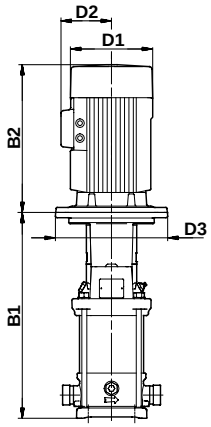
CRT, CRTE

Vertical multistage centrifugal pumps in titanium
50/60 Hz

Dimensions



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IMPORTANT NOTICE!

The dimensions on this sheet apply to 1.5 - 7.5 kW CRTE pumps until November 2004.

The motor design for **E-series pumps** will change in late 2004.

As a result, the dimensions in the data booklet for motor height and width for certain CRT**E** pumps apply **from November 2004** only.

The change applies to **3-phase MGE motors from 1.5 kW to 7.5 kW** only.

Please keep this sheet inside the data booklet until November 2004.

CRTE 2, 50 Hz

Pump type	Motor P_2 [kW]	PJE			D1	D2	D3
		B1	B2	B1+B2			
CRTE 2-15	1.5	476	441	917	178	110	-
CRTE 2-22	2.2	618	441	1059	178	110	-
CRTE 2-26	3.0	690	495	1185	178	110	-

CRTE 2, 60 Hz

Pump type	Motor P_2 [kW]	PJE			D1	D2	D3
		B1	B2	B1+B2			
CRTE 2-7	1.5	326	441	767	178	110	-
CRTE 2-11	2.2	404	441	845	178	110	-
CRTE 2-15	3.0	476	495	971	178	110	-
CRTE 2-18	4.0	546	536	1082	220	134	-

CRTE 4, 50 Hz

Pump type	Motor P_2 [kW]	PJE			D1	D2	D3
		B1	B2	B1+B2			
CRTE 4-8	1.5	422	441	863	178	110	-
CRTE 4-12	2.2	546	441	987	178	110	-
CRTE 4-16	3.0	654	495	1149	178	110	-
CRTE 4-22	4.0	627	536	1163	220	134	-

CRTE 4, 60 Hz

Pump type	Motor P_2 [kW]	PJE			D1	D2	D3
		B1	B2	B1+B2			
CRTE 4-4	1.5	310	441	751	178	110	-
CRTE 4-6	2.2	368	441	809	178	110	-
CRTE 4-8	3.0	422	495	917	178	110	-
CRTE 4-12	4.0	546	536	1082	220	134	-
CRTE 4-16	5.5	654	555	1209	220	134	300

CRTE 8, 50 Hz

Pump type	Motor P_2 [kW]	PJE			D1	D2	D3
		B1	B2	B1+B2			
CRTE 8-4	1.5	387	441	828	178	110	-
CRTE 8-6	2.2	493	441	934	178	110	-
CRTE 8-8	3.0	618	495	1113	178	110	-
CRTE 8-12	4.0	830	536	1366	220	134	-
CRTE 8-16	5.5	890	555	1445	220	134	300
CRTE 8-18	7.5	890	555	1445	220	134	300

CRTE 8, 60 Hz

Pump type	Motor P_2 [kW]	PJE			D1	D2	D3
		B1	B2	B1+B2			
CRTE 8-2	1.5	357	441	798	178	110	-
CRTE 8-3	2.2	387	441	828	178	110	-
CRTE 8-5	3.0	493	495	988	178	110	-
CRTE 8-6	4.0	493	536	1029	220	134	-
CRTE 8-8	5.5	618	555	1173	220	134	300
CRTE 8-12	7.5	830	555	1385	220	134	300

CRTE 16, 50 Hz

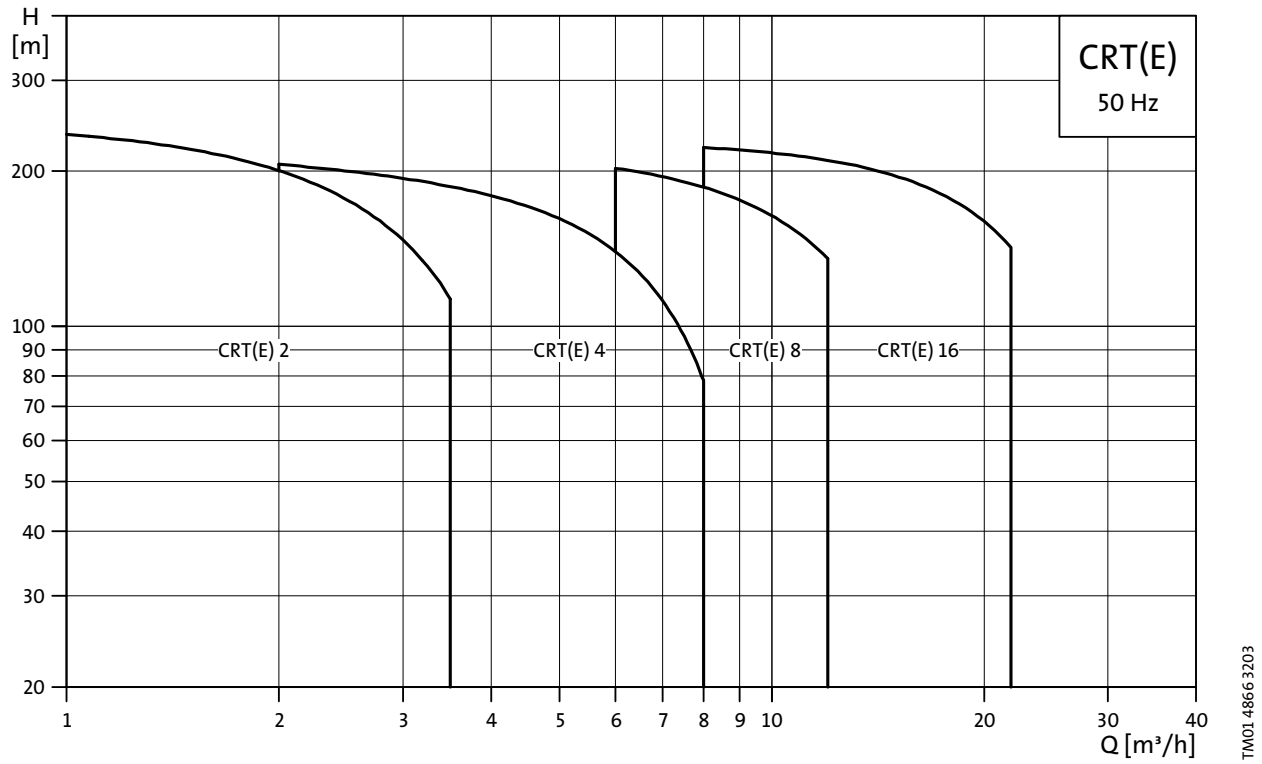
Pump type	Motor P_2 [kW]	PJE			D1	D2	D3
		B1	B2	B1+B2			
CRTE 16-2	2.2	463	441	904	178	110	-
CRTE 16-3	3.0	463	495	958	178	110	-
CRTE 16-4	4.0	585	536	1121	220	134	-
CRTE 16-6	5.5	675	555	1230	220	134	300
CRTE 16-8	7.5	887	555	1442	220	134	300

CRTE 16, 60 Hz

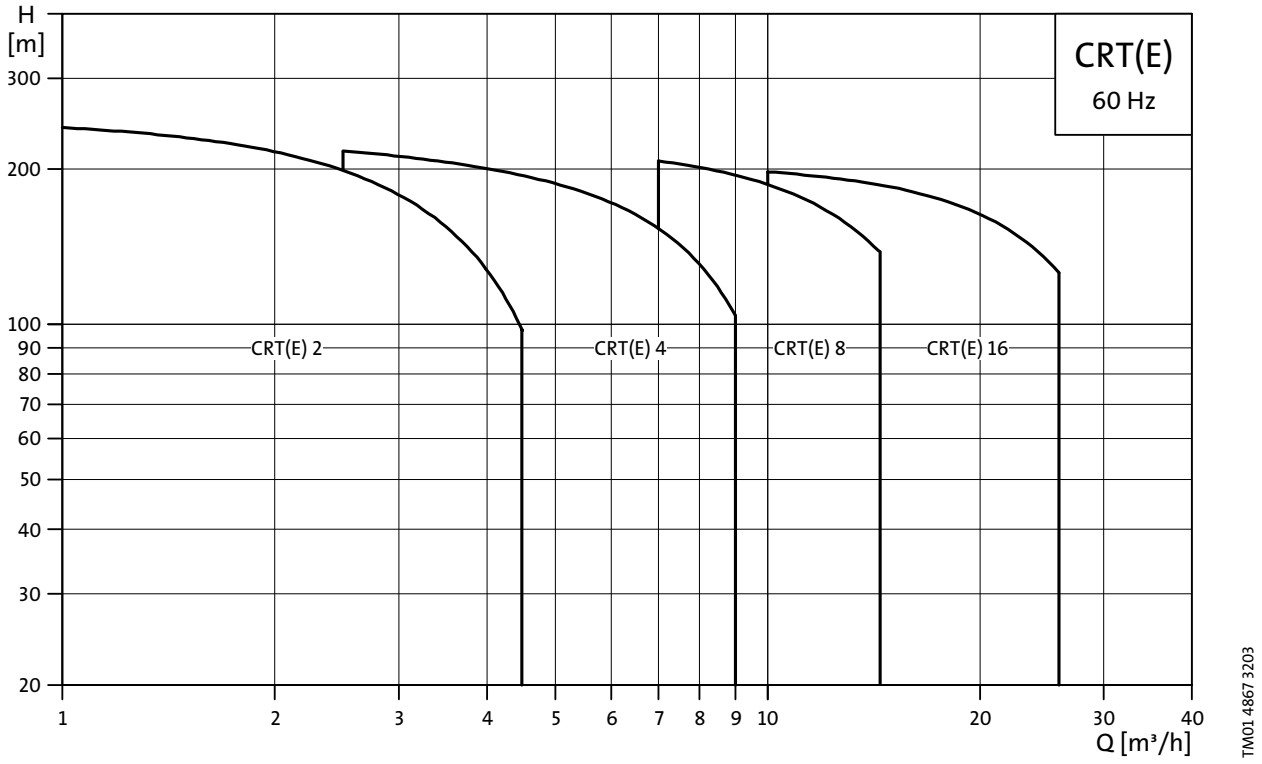
Pump type	Motor P_2 [kW]	PJE			D1	D2	D3
		B1	B2	B1+B2			
CRTE 16-2	3.0	463	495	958	178	110	-
CRTE 16-3	5.5	463	555	1018	220	134	300
CRTE 16-5	7.5	585	555	1140	220	134	300

Contents

Performance range, 50 Hz



Performance range, 60 Hz



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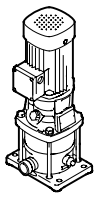
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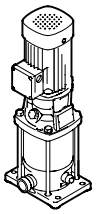
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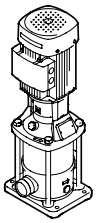
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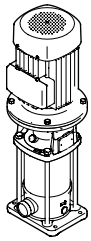
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Description	CRT(E) 2	CRT(E) 4	CRT(E) 8	CRT(E) 16
Range				
Nominal flow rate [m^3/h]	2	4	8	16
Max. pressure [bar]	25	25	25	25
Temperature range [°C]	–20 to +120	–20 to +120	–20 to +120	–20 to +120
Max. efficiency [%]	48	59	64	70
50 Hz				
Flow range [m^3/h]	1 - 3.5	2 - 8	6 -12	8 - 22
Motor power [kW]	0.37 - 3.0	0.37 - 4.0	0.37 - 7.5	2.2 - 18.5
60 Hz				
Flow range [m^3/h]	1 - 4.5	2 - 9	6 - 14.5	8 - 26
Motor power [kW]	0.37 - 4.0	0.37 - 5.5	0.37 - 11	2.2 - 15
Pipework connection				
PJE coupling with socket for welding/threaded socket	Rp 1¼	Rp 1¼	R 2	R 2
DIN flange - on request	DN 32	DN 32	DN 50	DN 50

Applications

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

Excellent corrosion resistance

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

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

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

Fields of application

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
- 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
- Aquaria
- Fun water parks

CRT(E) 2, 4, 8 and 16

GR7369

Fig. 1 CRT pumps

Pump

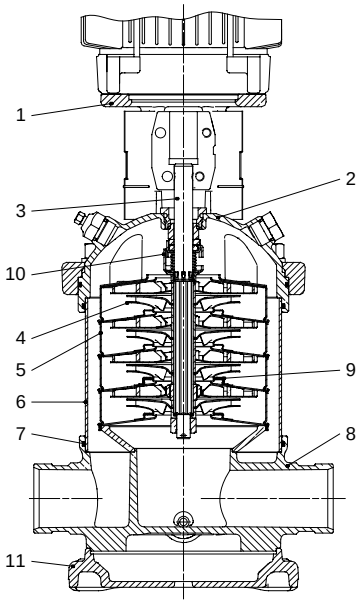
The CRT pump is a non self-priming, vertical multistage centrifugal pump fitted with a Grundfos standard motor.

