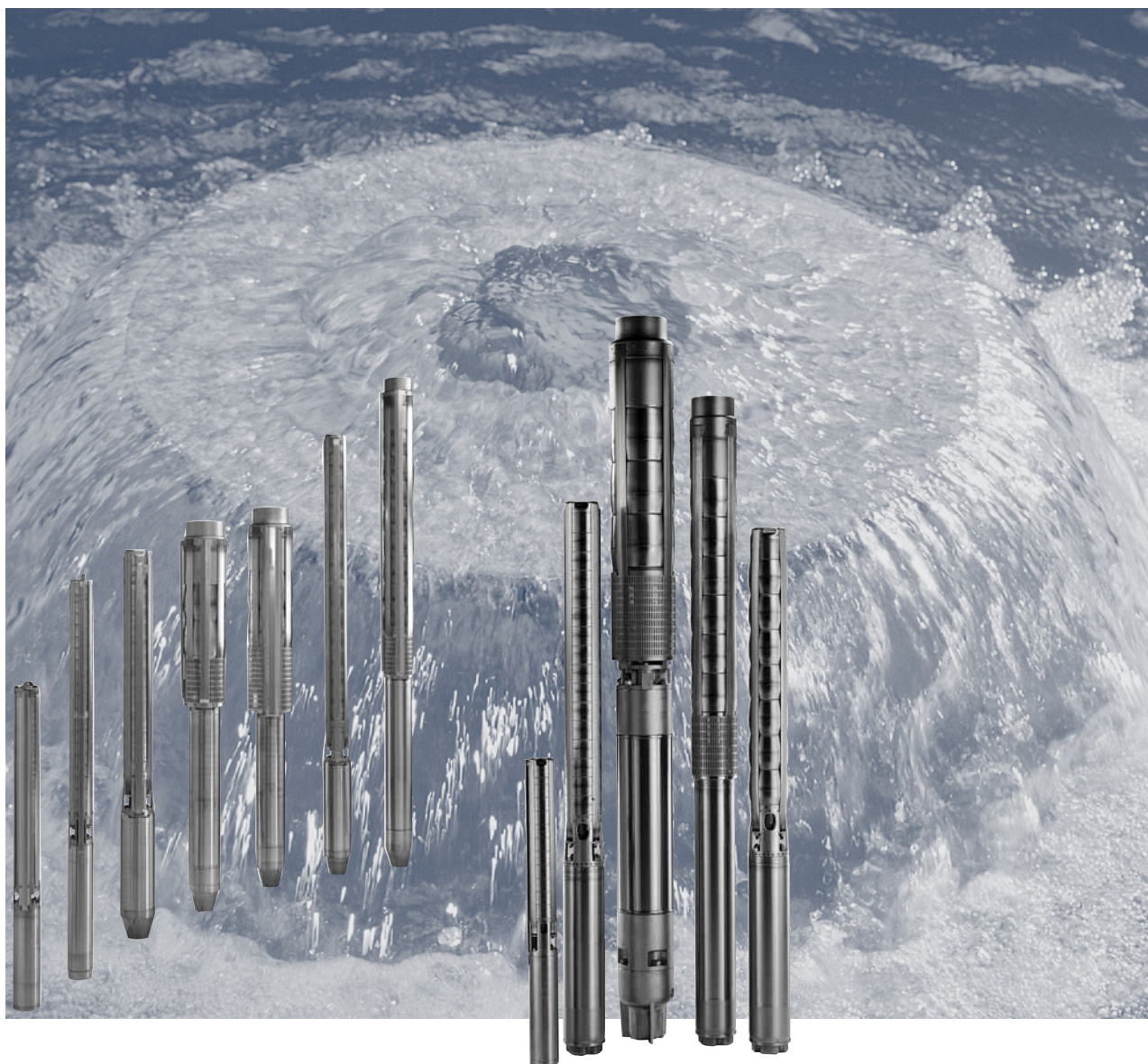


SP A, SP

Submersible pumps, motors and accessories
60 Hz



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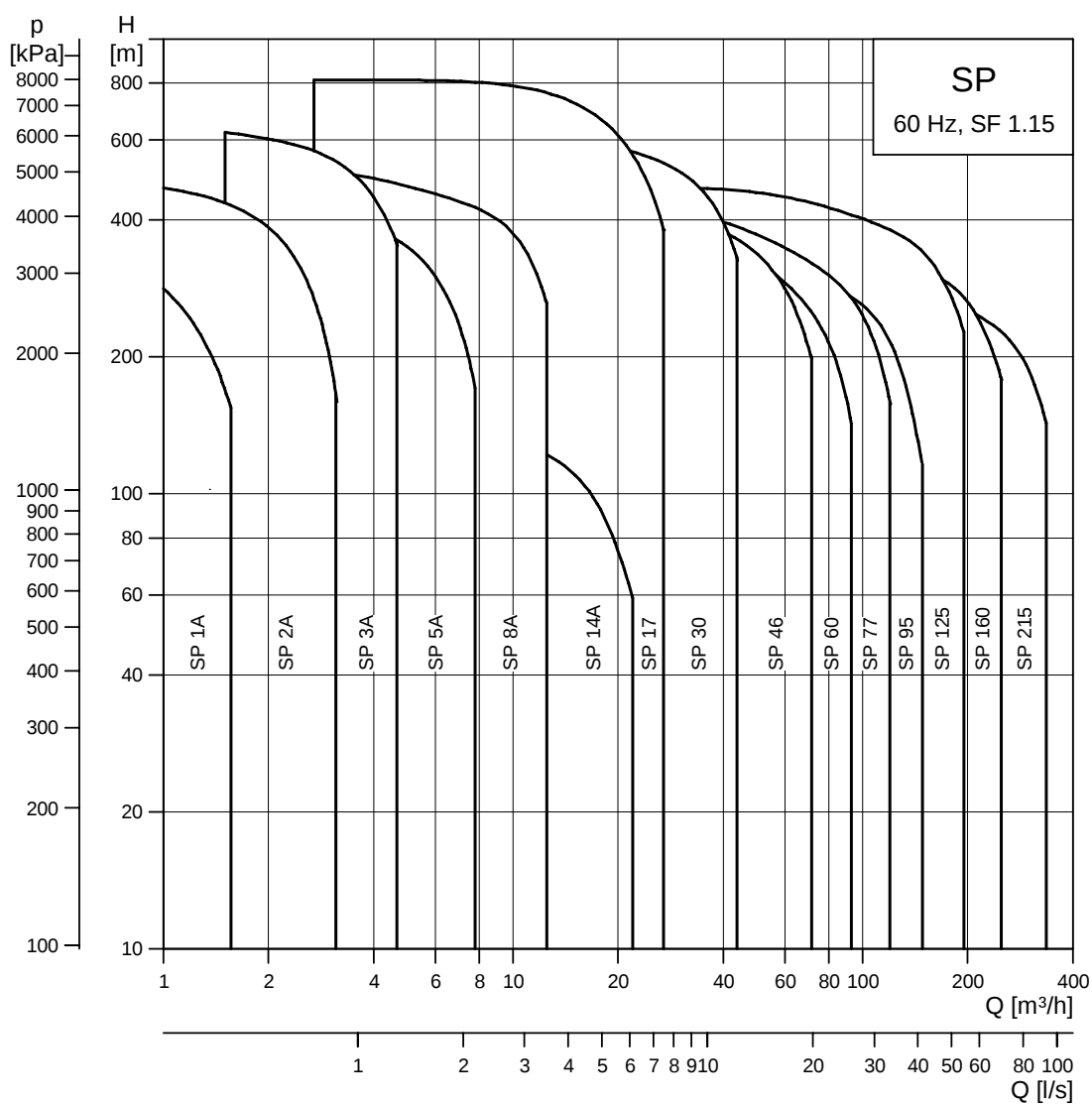
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Performance range



TM00 7574 0707

Applications

The SPA and SP pumps are suitable for the following applications:

- raw water supply
- irrigation systems
- groundwater lowering
- pressure boosting
- fountain applications
- mining applications
- off-shore applications.

Type key

Example	SP	95	-	5	-	A	B	N
Type range (SP A, SP)								
Rated flow rate in m ³ /h								
Number of impellers								
First reduced-diameter impeller (A, B or C)								
Second reduced-diameter impeller (A, B or C)								
Stainless steel parts of material								
= DIN W.-Nr. 1.4301								
N = DIN W.-Nr. 1.4401								
R = DIN W.-Nr. 1.4539								

Pumped liquids

Clean, thin, non-aggressive liquids without solid particles or fibres.

The special SP A-N and SP-N versions made of stainless steel to DIN W.-Nr. 1.4401 and SP A-R and SP-R versions made of stainless steel to DIN W.-Nr. 1.4539 are available for applications involving aggressive liquids.

Operating conditions

Flow rate, Q: 0.1-335 m³/h.

Head, H: Maximum 810 m.

Maximum liquid temperature

Motor	Installation		
	Flow velocity past motor	Vertical	Horizontal
Grundfos MS 4" and MS6 T30-versions	0.15 m/s	30°C	30°C
Grundfos 4" MS industry versions	0.15 m/s	60°C	60°C
Grundfos MS6 T60-versions	1.0 m/s	60°C	60°C
Grundfos MMS 6" to 12" rewindable with PVC in the windings	0.15 m/s	25°C	25°C
	0.50 m/s	30°C	30°C
Grundfos MMS 6" to 12" rewindable with PE/PA in the windings	0.15 m/s	40°C	40°C
	0.50 m/s	45°C	45°C

Note: For MMS 6000, 37 kW, MMS 8000, 110 kW, and MMS 10000, 170 kW, the maximum liquid temperature is 5 °C lower than the values stated in the table above. For MMS 10000, 190 kW the temperature is 10 °C lower.

Operating pressure

Motor	Maximum operating pressure
Grundfos MS 4" and 6"	
Grundfos MMS 6" to 10" rewindable	6 MPa (60 bar)

Curve conditions

The conditions below apply to the curves shown on pages 16-72:

General

- Curve tolerances according to ISO 9906, Annex A.
- The performance curves show pump performance at actual speed, cf. standard motor range. The speeds of the motors are approximately these:
 - 4" motors: $n = 3470 \text{ min}^{-1}$
 - 6" motors: $n = 3460 \text{ min}^{-1}$
 - 8" to 10" motors: $n = 3525 \text{ min}^{-1}$
- The measurements were made with airless water at a temperature of 20 °C. The curves apply to a kinematic viscosity of 1 mm²/s (1 cSt). When pumping liquids with a density higher than that of water, use motors with correspondingly higher outputs.
- The **bold** curves indicate the recommended performance range.
- The performance curves are inclusive of possible losses such as non-return valve loss.

SP A curves

- **Q/H:** The curves are inclusive of valve and inlet losses at the actual speed.
- **Power curve:** P₂ shows pump power input at the actual speed for each individual pump size.
- **Efficiency curve:** Eta shows pump stage efficiency.

SP curves

- **Q/H:** The curves are inclusive of valve and inlet losses at the actual speed. Operation without non-return valve will increase the actual head at rated performance by 0.5 to 1.0 m.
- **NPSH:** The curve is inclusive of pressure loss in the suction interconnector and shows required inlet pressure.
- **Power curve:** P₂ shows pump power input at the actual speed of each individual pump size.
- **Efficiency curve:** Eta shows pump stage efficiency. If Eta for the actual pump size is needed, please consult WinCAPS or WebCAPS.

Pump range

Type		SP 1A	SP 2A	SP 3A	SP 5A	SP 8A	SP 14A	SP 17	SP 30	SP 46	SP 60	SP 77	SP 95	SP 125	SP 160	SP 215
Steel: DIN 1.4301 AISI 304		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Steel: DIN 1.4401 AISI 316				•	•	•	•	•	•	•	•	•	•	•	•	•
Steel: DIN 1.4539 AISI 904L					•	•		•	•	•	•	•	•	•	•	•
Connection ★	Rp	1¼	1¼ (R 1¼)	1¼	1½ (R 1½)	2 (R 2)	2	2½ (R 3)	3 (R 3)	3 4 (R 4)	3 4	5	5	6	6	6
	NPT	1"	1¼"	1¼"	1½"	2"	2"	3" (3")	3" (3")	3" 4" (4")	3" 4"	5"	5"	6"	6"	6"
Flange connection: Grundfos flange												5"	5"	6"	6"	6"

★ Figures in brackets () indicate connection for pumps with sleeve.

Motor range

Motor output [kW]	0.25	0.37	0.55	0.75	1.1	1.5	2.2	3.0	3.7	4.0	5.5	7.5	9.2	11	13	15	18.5	22	26	30	37	45	55	63	75	92	110	132	147	170	190	
Single-phase	●	●	●	●	●	●	●																									
Three-phase		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Industrial motor and MS6 T60-versions							●	●	●	●	●	●	●	●	●	●	●	●														
Rewindable motor									●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Steel: DIN 1.4301 AISI 304	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●											
Steel: DIN 1.4301 and cast iron									●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Steel: DIN 1.4401 AISI 316									●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Steel: DIN 1.4539 AISI 904L				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
Built-in temperature transmitter in motor				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●											

Direct-on-line starting is recommended up to 75 kW.

Soft starter or autotransformer is recommended above 75 kW.

Motors with star/delta are available from 5.5 kW.

Motor protection and controllers

Motor output [kW]	0.37	0.55	0.75	1.1	1.5	2.2	3.0	3.7	4.0	5.5	7.5	9.2	11	13	15	18.5	22	26	30	37	45	55	63	75	92	110	132	147	170	190
MP 204	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Pt100								●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Zinc anode				●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Vertical flow sleeve	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Horizontal flow sleeve	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●											
SA-SPM	●	●	●	●	●	●	●	●																						
R100	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
RS-485 communi- cation module	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
G100	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Motor protection of single-phase motors, see "Technical data" on page 73.

Features and benefits

A wide pump range

Grundfos offers energy-efficient submersible pumps ranging from 1 to 335 m³/h. The pump range consists of many pump sizes - and each pump size is available with an optional number of stages to match any duty point.

High pump efficiency

Often pump efficiency is a neglected factor compared to the price. However, the observant user will notice that price variations are without importance to water supply economics compared to the importance of pump and motor efficiencies.

Example

When pumping 200 m³/h at a head of 100 m for a period of 10 years, EURO 60,000 will be saved if a pump/motor having a 10 % higher efficiency is chosen and the price is EURO 0.10 per kWh.

Material and pumped liquids

Grundfos offers a complete range of pumps and motors which as standard are made completely of stainless steel to DIN W.-Nr. 1.4301 (AISI 304). This ensures good wear resistance and a reduced risk of corrosion when pumping ordinary cold water with a minor chloride content.

A pump range made of upgraded stainless steel is available for more aggressive liquids:

SP N: DIN W.-Nr. 1.4401 (AISI 316)

SP R: DIN W.-Nr. 1.4539 (AISI 904L)

Alternatively, a complete range of zinc anodes for cathodic protection is available, see page 88. For example this may be advisable for sea water applications.

For slightly polluted liquids containing for example oil, Grundfos offers a complete range of stainless steel SP NE pumps to DIN W.-Nr. 1.4401 (AISI 316) with all rubber parts made of FKM.

Low installation costs

Stainless steel means low weight facilitating the handling of pumps and resulting in low equipment costs and reduced installation and service time.

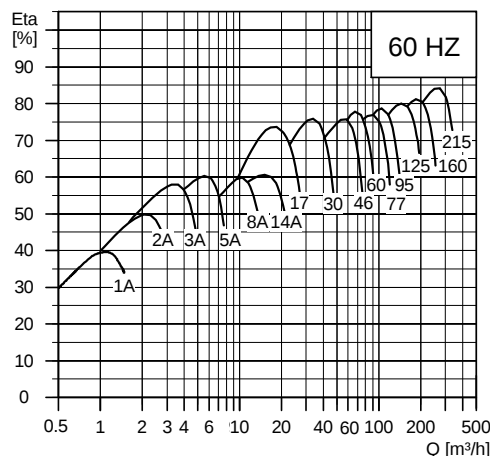


Fig. 1 Pump/motor efficiencies in relation to flow

TM00 7575 2598



Fig. 2 Various SP pumps

Gr6389 - GrA4019

Bearings with sand channels

All bearings are water-lubricated and have a squared shape enabling sand particles, if any, to leave the pump together with the pumped liquid.

Inlet strainer

The inlet strainer prevents particles over a certain size from entering the pump.

Non-return valve

All pumps are equipped with a reliable non-return valve in the valve casing preventing back flow in connection with pump stoppage.

Furthermore, the short closing time of the non-return valve means that the risk of destructive water hammer is reduced to a minimum.

The valve casing is designed for optimum hydraulic properties to minimize the pressure loss across the valve and thus to contribute to the high efficiency of the pump.

Priming screw

All Grundfos 4" pumps are fitted with a priming screw. Consequently, dry running is prevented, because the priming screw will make sure that pump bearings are always lubricated.

Due to the semi-axial impellers of large SP pumps this priming is provided automatically.

However, it applies to all pump types that if the water table is lowered to a level below the pump inlet neither pump nor motor will be protected against dry running.

Stop ring

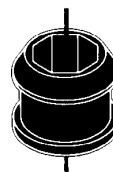
The stop ring prevents damage to the pump during transport and in case of up-thrust in connection with start-up.

The stop ring, which is designed as a thrust bearing, limits axial movements of the pump shaft.

Example: SP 77

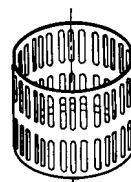
The stationary part of the stop ring (A) is secured in the upper intermediate chamber.

The rotating part (B) is fitted above the split cone (C).



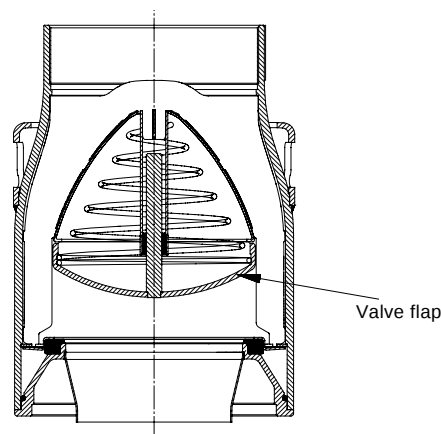
TM00 7301 1096

Fig. 3 Bearing



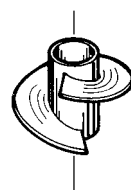
TM00 7302 1096

Fig. 4 Inlet strainer



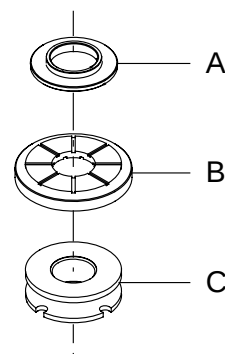
TM01 2499 1798

Fig. 5 Non-return valve



TM00 7304 1096

Fig. 6 Priming screw



TM01 3327 3898

Fig. 7 Stop ring (rotating and stationary part) and the split cone

Material specification

Pos.	Component	Materials	Standard	N-version	R-version
			DIN W.-Nr. / AISI		
1	Valve casing	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
1d	O-ring	NBR			
2	Valve cup	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
3	Valve seat	Standard/ N- version: NBR R-version: FKM			
3a	Lower valve seat retainer	Stainless steel	1.4308	1.4408/316	1.4517
3b	Upper valve seat retainer	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
4	Top chamber	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
6	Upper bearing	Stainless steel/ NBR	1.4401/304	1.4401/316	1.4539/904L
7	Neck ring	NBR/PPS			
8	Bearing	NBR			
8a	Washer for stop ring	Carbon/ graphite HY22 in PTFE mass			
8b	Stop ring	Stainless steel	1.4401/316	1.4401/316	1.4539/904L
9	Chamber	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
11	Split cone nut	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
11c	Nut for stop ring	Stainless steel	1.4401/316	1.4401/316	1.4539/904L
12	Split cone	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
13	Impeller	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
14	Suction interconnector	Stainless steel	1.4308	1.4408/316	1.4517
15	Strainer	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
16	Shaft complete	Stainless steel	1.4057/431	1.4460/329	1.4460/329
17	Strap	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
18	Cable guard	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
19	Nut for strap	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
39	Spring for valve cup	Stainless steel	1.4301/304	1.4401/316	1.4462/ SAF 2205
70	Valve guide	Stainless steel	1.4301/304	1.4401/316	1.4539/904L
71	Washer	Stainless steel	1.4401/316	1.4401/316	1.4539/904L
72	Wear ring	Stainless steel	1.4301/304	1.4401/316	1.4539/904L

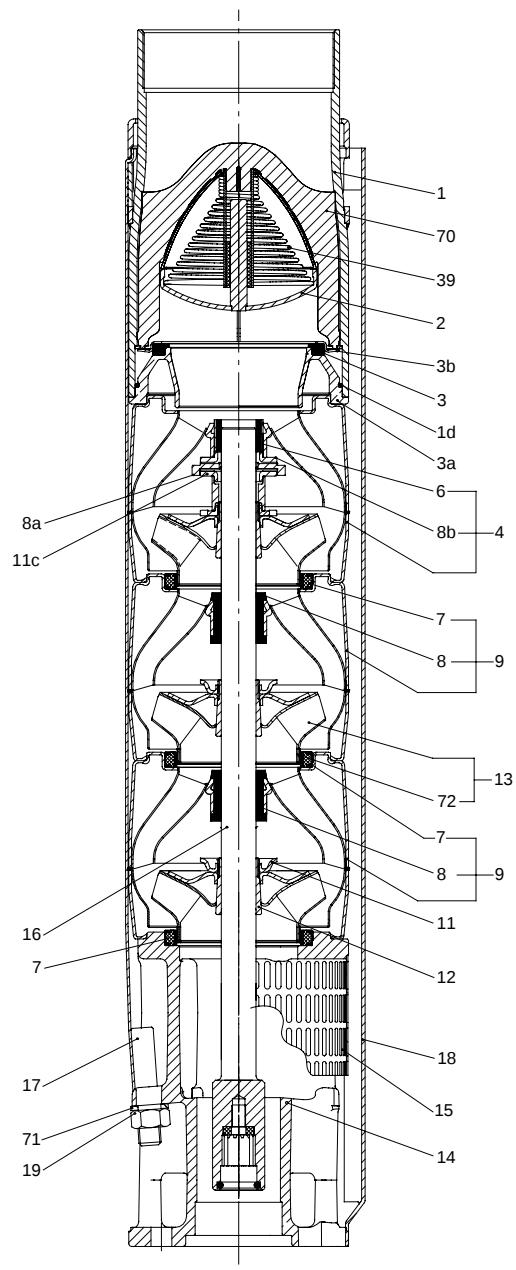


Fig. 8 SP 77

TM01 2359 2301

Features and benefits

A complete motor range

Grundfos offers a complete submersible motor range in different voltages:

Submersible motors, MS:

- 4" motors, single-phase up to 3.7 kW:
 - 2-wire
 - 3-wire
 - PSC (permanent split capacitor)
- 4" motors, three-phase up to 7.5 kW
- 6" motors, three-phase from 5.5 kW to 30 kW

Submersible, rewindable motors, MMS:

- 6" motors, three-phase from 3.7 kW up to 37 kW
- 8" motors, three-phase from 22 kW up to 110 kW
- 10" motors, three-phase from 75 kW up to 190 kW

High motor efficiency

Within the area of high motor efficiency Grundfos is a market leader.

Rewindable motors

The 2-pole Grundfos MMS submersible motors are all easy to rewind. The windings of the stator are made of a special water-proof wire of pure electrolytic copper sheathed with special non-hydroscopic thermoplastic material. The fine dielectric properties of this material allow direct contact between the windings and the liquid for efficient cooling of the windings.

Industrial motors and MS6 T60-versions

For heavy-duty applications Grundfos offers a complete motor range of industrial motors with up to 5 % higher efficiency than that of Grundfos' standard motors. The industrial motors are available in sizes as from 2.2 kW up to 22 kW. The cooling of the motor is very efficient due to the large motor surface. The efficient cooling makes it possible to increase the liquid temperature to 60 °C at a minimum flow of 0.15 m/s past the motor. The industrial motors are for customers who value low operating costs and long life higher than price.

Grundfos industrial motors are developed for difficult operating conditions. These motors will stand a higher thermal load than standard motors and thus have a longer life when subjected to high load. This applies whether the high load is caused by bad power supply, hot water, bad cooling conditions, high pump load etc.

Please note that heavy-duty motors are longer than motors for standard conditions.



Fig. 9 MS motors

TM00 7305 1096 - GrA4011 - GrA4013



Fig. 10 MMS motors

TM01 7873 4799

Overtemperature protection

Accessories for protection against overtemperature are available for both Grundfos MS and MMS submersible motors. When the temperature becomes too high, the protection device will cut out and damage to the pump and motor be avoided.

Restart of the motor after cut-out can be achieved in two ways:

- manual restart or
- automatic restart.

Automatic restart means that the MP 204 attempts to restart the motor after 15 min. If the first attempt is not successful, restarting will be reattempted at 30-minute intervals.

MS

The Grundfos MS submersible motors except MS 402 are available with a built-in Tempcon temperature transmitter for protection against overtemperature. By means of the transmitter it is possible to read out and/or monitor the motor temperature via an MP 204 or a PR 5714 relay.

The Grundfos MS6 submersible motors can be fitted with a Pt100. The Pt100 is fitted in the motor and connected directly to the MP 204 or monitored by the PR 5714 relay.

MMS

For the protection of the Grundfos MMS submersible motors against overtemperature Grundfos offers the Pt100 temperature sensor as an optional extra.

The Pt100 is fitted in the motor and connected directly to the MP 204 or monitored by the PR 5714 relay.

Protection against upthrust

In case of a very low counter pressure in connection with start-up there is a risk that the entire chamber stack may rise. This is called upthrust. Upthrust may damage both pump and motor. Therefore both Grundfos pumps and motors are protected against upthrust as standard, preventing upthrust from occurring in the critical start-up phase. The protection consists of either a built-in stop ring or hydraulic balancing.

Built-in cooling chambers

In all Grundfos MS submersible motors an efficient cooling is ensured by cooling chambers at the top and at the bottom of the motor, and by an internal circulation of motor liquid. See fig. 11. As long as the required flow velocity past the motor is maintained (see "Operating conditions" page 4) cooling of the motor will be efficient.

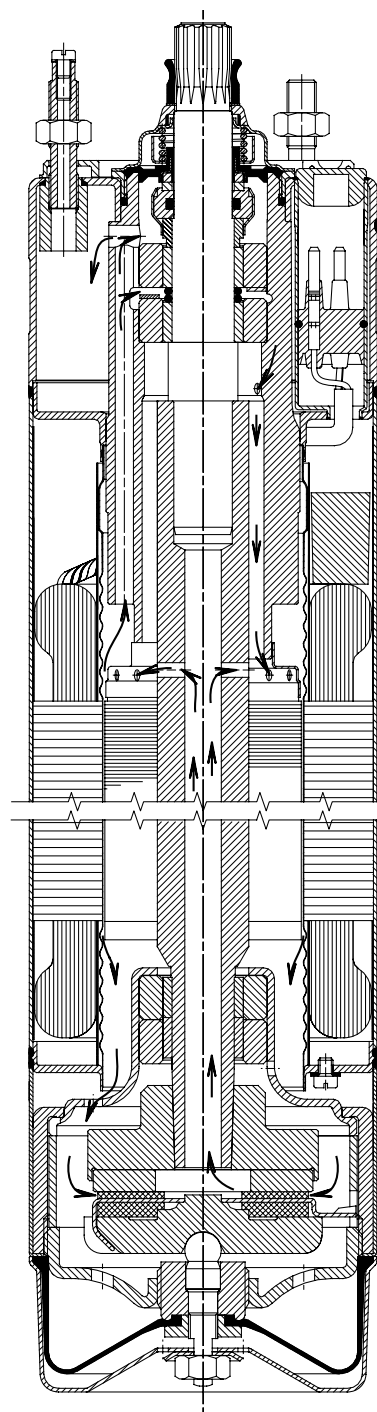


Fig. 11 MS 4000

TM00 5698 0996

Lightning protection

The smallest Grundfos submersible motors, i.e. of the type MS 402, are all insulated in order to minimize the risk of motor burnout caused by stroke of lightning.

Reduced risk of short-circuit

The embedded stator winding in the Grundfos MS submersible motor is hermetically enclosed in stainless steel. The result is high mechanical stability and optimum cooling. Also, this eliminates the risk of short-circuit of the windings caused by condensed water.

Shaft seal

MS 402

The shaft seal is of the lip seal type characterized by low friction against the rotor shaft.

The choice of rubber offers good wear resistance, good elasticity and resistance to particles. The rubber material is approved for use in drinking water.

MS 4000, MS6

The material is ceramic/tungsten carbide providing optimum sealing, optimum wear resistance and long life.

The spring loaded shaft seal is designed with a large surface and a sand shield. The result is a minimum exchange of pumped and motor liquids and no penetration of particles. Motors, version R, are supplied with a SiC/SiC shaft seal according to DIN 24960. Other combinations are available request.

MMS rewindable motors

The standard shaft seal is a ceramic/carbon mechanical shaft seal. The shaft seal is replaceable.

The material features good wear resistance and resistance to particles.

Together with the shaft seal housing, the sand shield forms a labyrinth seal, which during normal operating conditions prevents penetration of sand particles into the shaft seal.

On request, motors can be supplied with a SiC/SiC seal according to DIN 24960.

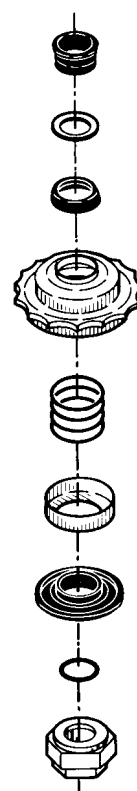


Fig. 12 Shaft seal, MS 4000



Fig. 13 Shaft seal, MS6

TM00 7306 2100

TM03 9225 3607

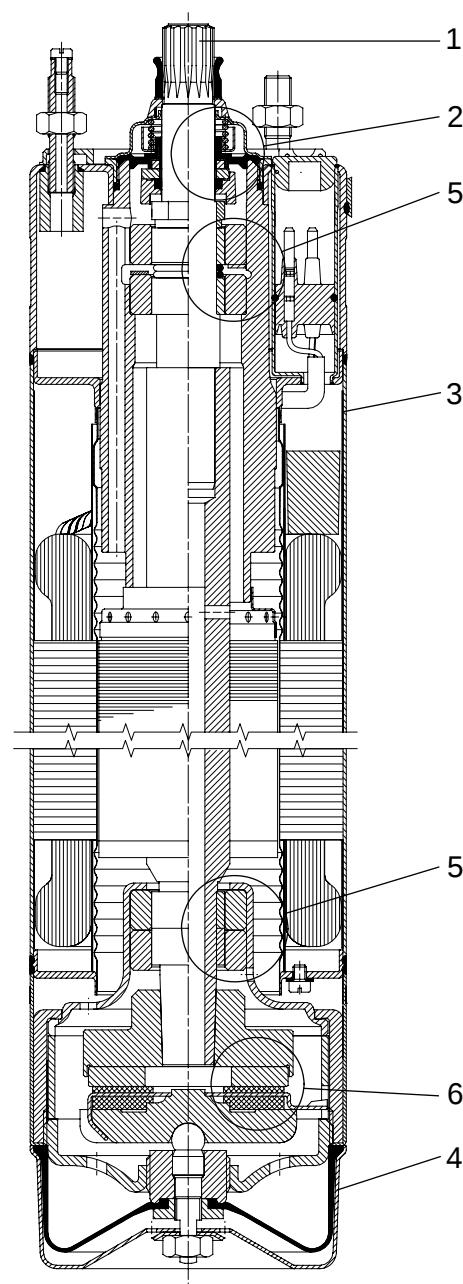
Material specification for MS motors

MS 402 and MS 4000 submersible motors

Pos.	Part	MS 402	MS 4000
1	Shaft	EN 1.4057	EN 1.4057
2	Shaft seal	NBR	Tungsten carbide/ ceramic
3	Motor sleeve	EN 1.4301	EN 1.4301
4	Motor end shield		EN 1.4301
5	Radial bearing	Ceramic	Ceramic/ tungsten carbide
6	Axial bearing	Ceramic/carbon	Ceramic/carbon
	Rubber parts	NBR	NBR

R-version motor

Pos.	Part	MS 4000
1	Shaft	EN 1.4462
2	Shaft seal	NBR/ceramic
3	Motor sleeve	EN 1.4539
4	Motor end shield	EN 1.4539
5	Radial bearing	Ceramic/ tungsten carbide
6	Thrust bearing	Ceramic/carbon
	Rubber parts	NBR



TM00 7865 2196

Fig. 14 MS 4000

Material specification for MS6 motors

Pos.	Part	MS6
202	Shaft with rotor	EN 1.4462
2	Shaft seal	Ceramic/carbon
3	Motor sleeve	EN 1.4301
4	Motor end cover	EN 1.4308
	Rubber parts	NBR/FKM

R-version motor

Pos.	Part	MS6
1	Shaft	EN 1.4462
2	Shaft seal	SiC/SiC
3	Motor sleeve	EN 1.4539
4	Motor end cover	EN 1.4517
	Rubber parts	FKM

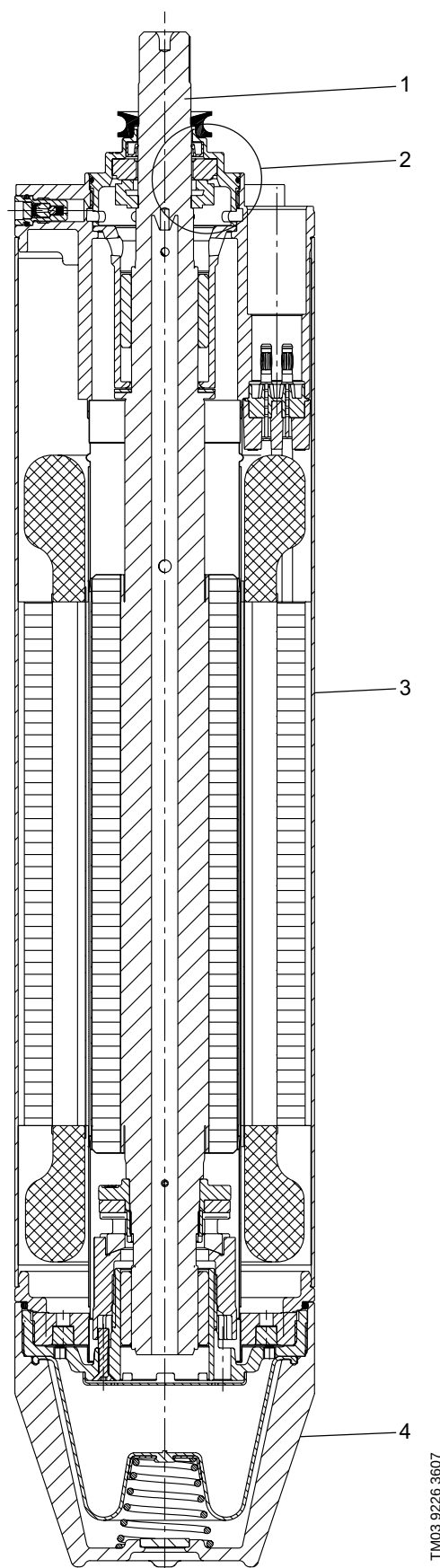


Fig. 15 MS6

TM03 9226 3607

Material specification for MMS motors

Submersible rewindable motors

Pos.	Component	Material	DIN/EN
202	Shaft	Steel	1.0533
202a	Shaft ends	Stainless steel	1.4460
203/ 206	Thrust bearing Stationary/ rotating part	6" 3.7 - 15 kW	Hardened steel/ EPDM
		6" 18.5 - 37 kW	Ceramic/carbon
		8"-10"	
204	Bearing bush	6"-10"	Carbon
205	Bearing housing, upper	Cast iron	EN-JL1040
212	Diaphragm	CR	
213	Motor end shield	Cast iron	EN-JL1040
218	Motor sleeve	Stainless steel	1.4301
220	Motor cable	EPDM	
226	Shaft seal	Ceramic/carbon	
235	Intermediate housing	Cast iron	EN-JL1040
236	Bearing housing, lower	Cast iron	EN-JL1040

N- and R-versions of MMS motors

Pos.	Component	Material	Version	
			N	R*
			DIN/EN	DIN/EN
202	Shaft	Steel	1.0533	1.0533
202a	Shaft ends	Stainless steel	1.4460	1.4462
203/ 206	Thrust bearing Stationary/ rotating part	6" 3.7 - 15 kW	Hardened steel/ EPDM	Ceramic/carbon
		6" 18.5 - 37 kW		
		8"-10"		
204	Bearing bush	6"-10"	Carbon	
205	Bearing housing, upper	Stainless steel	1.4401	1.4539
212	Diaphragm	CR		
213	Motor end shield	Stainless steel	1.4401	1.4539
218	Motor sleeve	Stainless steel	1.4401	1.4539
220	Motor cable	EPDM		
226	Shaft seal	Ceramic/carbon		
235	Intermediate housing	Stainless steel	1.4401	1.4539
236	Bearing housing, lower	Stainless steel	1.4401	1.4539

* Only MMS 6000 and MMS 8000 are available in R-versions

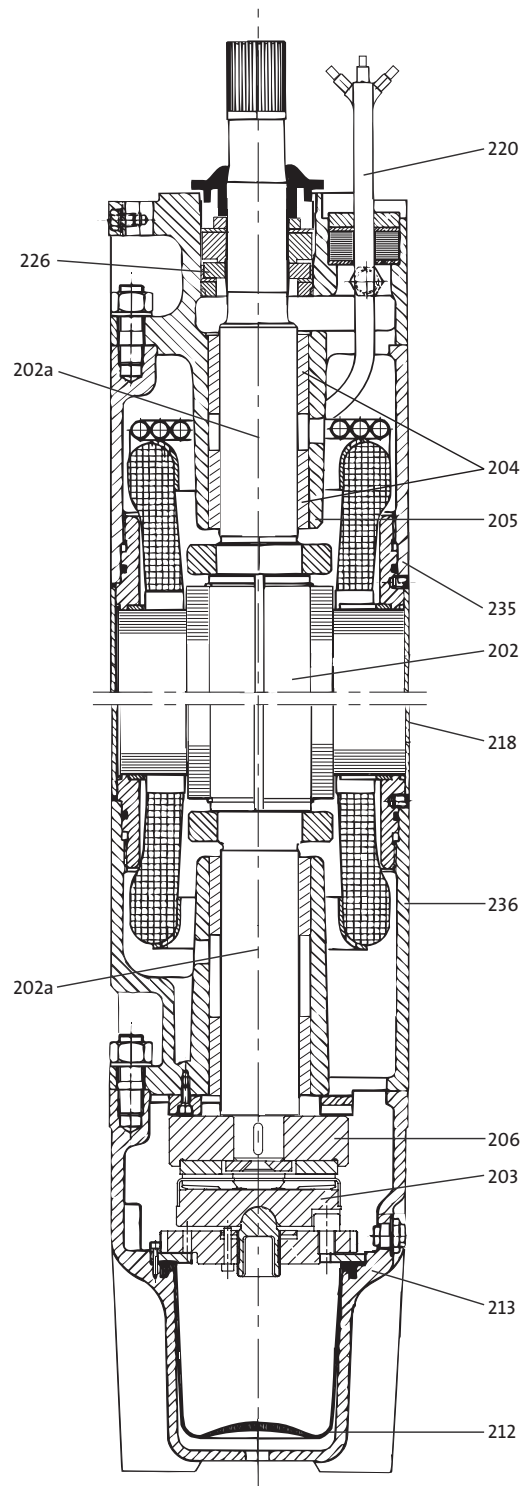
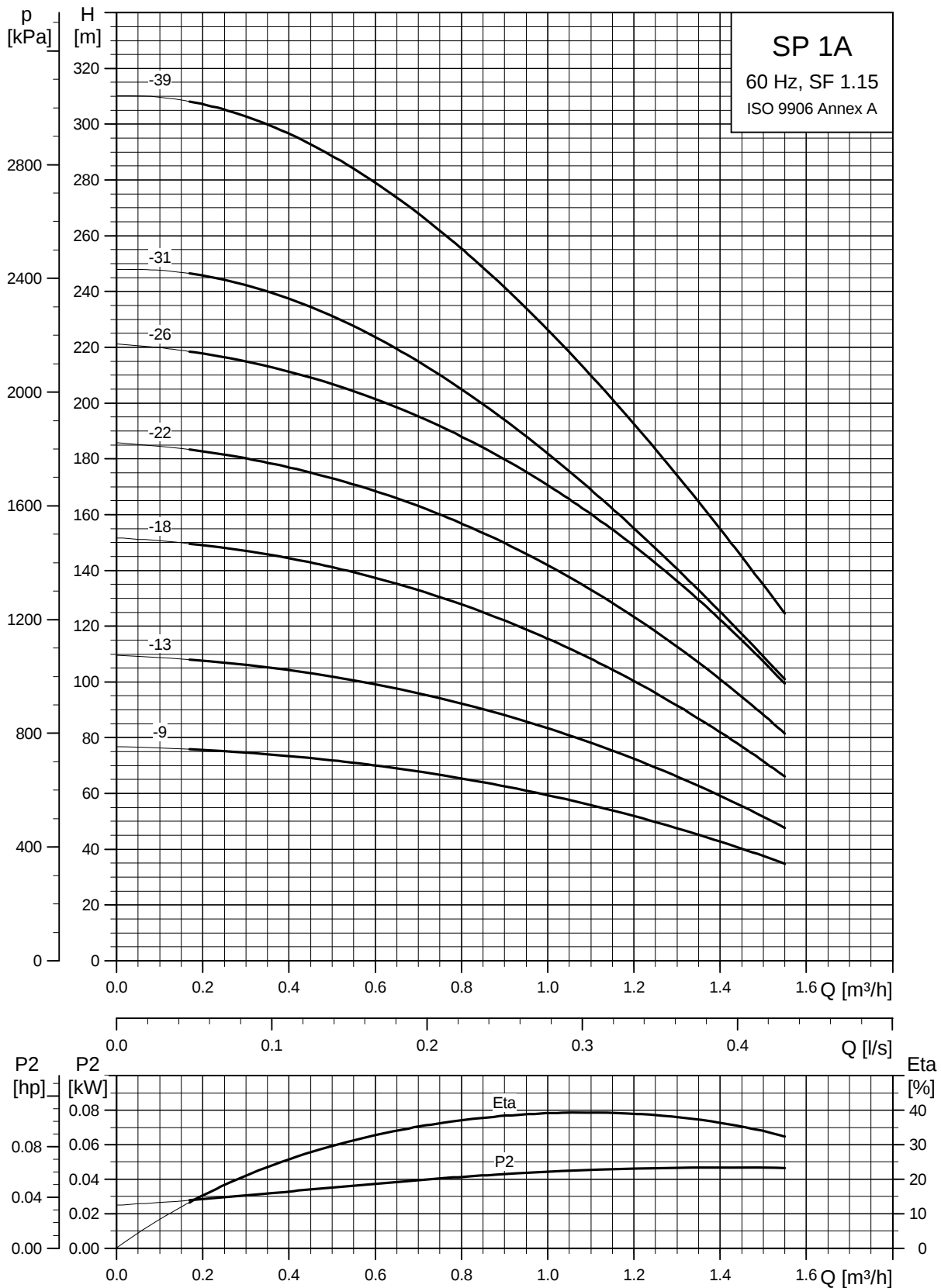


Fig. 16 MMS 10000

TM01 4985 0404

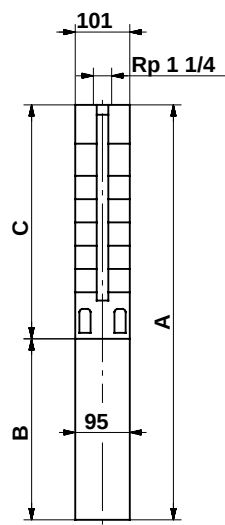
SP 1A



TM01 3419 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

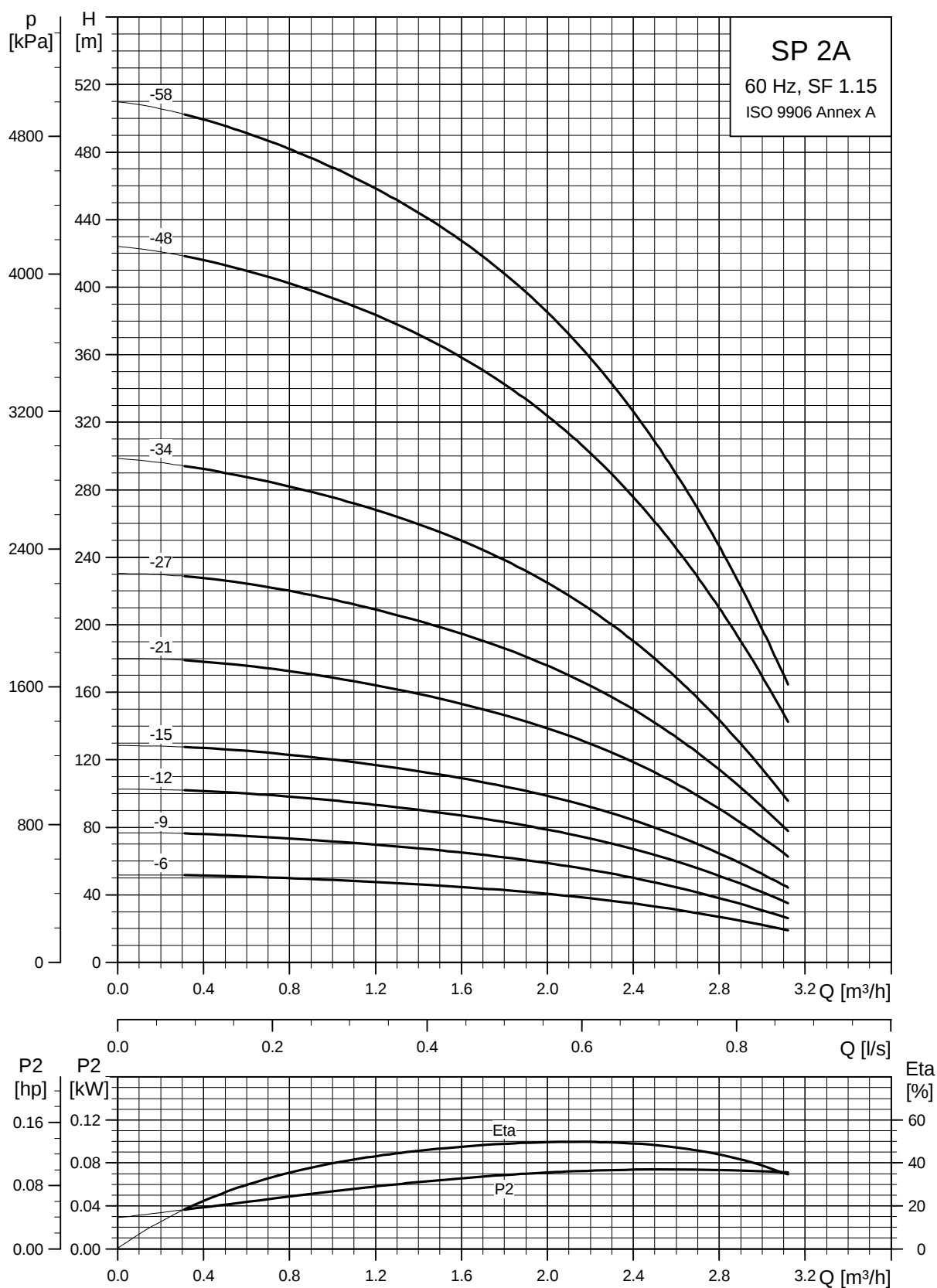
Dimensions and weights



101 mm = Maximum diameter of pump inclusive of cable guard and motor.

