ITT

Lowara

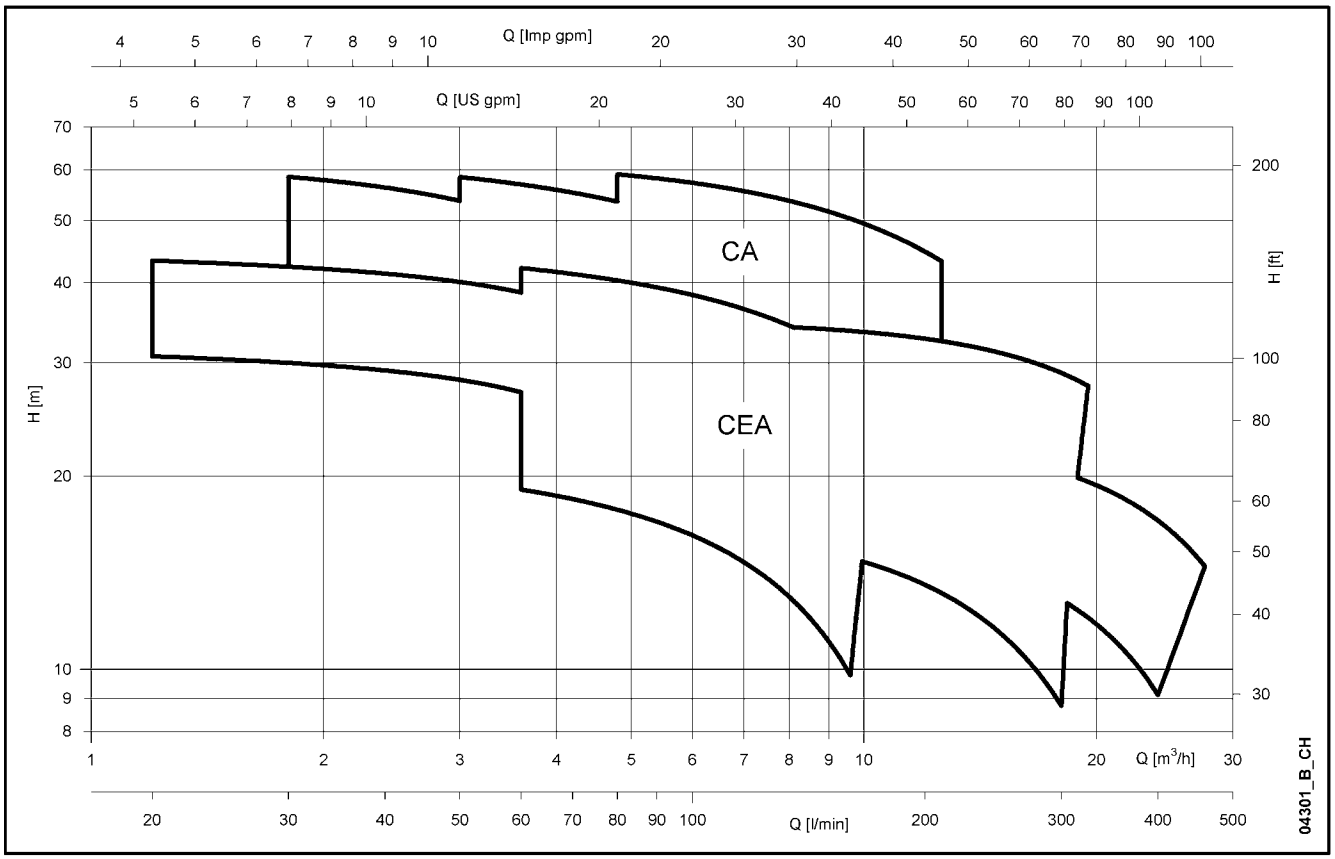
CEA-CA Series

Single and twin-impeller Centrifugal Electric Pumps

60 Hz

Engineered for life

CEA-CA SERIES
HYDRAULIC PERFORMANCE RANGE AT 60 Hz



PRINT 10-2007

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ITT

Lowara

Single-Impeller Centrifugal Electric Pumps

CEA 60 Hz Series

MARKET SECTORS

CIVIL, AGRICULTURAL, INDUSTRIAL.

APPLICATIONS

Version made of AISI 304

- Handling of chemically and mechanically non-aggressive water and liquids (*).
- Water supply.
- Irrigation.
- Water circulation (cold, hot, refrigerated).

* For moderately aggressive liquids, a version with FPM elastomers is available (CEA../..V). For very aggressive liquids, please contact our sales network.

On request "N" Version made of AISI 316 (for aggressive liquids)

- Reverse osmosis (where demineralized water is used).
- Industrial washing.
- Thermal waters.
- Chlorine dispensing in swimming pools.
- Jewellary industry.
- Wine production.

SPECIFICATIONS

PUMP

- **Delivery**: up to 460 l/min (28 m^3/h).
- **Head**: up to 45 m.
- **Temperature** of pumped liquid: -10°C to 85°C standard version (**).
- **Maximum** operating pressure: 8 bar (PN 8).
- Counterclockwise rotation facing the pump from the suction port.

** 110°C CEA../..-V version and N version.

MOTOR

- Asynchronous, squirrel cage rotor, closed construction, external ventilation.
- **Protection class**: IP55.
- **Insulation**: class F.
- Performances to EN 60034-1 specification.
- **Standard voltage**:
  Single-phase versions:
  220-230 V, 60 Hz, 2 poles, with automatic reset overload protection up to 1,5 kW. For higher powers, the overload protection must be provided and installed by the user in the control panel.
  Three-phase version:
  220-230 / 380-400 V, 60 Hz, 2 poles, the overload protection must be provided and installed by the user in the control panel.
- Condensate drain plug in the standard version.

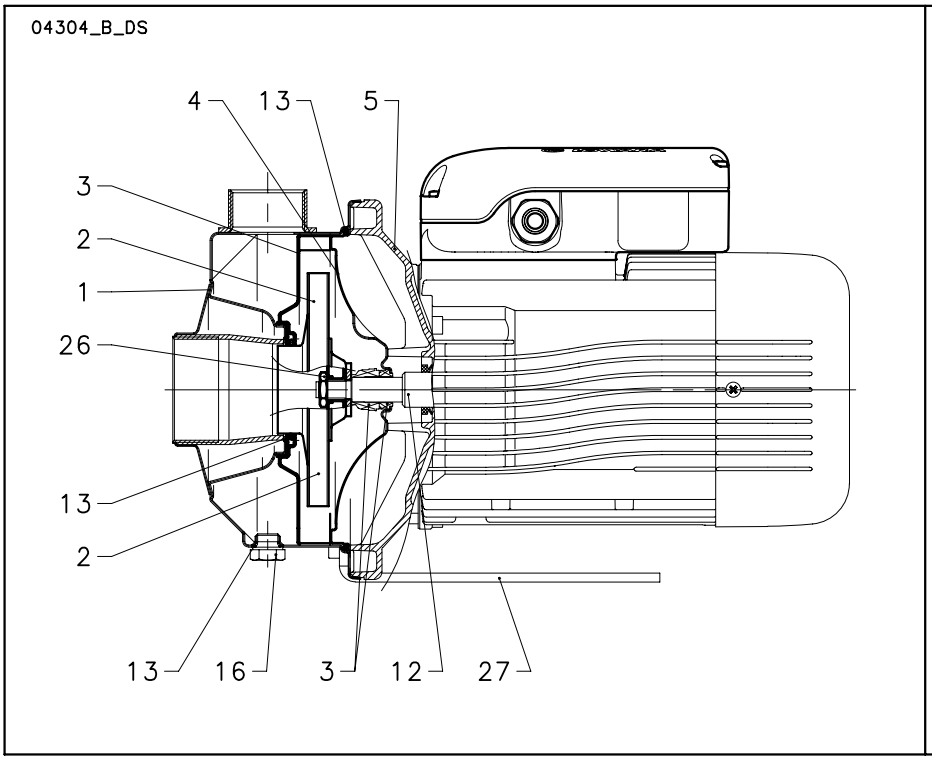
CONTRUCTION CHARACTERISTICS

- Close-coupled, single-impeller centrifugal pump featuring axial suction and radial discharge.
- Compact construction, with pump coupled directly to motor; special motor shaft extension supported by ball bearings.
- Rotating assembly has back pull-out design, no need to disconnect the pump body from the pipe line.
- Threaded suction and discharge ports (Rp UNI-ISO 7).
- High performance closed **impeller** made of AISI 304 stainless steel.
- **Mechanical seal** with ceramic/carbon rings, NBR elastomers, other parts are made of AISI 304 stainless steel. Mounting dimensions according to EN 12756 (ex DIN 24960) and ISO 3069.
- **NBR O-rings**
- Mounting pedestal.

OPTIONAL FEATURES

- Different voltages and frequencies.
- Different materials for the mechanical seal and O-rings.

CEA SERIES
LIST OF MODELS AND TABLE OF MATERIALS



VERSIONS
CEA706/3
CEA706/4
CEA706/5
CEA1206/1
CEA1206/2
CEA1206/3
CEA1206/4
CEA1206/5
CEA2106/0
CEA2106/1
CEA2106/2
CEA2106/3
CEA2106/4
CEA3706/0
CEA3706/0A
CEA3706/1

cea-ceaN-2p60-en_a_mo

CEA SERIES TABLE OF MATERIALS

REF. N.	PART	MATERIAL	REFERENCE STANDARDS	
			EUROPE	USA
1	Pump body	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
2	Impeller	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
3	Diffuser	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
4	Seal housing	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
5	Adapter	Aluminium	EN 1706-AC-AlSi11Cu2 (Fe) (AC46100)	-
12	Mechanical seal	Ceramic / Carbon / NBR (standard version)		
13	Elastomers	NBR (standard version)		
16	Fill/drain plugs	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
26	Impeller lock nut	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
27	Mounting pedestal	Painted steel		
28	Pump body fastening nuts and bolds	Zinc-plated steel		
29	Shaft extension	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316

cea-cea-en_b_tm

CEA(N) SERIES TABLE OF MATERIALS (ON REQUEST)

REF. N,	PART	MATERIAL	REFERENCE STANDARDS	
			EUROPE	USA
1	Pump body	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
2	Impeller	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
3	Diffuser	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
4	Seal housing	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
5	Adapter	Aluminium	EN 1706-AC-AlSi11Cu2 (Fe) (AC46100)	-
12	Mechanical seal	Ceramic / Carbon / EPDM		
13	Elastomers	EPDM		
16	Fill/drain plugs	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
26	Impeller lock nut	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
27	Mounting pedestal	Painted steel		
28	Pump body fastening nuts and bolds	Zinc-plated steel		
29	Shaft extension	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316

cea-ceaN-en_a_tm

Twin-Impeller Centrifugal Electric Pumps

CA 60 Hz Series

MARKET SECTORS

CIVIL, AGRICULTURAL, INDUSTRIAL.

