Multi-stage centrifugal pump DPV

Technical specification booklet

series: DPV(C/S) 2 - 4 - 6 - 10 - 15 - 25 - 40 - 60 - 85 - 125

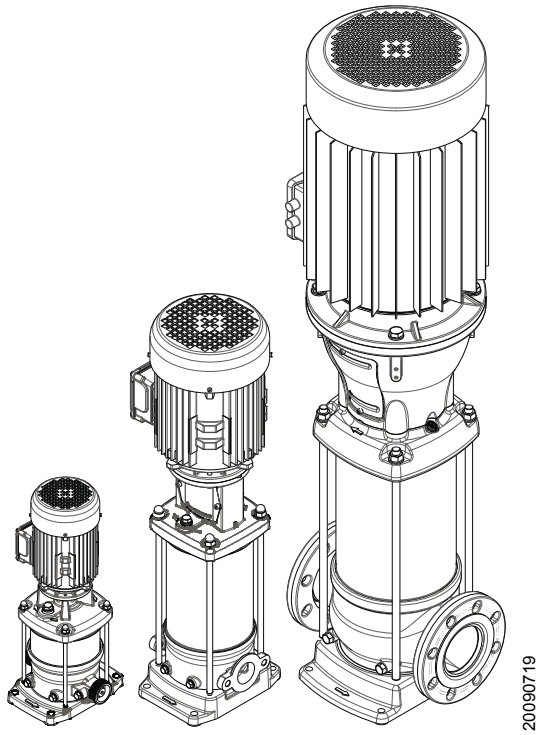
50 Hz (DIN/IEC)

Table of Contents

1 Pump introduction

1.1 General

The vertical, single or multi-stage centrifugal pump series are designed for pumping clean, or lightly aggressive, watery mediums.
Suction and discharge of the pump are in-line, making the pump easy to install.
The hydraulic assembly is driven by an electric motor.
All hydraulic parts of the pump are made of stainless steel.
The vertical, multi-stage centrifugal DPV pumps are produced by DP-Pumps.



DPV 2,4,6 B | DPV 10,15 B | DPV 25,40,60,85,125 B

1.2 Model key

Table 1: Model key Example DPVSF 85/3-1 B

	DP	VS	F	85	/3	-1	B	
Label	DP							Product Label
Material/Con-struction		VC						Cast Iron pump foot and top bracket, hydraulics 1.4301 / AISI 304
		V						All wetted parts Stainless Steel 1.4301 / AISI 304
		VM						All wetted parts Stainless Steel 1.4301 / AISI 304 with closed coupled motor
		VS						All wetted parts Stainless Steel 1.4401 / AISI 316
Connections			E					Male thread (with non-return valve insert)
								Oval flange with female thread
			F					Round flange
			V					Victaulic connections
			T					Tri-clamp connections
				85				Capacity in m^3/h at $Q._{opt}$.
					/3			Number of stages
					/3	-1		Number of stages of which one stage with reduced head
							B	Design version

1.3 Operation

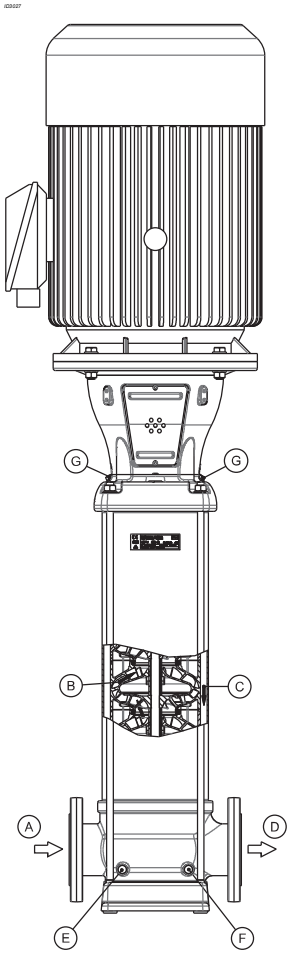


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Figure 1: DPVF 85

During centrifugal operation of the pump a negative pressure is created at the inlet of the impeller. This negative pressure enables the medium to enter the pump at the suction connection (A).
Every stage (B) consists of an impeller and diffuser. The passage of this stage determines the capacity of the pump. The diameter of the stages is related to the centrifugal forces and its “stage pressure”: the more stages, the more pressure.
This total capacity and raised pressure will be guided to the outside of the pump, between the pump stages and the outer sleeve (C) and the medium will leave the pump at the discharge connection (D).

1.4 Measuring, draining and venting

The pump is provided with plugs for measuring, draining and venting.
Connection (E) is meant to drain the inlet part of the pump. Or to measure the inlet / suction pressure using a G ¼ connection.
Connection (F) is meant to drain the outlet part of the pump. Or to measure the discharge pressure using a G ¼ connection.
Connections (G) are meant to vent the pump system when the pump is not in operation. Or to measure the discharge pressure of the pump using a G 3/8 connection.

1.5 Working range

The working range is depending on the application and a combination of pressure and temperature. For specific and detailed limits please consult the working ranges as described in the chapter 1.8Modular selection. The overall working range of the pumps can be summarised as follows:
Table 2: Specification of the working range

Pump type	DPV	note
Ambient temperature [°C]	-20 up to 40	1
Minimum inlet pressure	$NPSH_{req.}$ + 1m	
Viscosity [cSt]	1-100	2
Density [kg/m^3]	1000-2500	2
Cooling	forced motor cooling	3
Minimum frequency [Hz]	30	
Maximum frequency [Hz]	60	4
Allowable size of solids pumped	5µm to 1mm	

1. If the ambient temperature exceeds the above value or the motor is located more than 1000 m above sea level, the motor cooling is less effective and could require an adapted motor power. See table 5: Motor load dep. sea level or amb. temp or please contact your supplier for more detailed advice.
2. Deviation in viscosity and/or density could require an adapted motor power. Please contact your supplier for more detailed advice.
3. The free space above the motor cooling fan must be at least 1/4 of the diameter of the inlet of the cooling fan in order to have a sufficient flow of (cooling) air.
4. Pumps that are intended for 50 Hz operation, may not be connected to 60Hz power supply.

1.5.1 Minimum capacity

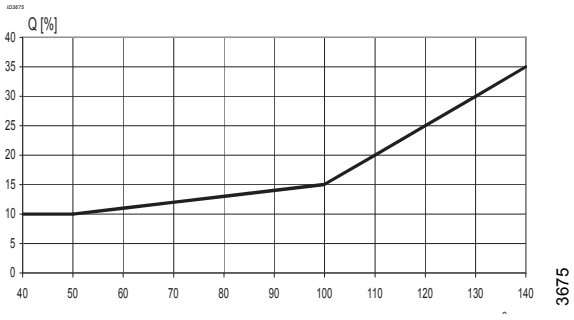
For minimum capacity at medium temperature of 20 ^{o}C, see table: 3Minimum capacity (Qmin); for higher temperatures, see table: 4Minimum capacity vs.temperature (in % of Q optimum).

To prevent the pump from overheating, gathering gas, cavitation etc. a minimum capacity has to be secured. The minimum capacity corresponds to all percentage of the optimum flow Q_{opt} in relation to the temperature of the liquid pumped.

Table 3: Minimum capacity (Q_{min})

size	Q_{min} [m^3/h]			
	50 Hz		60 Hz	
	2 pole	4 pole	2 pole	4 pole
2	0,2		0,2	
4	0,4		0,5	
6	0,6		0,8	
10	1,1	0,5	1,3	0,6
15	1,6	0,8	2,0	1,0
25	2,6	1,3	3,2	1,6
40	4	2	4,8	2,4
60	6	3	7,2	3,6
85	8,5	4,3	10,2	5,1
125	13,1		15,8	

Table 4: Minimum capacity vs.temperature (in % of Q optimum)



1.5.2 Ambient temperature and higher altitude

If the ambient temperature exceeds the above value, or if the motor is located more than 1000 m above sea level, the motor cooling is less effective and could require an adapted motor power. See below table for the increased percentage of the motor power or contact your supplier for more detailed advice.

Table 5: Increase of required motor power

Ambient temperature [°C]	Above sea level [m]	Increase of required power
40	1000	0%
45	1625	2%
50	2250	5%
55	2875	11%
60	3500	18%
65	4125	25%
70	4750	33%

1.6 Basic material variants

Table 6: Basic material variants

Model	Hydraulic	Casing	Sealing
V	1.4301	1.4308	EPDM
VS	1.4404	1.4408	FPM
VC	1.4301	JL1040	EPDM

1.7 Pump bearing

Medium lubricated stage bearing
Tungsten Carbide against Ceramic

1.8 Modular selection

To suit almost every application the pump is assembled out of modules which can be selected depending on the required working range.
Basic modules are:

- **Basic pump model,** which defines the capacity, pressure and basic material.
  Temperature range -20 up to 140 ^{o}C, with the exception of the DPV 125 this pump can be used upto 120 ^{o}C.
- **Connections,** which define the suction and discharge connection as well as the base plate.
  VE casing (with non return valve) max. temperature 90 ^{o}C. Other connections have same temperature range as basic pump model.
- **Sealings,** which define the elastomers, the mechanical seal and the shaft seal type.
  Temperature range, see chapter 4.1
- **Electric motor,** which defines all requirements of the motor such as motor size, power, voltage, frequency and all possible motor accessories.
  Due to mono-block motor version VM, max. fluid temperature is 60 ^{o}C

1.9 Approvals

CE Conformity with European Safety Directive
ACS Drinking Water Approval (F)
WRAS Drinking Water Approval (GB)
ATEX Conformity with “ATmosphères EXplosibles” Directive

