Sanitary pumps

FB

Centrifugal pumps
60 Hz

Contents

Mission

- It is our mission - the basis of our existence - to successfully develop, produce and sell high-quality pumps and pumping systems world-wide, contributing to a better quality of life and a healthy environment

Bjerringbro, Denmark

Fresno, California

Olathe, Kansas

Monterrey, Mexico

Allentown, Pennsylvania

Oakville, Ontario

- One of the 3 largest pump companies in the world
- The second largest manufacturer of submersible motors in the world
- World headquarters in Denmark
- North American headquarters in Kansas City - Manufacturing in Fresno, California
- 82 companies in 45 countries
- More than 16 million motors and pumps produced annually worldwide
- North American companies operating in USA, Canada and Mexico
- Continuous reinvestment in growth and development enables the company to **BE** responsible, **THINK** ahead, and **INNOVATE**

Introduction

Grundfos sanitary pumps

Stainless steel sanitary pumps designed for a wide range of hygienic and sanitary applications such as:

- food and beverage
- life science/pharmaceutical
- personal care
- water treatment.

The Grundfos range of sanitary pumps is comprised of a range of single- and multi-stage end-suction centrifugal pumps and side-channel, self-priming pumps, each state-of-the-art within its specific field of application.

The pumps can be fitted with a variety of features to adapt to specific pumping tasks. In addition, it is possible to customize the pumps for optimum function or performance in relation to the job at hand.

FB

Single-stage, end-suction centrifugal pumps. The pumps offer heads up to 279 ft, flow rates up to 418 US GPM and operating pressures up to 232 PSI. Pipe connections range from 1.5 inch to 4 inch and motor sizes from 1.0 to 25 Hp.

Hygienic design

The Grundfos sanitary pumps have been designed in accordance with the strictest hygienic design criteria.

The surface finish of the materials used is of paramount importance to prevent possible breeding grounds for bacteria and to facilitate efficient and thorough cleaning using CIP (Cleaning-In-Place) processes.

Fully drainable models are available, and the use of AISI 316L (DIN EN 1.4404/1.4435) cold-rolled and/or forged stainless steel ensures a homogeneous, pore-free surface in contrast to cast materials.

The design, materials and material surface finish are subject to a variety of national and international rules and regulations, guidelines and laws. Among these are the EU Machinery Directive, the GMP (Good Manufacturing Practices) rules and regulations, the FDA (Food and Drug Administration) regulations, the 3A Sanitary Standards, the EU foodstuff hygienic guidelines, the DIN EN 12462 Biotechnology Standard as well as the EHEDG (European Hygienic Engineering & Design Group) and the QHD (Qualified Hygienic Design) criteria.

Mechanical shaft seals

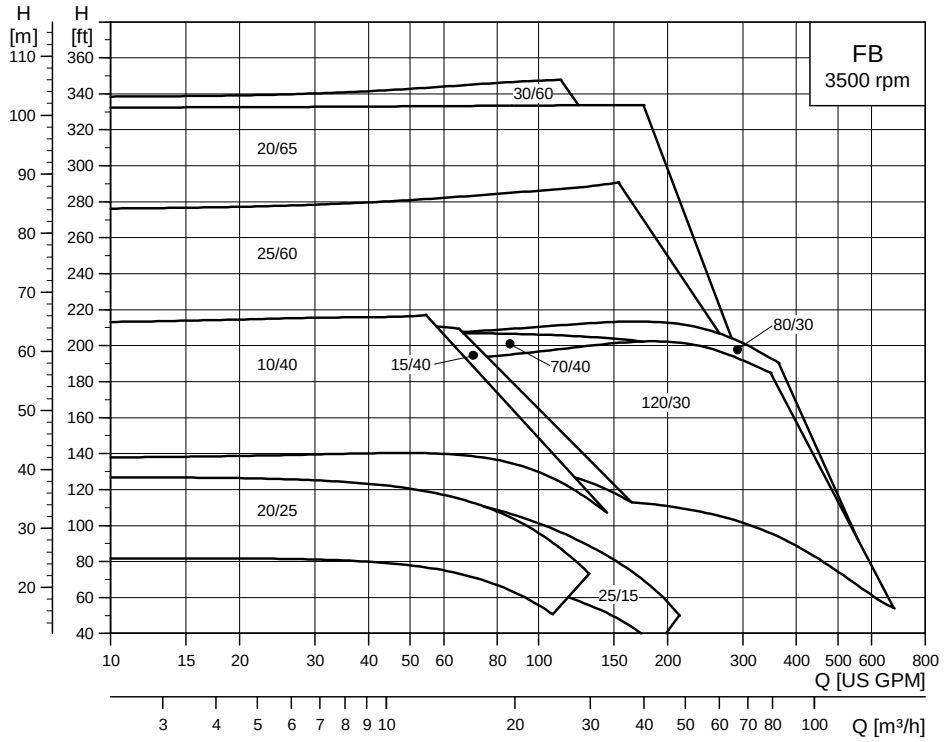
Single-seal and quenched seal arrangements are available as required for the application and the pumped liquid. The seals offer trouble-free operation.

Connections

A variety of connections are available, such as Tri-Clamp to DIN 32676, female NPT and ANSI 150lb flanges.

Performance range

FB, 2-pole



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FB, 4-pole

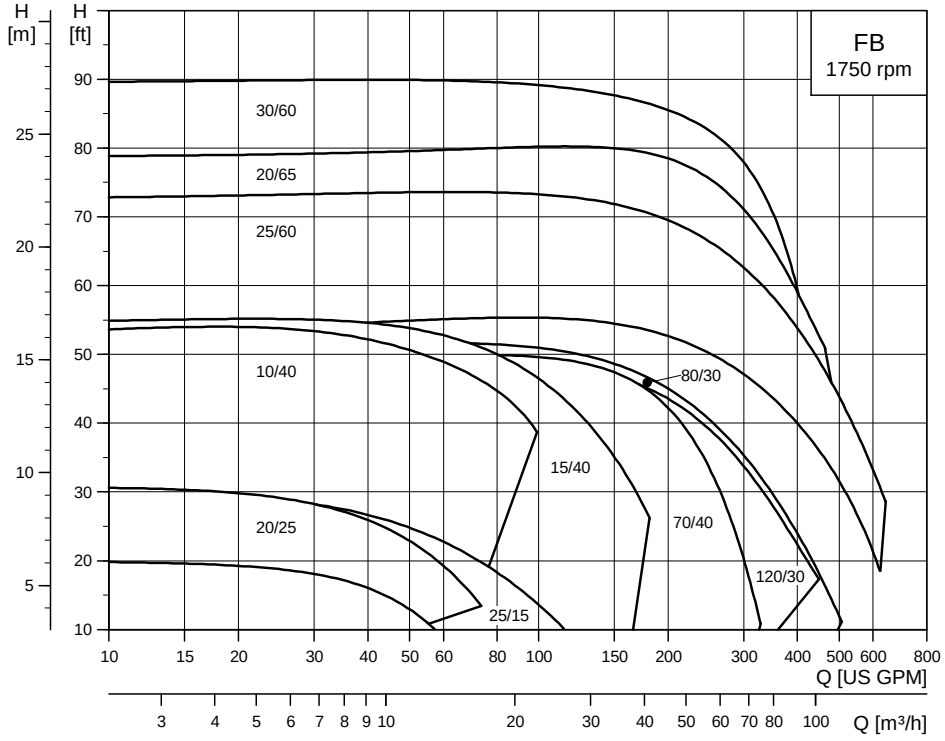

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Fig. 1 FB

Technical data

Head:	up to 350 ft
Flow rate:	up to 675 US GPM
Operating pressure:	up to 232 PSI
Operating temperature:	up to 203 °F (up to 302 °F on request)
Sterilization temperature:	284 °F (SIP) (Sterilization-In-Place).

Applications

The unique hygienic design and the materials used make the FB pump range suitable for these applications:

- **Beverages**
  Beer, soft drinks, alcohol, wine, fruit drinks, yeast, etc.
- **Dairies**
  Milk, whey, cream, condensed milk, etc.
- **Confectionery**
  Syrup, sugar solutions, etc.
- **Meat packing**
  Liquid fat, frying oil, smokehouse spray, blood processing, etc.

Features and benefits

- Support options for motor and pump for flexible installation meeting 3-A requirements.
- Extremely reliable operation under most working conditions for low maintenance cost; use same pump in variety of applications.
- Optimized hydraulics for high efficiency and reduced power consumption.
- Semi-closed impeller design for increased suitability for applications involving low-viscosity liquids and liquids containing particles.

Construction

FB pumps are single-stage, end-suction centrifugal pumps, designed to meet the hygienic requirements of sterile process technology.

The pumps are CIP and SIP capable in compliance with the DIN EN 12462 performance criteria.

The design of the wetted parts complies with:

- QHD criteria
- EHEDG recommendations for CIP cleanability (validated by the TNO Quality of Life institute)
- 3A Sanitary Standards (3A 02-10).

For explanation, see Certificates, page 9.

A-3

Fig. 2 Certification

Materials

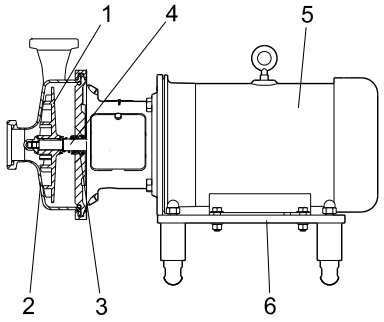

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Fig. 3 Sectional drawing of FB pump

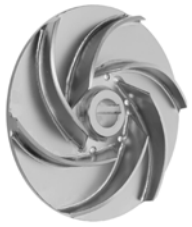
Pos.	Component	Material	DIN/EN	AISI/ ASTM
1	Impeller	CrNiMo steel	1.4404	316L
2	Pump housing	CrNiMo steel	1.4404	316L
3	Shaft seal	Seal faces: Carbon/stainless steel or SiC/SiC O-rings: EPDM or FKM		
4	Pump shaft	CrNiMo steel	1.4571	316Ti
5	Motor			
6	Feet and support bars	Stainless steel		

Pump housing

The pump housing is made of heavy-duty, rolled and deep-drawn CrNiMo steel to DIN EN 1.4404, the equivalent of AISI 316L.

Impeller

FB pumps feature a cast stainless steel, semi-closed impeller.



GR9394

Fig. 4 Semi-closed impeller

Connections

Standard connections

• Clamps for Tri-Clamp®.

Connections on request

- ANSI 150lb flanges
- Internal NPT thread.

Surface finish

In order to meet the demands of the pharmaceutical, food and beverage industries, all contact surfaces of the product have a surface finish of < 0.8µ Ra.

Mechanical shaft seals

The operating range of the shaft seal depends on the type of shaft seal, the operating pressure and the liquid temperature.

As standard, FB is fitted with a single, inboard, mechanical shaft seal with an optimum position in the pumped liquid. This ensures lubrication and cooling as well as CIP (Cleaning-In-Place) and SIP (Sterilization-In-Place), according to the criteria of hygienic design.

Seal faces of carbon/stainless steel or SiC/SiC and O-rings of EPDM or FKM are standard. Other seal face material pairings are available on request.

Grundfos offers the following shaft seal types as standard:

O-ring shaft seal with open spring driver

The seal is suitable for non-sanitary applications.

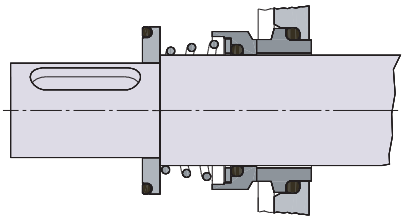


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Fig. 5 O-ring shaft seal with open spring driver

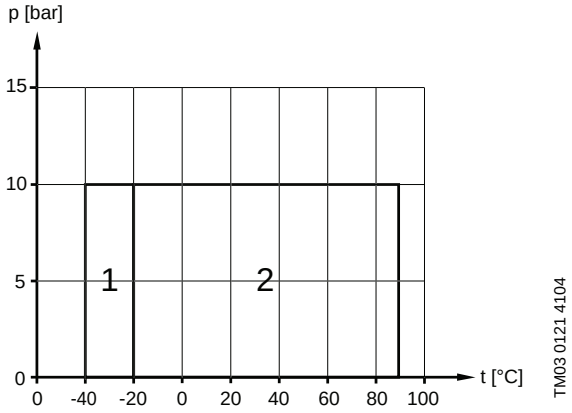

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Fig. 6 Operating range of O-ring shaft seal with open spring driver

1: EPDM
2: EPDM and FKM.

O-ring shaft seal with enclosed spring

The seal is suitable for hygienic applications or those requiring compliance with 3-A Sanitary Standards.

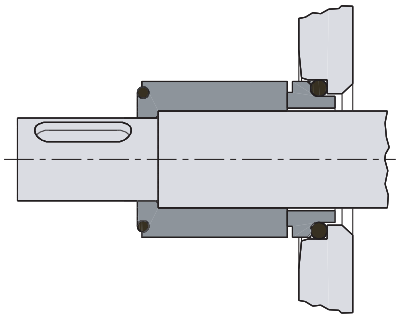

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Fig. 7 O-ring shaft seal with enclosed spring

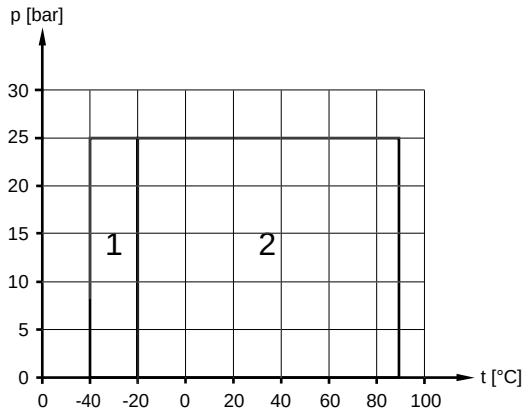

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Fig. 8 Operating range of O-ring shaft seal with enclosed spring

1: EPDM
2: EPDM and FKM.

Quench seal

All shaft seal types are available in quench design.

Motor

The standard motor is a totally enclosed, fan-cooled Baldor “Washdown Duty” motor.

Options for non-washdown duty types, “Premium Efficiency”, “Stainless Steel” and alternative voltages are available.

Design variations

Grundfos offers FB models with or without feet and support bars. FB feet comply with current 3-A sanitary standards.

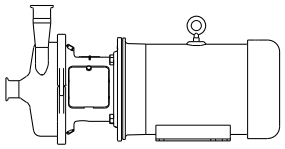

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Fig. 9 FB on foot-mounted motor

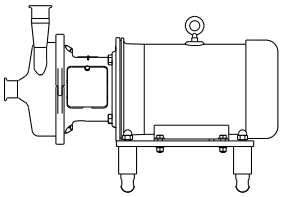

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Fig. 10 FB with stainless steel feet and support bars

Approvals and certificates

The design, materials used and surface finish are subject to a variety of national and international rules and regulations, such as the 3A Sanitary Standards, the EHEDG recommendations and the QHD criteria.

3A Sanitary Standards

A3

Fig. 11 3A symbol

The 3A Sanitary Standards for design and manufacture provide material specifications and requirements for surface finish.