The pump consists of a base and a pump head. The pump body and the outer sleeve are fixed between the base and the pump head by means of staybolts. The base has in-line suction and discharge ports. The pump has a maintenance-free mechanical shaft seal with dimensions to DIN 24960.

Operating conditions

Description	Operating conditions
Liquid temperature	EPDM: –20°C to +120°C. FKM: –20°C to +90°C.
Ambient temperature	Maximum +40°C.
Minimum inlet pressure	According to the NPSH curve + a safety margin of minimum 0.5 metres head.

Sectional drawing



Materials

Pos.	Description	Materials	EN/DIN	AISI/ASTM
1	Pump head	Stainless steel	1.4308	ASTM 25B
2	Pump head cover	Titanium		ASTM B 265/1993
3	Shaft	Titanium		ASTM B 348/1993
4	Impeller	Titanium		ASTM B 265
5	Intermediate chamber	Titanium		ASTM B 265
6	Outer sleeve	Titanium		ASTM B 265
7	O-ring for outer sleeve	EPDM or FKM		
8	Base	Titanium		ASTM B 265
9	Neck ring	PTFE		
10	Shaft seal	AUUE/AUUV		
11	Base plate	Stainless steel	1.4408	CF8M (eq. to AISI 316)
	Rubber parts in pump	Same as in shaft seal EPDM/FKM		

Pumped liquids

Thin, non-explosive liquids, not containing solid particles or fibres. 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.

Motor

The motor is a totally enclosed, fan-cooled, 2-pole Grundfos standard motor with principal dimensions in accordance with the IEC and DIN standards.

Electrical tolerances according to IEC 34/EN 60034.

Mounting designation	Up to 4 kW: V 18 From 5.5 kW: V 1
Insulation class	F
Efficiency class	Eff.2 Eff.1 - on request
Enclosure class	IP 55 IP 44, IP 54 and IP 65 - on request
50 Hz Standard voltages	3 x 200/346 V, 3 x 200-220/346-380 V, 3 x 220-240/380-415 V, 3 x 380-415Δ V, 1 x 220-230/240 V, 1 x 110/220 V.
60 Hz Standard voltages	3 x 220-255/380-440 V, 3 x 220-277/380-480 V, 3 x 380-480Δ V, 1 x 110-127/220-240 V.

Motors for other voltages are available on request.

Single-phase motors have a built-in thermal overload switch.

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

Three-phase Grundfos motors from 3 kW have a built-in thermistor (PTC) according to DIN 44082.

From 0.37 kW to 2.2 kW Grundfos offers CRT pumps fitted with single-phase MG motors (1x220-230V/240V).

From 0.37 kW to 1.1 kW Grundfos offers CRTE pumps fitted with single-phase MGE motors (1x220-240V).

Type key

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

Maximum operating pressure

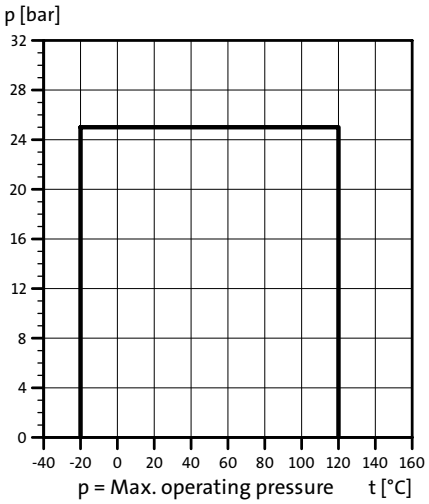


Fig. 2 Operating pressure and temperature limits.

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.

50 Hz			60 Hz		
CRT(E) 2-2	→ 2-11	10 bar	CRT(E) 2-2	→ 2-6	10 bar
CRT(E) 2-13	→ 2-26	15 bar	CRT(E) 2-7	→ 2-18	15 bar
CRT(E) 4-1	→ 4-12	10 bar	CRT(E) 4-1	→ 4-7	10 bar
CRT(E) 4-14	→ 4-22	15 bar	CRT(E) 4-8	→ 4-16	15 bar
CRT(E) 8-1	→ 8-20	10 bar	CRT(E) 8-1	→ 8-14	10 bar
CRT(E) 16-2	→ 16-17	10 bar	CRT(E) 16-2	→ 16-10	10 bar

Corrosion resistance for CRT(E)

Media	Conc. [%]	Temp. [°C]	Seal face/bearing	
			Binderless tungsten carbide	Silicium carbide
Demineralized water		120	●	
Ground water		120	●	
Brackish water		120	●	
Seawater		80	●	
Sulfuric acid	3	60	●	
Phosphoric acid	30 10	35 60	●	
Formic acid	50	80		●★★
Citric acid	50	100	●	
Oxalic acid	5	20	●	
Inorganic salts (including $FeCl_3$)			●	$FeCl_3$
Sodium hydroxide	10 50	100 60	●	
Potassium hydroxide	50	20	●	
Calcium hydroxide	saturated	100	●	
Ammonium hydroxide	28	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.

Selection of pumps

Selection of pumps should be based on

- The duty point of the pump (see section 1)
- Dimensional 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).

1. Duty point of the pump

From a duty point it is possible to select a pump on the basis of the curve charts shown in the chapter of "Performance curves/Technical data on page 12.

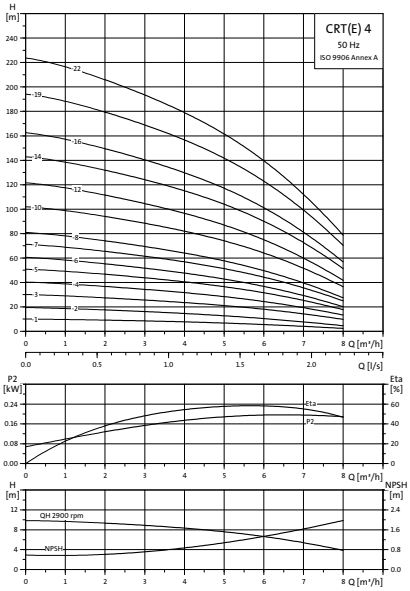


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Fig. 3 Example of a curve chart

2. Dimensional data

When dimensioning a pump size the following must be taken into account

- Required flow and pressure at the draw-off point.
- Pressure loss as a result of height differences (H_{geo}).
- Friction loss in the pipework (H_f).
  It may be necessary to account for pressure loss in connection with long pipes, bends or valves, etc.
- Best efficiency at the estimated duty point.
- NPSH value.
  For calculation of the NPSH value, see "Minimum inlet pressure - NPSH" page 11.

Efficiency

Before determining the point of best efficiency the operation pattern of the pump needs to be identified.

Is the pump expected to operate at the **same** duty point, then select a CR pump which is operating at a duty point corresponding with the best efficiency of the pump.

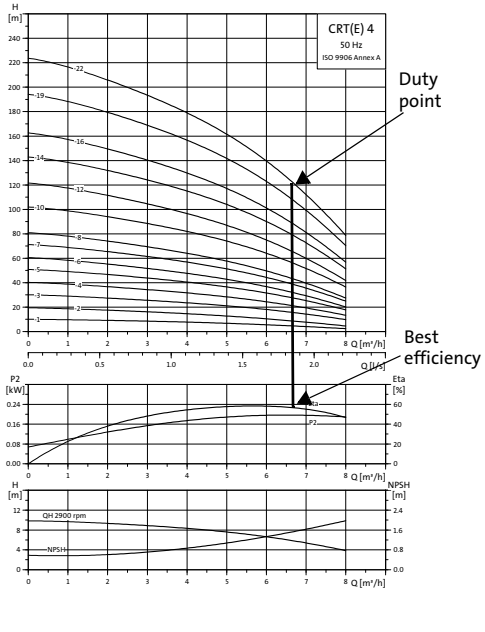

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Fig. 4 Example of a CRT(E) pump's duty point

As the pump is dimensioned on the basis of the highest possible flow, it is urgent always to have the duty point to the right on the efficiency curve (eta) in order to keep efficiency high when the flow drops.

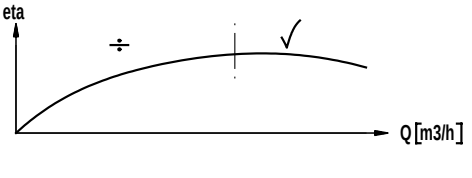

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Fig. 5 Best efficiency

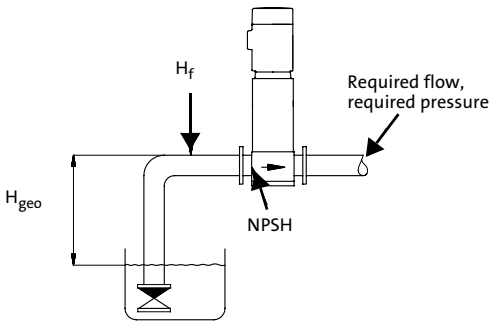

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Fig. 6 Dimensional data

Normally, 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 QH 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.

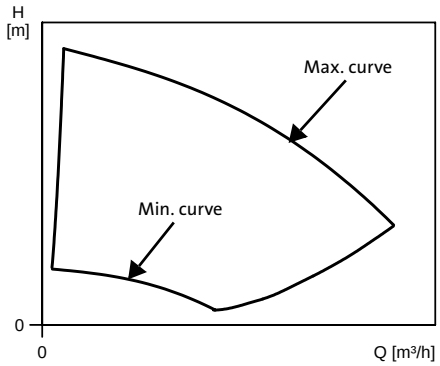

Fig. 7 Min. and max. performance curves

In situations where it is not possible to select a duty point close to the 100% curve the below affinity equations 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 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.

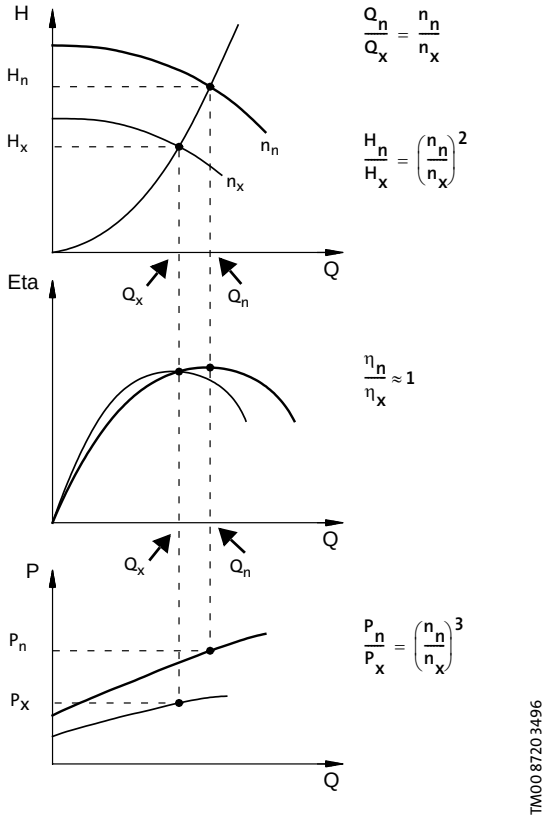

Fig. 8 Affinity equations

Legend

H_n	Rated head in metres
H_x	Current head in metres
Q_n	Rated flow in m^3/h
Q_x	Current flow in m^3/h
n_n	Rated motor speed in min^{-1} (n_n = 2900 min^{-1})
n_x	Current motor speed in min^{-1}
η_n	Rated efficiency in %
η_x	Current efficiency in %

WinCAPS and WebCAPS

WinCAPS and WebCAPS are both selection programmes offered by Grundfos.

The two programmes make it possible to calculate an E-pump's specific duty point and energy consumption.

By entering the dimensional data of the pump, WinCAPS and WebCAPS can calculate the exact duty point and energy comsumption. For further information see page 30 and page 31.