Pump type	Motor		C	Dimensions [mm]		Net weight [kg]
	Type	Power [kW]		B	A	
				3 x 220 V	3 x 220 V	
				3 x 380 V	3 x 380 V	
				3 x 460 V	3 x 460 V	3 x 460 V
SP 1A-9	MS 402	0.37	344	226	570	9
SP 1A-13	MS 402	0.37	428	226	654	10
SP 1A-18	MS 402	0.55	533	241	774	12
SP 1A-22	MS 402	0.75	617	276	893	14
SP 1A-26	MS 402	1.1	701	306	1007	16
SP 1A-31	MS 402	1.1	851	306	1157	22
SP 1A-39	MS 402	1.5	1019	346	1365	26

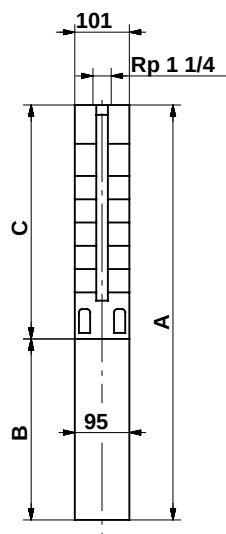
SP 2A



TM01 3420 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



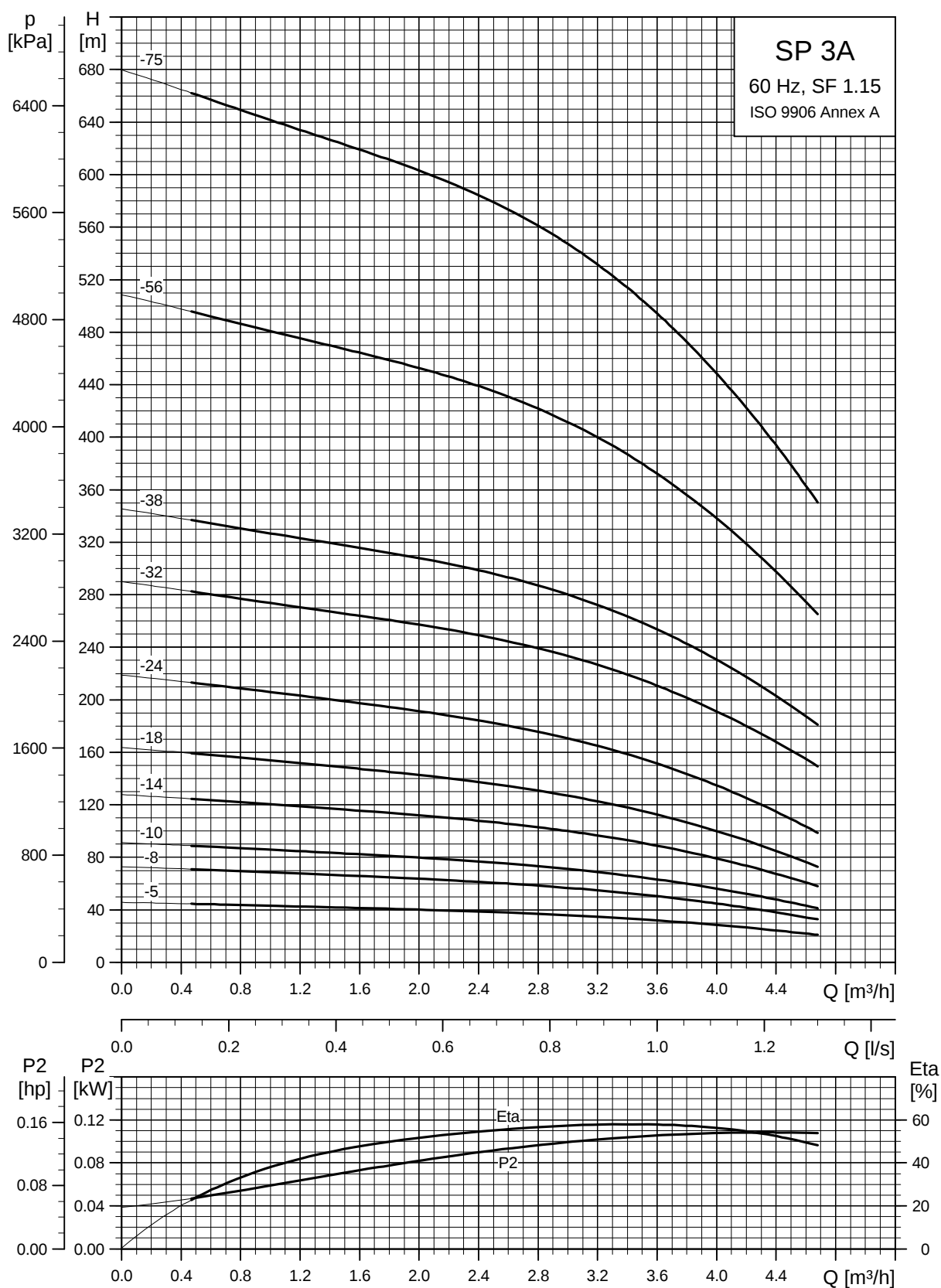
TM00 0955 1196

101 mm = Maximum diameter of pump inclusive of cable guard and motor.

SP 2A-58 are mounted in sleeve for R 1½ connection and with max. diameter 108 mm.

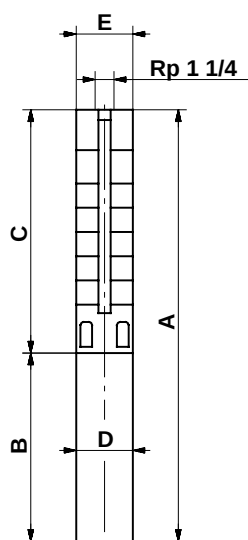
Pump type	Motor		C	Dimensions [mm]				Net weight [kg]	
	Type	Power [kW]		B		A		1x220V	3x220V 3x380V 3x460V
				1x220V	3x220V 3x380V 3x460V	1x220V	3x220V 3x380V 3x460V		
SP 2A-6	MS 402	0.25	281	256		537		10	
SP 2A-6	MS 402	0.37	281		226		507		9
SP 2A-9	MS 402	0.37	344	276	226	620	570	12	9
SP 2A-12	MS 402	0.55	407	291	241	698	648	13	11
SP 2A-15	MS 402	0.75	470	306	276	776	746	14	13
SP 2A-21	MS 402	1.1	596	346	306	942	902	17	15
SP 2A-27	MS 402	1.5	722		346		1068		18
SP 2A-34	MS 4000	2.2	914		453		1367		30
SP 2A-48	MS 4000	4.0	1208		573		1781		39
SP 2A-58	MS 4000	4.0	1597		573		2170		50

SP 2A



Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



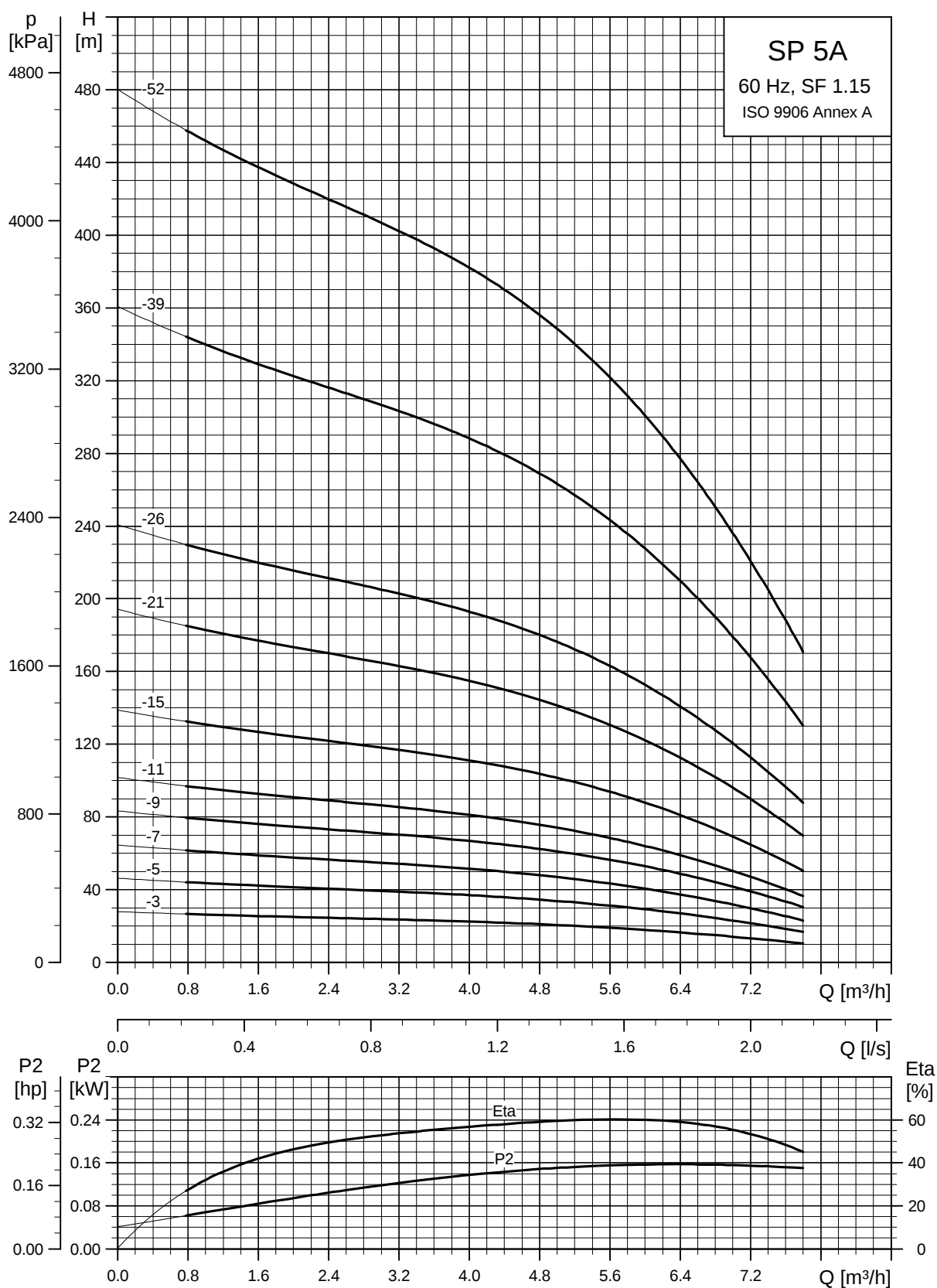
TM00 8521 3196

SP 3A-56 and SP 3A-75 are mounted in sleeve for R 1 1/4 connection.

Pump type	Motor		Dimensions [mm]							Net weight [kg]	
	Type	Power [kW]	C	B		A		D	E		
				1x220V	3x220V 3x380V 3x460V	1x220V	3x220V 3x380V 3x460V			1x220V	3x220V 3x380V 3x460V
SP 3A-5	MS 402	0.37	260	256	226	516	486	95	101	11	8
SP 3A-5N	MS 4000R	0.75	305		398		703	95	101		17
SP 3A-8	MS 402	0.55	323	291	241	614	564	95	101	12	10
SP 3A-8N	MS 4000R	0.75	368		398		766	95	101		18
SP 3A-10	MS 402	0.75	365	306	276	671	641	95	101	13	12
SP 3A-10N	MS 4000R	0.75	410		398		808	95	101		19
SP 3A-14	MS 402	1.1	449	346	306	795	755	95	101	15	14
SP 3A-14N	MS 4000R	1.1	494		413		907	95	101		21
SP 3A-18	MS 402	1.5	533		346		879	95	101		16
SP 3A-18N	MS 4000R	1.5	578		413		991	95	101		23
SP 3A-24	MS 4000	2.2	659		453		1112	95	101		23
SP 3A-24N	MS 4000R	2.2	704		453		1157	95	101		27
SP 3A-32	MS 4000	3.0	872		493		1365	95	101		30
SP 3A-32N	MS 4000R	3.0	872		493		1365	95	101		30
SP 3A-38	MS 4000	4.0	998		573		1571	95	101		36
SP 3A-38N	MS 4000R	4.0	998		573		1571	95	101		36
SP 3A-56	MS 4000	5.5	1747		673		2420	95	101		65
SP 3A-56	MS6	5.5	1747		565		2312	138	140		75
SP 3A-75	MS6	7.5	2146		590		2736	138	140		86

E = Maximum diameter of pump inclusive of cable guard and motor.

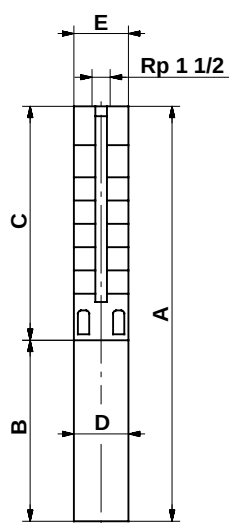
SP 5A



TM01 3422 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



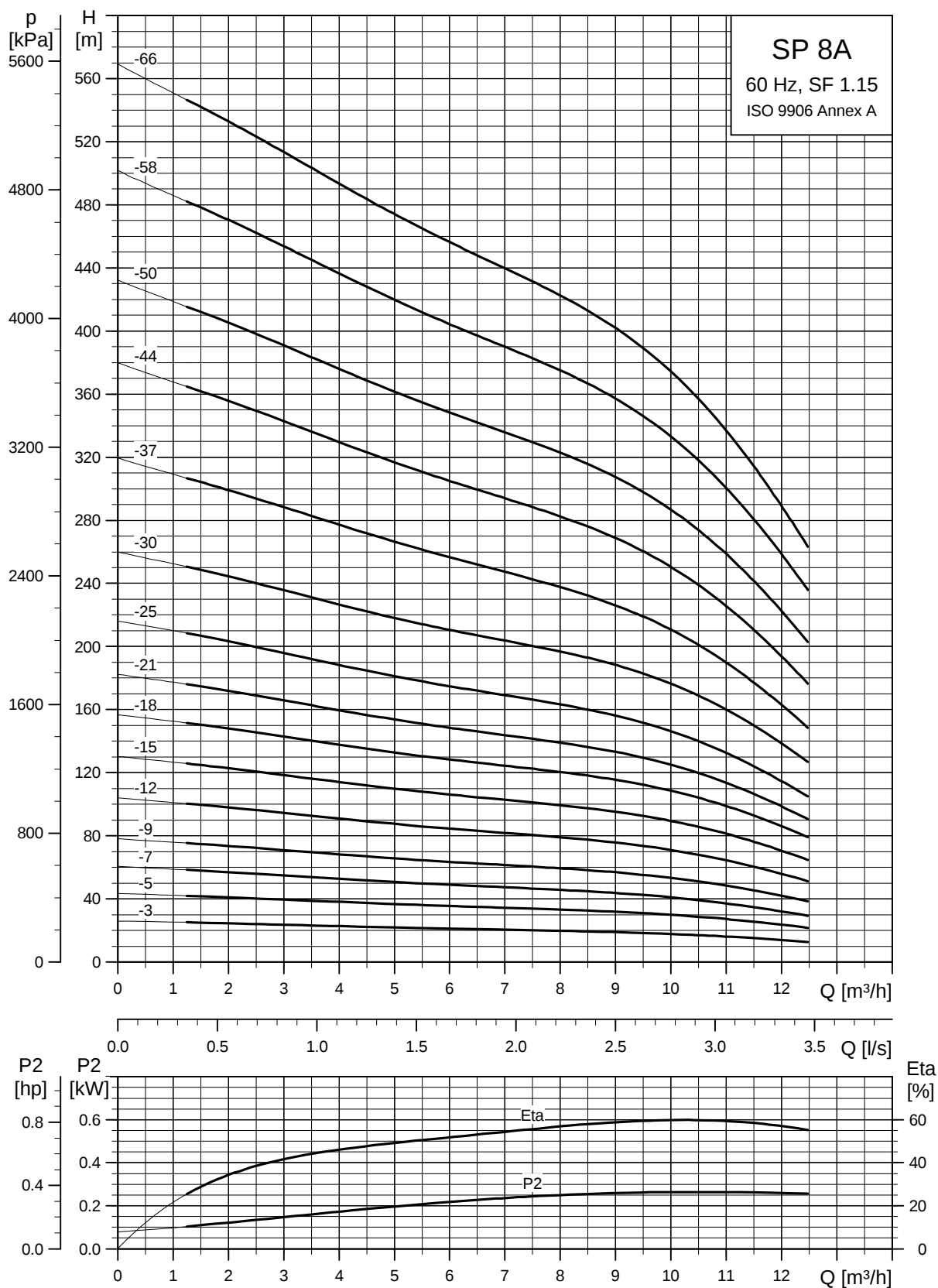
TM00 0956 1196

SP 5A-52 are mounted in sleeve for R 1½ connection.

Pump type	Motor		Dimensions [mm]								Net weight [kg]	
	Type	Powe [kW]	C	B		A		D	E			
				1x220V	3x220V 3x380V 3x460V	1x220V	3x220V 3x380V 3x460V					
					1x220V		3x220V 3x380V 3x460V					
SP 5A-3	MS 402	0.37	219	276	226	495	445	95	101	10	8	
SP 5A-3N	MS 4000R	0.75	263		398		661	95	101		17	
SP 5A-5	MS 402	0.55	261	291	241	552	502	95	101	11	9	
SP 5A-5N	MS 4000R	0.75	305		398		703	95	101		17	
SP 5A-7	MS 402	0.75	303	306	276	609	579	95	101	12	11	
SP 5A-7N	MS 4000R	0.75	347		398		745	95	101		18	
SP 5A-9	MS 402	1.1	345	346	306	691	651	95	101	14	13	
SP 5A-9N	MS 4000R	1.1	389		413		802	95	101		20	
SP 5A-11	MS 402	1.5	387		346		733	95	101		15	
SP 5A-11N	MS 4000R	1.5	431		413		844	95	101		20	
SP 5A-15	MS 4000	2.2	471		453		924	95	101		21	
SP 5A-15N	MS 4000R	2.2	515		453		968	95	101		24	
SP 5A-21	MS 4000	3.0	597		493		1090	95	101		23	
SP 5A-21N	MS 4000R	3.0	641		493		1134	95	101		26	
SP 5A-26	MS 4000	4.0	702		573		1275	95	101		29	
SP 5A-26N	MS 4000R	4.0	746		573		1319	95	101		32	
SP 5A-39	MS 4000	5.5	1019		673		1692	95	101		41	
SP 5A-39N	MS 4000R	5.5	1019		673		1692	95	101		41	
SP 5A-39	MS6	5.5	1081		565		1646	143	138		55	
SP 5A-39N	MS6R	5.5	1081		565		1646	143	138		55	
SP 5A-52	MS6	7.5	1663		590		2253	143	140		74	

E = Maximum diameter of pump inclusive of cable guard and motor.

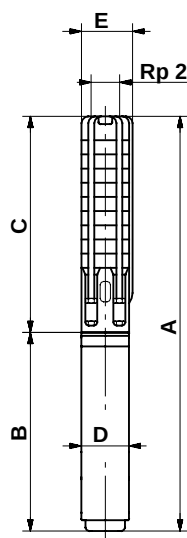
SP 8A



TM01 3423 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



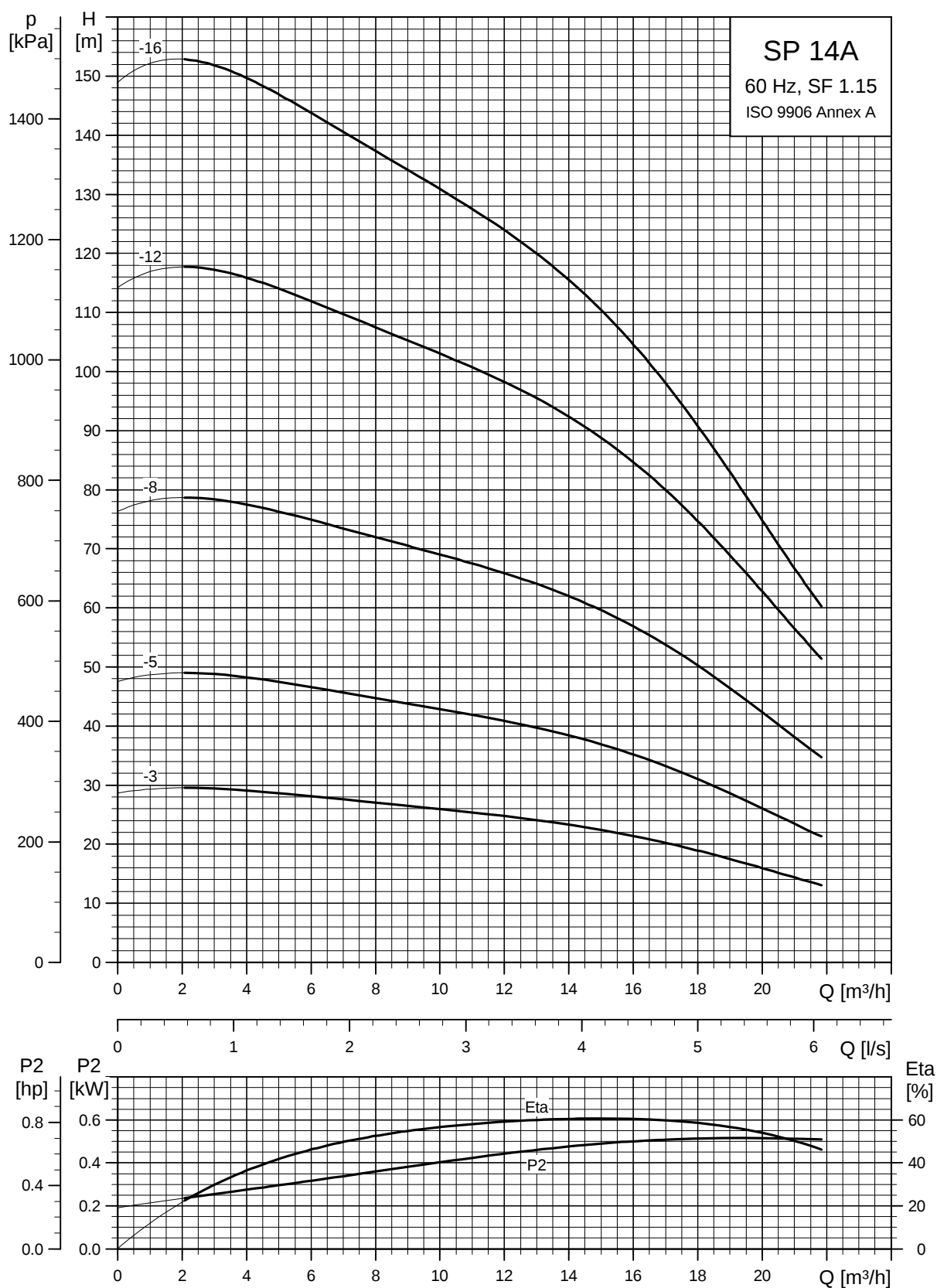
TM00 0957 1196

SP 8A-58(N) to SP 8A-66(N) are mounted in sleeve for R 2 connection.

Pump type	Motor		Dimensions [mm]							Net weight [kg]		
	Type	Power [kW]	C	B			A		D	E		
				1x220V	3x220V	1x220V	3x220V	1x220V			3x220V	
					3x380V		3x380V				3x460V	3x380V
SP 8A-3	MS 402	0.55	325	291	241	616	566	95	101	13	11	
SP 8A-3N	MS 4000R	0.75	325		398		723	95	101		18	
SP 8A-3R	MS 4000R	0.75	325		398		723	95	101		18	
SP 8A-5	MS 402	1.1	409	346	306	755	715	95	101	16	15	
SP 8A-5N	MS 4000R	1.1	409		413		822	95	101		20	
SP 8A-5R	MS 4000R	1.1	409		413		822	95	101		20	
SP 8A-7	MS 402	1.5	493		346		839	95	101		17	
SP 8A-7N	MS 4000R	1.5	493		413		906	95	101		21	
SP 8A-7R	MS 4000R	1.5	493		413		906	95	101		21	
SP 8A-9	MS 4000	2.2	577		453		1030	95	101		24	
SP 8A-9N	MS 4000R	2.2	577		453		1030	95	101		24	
SP 8A-9R	MS 4000R	2.2	577		453		1030	95	101		24	
SP 8A-12	MS 4000	3.0	703		493		1196	95	101		26	
SP 8A-12N	MS 4000R	3.0	703		493		1196	95	101		26	
SP 8A-12R	MS 4000R	3.0	703		493		1196	95	101		26	
SP 8A-15	MS 4000	4.0	829		573		1402	95	101		32	
SP 8A-15N	MS 4000R	4.0	829		573		1402	95	101		32	
SP 8A-15R	MS 4000R	4.0	829		573		1402	95	101		32	
SP 8A-18	MS 4000	5.5	955		673		1628	95	101		38	
SP 8A-18N	MS 4000R	5.5	955		673		1628	95	101		38	
SP 8A-21	MS 4000	5.5	1081		673		1754	95	101		40	
SP 8A-21N	MS 4000R	5.5	1081		673		1754	95	101		40	
SP 8A-25	MS 4000	5.5	1249		673		1922	95	101		42	
SP 8A-25N	MS 4000R	5.5	1249		673		1922	95	101		42	
SP 8A-30	MS 4000	7.5	1459		773		2232	95	101		50	
SP 8A-30N	MS 4000R	7.5	1459		773		2232	95	101		50	
SP 8A-18	MS6	5.5	1017		565		1582	143	138		50	
SP 8A-18N	MS6R	5.5	1017		565		1582	143	138		50	
SP 8A-21	MS6	5.5	1143		565		1708	143	138		51	
SP 8A-21N	MS6R	5.5	1143		565		1708	143	138		51	
SP 8A-25	MS6	5.5	1311		565		1876	143	138		53	
SP 8A-25N	MS6R	5.5	1311		565		1876	143	138		53	
SP 8A-30	MS6	7.5	1521		590		2111	143	138		59	
SP 8A-30N	MS6R	7.5	1521		590		2111	143	138		59	
SP 8A-37	MS6	9.2	1815		610		2425	143	138		69	
SP 8A-37N	MS6R	9.2	1815		610		2425	143	138		69	
SP 8A-44	MS6	11.0	2109		708		2817	143	138		75	
SP 8A-44N	MS6R	11.0	2109		708		2817	143	138		75	
SP 8A-50	MS6	13.0	2677		738		3415	143	140		103	
SP 8A-50N	MS6R	13.0	2677		738		3415	143	140		103	
SP 8A-58	MS6	15.0	3013		783		3796	143	140		114	
SP 8A-58N	MS6R	15.0	3013		783		3796	143	140		114	
SP 8A-66	MS6	15.0	3349		783		4132	143	140		121	
SP 8A-66N	MS6R	15.0	3349		783		4132	143	140		121	

E = Maximum diameter of pump inclusive of cable guard and motor.

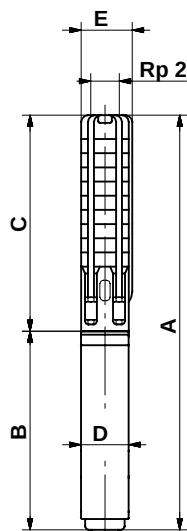
SP 14A



TM01 3424 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights

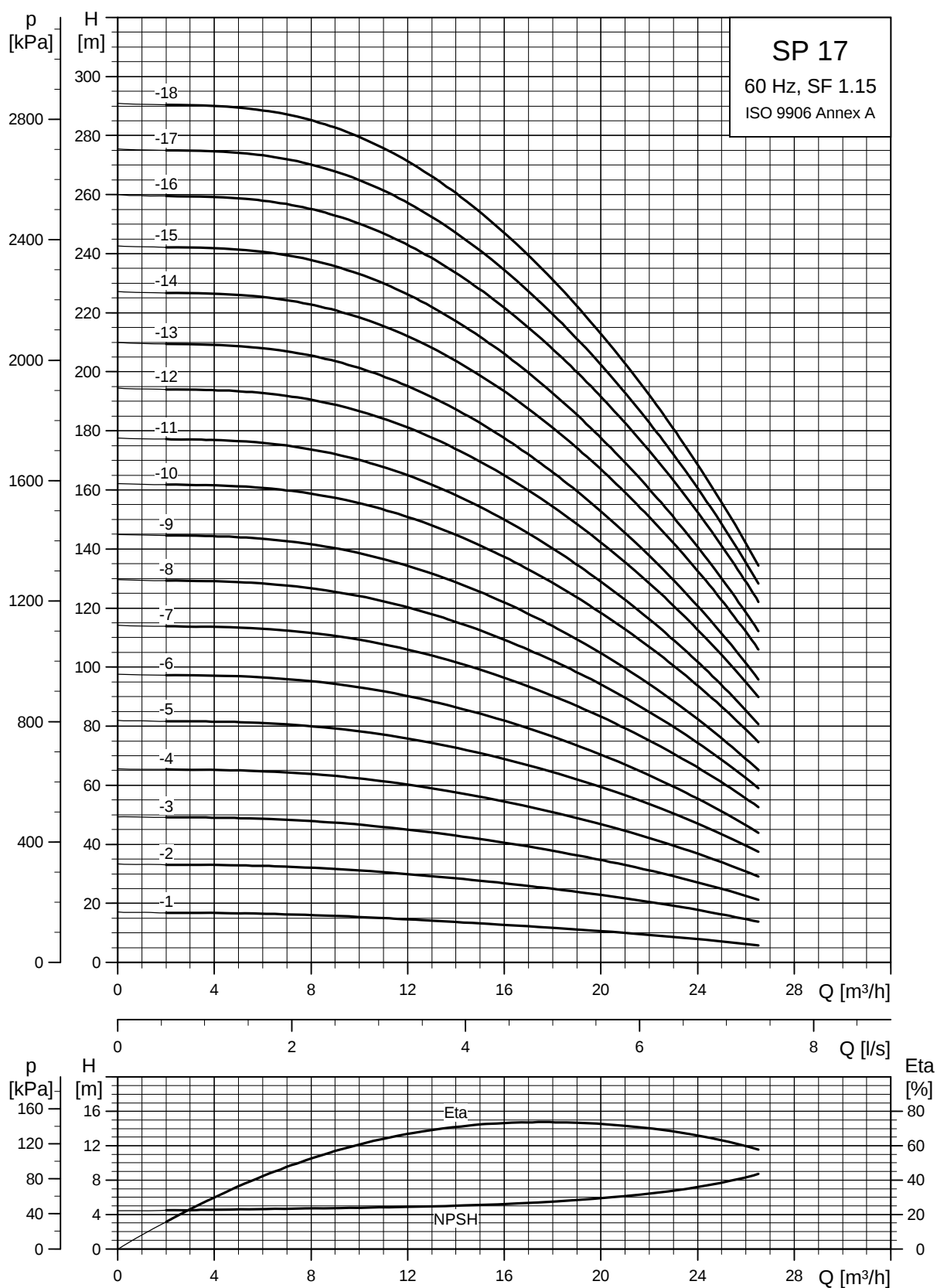


TM00 0957 1196

Pump type	Motor		Dimensions [mm]					Net weight [kg]
	Type	Power [kW]	C	B	A	D	E	
				3x220V 3x380V 3x460V	3x220V 3x380V 3x460V			3x220V 3x380V 3x460V
SP 14A-3	MS 402	1.5	380	346	726	95	101	16
SP 14A-5	MS 4000	2.2	510	453	963	95	101	23
SP 14A-8	MS 402	4.0	705	573	1278	95	101	30
SP 14A-12	MS 4000	5.5	965	673	1638	95	101	37
SP 14A-16	MS 4000	7.5	1225	773	1998	95	101	50
SP 14A-12	MS6	5.5	1027	565	1592	143	138	48
SP 14A-16	MS6	7.5	1287	590	1877	143	138	54

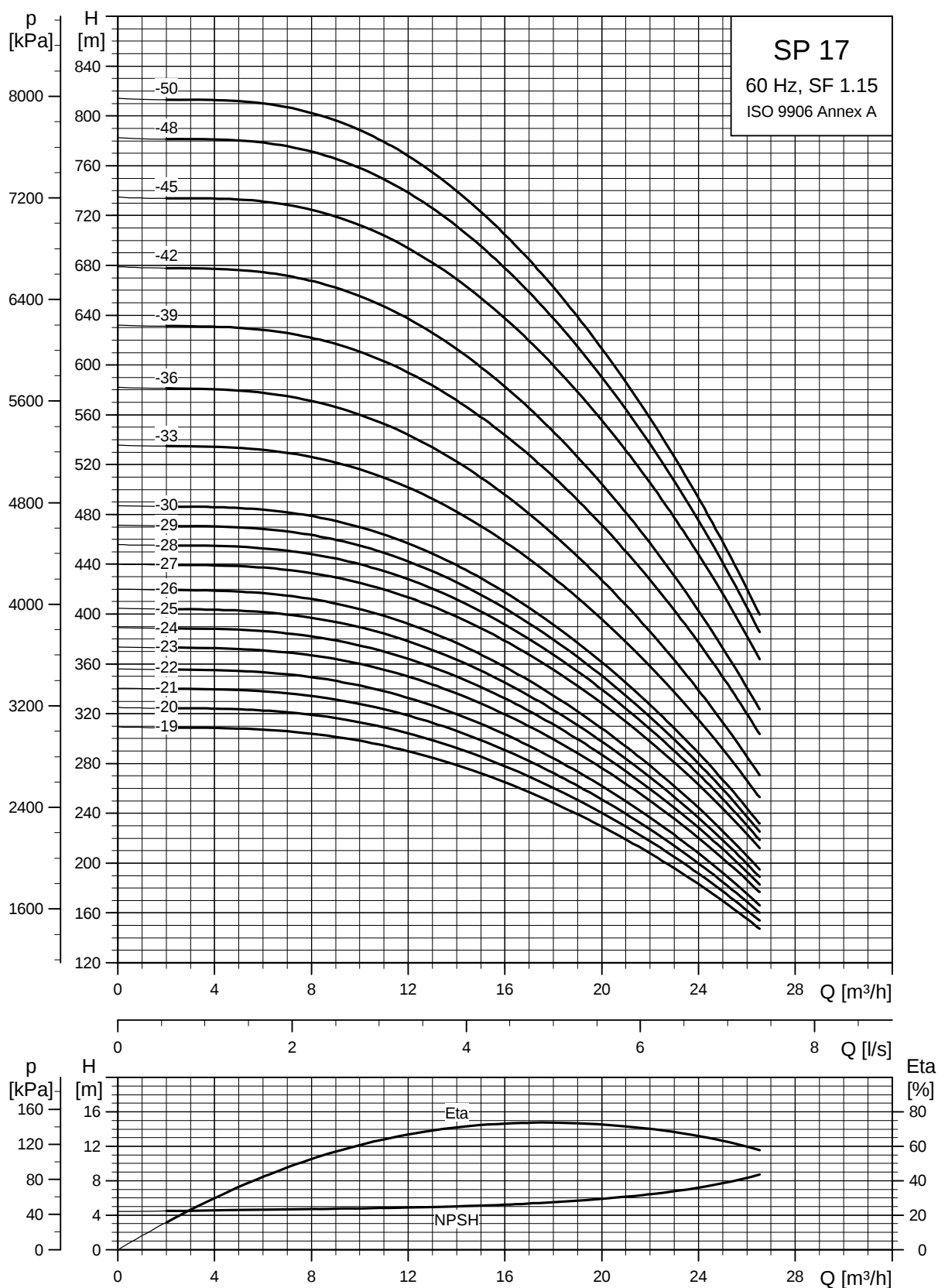
E = Maximum diameter of pump inclusive of cable guard and motor.

SP 17



TM01 3309 1802

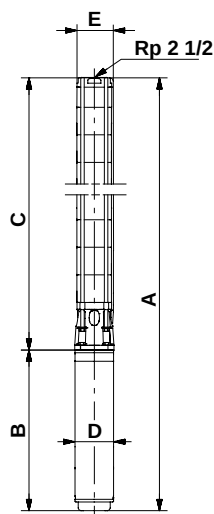
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 3310 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



TM01 2435 1798

SP 17-33 to SP 17-50 are mounted in sleeve for R 3 connection.