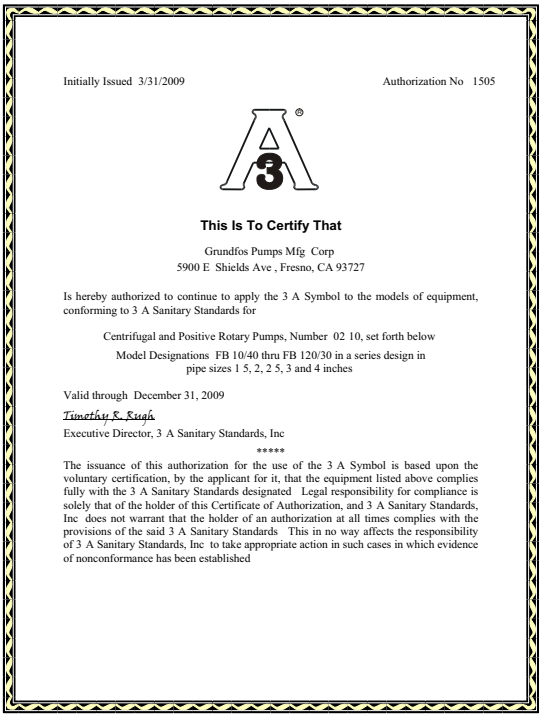
This ensures that dairy, food and other microbially sensitive products are protected from contamination and that all surfaces in contact with the products can be cleaned in place (CIP) or easily dismantled for manual cleaning.

The 3A symbol is used by manufacturers to indicate compliance with the 3A Sanitary Standards.

Certificates

Grundfos offers the following certificates and approvals for the FB models:

- Hygienic design certificates.
  Certifies compliance with the 3A Sanitary Standards.
- Performance certificates.
  Test reports guaranteeing and certifying QH test data, power consumption, speed, curves, etc.) are available upon request.



Initially Issued 3/31/2009 Authorization No 1505

This Is To Certify That

Grundfos Pumps Mfg Corp
5900 E Shields Ave , Fresno, CA 93727

Is hereby authorized to continue to apply the 3 A Symbol to the models of equipment, conforming to 3 A Sanitary Standards for

Centrifugal and Positive Rotary Pumps, Number 02 10, set forth below

Model Designations FB 10/40 thru FB 120/30 in a series design in pipe sizes 1 5, 2, 2 5, 3 and 4 inches

Valid through December 31, 2009

Timothy S. Krugh

Executive Director, 3 A Sanitary Standards, Inc

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The issuance of this authorization for the use of the 3 A Symbol is based upon the voluntary certification, by the applicant for it, that the equipment listed above complies fully with the 3 A Sanitary Standards designated Legal responsibility for compliance is solely that of the holder of this Certificate of Authorization, and 3 A Sanitary Standards, Inc does not warrant that the holder of an authorization at all times complies with the provisions of the said 3 A Sanitary Standards This in no way affects the responsibility of 3 A Sanitary Standards, Inc to take appropriate action in such cases in which evidence of nonconformance has been established

TM03 0091 3904

Certificate	Standard
3A hygienic design certificate	3A 02-10
Standard test report	ISO 9906

Type key

FB20/25-130-ACAE-ASCE-FY-1.5-4US	**Pump range**	**Model name**	**Impeller diameter (mm)**	**Physical variations**	**Connection type**	**Materials**	**Elastomer**	**Type**	**Rotating face material**	**Stationary seat material**	**Elastomer**	**Leg / feet**	**3-A**	**Hp**	**Poles**	**voltage**	**Duty**
FB20/25-130-ACAE-ASCE-FY-1.5-4US	FB	20/25	130	A	C	A	E	A	S	C	E	F	Y	1.5	4	U	S
10/40; 20/25; 15/40;25/15 30/60;70/40; 20/65; 80/30; 25/60;120/30																	
130; 140; 150; 150x6; 150x12; 155; 160; 165; 170; 175; 180; 185x6; 185x9; 190; 200; 210; 220; 230x12; 230x18																	
Basic version (standard volute with 12 o'clock discharge orientation and 3-A surface finish)				A													
Special version (e.g. non-standard discharge orientation, surface finish, drain port, cart mounting, etc.)				X													
Tri-Clamp					C												
Internal NPT thread					S												
ANSI flange					G												
Other connections available on request.					X												
Standard material (1.4404 stainless steel 316L)						A											
Special material						X											
EPDM							E										
FKM							V										
O-ring seal with enclosed spring (enclosed spring seal required for 3-A compliance)								A									
O-ring seal with open spring driver (for non-sanitary applications)								C									
Quench O-ring seal with enclosed spring (enclosed spring seal required for 3-A compliance)								Q									
Quench O-ring seal with open spring driver (for non-sanitary applications)								R									
Stainless steel	Other seal face materials available upon request.								S								
Silicon carbide									Q								
Carbon	Other seal face materials available upon request.									C							
Silicon carbide										Q							
EPDM											E						
FKM											V						
Stainless steel leg and foot assembly (3-A compliant)												F					
No feet												X					
Complies with 3-A and carries label													Y				
No 3-A label													N				
1; 1.5; 2; 3; 5; 7.5; 10; 15; 20; 25																	
2; 4																	
230/460 (USA)																U	
575 volt (Canada)																C	
Other (e.g. 115 V 1-phase)																X	
Baldor Super E Washdown (25 Hp has finned body) (CEWDM)																	E
Baldor Premium Efficient (CEM)																	P
Stainless steel motor																	S
Other motors available on request																	X

Mechanical installation

The pump should **never** be installed with the motor below the pump.

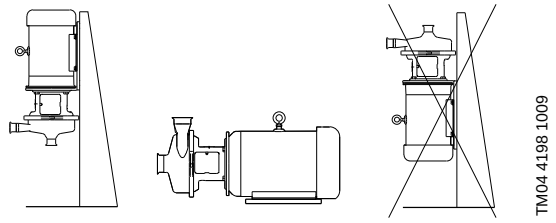


Fig. 12 Installation

The pumps must be installed in such a way that strain from the pipework is not transferred to the pump housing.

Space requirements

Vertical installation

- Pumps fitted with motors up to and including 5 Hp require a 12“ clearance above the motor. Consult the motor manufacturer’s instructions for details.
- Pumps fitted with motors of 7.5 Hp and up require at least a 3-feet clearance above the motor to allow the use of lifting equipment. Consult the motor manufacturer’s instructions for details.

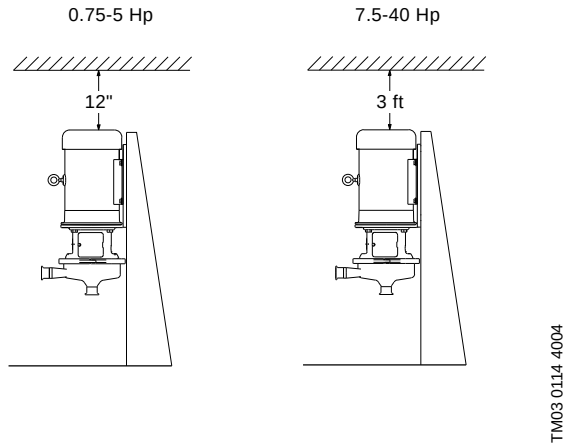


Fig. 13 Vertical installation

Horizontal installation

- Pumps fitted with motors up to and including 5 Hp require a 12" clearance behind the motor. Consult the motor manufacturer’s instructions for details.
- Pumps fitted with motors of 7.5 Hp and up require a 12 “ clearance behind and a 3 ft clearance above the motor to allow the use of lifting equipment. Consult the motor manufacturer’s instructions for details.

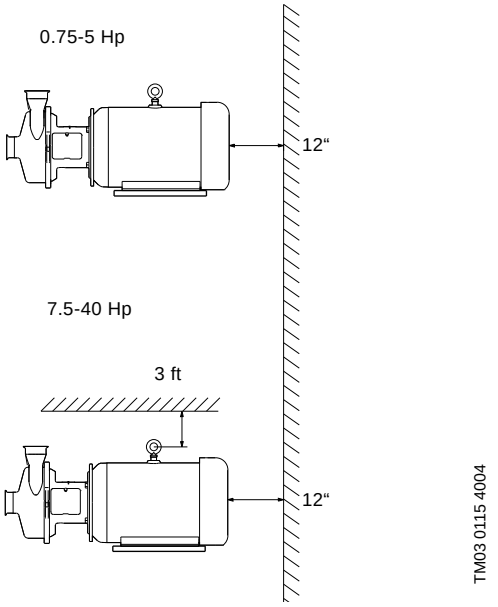


Fig. 14 Horizontal installation

Elimination of noise and vibration

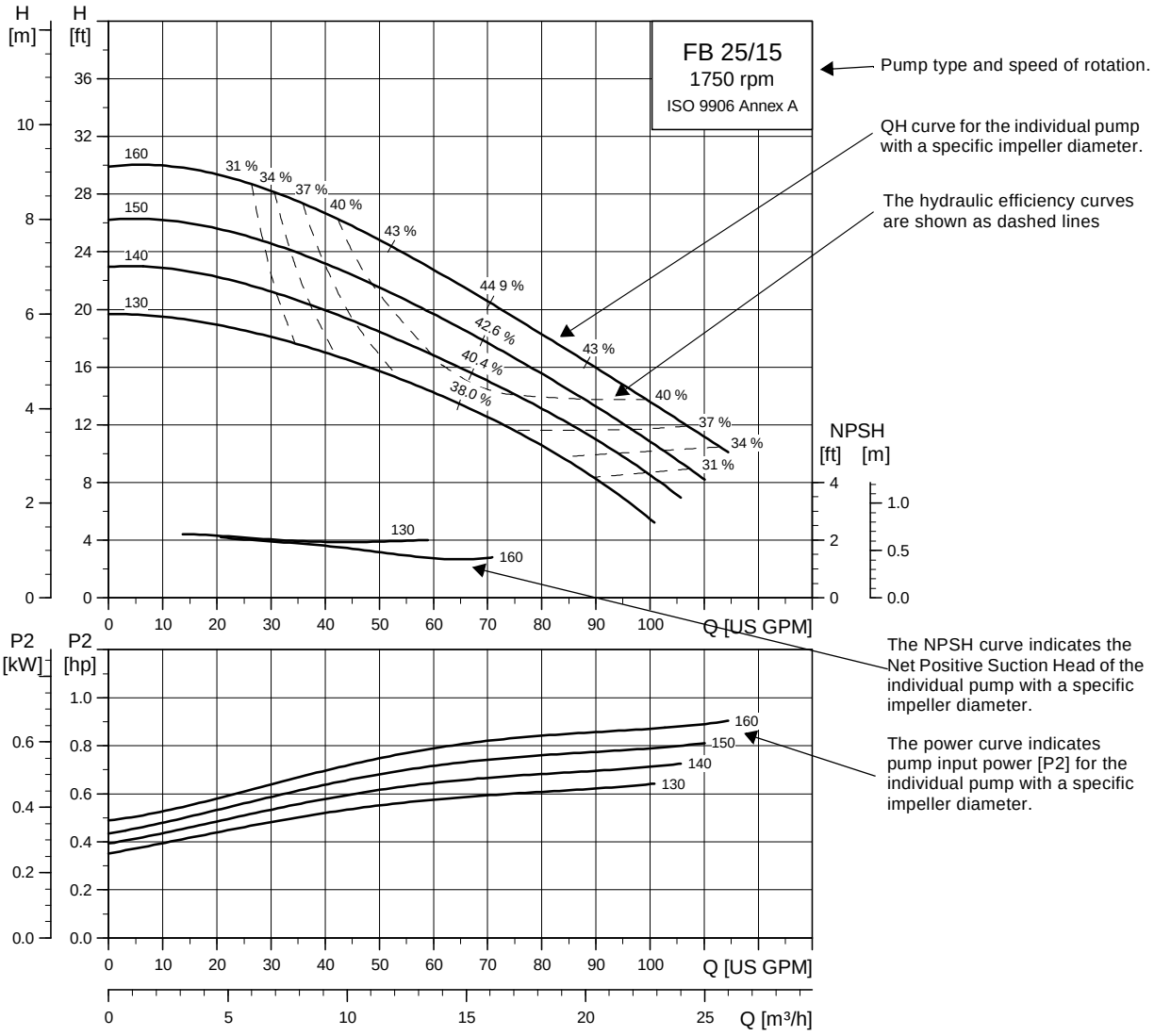
In order to achieve optimum operation with minimum noise and vibration, consider vibration dampening of the pump. This is most important for pumps with motors above 15 Hp. Smaller pumps may also cause undesirable noise and vibration.

Noise and vibration are generated by the rotation in the motor and pump, by the flow in pipes and fittings and other equipment connected in the same or adjacent processes. The effect on the environment is subjective and depends on correct installation and the system design.

The pipes should be anchored so that they do not stress the expansion joints and the pump. Follow the supplier’s instructions and pass them on to advisers or pipe installers.

Curve charts

How to read the pump curves



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Curve conditions

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

1. Tolerances to ISO 9906, Annex A.

   1.0 Hp < P2 < 15 Hp

Flow rate:	± 9 %
Total head:	± 7 %
Efficiency:	up to –7 %*

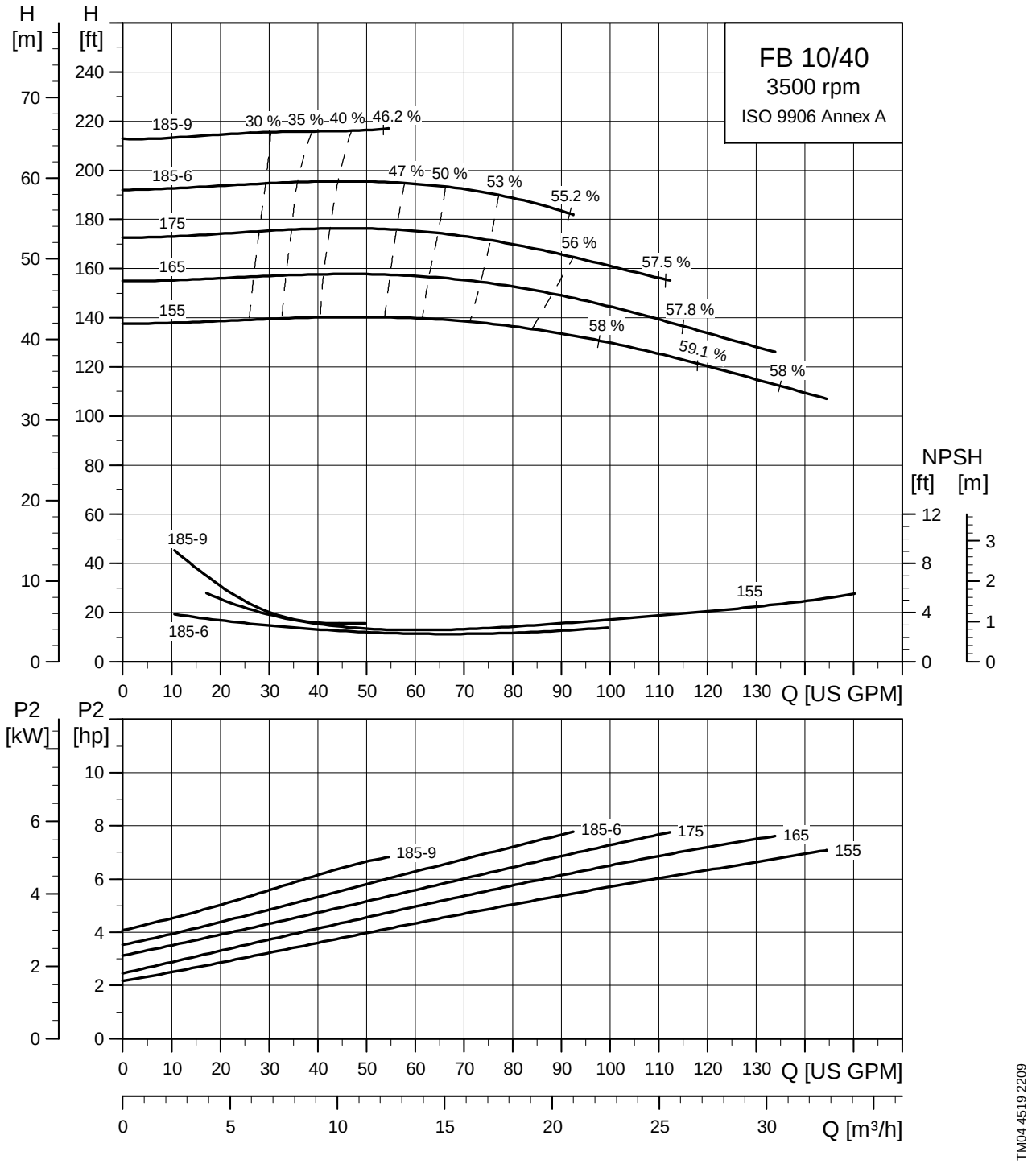
   * The efficiency of motor sizes below 15 Hp are calculated on the basis of a formula stated in ISO 9906.