3. Material

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

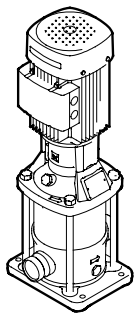

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Fig. 9 CRT pump

4. Pump connection

Selection of pump connection depends on the rated pressure and pipework. To meet any requirement the CRT(E) pumps offer a wide range of flexible connections such as:

- DIN flange - on request
- PJE coupling

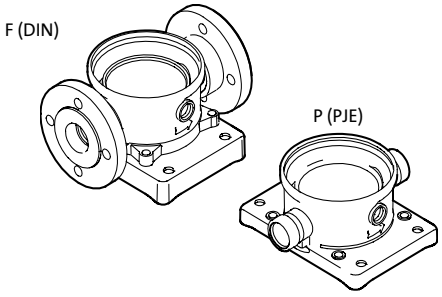

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Fig. 10 Pump connections

5. Shaft seal

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

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 and
- maximum pressure.

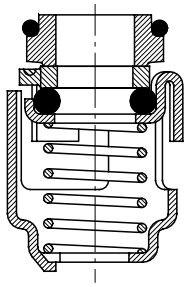

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Fig. 11 Shaft seal

Inlet pressure and operating pressure

The limit values stated on page 7 must **not** be exceeded as regards ...

- maximum inlet pressure and
- maximum operating pressure.

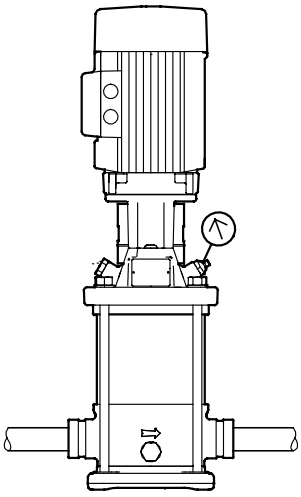

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Fig. 12 Inlet and operating pressure

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 suction side of the pump. The maximum suction lift "H" in metres head can be calculated as follows:

$H = p_b \times 10.2 - NPSH - H_f - H_v - H_s$

p_b = Barometric pressure in bar.
(Barometric pressure can be set to 1 bar).
In closed systems, p_b indicates the system pressure in bar.

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

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

H_v = Vapour pressure in metres head.
(To be read from the vapour pressure scale.
"H_v" depends on the liquid temperature "T_m").

H_s = Safety margin = minimum 0.5 metres head.

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

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

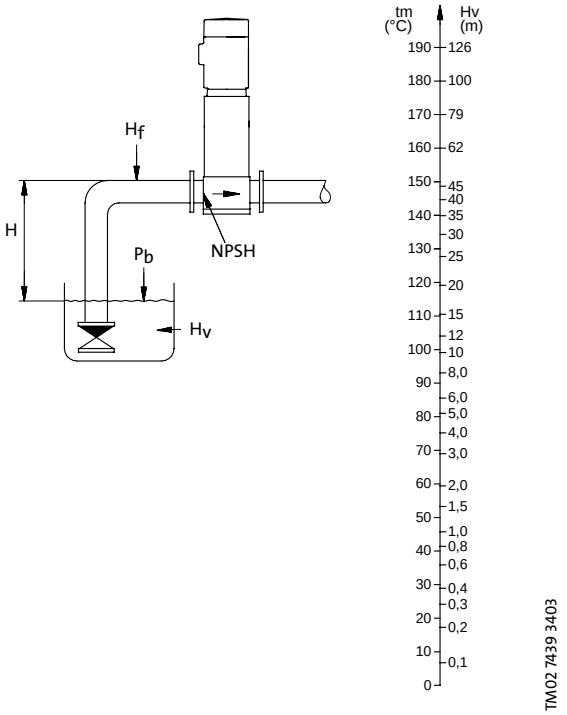
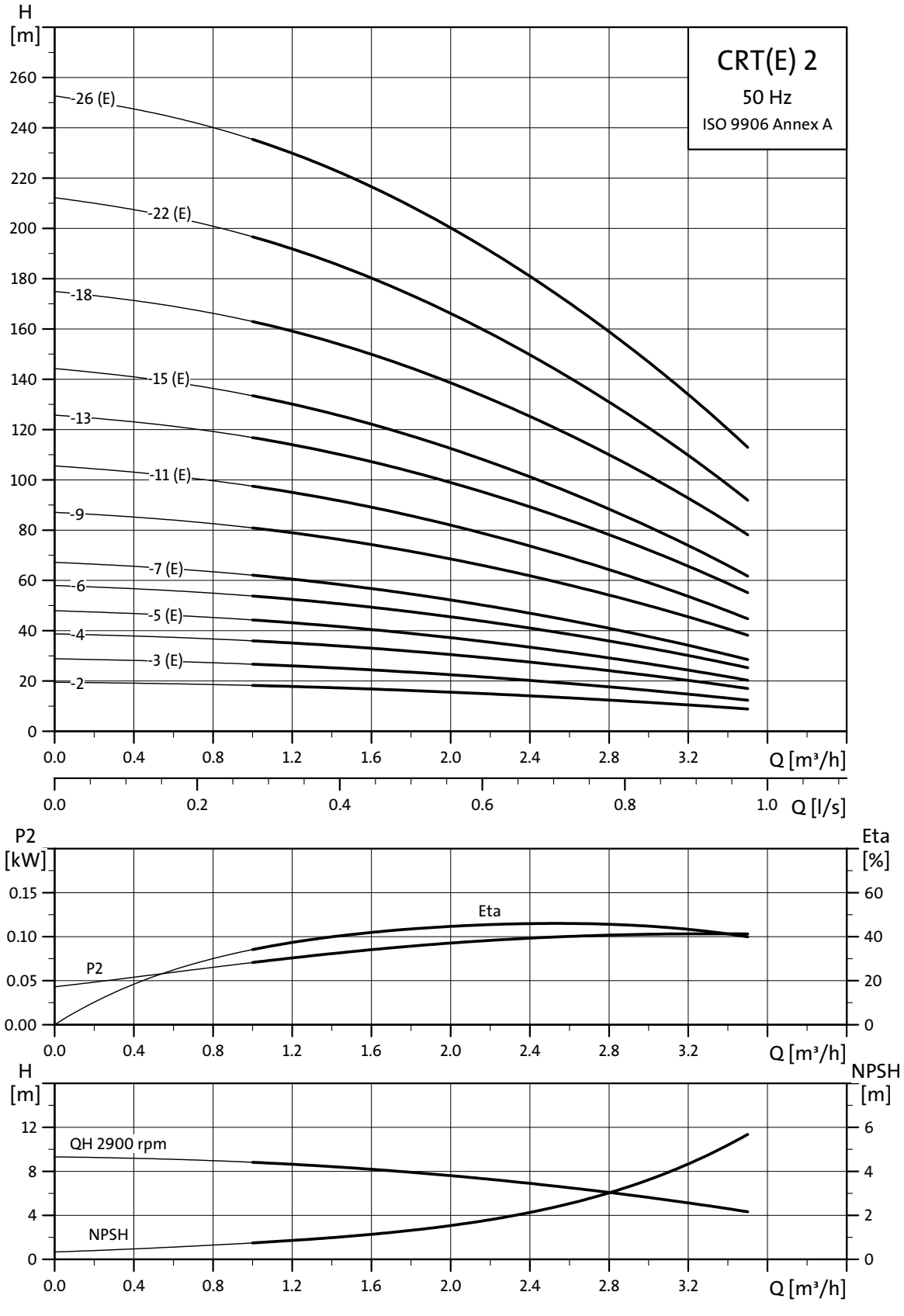


Fig. 13 Minimum inlet pressure - NPSH

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

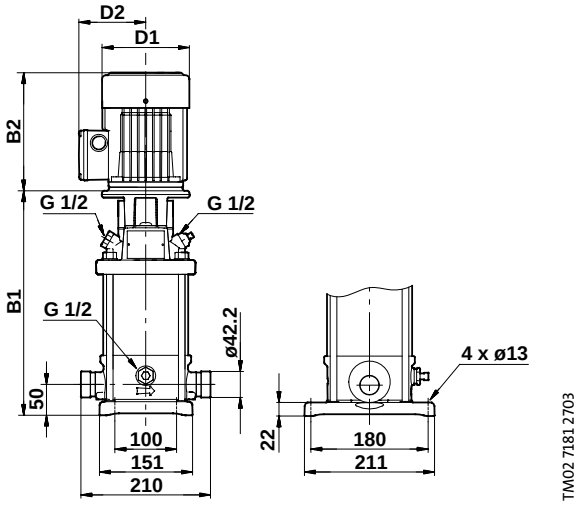
Always check the NPSH value of the pump at the highest possible flow.

Performance curves



Technical data

Dimensional sketches



Dimensions and weights

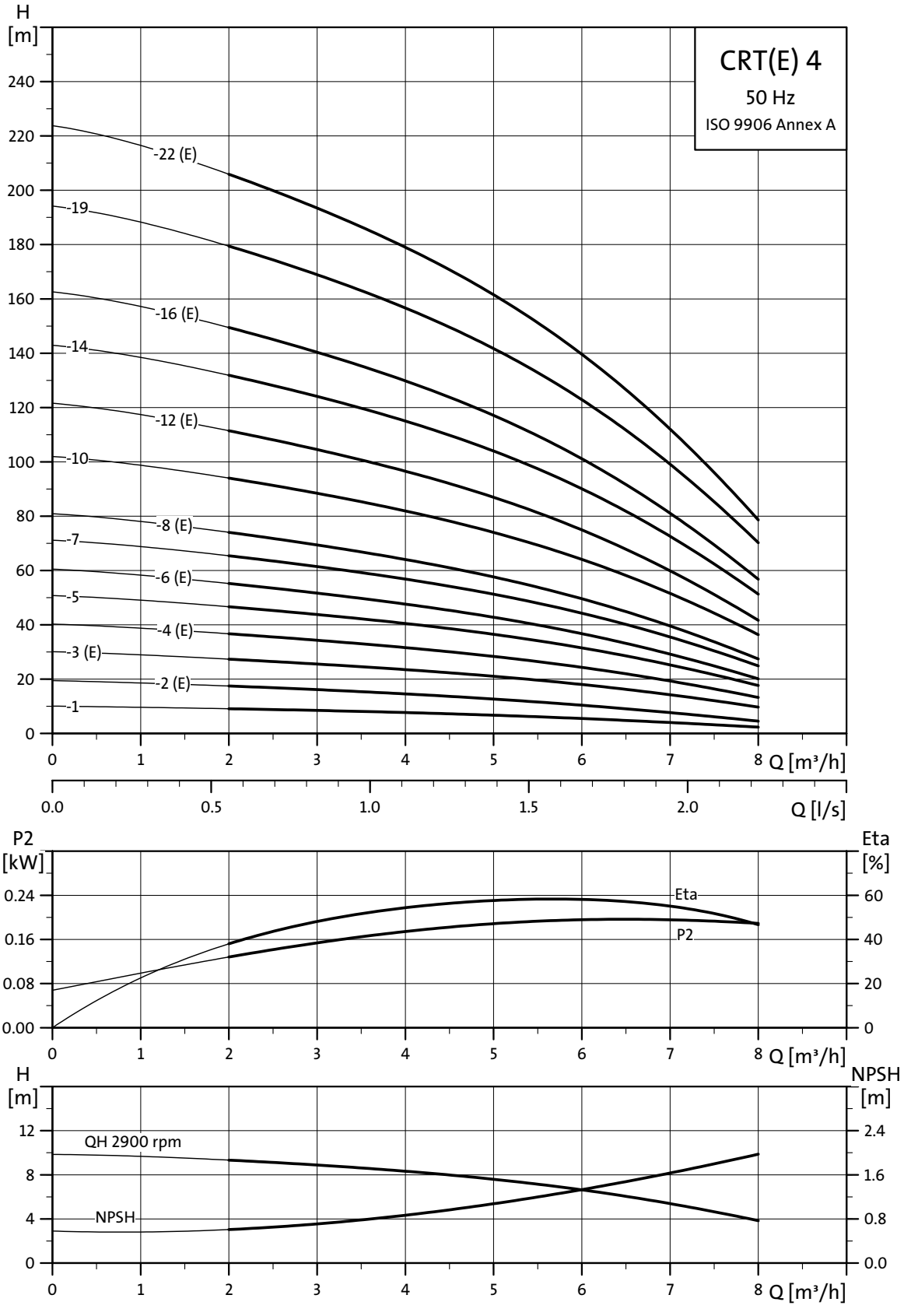
Pump type	CRT Dimensions [mm]				Net weight [kg]	CRTE Dimensions [mm]				Net weight [kg]
	B1	B1+B2	D1	D2		B1	B1+B2	D1	D2	
CRT 2-2	254	444	140	110	14	-	-	-	-	-
CRT(E) 2-3	254	444	140	110	15	254	445	141	140	18.3
CRT 2-4	290	480	140	110	15	-	-	-	-	-
CRT(E) 2-5	290	480	140	110	16	290	481	141	140	18.6
CRT 2-6	326	556	140	110	17	-	-	-	-	-
CRT(E) 2-7	326	556	140	110	18	326	607	178	167	30.1
CRT 2-9	404	634	140	110	20	-	-	-	-	-
CRT(E) 2-11	404	634	140	110	21	404	685	178	167	27.0
CRT 2-13	476	756	180	110	28	-	-	-	-	-
CRT(E) 2-15	476	756	180	110	29	476	757	178	167	37.5
CRT 2-18	546	826	180	110	32	-	-	-	-	-
CRT(E) 2-22	618	898	180	110	34	618	939	178	167	44.5
CRT(E) 2-26	690	1025	198	120	42	690	1025	198	177	51.0