2 Performance characteristics

2.1 Performance range

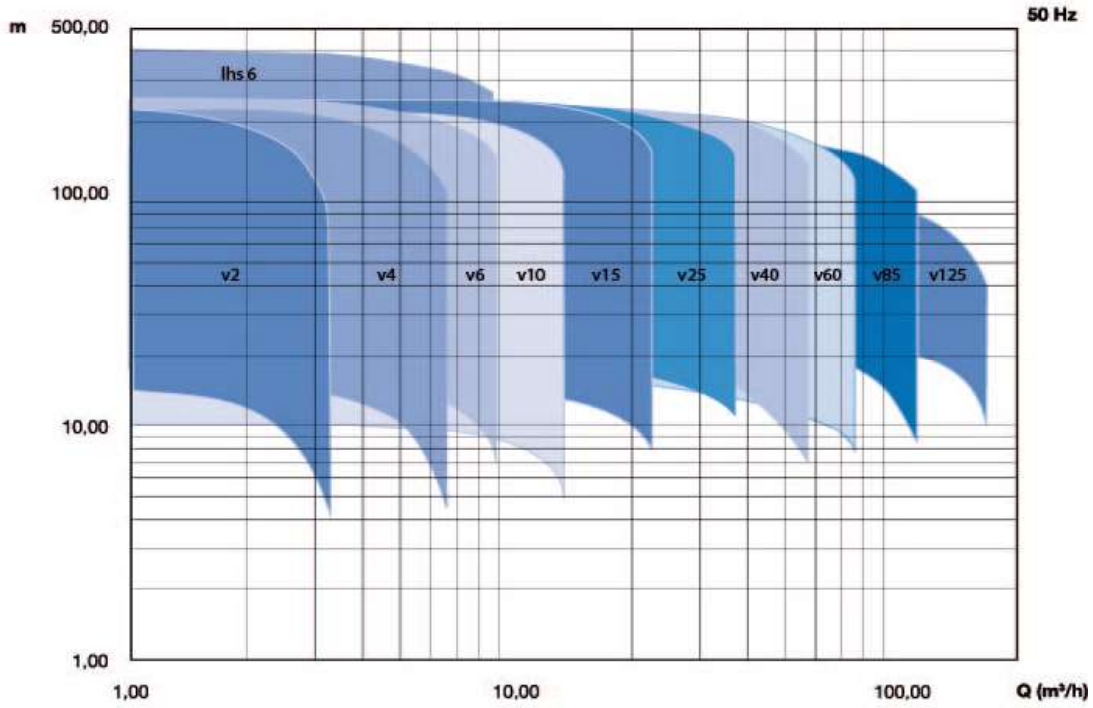


Figure 2: Performance range DPV (C/S) B 50 Hz

2.2 Performance curve details

The performance diagrams give a global overview of all the pump models the shaded models are mentioned in this documentation. Detailed characteristics are given for each model showing the hydraulic efficiency, $NPSH_{req}$, and shaft power as well.

The performance of the pump depends on the number of stages. As per example:

DPV 4/2 B:	model DPV 4 B	2 stages with 2 full head impellers
DPV 85/4-1 B	model DPV 85 B	4 stages with 3 full head impellers and 1 reduced impeller

The detailed performance curves are in accordance with ISO 9906:2012 (Grade 3B).

The pumps van be configured with multiple types of motors. Therefore the performance data, like Q/H, efficiency and shaft power used for published curves are converted to the average speed per motor power. To refine this data the published data has to be corrected accordingly.

The published curves and data mentioned on the pump are based on the following rotational speed:

Table 7: Rated motor power and speed in 2 & 4 pole

Rated motor power	Rated speed at 50 Hz [rpm] 2P	Rated speed at 60 Hz [rpm] 2P
0,37 and 0,55 kW	2800	3460
to 2,2 kW	2880	3460
to 4 kW	2920	3510
to 7,5 kW	2940	3530
to 22 kW	2950	3550
to 45 kW	2960	3550

Rated motor power	Rated speed at 50 Hz [rpm] 4P	Rated speed at 60 Hz [rpm] 4P
0,55 kW	1450	1740
0,75 kW	1440	1730
to 2,2 kW	1425	1710
to 4 kW	1450	1740
to 7,5 kW	1460‘	1750

The characteristics given are based on:

- De-aerated water at a temperature of 20 °C
- Density of 1,0 kg/dm^3
- Kinematical viscosity of 1 mm^2/s (1 cst)

To prevent the pump from overheating, gathering gas, cavitation etc. a minimum capacity has to be secured. The minimum capacity corresponds to a percentage of the optimum flow Q_{opt} in relation to the temperature of the liquid pumped.

2.3 Minimum efficiency index

The minimum energy-efficiency level according to the ErP regulations for water pumps is specified by the minimum efficiency index MEI. A high MEI value indicates a high efficiency of the determined pump. From 1 January 2015 on the minimum efficiency index (MEI) for standardised water pumps is ≥ 0.4.

The following MEI values apply for the pump range design version B:

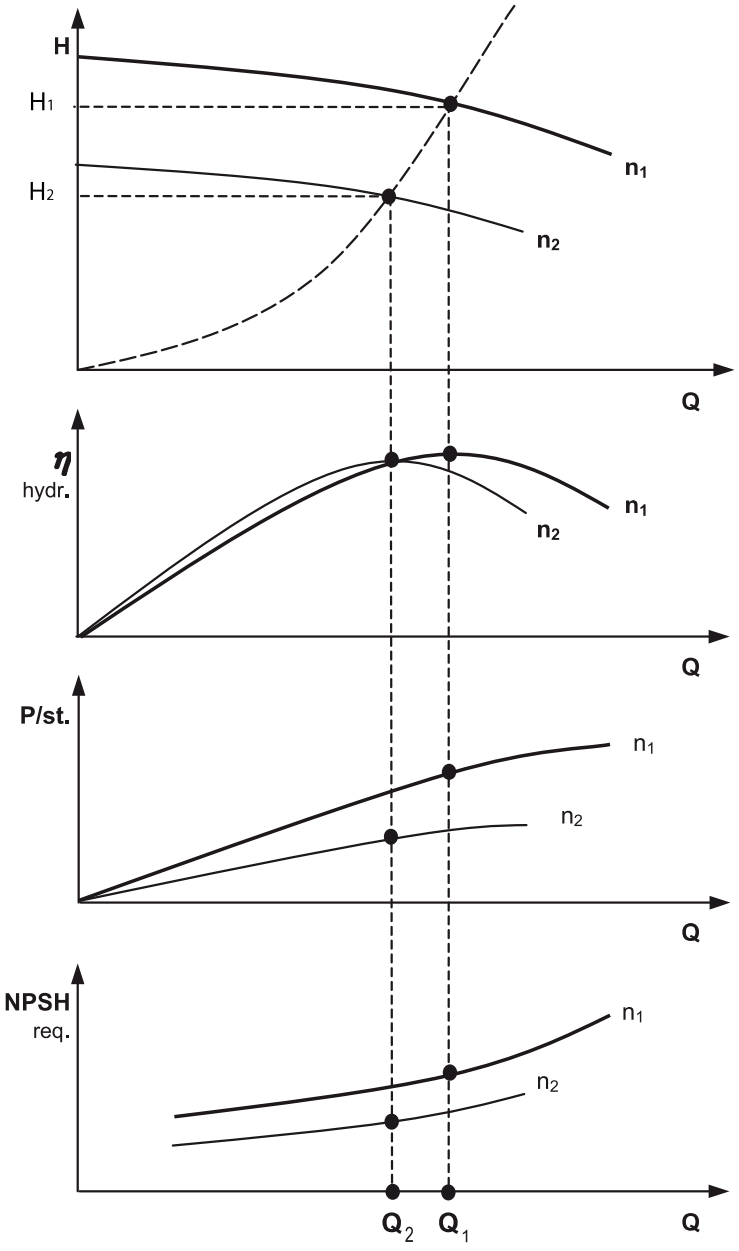
Table 8: Minimum efficiency index

Pump range	Minimum Efficiency index
DPV 2	MEI ≥ 0.70
DPV 4	MEI ≥ 0.70
DPV 6	MEI ≥ 0.70
DPV 10	MEI ≥ 0.70
DPV 15	MEI ≥ 0.40
DPV 25	MEI ≥ 0.70
DPV 40	MEI ≥ 0.70
DPV 60	MEI ≥ 0.70
DPV 85	MEI ≥ 0.60
DPV 125	MEI ≥ 0.70

2.4 Performance with variable frequency drive

The minimum frequency of the DP motor should be limited to 30 Hz. When the rotational speed exceeds the nominal speed of the motor, make sure that the power output of the motor is suitable to drive the corresponding pump model.

The performance of the pump differs from the fixed speed performance according to the recalculation scheme.



$$Q_2 = \frac{n_2}{n_1} \cdot Q_1$$

$$H_2 = \frac{(n_2)^2}{(n_1)^2} \cdot H_1$$

$$\eta_2 = 1 - \left((1 - \eta_1) \cdot \frac{(}{(} \right.$$

$$P_2 = \frac{(n_2)^3}{(n_1)^3} \cdot P_1$$

$$NPSH_2 = \frac{(n_2)^2}{(n_1)^2} \cdot N$$

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Figure 3: Performance characteristics

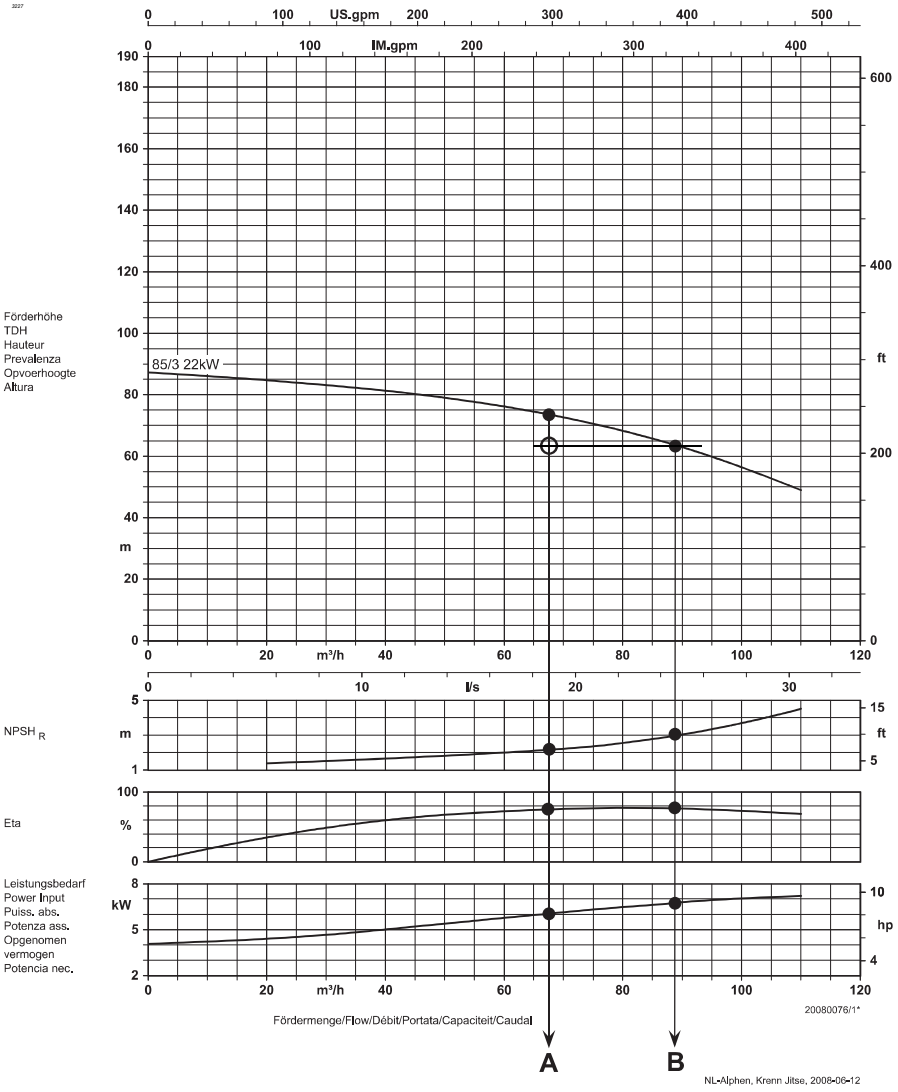
2.5 How to read the values from the curves

To find the required hydraulic information from the published curves, it is important to know the application in which the pump has to be installed. There are two main distinction to be made:

A Flow determined (like booster sets and cleaning) → Opening taps

B Pressure determined (like boiler feed and reverse osmosis systems) → Facing counter pressure.