   P2 > 15 Hp

Flow rate:	± 8 %
Total head:	± 5 %
Efficiency:	–5 %

2. QH curves of the individual pumps are shown with expected speed of a three-phase standard motor.
3. Measurements have been made with airless water at a temperature of +68 °F.
4. The curves apply to a kinematic viscosity of $\upsilon = 1\ mm^2/s$ (1 cSt).
5. If the pumped liquid density and/or viscosity is higher than that of water, it may be necessary to use a motor with a higher performance.

FB 10/40, 1 1/2” x 1 1/2”, 2-pole



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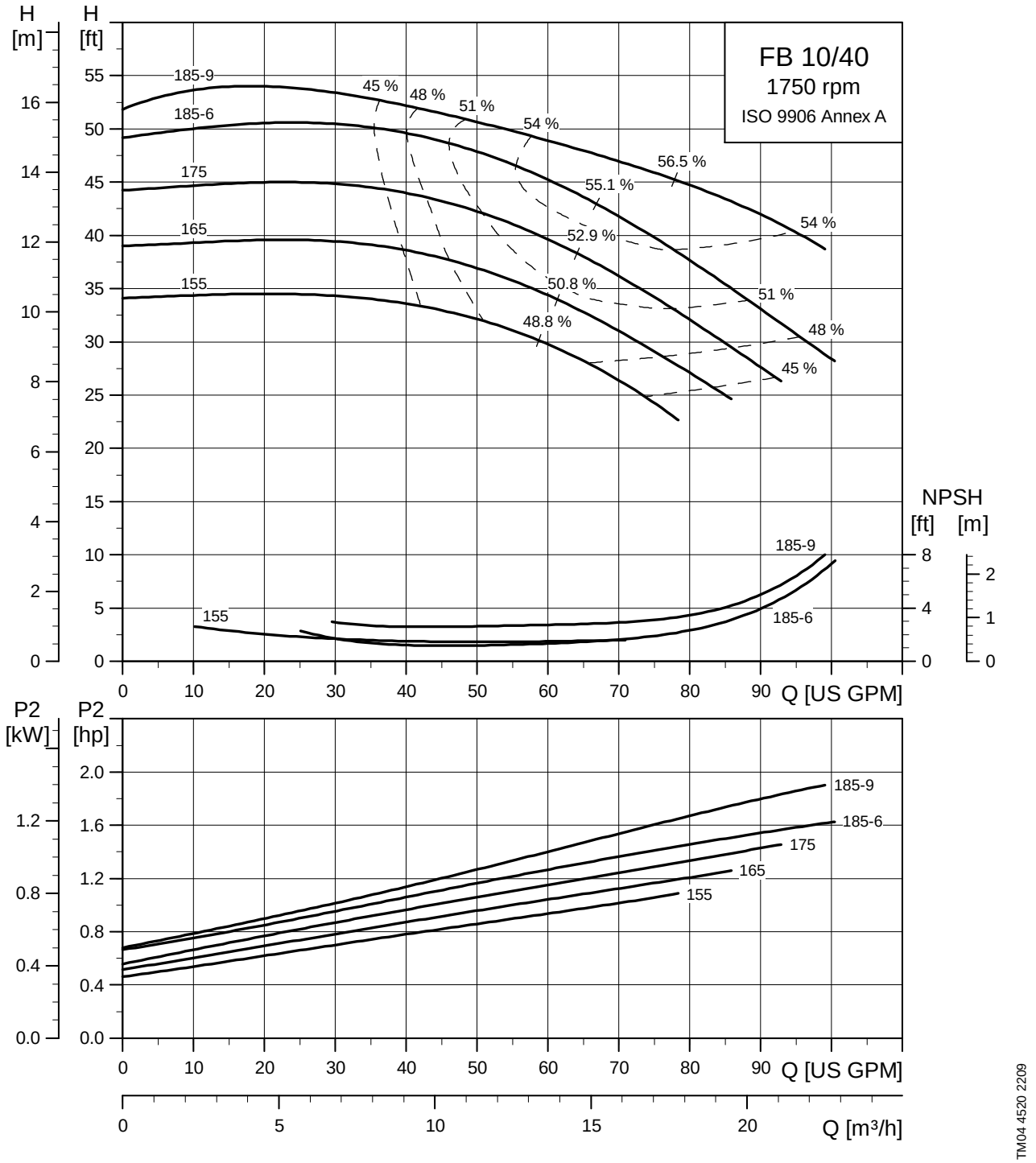
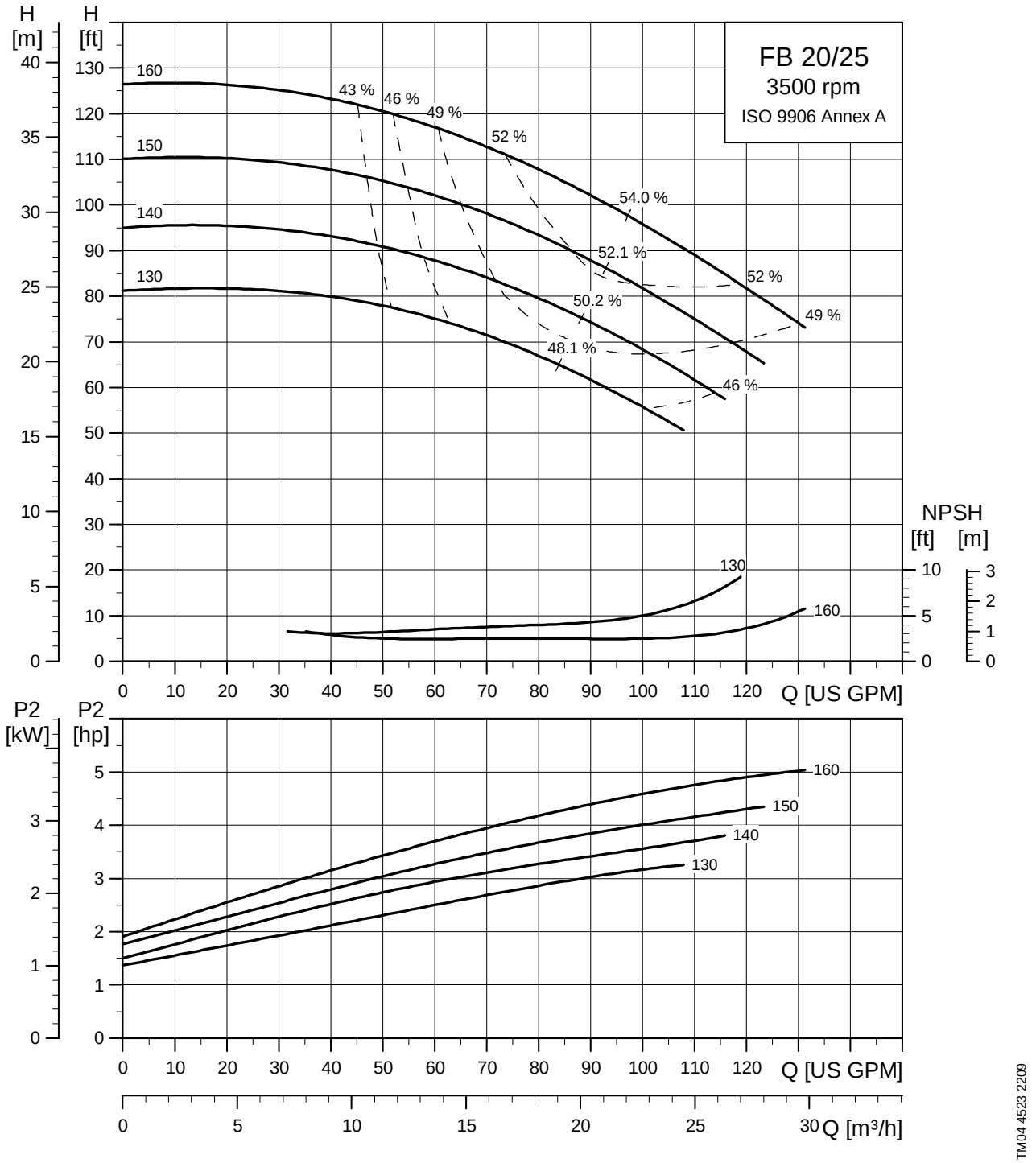
Performance curves

