

60 Hz



6Z6 Series

6" Submersible Pumps and Electric Pumps
6Z612, 6Z616, 6Z622, 6Z631, 6Z646 and 6Z660

ErP 2009/125/EC

Directive 2009/125/EC of the European Union

The **Directive 2005/32/EC** on energy-using products (**EuP**) and the subsequent **Directive 2009/125/EC** on energy-related products (**ErP**) established the ecodesign requirements for products to reduce their energy consumption and consequently their environmental impact.

These requirements apply to products placed and used in the European Economic Area (European Union plus Iceland, Liechtenstein and Norway) as a stand-alone unit or as integrated parts in other products.

The following tables show the Regulations that define the requirements applicable to Lowara products.

- Some types of **pump**, used for pumping clean water:

Regulations	From	Target
(EU) N. 547/2012 and subsequent updates	1 January 2015	MEI $\geq 0,4$

- Circulators** with a rated hydraulic output power of between 1 and 2500 W, designed for use in heating systems or in secondary circuits of cooling distribution systems:

Regulations	From	Target
(EC) N. 641/2009 and subsequent updates	1 August 2015	EEI $< 0,23$

- Three-phase motors** with frequency 50 or 60 or 50/60 Hz and voltages between 50 and 1000 V (S1 and D.O.L.):

Regulations	From	Target
(EU) 2019/1781 and subsequent updates	1 July 2023	IE2 : motors with a rated output $\geq 0,12$ and $< 0,749$ kW IE3 : motors with a rated output $\geq 0,75$ and $< 74,9$ kW IE4 : motors with a rated output ≥ 75 and < 200 kW IE3 : motors with a rated output ≥ 201 and < 1000 kW

- Single-phase motors** with frequency 50 or 60 or 50/60 Hz and voltages between 50 and 1000 V (S1 and D.O.L.):

Regulations	From	Target
(EU) 2019/1781 and 2021/341	1 July 2023	IE2 : motors with a rated output $\geq 0,12$ kW

- Variable speed drives** with three-phase input and rated output power from 0,12 kW up to 1000 kW, rated for operating with motor included in the same regulations:

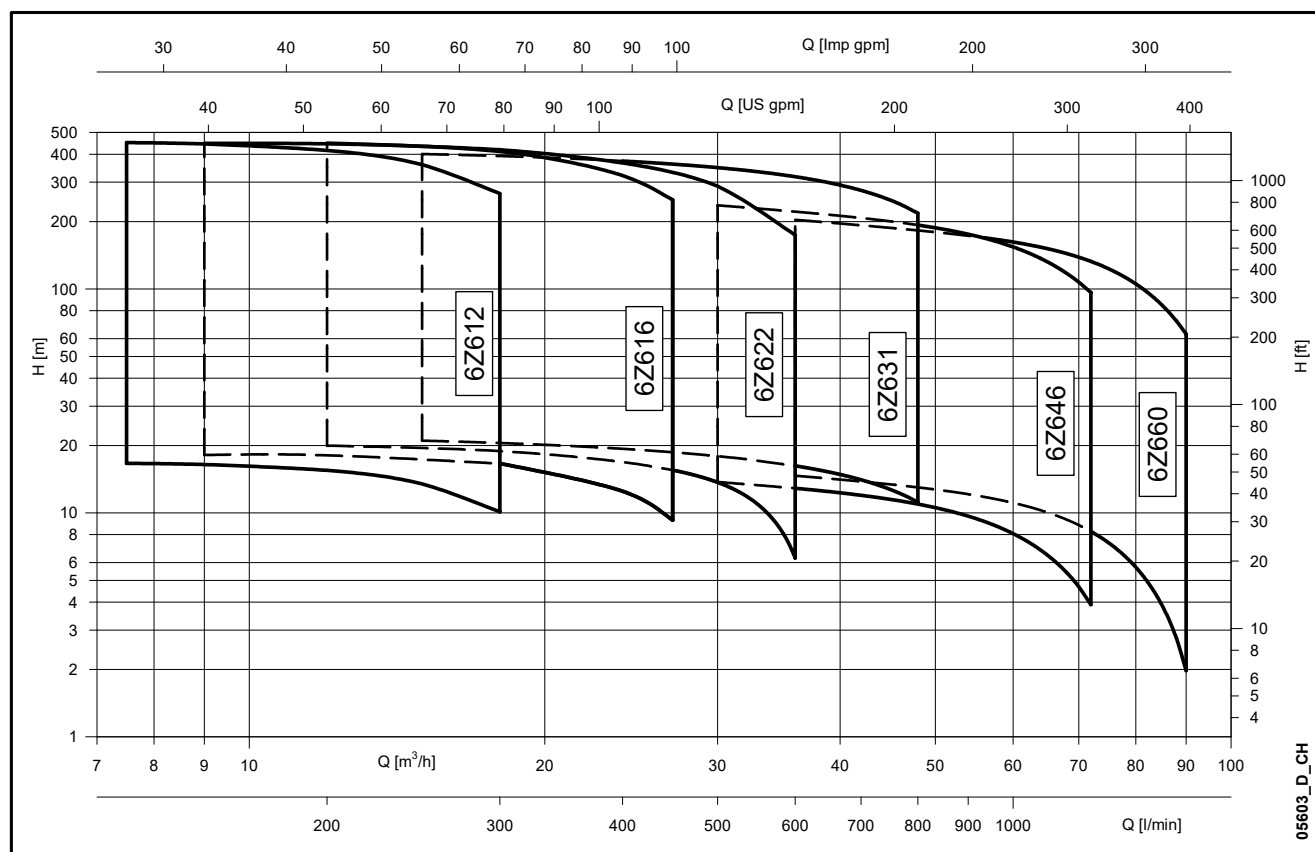
Regulations	From	Target
(EU) 2019/1781 and 2021/341	1 July 2021	IE2

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6Z6 SERIES

HYDRAULIC PERFORMANCE RANGE



6" Submersible Electric Pumps

6Z6 Series



MARKET SECTORS

RESIDENTIAL, AGRICULTURE, INDUSTRY.

APPLICATIONS

- Groundwater supply
- Irrigation
- Groundwater lowering
- Fountains waterworks
- Pressure boosting
- Industrial applications
- Mine dewatering.

SPECIFICATIONS

- **Delivery:** up to 78 m³/h.
- **Head:** up to 460 m.
- **Maximum overall diameter of pump:** 142 mm (one cable guard included).
- **Maximum pump immersion depth:** 150 m with 40S motors. 350 m with L6W motors.
- **Maximum permissible quantity of suspended sand:** 100 g/m³.
- **Delivery port:** Rp 2 1/2" for 6Z612-6Z616-6Z622 versions. Rp 3" for 6Z631-6Z646-6Z660 versions.
- **Construction materials available:** AISI304 stainless steel (6Z6), AISI316 stainless steel (6ZN6).
- **All pumps can operate in the horizontal position.** Ensure that the motor's operating conditions are compatible with this configuration.

CONSTRUCTION CHARACTERISTICS

- **Head and motor support** made of microcast stainless steel.
- **Delivery port** equipped with holes for safety hooks.
- Stainless steel **integrated non-return valve**.
- Stainless steel **impeller** with removable wear ring.
- Stainless steel **shaft** protected by shaft sleeves.
- **Replaceable coupling**.

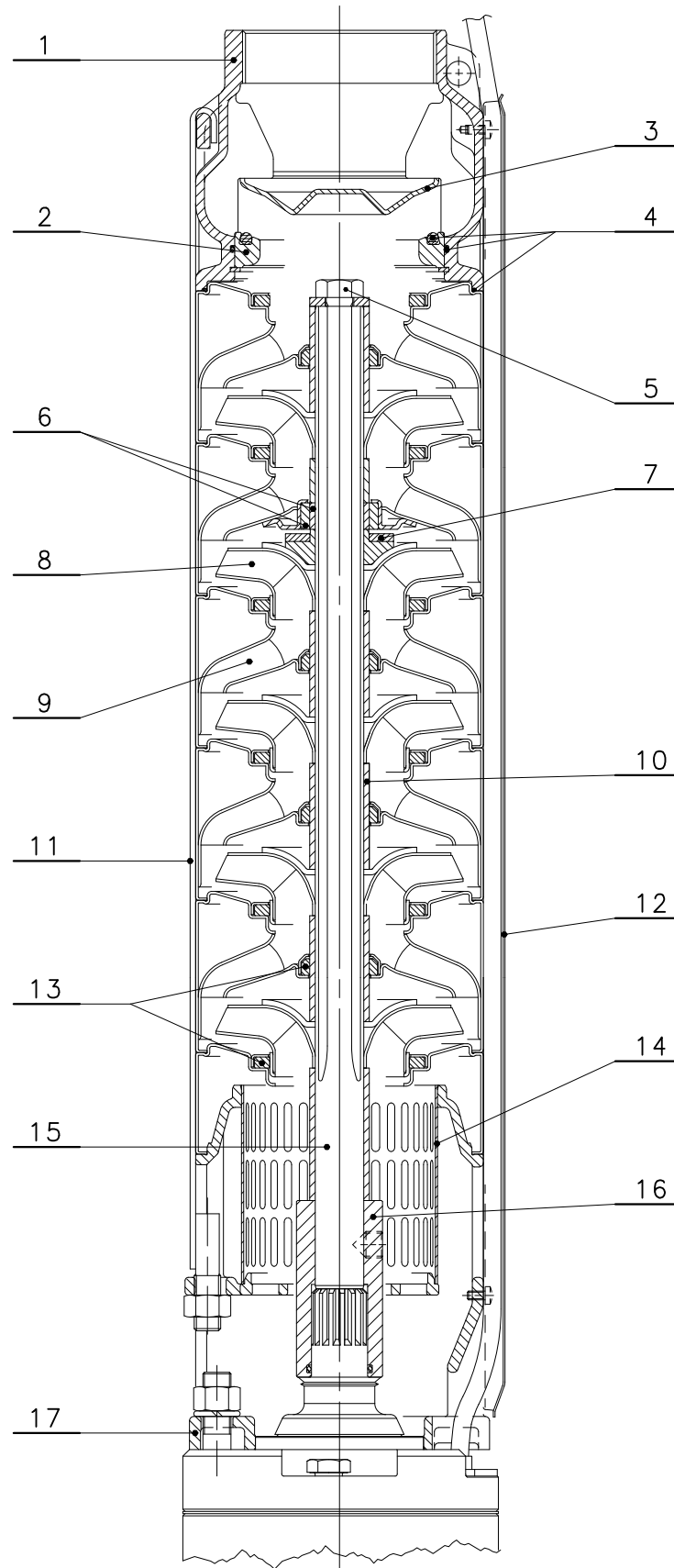
ACCESSORIES

- Coupling flanges.
- Control panels.
- Drop cables.
- Cable joints
- Cooling shrouds.



6Z6 SERIES

PUMP SECTION AND LIST OF MAIN COMPONENTS



05612_B_DS

6Z6 SERIES

TABLE OF MATERIALS

REF. N°	NAME	MATERIAL	REFERENCE STANDARDS	
			EUROPE	USA
1	Discharge head	Stainless steel	EN 10213-4 - GX5CrNi19-10 (1.4308)	ASTM CF-8 (AISI 304 cast)
2	Valve support	Stainless steel	EN 10213-4 - GX5CrNi19-10 (1.4308)	ASTM CF-8 (AISI 304 cast)
3	Valve	Stainless steel	EN 10088-1 - X5CrNi18-10 (1.4301)	AISI 304
4	Elastomers	EPDM		
5	Bolts and screws	Stainless steel	EN 10088-1 - X5CrNi18-10 (1.4301)	AISI 304
6	Shaft sleeve and bushing	Tungsten carbide		
7	Thrust bearing	PTFE+Graphite		
8	Impeller	Stainless steel	EN 10088-1 - X5CrNi18-10 (1.4301)	AISI 304
9	Diffuser	Stainless steel	EN 10088-1 - X5CrNi18-10 (1.4301)	AISI 304
10	Spacer	Stainless steel	EN 10088-1 - X17CrNi16-2 (1.4057)	AISI 431
11	Tie rod	Stainless steel	EN 10088-1 - X5CrNi18-10 (1.4301)	AISI 304
12	Cable guard	Stainless steel	EN 10088-1 - X5CrNi18-10 (1.4301)	AISI 304
13	Wear rings	Technopolymer PPO		
14	Strainer	Stainless steel	EN 10088-1 - X5CrNi18-10 (1.4301)	AISI 304
15	Shaft	Stainless steel	EN 10088-1 - X17CrNi16-2 (1.4057)	AISI 431
16	Coupling	Stainless steel	EN 10088-1 - X17CrNi16-2 (1.4057)	AISI 431
17	Lower support	Stainless steel	EN 10213-4 - GX5CrNi19-10 (1.4308)	ASTM CF-8 (AISI 304 cast)

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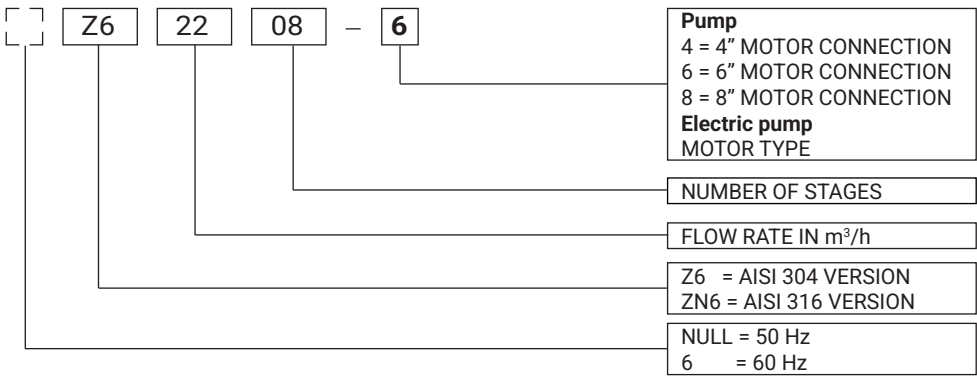
6ZN6 SERIES

TABLE OF MATERIALS

REF. N°	NAME	MATERIAL	REFERENCE STANDARDS	
			EUROPE	USA
1	Discharge head	Stainless steel	EN 10213-4 - GX5CrNiMo19-11-2 (1.4408)	ASTM CF-8M (AISI 316 cast)
2	Valve support	Stainless steel	EN 10213-4 - GX5CrNiMo19-11-2 (1.4408)	ASTM CF-8M (AISI 316 cast)
3	Valve	Stainless steel	EN 10088-1 - X2CrNiMo17-12-2 (1.4404)	AISI 316L
4	Elastomers	EPDM		
5	Bolts and screws	Stainless steel	EN 10088-1 - X5CrNiMo17-12-2 (1.4401)	AISI 316
6	Shaft sleeve and bushing	Tungsten carbide		
7	Thrust bearing	PTFE+Graphite		
8	Impeller	Stainless steel	EN 10088-1 - X2CrNiMo17-12-2 (1.4404)	AISI 316L
9	Diffuser	Stainless steel	EN 10088-1 - X2CrNiMo17-12-2 (1.4404)	AISI 316L
10	Spacer	Duplex stainless steel	EN 10088-1 - X2CrNiN23-4 (1.4362)	UNS S 32304
11	Tie rod	Stainless steel	EN 10088-1 - X2CrNiMo17-12-2 (1.4404)	AISI 316L
12	Cable guard	Stainless steel	EN 10088-1 - X2CrNiMo17-12-2 (1.4404)	AISI 316L
13	Wear rings	Technopolymer PPO		
14	Strainer	Stainless steel	EN 10088-1 - X2CrNiMo17-12-2 (1.4404)	AISI 316L
15	Shaft	Duplex stainless steel	EN 10088-1 - X2CrNiMoN22-5-3 (1.4462)	UNS S 31803
16	Coupling	Duplex stainless steel	EN 10088-1 - X2CrNiN23-4 (1.4362)	UNS S 32304
17	Lower support	Stainless steel	EN 10213-4 - GX5CrNiMo19-11-2 (1.4408)	ASTM CF-8M (AISI 316 cast)

z6-50-316-en_c_tm

6Z6 SERIES
IDENTIFICATION CODE

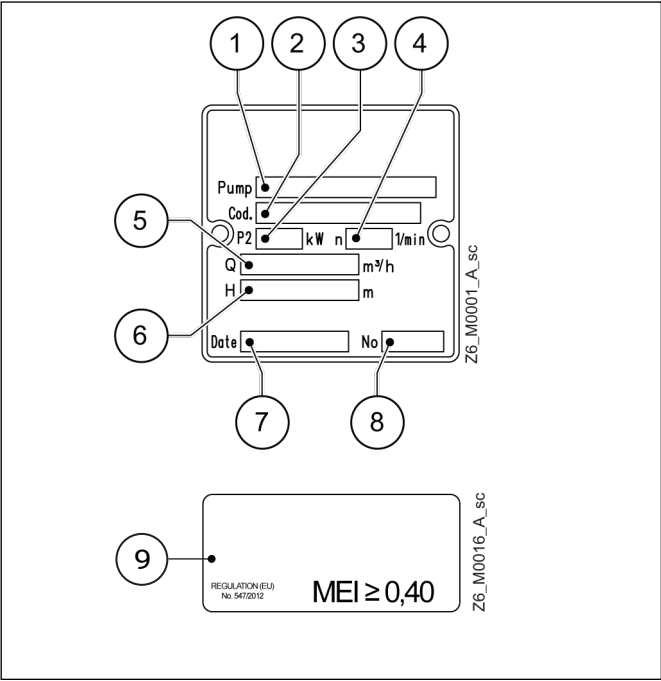


EXAMPLE :

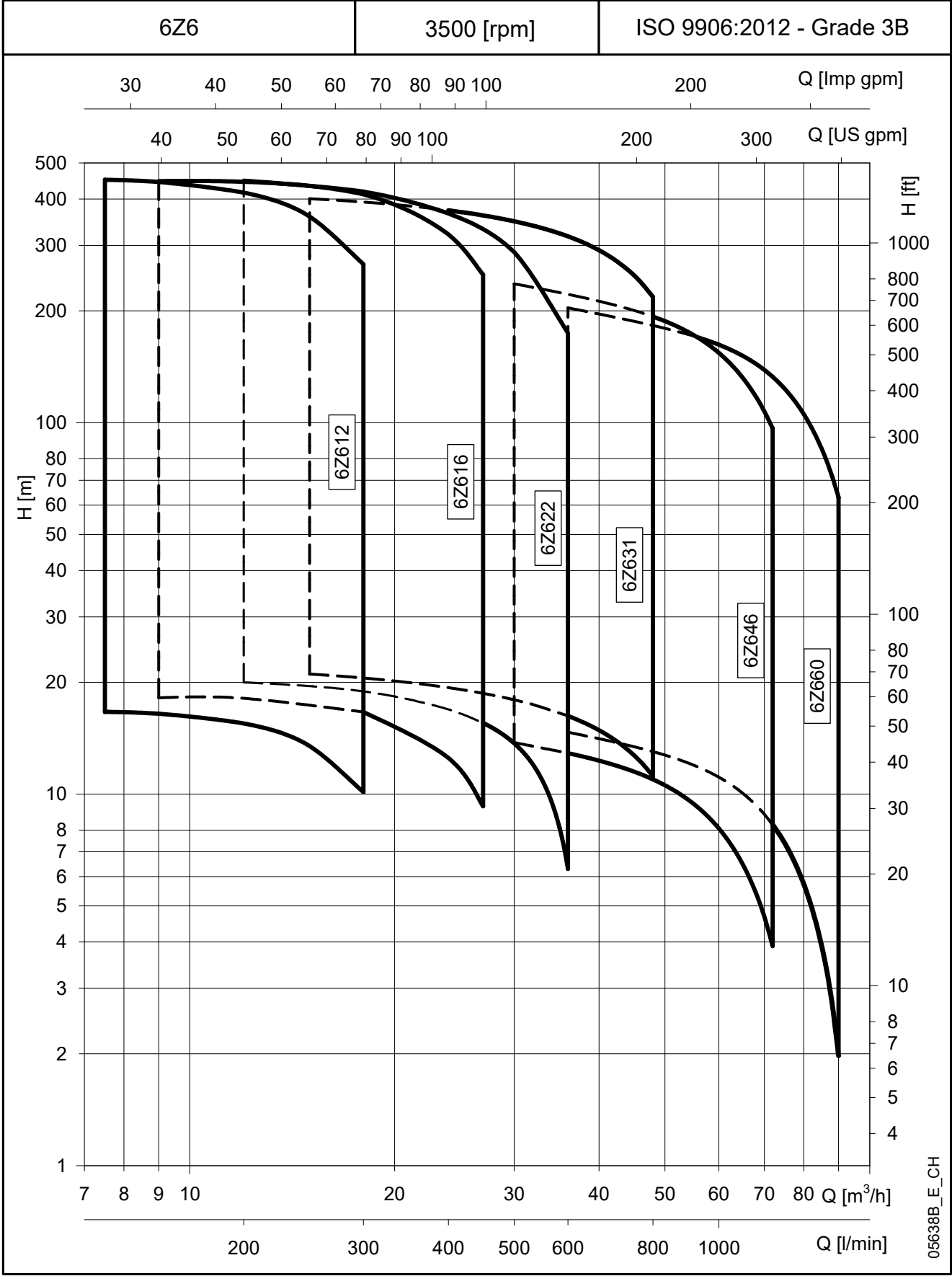
6Z622 08 - 6
6" Pump at 60 Hz, AISI 304, flow rate 22 m³/h, 8 stages, with 6" motor connection.