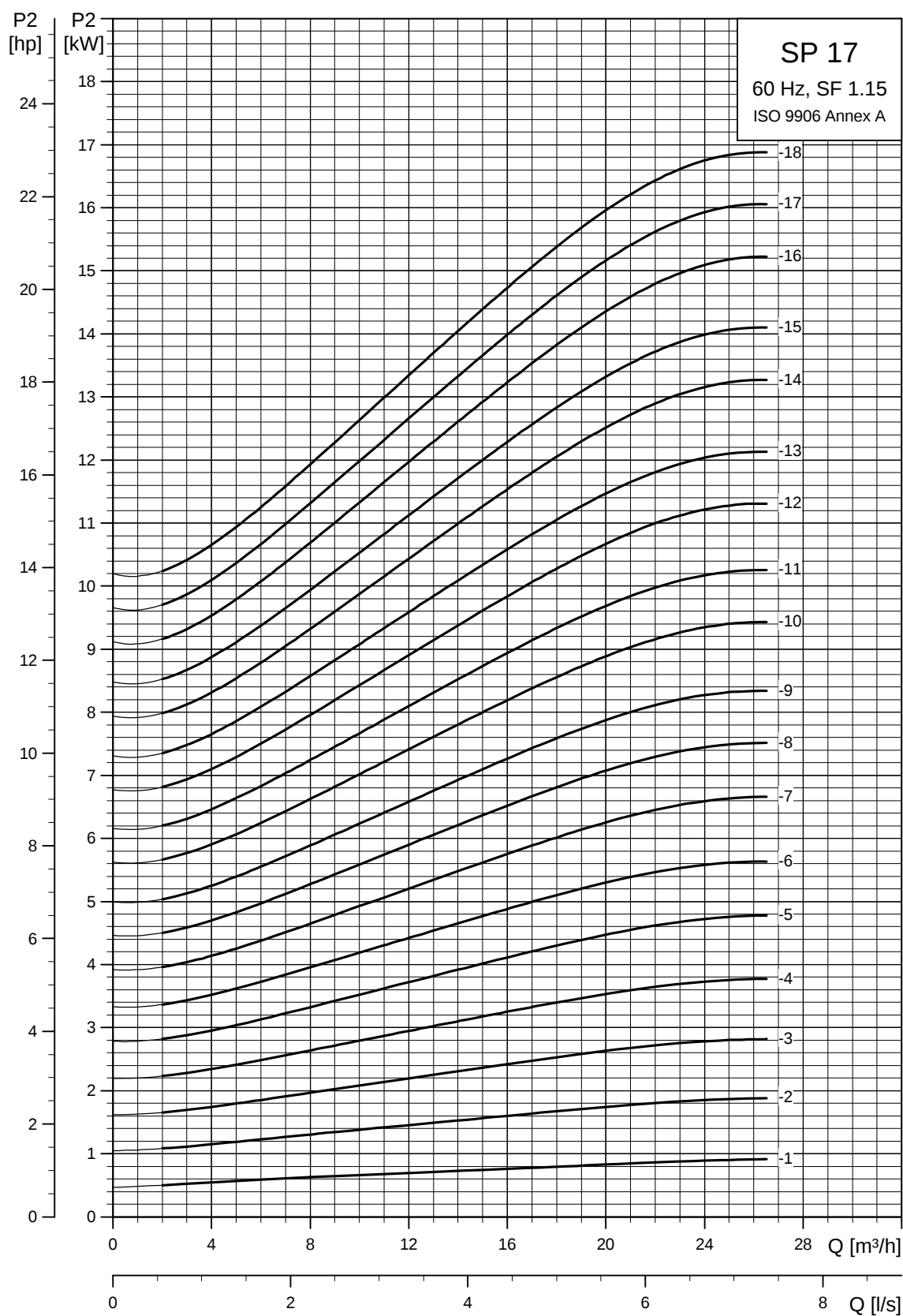
Pump type	Motor		Dimensions [mm]						Net weight [kg]
	Type	Power [kW]	C	B	A	D	E*	E**	
SP 17-1	MS 4000	1.1	314	413	727	95	131		18
SP 17-2	MS 4000	2.2	374	454	828	95	131		22
SP 17-3	MS 4000	3	435	494	929	95	131		24
SP 17-4	MS 4000	4	495	574	1069	95	131		29
SP 17-5	MS 4000	5.5	556	674	1230	95	131		35
SP 17-6	MS 4000	5.5	616	674	1290	95	131		36
SP 17-7	MS 4000	7.5	677	773	1450	95	131		43
SP 17-8	MS 4000	7.5	737	773	1510	95	131		44
SP 17-9	MS 4000	7.5	798	773	1571	95	131		45
SP 17-5	MS6	5.5	572	565	1137	143	142		47
SP 17-6	MS6	5.5	632	565	1197	143	142		48
SP 17-7	MS6	7.5	693	590	1283	143	142		50
SP 17-8	MS6	7.5	753	590	1343	143	142		51
SP 17-9	MS6	7.5	814	590	1404	143	142		52
SP 17-10	MS6	9.2	874	610	1484	143	142		59
SP 17-11	MS6	9.2	935	610	1545	143	142		60
SP 17-12	MS6	11	995	708	1703	143	142		64
SP 17-13	MS6	11	1056	708	1764	143	142		65
SP 17-14	MS6	13	1116	738	1854	143	142		69
SP 17-15	MS6	13	1177	738	1915	143	142		71
SP 17-16	MS6	15	1237	783	2020	143	142		76
SP 17-17	MS6	15	1298	783	2081	143	142		77
SP 17-18	MS6	15	1358	783	2141	143	142		78
SP 17-19	MS6	18.5	1419	838	2257	143	142		85
SP 17-20	MS6	18.5	1479	838	2317	143	142		87
SP 17-21	MS6	18.5	1540	838	2378	143	142		88
SP 17-22	MS6	18.5	1600	838	2438	143	142		89
SP 17-23	MS6	22	1661	903	2564	143	142		96
SP 17-24	MS6	22	1721	903	2624	143	142		97
SP 17-25	MS6	22	1782	903	2685	143	142		99
SP 17-26	MS6	22	1842	903	2745	143	142		100
SP 17-27	MS6	26	1903	968	2871	143	142		106
SP 17-28	MS6	26	1963	968	2931	143	142		107
SP 17-29	MS6	26	2024	968	2992	143	142		108
SP 17-30	MS6	26	2084	968	3052	143	142		110
SP 17-33	MS6	30	2513	1023	3536	143	175		155
SP 17-36	MS6	30	2694	1023	3717	143	175		160
SP 17-39	MMS 6000	37	2876	1425	4301	136	175		203
SP 17-42	MMS 6000	37	3057	1425	4482	144	175	181	208
SP 17-45	MMS 8000	45	3188	1270	4458	192	192	192	276
SP 17-48	MMS 8000	45	3369	1270	4639	192	192	192	281
SP 17-50	MMS 8000	45	3490	1270	4760	192	192	192	285

* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

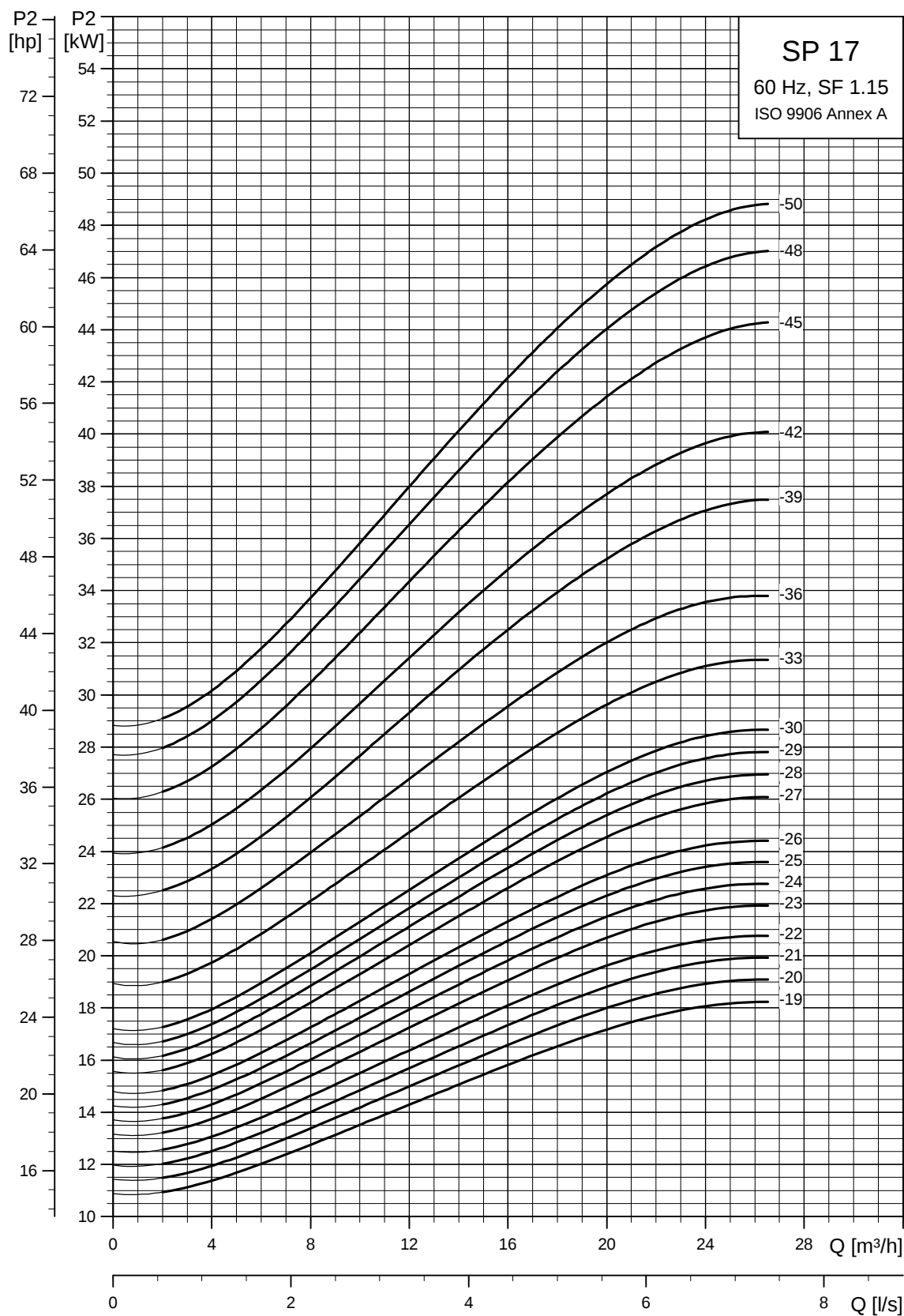
The pump types above are also available in N- and R-versions (R-versions up to and including SP 17-30), see page 5 for further details.
Dimensions as above.

Other types of connection are possible by means of connecting flanges, see page 86.



TM01 2342 1802

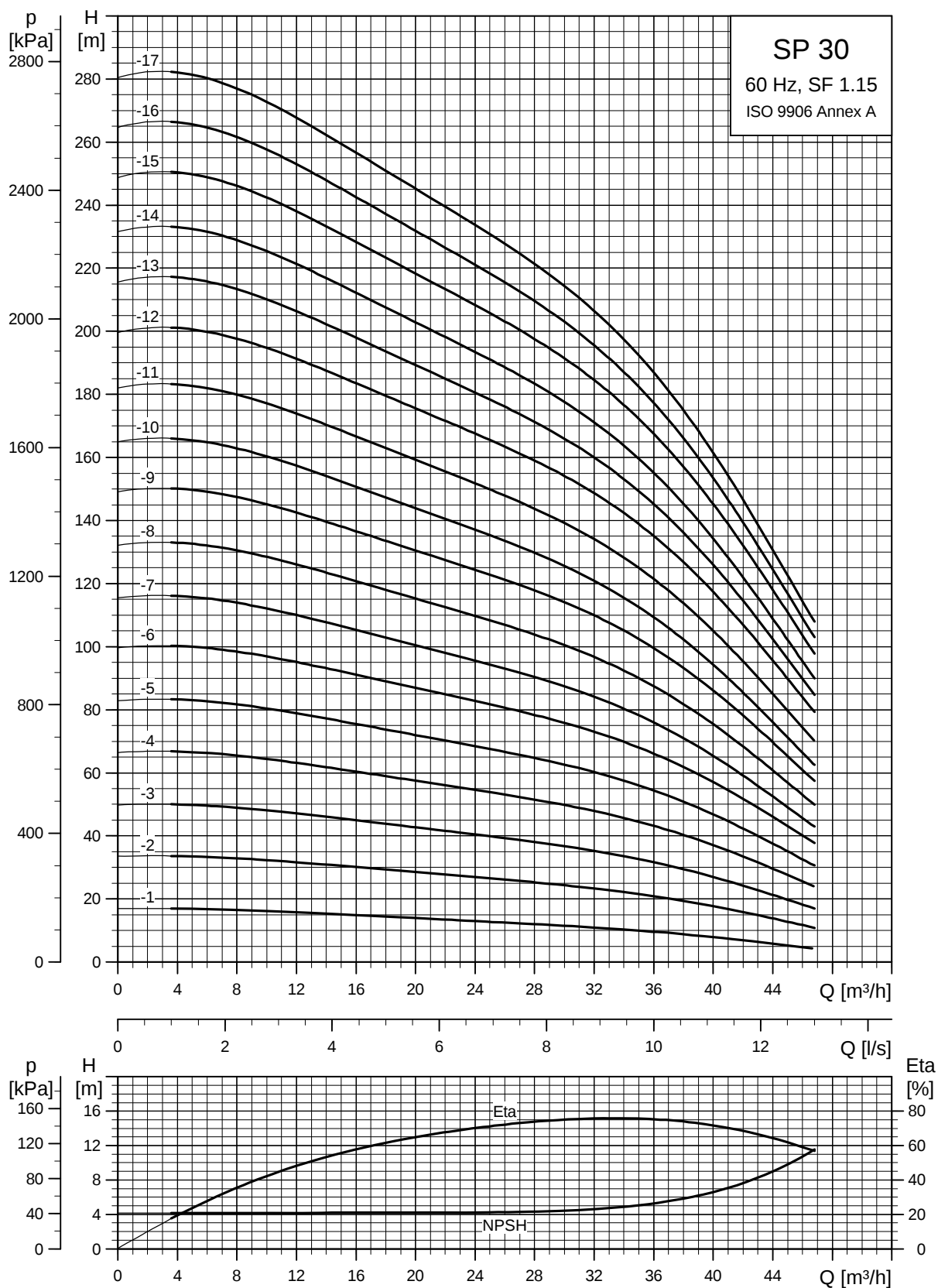
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 9243 1802

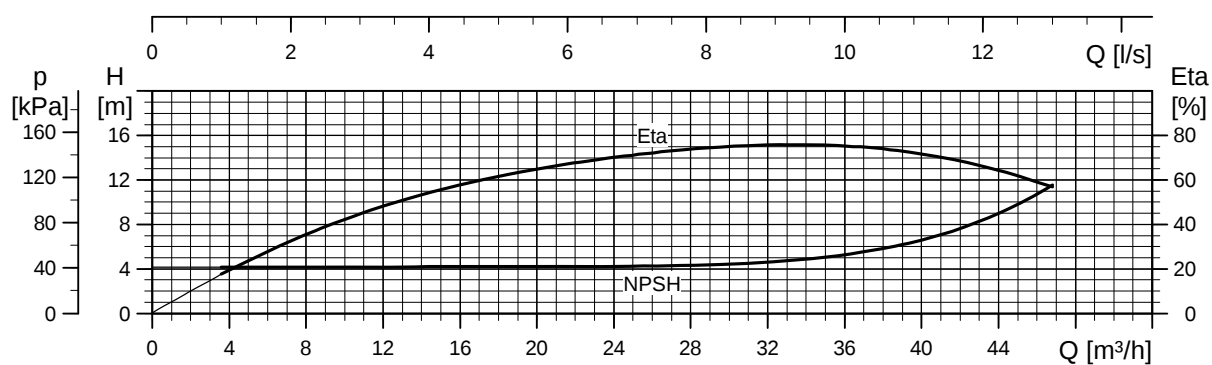
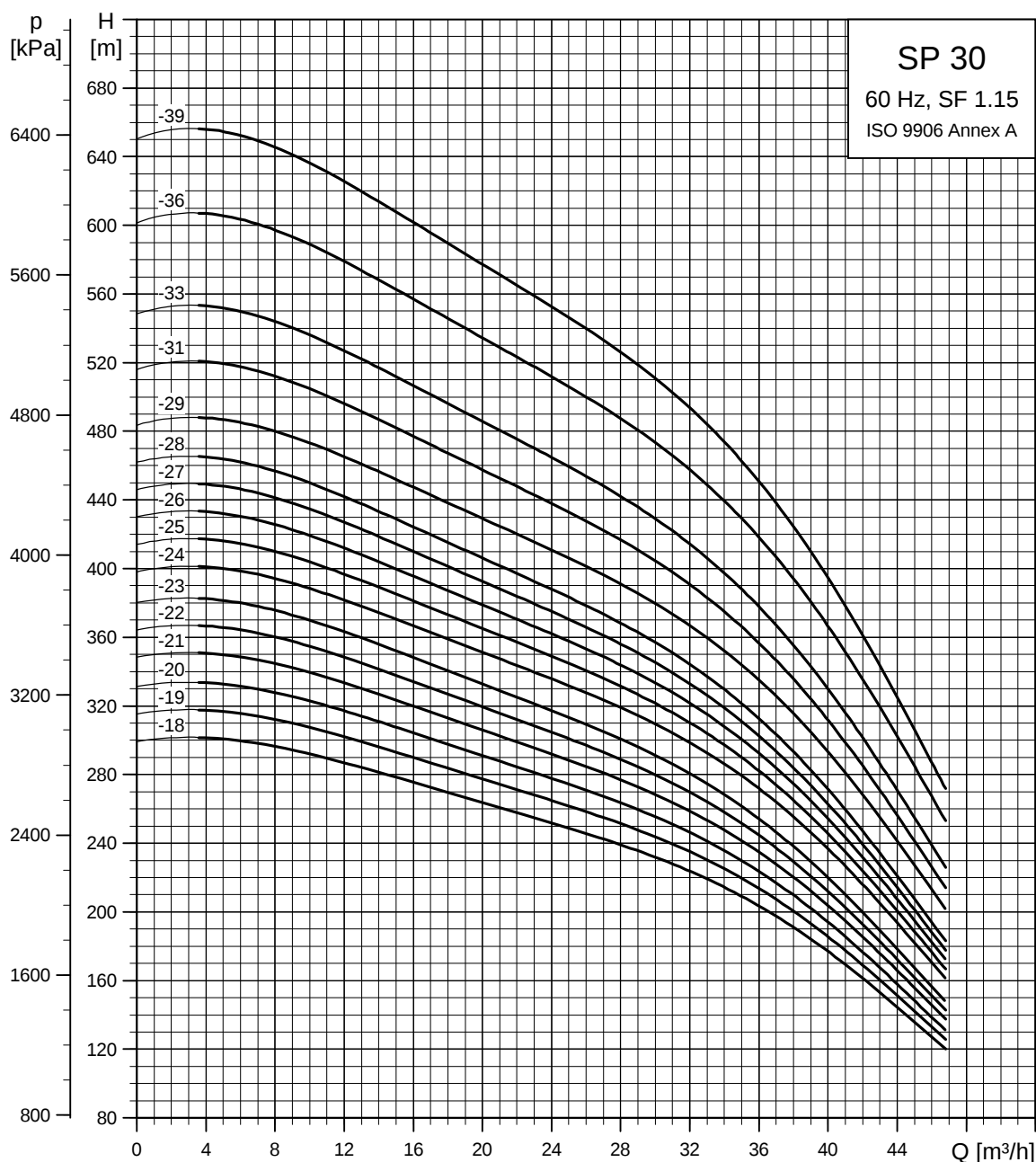
Explanation of efficiency curve, please see "Curve conditions" on page 4.

SP 30



TM01 3311 1802

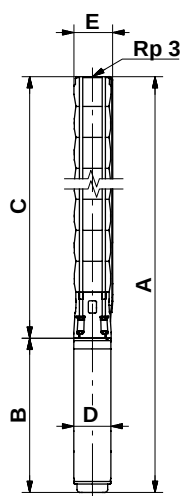
Explanation of efficiency curve, please see "Curve conditions" on page 4.



Explanation of efficiency curve, please see "Curve conditions" on page 4.

TM01 3312 1802

Dimensions and weights



TM00 0960 1196

SP 30-29 to SP 30-39 are mounted in sleeve for R 3 connection.

Pump type	Motor		Dimensions [mm]						Net weight [kg]
	Type	Power [kW]	C	B	A	D	E*	E**	
SP 30-1	MS 4000	1.5	349	413	762	95	131		21
SP 30-2	MS 4000	3	445	494	939	95	131		24
SP 30-3	MS 4000	4	541	574	1115	95	131		29
SP 30-4	MS 4000	5.5	637	674	1311	95	131		36
SP 30-5	MS 4000	7.5	733	773	1506	95	131		43
SP 30-4	MS6	5.5	653	565	1218	143	142	142	47
SP 30-5	MS6	7.5	749	590	1339	143	142	142	50
SP 30-6	MS6	9.2	845	610	1455	143	142	142	57
SP 30-7	MS6	9.2	941	610	1551	143	142	142	59
SP 30-8	MS6	11	1037	708	1745	143	142	142	63
SP 30-9	MS6	13	1133	738	1871	143	142	142	68
SP 30-10	MS6	13	1229	738	1967	143	142	142	70
SP 30-11	MS6	15	1325	783	2108	143	142	142	75
SP 30-12	MS6	18.5	1421	838	2259	143	142	142	83
SP 30-13	MS6	18.5	1517	838	2355	143	142	142	84
SP 30-14	MS6	18.5	1613	838	2451	143	142	142	86
SP 30-15	MS6	22	1709	903	2612	143	142	142	94
SP 30-16	MS6	22	1805	903	2708	143	142	142	95
SP 30-17	MS6	22	1901	903	2804	143	142	142	97
SP 30-18	MS6	26	1997	968	2965	143	142	142	104
SP 30-19	MS6	26	2093	968	3061	143	142	142	106
SP 30-20	MS6	26	2189	968	3157	143	142	142	108
SP 30-21	MS6	30	2285	1023	3308	143	144	145	117
SP 30-22	MS6	30	2381	1023	3404	143	144	145	119
SP 30-23	MS6	30	2477	1023	3500	143	144	145	121
SP 30-24	MMS 6000	37	2573	1425	3998	144	175	175	170
SP 30-25	MMS 6000	37	2669	1425	4094	144	175	175	171
SP 30-26	MMS 6000	37	2765	1425	4190	144	175	175	173
SP 30-27	MMS 6000	37	2861	1425	4286	144	175	175	175
SP 30-28	MMS 6000	37	2957	1425	4382	144	175	175	176
SP 30-29	MMS 8000	45	3249	1270	4519	192	192	192	280
SP 30-31	MMS 8000	45	3441	1270	4711	192	192	192	285
SP 30-33	MMS 8000	45	3633	1270	4903	192	192	192	290
SP 30-36	MMS 8000	55	3921	1350	5271	192	192	192	313
SP 30-39	MMS 8000	55	4209	1350	5559	192	192	192	322

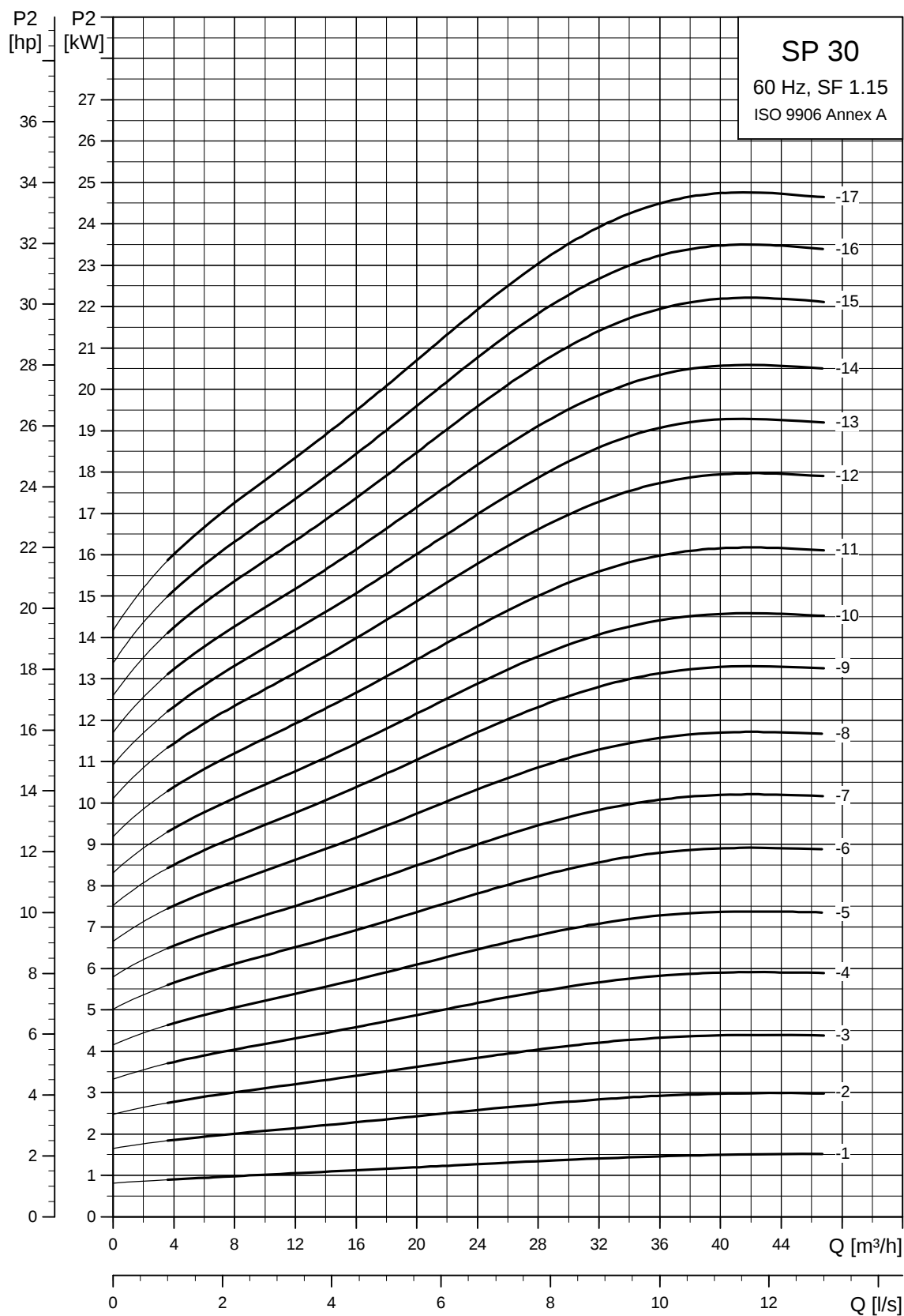
* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

The pump types above are also available in N and R-versions (R-versions up to and including SP 30-28), see page 5 for further details.

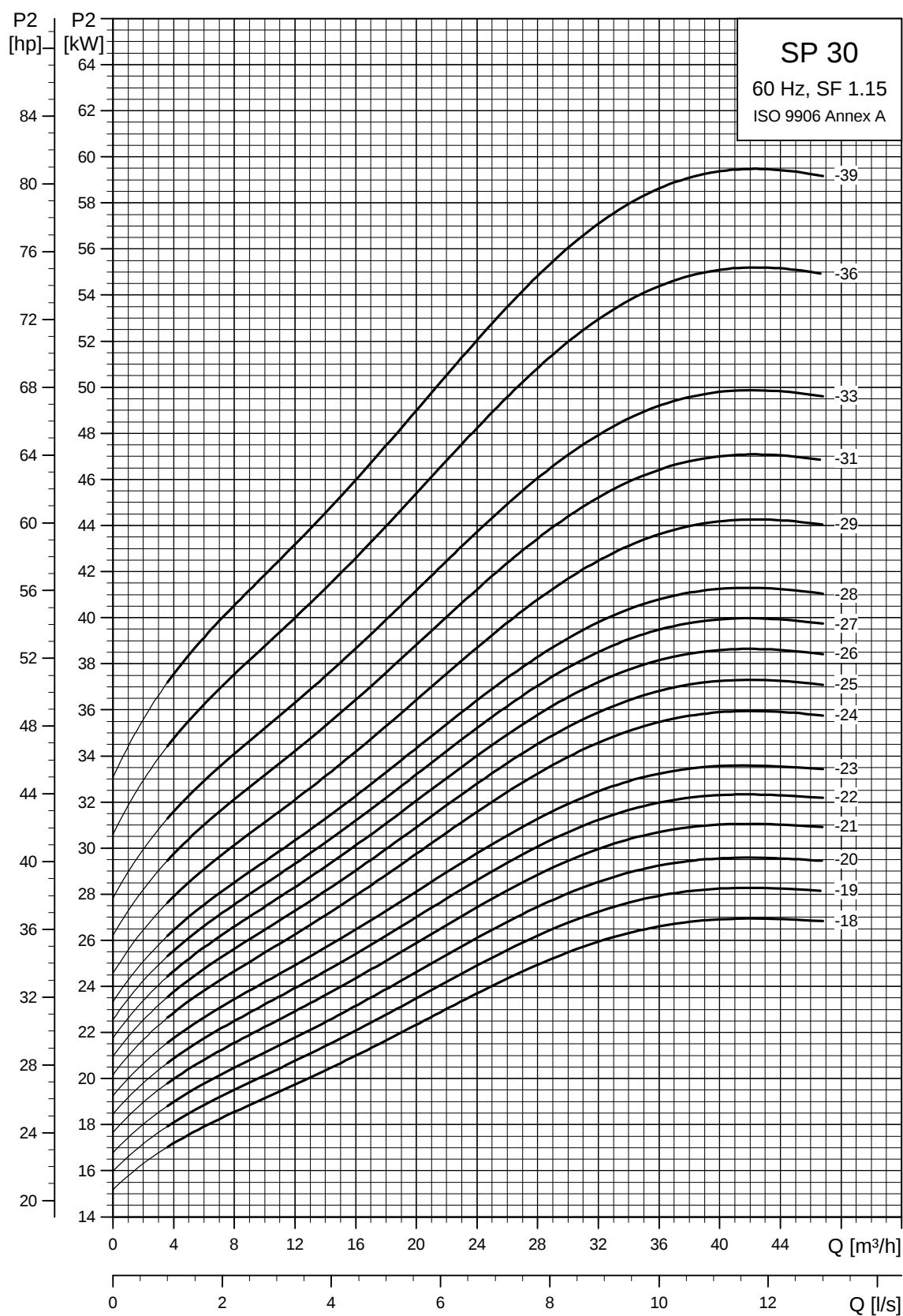
Dimensions as above.

Other types of connection are possible by means of connecting pieces, see page 86.



TM01 2266 1802

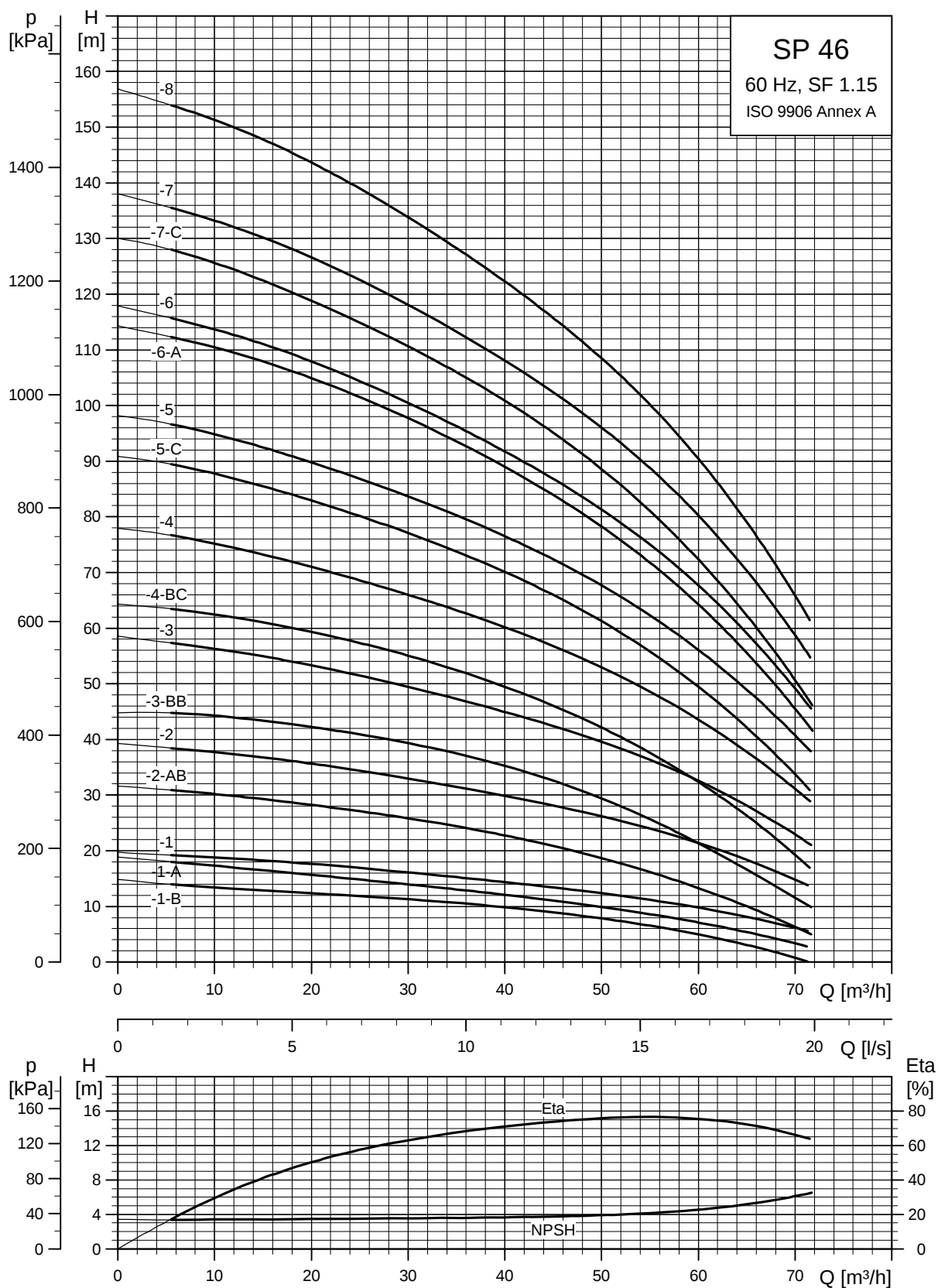
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 9244 1802

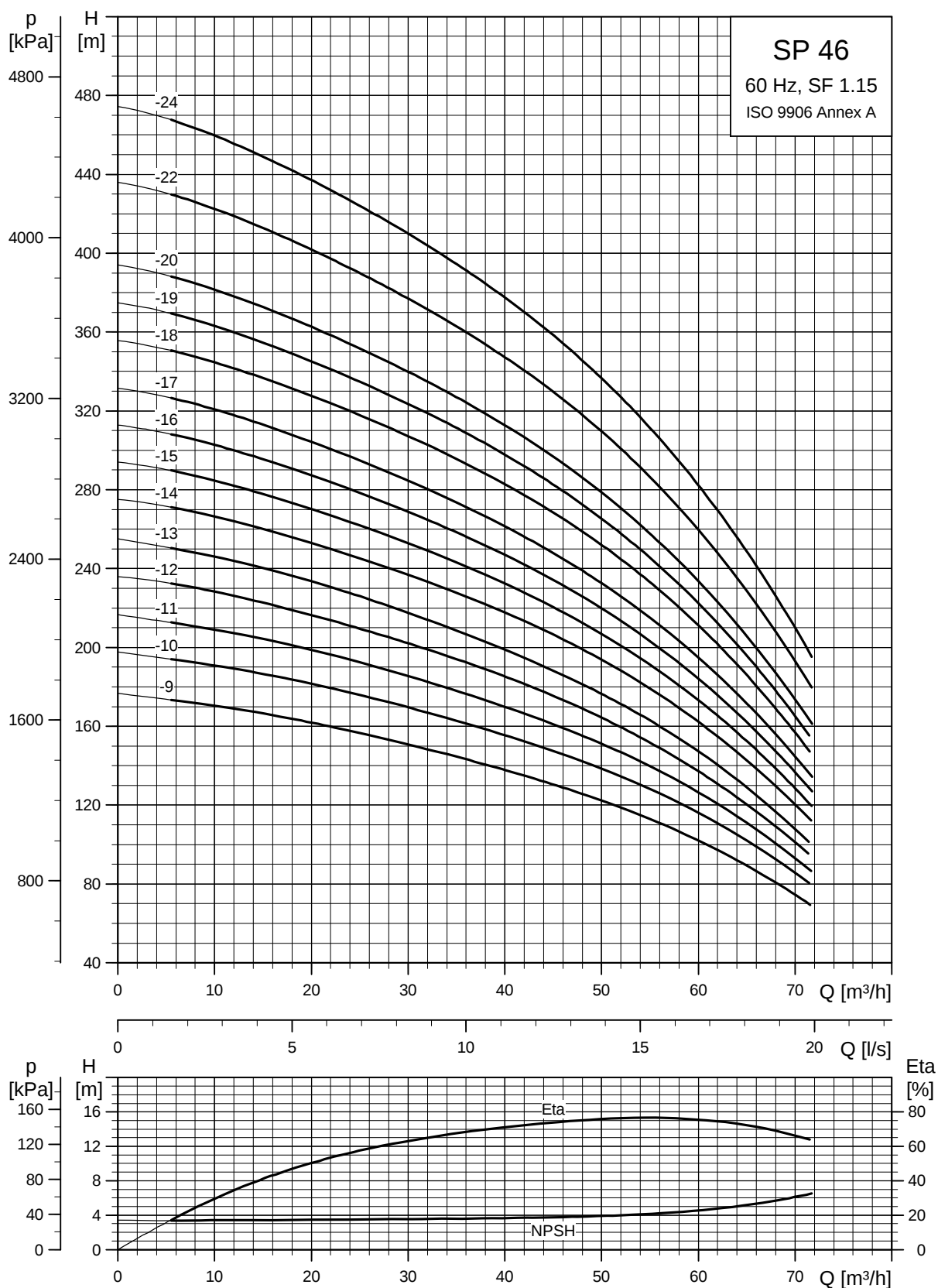
Explanation of efficiency curve, please see "Curve conditions" on page 4.

SP 46



TM01 3313 1802

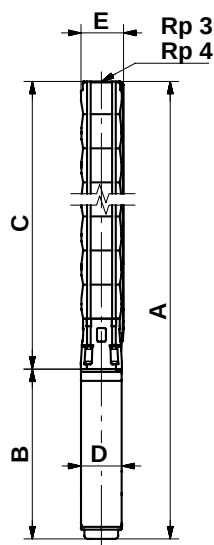
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 3314 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



TM00 0961 1196

SP 46-20 to SP 46-24 are mounted in sleeve for R 4 connection.