FB 10/40, 1 1/2” x 1 1/2”, 4-pole

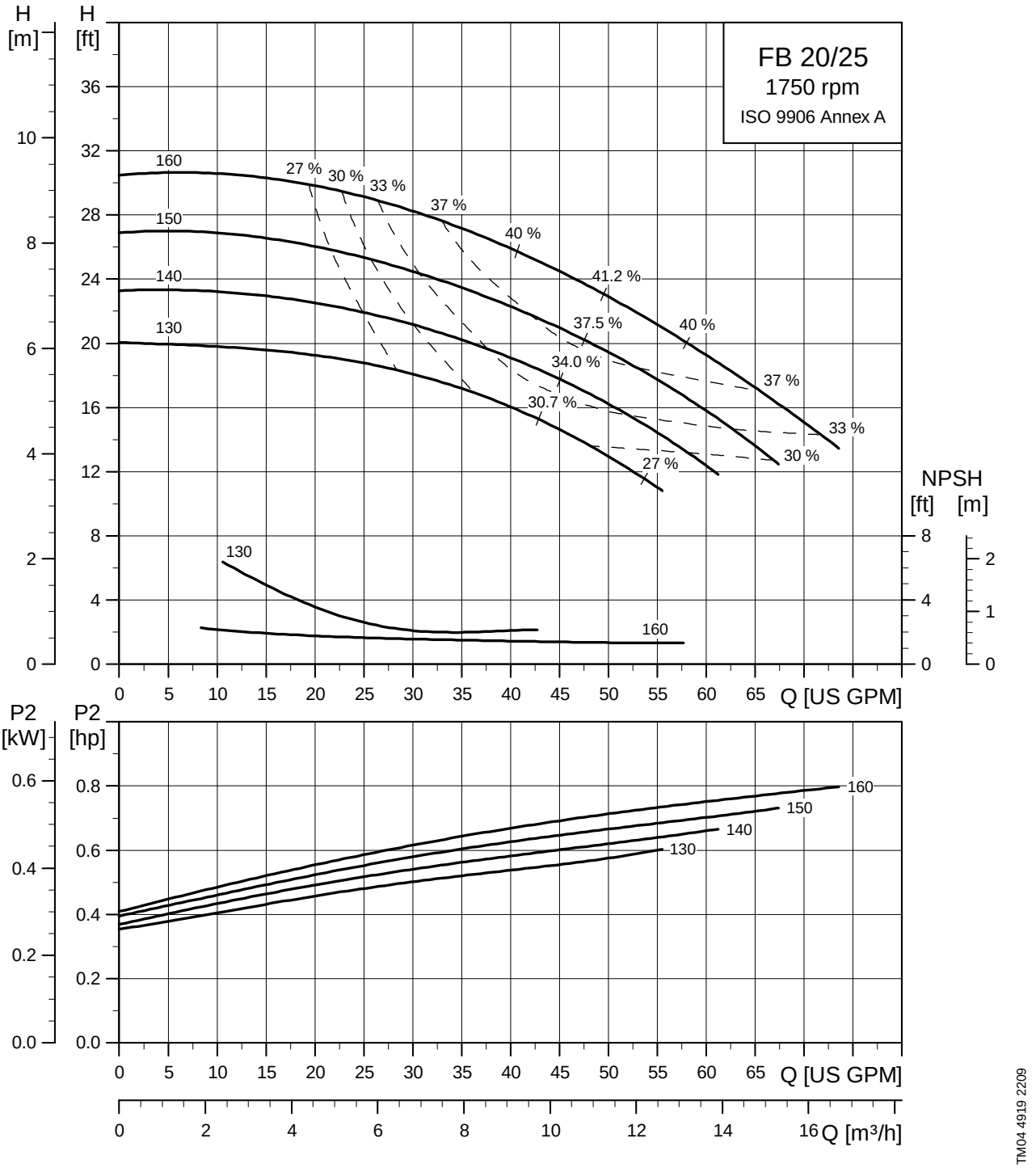


FB 20/25, 1 1/2” x 1 1/2”, 2-pole



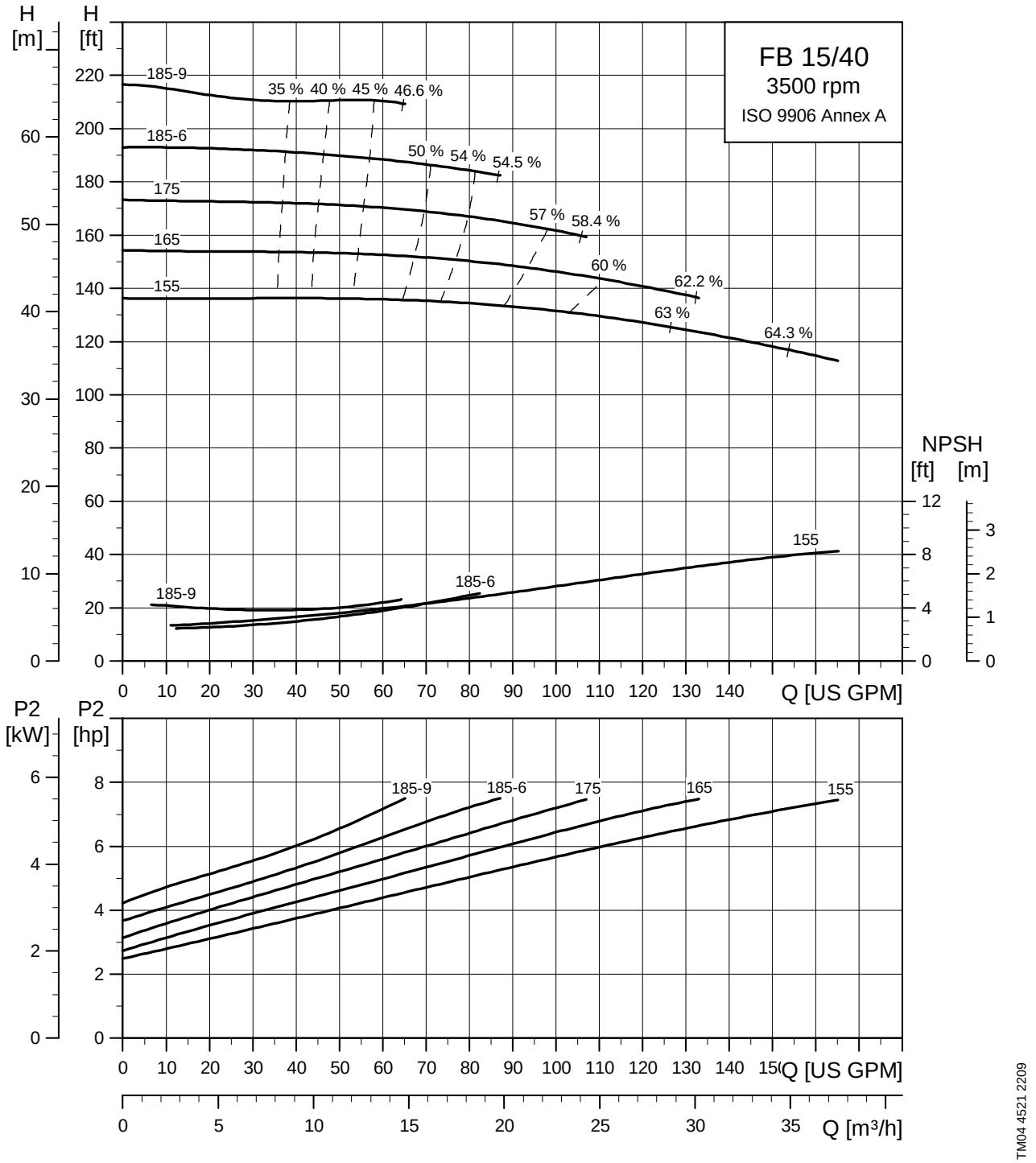
Performance curves

FB 20/25, 1 1/2” x 1 1/2”, 4-pole



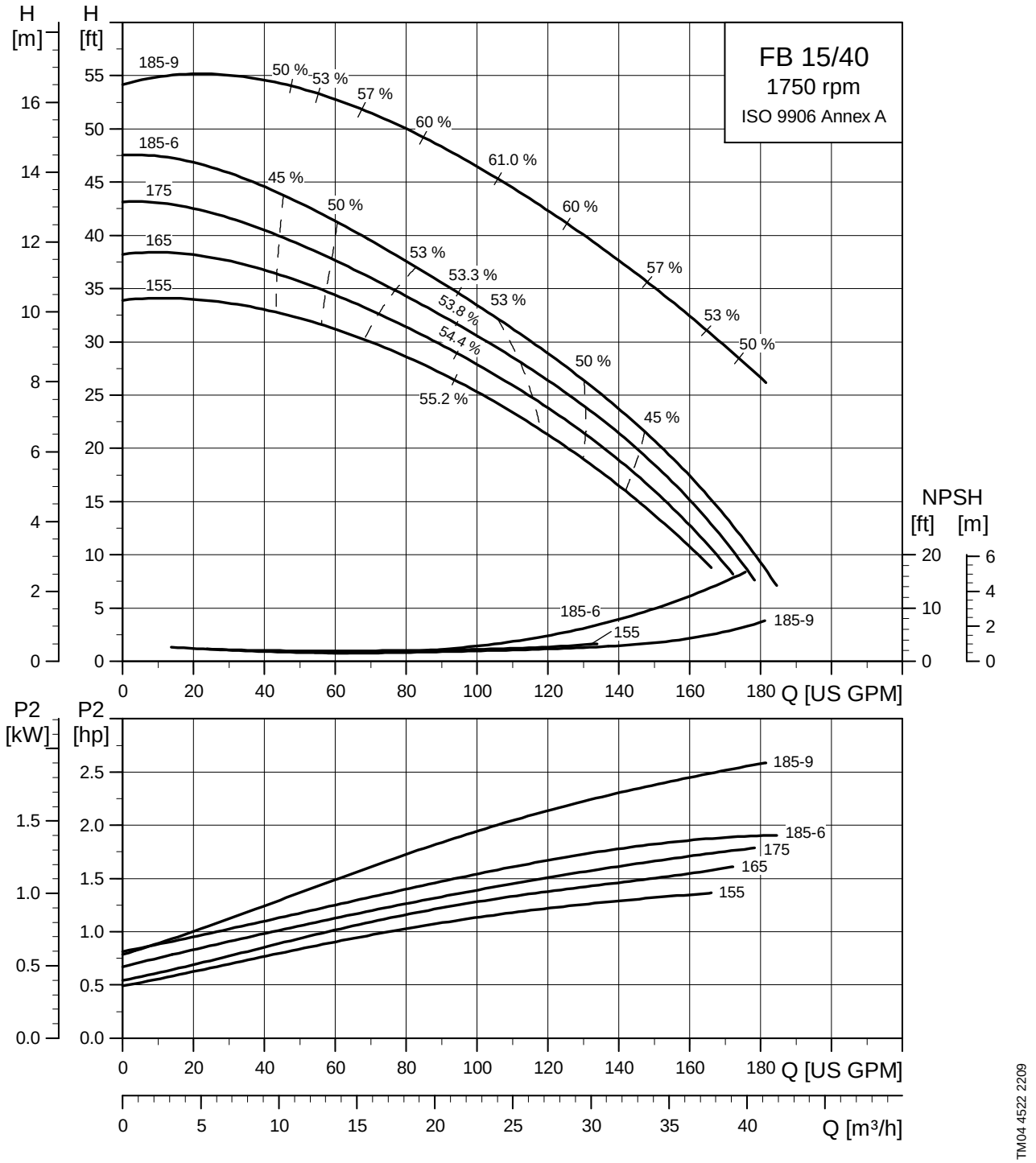
Performance curves

FB 15/40, 2” x 2”, 2-pole



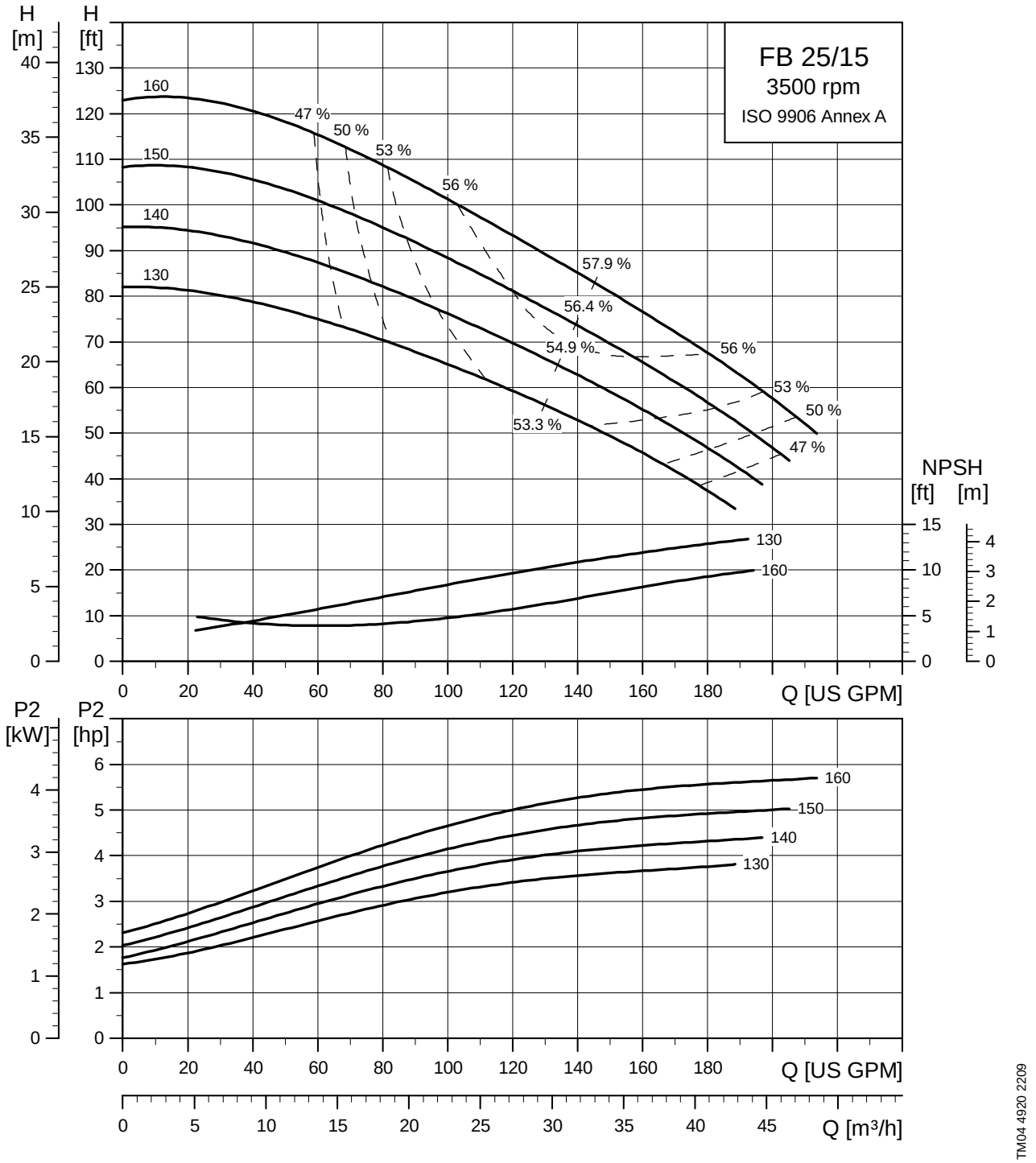
Performance curves

FB 15/40, 2” x 2”, 4-pole



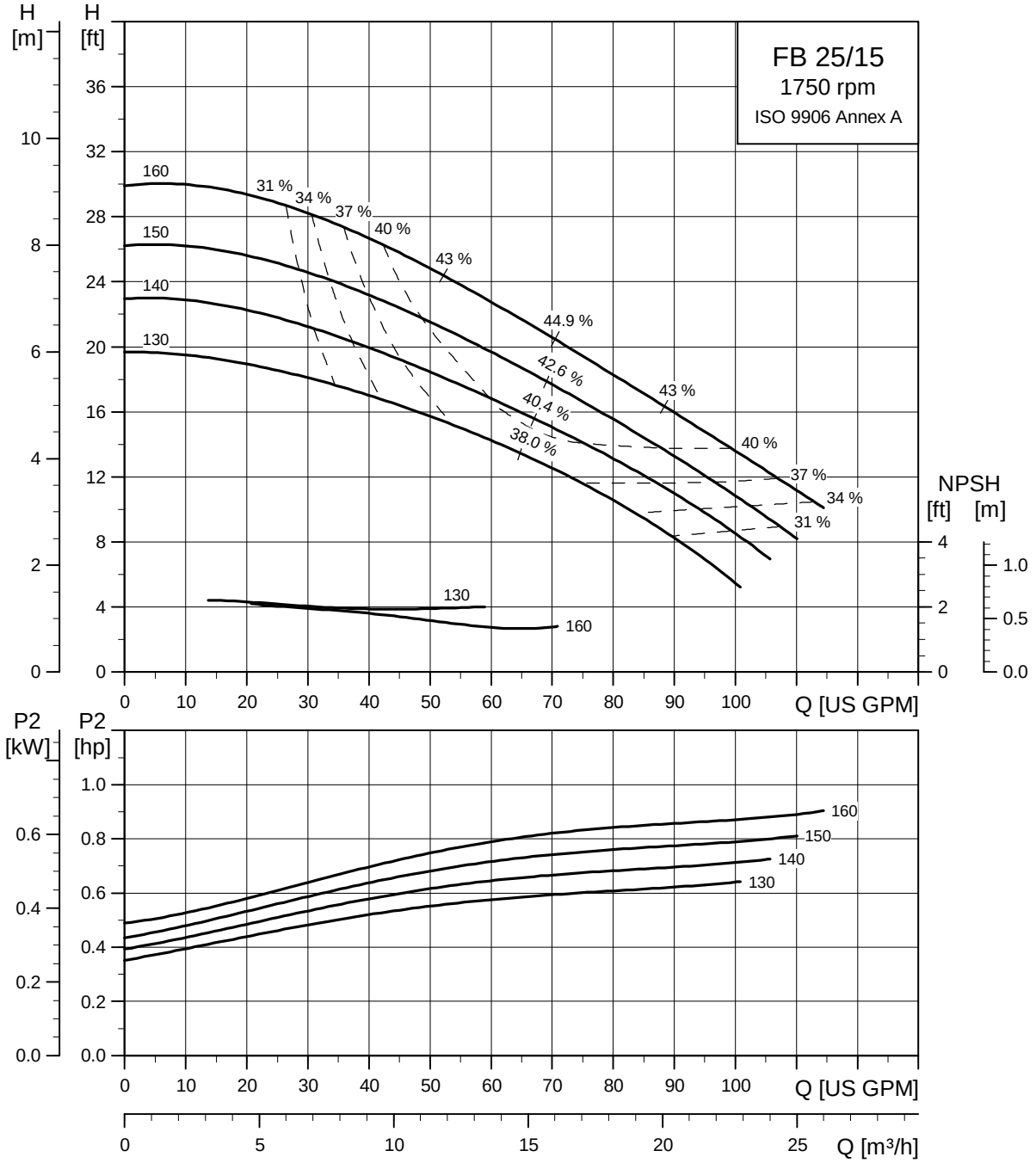
Performance curves

FB 25/15, 2” x 2”, 2-pole



Performance curves

FB 25/15, 2” x 2”, 4-pole



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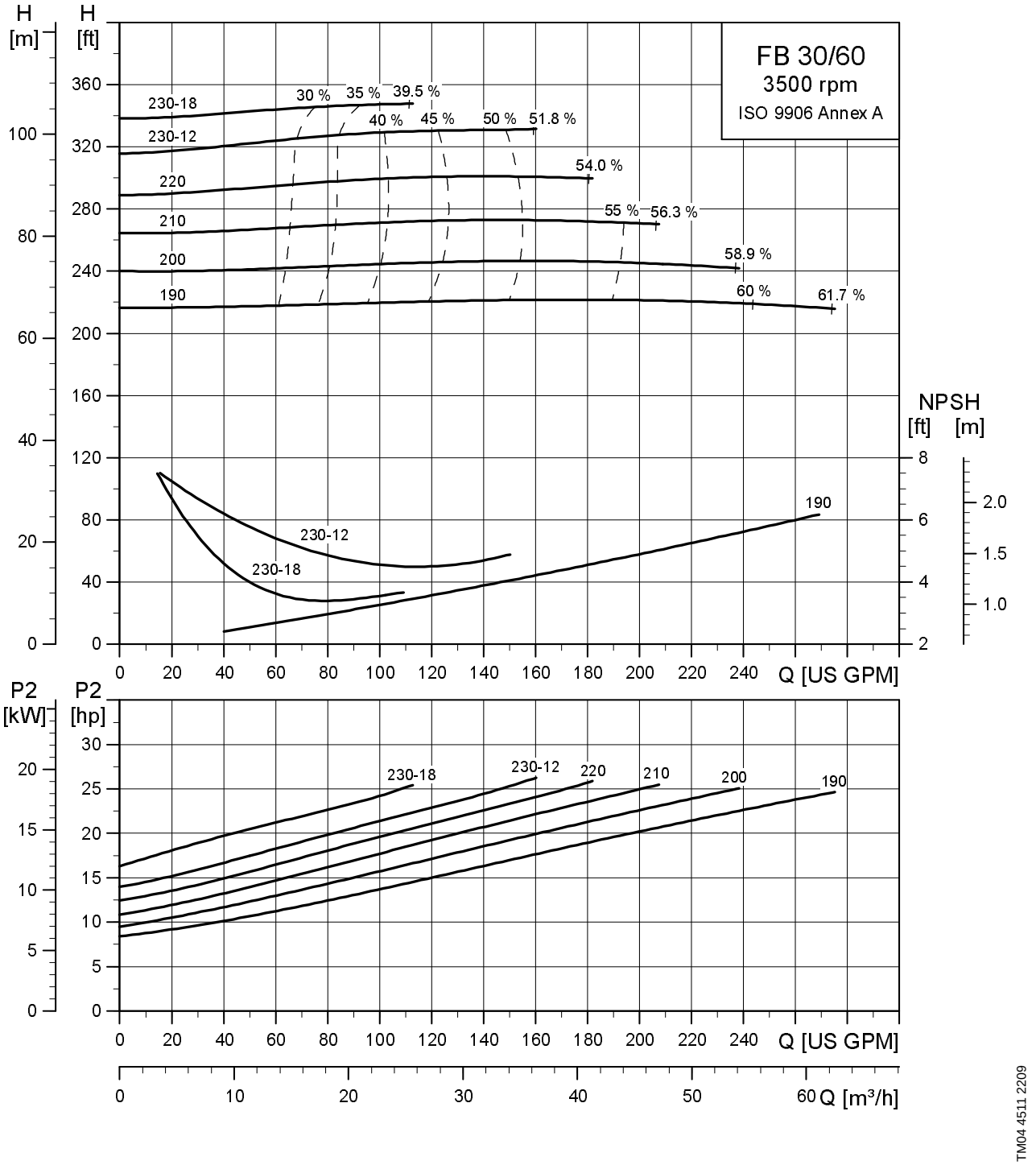
FB 30/60, 2 1/2” x 2 1/2”, 2-pole