6Z622 08 - L6W
6" Electric pump at 60 Hz, AISI 304, flow rate 22 m³/h, 8 stages, coupled to a 6" motor L6W.

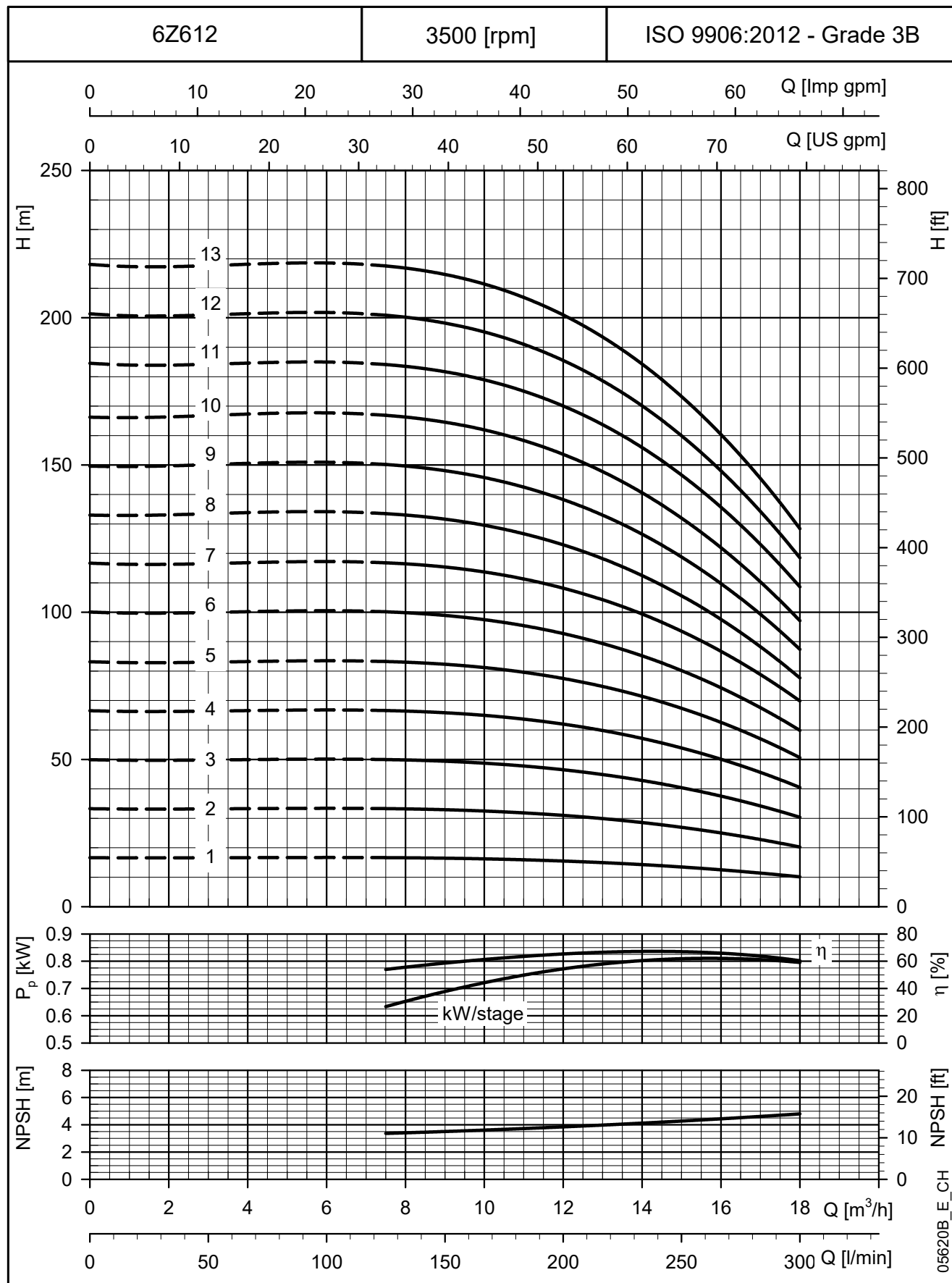
RATING PLATE



6Z6 SERIES
HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES

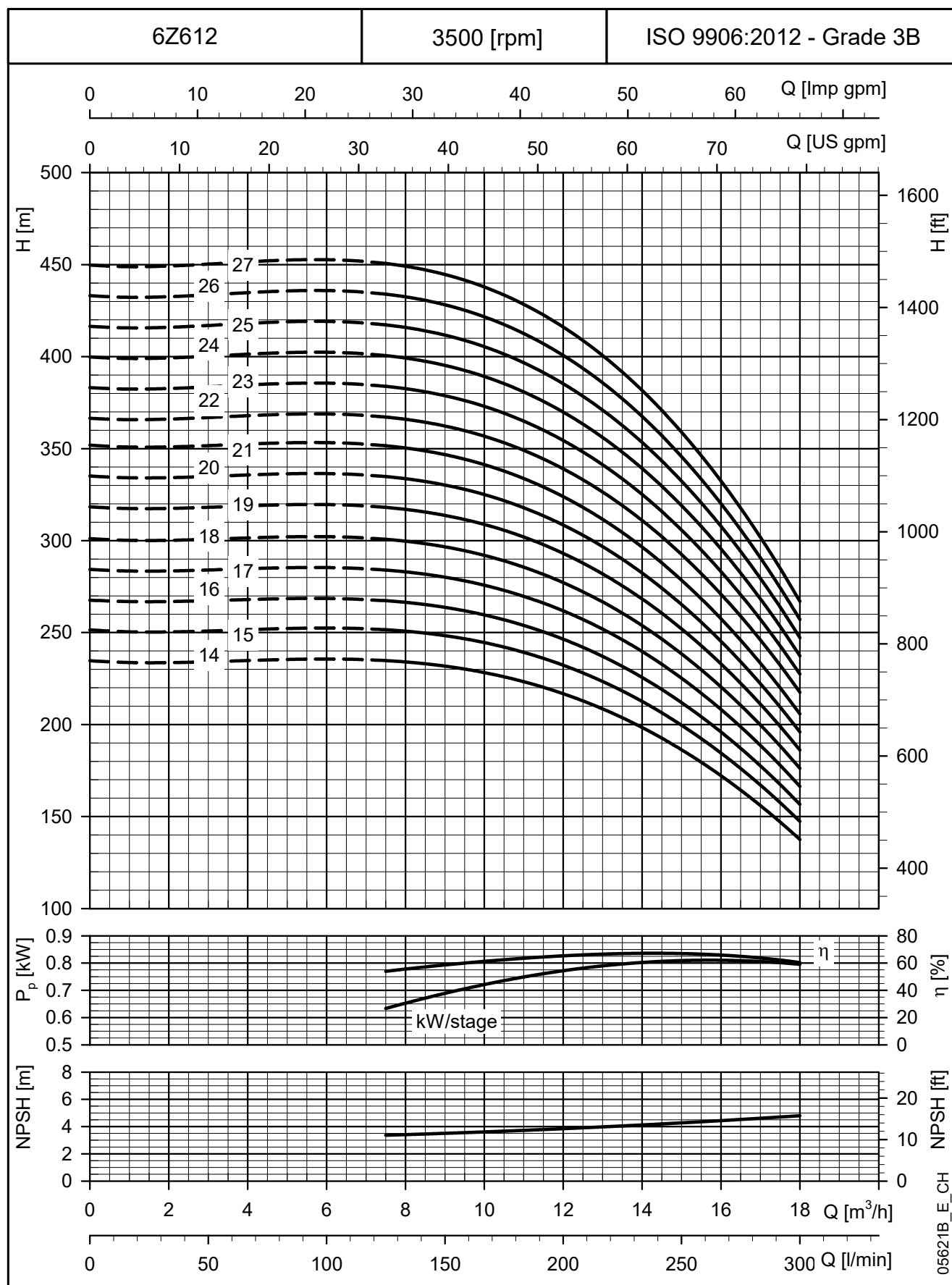


6Z612: FROM 1 TO 13 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**



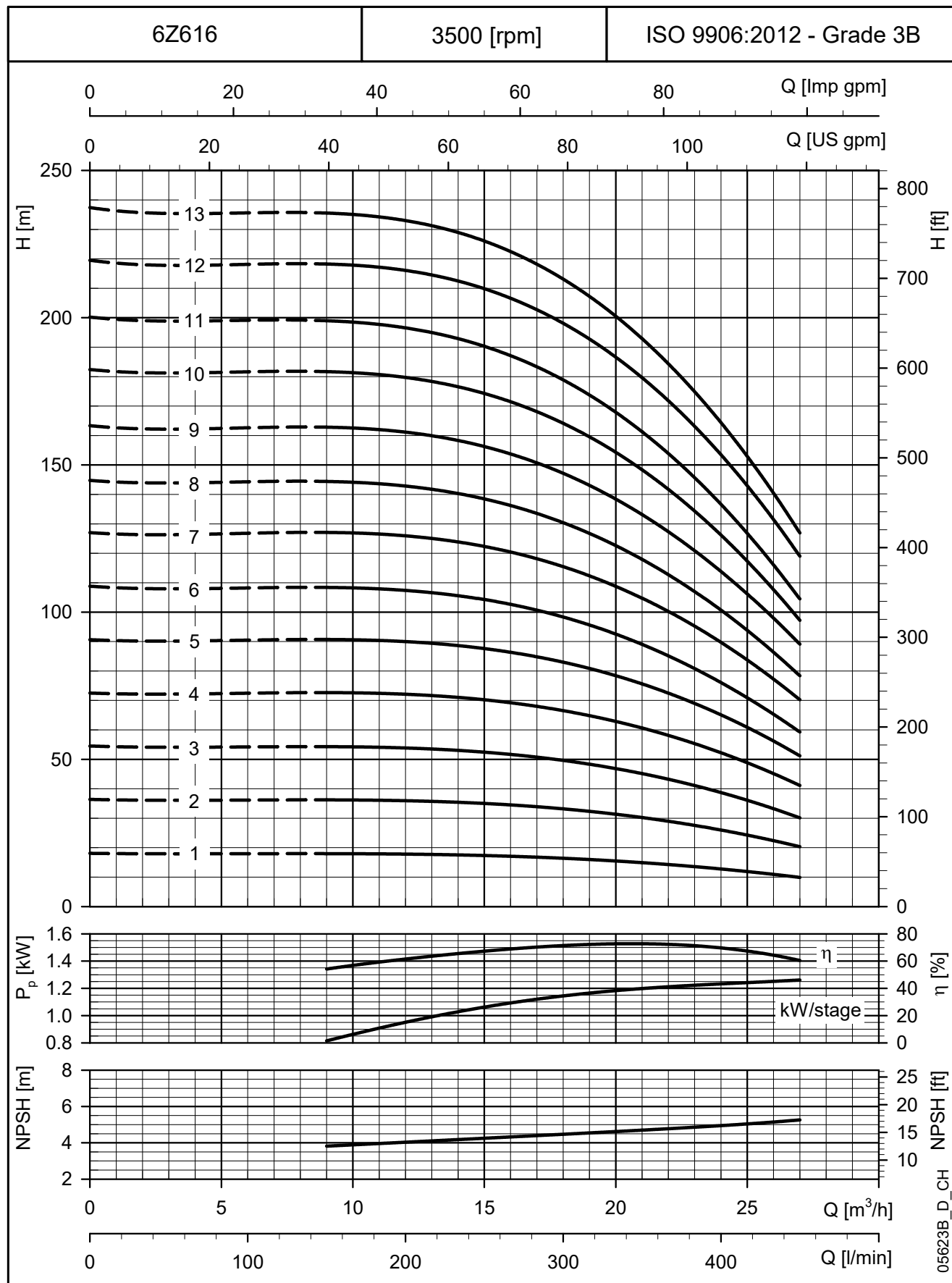
These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z612: FROM 14 TO 27 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**



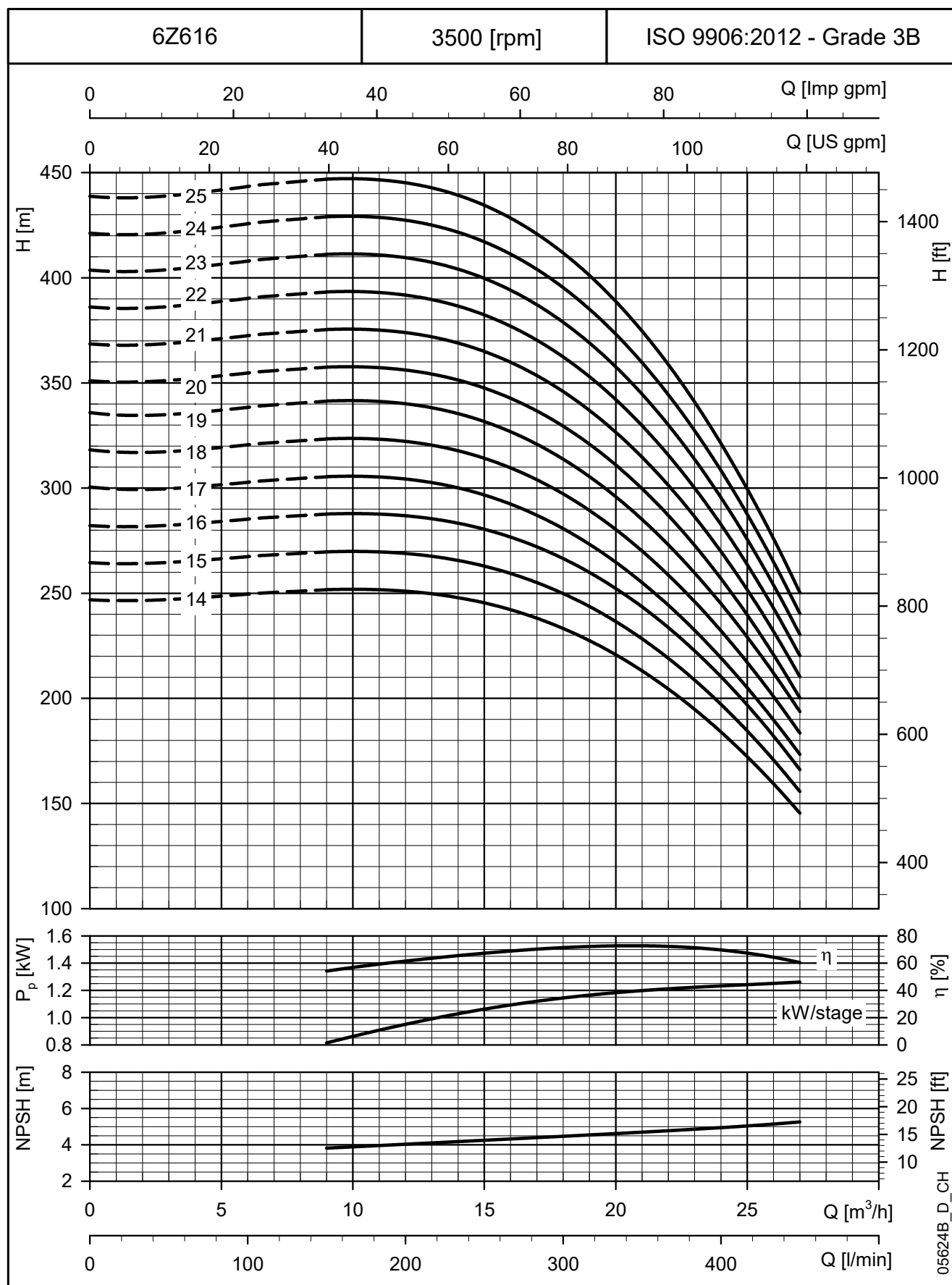
These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z616: FROM 1 TO 13 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**



