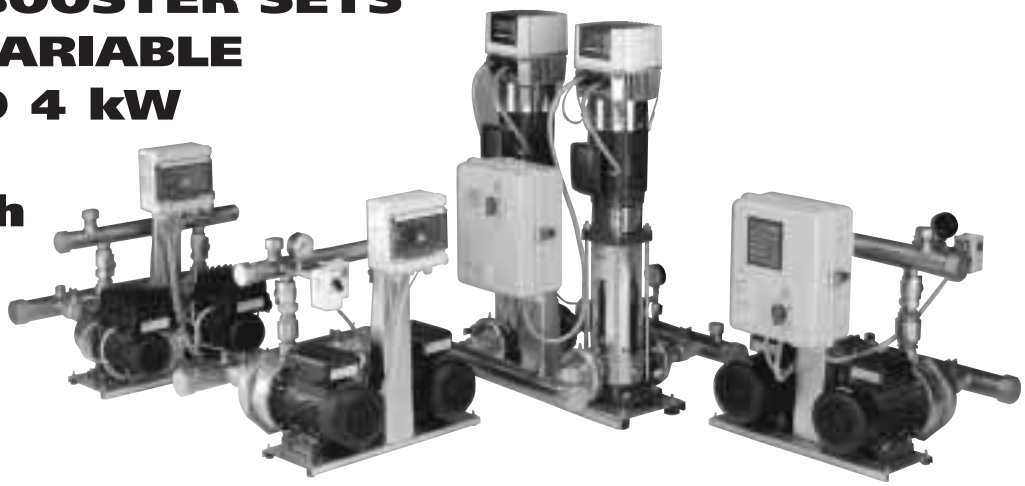
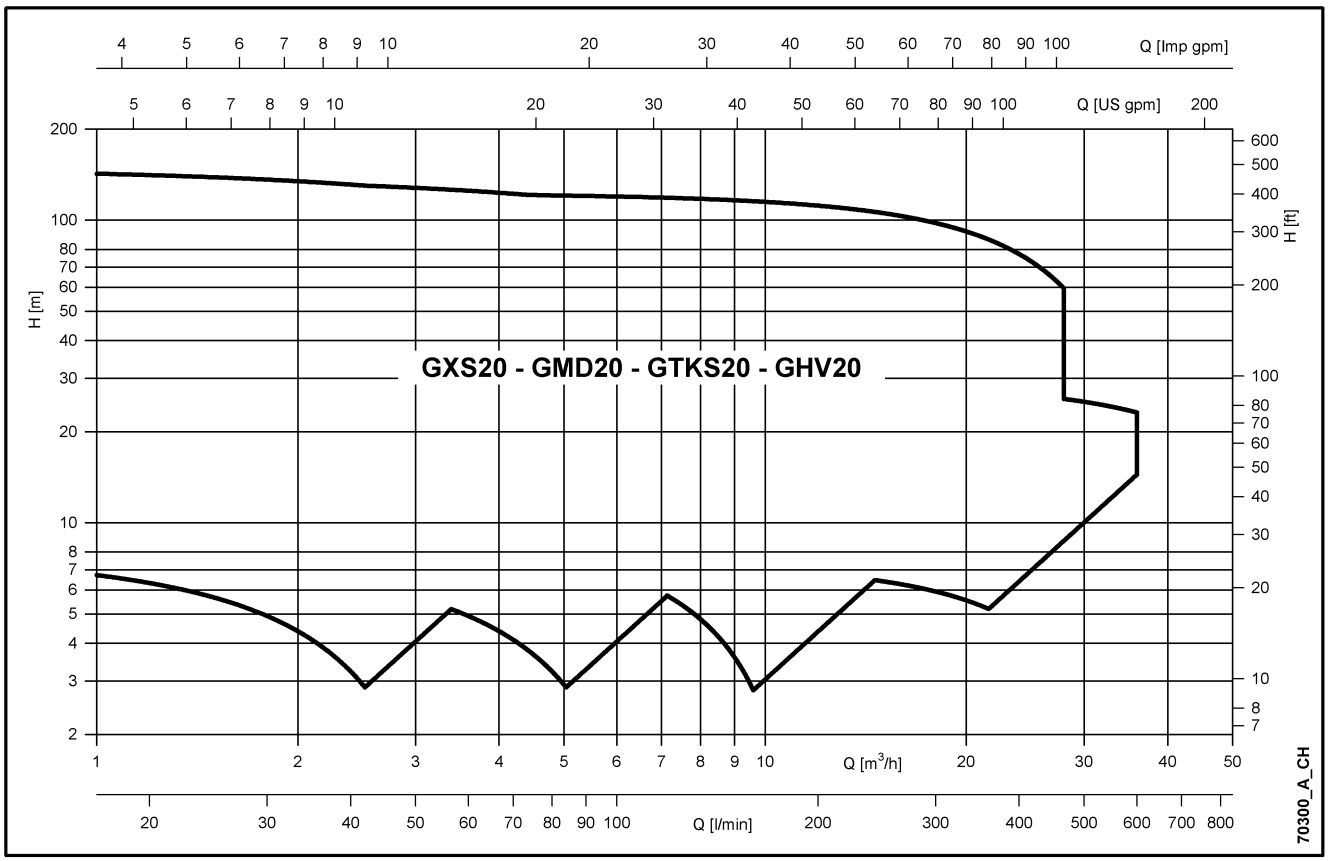
LOWARA

TWO-PUMP BOOSTER SETS FIXED AND VARIABLE SPEED UP TO 4 kW FLOW RATE UP TO 36 m³/h



50 Hz

GXS20 - GMD20 - GTKS20 - GHV20 SERIES



EDITION 09-2005

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CONTENTS

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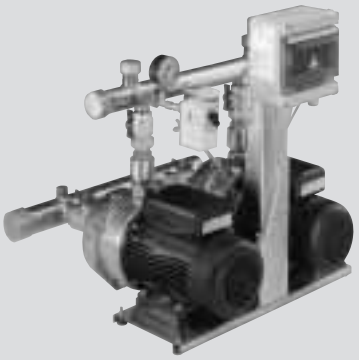
RANGE

- The range of two-pump booster sets includes fixed speed and variable speed systems available in a variety of material configurations to suit the specific requirements of different applications.



GXS SERIES SETS

- Single-phase power supply, fixed speed and pressure switch control. For BG, CA, CEA, HM and SV series electric pumps.

Flow rate up to 28 m³/h.
Power up to 2 x 1.5 kW

GMD SERIES SERS

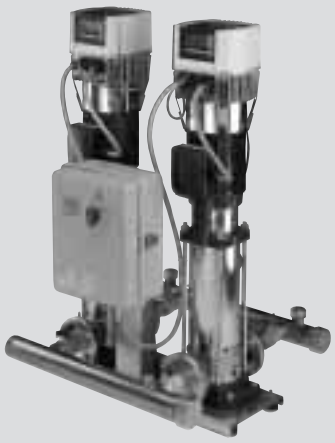
- Three-phase power supply, fixed speed and pressure switch control. For BG, CA, CEA, HM and SV series electric pumps.

Flow rate up to 36 m³/h.
Power up to 2 x 4 kW

GTKS SERIES SETS

- Single-phase power supply, variable speed and control by pressure transducers and Teknospeed electronic speed controllers integrated with the motor. For BG, CA, CEA, HM and SV series electric pumps.

Flow rate up to 16 m³/h.
Power up to 2 x 1.1 kW



GHV SERIES SETS

- Single-phase or three-phase power supply, variable speed and control by pressure transducers and Hydrovar electronic speed controllers mounted on the motor. For SV series electric pumps.

Flow rate up to 28 m³/h.
Power up to 2 x 4 kW

REFERENCE STANDARDS

- The Lowara two-pump booster sets are marked CE in conformity with the following directives:
  - Machinery Directive 98/37/EC
  - Low Voltage Directive 73/23/EEC and subsequent amendments
  - Electromagnetic Compatibility Directive 89/336/EEC and subsequent amendments

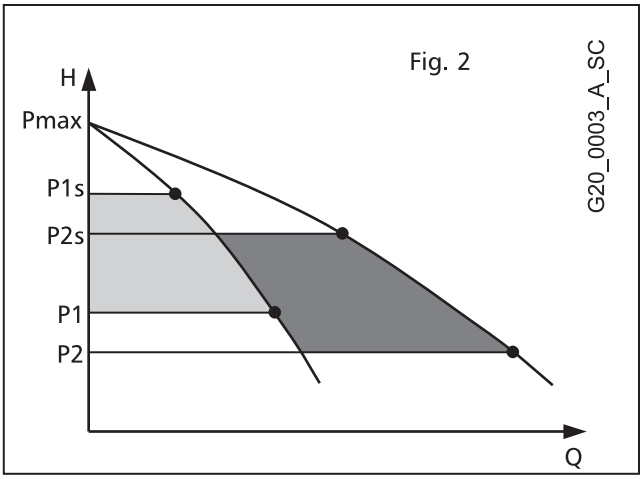
OPERATIONS DESCRIPTION

TWO-PUMP SETS WITH FIXED-SPEED MOTORS AND PRESSURE SWITCH CONTROL

The starting and stopping of the pumps are determined by the pressure values set on the pressure switches. Each pressure switch is connected to a single pump with a cyclic pump changeover.
The differential pressure is the difference between starting pressure and switch-off pressure. It is set at the same value for both pumps.

Figure 3 shows the operating mode with the pumps' curves.

- On demand, water is drawn from the tank.
- When the pressure drops to the P1 value the first pump starts.
- If the water consumption increases and the pressure drops to the P2 value, the second pump starts.
- When consumption reduces and the pressure increases until it reaches the P2s value, one of the pumps is switched off.
- If consumption keeps reducing, the pump charges the tank and stops at the P1s value.

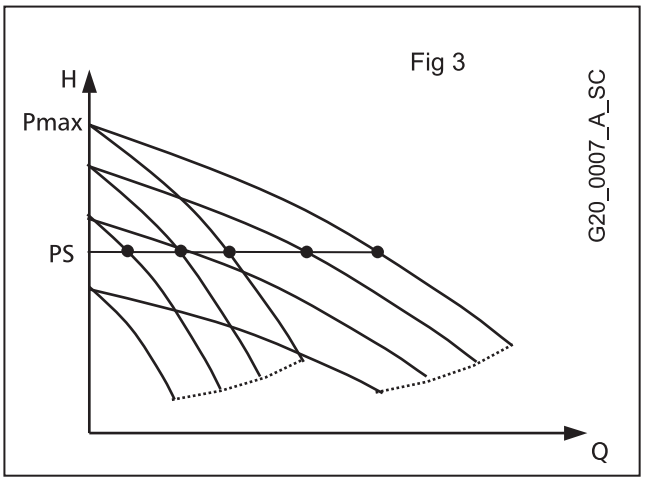


TWO-PUMP SETS WITH VARIABLE-SPEED MOTORS AND PRESSURE TRANSDUCER CONTROL

The starting and stopping of the pumps are determined by the pressure values set on the controller. Each frequency converter is connected to a pressure transducer. The converters exchange information with each other and provide for cyclic changeover.

Figure 3 shows the operating mode with the pumps' curves.

- On demand, water is drawn from the tank.
- When the pressure drops below the PS setting the first pump starts and the speed is adjusted to maintain a constant pressure as the demand increases.
- If the water consumption increases and the pump reaches maximum speed, the second pump starts and the speed is adjusted to maintain a constant pressure.
- When consumption reduces the speed is reduced until minimum speed is reached and one of the pumps is switched off.
- If consumption keeps reducing the pump slows down, charges the tank and stops at the PS setting.



SELECTING A SET

The first thing to do when selecting a set is to determine the quantity of water required and the pressure it must supply.

CALCULATING THE FLOW RATE

- The quantity of water called **water requirement** depends on the type of users, e.g. homes, offices, schools, as well as their number. The theoretic requirement is the total amount of water required by all the users simultaneously. In reality, since it is very unlikely that there should be a simultaneous demand by all the users, the **real requirement** is lower than the theoretic one.

CALCULATING THE HEAD

- The pressure required depends on the type of user. A number of factors must be taken into account, including the **height of the building**, the suction conditions and the flow resistance in the pipes.

SELECTING A BOOSTER SET

- According to the required flow rate and head values, it is possible to identify the most suitable type of electric pump. On two-pump sets the pumps normally act as **back-up for one another**. A single pump is normally sufficient to provide for average requirements, while in conditions of high demand the back up pump may be called in to assist. With the **cyclic changeover** function duty assignment is rotated to ensure both pumps remain active and with even running hours, so wear is uniform and the use factor is reduced for longer pump life. This system also ensures **continuity of operation** in case one of the pumps needs maintenance.

TANK

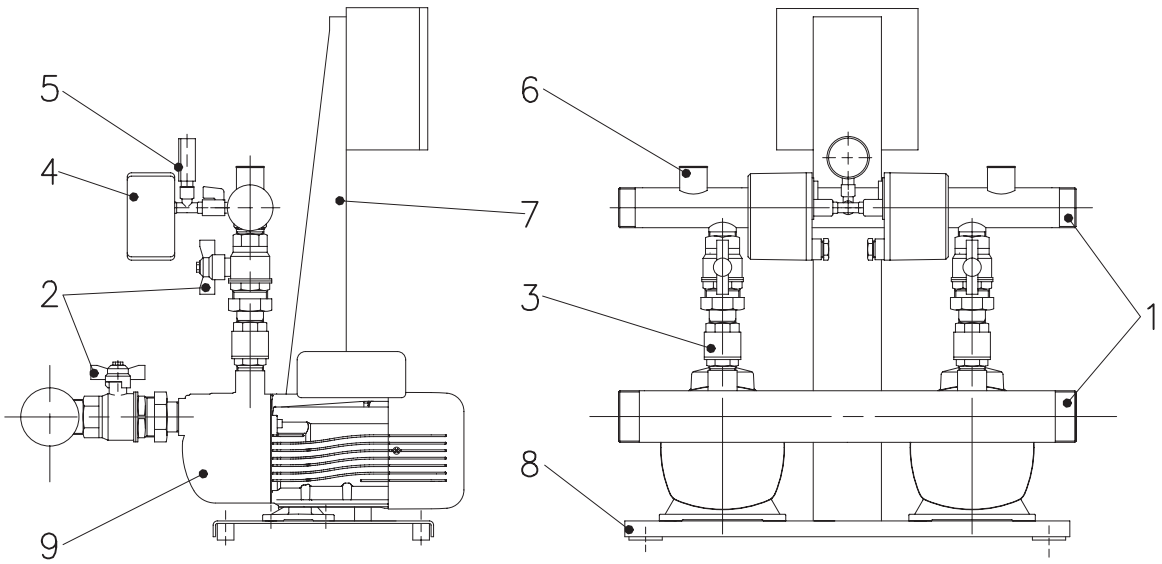
- Frequent demand or **small system losses** determine pressure variations that may be compensated for by using a **tank**. Correct selection of a diaphragm tank **reduces the number of pump starts** and, if it is installed near the booster set, helps reduce the effect of water hammer.

  The booster sets are **ready** for installation with diaphragm tanks mounted directly on the delivery manifold, and additional tanks can be connected to the unused end of the manifold.

  A **simplified calculation method**, developed from experience, is provided in the Appendix. It supplies useful flow rate and head values for most common requirements, as well as a method for calculating diaphragm tank size.

  Variable speed booster sets need **smaller tanks** compared to traditional systems. Generally speaking, a tank with a litre capacity of just 10% of the nominal capacity of a single pump, expressed in litres per minute, is needed.

2-PUMP BOOSTER SETS
MAIN COMPONENTS AND TABLE OF MATERIALS



MATERIAL LIST

REF. N.	NAME	MATERIAL (STANDARD)	UE	A304	A316
1	Manifolds	Galvanized steel	AISI 304	AISI 304	AISI 316
2	On-off-valves	Nickel-plated brass	Nickel-plated brass	AISI 316	AISI 316
3	Non-return valves	Brass	Brass	AISI 304	AISI 316
4	Pressure switches	Chrome plated zinc alloy	AISI 304	AISI 304	AISI 304
5	Pressure transducers	AISI 316	AISI 316	AISI 316	AISI 316
6	Covers/caps/flanges	Galvanized steel	AISI 304	AISI 304	AISI 316
7	Bracket	Galvanized steel	Galvanized steel	Galvanized steel	Galvanized steel
8	Base	Galvanized steel	Galvanized steel	Galvanized steel	Galvanized steel
9	Electric pump body	AISI 304	AISI 304	AISI 304	AISI 316

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Instead of AISI 304, certain components may be made of AISI 316 as an alternative. Certain sets may be supplied with stainless steel manifold as an alternative for the galvanized manifold.
Not all the electric pump models are available in the AISI 316 version.

OPERATING CHARACTERISTICS AND LIMITS

Type op pumped liquids	Water containing no gas or corrosive and/or aggressive substances.
Fluid temperature	Above 0°C to +40°C
Ambient temperature	Above 0°C to +40°C
Maximum operating pressure	Max 8 bar, 10 bar, 16 bar depending on the type of pump.
Minimum inlet pressure	According to NPSH curve and losses, with a minimum margin of 0,5 m.
Maximum inlet pressure	The inlet pressure added to the pressure of the pump at zero capacity must be lower than the maximum operating pressure of the set.
Hourly starts	Max 60 up to 3 kW, above 3 kW and up to 4 kW max 40.
Installation	Indoors, protected from the weather. Away from heat Sources. Max elevation 1000 m asl. Max humidity 50% without condensation.
Sound emission	Sound emission level Lp < 70 dB(A) for two-pump set with 2900 rpm motor with power up to 2 x 4 kW.

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MAIN CHARACTERISTICS OF ELECTRIC PUMPS USED IN TWO-PUMP BOOSTER SETS

BG, BGM

Close-coupled, self-priming centrifugal electric pumps with power up to 1.1 kW. Stainless steel pump body, seal housing and impeller. Diffuser, ejector made of thermoplastic material.
Continuous duty, enclosed motor with external ventilation and finned casing made of aluminium alloy. BGM single-phase versions with permanent capacitor and built-in, automatic reset overload protection.

CEA, CEAM, CA, CAM

Close-coupled, threaded centrifugal electric pumps, single impeller (CEA) and twin-impeller type (CA). Stainless steel pump body, seal housing, impeller and diffuser. Continuous duty, enclosed motor with external ventilation and finned casing made of aluminium alloy. Three-phase versions with up to 3 kW power. CEAM, CAM single-phase versions with power up to 1.5 kW, with permanent capacitor and built-in, automatic reset overload protection.

HM

Single-stage centrifugal horizontal electric pumps with power up to 0.9 kW. Stainless steel pump body, seal housing and diffuser. Impellers made of technopolymer. Continuous duty, enclosed motor with external ventilation and finned casing made of aluminium alloy. Single-phase versions with permanent capacitor and built-in, automatic reset overload protection.

SV

Multi-stage centrifugal vertical electric pumps with high power efficiency up to 4 kW. Stainless steel pump body, seal housing, diffuser and impellers. Continuous duty, enclosed standard motor with external ventilation and finned casing made of aluminium alloy. Single-phase SV..M versions up to 1.5 kW with permanent capacitor and built-in, automatic reset overload protection.

TWO-PUMP BOOSTER SETS, HORIZONTAL DESIGN
HYDRAULIC PERFORMANCE TABLE AT 50 Hz

PUMP TYPE	NOMINAL POWER	Q = DELIVERY												
		l/min 0	20	40	60	80	100	120	130	140				
		m^3/h 0	1,2	2,4	3,6	4,8	6	7,2	7,8	8,4				
	kW	H = TOTAL HEAD METRES COLUMN OF WATER												
2 x BG(M)3	2 x 0,37	36,9	30,6	25,6	21,5	17,7	13,8							
2 x BG(M)5	2 x 0,55	40,2	35,7	32,0	28,8	25,7	22,4	18,8						
2 x BG(M)7	2 x 0,75	45,4		38,1	34,8	31,7	28,6	25,6						
2 x BG(M)9	2 x 0,9	49,6		41,1	37,7	34,8	32,2	29,8	28,6					
2 x BG(M)11	2 x 1,1	53,2		45,8	42,5	39,5	36,5	33,5	31,9	30,3				

PUMP TYPE	NOMINAL POWER	Q = DELIVERY												
		l/min 0	40	60	80	100	120	140	160	200	240			
		m^3/h 0	2,4	3,6	4,8	6	7,2	8,4	9,6	12	14,4			
	kW	H = TOTAL HEAD METRES COLUMN OF WATER												
2 x 2HM3(T)	2 x 0,3	23,8	21,4	19,7	17,6	15,2	12,5	9,4						
2 x 2HM4(T)	2 x 0,45	35,4	32,0	29,5	26,5	23,0	19,0	14,5						
2 x 2HM5(T)	2 x 0,55	46,8	42,1	38,8	34,9	30,4	25,3	19,6						
2 x 2HM7(T)	2 x 0,75	58,5	53,2	49,5	44,9	39,5	33,2	25,8						
2 x 4HM4(T)	2 x 0,45	24,6			20,3	19,1	17,8	16,5	15,0	11,9	8,3			
2 x 4HM5(T)	2 x 0,55	35,4			28,9	27,2	25,4	23,6	21,6	17,2	12,1			
2 x 4HM7(T)	2 x 0,75	48,1			40,2	38,2	36,0	33,7	31,2	25,2	17,7			
2 x 4HM9(T)	2 x 0,9	60,7			51,2	48,6	45,9	42,9	39,7	32,4	23,6			

PUMP TYPE	NOMINAL POWER	Q = DELIVERY												
		l/min 0	60	80	120	160	200	240	280	320	360	400	500	600
		m^3/h 0	3,6	4,8	7,2	9,6	12	14,4	16,8	19,2	21,6	24	30	36
	kW	H = TOTAL HEAD METRES COLUMN OF WATER												
2 x CEA(M) 70/3	2 x 0,37	22	20,1	19,1	16,6	12,8								
2 x CEA(M) 70/5	2 x 0,55	31,1	28,8	27,7	24,7	20,2								
2 x CEA(M) 80/5	2 x 0,75	32	30	29,3	27,4	24,7	21							
2 x CEA(M) 120/3	2 x 0,55	22,4			18,9	17,5	15,9	14	11,8	9,2				
2 x CEA(M) 120/5	2 x 0,9	31,8			28,2	26,5	24,6	22,4	20	17,3				
2 x CEA(M) 210/2	2 x 0,75	17,7						16,5	16,1	15,6	15	14,4	12,6	10,4
2 x CEA(M) 210/3	2 x 1,1	20,8						19,7	19,3	19	18,5	18	16,5	14,4
2 x CEA(M) 210/4	2 x 1,5	25,5						24,8	24,5	24	23,6	23	21,3	19
2 x CEA(M) 210/5	2 x 1,85	29						28,2	27,9	27,5	27,1	26,6	25,1	23,1

PUMP TYPE	NOMINAL POWER	Q = DELIVERY												
		l/min 0	60	80	100	120	140	160	200	240	300	360	420	
		m^3/h 0	3,6	4,8	6	7,2	8,4	9,6	12	14,4	18	21,6	25,2	
	kW	H = TOTAL HEAD METRES COLUMN OF WATER												
2 x CA(M) 70/33	2 x 0,75	42,9	38,8	36,9	34,6	31,7	28,2	23,9						
2 x CA(M) 70/34	2 x 0,9	48,8	45,1	43,2	40,7	37,7	34,0	29,5						
2 x CA(M) 70/45	2 x 1,1	56,2	52,0	49,8	47,1	43,9	39,9	35,3						
2 x CA(M) 120/33	2 x 1,1	44,3			39,1	37,8	36,4	34,8	31,4	27,6	21,0			
2 x CA(M) 120/35	2 x 1,5	54,0			49,4	48,1	46,6	44,9	41,2	36,8	29,3			
2 x CA(M) 120/55	2 x 2,2	63,8			59,6	58,2	56,6	54,8	50,6	45,7	37,1			
2 x CA(M) 200/33	2 x 1,85	43,2			41,8	41,2	40,6	39,9	38,3	36,4	33,2	29,5	25,5	
2 x CA 200/35	2 x 2,2	53,5			52,4	51,9	51,4	50,7	49,2	47,5	44,3	40,6	36,5	
2 x CA 200/55	2 x 3	62,6			61,0	60,6	60,1	59,5	58,2	56,6	53,8	50,4	46,2	

The tables refer to performance with 2 pumps running.

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TWO-PUMP BOOSTER SETS, VERTICAL DESIGN
HYDRAULIC PERFORMANCE TABLE AT 50 Hz

PUMP TYPE	NOMINAL POWER	Q = DELIVERY													
		l/min 0	40	60	80	100	120	140	200	240	266	300	334	400	466
		m^3/h 0	2,4	3,6	4,8	6	7,2	8,4	12	14,4	16	18	20	24	28
	kW	H = TOTAL HEAD METRES COLUMN OF WATER													
2 x SV202F03T	2 x 0.37	21,5	18,5	17	15	13	10,5	7,5							
2 x SV203F03T	2 x 0.37	32	28	25,2	23	19,5	15,5	11							
2 x SV204F05T	2 x 0.55	42,5	37,5	34	30,5	26	20,5	15							
2 x SV205F07T	2 x 0.75	53,5	47	42,5	38	32	26	18							
2 x SV206F07T	2 x 0.75	64	56	51	45,5	38,5	31	22							
2 x SV207F11T	2 x 1.1	75	65,5	60	53	45	36,5	26							
2 x SV208F11T	2 x 1.1	85,5	75	68	61	51,5	41,5	30							
2 x SV209F11T	2 x 1.1	96	84	76,5	68,5	58	46,5	32,5							
2 x SV211F15T	2 x 1.5	117	103	94	84	71	57	41							
2 x SV212F15T	2 x 1.5	128	112	102	91	77	62	44							
2 x SV214F22T	2 x 2.2	150	131	119	106	90	73	52							
2 x SV402F03T	2 x 0.37	20			17	16	15	14,5	10,5	7,5	5				
2 x SV403F05T	2 x 0.55	30			25,5	24	23	22	16	11	7,5				
2 x SV404F07T	2 x 0.75	40			34	32	30,5	29	21	15	10				
2 x SV405F11T	2 x 1.1	50			42,5	40	38	36,5	26	18,5	12,5				
2 x SV406F11T	2 x 1.1	60			51	48	45,5	44	31,5	22	16				
2 x SV407F11T	2 x 1.1	70			59,5	56	53	51	37	26	18				
2 x SV408F15T	2 x 1.5	80			68	65	61	58,5	42	29,5	21				
2 x SV409F15T	2 x 1.5	90			76,5	73	68,5	65,5	47	33,5	23				
2 x SV411F22T	2 x 2.2	111			93,5	89	83,5	80,5	58	41	29				
2 x SV413F22T	2 x 2.2	131			111	105	99	95	68	48	34				
2 x SV414F30T	2 x 3	141			119	113	106	102	73,5	52	36				
2 x SV802F11T	2 x 1.1	27							24,8	24	23	22	20,5	17,2	13,2
2 x SV803F15T	2 x 1.5	41							37	36	34,5	33	30,5	25,8	20
2 x SV804F22T	2 x 2.2	55							50	47,5	46	44	41	34,5	26,5
2 x SV805F22T	2 x 2.2	68							62	60	57,5	55	51	43	33
2 x SV806F30T	2 x 3	82							74,5	71	69	66	61,5	52	40
2 x SV808F40T	2 x 4	110							99	95	92	87,5	81,5	69	53
2 x SV809F40T	2 x 4	123							112	107	104	97,5	92	78	60

The table refers to performances with 2 pumps running.

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TWO-PUMP BOOSTER SETS
ELECTRICAL DATA TABLE

PUMP TYPE	NOMINAL POWER kW	GXS20 ABSORBED CURRENT 1 x 230 V A	GMD20 ABSORBED CURRENT 3 x 400 V A	GTKS20 ABSORBED CURRENT 1 x 230 V A	GHV20../M ABSORBED CURRENT 1 x 230 V A	GHV20 ABSORBED CURRENT 3 x 400 V A
2 x BG3	2 x 0,37	2 x 2,96	2 x 1,48	-	-	-
2 x BG5	2 x 0,55	2 x 4,33	2 x 1,58	-	-	-
2 x BG7	2 x 0,75	2 x 5	2 x 2,14	2 x 4,9	-	-
2 x BG9	2 x 0,9	2 x 5,54	2 x 2,45	-	-	-
2 x BG11	2 x 1,1	2 x 6,47	2 x 2,65	2 x 6,8	-	-
2 x 2HM3 (ZT)	2 x 0,3	2 x 2,34	2 x 1,04	2 x 2,3	-	-
2 x 2HM4	2 x 0,45	2 x 2,92	2 x 1,48	-	-	-
2 x 2HM5 (ZT)	2 x 0,55	2 x 3,72	2 x 1,70	2 x 3,5	-	-
2 x 2HM7 (ZT)	2 x 0,75	2 x 5,09	2 x 2,16	2 x 4,9	-	-
2 x 4HM4	2 x 0,45	2 x 2,77	2 x 1,45	-	-	-
2 x 4HM5 (ZT)	2 x 0,55	2 x 3,76	2 x 1,71	2 x 3,5	-	-
2 x 4HM7	2 x 0,75	2 x 5,74	2 x 2,50	-	-	-
2 x 4HM9 (ZT)	2 x 0,9	2 x 6,49	2 x 2,66	2 x 6,8	-	-
2 x CEA 70/3	2 x 0,37	2 x 2,72	2 x 1,45	-	-	-
2 x CEA 70/5	2 x 0,55	2 x 4,55	2 x 1,65	-	-	-
2 x CEA 80/5	2 x 0,75	2 x 4,87	2 x 2,11	2 x 4,9	-	-
2 x CEA 120/3	2 x 0,55	2 x 4,33	2 x 1,58	-	-	-
2 x CEA 120/5	2 x 0,9	2 x 6,24	2 x 2,61	2 x 6,8	-	-
2 x CEA 210/2	2 x 0,75	2 x 5,1	2 x 2,17	-	-	-
2 x CEA 210/3	2 x 1,1	2 x 6,68	2 x 2,7	2 x 6,8	-	-
2 x CEA 210/4	2 x 1,5	2 x 8,6	2 x 3,49	-	-	-
2 x CEA 210/5	2 x 1,85	-	2 x 4,82	-	-	-
2 x CA 70/33	2 x 0,75	2 x 5,16	2 x 2,18	2 x 4,9	-	-
2 x CA 70/34	2 x 0,9	2 x 6,22	2 x 2,61	-	-	-
2 x CA 70/45 (44)	2 x 1,1	2 x 7,92	2 x 3,02	2 x 6,8	-	-
2 x CA 120/33	2 x 1,1	2 x 7,53	2 x 2,92	-	-	-
2 x CA 120/35	2 x 1,5	2 x 9,87	2 x 3,8	-	-	-
2 x CA 120/55	2 x 2,2	-	2 x 5,13	-	-	-
2 x CA 200/33	2 x 1,85	-	2 x 4,87	-	-	-
2 x CA 200/35	2 x 2,2	-	2 x 5,3	-	-	-
2 x CA 200/55	2 x 3	-	2 x 6,3	-	-	-
2 x SV202F03T	2 x 0,37	2 x 2,64	2 x 1,34	-	-	-
2 x SV203F03T	2 x 0,37	2 x 2,64	2 x 1,34	-	-	-
2 x SV204F05T	2 x 0,55	2 x 3,91	2 x 1,43	-	2 x 4,46	-
2 x SV205F07T	2 x 0,75	2 x 5,03	2 x 2,02	-	-	-
2 x SV206F07T	2 x 0,75	2 x 5,03	2 x 2,02	2 x 4,9	2 x 6,3	-
2 x SV207F11T	2 x 1,1	2 x 6,80	2 x 2,61	-	-	-
2 x SV208F11T	2 x 1,1	2 x 6,80	2 x 2,61	2 x 6,8	-	-
2 x SV209F11T	2 x 1,1	2 x 6,80	2 x 2,61	-	2 x 8,14	2 x 2,75
2 x SV211F15T	2 x 1,5	2 x 8,89	2 x 3,45	-	2 x 10,8	-
2 x SV212F15T	2 x 1,5	2 x 8,89	2 x 3,45	-	2 x 10,8	2 x 3,63
2 x SV214F22T	2 x 2,2	-	2 x 5,03	-	2 x 15,7	2 x 5,28
2 x SV402F03T	2 x 0,37	2 x 2,64	2 x 1,34	-	-	-
2 x SV403F05T	2 x 0,55	2 x 3,91	2 x 1,43	-	2 x 4,46	-
2 x SV404F07T	2 x 0,75	2 x 5,03	2 x 2,02	2 x 4,9	2 x 6,3	-
2 x SV405F11T	2 x 1,1	2 x 6,80	2 x 2,61	-	-	-
2 x SV406F11T	2 x 1,1	2 x 6,80	2 x 2,61	-	-	-
2 x SV407F11T	2 x 1,1	2 x 6,80	2 x 2,61	2 x 6,8	2 x 8,14	2 x 2,75
2 x SV408F15T	2 x 1,5	2 x 8,89	2 x 3,45	-	-	-
2 x SV409F15T	2 x 1,5	2 x 8,89	2 x 3,45	-	2 x 10,8	2 x 3,63
2 x SV411F22T	2 x 2,2	-	2 x 5,03	-	-	-
2 x SV413F22T	2 x 2,2	-	2 x 5,03	-	2 x 15,7	2 x 5,28
2 x SV414F30T	2 x 3	-	2 x 6,01	-	-	2 x 6,31
2 x SV802F11T	2 x 1,1	2 x 6,80	2 x 2,61	-	-	-
2 x SV803F15T	2 x 1,5	2 x 8,89	2 x 3,45	-	2 x 10,8	2 x 3,63
2 x SV804F22T	2 x 2,2	-	2 x 5,03	-	2 x 15,7	2 x 5,28
2 x SV805F22T	2 x 2,2	-	2 x 5,03	-	2 x 15,7	2 x 5,28
2 x SV806F30T	2 x 3	-	2 x 6,01	-	-	2 x 6,31
2 x SV808F40T	2 x 4	-	2 x 8,02	-	-	-
2 x SV809F40T	2 x 4	-	2 x 8,02	-	-	2 x 8,42

g20-2p50_b_te

Booster sets

GXS20 Series

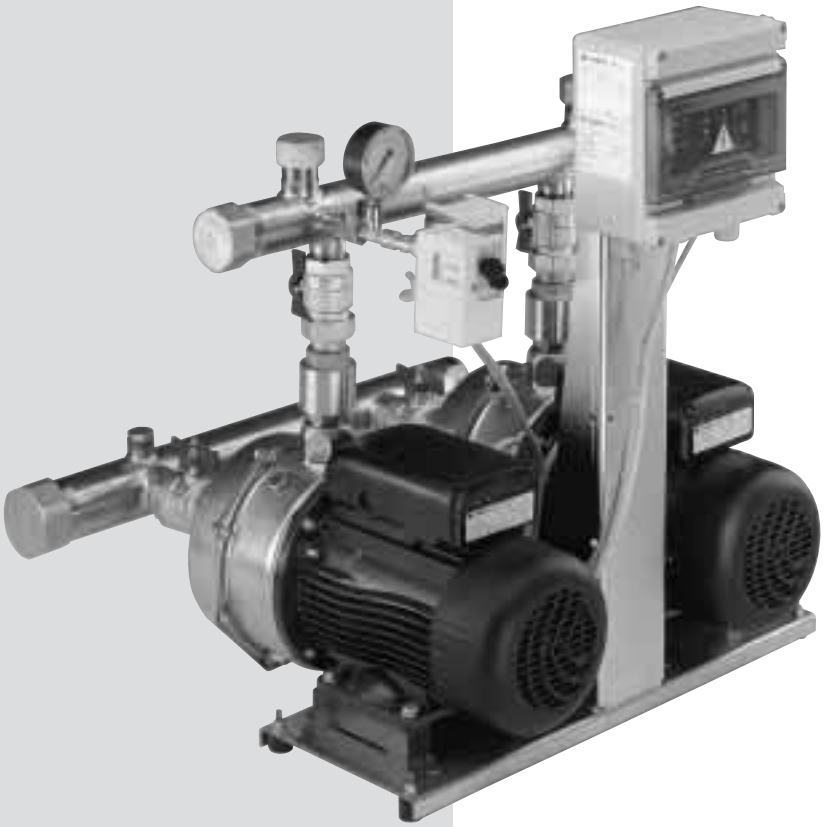
LOWARA

Market sectors

BUILDING TRADES, AGRICULTURE

APPLICATIONS

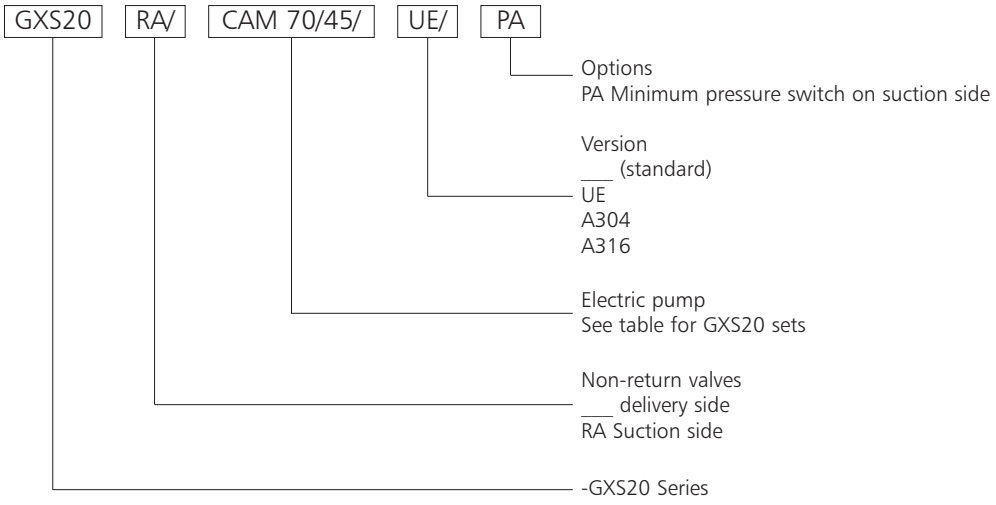
- Water network supply in condominiums, offices, hotels, shopping centres, factories.
- Water supply to agricultural water networks (e.g. irrigation).



SPECIFICATIONS

- **Flow rate**: up to 28 m^3/h.
- **Head**: up to 120 m.
- Electric panel supply voltage: 1 x 230V ± 10%.
- Frequency: 50 Hz.
- Electric panel protection class: IP55.
- Maximum electric pump power: 2 x 1.5 kW.
- Direct motor start.
- Max temperature of pumped liquid: over 0°C to +40°C.
- **Horizontal design pumps:** BGM-CEAM-CAM-HM series. Maximum operating pressure: 8 bar.
- **Vertical design pumps:** SV-SV..M series Maximum operating pressure: 5 bar.

IDENTIFICATION CODE



MAIN COMPONENTS

The **GXS20** set consists of:

- Two fixed-speed **electric** pumps, **BGM, CEAM, CAM, HM, SV..M** series, two control pressure switches connected to the delivery manifold, a mounting base for the electric pumps equipped with vibration dampers and made of fabricated sheetmetal, suction manifold, delivery manifold ready for the connection of diaphragm tanks and equipped with a pressure gauge. Plus an on-off valve on the suction side and one on the delivery side, a non-return valve for each electric pump.
- **Electrical panel** for single-phase power supply, with casing made of thermoplastic material, transparent door, fitted with thermal-magnetic main switch and command/control electronic card.
  Automatic/Manual/Off selector switches for each pump.
  Power on, pump running, dry run shutdown indicator lights.
  Cyclic changeover function (can be disabled).
  Ready for installation of one of the following dry running protectors: float switch, minimum pressure switch, external contact or electrode probes with sensitivity adjustment.
  Delay timer for dry running protector cut-in, with 0 to 30 second adjustment.
  Operation extension timer for each pump with 0 to 100 second adjustment.
  12 V auxiliary voltage.
  Single-phase electric motors with permanent capacitor and built-in automatic reset overload protection.
- The **non-return valves** are installed on the delivery side. For applications with air-cushion surge tank they can be mounted on the suction side and equipped with a connector for G1/2" threaded flexible air supply pipe (GXS20RA set).
- The available **options** are:
  Minimum pressure switch on suction side, connected to the electrical panel, with protection against dry running for operation with positive suction head.

The set comes pre-assembled and packed in a box set on a wooden base, complete with electrical connections, operating manual and wiring diagrams, in one of the following versions:

- **Standard version:**
  Manifolds, caps, covers and flanges made of galvanized steel, nickel-plated brass valves, brass non-return valves.
- **EU version:**
  Manifolds, caps, covers and flanges made of stainless steel, nickel-plated brass valves, brass non-return valves.
- **A304 version:**
  Manifolds, caps, covers, flanges and valves made of AISI 304 stainless steel.
- **A316 version:**
  Manifolds, caps, covers, flanges and valves made of AISI 316 stainless steel; this version is available only with SV electric pumps made of AISI 316.

Special versions are available on request
GMS20 single-phase version with power up to 2 x 2.2 kW, with electrical panel encased in a metal enclosure, electronic keypanel, ready for installation of a signal relay card. The GMS20 sets have the same dimensions as the GMD20 sets.

ACCESSORIES

Accessories on request (supplied separately)

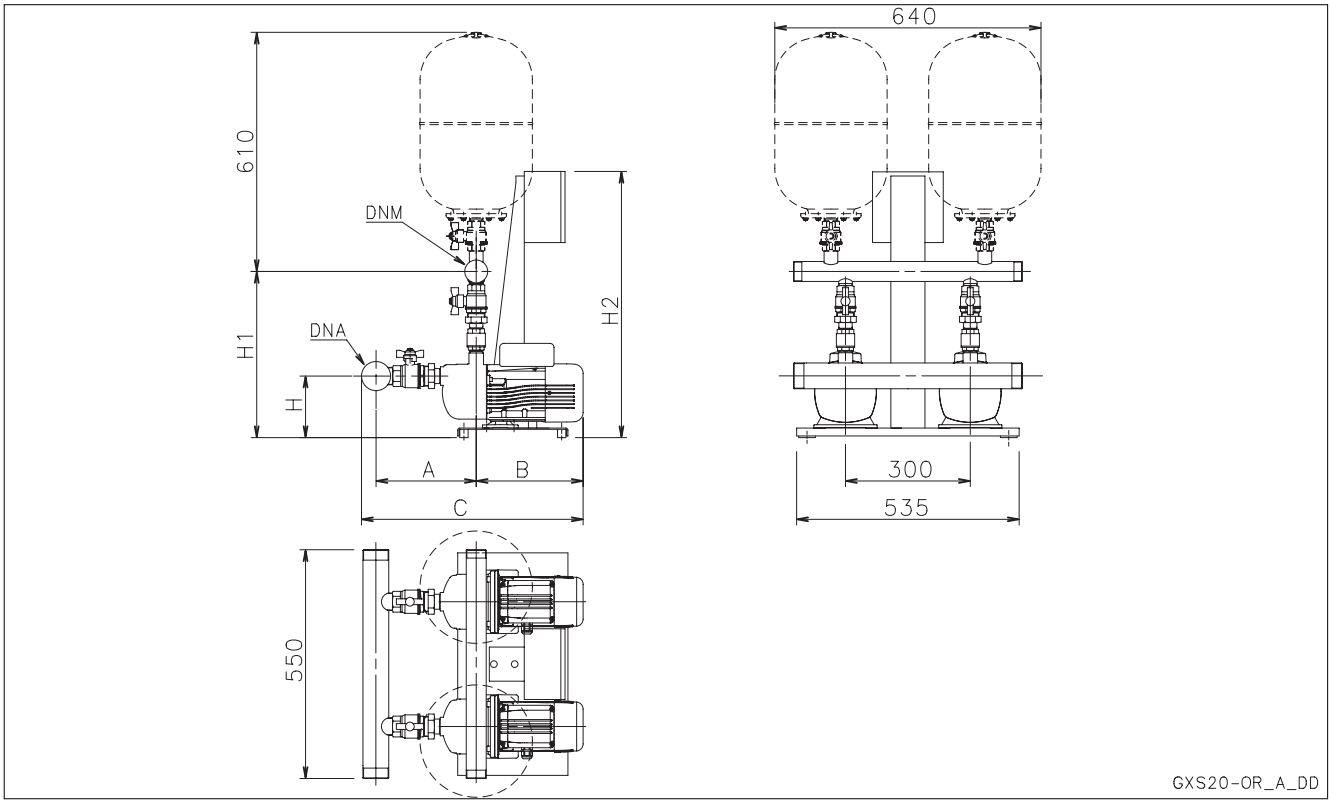
- Float switch for protection against dry running.
- Minimum pressure switch.
- Probe electrodes kit.

- Air-cushion surge tank with or without compressor and related accessories
- Air supply unit.
- Diaphragm tank as an alternative to the air-cushion tank.