Pump type	Motor		Dimensions [mm]										Net weight [kg]
	Type	Power [kW]	Rp 3 connection				Rp 4 connection				B	D	
			A	C	E*	E**	A	C	E*	E**			
SP 46-1-B	MS 4000	1.5	780	367	146	148	783	370	146	148	413	95	20
SP 46-1-B	MS 402	1.5	713	367	146	148	716	370	146	148	346	95	16
SP 46-1-A	MS 4000	2.2	821	367	146	148	824	370	146	148	454	95	22
SP 46-1	MS 4000	3	861	367	146	148	864	370	146	148	494	95	23
SP 46-2-AB	MS 4000	4.0	974	480	146	148	977	483	146	148	494	95	25
SP 46-2	MS 4000	5.5	1154	480	146	148	1157	483	146	148	674	95	34
SP 46-3-BB	MS 4000	5.5	1267	593	146	148	1267	593	146	148	674	95	37
SP 46-3	MS 4000	7.5	1367	593	149	152	1370	596	149	152	774	95	42
SP 46-3	MS6	7.5	1199	609	149	152	1202	612	149	152	590	143	49
SP 46-4-BC	MS6	7.5	1312	722	149	152	1315	725	149	152	590	143	52
SP 46-4	MS6	9.2	1332	722	149	152	1335	725	149	152	610	143	57
SP 46-5-C	MS6	11	1543	835	149	152	1546	838	149	152	708	143	63
SP 46-5	MS6	13	1573	835	149	152	1576	838	149	152	738	143	66
SP 46-6-A	MS6	13	1686	948	149	152	1689	951	149	152	738	143	68
SP 46-6	MS6	15	1731	948	149	152	1734	951	149	152	783	143	72
SP 46-7-C	MS6	15	1844	1061	149	152	1847	1064	149	152	783	143	75
SP 46-7	MS6	18.5	1899	1061	149	152	1902	1064	149	152	838	143	80
SP 46-8	MS6	18.5	2012	1174	149	152	2015	1177	149	152	838	143	83
SP 46-9	MS6	22	2190	1287	149	152	2193	1290	149	152	903	143	91
SP 46-10	MS6	22	2303	1400	149	152	2306	1403	149	152	903	143	94
SP 46-11	MS6	26	2481	1513	149	152	2484	1516	149	152	968	143	102
SP 46-12	MS6	30	2649	1626	149	152	2652	1629	149	152	1023	143	112
SP 46-13	MS6	30	2762	1739	149	152	2765	1742	149	152	1023	143	115
SP 46-14	MMS 6000	37	3357	1932	149	152	3360	1935	149	152	1425	138	168
SP 46-15	MMS 6000	37	3470	2045	149	152	3473	2048	149	152	1425	138	170
SP 46-16	MMS 6000	37	3583	2158	149	152	3586	2161	149	152	1425	138	173
SP 46-17	MMS 6000	37	3696	2271	149	152	3699	2274	149	152	1425	138	175
SP 46-18	MMS 8000	45	3603	2333	192	192	3606	2336	192	192	1270	192	228
SP 46-19	MMS 8000	45	3717	2446	192	192	3719	2449	192	192	1270	192	231
SP 46-20	MMS 8000	45	3829	2559	192	192	3832	2562	192	192	1270	192	234
SP 46-22	MMS 8000	55	4298	2948	193	195	4301	2951	193	195	1350	192	281
SP 46-24	MMS 8000	55					4527	3177	193	195	1350	192	287

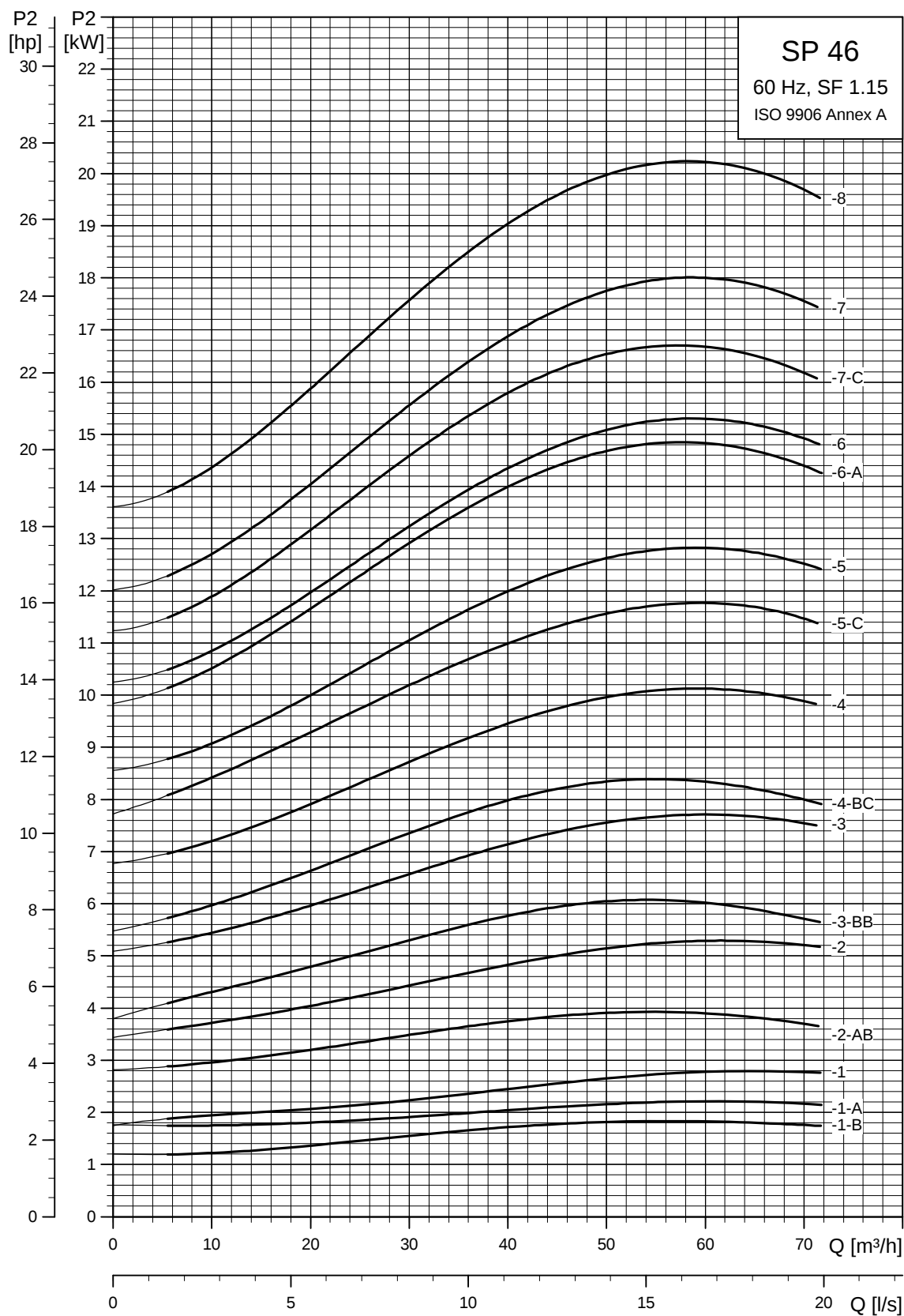
* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

The pump types above are also available in N and R-versions (R-versions up to and including SP 46-17), see page 5 for further details.

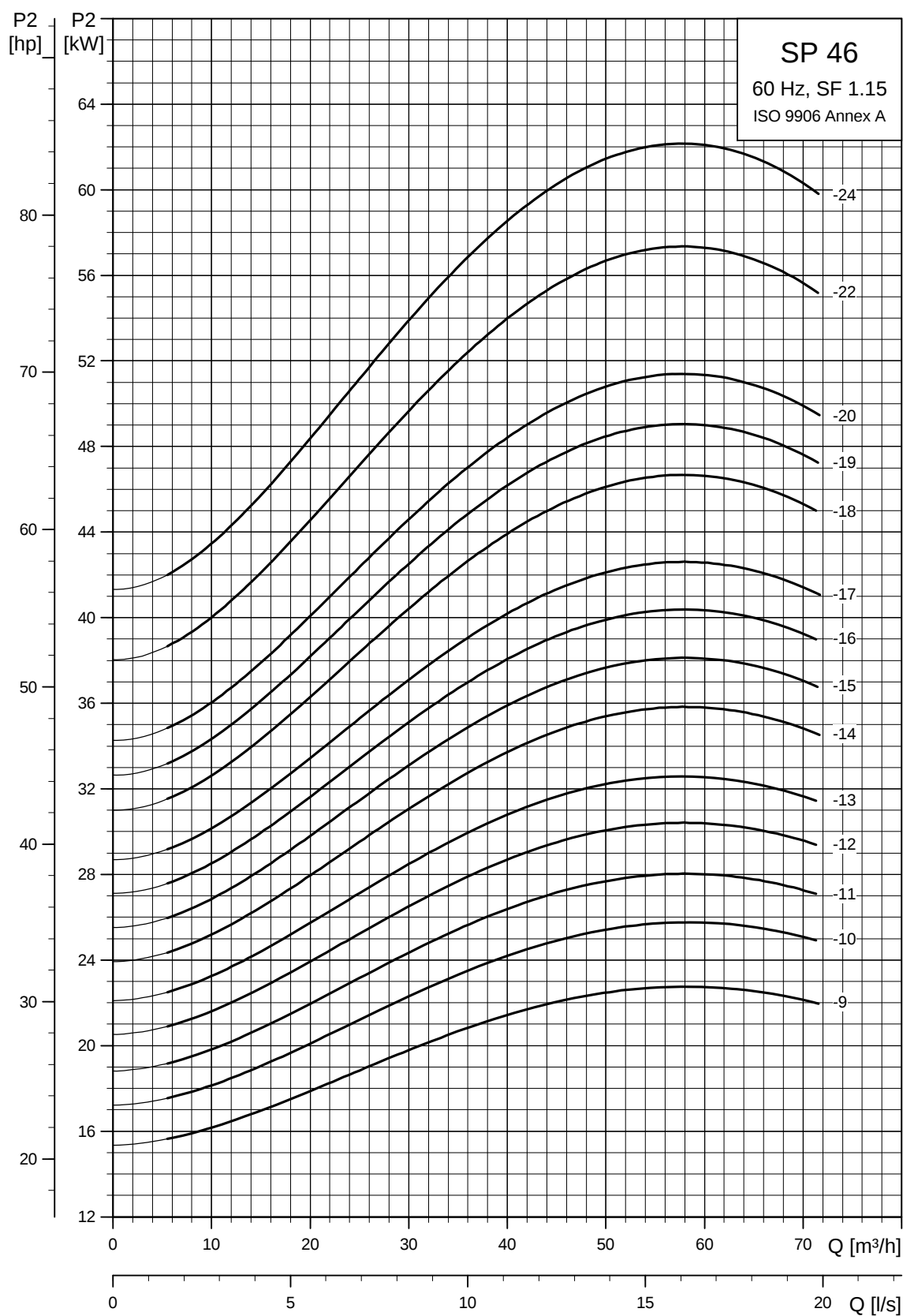
Dimensions as above.

Other types of connection are possible by means of connecting pieces, see page 86.



TM00 7515 1802

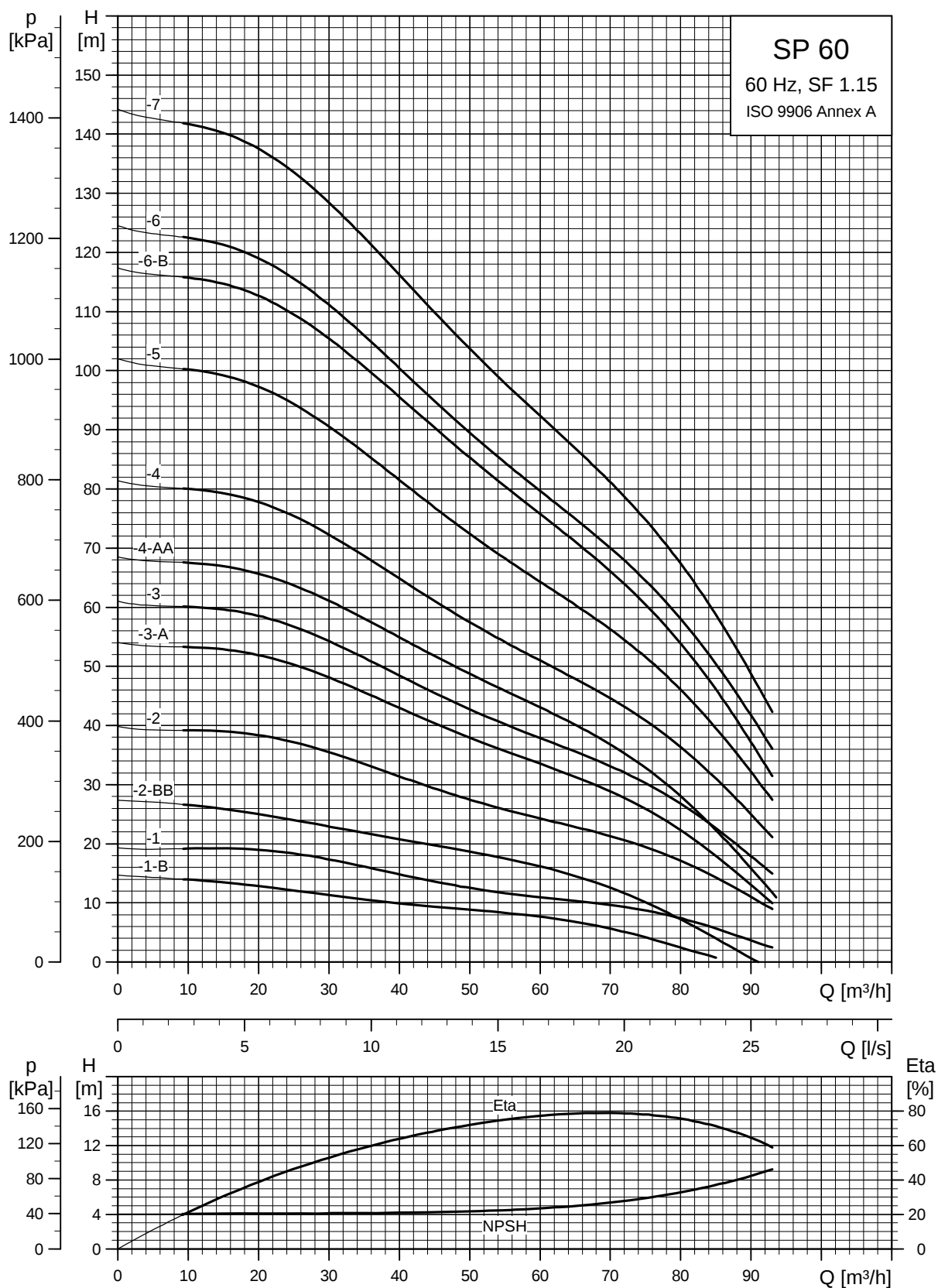
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 9245 1802

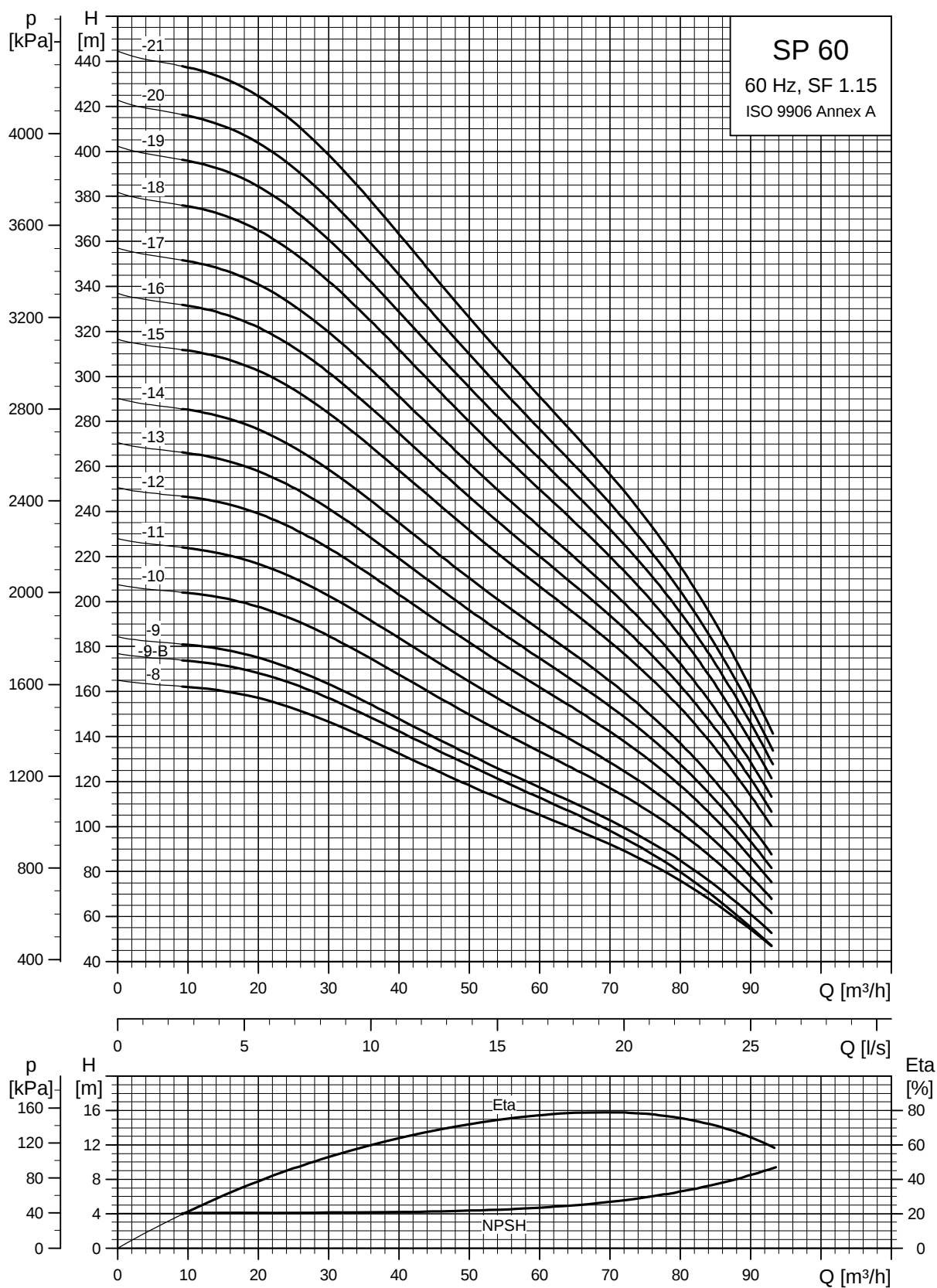
Explanation of efficiency curve, please see "Curve conditions" on page 4.

SP 60



TM01 3315 1802

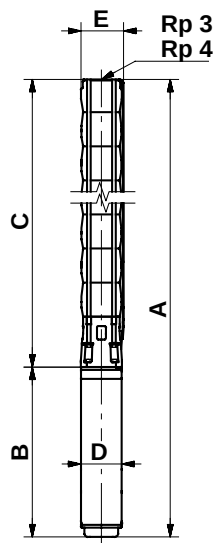
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 3316 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



SP 60-19 to SP 60-21 are mounted in sleeve for R 4 connection.

TM00 0961 1196

Pump type	Motor		Dimensions [mm]										Net weight [kg]
	Type	Power [kW]	Rp 3 connection				Rp 4 connection				B	D	
			A	C	E*	E**	A	C	E*	E**			
SP 60-1-B	MS 4000	2.2	821	367	146	148	824	370	146	148	454	95	22
SP 60-1-A	MS 4000	3.7					864	370	146	148	494	95	23
SP 60-1	MS 4000	4.0	941	367	146	148	944	370	146	148	574	95	27
SP 60-2-BB	MS 4000	4.0	974	480	146	148	977	483	146	148	494	95	25
SP 60-2	MS 4000	5.5	1154	480	146	148	1157	483	146	148	674	95	34
SP 60-3-A	MS 4000	7.5	1367	593	146	148	1370	596	146	148	774	95	39
SP 60-3-A	MS6	7.5	1199	609	152	156	1202	612	152	156	590	143	49
SP 60-3	MS6	9.2	1219	609	152	156	1219	612	152	156	610	143	55
SP 60-4-AA	MS6	9.2	1332	722	152	156	1335	725	152	156	610	143	57
SP 60-4	MS6	11	1430	722	152	156	1433	725	152	156	708	143	60
SP 60-5	MS6	13	1573	835	152	156	1573	838	152	156	738	143	66
SP 60-6-B	MS6	15	1731	948	152	156	1734	951	152	156	783	143	72
SP 60-6	MS6	18.5	1786	948	152	156	1789	951	152	156	838	143	78
SP 60-7	MS6	18.5	1899	1061	152	156	1902	1064	152	156	838	143	80
SP 60-8	MS6	22	2077	1174	152	156	2080	1177	152	156	903	143	89
SP 60-9-B	MS6	22	2190	1287	152	156	2193	1290	152	156	903	143	91
SP 60-9	MS6	26	2255	1287	152	156	2258	1290	152	156	968	143	97
SP 60-10	MS6	26	2368	1400	152	156	2371	1403	152	156	968	143	100
SP 60-11	MS6	30	2536	1513	152	156	2539	1516	152	156	1023	143	110
SP 60-12	MMS 6000	37	3131	1706	152	156	3134	1709	152	156	1425	138	163
SP 60-13	MMS 6000	37	3244	1819	152	156	3247	1822	152	156	1425	138	165
SP 60-14	MMS 6000	37					3360	1935	152	156	1425	138	168
SP 60-15	MMS 8000	45					3267	1997	192	192	1270	192	221
SP 60-16	MMS 8000	45					3380	2110	192	192	1270	192	223
SP 60-17	MMS 8000	45					3493	2223	192	192	1270	192	226
SP 60-18	MMS 8000	55					3686	2336	192	192	1350	192	243
SP 60-19	MMS 8000	55					3962	2612	193	195	1350	192	272
SP 60-20	MMS 8000	55					4075	2725	193	195	1350	192	275
SP 60-21	MMS 8000	63					4328	2838	193	195	1490	192	304

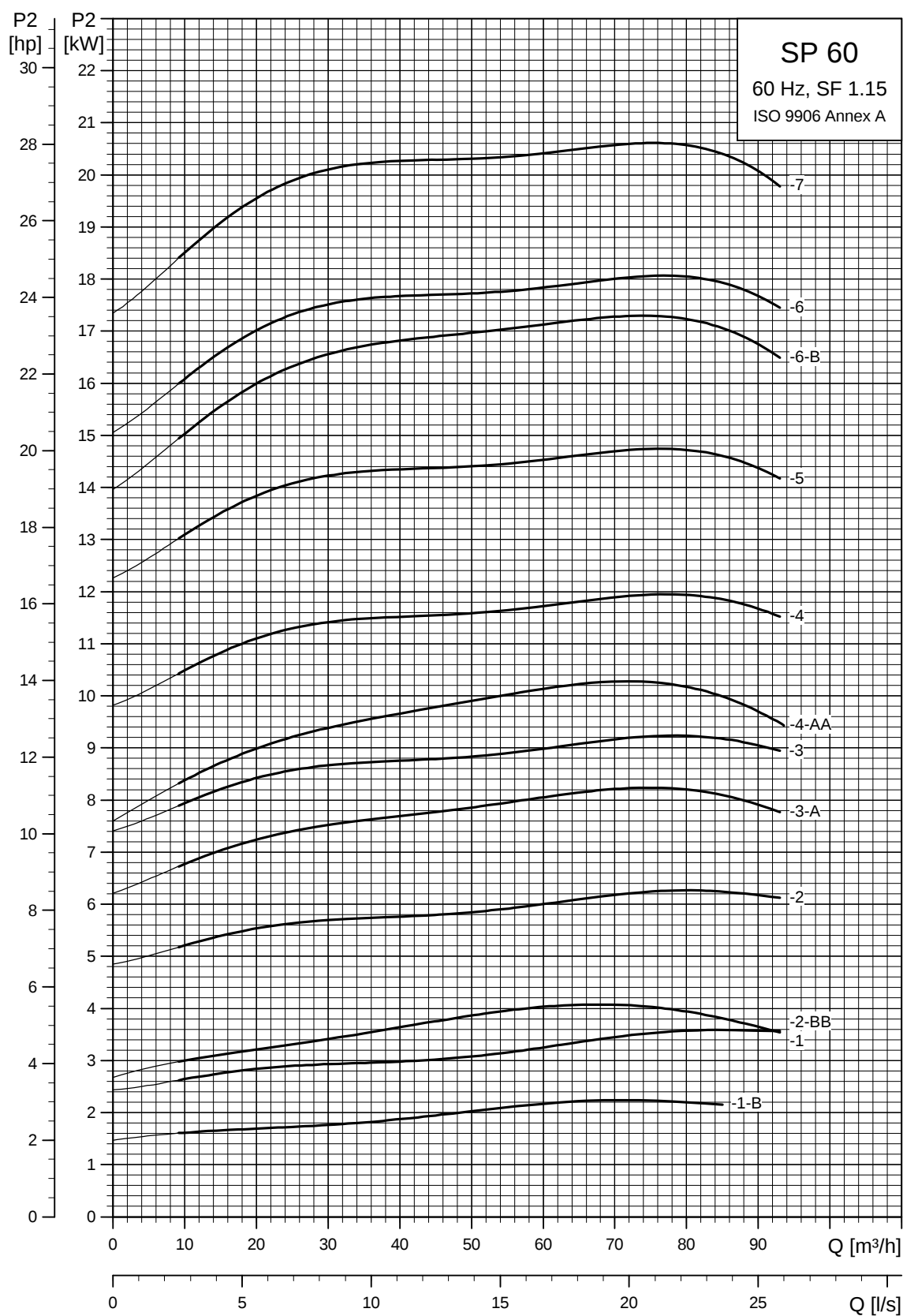
* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

The pump types above are also available in N and R-versions (R-version up to and including SP 60-18), see page 5 for further details.

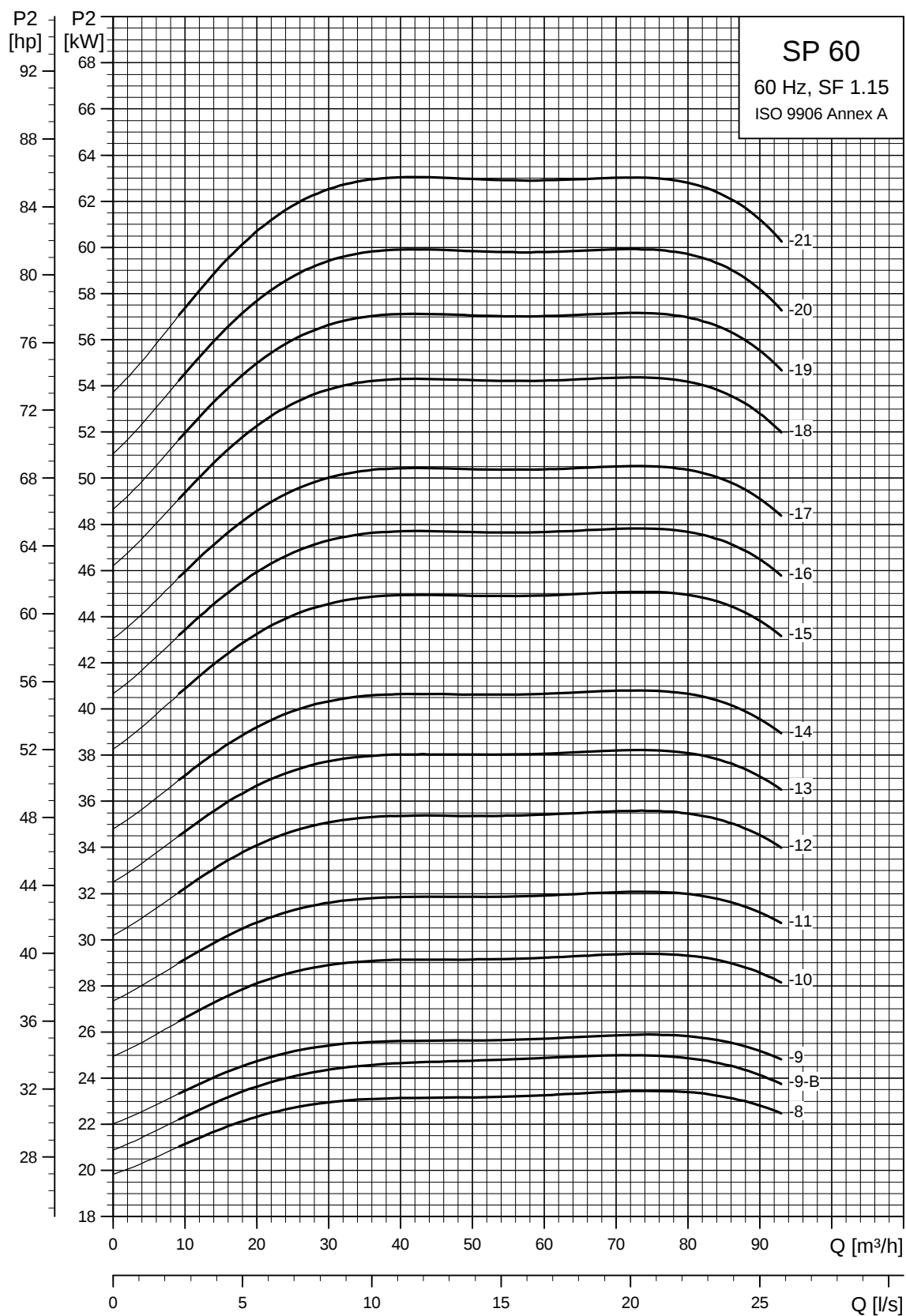
Dimensions as above.

Other types of connection are possible by means of connecting pieces, see page 86.



TM00 8054 1802

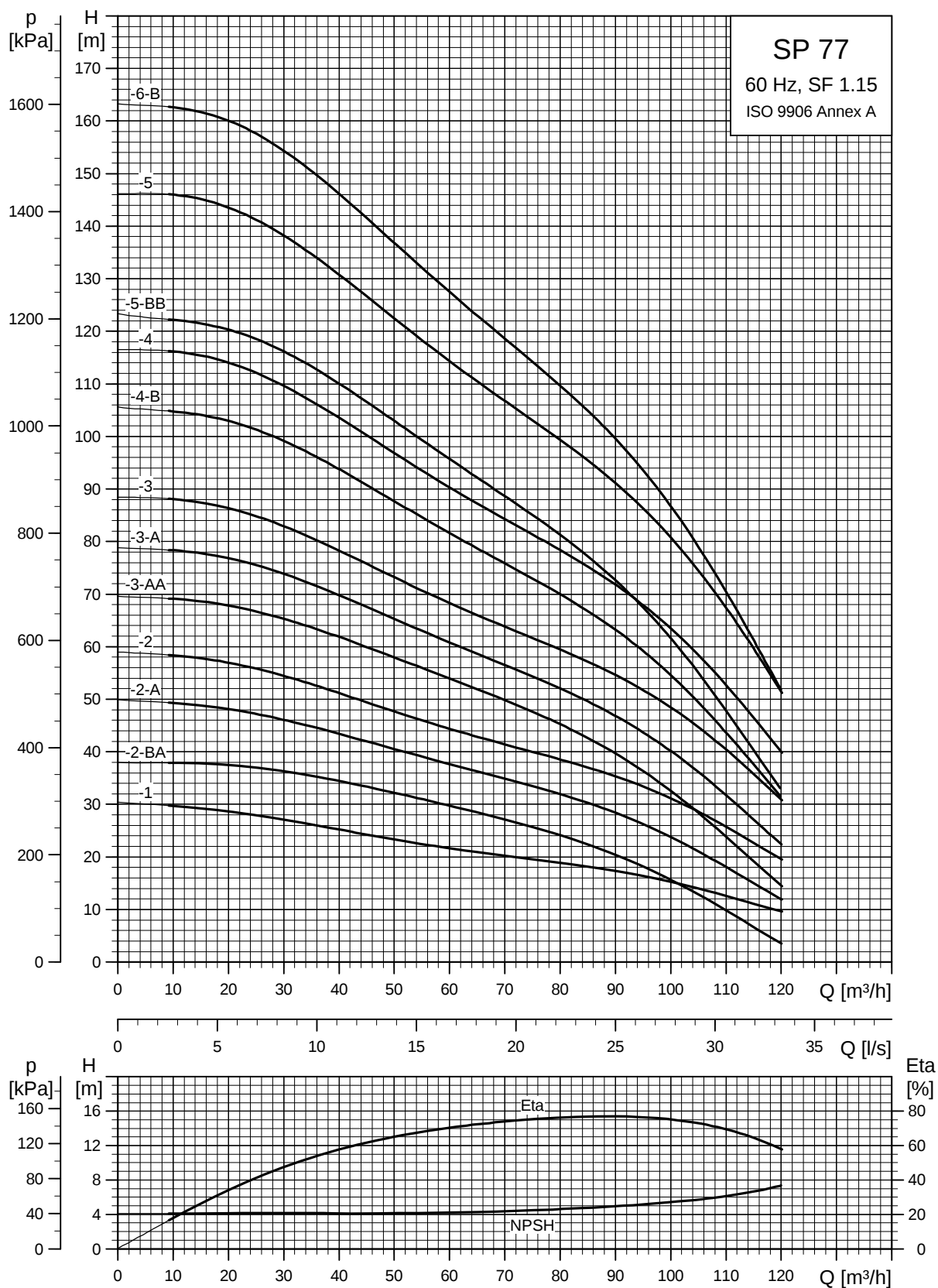
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 9246 1802

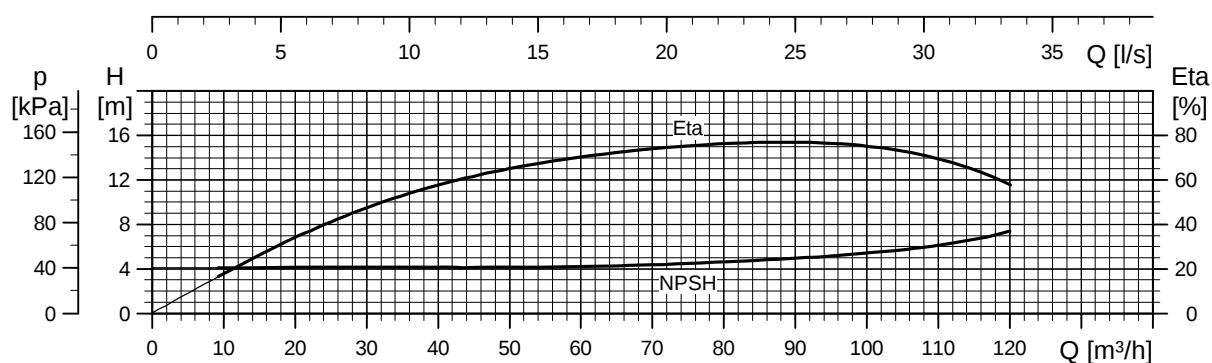
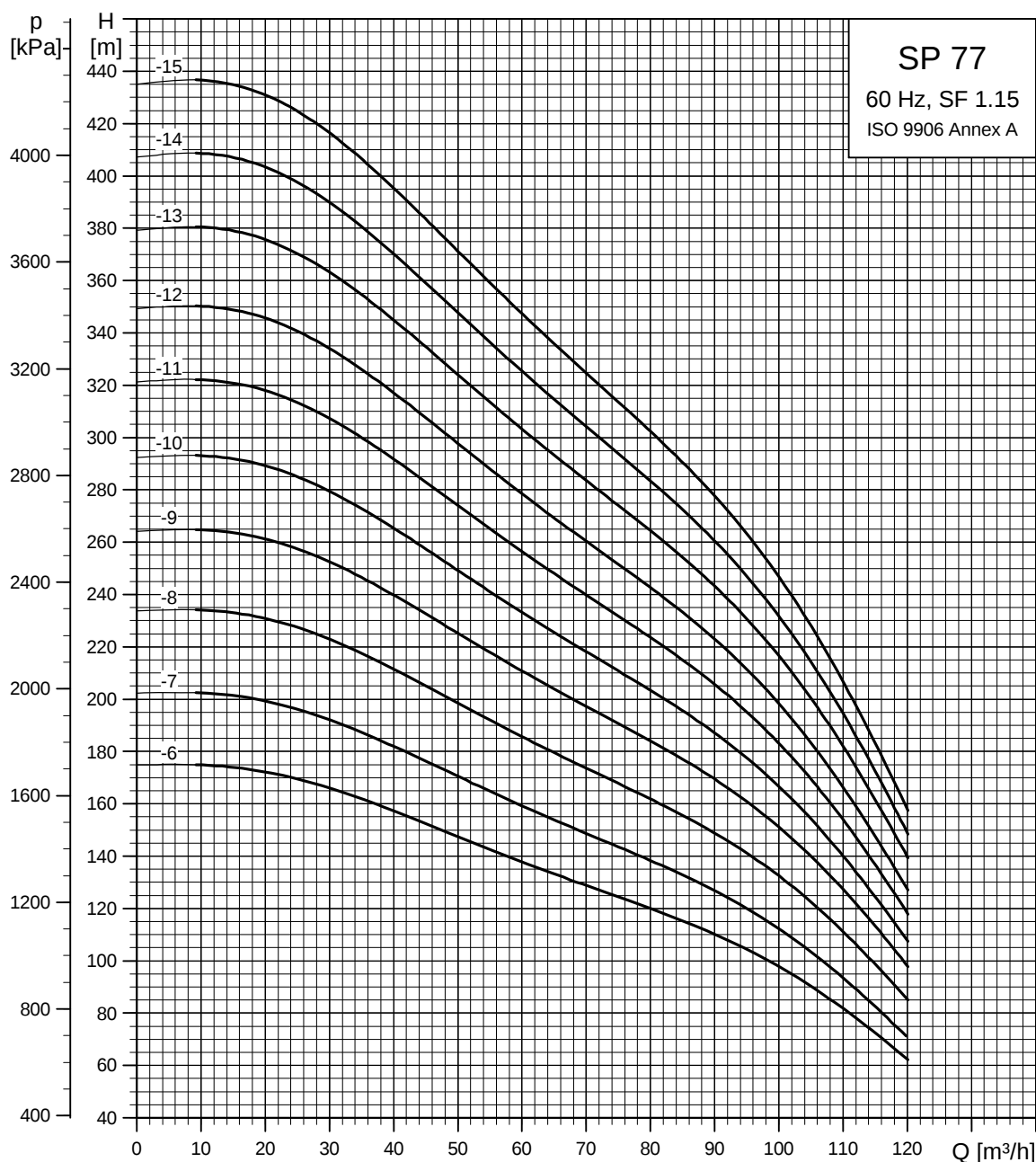
Explanation of efficiency curve, please see "Curve conditions" on page 4.

SP 77



TM01 3317 1802

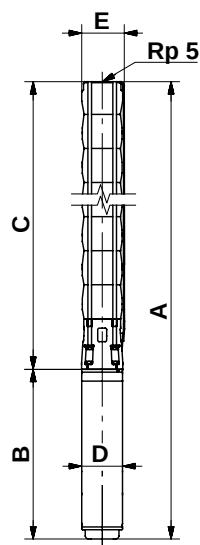
Explanation of efficiency curve, please see "Curve conditions" on page 4.



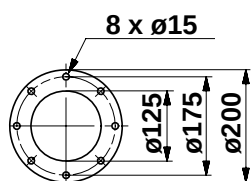
Explanation of efficiency curve, please see "Curve conditions" on page 4.