How to read the motor power.
The required motor power can be read in the curve'Power input'.
Attention: the power value as mentioned in this curve is the required power per stage. For some pump types there are two lines in the curve this is related to the full impeller or reduced impeller [-1].



Pump size / no of stages.
Installed motor power

Capacity @ Pressure

NPSH (m)

Hydraulic efficiency (%)

Required power (P2)

Figure 4: How to read the values from the curves

O Calculated duty point
● Actual hydraulic performance
A Flow determined
B Pressure determined

2.6 Hydraulic performance curve DPV(C/S) 2 B - 50Hz -2 pole

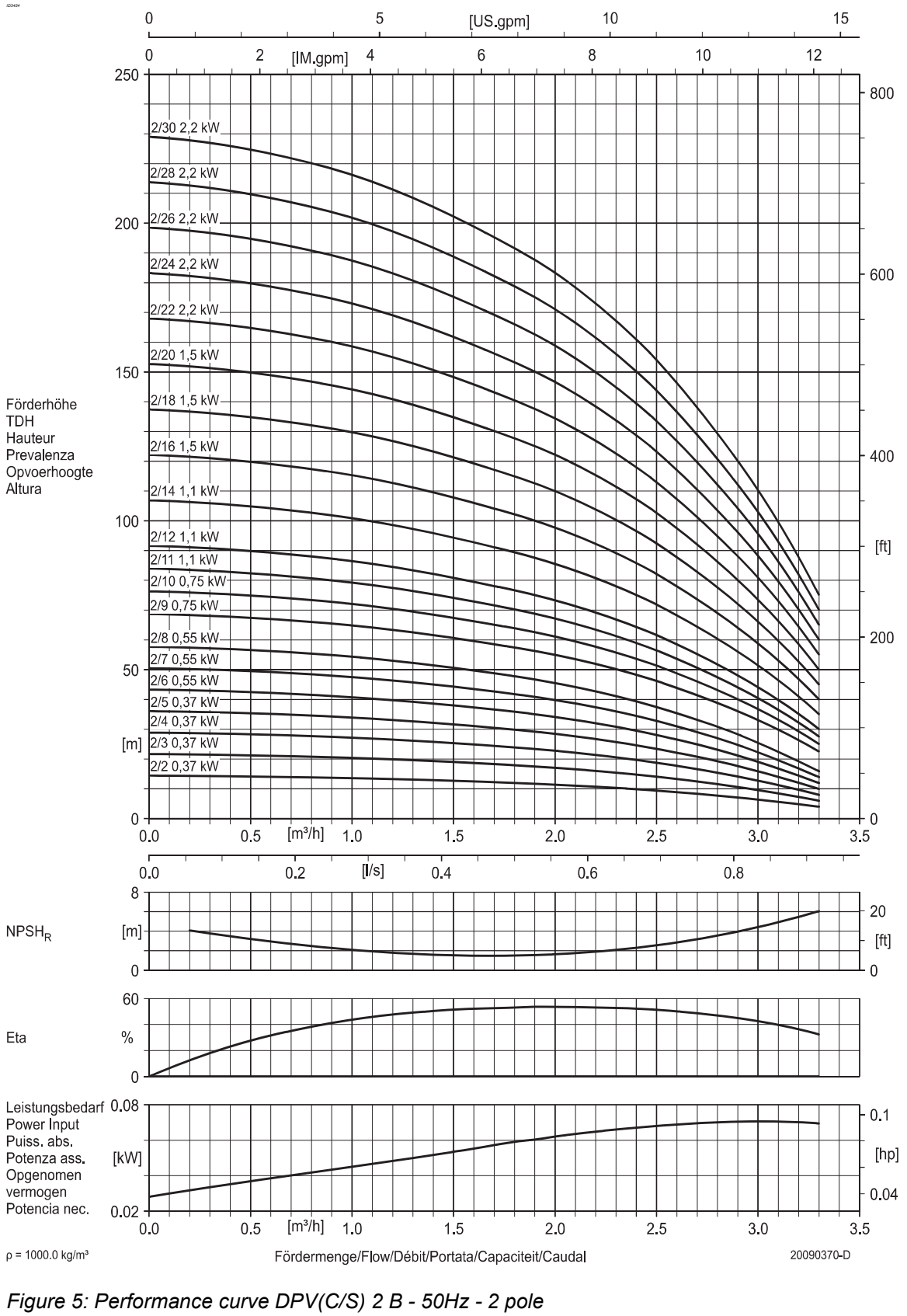


Figure 5: Performance curve DPV(C/S) 2 B - 50Hz - 2 pole

2.7 Hydraulic performance curve DPV(C/S) 4 B - 50Hz - 2 pole

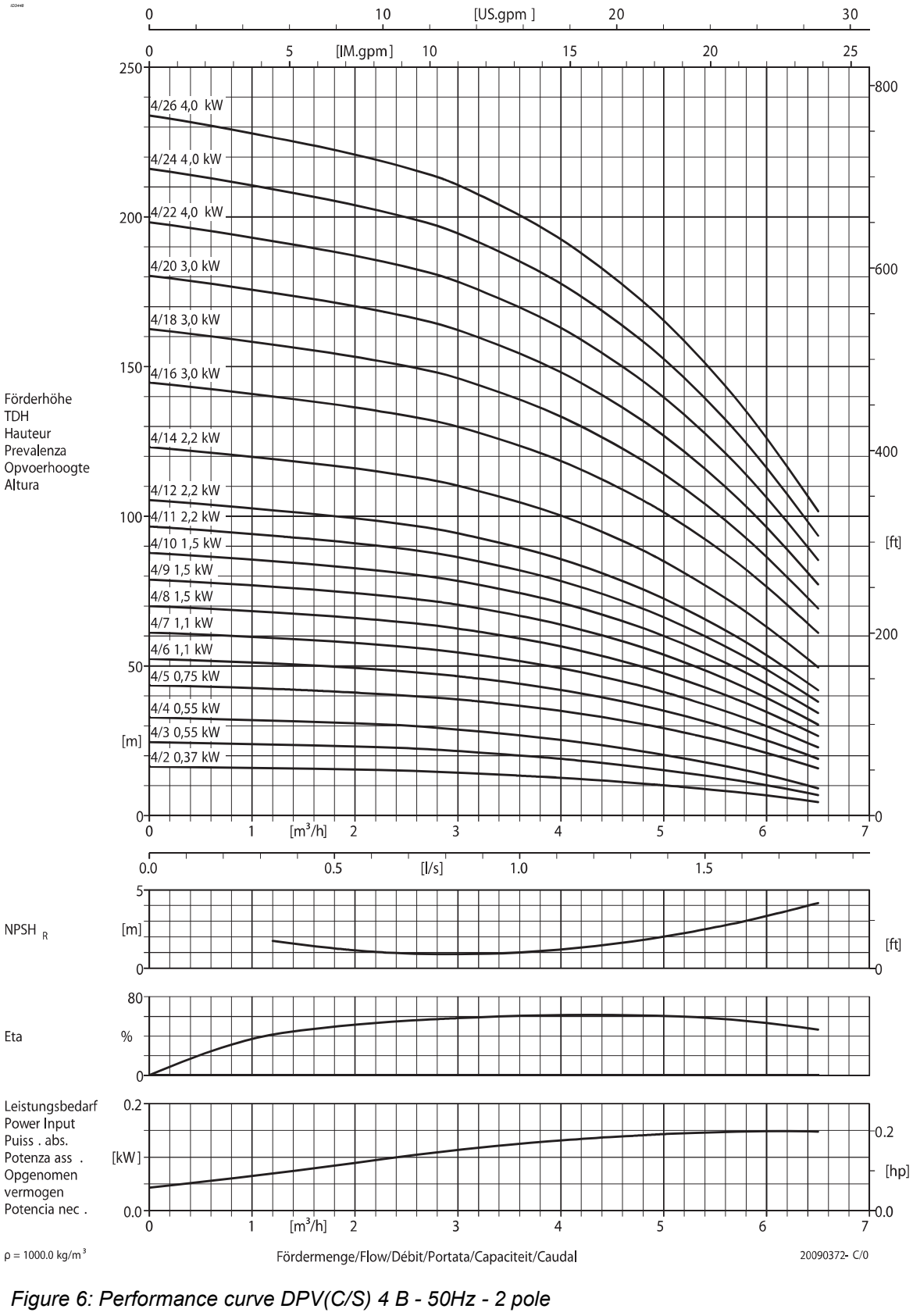


Figure 6: Performance curve DPV(C/S) 4 B - 50Hz - 2 pole

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2.8 Hydraulic performance curve DPV(C/S) 6 B - 50Hz - 2 pole