- Kit featuring a 24-litre diaphragm expansion tank equipped with a ball valve (Rp 1" threaded connectors) for installation on delivery manifold, in the following versions:
  - 24-litre 8 bar cylinder water tank kit
  - 24-litre 10 bar cylinder water tank kit
  - 24-litre 16 bar cylinder water tank kit

Electrical panel

TWO-PUMP BOOSTER SETS, GXS20 SERIES
HORIZONTAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON DELIVERY SIDE

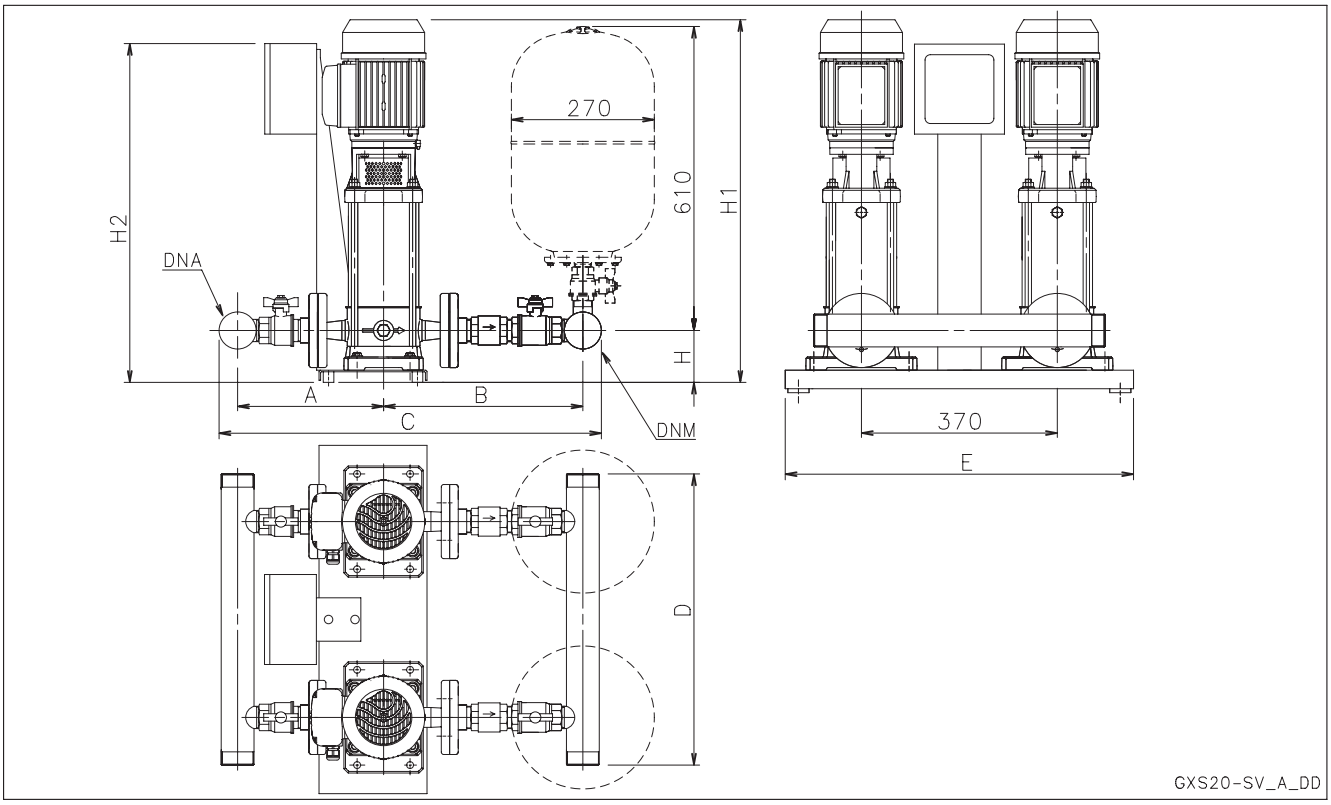


GXS 20	DNA	DNM	A		B	C		H	H1		H2
			STD / UE	A304		STD / UE	A304		STD / UE	A304	
BGM3	R 2"	R 1 "1/2	214	299	297	541	626	189	440	501	640
BGM5	R 2"	R 1 "1/2	214	299	311	555	640	189	440	501	640
BGM7	R 2"	R 1 "1/2	214	299	311	555	640	189	440	501	640
BGM9	R 2"	R 1 "1/2	214	299	311	555	640	189	440	501	640
BGM11	R 2"	R 1 "1/2	214	299	356	600	685	189	440	501	640
2HM3	R 2"	R 1 "1/2	241	326	249	520	605	149	399	460	640
2HM4	R 2"	R 1 "1/2	266	351	249	545	630	149	399	460	640
2HM5	R 2"	R 1 "1/2	291	376	249	570	655	149	399	460	640
2HM7	R 2"	R 1 "1/2	316	401	263	609	694	149	399	460	640
4HM4	R 2"	R 1 "1/2	241	326	249	520	605	149	399	460	640
4HM5	R 2"	R 1 "1/2	266	351	249	545	630	149	399	460	640
4HM7	R 2"	R 1 "1/2	291	376	263	584	669	149	399	460	640
4HM9	R 2"	R 1 "1/2	316	401	263	609	694	149	399	460	640
CEAM70/3	R 2"	R 1 "1/2	196	281	260	486	571	132	438	499	640
CEAM70/5	R 2"	R 1 "1/2	196	281	274	500	585	132	438	499	640
CEAM80/5	R 2"	R 1 "1/2	196	281	274	500	585	132	438	499	640
CEAM120/3	R 2"	R 2"	196	281	274	500	585	132	476	505	640
CEAM120/5	R 2"	R 2"	196	281	274	500	585	132	476	505	640
CEAM210/2	R 2" 1/2	R 2 "1/2	243	318	285	566	641	132	468	602	640
CEAM210/3	R 2" 1/2	R 2 "1/2	243	318	331	612	687	132	468	602	640
CEAM210/4	R 2" 1/2	R 2 "1/2	243	318	331	612	687	132	468	602	640
CAM70/33	R 2"	R 1 "1/2	276	361	252	558	643	128	452	513	640
CAM70/34	R 2"	R 1 "1/2	276	361	252	558	643	128	452	513	640
CAM70/45	R 2"	R 1 "1/2	276	361	289	595	680	128	452	513	640
CAM120/33	R 2"	R 2"	276	361	289	595	680	128	490	519	640
CAM120/35	R 2"	R 2"	276	361	289	595	680	128	490	519	640

gxs20_or_a_td

Dimensions in mm, tolerance ± 10 mm.

TWO-PUMP BOOSTER SETS, GXS20 SERIES
VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON DELIVERY SIDE

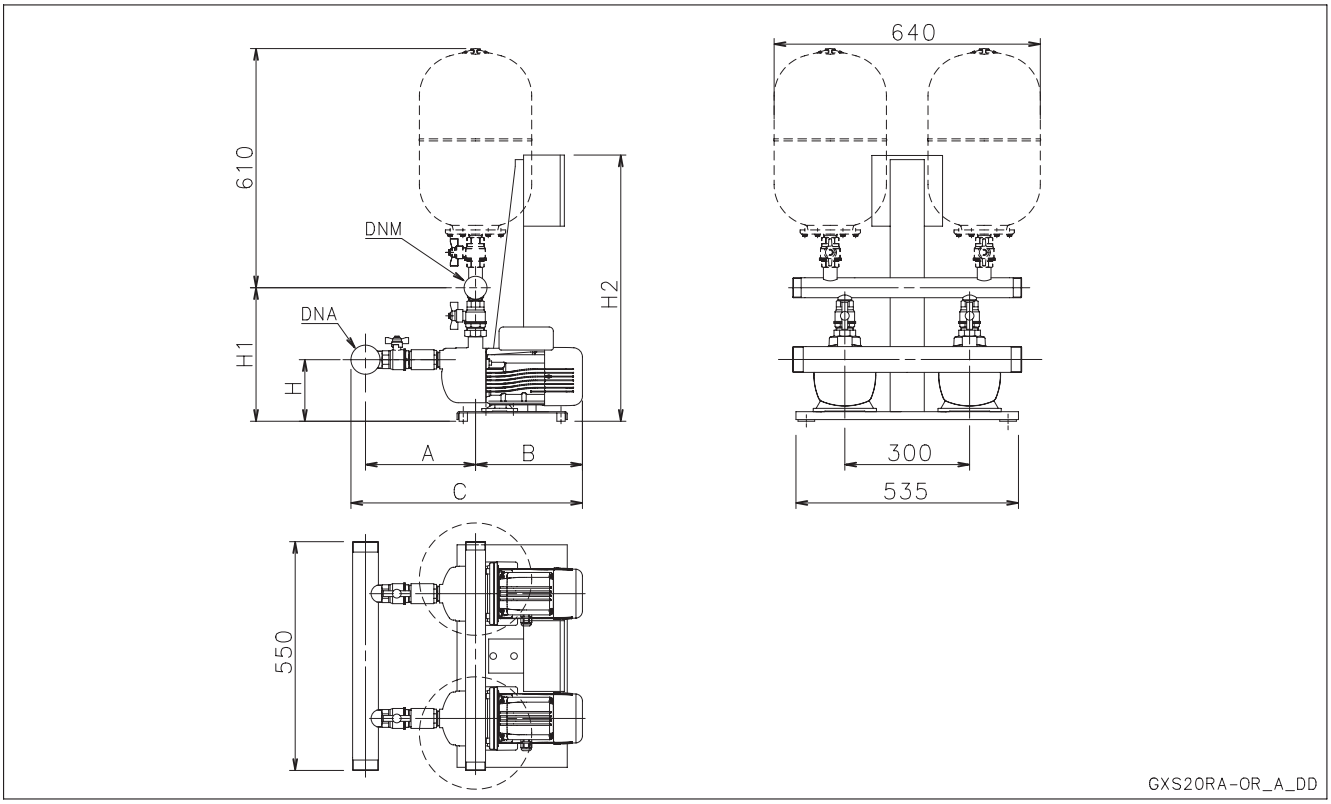


GXS 20	DNA	DNM	A		B		C		D		E	H	H1	H2
			STD/UE	A304	STD/UE	A304	STD/UE	A304	STD	UE/A304				
SV202F03M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	517	640
SV203F03M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	542	640
SV204F05M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	589	640
SV205F07M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	619	640
SV206F07M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	644	640
SV207F11M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	706	640
SV208F11M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	731	640
SV209F11M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	756	640
SV211F15M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	816	640
SV212F15M	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	841	640
SV402F03M	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	517	640
SV403F05M	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	564	640
SV404F07M	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	594	640
SV405F11M	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	656	640
SV406F11M	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	681	640
SV407F11M	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	706	640
SV408F15M	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	741	640
SV409F15M	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	766	640
SV802F11M	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	660	651
SV803F15M	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	708	651

gxs20_sv_a_td

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

TWO-PUMP BOOSTER SETS, GXS20 RA SERIES HORIZONTAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON SUCTION SIDE

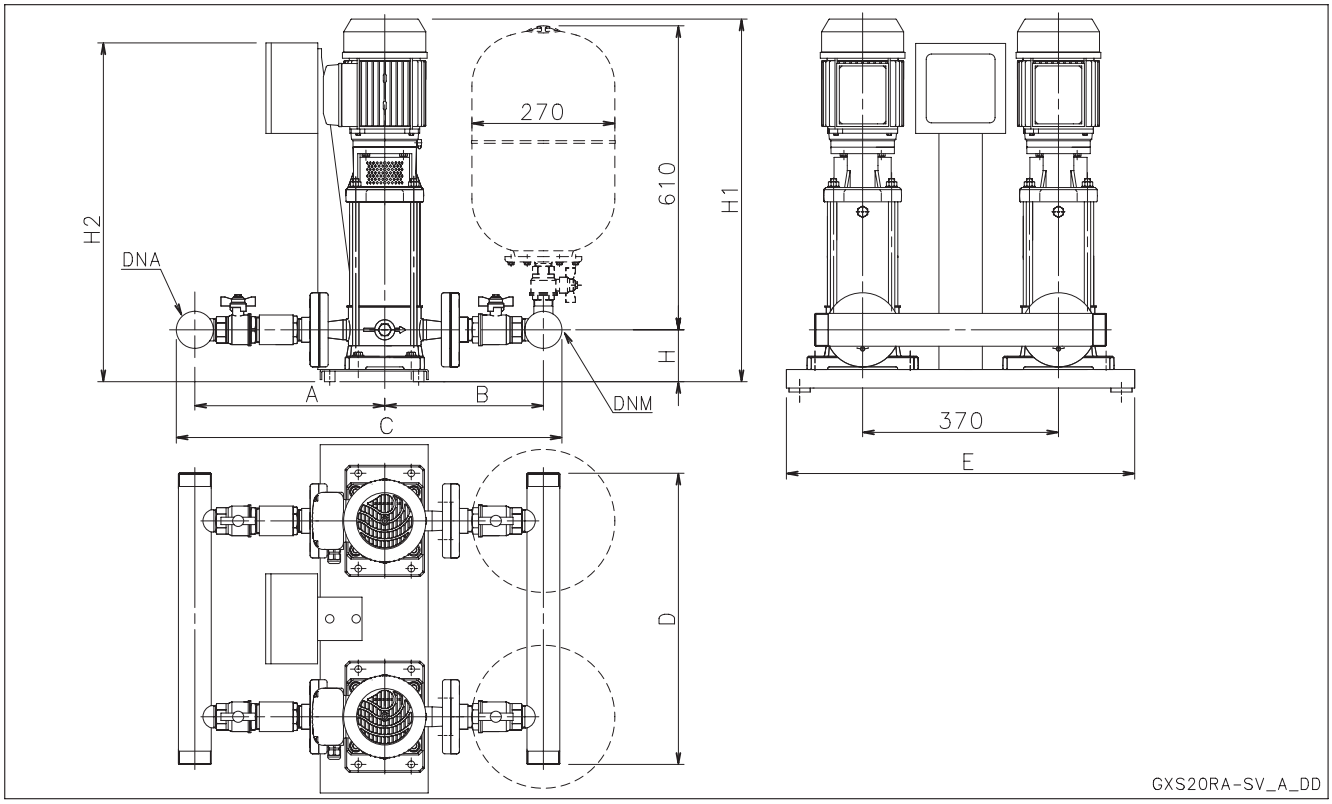


GXS 20RA	DNA	DNM	A		B	C		H	H1		H2
			STD / UE	A304		STD / UE	A304		STD / UE	A304	
BGM3	R 2"	R 1 "1/2	302	445	297	629	772	189	371	454	640
BGM5	R 2"	R 1 "1/2	302	445	311	643	786	189	371	454	640
BGM7	R 2"	R 1 "1/2	302	445	311	643	786	189	371	454	640
BGM9	R 2"	R 1 "1/2	302	445	311	643	786	189	371	454	640
BGM11	R 2"	R 1 "1/2	302	445	356	688	831	189	371	454	640
2HM3	R 2"	R 1 "1/2	329	472	249	608	751	149	330	413	640
2HM4	R 2"	R 1 "1/2	354	497	249	633	776	149	330	413	640
2HM5	R 2"	R 1 "1/2	379	522	249	658	801	149	330	413	640
2HM7	R 2"	R 1 "1/2	404	547	263	697	840	149	330	413	640
4HM4	R 2"	R 1 "1/2	329	472	249	608	751	149	330	413	640
4HM5	R 2"	R 1 "1/2	354	497	249	633	776	149	330	413	640
4HM7	R 2"	R 1 "1/2	379	522	263	672	815	149	330	413	640
4HM9	R 2"	R 1 "1/2	404	547	263	697	840	149	330	413	640
CEAM70/3	R 2"	R 1 "1/2	284	427	260	574	717	132	369	452	640
CEAM70/5	R 2"	R 1 "1/2	284	427	274	588	731	132	369	452	640
CEAM80/5	R 2"	R 1 "1/2	284	427	274	588	731	132	369	452	640
CEAM120/3	R 2"	R 2"	284	427	274	588	731	132	375	458	640
CEAM120/5	R 2"	R 2"	284	427	274	588	731	132	375	458	640
CEAM210/2	R 2" 1/2	R 2 "1/2	374	493	285	697	816	132	398	483	640
CEAM210/3	R 2" 1/2	R 2 "1/2	374	493	331	743	862	132	398	483	640
CEAM210/4	R 2" 1/2	R 2 "1/2	374	493	331	743	862	132	398	483	640
CAM70/33	R 2"	R 1 "1/2	364	507	252	646	789	128	383	466	640
CAM70/34	R 2"	R 1 "1/2	364	507	252	646	789	128	383	466	640
CAM70/45	R 2"	R 1 "1/2	364	507	289	683	826	128	383	466	640
CAM120/33	R 2"	R 2"	364	507	289	683	826	128	389	472	640
CAM120/35	R 2"	R 2"	364	507	289	683	826	128	389	472	640

gxs20ra_or_a_td

Dimensions in mm, tolerance ± 10 mm.

TWO-PUMP BOOSTER SETS, GXS20 RA SERIES VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON SUCTION SIDE



GXS 20RA	DNA	DNM	A		B		C		D		E	H	H1	H2
			STD/UE	A304	STD/UE	A304	STD/UE	A304	STD	UE/A304				
SV202F03M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	517	640
SV203F03M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	542	640
SV204F05M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	589	640
SV205F07M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	619	640
SV206F07M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	644	640
SV207F11M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	706	640
SV208F11M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	731	640
SV209F11M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	756	640
SV211F15M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	816	640
SV212F15M	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	841	640
SV402F03M	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	517	640
SV403F05M	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	564	640
SV404F07M	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	594	640
SV405F11M	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	656	640
SV406F11M	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	681	640
SV407F11M	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	706	640
SV408F15M	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	741	640
SV409F15M	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	766	640
SV802F11M	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	660	651
SV803F15M	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	708	651

gxs20ra_sv_a_td

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

Booster sets

GMD20 Series

LOWARA

Market sectors

BUILDING TRADES, AGRICULTURE

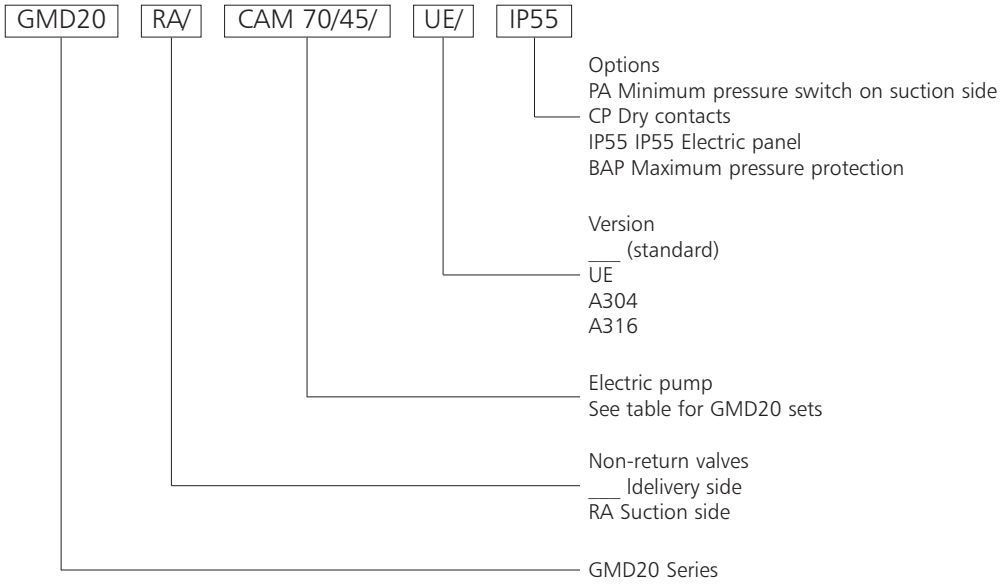
APPLICATIONS

- Water network supply in condominiums, offices, hotels, shopping centres, factories
- Water supply to agricultural water networks (e.g. irrigation).

SPECIFICATIONS

- **Flow rate**: up to 36 m^3/h.
- **Head**: up to 150 m.
- Electric panel supply voltage: 3 x 400V ± 10%.
- Frequency: 50 Hz.
- Electric panel protection class: IP54.
- Maximum electric pump power: 2 x 4 kW.
- Direct motor start.
- Max temperature of pumped liquid: over 0°C to +40°C.
- **Horizontal design pumps:** BG-CEA-CA-HM series Maximum operating pressure: 8 bar.
- **Vertical design pumps:** - SV series Maximum operating pressure: 16 bar.

IDENTIFICATION CODE



MAIN COMPONENTS

The **GMD20** set consists of:

- Two fixed-speed **electric pumps** with three-phase motor, **BG, CEA, CA, HM, SV** series, two control pressure switches connected to the delivery manifold, a mounting base for the electric pumps equipped with vibration dampers and made of fabricated sheetmetal, suction manifold, delivery manifold ready for the connection of diaphragm tanks and equipped with a pressure gauge. Plus an on-off valve on the suction side and one on the delivery side, a non-return valve for each electric pump.
- **Electrical panel** for three-phase power supply, with casing made of steel, fitted with main doorlock switch, startup contactors, and **thermal-magnetic motor protectors** and command/control electronic card.
  Automatic/Manual/Off selector switches for each pump (inside the panel).
  Power on, pump running, dry run shutdown, thermal overload protection indicator lights.
  Automatic/Manual buttons and start/stop buttons for each pump.
  Cyclic changeover function (can be disabled).
  Ready for installation of one of the following dry running protectors: float switch, minimum pressure switch, external contact or electrode probes with sensitivity adjustment.
- Delay timer for dry running protector cut-in, with 0 to 30 second adjustment.
  Operation extension timer for each pump with 0 to 100 second adjustment.
  Ready for installation of a signal-relay card inside the electric panel to warn about: pump running, manual mode, thermal alarm, water failure alarm, power on.
  24 V auxiliary voltage.
- The **non-return valves** are installed on the delivery side. For applications with air-cushion surge tank they can be mounted on the suction side and equipped with a connector for G1/2" threaded flexible air supply pipe (**GMD20RA** set).

OPTIONAL FEATURES

- The available options are:
  Minimum pressure switch on suction side, connected to the electrical panel, with protection against dry running for operation with positive suction head.
  Dry contacts with card inside the panel.
  Electric panel with IP55 protection class.
  Maximum pressure switch on delivery side, connected to the electric panel.
  The options do not affect the dimensions.
  For sets featuring vertical electric pumps of the SV series, the optional features are available only for the following versions: EU, A304, A316.

- **The set comes pre-assembled** and packed in a box mounted on a wooden base, complete with electrical connections, operating manual and wiring diagrams, in one of the following versions:

  – **Standard version:**
  Manifolds, caps, covers and flanges made of galvanized steel, nickel-plated brass valves, brass non-return valves.
  – **EU version:**
  Manifolds, caps, covers and flanges made of stainless steel, nickel-plated brass valves, brass non-return valves.
  – **A304 version:**
  Manifolds, caps, covers, flanges and valves made of AISI 304 stainless steel.
  – **A316 version:**
  Manifolds, caps, covers, flanges and valves made of AISI 316 stainless steel; this version is available only with SV electric pumps made of AISI 316.

Special versions are available on request

Electrical panel

ACCESSORIES

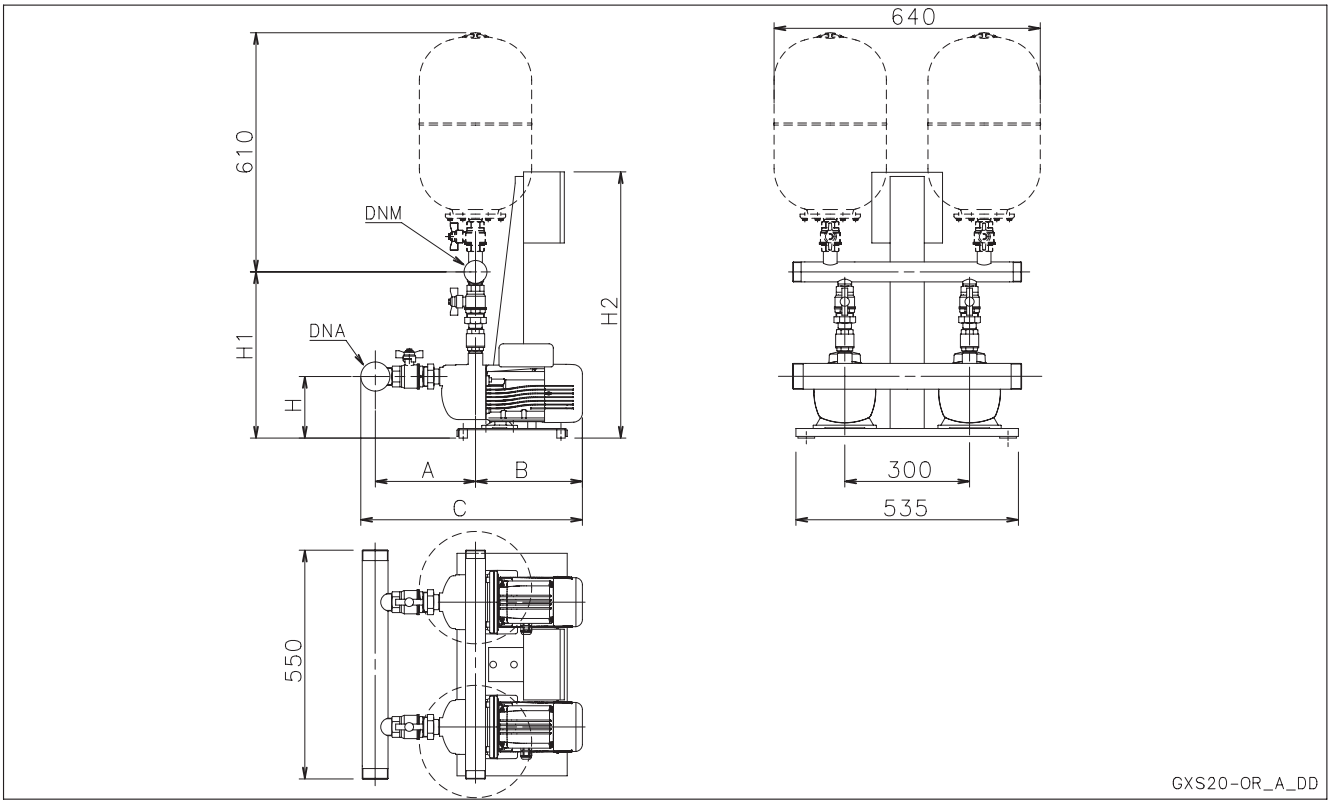
Accessories on request (supplied separately)
- Float switch for protection against dry running.
- Minimum pressure switch.
- Probe electrodes kit.

- Air-cushion surge tank with or without compressor and related accessories
- Air supply unit.
- Diaphragm tank as an alternative to the air-cushion tank.

- Kit featuring a 24-litre diaphragm expansion tank equipped with a ball valve (Rp 1" threaded connectors) for installation on delivery manifold, in the following versions:
  - 24-litre 8 bar cylinder water tank kit
  - 24-litre 10 bar cylinder water tank kit
  - 24-litre 16 bar cylinder water tank kit

Keypad

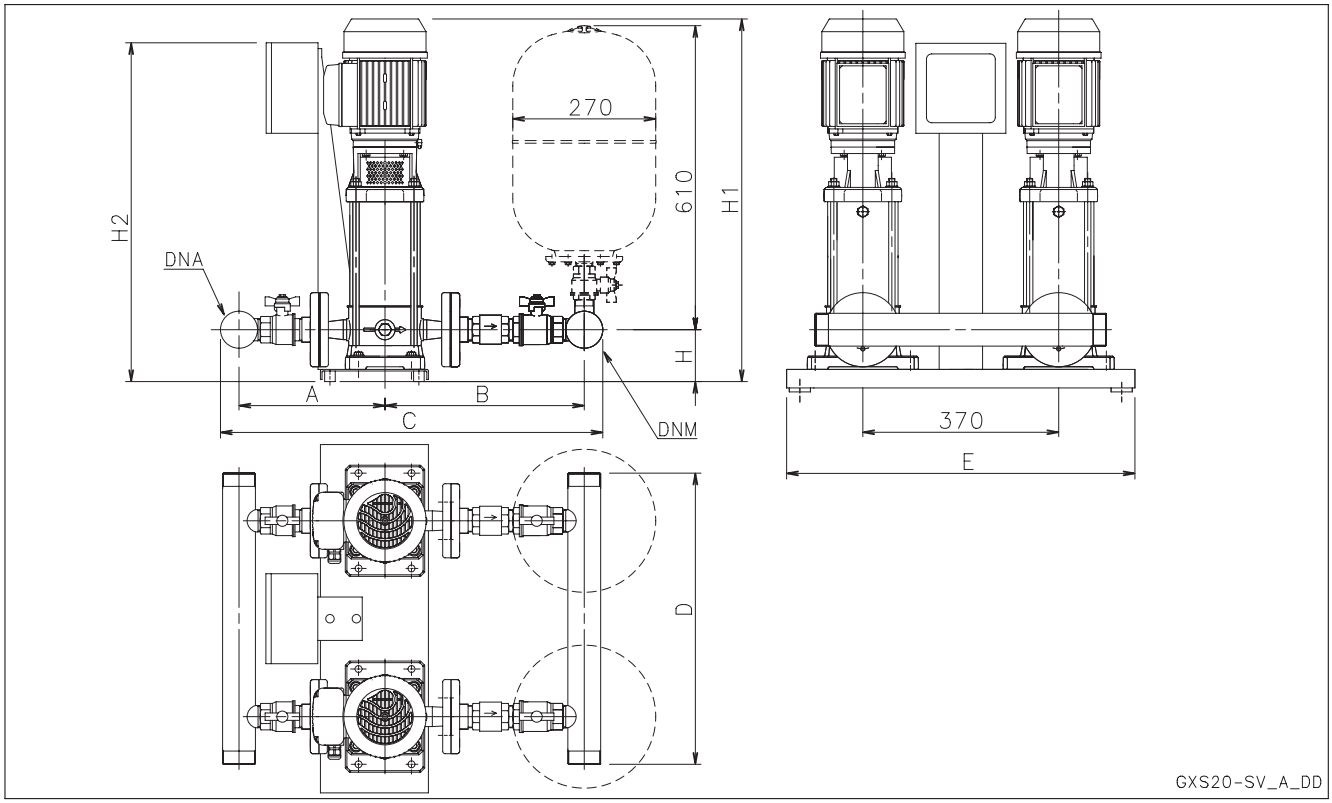
TWO-PUMP BOOSTER SETS, GMD20 SERIES HORIZONTAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON DELIVERY SIDE



GMD 20	DNA	DNM	A		B	C		H	H1		H2
			STD / UE	A304		STD / UE	A304		STD / UE	A304	
BG3	R 2"	R 1 "1/2	214	299	297	541	626	189	440	501	640
BG5	R 2"	R 1 "1/2	214	299	311	555	640	189	440	501	640
BG7	R 2"	R 1 "1/2	214	299	311	555	640	189	440	501	640
BG9	R 2"	R 1 "1/2	214	299	311	555	640	189	440	501	640
BG11	R 2"	R 1 "1/2	214	299	356	600	685	189	440	501	640
2HM3T	R 2"	R 1 "1/2	241	326	249	520	605	149	399	460	640
2HM4T	R 2"	R 1 "1/2	266	351	249	545	630	149	399	460	640
2HM5T	R 2"	R 1 "1/2	291	376	249	570	655	149	399	460	640
2HM7T	R 2"	R 1 "1/2	316	401	263	609	694	149	399	460	640
4HM4T	R 2"	R 1 "1/2	241	326	249	520	605	149	399	460	640
4HM5T	R 2"	R 1 "1/2	266	351	249	545	630	149	399	460	640
4HM7T	R 2"	R 1 "1/2	291	376	263	584	669	149	399	460	640
4HM9T	R 2"	R 1 "1/2	316	401	263	609	694	149	399	460	640
CEA70/3	R 2"	R 1 "1/2	196	281	260	486	571	132	438	499	640
CEA70/5	R 2"	R 1 "1/2	196	281	274	500	585	132	438	499	640
CEA80/5	R 2"	R 1 "1/2	196	281	274	500	585	132	438	499	640
CEA120/3	R 2"	R 2"	196	281	274	500	585	132	476	505	640
CEA120/5	R 2"	R 2"	196	281	274	500	585	132	476	505	640
CEA210/2	R 2" 1/2	R 2 "1/2	243	318	285	566	641	132	468	602	640
CEA210/3	R 2" 1/2	R 2 "1/2	243	318	331	612	687	132	468	602	640
CEA210/4	R 2" 1/2	R 2 "1/2	243	318	331	612	687	132	468	602	640
CEA210/5	R 2" 1/2	R 2 "1/2	243	318	331	612	687	132	468	602	640
CA70/33	R 2"	R 1 "1/2	276	361	252	558	643	128	452	513	640
CA70/34	R 2"	R 1 "1/2	276	361	252	558	643	128	452	513	640
CA70/45	R 2"	R 1 "1/2	276	361	289	595	680	128	452	513	640
CA120/33	R 2"	R 2"	276	361	289	595	680	128	490	519	640
CA120/35	R 2"	R 2"	276	361	289	595	680	128	490	519	640
CA120/55	R 2"	R 2"	276	361	289	595	680	128	490	519	640
CA200/33	R 2" 1/2	R 2"	320	395	289	647	722	128	490	519	640
CA200/35	R 2" 1/2	R 2"	320	395	319	677	752	128	490	519	640
CA200/55	R 2" 1/2	R 2"	320	395	319	677	752	128	490	519	640

Dimensions in mm, tolerance ± 10 mm.

TWO-PUMP BOOSTER SETS, GMD20 SERIES VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON DELIVERY SIDE

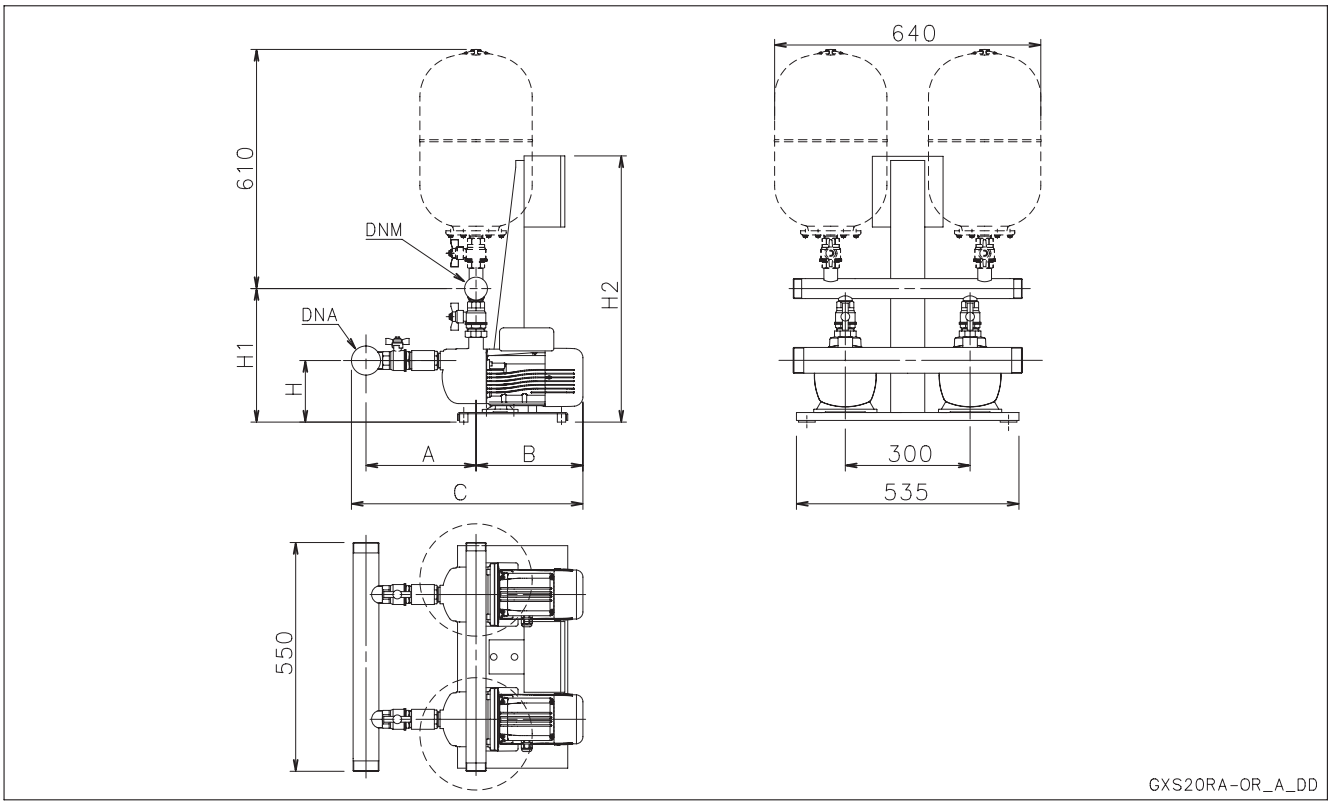


GMD 20	DNA	DNM	A		B		C		D		E	H	H1	H2
			STD/UE	A304	STD/UE	A304	STD/UE	A304	STD	UE/A304				
SV202F03T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	517	640
SV203F03T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	542	640
SV204F05T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	589	640
SV205F07T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	619	640
SV206F07T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	644	640
SV207F11T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	706	640
SV208F11T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	731	640
SV209F11T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	756	640
SV211F15T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	816	640
SV212F15T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	841	640
SV214F22T	R 2"	R 2"	252	301	321	346	633	707	550	610	658	98	891	640
SV402F03T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	517	640
SV403F05T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	564	640
SV404F07T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	594	640
SV405F11T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	656	640
SV406F11T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	681	640
SV407F11T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	706	640
SV408F15T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	741	640
SV409F15T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	766	640
SV411F22T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	816	640
SV413F22T	R 2"	R 2"	265	311	328	431	653	802	550	610	658	98	866	640
SV414F30T	R 2"	R 2"	265	311	328	431	653	802	550	610	682	109	952	651
SV802F11T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	660	651
SV803F15T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	708	651
SV804F22T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	746	651
SV805F22T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	784	651
SV806F30T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	872	651
SV808F40T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	952	651
SV809F40T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	550	610	682	114	990	651

gmd20_sv_a_td

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

TWO-PUMP BOOSTER SETS, GMD20 RA SERIES HORIZONTAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON SUCTION SIDE

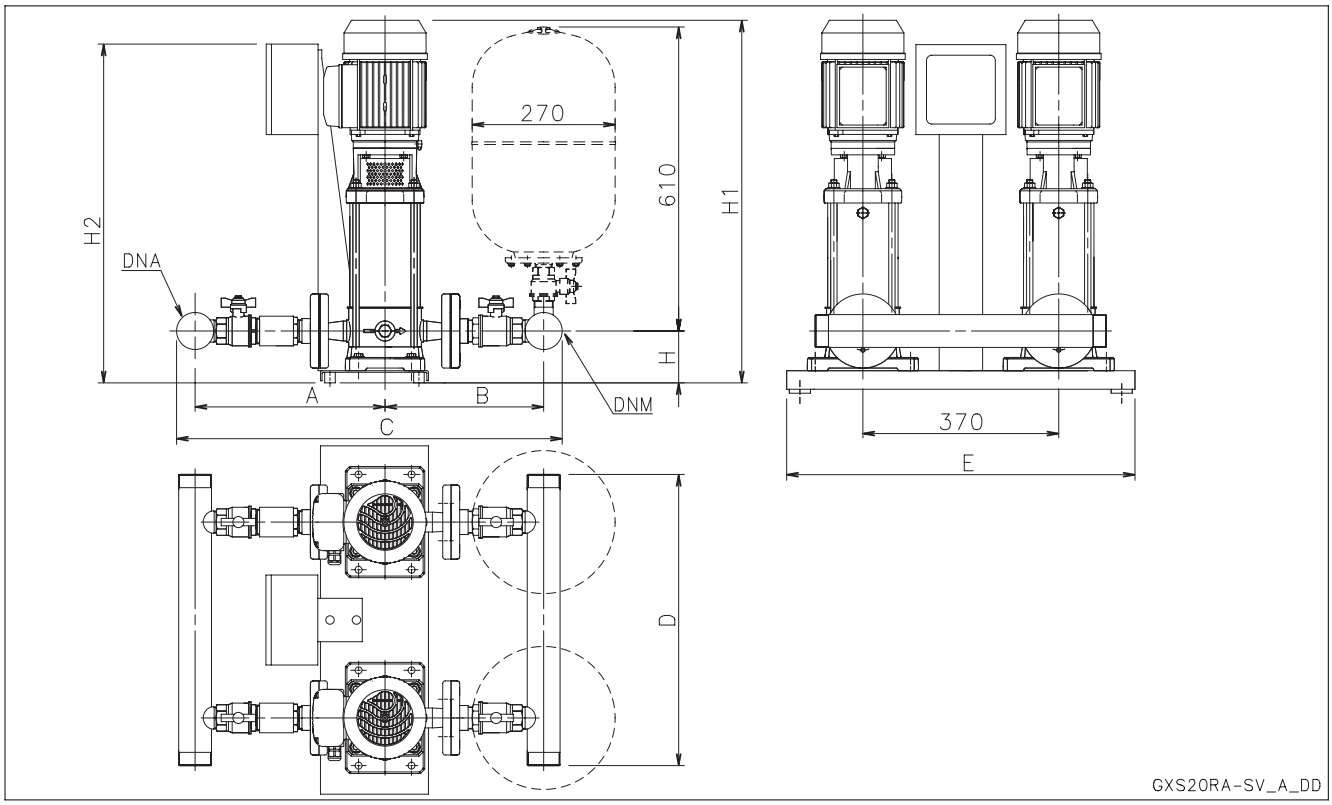


GMD 20RA	DNA	DNM	A		B	C		H	H1		H2
			STD / UE	A304		STD / UE	A304		STD / UE	A304	
BG3	R 2"	R 1 "1/2	302	445	297	629	772	189	371	454	640
BG5	R 2"	R 1 "1/2	302	445	311	643	786	189	371	454	640
BG7	R 2"	R 1 "1/2	302	445	311	643	786	189	371	454	640
BG9	R 2"	R 1 "1/2	302	445	311	643	786	189	371	454	640
BG11	R 2"	R 1 "1/2	302	445	356	688	831	189	371	454	640
2HM3T	R 2"	R 1 "1/2	329	472	249	608	751	149	330	413	640
2HM4T	R 2"	R 1 "1/2	354	497	249	633	776	149	330	413	640
2HM5T	R 2"	R 1 "1/2	379	522	249	658	801	149	330	413	640
2HM7T	R 2"	R 1 "1/2	404	547	263	697	840	149	330	413	640
4HM4T	R 2"	R 1 "1/2	329	472	249	608	751	149	330	413	640
4HM5T	R 2"	R 1 "1/2	354	497	249	633	776	149	330	413	640
4HM7T	R 2"	R 1 "1/2	379	522	263	672	815	149	330	413	640
4HM9T	R 2"	R 1 "1/2	404	547	263	697	840	149	330	413	640
CEA70/3	R 2"	R 1 "1/2	284	427	260	574	717	132	369	452	640
CEA70/5	R 2"	R 1 "1/2	284	427	274	588	731	132	369	452	640
CEA80/5	R 2"	R 1 "1/2	284	427	274	588	731	132	369	452	640
CEA120/3	R 2"	R 2"	284	427	274	588	731	132	375	458	640
CEA120/5	R 2"	R 2"	284	427	274	588	731	132	375	458	640
CEA210/2	R 2" 1/2	R 2 "1/2	374	493	285	697	816	132	398	483	640
CEA210/3	R 2" 1/2	R 2 "1/2	374	493	331	743	862	132	398	483	640
CEA210/4	R 2" 1/2	R 2 "1/2	374	493	331	743	862	132	398	483	640
CEA210/5	R 2" 1/2	R 2 "1/2	374	493	331	743	862	132	398	483	640
CA70/33	R 2"	R 1 "1/2	364	507	252	646	789	128	383	466	640
CA70/34	R 2"	R 1 "1/2	364	507	252	646	789	128	383	466	640
CA70/45	R 2"	R 1 "1/2	364	507	289	683	826	128	383	466	640
CA120/33	R 2"	R 2"	364	507	289	683	826	128	389	472	640
CA120/35	R 2"	R 2"	364	507	289	683	826	128	389	472	640
CA120/55	R 2"	R 2"	364	507	289	683	826	128	389	472	640
CA200/33	R 2" 1/2	R 2"	425	570	289	752	897	128	389	472	640
CA200/35	R 2" 1/2	R 2"	425	570	319	782	927	128	389	472	640
CA200/55	R 2" 1/2	R 2"	425	570	319	782	927	128	389	472	640

gmd20ra_or_c_td

Dimensions in mm, tolerance ± 10 mm.