TM01 3318 1802

Dimensions and weights



TM00 7872 2196



TM00 7323 1798

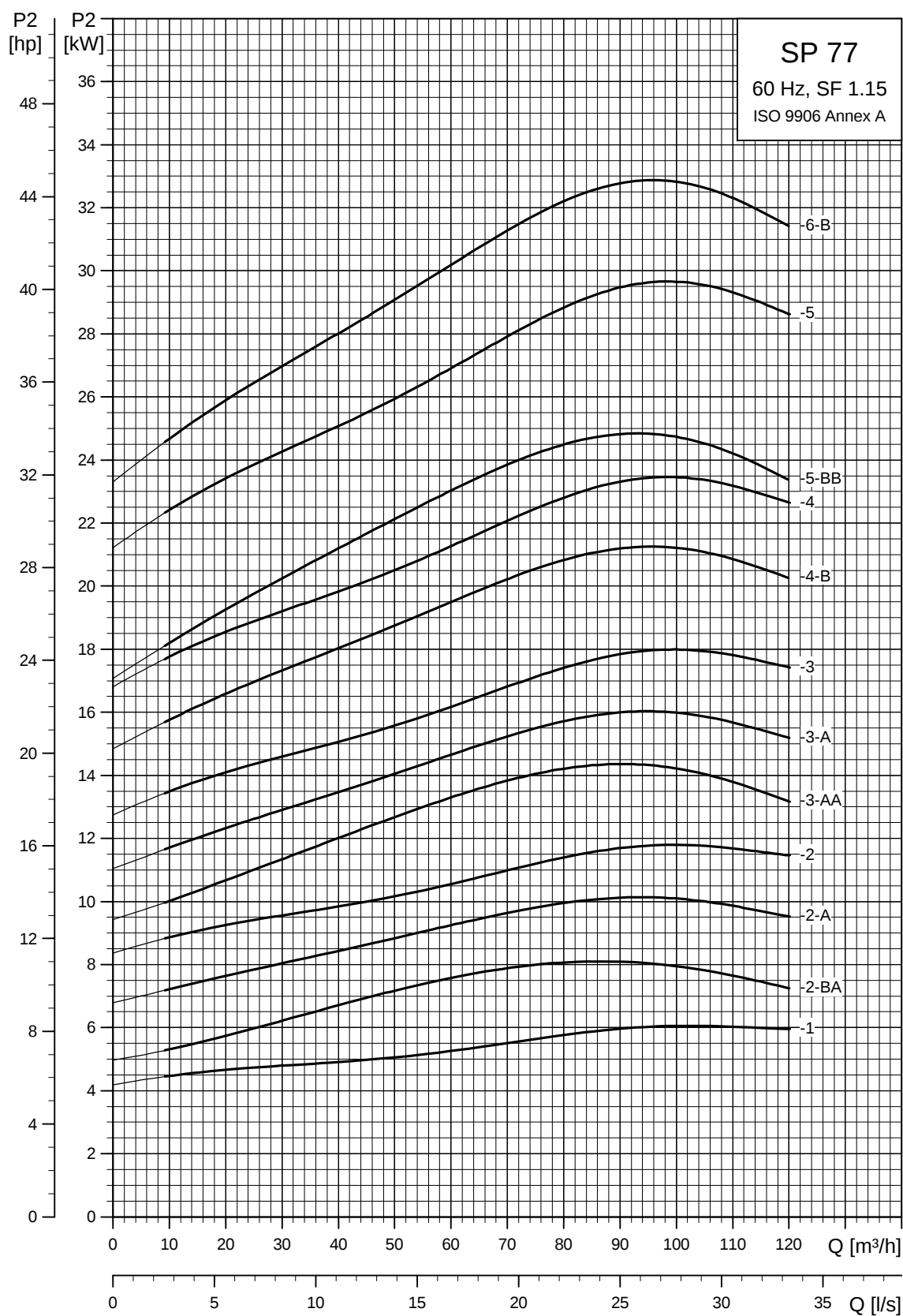
Pump type	Motor		Dimensions [mm]										Net weight [kg]
	Type	Power [kW]	Rp 5 connection				5" Grundfos flange				B	D	
			A	C	E*	E**	A	C	E*	E**			
SP 77-1	MS6	5.5	1183	618	178	186	1183	618	200	200	565	143	55
SP 77-2-BA	MS6	7.5	1336	746	178	186	1336	746	200	200	590	143	63
SP 77-2-A	MS6	9.2	1356	746	178	186	1356	746	200	200	610	143	69
SP 77-2	MS6	11	1454	746	178	186	1454	746	200	200	708	143	71
SP 77-3-AA	MS6	13	1612	874	178	186	1612	874	200	200	738	143	78
SP 77-3-A	MS6	15	1657	874	178	186	1657	874	200	200	783	143	82
SP 77-3	MS6	18.5	1712	874	178	186	1712	874	200	200	838	143	87
SP 77-4-B	MS6	18.5	1840	1002	178	186	1840	1002	200	200	838	143	91
SP 77-4	MS6	22	1905	1002	178	186	1905	1002	200	200	903	143	97
SP 77-5-BB	MS6	22	2033	1130	178	186	2033	1130	200	200	903	143	101
SP 77-5	MS6	26	2098	1130	178	186	2098	1130	200	200	968	143	106
SP 77-6-B	MS6	30	2281	1258	178	186	2281	1258	200	200	1023	143	118
SP 77-6	MMS 6000	37	2683	1258	178	186	2683	1258	200	200	1425	138	166
SP 77-7	MMS 6000	37	2811	1386	178	186	2811	1386	200	200	1425	138	169
SP 77-8	MMS 8000	45	2798	1528	200	204	2798	1528	205	205	1270	192	225
SP 77-9	MMS 8000	55	3006	1656	200	204	3006	1656	205	205	1350	192	244
SP 77-10	MMS 8000	55	3134	1784	200	204	3134	1784	205	205	1350	192	248
SP 77-11	MMS 8000	63	3402	1912	200	204	3402	1912	205	205	1490	192	277
SP 77-12	MMS 8000	63	3530	2040	200	204					1490	192	281
SP 77-13	MMS 8000	75	3758	2168	200	204					1590	192	304
SP 77-14	MMS 8000	92	4426	2596	200	202					1830	192	361
SP 77-15	MMS 8000	92	4554	2724	200	202					1830	192	365

* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

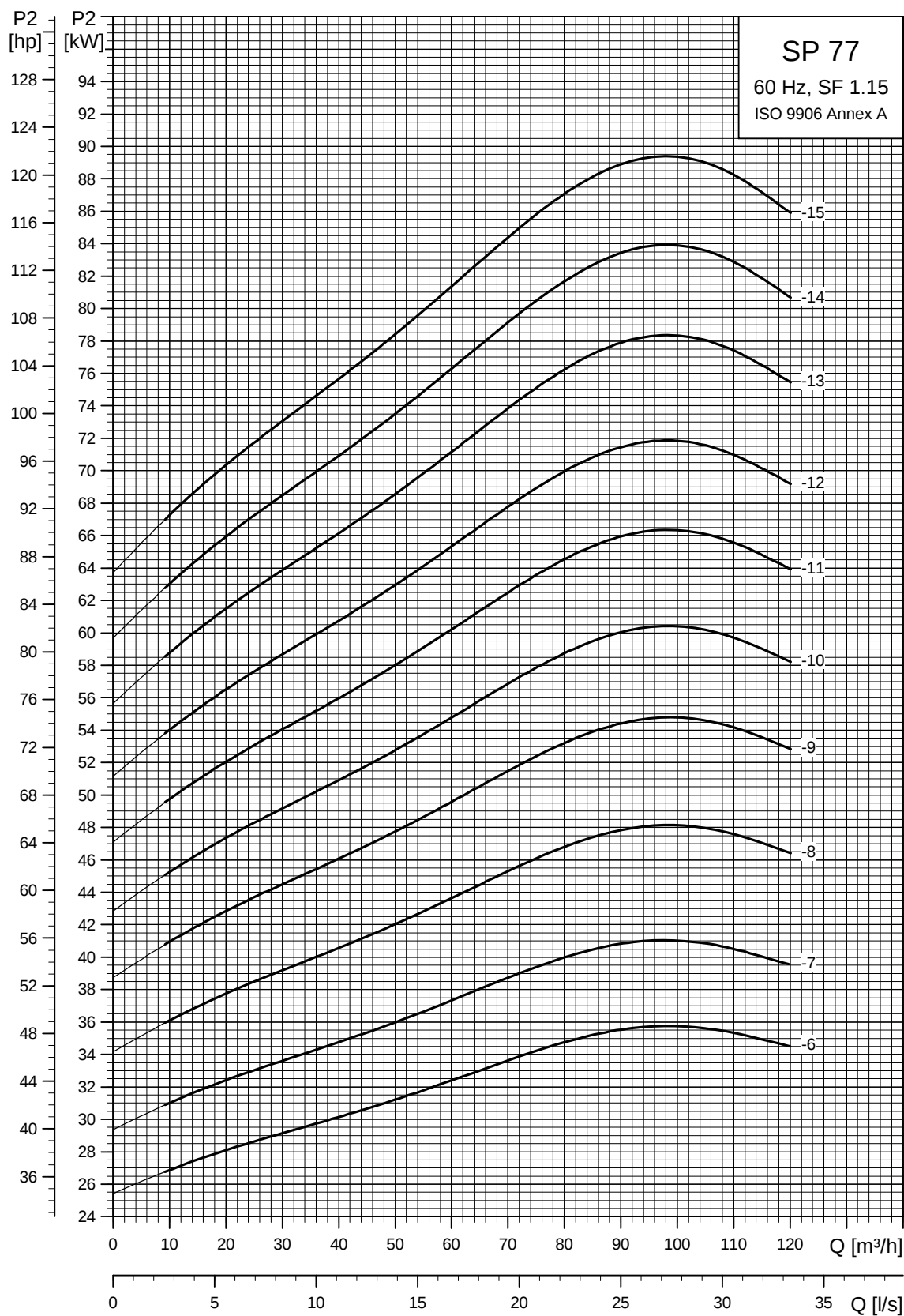
The pump types above are also available in N-version, see page 5 for further details. Dimensions as above.

Other types of connection are possible by means of connecting pieces, see page 86.



TW0 7450 1802

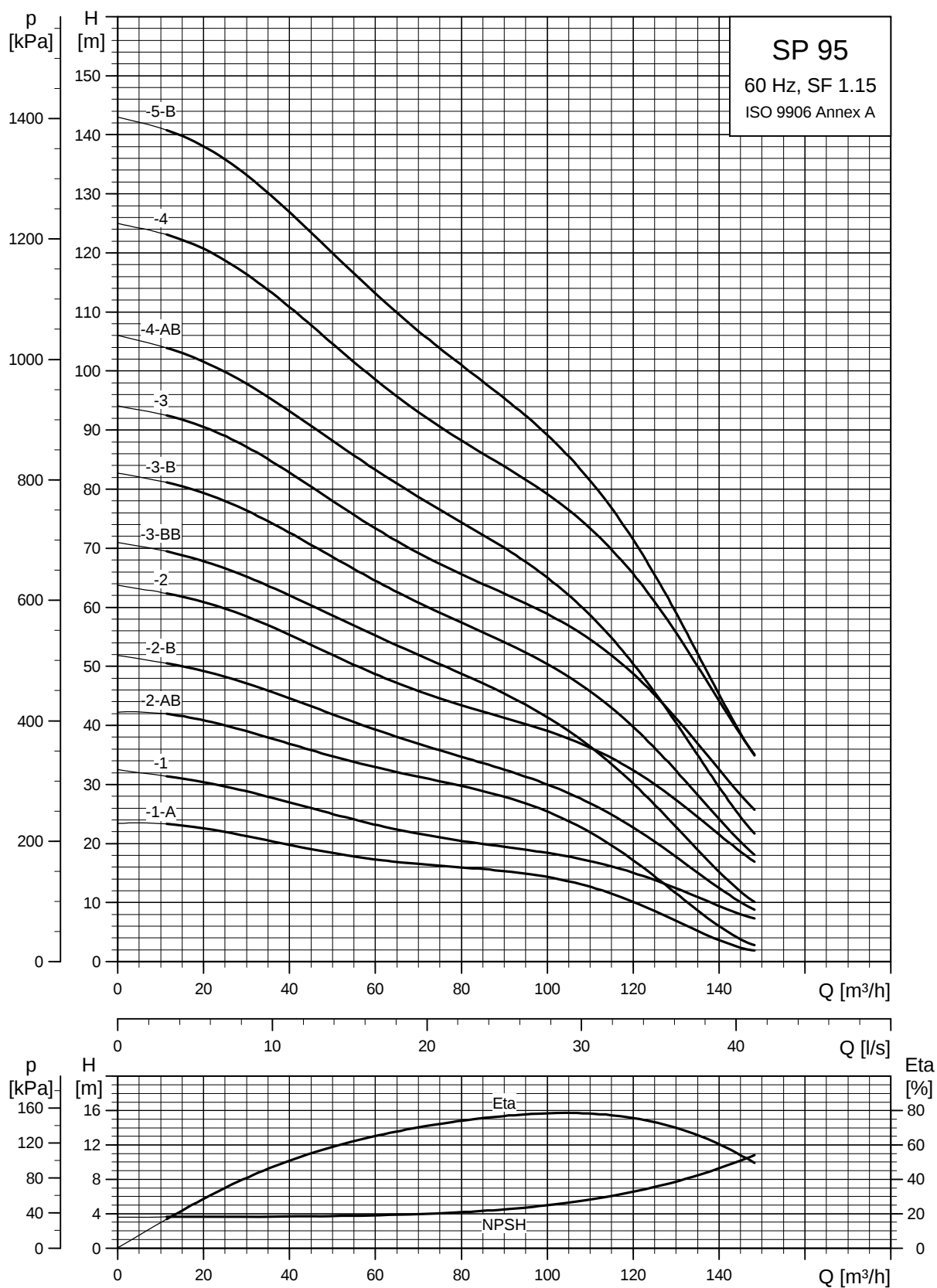
Explanation of efficiency curve, please see "Curve conditions" on page 4.



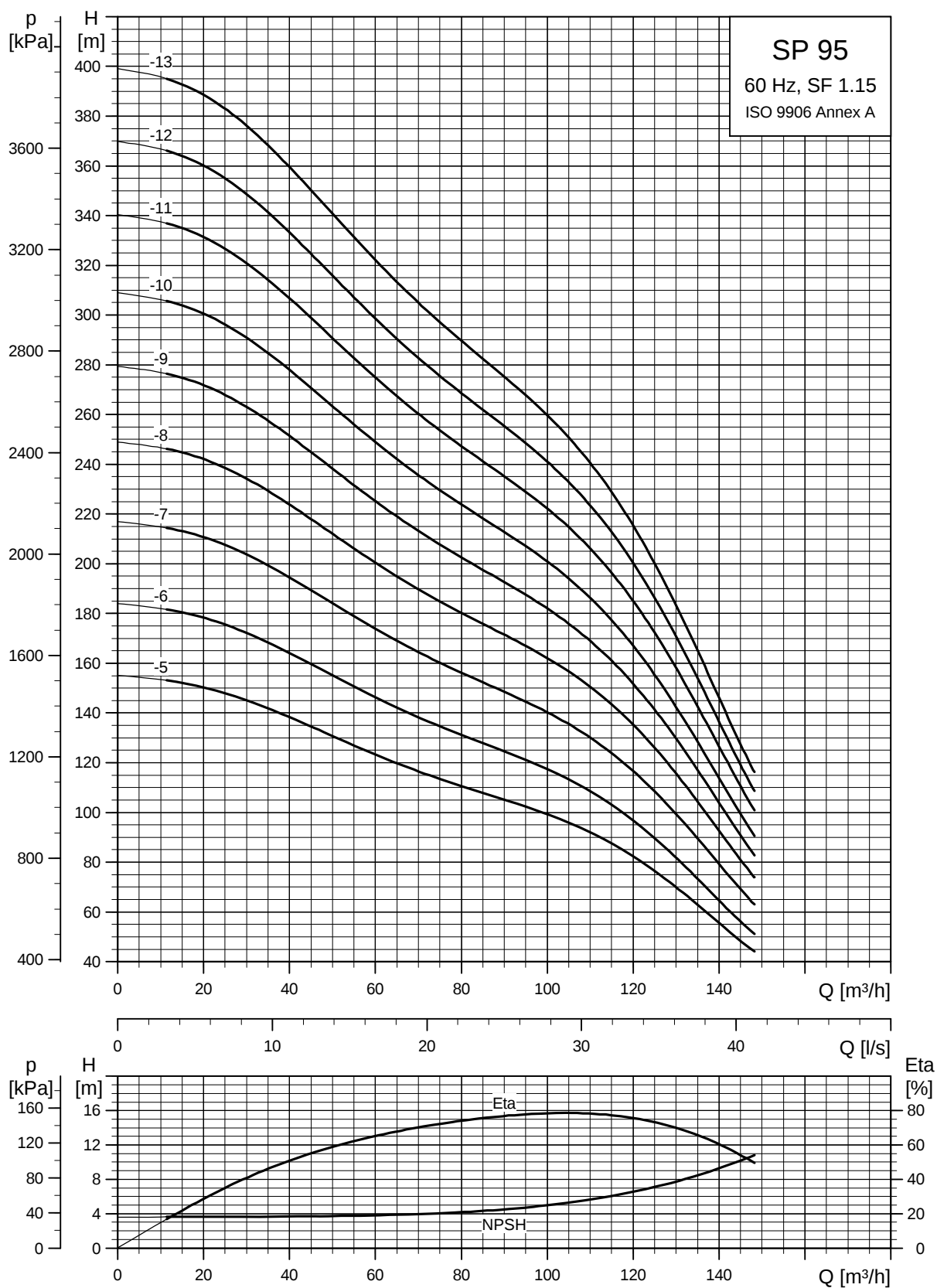
TM01 9247 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

SP 95



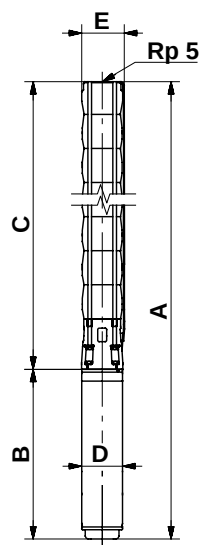
Explanation of efficiency curve, please see "Curve conditions" on page 4.



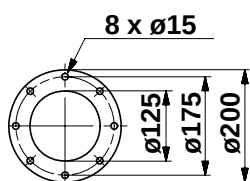
TM01 3320 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



TM00 7872 2196



TM00 7323 1798

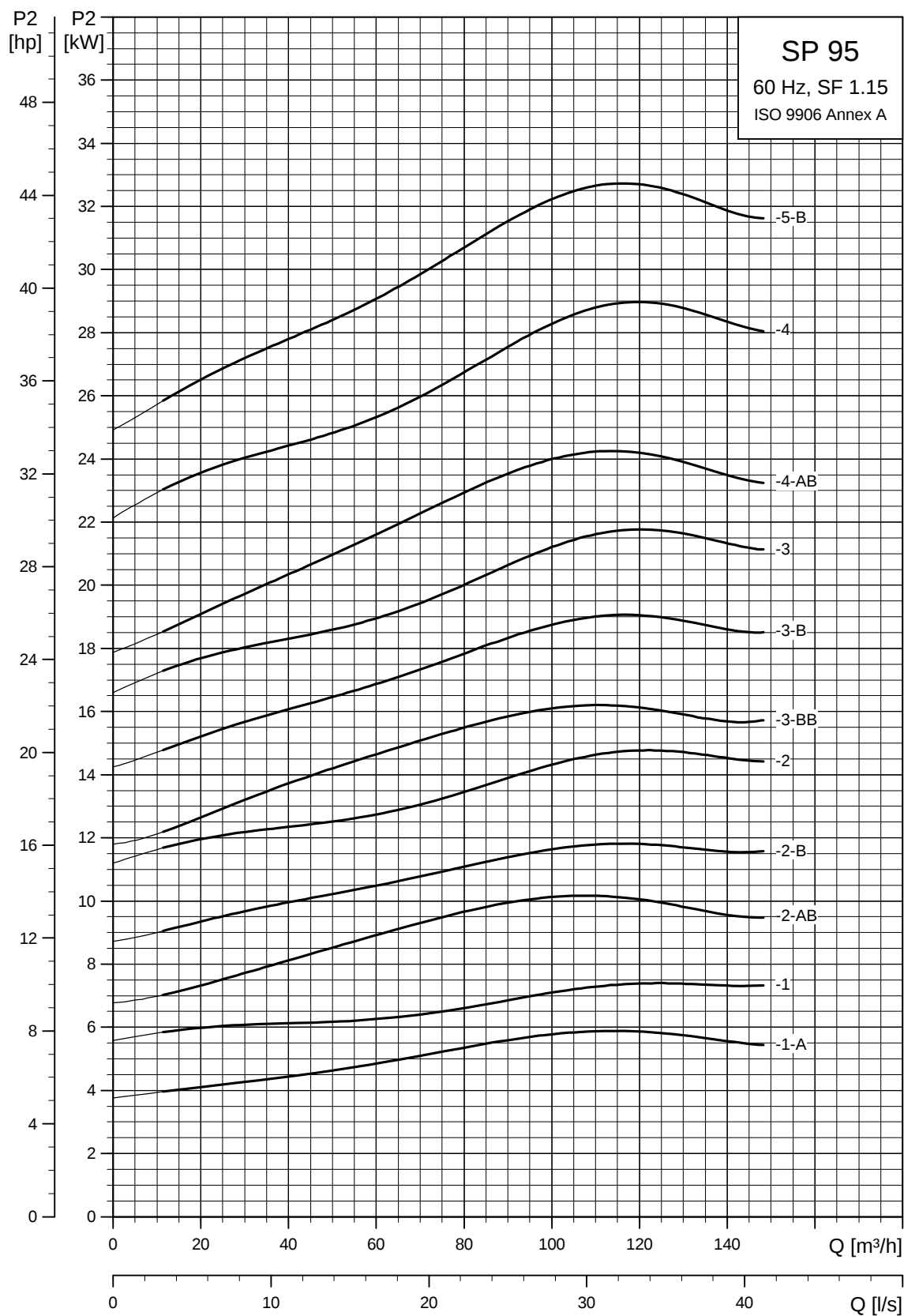
Pump type	Motor		Dimensions [mm]										Net weight [kg]
	Type	Power [kW]	Rp 5 connection				5" Grundfos flange				B	D	
			A	C	E*	E**	A	C	E*	E**			
SP 95-1-A	MS6	5.5	1183	618	179	183	1183	618	200	200	565	143	55
SP 95-1	MS6	7.5	1208	618	179	183	1208	618	200	200	590	143	59
SP 95-2-AB	MS6	9.2	1356	746	179	183	1356	746	200	200	610	143	69
SP 95-2-B	MS6	11	1454	746	179	183	1454	746	200	200	708	143	71
SP 95-2	MS6	13	1484	746	179	183	1484	746	200	200	738	143	74
SP 95-3-BB	MS6	15	1657	874	179	183	1657	874	200	200	783	143	82
SP 95-3-B	MS6	18.5	1712	874	179	183	1712	874	200	200	838	143	87
SP 95-3	MS6	22	1777	874	179	183	1777	874	200	200	903	143	93
SP 95-4-AB	MS6	22	1905	1002	179	183	1905	1002	200	200	903	143	97
SP 95-4	MS6	26	1970	1002	179	183	1970	1002	200	200	968	143	103
SP 95-5-B	MS6	30	2153	1130	179	183	2153	1130	200	200	1023	143	114
SP 95-5	MMS 6000	37	2555	1130	179	183	2555	1130	200	200	1425	138	162
SP 95-6	MMS 6000	37	2683	1258	179	183	2683	1258	200	200	1425	138	166
SP 95-7	MMS 8000	45	2670	1400	205	205	2670	1400	200	202	1270	192	221
SP 95-8	MMS 8000	55	2878	1528	205	205	2878	1528	200	202	1350	192	240
SP 95-9	MMS 8000	63	3146	1656	205	205	3146	1656	200	202	1490	192	270
SP 95-10	MMS 8000	63	3274	1784	205	205	3274	1784	200	202	1490	192	274
SP 95-11	MMS 8000	75	3502	1912	205	205					1590	192	296
SP 95-12	MMS 8000	92	3870	2040	205	205					1830	192	346
SP 95-13	MMS 8000	92	3998	2168	205	205					1830	192	350

* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

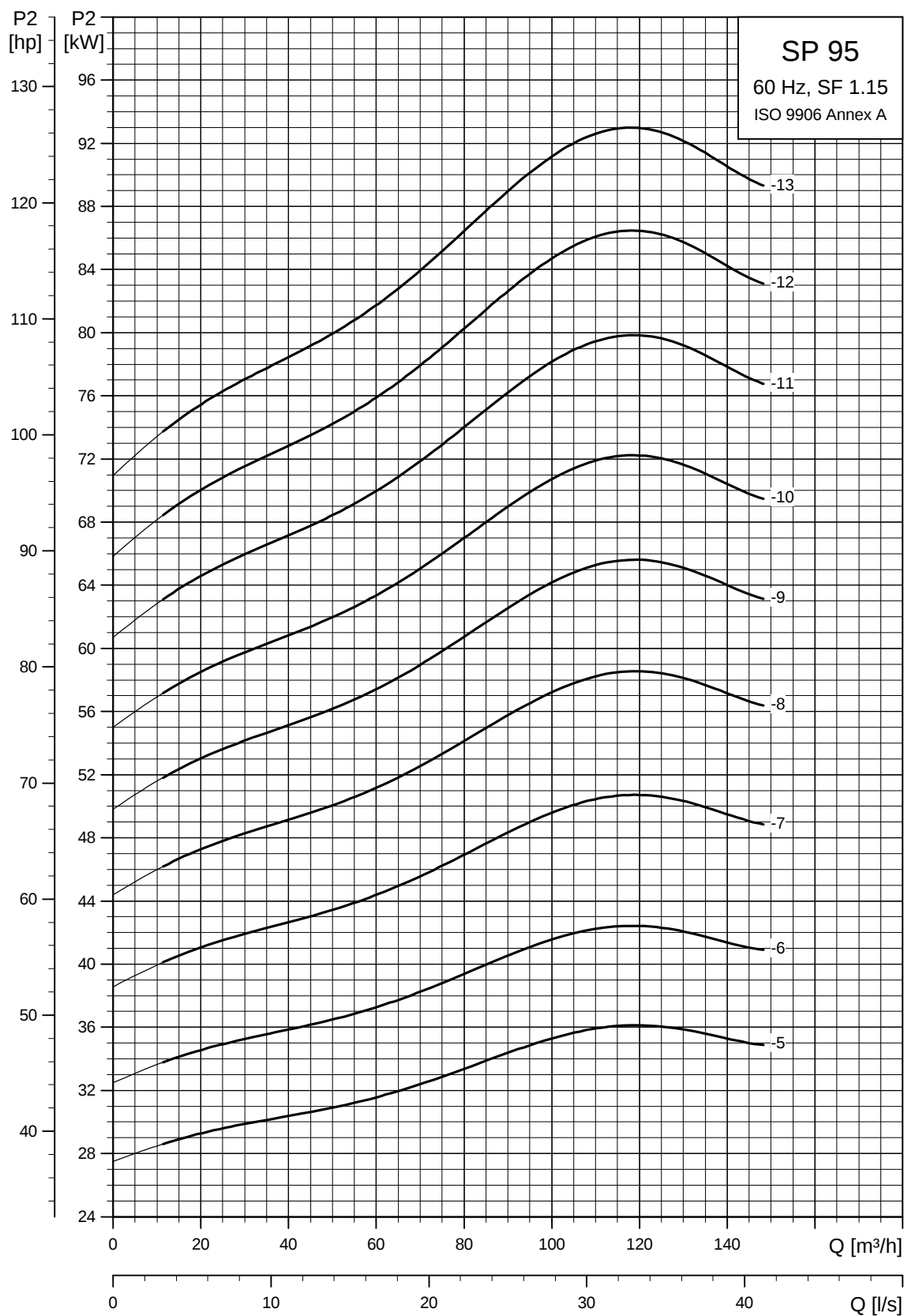
The pump types above are also available in R and N-version, see page 5 for further details.
Dimensions as above

Other types of connection are possible by means of connecting pieces, see page 86.



TM00 8458 1802

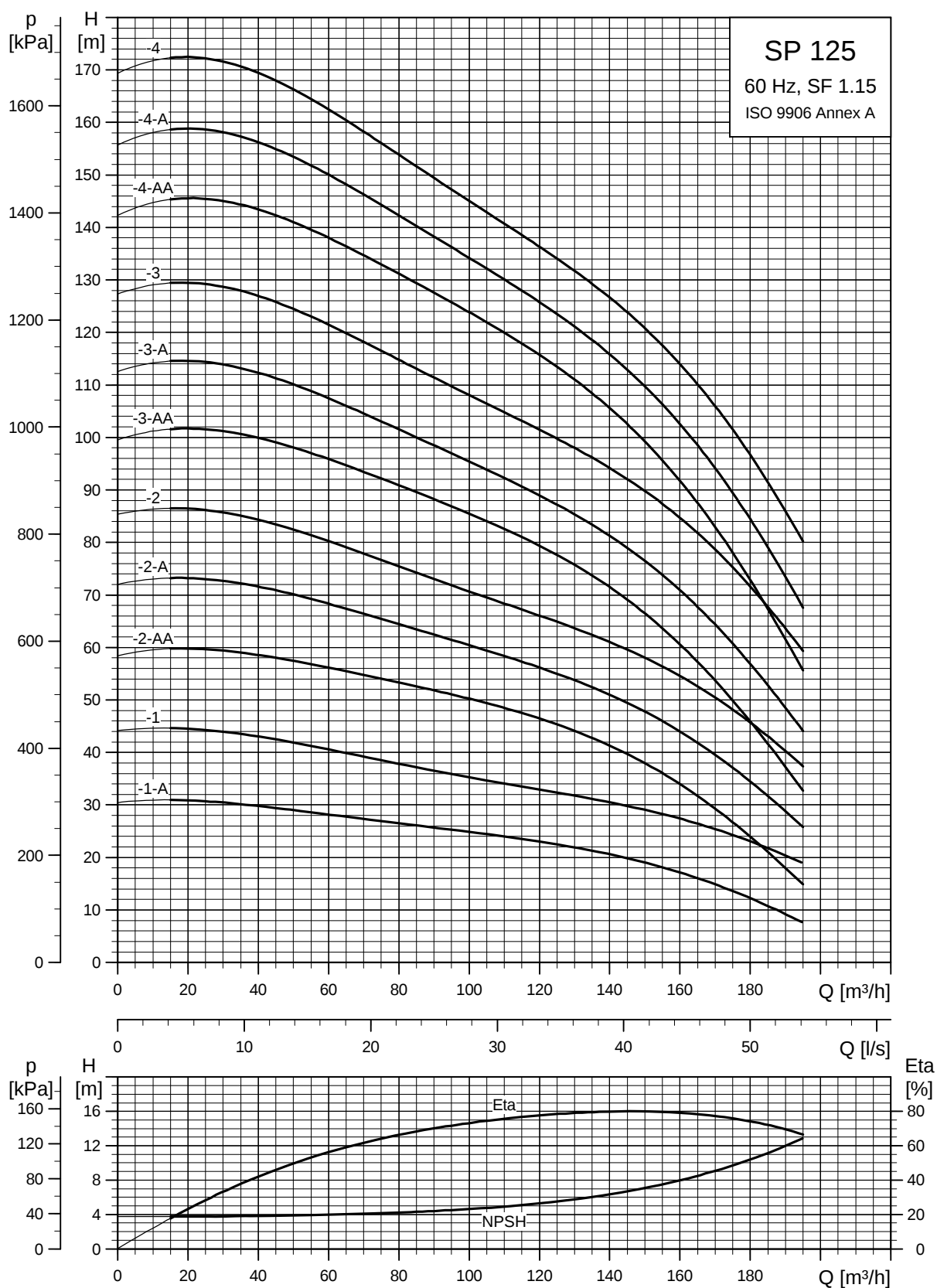
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 9248 1802

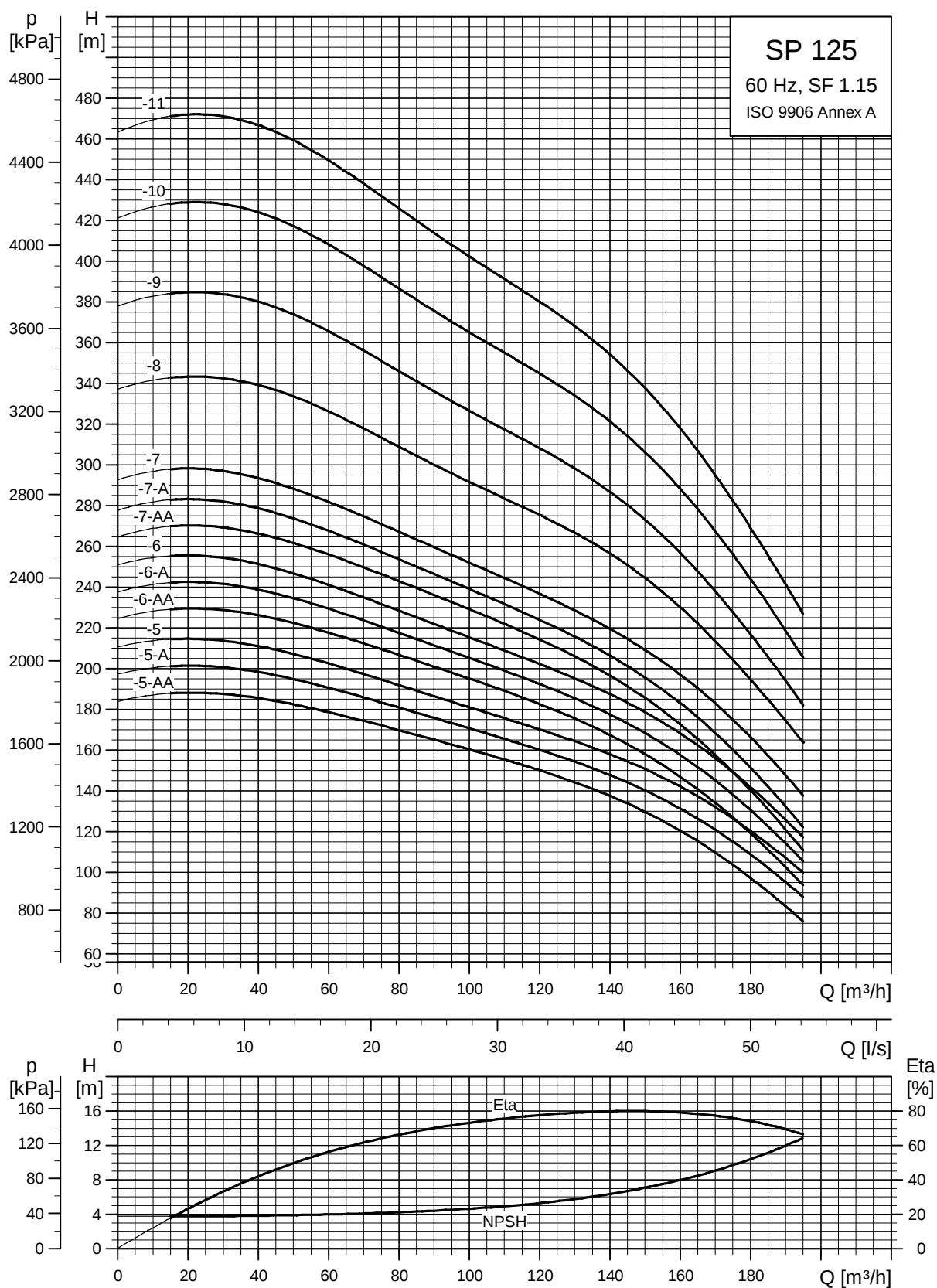
Explanation of efficiency curve, please see "Curve conditions" on page 4.

SP 125



TM01 3321 1802

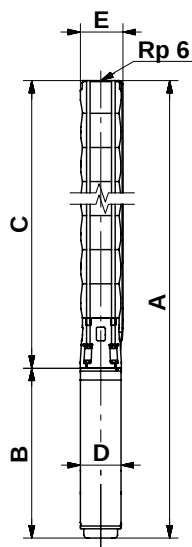
Explanation of efficiency curve, please see "Curve conditions" on page 4.



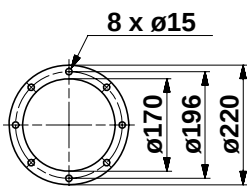
TM01 3322 0707

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



TM00 8760 3596



TM00 7324 1798

Pump type	Motor		Dimensions [mm]										Net weight [kg]
	Type	Power [kW]	Rp 6 connection				6" Grundfos flange				B	D	
			A	C	E*	E**	A	C	E*	E**			
SP 125-1-A	MS6	11	1360	652	211	215	1360	652	222	226	708	143	81
SP 125-1	MS6	18.5	1520	652	211	215	1520	652	222	226	838	143	93
SP 125-2-AA	MS6	22	1710	807	211	215	1710	807	222	226	903	143	105
SP 125-2-A	MS6	26	1775	807	211	215	1775	807	222	226	968	143	111
SP 125-2	MS6	30	1830	807	211	215	1830	807	222	226	1023	143	119
SP 125-3-AA	MMS 6000	37	2388	963	211	215	2388	963	222	226	1425	138	172
SP 125-3-A	MMS 6000	37	2388	963	211	215	2388	963	222	226	1425	138	172
SP 125-3	MMS 8000	45	2233	963	213	219	2233	963	229	232	1270	192	226
SP 125-4-AA	MMS 8000	55	2468	1118	213	219	2468	1118	229	232	1350	192	247
SP 125-4-A	MMS 8000	55	2468	1118	213	219	2468	1118	229	232	1350	192	247
SP 125-4	MMS 8000	63	2608	1118	213	219	2608	1118	229	232	1490	192	273
SP 125-5-AA	MMS 8000	75	2864	1274	213	219					1590	192	296
SP 125-5-A	MMS 8000	75	2864	1274	213	219					1590	192	296
SP 125-5	MMS 8000	75	2864	1274	213	219					1590	192	296
SP 125-6-AA	MMS 8000	75	3019	1429	213	219					1590	192	302
SP 125-6-A	MMS 8000	92	3259	1429	213	219					1830	192	348
SP 125-6	MMS 8000	92	3259	1429	213	219					1830	192	348
SP 125-7-AA	MMS 8000	92	3415	1585	213	219					1830	192	354
SP 125-7-A	MMS 8000	92	3415	1585	213	219					1830	192	354
SP 125-7	MMS 8000	110	3645	1585	213	219					2060	192	404
SP 125-8	MMS 10000	132	3962	2092	237	237					1870	237	532
SP 125-9	MMS 10000	132	4118	2248	237	237					1870	237	538
SP 125-10	MMS 10000	147	4473	2403	237	237					2070	237	609
SP 125-11	MMS 10000	170	4779	2559	237	237					2220	237	655

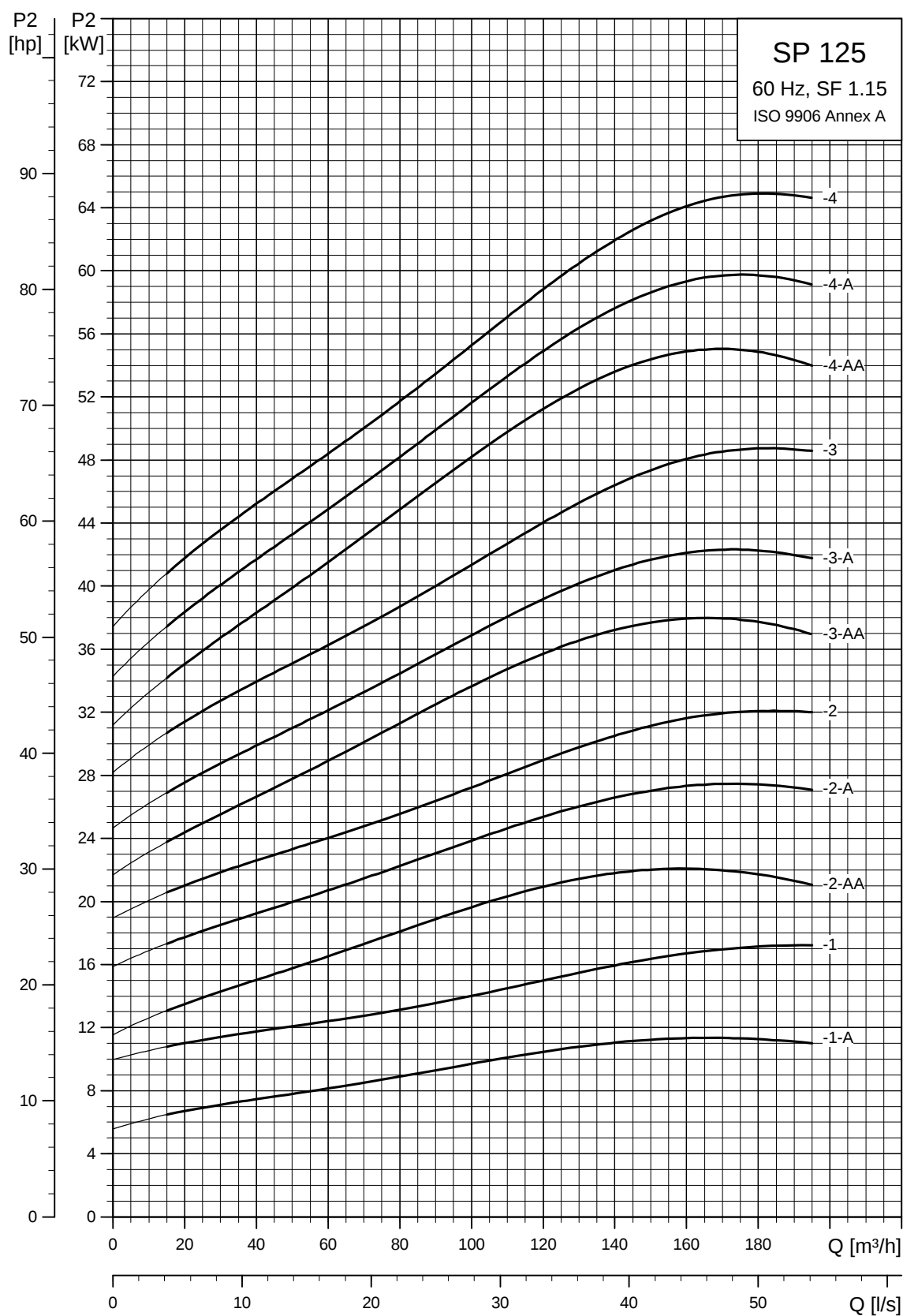
* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

The pump types above are also available in N- and R-versions up to and including SP 125-7, see page 5 for further details.

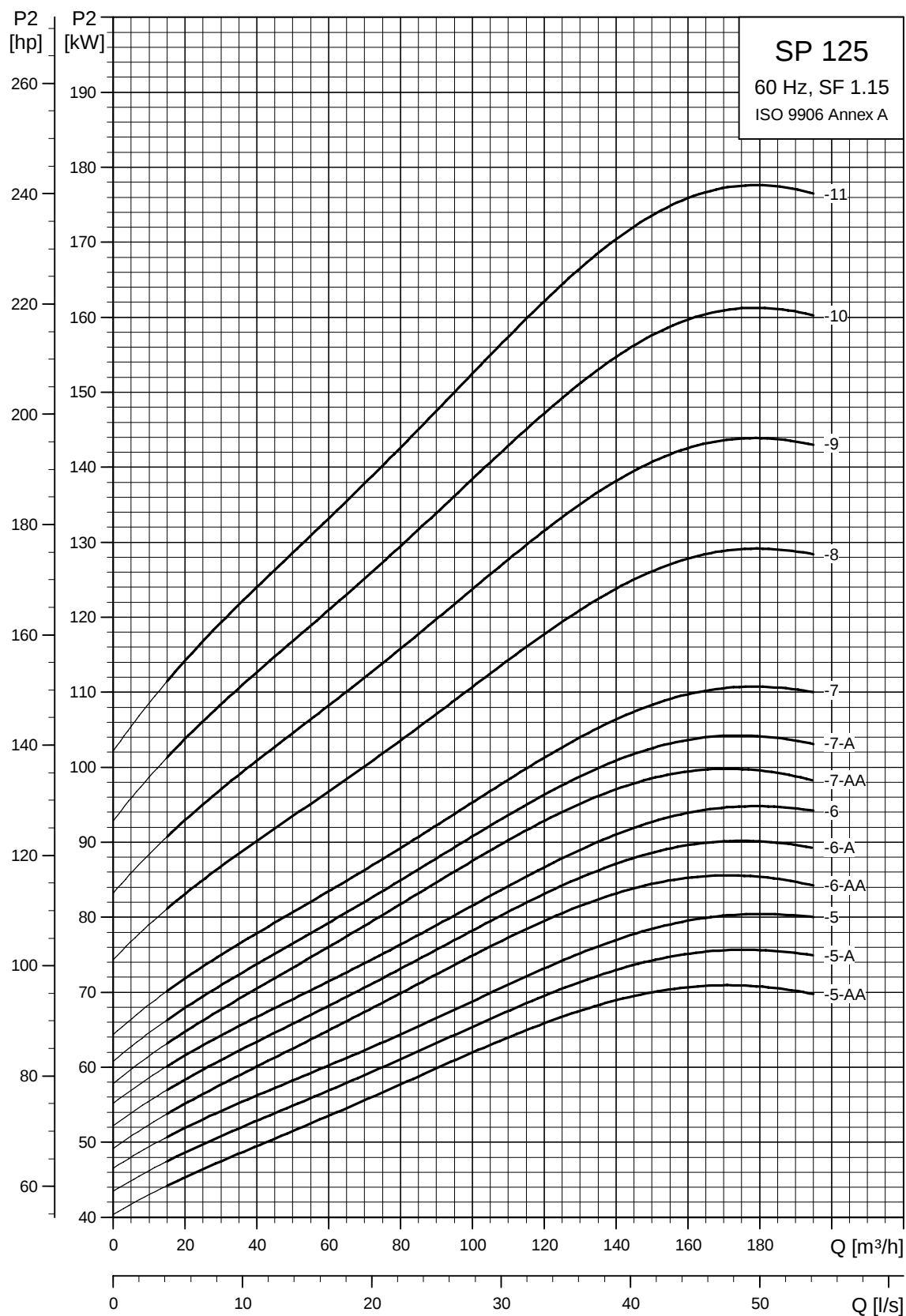
Dimensions as above.

Other types of connection are possible by means of connecting pieces, see page 86.