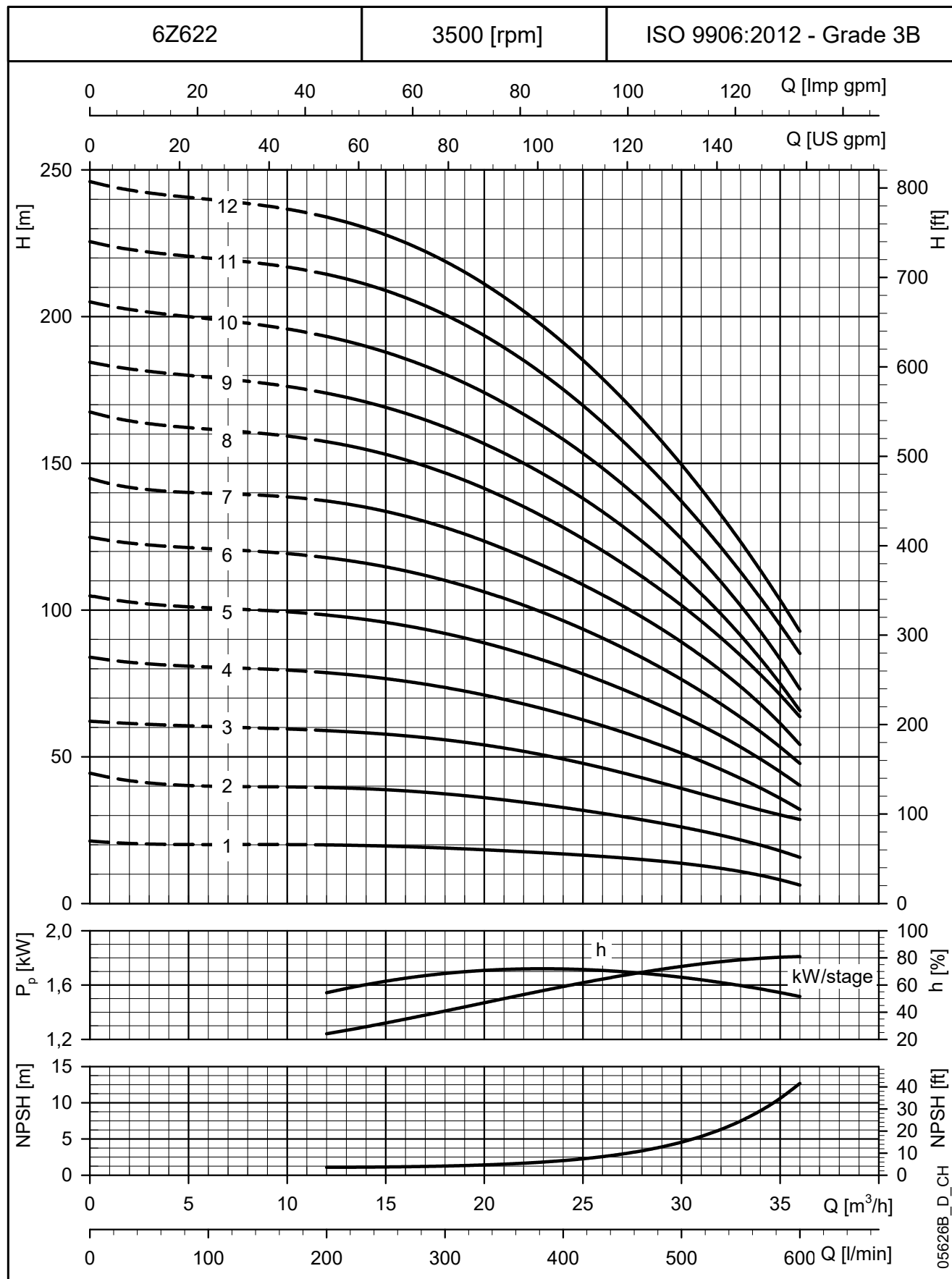
These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z616: FROM 14 TO 25 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**



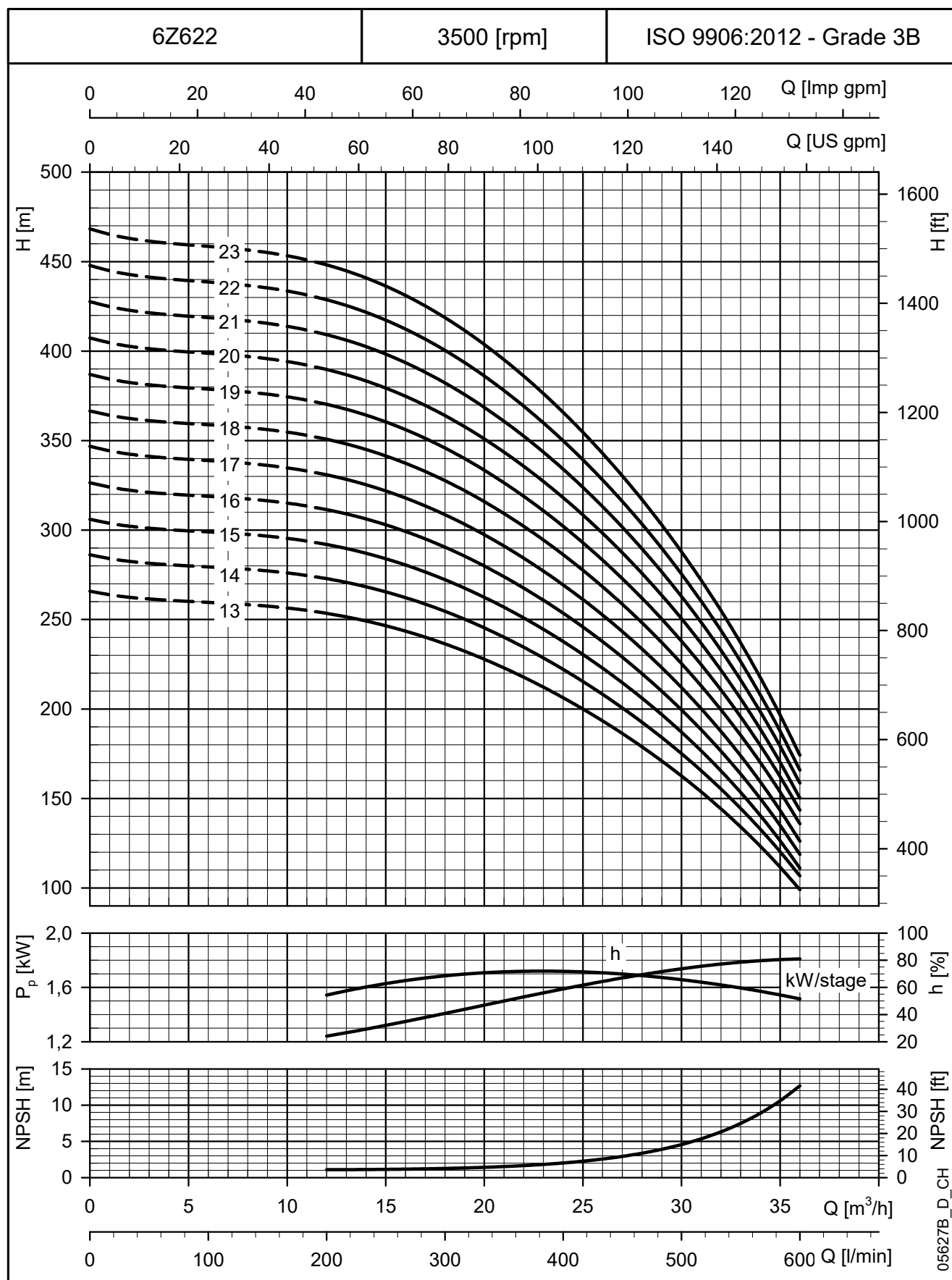
These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z622: FROM 1 TO 12 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**



These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z622: FROM 13 TO 23 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**



These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z631: FROM 1 TO 19 STAGES

HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES

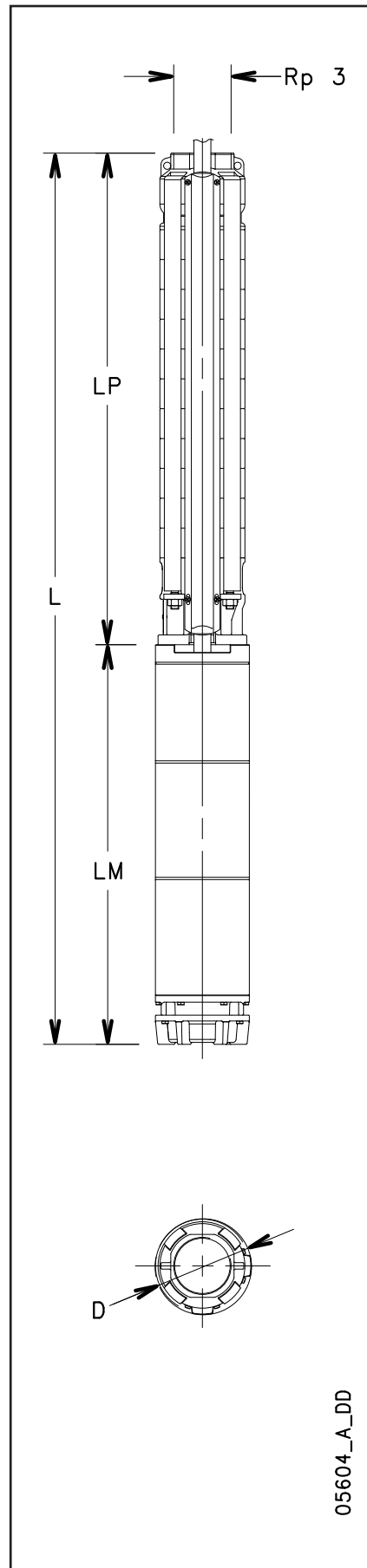
PUMP TYPE	RATED POWER		Q = DELIVERY						
			l/min	0	250	400	500	650	800
			m³/h	0	15	24	30	39	48
	kW	S.F.	H = TOTAL HEAD METRES COLUMN OF WATER						
6Z631 01	2,2	1,15	22,0	21,0	19,3	17,9	15,2	11,2	
6Z631 02	4	1,15	44,0	42,1	38,7	35,9	30,4	22,3	
6Z631 03	7,5	1,15	66,1	62,8	58,0	54,0	46,1	33,9	
6Z631 04	9,3	1,15	88,6	84,1	77,7	72,5	62,3	46,3	
6Z631 05	11	1,15	110,1	105,4	97,5	90,9	78,1	57,8	
6Z631 06	13	1,15	131,3	126,4	117,2	109,4	93,6	68,5	
6Z631 07	15	1,15	153,0	147,6	137,0	127,8	109,2	79,8	
6Z631 08	18,5	1,15	173,8	168,2	155,9	145,4	124,3	90,7	
6Z631 09	18,5	1,15	195,5	189,3	175,4	163,6	139,8	102,1	
6Z631 10	22	1,15	217,5	210,0	194,0	180,6	154,1	112,5	
6Z631 11	22	1,15	239,3	231,0	213,4	198,7	169,5	123,7	
6Z631 12	26	1,15	260,5	253,3	235,8	220,2	188,7	140,5	
6Z631 13	26	1,15	282,2	274,4	255,4	238,5	204,4	152,2	
6Z631 14	30	1,15	304,6	295,9	274,9	256,8	220,5	162,8	
6Z631 15	30	1,15	326,4	317,0	294,5	275,2	236,3	174,4	
6Z631 16	37	1,15	348,2	337,5	314,0	293,5	251,2	183,5	
6Z631 17	37	1,15	369,9	358,6	333,6	311,8	266,9	195,0	
6Z631 18	37	1,15	391,7	379,7	353,3	330,1	282,6	206,5	
6Z631 19	37	1,15	413,5	400,8	372,9	348,5	298,3	218,0	

6z631-1-60-en_b_th

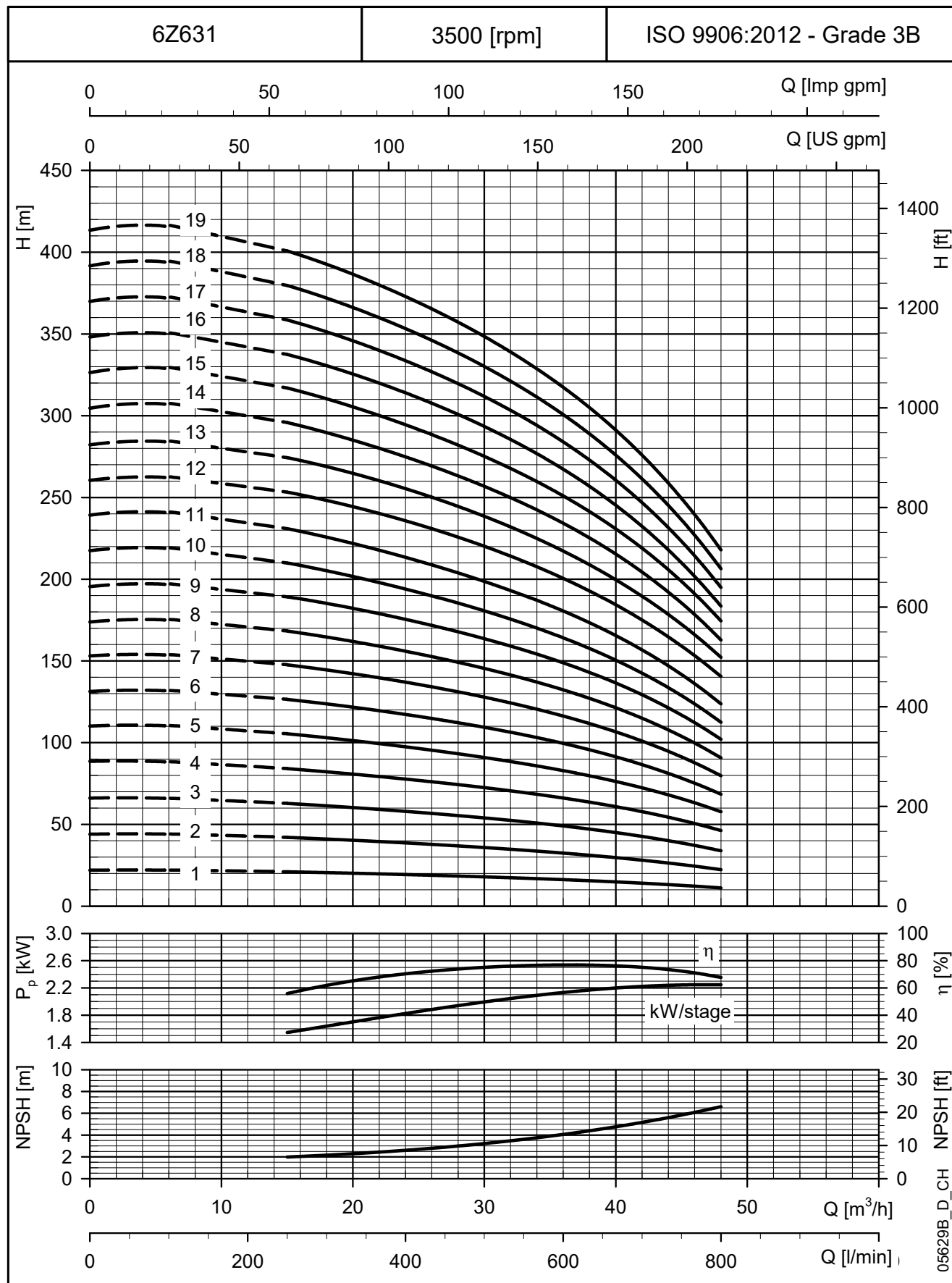
DIMENSIONS AND WEIGHTS

ELECTRO PUMP TYPE	RATED POWER		DIMENSIONS (mm)						WEIGHT
	kW	S.F.	L	LM	LP	ø D		Kg	
						1 Cable	2 Cables		
6Z631 01-4OS	2,2	1,15	747	380	367	142	144	23	
6Z631 02-4OS	4	1,15	986	550	436	142	144	33	
6Z631 03-4OS	7,5	1,15	1270	765	505	142	144	45	
6Z631 02-L6W	4	1,15	1019	583	436	144	146	48	
6Z631 03-L6W	7,5	1,15	1158	653	505	144	146	58	
6Z631 04-L6W	9,3	1,15	1257	683	574	144	146	64	
6Z631 05-L6W	11	1,15	1366	723	643	144	146	69	
6Z631 06-L6W	13	1,15	1475	763	712	144	146	75	
6Z631 07-L6W	15	1,15	1614	833	781	144	146	84	
6Z631 08-L6W	18,5	1,15	1753	903	850	144	146	94	
6Z631 09-L6W	18,5	1,15	1822	903	919	144	146	95	
6Z631 10-L6W	22	1,15	1931	943	988	144	146	100	
6Z631 11-L6W	22	1,15	2000	943	1057	144	146	101	
6Z631 12-L6W	26	1,15	2197	1071	1126	144	146	112	
6Z631 13-L6W	26	1,15	2266	1071	1195	144	146	113	
6Z631 14-L6W	30	1,15	2405	1141	1264	144	146	118	
6Z631 15-L6W	30	1,15	2474	1141	1333	144	146	120	
6Z631 16-L6W	37	1,15	2653	1251	1402	144	146	137	
6Z631 17-L6W	37	1,15	2722	1251	1471	144	146	139	
6Z631 18-L6W	37	1,15	2791	1251	1540	144	146	140	
6Z631 19-L6W	37	1,15	2860	1251	1609	144	146	142	