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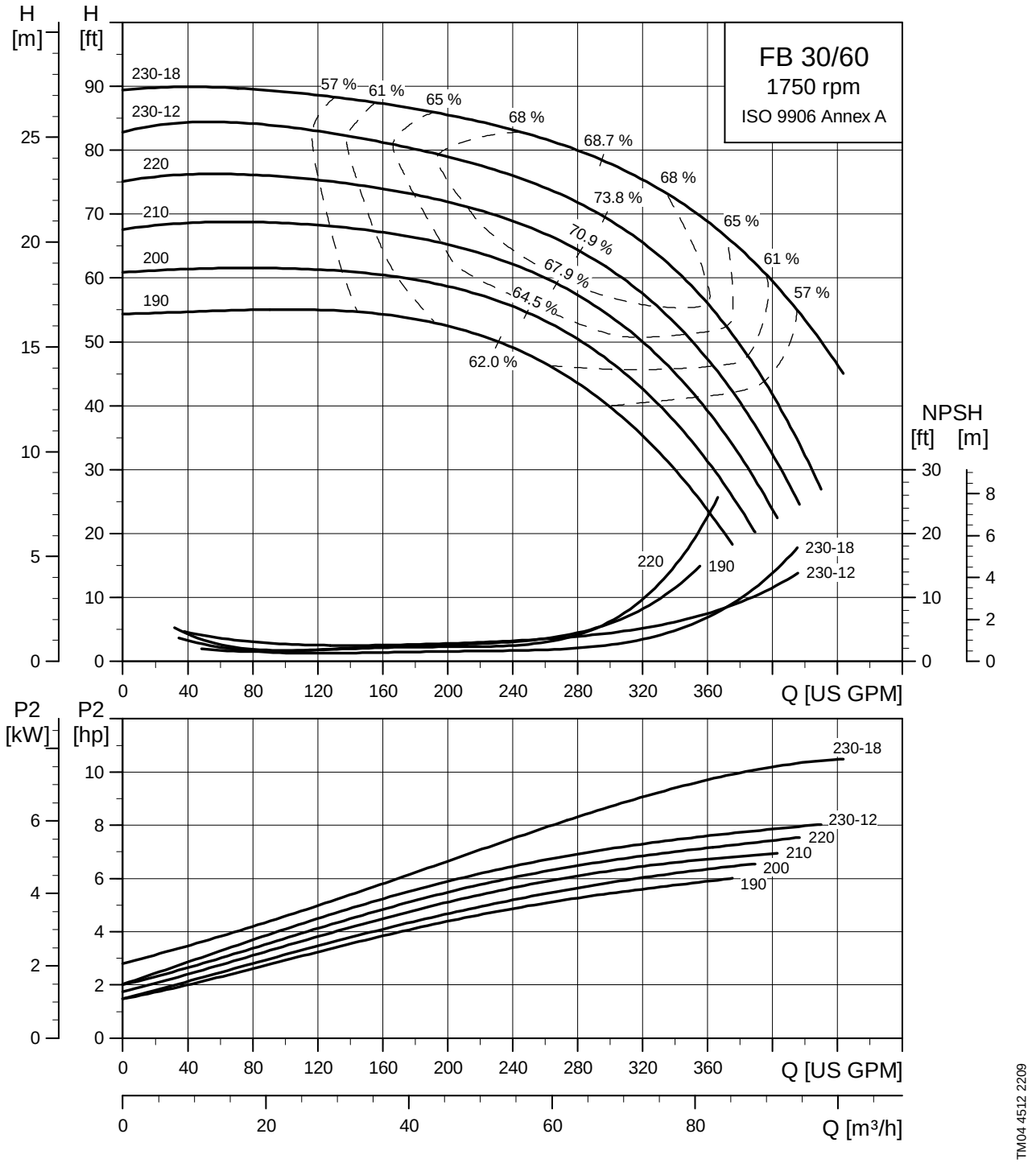
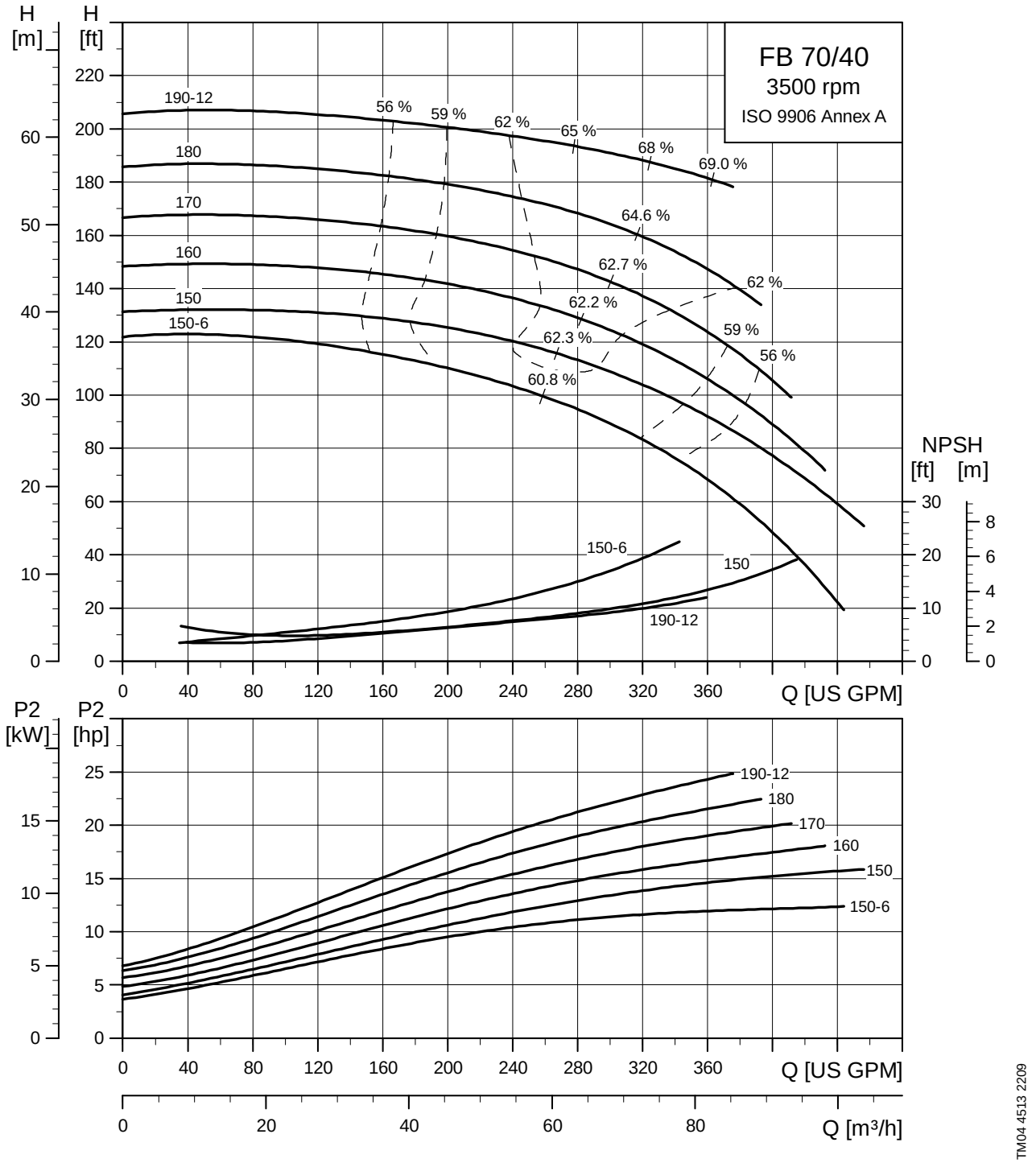
FB 30/60, 2 1/2” x 2 1/2”, 4-pole



FB 70/40, 2 1/2” x 2 1/2”, 2-pole



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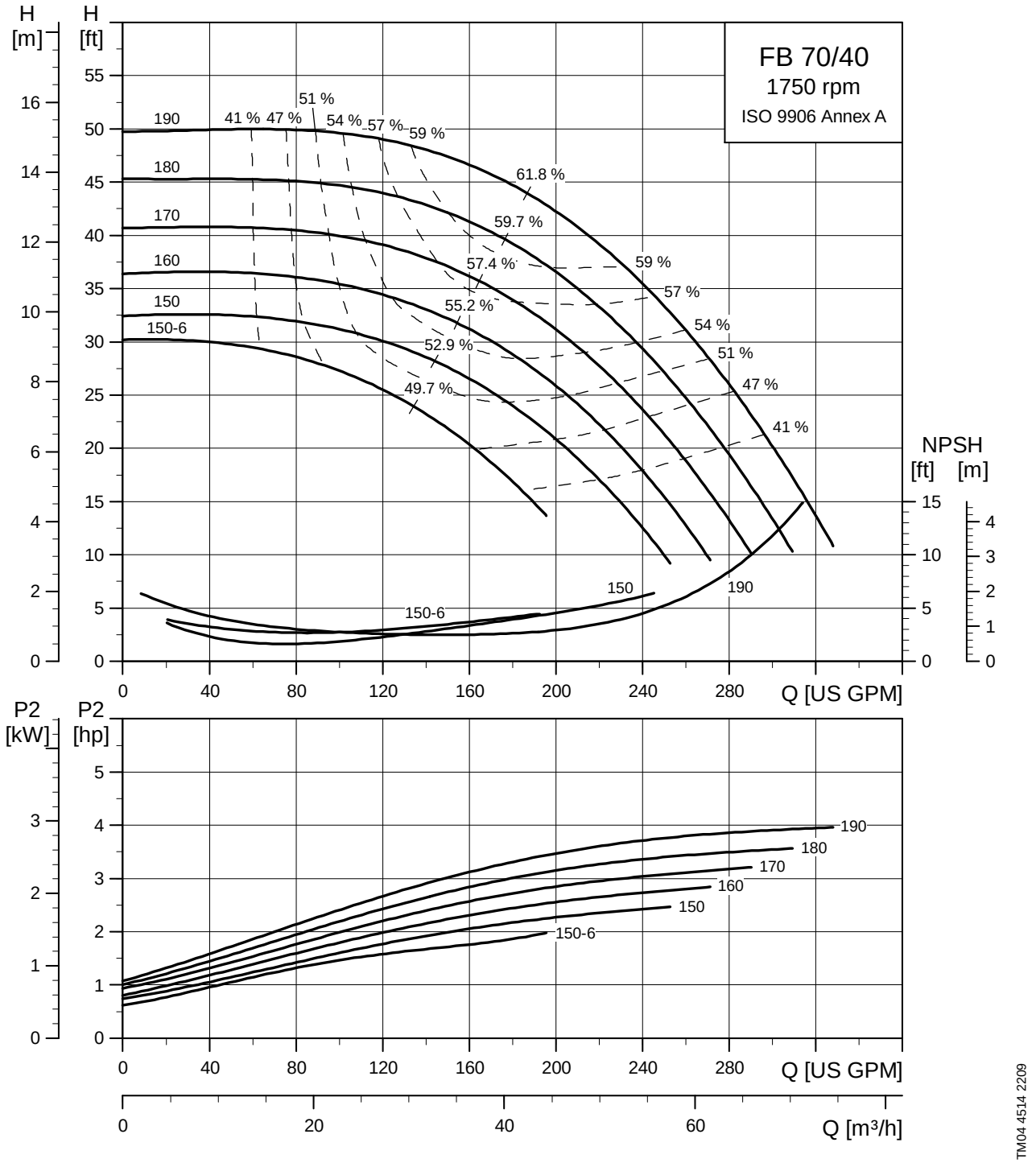
Performance curves