Electrical data

3 x 380-415 V, 50 Hz

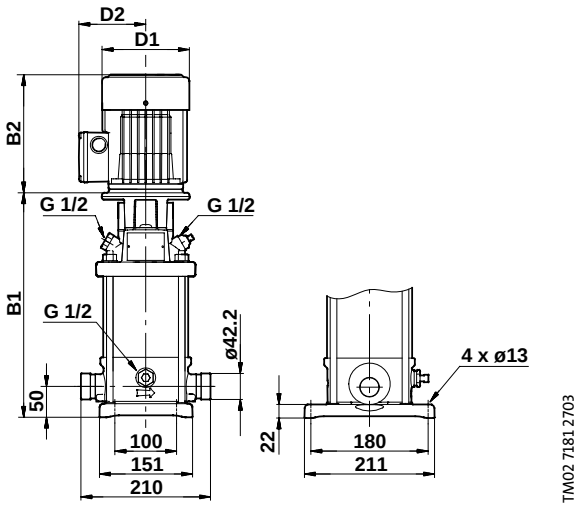
Pump type	Motor [kW]	CRT Full load current $I_{1/1}$ [A]	Power factor Cos $\varphi_{1/1}$	Motor efficiency η [%]	$\frac{I_{start}}{I_{1/1}}$	CRTE Full load current $I_{1/1}$ [A]
CRT 2-2	0.37	0.96	0.84-0.76	72	4.8-5.2	-
CRT(E) 2-3	0.37	0.96	0.84-0.76	72	4.8-5.2	2.70-2.50
CRT 2-4	0.55	1.44	0.84-0.76	72	4.8-5.2	-
CRT(E) 2-5	0.55	1.44	0.84-0.76	72	4.8-5.2	3.90-3.60
CRT 2-6	0.75	1.86	0.86-0.78	74	5.0-5.5	-
CRT(E) 2-7	0.75	1.86	0.86-0.78	74	5.0-5.5	2.0-1.8
CRT 2-9	1.1	2.65	0.87-0.79	76	5.2-5.7	-
CRT(E) 2-11	1.1	2.65	0.87-0.79	76	5.2-5.7	2.6-2.3
CRT 2-13	1.5	3.40	0.85-0.79	82	6.3-6.9	-
CRT(E) 2-15	1.5	3.40	0.85-0.79	82	6.3-6.9	3.3-2.7
CRT 2-18	2.2	4.75	0.87-0.82	84	7.0-7.6	-
CRT(E) 2-22	2.2	4.75	0.87-0.82	84	7.0-7.6	4.6-3.8
CRT(E) 2-26	3.0	6.95/6.95	0.79-0.69	85-85	5.8-6.3	6.4-5.2

Performance curves



Technical data

Dimensional sketches



Dimensions and weights

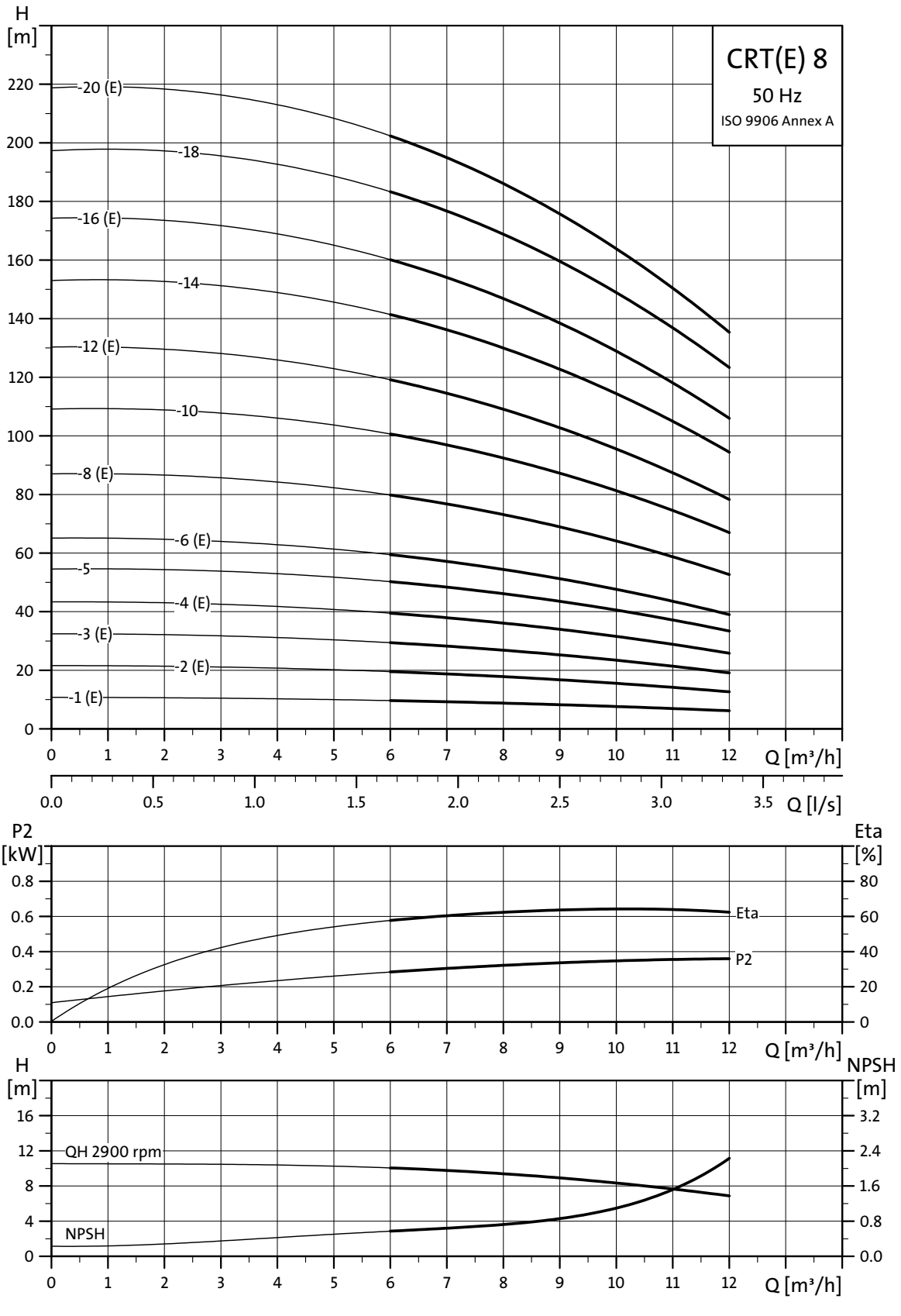
Pump type	CRT Dimensions [mm]				Net weight [kg]	CRTE Dimensions [mm]				Net weight [kg]
	B1	B1+B2	D1	D2		B1	B1+B2	D1	D2	
CRT 4-1	256	446	140	110	14	-	-	-	-	-
CRT(E) 4-2	256	446	140	110	14	256	447	141	140	17.3
CRT(E) 4-3	310	500	140	110	15	310	501	141	140	17.6
CRT(E) 4-4	310	540	140	110	17	310	591	178	167	29.1
CRT 4-5	368	598	140	110	19	-	-	-	-	-
CRT(E) 4-6	368	598	140	110	20	368	649	178	167	26.0
CRT 4-7	422	702	180	110	27	-	-	-	-	-
CRT(E) 4-8	422	702	180	110	27	422	703	178	167	35.5
CRT 4-10	546	826	180	110	30	-	-	-	-	-
CRT(E) 4-12	546	826	180	110	31	546	867	178	167	41.5
CRT 4-14	654	989	198	120	38	-	-	-	-	-
CRT(E) 4-16	654	989	198	120	38	654	989	198	177	47.0
CRT 4-19	739	1111	180	135	49	-	-	-	-	-
CRT(E) 4-22	820	1192	180	135	51	627	999	220	188	62.3

Electrical data

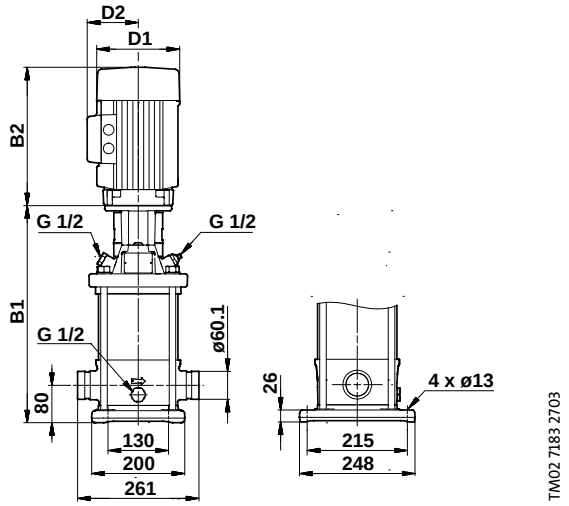
3 x 380-415 V, 50 Hz

Pump type	Motor [kW]	CRT Full load current $I_{1/1}$ [A]	Power factor Cos $\varphi_{1/1}$	Motor efficiency η [%]	$\frac{I_{start}}{I_{1/1}}$	CRTE Full load current $I_{1/1}$ [A]
CRT 4-1	0.37	0.96	0.84-0.76	72	4.8-5.2	-
CRT(E) 4-2	0.37	0.96	0.84-0.76	72	4.8-5.2	2.70-2.50
CRT(E) 4-3	0.55	1.44	0.84-0.76	72	4.8-5.2	3.90-3.60
CRT(E) 4-4	0.75	1.86	0.86-0.78	74	5.0-5.5	2.0-1.8
CRT 4-5	1.1	2.65	0.87-0.79	76	5.2-5.7	-
CRT(E) 4-6	1.1	2.65	0.87-0.79	76	5.2-5.7	2.6-2.3
CRT 4-7	1.5	3.40	0.85-0.79	82	6.3-6.9	-
CRT(E) 4-8	1.5	3.40	0.85-0.79	82	6.3-6.9	3.3-2.7
CRT 4-10	2.2	4.75	0.87-0.82	84	7.0-7.6	-
CRT(E) 4-12	2.2	4.75	0.87-0.82	84	7.0-7.6	4.6-3.8
CRT 4-14	3.0	6.95/6.95	0.79-0.69	85-85	5.8-6.3	-
CRT(E) 4-16	3.0	6.95/6.95	0.79-0.69	85-85	5.8-6.3	6.4-5.2
CRT 4-19	4.0	8.00	0.90-0.87	87	8.7-9.5	-
CRT(E) 4-22	4.0	8.00	0.90-0.87	87	8.7-9.5	8.1-6.6