TWO-PUMP BOOSTER SETS, GMD20 RA SERIES VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON SUCTION SIDE



GMD 20RA	DNA	DNM	A		B		C		D		E	H	H1	H2
			STD/UE	A304	STD/UE	A304	STD/UE	A304	STD	UE/A304				
SV202F03T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	517	640
SV203F03T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	542	640
SV204F05T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	589	640
SV205F07T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	619	640
SV206F07T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	644	640
SV207F11T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	706	640
SV208F11T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	731	640
SV209F11T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	756	640
SV211F15T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	816	640
SV212F15T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	841	640
SV214F22T	R 2"	R 2"	360	439	252	301	672	800	550	610	658	98	891	640
SV402F03T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	517	640
SV403F05T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	564	640
SV404F07T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	594	640
SV405F11T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	656	640
SV406F11T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	681	640
SV407F11T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	706	640
SV408F15T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	741	640
SV409F15T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	766	640
SV411F22T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	816	640
SV413F22T	R 2"	R 2"	382	458	265	311	707	829	550	610	658	98	866	640
SV414F30T	R 2"	R 2"	382	458	265	311	707	829	550	610	682	109	952	651
SV802F11T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	660	651
SV803F15T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	708	651
SV804F22T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	746	651
SV805F22T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	784	651
SV806F30T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	872	651
SV808F40T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	952	651
SV809F40T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	550	610	682	114	990	651

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

gmd20ra_sv_a_td

Booster sets

GTKS20 Series

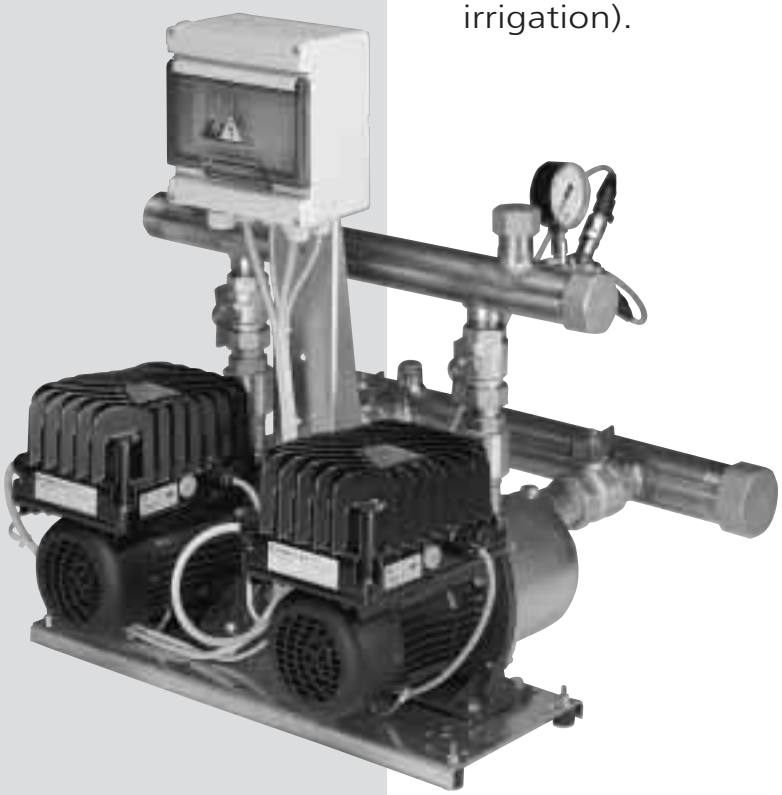
LOWARA

Market sectors

BUILDING TRADES, AGRICULTURE

APPLICATIONS

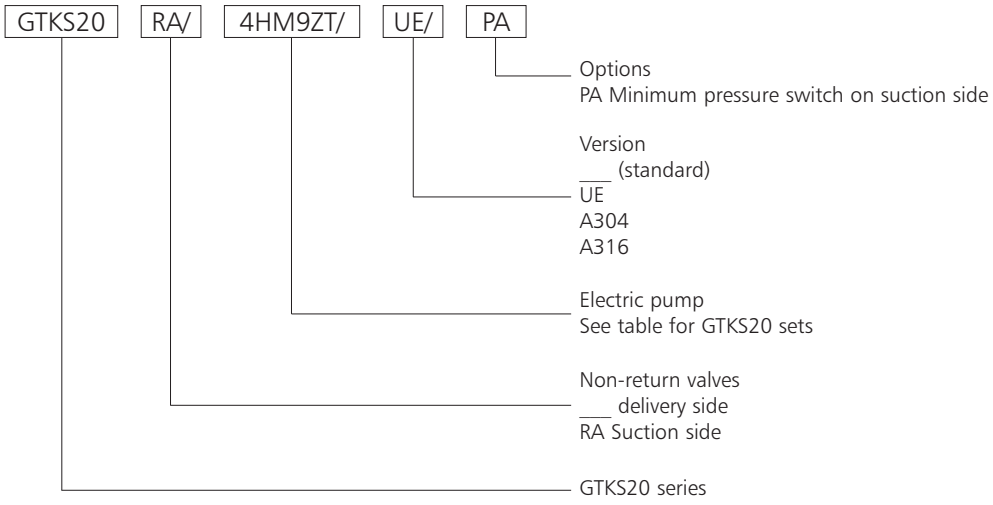
- Water network supply in condominiums, offices, hotels, shopping centres, factories
- Water supply to agricultural water networks (e.g. irrigation).



SPECIFICATIONS

- **Flow rate:** up to 16 m^3/h.
- **Head:** up to 100 m.
- Electric panel supply voltage: 1 x 230V ±10%.
- Frequency: 50 Hz.
- Electric panel protection class: IP55.
- Maximum electric pump power: 2 x 1.1 kW.
- **Motor start** with converter.
- Max temperature of pumped liquid: over 0°C to +40°C.
- **Horizontal design pumps:** BG-CEA-CA-HM series Maximum operating pressure: 8 bar.
- **Vertical design pumps:** SV series Maximum operating pressure: 16 bar.

IDENTIFICATION CODE



MAIN COMPONENTS

The **GTKS20** set consists of:

- Two variable-speed **electric pumps** with three-phase motor, **BG, CEA, CA, HM, SV** series, powered by single-phase frequency converters built into the motor, two pressure transmitters connected to the delivery manifold, a mounting base for the electric pumps equipped with vibration dampers and made of fabricated sheetmetal, suction manifold, delivery manifold ready for the connection of diaphragm tanks and equipped with a pressure gauge. Plus an on-off valve on the suction side and one on the delivery side, a non-return valve for each electric pump.

- **Electrical panel** for single-phase power supply, with casing made of thermoplastic material, transparent door, fitted with a thermal-magnetic protection switch for each converter.
  Ready for installation of one of the following dry running protectors: float switch, minimum pressure switch, external contact. An optional module inserted in the panel enables the installation of electrode probes with sensitivity adjustment.

- **Teknospeed frequency converter** integrated into the motor of each electric pump, designed to control the speed in order to maintain a constant pressure. It is equipped with:
  Power on, pump running and malfunction indicator lights, a relay for remote overload alarm signal, water failure, overtemperature.

A serial line for information transmission between the two units so as to ensure cyclic changeover, simultaneous operation at times of peak demand and continuous duty if one of the pumps is deactivated.

- The **non-return valves** are installed on the delivery side but, upon request, they can be mounted on the suction side (**GTKS20RA** set).

OPTIONAL FEATURES

- The available **options** are:
  Minimum pressure switch on suction side, connected to the electrical panel, with protection against dry running for operation with positive suction head.
  The options do not affect the dimensions.

- **The set comes pre-assembled** and packed in a box mounted on a wooden base, complete with electrical connections, operating manual and wiring diagrams, in one of the following versions:

- **Standard version:**
  Manifolds, caps, covers and flanges made of galvanized steel, nickel-plated brass valves, brass non-return valves. The standard version is available only for BG, CEA, CA, HM series horizontal design electric pumps.
  - **EU version:**
    Manifolds, caps, covers and flanges made of stainless steel, nickel-plated brass valves, brass non-return valves.
  - **A304 version:**
    Manifolds, caps, covers, flanges and valves made of AISI 304 stainless steel.
  - **A316 version:**
    Manifolds, caps, covers, flanges and valves made of AISI 316 stainless steel; this version is available only with SV electric pumps made of AISI 316.

Special versions are available on request

ACCESSORIES

Accessories on request (supplied separately)

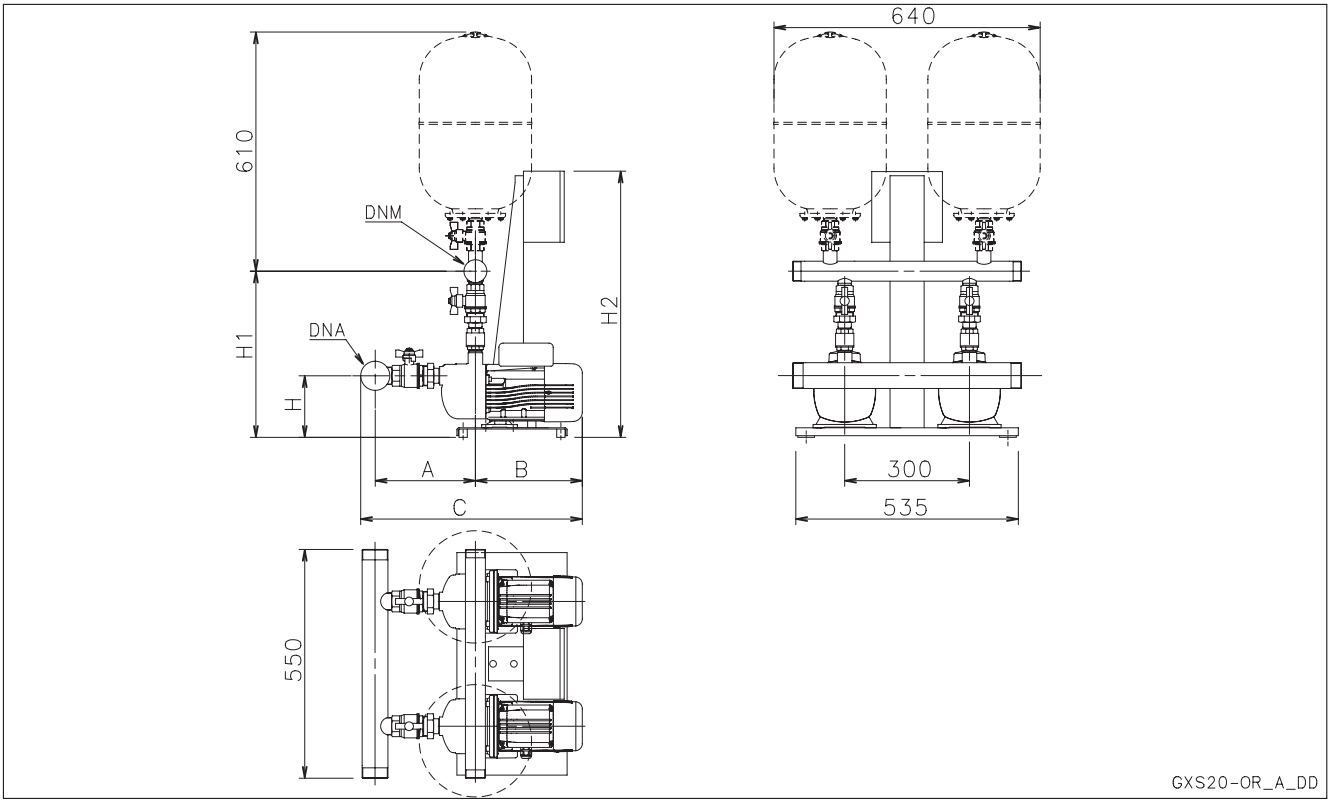
- Float switch for protection against dry running.
- Minimum pressure switch.
- Optional level control module with probe electrode kit.

- Kit featuring a 24-litre diaphragm expansion tank equipped with a ball valve (Rp 1" threaded connectors) for installation on delivery manifold, in the following versions:
  - 24-litre 8 bar cylinder water tank kit
  - 24-litre 10 bar cylinder water tank kit

Electrical panel

Converter

TWO-PUMP BOOSTER SETS, GTKS20 SERIES HORIZONTAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON DELIVERY SIDE

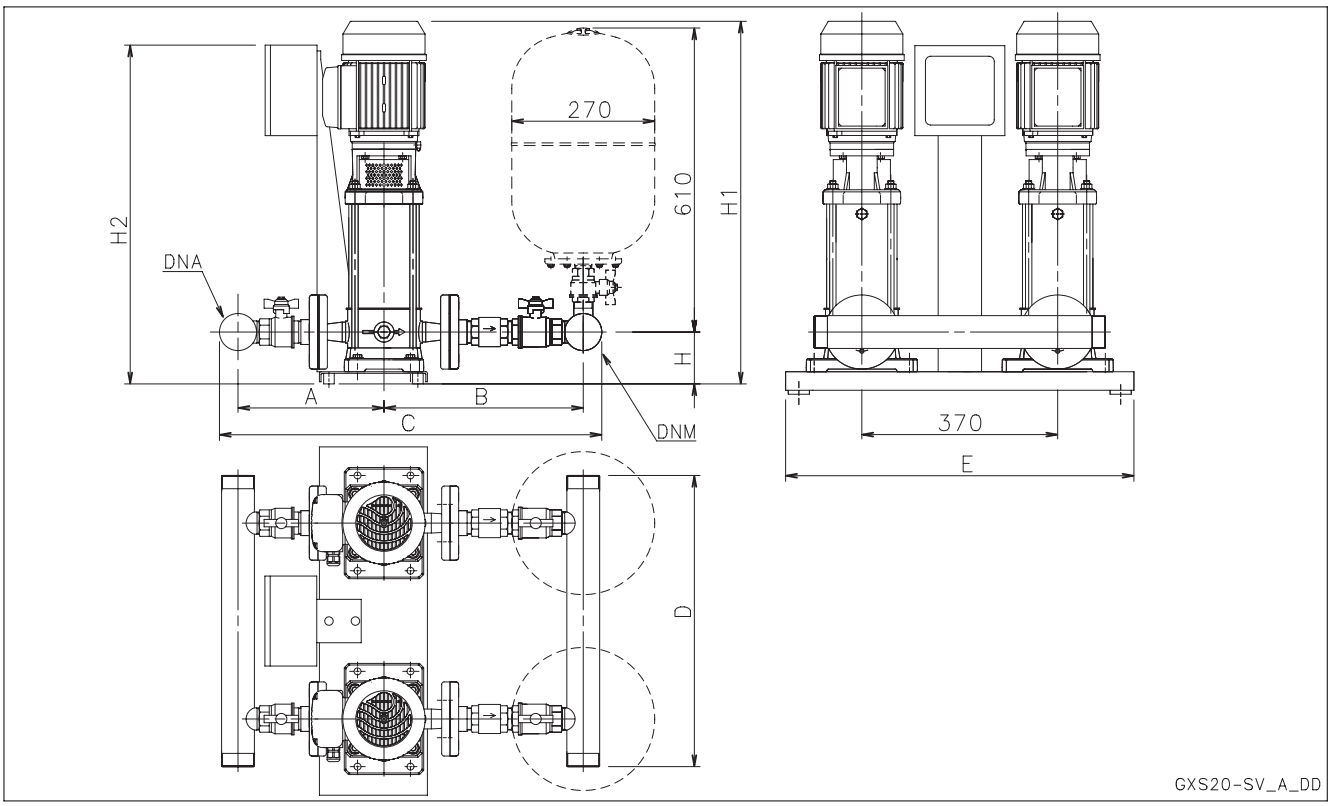


GTKS 20	DNA	DNM	A		B	C		H	H1		H2
			STD / UE	A304		STD / UE	A304		STD / UE	A304	
BG7	R 2"	R 1 "1/2	214	299	311	555	640	189	440	501	640
BG11	R 2"	R 1 "1/2	214	299	356	600	685	189	440	501	640
2HM3ZT	R 2"	R 1 "1/2	241	326	249	520	605	149	399	460	640
2HM5ZT	R 2"	R 1 "1/2	291	376	249	570	655	149	399	460	640
2HM7ZT	R 2"	R 1 "1/2	316	401	263	609	694	149	399	460	640
4HM5ZT	R 2"	R 1 "1/2	266	351	249	545	630	149	399	460	640
4HM9ZT	R 2"	R 1 "1/2	316	401	308	654	739	141	391	452	640
CEA80/5	R 2"	R 1 "1/2	196	281	274	500	585	132	438	499	640
CEA120/5	R 2"	R 2"	196	281	274	500	585	132	476	505	640
CEA210/3	R 2" 1/2	R 2 "1/2	243	318	331	612	687	132	468	602	640
CA70/33	R 2"	R 1 "1/2	276	361	252	558	643	128	452	513	640
CA70/44	R 2"	R 1 "1/2	276	361	252	558	643	128	452	513	640

gtks20_or_b_td

Dimensions in mm, tolerance ± 10 mm.

TWO-PUMP BOOSTER SETS, GTKS20 SERIES VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON DELIVERY SIDE



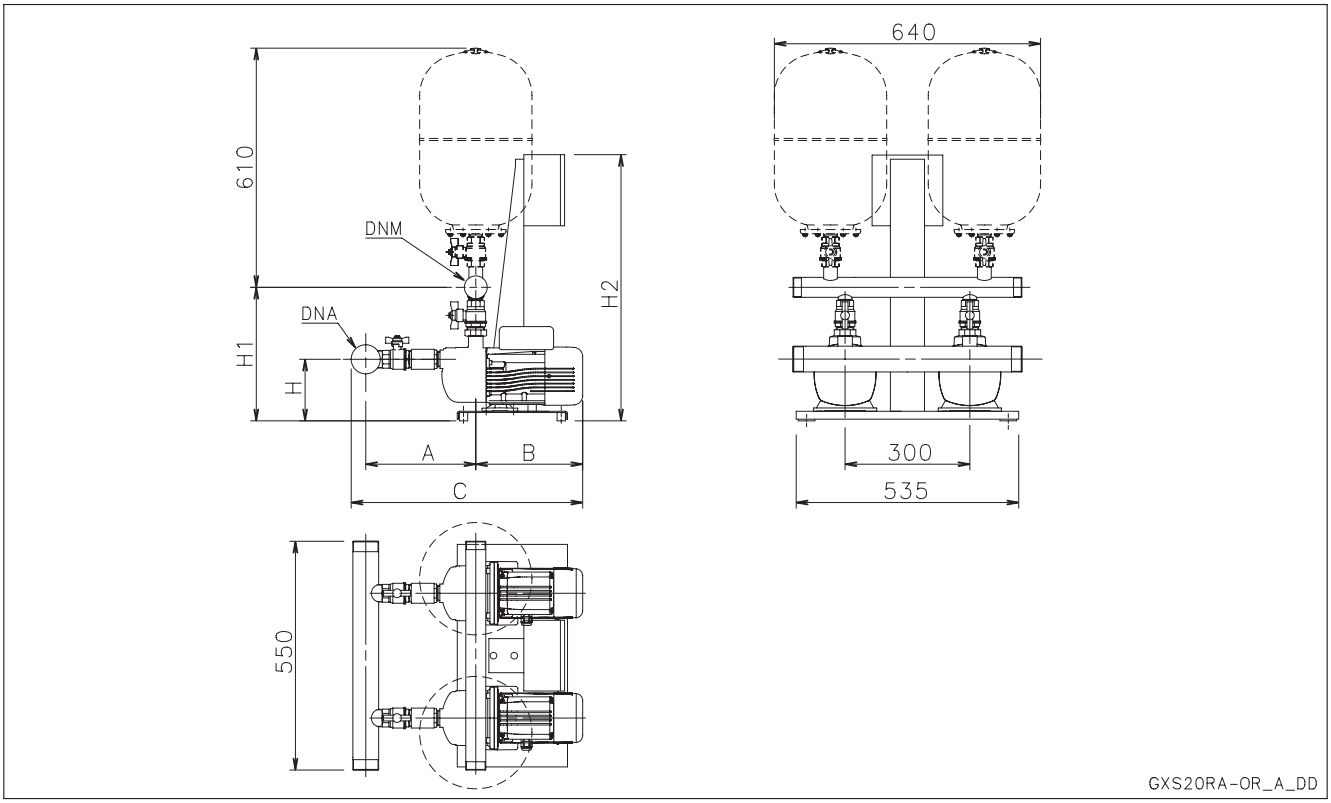
GTKS 20	DNA	DNM	A		B		C		D	E	H	H1	H2
			UE	A304	UE	A304	UE	A304					
SV206F07T	R 2"	R 2"	252	301	321	346	633	707	610	658	98	644	640
SV208F11T	R 2"	R 2"	252	301	321	346	633	707	610	658	98	731	640
SV404F07T	R 2"	R 2"	265	311	328	431	653	802	610	658	98	594	640
SV407F11T	R 2"	R 2"	265	311	328	431	653	802	610	658	98	706	640

gtks20_sv_a_td

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

The GTKS20 sets with vertical electric pumps in the Standard version use the stainless steel manifold and have the same dimensions as the /EU version.

TWO-PUMP BOOSTER SETS, GTKS20 RA SERIES HORIZONTAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON SUCTION SIDE

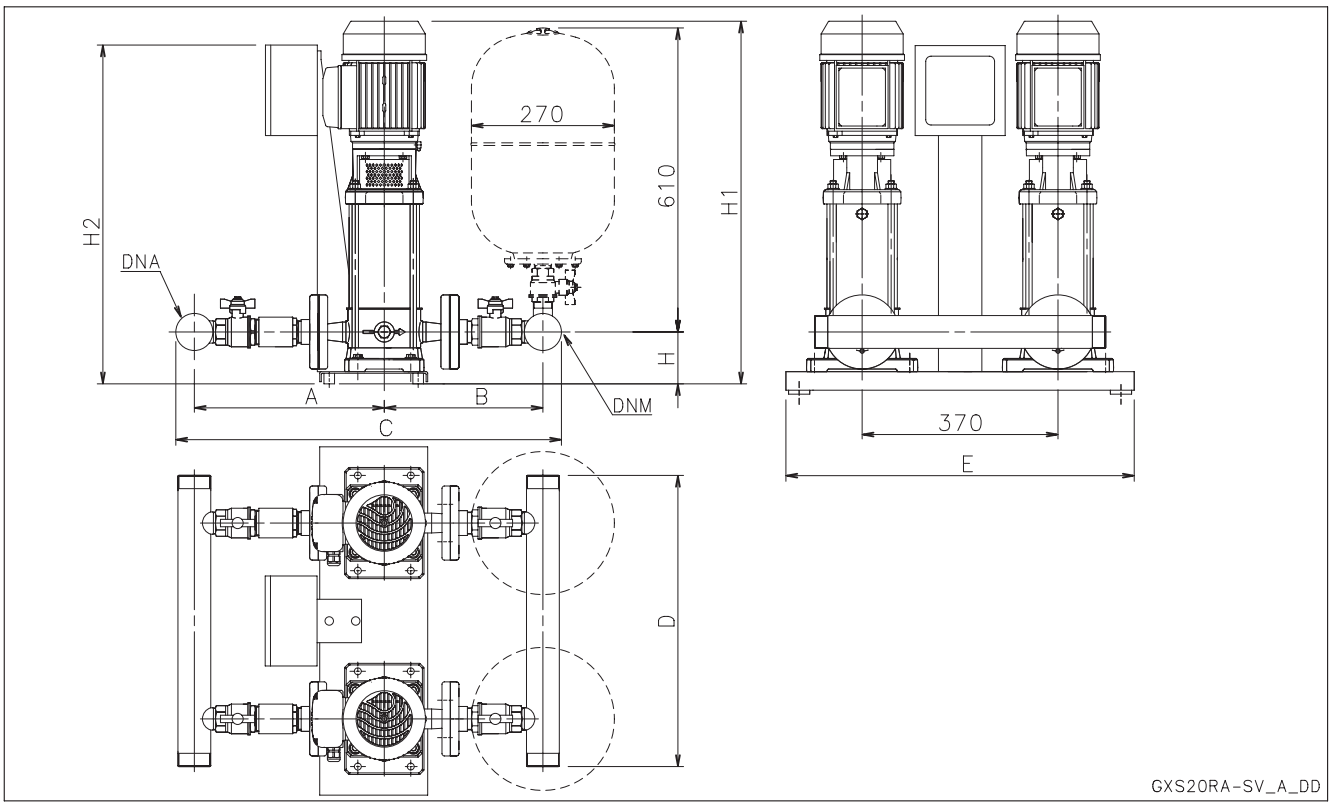


GTKS 20RA	DNA	DNM	A		B	C		H	H1		H2
			STD / UE	A304		STD / UE	A304		STD / UE	A304	
BG7	R 2"	R 1 "1/2	284	429	311	625	770	189	371	454	640
BG11	R 2"	R 1 "1/2	284	429	356	670	815	189	371	454	640
2HM3ZT	R 2"	R 1 "1/2	311	456	249	590	735	149	330	413	640
2HM5ZT	R 2"	R 1 "1/2	361	506	249	640	785	149	330	413	640
2HM7ZT	R 2"	R 1 "1/2	386	531	263	679	824	149	330	413	640
4HM5ZT	R 2"	R 1 "1/2	336	481	249	615	760	149	330	413	640
4HM9ZT	R 2"	R 1 "1/2	386	531	308	724	869	141	322	405	640
CEA80/5	R 2"	R 1 "1/2	266	411	274	570	715	132	369	452	640
CEA120/5	R 2"	R 2"	266	411	274	570	715	132	375	458	640
CEA210/3	R 2" 1/2	R 2 "1/2	338	467	331	707	836	132	398	483	640
CA70/33	R 2"	R 1 "1/2	346	491	252	628	773	128	383	466	640
CA70/44	R 2"	R 1 "1/2	346	491	252	628	773	128	383	466	640

gtks20ra_or_b_td

Dimensions in mm, tolerance ± 10 mm.

TWO-PUMP BOOSTER SETS, GMD20 RA SERIES VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON SUCTION SIDE



GTKS 20RA	DNA	DNM	A		B		C		D	E	H	H1	H2
			UE	A304	UE	A304	UE	A304					
SV206F07T	R 2"	R 2"	320	372	252	301	632	733	610	658	98	644	640
SV208F11T	R 2"	R 2"	320	372	252	301	632	733	610	658	98	731	640
SV404F07T	R 2"	R 2"	335	431	265	311	660	802	610	658	98	594	640
SV407F11T	R 2"	R 2"	335	431	265	311	660	802	610	658	98	706	640

gtks20ra_sv_a_td

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

The GTKS20 sets with vertical electric pumps in the Standard version use the stainless steel manifold and have the same dimensions as the /EU version.

Booster sets

GHV20 Series

LOWARA

Market sectors

BUILDING TRADES, AGRICULTURE

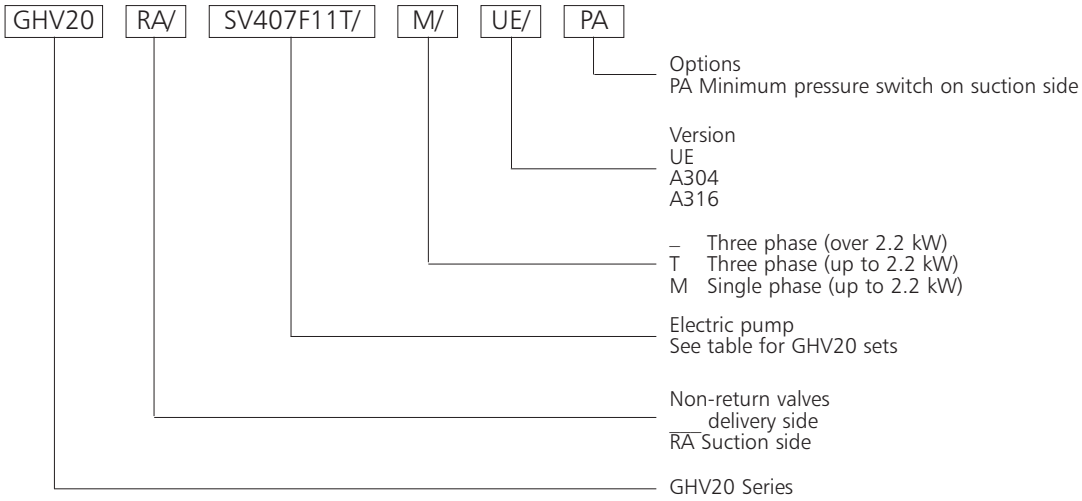
APPLICATIONS

- Water network supply in condominiums, offices, hotels, shopping centres, factories
- Water supply to agricultural water networks (e.g. irrigation).

SPECIFICATIONS

- **Flow rate:** up to 28 m³/h.
- **Head:** up to 150 m.
- Electric panel supply voltage: 1 x 230V ± 10% for powers up to 2.2 kW.
- Electric panel supply voltage: 3 x 400V ± 10% for 1.1 kW to 4 kW power.
- Frequency: 50 Hz.
- Electric panel protection class: IP55.
- Converter protection class: IP55.
- Maximum electric pump power: 2 x 4 kW.
- **Motor start** with converter.
- Max temperature of pumped liquid: over 0°C to +40°C.
- **Vertical design pumps:** SV series
  Maximum operating pressure: 16 bar.

IDENTIFICATION CODE



MAIN COMPONENTS

The **GHV20** set consists of:

Two variable-speed electric pumps with three-phase motor, SV series, powered by single-phase or three-phase frequency converters mounted on the motor, two pressure transmitters connected to the delivery manifold, a mounting base for the electric pumps equipped with vibration dampers and made of fabricated sheetmetal, suction manifold, delivery manifold ready for the connection of diaphragm tanks and equipped with a pressure gauge. Plus an on-off valve on the suction side and one on the delivery side, a non-return valve for each electric pump.

Depending on the type of power supply:

Electrical panel for **single-phase** power supply (GHV..../M), with casing made of thermoplastic material, transparent door, fitted with a thermal-magnetic protection switch for each converter. Ready for installation of one of the following dry running protectors: float switch, minimum pressure switch, external contact. An optional module inserted in the panel enables the installation of electrode probes with sensitivity adjustment.

Electrical panel for **three-phase** power supply, with casing made of steel, transparent door, main doorlock switch fitted with a thermal-magnetic protection switch for each converter.
Ready for installation of one of the following dry running protectors: float switch, minimum pressure switch, external contact, electrode probes.

Hydrovar® frequency converter integrated into the motor of each electric pump, designed to control the speed in order to maintain a constant pressure. It is equipped with:
Power on, pump running and malfunction indicator lights, a liquid crystal display and control buttons. Fitted with two relays for remote alarm and pump running signals.

A serial line for information transmission between the two units so as to ensure cyclic changeover, simultaneous operation at times of peak demand and continuous duty if one of the pumps is deactivated. The serial line enables connection to a remote control system.

The **non-return valves** are installed on the delivery side but, upon request, they can be mounted on the suction side (GHV20RA set).

The available **options** are:
Minimum pressure switch on suction side, connected to the electrical panel, with protection against dry running for operation with positive suction head.
Maximum pressure switch on delivery side.
The options do not affect the dimensions.

The set comes pre-assembled and packed in a box mounted on a wooden base, complete with electrical connections, operating manual and wiring diagrams, in one of the following versions:

- **Standard version:**
  Manifolds, caps, covers and flanges made of galvanized steel, nickel-plated brass valves, brass non-return valves.
- **EU version:**
  Manifolds, caps, covers and flanges made of stainless steel, nickel-plated brass valves, brass non-return valves.
- **A304 version:**
  Manifolds, caps, covers, flanges and valves made of AISI 304 stainless steel.
- **A316 version:**
  Manifolds, caps, covers, flanges and valves made of AISI 316 stainless steel; this version is available only with SV electric pumps made of AISI 316.

Special versions are available on request

ACCESSORIES

Accessories on request (supplied separately)

- Float switch for protection against dry running.
- Minimum pressure switch.
- Optional level control module with probe electrodes kit (for single-phase panel).
  Probe electrodes kit.

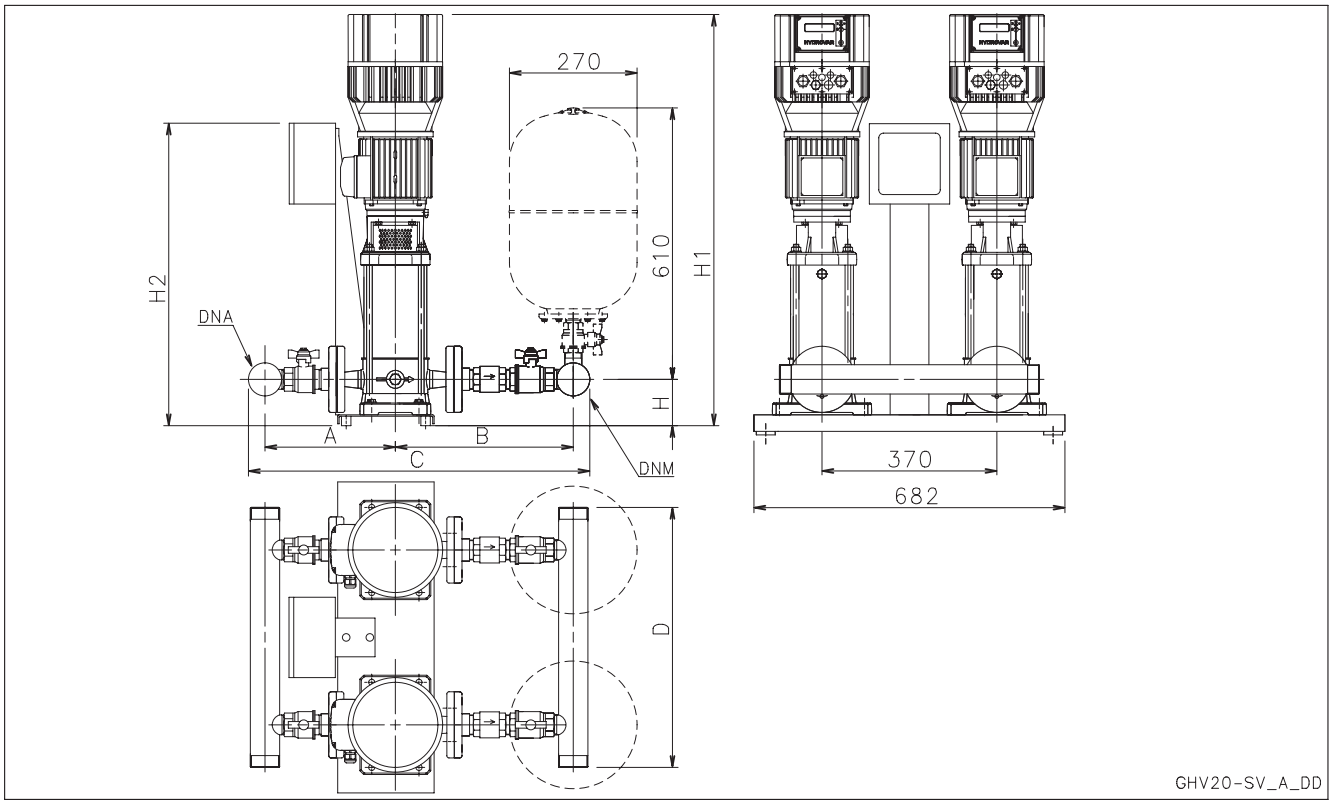
- Kit featuring a 24-litre diaphragm expansion tank equipped with a ball valve (Rp 1" threaded connectors) for installation on delivery manifold, in the following versions:
  - 24-litre 8 bar cylinder water tank kit
  - 24-litre 10 bar cylinder water tank kit
  - 24-litre 16 bar cylinder water tank kit

Single-phase electrical panel

Three-phase electrical panel

Converter

TWO-PUMP BOOSTER SETS, GHV20..../M SERIES VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON DELIVERY SIDE SINGLE-PHASE POWER SUPPLY



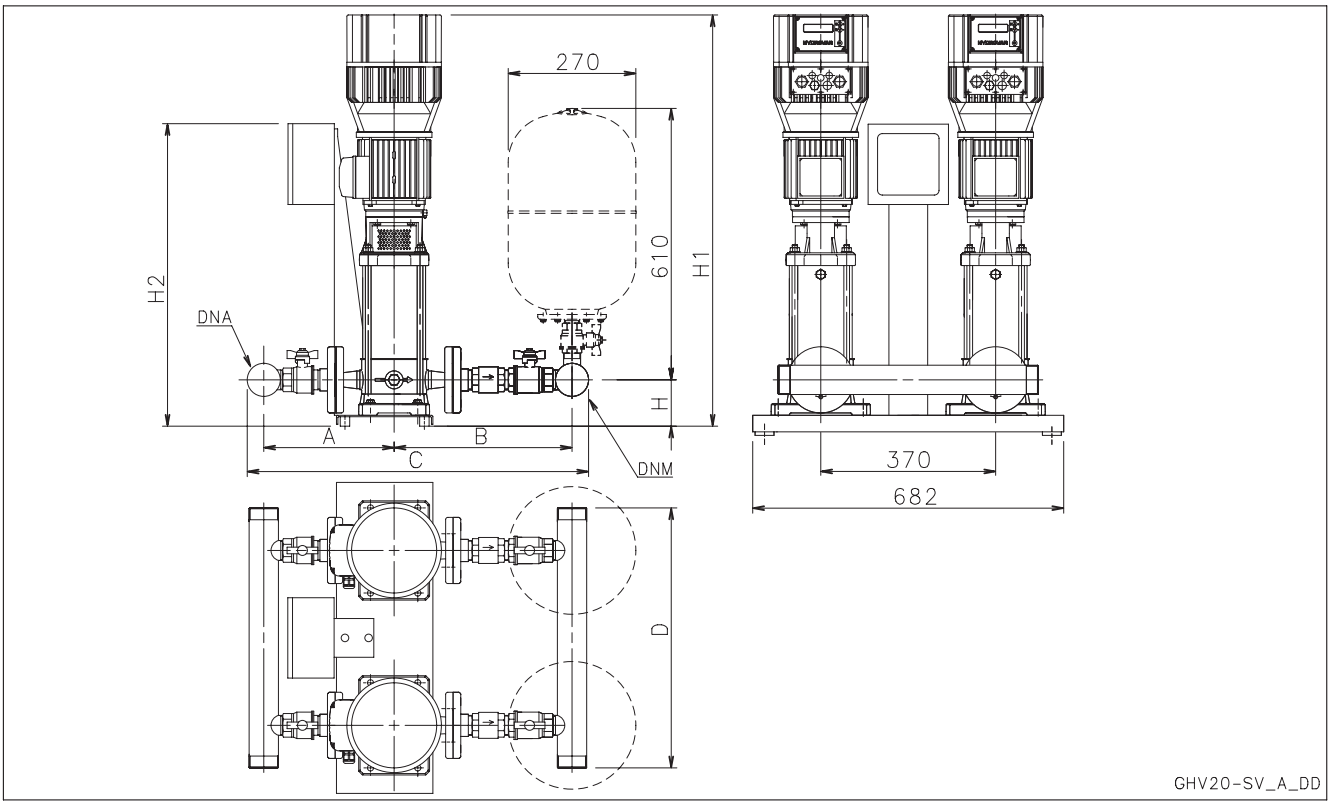
GHV 20	DNA	DNM	A		B		C		D	H	H1	H2
			UE	A304	UE	A304	UE	A304				
SV204F05T	R 2"	R 2"	252	301	321	346	633	707	610	109	785	651
SV206F07T	R 2"	R 2"	252	301	321	346	633	707	610	109	840	651
SV209F11T	R 2"	R 2"	252	301	321	346	633	707	610	109	952	651
SV211F15T	R 2"	R 2"	252	301	321	346	633	707	610	109	1012	651
SV212F15T	R 2"	R 2"	252	301	321	346	633	707	610	109	1037	651
SV214F22T	R 2"	R 2"	252	301	321	346	633	707	610	109	1087	651
SV403F05T	R 2"	R 2"	265	311	328	431	653	802	610	109	760	651
SV404F07T	R 2"	R 2"	265	311	328	431	653	802	610	109	790	651
SV407F11T	R 2"	R 2"	265	311	328	431	653	802	610	109	902	651
SV409F15T	R 2"	R 2"	265	311	328	431	653	802	610	109	962	651
SV413F22T	R 2"	R 2"	265	311	328	431	653	802	610	109	1062	651
SV803F15T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	610	114	893	651
SV804F22T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	610	114	931	651
SV805F22T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	610	114	969	651

ghvm20_sv_a_td

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

The GHV20 sets with vertical electric pumps in the Standard version use the stainless steel manifold and have the same dimensions as the /EU version.

TWO-PUMP BOOSTER SETS, GHV20 SERIES
VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON DELIVERY SIDE
THREE-PHASE POWER SUPPLY



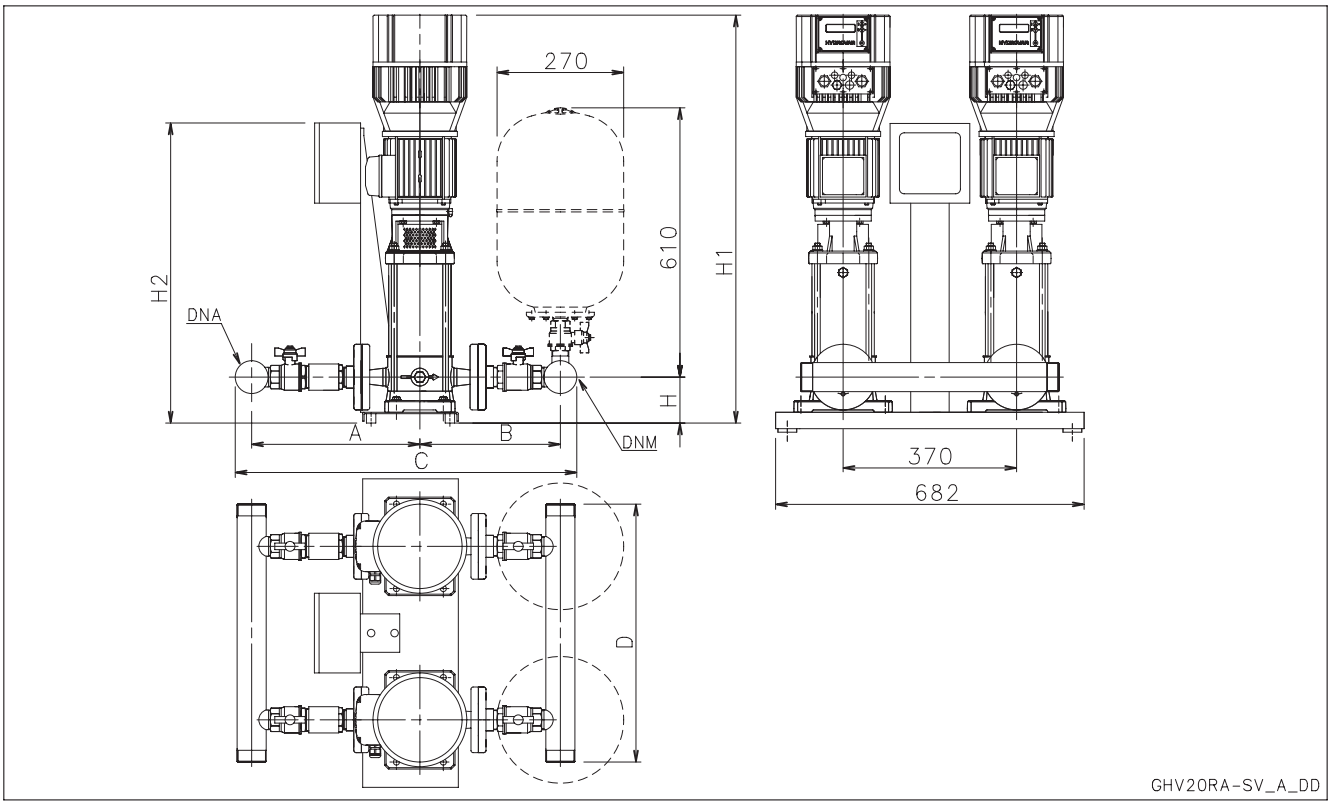
GHV 20	DNA	DNM	A		B		C		D	H	H1	H2
			UE	A304	UE	A304	UE	A304				
SV209F11T	R 2"	R 2"	252	301	321	346	633	707	610	109	952	651
SV212F15T	R 2"	R 2"	252	301	321	346	633	707	610	109	1037	651
SV214F22T	R 2"	R 2"	252	301	321	346	633	707	610	109	1087	651
SV407F11T	R 2"	R 2"	265	311	328	431	653	802	610	109	902	651
SV409F15T	R 2"	R 2"	265	311	328	431	653	802	610	109	962	651
SV413F22T	R 2"	R 2"	265	311	328	431	653	802	610	109	1062	651
SV414F30T	R 2"	R 2"	265	311	328	431	653	802	610	109	1137	651
SV803F15T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	610	114	893	651
SV804F22T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	610	114	931	651
SV805F22T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	610	114	969	651
SV806F30T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	610	114	1057	651
SV809F40T	R 2"1/2	R 2"1/2	302	356	397	497	775	929	610	114	1175	651

ghvt20_sv_a_td

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

The GHV20 sets with vertical electric pumps in the Standard version use the stainless steel manifold and have the same dimensions as the /EU version.