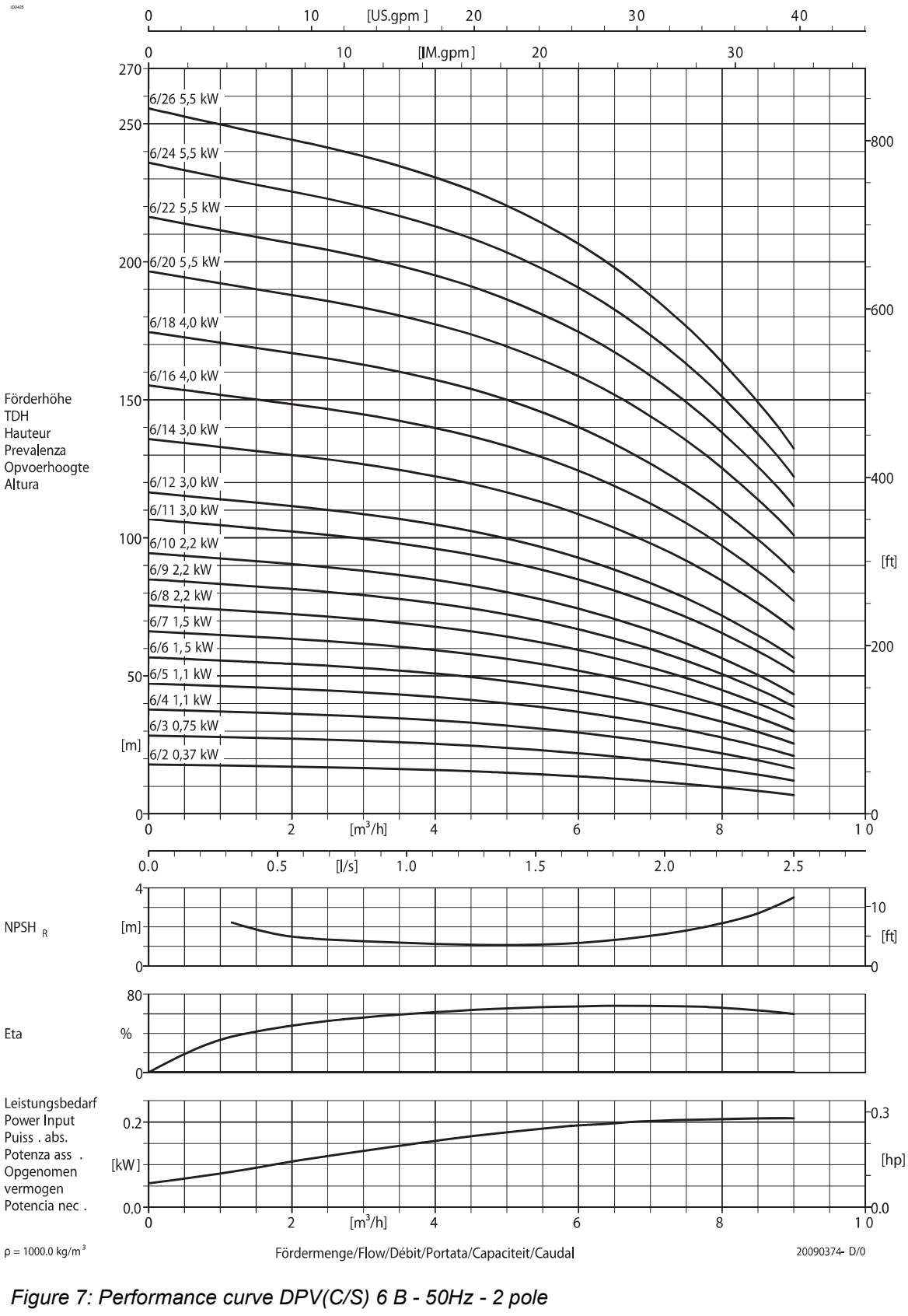

Figure 7: Performance curve DPV(C/S) 6 B - 50Hz - 2 pole

2.9 Hydraulic performance curve DPV(C/S) 10 B - 50Hz - 2 pole

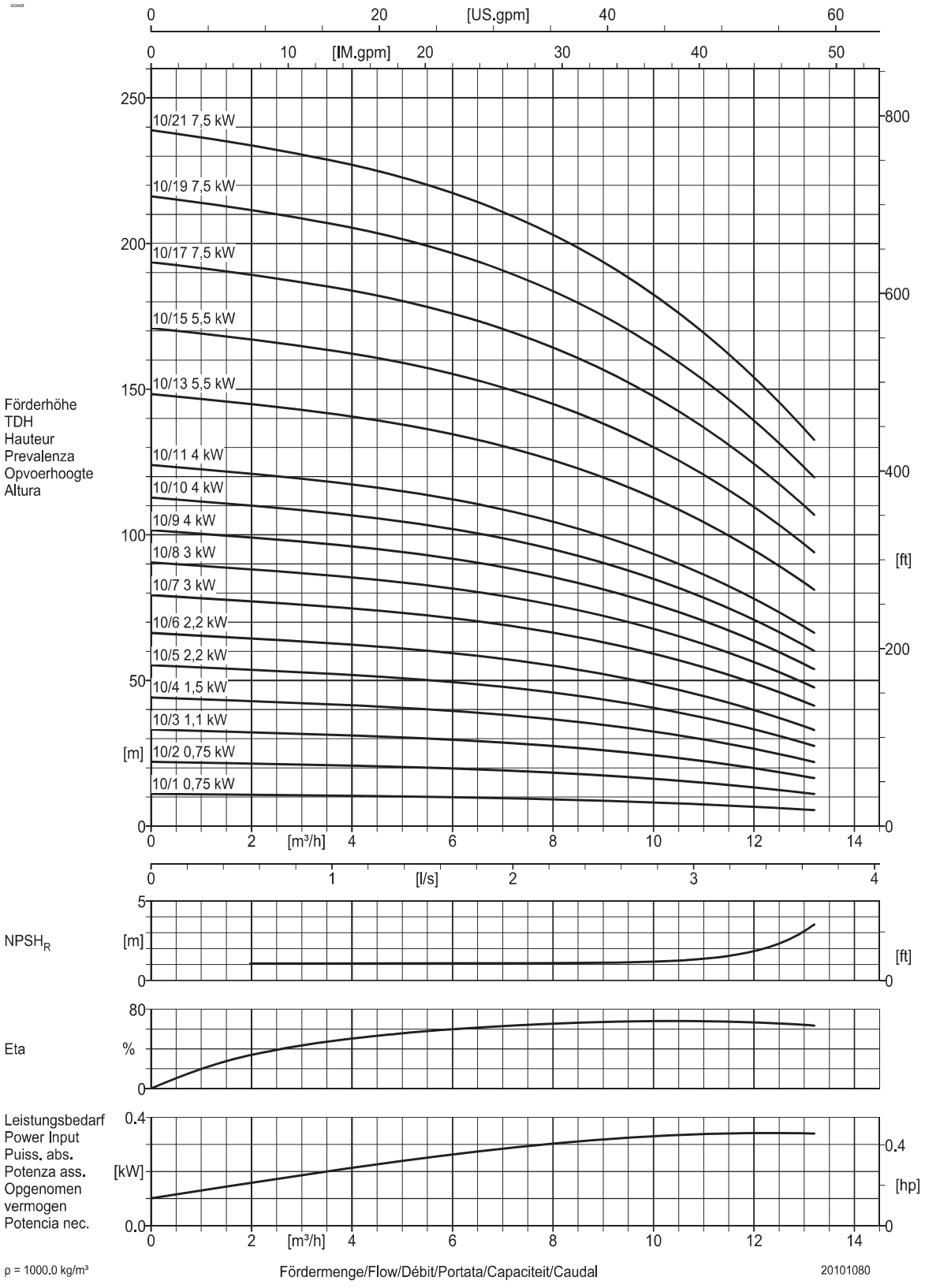

Figure 8: Performance curve DPV(C/S) 10 B - 50Hz- 2 pole

2.10 Hydraulic performance curve DPV(C/S) 10 B - 50Hz - 4 pole

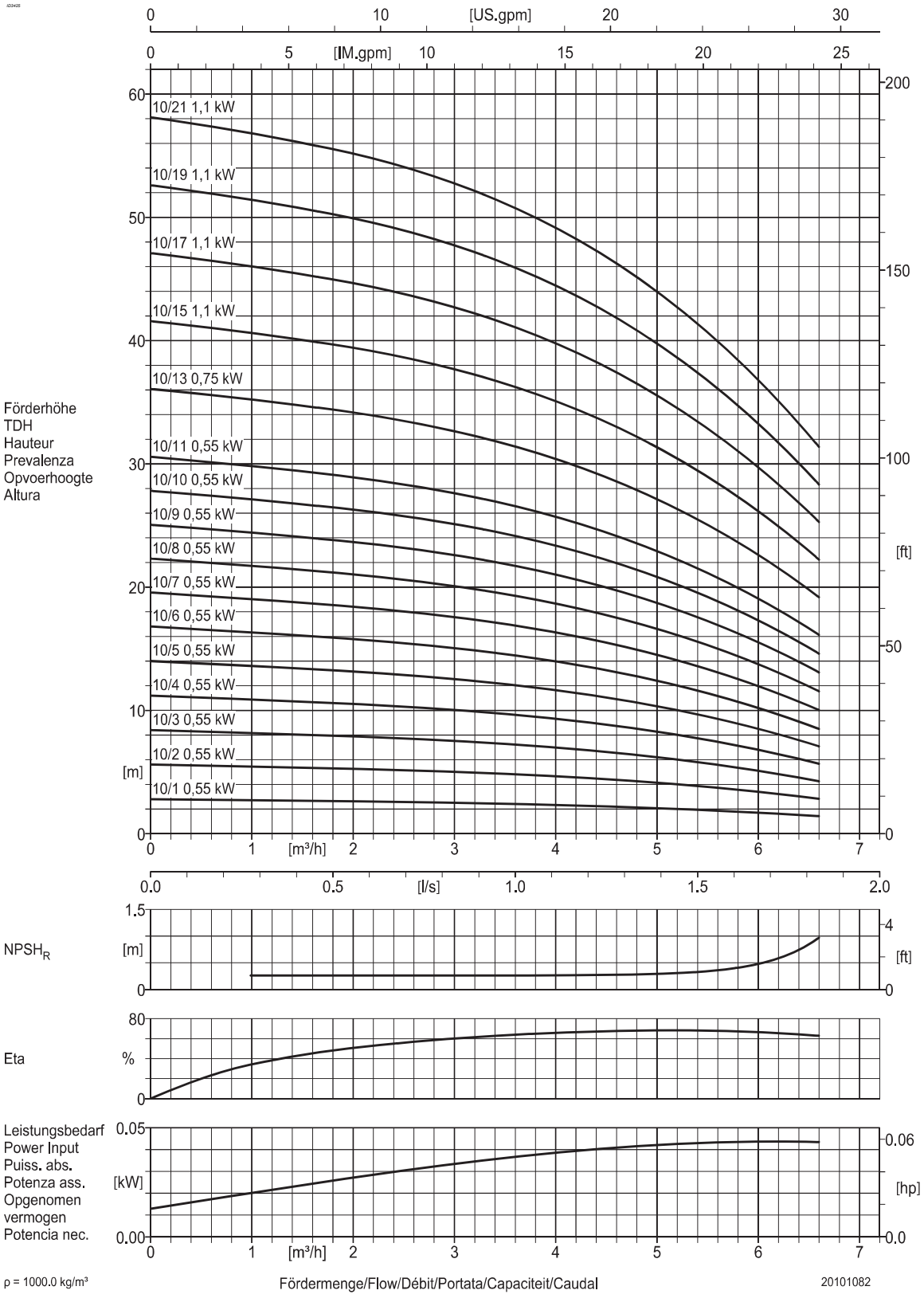

Figure 9: Performance curve DPV(C/S) 10 B - 50Hz - 4 pole