Performance curves



Dimensional sketches



Dimensions and weight

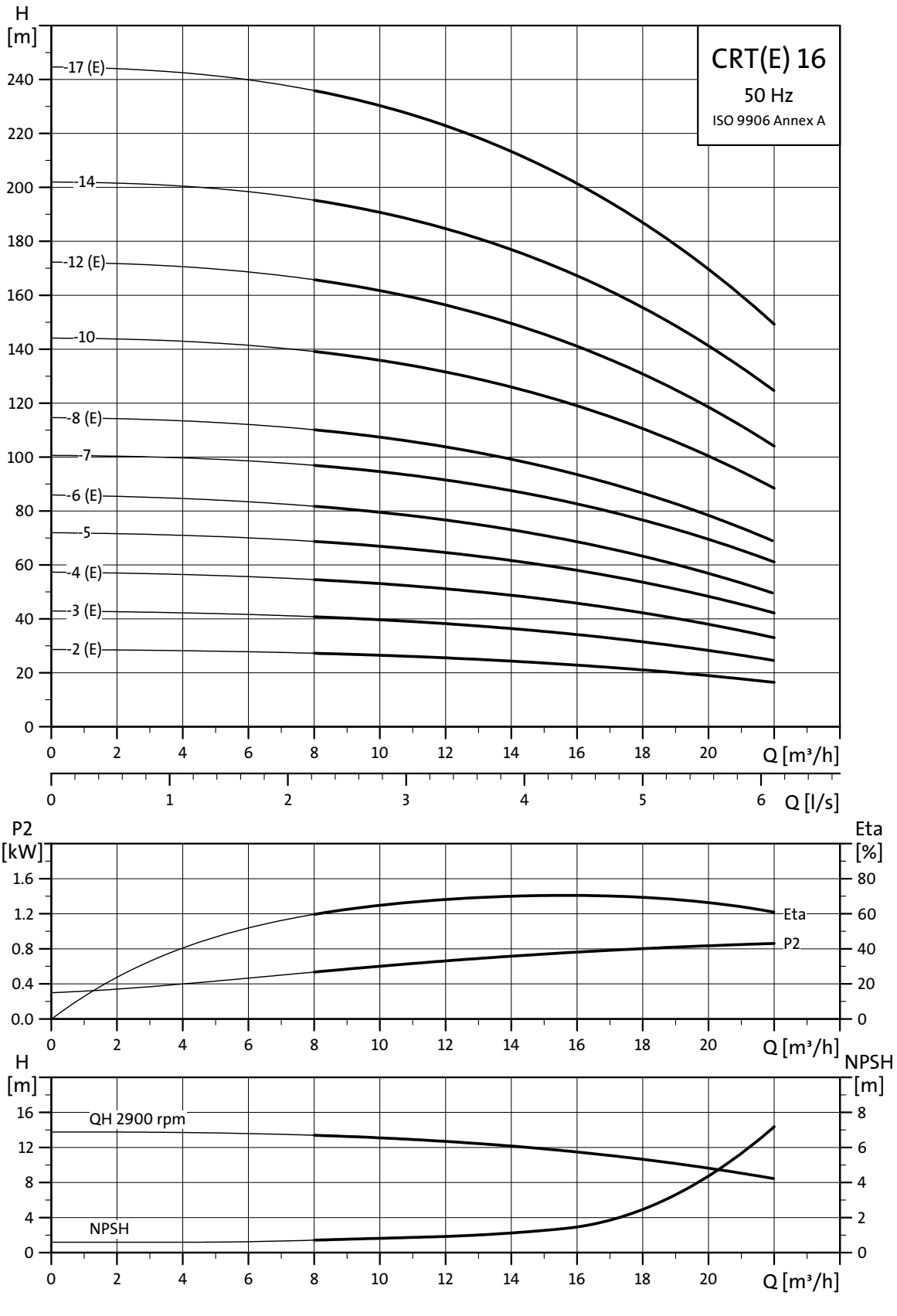
Pump type	CRT Dimensions [mm]					CRT Net weight [kg]	CRTE Dimensions [mm]					CRTE Net weight [kg]
	B1	B1 + B2	D1	D2	D3		B1	B1 + B2	D1	D2	D3	
CRT(E) 8-1	357	548	140	110	-	24	357	548	141	140	-	27.3
CRT(E) 8-2	357	588	140	110	-	25	357	638	178	167	-	37.1
CRT(E) 8-3	387	618	140	110	-	27	387	668	178	167	-	33.0
CRT(E) 8-4	387	668	180	110	-	33	387	668	178	167	-	41.5
CRT 8-5	493	774	180	110	-	36	-	-	-	-	-	-
CRT(E) 8-6	493	774	180	110	-	36	493	814	178	167	-	46.5
CRT(E) 8-8	618	953	198	120	-	42	618	953	198	177	-	51.0
CRT 8-10	618	990	180	135	-	53	-	-	-	-	-	-
CRT(E) 8-12	830	1202	180	135	-	54	830	1202	220	188	-	65.3
CRT 8-14	830	1221	220	135	300	62	-	-	-	-	-	-
CRT(E) 8-16	890	1281	220	135	300	62	890	1281	220	188	298	74.9
CRT(E) 8-18	890	1281	220	135	300	66	890	1281	220	188	298	89.0
CRT(E) 8-20	950	1414	220	135	300	99	950	1341	220	188	298	110.7

Electrical data

3 x 380-415 V, 50 Hz

Pump type	Motor [kW]	CRT Full load current $I_{1/1}$ [A]	CRT Power factor Cos $\varphi_{1/1}$	CRT Motor efficiency η [%]	CRT $\frac{I_{start}}{I_{1/1}}$	CRTE Full load current $I_{1/1}$ [A]
CRT(E) 8-1	0.37	0.96	0.84-0.76	72	4.8-5.2	2.70-2.50
CRT(E) 8-2	0.75	1.86	0.86-0.78	74	5.0-5.5	2.0-1.8
CRT(E) 8-3	1.1	2.65	0.87-0.79	76	5.2-5.7	2.6-2.3
CRT(E) 8-4	1.5	3.40	0.85-0.79	82	6.3-6.9	3.3-2.7
CRT 8-5	2.2	4.75	0.87-0.82	84	7.0-7.6	-
CRT(E) 8-6	2.2	4.75	0.87-0.82	84	7.0-7.6	4.6-3.8
CRT(E) 8-8	3.0	6.95/6.95	0.79-0.69	85-85	5.8-6.3	6.4-5.2
CRT 8-10	4.0	8.00	0.90-0.87	87	8.7-9.5	-
CRT(E) 8-12	4.0	8.00	0.90-0.87	87	8.7-9.5	8.1-6.6
CRT 8-14	5.5	11.0	0.89-0.86	88.5	8.9-9.7	-
CRT(E) 8-16	5.5	11.0	0.89-0.86	88.5	8.9-9.7	11.0-8.8
CRT(E) 8-18	7.5	15.2	0.87-0.81	89	9.1-9.9	-
CRT(E) 8-20	11.0	21.5	0.91-0.87	85	7.3-8.0	21.3

Performance curves



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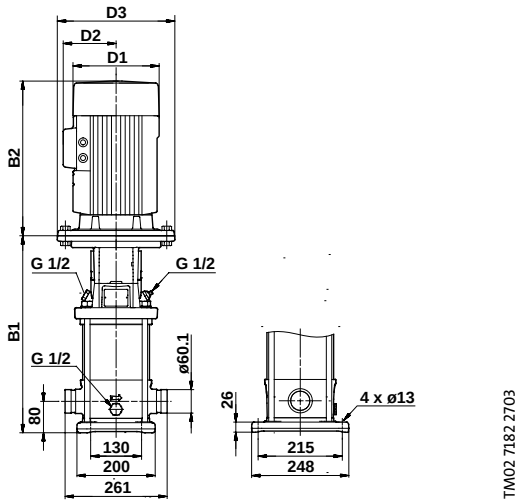
Dimensional sketches



Dimensions and weight

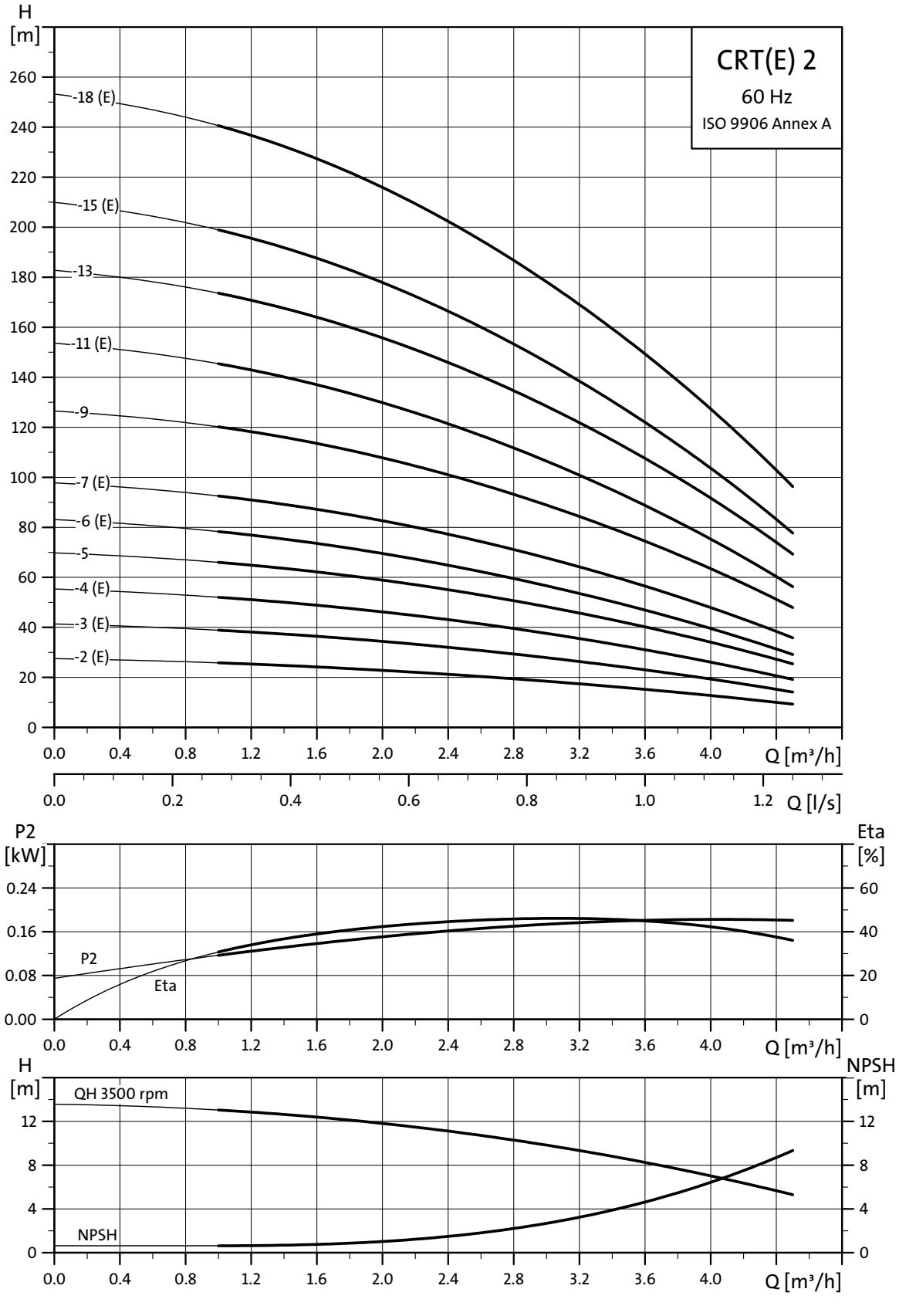
Pump type	CRT Dimensions [mm]					CRT Net weight [kg]	CRTE Dimensions [mm]					CRTE Net weight [kg]
	B1	B1 + B2	D1	D2	D3		B1	B1 + B2	D1	D2	D3	
CRT(E) 16-2	463	744	180	110	-	37	463	784	178	167	-	47.5
CRT(E) 16-3	463	798	198	120	-	40	463	798	198	177	-	49.0
CRT(E) 16-4	585	957	180	135	-	52	585	957	220	188	-	63.3
CRT 16-5	585	976	220	135	300	60	-	-	-	-	-	-
CRT(E) 16-6	675	1066	220	135	300	61	675	1066	220	188	298	73.9
CRT 16-7	675	1066	220	135	300	64	-	-	-	-	-	-
CRT(E) 16-8	887	1278	220	135	300	65	887	1278	220	188	298	76.7
CRT 16-10	887	1351	260	170	350	97	-	-	-	-	-	-
CRT(E) 16-12	1067	1531	260	170	350	98	1067	1516	258	359	350	150.0
CRT(E) 16-14	1067	1545	325	250	350	103	1067	1528	313	377	350	-
CRT(E) 16-17	1202	1680	325	250	350	115	1202	1701	313	377	350	150.5