TWO-PUMP BOOSTER SETS, GHV20 RA ..../M SERIES VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON SUCTION SIDE SINGLE-PHASE POWER SUPPLY



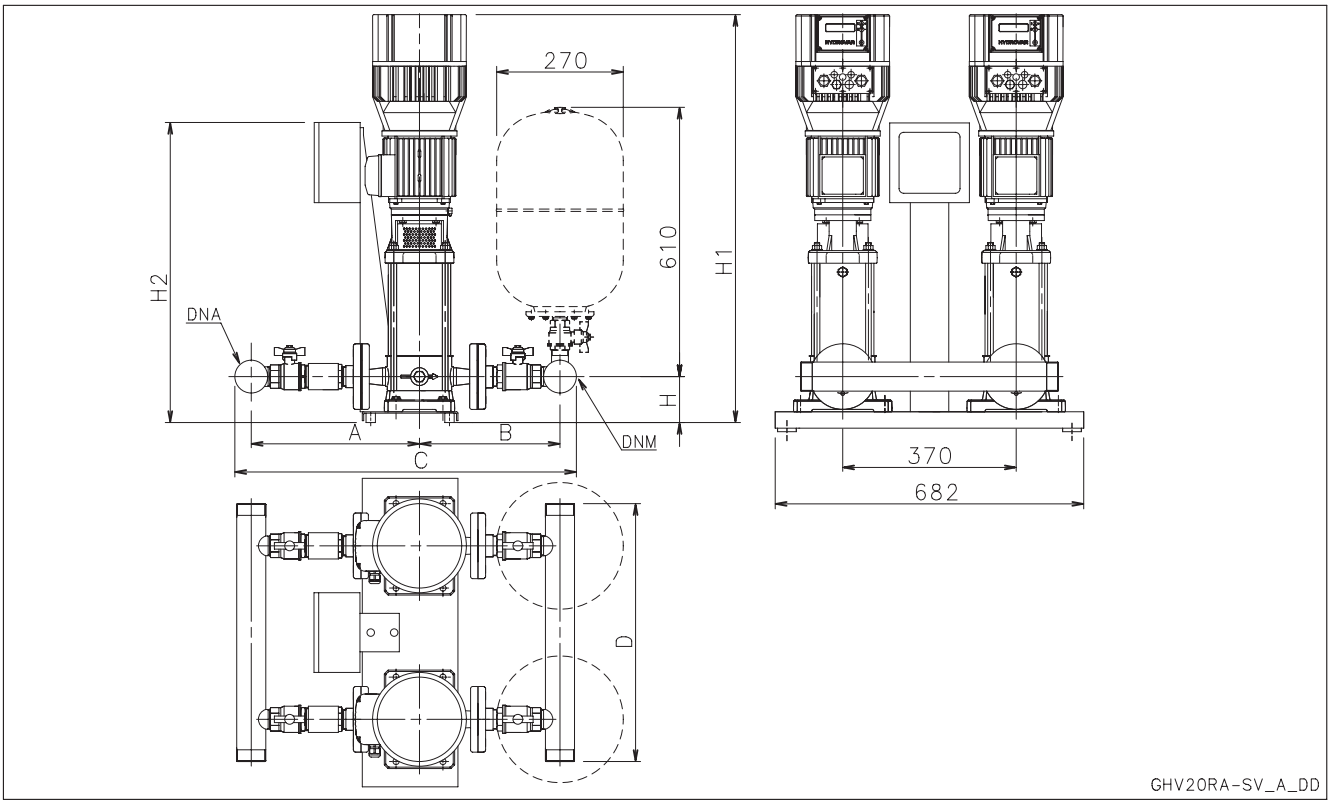
GHV 20RA	DNA	DNM	A		B		C		D	H	H1	H2
			UE	A304	UE	A304	UE	A304				
SV204F05T	R 2"	R 2"	320	372	252	301	632	733	610	109	785	651
SV206F07T	R 2"	R 2"	320	372	252	301	632	733	610	109	840	651
SV209F11T	R 2"	R 2"	320	372	252	301	632	733	610	109	952	651
SV211F15T	R 2"	R 2"	320	372	252	301	632	733	610	109	1012	651
SV212F15T	R 2"	R 2"	320	372	252	301	632	733	610	109	1037	651
SV214F22T	R 2"	R 2"	320	372	252	301	632	733	610	109	1087	651
SV403F05T	R 2"	R 2"	335	431	265	311	660	802	610	109	760	651
SV404F07T	R 2"	R 2"	335	431	265	311	660	802	610	109	790	651
SV407F11T	R 2"	R 2"	335	431	265	311	660	802	610	109	902	651
SV409F15T	R 2"	R 2"	335	431	265	311	660	802	610	109	962	651
SV413F22T	R 2"	R 2"	335	431	265	311	660	802	610	109	1062	651
SV803F15T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	610	114	893	651
SV804F22T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	610	114	931	651
SV805F22T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	610	114	969	651

ghvm20ra_sv_b_td

Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

The GHV20 sets with vertical electric pumps in the Standard version use the stainless steel manifold and have the same dimensions as the /EU version.

TWO-PUMP BOOSTER SETS, GHV20 RA SERIES
VERTICAL ELECTRIC PUMPS WITH NON-RETURN VALVE ON SUCTION SIDE
THREE-PHASE POWER SUPPLY



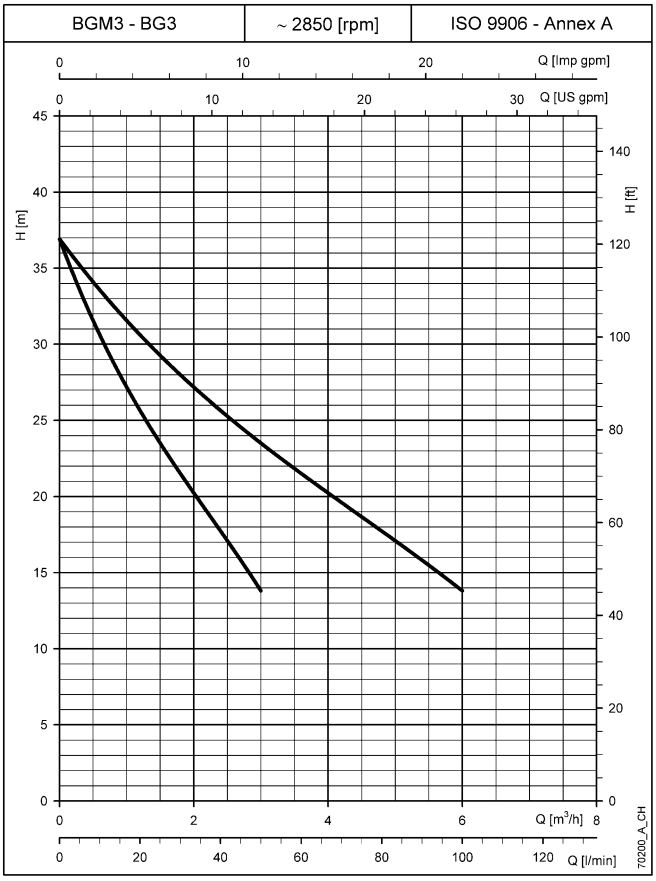
GHV 20RA	DNA	DNM	A		B		C		D	H	H1	H2
			UE	A304	UE	A304	UE	A304				
SV209F11T	R 2"	R 2"	320	372	252	301	632	733	610	109	952	651
SV212F15T	R 2"	R 2"	320	372	252	301	632	733	610	109	1037	651
SV214F22T	R 2"	R 2"	320	372	252	301	632	733	610	109	1087	651
SV407F11T	R 2"	R 2"	335	431	265	311	660	802	610	109	902	651
SV409F15T	R 2"	R 2"	335	431	265	311	660	802	610	109	962	651
SV413F22T	R 2"	R 2"	335	431	265	311	660	802	610	109	1062	651
SV414F30T	R 2"	R 2"	335	431	265	311	660	802	610	109	1137	651
SV803F15T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	610	114	893	651
SV804F22T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	610	114	931	651
SV805F22T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	610	114	969	651
SV806F30T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	610	114	1057	651
SV809F40T	R 2"1/2	R 2"1/2	397	497	302	356	775	929	610	114	1175	651

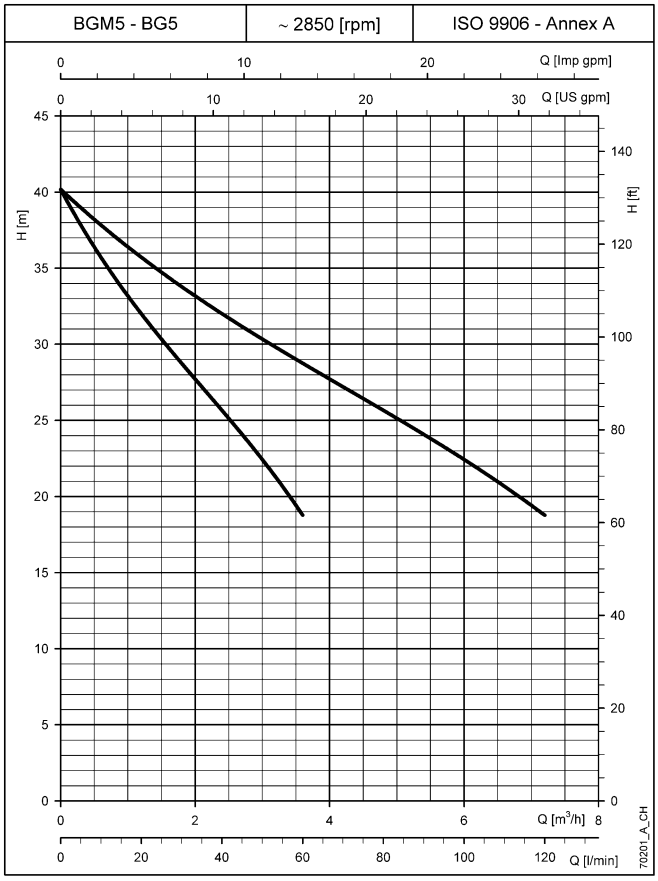
ghvt20ra_sv_b_td

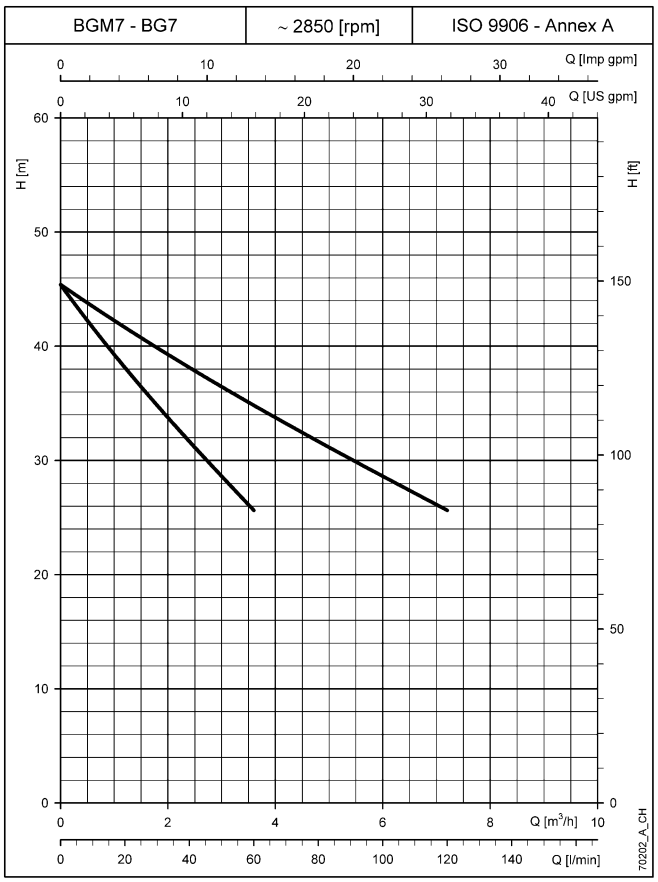
Dimensions in mm, tolerance ± 10 mm.
The /A316 versions have the same dimensions as the /A304 versions.

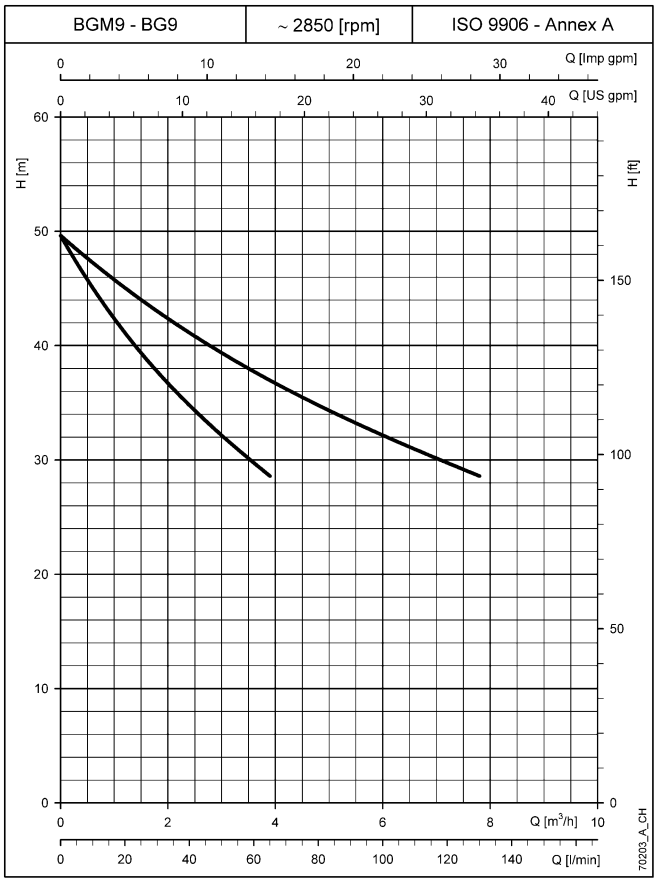
The GHV20 sets with vertical electric pumps in the Standard version use the stainless steel manifold and have the same dimensions as the /EU version.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz





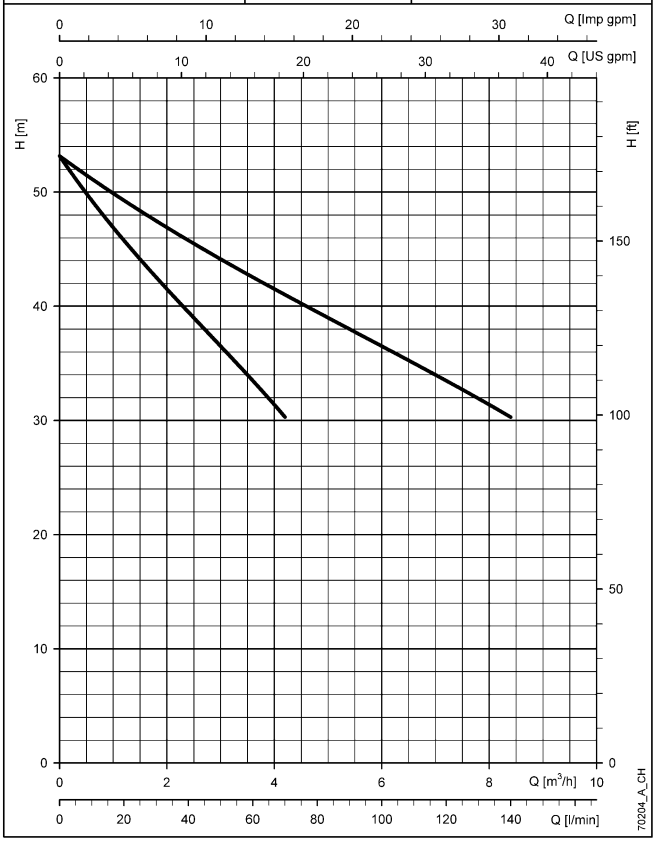




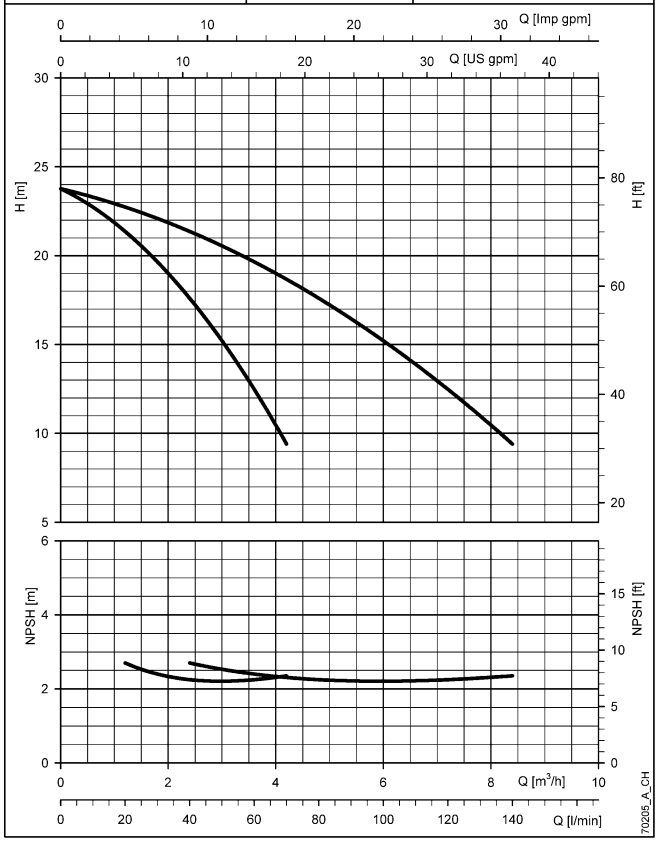
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density $\rho = 1.0$ kg/dm³ and kinematic viscosity $\nu = 1$ mm²/sec.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

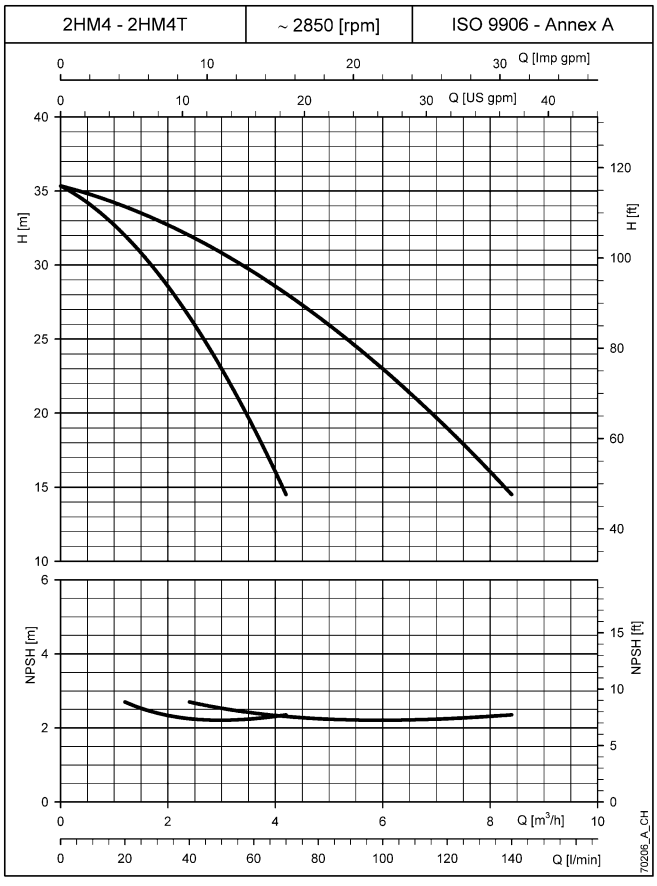
BGM11 - BG11 | ~ 2850 [rpm] | ISO 9906 - Annex A



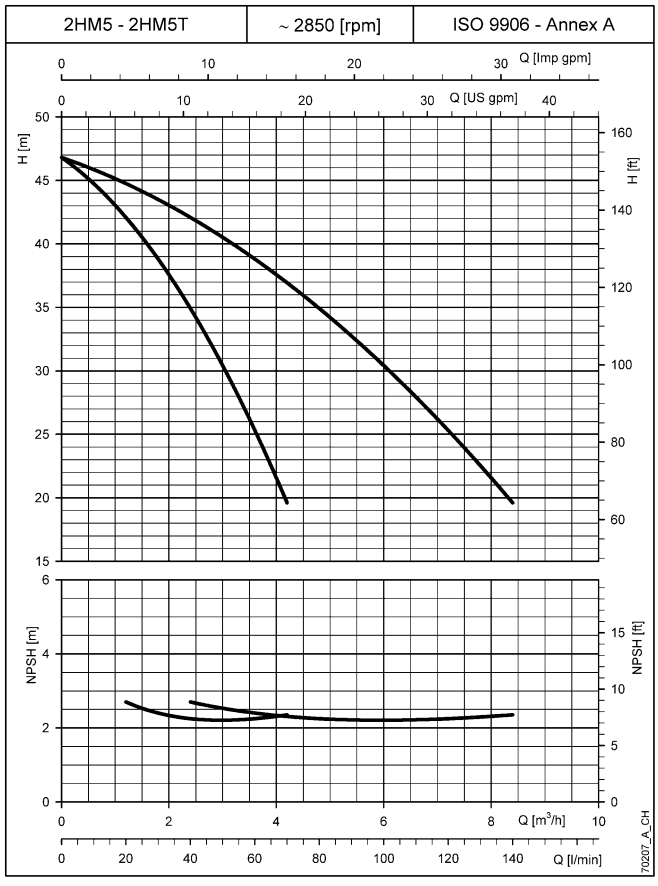
2HM3 - 2HM3T | ~ 2850 [rpm] | ISO 9906 - Annex A



2HM4 - 2HM4T | ~ 2850 [rpm] | ISO 9906 - Annex A

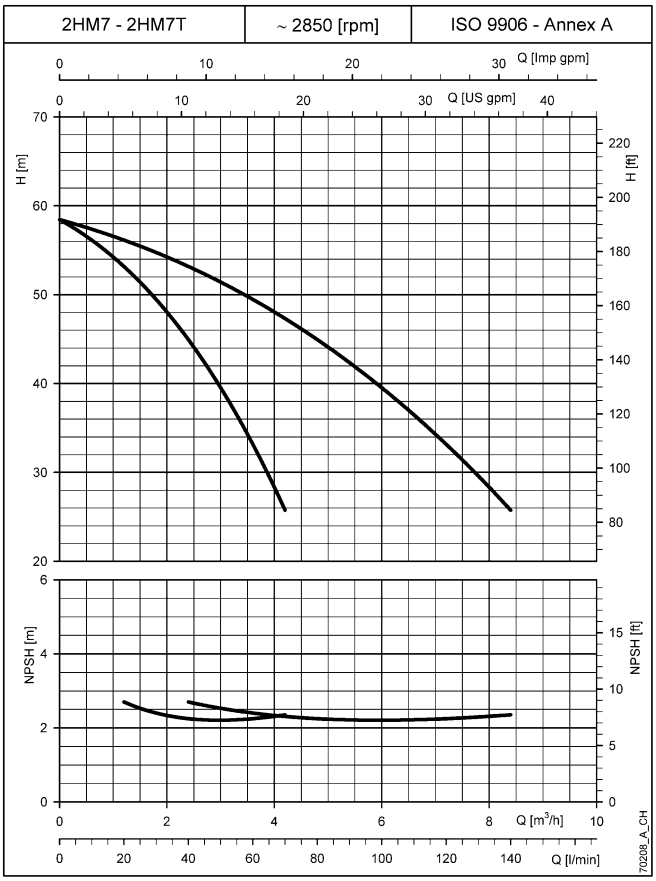


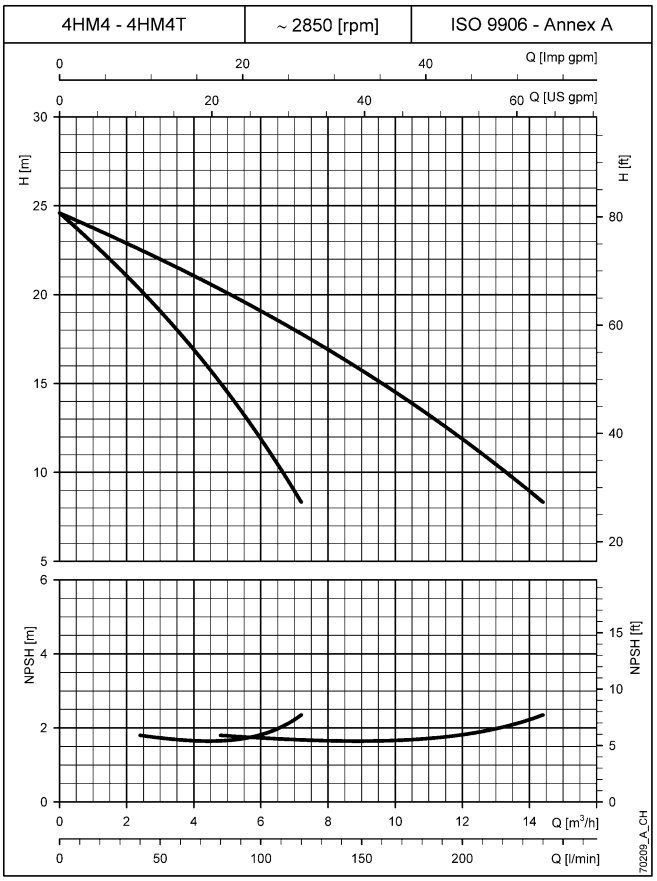
2HM5 - 2HM5T | ~ 2850 [rpm] | ISO 9906 - Annex A

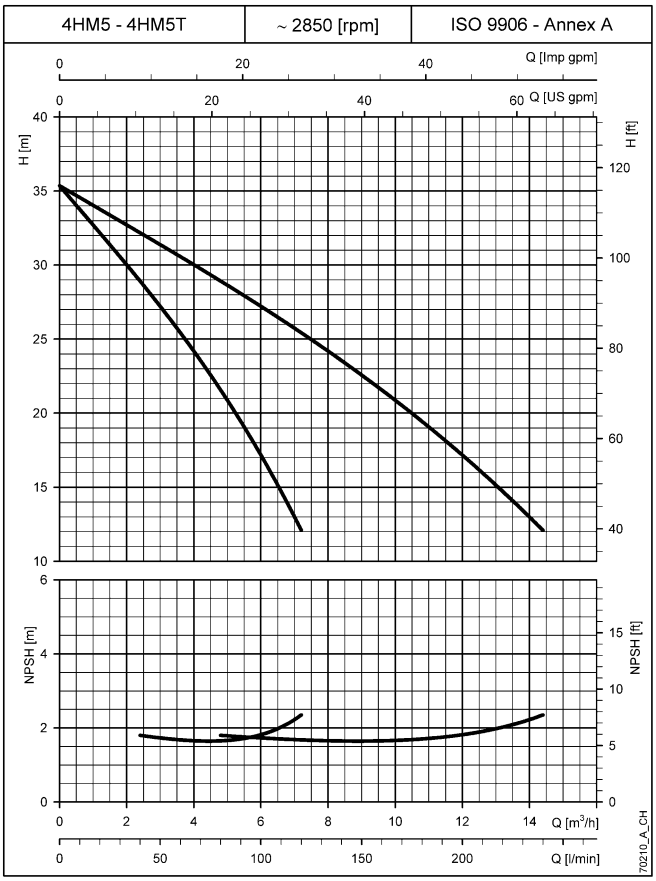


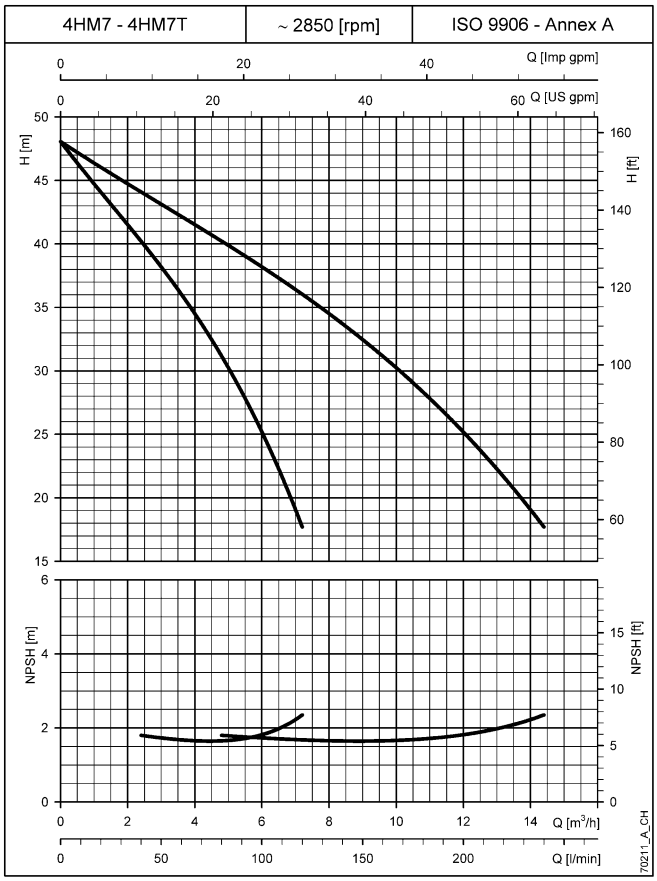
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm^3 and kinematic viscosity ν = 1 mm^2/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz





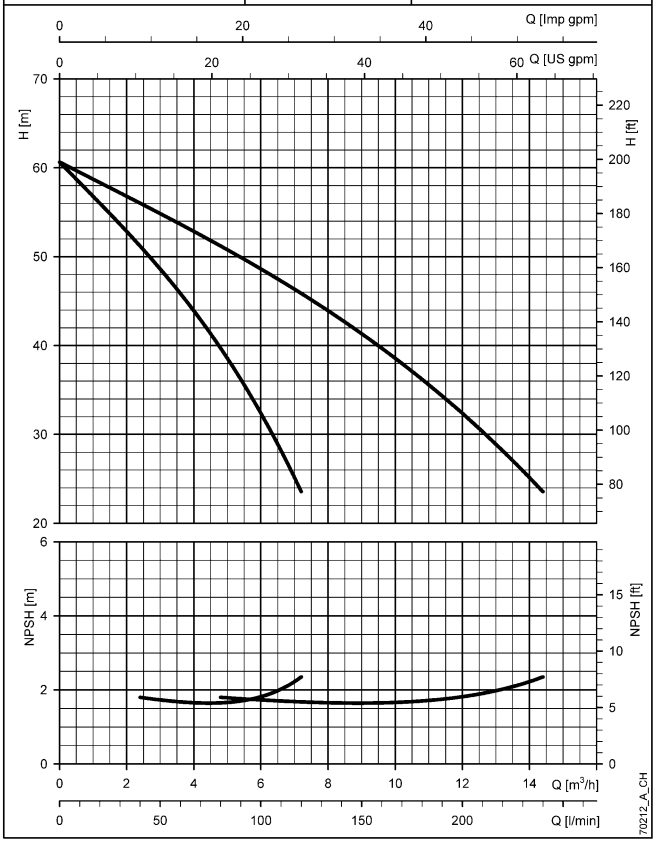




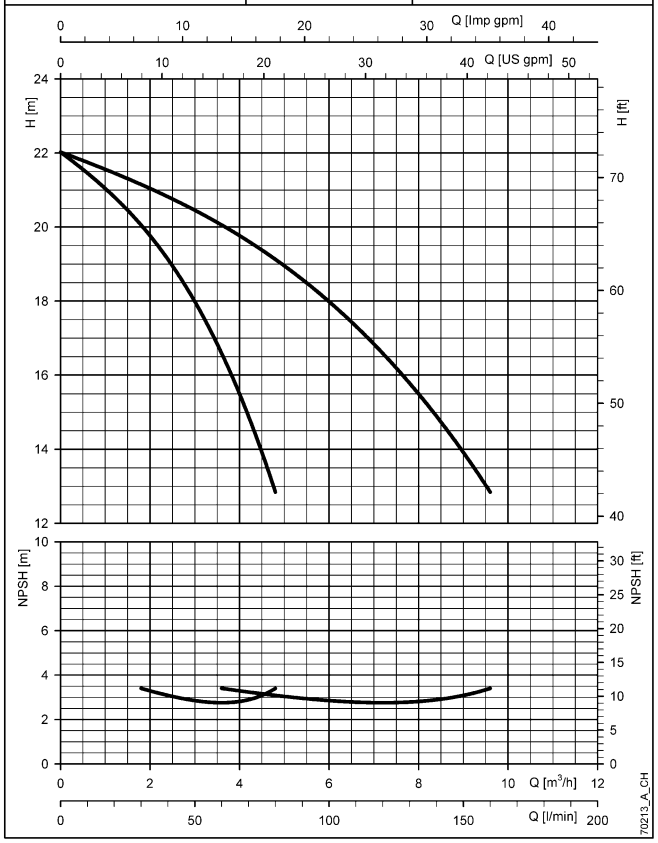
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

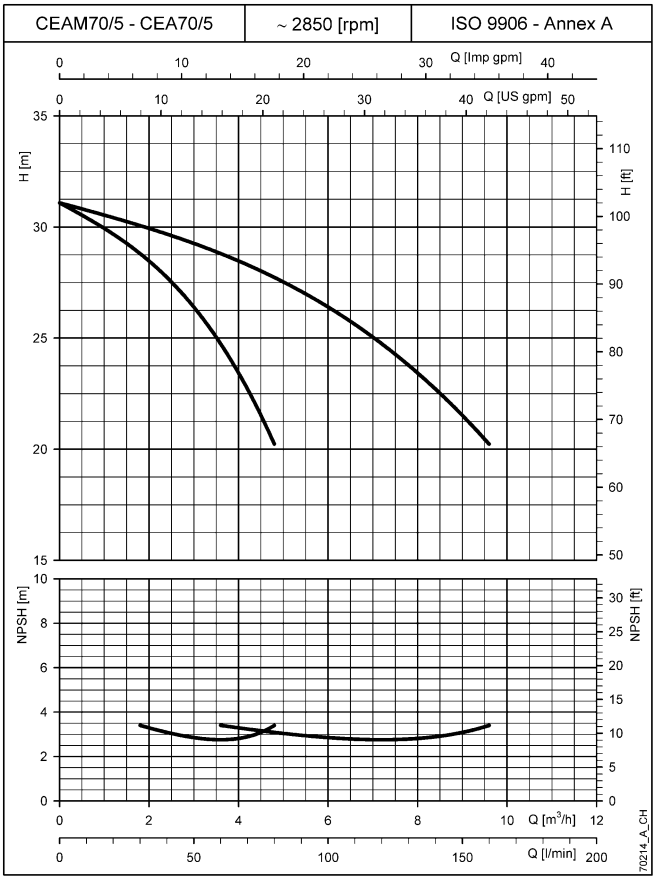
4HM9 - 4HM9T	~ 2850 [rpm]	ISO 9906 - Annex A



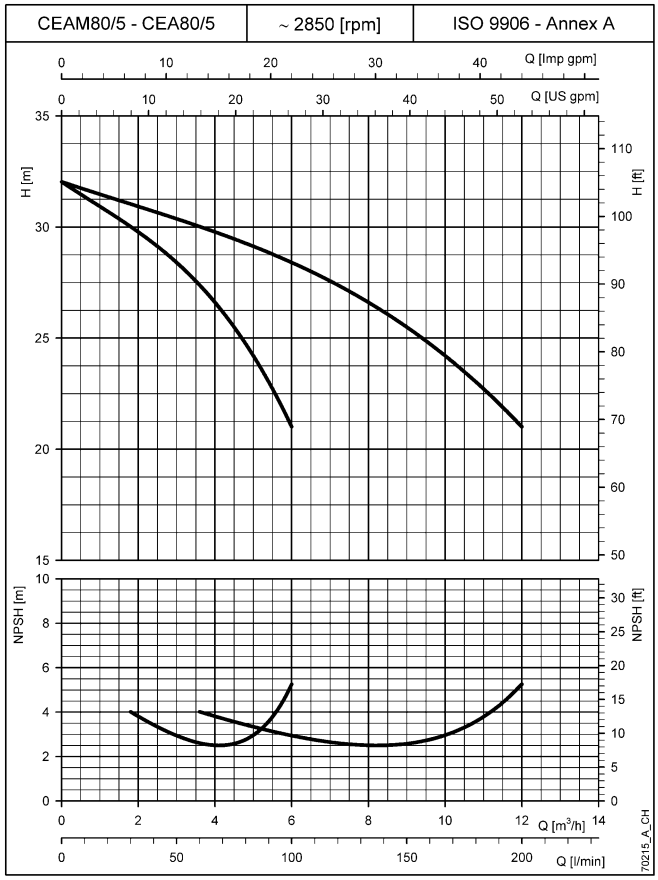
CEAM70/3 - CEA70/3	~ 2850 [rpm]	ISO 9906 - Annex A



CEAM70/5 - CEA70/5	~ 2850 [rpm]	ISO 9906 - Annex A



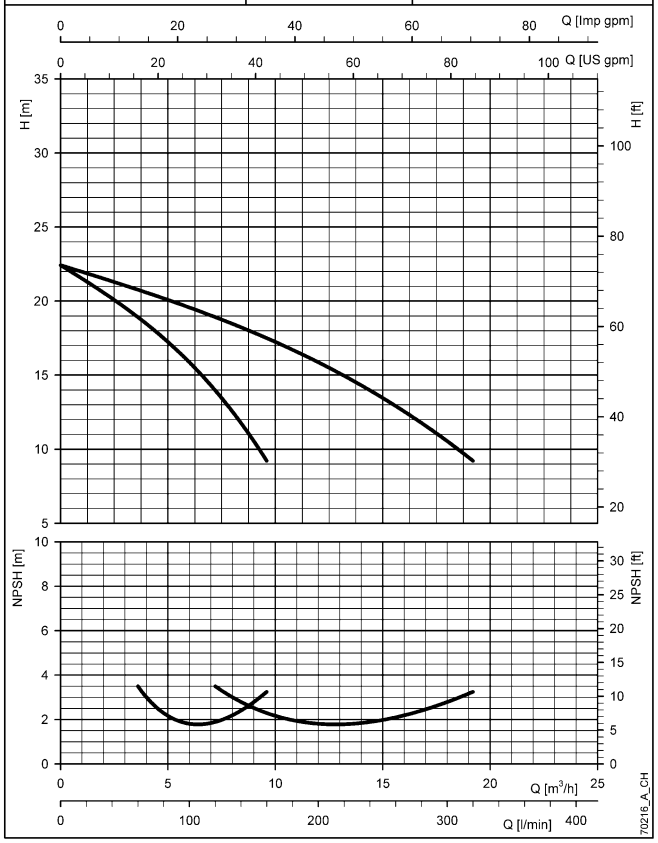
CEAM80/5 - CEA80/5	~ 2850 [rpm]	ISO 9906 - Annex A



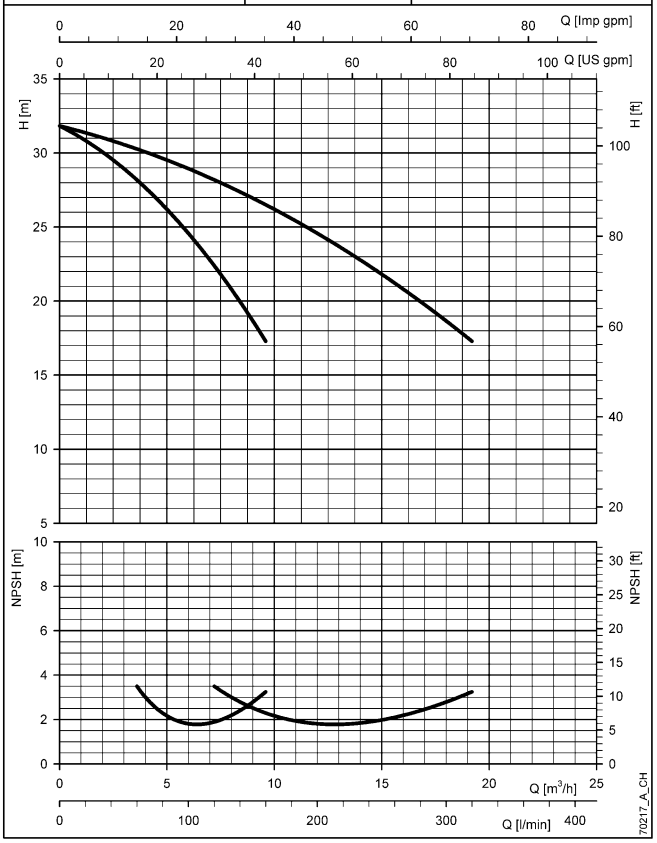
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm^3 and kinematic viscosity ν = 1 mm^2/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

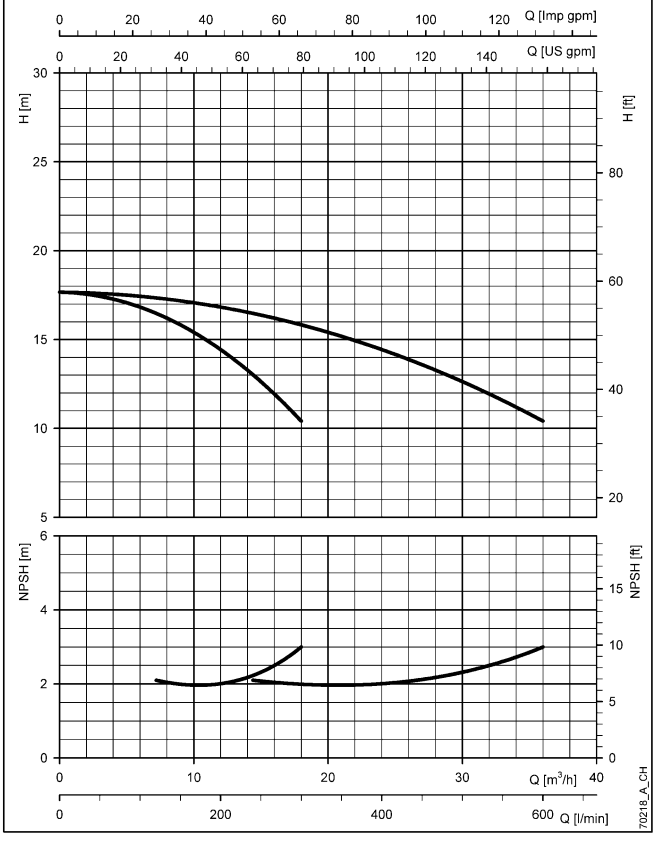
CEAM120/3 - CEA120/3 | ~ 2850 [rpm] | ISO 9906 - Annex A



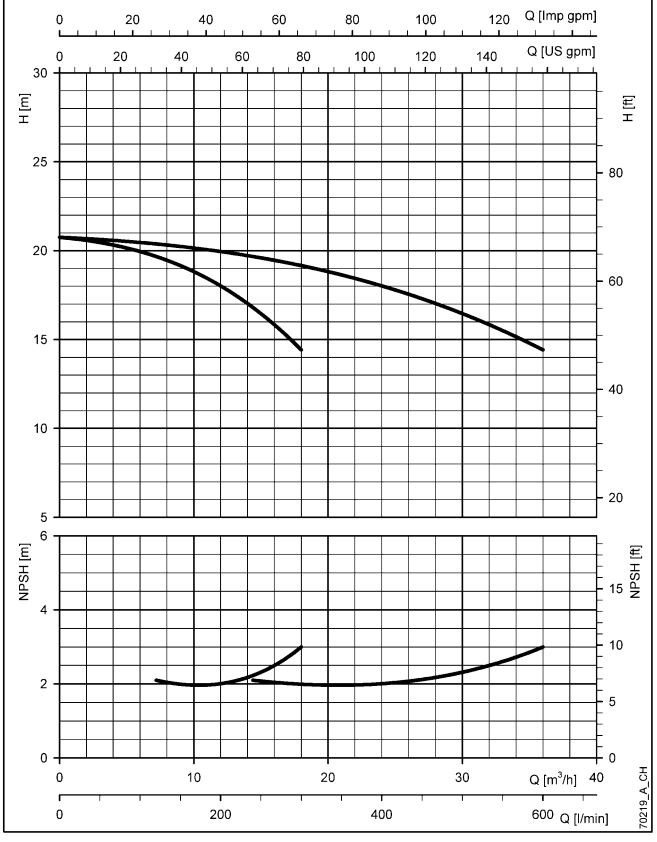
CEAM120/5 - CEA120/5 | ~ 2850 [rpm] | ISO 9906 - Annex A