6z631-1-60-en_c_td

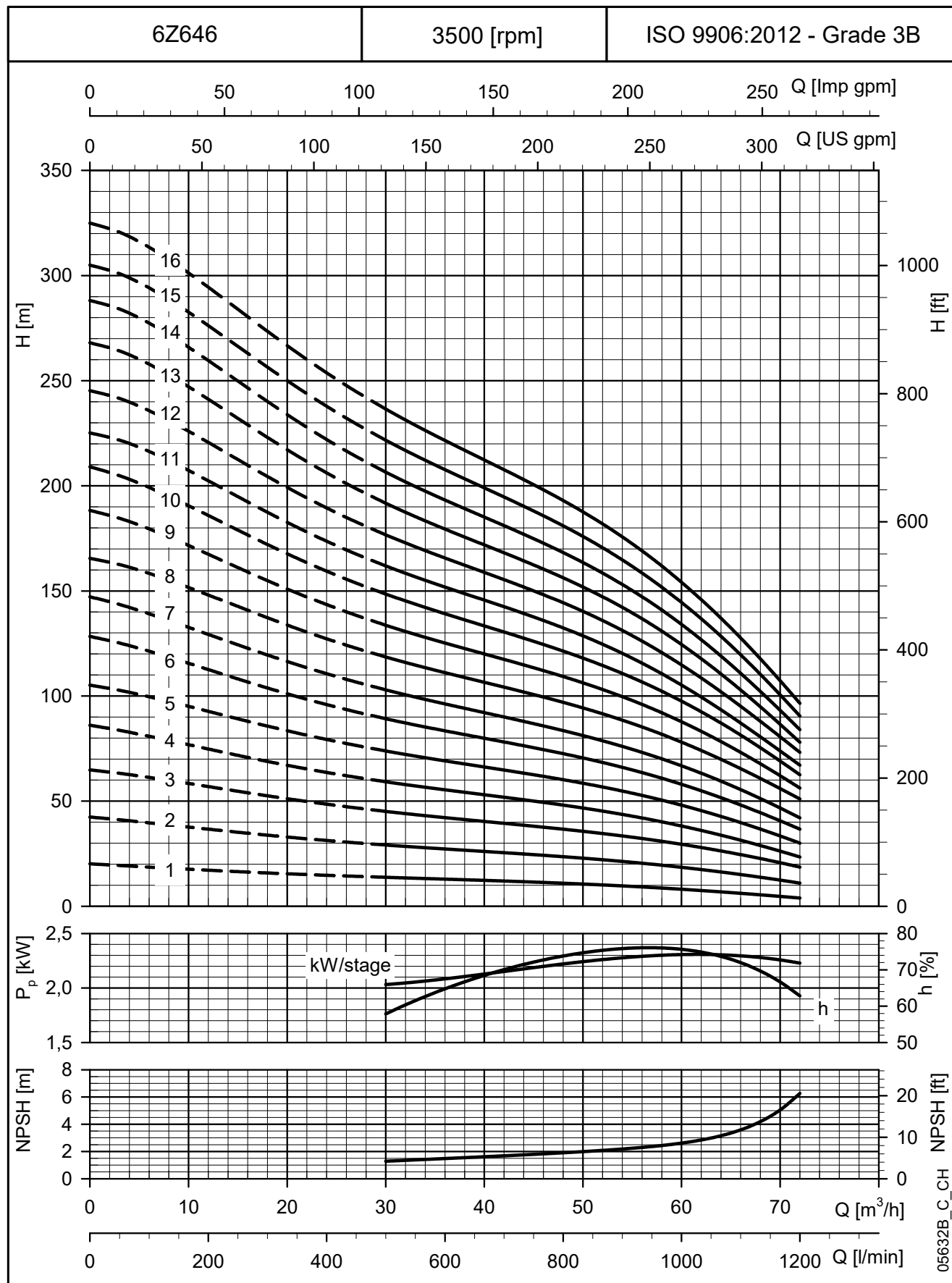


6Z631: FROM 1 TO 19 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**



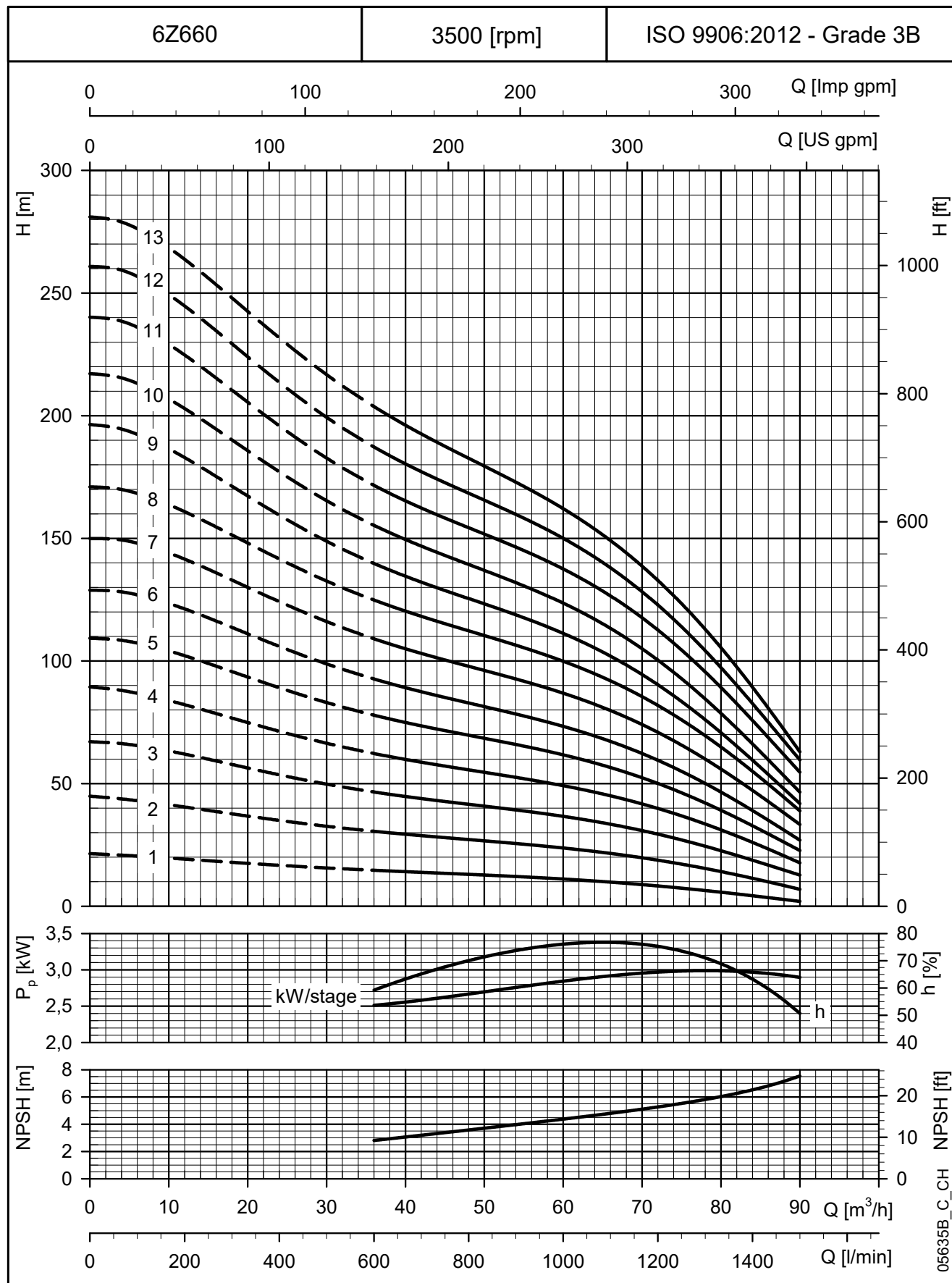
These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z646: FROM 1 TO 16 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**



These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z660: FROM 1 TO 13 STAGES **HYDRAULIC PERFORMANCE RANGE AT 60 Hz, 2 POLES**

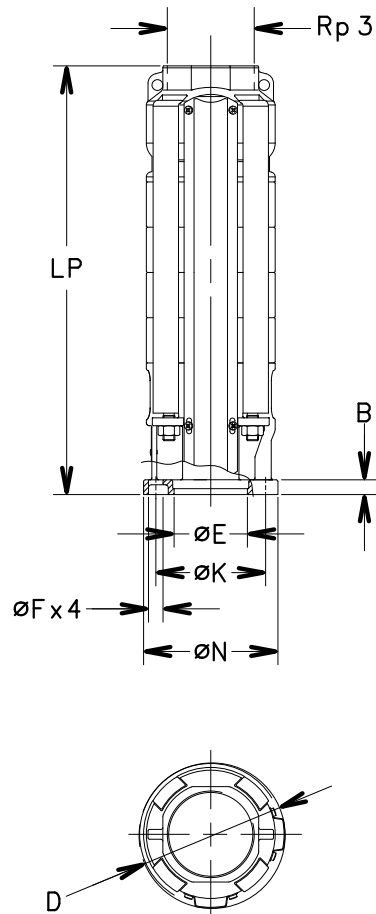


These performances are valid for liquids with density $\rho = 1.0 \text{ kg/dm}^3$ and kinematic viscosity $\nu = 1 \text{ mm}^2/\text{sec}$.

6Z631 SERIES

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6z631p-2p60-en_b_td



05608_B_DD

PUMPS MOTOR CONNECTION

MOTOR	DIMENSIONS (mm)				
	N	K	F	B	E ^{H7}
4" (NEMA)	130	76,2	9,5	10,5	87,3
6" (NEMA)	136	111,1	14,5	15	76,2

Coupling 4" and 6" according to NEMA standards

z6-mtcn-2p50-en_a_td

ACCESSORIES

40S SERIES MOTORS

MOTOR - CONTROL PANEL COMBINATION TABLE

MOTOR TYPE 40S - 4" SINGLE-PHASE	RATED POWER		RATED CURRENT 220-240 V	CAPACITOR	PANEL TYPE		
	kW	HP	A	μF / 450 V	QPC...	QPCS...	QSC...
	0,37	0,5	3,2	16	...03	...03	...03
	0,55	0,75	4,3	20	...05	...05	...05
	0,75	1	5,6	30	...07	...07	...07
	1,1	1,5	7,6	40	...11	...11	...11
	1,5	2	10,5	50	...15	...15	...15
	2,2	3	14,4	70	...22	...22	...22

MOTOR TYPE 40S - 4" THREE-PHASE	RATED POWER		RATED CURRENT 380-415 V		PANEL TYPE				
	kW	HP	A		Q1D/...	Q3D/...	Q3I/...	Q3A/...	Q3SF/...
	0,37	0,5	1,2		...03-05	...03-05	-	-	-
	0,55	0,75	1,7		...07	...05-07	-	-	-
	0,75	1	2,4		...07	...05-07	-	-	-
	1,1	1,5	3,1		...11-15	...07-15	-	-	-
	1,5	2	4,4		...22	...15-22	-	-	-
	2,2	3	6,1		...22	...15-22	-	-	-
	3	4	7,1		...30-40	...22-40	-	-	-
	4	5,5	9,8		...55	...22-40	-	-	-
	5,5	7,5	13,7		...75	...40-75	...40-75	...40-75	-
	7,5	10	18,7		...92	...75-92	...75-92	...75-92	...150

For different voltages, please contact our sales network.

40S-2p50-en_g_tc

L6W SERIES MOTORS

MOTOR - CONTROL PANEL COMBINATION TABLE

	RATED POWER		CURRENT AT S.F. 380 V	PANEL TYPE					
	kW	HP		QTD/...	Q3D/...	Q3V/...	Q3A/...	Q3Y/...	Q3SF/...
MOTOR TYPE L6W-6" THREE-PHASE	4	5,5	11,2	...40-75	...40-75	...40-75	...40-75	...40-75	...75
	5,5	7,5	15,1	...40-75	...40-75	...40-75	...40-75	...40-75	...75
	7,5	10	19,4	...75-92	...75-92	...75-92	...75-92	...75-92	...150
	9,3	12,5	23,8	-	...92-110	...92-110	...92-110	...92-110	...150
	11	15	27,8	-	...110-150	...110-150	...110-150	...110-150	...150
	13	17,5	32,9	-	...150-185	...150-185	...150-185	...150-185	...220
	15	20	36,6	-	...150-185	...150-185	...150-185	...150-185	...220
	18,5	25	45,1	-	...185-220	...185-220	...185-220	...185-220	...300
	22	30	53,8	-	...220-300	...220-300	...220-300	...220-300	...300
	26	35	66,5	-	...300-370	...300-370	...300-370	...300-370	...370
	30	40	72,6	-	...300-370	...300-370	...300-370	...300-370	...370
	37	50	95,9	-	-	...450-550	...450-550	...450-550	...550
MOTOR TYPE L6W HT-6" THREE-PHASE	4	5,5	12,3	...40-75	...40-75	...40-75	...40-75	...40-75	...75
	5,5	7,5	15,5	...40-75	...40-75	...40-75	...40-75	...40-75	...75
	7,5	10	20,2	...92-110	...92-110	...92-110	...92-110	...92-110	...150
	9,3	12,5	24,2	-	...92-110	...92-110	...92-110	...92-110	...150
	11	15	28,9	-	...110-150	...110-150	...110-150	...110-150	...150
	13	17,5	34,1	-	...150-185	...150-185	...150-185	...150-185	...220
	15	20	38,3	-	...150-185	...150-185	...150-185	...150-185	...220
	18,5	25	46,3	-	...185-220	...185-220	...185-220	...185-220	...300
	22	30	58,6	-	...220-300	...220-300	...220-300	...220-300	...300
	26	35	64,8	-	...300-370	...300-370	...300-370	...300-370	...370
	30	40	82,1	-	...370-450	...370-450	...370-450	...370-450	...450

For different voltages, please contact our sales network.

L6w-2p60_b_tc

L8W SERIES MOTORS

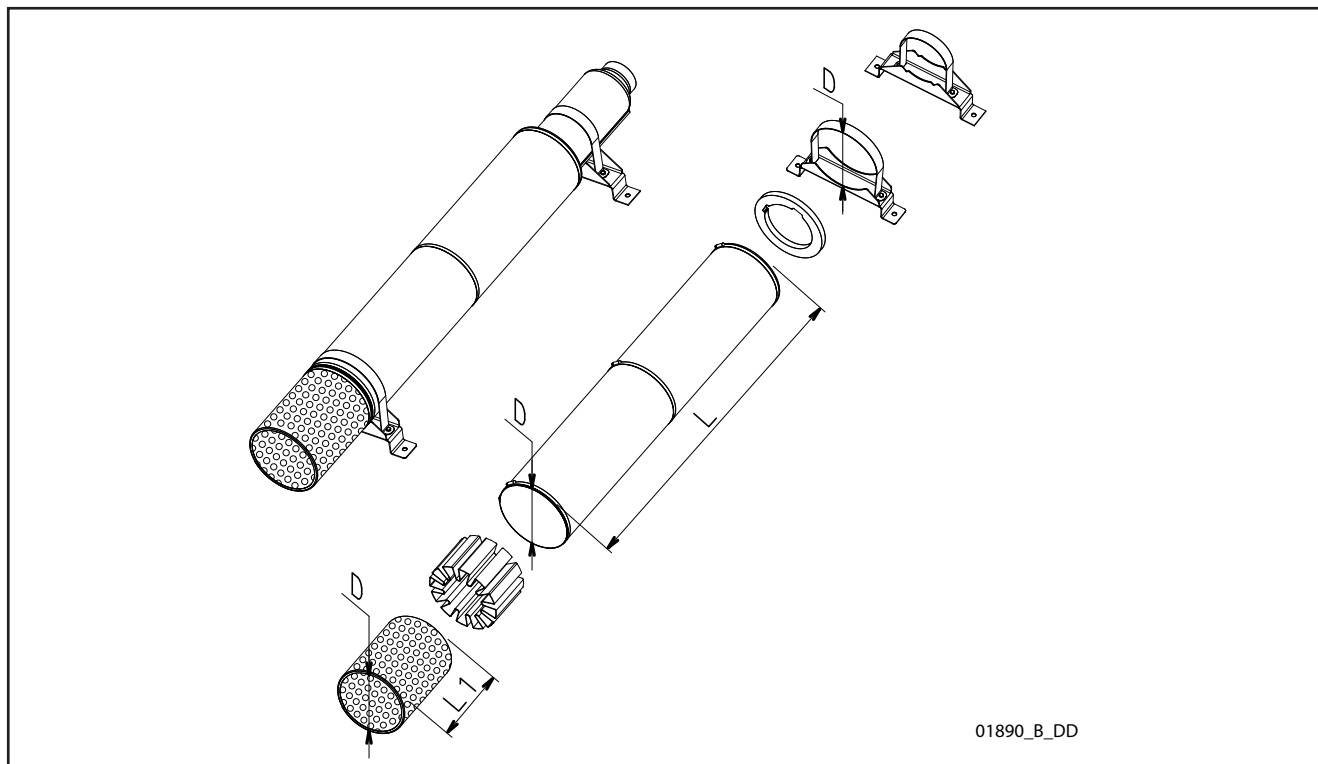
MOTOR - CONTROL PANEL COMBINATION TABLE

	RATED POWER		CURRENT AT S.F. 380 V A	PANEL TYPE				
	kW	HP			Q3I/...	Q3A/...	Q3SF/...	
MOTOR TYPE L8W-8" THREE-PHASE	30	40	74,2		...370-450	...370-450	...450	
	37	50	92,2		...450-550	...450-550	...550	
	45	60	110		...550-750	...550-750	...590	
	52	70	127		...550-750	...550-750	...750	
	55	75	135		...750-900	...750-900	...750	
	60	80	147		...750-900	...750-900	...900	
	67	90	160		...750-900	...750-900	...900	
	75	100	178		...900-1100	...900-1100	...900	
	83	110	196		...900-1100	...900-1100	...1100	
	93	125	220		...1100-1320	...1100-1320	...1100	
MOTOR TYPE L8W HT-8" THREE-PHASE	30	40	74,7		...370-450	...370-450	...450	
	37	50	89,3		...450-550	...450-550	...550	
	45	60	110		...550-750	...550-750	...590	
	52	70	128		...550-750	...550-750	...750	
	55	75	135		...750-900	...750-900	...750	
	60	80	143		...750-900	...750-900	...900	
	67	90	160		...750-900	...750-900	...900	
	75	100	177		...900-1100	...900-1100	...900	
	83	110	198		...900-1100	...900-1100	...1100	

For different voltages, please contact our sales network.

L8w-2p60_d_tc

COOLING SHROUDS

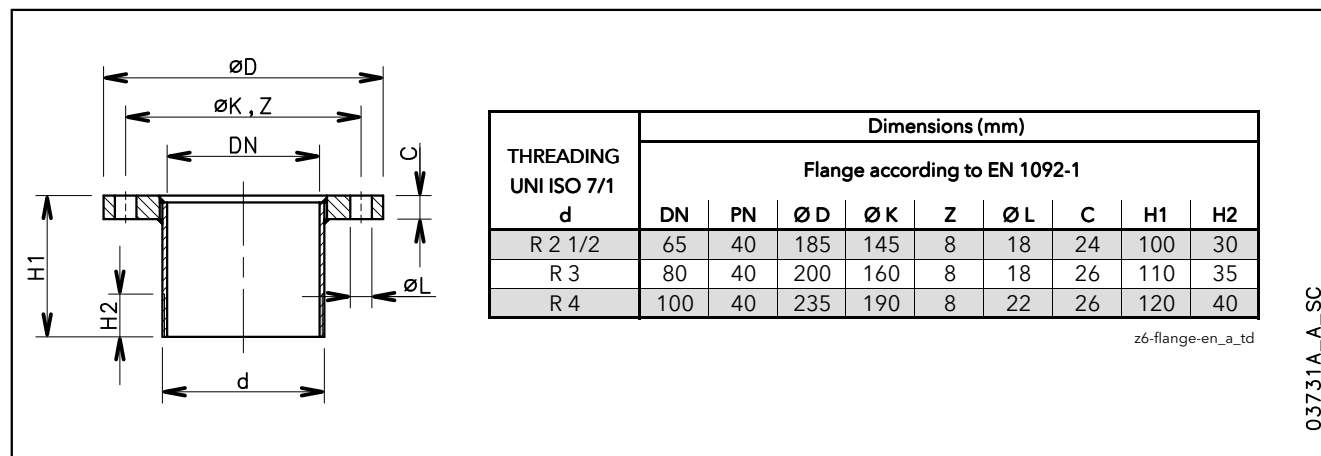


PUMP TYPE	MOTOR TYPE		COOLING SET SHROUD (D x L)	COOLING SET FILTER (D x L1)	COOLING SET BRACKETS (D)
	40S/B	L6W			
6Z612 6Z616 6Z622 6Z631 6Z646	0,55		D160X800	D160X158	D160 - 2pcs
	0,75				
	1,1				
	1,5				
	2,2				
	3				
	4				
6Z660	5,5		D160X1000	D160X158	D160 - 2pcs
	7,5				
	4				
6Z612 6Z616 6Z622 6Z631 6Z646	5,5		D180X1000	D180X192	D180 - 2pcs
	7,5				
	4	3			
		4			
		5,5			
		7,5			
		9,3			
		11			
		13			
		15			
		18,5			
		22			
6Z660		26	D180X1500	D180X192	D180 - 3pcs
		30			
		37			
		4			
		5,5			
		7,5			
		9,3			
		11			
		13			
		15			
		18,5			
		22			
6Z660		26	D200X1000	D200X192	D200 - 2pcs
		30			
		37			
		4			
		5,5			
		7,5			
		9,3			
6Z660		11	D200X1500	D200X192	D200 - 3pcs
		13			
		15			
		18,5			
		22			
		26			
		30			
		37			