Electrical data

3 x 380-415 V, 50 Hz

Pump type	Motor [kW]	CRT Full load current $I_{1/1}$ [A]	CRT Power factor Cos $\varphi_{1/1}$	CRT Motor efficiency η [%]	CRT $\frac{I_{start}}{I_{1/1}}$	CRTE Full load current $I_{1/1}$ [A]
CRT(E) 16-2	2.2	4.75	0.87-0.82	84	7.0-7.6	4.6-3.8
CRT(E) 16-3	3.0	6.95/6.95	0.79-0.69	85-85	5.8-6.3	6.4-5.2
CRT(E) 16-4	4.0	8.00	0.90-0.87	87	8.7-9.5	8.1-6.6
CRT 16-5	5.5	11.0	0.89-0.86	88.5	8.9-9.7	-
CRT(E) 16-6	5.5	11.0	0.89-0.86	88.5	8.9-9.7	11.0-8.8
CRT 16-7	7.5	15.2	0.87-0.81	89	9.1-9.9	-
CRT(E) 16-8	7.5	15.2	0.87-0.81	89	9.1-9.9	15.0-12.0
CRT 16-10	11.0	21.5	0.91-0.87	85	7.3-8.0	-
CRT(E) 16-12	11.0	21.5	0.91-0.87	85	7.3-8.0	21.3
CRT(E) 16-14	15.0	28.7	0.87	90.0	6.0	28.1
CRT(E) 16-17	18.5	35.9-34.1	0.86	91.0	7.2	34.2

Performance curves



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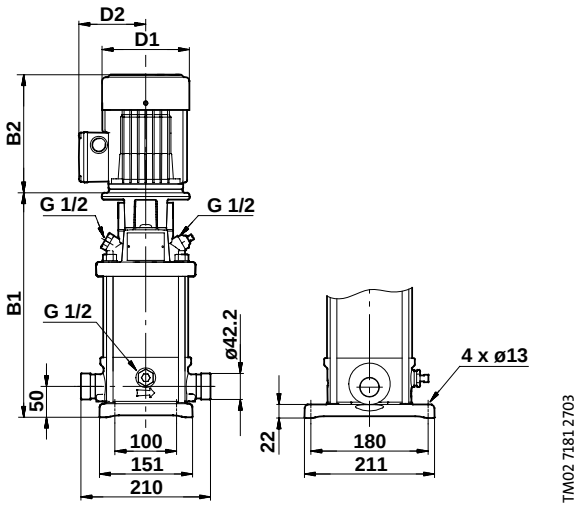
Technical data

Dimensional sketches



Dimensions and weight

Pump type	CRT Dimensions [mm]				CRT Net weight [kg]	CRTE Dimensions [mm]				CRTE Net weight [kg]
	B1	B1+B2	D1	D2		B1	B1+B2	D1	D2	
CRT(E) 2-2	254	444	140	110	14	254	445	141	140	17.3
CRT(E) 2-3	254	444	140	110	15	254	445	141	140	17.6
CRT(E) 2-4	290	520	140	110	17	290	571	178	167	29.1
CRT 2-5	290	520	140	110	18	-	-	-	-	-
CRT(E) 2-6	326	556	140	110	19	326	607	178	167	25.0
CRT(E) 2-7	326	606	180	110	25	326	607	178	167	33.5
CRT 2-9	404	684	180	110	28	-	-	-	-	-
CRT(E) 2-11	404	684	180	110	29	404	725	178	167	39.5
CRT 2-13	476	811	198	120	35	-	-	-	-	-
CRT(E) 2-15	476	811	198	120	36	476	811	198	177	45.0
CRT(E) 2-18	546	916	180	135	46	546	918	220	188	57.3

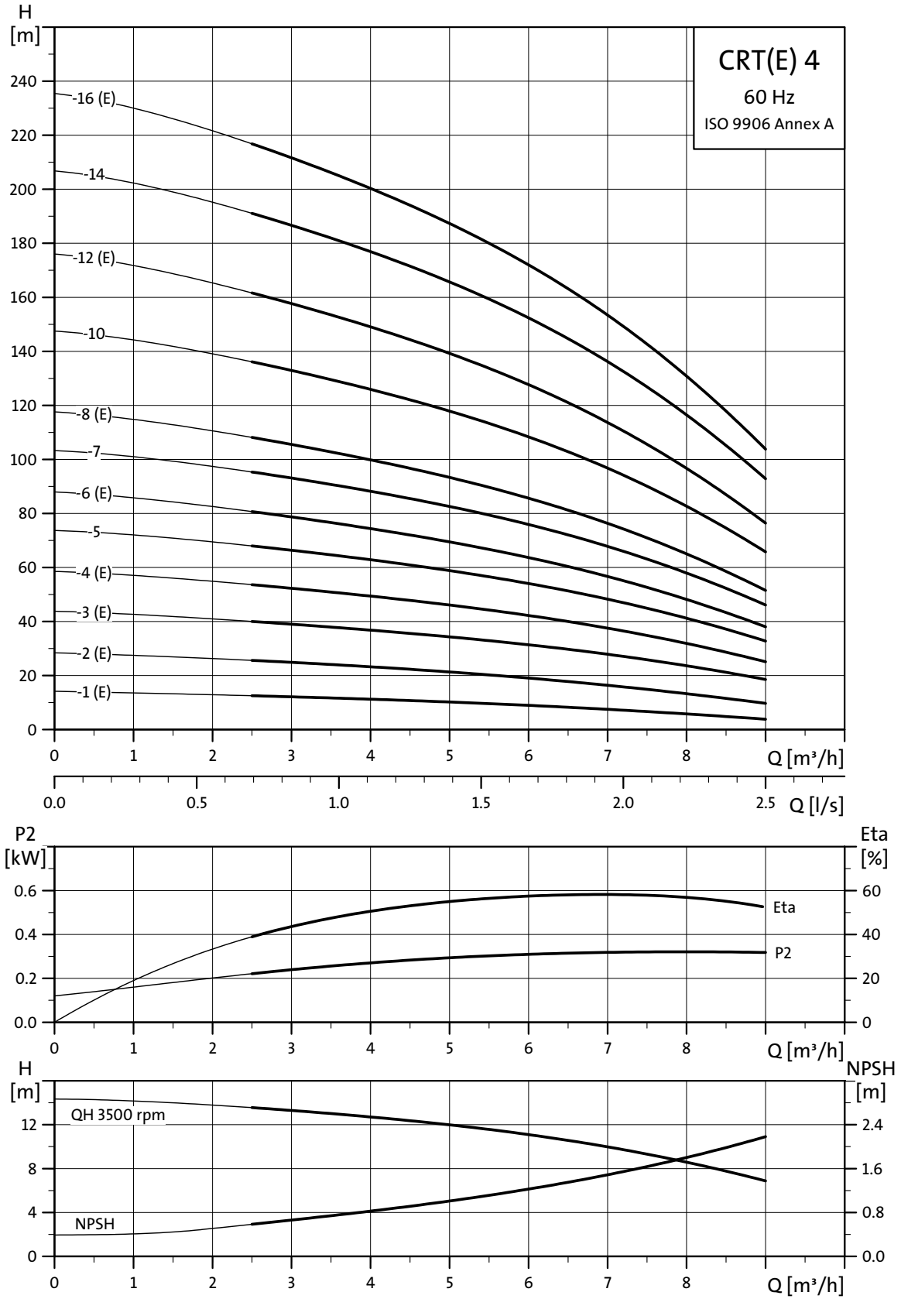
Electrical data 3 x 220-255 V/380-440 V, 60 Hz

Pump type	Motor [kW]	CRT Full load current $I_{1/1}$ [A]	CRT Power factor Cos $\varphi_{1/1}$	CRT Motor efficiency η [%]	CRT $\frac{I_{start}}{I_{1/1}}$	CRTE Full load current $I_{1/1}$ [A]
CRT(E) 2-2	0.37	1.58-1.46/0.91-0.84	0.88-0.82	72.0-73.0	4.80-6.00	3.0-2.5
CRT(E) 2-3	0.55	2.40-2.18/1.38-1.26	0.88-0.82	71.0-72.0	4.80-6.00	4.3-3.6
CRT(E) 2-4	0.75	3.15-2.85/1.82-1.64	0.89-0.84	73.0-74.0	5.10-6.50	5.1-4.7
CRT 2-5	1.1	4.50-4.00/2.60-2.32	0.89-0.84	76.0-77.0	5.10-6.50	-
CRT(E) 2-6	1.1	4.50-4.00/2.60-2.32	0.89-0.84	76.0-77.0	5.10-6.50	7.4-6.8

Electrical data 3 x 220-277 V/380-480 V, 60 Hz

Pump type	Motor [kW]	CRT Full load current $I_{1/1}$ [A]	CRT Power factor Cos $\varphi_{1/1}$	CRT Motor efficiency η [%]	CRT $\frac{I_{start}}{I_{1/1}}$	CRTE Full load current $I_{1/1}$ [A]
CRT(E) 2-7	1.5	5.70-5.00/3.30-2.90	0.89-0.78	80.5-82.0	5.90-8.40	3.3-2.7
CRT 2-9	2.2	8.05-6.95/4.65-4.00	0.90-0.81	83.0-84.5	6.50-9.50	-
CRT(E) 2-11	2.2	8.05-6.95/4.65-4.00	0.90-0.81	83.0-84.5	6.50-9.50	4.6-3.8
CRT 2-13	3.0	6.20/6.60	0.89-0.70	85.0-85.0	5.60-6.60	-
CRT(E) 2-15	3.0	6.20/6.60	0.89-0.70	85.0-85.0	5.60-6.60	6.4-5.2
CRT(E) 2-18	4.0	13.6-11.4/7.85-6.60	0.92-0.85	87.0-88.0	8.00-12.0	8.1-6.6

Performance curves



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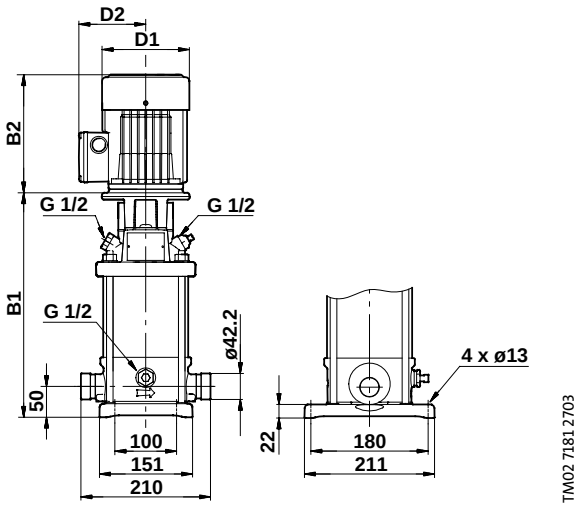
Technical data

Dimensional sketches



Dimensions and weight

Pump type	CRT						CRTE					
	Dimensions [mm]					Net weight [kg]	Dimensions [mm]					Net weight [kg]
	B1	B1+B2	D1	D2	D3		B1	B1+B2	D1	D2	D3	
CRT(E) 4-1	256	446	140	110	-	14	256	447	141	140	-	17.3
CRT(E) 4-2	256	486	140	110	-	16	256	537	178	167	-	28.1
CRT(E) 4-3	310	540	140	110	-	18	310	591	178	167	-	24.0
CRT(E) 4-4	310	590	180	110	-	25	310	591	178	167	-	33.5
CRT 4-5	368	648	180	110	-	27	-	-	-	-	-	-
CRT(E) 4-6	368	648	180	110	-	28	368	689	178	167	-	38.5
CRT 4-7	422	757	198	120	-	34	-	-	-	-	-	-
CRT(E) 4-8	422	757	198	120	-	34	422	757	198	177	-	43.0
CRT 4-10	546	916	180	135	-	44	-	-	-	-	-	-
CRT(E) 4-12	546	916	135	125	-	45	546	918	220	188	-	56.3
CRT 4-14	654	1044	220	135	300	57	-	-	-	-	-	-
CRT(E) 4-16	654	1044	220	135	300	58	654	1045	220	188	298	66.5