APPLICATIONS

- Handling of chemically and mechanically non-aggressive water and liquids (*).
- Water supply.
- Irrigation.
- Water circulation (cold, hot, refrigerated).

* For moderately aggressive liquids, a version with FPM elastomers is available (CA../..V). For very aggressive liquids, please contact our sales network.

On request "N" Version made of AISI 316 (for aggressive liquids)

- Reverse osmosis (where demineralized water is used).
- Industrial washing.
- Thermal waters.
- Chlorine dispensing in swimming pools.
- Jewellary industry.
- Wine production.

SPECIFICATIONS

PUMP

- **Delivery**: up to 210 l/min (12,5 m^3/h).
- **Head**: up to 62 m.
- **Temperature** of pumped liquid: -10°C to 85°C standard version (**).
- **Maximum** operating pressure: 8 bar (PN 8).
- Counterclockwise rotation facing the pump from the suction port.

** 110°C CA../..-V version and N version.

MOTOR

- Asynchronous, squirrel cage rotor, closed construction, external ventilation.
- **Protection class**: IP55.
- **Insulation**: class F.
- Performances to EN 60034-1 specification.
- **Standard voltage**:
  Single-phase versions:
  220-230 V, 60 Hz, 2 poles, with automatic reset overload protection up to 1,5 kW. For higher powers, the overload protection must be provided and installed by the user in the control panel.
  Three-phase version:
  220-230 / 380-400 V, 60 Hz, 2 poles, the overload protection must be provided and installed by the user in the control panel.
- Condensate drain plug in the standard version.

CONTRUCTION CHARACTERISTICS

- Close-coupled, single-impeller centrifugal pump featuring axial suction and radial discharge.
- Compact construction, with pump coupled directly to motor; special motor shaft extension supported by ball bearings.
- Rotating assembly has back pull-out design, no need to disconnect the pump body from the pipe line.
- Threaded suction and discharge ports (Rp UNI-ISO 7).
- High performance closed **impeller** made of AISI 304 stainless steel.
- **Mechanical seal** with ceramic/carbon rings, NBR elastomers, other parts are made of AISI 304 stainless steel. Mounting dimensions according to EN 12756 (ex DIN 24960) and ISO 3069.
- **NBR O-rings**
- Mounting pedestal.

OPTIONAL FEATURES

- Different voltages and frequencies.
- Different materials for the mechanical seal and O-rings.

CA SERIES
LIST OF MODELS AND TABLE OF MATERIALS

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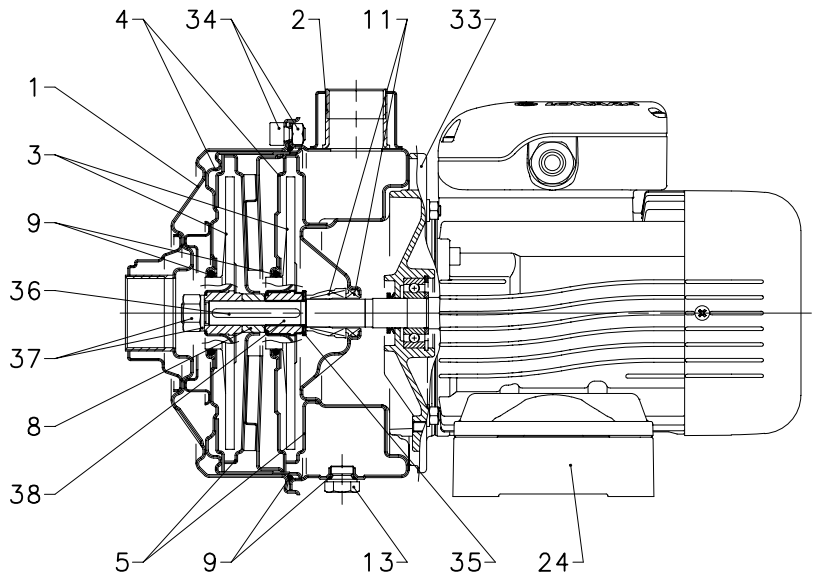


VERSIONS
CA706/33
CA1206/33
CA2006/33

ca-caN-2p60-en_a_mo

CA SERIES TABLE OF MATERIALS

REF. N.	PART	MATERIAL	REFERENCE STANDARDS	
			EUROPE	USA
1	Suction flange	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
2	Pump body	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
3	Impeller	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
4	Diffuser cover	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
5	Diffuser	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
8	Impeller spacer	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
9	Elastomers	NBR (standard version)		
11	Mechanical seal	Ceramic / Carbon / NBR (standard version)		
13	Fill/drain plugs	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
24	Mounting pedestal	Aluminium	EN 1706-AC-AlSi11Cu2 (Fe) (AC46100)	-
33	Adapter	Aluminium	EN 1706-AC-AlSi11Cu2 (Fe) (AC46100)	-
34	Pump body fastening nuts and bolds	Zinc-plated steel		
35	Impeller shoulder washer	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
36	Key	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
37	Impeller lock nut and washer	Stainless steel	EN 10088-1-X5CrNi18-10 (1.4301)	AISI 304
38	Shaft extension	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316

ca-ca-en_b_tm

CA(N) SERIES TABLE OF MATERIALS (ON REQUEST)

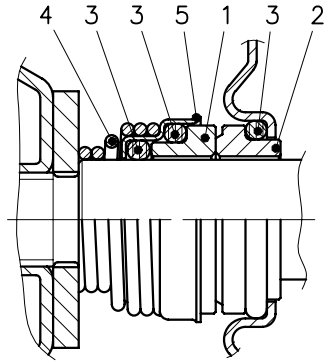
REF. N.	PART	MATERIAL	REFERENCE STANDARDS	
			EUROPE	USA
1	Suction flange	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
2	Pump body	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
3	Impeller	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
4	Diffuser cover	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
5	Diffuser	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
8	Impeller spacer	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
9	Elastomers	EPDM (standard version)		
11	Mechanical seal	Ceramic / Carbon / EPDM (standard version)		
13	Fill/drain plugs	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
24	Mounting pedestal	Aluminium	EN 1706-AC-AlSi11Cu2 (Fe) (AC46100)	-
33	Adapter	Aluminium	EN 1706-AC-AlSi11Cu2 (Fe) (AC46100)	-
34	Pump body fastening nuts and bolds	Zinc-plated steel		
35	Impeller shoulder washer	Stainless steel	EN 10088-1-X2CrNiMo17-12-2 (1.4404)	AISI 316L
36	Key	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
37	Impeller lock nut and washer	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316
38	Shaft extension	Stainless steel	EN 10088-1-X5CrNiMo17-12-2 (1.4401)	AISI 316

ca-caN-en_a_tm

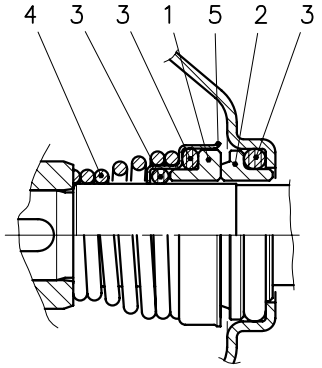
CEA-CA, MECHANICAL SEAL, ACCORDING TO EN 12756

Mechanical seal with mounting dimensions according to EN12756 (ex DIN 24960) and ISO 3069.

CEA



CA



CEA-CA, LIST OF MATERIALS

POSITION 1 - 2	POSITION 3	POSITION 4 - 5
B : Resin impregnated carbon	P : NBR	F : AISI 304
C : Special resin impregnated carbon	E : EPDM	G : AISI 316
Q_1 : Silicon carbide	V : FPM	
U_3 : Tungsten carbide		
V : Ceramic		
J : Special silicon carbide		

cea-ca_ten-mec-en_a_tm

CEA MECHANICAL SEALS

TYPE	POSITION					TEMPERATURE (°C)
	1	2	3	4	5	
	ROTATING ASSEMBLY	FIXED ASSEMBLY	ELASTOMERS	SPRINGS	OTHER COMPONENTS	
STANDARD MECHANICAL SEAL						
V B P GF	V	B	P	G	F	-10 +85
OTHER TYPES OF MECHANICAL SEAL						
VBEGG	V	B	E	G	G	-10 +110
VCEGG	V	C	E	G	G	-10 +110
Q_1CEGG	Q_1	C	E	G	G	-10 +110
Q_1Q_1EGG	Q_1	Q_1	E	G	G	-10 +110
U_3CEGG	U_3	C	E	G	G	-10 +110
U_3Q_1EGG	U_3	Q_1	E	G	G	-10 +110
U_3U_3EGG	U_3	U_3	E	G	G	-10 +110
VBVGG	V	B	V	G	G	-10 +110
VCVGG	V	C	V	G	G	-10 +110
Q_1CVGG	Q_1	C	V	G	G	-10 +110
Q_1Q_1VGG	Q_1	Q_1	V	G	G	-10 +110
U_3CVGG	U_3	C	V	G	G	-10 +110
U_3Q_1VGG	U_3	Q_1	V	G	G	-10 +110
U_3U_3VGG	U_3	U_3	V	G	G	-10 +110

cea_tipi-ten-mec-en_a_tc

CEA-CA, MECHANICAL SEAL, ACCORDING TO EN 12756

Mechanical seal with mounting dimensions according to EN12756 (ex DIN 24960) and ISO 3069.