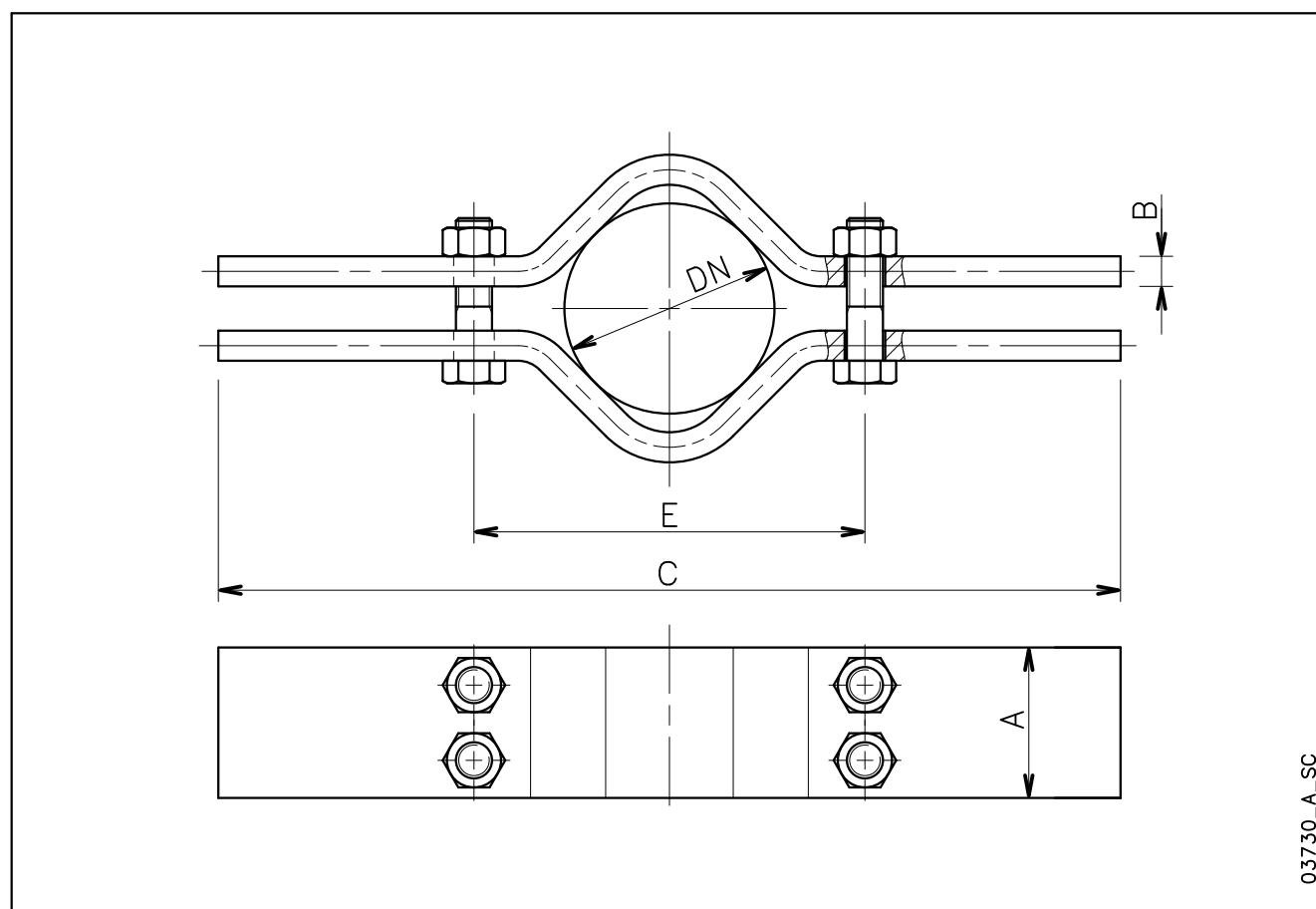
Note: Not available for high pressure version.

6Z6_kit-raf60-en_c_ta

THREADED FLANGES ISO



CARRYING CLAMPS



Ø PIPE NOMINAL DN		CARRYNG CLAMPS						PIPE WEIGHT		
		Dimensions (mm)					Pmax ⁽¹⁾ kg	Flanged	Threaded	Water
		A	B	C	E	SCREW		kg/m	kg/m	kg/m
65	R 2 1/2	50	15	600	130	M16x90	1300	6,7	8,0	3,3
80	R 3	80	15	600	180	M20x70	3400	8,4	10,5	5,0
100	R 4	80	15	600	180	M20x110	3400	20,5	15,0	7,9

1) Max weight allowable.

z6-clamp-en_a_td

TECHNICAL APPENDIX

MOTORS 40S - C4S - C6S - L6W - L8W - L10W - L12W SERIES

TABLE OF POWER REDUCTION COEFFICIENTS WITH INCREASED WATER TEMPERATURE

MOTOR TYPE	RATED POWER kW	TEMPERATURE							
		°C							
		25	30	35	40	45	50	55	60
40S	all models	1,00	1,00	1,00	0,90	0,80	0,70	0,60	0,50
C4S		1,00	1,00	1,00	0,95	0,90	0,85	0,80	0,50
C6S		1,00	1,00	1,00	0,95	0,80	0,75	0,70	0,50
L6W		1,00	1,00	0,75	-	-	-	-	-
L8W		1,00	1,00	0,75	-	-	-	-	-
L10W		1,00	1,00	0,75	-	-	-	-	-
L12W		1,00	1,00	0,75	-	-	-	-	-
L6W..HT		1,00	1,00	1,00	1,00	1,00	0,85	0,75	0,65
L8W..HT		1,00	1,00	1,00	1,00	1,00	0,85	0,75	0,65
L10W..HT		1,00	1,00	1,00	1,00	z	0,85	0,75	0,65
L12W..HT		1,00	1,00	1,00	1,00	1,00	0,85	0,75	0,65

40S-LC-LW-derating-en_c_te

EXAMPLE 1

A 2,2 kW 40S motor is to be used in 50°C water.

Motor power at 50 °C = $2,2 \times 0,7 = 1,54$ kW

EXAMPLE 2

A 2,2 kW C4S motor is to be used in 50°C water.

Motor power at 50 °C = $2,2 \times 0,85 = 1,87$ kW

EXAMPLE 3

A 7,5 kW C6S motor is to be used in 45°C water.

Motor power at 50 °C = $7,5 \times 0,8 = 6$ kW

EXAMPLE 4

A 15 kW L6W motor is to be used in 35°C water.

Motor power at 35 °C = $15 \times 0,75 = 11,25$ kW

SELECTING CABLE CROSS-SECTIONS FOR SUBMERSIBLE MOTORS

To select the cross-section of power cables for submersible pumps, consult the tables shown below. In these tables, the maximum lengths of the power cable for each cross-section are shown for each motor and next to the various input voltage ratings.

Therefore, to find the required cable cross-section, simply read off the maximum permitted lengths for each cross-section next to the selected motor and required input voltage.

E.g.:

A 120 m long power cable must be matched with a 230V L4C07M235 motor.

To determine the cross-section of the cable, simply move along the row of the 230V motor until you find the maximum length of 120 m or immediately above it and then read off the corresponding cross-section in that column.

In this case, the 4 mm² cable is selected.

N.B.: the tables include specific data (current and power factor) for each motor and voltage rating based on a maximum voltage drop of 4% (HD 384.5), a maximum cable temperature of 90°C, water installation similar to air installation at a temperature of 30°C.

CABLE TYPES

SECTION mm ²	THREE CORE FLAT					FOUR CORE FLAT					SINGLE CORE ROUND			FOUR CORE ROUND		
	Hmin mm	Lmin mm	Hmax mm	Lmax mm	Weight kg/km	Hmin mm	Lmin mm	Hmax mm	Lmax mm	Weight kg/km	Dmin mm	Dmax mm	Weight kg/km	Dmin mm	Dmax mm	Weight kg/km
4	8	19,2	9	20,8	250	8	25,2	9	26,8	395	6,5	7,5	92	14	16,1	360
6	8	19,2	9	20,8	325	8	25,2	9	26,8	470	7,4	8	118	15,7	18	475
10	8	19,2	9	20,8	535	8	25,2	9	26,8	710	8,6	10	183	20,9	23,9	836
16	-	-	-	-	-	-	-	-	-	-	9,6	11	251	23,8	27,1	1145
25	-	-	-	-	-	-	-	-	-	-	11	13	362	28,9	32,9	1716
35	-	-	-	-	-	-	-	-	-	-	12,5	14,5	497	-	-	-
50	-	-	-	-	-	-	-	-	-	-	15	17	669	-	-	-
70	-	-	-	-	-	-	-	-	-	-	17,5	19,5	901	-	-	-
95	-	-	-	-	-	-	-	-	-	-	20,5	22,5	1141	-	-	-
120	-	-	-	-	-	-	-	-	-	-	22	24,4	1435	-	-	-
150	-	-	-	-	-	-	-	-	-	-	25,2	28,3	1795	-	-	-
185	-	-	-	-	-	-	-	-	-	-	27,6	31	2156	-	-	-
240	-	-	-	-	-	-	-	-	-	-	30,6	34,5	2760	-	-	-

L-cavi-en_a_td

4OS SINGLE-PHASE, 60 Hz: SIZING OF ETHYLENE-PROPILENE (EPR) CABLES, DOL (DIRECT ON LINE) STARTING

MOTOR TYPE SINGLE-PHASE	RATED POWER		RATED VOLTAGE V	Cos φ	CURRENT AT S.F. A	VOLTAGE DROP %	Cable cross section: 4G x ...mm²								
	Kw	HP					mm²	1,5	2,5	4	6	10	16	25	35
							A max	23	32	42	54	75	100	127	158
							Maximum lenght in metres								
4OS03M236	0,37	0,5	220	0,99	4,50	4		71	118	191	286				
			230	0,98	4,42										
4OS05M236	0,55	0,8	220	0,99	6,23			51	85	137	206	356			
			230	0,97	6,00										
4OS07M236	0,75	1	220	0,97	7,41			43	73	117	176	304			
			230	0,94	7,36										
4OS11M236	1,1	1,5	220	0,99	9,34			33	56	91	137	237	373		
			230	0,99	9,05										
4OS15M236	1,5	2	220	0,99	12,2			25	42	69	104	181	285	441	
			230	0,97	11,9										
4OS22M236	2,2	3	220	0,93	17,1			17	31	51	78	135	212	324	
			230	0,90	17,1										
4OS03M116	0,37	0,5	110	0,99	9,02			17	29	47	71	123	193	299	418
			115	0,98	8,86										
4OS05M116	0,55	0,75	110	0,98	12,3			12	21	35	52	91	143	220	307
			115	0,94	12,3										
4OS07M116	0,75	1	110	0,98	14,5			10	18	29	44	76	120	186	259
			115	0,95	14,3										
4OS11M116	1,1	1,5	110	0,99	18,1			8	14	23	35	60	96	148	208
			115	0,98	17,7										

Exposed cable laid at a temperature of 30°C, maximum conductor temperature of 90°C

4osm-b_cavi-60_d_te

4OS THREE-PHASE, 60 Hz: SIZING OF ETHYLENE-PROPYLENE (EPR) CABLES, DOL (DIRECT ON LINE) STARTING

MOTOR TYPE THREE-PHASE	RATED POWER Kw HP		RATED VOLTAGE V	Cos φ	CURRENT AT S.F. A	VOLTAGE DROP %	Cable cross section: 4G x ...mm ²								
							mm ²	1,5	2,5	4	6	10	16	25	35
							A max	23	32	42	54	75	100	127	158
Maximum lenght in metres															
4OS03T236	0,37	0,5	220 230	0,62 0,56	3,17 3,31	4		184	305						
4OS05T236	0,55	0,75	220 230	0,71 0,65	4,00 4,05			127	212	339					
4OS07T236	0,75	1	220 230	0,66 0,59	5,21 5,51			104	174	279	414				
4OS11T236	1,1	1,5	220 230	0,72 0,65	6,53 6,70			76	127	204	304				
4OS15T236	1,5	2	220 230	0,71 0,65	8,40 8,73			59	99	160	239	407			
4OS22T236	2,2	3	220 230	0,71 0,64	11,6 12,5			41	71	115	172	294	454		
4OS30T236	3	4	220 230	0,79 0,72	14,5 14,8			29	50	82	124	213	331		
4OS40T236	4	5,5	220 230	0,85 0,81	17,7 17,4			21	37	62	94	163	254	386	
4OS55T236	5,5	7,5	220 230	0,86 0,83	24,4 23,8			-	33	52	78	133	206	312	428
4OS75T236	7,5	10	220 230	0,75 0,68	36,8 38,1			-	-	29	47	84	133	201	276
4OS03T386	0,37	0,5	380	0,62	1,83			552							
4OS05T386	0,55	0,75	380	0,71	2,31			382							
4OS07T386	0,75	1	380	0,66	3,01			315	522						
4OS11T386	1,1	1,5	380	0,72	3,77			230	383						
4OS15T386	1,5	2	380	0,71	4,85			180	301	482					
4OS22T386	2,2	3	380	0,71	6,69			129	217	349	519				
4OS30T386	3	4	380	0,79	8,35			92	156	251	376				
4OS40T386	4	5,5	380	0,85	10,2			69	118	191	287	492			
4OS55T386	5,5	7,5	380	0,86	14,1			47	82	135	203	351			
4OS75T386	7,5	10	380	0,75	21,2			32	59	99	150	261	406		

Exposed cable laid at a temperature of 30°C, maximum conductor temperature of 90°C

4ost-b_cavi-60_c_te

L6W, 60 Hz: SIZING OF ETHYLENE-PROPILENE (EPR) CABLES DOL (DIRECT ON LINE) STARTING

MOTOR TYPE THREE-PHASE	RATED POWER		RATED VOLTAGE V	Cos φ AT S.F.	CURRENT AT S.F. A	VOLTAGE DROP %	Cable cross section: 4G x ...mm²									
	Kw	HP					mm2	4	6	10	16	25	35	50	70	
							A max	42	54	75	100	127	158	192	246	
							Maximum lenght in metres									
L6W40T236	4	5,5	230	0,83	19,0	4		61	93	161	252	382	525			
L6W40T386				170	255		438									
L6W40T406				253	379											
L6W55T236	5,5	7,5	230	0,79	26,4			44	68	120	188	284	390			
L6W55T386				128	194		334	521								
L6W55T406				192	289		497									
L6W75T236	7,5	10	230	0,82	33,6			32	50	89	141	216	297	411		
L6W75T386				96	146		253	396								
L6W75T406				143	216		374	585								
L6W93T236	9,3	12,5	230	0,82	41,3			24	39	71	113	174	241	333	451	
L6W93T386				76	117		204	321	489							
L6W93T406				114	173		301	472								
L6W110T236	11	15	230	0,83	47,9			-	32	59	95	147	205	284	386	
L6W110T386				62	97		172	271	414							
L6W110T406				95	146		256	403	614							
L6W130T236	13	17,5	230	0,81	57,4			-	-	48	79	124	172	239	325	
L6W130T386				52	82		146	232	354	490						
L6W130T406				80	123		217	343	524							
L6W150T236	15	20	230	0,84	62,5			-	-	42	70	109	153	214	293	
L6W150T386				44	70		127	203	312	433						
L6W150T406				68	107		190	301	460							
L6W185T236	18,5	25	230	0,82	78,2			-	-	-	54	86	122	171	235	
L6W185T386				-	55		101	164	253	351	489					
L6W185T406				-	85		153	245	376	522						
L6W220T236	22	30	230	0,82	91,9			-	-	-	44	71,1	102	144	198	
L6W220T386				-	44		83	136	211	295	411					
L6W220T406				-	68		125	202	312	433	601					
L6W260T236	26	35	230	0,76	117			-	-	-	-	56	81	115	159	
L6W260T386				-	-		66	110	173	243	338	461				
L6W260T406				-	-		103	168	261	363	505					
L6W300T236	30	40	230	0,82	126			-	-	-	-	47,2	69,7	100	141	
L6W300T386				-	-		55	94	150	212	298	410				
L6W300T406				-	-		85	141	221	310	433	594				
L6W370T386	37	50	380	0,82	80,4			-	-	-	86	138	196	274	377	
L6W370T406				-	-		-	134	210	295	410	559				

Exposed cable laid at a temperature of 30°C, maximum conductor temperature of 90°C

l6w_cavi-60_c_te

L6W, 60 Hz: SIZING OF ETHYLENE-PROPYLENE (EPR) CABLES Y/Δ (STAR / DELTA) STARTING

MOTOR TYPE THREE-PHASE	RATED POWER		RATED VOLTAGE V	Cos φ AT S.F.	CURRENT AT S.F. A	VOLTAGE DROP %	Cable cross section: 4G x ...mm² + 3 x ...mm²								
							mm²	4	6	10	16	25	35	50	70
	A max*	73					94	130	173	220	274	333	426		
	Maximum lenght in metres														
L6W40T236	4	5,5	230	0,83	19,0	4		110	165	282	440				
L6W40T386			380	0,87	11,2			297	445						
L6W40T406			460	0,87	9,2			441							
L6W55T236	5,5	7,5	230	0,79	26,4			81	123	211	329	496			
L6W55T386			380	0,84	15,1			227	340	582					
L6W55T406			460	0,85	12,2			338	505						
L6W75T236	7,5	10	230	0,82	33,6			61	92	160	249	378	519		
L6W75T386			380	0,86	19,4			172	258	443					
L6W75T406			460	0,87	15,8			254	380						
L6W93T236	9,3	12,5	230	0,82	41,3			48	74	129	202	307	421		
L6W93T386			380	0,86	23,8			139	209	360	562				
L6W93T405			460	0,87	19,5			204	307	528					
L6W110T236	11	15	230	0,83	47,9			40	62	109	172	261	360	496	
L6W110T386			380	0,87	27,8			116	176	304	476				
L6W110T406			460	0,87	22,8			174	261	450					
L6W130T236	13	17,5	230	0,81	57,4			33	51	92	145	221	304	419	567
L6W130T386			380	0,85	32,9			99	151	261	409				
L6W130T406			460	0,88	26,4			147	222	384					
L6W150T236	15	20	230	0,84	62,5			28	45	81	128	197	272	377	512
L6W150T386			380	0,87	36,6			86	131	229	359	548			
L6W150T406			460	0,86	30,5			129	195	338	529				
L6W185T236	18,5	25	230	0,82	78,2			21	35	64	103	158	219	304	412
L6W185T386			380	0,86	45,1			68	106	186	293	447			
L6W185T406			460	0,87	36,7			104	159	276	434				
L6W220T236	22	30	230	0,82	91,9			-	28	53	86	133	185	257	350
L6W220T386			380	0,85	53,8			56	88	155	246	376	519		
L6W220T406			460	0,84	45,0			85	131	230	362	552			
L6W260T236	26	35	230	0,76	117			-	-	41	69	108	151	209	283
L6W260T386			380	0,81	66,5			44	71	128	205	313	432		
L6W260T406			460	0,83	53,7			69	109	193	305	464			
L6W300T236	30	40	230	0,82	126			-	-	35	59	94	132	185	253
L6W300T386			380	0,86	72,6			37	60	110	177	273	379	527	
L6W300T406			460	0,86	61,0			57	90	162	258	396	549		
L6W370T386	37	50	380	0,82	80,4			-	-	102	165	254	352	488	662
L6W370T406			460	0,81	66,4			-	86	156	248	380	524		