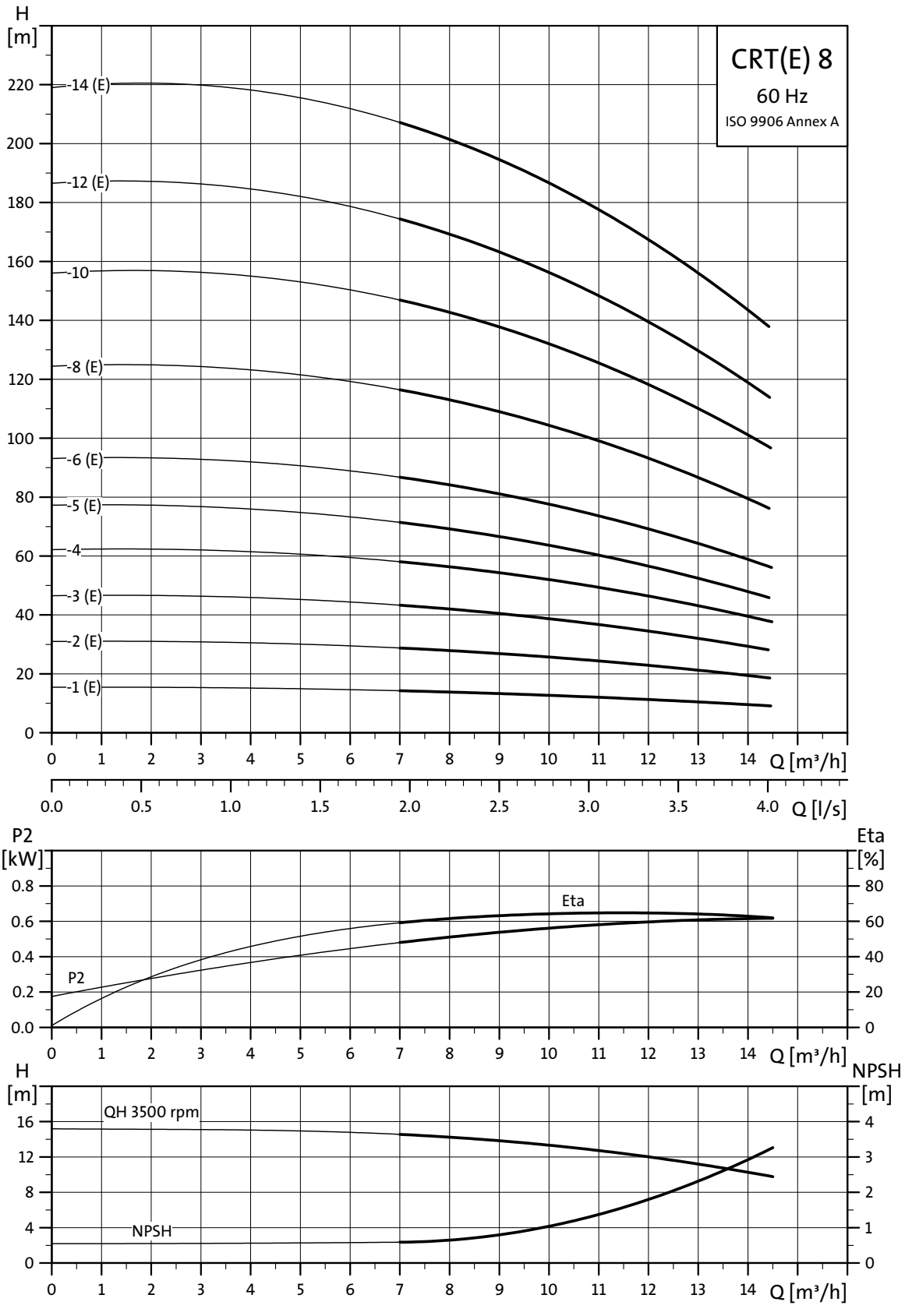
Electrical data 3 x 220-255 V/380-440 V, 60 Hz

Pump type	Motor [kW]	CRT				CRTE
		Full load current $I_{1/1}$ [A]	Power factor Cos $\varphi_{1/1}$	Motor efficiency η [%]	$\frac{I_{start}}{I_{1/1}}$	Full load current $I_{1/1}$ [A]
CRT(E) 4-1	0.37	1.58-1.46/0.91-0.84	0.88-0.82	72.0-73.0	4.80-6.00	3.0-2.5
CRT(E) 4-2	0.75	3.15-2.85/1.82-1.64	0.89-0.84	73.0-74.0	5.10-6.50	4.3-3.6
CRT(E) 4-3	1.1	4.50-4.00/2.60-2.32	0.89-0.84	76.0-77.0	5.10-6.50	5.1-4.7

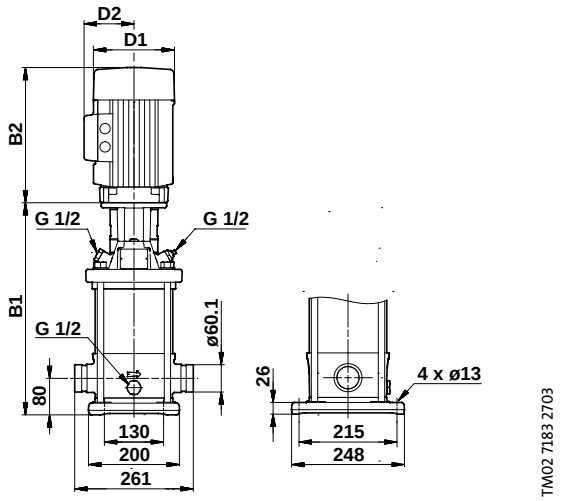
Electrical data 3 x 220-277 V/380-480 V, 60 Hz

Pump type	Motor [kW]	CRT				CRTE
		Full load current $I_{1/1}$ [A]	Power factor Cos $\varphi_{1/1}$	Motor efficiency η [%]	$\frac{I_{start}}{I_{1/1}}$	Full load current $I_{1/1}$ [A]
CRT(E) 4-4	1.5	5.70-5.00/3.30-2.90	0.89-0.78	80.5-82.0	5.90-8.40	3.3-2.7
CRT 4-5	2.2	8.05-6.95/4.65-4.00	0.90-0.81	83.0-84.5	6.50-9.50	-
CRT(E) 4-6	2.2	8.05-6.95/4.65-4.00	0.90-0.81	83.0-84.5	6.50-9.50	4.6-3.8
CRT 4-7	3.0	6.20/6.60	0.89-0.70	85.0-85.0	5.60-6.60	-
CRT(E) 4-8	3.0	6.20/6.60	0.89-0.70	85.0-85.0	5.60-6.60	6.4-5.2
CRT 4-10	4.0	13.6-11.4/7.85-6.60	0.92-0.85	87.0-88.0	8.00-12.0	-
CRT(E) 4-12	4.0	13.6-11.4/7.85-6.60	0.92-0.85	87.0-88.0	8.00-12.0	8.1-6.6
CRT 4-14	5.5	18.8-15.6/10.8-9.00	0.92-0.85	87.5-89.5	8.20-12.4	-
CRT(E) 4-16	5.5	18.8-15.6/10.8-9.00	0.92-0.85	87.5-89.5	8.20-12.4	11.0-8.8

Performance curves



Dimensional sketches



Dimensions and weight

Pump type	CRT Dimensions [mm]					CRT Net weight [kg]	CRTE Dimensions [mm]					CRTE Net weight [kg]
	B1	B1 + B2	D1	D2	D3		B1	B1 + B2	D1	D2	D3	
CRT(E) 8-1	357	588	140	110	-	25	357	638	178	167	-	37.1
CRT(E) 8-2	357	638	180	110	-	33	357	638	178	167	-	41.5
CRT(E) 8-3	387	668	180	110	-	35	387	708	178	167	-	45.5
CRT 8-4	387	722	198	120	-	40	-	-	-	-	-	-
CRT(E) 8-5	493	828	198	120	-	41	493	828	198	177	-	50.0
CRT(E) 8-6	493	865	180	135	-	52	493	865	220	188	-	63.3
CRT(E) 8-8	618	1009	220	135	300	61	618	1009	220	188	298	73.9
CRT 8-10	618	1009	220	135	300	65	-	-	-	-	-	-
CRT(E) 8-12	830	1221	220	135	300	65	830	1221	220	188	298	76.7
CRT(E) 8-14	830	1294	260	170	350	97	830	1268	258	344	350	149.0

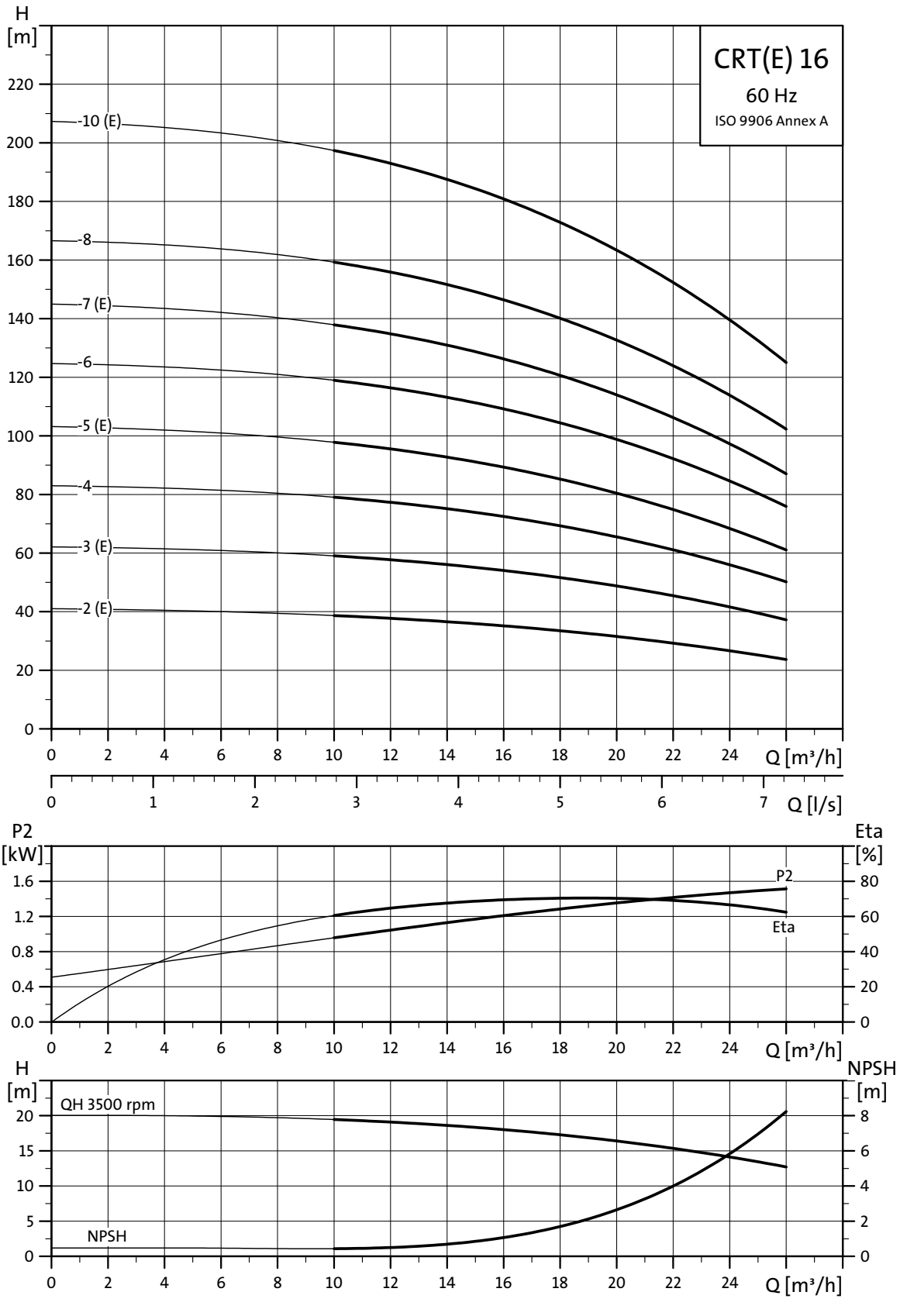
Electrical data 3 x 220-255 V/380-440 V, 60 Hz

Pump type	Motor [kW]	CRT Full load current $I_{1/1}$ [A]	CRT Power factor Cos $\varphi_{1/1}$	CRT Motor efficiency η [%]	CRT $\frac{I_{start}}{I_{1/1}}$	CRTE Full load current $I_{1/1}$ [A]
CRT(E) 8-1	0.75	3.15-2.85/1.82-1.64	0.89-0.84	73.0-74.0	5.10-6.50	5.1-4.7