CA MECHANICAL SEALS

TYPE	POSITION					TEMPERATURE (°C)
	1	2	3	4	5	
	ROTATING ASSEMBLY	FIXED ASSEMBLY	ELASTOMERS	SPRINGS	OTHER COMPONENTS	
STANDARD MECHANICAL SEAL						
V B P GF	V	B	P	G	F	-10 +85
OTHER TYPES OF MECHANICAL SEAL						
VBEGF	V	B	E	G	F	-10 +110
VCEGG	V	C	E	G	G	-10 +110
JQ_1EGF	J	Q_1	E	G	F	-10 +110
JU_3EGF	J	U_3	E	G	F	-10 +110
U_3BEGF	U_3	B	E	G	F	-10 +110
U_3CEGF	U_3	C	E	G	F	-10 +110
U_3U_3EGF	U_3	U_3	E	G	F	-10 +110
VBVGF	V	B	V	G	F	-10 +110
VCVGF	V	C	V	G	F	-10 +110
JQ_1VGF	J	Q_1	V	G	F	-10 +110
JU_3VGF	J	U_3	V	G	F	-10 +110
U_3CVGF	U_3	C	V	G	F	-10 +110
U_3U_3VGF	U_3	U_3	V	G	F	-10 +110

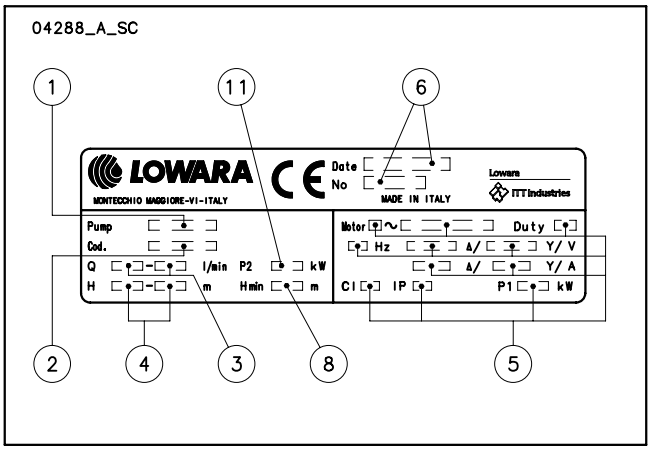
ca_tipi-ten-mec-en_a_tc

CEA-CA MECHANICAL SEALS

TYPE	POSITION					TEMPERATURE (°C)
	1	2	3	4	5	
	ROTATING ASSEMBLY	FIXED ASSEMBLY	ELASTOMERS	SPRINGS	OTHER COMPONENTS	
STANDARD MECHANICAL SEAL						
V B E G G	V	B	E	G	G	-10 +110
OTHER TYPES OF MECHANICAL SEAL						
Q_1 C E G G	Q_1	C	E	G	G	-10 +110
Q_1 Q_1 E G G	Q_1	Q_1	E	G	G	-10 +110
Q_1 C V G G	Q_1	C	V	G	G	-10 +110
Q_1 Q_1 V G G	Q_1	Q_1	V	G	G	-10 +110

cean-can_tipi-ten-mec-en_a_tc

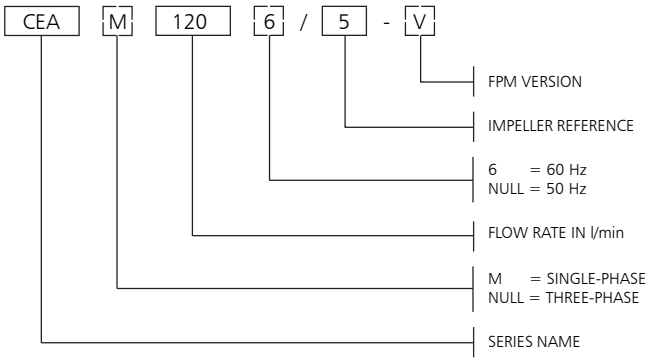
CEA-CA RATING PLATE



LEGEND

1 - Electric pump type
2 - Code
3 - Delivery range
4 - Head range
5 - Motor characteristics
6 - Date of manufacturing and serial number
8 - Minimum head
11 - Rated power

CEA SERIES IDENTIFICATION CODE



EXAMPLE : CEAM 1206/5-V
CEA series electric pump, single-phase, flow rate 120 l/min
60 Hz, impeller reference 5, FPM version.

CEA SERIES
HYDRAULIC PERFORMANCE TABLE AT 60 Hz

PUMP TYPE	RATED POWER		Q = DELIVERY																	
			l/min 0	20	30	40	60	80	120	140	160	180	240	300	315	325	360	400	440	460
			m^3/h 0	1,2	1,8	2,4	3,6	4,8	7,2	8,4	9,6	10,8	14,4	18	18,9	19,5	21,6	24	26	28
	kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER																	
CEA(M) 706/3	0,75	1	32,3	30,7	30,0	29,2	27,0	23,5												
CEA(M) 706/4	0,9	1,2	39,2	37,5	36,6	35,7	33,4	28,7												
CEA(M) 706/5	1,1	1,5	45,2	43,3	42,4	41,4	38,6	31,6												
CEA(M) 1206/1	0,55	0,75	22,1				19,1	17,7	14,4	12,2	9,8									
CEA(M) 1206/2	0,75	1	27,8				24,1	22,6	19,1	16,9	14,3									
CEA(M) 1206/3	0,9	1,2	32,8				29,1	27,7	24,1	22,0	19,6									
CEA(M) 1206/4	1,5	2	40,5				36,3	34,6	30,6	28,2	25,4									
CEA(M) 1206/5	1,85	2,5	46,6				42,2	40,4	36,0	33,4	30,6	27,4								
CEA(M) 2106/0	0,75	1	17,0						15,9	15,5	14,9	14,3	11,9	8,8						
CEA(M) 2106/1	1,1	1,5	21,1						20,4	20,0	19,5	19,0	16,9	14,0						
CEA(M) 2106/2	1,5	2	25,3						24,5	24,1	23,7	23,2	21,3	18,7	18,0					
CEA(M) 2106/3	1,85	2,5	30,0						29,4	29,1	28,8	28,3	26,7	24,3	23,5					
CEA(M) 2106/4	2,2	3	34,8						34,3	34,0	33,6	33,2	31,5	28,9	28,2	27,6				
CEA(M) 3706/0	1,1	1,5	16,9								15,9	15,6	14,4	12,8	12,4	12,0	10,8	9,1		
CEA(M) 3706/0A	1,5	2	19,8								19,4	19,2	18,4	17,2	16,8	16,5	15,4	13,8	11,9	
CEA(M) 3706/1	1,85	2,5	23,5								22,9	22,6	21,7	20,3	19,9	19,6	18,5	17,1	15,4	14,5

cea-2p60-en_b_th

CEA SERIES
ELECTRICAL DATA AT 60 Hz

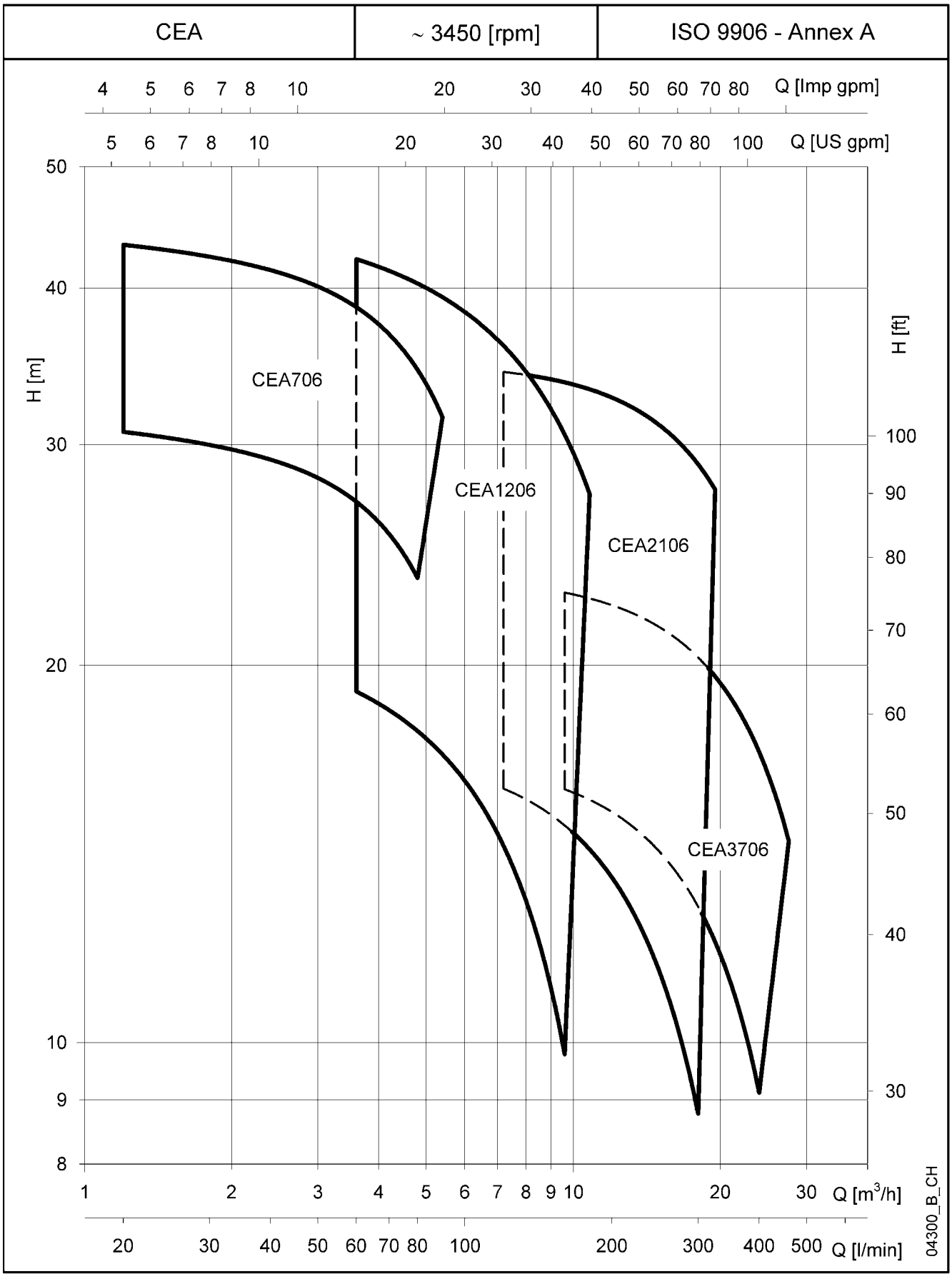
PUMP TYPE SINGLE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-230 V A	CAPACITOR μF / 450 V
CEAM 706/3	0,96	4,39	20
CEAM 706/4	1,30	5,91	25
CEAM 706/5	1,54	7,13	30
CEAM 1206/1	0,84	3,87	16
CEAM 1206/2	1,05	4,79	20
CEAM 1206/3	1,39	6,31	25
CEAM 1206/4	1,85	8,71	40
CEAM 1206/5	2,23	10,6	40
CEAM 2106/0	1,06	4,85	20
CEAM 2106/1	1,50	6,98	30
CEAM 2106/2	1,90	8,87	40
CEAM 2106/3	2,29	10,8	40
CEAM 2106/4	3,02	14,2	40
CEAM 3706/0	1,54	7,15	30
CEAM 3706/0A	1,97	9,19	40
CEAM 3706/1	2,51	11,7	40