FB 70/40, 2 1/2” x 2 1/2”, 4-pole



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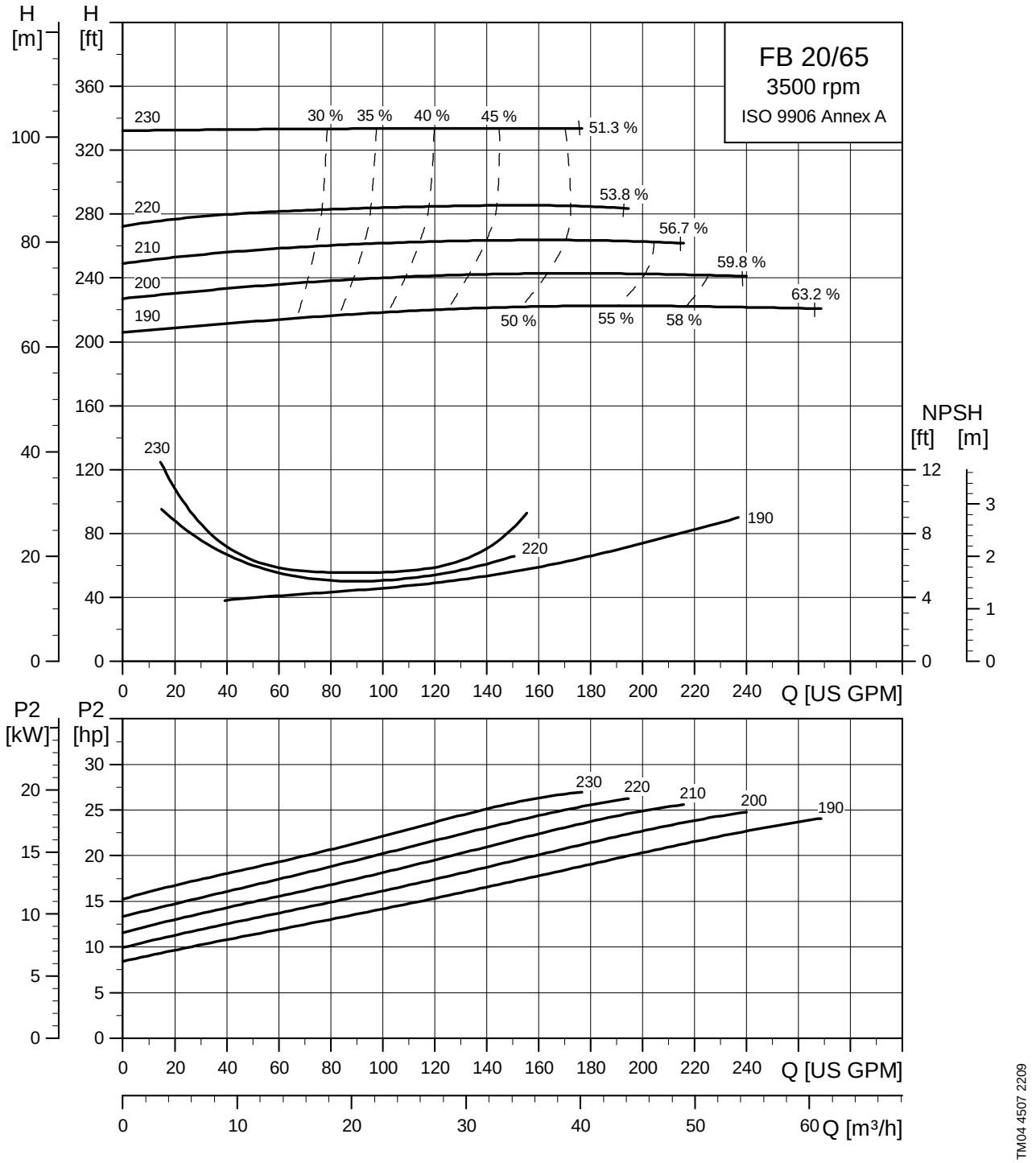
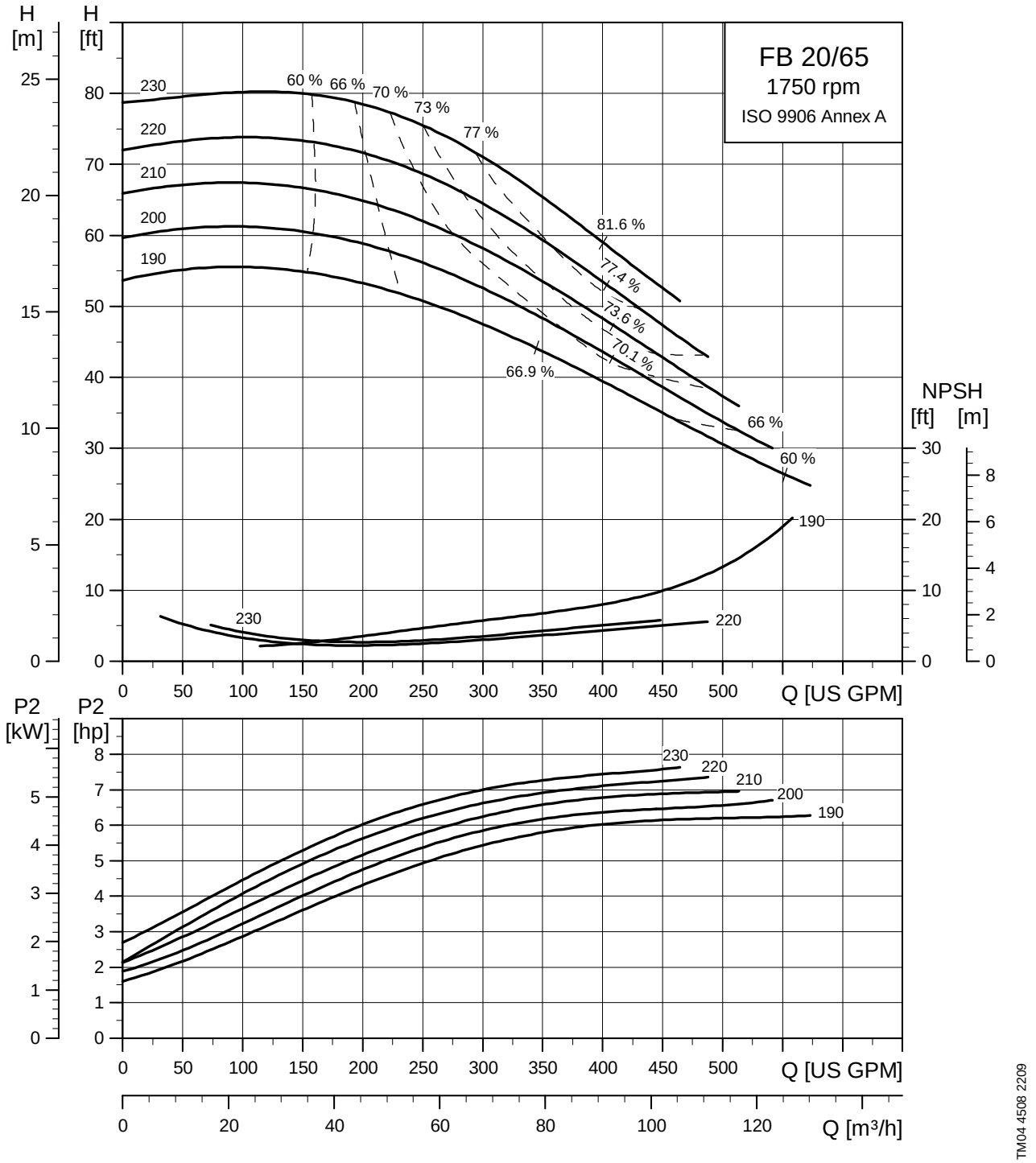
Performance curves