CEAM210/2 - CEA210/2 | ~ 2850 [rpm] | ISO 9906 - Annex A



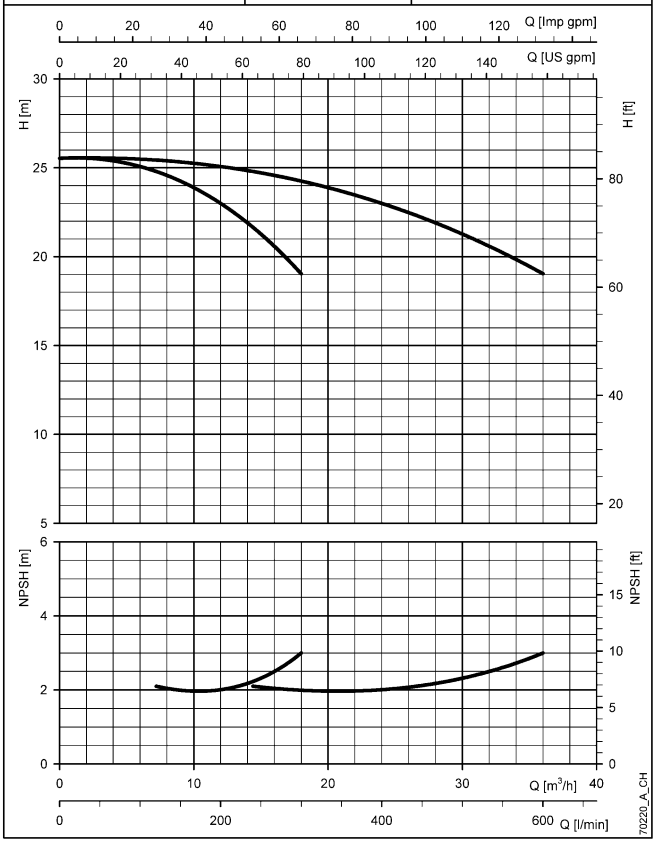
CEAM210/3 - CEA210/3 | ~ 2850 [rpm] | ISO 9906 - Annex A



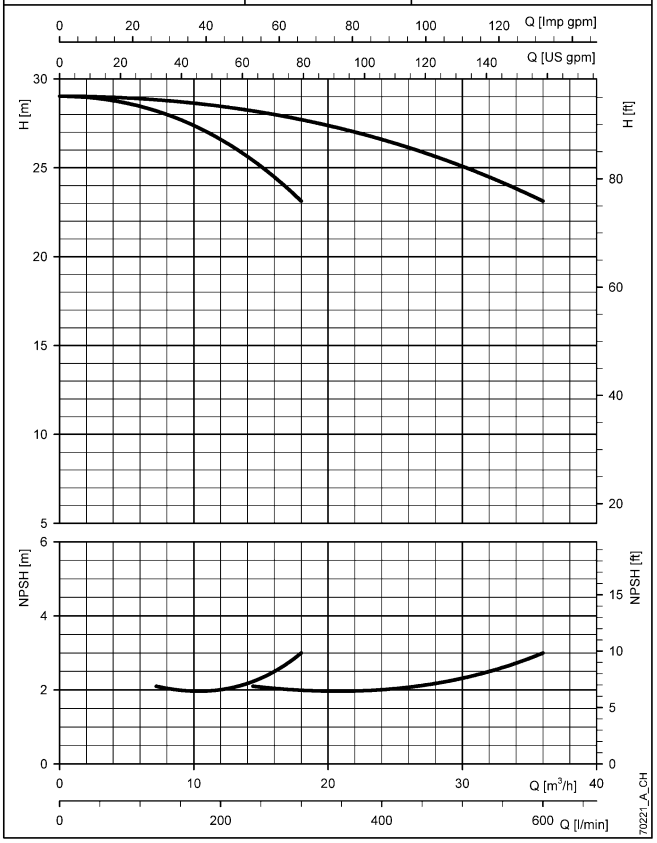
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

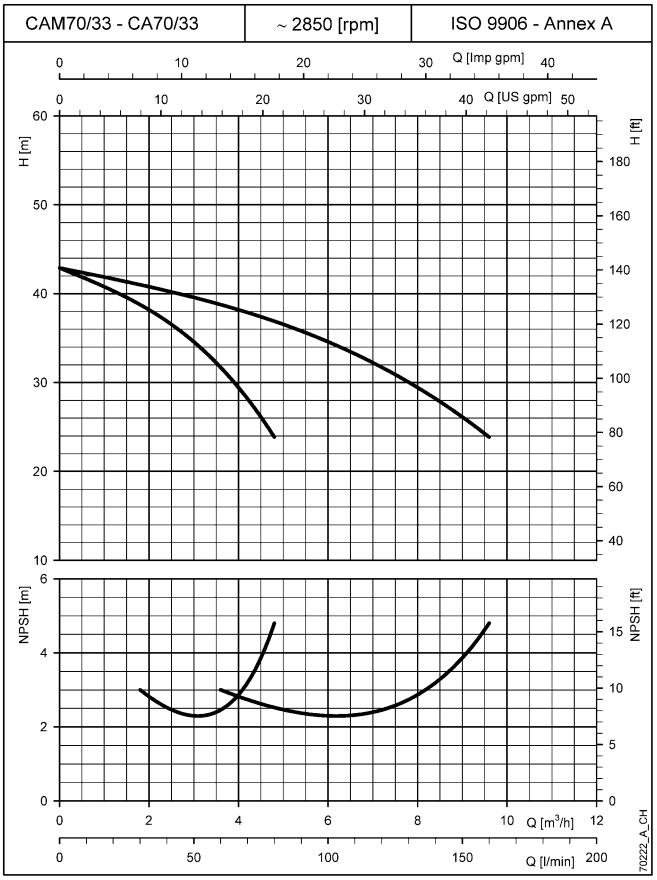
CEAM210/4 - CEA210/4 | ~ 2850 [rpm] | ISO 9906 - Annex A



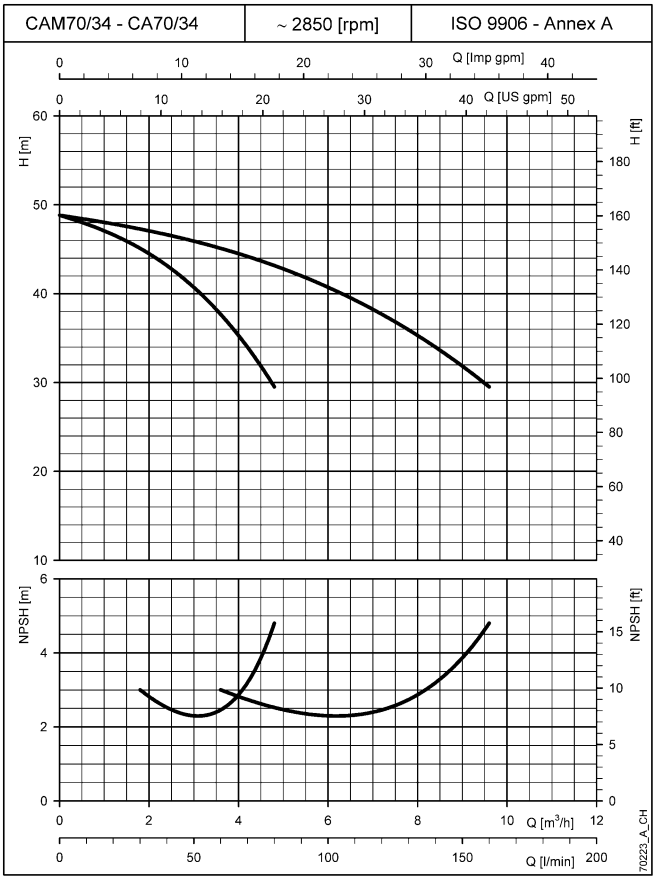
CEAM210/5 - CEA210/5 | ~ 2850 [rpm] | ISO 9906 - Annex A



CAM70/33 - CA70/33 | ~ 2850 [rpm] | ISO 9906 - Annex A



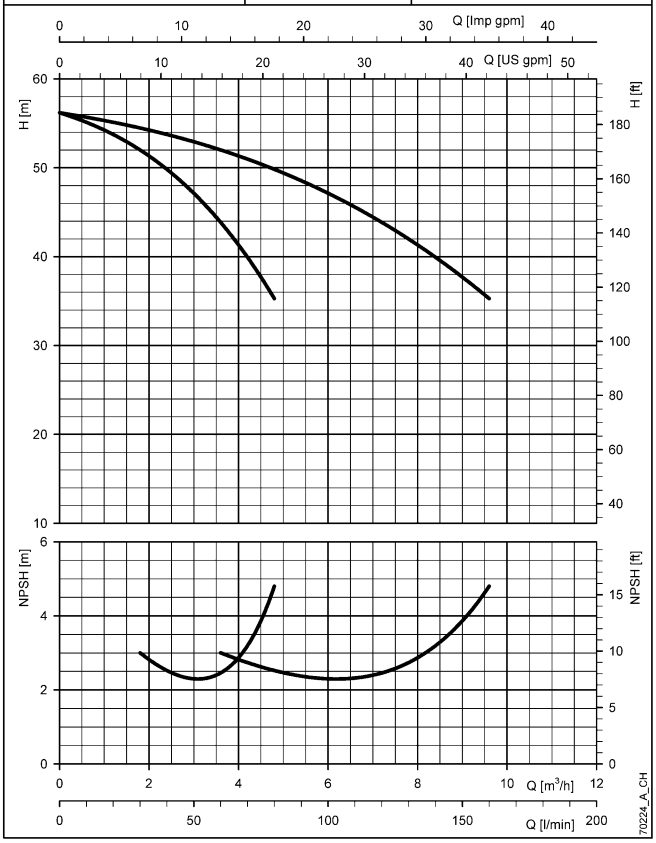
CAM70/34 - CA70/34 | ~ 2850 [rpm] | ISO 9906 - Annex A



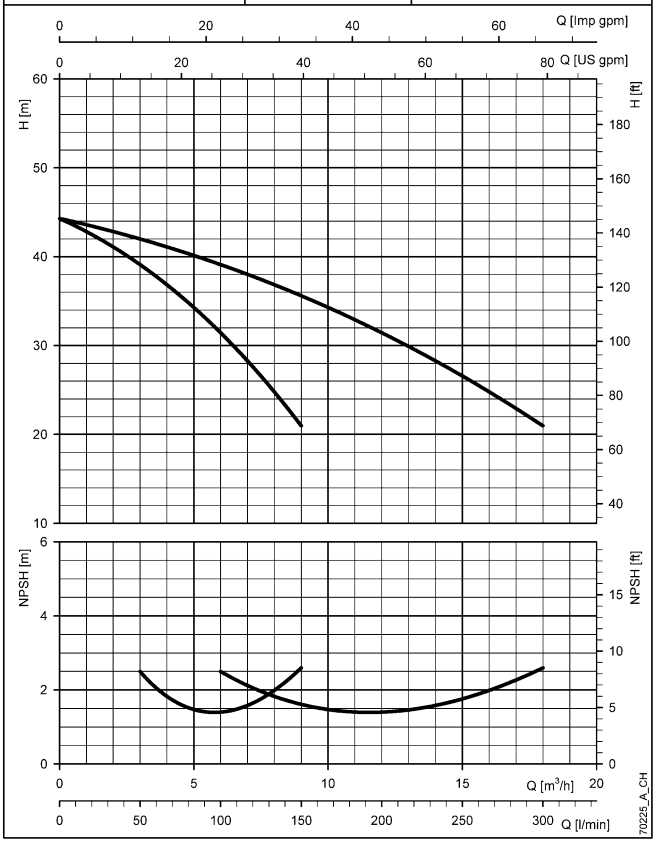
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm^3 and kinematic viscosity ν = 1 mm^2/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

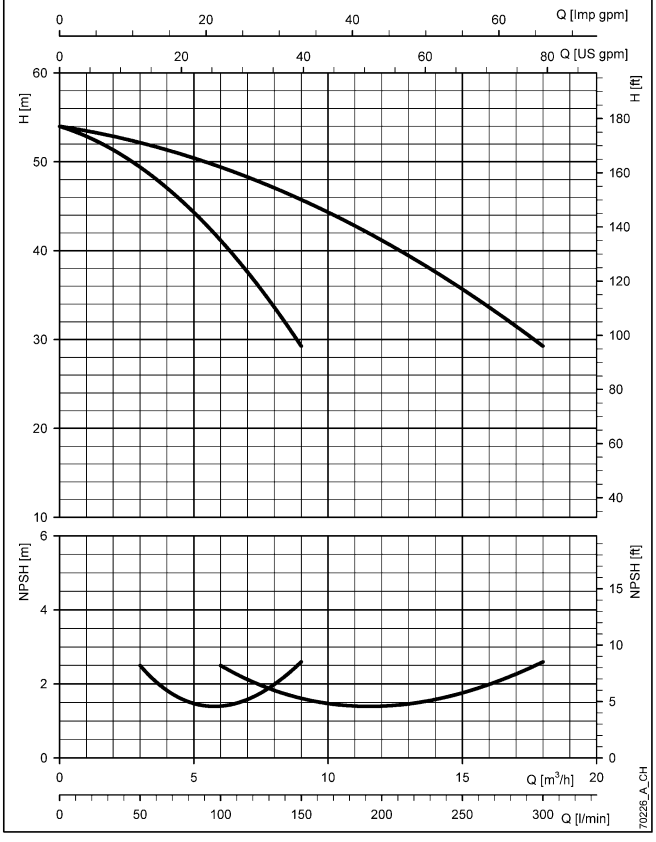
CAM70/45 - CA70/45 | ~ 2850 [rpm] | ISO 9906 - Annex A



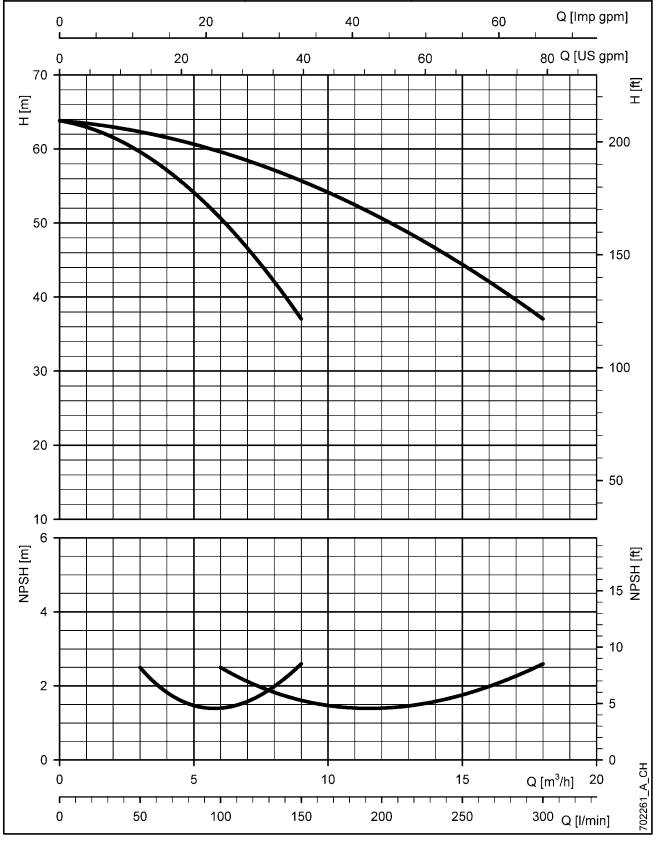
CAM120/33 - CA120/33 | ~ 2850 [rpm] | ISO 9906 - Annex A



CAM120/35 - CA120/35 | ~ 2850 [rpm] | ISO 9906 - Annex A



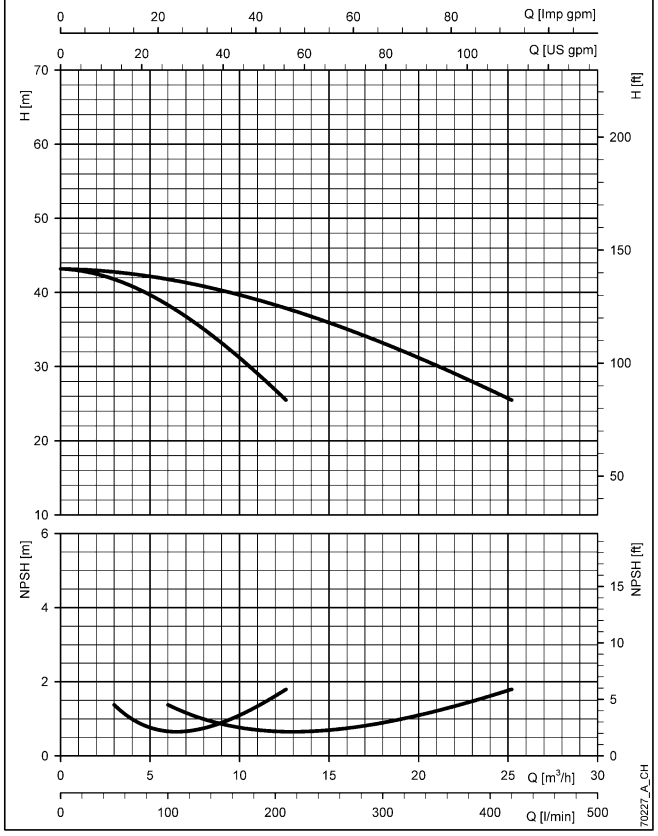
CAM120/55 - CA120/55 | ~ 2850 [rpm] | ISO 9906 - Annex A



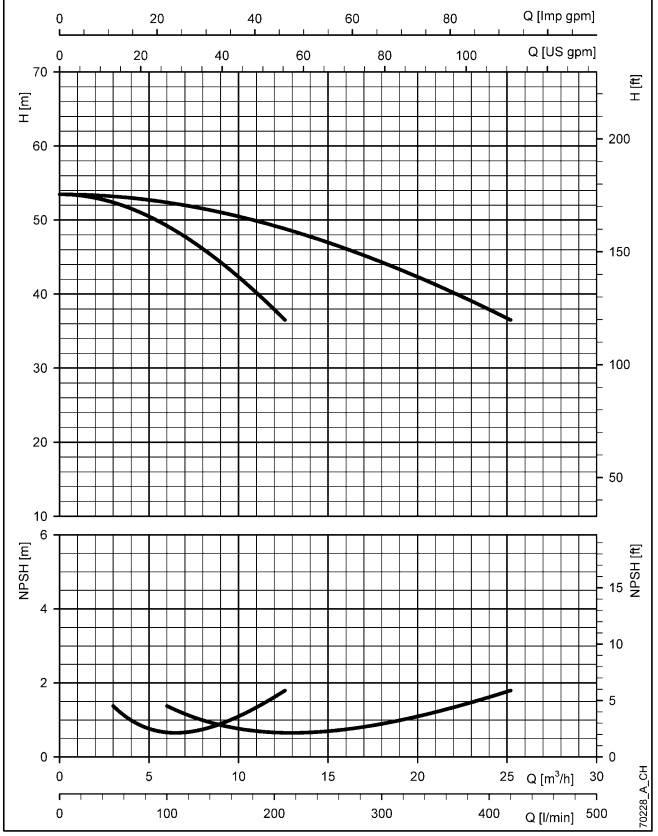
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

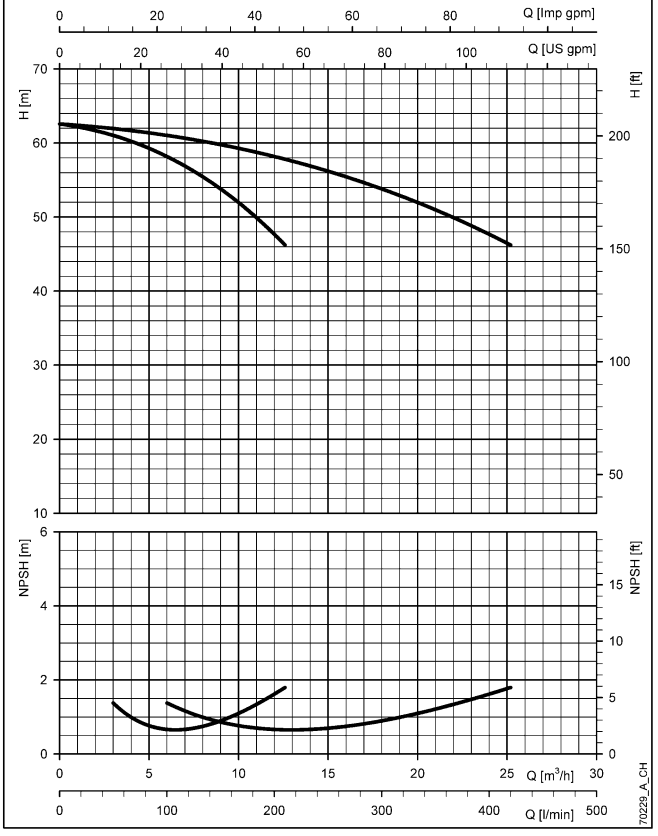
CAM200/33 - CA200/33 | ~ 2850 [rpm] | ISO 9906 - Annex A



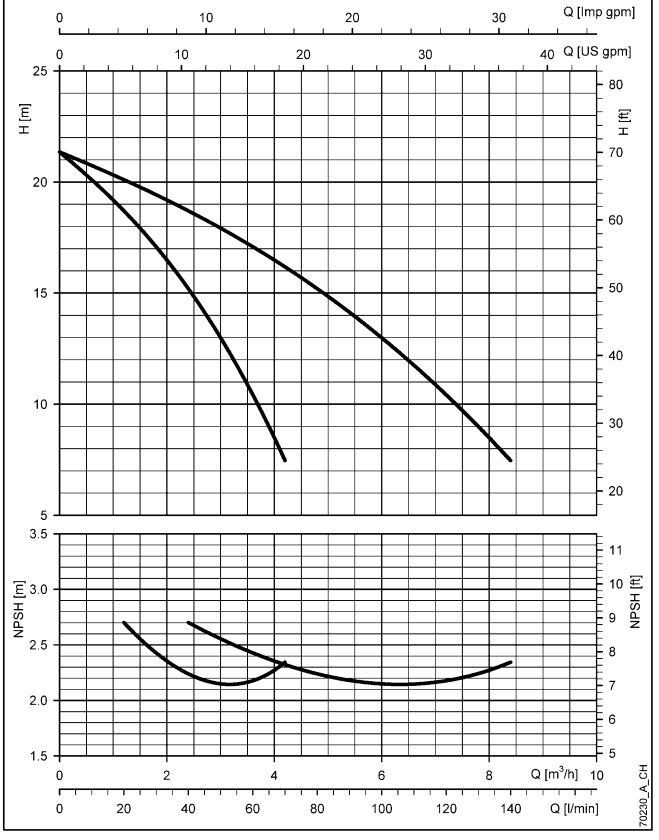
CAM200/35 - CA200/35 | ~ 2850 [rpm] | ISO 9906 - Annex A



CAM200/55 - CA200/55 | ~ 2850 [rpm] | ISO 9906 - Annex A

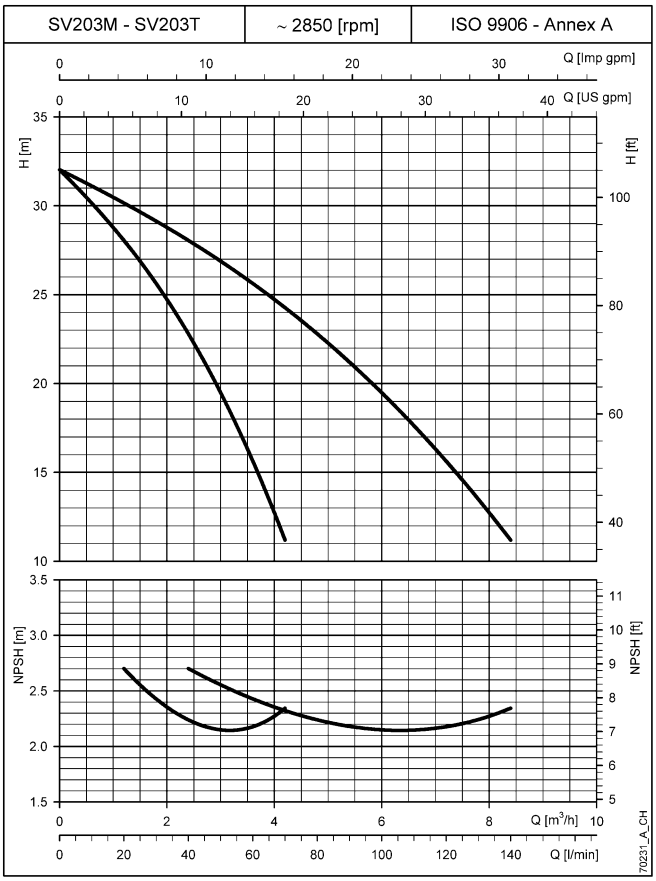


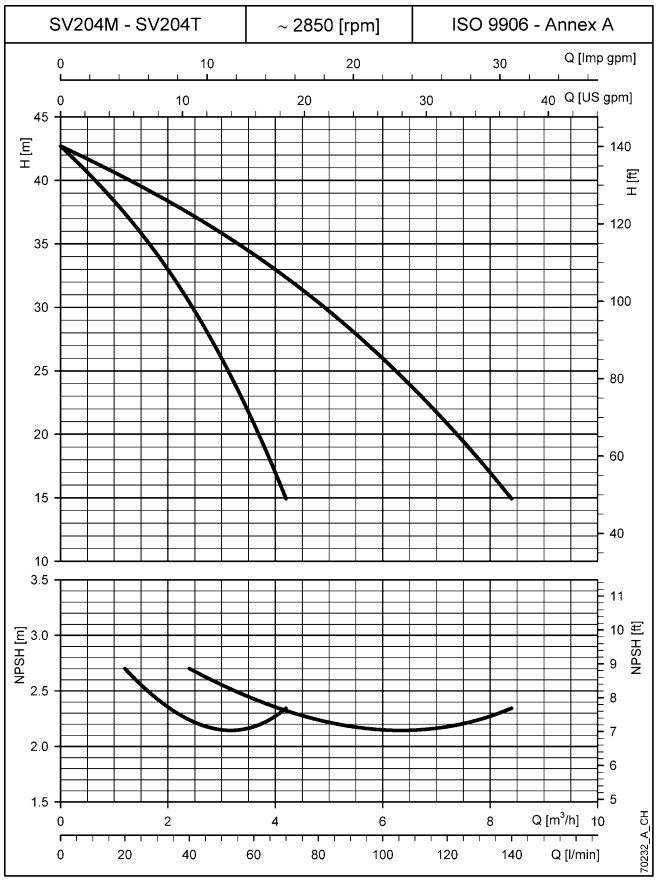
SV202M - SV202T | ~ 2850 [rpm] | ISO 9906 - Annex A

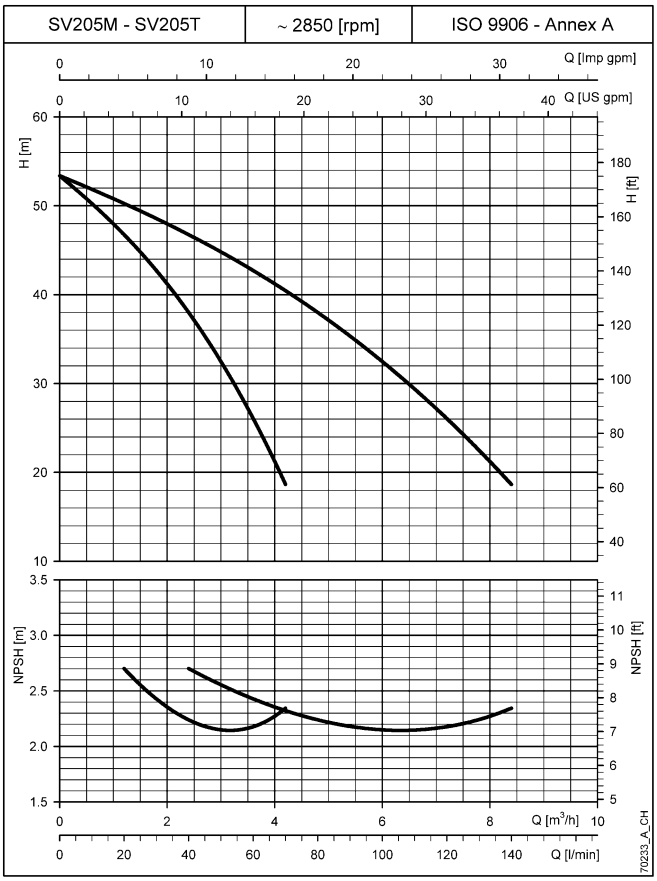


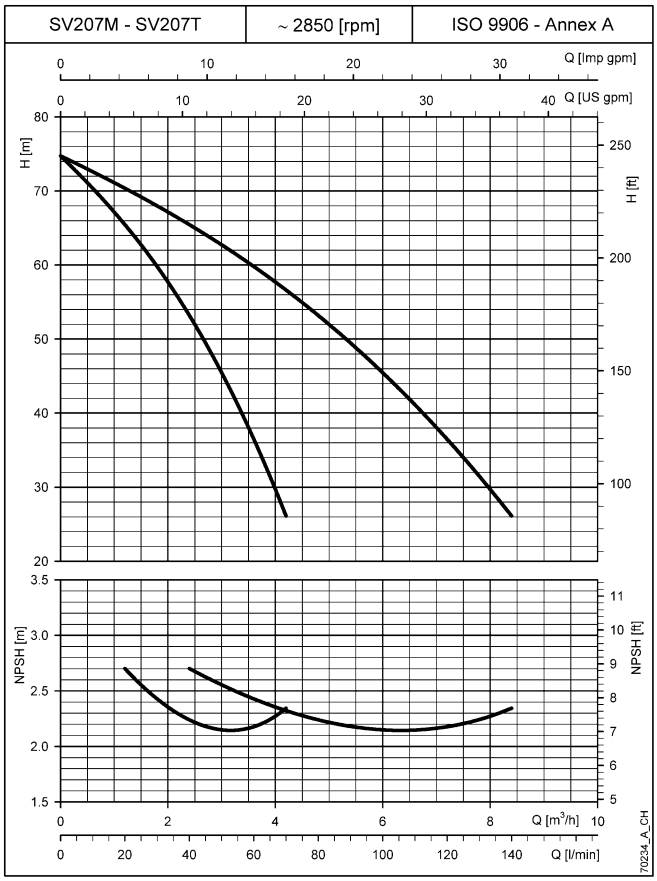
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm^3 and kinematic viscosity ν = 1 mm^2/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz





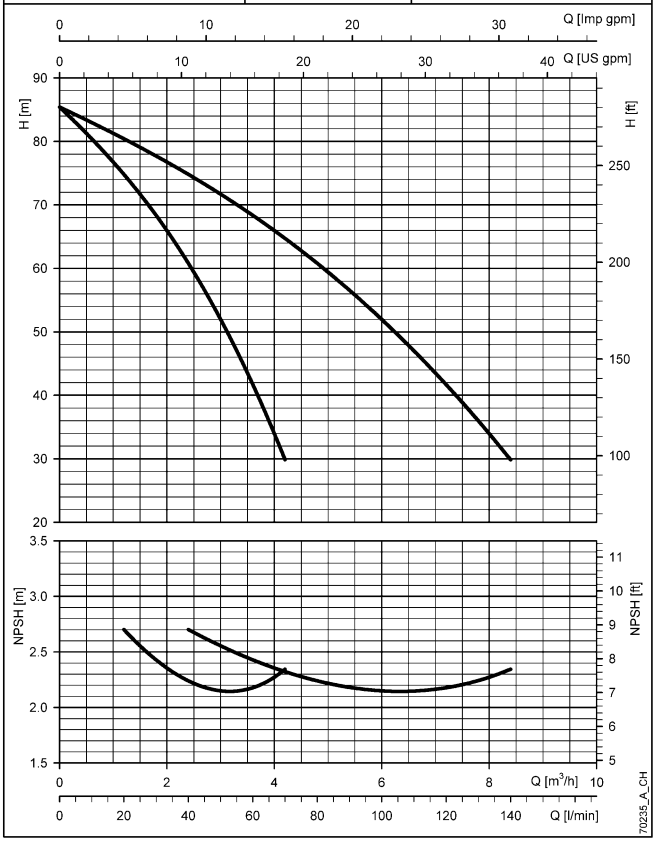




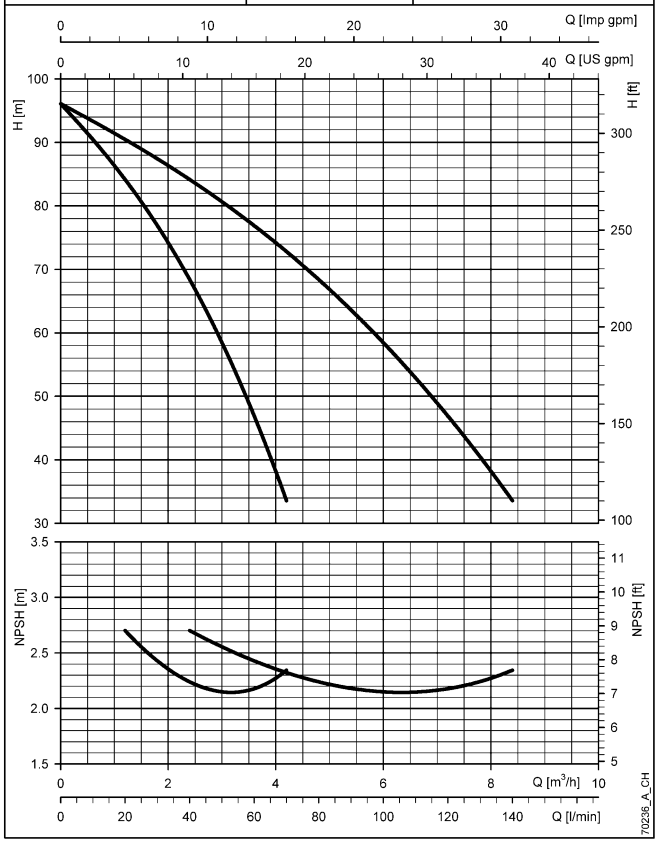
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

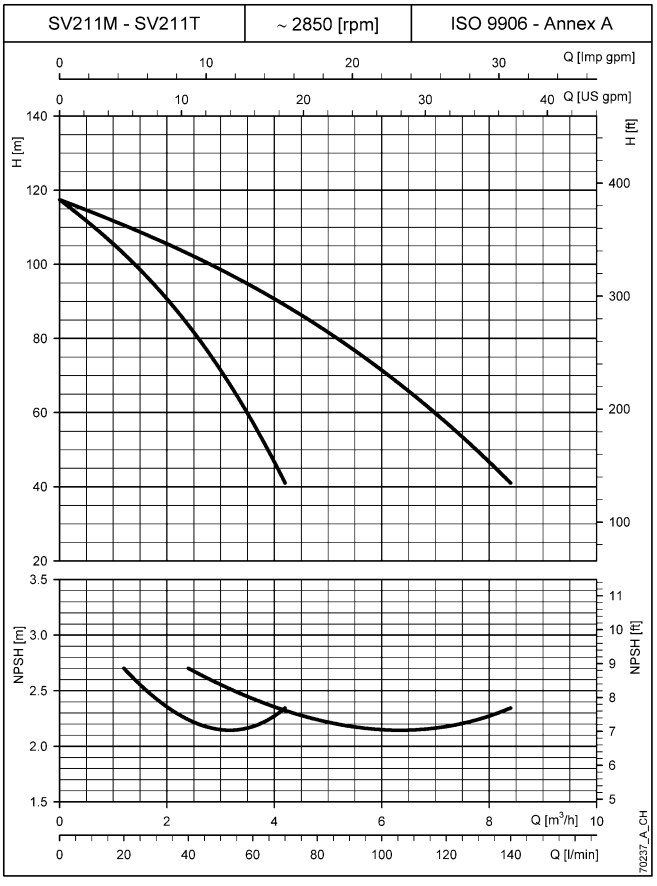
SV208M - SV208T | ~ 2850 [rpm] | ISO 9906 - Annex A



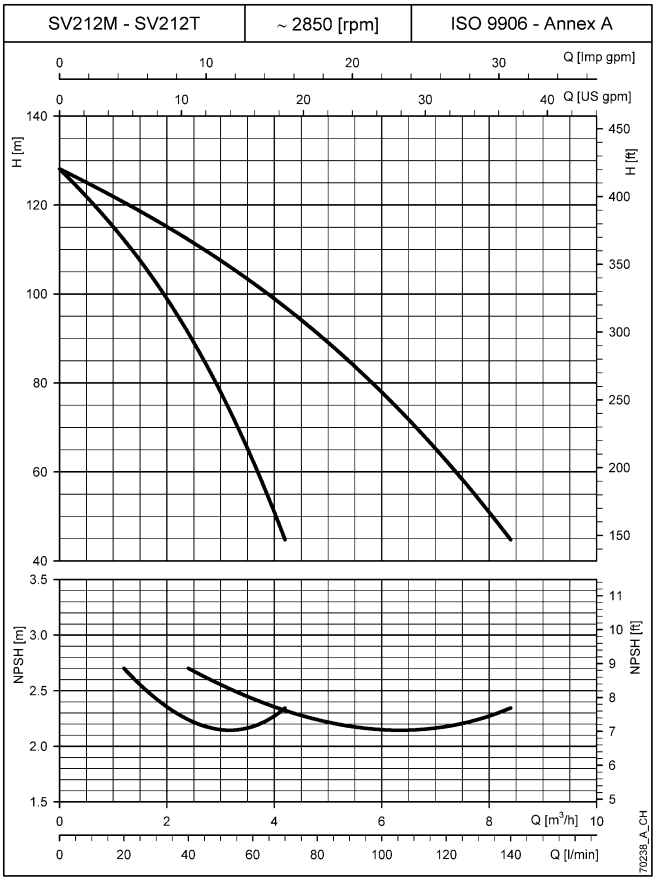
SV209M - SV209T | ~ 2850 [rpm] | ISO 9906 - Annex A



SV211M - SV211T | ~ 2850 [rpm] | ISO 9906 - Annex A



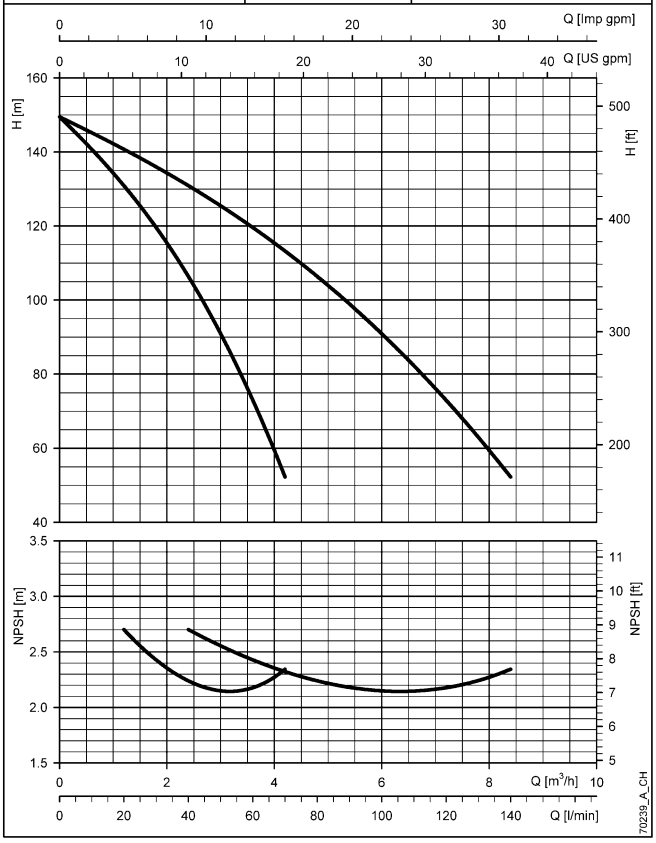
SV212M - SV212T | ~ 2850 [rpm] | ISO 9906 - Annex A



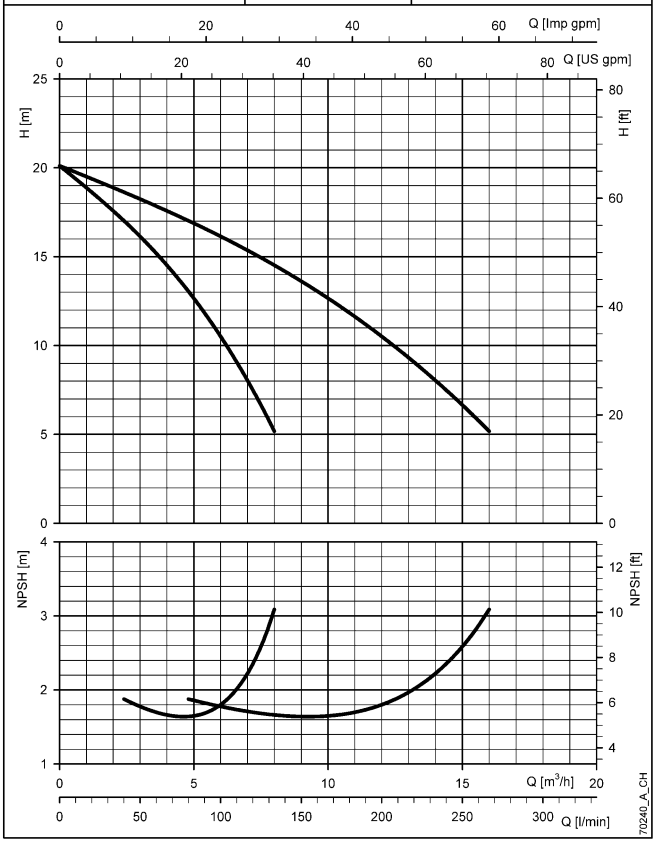
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

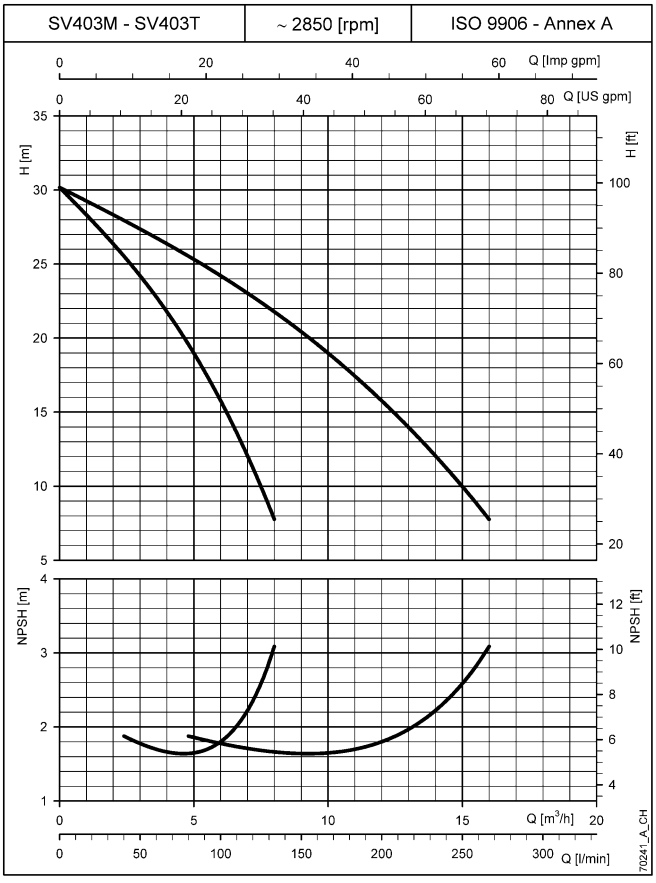
SV214M - SV214T | ~ 2850 [rpm] | ISO 9906 - Annex A



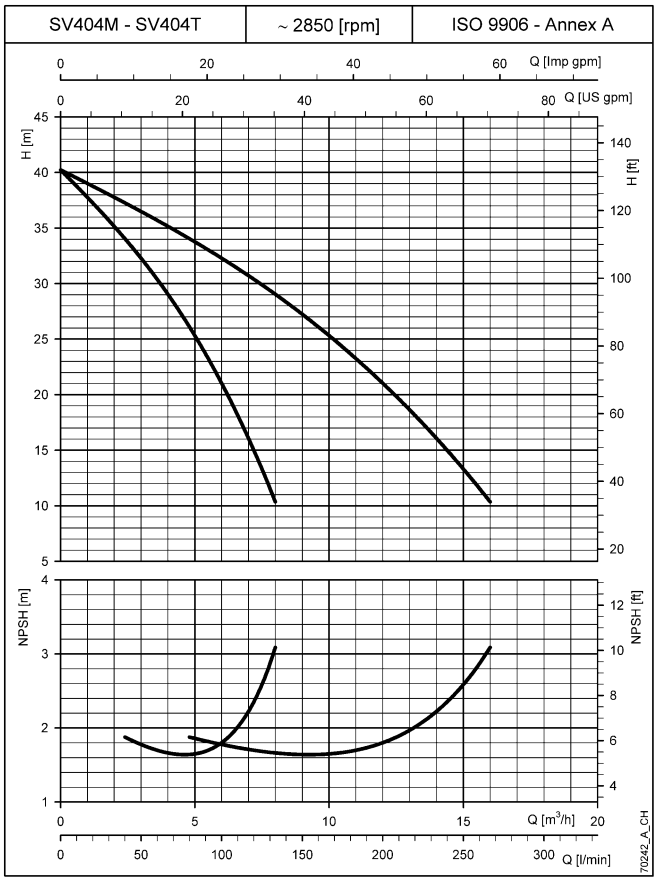
SV402M - SV402T | ~ 2850 [rpm] | ISO 9906 - Annex A