PUMP TYPE THREE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-230 V A	INPUT CURRENT* 380-400 V A
CEA 706/3	0,89	2,93	1,69
CEA 706/4	1,15	3,65	2,11
CEA 706/5	1,40	4,17	2,41
CEA 1206/1	0,74	2,36	1,36
CEA 1206/2	0,99	3,14	1,81
CEA 1206/3	1,24	3,88	2,24
CEA 1206/4	1,70	5,09	2,94
CEA 1206/5	2,05	6,26	3,62
CEA 2106/0	1,00	3,17	1,83
CEA 2106/1	1,37	4,09	2,36
CEA 2106/2	1,75	5,21	3,01
CEA 2106/3	2,12	6,43	3,71
CEA 2106/4	2,86	8,35	4,82
CEA 3706/0	1,41	4,19	2,42
CEA 3706/0A	1,84	5,44	3,14
CEA 3706/1	2,35	7,00	4,04

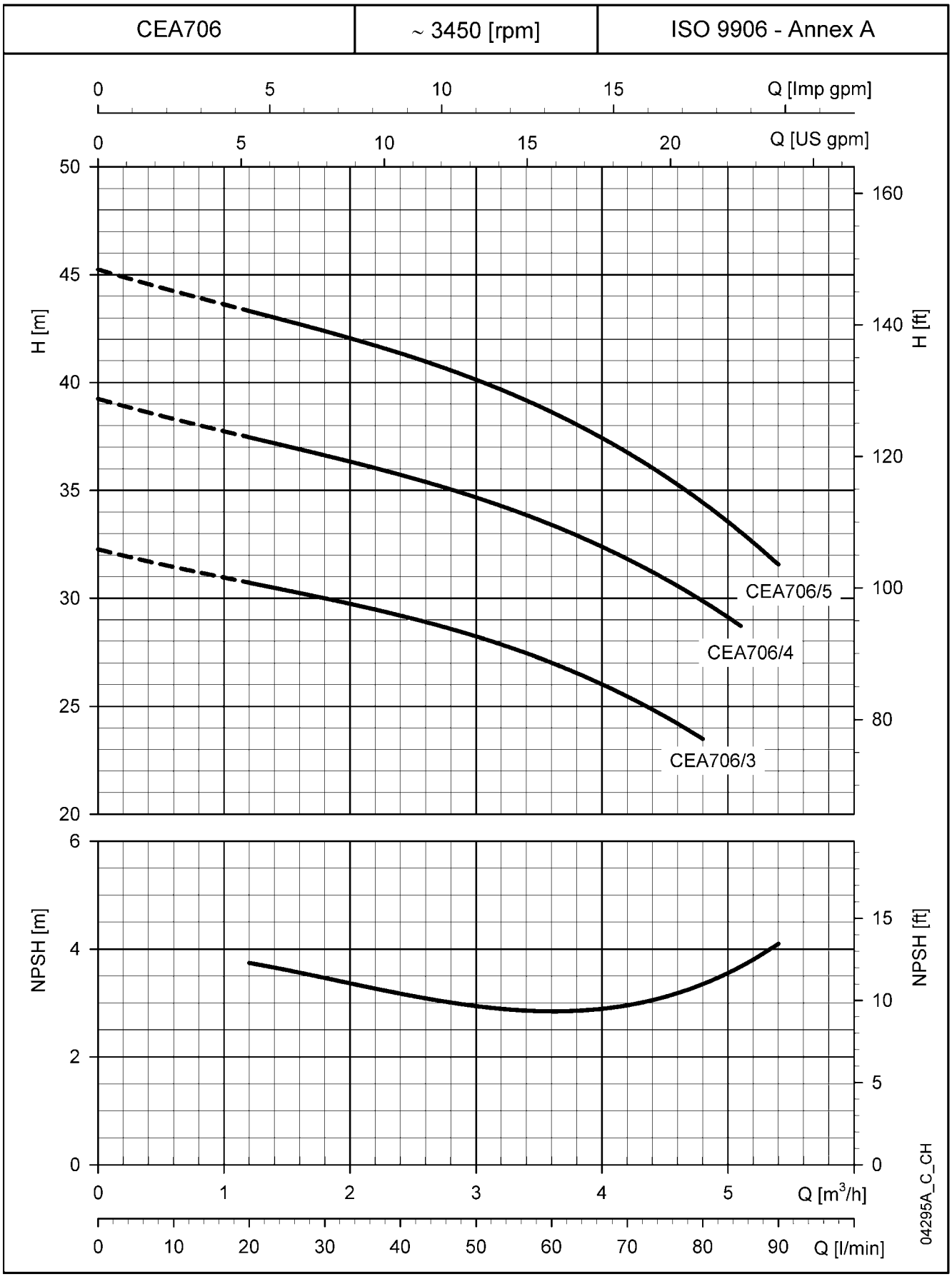
* Maximum value in specified range

cea-2p60-en_b_te

CEA SERIES
HYDRAULIC PERFORMANCE RANGE AT 60 Hz



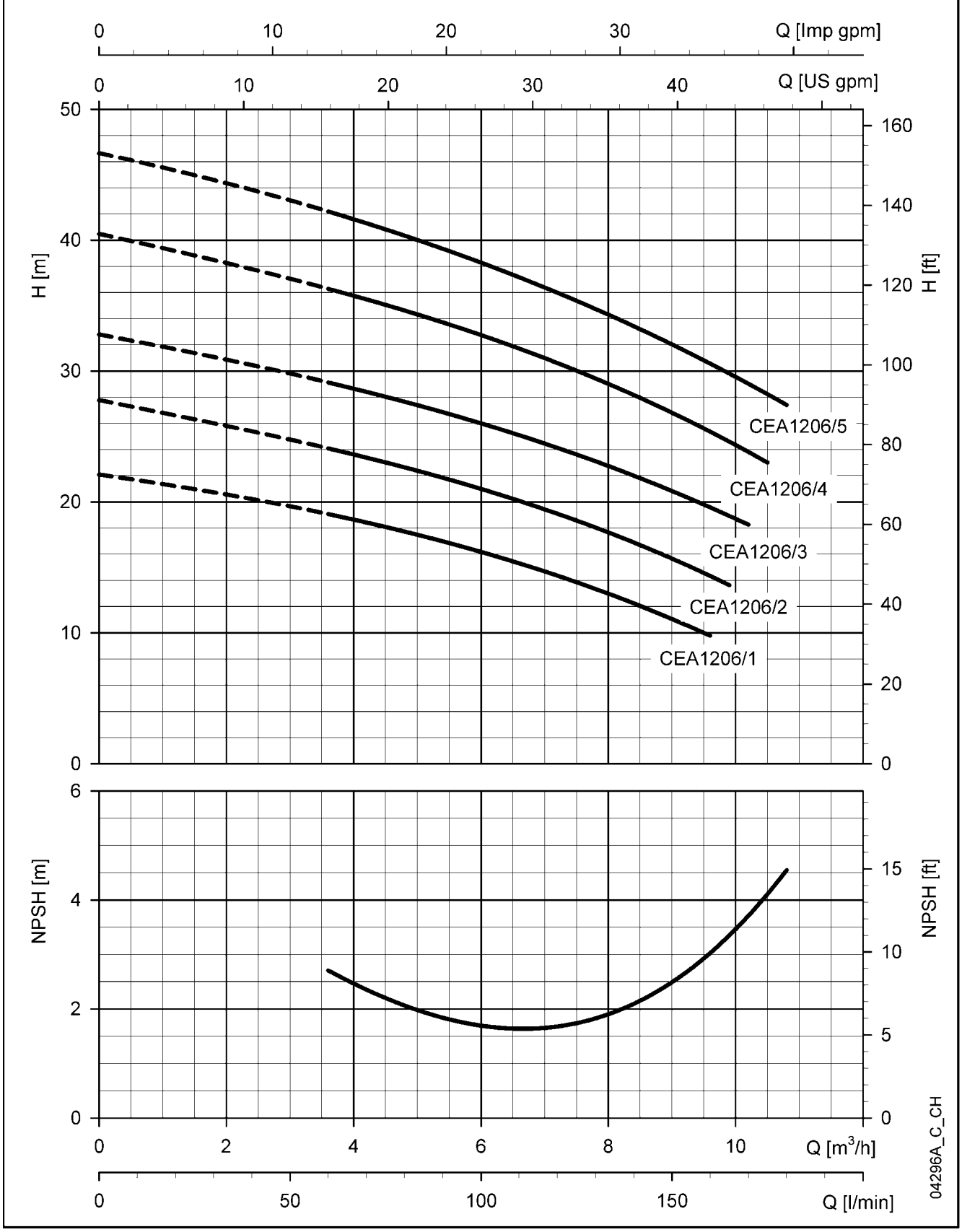
CEA706 SERIES
OPERATING CHARACTERISTICS AT 60 Hz



These performances are valid for liquids with density ρ = 1.0 Kg/dm³ and kinematic viscosity ν = 1 mm²/sec.