TM00 7634 1802

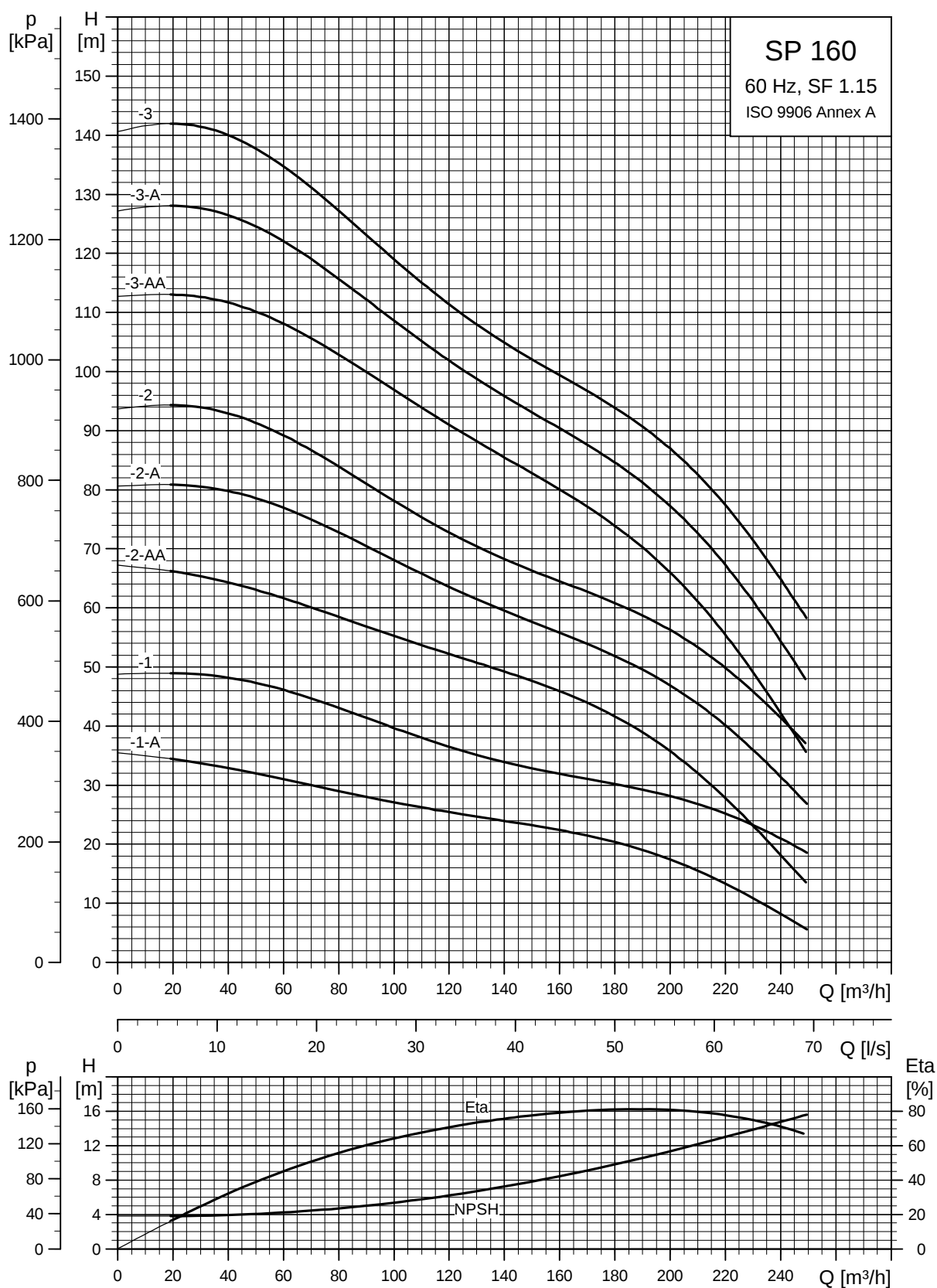
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 9249 0707

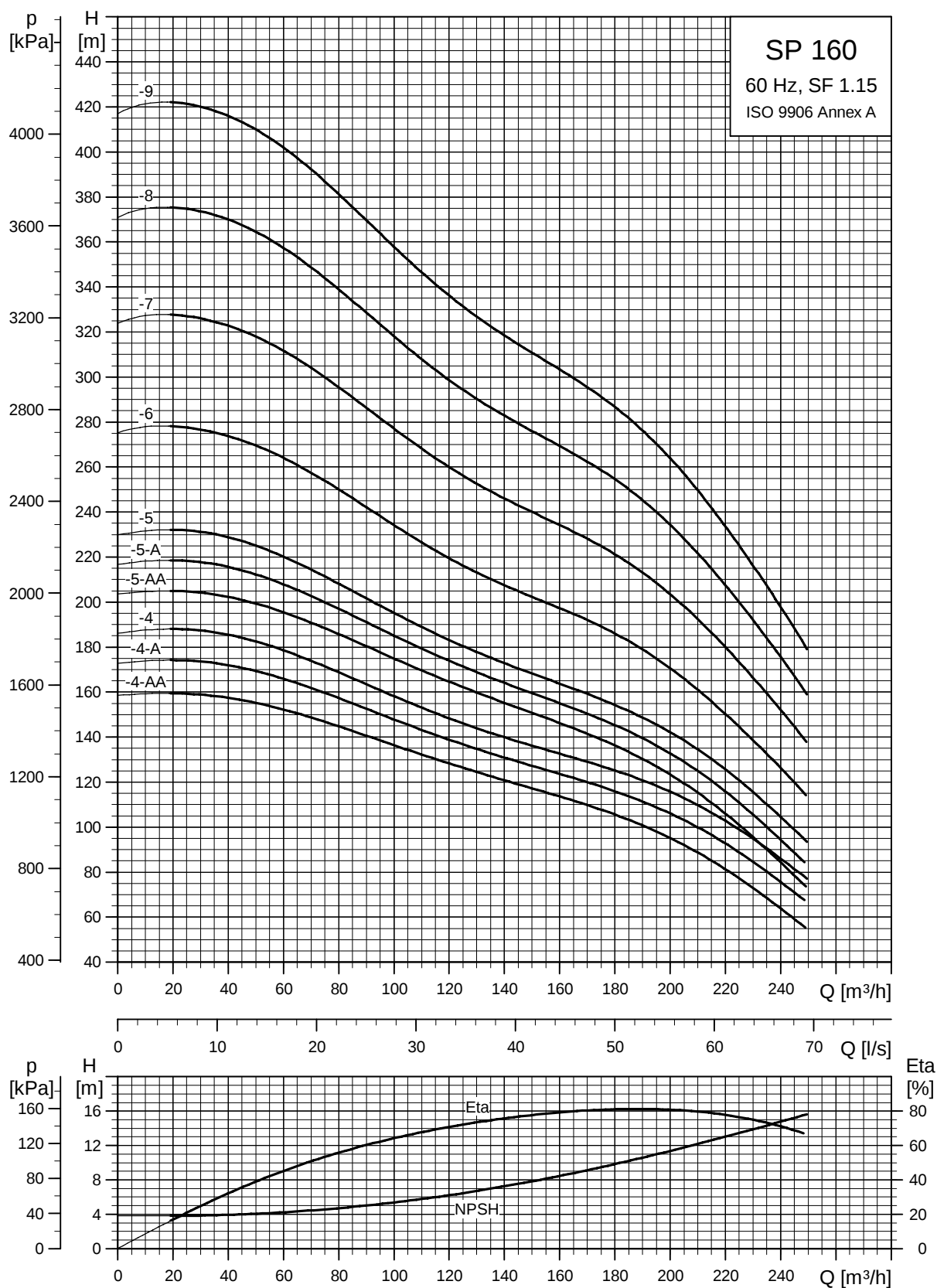
Explanation of efficiency curve, please see "Curve conditions" on page 4.

SP 160



TM01 3323 1802

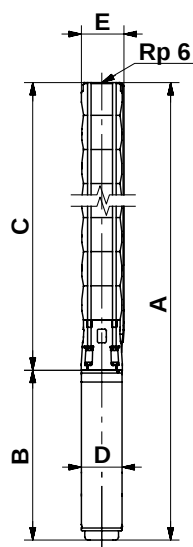
Explanation of efficiency curve, please see "Curve conditions" on page 4.



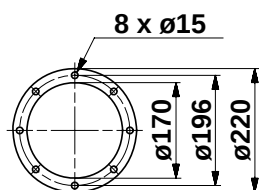
TM01 3324 0707

Explanation of efficiency curve, please see "Curve conditions" on page 4.

Dimensions and weights



TM00 8760 3596



TM00 7324 1798

Pump type	Motor		Dimensions [mm]										Net weight [kg]
	Type	Power [kW]	Rp 6 connection				6" Grundfos flange				B	D	
			A	C	E*	E**	A	C	E*	E**			
SP 160-1-A	MS6	15	1435	652	211	215	1435	652	222	226	143	138	88
SP 160-1	MS6	22	1555	652	211	215	1555	652	222	226	143	138	99
SP 160-2-AA	MS6	26	1775	807	211	215	1775	807	222	226	143	138	111
SP 160-2-A	MMS 6000	37	2232	807	211	215	2232	807	222	226	1425	138	166
SP 160-2	MMS 6000	37	2232	807	211	215	2232	807	222	226	1425	138	166
SP 160-3-AA	MMS 8000	45	2233	963	213	219	2233	963	229	232	1270	192	226
SP 160-3-A	MMS 8000	55	2313	963	213	219	2313	963	229	232	1350	192	241
SP 160-3	MMS 8000	55	2313	963	213	219	2313	963	229	232	1350	192	241
SP 160-4-AA	MMS 8000	63	2608	1118	213	219					1490	192	271
SP 160-4-A	MMS 8000	75	2708	1118	213	219					1590	192	290
SP 160-4	MMS 8000	75	2708	1118	213	219					1590	192	290
SP 160-5-AA	MMS 8000	92	3104	1274	213	219					1830	192	342
SP 160-5-A	MMS 8000	92	3104	1274	213	219					1830	192	342
SP 160-5	MMS 8000	92	3104	1274	213	219					1830	192	342
SP 160-6	MMS 8000	110	3789	1729	213	219					2060	192	408
SP 160-7	MMS 10000	132	3807	1937	237	237					1870	237	526
SP 160-8	MMS 10000	147	4162	2092	237	237					2070	237	597
SP 160-9	MMS 10000	170	4468	2248	237	237					2220	237	643

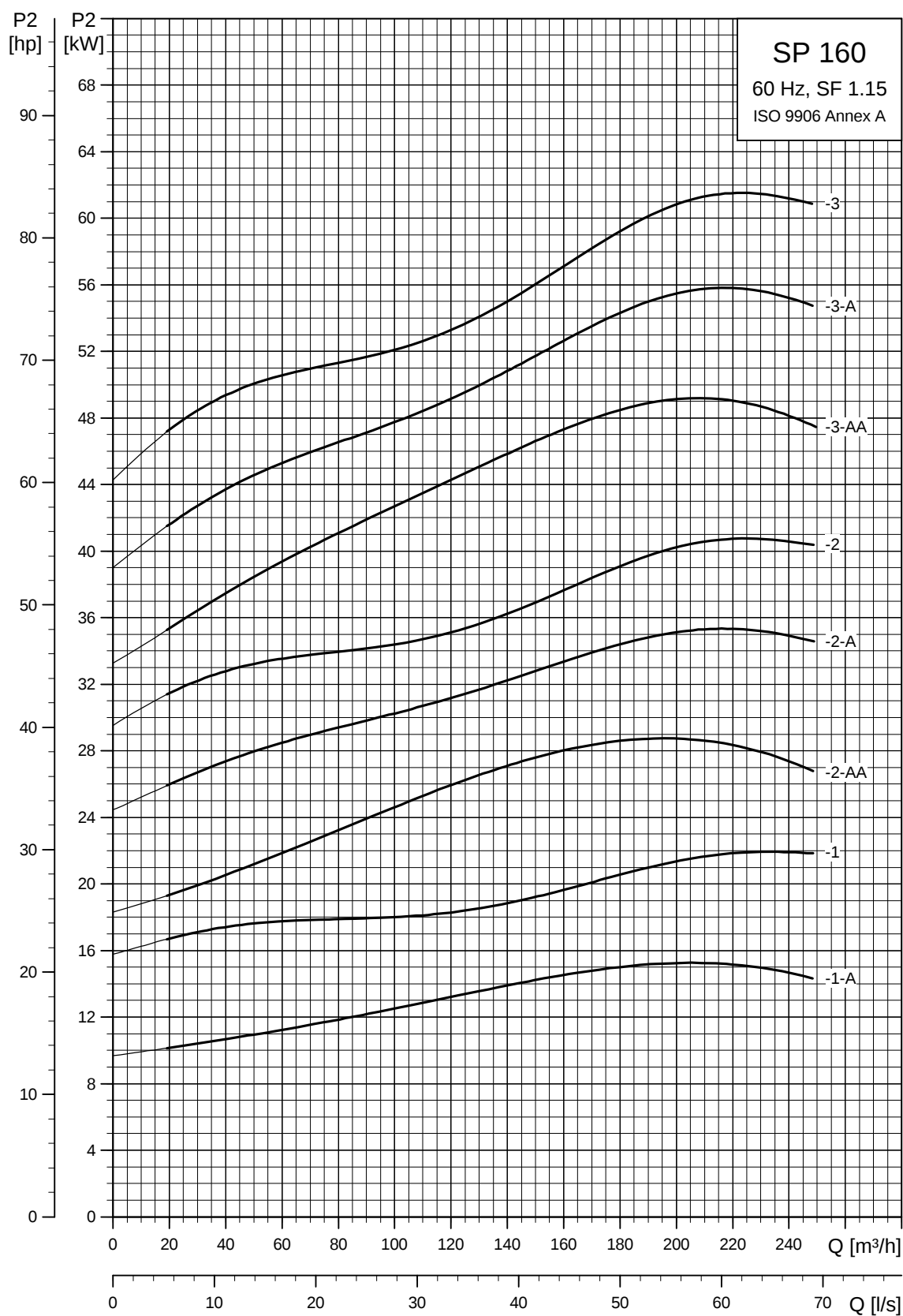
* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

The pump types above are also available in N- and R-versions up to and including SP 160-6, see page 5 for further details.

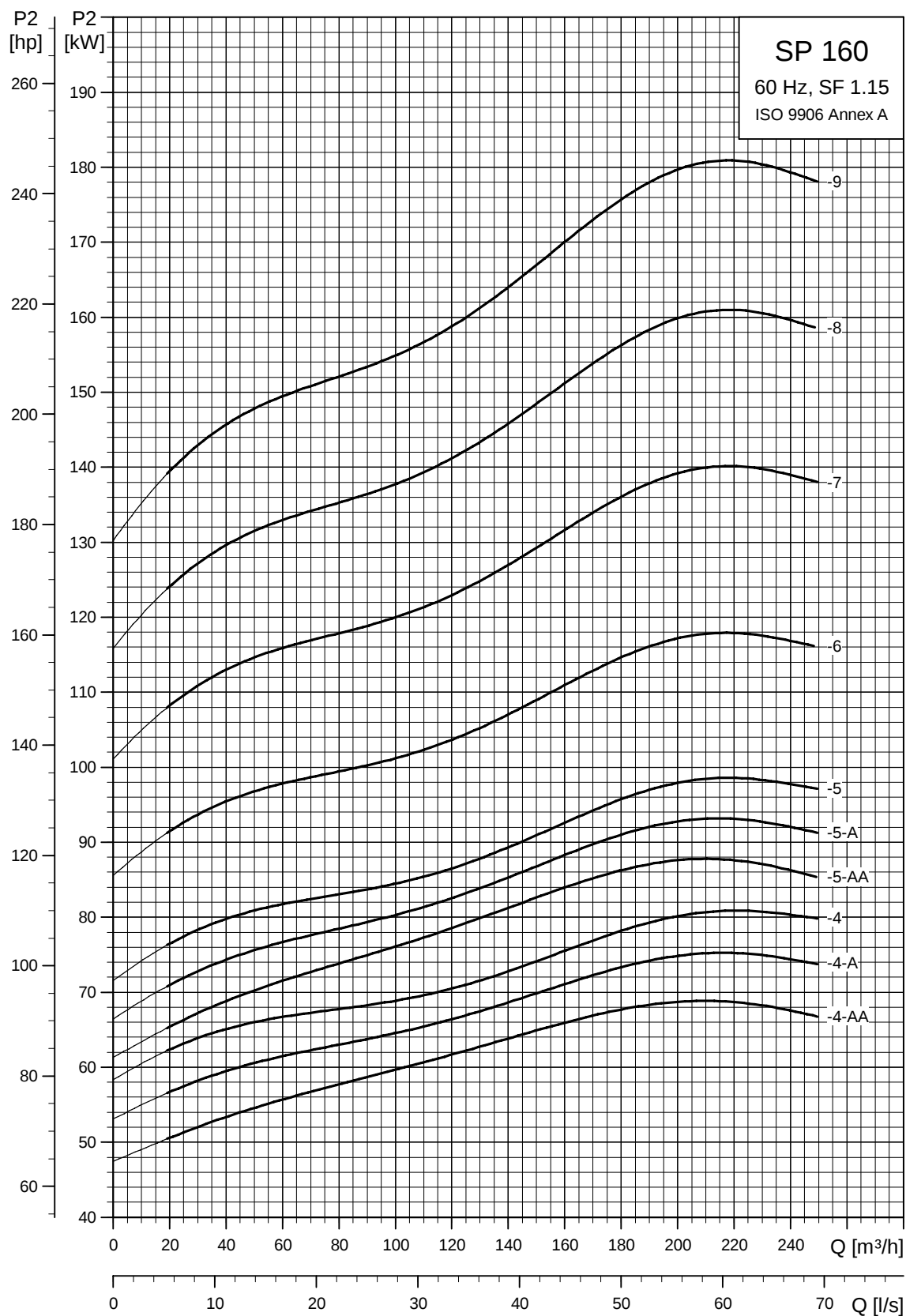
Dimensions as above.

Other types of connection are possible by means of connecting pieces, see page 86.



TM00 7688 1802

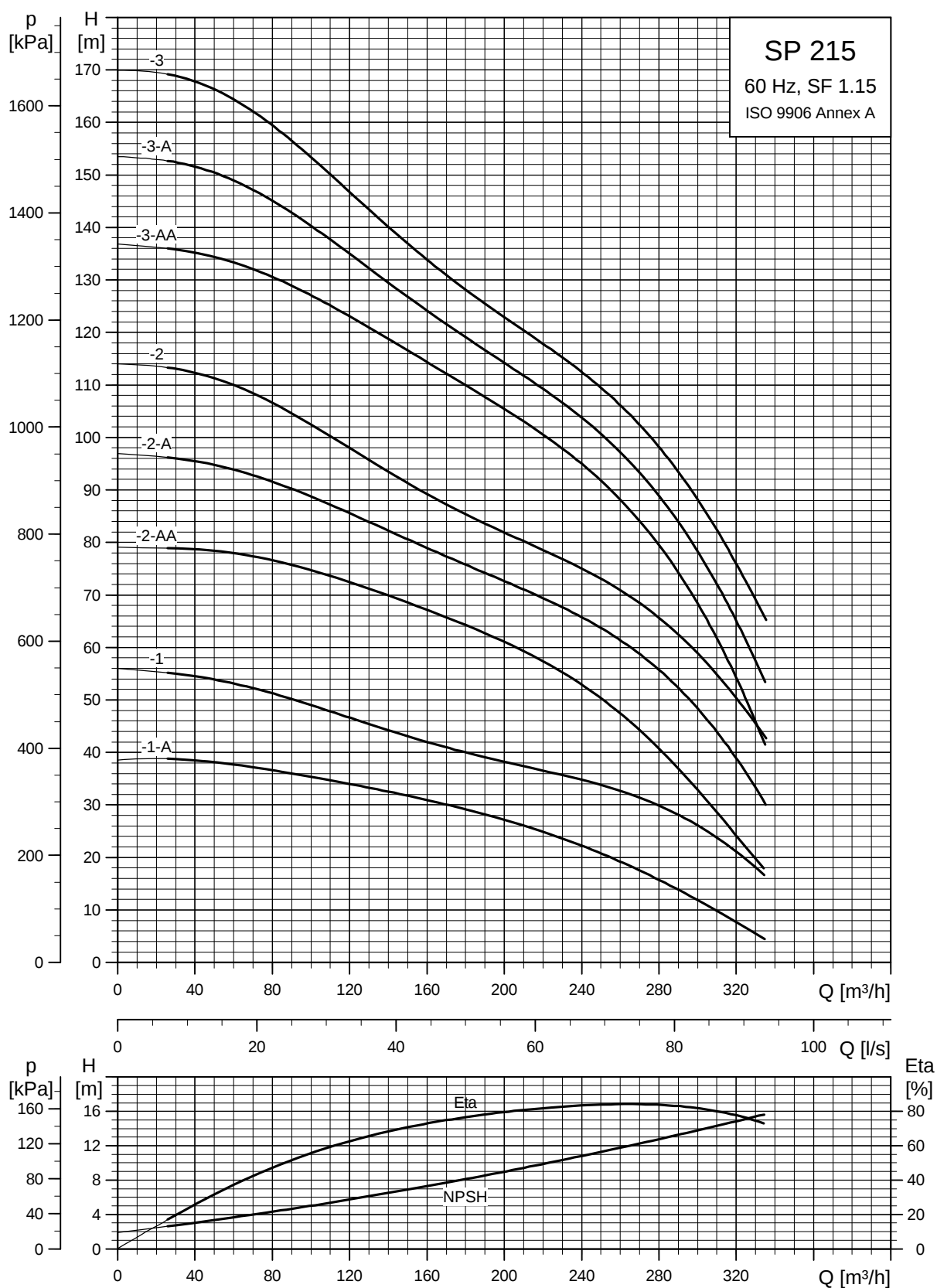
Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 9250 0707

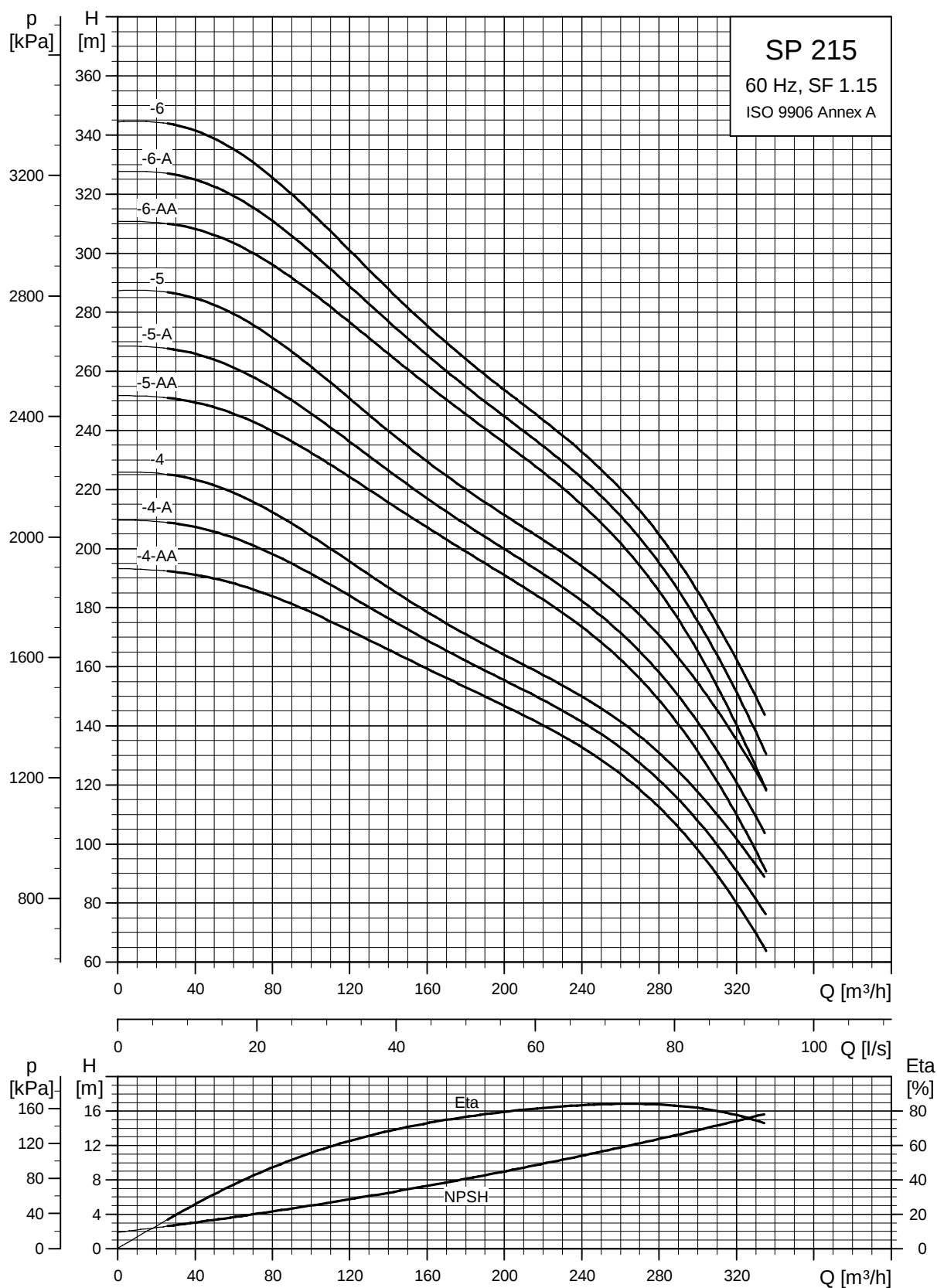
Explanation of efficiency curve, please see "Curve conditions" on page 4.

SP 215



TM01 3325 1802

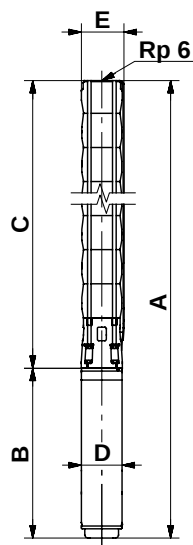
Explanation of efficiency curve, please see "Curve conditions" on page 4.



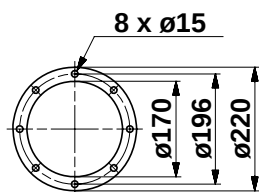
Explanation of efficiency curve, please see "Curve conditions" on page 4.

TM01 3326 0707

Dimensions and weights



TM00 8760 3596



TM00 7324 1798

Pump type	Motor		Dimensions [mm]										Net weight [kg]
	Type	Power [kW]	Rp 6 connection				6" Grundfos flange				B	D	
			A	C	E*	E**	A	C	E*	E**			
SP 215-1-A	MS6	22	1693	790	236	239	1693	790	241	247	903	143	106
SP 215-1	MS6	30	1813	790	236	239	1813	790	241	247	1023	143	120
SP 215-2-AA	MMS 8000	45	2236	966	239	244	2236	966	241	247	1270	192	231
SP 215-2-A	MMS 8000	55	2316	966	239	244	2316	966	241	247	1350	192	246
SP 215-2	MMS 8000	63	2456	966	239	244	2456	966	241	247	1490	192	272
SP 215-3-AA	MMS 8000	75	2732	1142	239	244	2732	1142	241	247	1590	192	301
SP 215-3-A	MMS 8000	92	2972	1142	239	244	2972	1142	241	247	1830	192	347
SP 215-3	MMS 8000	92	2972	1142	239	244	2972	1142	241	247	1830	192	347
SP 215-4-AA	MMS 8000	110	3378	1318	239	244	3378	1318	241	247	2060	192	407
SP 215-4-A	MMS 8000	110	3378	1318	239	244	3378	1318	241	247	2060	192	407
SP 215-4	MMS 8000	110	3378	1318	239	244	3378	1318	241	247	2060	192	407
SP 215-5-AA	MMS 10000	132	3364	1494	250	254					1870	237	519
SP 215-5-A	MMS 10000	132	3364	1494	250	254					1870	237	519
SP 215-5	MMS 10000	147	3564	1494	250	254					2070	237	584
SP 215-6-AA	MMS 10000	170	3890	1670	250	254					2220	237	634
SP 215-6-A	MMS 10000	170	3890	1670	250	254					2220	237	634
SP 215-6	MMS 10000	170	3890	1670	250	254					2220	237	634

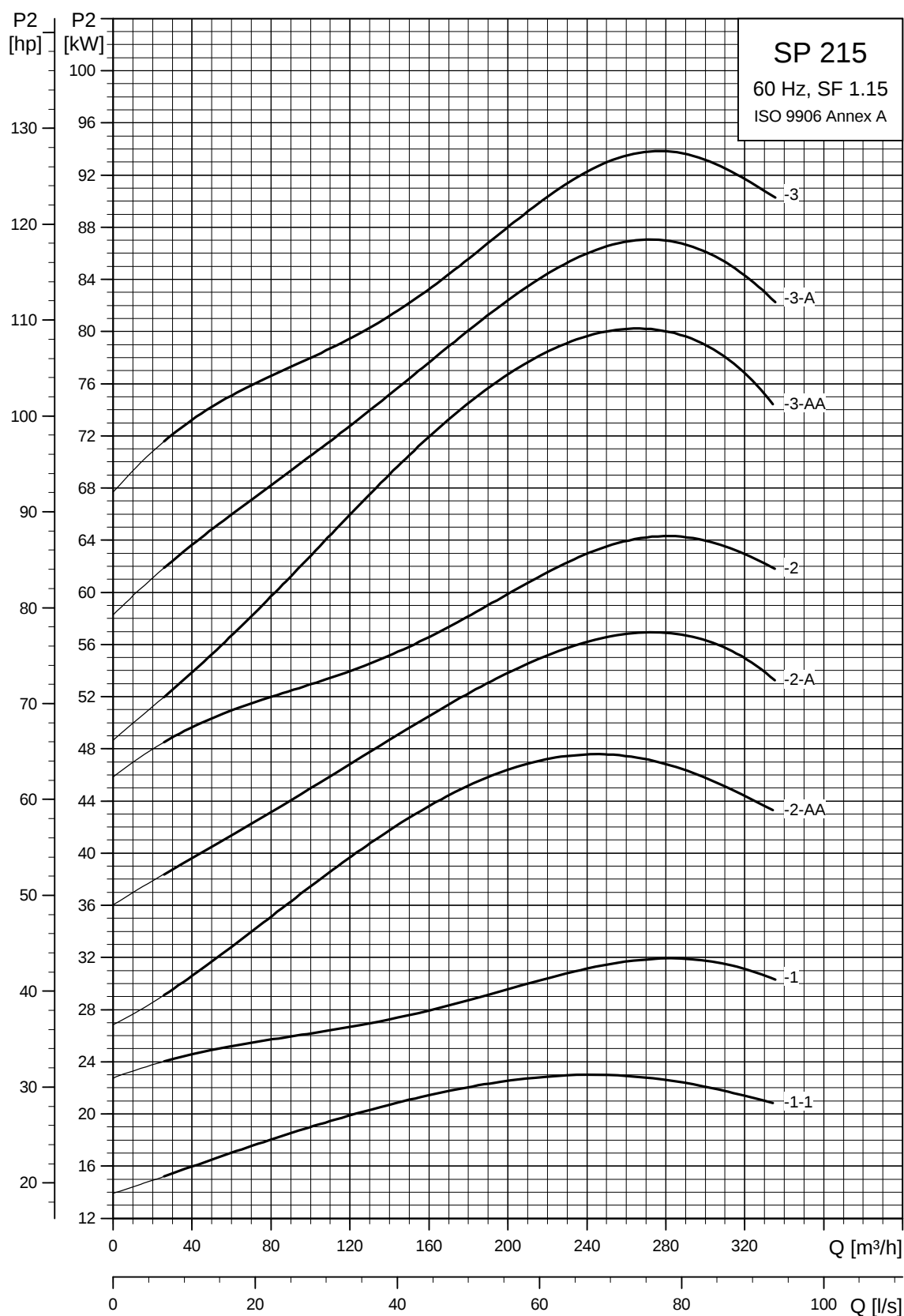
* Maximum diameter of pump with one motor cable.

** Maximum diameter of pump with two motor cables.

The pump types above are also available in R and N-versions up to and including SP 215-4, see page 5 for further details.

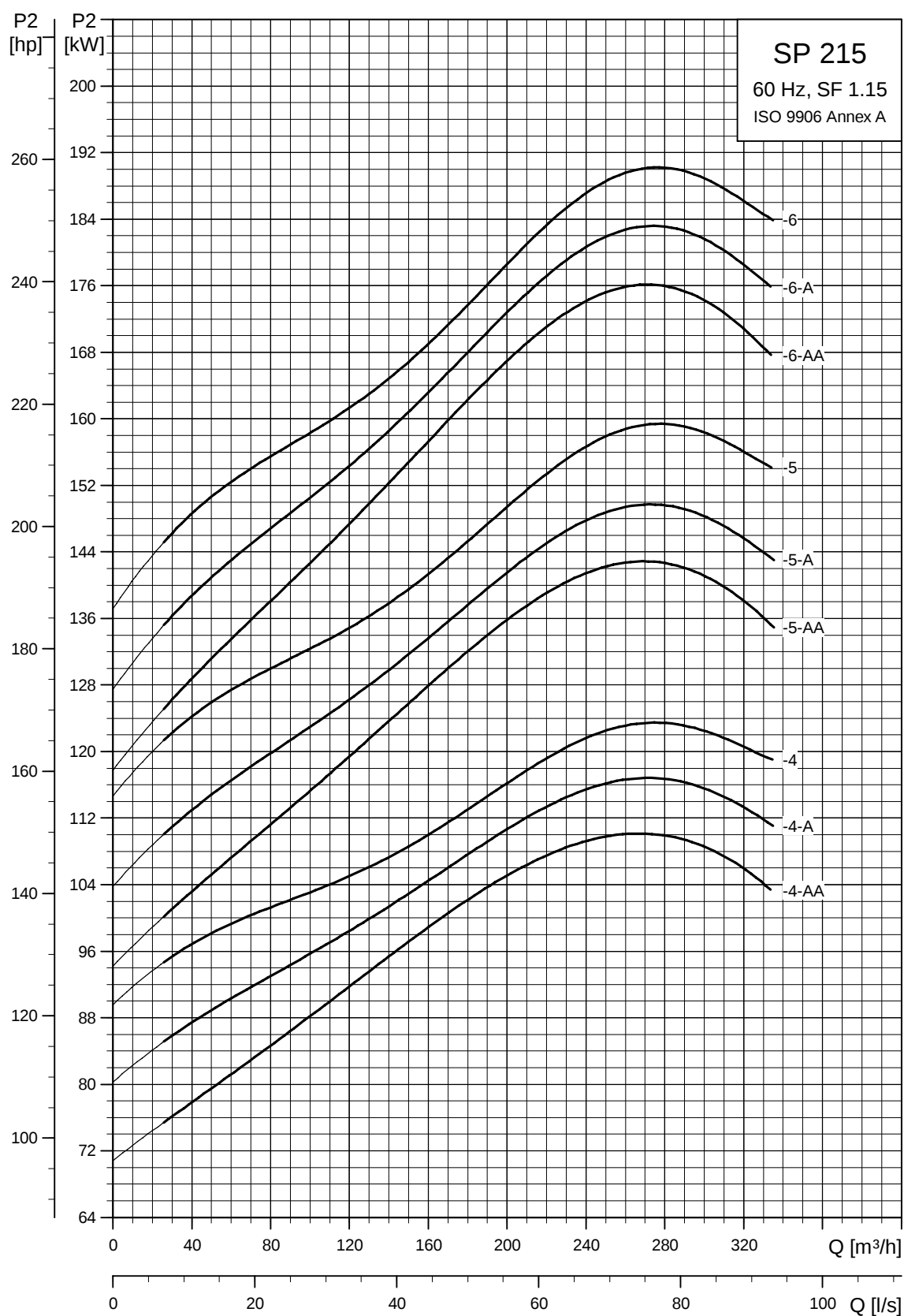
Dimensions as above.

Other types of connection are possible by means of connecting pieces, see page 86.



TM00 7627 1802

Explanation of efficiency curve, please see "Curve conditions" on page 4.



TM01 9251 0707

Explanation of efficiency curve, please see "Curve conditions" on page 4.

1 x 220 V, submersible motors

Electrical data													Dimensions	
Type	Motor			Full-load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Control box for 3-wire	Length [mm]	Weight [kg]
	Size	Power [kW]	Power [hp]		η50%	η75%	η100%	Cos φ 50%	Cos φ 75%	Cos φ 100%				
MS 402	4"	0.25	0.33	4.40	39.0	49.0	54.0	0.48	0.51	0.64	3.0*	SA-SPM 5	256	6.8
MS 402	4"	0.37	0.5	5.90	43.0	52.5	56.0	0.46	0.54	0.62	3.6*	SA-SPM 5	256	6.8
MS 402	4"	0.55	0.75	8.00	42.5	51.0	57.0	0.47	0.56	0.63	3.7*	SA-SPM 5	291	8.2
MS 402	4"	0.75	1.0	9.60	47.0	55.5	60.0	0.50	0.60	0.70	3.8*	SA-SPM 5	306	8.9
MS 402	4"	1.1	1.5	11.5	53.5	62.0	67.0	0.60	0.73	0.82	4.0*	SA-SPM 5	346	10.5
MS 402	4"	1.1	1.5	13.1			88.0			0.63	4.4**		346	10.5

* Applies to 2- and 3-wire motors.

** Applies to 2-wire motors.

MS 402 2-wire motors incorporate motor protection and can therefore be connected directly to the mains.

1 x 230 V, submersible motors

Electrical data													Dimensions	
Type	Motor			Full-load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Control box for 3-wire	Length [mm]	Weight [kg]
	Size	Power [kW]	Power [hp]		η50%	η75%	η100%	Cos φ 50%	Cos φ 75%	Cos φ 100%				
MS 4000	4"	1.5	2.0	13.2	0.53	0.56	0.57	0.7	0.8	0.86	4.3*	SA-SPM 5	496	17.0
MS 4000	4"	2.2	3.0	17.0	0.61	0.63	0.62	0.85	0.92	0.94	4.7*	SA-SPM 5	576	20.5
MS 4000	4"	3.7	5.0	27.5	0.58	0.63	0.66	0.89	0.94	0.96	4.3*	SA-SPM 5	676	25.5

MS 4000 3-wire motors comes as CSCR versions and do not incorporate motor protection, the motor is connected via a Grundfos SA-SPM 5 control box.