Electrical data 3 x 220-277 V/380-480 V, 60 Hz

Pump type	Motor [kW]	CRT Full load current $I_{1/1}$ [A]	CRT Power factor Cos $\varphi_{1/1}$	CRT Motor efficiency η [%]	CRT $\frac{I_{start}}{I_{1/1}}$	CRTE Full load current $I_{1/1}$ [A]
CRT(E) 8-2	1.5	5.70-5.00/3.30-2.90	0.89-0.78	80.5-82.0	5.90-8.40	3.3-2.7
CRT(E) 8-3	2.2	8.05-6.95/4.65-4.00	0.90-0.81	83.0-84.5	6.50-9.50	4.6-3.8
CRT 8-4	3.0	6.20/6.60	0.89-0.70	85.0-85.0	5.60-6.60	-
CRT(E) 8-5	3.0	6.20/6.60	0.89-0.70	85.0-85.0	5.60-6.60	6.4-5.2
CRT(E) 8-6	4.0	13.6-11.4/7.85-6.60	0.92-0.85	87.0-88.0	8.00-12.0	8.1-6.6
CRT(E) 8-8	5.5	18.8-15.6/10.8-9.00	0.92-0.85	87.5-89.5	8.20-12.4	11.0-8.8
CRT 8-10	7.5	25.5-22.6/14.6-13.0	0.92-0.80	88.5-90.0	9.50-11.6	-
CRT(E) 8-12	7.5	25.5-22.6/14.6-13.0	0.92-0.80	88.5-90.0	9.50-11.6	15.0-12.0
CRT(E) 8-14	11	38.0-32.5/22.0-18.8	0.92-0.86	83.0-86.0	6.80-8.60	21.3

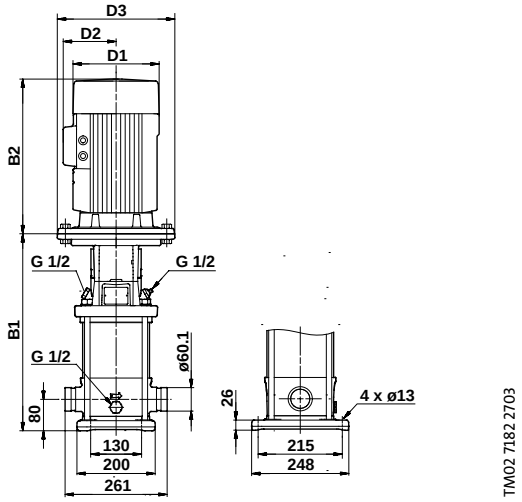
Performance curves



TM01 4877 1203

Technical data

Dimensional sketches



Dimensions and weight

Pump type	CRT						CRTE					
	Dimensions [mm]					Net weight [kg]	Dimensions [mm]					Net weight [kg]
	B1	B1 + B2	D1	D2	D3		B1	B1 + B2	D1	D2	D3	
CRT(E) 16-2	463	798	198	120	-	40	463	798	198	177	-	49.0
CRT(E) 16-3	463	854	220	135	300	60	463	854	220	188	298	72.9
CRT 16-4	585	976	220	135	300+	64	-	-	-	-	-	-
CRT(E) 16-5	585	976	220	135	300	64	585	976	220	188	298	75.7
CRT 16-6	675	1139	260	170	350	96	-	-	-	-	-	-
CRT(E) 16-7	675	1139	260	170	350	96	675	1124	258	359	350	148.0
CRT 16-8	887	1365	325	250	350	101	-	-	-	-	-	-
CRT(E) 16-10	887	1365	325	250	350	101	887	1348	313	377	350	136.5

Electrical data

3 x 220-277 V/380-480 V, 60 Hz

Pump type	Motor [kW]	CRT				CRTE
		Full load current $I_{1/1}$ [A]	Power factor Cos $\varphi_{1/1}$	Motor efficiency η [%]	$\frac{I_{start}}{I_{1/1}}$	Full load current $I_{1/1}$ [A]
CRT(E) 16-2	3.0	6.20/6.60	0.89-0.70	85.0-85.0	5.60-6.60	6.4-5.2
CRT(E) 16-3	5.5	18.8-15.6/10.8-9.00	0.92-0.85	87.5-89.5	8.20-12.4	11.0-8.8
CRT 16-4	7.5	25.5-22.6/14.6-13.0	0.92-0.80	88.5-90.0	9.50-11.6	-
CRT(E) 16-5	7.5	25.5-22.6/14.6-13.0	0.92-0.80	88.5-90.0	9.50-11.6	15.0-12.0
CRT 16-6	11.0	38.0-32.5/22.0-18.8	0.92-0.86	83.0-86.0	6.80-8.60	-
CRT(E) 16-7	11.0	38.0-32.5/22.0-18.8	0.92-0.86	83.0-86.0	6.80-8.60	21.3
CRT 16-8	15.0	48.8-41.0/28.1-23.7	0.91-0.86	87.9-88.4	5.40-9.15	-
CRT(E) 16-10	15.0	48.8-41.0/28.1-23.7	0.91-0.86	87.9-88.4	5.40-9.15	28.1

Pipework connection

PJE couplings for CRT(E)

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

Pump type	Socket	PN	Pipework connection	Number of coupling sets needed	Part number	
					EPDM	FKM
CRT(E) 2 and CRT(E) 4	Threaded	80 bar	R 1¼	2	41 55 20	41 55 38
	For welding	80 bar	DN 32	2	41 55 21	41 55 39
CRT(E) 8 and CRT(E) 16	Threaded	70 bar	R 2	2	42 59 35	42 59 51
	For welding	70 bar	DN 50	2	42 59 34	42 59 52

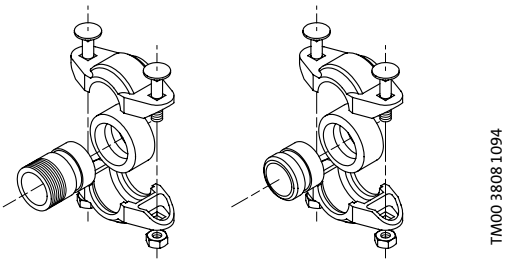


Fig. 14 PJE couplings

DIN flanges for CRT(E)

For pipework connection, Grundfos offers the following sets of DIN flanges.

Pump type	Pipework connection	EPDM	FKM
CRT(E) 2	DN 32	96 51 39 01	96 51 39 02
CRT(E) 4	DN 32	96 51 39 01	96 51 39 02
CRT(E) 8	DN 50	96 51 39 03	96 51 39 04
CRT(E) 16	DN 50	96 51 39 03	96 51 39 04

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.

Below 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
ATEX motors (EExe II T3 and EExd IIB T4)	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.
Low-noise motors	Grundfos offers low-noise motor range.
Efficiency class 1 motors	Grundfos offers motors from 1.1 to 45 kW in the highest European efficiency class, EFF. 1. The motors are classified under the EU/CEMEP motor efficiency labelling scheme.
Motors with thermal protection	Grundfos offers motors with built-in bimetallic thermal switches or temperature-controlled PTC sensors (thermistors) incorporated in the motor windings.
Oversized motor	Ambient temperatures above 40°C or installation at altitudes of more than 1000 metres above sea level require the use of an oversized motor (i.e. derating).
4-pole motors	Grundfos offers standard motors fitted with 4-poles.

Shaft seals

Variant	Description
Shaft seal with FFKM O-ring material	Shaft seals with 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 pump	For safety or height reasons, certain applications, for instance on ships, require the pump to be mounted in the horizontal position. For easy installation the pump is equipped with brackets that support motor and pump.
Pump with bearing flange	The bearing flange is suitable for applications where the inlet pressure is higher than the maximum pressure recommended. 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.

Further product documentation

Sources of product documentation

In addition to the printed data booklet, Grundfos offers the following sources of product documentation.

- WinCAPS
- WebCAPS.

WinCAPS

WinCAPS is a **Win**dows-based **C**omputer-**A**ided **P**roduct **S**election program containing information on more than 90,000 Grundfos products.

Available on CD-ROM in more than 15 languages, WinCAPS offers

- detailed technical information
- selection of the optimum pump solution
- dimensional drawings of each pump
- detailed service documentation
- installation and operating instructions
- wiring diagrams of each pump.

cd-wincaps

Fig. 15 WinCAPS CD-ROM

WinCAPS

Fig. 16 WinCAPS

Further product documentation

WebCAPS

WebCAPS is a **Web**-based **C**omputer **A**ided-**P**roduct **S**election program and a web-version of WinCAPS.

Available on Grundfos' homepage, **www.grundfos.com**, WebCAPS offers

- detailed technical information
- dimensional drawings of each pump
- wiring diagrams of each pump.

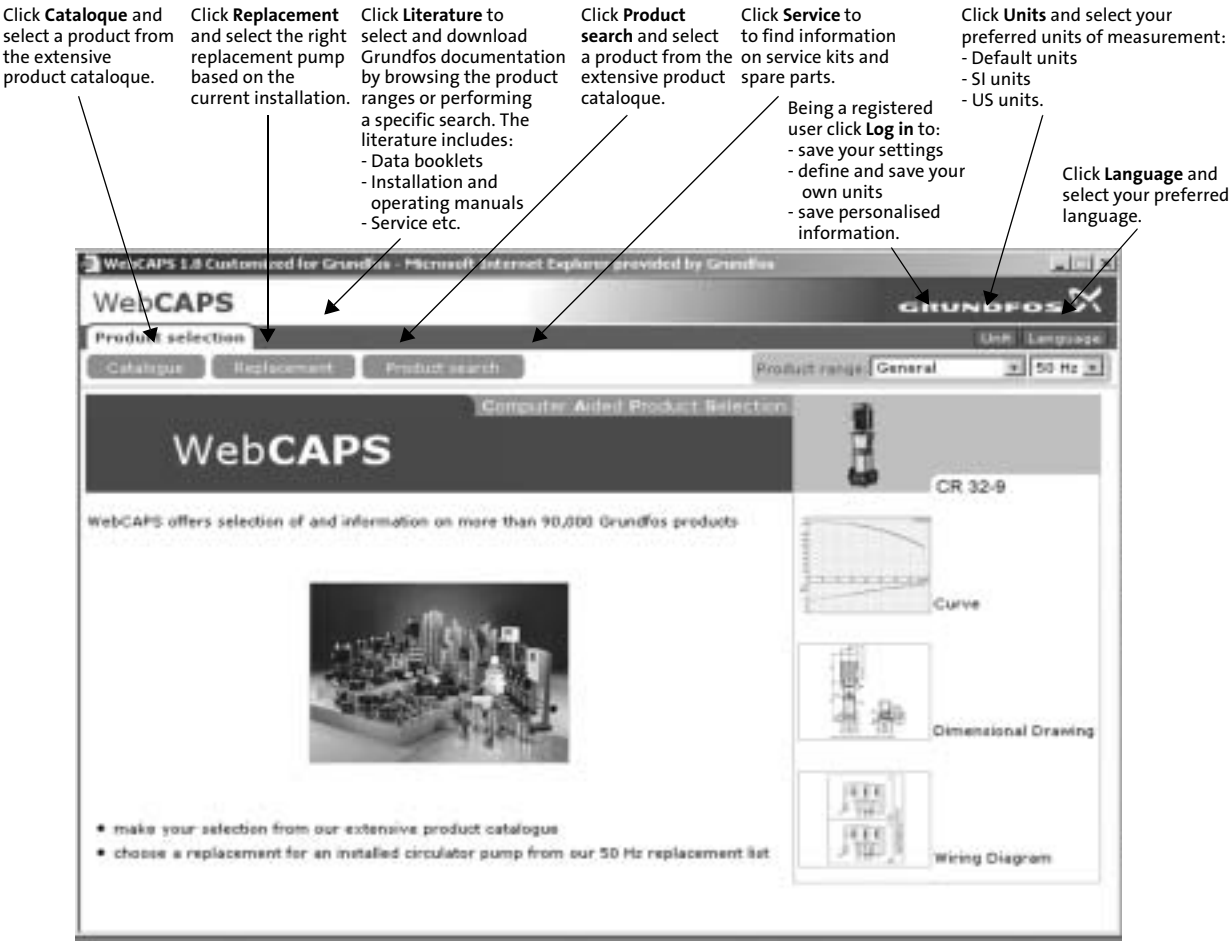


Fig. 17 WebCAPS

V7 14 98 94 01 04	GB
Repl. V7 14 98 94 02 03	

Subject to alterations.

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