CEA1206 SERIES
OPERATING CHARACTERISTICS AT 60 Hz

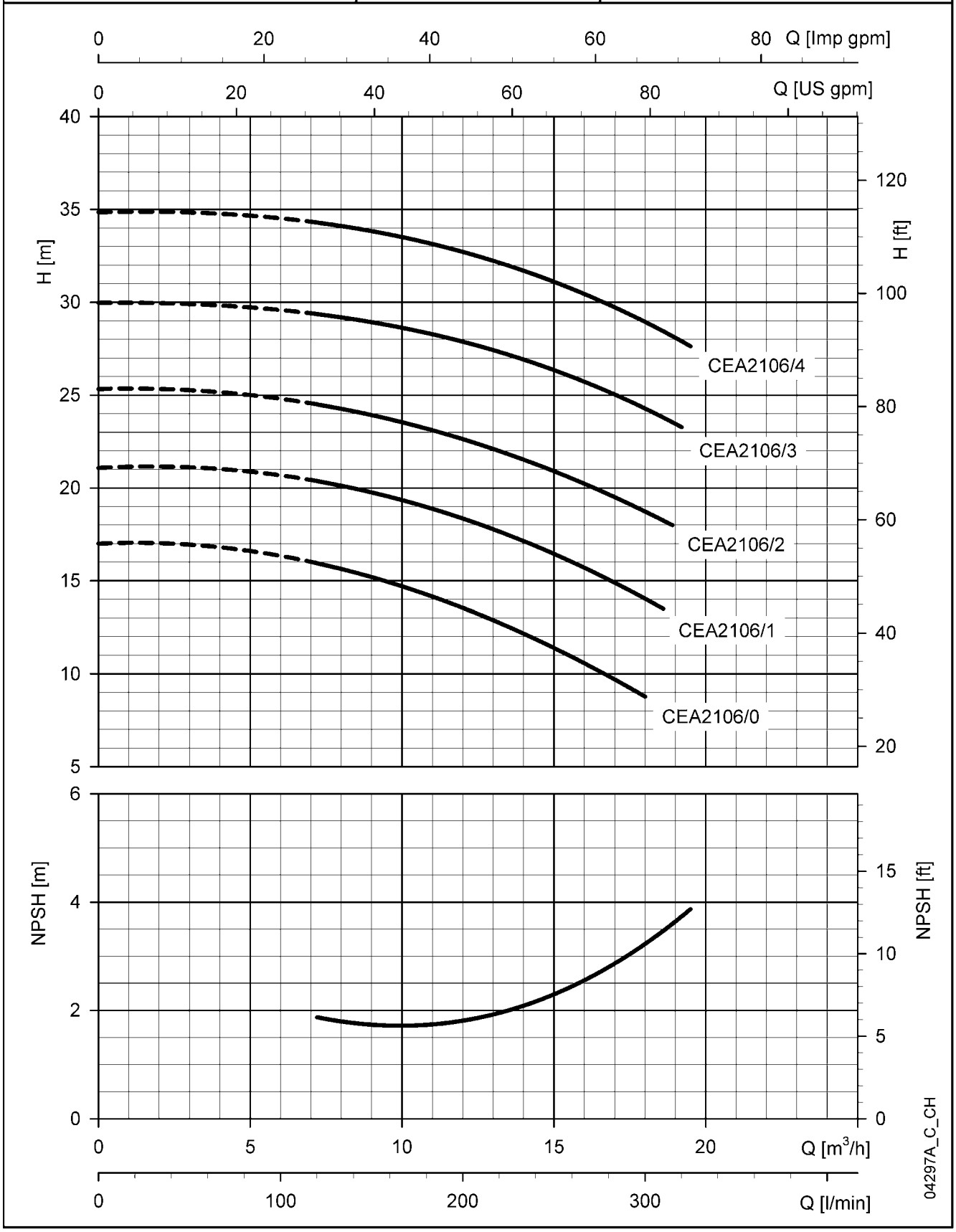
CEA1206	~ 3450 [rpm]	ISO 9906 - Annex A



These performances are valid for liquids with density ρ = 1.0 Kg/dm³ and kinematic viscosity ν = 1 mm²/sec.

CEA2106 SERIES
OPERATING CHARACTERISTICS AT 60 Hz

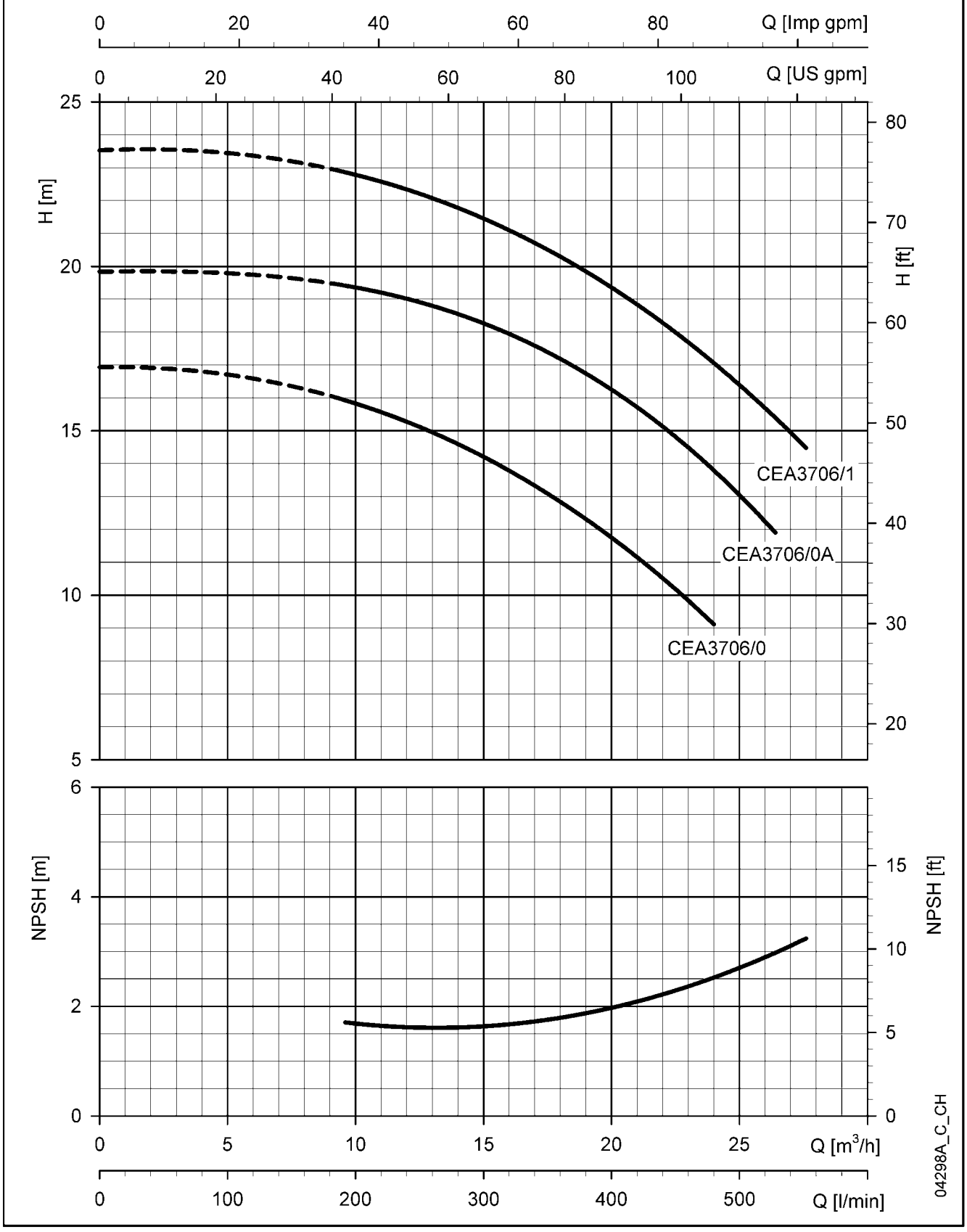
CEA2106	~ 3450 [rpm]	ISO 9906 - Annex A



These performances are valid for liquids with density ρ = 1.0 Kg/dm³ and kinematic viscosity ν = 1 mm²/sec.