SV403M - SV403T | ~ 2850 [rpm] | ISO 9906 - Annex A



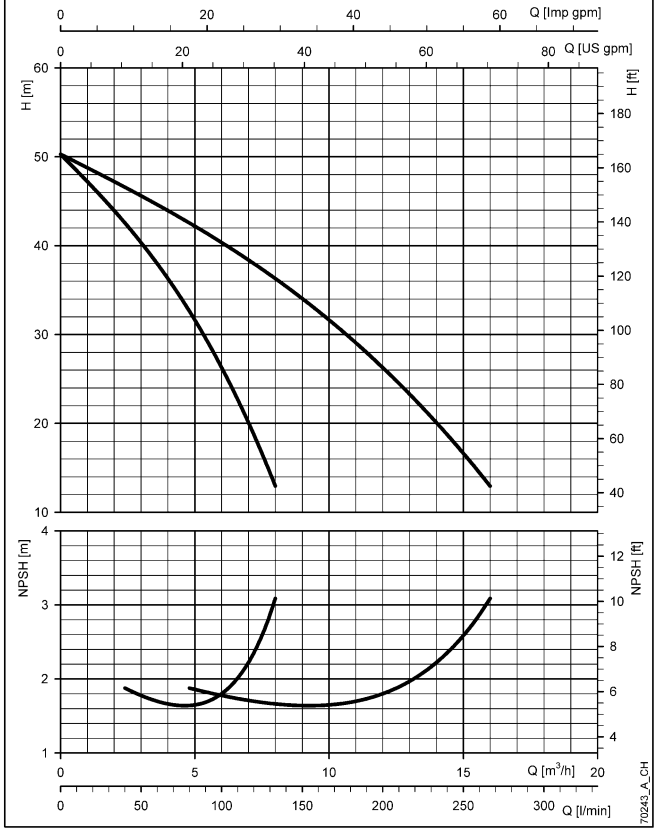
SV404M - SV404T | ~ 2850 [rpm] | ISO 9906 - Annex A



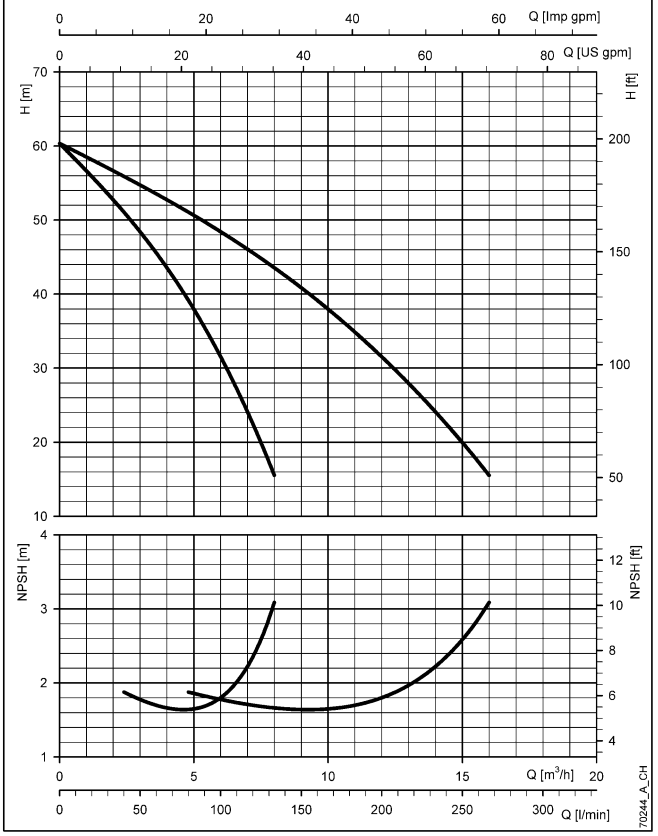
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

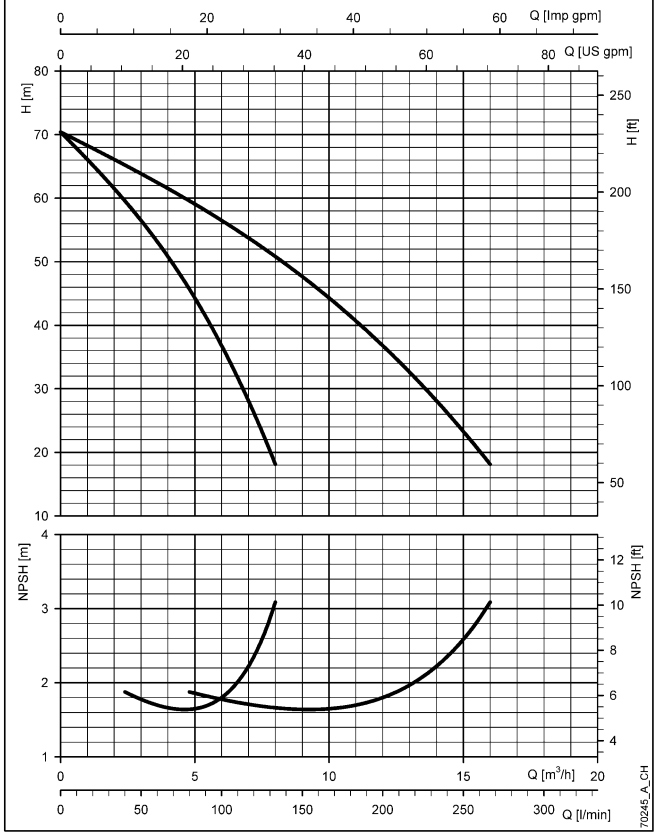
SV405M - SV405T | ~ 2850 [rpm] | ISO 9906 - Annex A



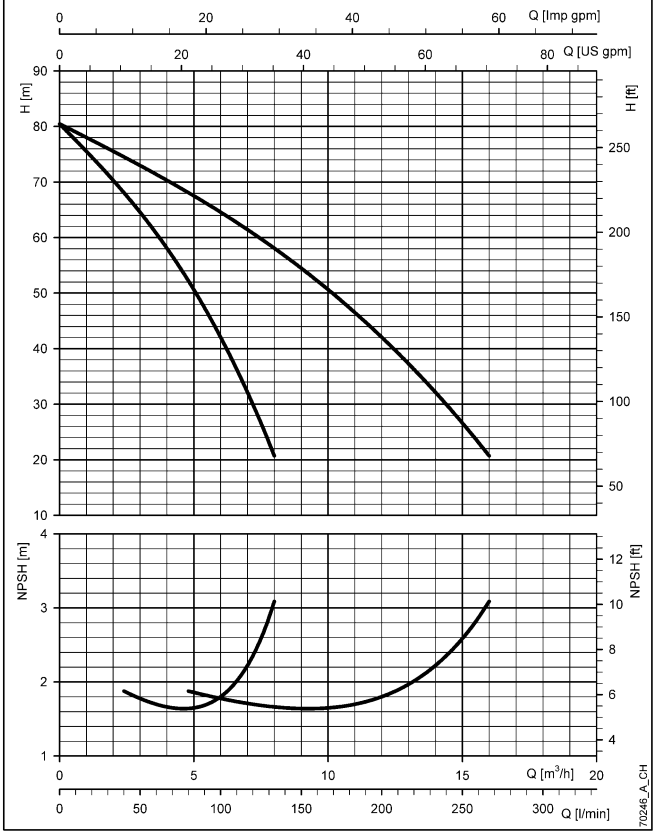
SV406M - SV406T | ~ 2850 [rpm] | ISO 9906 - Annex A



SV407M - SV407T | ~ 2850 [rpm] | ISO 9906 - Annex A



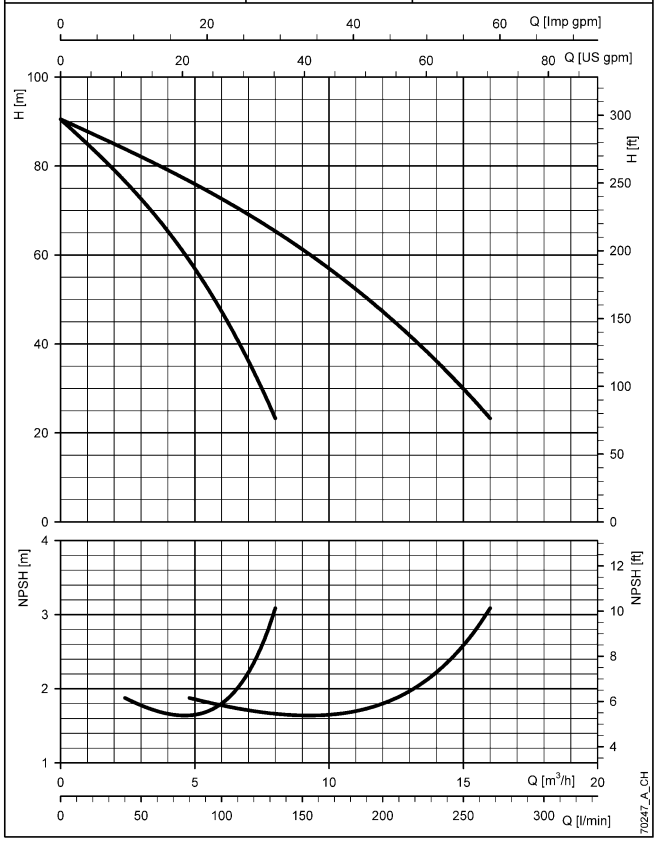
SV408M - SV408T | ~ 2850 [rpm] | ISO 9906 - Annex A



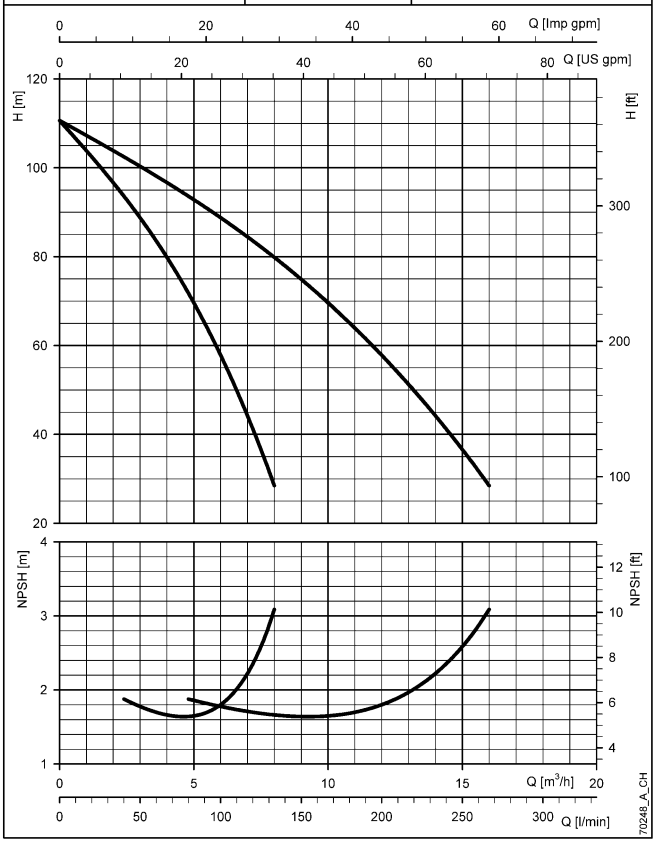
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm^3 and kinematic viscosity ν = 1 mm^2/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

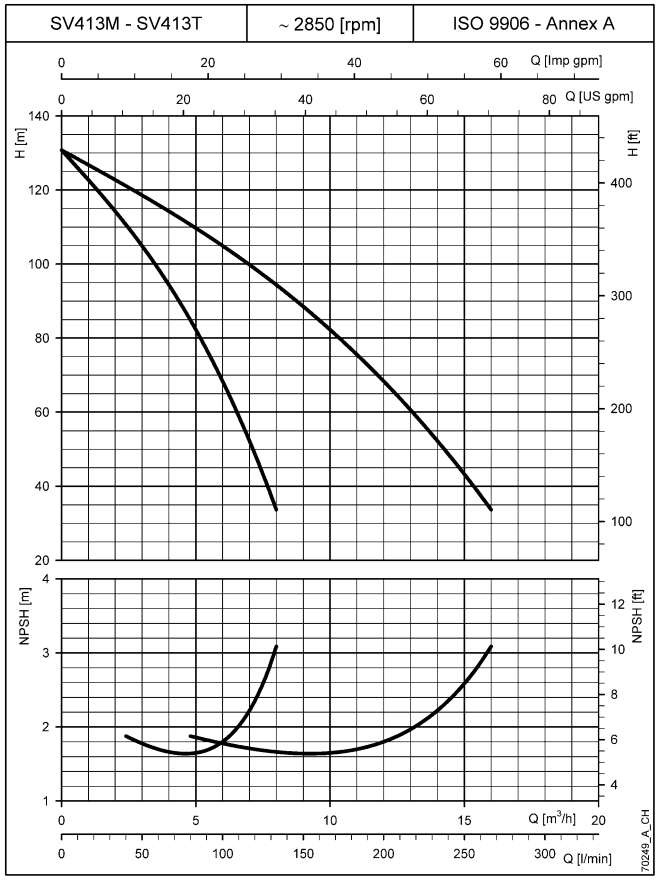
SV409M - SV409T | ~ 2850 [rpm] | ISO 9906 - Annex A



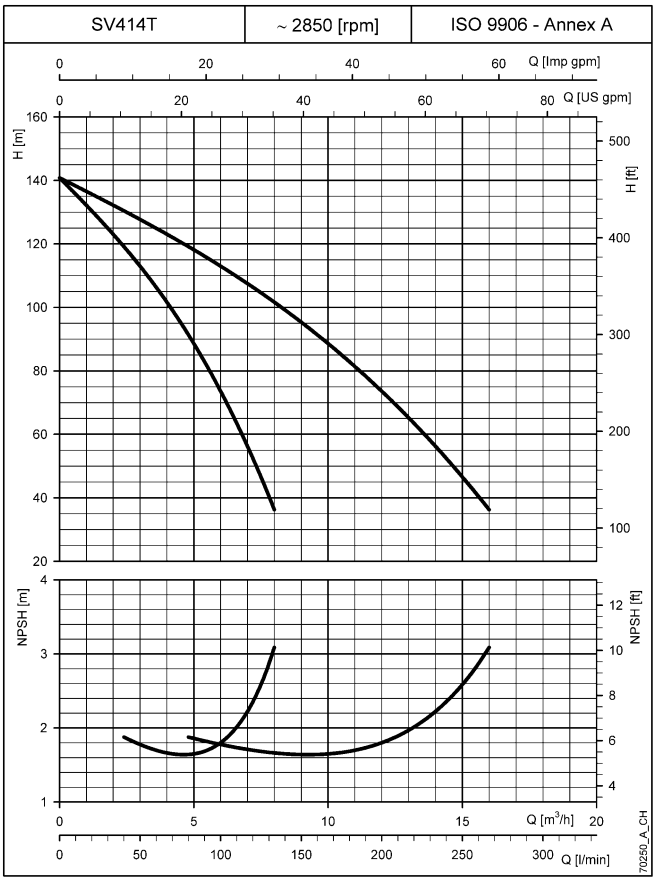
SV411M - SV411T | ~ 2850 [rpm] | ISO 9906 - Annex A



SV413M - SV413T | ~ 2850 [rpm] | ISO 9906 - Annex A



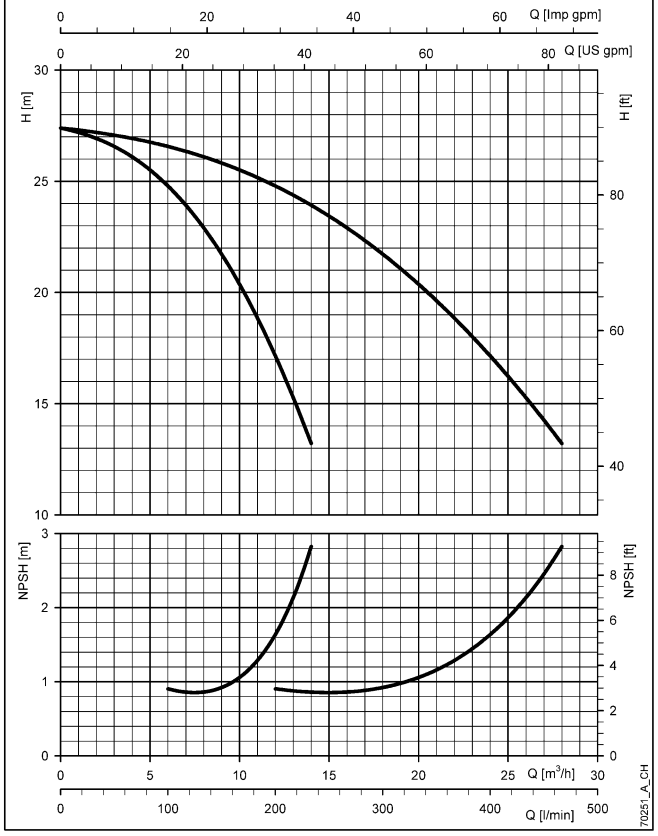
SV414T | ~ 2850 [rpm] | ISO 9906 - Annex A



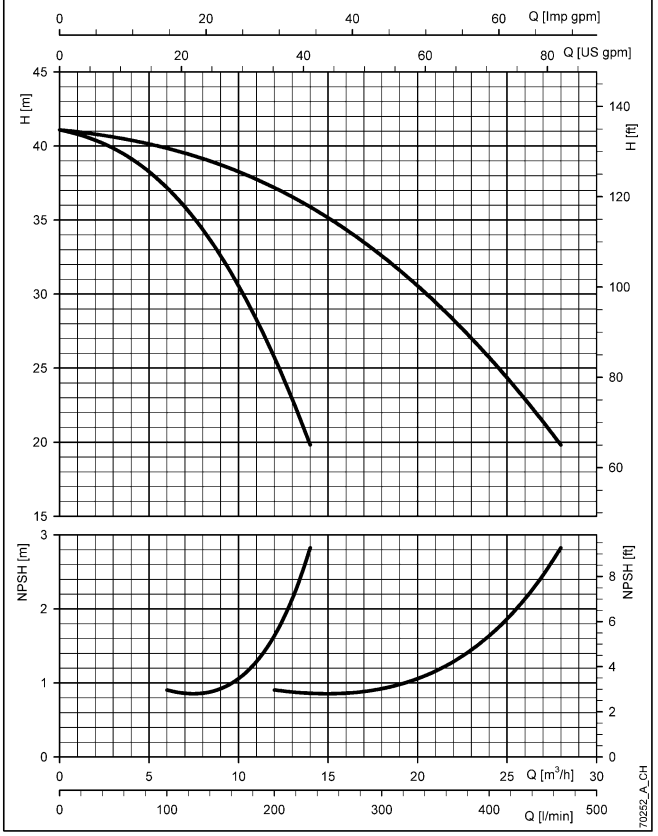
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density $\rho = 1.0$ kg/dm³ and kinematic viscosity $\nu = 1$ mm²/sec.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

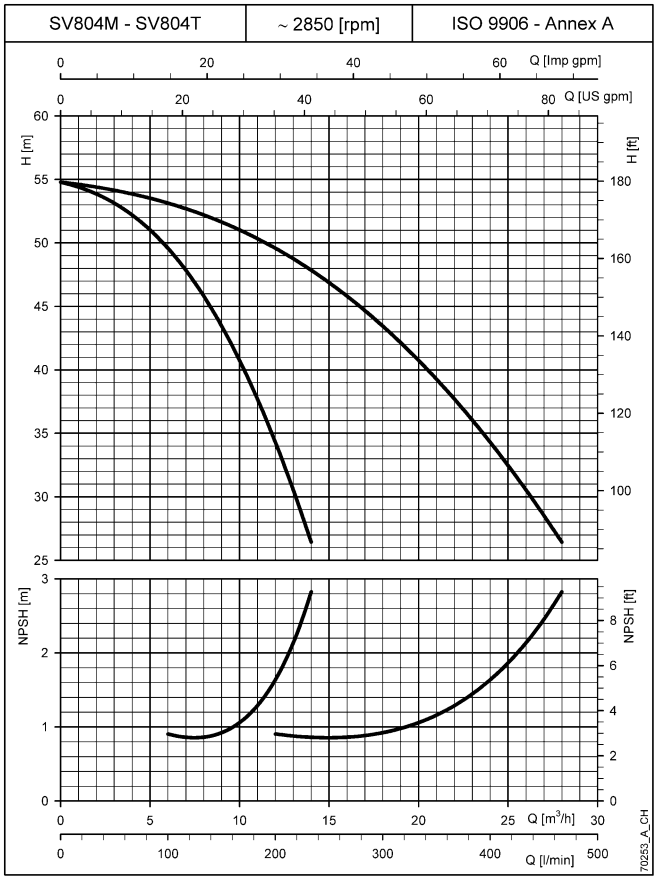
SV802M - SV802T | ~ 2850 [rpm] | ISO 9906 - Annex A



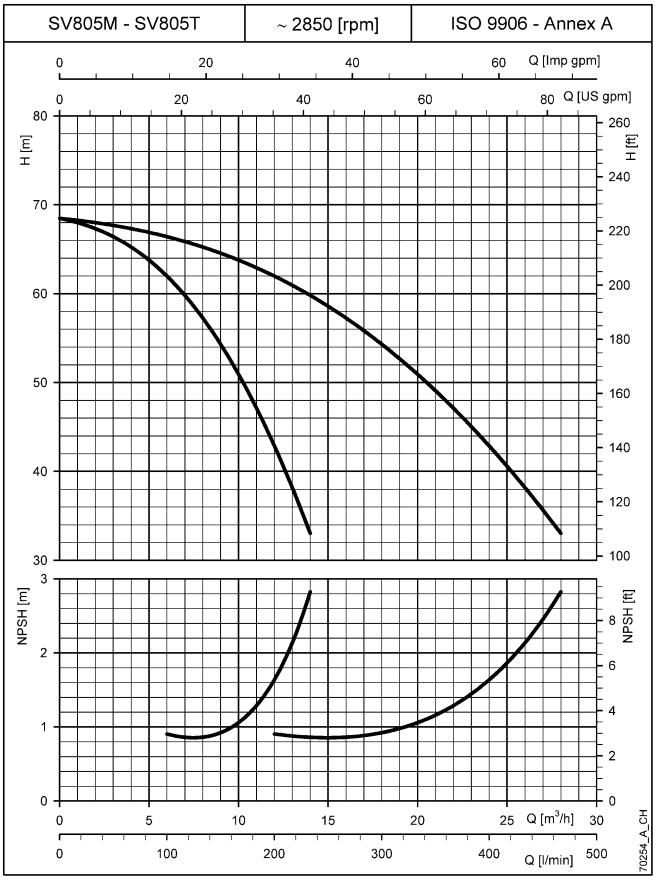
SV803M - SV803T | ~ 2850 [rpm] | ISO 9906 - Annex A



SV804M - SV804T | ~ 2850 [rpm] | ISO 9906 - Annex A



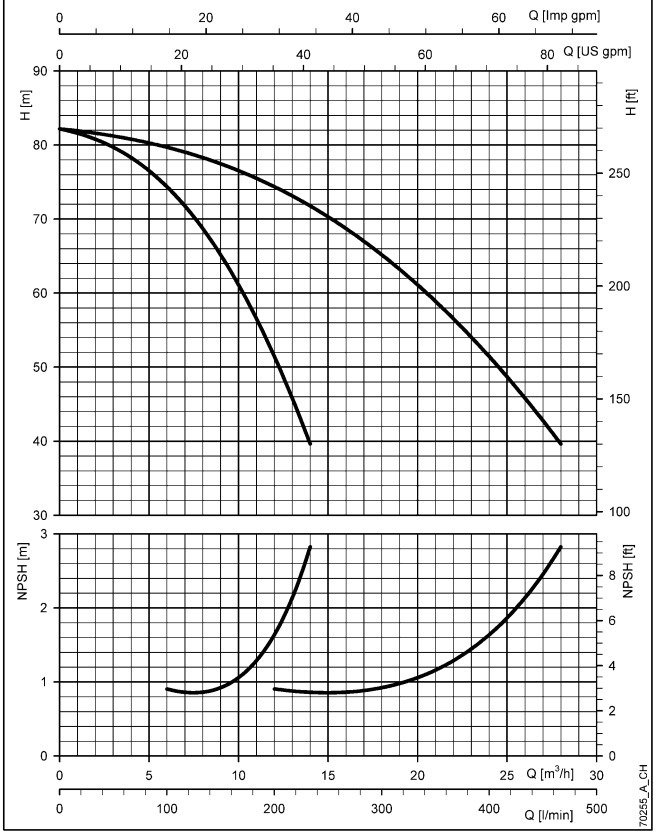
SV805M - SV805T | ~ 2850 [rpm] | ISO 9906 - Annex A



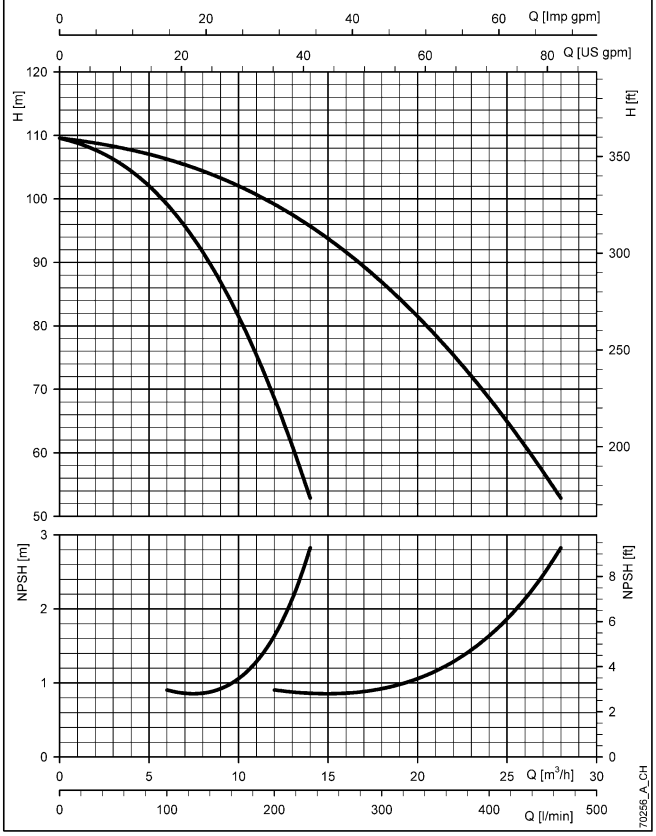
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm^3 and kinematic viscosity ν = 1 mm^2/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 50 Hz

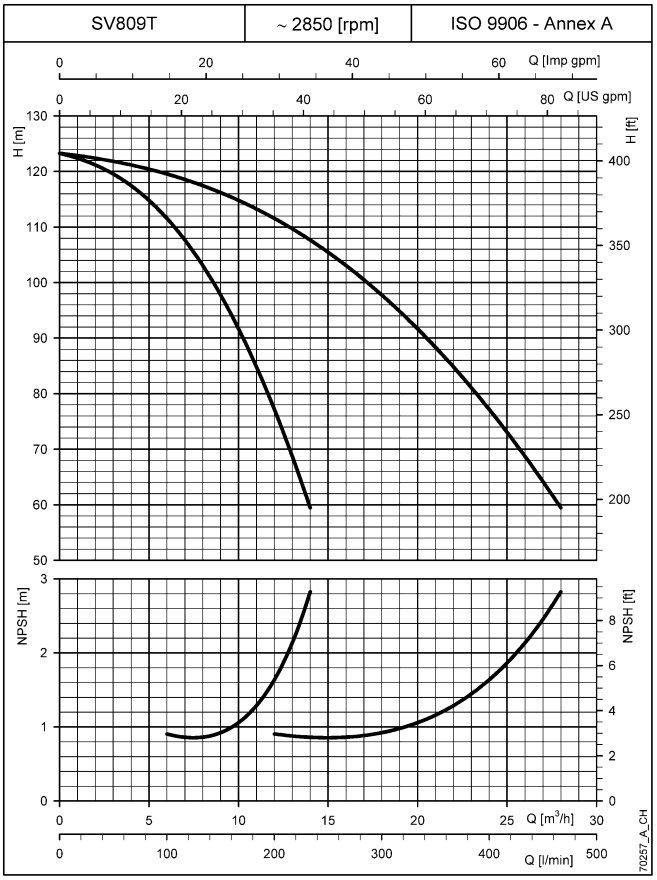
SV806T | ~ 2850 [rpm] | ISO 9906 - Annex A



SV808T | ~ 2850 [rpm] | ISO 9906 - Annex A



SV809T | ~ 2850 [rpm] | ISO 9906 - Annex A

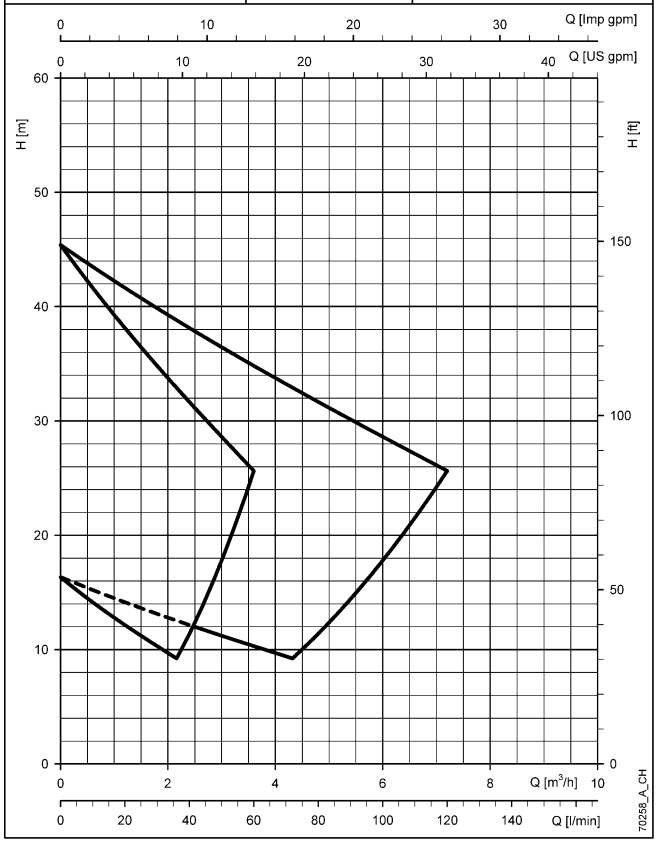


The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

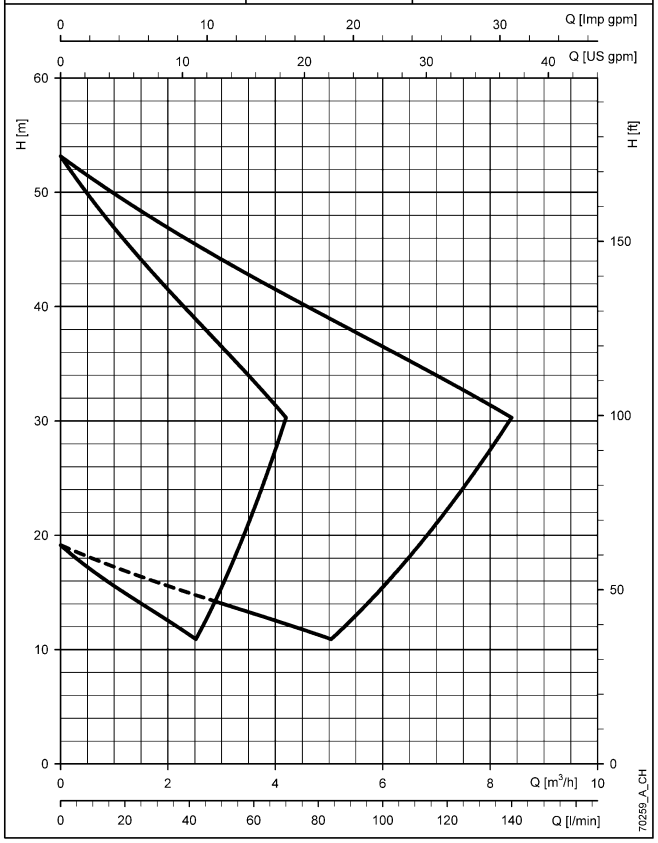
TWO-PUMP BOOSTER SETS OPERATING CHARACTERISTICS AT VARIABLE SPEED, 30..50 Hz

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 30..50 Hz

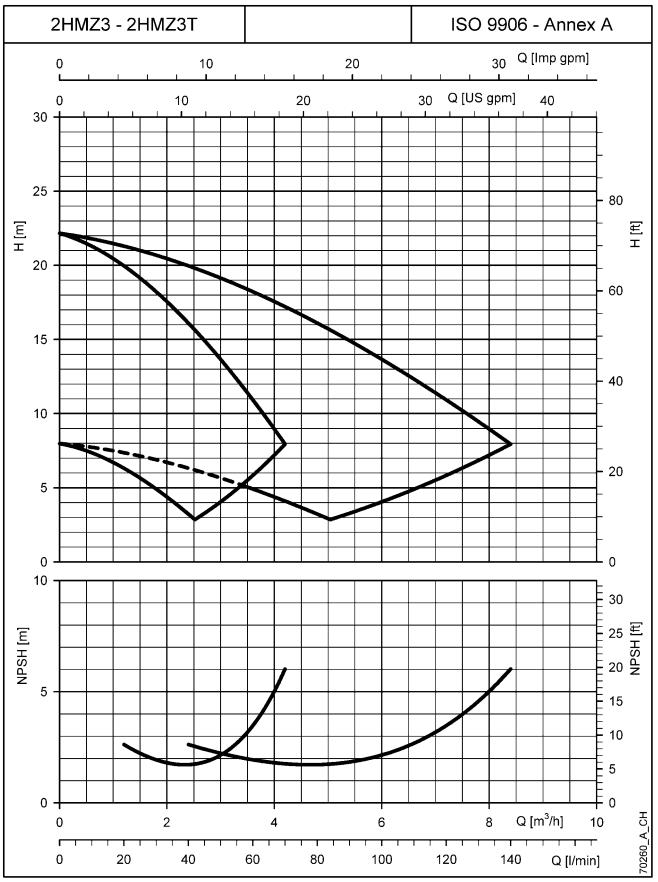
BGM7 - BG7 | ISO 9906 - Annex A



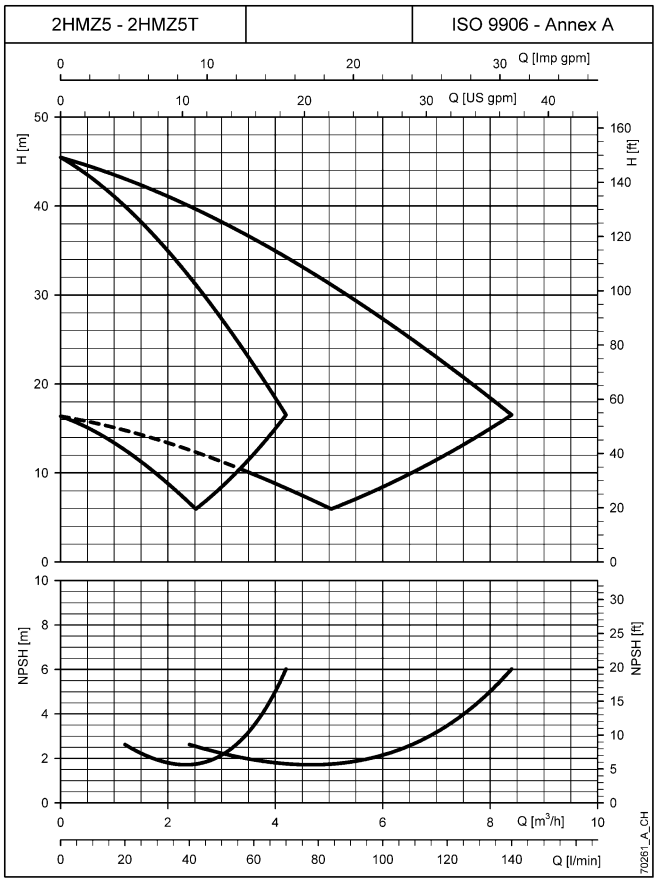
BGM11 - BG11 | ISO 9906 - Annex A



2HMZ3 - 2HMZ3T | ISO 9906 - Annex A



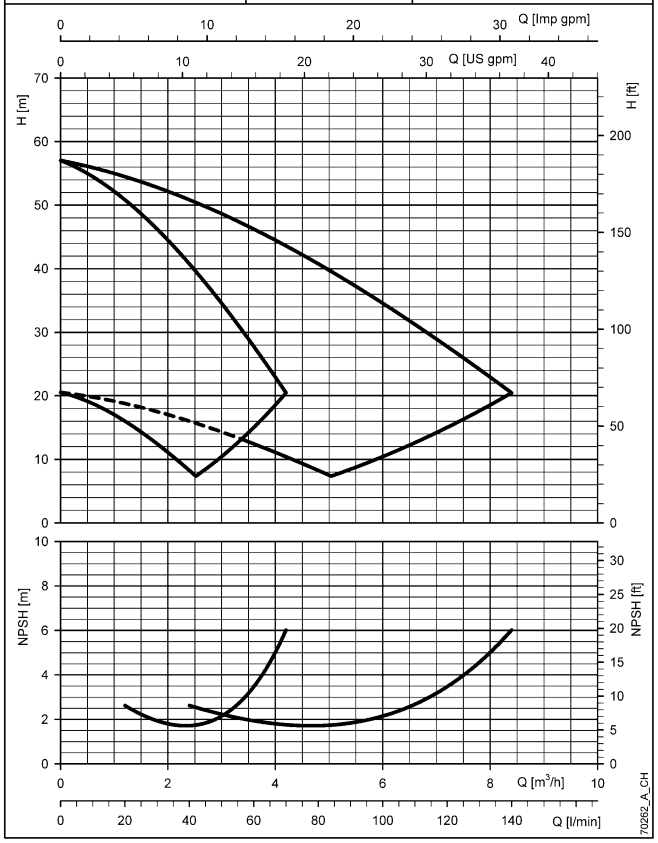
2HMZ5 - 2HMZ5T | ISO 9906 - Annex A



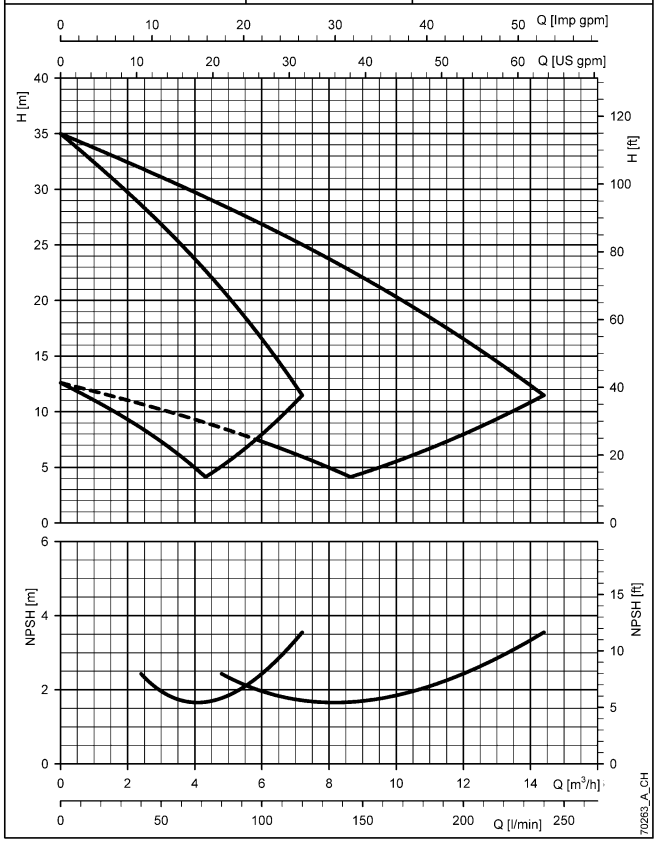
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm^3 and kinematic viscosity ν = 1 mm^2/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 30..50 Hz

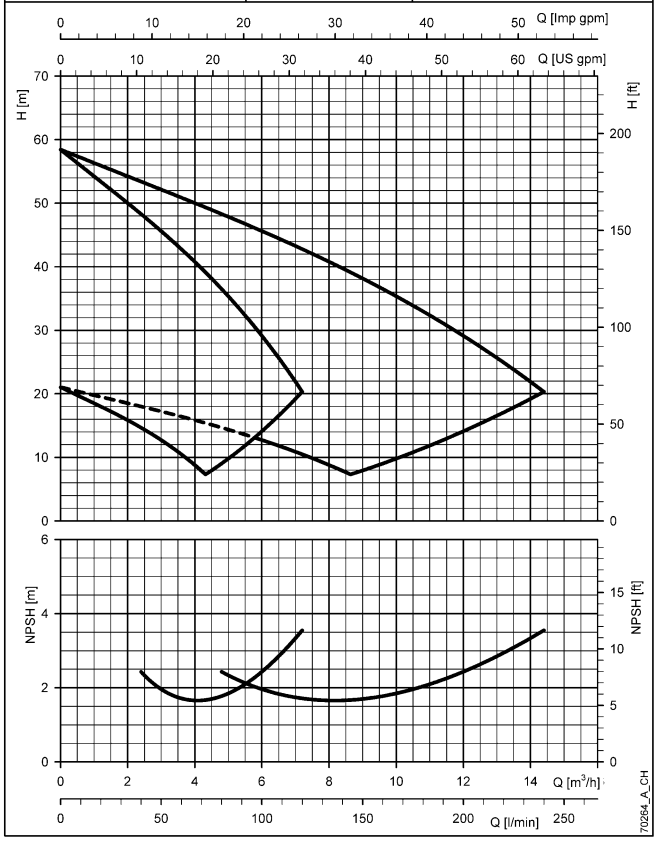
2HMZ7 - 2HMZ7T | ISO 9906 - Annex A



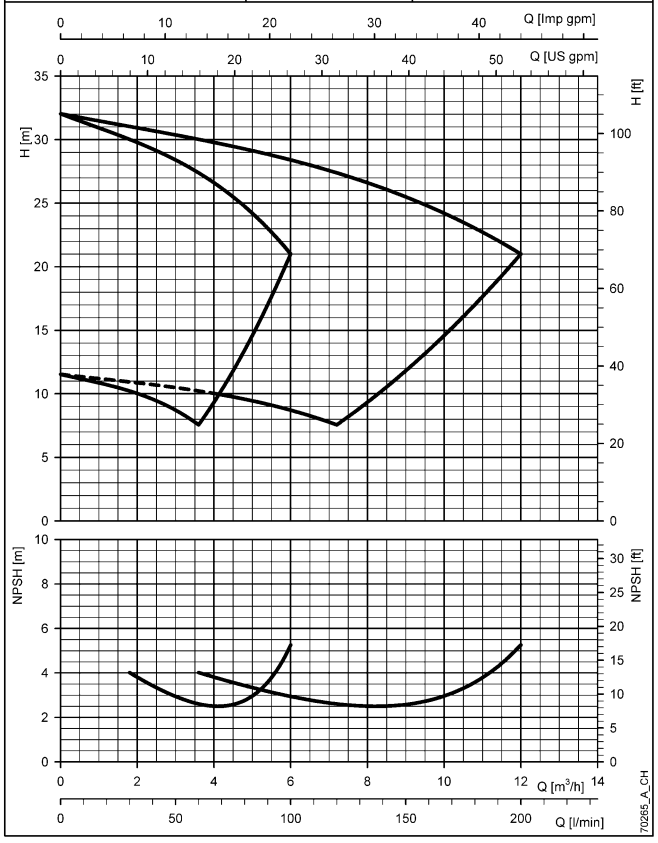
4HMZ5 - 4HMZ5T | ISO 9906 - Annex A



4HMZ9 - 4HMZ9T | ISO 9906 - Annex A



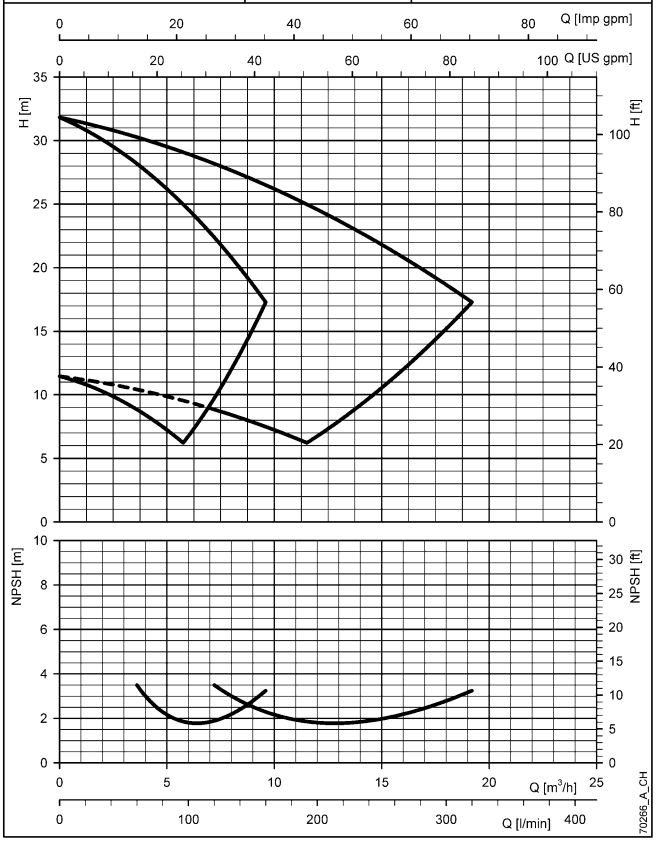
CEAM80/5 - CEA80/5 | ISO 9906 - Annex A



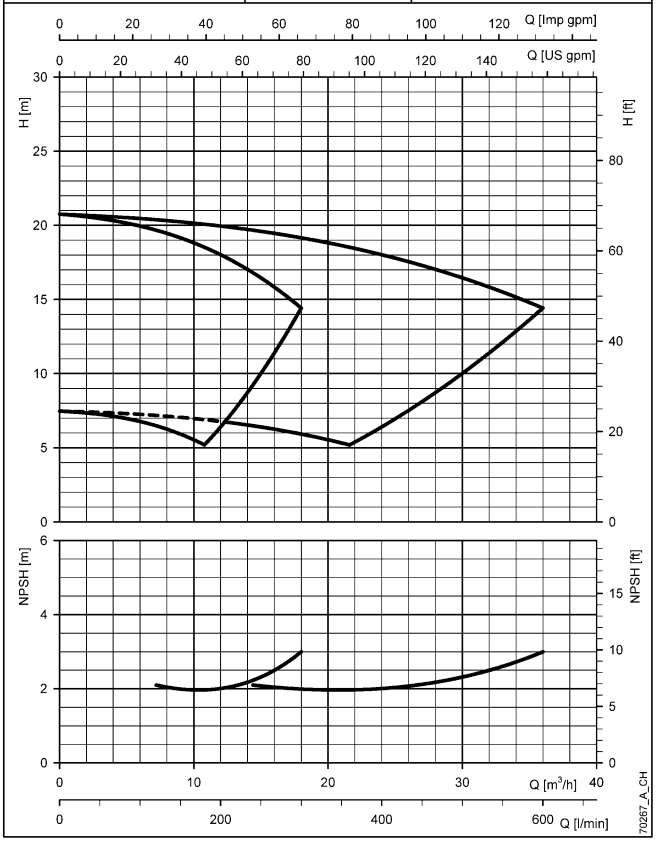
The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 30..50 Hz