2.11 Hydraulic performance curve DPV(C/S) 15 B - 50Hz - 2 pole

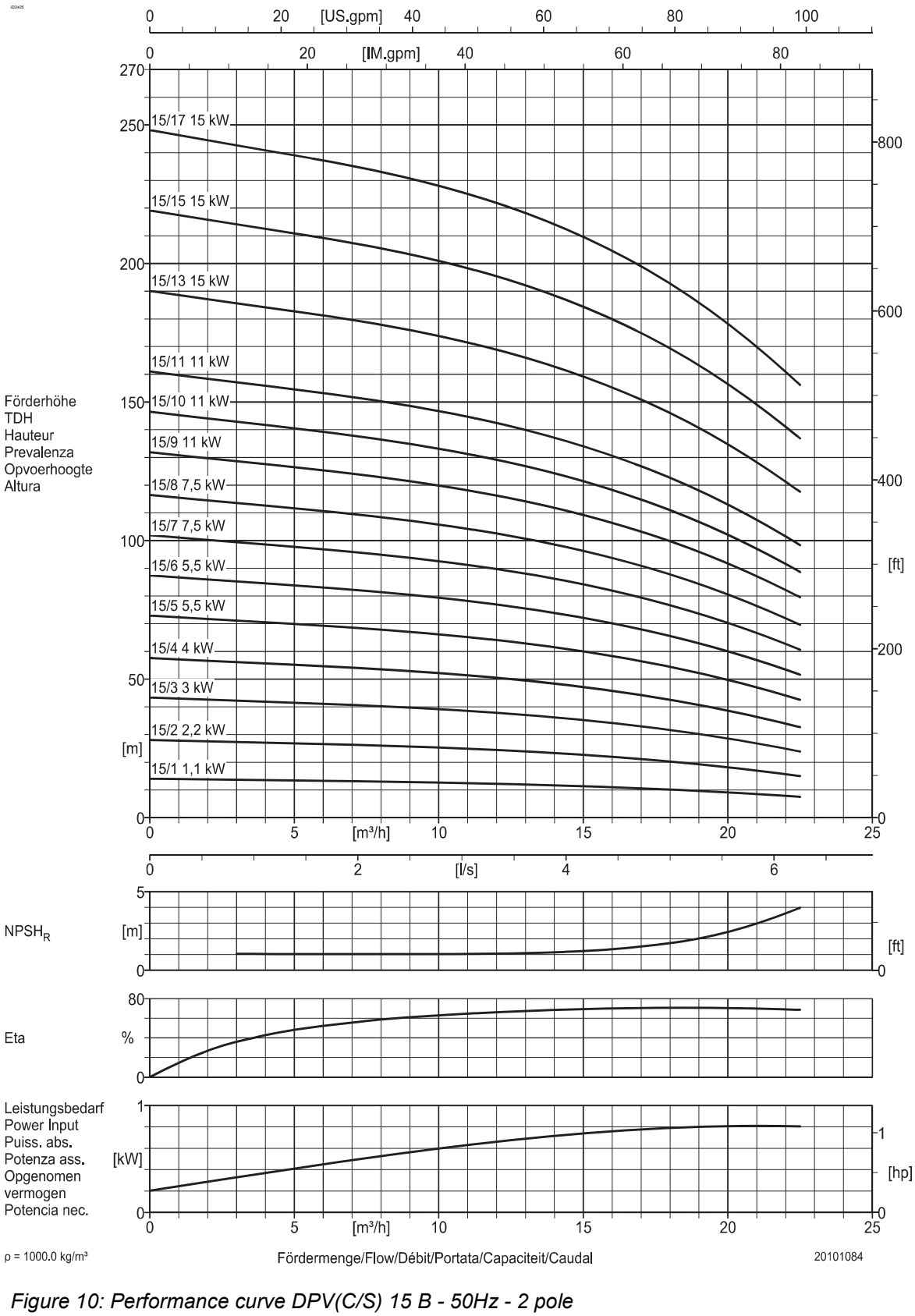

Figure 10: Performance curve DPV(C/S) 15 B - 50Hz - 2 pole

2.12 Hydraulic performance curve DPV(C/S) 15 B - 50Hz - 4 pole

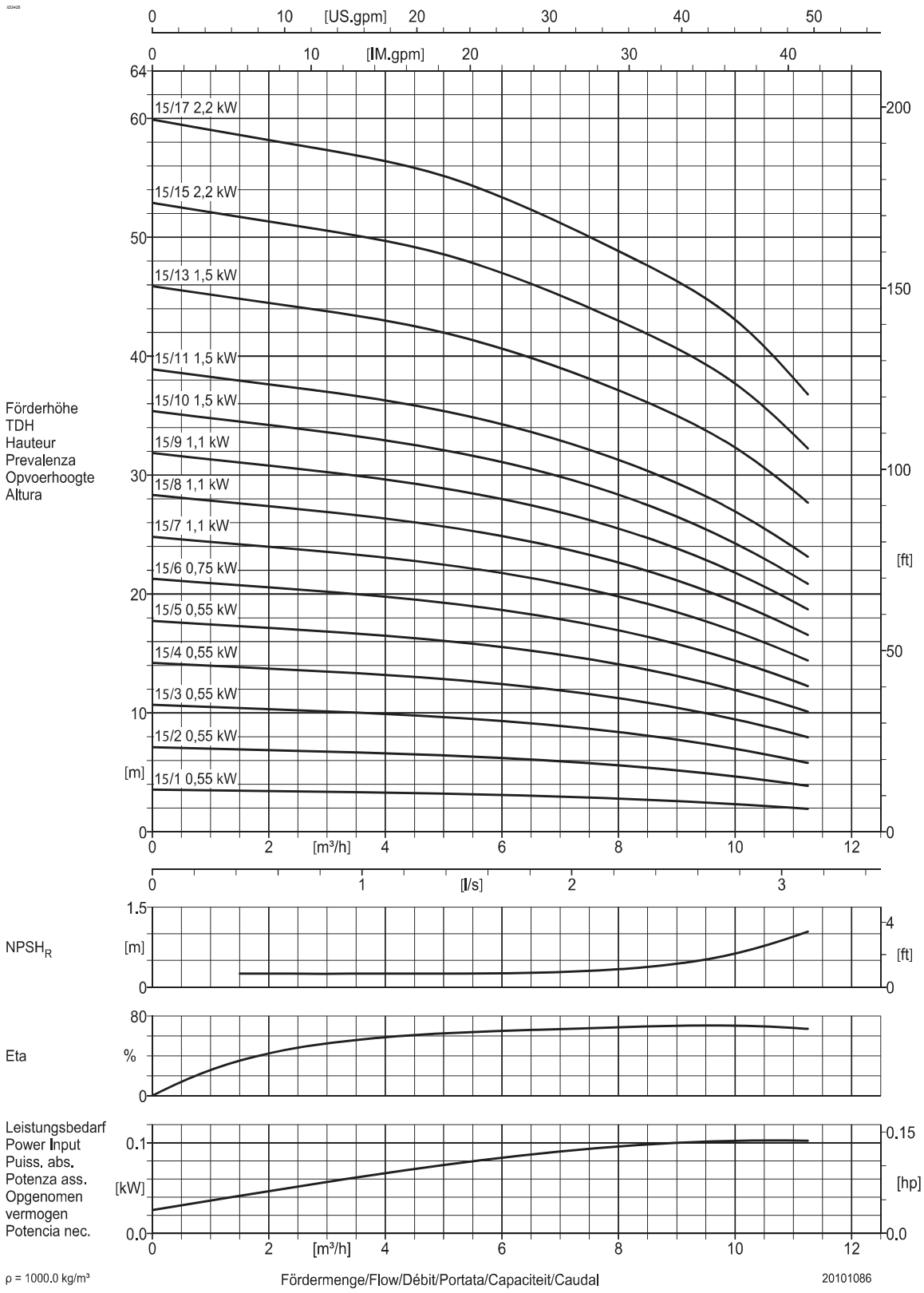

Figure 11: Performance curve DPV(C/S) 15 B - 50Hz - 4 pole

2.13 Hydraulic performance curve DPV(C/S) 25 B - 50Hz - 2 pole

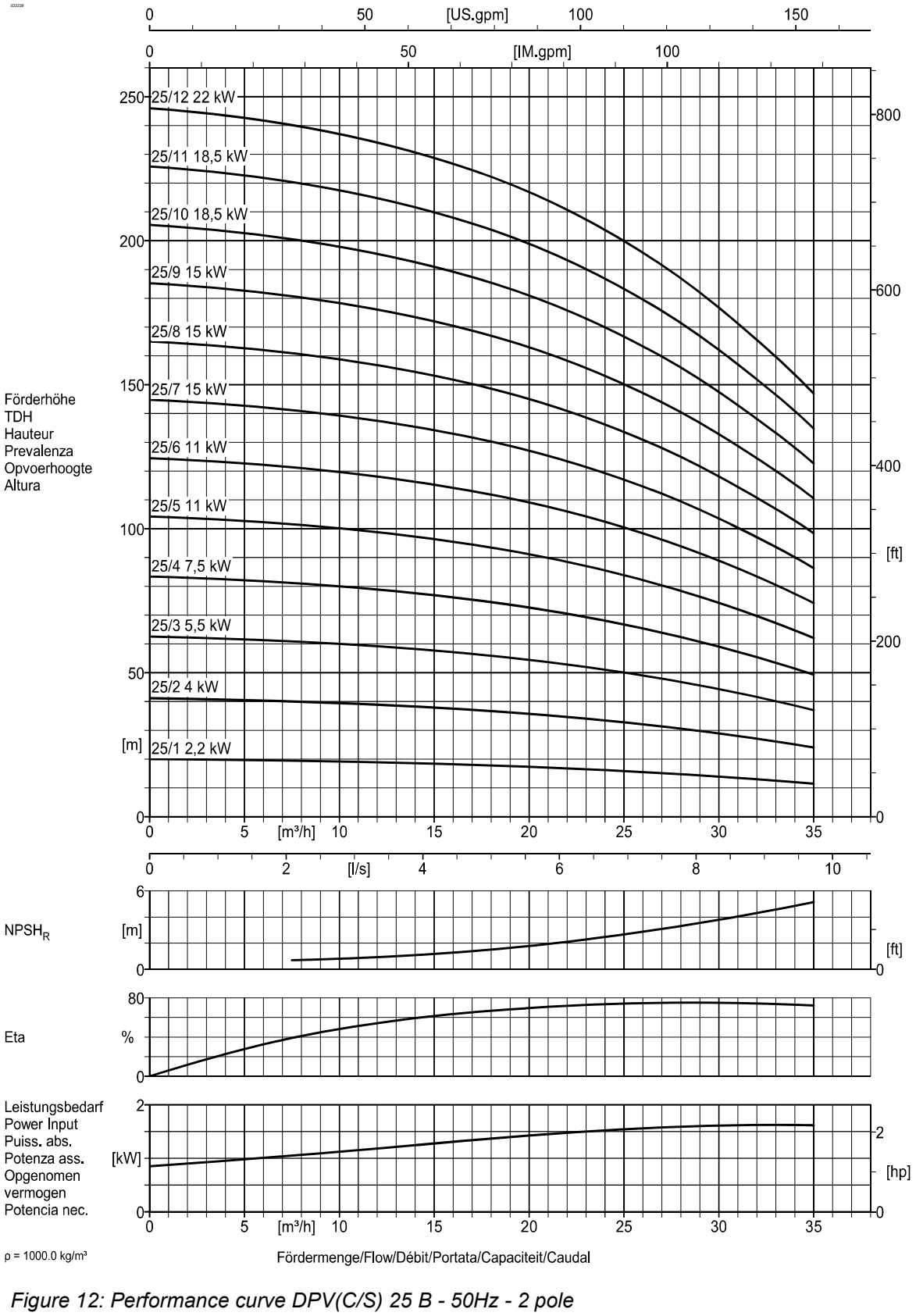

Figure 12: Performance curve DPV(C/S) 25 B - 50Hz - 2 pole