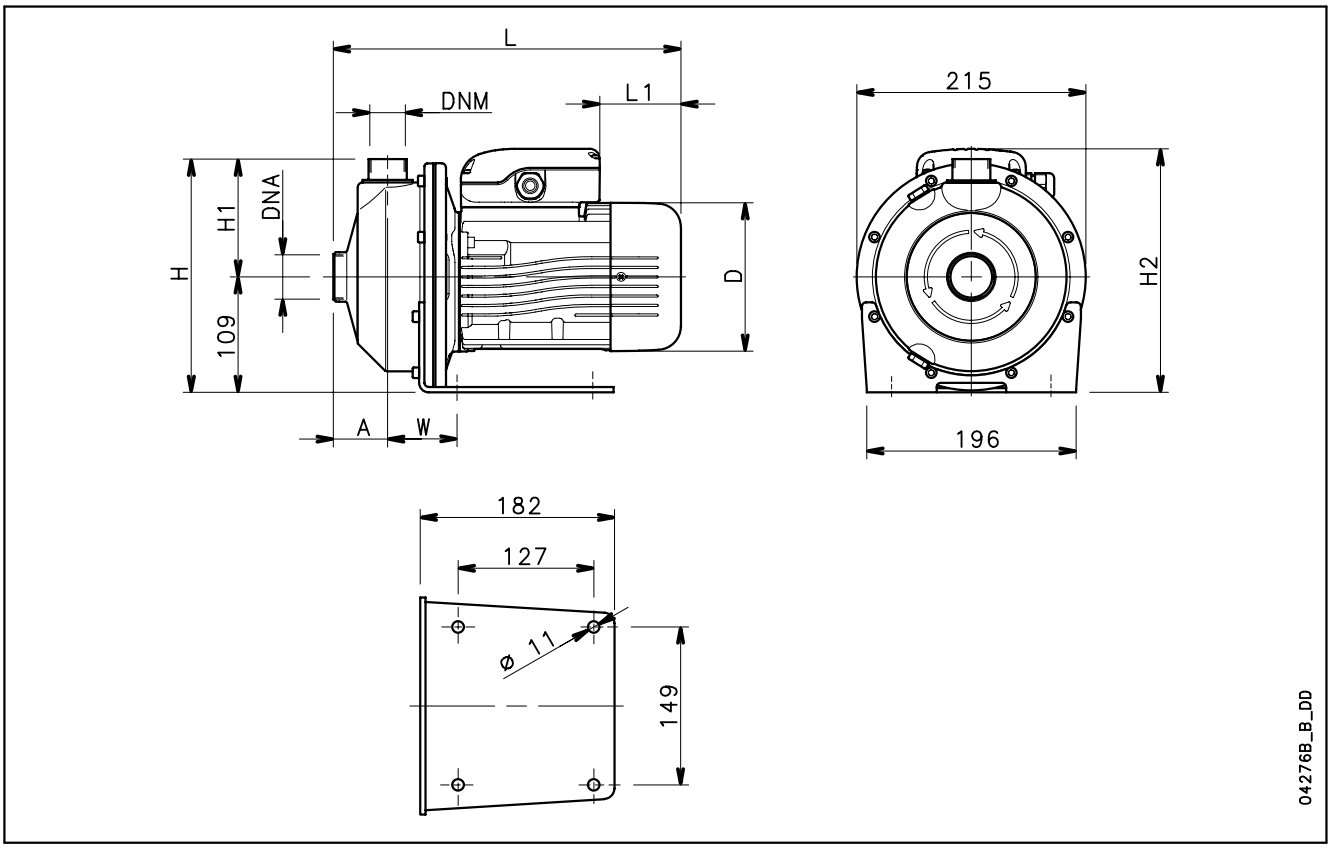
CEA3706 SERIES
OPERATING CHARACTERISTICS AT 60 Hz

CEA3706	~ 3450 [rpm]	ISO 9906 - Annex A



These performances are valid for liquids with density ρ = 1.0 Kg/dm³ and kinematic viscosity ν = 1 mm²/sec.

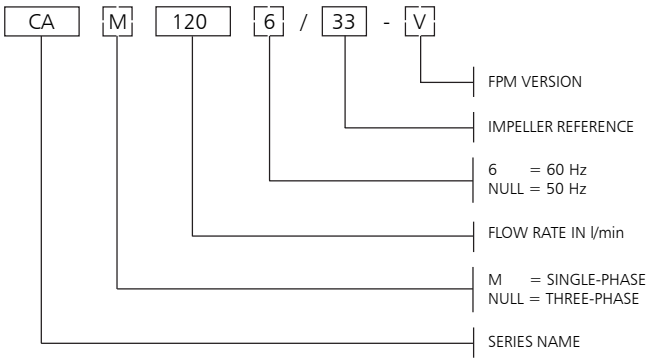
CEA SERIES
DIMENSIONS AND WEIGHTS AT 60 Hz



PUMP TYPE	DIMENSIONS (mm)								DNA	DNM	WEIGHT
	A	D	H	H1	H2	L	L1	W			kg
CEAM 706/3	51	140	220	111	230	325	76	65	Rp 1¼	Rp 1	12,8
CEAM 706/4	51	140	220	111	239	325	31	65	Rp 1¼	Rp 1	13
CEAM 706/5	51	156	220	111	246	371	69	65	Rp 1¼	Rp 1	14,5
CEAM 1206/1	51	140	220	111	230	325	76	65	Rp 1¼	Rp 1	11,7
CEAM 1206/2	51	140	220	111	230	325	76	65	Rp 1¼	Rp 1	11,7
CEAM 1206/3	51	140	220	111	239	325	31	65	Rp 1¼	Rp 1	11,7
CEAM 1206/4	51	156	220	111	246	371	69	65	Rp 1¼	Rp 1	16,7
CEAM 1206/5	51	176	220	111	230	402	114	65	Rp 1¼	Rp 1	21,5
CEAM 2106/0	54	140	222	113	230	339	76	76	Rp 1½	Rp 1¼	12,8
CEAM 2106/1	54	156	222	113	246	385	69	76	Rp 1½	Rp 1¼	16,8
CEAM 2106/2	54	156	222	113	246	385	69	76	Rp 1½	Rp 1¼	17
CEAM 2106/3	54	176	222	113	230	416	114	76	Rp 1½	Rp 1¼	21,6
CEAM 2106/4	54	176	222	113	230	416	114	76	Rp 1½	Rp 1¼	22
CEAM 3706/0	54	156	222	113	246	385	69	76	Rp 2	Rp 1¼	15
CEAM 3706/0A	54	156	222	113	246	385	69	76	Rp 2	Rp 1¼	21
CEAM 3706/1	54	176	222	113	230	416	114	76	Rp 2	Rp 1¼	15
CEA 706/3	51	140	220	111	230	325	76	65	Rp 1¼	Rp 1	11
CEA 706/4	51	140	220	111	230	325	76	65	Rp 1¼	Rp 1	12,7
CEA 706/5	51	156	220	111	238	371	114	65	Rp 1¼	Rp 1	14,5
CEA 1206/1	51	140	220	111	230	325	76	65	Rp 1¼	Rp 1	11,5
CEA 1206/2	51	140	220	111	230	325	76	65	Rp 1¼	Rp 1	12,3
CEA 1206/3	51	140	220	111	230	325	76	65	Rp 1¼	Rp 1	13
CEA 1206/4	51	156	220	111	238	371	114	65	Rp 1¼	Rp 1	14,5
CEA 1206/5	51	156	220	111	238	371	114	65	Rp 1¼	Rp 1	15
CEA 2106/0	54	140	222	113	230	339	76	76	Rp 1½	Rp 1¼	12,1
CEA 2106/1	54	156	222	113	238	385	114	76	Rp 1½	Rp 1¼	14
CEA 2106/2	54	156	222	113	238	385	114	76	Rp 1½	Rp 1¼	16
CEA 2106/3	54	156	222	113	238	385	114	76	Rp 1½	Rp 1¼	16,5
CEA 2106/4	54	156	222	113	238	385	114	76	Rp 1½	Rp 1¼	17
CEA 3706/0	54	156	222	113	238	285	114	76	Rp 2	Rp 1¼	14
CEA 3706/0A	54	156	222	113	238	385	114	76	Rp 2	Rp 1¼	16
CEA 3706/1	54	156	222	113	238	385	114	76	Rp 2	Rp 1¼	17

cea-2p60-en_b_td

CA SERIES
IDENTIFICATION CODE



EXAMPLE : CAM 1206/33-V
CA series electric pump, single-phase, flow rate 120 l/min
60 Hz, impeller reference 33, FPM version.

CA SERIES
HYDRAULIC PERFORMANCE TABLE AT 60 Hz

PUMP TYPE	RATED POWER		Q = DELIVERY											
			l/min	0	30	40	50	60	70	80	90	120	150	180	210
			m^3/h	0	1,8	2,4	3	3,6	4,2	4,8	5,4	7,2	9	10,8	12,6
	kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
CA(M) 706/33	1,5	2	62,6	58,5	56,3	53,7	50,6	46,9	42,8	38,1				
CA(M) 1206/33	1,85	2,5	64,2			58,5	56,9	55,3	53,5	51,7	45,5	38,7		
CA 2006/33	3	4	62,4						59	58,2	55,2	51,7	47,6	43,2

ca-2p60-en_b_th

CA SERIES
ELECTRICAL DATA AT 60 Hz

PUMP TYPE SINGLE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-230 V A	CAPACITOR µF / 450 V
CAM 706/33	2,01	9,32	40
CAM 1206/33	2,69	12,6	40
-	-	-	-