Exposed cable laid at a temperature of 30°C, maximum conductor temperature of 90°C

l6w_cavi-SD-60_c_te

L8W, 60 Hz: SIZING OF ETHYLENE-PROPILENE (EPR) CABLES DOL (DIRECT ON LINE) STARTING

MOTOR TYPE THREE-PHASE	RATED POWER		RATED VOLTAGE V	Cos φ AT S.F.	CURRENT AT S.F. A	VOLTAGE DROP %	Cable cross section: 4G x ...mm ²									
							mm2	10	16	25	35	50	70	95	120	150
	A max	75					100	127	158	192	246	298	346	399		
	Maximum lenght in metres															
L8W300T386	30	40	380	0,83	78,0	4		-	89	142	201	282	387	485		
L8W300T406				81	136		213	299	418							
L8W370T386	37	50	380	0,83	96,1			-	68	110	158	224	310	391	478	
L8W370T406				-	105		168	238	335	460						
L8W450T386	45	60	380	0,85	114			-	52	87	127	182	255	324	398	
L8W450T406				-	82		134	193	273	379	479					
L8W520T386	52	70	380	0,83	134			-	-	-	106	154	217	276	339	442
L8W520T406				-	-		112	163	232	324	409	501				
L8W550T386	55	75	380	0,85	139			-	-	-	99	144	205	262	323	426
L8W550T405				-	-		104	152	219	306	389	478				
L8W600T386	60	80	380	0,85	149			-	-	-	90	133	189	243	301	398
L8W600T406				-	-		95	140	202	284	362	446				
L8W670T386	67	90	380	0,86	168			-	-	-	-	113	163	212	263	352
L8W670T406				-	-		-	118	173	247	316	391	516			
L8W750T386	75	100	380	0,85	187			-	-	-	-	99	145	189	235	318
L8W750T406				-	-		-	104	154	220	284	351	465			
L8W830T386	83	110	380	0,85	206			-	-	-	-	-	128	168	211	288
L8W830T406				-	-		-	-	135	196	254	315	421			
L8W930T386	93	125	380	0,87	231			-	-	-	-	-	109	146	184	257
L8W930T406				-	-		-	-	114	169	221	277	377			

Exposed cable laid at a temperature of 30°C, maximum conductor temperature of 90°C

l8w_cavi-60_b_te

L8W, 60 Hz: SIZING OF ETHYLENE-PROPYLENE (EPR) CABLES Y/Δ (STAR / DELTA) STARTING

MOTOR TYPE THREE-PHASE	RATED POWER		RATED VOLTAGE V	Cos φ AT S.F.	CURRENT AT S.F. A	VOLTAGE DROP %	Cable cross section: 4G x ...mm2 + 3 x ...mm2									
							mm2	4	6	10	16	25	35	50	70	95
	A max*	73					94	130	173	220	274	333	426	516		
	Maximum lenght in metres															
L8W300T386	30	40	380	0,83	78,0	4		-	57	105	169	260	361	500		
L8W300T406			460	0,83	64,4			55	88	158	251	385				
L8W370T386	37	50	380	0,83	96,1			-	-	81	134	208	290	403		
L8W370T406			460	0,83	79,4			-	67	124	201	309	429			
L8W450T386	45	60	380	0,85	114			-	-	64	107	169	237	332	456	
L8W450T406			460	0,85	94,3			-	52	99	162	252	352	491		
L8W520T386	52	70	380	0,83	134			-	-	-	90	143	203	285	391	
L8W520T406			460	0,83	110			-	-	83	138	216	303	422		
L8W550T386	55	75	380	0,85	139			-	-	-	84	134	191	269	371	
L8W550T406			460	0,85	115			-	-	77	128	203	285	399		
L8W600T386	60	80	380	0,85	149			-	-	-	77	124	177	250	345	487
L8W600T406			460	0,85	123			-	-	70	118	188	265	372		
L8W670T386	67	90	380	0,86	168			-	-	-	64	106	152	217	302	430
L8W670T406			460	0,86	139			-	-	-	100	161	229	324	447	
L8W750T386	75	100	380	0,85	187			-	-	-	-	94	136	195	272	389
L8W750T406			460	0,85	154			-	-	-	89	144	206	292	403	
L8W830T386	83	110	380	0,85	206			-	-	-	-	82	121	174	244	352
L8W830T406			460	0,85	170			-	-	-	77,6	127	184	261	363	
L8W930T386	93	125	380	0,87	231			-	-	-	-	69	103	150	213	313
L8W930T406			460	0,87	191			-	-	-	-	108	158	227	318	458

Exposed cable laid at a temperature of 30°C, maximum conductor temperature of 90°C

l8w_cavi-SD-60_a_te

*A max is the maximum rated current of the motor

SPLICE BETWEEN DROP CABLE AND MOTOR CABLE

MOTOR TYPE	POWER kW	TYPE OF SPLICE	FOUR-CORE DROP CABLE - SECTION (mm ²)												
			1,5	2,5	4	6	10	16	25	35	50	70	95	120	150
4OS C4S	0,37 - 7,5	Resin-filled method	GR11	GR11	GR12	GR12	GR12	GR13	GR13	GR14	GR14	GR15	GR15	GR16	-
		Heat-shrink method	GT11	GT11	GT12	GT12	GT13	GT14	GT15	GT16	-	-	-	-	-
		Tape method	Self-vulcanizing tape + self-vulcanizing sealing putty and PVC tape (1)												
C6S L6W	4 - 37	Resin-filled method	-	-	GR12	GR12	GR12	GR13	GR13	GR14	GR14	GR15	GR15	GR16	-
		Heat-shrink method	-	-	GT12	GT12	GT13	GT14	GT15	GT16	-	-	-	-	-
		Tape method	Self-vulcanizing tape + self-vulcanizing sealing putty and PVC tape (1)												

MOTOR TYPE	POWER kW	TYPE OF SPLICE	THREE-CORE DROP CABLE - SECTION (mm ²)												
			1,5	2,5	4	6	10	16	25	35	50	70	95	120	150
C6S L6W	4 - 37	Resin-filled method	-	-	GR12	GR12	GR12	GR13	GR13	GR14	GR14	GR15	GR15	GR16	-
		Heat-shrink method	-	-	GT12	GT12	GT13	GT14	GT15	GT16	-	-	-	-	-
		Tape method	Self-vulcanizing tape + PVC tape												

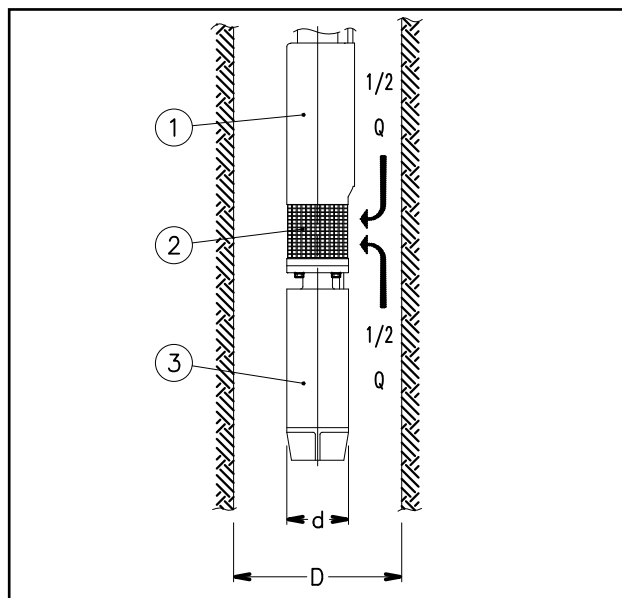
MOTOR TYPE	POWER kW	TYPE OF SPLICE	SINGLE-CORE DROP CABLE - SECTION (mm ²)												
			1,5	2,5	4	6	10	16	25	35	50	70	95	120	150
L8W L10W L12W	30 - 300	Resin-filled method	-	-	-	GR12	GR12	GR17	GR17	GR17	GR18	GR18	GR18	GR19	GR19
		Heat-shrink method	-	-	-	-	-	-	-	-	-	-	-	-	-
		Tape method	Self-vulcanizing tape + PVC tape												

(1) Use self-vulcanizing sealing putty to fill in the gaps between the three-conductor cable and the ground cable in the area covered by the final layer of tape, to restore continuity to the protective sheath.

RESIN-FILLED SPLICES				HEAT-SHRINK SPLICES			
TYPE	L x D [mm]	TYPE	L x D [mm]	TYPE	L x D [mm]	TYPE	L x D [mm]
GR11	190 x 45	GR14	357 x 62	GT11	330	GT14	330
GR12	190 x 51	GR15	325 x 95	GT12	330	GT15	500
GR13	240 x 62	GR16	520 x 100	GT13	330	GT16	500

L-giunzioni-en_f_te

CALCULATING THE SPEED OF THE FLUID THAT FLOWS AROUND A SUBMERGED MOTOR AND SIZING OF THE COOLING SLEEVE



The following formula is used to verify whether the speed of the fluid that flows around the motor of a submersible pump is high enough to guarantee the proper cooling of the motor:

$$v = \frac{\frac{Q}{2}}{\pi \cdot \left(\frac{D^2}{4} - \frac{d^2}{4} \right)}$$

Where:

Q in [m³/s] is the operating flow rate of the electric pump; only half of this flow is taken into account, because the fluid which is sucked into the area of the filter (2), comes from the motor side (3) as well as from the pump side (1);

D in [m] is the diameter of the well;

d in [m] is the diameter of the motor (3);

v in [m/s] is the calculated speed of the fluid that flows around the motor.

Now, compare the speed thus calculated (v) with the minimum speed required for correct cooling of the motor (v_m) if:

$v \geq v_m$ the motor is properly cooled

$v < v_m$ it will be necessary to mount a cooling sleeve (4)

Example:

An electric pump with motor diameter $d = 0.144$ m operates in an 8" well (well diameter $D = 0.203$ m) with flow rate:

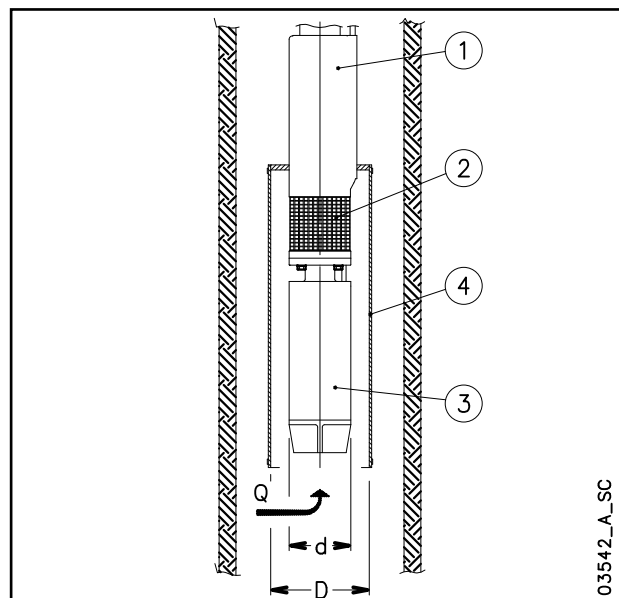
$Q = 20 \text{ m}^3/\text{h} = 0.0055 \text{ m}^3/\text{s}$

and speed of the fluid:

$v = (0.0055/2) / \{\pi \cdot [(0.203)^2/4 - (0.144)^2/4]\} = 0.17 \text{ m/s}$

The minimum speed required for proper motor cooling is $v_m = 0.20 \text{ m/s}$.

As $v < v_m$ it will be necessary to mount a cooling sleeve.



The following formula is used to determine the maximum diameter of a cooling sleeve to be mounted on a submersible motor:

$$D = \sqrt{4 \cdot \left(\frac{Q}{v \cdot \pi} + \frac{d^2}{4} \right)}$$

Where:

Q in [m³/s] is the operating flow rate of the electric pump; the entire flow is taken into account because the fluid comes from the motor side (3) only;

D in [m] corresponds to the diameter of the cooling sleeve (4);

d in [m] corresponds to the diameter of the motors(3);

v_m in [m/s] is the minimum speed of the fluid that flows around the motor.

If the electric pump operates at different flow rate, the minimum flow rate must be taken into account for calculating the diameter of the cooling sleeve.

Example:

A motor coupled to an electric pump with motor diameter $d = 0.144$ m, which operates with flow rate:

$Q = 15 \text{ m}^3/\text{h} = 0.0042 \text{ m}^3/\text{s}$

requires a minimum speed of the fluid:

$v_m = 0.20 \text{ m/s}$.

cooling sleeve diameter:

$D = \{4 \cdot [(0.0042/(0.2 \cdot \pi) + (0.144)^2/4)]\}^{0.5} = 0.217 \text{ m}$.

ASYNCHRONOUS MOTOR STARTING SYSTEMS

Direct

Suitable for low-power motors.

The starting current (I_s) is much higher than the rated current (I_n).

Starting current $I_s = I_n \times 4 \div 8$

Starting torque $T_s = T_n \times 2 \div 3$

Indirect

• Star/Delta

The starting current (I_s) is three times less than the direct starting current.

Starting current $I_s = I_n \times 1.3 \div 2.7$

Starting torque $T_s = T_n \times 0.7 \div 1$

In the star to delta changeover phase (approx. 70 ms) the motor is not supplied and tends to reduce its rotation speed.

In the case of submersible electric pumps with power above 10 HP, the modest mass of the rotor causes a slowdown at changeover, so that the initial Star supply phase is rendered partially useless.

In such cases we recommend using impedance panels or an autotransformer.

• Impedances

The motor is started with a voltage which is lower than the rated one, and which is obtained by means of impedances.

The Lowara panels use impedances which cut down to 70% the starting voltage.

The switch to the rated voltage takes place without any interruptions of the power supply.

Rated voltage $U_n = 400 \text{ V}$

Starting voltage $U_s = U_n \times 0.7 = 280 \text{ V}$

Starting current

$$I_s = I_n \times 4 \div 8 \times \left(\frac{U_s}{U_n} \right) = I_n \times 3 \div 6$$

Starting torque

$$T_s = T_n \times 2 \div 3 \times \left(\frac{U_s}{U_n} \right)^2 = T_n \times 1 \div 1.5$$

Autotransformer

The pump is started with a voltage which is lower than the rated one.

The Lowara panels use an autotransformer with a voltage that is 70% the value of the line voltage.

The switch to the rated voltage occurs without any interruptions of the power supply.

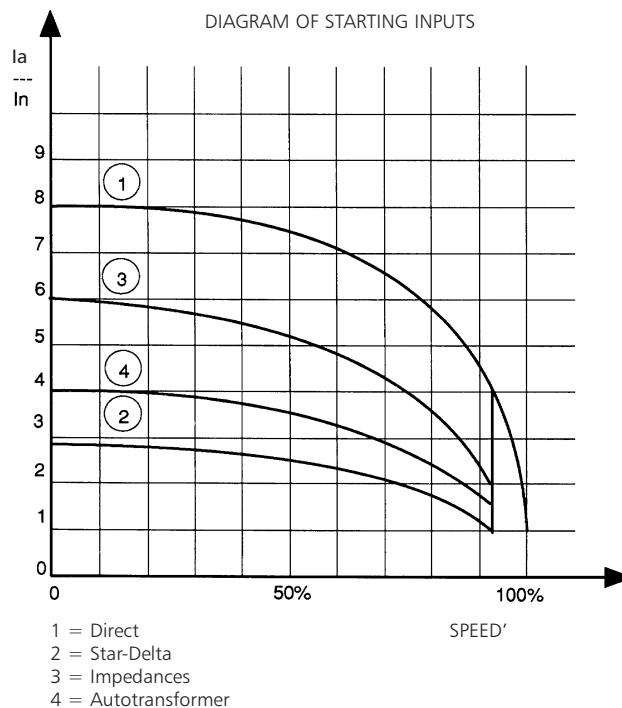
Rated voltage $U_n = 400 \text{ V}$

Starting current

$$I_s = I_n \times 4 \div 8 \times \left(\frac{U_s}{U_n} \right) = I_n \times 3 \div 6$$

Starting torque

$$T_s = T_n \times 2 \div 3 \times \left(\frac{U_s}{U_n} \right)^2 = T_n \times 1 \div 1.5$$



WATER REQUIREMENTS IN CIVIL USERS

Determination of the water requirement depends on the type of users and contemporaneity factor. The calculation may be subject to regulations, standards or customs that may vary from country to country. The calculation method shown below is an example based on practical experience, designed to provide a reference value and not a substitute for detailed analytical calculation.

Water requirements in condominiums.

The **consumption table** shows the maximum values for each delivery point, depending on the plumbing amenities.

MAXIMUM CONSUMPTION FOR EACH DELIVERY POINT

TYPE	CONSUMPTION (l/min)
Sink	9
Dishwasher	10
Washing machine	12
Shower	12
Bathtub	15
Washbasin	6
Bidet	6
Flush tank WC	6
Controlled flushing system WC	90

The **sum of the water consumption values** of each delivery point determines the maximum theoretical requirement, which must be reduced according to the **contemporaneity coefficient**, because in actual fact the delivery points are never used all together.

$f = \frac{1}{\sqrt{(0,857 \times Nr \times Na)}}$	Coefficient for apartments with one bathroom and flush tank WC
$f = \frac{1}{\sqrt{(0,857 \times Nr \times Na)}}$	Coefficient for apartments with one bathroom and controlled flushing system WC
$f = \frac{1,03}{\sqrt{(0,545 \times Nr \times Na)}}$	Coefficient for apartments with two bathrooms and flush tank WC
$f = \frac{0,8}{\sqrt{(0,727 \times Nr \times Na)}}$	Coefficient for apartments with two bathrooms and controlled flushing system WC
f= coefficient; Nr= number of delivery points; Na= number of apartments	

The **table of water requirements in civil users** shows the maximum contemporaneity flow-rate values based on the **number of apartments** and the type of WC for apartments with one bathroom and two bathrooms. As regards apartments with one bathroom, 7 drawing points have been taken into consideration, while 11 points have been considered for apartments with two bathrooms. If the number of drawing points or apartments is different, use the formulas to **calculate** the requirement.

