors).
Belt-driven pumps	Belt-driven pumps designed to operate in places with limited space or where no electrical power is available.

CRT, CRTE Vertical multistage centrifugal pumps	Company name:
	Prepared by:
	Phone number: ()
	Fax number: ()
	Date: Page 1 of:
	Quote number:

Client information	
Project title:	Client name:
Reference number:	Client number:
Client contact:	Client phone number: ()

Location information			
For:	Unit:		
Site:	Service:		
Address:	City:	State:	Zip code:

Application information						
Operating conditions			Pumped fluid			
Fluid type:						
	Max.	Norm.	Min.	Rated	Max.	Norm.
Capacity (gpm)				Fluid temperature (°F)		
Inlet (suction) pressure (psig)				at designated temperature		
Outlet (discharge) pressure (psig)				Specific gravity		
Differential head (ft)				Vapor pressure (psia)		
Hydraulic power (hp) at designated capacity				Viscosity (cp)		
NPSH available (ft)				Fluid ph:	Chlorides (ppm):	
Service			Hazardous:		Corrosion/Erosion caused by:	
Continuous			Flammable:			
Intermittent (starts/day):			Other:			

Pump information	
Model Information from type key and codes:	----> (Example: CR 5-10 A-FGJ-A-E-HQQE)
Quantity required:	
Minimum required flow:	NPSH required at duty point:

Data booklet additional information pages	
Materials page number:	Performance curve page number:
Technical data page number:	Motor data page number:

Motor Information			
HP:	Phase:	Voltage:	Enclosure:

Custom-built pump information (optional):

Additional information	

12. Quotation text

CRT, CRTE

Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation.

The pump has the following characteristics:

- impellers and intermediate chambers are made of AISI _____ Stainless Steel
 - Pump head and base are made of _____
 - Power transmission is via cast iron split coupling.
 - pipework connections is via _____
- The motor is a _____-phase AC motor.

Technical

Rated flow: _____ GPM
 Rated head: _____ Feet
 Minimum liquid temperature: _____ °F
 Maximum liquid temperature: _____ °F
 Type of shaft seal: _____

Materials

Material, pump housing: _____
 Material, shaft: AISI _____ Stainless Steel
 Material, impeller: AISI _____ Stainless Steel
 Material, sleeve: AISI _____ Stainless Steel
 Material, seal metal: AISI _____ Stainless Steel

- seal face: _____
- seal face: _____
- seal elastomer: _____

Installation

Maximum ambient temperature:
 _____ °F

Max. pressure at stated temp.:
 _____ PSI/ °F

Standard, pipe connection:

Size, pipe connection: _____
 Rated pressure, pipe connection: _____ PSI
 Frame size for motor: _____ NEMA

Electrical data

Motor type: _____
 Rated power (P2): _____ HP
 Frequency: _____ Hz
 Rated voltage: _____ V
 Rated current: _____ A
 Service factor: _____
 Starting current: _____ A
 Rated speed: _____ RPM
 Full load motor efficiency: _____ %
 Insulation class: _____

Additional

Gross weight: _____ l.bs.
 Shipping volume: _____
 Model: _____

13. Grundfos Product Center

Online search and sizing tool to help you make the right choice.

<http://product-selection.grundfos.com>



"SIZING" enables you to size a pump based on entered data and selection choices.

"REPLACEMENT" enables you to find a replacement product. Search results will include information on

- the lowest purchase price
- the lowest energy consumption
- the lowest total life cycle cost.

The screenshot shows the Grundfos Product Center website. At the top, there is a navigation bar with the Grundfos logo and 'PRODUCT CENTER'. Below this is a secondary navigation bar with tabs: HOME, FIND PRODUCT, COMPARE, YOUR PROJECTS, SAVED ITEMS, and HELP. A search bar is located below the navigation, with a 'SEARCH' button. Below the search bar are four main navigation buttons: 'SIZING' (with a subtext 'Enter pump sizing'), 'CATALOG' (with a subtext 'Product and services'), 'REPLACEMENT' (with a subtext 'Replace an old pump with a new'), and 'LIQUIDS' (with a subtext 'Find liquid pump'). Below these buttons is a 'QUICK SIZING' section. It contains two input fields for 'Enter duty point': 'Flow (Q)*' and 'Head (H)*'. Each field has a numerical input box and a unit dropdown menu (US gpm and ft respectively). To the right of these fields is a 'Select what to size by:' section with three radio button options: 'Size by application', 'Size by pump design', and 'Size by pump family'. A 'START SIZING' button is located to the right of the radio buttons. At the bottom of the 'QUICK SIZING' section, there is an 'ADVANCED SIZING:' section with two toggle switches: 'Advanced sizing by application' and 'Guided selection'.

"CATALOG" gives you access to the Grundfos product catalog.

"LIQUIDS" enables you to find pumps designed for aggressive, flammable or other special liquids.

All the information you need in one place

Performance curves, technical specifications, pictures, dimensional drawings, motor curves, wiring diagrams, spare parts, service kits, 3D drawings, documents, system parts. The Product Center displays any recent and saved items - including complete projects - right on the main page.

Downloads

On the product pages, you can download Installation and Operating Instructions, Data Booklets, Service Instructions, etc. in PDF format.

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ECM: 1233475

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Fax: 011-52-81-8144 4010
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