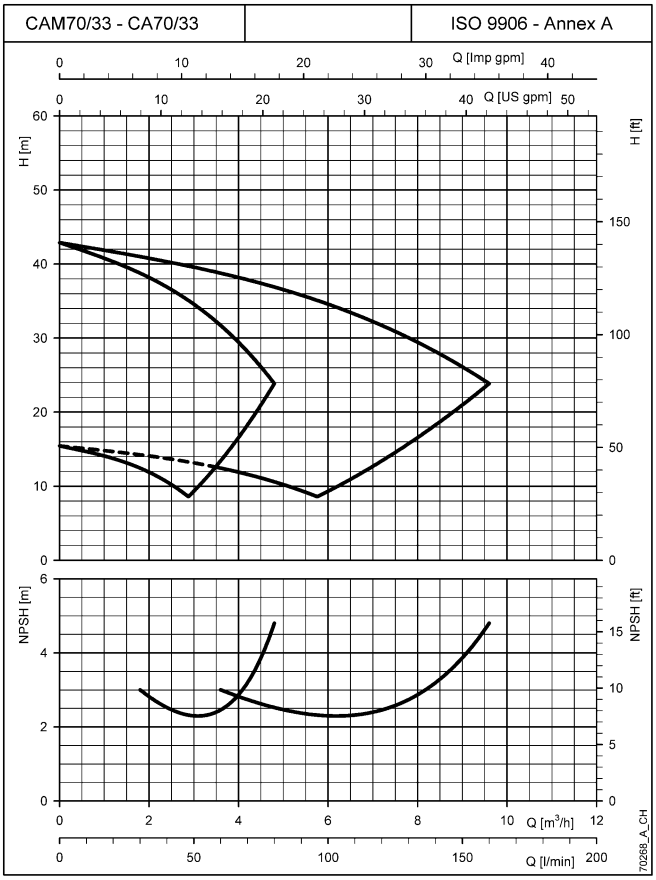
CEAM120/5 - CEA120/5 | ISO 9906 - Annex A



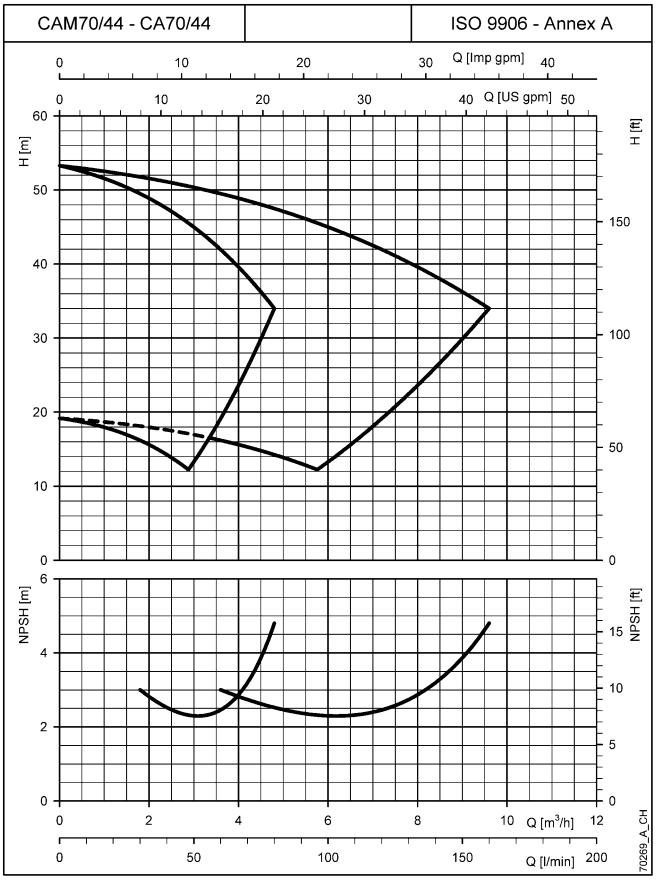
CEAM210/3 - CEA210/3 | ISO 9906 - Annex A



CAM70/33 - CA70/33 | ISO 9906 - Annex A



CAM70/44 - CA70/44 | ISO 9906 - Annex A



The performance curves do not take into account flow resistance in the valves and piping.
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
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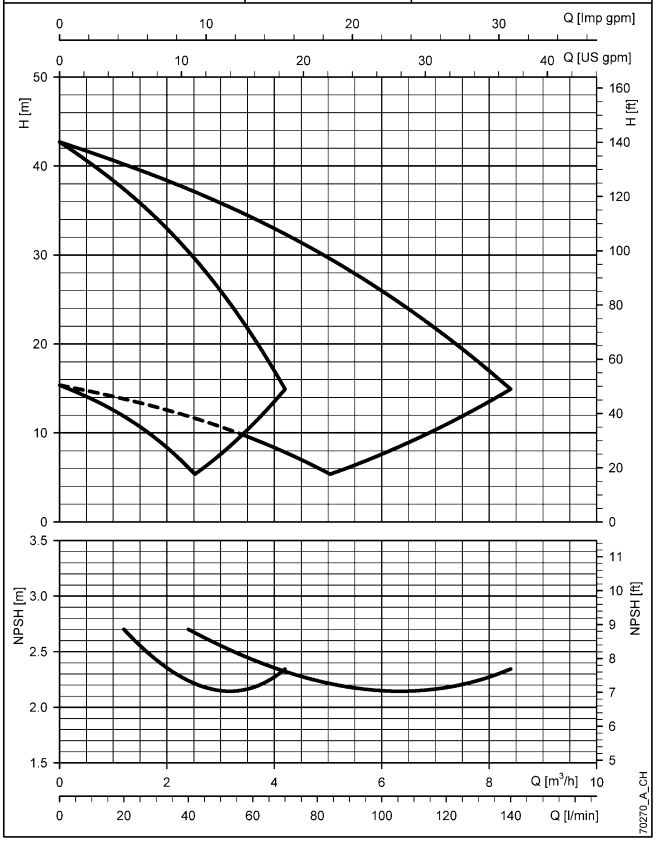
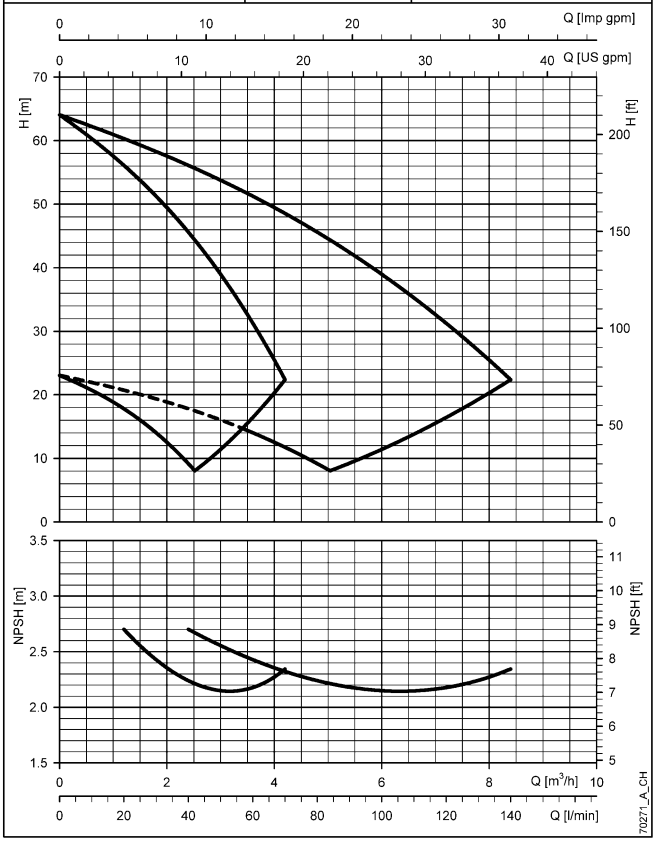
TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 30..50 Hz

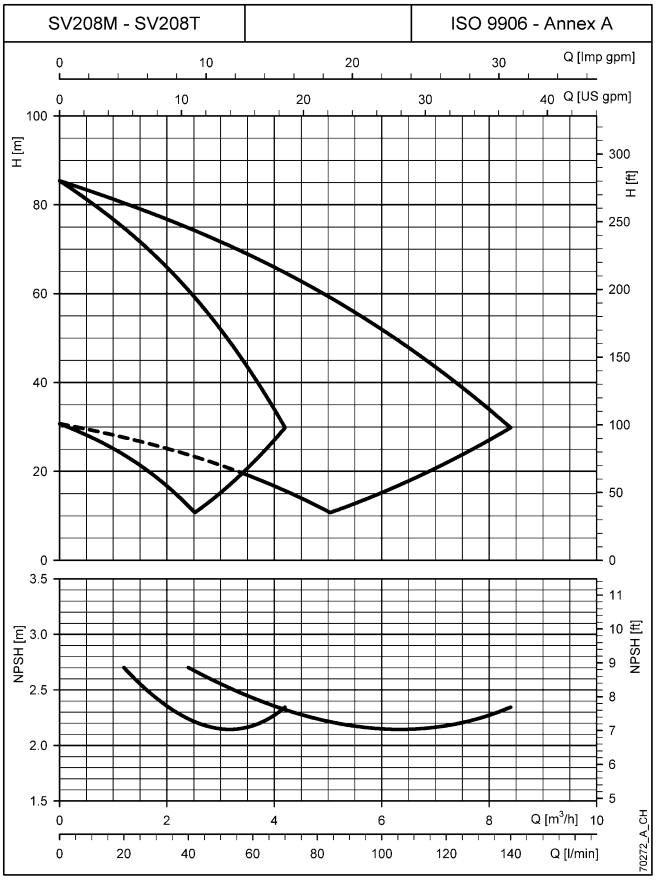
SV204M - SV204T | ISO 9906 - Annex A



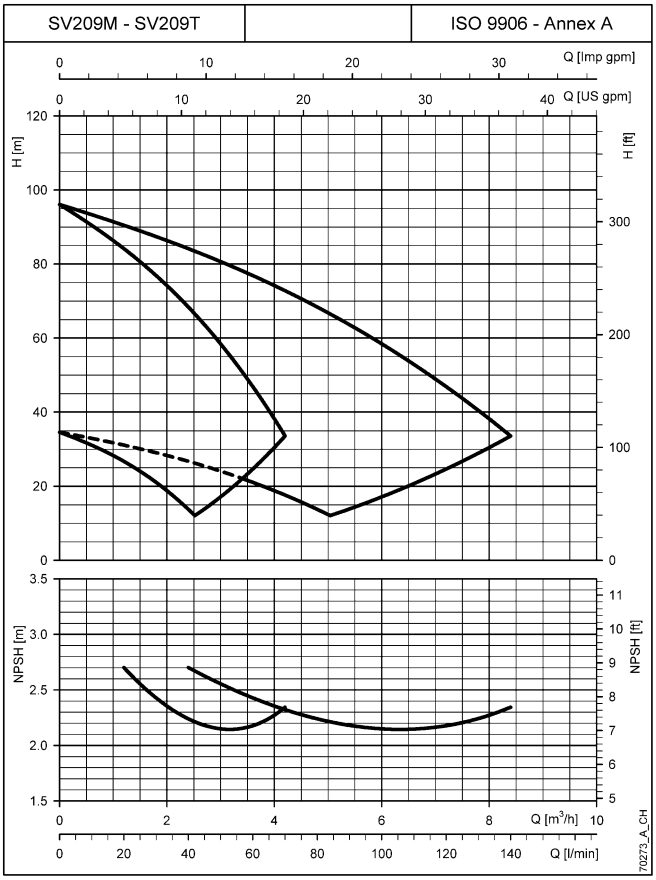
SV206M - SV206T | ISO 9906 - Annex A



SV208M - SV208T | ISO 9906 - Annex A



SV209M - SV209T | ISO 9906 - Annex A



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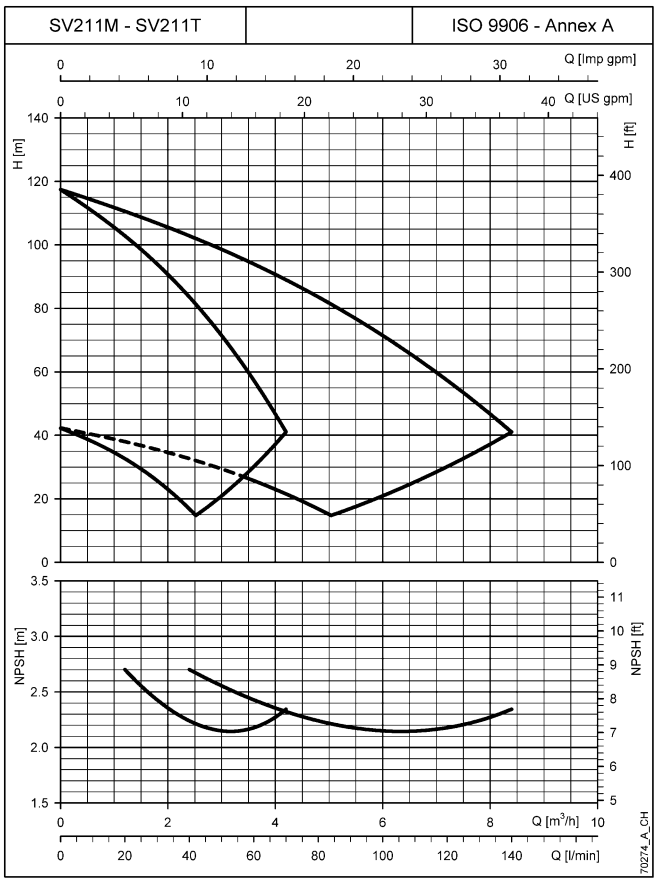
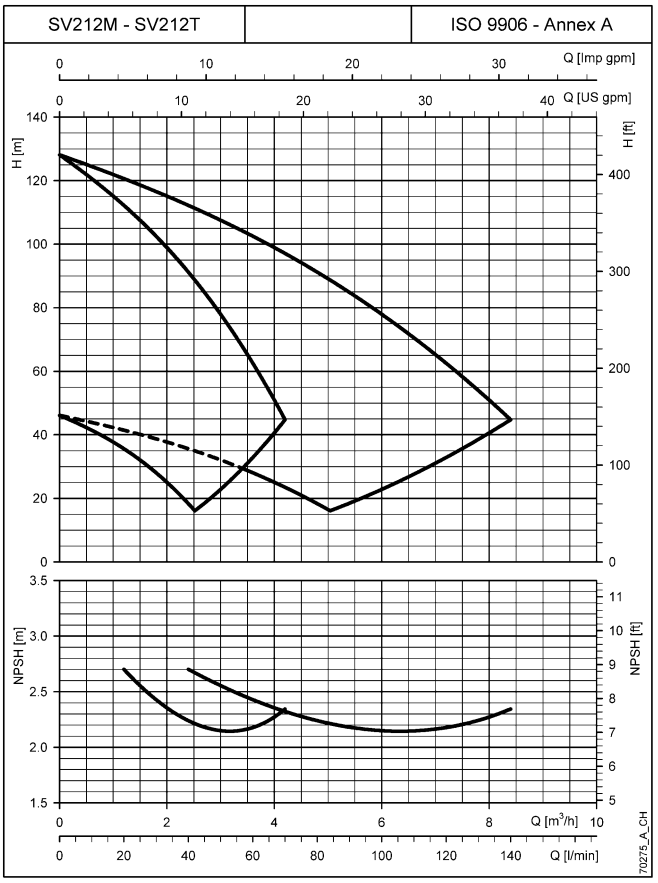
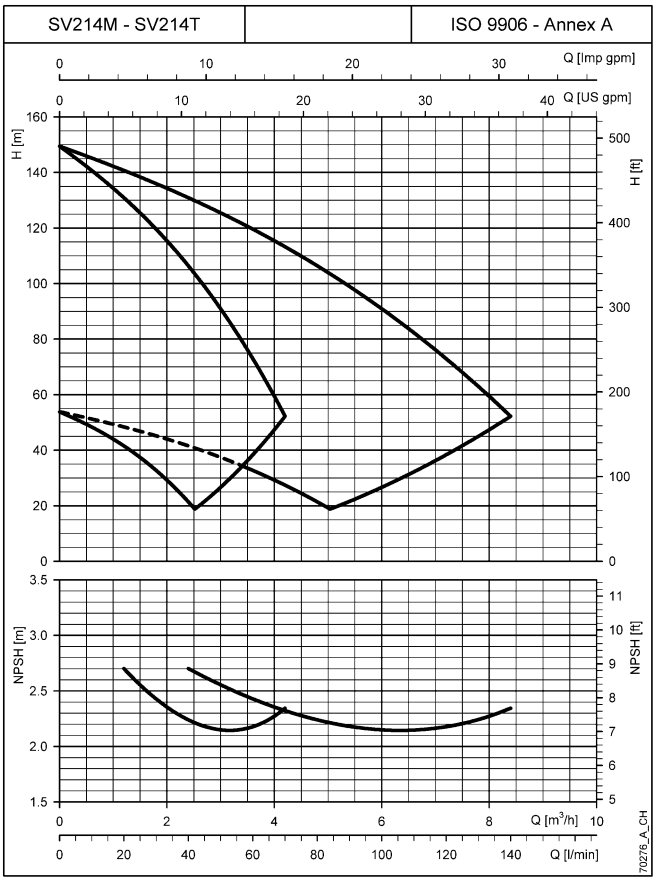
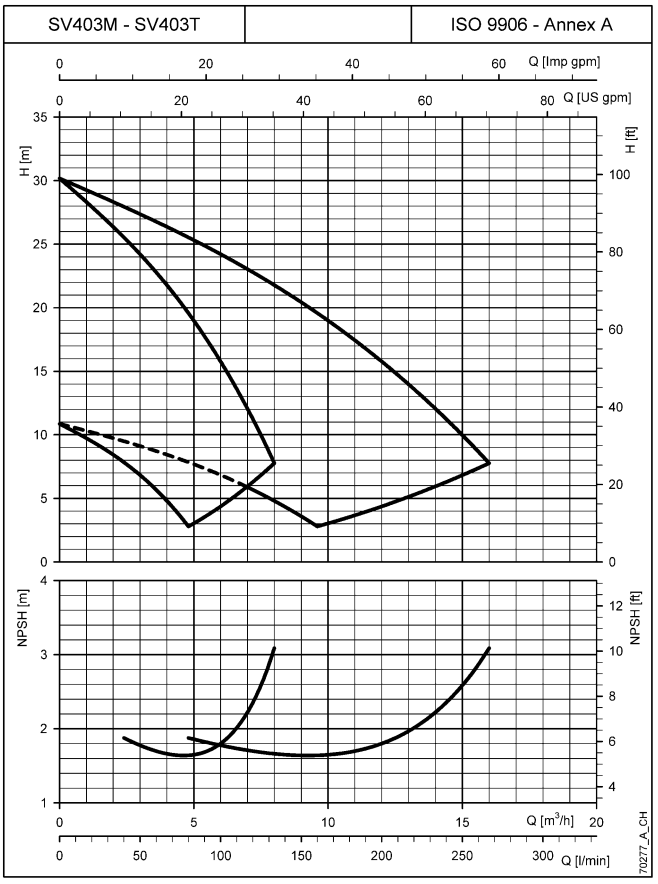
The curves show the performance with one pump and two pumps running.
These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 30..50 Hz









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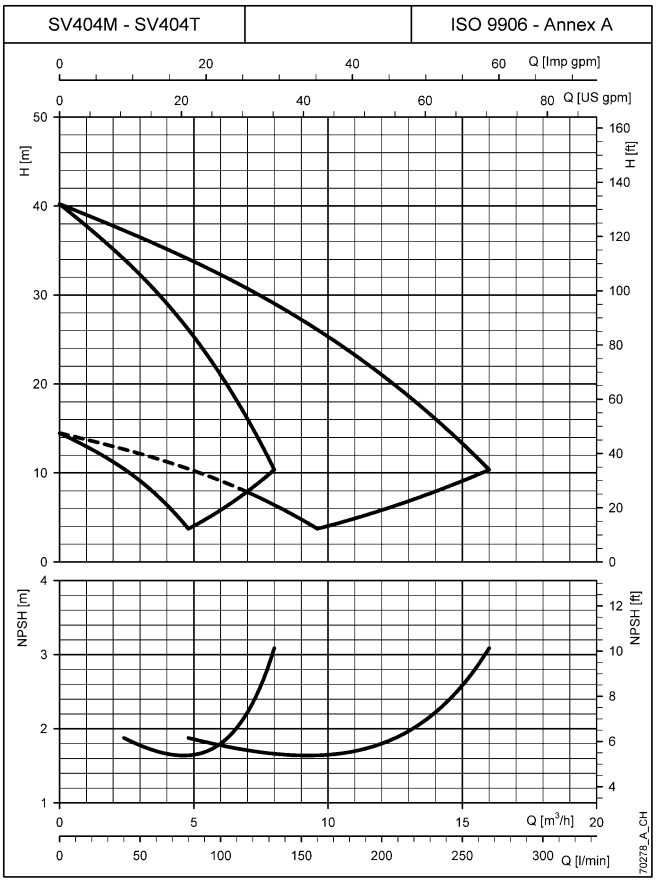
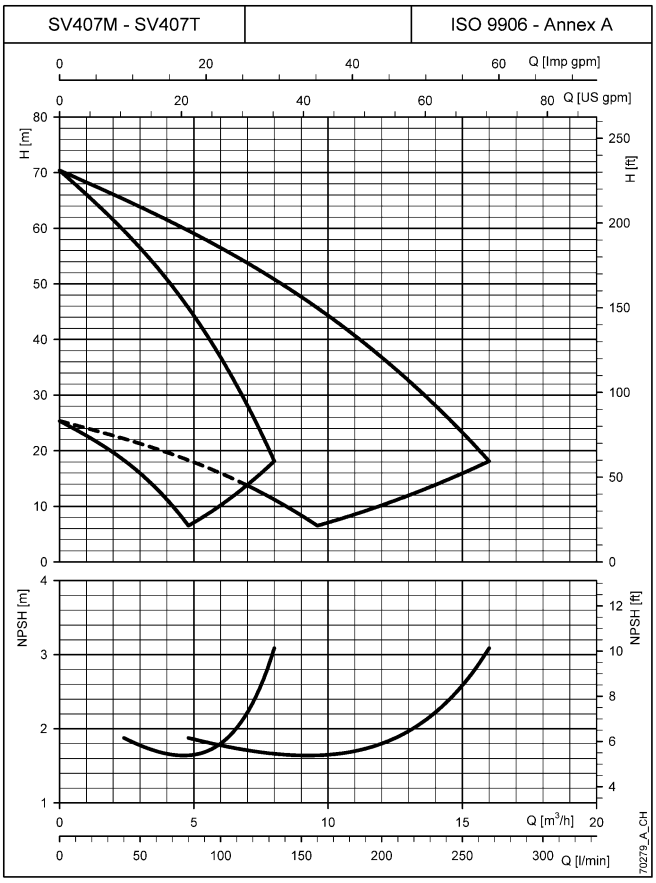
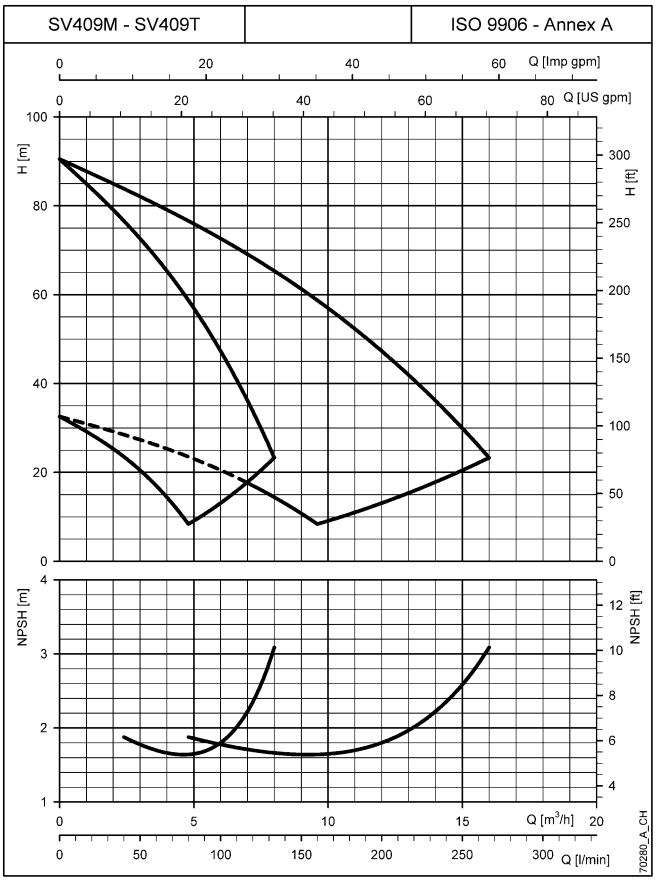
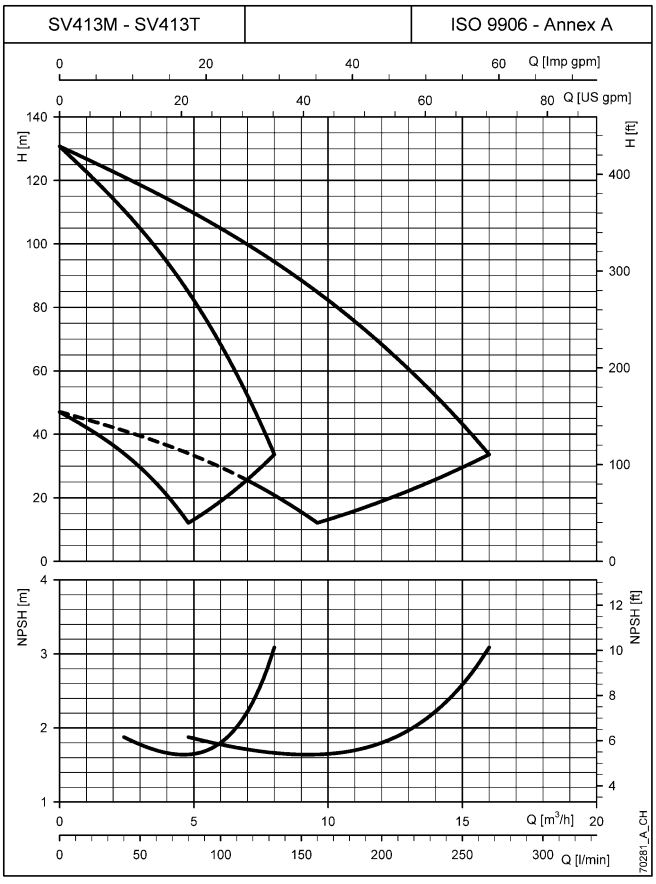
TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 30..50 Hz









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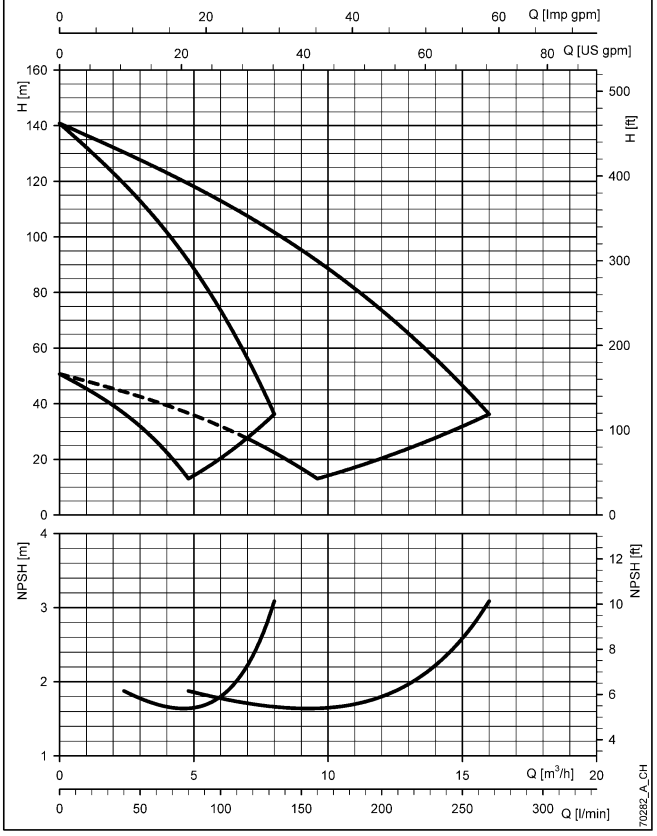
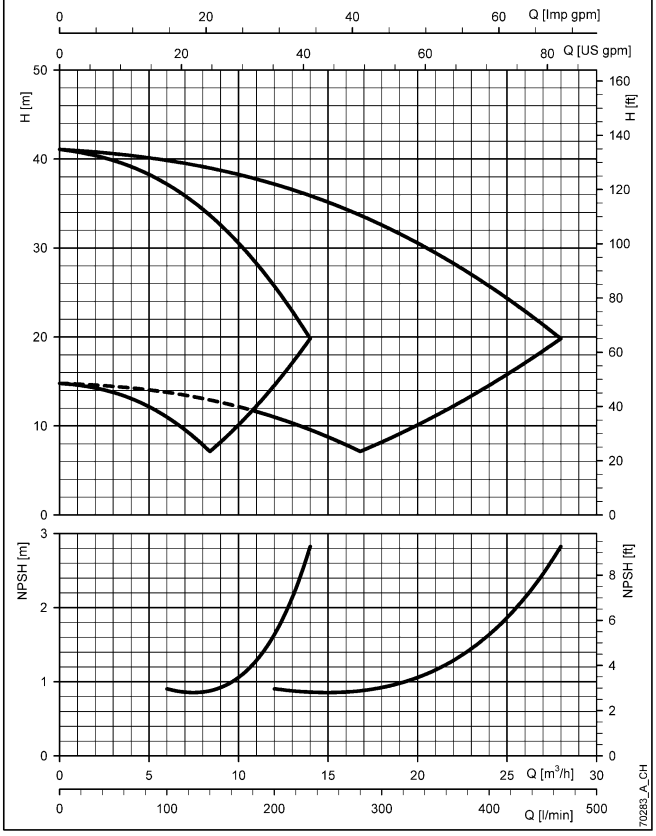
TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 30..50 Hz

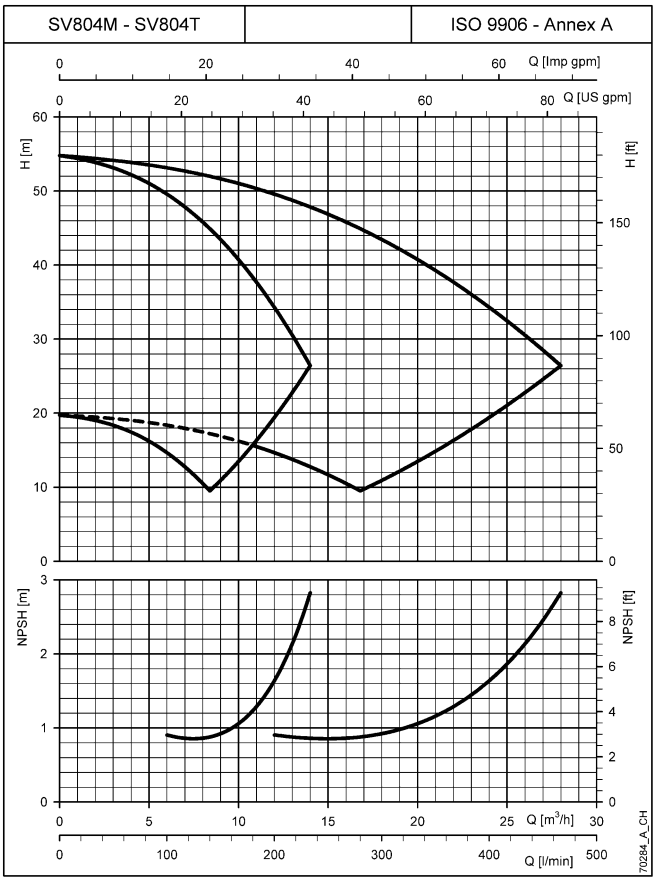
SV414T | ISO 9906 - Annex A



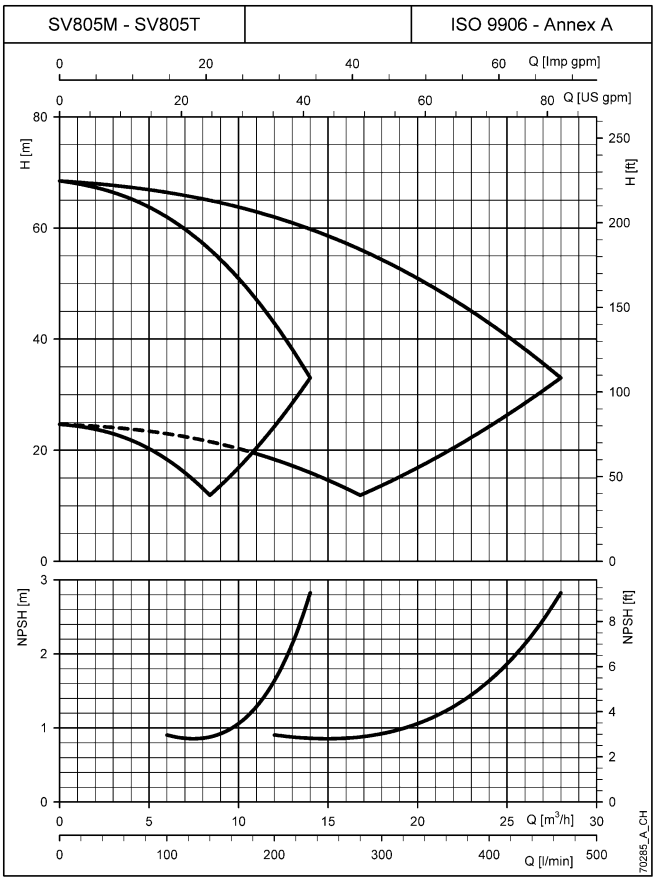
SV803M - SV803T | ISO 9906 - Annex A



SV804M - SV804T | ISO 9906 - Annex A



SV805M - SV805T | ISO 9906 - Annex A



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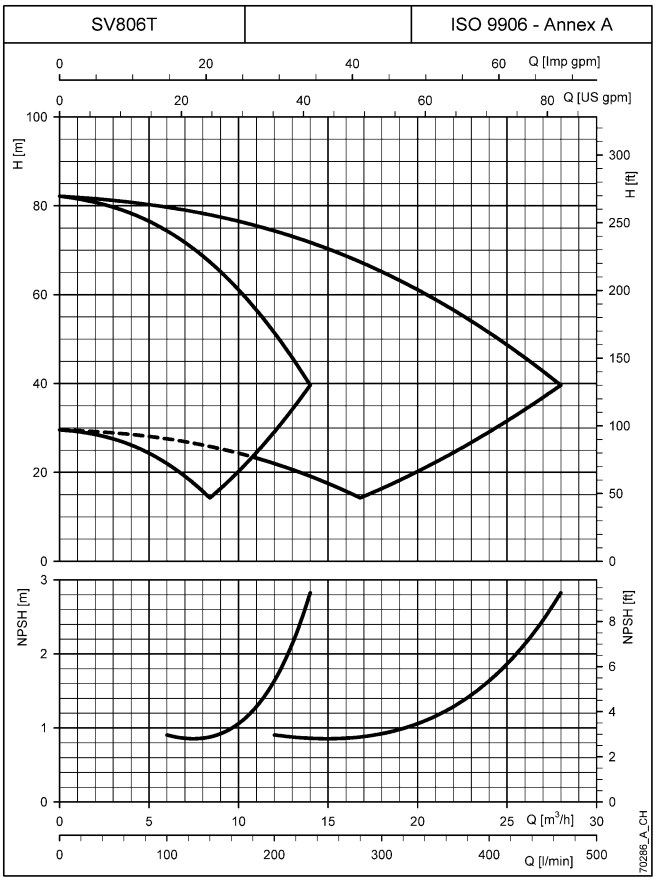
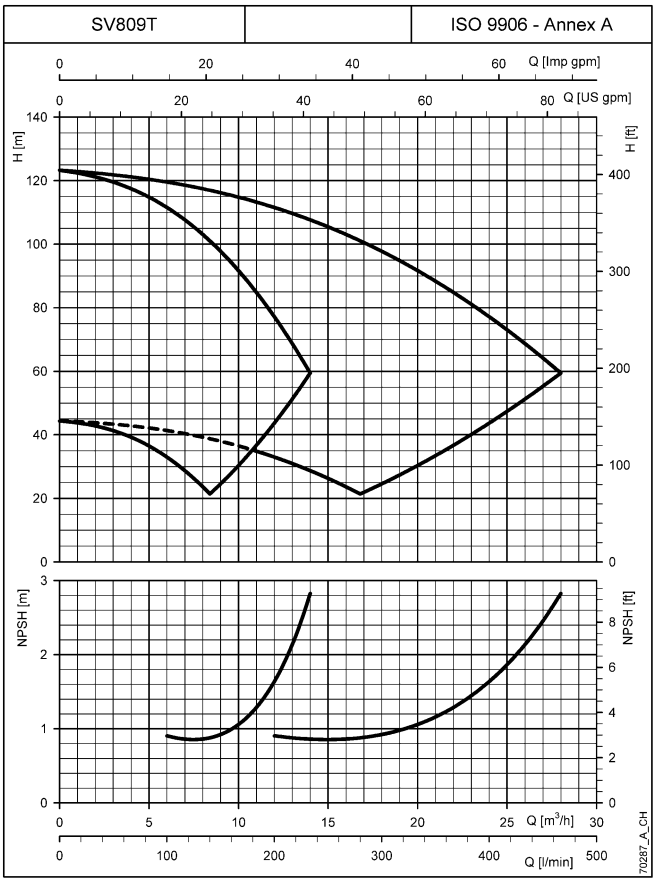
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TWO-PUMP BOOSTER SETS
OPERATING CHARACTERISTICS AT 30..50 Hz





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These performances are valid for liquid with density ρ = 1.0 kg/dm³ and kinematic viscosity ν = 1 mm²/sec.
The declared NPSH values are laboratory values: for practical use we recommend increasing these values by 0.5 m.

TECHNICAL APPENDIX

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

G-at-cm_a_th

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 appartements 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. With 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

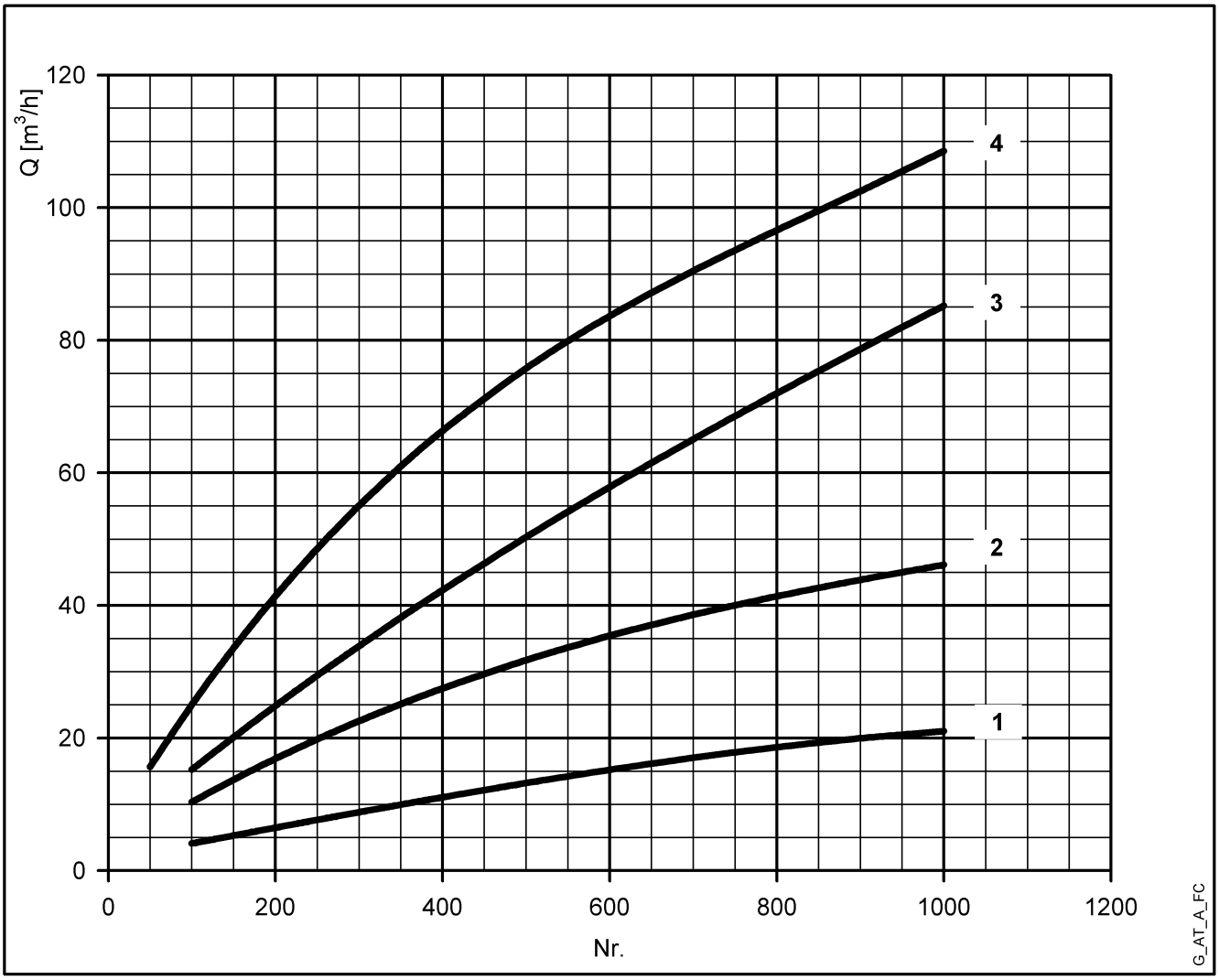
NUMBER OF APARTMENTS	WITH FLUSH TANK WC		WITH CONTROLLED FLUSHING SYSTEM WC	
	1	2	1	2
	FLOW RATE (l/min)			
1	32	40	60	79
2	45	56	85	111
3	55	68	105	136
4	63	79	121	157
5	71	88	135	176
6	78	97	148	193
7	84	105	160	208
8	90	112	171	223
9	95	119	181	236
10	100	125	191	249
11	105	131	200	261
12	110	137	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%.