2.14 Hydraulic performance curve DPV(C/S) 25 B - 50Hz - 4 pole

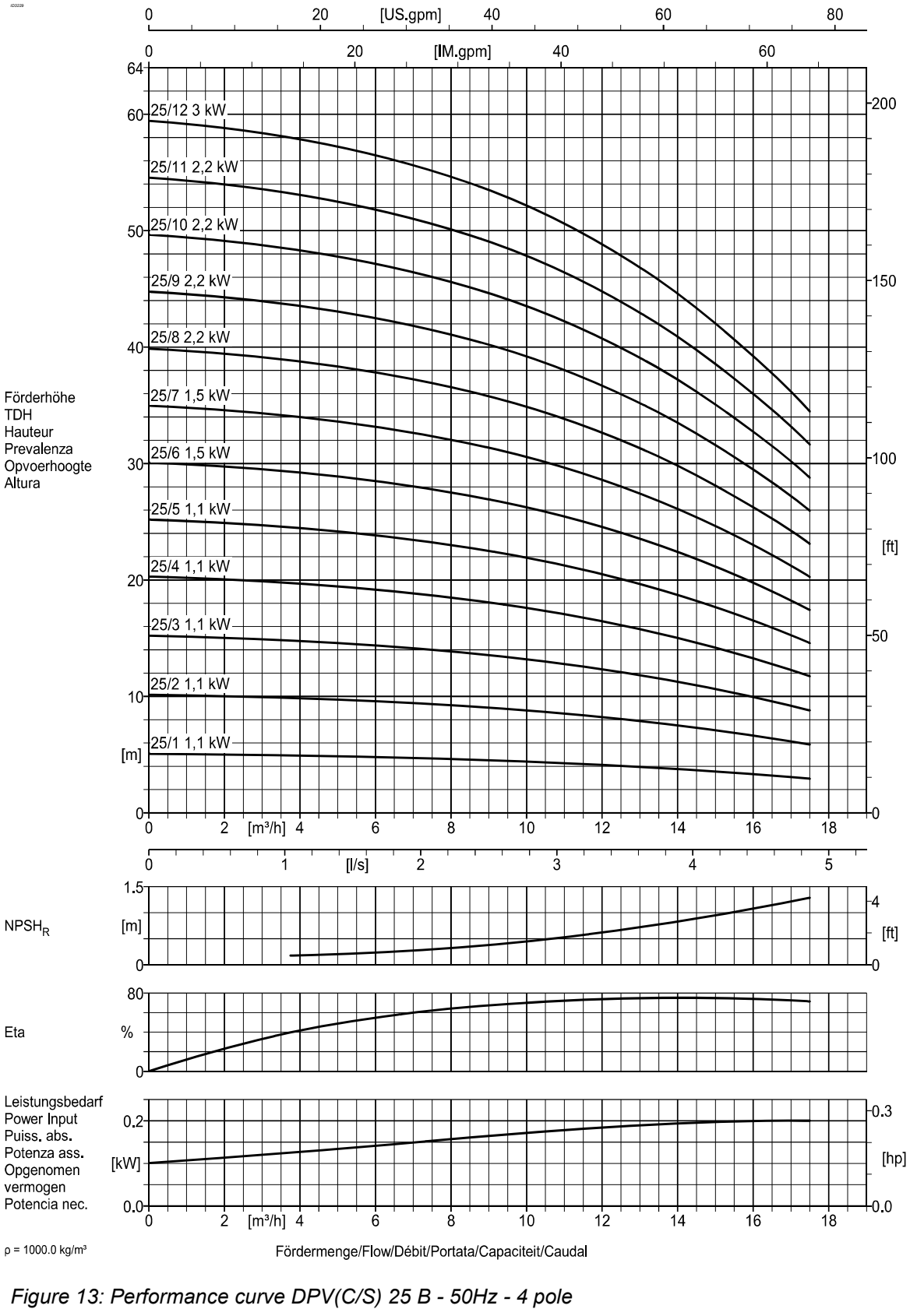

Figure 13: Performance curve DPV(C/S) 25 B - 50Hz - 4 pole

2.15 Hydraulic performance curve DPV(C/S) 40 B - 50Hz - 2 pole

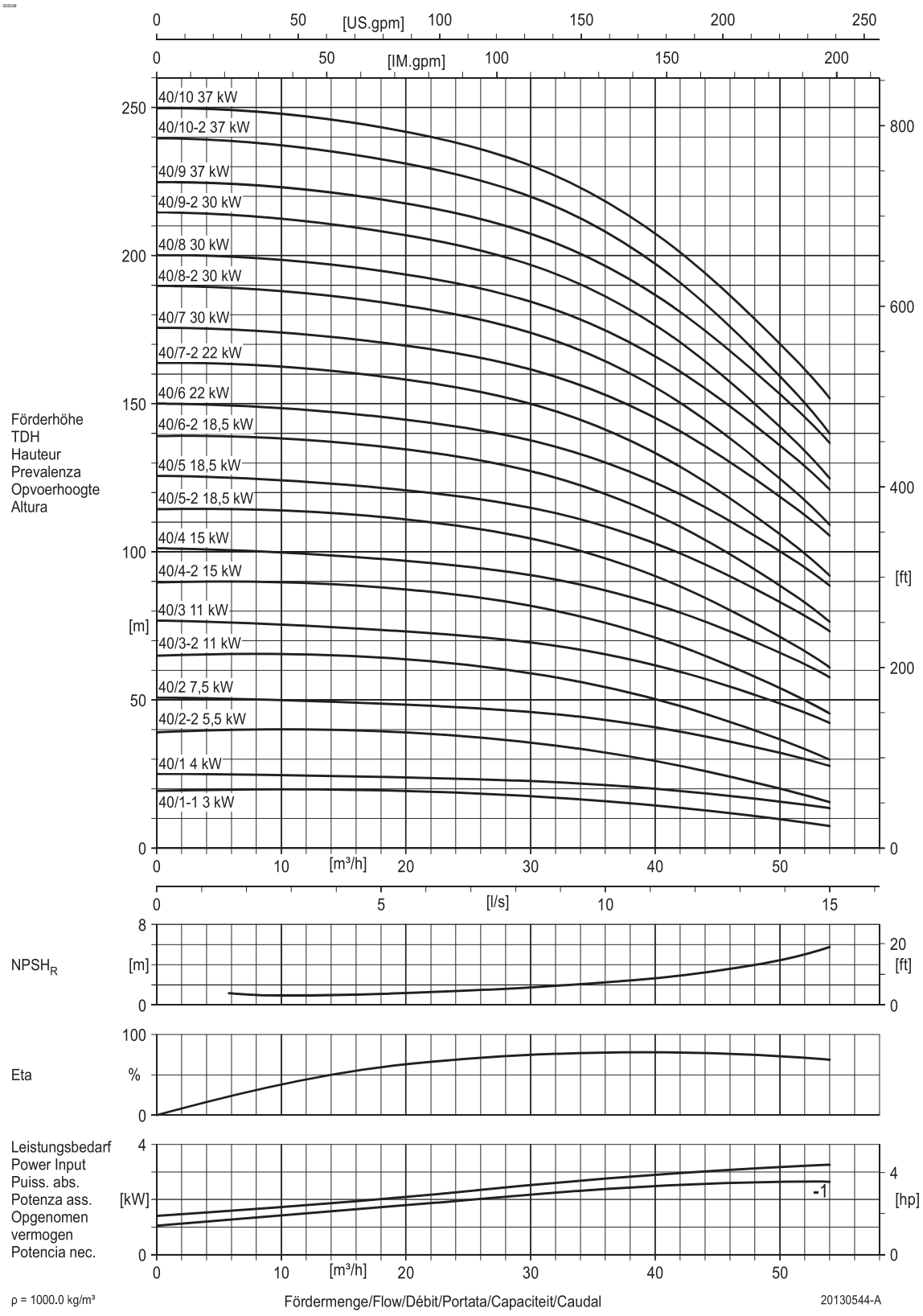

Figure 14: Performance curve DPV(C/S) 40 B - 50Hz - 2 pole

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2.16 Hydraulic performance curve DPV(C/S) 40 B - 50Hz - 4 pole