FB 20/65, 3” x 3”, 2-pole



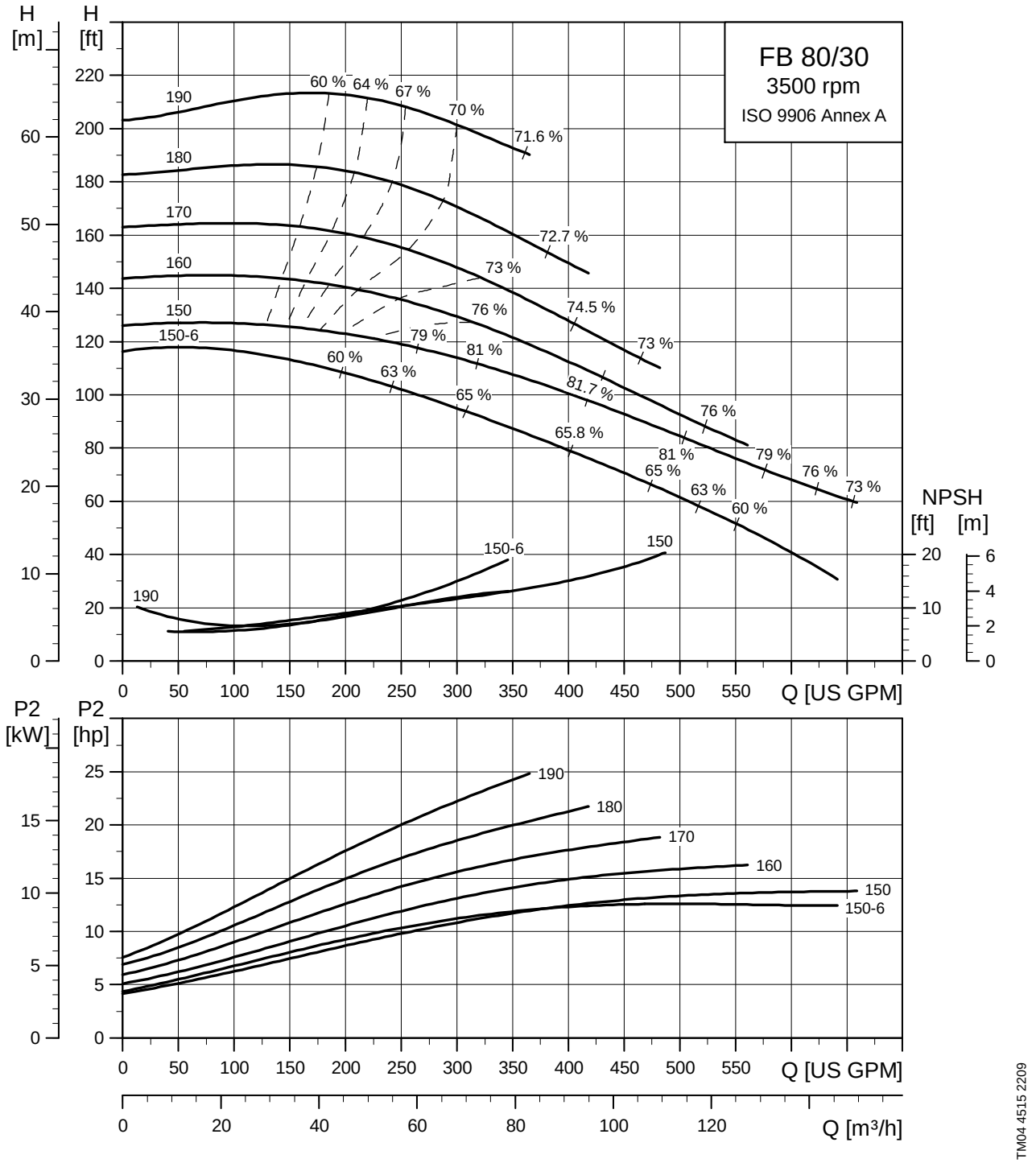
Performance curves

FB 20/65, 3” x 3”, 4-pole

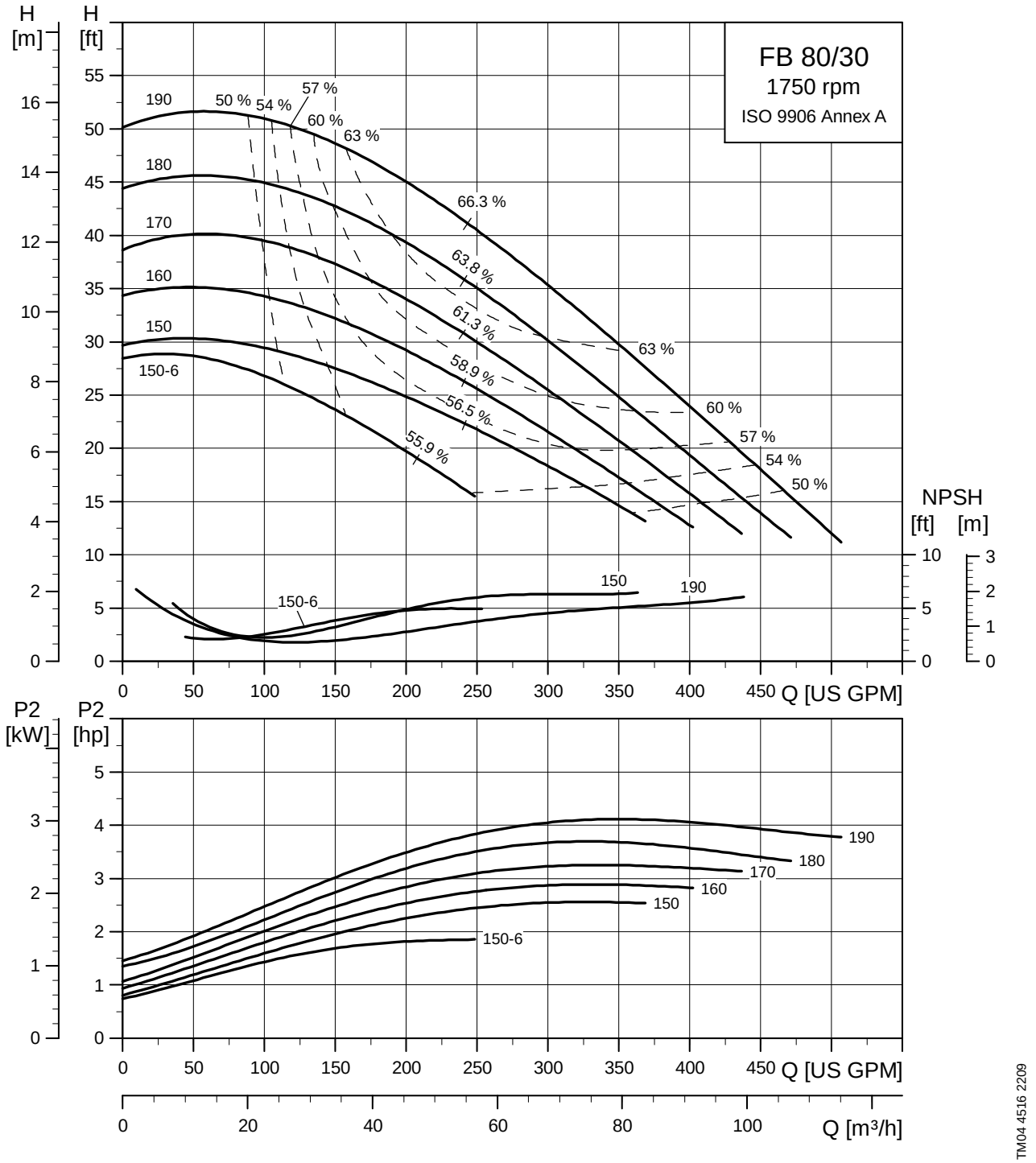


TM04 4508 2209

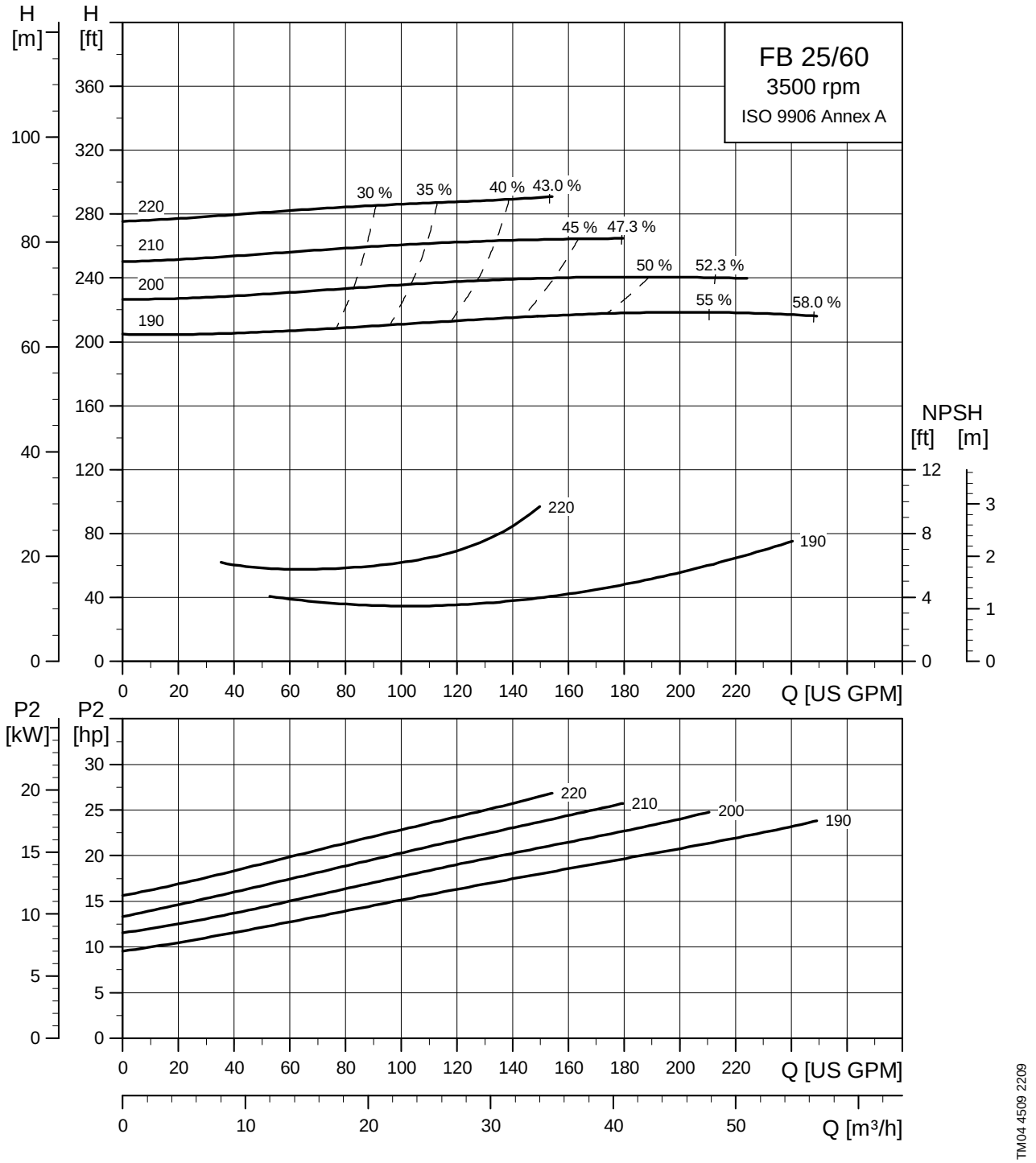
FB 80/30, 3” x 3”, 2-pole



FB 80/30, 3” x 3”, 4-pole

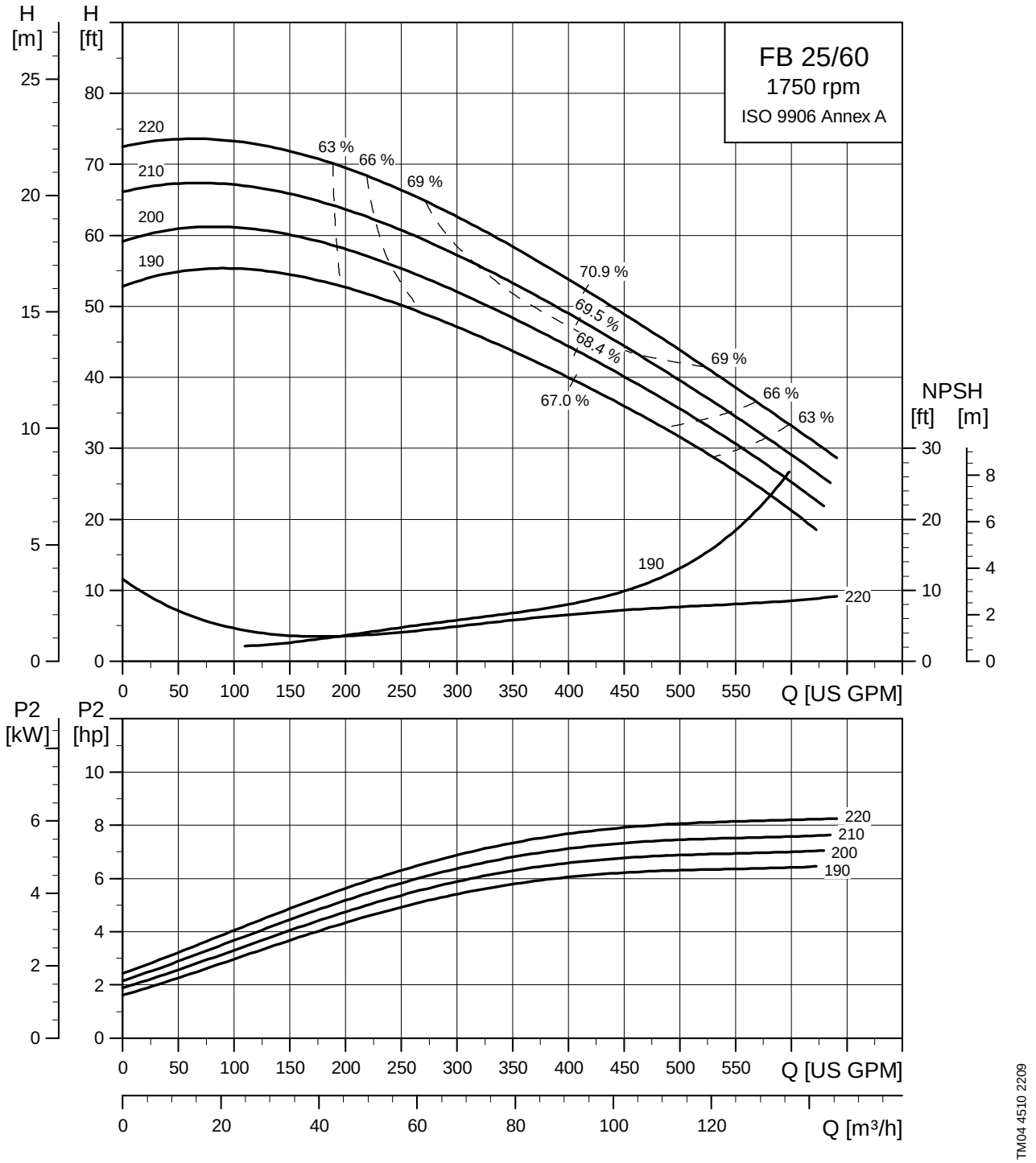


FB 25/60, 4” x 4”, 2-pole



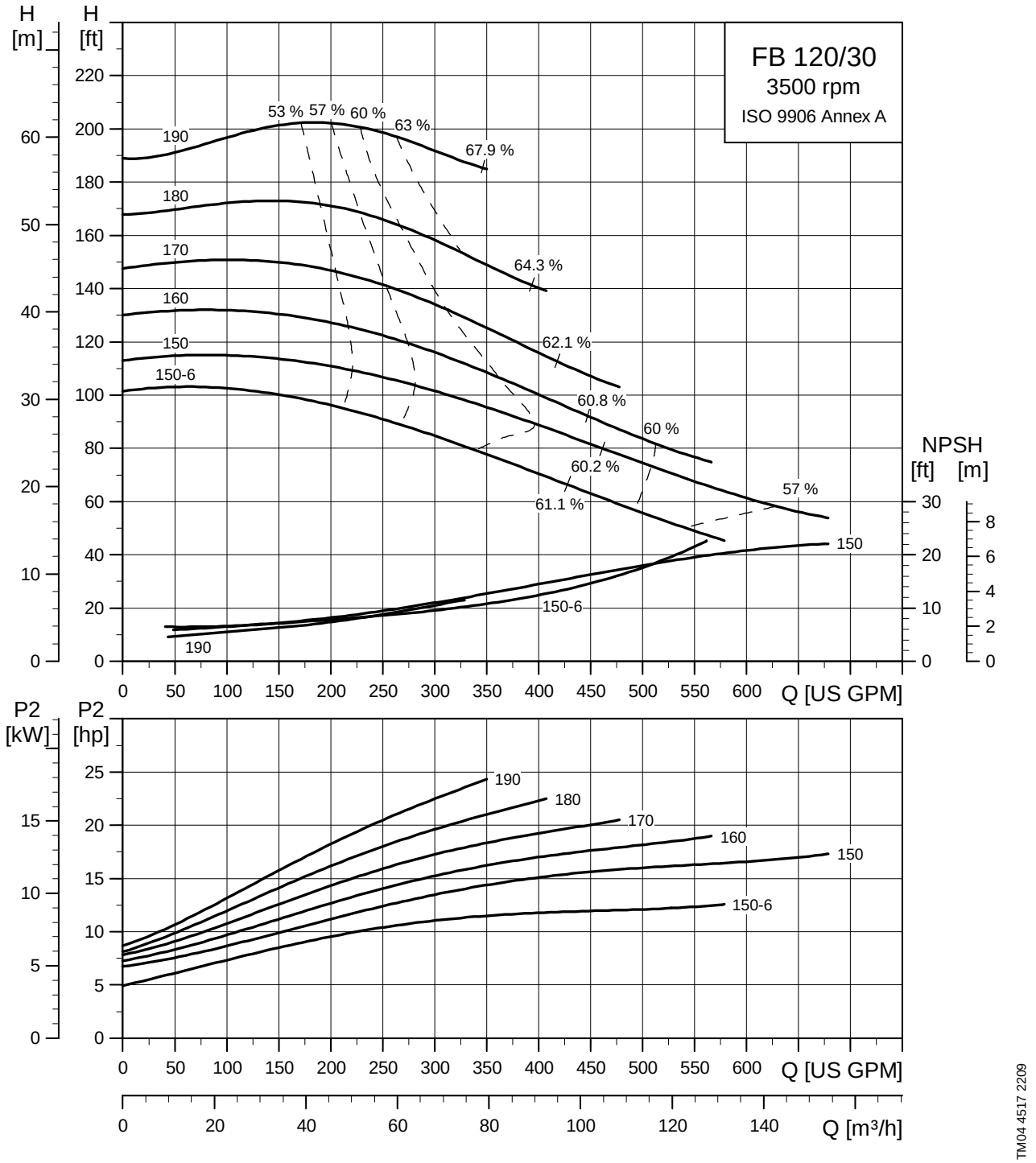
TM04 4509 2209

FB 25/60, 4” x 4”, 4-pole



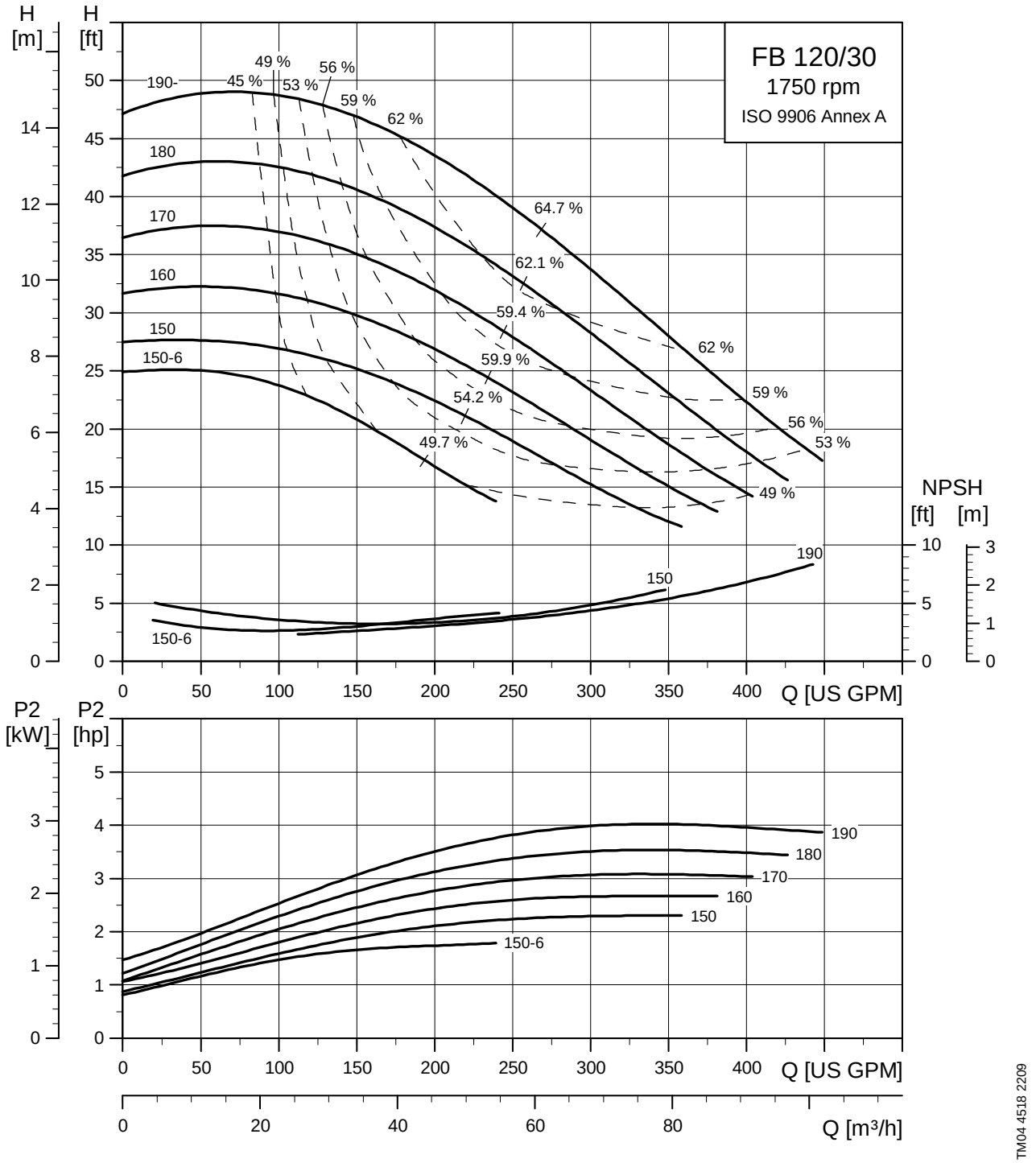
Performance curves

FB 120/30, 4” x 4”, 2-pole



Performance curves

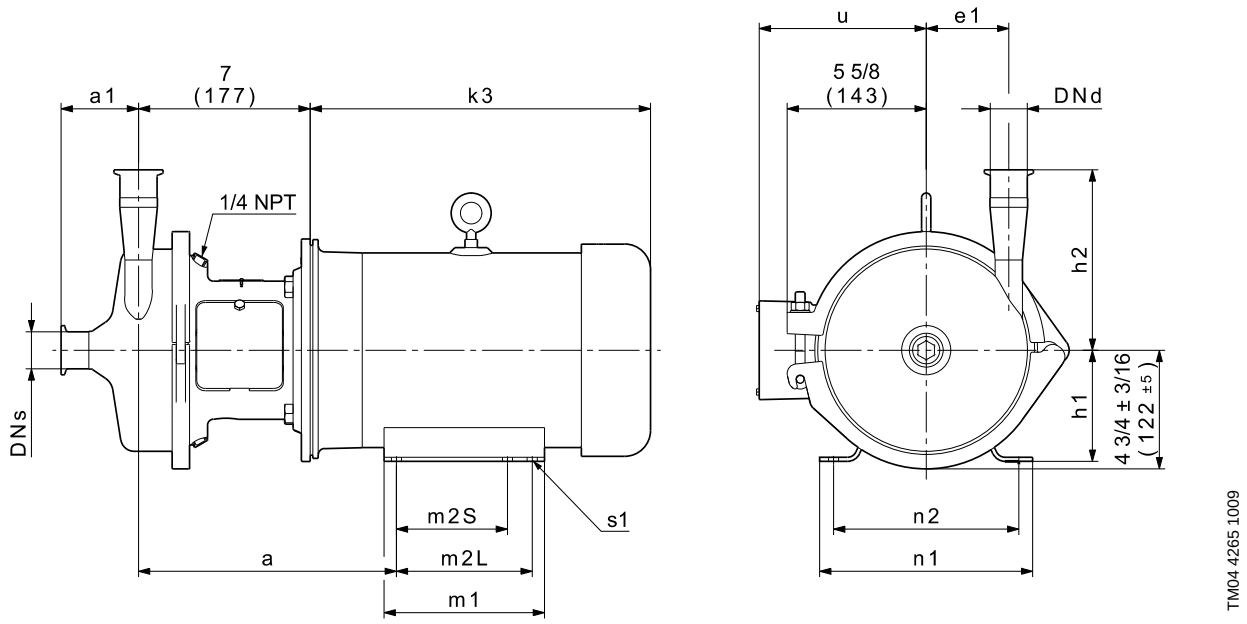
FB 120/30, 4” x 4”, 4-pole



Dimensions

FB pump on foot-mounted motor

Models 10/40, 20/25, 15/40, 25/15



Pump dimensions

P2 [Hp]	No. of motor poles	NEMA frame size	Motor TEFC C-Face (Baldor Premium Efficient Washdown CEWDM) Dimensions [inch (mm)]									
			n1	n2	a	u	k3	m1	m2S	m2L	s1	h1
1.0	4	182TCZ	8 5/8 (219)	7 1/2 (191)	10 1/2 (265)	5 3/4 (146)	12 3/8 (316)	6 1/2 (165)	4 1/2 (114)	5 1/2 (140)	13/32 (10.4)	4 1/2 (114)
1.5	4	182TCZ										
2.0	4	182TCZ										
3.0	2	182TCZ				6 7/8 (175)	13 3/4 (350)					
5.0	2	184TCZ										
7.5	2	213TCZ	9 1/2 (241)	8 1/2 (216)	11 1/4 (287)	8 (205)	16 1/2 (420)	8 (203)	5 1/2 (140)	7 (178)		5 1/4 (133)