3 x 220 V, submersible motors (SF 1.0)

Type	Electrical data											Dimensions	
	Motor		Full-load current I_n [A]	Motor efficiency [%]			Power factor			I_{st}/I_n	Control box for 3-wire	Length [mm]	Weight [kg]
	Size	Power [kW]	Power [hp]	$\eta_{50\%}$	$\eta_{75\%}$	$\eta_{100\%}$	$\cos \varphi_{50\%}$	$\cos \varphi_{75\%}$	$\cos \varphi_{100\%}$				
MS 402	4"	0.37	0.5	3.30	57.5	65.0	68.0	0.52	0.63	0.72	5.0	226	5.5
MS 402	4"	0.55	0.75	4.80	58.0	65.5	68.0	0.47	0.59	0.70	4.8	241	6.3
MS 402	4"	0.75	1.0	5.65	61.0	67.5	71.0	0.50	0.63	0.73	5.0	276	7.7
MS 4000R	4"	0.75	1.0	4.60	70.5	72.0	71.1	0.81	0.86	0.88	3.9	398	13.0
MS 402	4"	1.1	1.5	7.60	65.0	71.0	73.5	0.50	0.67	0.72	5.5	306	8.9
MS 4000R	4"	1.1	1.5	6.10	71.4	74.7	74.8	0.73	0.82	0.86	4.6	413	14.0
MS 402	4"	1.5	2.0	9.10	67.0	73.0	75.5	0.54	0.67	0.75	5.5	346	10.5
MS 4000R	4"	1.5	2.0	8.20	73.0	74.8	74.5	0.67	0.78	0.85	4.1	413	14.0
MS 4000 (R)	4"	2.2	3.0	11.4	73.9	76.6	77.2	0.58	0.71	0.80	4.7	453	16.0
MS 4000 (R)	4"	3.0	4.0	14.8	76.9	79.0	78.3	0.60	0.74	0.82	4.7	493	17.0
MS 4000 (R)	4"	4.0	5.5	19.0	77.6	79.7	79.2	0.68	0.79	0.85	5.4	573	21.0
MS 4000 (R)	4"	5.5	7.5	25.0	80.0	80.5	78.0	0.67	0.80	0.87	5.1	673	26.0
MS6 (R)	6"	5.5	7.5	21.8	77.8	81.9	83.2	0.72	0.80	0.84	6.3	565	38
MS6 (R)	6"	7.5	10	29.0	78.6	82.6	83.9	0.72	0.80	0.84	6.2	610	43
MS6 (R)	6"	9.2	12.5	35.5	79.2	83.0	84.1	0.72	0.80	0.84	5.9	635	46
MS6 (R)	6"	11	15	42.5	79.8	83.4	84.4	0.72	0.82	0.86	5.6	738	53
MS6 (R)	6"	13	17.5	50.0	80.0	83.6	84.7	0.72	0.82	0.86	5.9	783	58
MS6 (R)	6"	15	20	58.0	79.7	83.6	84.9	0.72	0.80	0.84	6.4	838	64
MS6 (R)	6"	18.5	25	71.5	79.8	83.4	84.5	0.72	0.80	0.86	6.5	903	71
MS6 (R)	6"	22	30	84.5	79.7	83.6	85.0	0.74	0.82	0.86	7.0	1023	84

3 x 220 V, submersible rewindable motors

Type	Electrical data										Dimensions		
	Size	Motor		Full-load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Length [mm]	Weight [kg]
		Power [kW]	Power [hp]		η50%	η75%	η100%	cos φ 50%	cos φ 75%	cos φ 100%			
MMS 6000 (N)	6"	3.7	5.0	19.6	66	72	74	0.68	0.76	0.80	4.3	630	45
MMS 6000 (N)	6"	5.5	7.5	27.5	74	77	75	0.72	0.80	0.83	3.8	660	48
MMS 6000 (N)	6"	7.5	10	37.0	77	79	77	0.73	0.81	0.84	3.5	690	50
MMS 6000 (N)	6"	9.2	12.5	45.0	74	77	76	0.74	0.82	0.85	3.5	720	55
MMS 6000 (N)	6"	11	15	51.5	79	81	79	0.77	0.84	0.86	3.5	780	60
MMS 6000 (N)	6"	13	17.5	60.5	80	82	80	0.78	0.82	0.85	3.6	915	72
MMS 6000 (N)	6"	15	20	69.0	79	82	81	0.82	0.86	0.86	3.5	975	78
MMS 6000 (N)	6"	18.5	25	81.0	82	84	83	0.85	0.88	0.88	4.6	1085	90
MMS 6000 (N)	6"	22	30	96.0	82	84	84	0.84	0.88	0.88	4.9	1195	100
MMS 6000 (N)	6"	26	35	114	83	85	83	0.77	0.84	0.87	4.4	1315	115
MMS 6000 (N)	6"	30	40	130	84	85	84	0.77	0.84	0.87	4.4	1425	125
MMS 6000 (-N, -R)	6"	37	50	166	83	85	84	0.68	0.88	0.84	4.8	1425	125
MMS 8000 (-N, -R)	8"	22	30	102	75	79	80	0.80	0.85	0.86	4.4	1010	126
MMS 8000 (-N, -R)	8"	26	35	118	75	79	80	0.82	0.87	0.87	4.3	1050	134
MMS 8000 (-N, -R)	8"	30	40	134	77	81	82	0.77	0.84	0.87	5.2	1110	146
MMS 8000 (-N, -R)	8"	37	50	164	78	82	82	0.77	0.84	0.86	5.0	1160	156
MMS 8000 (-N, -R)	8"	45	60	192	80	84	85	0.75	0.83	0.86	5.7	1270	177
MMS 8000 (-N, -R)	8"	55	75	232	82	85	85	0.79	0.86	0.88	5.3	1350	192
MMS 8000 (-N, -R)	8"	63	85	265	83	85	85	0.84	0.89	0.90	4.8	1490	218
MMS 8000 (-N, -R)	8"	75	100	315	83	86	85	0.85	0.89	0.90	4.8	1590	237
MMS 10000 (N)	10"	75	100	320	83	85	84	0.83	0.87	0.88	4.7	1400	280
MMS 10000 (N)	10"	92	125	395	82	85	85	0.77	0.84	0.87	4.9	1500	330
MMS 10000 (N)	10"	110	150	470	82	85	85	0.85	0.88	0.89	4.5	1690	385
MMS 10000 (N)	10"	132	180	570	82	85	84	0.86	0.89	0.89	4.2	1870	435

3 x 380 V, submersible motors

Type	Electrical data										Dimensions		
	Size	Motor		Full load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Length [mm]	Weight [kg]
		Power [kW]	Power [hp]		η50%	η75%	η100%	cos φ 50%	cos φ 75%	cos φ 100%			
MS 402	4"	0.37	0.5	1.90	57.0	67.0	69.0	0.52	0.64	0.72	5.0	226	5.5
MS 402	4"	0.55	0.75	2.80	58.0	65.5	69.0	0.47	0.59	0.70	4.8	241	6.3
MS 402	4"	0.75	1.0	3.25	61.0	67.0	71.0	0.50	0.63	0.73	5.0	276	7.7
MS 4000R	4"	0.75	1.0	2.65	68.8	71.3	71.3	0.77	0.83	0.87	4.2	398	13.0
MS 402	4"	1.1	1.5	4.40	65.0	72.0	72.0	0.49	0.62	0.72	5.5	306	8.9
MS 4000R	4"	1.1	1.5	3.65	72.9	74.8	74.4	0.68	0.79	0.85	4.9	413	14.0
MS 402	4"	1.5	2.0	5.25	67.5	73.0	76.0	0.53	0.67	0.75	5.5	346	10.5
MS 4000R	4"	1.5	2.0	4.90	72.0	74.5	75.2	0.60	0.73	0.82	4.5	413	14.0
MS 4000 (R)	4"	2.2	3.0	7.00	70.0	75.0	76.2	0.52	0.66	0.75	4.9	453	16.0
MS 4000 (R)	4"	3.0	4.0	9.10	73.4	77.3	78.0	0.54	0.68	0.78	4.9	493	17.0
MS 4000 (R)	4"	4.0	5.5	11.4	77.1	79.8	79.9	0.60	0.74	0.82	5.7	573	21.0
MS 4000 (R)	4"	5.5	7.5	15.2	79.5	80.7	81.0	0.60	0.74	0.82	5.3	673	26.0
MS6 (R)	6"	5.5	7.5	14.2	80.4	82.9	82.8	0.78	0.84	0.86	4.9	565	38
MS6 (R)	6"	7.5	10	19.2	81.1	83.6	83.5	0.78	0.84	0.86	5.0	590	41
MS6 (R)	6"	9.2	12.5	23.6	81.2	83.8	83.9	0.74	0.82	0.86	5.1	610	43
MS6 (R)	6"	11	15	28.5	81.1	83.9	84.1	0.72	0.80	0.86	5.1	708	49
MS6 (R)	6"	13	17.5	34.0	80.8	83.7	84.1	0.70	0.80	0.84	5.0	738	53
MS6 (R)	6"	15	20	38.5	81.7	84.4	84.8	0.72	0.82	0.86	5.2	783	58
MS6 (R)	6"	18.5	25	47.0	82.3	84.8	84.9	0.74	0.82	0.86	5.2	838	64
MS6 (R)	6"	22	30	55.5	82.3	84.7	84.8	0.74	0.82	0.86	5.4	903	71
MS6 (R)	6"	26	35	65.5	82.6	84.9	85.0	0.76	0.84	0.86	5.5	968	78
MS6 (R)	6"	30	40	76.0	82.4	84.9	85.0	0.74	0.82	0.86	5.7	1023	84

3 x 380 V, submersible rewindable motors

Electrical data												Dimensions	
Type	Motor			Full-load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Length [mm]	Weight [kg]
	Size	Power [kW]	Power [hp]		η50%	η75%	η100%	Cos φ 50%	Cos φ 75%	Cos φ 100%			
MMS 6000 (N)	6"	3.7	5.0	11.4	66	72	74	0.69	0.77	0.80	4.2	630	45
MMS 6000 (N)	6"	5.5	7.5	16.0	74	77	75	0.72	0.80	0.83	3.8	660	48
MMS 6000 (N)	6"	7.5	10	21.4	77	79	77	0.73	0.81	0.84	3.5	690	50
MMS 6000 (N)	6"	9.2	12.5	26.0	74	78	76	0.75	0.82	0.85	3.5	720	55
MMS 6000 (N)	6"	11	15	29.5	79	81	79	0.77	0.84	0.86	3.6	780	60
MMS 6000 (N)	6"	13	17.5	35.0	80	82	80	0.75	0.82	0.85	3.7	915	72
MMS 6000 (N)	6"	15	20	40.5	79	82	80	0.78	0.84	0.86	3.5	975	78
MMS 6000 (N)	6"	18.5	25	46.5	82	85	83	0.79	0.85	0.87	4.7	1085	90
MMS 6000 (N)	6"	22	30	55.5	83	85	84	0.78	0.85	0.87	4.9	1195	100
MMS 6000 (N)	6"	26	35	65.5	84	85	84	0.78	0.85	0.87	4.6	1315	115
MMS 6000 (N)	6"	30	40	75.5	84	85	84	0.76	0.84	0.87	4.7	1425	125
MMS 6000 (-N, -R)	6"	37	50	94.5	84	85	83	0.76	0.84	0.87	4.5	1425	125
MMS 8000 (-N, -R)	8"	22	30	59.0	75	79	80	0.80	0.85	0.86	4.4	1010	126
MMS 8000 (-N, -R)	8"	26	35	69.0	75	79	80	0.81	0.86	0.87	4.4	1050	134
MMS 8000 (-N, -R)	8"	30	40	77.0	77	81	82	0.78	0.84	0.87	5.1	1110	146
MMS 8000 (-N, -R)	8"	37	50	94.0	79	83	83	0.79	0.85	0.87	4.9	1160	156
MMS 8000 (-N, -R)	8"	45	60	110	81	85	85	0.80	0.86	0.88	5.5	1270	177
MMS 8000 (-N, -R)	8"	55	75	132	82	85	86	0.83	0.88	0.89	5.0	1350	192
MMS 8000 (-N, -R)	8"	63	85	152	83	85	85	0.81	0.87	0.89	5.3	1490	218
MMS 8000 (-N, -R)	8"	75	100	182	84	86	85	0.86	0.89	0.90	4.7	1590	237
MMS 8000 (-N, -R)	8"	92	125	220	85	87	86	0.85	0.89	0.90	4.8	1830	283
MMS 8000 (-N, -R)	8"	110	150	260	83	86	86	0.84	0.89	0.90	5.0	2060	333
MMS 10000 (N)	10"	75	100	182	82	85	86	0.81	0.86	0.88	5.0	1400	280
MMS 10000 (N)	10"	92	125	224	82	86	87	0.77	0.84	0.87	5.1	1500	330
MMS 10000 (N)	10"	110	150	265	83	86	87	0.84	0.88	0.89	4.7	1690	385
MMS 10000 (N)	10"	132	180	315	84	86	87	0.84	0.88	0.89	4.8	1870	435
MMS 10000 (N)	10"	147	200	355	83	86	87	0.78	0.85	0.87	5.6	2070	500
MMS 10000 (N)	10"	170	230	415	83	86	87	0.75	0.83	0.86	5.4	2220	540
MMS 10000 (N)	10"	190	260	475	82	86	87	0.69	0.79	0.85	5.7	2400	580

3 x 380 V, submersible motors, MS6 T60

Electrical data												Dimensions	
Type	Motor			Full-load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Length [mm]	Weight [kg]
	Size	Power [kW]	Power [hp]		η50%	η75%	η100%	cos φ 50%	cos φ 75%	cos φ 100%			
MS6 (R)T60	6"	4	5.5	10.4	79.1	82.2	82.6	0.76	0.82	0.86	5.0	535	35
MS6 (R)T60	6"	5.5	7.5	14.2	80.0	83.0	83.4	0.76	0.84	0.86	5.4	565	38
MS6 (R)T60	6"	7.5	10.0	19.2	80.5	83.4	83.7	0.78	0.84	0.86	5.2	610	43
MS6 (R)T60	6"	9.2	12.5	23.6	80.6	83.7	84.3	0.74	0.82	0.86	5.3	635	46
MS6 (R)T60	6"	11.0	15.0	28.0	81.0	83.9	84.2	0.74	0.82	0.86	5.0	738	53
MS6 (R)T60	6"	13.0	17.5	32.5	81.5	84.3	84.7	0.76	0.84	0.86	5.2	783	58
MS6 (R)T60	6"	15.0	20.0	37.5	81.7	84.4	84.7	0.78	0.84	0.86	5.3	838	64
MS6 (R)T60	6"	18.5	25.0	46.5	81.8	84.6	85.1	0.76	0.84	0.86	5.7	903	71
MS6 (R)T60	6"	22.0	30.0	55.0	81.9	84.6	85.0	0.78	0.86	0.88	5.8	1023	84

3 x 460 V, submersible motors

Electrical data												Dimensions	
Type	Motor			Full load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Length [mm]	Weight [kg]
	Size	Power [kW]	Power [hp]		η50%	η75%	η100%	cos φ 50%	cos φ 75%	cos φ 100%			
MS 402	4"	0.37	0.5	1.60	58.0	65.0	68.5	0.51	0.64	0.73	5.0	226	5.5
MS 402	4"	0.55	0.75	2.30	58.5	65.5	68.5	0.47	0.59	0.69	4.8	241	6.3
MS 402	4"	0.75	1.0	2.70	61.5	67.0	71.0	0.50	0.63	0.73	5.0	276	7.7
MS 4000R	4"	0.75	1.0	2.20	68.0	71.2	71.3	0.76	0.83	0.87	4.5	398	13.0
MS 402	4"	1.1	1.5	3.65	64.5	70.5	73.5	0.49	0.62	0.72	5.5	306	8.9
MS 4000R	4"	1.1	1.5	3.00	72.0	74.5	75.0	0.69	0.79	0.85	5.0	413	14.0
MS 402	4"	1.5	2.0	4.35	68.0	72.5	75.5	0.54	0.66	0.76	5.5	346	10.5
MS 4000R	4"	1.5	2.0	4.05	71.0	74.5	75.2	0.60	0.73	0.82	4.4	413	14.0
MS 4000 (R)	4"	2.2	3.0	5.80	70.0	75.0	76.2	0.52	0.65	0.75	4.8	453	16.0
MS 4000 (R)	4"	3.0	4.0	7.50	73.4	77.3	78.0	0.54	0.68	0.78	4.9	493	17.0
MS 4000 (R)	4"	4.0	5.5	9.45	77.1	79.8	80.0	0.60	0.74	0.82	5.7	573	21.0
MS 4000 (R)	4"	5.5	7.5	12.6	79.5	80.7	81.0	0.60	0.74	0.82	5.3	673	26.0
MS 4000 (R)	4"	7.5	10	18.0	78.5	80.7	80.6	0.56	0.69	0.79	5.2	773	31.0
MS6 (R)	6"	5.5	7.5	11.6	80.6	82.9	82.7	0.80	0.84	0.86	4.7	565	38
MS6 (R)	6"	7.5	10	15.8	81.1	83.4	83.2	0.78	0.84	0.86	4.9	590	41
MS6 (R)	6"	9.2	12.5	19.4	81.4	83.8	83.7	0.76	0.84	0.86	5.0	610	43
MS6 (R)	6"	11	15	23.4	81.1	83.9	84.2	0.72	0.80	0.84	5.1	708	49
MS6 (R)	6"	13	17.5	28.0	81.1	84.0	84.3	0.70	0.80	0.84	5.0	738	53
MS6 (R)	6"	15	20	31.5	81.6	84.3	84.6	0.72	0.82	0.86	5.1	783	58
MS6 (R)	6"	18.5	25	39.0	82.1	84.7	85.0	0.72	0.82	0.86	5.3	838	64
MS6 (R)	6"	22	30	46.0	82.3	84.8	85.0	0.74	0.82	0.86	5.4	903	71
MS6 (R)	6"	26	35	54.5	82.2	84.8	85.1	0.72	0.82	0.86	5.7	968	78
MS6 (R)	6"	30	40	63.0	82.2	84.8	85.1	0.72	0.80	0.86	5.9	1023	84

3 x 460 V, submersible rewindable motors

Type	Electrical data											Dimensions	
	Motor			Full-load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Length [mm]	Weight [kg]
	Size	Power [kW]	Power [hp]		η50%	η75%	η100%	Cos φ 50%	Cos φ 75%	Cos φ 100%			
MMS 6000 (N)	6"	3.7	5.0	9.75	64	69	70	0.63	0.74	0.80	4.2	630	45
MMS 6000 (N)	6"	5.5	7.5	13.8	73	76	74	0.63	0.74	0.80	4.0	660	48
MMS 6000 (N)	6"	7.5	10	18.0	77	79	78	0.61	0.73	0.79	3.8	690	50
MMS 6000 (N)	6"	9.2	12.5	22.0	74	77	77	0.65	0.76	0.81	3.7	720	55
MMS 6000 (N)	6"	11	15	25.5	78	80	79	0.65	0.76	0.82	3.8	780	60
MMS 6000 (N)	6"	13	17.5	29.5	80	82	80	0.65	0.76	0.82	4.0	915	72
MMS 6000 (N)	6"	15	20	33.5	80	82	81	0.68	0.78	0.83	4.0	975	78
MMS 6000 (N)	6"	18.5	25	39.0	83	85	85	0.65	0.77	0.83	5.5	1085	90
MMS 6000 (N)	6"	22	30	46.0	85	85	85	0.67	0.78	0.83	5.6	1195	100
MMS 6000 (N)	6"	26	35	54.5	84	86	84	0.69	0.80	0.85	5.0	1315	115
MMS 6000 (N)	6"	30	40	62.5	85	86	85	0.68	0.79	0.85	5.1	1425	125
MMS 6000 (-N, -R)	6"	37	50	79.0	84	85	84	0.65	0.75	0.83	4.7	1425	125
MMS 8000 (-N, -R)	8"	22	30	48.5	75	79	81	0.73	0.81	0.84	5.3	1010	126
MMS 8000 (-N, -R)	8"	26	35	56.5	76	80	81	0.77	0.83	0.86	5.1	1050	134
MMS 8000 (-N, -R)	8"	30	40	64.0	78	82	83	0.74	0.82	0.85	5.8	1110	146
MMS 8000 (-N, -R)	8"	37	50	78.0	80	83	84	0.74	0.82	0.85	5.5	1160	156
MMS 8000 (-N, -R)	8"	45	60	92.5	82	85	86	0.71	0.80	0.85	6.4	1270	177
MMS 8000 (-N, -R)	8"	55	75	112	82	85	86	0.73	0.82	0.86	5.8	1350	192
MMS 8000 (-N, -R)	8"	63	85	126	83	86	86	0.72	0.82	0.86	6.0	1490	218
MMS 8000 (-N, -R)	8"	75	100	150	84	86	87	0.72	0.82	0.86	5.7	1590	237
MMS 8000 (-N, -R)	8"	92	125	184	85	87	87	0.74	0.83	0.87	6.0	1830	283
MMS 8000 (-N, -R)	8"	110	150	220	84	86	86	0.75	0.83	0.87	5.8	2060	333
MMS 10000 (N)	10"	75	100	154	81	85	87	0.72	0.80	0.84	5.7	1400	280
MMS 10000 (N)	10"	92	125	190	82	86	87	0.69	0.78	0.83	5.5	1500	330
MMS 10000 (N)	10"	110	150	224	82	86	88	0.72	0.80	0.84	5.8	1690	385
MMS 10000 (N)	10"	132	180	265	83	86	88	0.73	0.82	0.85	5.7	1870	435
MMS 10000 (N)	10"	147	200	305	82	86	87	0.66	0.77	0.82	6.2	2070	500
MMS 10000 (N)	10"	170	230	355	82	86	87	0.66	0.76	0.82	5.9	2220	540
MMS 10000 (N)	10"	190	260	405	82	85	87	0.62	0.73	0.79	6.1	2400	580

3 x 460 V, submersible industrial motors

Electrical data											Dimensions		
Type	Motor			Full-load current I _n [A]	Motor efficiency [%]			Power factor			I _{st} I _n	Length [mm]	Weight [kg]
	Size	Power [kW]	Power [hp]		η50%	η75%	η100%	cos φ 50%	cos φ 75%	cos φ 100%			
MS 4000	4"	2.2	3.0	5.70	72.4	76.3	77.8	0.62	0.74	0.81	5.3	493	17
MS 4000	4"	3.0	4.0	7.55	75.2	78.6	80.3	0.61	0.74	0.81	5.6	573	21
MS 4000	4"	3.7	5.0	9.05	75.4	79.0	79.6	0.68	0.79	0.83	5.7	673	26
MS 4000	4"	4.0	5.5	9.55	75.9	78.8	80.0	0.69	0.70	0.85	5.3	673	26
MS 4000	4"	5.5	7.5	13.8	76.2	79.9	81.3	0.55	0.68	0.77	5.5	773	31

MP 204

The MP 204 is an electronic motor protector, designed for the protection of an asynchronous motor or a pump.

The motor protector consists of:

- a cabinet incorporating transformers and electronics
- a control panel with operating buttons and display for reading of data.

The MP 204 operates with two sets of limits:

- a set of warning limits and
- a set of trip limits.

If one or more of the warning limits are exceeded, the motor continues to run, but the warnings will appear in the MP 204 display.

Some values only have a warning limit.

The warning can also be read out by means of the Grundfos R100 remote control.

If one of the trip limits is exceeded, the trip relay will stop the motor. At the same time, the signal relay is operating to indicate that the limit has been exceeded.

Applications

The MP 204 can be used as a stand-alone motor protector.

The MP 204 can be monitored via a Grundfos GENIbus.

The power supply to the MP 204 is in parallel with the supply to the motor. Motor currents up to 120 A are passed directly through the MP 204. The MP 204 protects the motor primarily by measuring the motor current by means of a true RMS measurement. The MP 204 disconnects the contactor if, for example, the current exceeds the preset value.

Secondarily, the motor is protected via temperature measuring by a Tempcon sensor, a Pt100/Pt1000 sensor and a PTC sensor/thermal switch.

The MP 204 is designed for single- and three-phase motors. In single-phase motors, the starting and run capacitors are also measured. $\cos \phi$ is measured in both single- and three-phase systems.

Benefits

The MP 204 offers these benefits:

- Suitable for both single- and three-phase motors
- Dry-running protection
- Overload protection
- Very high accuracy
- Made for submersible pumps.

The MP 204 - many monitoring options

The MP 204 monitors the following parameters:

- Insulation resistance before start-up
- Temperature (Tempcon, Pt sensor and PTC/thermal switch)
- Overload/underload
- Overvoltage/undervoltage
- Phase sequence
- Phase failure
- Power factor
- Power consumption
- Harmonic distortion
- Operating hours and number of starts.



TM03 1471 2205

Fig. 17 MP 204

Five sizes of single-turn transformers, 120-999 A.

Note: Monitoring of motor temperature is not possible when single-turn transformers are used.



TM03 2033 3505

Fig. 18 Single-turn transformers

Product numbers

Product	Product number
MP 204	96079927
R100	625333

Functions

- Phase-sequence monitoring
- Indication of current or temperature (user selection)
- Indication of temperature in °C or °F (user selection)
- 4-digit, 7-segment display
- Setting and status reading with the R100
- Setting and status reading via the GENIbus.

Tripping conditions

- Overload
- Underload (dry running)
- Temperature (Tempcon sensor, PTC/thermal switch and Pt sensor)
- Phase failure
- Phase sequence
- Overvoltage
- Undervoltage
- Power factor ($\cos \phi$)
- Current unbalance.

Warnings

- Overload
 - Underload
 - Temperature (Tempcon and Pt sensor)
 - Overvoltage
 - Undervoltage
 - Power factor ($\cos \phi$)
- Note:** In connection with single- and three-phase connection.
- Run capacitor (single-phase operation)
 - Starting capacitor (single-phase operation)
 - Loss of communication in network
 - Harmonic distortion.

Learning function

- Phase sequence (three-phase operation)
- Run capacitor (single-phase operation)
- Starting capacitor (single-phase operation)
- Identification and measurement of Pt100/Pt1000 sensor circuit.

External current transformers

When fitted with external current transformers, the MP 204 unit can handle currents from 120 to 999 A. Grundfos can supply approved current transformers from stock (200/5A, 300/5A, 500/5A, 750/5A, 1000/5A).

Remote control R100

The R100 remote control from Grundfos allows for wireless infrared remote control of your MP 204 unit.

With the R100, you get access to a full range of options such as factory setting adjustment, service and fault finding.

Ready for bus communication

The MP 204 allows for monitoring and communication via GENIbus - a Grundfos-designed bus for exchange of pump data, alarms, status information, and setpoints. This enables users to connect the MP 204 to, for instance, SCADA systems.

Technical data - MP 204

Enclosure class	IP 20
Ambient temperature	−20 °C to +60 °C
Relative air humidity	99%
Voltage range	100-480 VAC
Current range	3-999 A
Frequency	50 to 60 Hz
IEC trip class	1-45
Special Grundfos trip class	0.1 to 30 s
Voltage variation	−25 %/+15 % of nominal voltage
Approvals	EN 60947, EN 60335, UL/CSA 508
Marking	CE, cUL, C-tick
Consumption	Max. 5 W
Plastic type	Black PC / ABS

	Measuring range	Accuracy	Resolution
Current without external current transformers	3-120 A	±1 %	0.1 A
Current with external current transformers	120-999 A	±1 %	1 A
Phase-to-phase voltage	80-610 VAC	±1 %	1 V
Frequency	47-63 Hz	±1 %	0.5 Hz
Power	0-1 MW	±2 %	1 W
Power factor	0-0.99	±2 %	0.01
Energy consumption	0-4x10 ⁹ kWh	±5 %	1 kWh

IO 112	Description	Product number
	The IO 112 is a measuring module and a 1-channel protection unit for use in connection with the MP 204 motor protection unit. The module can be used for protection of pump against other factors than the electrical conditions, for instance dry-running. It can also be used as a stand-alone protection module. The IO 112 interface has three inputs for measured values one potentiometer for setting of limits indicator lights indicating the • measured value of the input • value of the limit set • alarm source • pump status. Electrical data: • Supply voltage: 24 VAC ±10% 50/60 Hz or 24 VDC ±10% • Supply current: Min. 2.4 A; max. 8 A • Power consumption: Max. 5 W Ambient temperature: −25°C to +65°C • Enclosure class: IP 20	96651601

Control functions

This table describes the protection provided by MP 204.

Control parameters	Function	Problem	Advantages
Temperature	MS The motor temperature is measured by means of the built-in Tempcon temperature transmitter and a signal is sent to MP 204 via the phase leads. In MP 204 the measured temperature is compared with the factory-set value (75 °C).	Overload, frequent starts/stops, operation against blocked discharge pipe, insufficient flow velocity past the motor.	Longer motor life, safe operating conditions, service indication.
	MMS The motor temperature is measured by means of the Pt100. The signal is sent to the MP 204 where the measured temperature is compared with the factory-set value. Temperature protection requires a submersible motor with a Pt100. The motor temperature must be monitored during frequency converter operation.		
Overvoltage/ under-voltage	If the set trip value is exceeded, the motor will stop.	The installation is close to a transformer. The mains do not absorb load variations.	Important installation parameter, possibility of improving operating conditions.
Overload	The motor power input is measured on each of the three phases. The registered power input is an average of these three values. If the factory-set value is exceeded, the motor will stop.	Incorrect sizing of pump/motor, voltage supply failure, defective cable, blocking, wear or corrosion.	Longer pump life, safe operating conditions, service indication.
Underload (dry running)	The motor power input is measured on each of the three phases. The registered power input is an average of these three values. If the average value is lower than the factory-set value, the motor will stop.	Pump exposed to dry running or underload, for example caused by wear.	Traditional dry-running protection is no longer necessary, no extra cables.
Current unbalance	The power input of the motor is measured on each of the three phases.	Mains load is uneven, incipient motor defect, phase voltages diverging.	Motor protection against overload, service indication.
Phase sequence	MP 204 and motor are installed so that the phase sequence corresponds to correct direction of rotation. MP 204 monitors changes in the phase sequence.	Two phases are wrongly connected.	Ensures correct pump performance.
Phase failure	MP 204 checks the phases connected, phase failure will cause an alarm.	Phase failure	Indication of phase failure, and alarm.

R100 menus

0. GENERAL

See the operating instructions for the R100.

1. OPERATION

- Operating mode
- Actual trip
- Actual warning 1
- Actual warning 2
- Alarm log 1
- Alarm log 2
- Alarm log 3
- Alarm log 4
- Alarm log 5.

2. STATUS

Display of

- Supply overview
- Average current
- Average voltage
- Tempcon sensor
- Pt100/Pt1000 sensor
- **Power input and energy consumption** (described in the following)
- Energy trip counter
- Phase sequence
- Current unbalance
- Operating hours and number of starts
- Trip counter of hours and starts
- Starting capacitor
- Run capacitor
- Insulation resistance
- Cos ϕ
- Harmonic distortion.

3. LIMITS

Display and setting of warning and trip limits.

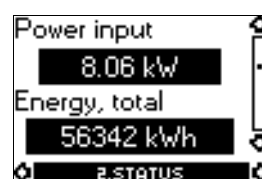
- Tempcon sensor
- Pt sensor
- Tripping current
- Current warning
- Nominal voltage
- Voltage limits
- Current unbalance
- Starting capacitor
- Run capacitor
- Insulation resistance
- Cos ϕ trip
- Cos ϕ warning.

4. INSTALLATION

Setting and display of

- Supply mains
- **Trip class** (described in the following)
- Trip delay
- External current transformers
- Power-on delay
- Restarting (described in the following)
- Automatic restarting (described in the following)
- Tempcon sensor
- Pt sensor
- Insulation resistance measurement
- PTC/thermal switch
- Resetting of trip counters
- Service interval
- Number of automatic restarts
- Units/display
- MP 204 display
- GENIbus ID number
- Learning function.

Power input and energy consumption



Actual input power and motor energy consumption.

The energy consumption is an accumulated value which cannot be reset.

The power is calculated like this:

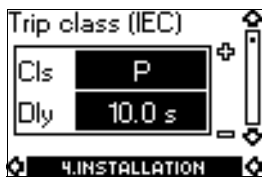
$$U_{\text{average}} = \frac{U_{L1-L2} + U_{L2-L3} + U_{L3-L1}}{3} [\text{V}]$$

$$I_{\text{average}} = \frac{I_{L1} + I_{L2} + I_{L3}}{3} [\text{A}]$$

$$\cos \phi_{\text{average}} = \frac{\cos \phi_{L1} + \cos \phi_{L2} + \cos \phi_{L3}}{3} [-]$$

$$P = (U_{\text{average}} \times I_{\text{average}} \times \sqrt{3} \times \cos \phi_{\text{average}}) [\text{W}]$$

Trip class



Line 1: Select IEC trip class (1 to 45).

If manual indication of trip delay in the case of overload is required, select trip class "P".

Factory setting:

- Cls (trip class): P.

Line 2: Select trip delay.

Factory setting:

- Dly (trip delay): 10 s.

Restarting



Set whether restarting after tripping is to be

- **Automatic** (factory setting)
- *Manual*.

Setting of time, see section "Automatic restarting".

Automatic restarting



Set the time after which the MP 204 is to attempt automatic restarting of motor after cut-out.

The time runs from the moment when the value which triggered the fault has returned to normal.

Factory setting:

- 300 s.

G100 gateway for communication with Grundfos products

The G100 offers a wide selection of options for integration of Grundfos products provided with GENIbus interface into main control and monitoring systems.

The G100 enables a pump installation to meet future demands for optimum pump operation in terms of reliability, operating costs, centralization and automation.



Fig. 19 G100

GR5940

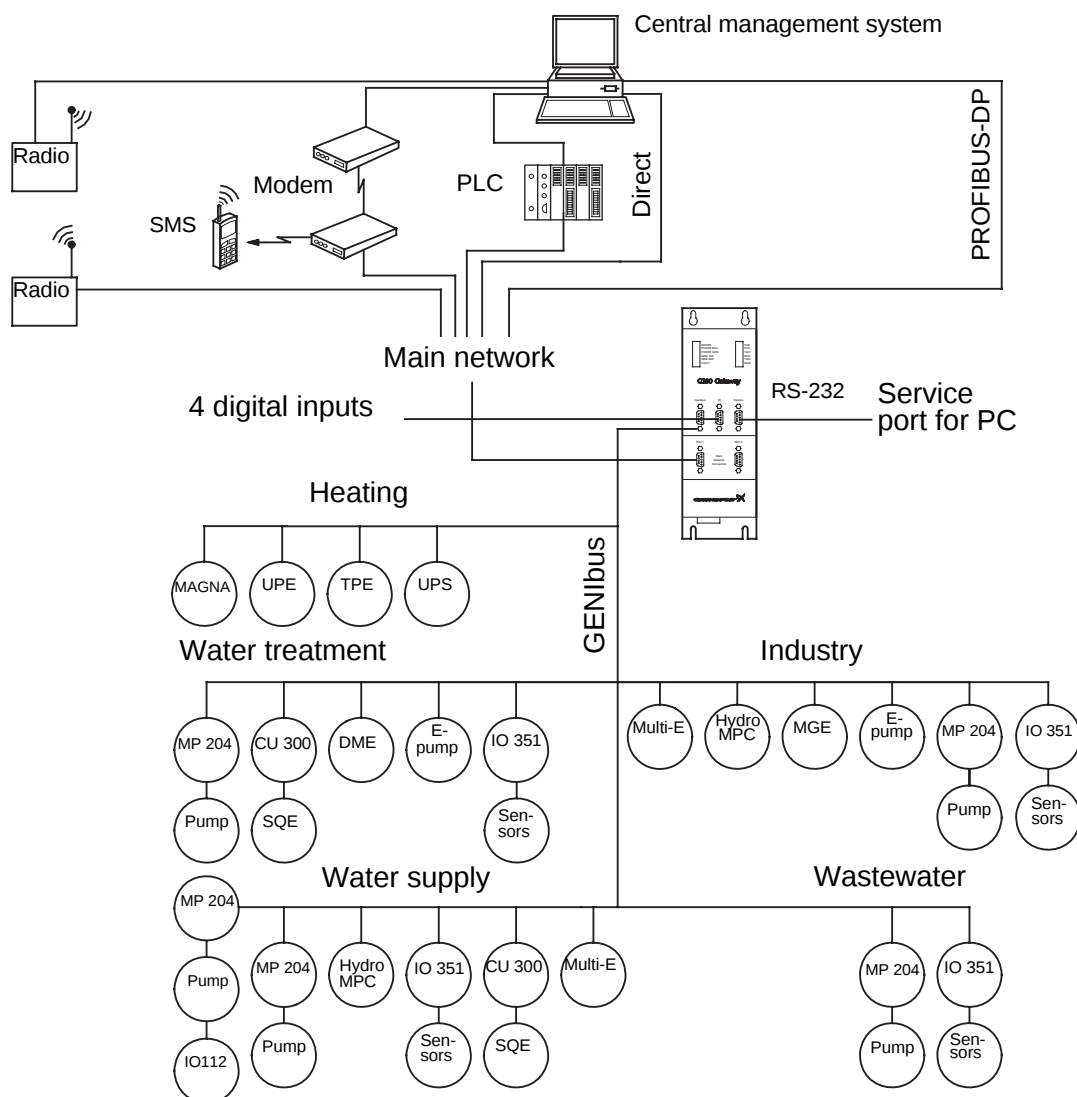


Fig. 20 Examples of G100 applications

TM03 9224 3607

Product description

The G100 Gateway enables communication of operating data, such as measured values and setpoints, between Grundfos products with GENIbus interface and a main network for control and monitoring.

As indicated in the illustration on page 84, the G100 is suitable for use in applications such as water supply, water treatment, wastewater, building automation and industry.

Common to above applications is that downtime is usually costly, and extra investments are therefore often made to achieve maximum reliability by monitoring selected operating variables.

The day-to-day operation, such as starting and stopping of pumps and changing of setpoints, can also be effected from the main system by communication with the G100. In addition, the G100 can be set up to send event-controlled status indications such as alarms via the SMS to mobile phones, and to make automatic alarm call-backs to a central management system.

Data logging

Besides the possibility of data communication, the G100 offers logging of up to 350,000 time-stamped data. The logged data can be transmitted to the main system or a PC for further analysis in a spreadsheet or similar program.

For the data logging, the "PC Tool G100 Data Log" software tool is used. The tool is part of the PC Tool G100 package, which is supplied with the G100.

Other features

- Four digital inputs.
- Stop of all pumps in case of failing communication with the management system (optional).
- Access code for modem communication (optional).
- Alarm log.

Installation

Installation of the G100 is effected by the system integrator. The G100 is connected to the GENIbus as well as to the main network. All units on the GENIbus can thus be controlled from a central management system on the main network.

The "G100 Support Files" CD-ROM supplied with the G100 contains examples of programs to be used when the G100 is connected to the various main network systems. Included is also a description of the data points available in Grundfos products with GENIbus interface.

The "PC Tool G100" software tool included can be used for the installation and use of G100.

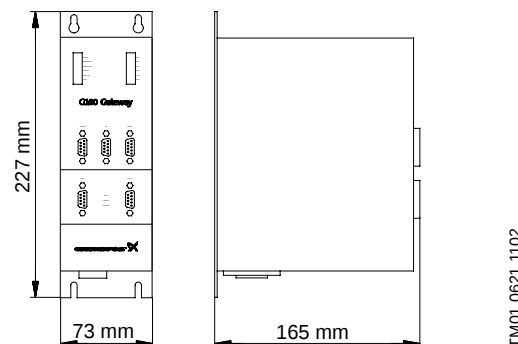


Fig. 21 Dimensional sketch

Technical data

Overview of protocols

Main system	Software protocol
PROFIBUS-DP	DP
Radio	Satt Control COMLI/Modbus
Modem	Satt Control COMLI/Modbus
PLC	Satt Control COMLI/Modbus
GSM mobile phone	SMS, UCP

Other possible connections

- GENIbus RS-485: Connection of up to 32 units.
- Service port RS-232: For direct connection to a PC or via radio modem.
- Digital inputs: 4.
- Voltage supply: 1 x 110-240 V, 50/60 Hz.
- Ambient temperature: In operation: -20 °C to +60 °C.
- Enclosure class: IP 20.
- Weight: 1.8 kg.

Accessories

- PC Tool G100 package (supplied with the product)
- G100 Support Files CD-ROM (supplied with product)

Product numbers

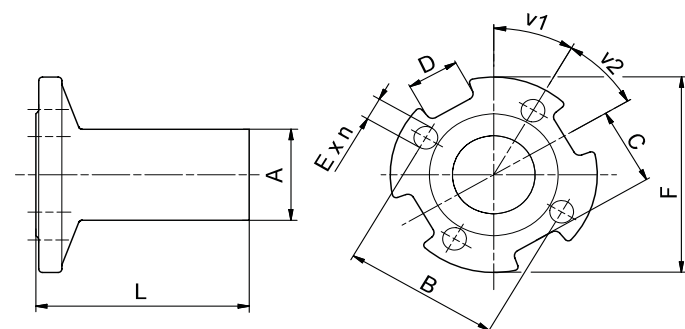
Product	Product number
G100 with Profibus-DP expansion board*	96411135
G100 with Radio/Modem/PLC expansion board*	96411136
G100 Basic Version*	96411137
PC Tool G100 package	96415783

* CD-ROM with G100 Support Files included.

Connecting pieces

The tables below show the range of connecting pieces for connection of thread-to-flange and thread-to-thread.