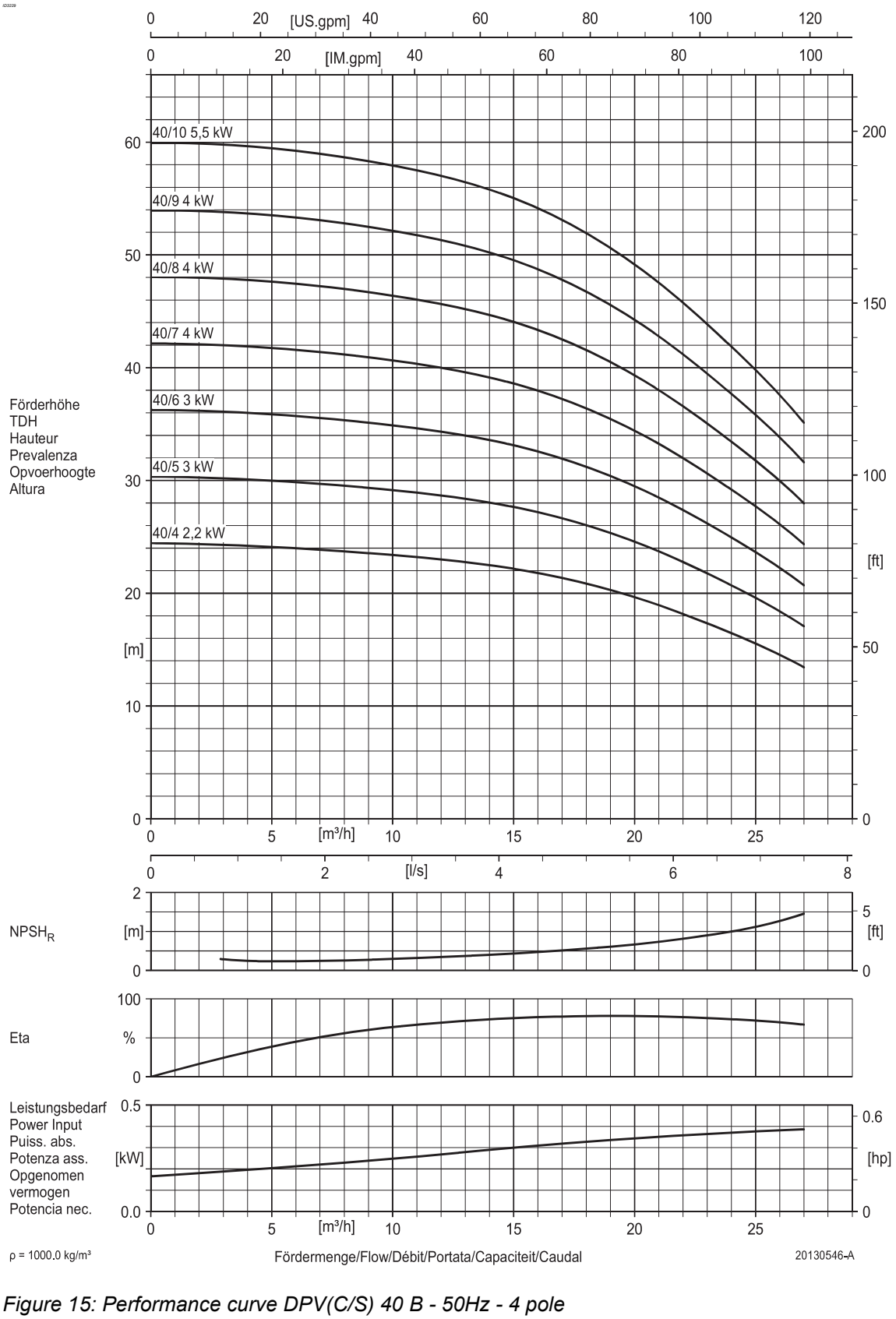

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Figure 15: Performance curve DPV(C/S) 40 B - 50Hz - 4 pole

2.17 Hydraulic performance curve DPV(C/S) 60 B - 50Hz - 2 pole

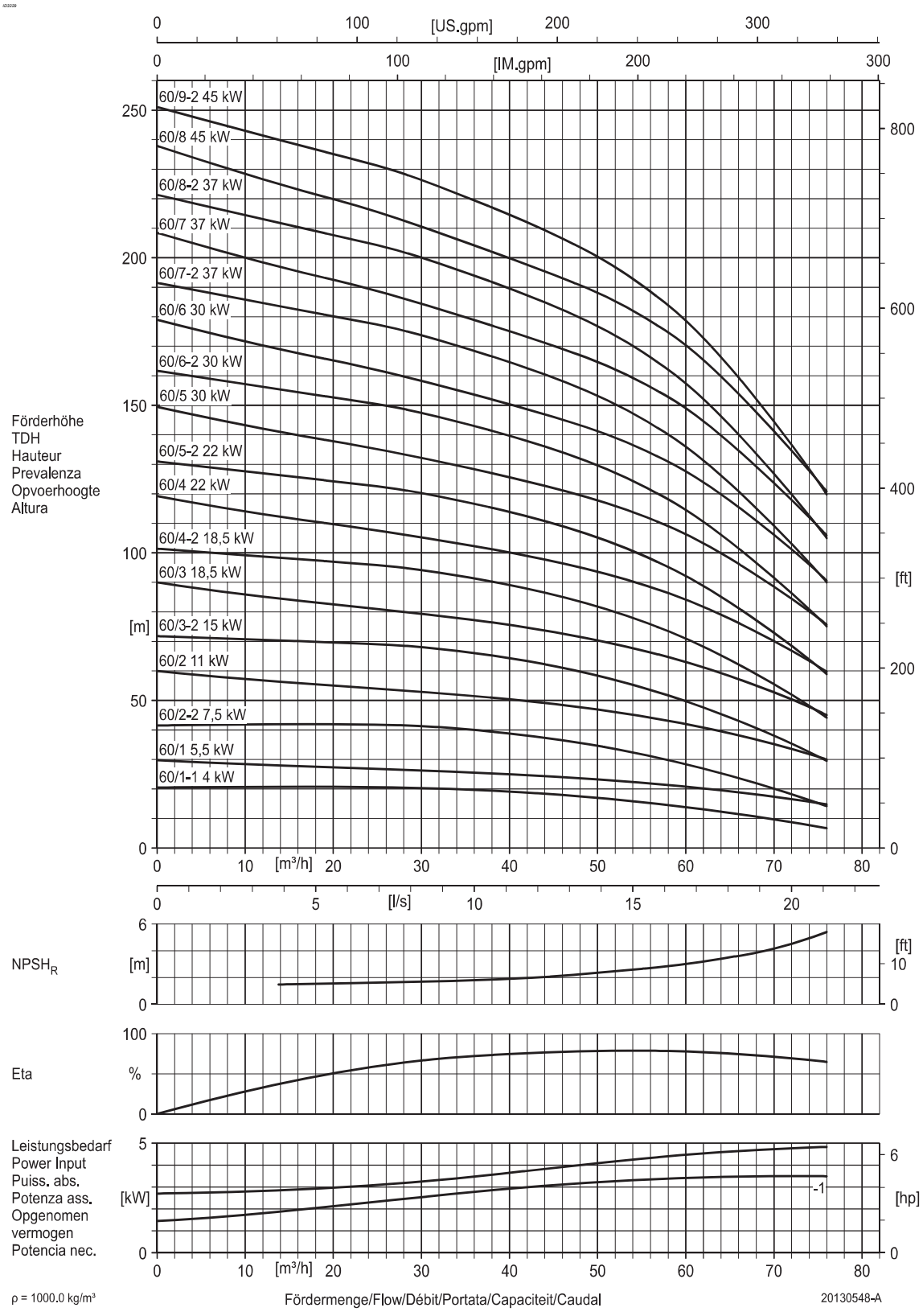

Figure 16: Performance curve DPV(C/S) 60 B - 50Hz - 2 pole

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2.18 Hydraulic performance curve DPV(C/S) 60 B - 50Hz - 4 pole

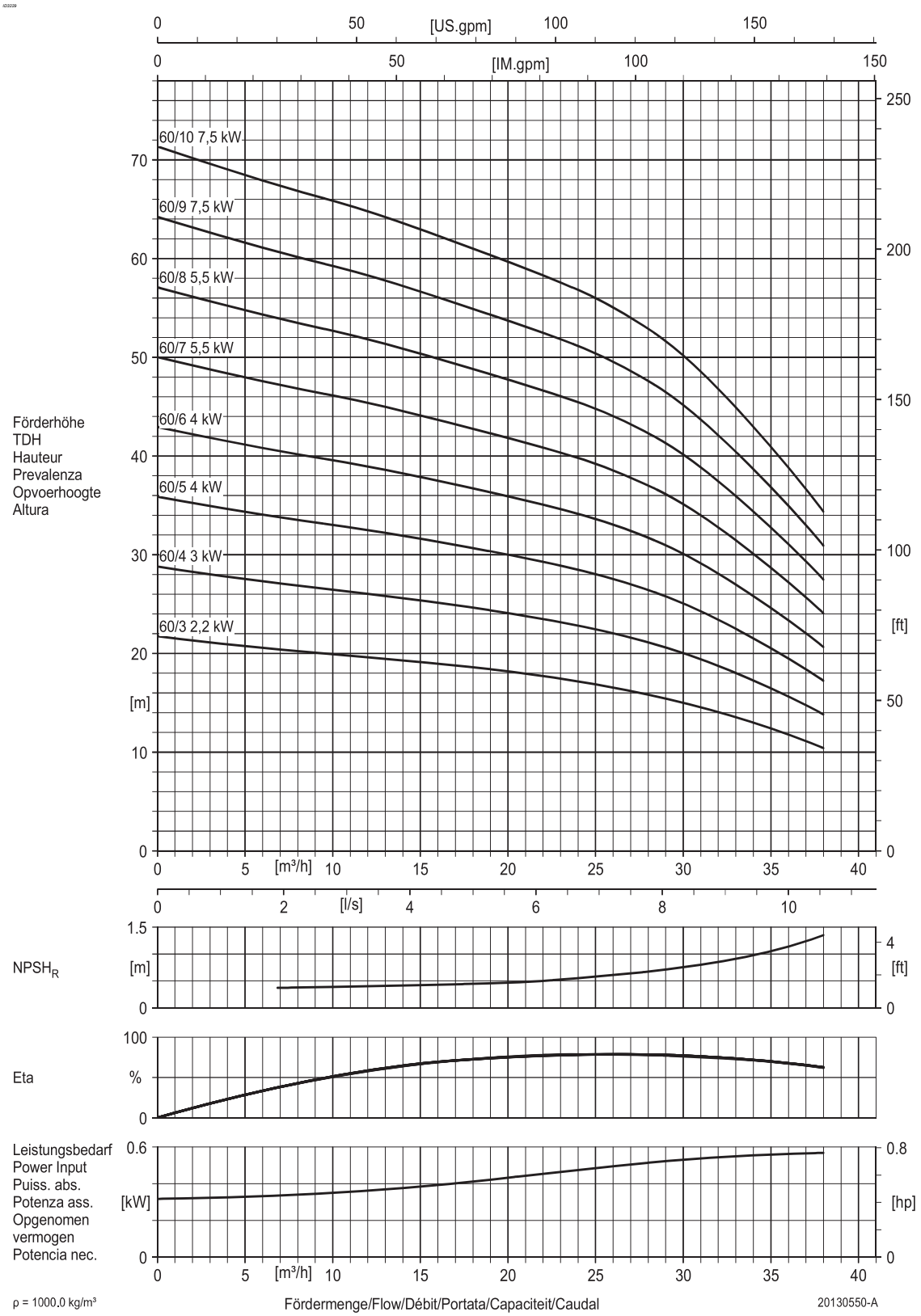

Figure 17: Performance curve DPV(C/S) 60 B - 50Hz - 4 pole

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2.19 Hydraulic performance curve DPV(C/S) 85 B - 50Hz - 2 pole