G-at-fi_a_th

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)

USE OF BOOSTER SET

Water is usually delivered by public supply systems and the pressure is generally sufficient for the proper operation of the users' water and sanitary equipment.
When this pressure is not sufficient, booster sets are employed to increase water pressure and ensure an acceptable minimum value at the furthest points. Therefore, the water supply to a building, group of buildings or to a system in general, can be considered satisfactory when all the user points can deliver the required quantity of water.

Set connection methods (intake side)

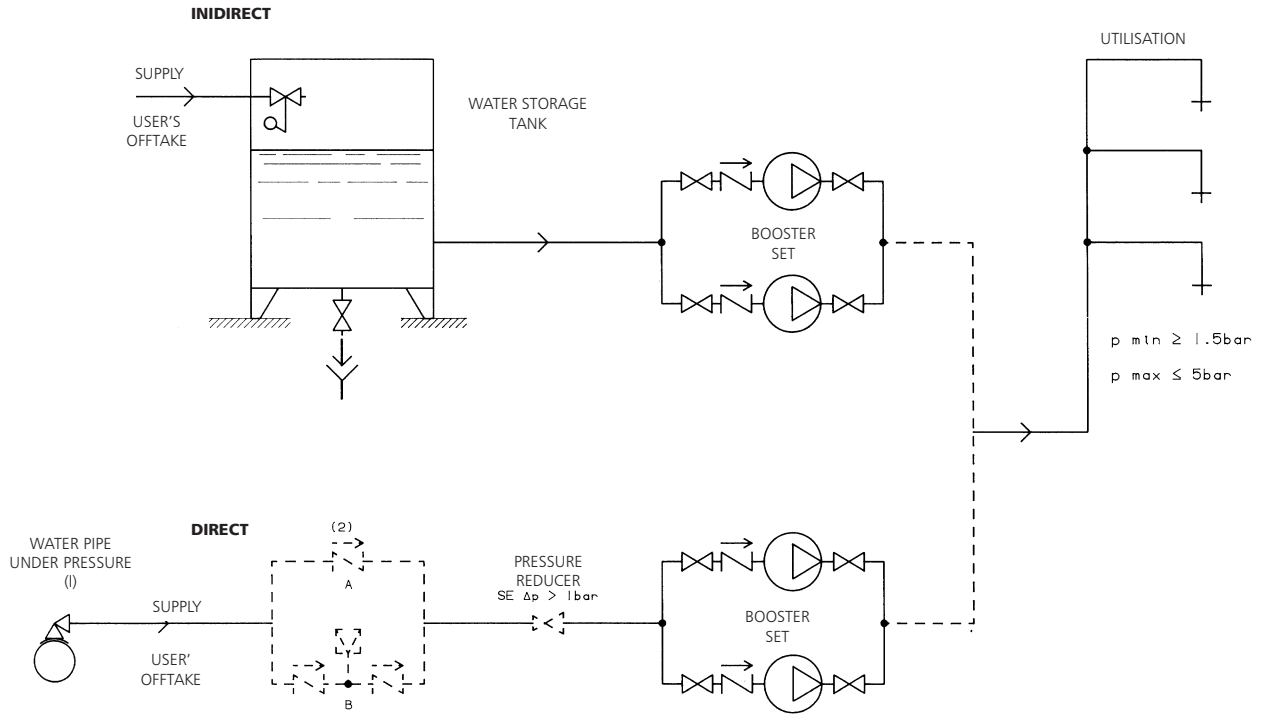
Water can be supplied to a booster set in two ways:

1 – By installing a water storage tank between the user's offtake and the booster set (indirect connection, fig. 7.1.1).
2 – By connecting the booster set directly between the user's offtake and the system (direct connection, fig. 7.1.1).

The indirect connection does not allow the water system pressure to be utilized. Therefore, it requires pumps with greater head.

The direct connection allows the water system pressure to be utilized, provided the fluctuation is pressure (Δp) does not exceed 1 bar.

If it does, a pressure reducer must be installed for the proper operation of the booster set.



(1) BY PIPE UNDER PRESSURE WE MEAN A WATER SYSTEM, A CLOSED TANK, E(1) BY PIPE UNDER PRESSURE WE MEAN A WATER SYSTEM, A CLOSED TANK, ETC.

(2) IN THE CASE OF A WATER SYSTEM INSTALL A CHECK VALVE (A) OR A DISCONNECTING DEVICE (B), UNLESS OTHERWISE PROVIDED BY LOCAL REGULATIONS TC.

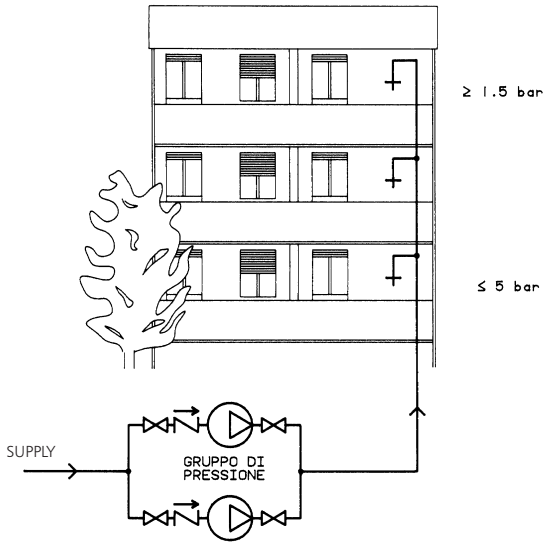
fig. 7.1.1

Water supply systems in civil buildings

The configuration of the supply system must comply with the following conditions:

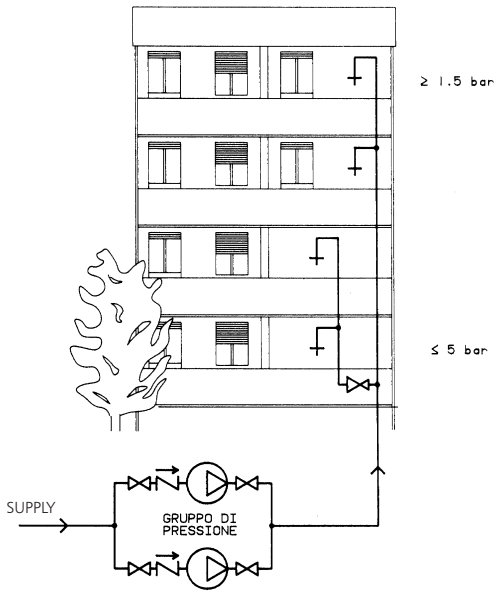
- The minimum pressure ensuring the proper operation of the equipment must be guaranteed at the most unfavourable drawing point (1.5 bar for valves and flush tank WC, and 2 bar for controlled flushing system WC).
- At the most favourable drawing point, pressure must not exceed 5 bar.

Once these parameters have been satisfied, in relation to the height of the building and to the set intake conditions, the water supply system can have one of the following configurations:



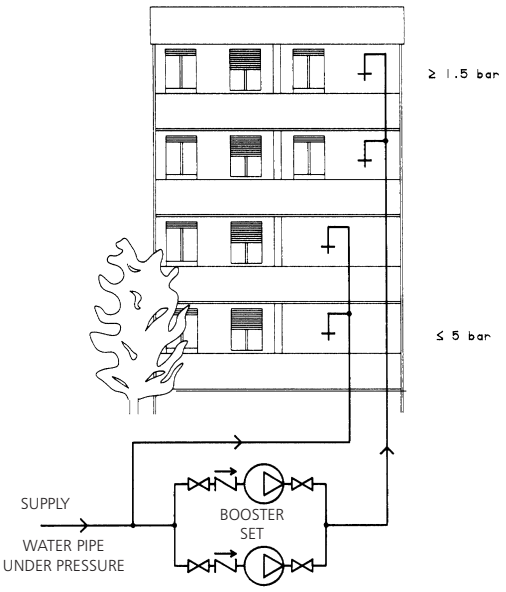
A) THE SET SERVES THE ENTIRE BUILDING

fig. 7.1.2



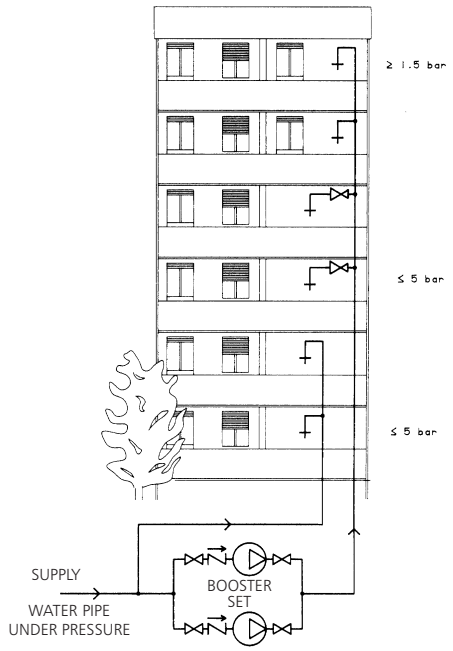
B) THE SET SERVES THE ENTIRE BUILDING, BUT THE LOWER FLOORS ARE CONNECTED THROUGH A PRESSURE REDUCER SINCE THE PRESSURE TO THE NEAREST UTILIZATION POINTS IS TOO HIGH

fig. 7.1.3



C) THE SET SERVES THE UPPER FLOORS, WHEREAS THE LOWER FLOORS ARE SUPPLIED BY THE WATER PIPE UNDER PRESSURE

fig. 7.1.4



D) THIS CASE RESEMBLES THE PREVIOUS ONE EXCEPT THAT PRESSURE REDUCERS NEED TO BE INSTALLED ON SOME OF THE LOWER FLOORS

fig. 7.1.5

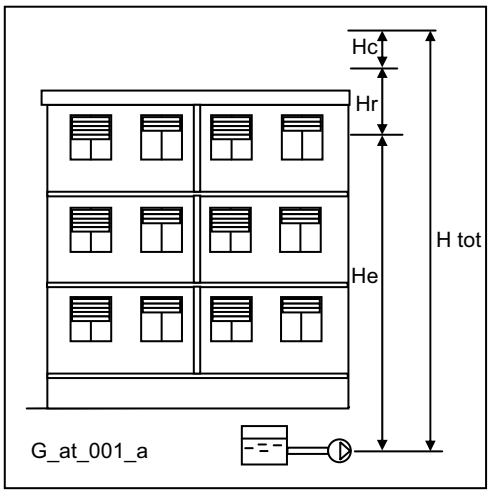
DETERMINING THE HEAD OF THE SET AND INTAKE CONDITIONS

Level intake

The delivery head of the set (H tot) is the sum of:

- He: geodetic difference in level between the set and the furthest delivery point.
- Hc: flow resistance along all the pipes and through other system components, such as valves, filters, etc..
- Hr: pressure required at the most unfavourable point

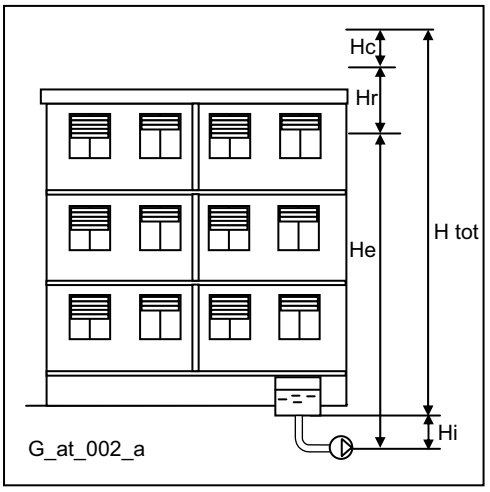
$$H\ tot = He+Hc+Hr$$



Intake with positive head

In this case, the necessary delivery head (H tot) will be reduced by the inlet pressure value (Hi).

$$H\ tot = He+Hc+Hr- Hi$$

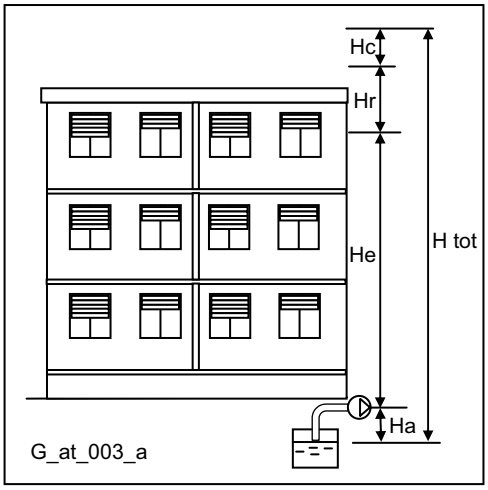


Intake with negative head

When the pumps suck from an underground tank or well, the necessary head will be increased by the value of the intake height (Ha):

$$H\ tot = He+Hc+Hr+ Ha$$

In this case the intake height must be considered very carefully, bearing in mind that an excessive difference in level between the water storage tank and the set, or the wrong sizing of the intake pipe, can have adverse effects on pump operation, such as cavitation and unpriming.



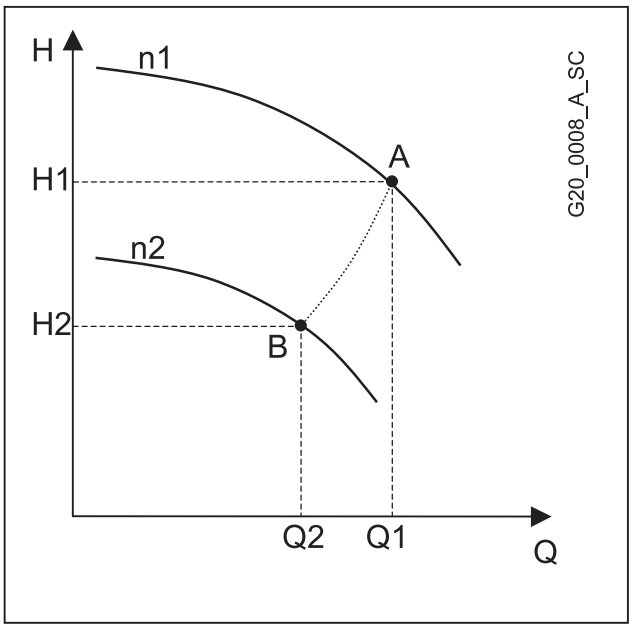
PERFORMANCE WITH VARYING SPEED EQUIVALENCE RELATIONS

Fitting the electric pump with a frequency converter makes it possible to vary the pump rotation speed, normally according to the system pressure parameter. **Variations in electric pump speed** result in **modified performances** according to the equivalence relations.

Flow rate $\frac{Q1}{Q2} = \left[\frac{n1}{n2}\right]$

Head $\frac{H1}{H2} = \left[\frac{n1}{n2}\right]^2$

Power $\frac{P1}{P2} = \left[\frac{n1}{n2}\right]^3$



n1 = initial speed; n2= speed required.
Q1 = initial flow rate; Q2= flow rate required.
H1 = initial head; H2= head required.
P1 = initial power; P2= power required

Frequency ratios can be used instead of speed in practical applications, keeping 30 Hz as the bottom limit.

Example: 2-pole 50 Hz electric pump n1 =2900 (point A)
Flow rate (A) = 100 l/min; Head (A) = 50m
By reducing the frequency to 30 Hz the speed is reduced to approx. n2 = 1740 rpm (point B)
Flow rate (B) = 60 l/min; Head (B) = 18 m
The power of the new work point B is cut to about 22% of the initial power.

SIZING THE DIAPHRAGM TANK IN SYSTEMS WITH SPEED VARIATION

Variable speed booster sets need **smaller tanks** compared to traditional systems. Generally speaking, a tank with a litre capacity of just 10% of the nominal capacity of a single pump, expressed in litres per minute, is needed.
The **gradual starting** of the pumps controlled by the frequency converters reduces the need to limit the number of hourly starts; the main purpose of the tank is to compensate for small system losses, stabilize the pressure and make up for pressure variations caused by sudden demand.

Make the following calculation:
Set made up of three electric pumps, each with a maximum flow rate of 400 l/min, for a total capacity of 1200 l/min. The **volume** required for the tank is 40 litres. This size can be obtained by using two 24-litre tanks mounted directly onto the set's manifold.
The calculation establishes the minimum value needed for proper operation.

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 hz at which to install the machine under safe conditions, the following formula must be verified:

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

where:

- **h_p** is the absolute pressure applied to the free liquid surface in the suction tank, expressed in m. of liquid; hp 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.; hz 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. hpv is the quotient between the Pv 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 temperature (°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

Flow resistance is shown in the tables at pages 78-79 of this catalogue. 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 $\gamma = 1$ kg/dm³
Flow rate required: 10 m³/h
Head for required delivery: 51 m.
Suction lift: 4.5 m.
The selection is an SV805 pump whose NPSH required value is, at 10 m³/h, 1.2 m.

For water at 15°C the hpv term is $\frac{Pv}{\gamma} = 0{,}174$ m (0.01701 bar)

and $h = \frac{Pa}{\gamma} = 10{,}33$m

The Hf flow resistance in the suction line with foot valves is ~2 m.
By substituting the parameters in formula ① with the numeric values above, we have:

$$10{,}33 + (-4{,}5) \geq (1{,}2 + 0{,}5) + 2 + 0{,}17$$

from which we have: $5.8 > 3.9$

The relation is therefore verified.

VAPOUR PRESSURE
ps VAPOUR PRESSURE AND ρ DENSITY OF WATER TABLE

t	T	ps	ρ
°C	K	bar	kg/dm³
0	273,15	0,00611	0,9998
1	274,15	0,00657	0,9999
2	275,15	0,00706	0,9999
3	276,15	0,00758	0,9999
4	277,15	0,00813	1,0000
5	278,15	0,00872	1,0000
6	279,15	0,00935	1,0000
7	280,15	0,01001	0,9999
8	281,15	0,01072	0,9999
9	282,15	0,01147	0,9998
10	283,15	0,01227	0,9997
11	284,15	0,01312	0,9997
12	285,15	0,01401	0,9996
13	286,15	0,01497	0,9994
14	287,15	0,01597	0,9993
15	288,15	0,01704	0,9992
16	289,15	0,01817	0,9990
17	290,15	0,01936	0,9988
18	291,15	0,02062	0,9987
19	292,15	0,02196	0,9985
20	293,15	0,02337	0,9983
21	294,15	0,24850	0,9981
22	295,15	0,02642	0,9978
23	296,15	0,02808	0,9976
24	297,15	0,02982	0,9974
25	298,15	0,03166	0,9971
26	299,15	0,03360	0,9968
27	300,15	0,03564	0,9966
28	301,15	0,03778	0,9963
29	302,15	0,04004	0,9960
30	303,15	0,04241	0,9957
31	304,15	0,04491	0,9954
32	305,15	0,04753	0,9951
33	306,15	0,05029	0,9947
34	307,15	0,05318	0,9944
35	308,15	0,05622	0,9940
36	309,15	0,05940	0,9937
37	310,15	0,06274	0,9933
38	311,15	0,06624	0,9930
39	312,15	0,06991	0,9927
40	313,15	0,07375	0,9923
41	314,15	0,07777	0,9919
42	315,15	0,08198	0,9915
43	316,15	0,09639	0,9911
44	317,15	0,09100	0,9907
45	318,15	0,09582	0,9902
46	319,15	0,10086	0,9898
47	320,15	0,10612	0,9894
48	321,15	0,11162	0,9889
49	322,15	0,11736	0,9884
50	323,15	0,12335	0,9880
51	324,15	0,12961	0,9876
52	325,15	0,13613	0,9871
53	326,15	0,14293	0,9862
54	327,15	0,15002	0,9862

t	T	ps	ρ
°C	K	bar	kg/dm³
55	328,15	0,15741	0,9857
56	329,15	0,16511	0,9852
57	330,15	0,17313	0,9846
58	331,15	0,18147	0,9842
59	332,15	0,19016	0,9837
60	333,15	0,1992	0,9832
61	334,15	0,2086	0,9826
62	335,15	0,2184	0,9821
63	336,15	0,2286	0,9816
64	337,15	0,2391	0,9811
65	338,15	0,2501	0,9805
66	339,15	0,2615	0,9799
67	340,15	0,2733	0,9793
68	341,15	0,2856	0,9788
69	342,15	0,2984	0,9782
70	343,15	0,3116	0,9777
71	344,15	0,3253	0,9770
72	345,15	0,3396	0,9765
73	346,15	0,3543	0,9760
74	347,15	0,3696	0,9753
75	348,15	0,3855	0,9748
76	349,15	0,4019	0,9741
77	350,15	0,4189	0,9735
78	351,15	0,4365	0,9729
79	352,15	0,4547	0,9723
80	353,15	0,4736	0,9716
81	354,15	0,4931	0,9710
82	355,15	0,5133	0,9704
83	356,15	0,5342	0,9697
84	357,15	0,5557	0,9691
85	358,15	0,5780	0,9684
86	359,15	0,6011	0,9678
87	360,15	0,6249	0,9671
88	361,15	0,6495	0,9665
89	362,15	0,6749	0,9658
90	363,15	0,7011	0,9652
91	364,15	0,7281	0,9644
92	365,15	0,7561	0,9638
93	366,15	0,7849	0,9630
94	367,15	0,8146	0,9624
95	368,15	0,8453	0,9616
96	369,15	0,8769	0,9610
97	370,15	0,9094	0,9602
98	371,15	0,9430	0,9596
99	372,15	0,9776	0,9586
100	373,15	1,0133	0,9581
102	375,15	1,0878	0,9567
104	377,15	1,1668	0,9552
106	379,15	1,2504	0,9537
108	381,15	1,3390	0,9522
110	383,15	1,4327	0,9507
112	385,15	1,5316	0,9491
114	387,15	1,6362	0,9476
116	389,15	1,7465	0,9460
118	391,15	1,8628	0,9445

t	T	ps	ρ
°C	K	bar	kg/dm³
120	393,15	1,9854	0,9429
122	395,15	2,1145	0,9412
124	397,15	2,2504	0,9396
126	399,15	2,3933	0,9379
128	401,15	2,5435	0,9362
130	403,15	2,7013	0,9346
132	405,15	2,867	0,9328
134	407,15	3,041	0,9311
136	409,15	3,223	0,9294
138	411,15	3,414	0,9276
140	413,15	3,614	0,9258
145	418,15	4,155	0,9214
155	428,15	5,433	0,9121
160	433,15	6,181	0,9073
165	438,15	7,008	0,9024
170	433,15	7,920	0,8973
175	448,15	8,924	0,8921
180	453,15	10,027	0,8869
185	458,15	11,233	0,8815
190	463,15	12,551	0,8760
195	468,15	13,987	0,8704
200	473,15	15,550	0,8647
205	478,15	17,243	0,8588
210	483,15	19,077	0,8528
215	488,15	21,060	0,8467
220	493,15	23,198	0,8403
225	498,15	25,501	0,8339
230	503,15	27,976	0,8273
235	508,15	30,632	0,8205
240	513,15	33,478	0,8136
245	518,15	36,523	0,8065
250	523,15	39,776	0,7992
255	528,15	43,246	0,7916
260	533,15	46,943	0,7839
265	538,15	50,877	0,7759
270	543,15	55,058	0,7678
275	548,15	59,496	0,7593
280	553,15	64,202	0,7505
285	558,15	69,186	0,7415
290	563,15	74,461	0,7321
295	568,15	80,037	0,7223
300	573,15	85,927	0,7122
305	578,15	92,144	0,7017
310	583,15	98,70	0,6906
315	588,15	105,61	0,6791
320	593,15	112,89	0,6669
325	598,15	120,56	0,6541
330	603,15	128,63	0,6404
340	613,15	146,05	0,6102
350	623,15	165,35	0,5743
360	633,15	186,75	0,5275
370	643,15	210,54	0,4518
374,15	647,30	221,20000	0,3154

G-at_npsh_a_sc

CHOOSING AND SIZING THE SURGE TANK

The purpose of the surge tank is to limit the number of hourly starts of the pumps, placing part of its stock of water, which is maintained under pressure by the air above it, at the disposal of the system.

The surge tank can be of the air cushion or diaphragm type.

In the air cushion version there is no clear separation between air and water. Since part of the air tends to mix with water, it is necessary to restore it by means of air supply units or a compressor.

In the diaphragm version, neither air supply units nor compressor are needed, as contact between air and water is prevented by a flexible diaphragm inside the tank.

The following method, which is used to determine the volume of a surge tank, is valid both for horizontal and vertical surge tanks.

When calculation the volume of the surge tank, it is generally sufficient to consider the first pump only.

AIR-CUSHION SURGE TANK

It is determined in relation to flow rate, pump pressure,, and number of starts per hour allowed by the motor.

$$Va = \frac{1{,}25 \times Qp \times (Pmax + 10)}{4 \times Z \times (Pmax - Pmin)}$$

where:

Va = Total volume of the air-cushion surge tank in m^3
Qp = Average pump flow rate in m^3/h
Pmax = Maximum pressure setting (wcm)
Pmin = Minimum pressure setting (wcm)
Z = Maximum number of starts per hour allowed by the motor

Warning! By pump flow rate we mean the average between the flow rate at the maximum pressure switch setting (Qmax) and the flow rate at the minimum pressure switch setting (Qmin), i.e.:

$$Qp = \frac{Qmax + Qmin}{2} \ (m^3/h)$$

Example:

CN 32 - 160/22 pump
Pmax = 32 mca
Pmin = 22 mca
Qp = 18 m^3/h
Z = 30

$$Va = \frac{1{,}25 \times 18 \times (32 + 10)}{4 \times 30 \times (32 - 22)} = 0{,}788 \ m^3$$

A 750-litre surge tank is therefore required.

DIAPHRAGM TANK

If you decide to use a diaphragm tank, the volume will be lower than that of the air-cushion tank. It can be calculated with the following formula:

$$Vm = \frac{Qp}{4 \times Z} \times \frac{1}{1 - \frac{(Pmin - 2)}{Pmax}}$$

where:

Vm = Total volume of the air-cushion surge tank in m^3
Qp = Average pump flow rate in m^3/h
Pmax = Maximum pressure setting (wcm)
Pmin = Minimum pressure setting (wcm)
Z = Maximum number of starts per hour allowed by the motor

Example:

CN 32 - 160/22 pump
Pmax = 32 mca
Pmin = 22 mca
Qp = 18 m^3/h
Z = 30

$$Vm = \frac{Qp}{4 \times Z} \times \frac{1}{1 - \frac{(Pmin - 2)}{Pmax}} = 0{,}4 \ m^3$$

A 500-litre surge tank is therefore required.

Approximate comparison between Lowara air-cushion tanks and diaphragm tanks, as regards some pressure switch setting values

NOMINAL CAPACITY OF AIR CUSHION TANK (litres)	PRESSURE SWITCH SETTING									
	1,5/2,5	2/3	2,5/3,5	3/4	3,5/4,5	4/5	4,5/5,5	5/6	5,5/6,5	6/7
	NOMINAL CAPACITY OF DIAPHRAGM TANK (litres)									
100	N. 2 ball types tanks/cylinder type tanks or 60 l Export tank or 100-litre tanks (Ispesl tested) table 7.2.1									
200	100									
300	200									
500	300									
1000	500									
1500	500 + 200			500 + 300						
2000	500 + 500									
2500	500 + 500	500 + 500 + 300								500 + 500 + 500

tab. 7.2.1

TABLE OF FLOW RESISTANCE IN 100 M OF A NEW AND STRAIGHT CAST IRON PIPELINE (HAZEN-WILLIAMS FORMULA C = 100)

FLOW RATE			NOMINAL DIAMETER IN mm AND INCHES																
m^3/h	l/min		15	20	25	32	40	50	65	80	100	125	150	175	200	250	300	350	400
			1/2"	3/4"	1"	1 1/4"	1 1/2"	2	2 1/2"	3"	4"	5"	6"	7"	8"	10"	12"	14"	16"
0,6	10	v	0,94	0,53	0,34	0,21	0,13												
		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

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

G-at-pct_a_th

hr = flow resistance for 100 m of straight pipeline (m)
V = water speed (m/s)

FLOW RESISTANCE

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	-	-	-	0,2	0,2	0,2	0,4	0,4	0,6	0,9	1,1	1,3
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

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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.

Air supply unit

The most commonly used air supply unit model is the “depression” type, which uses the depression produced by the pump suction.

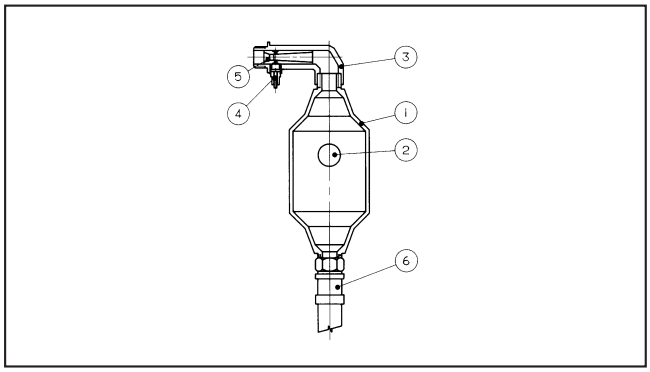


fig. 7.2.2 - The air supply unit consists of a body made of plastic material suitable for foodstuffs (1), a spherical rubber shutter (2), an upper brass union (3) with an air valve (4), a Venturi tube (5), and a flexible pipe (6) to be connected to the pump intake.

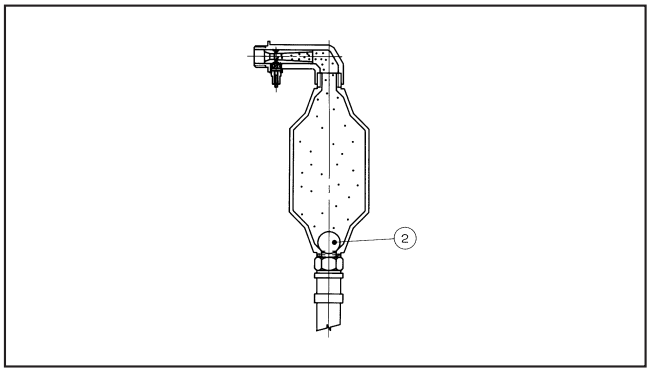


fig. 7.2.5 - The air accumulated inside the body pushes the rubber ball (2) to the bottom, thus blocking the passage. At this point the valve closes and the rubber ball prevents the air accumulated inside the body of the air supply unit from reaching the pump intake.

Air supply unit operation

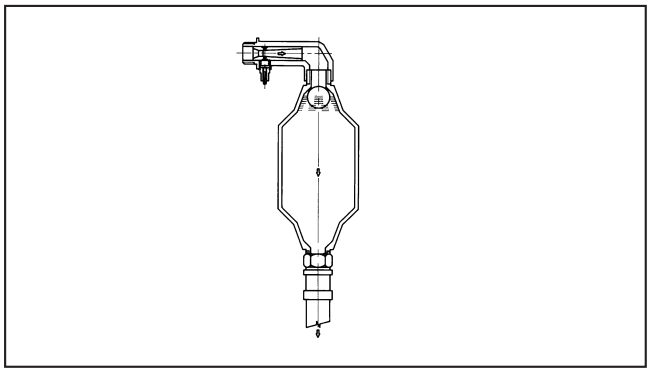


fig. 7.2.3 - When the pump starts up, the intake pressure is lower than the pressure in the surge tank. This difference causes water to flow from the surge tank to the pump intake, through the air supply unit.

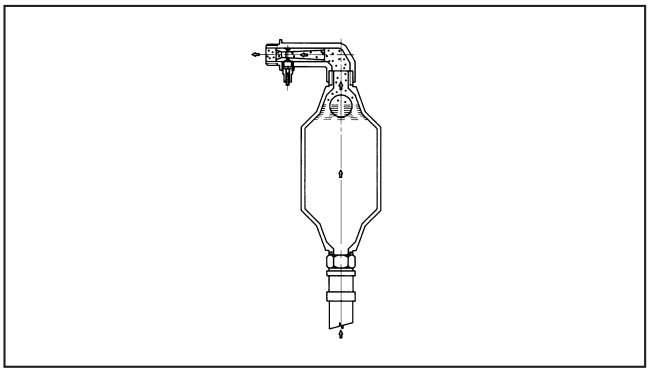


fig. 7.2.6 - When the pump stops the depression ceases and a flow of water is produced, which lifts the ball and pushes the air in the body of the supply unit into the tank.

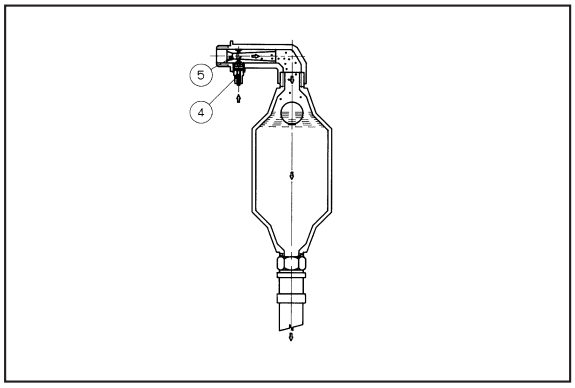


fig. 7.2.4 - The flow of water that passes through the Venturi tube (5) generates a depression and allows the opening of the air valve (4). As a consequence, air enters the body of the supply unit.

Air supply unit selection tank

TANK CAPACITY L	AVERAGE PRESSURE SETTING bar 2,5	3,5	4,5	5,5	6,5	7,5
100						
200	LOW 5					
300						
500		LOW 10				
700						
1000						
1500						
2000						
2500			LOW 25			
3000						
4000				LOW 40		
5000						
6000						

tab. 7.2.7

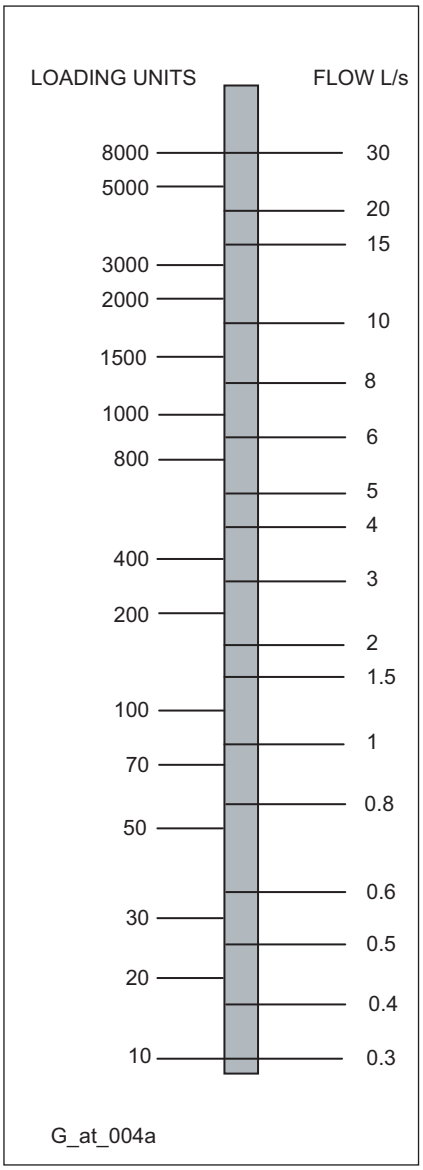
This cycle is repeated each time the pump starts up until the required quantity of air has accumulated. To ensure proper system operation, no check valve must be mounted between the pump delivery outlet and the surge tank, as it would impede the return flow of water through the pump.

ASSESSMENT OF PROBABLE DEMAND (VALID IN U.K. ONLY)

The method adopted is based on loading unit values as detailed in the Plumbing Engineering Design Guide published by the Institute of Plumbing.

When designing a hot or cold water supply system an assessment must be made to obtain the maximum probable simultaneous demand.
Depending on the type of services being provided it rarely occurs for all the appliances to be used at the same time therefore the design usually allows for a peak usage which is less than the maximum.
Probable demand will depend on, the type of building and its use, type of appliances installed and frequency of use.
The simultaneous demand in most installations can be calculated with an adequate degree of accuracy using the loading unit concept.
The usage patterns and types of appliances in different installations will vary greatly.
Sports and Leisure centres for example are usually calculated directly by the flow rates of each appliance, without diversity factors. Each case will need to be looked at in its own right and assessed accordingly. Judgement of the designer must prevail.

Loading unit values vary for each type of appliance. A loading unit has no precise value in terms of litres per second.
See loading unit table below.
By multiplying the total number of each appliance by the appropriate loading unit number and adding the resultant totals together, the recommended flow can be read from chart.



Loading unit table

APPLIANCE	Loading Unit	Recommended Flow L/s
WC	1,5	0,12
Wash basin (hot & cold)	3	0,3
Sink (hot & cold)	6	0,4
Bath (hot & cold)	20	0,6
Shower (hot & cold)	10	0,24
Washing machine	2	0,3

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Working Example

A block of standard flats containing a total of 70 dwellings

Each standard flat is assumed to have:
1 x Hand basin hot & cold = 3 L/U x 70 = 210
1 x WC cold only = 1.5 L/U x 70 = 105
1 x Shower hot & cold = 10 L/U x 70 = 700
1 x Sink hot & cold = 6 L/U x 70 = 420

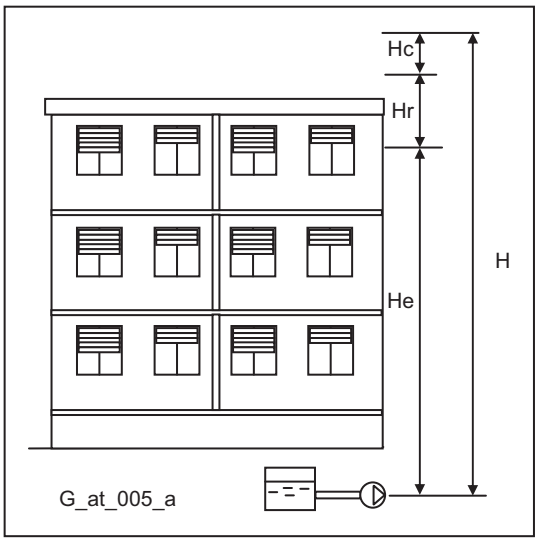
Total Loading Unit =1435

This figure can now be read from chart opposite: total flow = 8.5 L/s

ASSESSING HEAD REQUIREMENT (VALID IN U.K. ONLY)

The **head** required in a boosted cold water system consists of three components, static head, residual pressure and system friction losses. The values of these three components are added together to give the total required head at the system flow rate.

Static head (He): This is the difference between the break tank low water line and the highest discharge point in the building. If the height of the build is not known, then 2.8-3.0 metres per floor can be used to assess the building height.



Residual pressure (Hr): This is the pressure required at the highest outlet device, normally 20metres.
Note: some modern showers may require higher pressures.

System friction losses (Hc): The total losses through pipework, pipework fittings, valves, PRV's and all other equipment fed through the pumpset must be added to find the total system losses.
On conventional systems that do not include excessive runs of pipe or specialised components a rough guide would be to allow 0.05 metres friction loss for each metre of static head.

Example:
Static head (He): Building height four floors @ 2.8m each = 11.2m +
Residual pressure (Hr): Pressure at highest outlet = 20m +
Friction loses (Hc): 11.2 (static head) x 0.05 = 0.56m
Total pump head required (H) = 31.76m (3.11 Bar)

Pressure limitations

The designer must ensure that adequate precautions are taken to ensure that the system is capable of withstanding the closed valve head produced by the pump set. In cases where closed valve pressures cannot be tolerated, pressure reducing valves should be fitted down stream of the booster set.

Velocity

Pipework within the system should be sized to limit the velocity to the figures stated in table below
Higher velocities will lead to excessive noise, ware and higher running costs

PIPE SIZE	SUCTION PIPE m/s	DELIVERY PIPE m/s
Less than 80mm	0,46	0,91 to 1,07
100-150mm	0,55	1,22 to 1,52
200mm	0,76	1,68
250 and above	0,91	1,82 to 2,13

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BOOSTER SIZING

What information do we require to size a booster set?

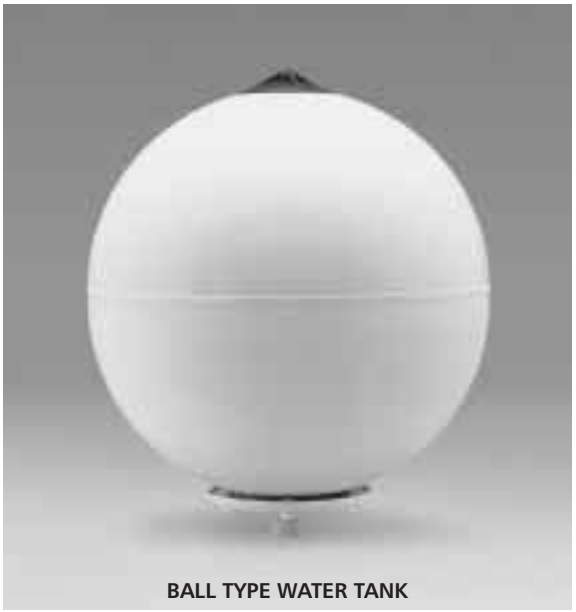
- As a minimum we need to know:
  – The total flow rate, or information to assess this.
  – The total head at flow rate, or the height of building.
  – If the pumps are to operate under positive head, or suction lift conditions.
  – Where the set is to be sited, I.E. basement or roof.
  – Preferred choice fixed or variable speed

- Additional information if available:
  – How to split the duty for particular applications I.E. duty/standby or duty/assist.
  – The size and material of the connecting pipework.
  – Is a Jockey pump required.

ACCESSORIES

AIR SUPPLY UNITS

FLOAT SWITCHES



BALL TYPE WATER TANK

CYLINDER WATER TANK

PRESSURE SWITCHES

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	Imp. gal. per minute Imp. gal/min	US gal. per minute Us gal./min
1,0000	0,0600	2,1189	0,0353	0,2200	0,2640
16,6670	1,0000	35,3147	0,5886	3,6660	4,4030
0,4720	0,0283	1,0000	0,0167	0,1040	0,1250
28,3170	1,6990	60,0000	1,0000	6,2290	7,4800
4,5460	0,2728	9,6326	0,1605	1,0000	1,2010
3,7850	0,2271	8,0209	0,1337	0,8330	1,0000
0,1100	0,0066	0,2339	0,0039	0,0240	0,0290

PRESSURE AND HEAD

Newtons per square metre N/m^2	kilopascal kPa	bar bar	Pound force per square inch psi	metre of water m H_2O	millimetre of mercury mm Hg
1,0000	0,0010	1 x 105	$1,45 \times 10^{-4}$	$1,02 \times 10^{-4}$	0,0075
1000,0000	1,0000	0,0100	0,1450	0,1020	7,5000
100000,0000	100,0000	1,0000	14,5000	10,2000	750,1000
98067,0000	98,0700	0,9810	14,2200	10,0000	735,6000
6895,0000	6,8950	0,0690	1,0000	0,7030	51,7200
2984,0000	2,9840	0,0300	0,4330	0,3050	22,4200
9789,0000	9,7890	0,0980	1,4200	1,0000	73,4200
133,3000	0,1330	0,0013	0,0190	0,0140	1,0000
3386,0000	3,3860	0,0338	0,4910	0,3450	25,4000

LENGHT

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
1000,0000	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 litre	millilitre ml	imp. gallon imp. gal.	US gallon US gal.	cubic foot ft^3
1,0000	1000,0000	1 x 106	220,0000	264,2000	35,3147
0,0010	1,0000	1000,0000	0,2200	0,2642	0,0353
1 x 10-6	0,0010	1,0000	2,2 x 10-4	2,642 x 10-4	3,53 x 10-5
0,0045	4,5460	4546,0000	1,0000	1,2010	0,1605
0,0038	3,7850	3785,0000	0,8327	1,0000	0,1337
0,0283	28,3170	28317,0000	6,2288	7,4805	1,0000

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cod. 191000671 09/05