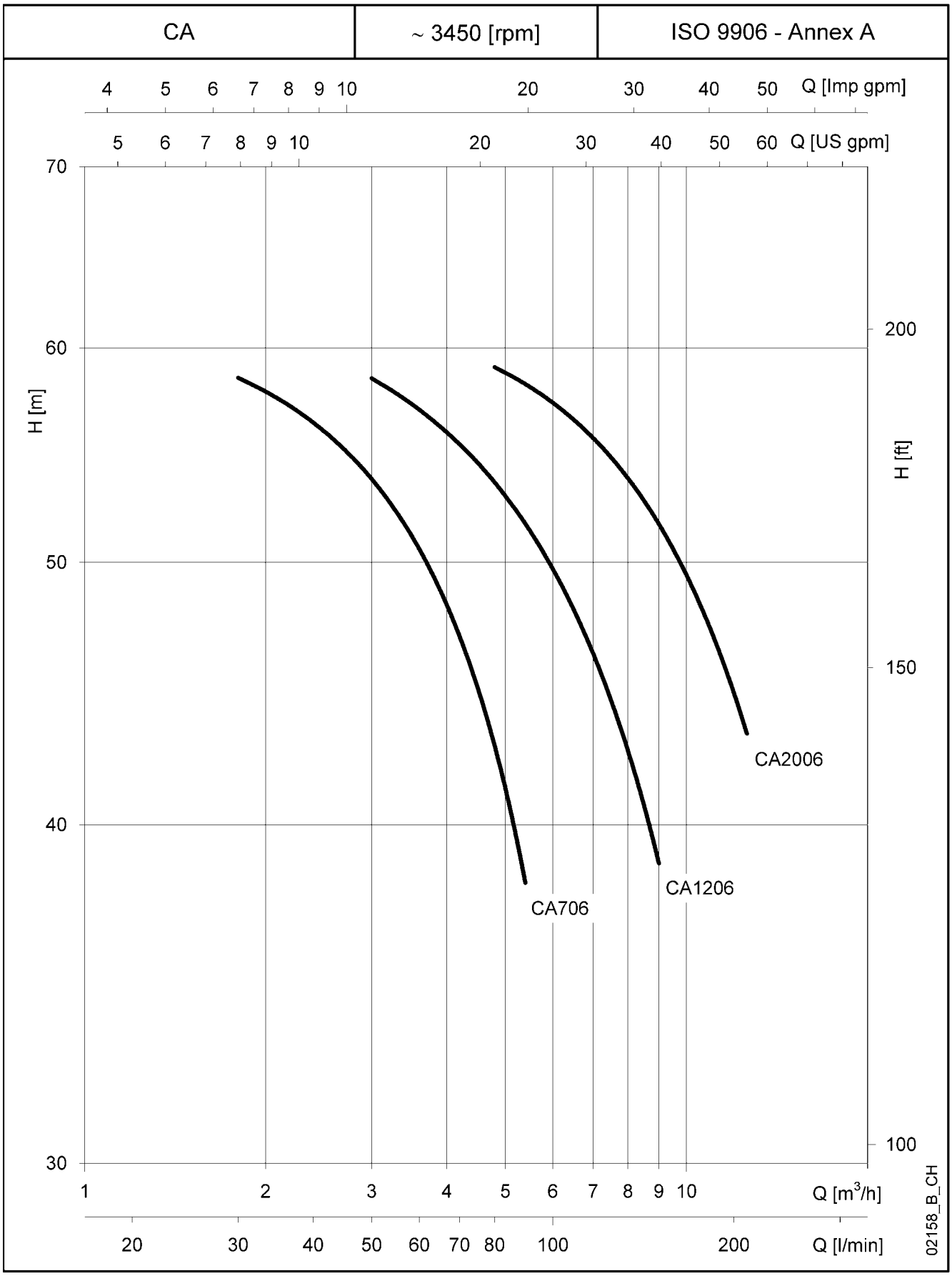
PUMP TYPE THREE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-230 V A	INPUT CURRENT* 380-400 V A
CA 706/33	1,87	5,54	3,20
CA 1206/33	2,53	7,48	4,32
CA 2006/33	3,54	10,3	5,97

* Maximum value in specified range

ca-2p60-en_b_te

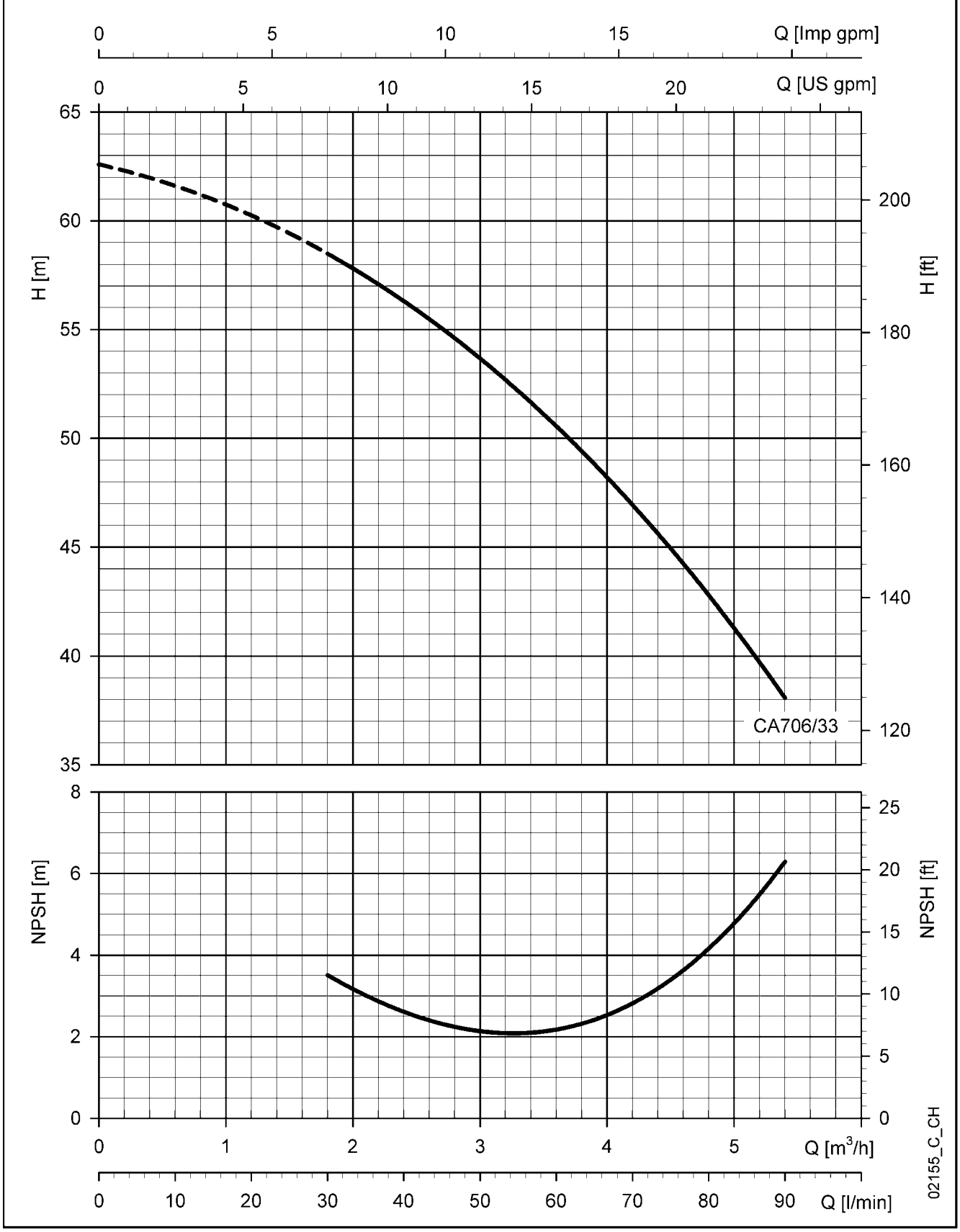
CA SERIES
HYDRAULIC PERFORMANCE RANGE AT 60 Hz

CA	~ 3450 [rpm]	ISO 9906 - Annex A



CA706 SERIES
OPERATING CHARACTERISTICS AT 60 Hz

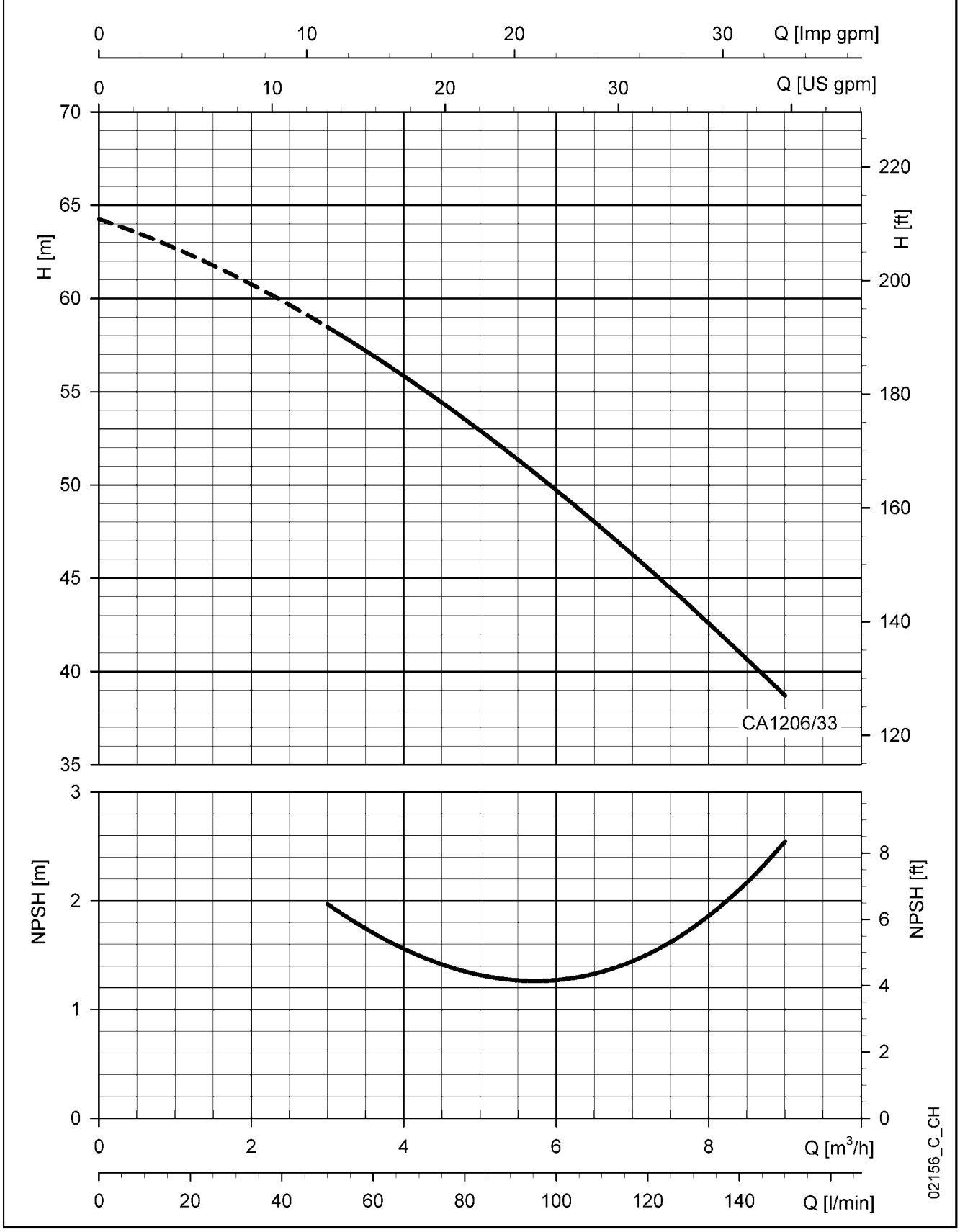
CA706	~ 3450 [rpm]	ISO 9906 - Annex A



These performances are valid for liquids with density ρ = 1.0 Kg/dm³ and kinematic viscosity ν = 1 mm²/sec.