Thread-to-flange

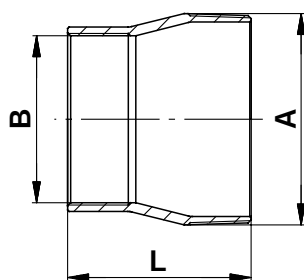


TM01 2396 2506 - GRA2552

Fig. 22 Dimensional sketch and photo of the connecting pieces thread-to-flange

Type	Pump outlet	Connecting piece	Thread-to-flange										Product number	
			Dimensions [mm]										DIN W.-Nr. 1.4308	DIN W.-Nr. 1.4517
			A	B	C	D	E	F	L	V1	V2	n		
SP 17	Rp 2.5	R 2½ → DN 50 PN 16/40	R 2½	125	65	40	ø19	ø165	170	60	90	4	120125	120911
		R 2½ → DN 65 PN 16/40	R 2½	145	71	30	ø19	ø185	170	22.5	45	8	120126	120910
		R 2½ → DN 80 PN 16/40	R 2½	160	82.5	40	ø19	ø200	170	22.5	45	8	120127	120909
SP 30	Rp 3	R 3 → DN 65 PN 16/40	R 3	145	71	30	ø19	ø185	170	22.5	45	8	130187	130920
		R 3 → DN 80 PN 16/40	R 3	160	82.5	40	ø19	ø200	170	22.5	45	8	130188	130921
		R 3 → DN 100 PN 16/40	R 3	180/190	100	40	ø19/ø23	ø235	170	22.5	45	8	130189	130922
SP 46 SP 60	Rp 3 Rp 4	R 3 → DN 65 PN 16	R 3	145	71	30	ø19	ø185	170	22.5	45	8	130187	130920
		R 3 → DN 80 PN 16	R 3	160	82.5	40	ø19	ø200	170	22.5	45	8	130188	130921
		R 3 → DN 100 PN 16	R 3	180/190	100	40	ø19/ø23	ø235	170	22.5	45	8	130189	130922
SP 77 SP 95	Rp 5	R 4 → DN 100 PN 16	R 4	180/190	100	40	ø19/ø23	ø235	180	22.5	45	8	140071	140577
		R 5 → DN 100 PN 16/40	R 5	180/190	82	35	ø19/ø23	ø235	195	22.5	45	8	160148	160646
		R 5 → DN 125 PN 16/40	R 5	210/220	99	37	ø19/ø28	ø270	195	22.5	45	8	160149	160647
SP 125 SP 160 SP 215	Rp 6	R 5 → DN 150 PN 16/40	R 5	240/250	115	36	ø23/ø28	ø300	195	22.5	45	8	160150	160648
		R 6 → DN 125 PN 16/40	R 6	210/220	99	36	ø19/ø28	ø270	195	22.5	45	8	170159	170596
		R 6 → DN 150 PN 16/40	R 6	240	114	36	ø23/ø28	ø300	195	22.5	45	8	170160	170597
		R 6 → DN 200 PN 16	R 6	295	134	36	ø23	ø340	195	15	30	12	170161	170598
		R 6 → DN 200 PN 40	R 6	320	151	36	ø31	ø375	200	15	30	12	170162	170599

Thread-to-thread



TM01 2397 1698 - GRA2555

Fig. 23 Dimensional sketch and photo of connecting piece thread-to-thread

Type	Pump outlet	Connecting piece	Dimensions			Product number	
			Thread-to-thread		L [mm]	DIN W.-Nr. 1.4301	DIN W.-Nr. 1.4401
			A	B			
SP 77 SP 95	Rp 5	R 5 → Rp 4	R 5	Rp 4	121	190063	190585
		R 5 → Rp 6	R 5	Rp 6	150	190069	190591
	NPT 5	NPT 5 → NPT 4	NPT 5	NPT 4	121	190064	190586
		NPT 5 → NPT 6	NPT 5	NPT 6	150	190070	190592
SP 125	Rp 6	R 6 → Rp 5	R 6	Rp 5	150	200130	200640
SP 160 SP 215	NPT 6	NPT 6 → NPT 5	NPT 6	NPT 5	150	200135	200645

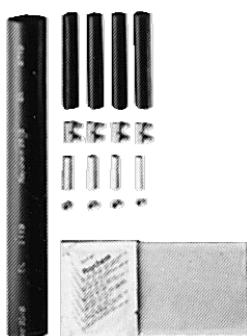
Cable termination kit with plug



TM00 7883 2296

Description	Version	Prod. no.
For watertight joining of motor cable and submersible drop cable in an acrylic tube filled with resin. Used for both single and multi-core cables during installation of submersible pumps. 24 hours of hardening is required.	MS 402 and MS 4000 up to 7.5 kW:	
	For cables up to 4 x 2.5 mm ²	799901
	For cables up to 4 x 6 mm ²	799902

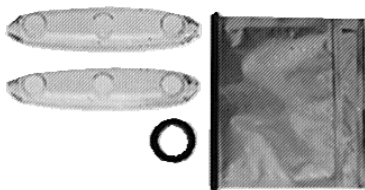
Cable termination kit, type KM



TM00 7885 2296

Description	Version			Prod. no.
	Motor cable	[mm ²]	Number of leads	
For watertight shrink-joining of motor cable and submersible drop cable.	Flat cable	1.5 - 6.0 1.5 - 4.0	3 4	116251
	Flat cable	6 - 10 10 - 16	4 3	116252
Enables the joining of: • cables of equal size. • cables of different sizes. • a cable lead and a single-lead.	Flat cable	16 - 25	3 4	116255
	3 single leads	1.5 - 6.0	3	116253
The joint is ready for use after a few minutes and requires no long hardening time as do resin joints.	3 single leads	10 - 25	3	116254
	4 single leads	1.5 - 4.0	4	116257
The joint cannot be separated.	4 single leads	6 - 16	4	116258
	Single lead	35 - 120	1	116256
For watertight joining of motor cable and submersible drop cable. By means of shrink-screw-glue casting	Screw-shrinking	6 - 50	4	96636867
		19 - 95		96636868
		35 - 185		96637278
		70 - 240		96637279
Reduce from 3 or 4 to one as from drop cable to single leads	Reducer-shrinking	10 - 50	3	96637318
		10 - 50	4	96637330
		16 - 70	3	96637331
		16 - 70	4	96637332

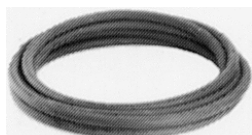
Cable termination kit, type M0 to M6



TM00 7884 2296

Description	Version			
For watertight shrink-joining of motor cable and submersible drop cable.	Type	Diameter of cable joint [mm²]	Fit cables with outer diameter of	Prod. no.
	M0	ø40	ø6 to ø15	ID8903
	M1	ø46	ø9 to ø23	ID8904
	M2	ø52	ø17 to ø31	ID8905
	M3	ø77	ø26 to ø44	ID8906
	M4	ø97	ø29 to ø55	91070700
	M5	ø110	ø40 to ø62	96496918
	M6	ø144	ø50 to ø80	96496919
Accessories for cable kit, type M0-6 Screw connectors only	Diameter of the lead [mm²]		Number of connectors	Prod. no.
	6 - 50		4	96626021
	19 - 95			96626022
	35 - 185			96626023
	70 - 240			96626028

Submersible drop cable



TM00 7882 2296

Description	Description			
	Number of leads and nominal cross section [mm ²]	Outer diameter Min./Max. [mm ²]	Weight [kg/m]	Product no.
Suitable for	1 x 25	12.5 / 16.5	0.410	ID4072
• continuous application in groundwater and potable water (approved for potable applications)	1 x 35	14.0 / 18.5	0.560	ID4073
• connection of electrical equipment such as submersible motors	1 x 50	16.5 / 21.0	0.740	ID4074
• installation depths up to 500 metres and average loads.	1 x 70	18.5 / 23.5	1.000	ID4075
	1 x 95	21.0 / 26.5	1.300	ID4076
	1 x 120	23.5 / 28.5	1.650	ID4077
	1 x 150	26.0 / 31.5	2.000	ID4078
Insulation and sheath are made of special EPR-based elastomer materials adapted to applications in water.	1 x 185	27.5 / 34.5	2.500	ID4079
Maximum permissible water temperature: 60 °C.	3 x 25	26.5 / 34.0	1.450	ID4062
Maximum permissible lead service temperature: 90 °C.	4G1.5	10.5 / 13.5	0.190	ID4063
	4G2.5	12.5 / 15.5	0.280	ID4064
	4G4.0	14.5 / 18.0	0.390	ID4065
	4G6.0	16.5 / 22.0	0.520	ID4066
Further cable sizes are available on request.	4G10	22.5 / 24.5	0.950	ID4067
	4G16	26.5 / 28.5	1.400	ID4068
	4G25	32.0 / 34.0	1.950	ID4069
	4G35	33.0 / 42.5	2.700	96432949
	4G50	38.0 / 48.5	3.600	96432950
	4G70	43.0 / 54.5	4.900	96432951

Zinc anodes

Application

Cathodic protection by means of zinc can be used for corrosion protection of SP pumps in chloride-containing liquids such as brackish water and seawater.

Sacrificial anodes are placed on the outside of the pump and motor as protection against corrosion.

The number of anodes required depends on the pump and motor in question.

Please contact Grundfos for further details.

Liquid temperatures

Seawater: Up to 35 °C.

Brackish water (min. 1500 g/m³ chloride): Up to 35 °C.

Anode life

The zinc anodes have a life of one to four years, depending on operating conditions (temperature, flow and chloride content).

Product numbers of zinc anodes

Zinc anodes for pumps											
Product number	Used for pump type										
	SP 1A to SP 14A	SP 17	SP 30	SP 46	SP 60	SP 77	SP 95	SP 125	SP 160	SP 215	
96421444	●										
96421445		●	●	●	●						
96421447						●	●				
96421448							●				
96421449								●			
96421450								●	●	●	

Zinc anodes for motors			
4" motors	6" motors	8" motors	10" motors
96421444	96421446	96421450	96564808

Flow sleeves

Grundfos offers a complete range of stainless steel flow sleeves for both vertical and horizontal operation. Flow sleeves are recommended for all applications in which motor cooling is insufficient. The result is a general extension of motor life. Flow sleeves are to be fitted in these cases:

- If the submersible pump is exposed to high thermal load like current unbalance, dry running, overload, high ambient temperature, bad cooling conditions.
- If aggressive liquids are pumped, since corrosion is doubled for every 10 °C the temperature rises.
- If sedimentation or deposits occur around and/or on the motor.

Note: More information about accessories is available on request.



TM01 0751 2197 - TM01 0750 2197

Fig. 24 Flow sleeves

SA-SPM 5 control boxes

Application

SA-SPM 5 control boxes are used as starting units for single-phase, 3-wire motors, types MS 402B with power input lower than or equal to 1.1 kW (1.5 hp).

SA-SPM 5 is available in two versions, standard and DeLuxe. The standard version incorporates a motor - protective circuit breaker and thus protects the motor against overload. The DeLuxe version is identical to the standard version with the following addition a motor contactor is included for connection and disconnection of the power supply.

Technical data

Enclosure class: IP 42.

Ambient temperature: -20 °C to 60 °C.

Relative humidity: Maximum 95 %, normal non-aggressive atmosphere.



TM03 8150 0607

Fig. 25 SA-SPM 5 control box

Product numbers

Product	Description					Product number
	1 x 220-230 V	1.1 kW (1.5 hp)	1.5 kW (2.0 hp)	2.2 kW (3.0 hp)	3.7 kW (5.0 hp)	
SA-SPM 5 (Standard version)	•	•				91126212
SA-SPM 5 (DeLuxe version)	•	•				91126213
SA-SPM 5 (Standard version)	•		•			91126214
SA-SPM 5 (DeLuxe version)	•		•			91126215
SA-SPM 5 (Standard version)	•			•		91126216
SA-SPM 5 (DeLuxe version)	•			•		91126217
SA-SPM 5 (Standard version)	•				•	91126218
SA-SPM 5 (DeLuxe version)	•				•	91126219

Pt100

The Pt100 sensor offers these features:

- Continuous monitoring of the motor temperature
- Protection against too high motor temperature.

Protecting the motor against too high motor temperature is the simplest and cheapest way of avoiding that motor lifetime is reduced. Pt100 ensures that operating conditions are not exceeded and indicates when it is time for service of the motor.

Monitoring and protection by means of Pt100 require the following parts:

- Pt100 sensor
- Relay, type PR 5714
- Cable.

The PR 5714 relay is fitted with a Pt100 module. For both relays the following temperature limits are preset on delivery:

- 60 °C warning limit
- 75 °C stop limit.

Technical data

	Relay type
	PR 5714
Enclosure class	IP 65 (mounted in a control panel)
Ambient temperature	-20 °C to +60 °C
Relative humidity	95 % (condensating)
Voltage variation	• 1 x 24-230 VAC ±10 %, 50 - 60 Hz. • 24-250 VDC ±20 %.
Approvals	UL, DNV
Mark	CE

Pt100 sensor with/without PR 5714 relay and cable	Cable length [m]	PR 5714	Product number		
			MS6	MMS 6000, MMS 8000	MMS 10000, MMS 12000
	20	Yes	96408953	96494596	96437287
	40	Yes	96408681	96494597	96437288
	60	Yes	96408954	96494598	96437289
	80	Yes	96408955	96494599	96437290
	100	Yes	96408956	96494610	96437291
	20	No	96658626	96658629	96658633
	40	No	96658627	96658630	96658634
	60	No	96658628	96658631	96658635
	80	No	96658637	96658632	96658636
	100	No	96658638	96658639	96658640

PR 5714 relay	Voltage	Product number
	24-230 VAC, 50/60 Hz / 24-250 VDC	96621274

Pt100 sensor including cable	Cable length	Product number	
		MS6 MMS 6000 MMS 8000	MMS 10000 MMS 12000
	20 m	96408957	96437784
	40 m	96408684	96437785
	60 m	96408958	96437786
	80 m	96408959	96437787
	100 m	96408960	96437788

Staybolts for Pt100	Description	Product number
	Bolt KIT for Pt100 (for MS6)	96611899

Energy consumption of submersible pumps

The percentage distribution of service life costs of a submersible pump for water supply is:

- 5 % initial costs (pump)
- 85 % operating costs / energy consumption
- 10 % maintenance costs.

It is obvious that the highest savings can be achieved within energy consumption!

The annual energy consumption, E, of a submersible pump can be calculated as follows:

$$E = c \times h \times P_1 \text{ (EURO)}$$

c = specific energy price (EURO/kWh)

h = operating hours/year (hours)

P₁ = power input of the submersible pump (kW).

Example: Calculation of the annual energy consumption of the submersible pump, type SP 125-3.

SP 125-3 with MS 8000, 45 kW, 3 x 460 V, 60 Hz.

Duty point:

Flow rate: Q = 120 m³/h

Total head: H = 102 m

Specific energy price: c = EURO 0.1/kWh
(consisting of day and night rate)

Operating hours/year: h = 3200.

$$P_1 = \frac{Q \times H \times \rho}{367 \times \eta_{\text{pump}} \times \eta_{\text{motor}}} \text{ in kW}$$

Q = m³/h

H = m

Density ρ = kg/dm³ (assumed 1)

367 = conversion factor

η_{motor} = (example 84.5 %, in equation 0.845)

η_{pump} = (not to be confused with the stage efficiency curve).

By showing the P₂/Q curve we make it easier for you to calculate the energy consumption.

$$P_1 = \frac{P_2}{\eta_{\text{motor}}}$$

P₂ = 26 kW (power requirement of SP 125-3 pump at 120 m³/h, from curve P₂ / Q on page 61).

Calculation of motor efficiency at duty point

As standard the SP 125-3 is equipped with a 45 kW MS6 motor.

At duty point (Q = 120 m³/h) the pump requires 44 kW, thus:

a motor load of 87 % (44 kW / 45 kW) and a power reserve of 2 %.

From the table on page 73 the motor efficiency can be read as:

84.6 % at a load of 75 %. (η₇₅ %)

85.6 % at a load of 100 %. (η₁₀₀ %)

The interpolated value in this example is

η_{motor} = 85.1 %, η_{motor} = 0.851.

$$P_1 = \frac{44}{0.851} = 51.7 \text{ kW}$$

E = 0.1 EURO/kWh x 3200 h x 51.7 kW.

The annual energy costs amount to EURO 16544.

The pay-off time, A, (months) is calculated as follows:

$$A = \frac{\text{Purchase price of energy} - \text{efficiency pump}}{\text{Energy savings/year}} \times 12$$

Cable sizing

In order to obtain an economical duty of the pump the voltage drop should be low.

Today large water works already size cables for a maximum voltage drop of 1 %).

The hydraulic resistance in the discharge pipe should be as low as possible.

Cables

Grundfos offers submersible drop cables for all applications: 3-core cable, 4-core cable, single leads.

Cables for Grundfos 4" submersible motors are available with or without plugs. The submersible drop cable is chosen according to application and type of installation.

Standard version: Max. liquid temperature +60 °C.

Hot water version: Max. liquid temperature +70 °C, for short periods up to +90 °C (for MS only).

Tables indicating cable dimension in borehole

The tables indicate the maximum length of drop cables in metres from motor starter to pump at direct-on-line starting at different cable dimensions.

If star/delta starting is used the current will be reduced by $\sqrt{3}$ ($I \times 0.58$), meaning that the cable length may be $\sqrt{3}$ longer ($L \times 1.73$) than indicated in the tables.

If for example the operating current is 10 % lower than the full-load current, the cable may be 10 % longer than indicated in the tables.

The calculation of the cable length is based on a maximum voltage drop of 1 % to 3 % of the rated voltage and a water temperature of maximum 30 °C.

In order to minimize operating losses the cable cross section may be increased compared to what is indicated in the tables. This is economical only if the borehole provides the necessary space, and if the operational time of the pump is long, especially if the operating voltage is below the rated voltage.

The table values are calculated on the basis of the formula:

Max. cable length of a single-phase submersible pump:

$$L = \frac{U \times \Delta U}{I \times 2 \times 100 \times \left(\cos \varphi \times \frac{\rho}{q} + \sin \varphi \times X_L \right)} [\text{m}]$$

Max. cable length of a three-phase submersible pump:

$$L = \frac{U \times \Delta U}{I \times 1.73 \times 100 \times \left(\cos \varphi \times \frac{\rho}{q} + \sin \varphi \times X_L \right)} [\text{m}]$$

where

U = Rated voltage [V]

ΔU = Voltage drop [%]

I = Rated current of the motor [A]

q = Cross-section of submersible drop cable [mm²]

X_L = Inductive resistance: 0.078×10^{-3} [Ω/m]

$\cos \varphi$ = Power factor

$\sin \varphi = \sqrt{1 - \cos^2 \varphi}$

ρ = Specific resistance: 0.02 [$\Omega \text{ mm}^2/\text{m}$]

Example

Motor size: 30 kW, MMS 8000

Rated current: 64.0 A

Rated voltage: 3 x 460 V, 60 Hz

Starting method: Direct-on-line

Power factor: $\cos \varphi = 0.85$

Voltage drop: 3 %

Cross-section: 16 mm²

$\sin \varphi$: 0.53

$$L = \frac{460 \times 3}{64.0 \times 1.73 \times 100 \times \left(0.85 \times \frac{0.02}{16} + 0.53 \times 0.078 \times 10^{-3} \right)}$$

L = 113 m

Cable dimensions at 1 x 220 V, 60 Hz

Motor	kW	I _n [A]	1.5 mm ²	2.5 mm ²	4 mm ²	6 mm ²	10 mm ²
4"	0.25	3.3	96	159	254	379	624
	0.37	4.4	73	121	192	286	472
	0.55	6.6	48	80	127	189	311
	0.75	7.7	37	62	98	147	243
	1.1	9.0	30	50	79	118	196

Maximum cable length in metres from motor starter to pump.

Cable dimensions at 3 x 460 V, 60 Hz, DOL

Voltage drop: 1 %

Motor	kW	I _n [A]	Cosφ 100%	Dimensions [mm ²]															
				1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
4"	0.37	1.6	0.73	170	282	448	668												
4"	0.55	2.3	0.69	125	207	329	490	804											
4"	0.75	2.7	0.73	101	167	266	396	650											
4"	1.1	3.65	0.72	75	125	199	296	487	763										
4"	1.5	4.35	0.76	60	100	159	236	389	610	927									
4"	2.2	5.8	0.75	46	76	120	179	295	463	703	954								
4"	3.0	7.5	0.78	34	56	90	134	220	346	526	716	981							
4"	4.0	9.45	0.82	26	43	68	101	167	263	401	548	754							
4"	5.5	12.6	0.82	19	32	51	76	125	197	301	411	566	756	970					
4"	7.5	18	0.79	14	23	37	55	91	143	217	296	406	539	689	822	963			
6"	5.5	13.2	0.76	20	33	52	78	128	201	305	415	567	751	955					
6"	7.5	17	0.79	15	25	39	58	96	151	230	313	429	571	730	870				
6"	9.2	21.4	0.8		19	31	46	75	119	181	246	338	451	577	689	809	931		
6"	11	24.5	0.82		16	26	39	64	101	155	211	291	389	499	598	704	813	959	
6"	13	29	0.81			22	33	55	87	132	180	248	330	423	507	596	687	809	918
6"	15	33	0.82			19	29	48	75	115	157	216	289	370	444	523	604	712	810
6"	18.5	41	0.8				24	39	62	94	129	177	235	301	360	422	486	571	647
6"	22	46.5	0.83					34	53	81	110	152	204	262	314	370	429	507	578
6"	26	55.5	0.83					28	44	68	92	127	171	219	263	310	359	425	484
6"	30	64	0.85						38	58	79	109	146	189	227	269	312	371	424
6"	37	81.5	0.79							48	65	90	119	152	182	213	245	287	324
8"	22	48.5	0.84					32	50	77	105	145	194	250	300	355	411	488	557
8"	26	56.5	0.86					27	42	65	88	122	165	213	257	304	354	422	484
8"	30	64	0.85						38	58	79	109	146	189	227	269	312	371	424
8"	37	78	0.85					31	47	65	89	120	155	186	220	256	304	348	
8"	45	92.5	0.85						40	55	75	101	130	157	186	216	257	294	
8"	55	112	0.86							45	62	83	107	129	154	179	213	244	
8"	63	126	0.86								55	74	95	115	136	159	189	217	
8"	75	150	0.86								46	62	80	97	115	133	159	182	
8"	92	184	0.87									50	65	79	93	109	130	150	
8"	110	220	0.87										54	66	78	91	109	125	
10"	75	154	0.84									61	79	95	112	130	154	175	
10"	92	190	0.83									50	64	77	91	105	124	141	
10"	110	224	0.84										54	65	77	89	106	121	
10"	132	265	0.85											55	65	75	90	103	
10"	147	305	0.82												57	65	77	88	
10"	170	355	0.82													56	66	75	
10"	190	405	0.79														58	65	
Max.current for cable [A] ★				18.5	25	34	43	60	80	101	126	153	196	238	276	319	364	430	497

★ At particularly favourable heat dissipation conditions.
Maximum cable length in metres from motor starter to pump.

Cable dimensions at 3 x 460 V, 60 Hz, DOL

Voltage drop: 3 %

Motor	kW	I _n [A]	Cosφ 100%	Dimensions [mm ²]															
				1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
4"	0.37	1.6	0.73	509	845														
4"	0.55	2.3	0.69	374	621	988													
4"	0.75	2.7	0.73	302	501	797													
4"	1.1	3.65	0.72	226	375	597	889												
4"	1.5	4.35	0.76	180	299	476	709												
4"	2.2	5.8	0.75	137	227	361	538	885											
4"	3.0	7.5	0.78	102	169	269	401	660											
4"	4.0	9.45	0.82	77	128	203	303	500	788										
4"	5.5	12.6	0.82	58	96	153	228	375	591	903									
4"	7.5	18	0.79	42	70	111	165	272	428	651	887								
6"	5.5	13.2	0.76	59	98	157	234	384	603	916									
6"	7.5	17	0.79	44	74	117	175	288	453	689	939								
6"	9.2	21.4	0.8		58	92	137	226	356	542	739								
6"	11	24.5	0.82		49	78	117	193	304	464	634	873							
6"	13	29	0.81			67	100	165	260	396	540	743	991						
6"	15	33	0.82			58	87	143	226	345	470	648	866						
6"	18.5	41	0.8				72	118	186	283	386	530	706	903					
6"	22	46.5	0.83					101	159	242	331	456	611	785	942				
6"	26	55.5	0.83					84	133	203	277	382	512	658	789	931			
6"	30	64	0.85						113	173	236	327	438	566	681	806	936		
6	37	81.5	0.79							144	196	269	357	457	545	638	734	860	973
8"	22	48.5	0.84					95	150	230	315	434	582	750	901				
8"	26	56.5	0.86					80	126	194	265	367	494	639	770	913			
8"	30	64	0.85						113	173	236	327	438	566	681	806	936		
8"	37	78	0.85						93	142	194	268	360	464	559	661	768	913	
8"	45	92.5	0.85							119	164	226	303	391	471	558	648	770	881
8"	55	112	0.86								134	185	249	322	388	461	536	638	732
8"	63	126	0.86									165	221	286	345	409	476	567	651
8"	75	150	0.86									138	186	241	290	344	400	477	547
8"	92	184	0.87										151	195	236	280	327	390	449
8"	110	220	0.87											163	197	234	273	326	375
10"	75	154	0.84										183	236	284	335	389	461	526
10"	92	190	0.83										149	192	231	272	315	372	424
10"	110	224	0.84											162	195	230	267	317	362
10"	132	265	0.85												165	195	226	269	308
10"	147	305	0.82													170	196	231	263
10"	170	355	0.82														168	199	226
10"	190	405	0.79															173	196
Max.current for cable [A] ★				18.5	25	34	43	60	80	101	126	153	196	238	276	319	364	430	497

★ At particularly favourable heat dissipation conditions.
Maximum cable length in metres from motor starter to pump.

Dimensioning of cable

Calculation of the cross-section of the cable

Formula designations

U = Rated voltage [V]

ΔU = Voltage drop [%]

I = Rated current of the motor [A]

q = Cross-section [mm²]

X_L = Inductive resistance 0.078×10^{-3} [Ω/m]

$\cos\phi$ = Power factor

$\sin\phi = \sqrt{1 - \cos^2\phi}$

L = Length of cable [m]

Δp = Power loss [W]

$\rho = 1/\chi$

Materials of cable:

Copper: $\chi = 52 \text{ m}/\Omega \times \text{mm}^2$

Aluminium: $\chi = 35 \text{ m}/\Omega \times \text{mm}^2$

For calculation of the cross-section of the submersible drop cable, use the following formula:

DOL

$$q = \frac{I \times 1.73 \times 100 \times L \times \rho \times \cos\phi}{U \times \Delta U - (I \times 1.73 \times 100 \times L \times X_L \times \sin\phi)}$$

Star-delta

$$q = \frac{I \times 100 \times L \times \rho \times \cos\phi}{U \times \Delta U - (I \times 1.73 \times 100 \times L \times X_L \times \sin\phi)}$$

The values of the rated current (I) and the power factor ($\cos\phi$) can be read in the tables on pages 73-77.

Calculation of the power loss

For calculation of the power loss in the submersible drop cable, use the following formula:

$$\Delta p = \frac{3 \times L \times \rho \times I^2}{q}$$

Example:

Motor size: 45 kW, MMS 8000

Rated current: $I_n = 92.5 \text{ A}$

Voltage: 3 x 460 V, 60 Hz

Starting method: Direct-on-line

Required cable length: 200 m

Power factor: $\cos\phi_{100\%} = 0.85$

Water temperature: 30 °C

Cable selection:

Choice A: 3 x 150 mm²

Choice B: 3 x 185 mm²

Calculation of power loss

Choice A:

$$\Delta p_A = \frac{3 \times L \times \rho \times I^2}{q}$$

$$\Delta p_A = \frac{3 \times 200 \times 0.02 \times 92.5^2}{150}$$

$$\Delta p_A = 685 \text{ W}$$

Choice B:

$$\Delta p_B = \frac{3 \times 200 \times 0.02 \times 92.5^2}{185}$$

$$\Delta p_B = 555 \text{ W}$$

Savings

Operating hours/year: $h = 4000$.

Annual saving (A):

$$A = (\Delta p_A - \Delta p_B) \times h = (685 \text{ W} - 555 \text{ W}) \times 4000 = 520000 \text{ Wh} = 520 \text{ kWh}$$

By choosing the cable size 3 x 185 mm² instead of 3 x 150 mm², an annual saving of 520 kWh is achieved.

Operating time: 10 years

Saving after 10 years (A_{10}):

$$A_{10} = A \times 10 = 520 \times 10 = 5200 \text{ kWh}$$

The saving in amount must be calculated in the local currency.

Table of head losses

SP A, SP

Head losses in ordinary water pipes

Upper figures indicate the velocity of water in m/sec.

Lower figures indicate head loss in metres per 100 metres of straight pipes.

Quantity of water			Head losses in ordinary water pipes											
m ³ /h	Litres/min.	Litres/sec.	Nominal pipe diameter in inches and internal diameter in [mm]											
			½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	5"	6"
0.6	10	0.16	0.855 9.910	0.470 2.407	0.292 0.784									
0.9	15	0.25	1.282 20.11	0.705 4.862	0.438 1.570	0.249 0.416								
1.2	20	0.33	1.710 33.53	0.940 8.035	0.584 2.588	0.331 0.677	0.249 0.346							
1.5	25	0.42	2.138 49.93	1.174 11.91	0.730 3.834	0.415 1.004	0.312 0.510							
1.8	30	0.50	2.565 69.34	1.409 16.50	0.876 5.277	0.498 1.379	0.374 0.700	0.231 0.223						
2.1	35	0.58	2.993 91.54	1.644 21.75	1.022 6.949	0.581 1.811	0.436 0.914	0.269 0.291						
2.4	40	0.67		1.879 27.66	1.168 8.820	0.664 2.290	0.499 1.160	0.308 0.368						
3.0	50	0.83		2.349 41.40	1.460 13.14	0.830 3.403	0.623 1.719	0.385 0.544	0.229 0.159					
3.6	60	1.00		2.819 57.74	1.751 18.28	0.996 4.718	0.748 2.375	0.462 0.751	0.275 0.218					
4.2	70	1.12		3.288 76.49	2.043 24.18	1.162 6.231	0.873 3.132	0.539 0.988	0.321 0.287	0.231 0.131				
4.8	80	1.33			2.335 30.87	1.328 7.940	0.997 3.988	0.616 1.254	0.367 0.363	0.263 0.164				
5.4	90	1.50			2.627 38.30	1.494 9.828	1.122 4.927	0.693 1.551	0.413 0.449	0.269 0.203				
6.0	100	1.67			2.919 46.49	1.660 11.90	1.247 5.972	0.770 1.875	0.459 0.542	0.329 0.244	0.248 0.124			
7.5	125	2.08			3.649 70.41	2.075 17.93	1.558 8.967	0.962 2.802	0.574 0.809	0.412 0.365	0.310 0.185	0.241 0.101		
9.0	150	2.50				2.490 25.11	1.870 12.53	1.154 3.903	0.668 1.124	0.494 0.506	0.372 0.256	0.289 0.140		
10.5	175	2.92				2.904 33.32	2.182 16.66	1.347 5.179	0.803 1.488	0.576 0.670	0.434 0.338	0.337 0.184		
12	200	3.33				3.319 42.75	2.493 21.36	1.539 6.624	0.918 1.901	0.659 0.855	0.496 0.431	0.385 0.234	0.251 0.084	
15	250	4.17				4.149 64.86	3.117 32.32	1.924 10.03	1.147 2.860	0.823 1.282	0.620 0.646	0.481 0.350	0.314 0.126	
18	300	5.00					3.740 45.52	2.309 14.04	1.377 4.009	0.988 1.792	0.744 0.903	0.577 0.488	0.377 0.175	0.263 0.074
24	400	6.67					4.987 78.17	3.078 24.04	1.836 6.828	1.317 3.053	0.992 1.530	0.770 0.829	0.502 0.294	0.351 0.124
30	500	8.33						3.848 36.71	2.295 10.40	1.647 4.622	1.240 2.315	0.962 1.254	0.628 0.445	0.439 0.187
36	600	10.0						4.618 51.84	2.753 14.62	1.976 6.505	1.488 3.261	1.155 1.757	0.753 0.623	0.526 0.260
42	700	11.7							3.212 19.52	2.306 8.693	1.736 4.356	1.347 2.345	0.879 0.831	0.614 0.347
48	800	13.3							3.671 25.20	2.635 11.18	1.984 5.582	1.540 3.009	1.005 1.066	0.702 0.445
54	900	15.0							4.130 31.51	2.964 13.97	2.232 6.983	1.732 3.762	1.130 1.328	0.790 0.555
60	1000	16.7							4.589 38.43	3.294 17.06	2.480 8.521	1.925 4.595	1.256 1.616	0.877 0.674
75	1250	20.8								4.117 26.10	3.100 13.00	2.406 7.010	1.570 2.458	1.097 1.027
90	1500	25.0								4.941 36.97	3.720 18.42	2.887 9.892	1.883 3.468	1.316 1.444
105	1750	29.2									4.340 24.76	3.368 13.30	2.197 4.665	1.535 1.934
120	2000	33.3									4.960 31.94	3.850 17.16	2.511 5.995	1.754 2.496
150	2500	41.7										4.812 26.26	3.139 9.216	2.193 3.807
180	3000	50.0											3.767 13.05	2.632 5.417
240	4000	66.7											5.023 22.72	3.509 8.926
300	5000	83.3												4.386 14.42
90 ° bends; slide valves			1.0	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.6	1.7	2.0	2.5
T-pieces, non-return valves			4.0	4.0	4.0	5.0	5.0	5.0	6.0	6.0	6.0	7.0	8.0	9.0

The table is calculated in accordance with H. Lang's new formula $a = 0.02$ and for a water temperature of 10 °C.

The head loss in bends, slide valves, T-pieces and non-return valves is equivalent to the metres of straight pipes stated in the last two lines of the table. To find the head loss in foot valves multiply the loss in T-pieces by two.

Table of head losses

SP A, SP

Head losses in plastic pipes

Upper figures indicate the velocity of water in m/sec.

Lower figures indicate head loss in metres per 100 metres of straight pipes.

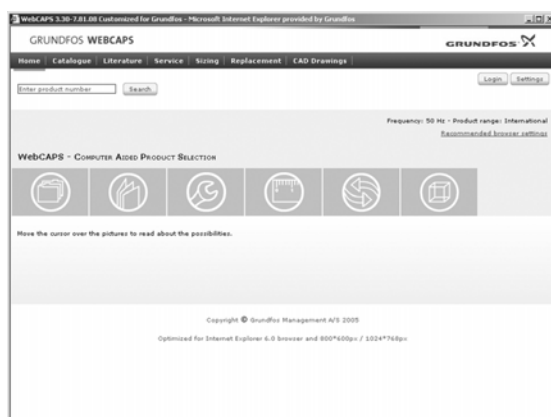
Quantity of water			PELM/PEH PN 10											
m³/h	Litres/min.	Litres/sec.	PELM				PEH							
			25	32	40	50	63	75	90	110	125	140	160	180
			20.4	26.2	32.6	40.8	51.4	61.4	73.6	90.0	102.2	114.6	130.8	147.2
0.6	10	0.16	0.49 1.8	0.30 0.66	0.19 0.27	0.12 0.085								
0.9	15	0.25	0.76 4.0	0.46 1.14	0.3 0.6	0.19 0.18	0.12 0.63							
1.2	20	0.33	1.0 6.4	0.61 2.2	0.39 0.9	0.25 0.28	0.16 0.11							
1.5	25	0.42	1.3 10.0	0.78 3.5	0.5 1.4	0.32 0.43	0.2 0.17	0.14 0.074						
1.8	30	0.50	1.53 13.0	0.93 4.6	0.6 1.9	0.38 0.57	0.24 0.22	0.17 0.092						
2.1	35	0.58	1.77 16.0	1.08 6.0	0.69 2.0	0.44 0.70	0.28 0.27	0.2 0.12						
2.4	40	0.67	2.05 22.0	1.24 7.5	0.80 3.3	0.51 0.93	0.32 0.35	0.23 0.16	0.16 0.063					
3.0	50	0.83	2.54 37.0	1.54 11.0	0.99 4.8	0.63 1.40	0.4 0.50	0.28 0.22	0.2 0.09					
3.6	60	1.00	3.06 43.0	1.85 15.0	1.2 6.5	0.76 1.90	0.48 0.70	0.34 0.32	0.24 0.13	0.16 0.050				
4.2	70	1.12	3.43 50.0	2.08 18.0	1.34 8.0	0.86 2.50	0.54 0.83	0.38 0.38	0.26 0.17	0.18 0.068				
4.8	80	1.33		2.47 25.0	1.59 10.5	1.02 3.00	0.64 1.20	0.45 0.50	0.31 0.22	0.2 0.084				
5.4	90	1.50		2.78 30.0	1.8 12.0	1.15 3.50	0.72 1.30	0.51 0.57	0.35 0.26	0.24 0.092	0.18 0.05			
6.0	100	1.67		3.1 39.0	2.0 16.0	1.28 4.6	0.8 1.80	0.56 0.73	0.39 0.30	0.26 0.12	0.2 0.07			
7.5	125	2.08		3.86 50.0	2.49 24.0	1.59 6.6	1.00 2.50	0.70 1.10	0.49 0.50	0.33 0.18	0.25 0.10	0.20 0.055		
9.0	150	2.50			3.00 33.0	1.91 8.6	1.20 3.5	0.84 1.40	0.59 0.63	0.39 0.24	0.30 0.13	0.24 0.075		
10.5	175	2.92			3.5 38.0	2.23 11.0	1.41 4.3	0.99 1.80	0.69 0.78	0.46 0.30	0.36 0.18	0.28 0.09		
12	200	3.33			3.99 50.0	2.55 14.0	1.60 5.5	1.12 2.40	0.78 1.0	0.52 0.40	0.41 0.22	0.32 0.12	0.25 0.065	
15	250	4.17				3.19 21.0	2.01 8.0	1.41 3.70	0.98 1.50	0.66 0.57	0.51 0.34	0.40 0.18	0.31 0.105	0.25 0.06
18	300	5.00				3.82 28.0	2.41 10.5	1.69 4.60	1.18 1.95	0.78 0.77	0.61 0.45	0.48 0.25	0.37 0.13	0.29 0.085
24	400	6.67					3.21 19.0	2.25 8.0	1.57 3.60	1.05 1.40	0.81 0.78	0.65 0.44	0.50 0.23	0.39 0.15
30	500	8.33					4.01 28.0	2.81 11.5	1.96 5.0	1.31 2.0	1.02 1.20	0.81 0.63	0.62 0.33	0.49 0.21
36	600	10.0					4.82 37.0	3.38 15.0	2.35 6.6	1.57 2.60	1.22 1.50	0.97 0.82	0.74 0.45	0.59 0.28
42	700	11.7					5.64 47.0	3.95 24.0	2.75 8.0	1.84 3.50	1.43 1.90	1.13 1.10	0.87 0.60	0.69 0.40
48	800	13.3						4.49 26.0	3.13 11.0	2.09 4.5	1.62 2.60	1.29 1.40	0.99 0.81	0.78 0.48
54	900	15.0						5.07 33.0	3.53 13.5	2.36 5.5	1.83 3.20	1.45 1.70	1.12 0.95	0.08 0.58
60	1000	16.7						5.64 40.0	3.93 16.0	2.63 6.7	2.04 3.90	1.62 2.2	1.24 1.2	0.96 0.75
75	1250	20.8							4.89 25.0	3.27 9.0	2.54 5.0	2.02 3.0	1.55 1.6	1.22 0.95
90	1500	25.0							5.88 33.0	3.93 13.0	3.05 8.0	2.42 4.1	1.86 2.3	1.47 1.40
105	1750	29.2							6.86 44.0	4.59 17.5	3.56 9.7	2.83 5.7	2.17 3.2	1.72 1.9
120	2000	33.3								5.23 23.0	4.06 13.0	3.23 7.0	2.48 4.0	1.96 2.4
150	2500	41.7								6.55 34.0	5.08 18.0	4.04 10.5	3.10 6.0	2.45 3.5
180	3000	50.0								7.86 45.0	6.1 27.0	4.85 14.0	3.72 7.6	2.94 4.4
240	4000	66.7									8.13 43.0	6.47 24.0	4.96 13.0	3.92 7.5
300	5000	83.3										8.08 33.0	6.2 18.0	4.89 11.0

The table is based on a nomogram.

Roughness: K = 0.01 mm.

Water temperature: t = 10 °C.

WebCAPS

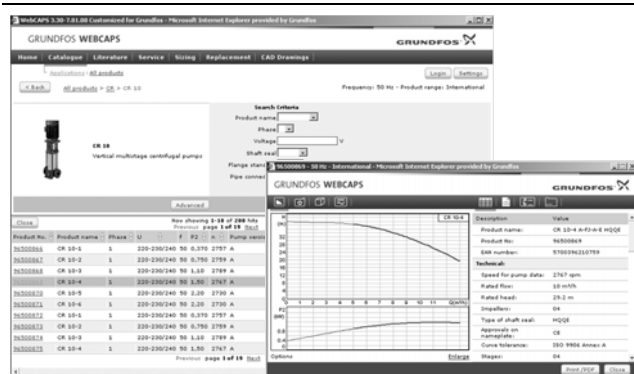


WebCAPS is a **Web**-based **C**omputer **A**ided **P**roduct **S**election program available on www.grundfos.com.

WebCAPS contains detailed information on more than 185,000 Grundfos products in more than 20 languages.

In WebCAPS, all information is divided into 6 sections:

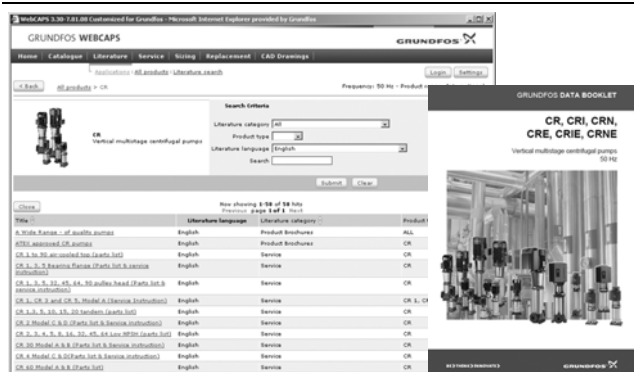
- Catalogue
- Literature
- Service
- Sizing
- Replacement
- CAD drawings.



Catalogue

This section is based on fields of application and pump types, and contains

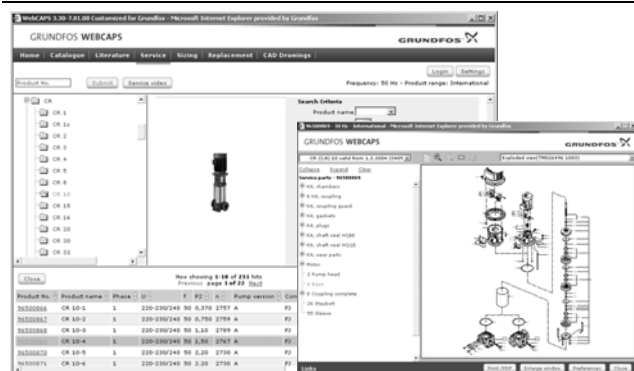
- technical data
- curves (QH, Eta, P1, P2, etc) which can be adapted to the density and viscosity of the pumped liquid and show the number of pumps in operation
- product photos
- dimensional drawings
- wiring diagrams
- quotation texts, etc.



Literature

In this section you can access all the latest documents of a given pump, such as

- data booklets
- installation and operating instructions
- service documentation, such as Service kit catalogue and Service kit instructions
- quick guides
- product brochures.



Service

This section contains an easy-to-use interactive service catalogue. Here you can find and identify service parts of both existing and discontinued Grundfos pumps.

Furthermore, this section contains service videos showing you how to replace service parts.



Sizing

This section is based on different fields of application and installation examples, and gives easy step-by-step instructions in how to

- select the most suitable and efficient pump for your installation
- carry out advanced calculations based on energy consumption, payback periods, load profiles, life cycle costs, etc.
- analyse your selected pump via the built-in life cycle cost tool
- determine the flow velocity in wastewater applications, etc.



Replacement

In this section you find a guide to selecting and comparing replacement data of an installed pump in order to replace the pump with a more efficient Grundfos pump. The section contains replacement data of a wide range of pumps produced by other manufacturers than Grundfos.

Based on an easy step-by-step guide, you can compare Grundfos pumps with the one you have installed on your site. When you have specified the installed pump, the guide will suggest a number of Grundfos pumps which can improve both comfort and efficiency.



CAD drawings

In this section it is possible to download two-dimensional (2D) and three-dimensional (3D) CAD drawings of most Grundfos pumps.

These formats are available in WebCAPS:

- Two-dimensional drawings:
- .dxf, wireframe drawings
 - .dwg, wireframe drawings.
- Three-dimensional drawings:
- .dwg, wireframe drawings (without surfaces)
 - .stp, solid drawings (with surfaces)
 - .eprt, E-drawings.



WinCAPS



Fig. 26 WinCAPS CD-ROM

WinCAPS is a **Windows-based Computer Aided Product Selection** program containing detailed information on more than 185,000 Grundfos products in more than 20 languages.

The program contains the same features and functions as WebCAPS, but is an ideal solution if no Internet connection is available.

WinCAPS is available on CD-ROM and updated once a year.

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Subject to alterations.