TABLE OF WATER REQUIREMENTS IN CIVIL USERS

NUMBER OF APARTMENTS	WITH FLUSH TANK WC		WITH CONTROLLED FLUSHING SYSTEM WC	
	1	2	1	2
	FLOW RATE (l/min)			
1	32	40	60	79
2	45	56	85	111
3	55	68	105	136
4	63	79	121	157
5	71	88	135	176
6	78	97	148	193
7	84	105	160	208
8	90	112	171	223
9	95	119	181	236
10	100	125	191	249
11	105	131	200	261
12	110	137	209	273
13	114	143	218	284
14	119	148	226	295
15	123	153	234	305
16	127	158	242	315
17	131	163	249	325
18	134	168	256	334
19	138	172	263	343
20	142	177	270	352
21	145	181	277	361
22	149	185	283	369
23	152	190	290	378
24	155	194	296	386
25	158	198	302	394
26	162	202	308	401
27	165	205	314	409
28	168	209	320	417
29	171	213	325	424
30	174	217	331	431
35	187	234	357	466
40	200	250	382	498
45	213	265	405	528
50	224	280	427	557
55	235	293	448	584
60	245	306	468	610
65	255	319	487	635
70	265	331	506	659
75	274	342	523	682
80	283	354	540	704
85	292	364	557	726
90	301	375	573	747
95	309	385	589	767
100	317	395	604	787
120	347	433	662	863
140	375	468	715	932
160	401	500	764	996
180	425	530	811	1056
200	448	559	854	1114

For seaside resorts, a flow rate increased by at least 20% must be considered.

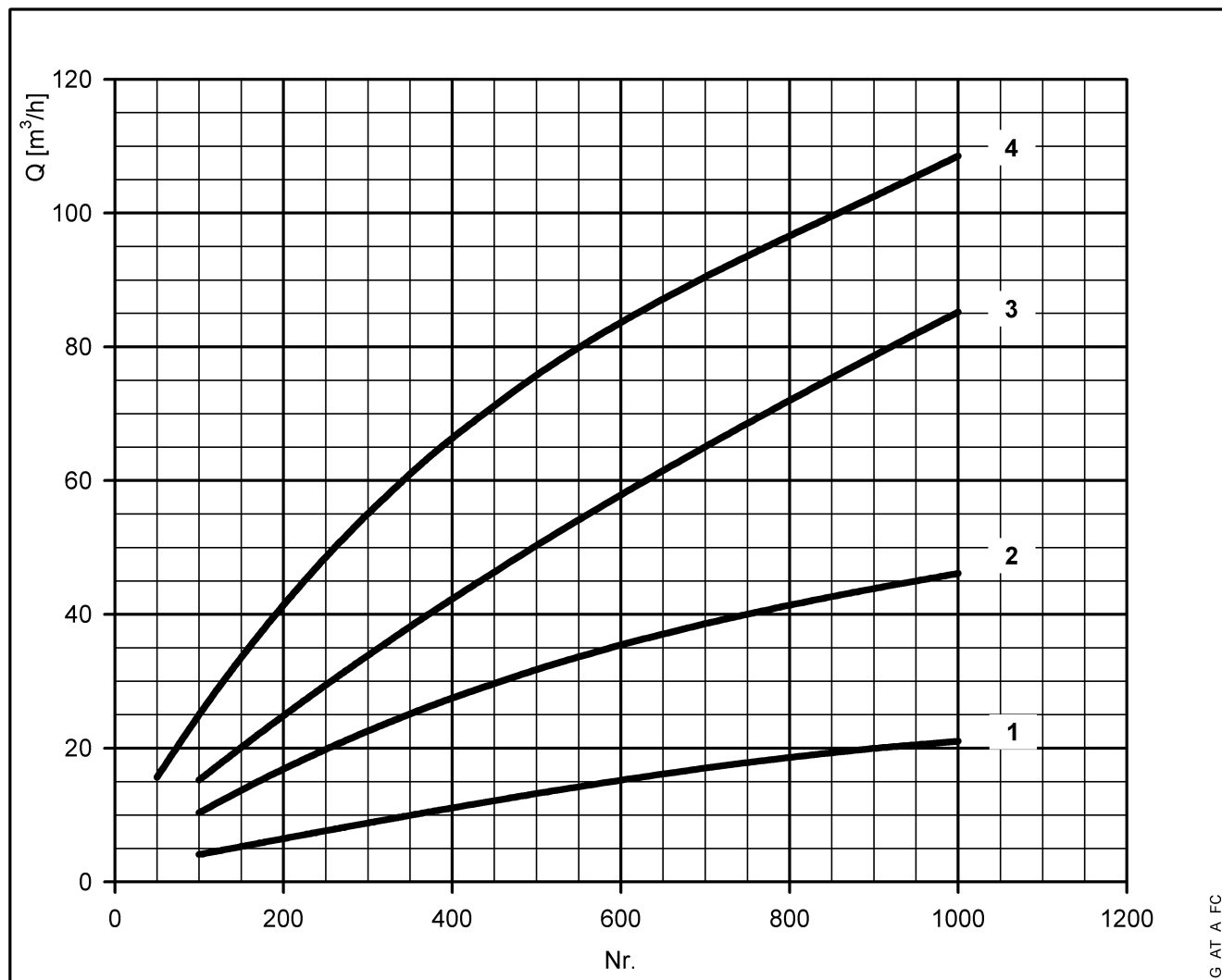
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WATER REQUIREMENTS FOR COMMUNITY BUILDINGS

The requirements of buildings intended for specific uses, such as **offices, residential units, hotels, department stores, nursing homes** and so on, are different from those of condominiums, and both their global daily water consumption and the maximum contemporaneity flow rate are usually greater.

The **diagram of water requirements for community buildings** shows the maximum contemporaneity flow rate of some types of communities, for guidance.

These requirements must be determined case by case with the utmost accuracy, using analytical calculation methods, according to particular needs and local provisions.



For seaside resorts, the flow rate must be increased by at least 20%.

- 1= Offices (N. of people)
- 2= Department stores (N. of people)
- 3= Nursing homes (N. of beds)
- 4= Hotels, residences (N. of beds)

NPSH

The minimum operating values that can be reached at the pump suction end are limited by the onset of cavitation.

Cavitation is the formation of vapour-filled cavities within liquids where the pressure is locally reduced to a critical value, or where the local pressure is equal to, or just below the vapour pressure of the liquid.

The vapour-filled cavities flow with the current and when they reach a higher pressure area the vapour contained in the cavities condenses. The cavities collide, generating pressure waves that are transmitted to the walls. These, being subjected to stress cycles, gradually become deformed and yield due to fatigue. This phenomenon, characterized by a metallic noise produced by the hammering on the pipe walls, is called incipient cavitation.

The damage caused by cavitation may be magnified by electrochemical corrosion and a local rise in temperature due to the plastic deformation of the walls. The materials that offer the highest resistance to heat and corrosion are alloy steels, especially austenitic steel. The conditions that trigger cavitation may be assessed by calculating the total net suction head, referred to in technical literature with the acronym NPSH (Net Positive Suction Head).

The NPSH represents the total energy (expressed in m.) of the liquid measured at suction under conditions of incipient cavitation, excluding the vapour pressure (expressed in m.) that the liquid has at the pump inlet.

To find the static height h_z at which to install the machine under safe conditions, the following formula must be verified:

$$h_p + h_z \geq (NPSH_r + 0.5) + h_f + h_{pv} \quad (1)$$

where:

h_p is the absolute pressure applied to the free liquid surface in the suction tank, expressed in m. of liquid; h_p is the quotient between the barometric pressure and the specific weight of the liquid.

h_z is the suction lift between the pump axis and the free liquid surface in the suction tank, expressed in m.; h_z is negative when the liquid level is lower than the pump axis.

h_f is the flow resistance in the suction line and its accessories, such as: fittings, foot valve, gate valve, elbows, etc.

h_{pv} is the vapour pressure of the liquid at the operating temperature, expressed in m. of liquid. h_{pv} is the quotient between the P_v vapour pressure and the liquid's specific weight.

0,5 is the safety factor.

The maximum possible suction head for installation depends on the value of the atmospheric pressure (i.e. the elevation above sea level at which the pump is installed) and the temperature of the liquid.

To help the user, with reference to water temperature (4° C) and to the elevation above sea level, the following tables show the drop in hydraulic pressure head in relation to the elevation above sea level, and the suction loss in relation to temperature.

Water temperat. (°C)	20	40	60	80	90	110	120
Suction loss (m)	0,2	0,7	2,0	5,0	7,4	15,4	21,5

Elevation above sea level (m)	500	1000	1500	2000	2500	3000
Suction loss (m)	0,55	1,1	1,65	2,2	2,75	3,3

Friction loss is shown in the tables at pages 62-63.

To reduce it to a minimum, especially in cases of high suction head (over 4-5 m.) or within the operating limits with high flow rates, we recommend using a suction line having a larger diameter than that of the pump's suction port.

It is always a good idea to position the pump as close as possible to the liquid to be pumped.

Make the following calculation:

Liquid: water at ~15°C $\gamma = 1 \text{ kg/dm}^3$

Flow rate required: 30 m³/h

Head for required delivery: 43 m.

Suction lift: 3,5 m.

The selection is an FHE 40-200/75 pump whose NPSH required value is, at 30 m³/h, di 2,5 m.

For water at 15 °C

$$h_p = P_a / \gamma = 10,33\text{m}, h_{pv} = P_v / \gamma = 0,174\text{m} (0,01701 \text{ bar})$$

The H_f flow resistance in the suction line with foot valves is ~ 1,2 m.

By substituting the parameters in formula (1) with the numeric values above, we have:

$$10,33 + (-3,5) \geq (2,5 + 0,5) + 1,2 + 0,17$$

from which we have: 6,8 > 4,4

The relation is therefore verified.

TECHNICAL APPENDIX VAPOUR PRESSURE p_s VAPOUR PRESSURE AND ρ DENSITY OF WATER TABLE

t °C	T K	p_s bar	ρ kg/dm ³	t °C	T K	p_s bar	ρ kg/dm ³	t °C	T K	p_s bar	ρ kg/dm ³
0	273,15	0,00611	0,9998	55	328,15	0,15741	0,9857	120	393,15	1,9854	0,9429
1	274,15	0,00657	0,9999	56	329,15	0,16511	0,9852	122	395,15	2,1145	0,9412
2	275,15	0,00706	0,9999	57	330,15	0,17313	0,9846	124	397,15	2,2504	0,9396
3	276,15	0,00758	0,9999	58	331,15	0,18147	0,9842	126	399,15	2,3933	0,9379
4	277,15	0,00813	1,0000	59	332,15	0,19016	0,9837	128	401,15	2,5435	0,9362
5	278,15	0,00872	1,0000	60	333,15	0,1992	0,9832	130	403,15	2,7013	0,9346
6	279,15	0,00935	1,0000	61	334,15	0,2086	0,9826	132	405,15	2,867	0,9328
7	280,15	0,01001	0,9999	62	335,15	0,2184	0,9821	134	407,15	3,041	0,9311
8	281,15	0,01072	0,9999	63	336,15	0,2286	0,9816	136	409,15	3,223	0,9294
9	282,15	0,01147	0,9998	64	337,15	0,2391	0,9811	138	411,15	3,414	0,9276
10	283,15	0,01227	0,9997	65	338,15	0,2501	0,9805	140	413,15	3,614	0,9258
11	284,15	0,01312	0,9997	66	339,15	0,2615	0,9799	145	418,15	4,155	0,9214
12	285,15	0,01401	0,9996	67	340,15	0,2733	0,9793	155	428,15	5,433	0,9121
13	286,15	0,01497	0,9994	68	341,15	0,2856	0,9788	160	433,15	6,181	0,9073
14	287,15	0,01597	0,9993	69	342,15	0,2984	0,9782	165	438,15	7,008	0,9024
15	288,15	0,01704	0,9992	70	343,15	0,3116	0,9777	170	443,15	7,920	0,8973
16	289,15	0,01817	0,9990	71	344,15	0,3253	0,9770	175	448,15	8,924	0,8921
17	290,15	0,01936	0,9988	72	345,15	0,3396	0,9765	180	453,15	10,027	0,8869
18	291,15	0,02062	0,9987	73	346,15	0,3543	0,9760	185	458,15	11,233	0,8815
19	292,15	0,02196	0,9985	74	347,15	0,3696	0,9753	190	463,15	12,551	0,8760
20	293,15	0,02337	0,9983	75	348,15	0,3855	0,9748	195	468,15	13,987	0,8704
21	294,15	0,24850	0,9981	76	349,15	0,4019	0,9741	200	473,15	15,550	0,8647
22	295,15	0,02642	0,9978	77	350,15	0,4189	0,9735	205	478,15	17,243	0,8588
23	296,15	0,02808	0,9976	78	351,15	0,4365	0,9729	210	483,15	19,077	0,8528
24	297,15	0,02982	0,9974	79	352,15	0,4547	0,9723	215	488,15	21,060	0,8467
25	298,15	0,03166	0,9971	80	353,15	0,4736	0,9716	220	493,15	23,198	0,8403
26	299,15	0,03360	0,9968	81	354,15	0,4931	0,9710	225	498,15	25,501	0,8339
27	300,15	0,03564	0,9966	82	355,15	0,5133	0,9704	230	503,15	27,976	0,8273
28	301,15	0,03778	0,9963	83	356,15	0,5342	0,9697	235	508,15	30,632	0,8205
29	302,15	0,04004	0,9960	84	357,15	0,5557	0,9691	240	513,15	33,478	0,8136
30	303,15	0,04241	0,9957	85	358,15	0,5780	0,9684	245	518,15	36,523	0,8065
31	304,15	0,04491	0,9954	86	359,15	0,6011	0,9678	250	523,15	39,776	0,7992
32	305,15	0,04753	0,9951	87	360,15	0,6249	0,9671	255	528,15	43,246	0,7916
33	306,15	0,05029	0,9947	88	361,15	0,6495	0,9665	260	533,15	46,943	0,7839
34	307,15	0,05318	0,9944	89	362,15	0,6749	0,9658	265	538,15	50,877	0,7759
35	308,15	0,05622	0,9940	90	363,15	0,7011	0,9652	270	543,15	55,058	0,7678
36	309,15	0,05940	0,9937	91	364,15	0,7281	0,9644	275	548,15	59,496	0,7593
37	310,15	0,06274	0,9933	92	365,15	0,7561	0,9638	280	553,15	64,202	0,7505
38	311,15	0,06624	0,9930	93	366,15	0,7849	0,9630	285	558,15	69,186	0,7415
39	312,15	0,06991	0,9927	94	367,15	0,8146	0,9624	290	563,15	74,461	0,7321
40	313,15	0,07375	0,9923	95	368,15	0,8453	0,9616	295	568,15	80,037	0,7223
41	314,15	0,07777	0,9919	96	369,15	0,8769	0,9610	300	573,15	85,927	0,7122
42	315,15	0,08198	0,9915	97	370,15	0,9094	0,9602	305	578,15	92,144	0,7017
43	316,15	0,09639	0,9911	98	371,15	0,9430	0,9596	310	583,15	98,70	0,6906
44	317,15	0,09100	0,9907	99	372,15	0,9776	0,9586	315	588,15	105,61	0,6791
45	318,15	0,09582	0,9902	100	373,15	1,0133	0,9581	320	593,15	112,89	0,6669
46	319,15	0,10086	0,9898	102	375,15	1,0878	0,9567	325	598,15	120,56	0,6541
47	320,15	0,10612	0,9894	104	377,15	1,1668	0,9552	330	603,15	128,63	0,6404
48	321,15	0,11162	0,9889	106	379,15	1,2504	0,9537	340	613,15	146,05	0,6102
49	322,15	0,11736	0,9884	108	381,15	1,3390	0,9522	350	623,15	165,35	0,5743
50	323,15	0,12335	0,9880	110	383,15	1,4327	0,9507	360	633,15	186,75	0,5275
51	324,15	0,12961	0,9876	112	385,15	1,5316	0,9491	370	643,15	210,54	0,4518
52	325,15	0,13613	0,9871	114	387,15	1,6362	0,9476	374,15	647,30	221,20	0,3154
53	326,15	0,14293	0,9862	116	389,15	1,7465	0,9460				
54	327,15	0,15002	0,9862	118	391,15	1,8628	0,9445				