Pipe connection dimensions

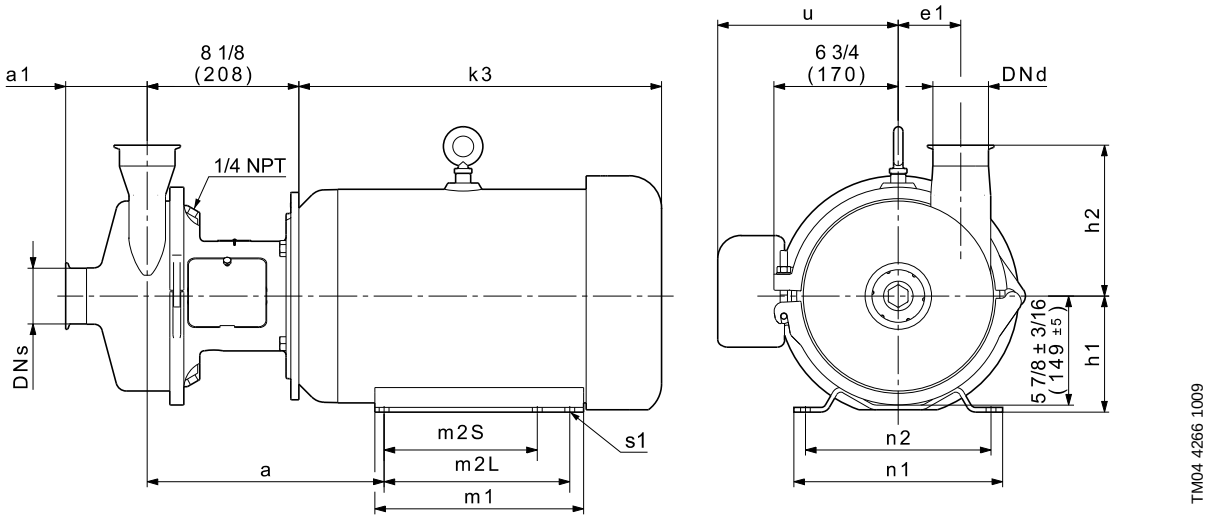
Dimensions depend on housing size (DNs, DNd, a1, h2, e1).

Connections	Pump model	FB 10/40, FB 20/25	FB 15/40, FB 25/15
	OD (DNs/DNd)	1½ / 1½	2 / 2
		Dimensions [inch (mm)]	
Tri-Clamp®	a1	3 1/8 (80)	3 (76)
	e1	3 3/8 (85)	3 (75)
	h2	7 1/4 (186)	7 1/4 (186)
Flange ANSI B16.5 150 lbs	a1	2 7/8 (73)	3 1/8 (80)
	e1	3 3/8 (85)	3 (75)
	h2	6 3/4 (170)	6 3/4 (170)
NPT thread Internal	a1	4 1/8 (106)	4 (102)
	e1	3 3/8 (85)	3 (75)
	h2	8 1/2 (217)	8 1/2 (217)

Dimensions

FB pump on foot-mounted motor

Models 30/60, 70/40, 20/65, 80/30, 25/60, 120/30



Pump dimensions

P2 [Hp]	No. of motor poles	NEMA frame size	Motor TEFC C-Face (Baldor Premium Efficient Washdown CEWDM) Dimensions [inch (mm)]									
			n1	n2	a	u	k3	m1	m2S	m2L	s1	h1
1.0	4	182TCZ	8 5/8 (219)	7 1/2 (191)	11 1/2 (293)	5 3/4 (146)	12 1/4 (312)	6 1/2 (165)	4 1/2 (114)	5 1/2 (140)	13/32 (10.4)	4 1/2 (114)
1.5	4	182TCZ										
2.0	4	182TCZ										
3.0	4	182TCZ				6 7/8 (175)	13 3/4 (350)					
5.0	4	184TCZ					15 1/4 (356)					
7.5	4	213TCZ	9 1/2 (241)	8 1/2 (216)	12 3/8 (315)	8 (205)	16 1/2 (420)	8 (203)	5 1/2 (140)	7 (178)		5 1/4 (133)
10	2	215TCZ										
15	2	215TCZ					16 (457)					
20	2	256TCZ	11 1/4 (286)	10 (254)	12 7/8 (327)	9.75 (247)	19 1/2 (495)	11 1/4 (286)	8 1/4 (210)	10 (254)	17/32 (13.5)	6 1/4 (159)
25	2	284TSCZ	12 3/4 (324)	11 (279)	13 (330)	12 5/16 (313)	21.5 (546)	12 13/16 (326)	9 1/2 (241)	11 (279)		7(178)

Pipe connection dimensions

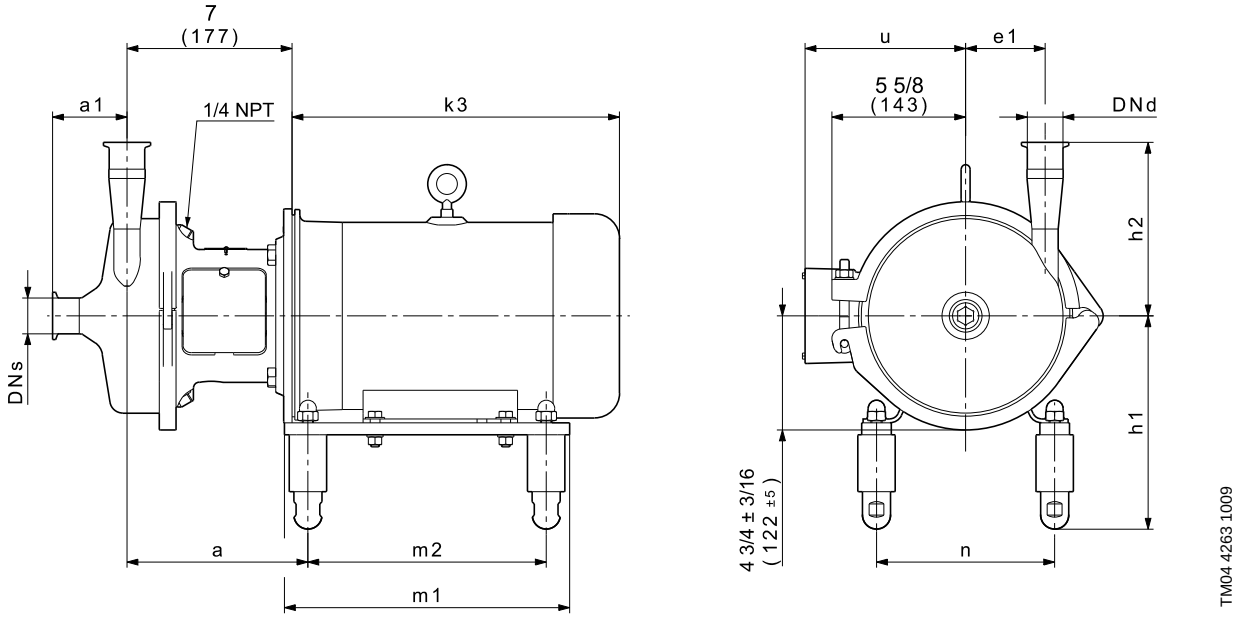
Dimensions depend on housing size (DNs, DNd, a1, h2, e1).

Connections	Pump model	FB 30/60, FB 70/40	FB 20/65, FB 80/30	FB 25/60, FB 120/30
	OD (DNs/DNd)	2½ / 2½	3 / 3	4 / 4
		Dimensions [inch (mm)]		
Tri-Clamp®	a1	4 3/8 (112)	4 3/8 (112)	4 3/8 (112)
	e1	3 7/8 (98)	3 3/8 (86)	3 3/8 (86)
	h2	8 1/2 (216)	8 1/8 (207)	8 1/8 (206)
Flange ANSI B16.5 150 lbs	a1	4 1/2 (116)	4 1/2 (116)	4 1/2 (116)
	e1	3 7/8 (98)	3 3/8 (86)	3 3/8 (86)
	h2	7 7/8 (200)	7 7/8 (200)	7 7/8 (200)
NPT thread, internal	a1	5 3/8 (138)	5 3/8 (138)	5 3/8 (138)
	e1	3 7/8 (98)	3 3/8 (86)	3 3/8 (86)
	h2	9 3/4 (247)	9 3/8 (238)	9 3/8 (238)

Dimensions

FB pump with feet and support bars

Models 10/40, 20/25, 15/40, 25/15



Pump dimensions

P2 [Hp]	No. of motor poles	NEMA frame size	Motor TEFC C-Face (Baldor Premium Efficient Washdown CEWDM) Dimensions [inch (mm)]						
			n	a	u	k3	m1	m2	h1
1.0	4	182TCZ	7 1/2 (191)	7 1/2 (191)	5 3/4 (146)	12 3/8 (316)	12 (305)	10 (254)	8 7/8 (227) [1]
1.5	4	182TCZ							
2.0	4	182TCZ							
3.0	2	182TCZ			6 7/8 (175)	13 3/4 (350)			
5.0	2	182TCZ							
7.5	2	213TCZ	8 1/2 (216)	7 3/4 (198)	8 (205)	16 1/2 (420)	14 (356)	12 (305)	9 5/8 (246) [1]

[1] Adjustable feet: +9/16, –3/8 (+15, –10)

Pipe connection dimensions

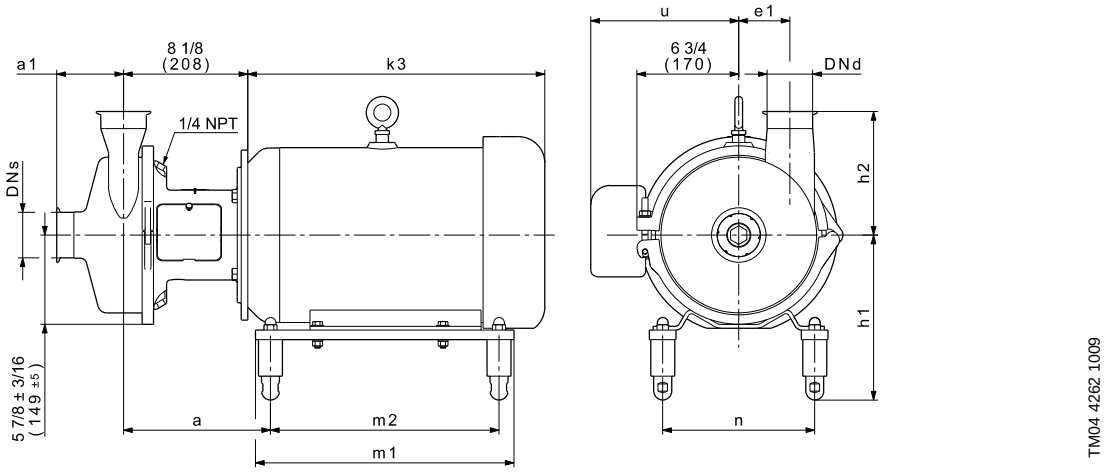
Dimensions depend on housing size (DNs, DNd, a1, h2, e1).

Connections	Pump model	FB 10/40, FB 20/25	FB 15/40, FB 25/15
	OD (DNs/DNd)	1½ / 1½	2 / 2
		Dimensions [inch (mm)]	
Tri-Clamp®	a1	3 1/8 (80)	3 (76)
	e1	3 3/8 (85)	3 (75)
	h2	7 1/4 (186)	7 1/4 (186)
Flange ANSI B16.5 150 lbs	a1	2 7/8 (73)	3 1/8 (80)
	e1	3 3/8 (85)	3 (75)
	h2	6 3/4 (170)	6 3/4 (170)
NPT thread, internal	a1	4 1/8 (106)	4 (102)
	e1	3 3/8 (85)	3 (75)
	h2	8 1/2 (217)	8 1/2 (217)

Dimensions

FB pump with feet and support bars

Models 30/60, 70/40, 20/65, 80/30, 25/60, 120/30



Pump dimensions

P2 [Hp]	No. of motor poles	NEMA frame size	Motor TEFC C-Face (Baldor Premium Efficient Washdown CEWDM) Dimensions [inch (mm)]						
			n	a	u	k3	m1	m2	h1
1.0	4	182TCZ	7 1/2 (191)	4 1/2 (115)	5 3/4 (146)	12 1/4 (312)	16 (406)	14 (356)	9 3/8 (240) [1]
1.5	4	182TCZ							
2.0	4	182TCZ							
3.0	4	182TCZ			6 7/8 (175)	13 3/4 (350)			
5.0	4	184TCZ				15 1/4 (356)			
7.5	4	213TCZ	8 1/2 (216)	8 7/8 (225)	8 (205)	16 1/2 (420)	14 (356)	12 (305)	9 3/4 (246) [1]
10	2	215TCZ							
15	2	215TCZ				16 (457)			
20	2	256TCZ	10 (254)	9 7/8 (251)	9 3/4 (247)	19 1/2 (495)	17 (432)	15 (381)	10 7/8 (274) [1]
25	2	284TSCZ	11 (279)	9 (229)	12 5/16 (313)	21.5 (546)	19 (483)	17 (432)	11 5/8 (294) [1]

[1] Adjustable feet: +9/16, –3/8 (+15, –10)

Pipe connection dimensions

Dimensions depend on housing size (DNs, DNd, a1, h2, e1).

Connections	Pump model	FB 30/60, FB 70/40	FB 20/65, FB 80/30	FB 25/60, FB 120/30
	OD (DNs/DNd)	2½ / 2½	3 / 3	4 / 4
		Dimensions [inch (mm)]		
Tri-Clamp®	a1	4 3/8 (112)	4 3/8 (112)	4 3/8 (112)
	e1	3 7/8 (98)	3 3/8 (86)	3 3/8 (86)
	h2	8 1/2 (216)	8 1/8 (207)	8 1/8 (206)
Flange ANSI B16.5 150 lbs	a1	4 1/2 (116)	4 1/2 (116)	4 1/2 (116)
	e1	3 7/8 (98)	3 3/8 (86)	3 3/8 (86)
	h2	7 7/8 (200)	7 7/8 (200)	7 7/8 (200)
NPT thread, internal	a1	5 3/8 (138)	5 3/8 (138)	5 3/8 (138)
	e1	3 7/8 (98)	3 3/8 (86)	3 3/8 (86)
	h2	9 3/4 (247)	9 3/8 (238)	9 3/8 (238)

BE > THINK > INNOVATE >

Being responsible is our foundation
Thinking ahead makes it possible
Innovation is the essence

L-FB-PG-001 0710
Repl. 10/09 **US**
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