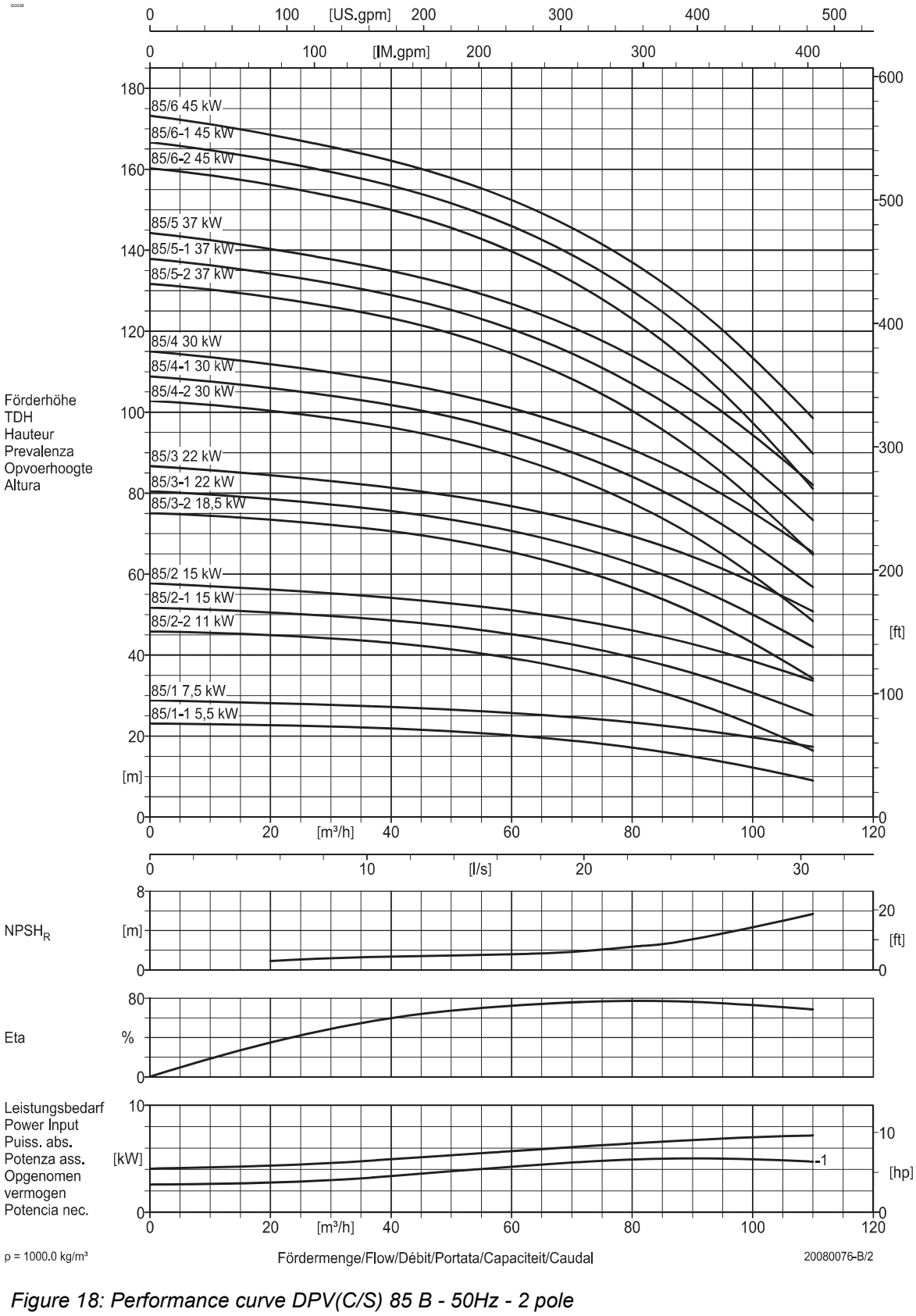

Figure 18: Performance curve DPV(C/S) 85 B - 50Hz - 2 pole

2.20 Hydraulic performance curve DPV(C/S) 85 B - 50Hz - 4 pole

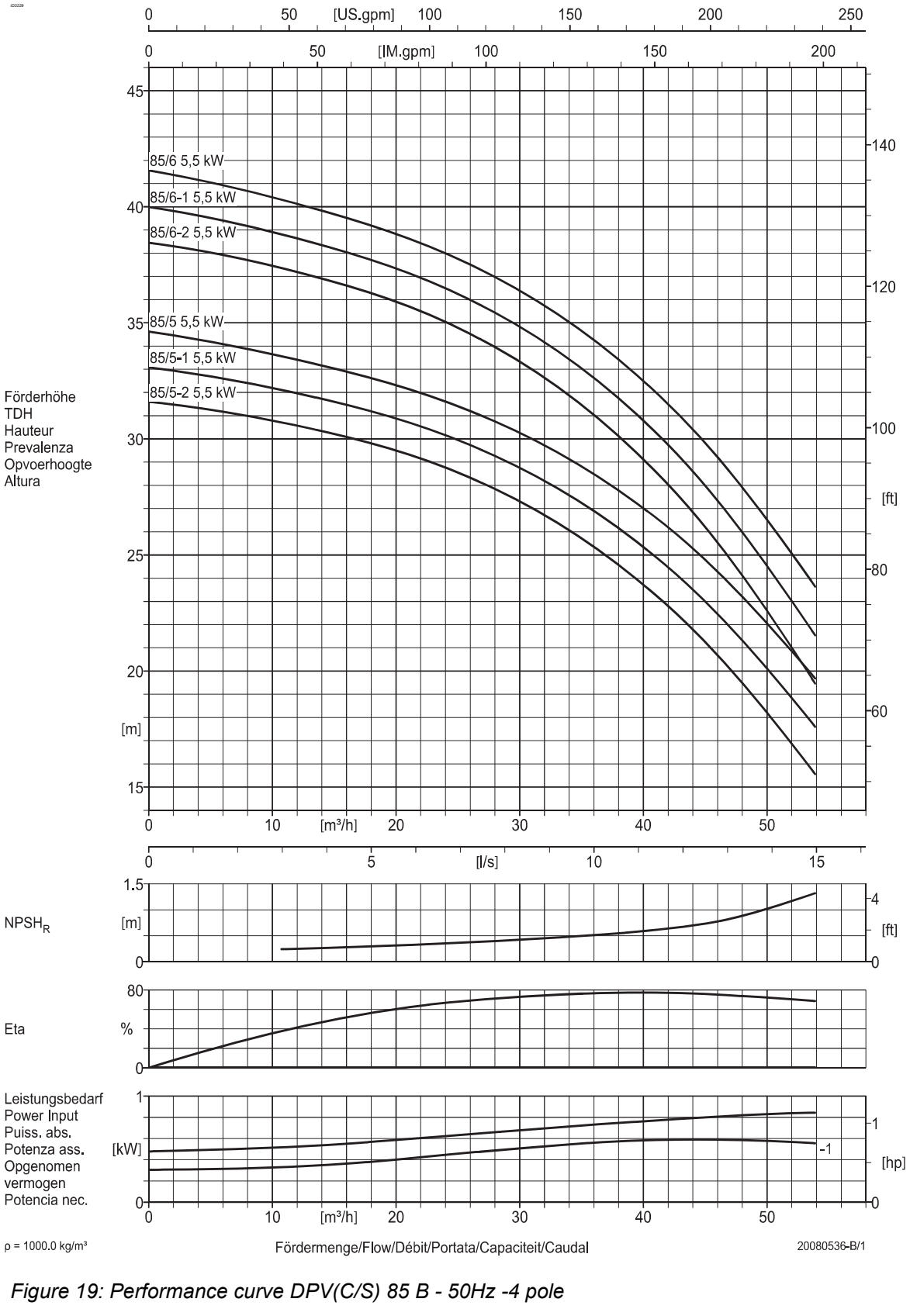

Figure 19: Performance curve DPV(C/S) 85 B - 50Hz -4 pole

2.21 Hydraulic performance curve DPV(C/S) 125 B - 50Hz - 2 pole

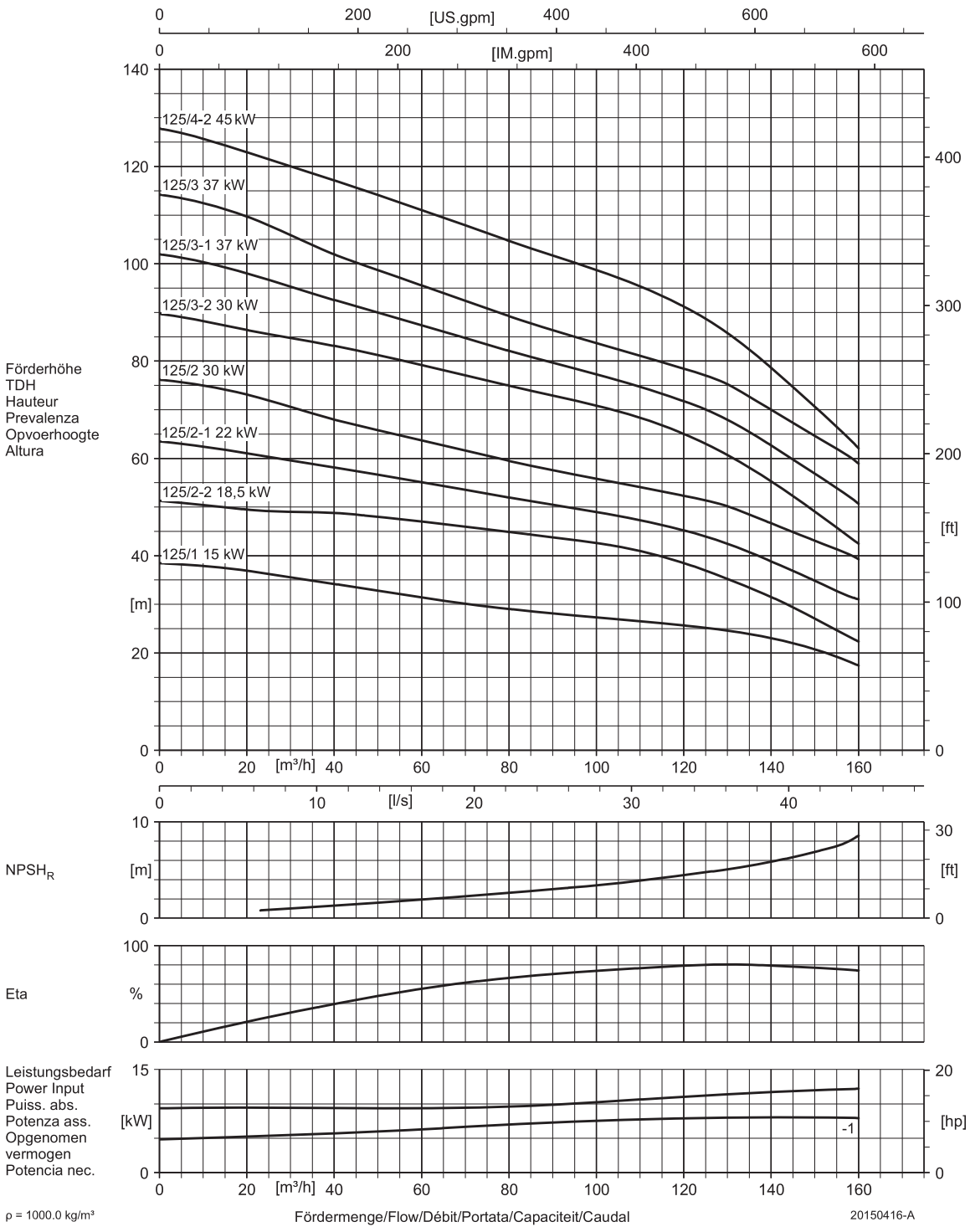

Figure 20: Performance curve DPV(C/S) 125 B - 50Hz - 2 pole

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