G-at_npsb_b_sc

**TABLE OF FLOW RESISTANCE IN 100 m OF STRAIGHT
CAST IRON PIPELINE (HAZEN-WILLIAMS FORMULA C=100)**

FLOW RATE		NOMINAL DIAMETER in mm and inches																	
m ³ /h	l/min		15 1/2"	20 3/4"	25 1"	32 1 1/4"	40 1 1/2"	50 2	65 2 1/2"	80 3"	100 4"	125 5"	150 6"	175 7"	200 8"	250 10"	300 12"	350 14"	400 16"
0,6	10	v	0,94	0,53	0,34	0,21	0,13		The hr values must be multiplied by: 0,71 for galvanized or painted steel pipes 0,54 for stainless steel or copper pipes 0,47 for PVC or PE pipes										
		hr	16	3,94	1,33	0,40	0,13												
0,9	15	v	1,42	0,80	0,51	0,31	0,20												
		hr	33,9	8,35	2,82	0,85	0,29												
1,2	20	v	1,89	1,06	0,68	0,41	0,27	0,17											
		hr	57,7	14,21	4,79	1,44	0,49	0,16											
1,5	25	v	2,36	1,33	0,85	0,52	0,33	0,21											
		hr	87,2	21,5	7,24	2,18	0,73	0,25											
1,8	30	v	2,83	1,59	1,02	0,62	0,40	0,25											
		hr	122	30,1	10,1	3,05	1,03	0,35											
2,1	35	v	3,30	1,86	1,19	0,73	0,46	0,30											
		hr	162	40,0	13,5	4,06	1,37	0,46											
2,4	40	v		2,12	1,36	0,83	0,53	0,34	0,20										
		hr		51,2	17,3	5,19	1,75	0,59	0,16										
3	50	v		2,65	1,70	1,04	0,66	0,42	0,25										
		hr		77,4	26,1	7,85	2,65	0,89	0,25										
3,6	60	v		3,18	2,04	1,24	0,80	0,51	0,30										
		hr		108	36,6	11,0	3,71	1,25	0,35										
4,2	70	v		3,72	2,38	1,45	0,93	0,59	0,35										
		hr		144	48,7	14,6	4,93	1,66	0,46										
4,8	80	v		4,25	2,72	1,66	1,06	0,68	0,40										
		hr		185	62,3	18,7	6,32	2,13	0,59										
5,4	90	v			3,06	1,87	1,19	0,76	0,45	0,30									
		hr			77,5	23,3	7,85	2,65	0,74	0,27									
6	100	v			3,40	2,07	1,33	0,85	0,50	0,33									
		hr			94,1	28,3	9,54	3,22	0,90	0,33									
7,5	125	v			4,25	2,59	1,66	1,06	0,63	0,41									
		hr			142	42,8	14,4	4,86	1,36	0,49									
9	150	v				3,11	1,99	1,27	0,75	0,50	0,32								
		hr				59,9	20,2	6,82	1,90	0,69	0,23								
10,5	175	v				3,63	2,32	1,49	0,88	0,58	0,37								
		hr				79,7	26,9	9,07	2,53	0,92	0,31								
12	200	v				4,15	2,65	1,70	1,01	0,66	0,42								
		hr				102	34,4	11,6	3,23	1,18	0,40								
15	250	v				5,18	3,32	2,12	1,26	0,83	0,53	0,34							
		hr				154	52,0	17,5	4,89	1,78	0,60	0,20							
18	300	v					3,98	2,55	1,51	1,00	0,64	0,41							
		hr					72,8	24,6	6,85	2,49	0,84	0,28							
24	400	v					5,31	3,40	2,01	1,33	0,85	0,54	0,38						
		hr					124	41,8	11,66	4,24	1,43	0,48	0,20						
30	500	v					6,63	4,25	2,51	1,66	1,06	0,68	0,47						
		hr					187	63,2	17,6	6,41	2,16	0,73	0,30						
36	600	v					5,10	3,02	1,99	1,27	0,82	0,57	0,42						
		hr					88,6	24,7	8,98	3,03	1,02	0,42	0,20						
42	700	v					5,94	3,52	2,32	1,49	0,95	0,66	0,49						
		hr					118	32,8	11,9	4,03	1,36	0,56	0,26						
48	800	v					6,79	4,02	2,65	1,70	1,09	0,75	0,55						
		hr					151	42,0	15,3	5,16	1,74	0,72	0,34						
54	900	v					7,64	4,52	2,99	1,91	1,22	0,85	0,62						
		hr					188	52,3	19,0	6,41	2,16	0,89	0,42						
60	1000	v					5,03	3,32	2,12	1,36	0,94	0,69	0,53						
		hr					63,5	23,1	7,79	2,63	1,08	0,51	0,27						
75	1250	v					6,28	4,15	2,65	1,70	1,18	0,87	0,66						
		hr					96,0	34,9	11,8	3,97	1,63	0,77	0,40						
90	1500	v					7,54	4,98	3,18	2,04	1,42	1,04	0,80						
		hr					134	48,9	16,5	5,57	2,29	1,08	0,56						
105	1750	v					8,79	5,81	3,72	2,38	1,65	1,21	0,93						
		hr					179	65,1	21,9	7,40	3,05	1,44	0,75						
120	2000	v					6,63	4,25	2,72	1,89	1,39	1,06	0,68						
		hr					83,3	28,1	9,48	3,90	1,84	0,96	0,32						
150	2500	v					8,29	5,31	3,40	2,36	1,73	1,33	0,85						
		hr					126	42,5	14,3	5,89	2,78	1,45	0,49						
180	3000	v								6,37	4,08	2,83	2,08	1,59	1,02	0,71			
		hr								59,5	20,1	8,26	3,90	2,03	0,69	0,28			
210	3500	v								7,43	4,76	3,30	2,43	1,86	1,19	0,83			
		hr								79,1	26,7	11,0	5,18	2,71	0,91	0,38			
240	4000	v								8,49	5,44	3,77	2,77	2,12	1,36	0,94			
		hr								101	34,2	14,1	6,64	3,46	1,17	0,48			
300	5000	v									6,79	4,72	3,47	2,65	1,70	1,18			
		hr									51,6	21,2	10,0	5,23	1,77	0,73			
360	6000	v									8,15	5,66	4,16	3,18	2,04	1,42			
		hr									72,3	29,8	14,1	7,33	2,47	1,02			
420	7000	v										6,61	4,85	3,72	2,38	1,65	1,21		
		hr										39,6	18,7	9,75	3,29	1,35	0,64		
480	8000	v										7,55	5,55	4,25	2,72	1,89	1,39		
		hr										50,7	23,9	12,49	4,21	1,73	0,82		
540	9000	v										8,49	6,24	4,78	3,06	2,12	1,56	1,19	
		hr										63,0	29,8	15,5	5,24	2,16	1,02	0,53	
600	10000	v											6,93	5,31	3,40	2,36	1,73	1,33	
		hr											36,2	18,9	6,36	2,62	1,24	0,65	

hr = flow resistance for 100 m of straight pipeline (m)

V = water speed (m/s)

G-at-pct-en_b_th

TABLE OF FLOW RESISTANCE IN BENDS, VALVES AND GATES

The flow resistance is calculated using the equivalent pipeline length method according to the table below:

ACCESSORY TYPE	DN											
	25	32	40	50	65	80	100	125	150	200	250	300
	Equivalent pipeline length (m)											
45° bend	0,2	0,2	0,4	0,4	0,6	0,6	0,9	1,1	1,5	1,9	2,4	2,8
90° bend	0,4	0,6	0,9	1,1	1,3	1,5	2,1	2,6	3,0	3,9	4,7	5,8
90° smooth bend	0,4	0,4	0,4	0,6	0,9	1,1	1,3	1,7	1,9	2,8	3,4	3,9
Union tee or cross	1,1	1,3	1,7	2,1	2,6	3,2	4,3	5,3	6,4	7,5	10,7	12,8
Gate valve	-	-	-	0,2	0,2	0,2	0,4	0,4	0,6	0,9	1,1	1,3
Foot check valve	1,1	1,5	1,9	2,4	3,0	3,4	4,7	5,9	7,4	9,6	11,8	13,9
Non return valve	1,1	1,5	1,9	2,4	3,0	3,4	4,7	5,9	7,4	9,6	11,8	13,9

G-a-pcv-en_b_th

The table is valid for the Hazen Williams coefficient $C = 100$ (cast iron pipework). For steel pipework, multiply the values by 1.41. For stainless steel, copper and coated cast iron pipework, multiply the values by 1.85.

When the **equivalent pipeline length** has been determined, the flow resistance is obtained from the table of flow resistance.

The values given are guideline values which are bound to vary slightly according to the model, especially for gate valves and non-return valves, for which it is a good idea to check the values supplied by the manufacturers.

VOLUMETRIC CAPACITY

Litres per minute l/min	Cubic metres per hour m ³ /h	Cubic feet per hour ft ³ /h	Cubic feet per minute ft ³ /min	Imperial gallon per minute Imp. gal/min	U.S. gallon per minute US gal/min
1,0000	0,0600	2,1189	0,0353	0,2200	0,2642
16,6667	1,0000	35,3147	0,5886	3,6662	4,4029
0,4719	0,0283	1,0000	0,0167	0,1038	0,1247
28,3168	1,6990	60,0000	1,0000	6,2288	7,4805
4,5461	0,2728	9,6326	0,1605	1,0000	1,2009
3,7854	0,2271	8,0208	0,1337	0,8327	1,0000

PRESSURE AND HEAD

Newton per square metre N/m ²	kilo Pascal kPa	bar bar	Pound force per square inch psi	Metre of water m H ₂ O	Millimetre of mercury mm Hg
1,0000	0,0010	1×10^{-5}	$1,45 \times 10^{-4}$	$1,02 \times 10^{-4}$	0,0075
1 000,0000	1,0000	0,0100	0,1450	0,1020	7,5006
1×10^5	100,0000	1,0000	14,5038	10,1972	750,0638
6 894,7570	6,8948	0,0689	1,0000	0,7031	51,7151
9 806,6500	9,8067	0,0981	1,4223	1,0000	73,5561
133,3220	0,1333	0,0013	0,0193	0,0136	1,0000

LENGTH

Millimetre mm	Centimetre cm	Metre m	Inch in	Foot ft	Yard yd
1,0000	0,1000	0,0010	0,0394	0,0033	0,0011
10,0000	1,0000	0,0100	0,3937	0,0328	0,0109
1 000,0000	100,0000	1,0000	39,3701	3,2808	1,0936
25,4000	2,5400	0,0254	1,0000	0,0833	0,0278
304,8000	30,4800	0,3048	12,0000	1,0000	0,3333
914,4000	91,4400	0,9144	36,0000	3,0000	1,0000

VOLUME

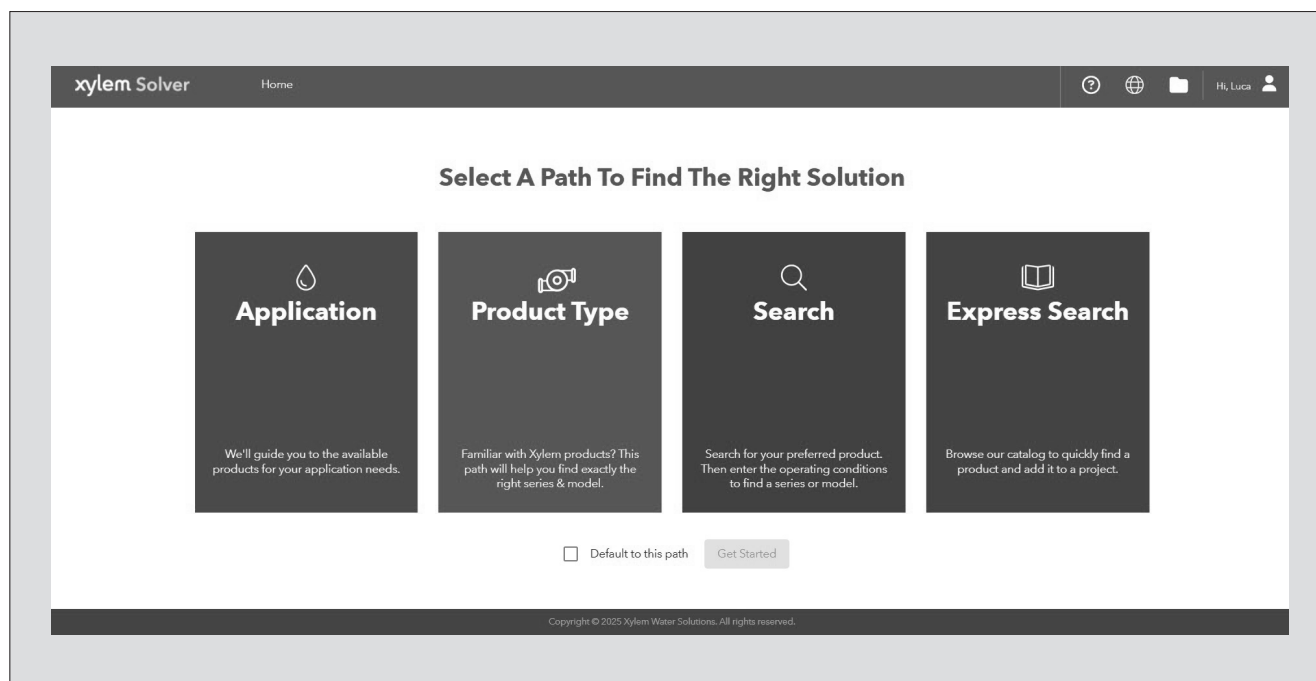
Cubic metre m ³	Litre L	Millilitre ml	Imperial gallon imp. gal.	U.S. gallon US gal.	Cubic foot ft ³
1,0000	1 000,0000	1×10^6	219,9694	264,1720	35,3147
0,0010	1,0000	1 000,0000	0,2200	0,2642	0,0353
1×10^{-6}	0,0010	1,0000	$2,2 \times 10^{-4}$	$2,642 \times 10^{-4}$	$3,53 \times 10^{-5}$
0,0045	4,5461	4 546,0870	1,0000	1,2009	0,1605
0,0038	3,7854	3 785,4120	0,8327	1,0000	0,1337
0,0283	28,3168	28 316,8466	6,2288	7,4805	1,0000

TEMPERATURE

Water	Kelvin K	Celsius °C	Fahrenheit °F	$^{\circ}\text{F} = ^{\circ}\text{C} \times \frac{9}{5} + 32$ $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times \frac{5}{9}$
icing	273,1500	0,0000	32,0000	
boiling	373,1500	100,0000	212,0000	

G-at_pp-en_b_sc

FURTHER PRODUCT SELECTION AND DOCUMENTATION Xylem Solver



Xylem Solver is pump solution selection software with an extensive online database of product information across the entire Xylem range of pumps and related products, with multiple search options and helpful project management facilities. The system holds up-to-date product information on thousands of products and accessories.

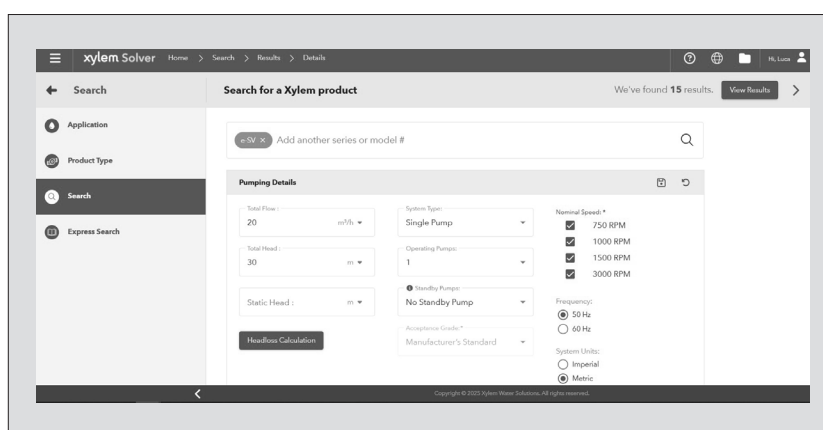
The possibility to search by applications and the detailed information output given makes it easy to make the optimal selection without having detailed knowledge about the Xylem products.

The search can be made by:

- Application
- Product type
- Duty point

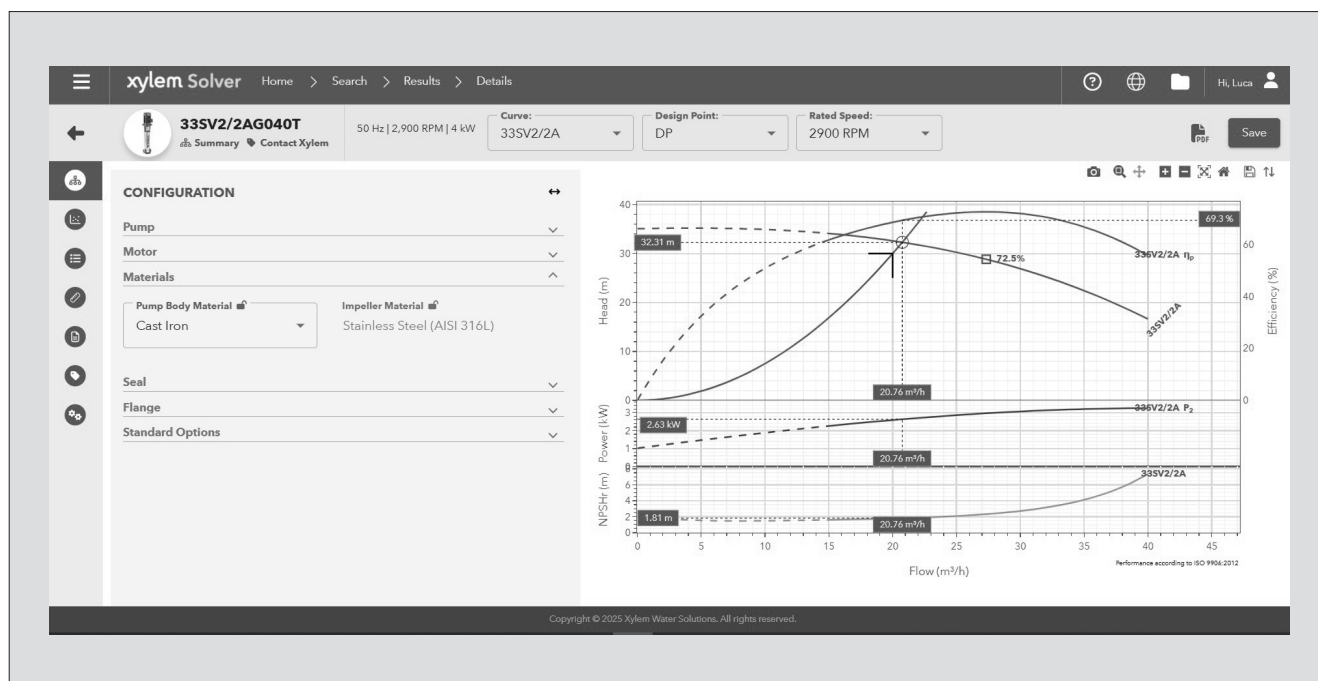
Xylem Solver gives a detailed output:

- List with search results in which you can compare up to four products
- Performance curves (flow, head, power, efficiency, NPSH)
- Motor data
- Dimensional drawings
- Options
- Data sheet printouts
- Document downloads incl dxf, stp and BIM files



Once a product series has been selected, input design criteria to select pumps that meet the design requirements.

FURTHER PRODUCT SELECTION AND DOCUMENTATION Xylem Solver



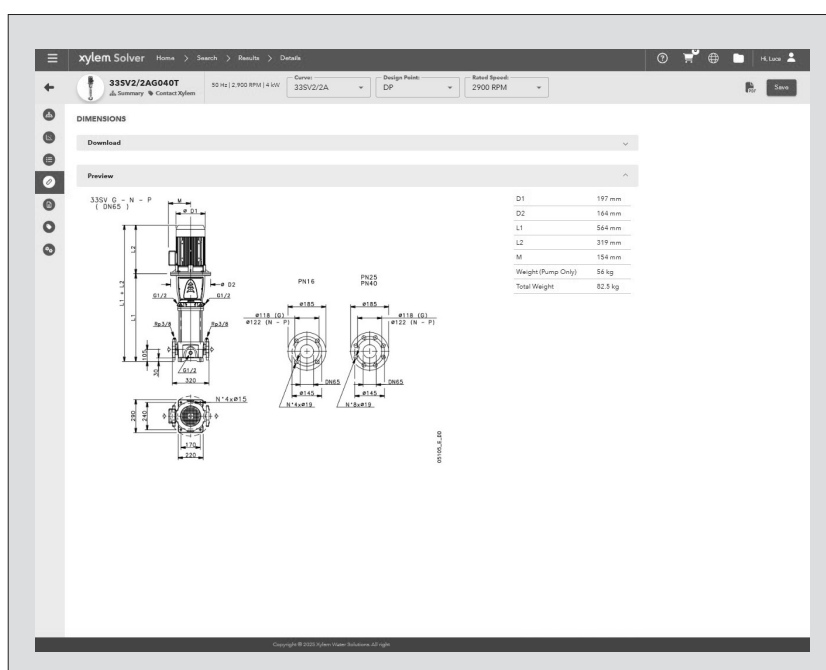
The detailed output makes it easy to select the optimal pump from the given alternatives.

The best way to work with Xylem Solver is to create a personal account. This makes it possible to:

- Set own standard units
- Create and save projects

Every registered user has a proper space, where all projects are saved.

For more information about Xylem Solver please contact our sales network or visit <https://solver.xylem.com>.



The dimensions tab shows technical drawings, dimensions, and CAD files when available.

Xylem | 'zīlām|

- 1) the tissue in plants that brings water and nutrients upward from the roots.
- 2) a leading global water solutions company.

Xylem is the connective tissue and system in plants which cleanses and transports water from the root to where it is needed most to sustain life.

And this is the essence of Xylem as a company. We are committed to driving sustainable impact by ensuring our connected technologies and solutions support our customers and the communities they serve, to tackle the water challenges that matter most to them.

For more information on how Xylem can help you, visit xylem.com.

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The logo for Xylem, featuring the word "xylem" in a lowercase, blue, sans-serif font.