CA1206 SERIES
OPERATING CHARACTERISTICS AT 60 Hz

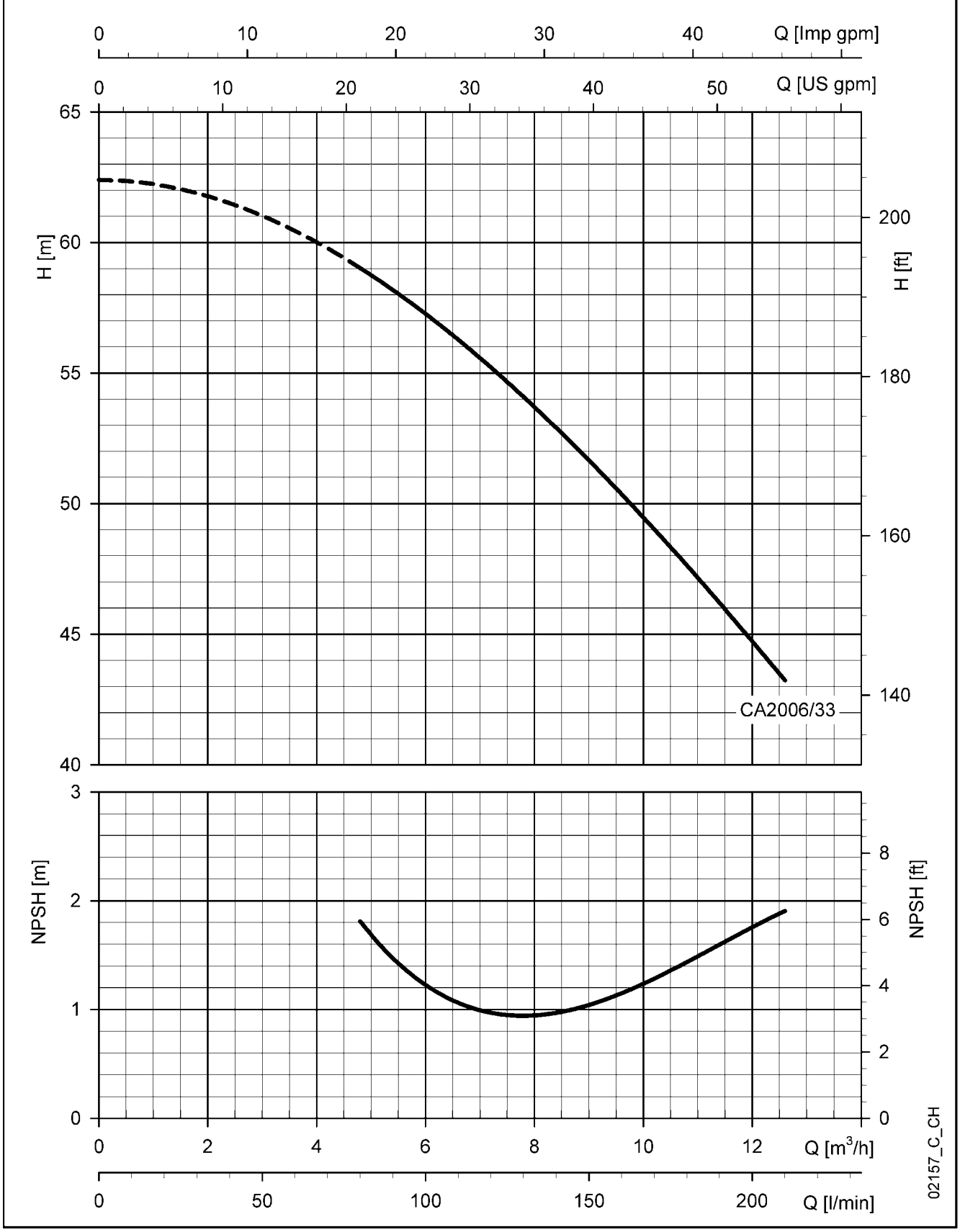
CA1206	~ 3450 [rpm]	ISO 9906 - Annex A



These performances are valid for liquids with density ρ = 1.0 Kg/dm³ and kinematic viscosity ν = 1 mm²/sec.

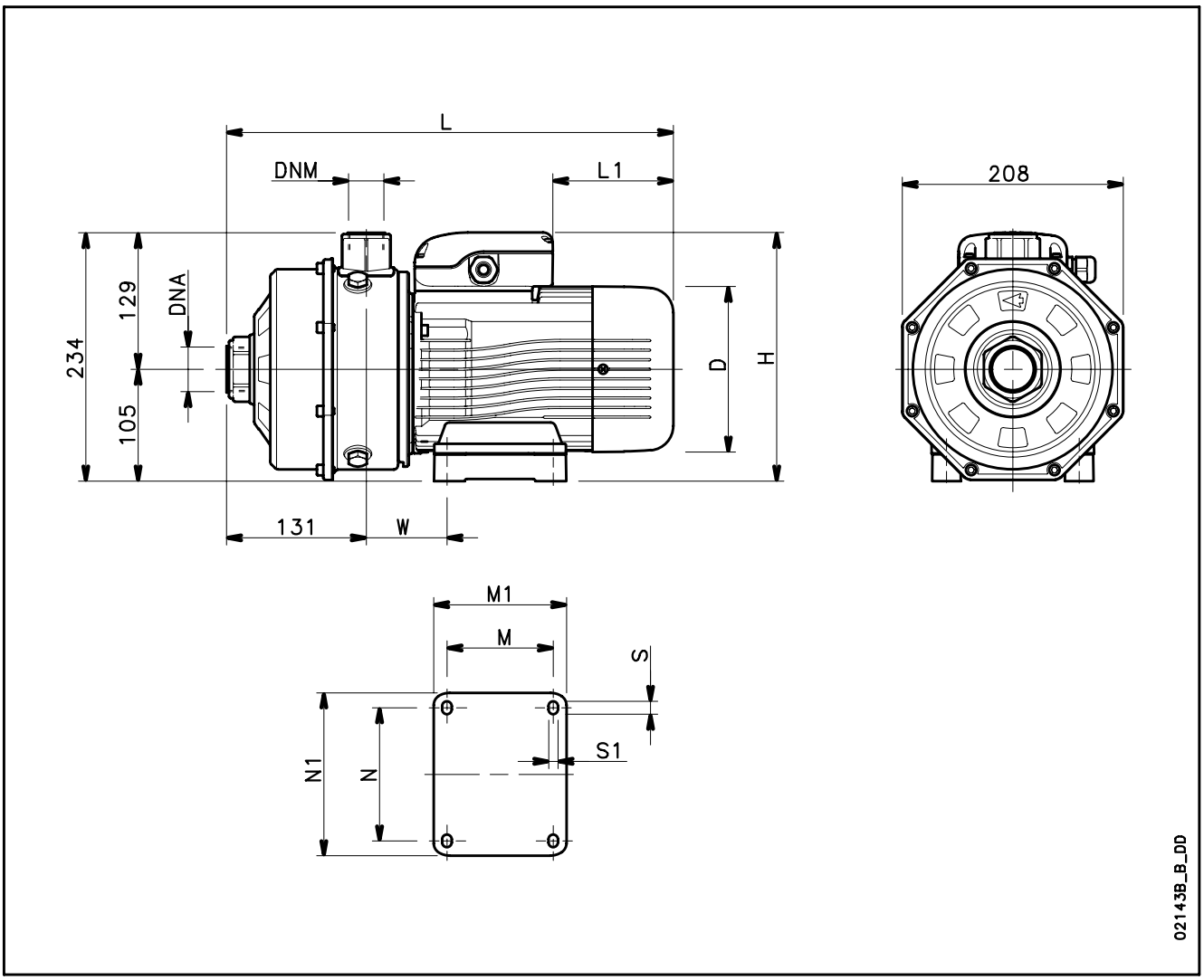
CA2006 SERIES
OPERATING CHARACTERISTICS AT 60 Hz

CA2006	~ 3450 [rpm]	ISO 9906 - Annex A



These performances are valid for liquids with density ρ = 1.0 Kg/dm³ and kinematic viscosity ν = 1 mm²/sec.

CA SERIES
DIMENSIONS AND WEIGHTS AT 60 Hz



PUMP TYPE	DIMENSIONS (mm)											DNA	DNM	WEIGHT
	D	H	L	L1	M	M1	N	N1	S	S1	W			kg
CAM 706/33	156	242	420	69	100	125	125	153	12	9	76	Rp 1¼	Rp 1	18,4
CAM 1206/33	176	226	450	114	125	156	140	170	13	9	98	Rp 1¼	Rp 1	18,2
CA 706/33	156	234	420	114	100	125	125	153	12	9	76	Rp 1¼	Rp 1	17
CA 1206/33	156	234	420	114	100	125	125	153	12	9	76	Rp 1¼	Rp 1	16,8
CA 2006/33	176	226	450	149	125	156	140	170	13	9	98	Rp 1½	Rp 1	24

ca-2p60-en_b_td

TECHNICAL APPENDIX

TYPICAL APPLICATIONS CEA AND CA SERIES ELECTRIC PUMPS

Water Purification:
Filtration
De-ionized water
Water treatment
Commercial and residential pools

Plastic Industry:
Temperature Regulators
Extrusion machines
Manufacture of polymers

Agricultural Residential Applications:
Irrigation
Greenhouses
Humidifiers
Water supply

Heating, Ventilating & Air Conditioning:
Air scrubbers
Water re-circulation
Cooling towers
Cooling systems
Temperature control
Chillers
Induction heating
Heat exchangers
Water heating
Booster packages

General Industry:
Spray booths
Light chemical transfer
Booster systems

Medical:
Laser cooling
Massage
Medical chillers
Sanitary equipment

Waste Management:
Waste treatment
Pollution control

Machine Tool:
Degreasing
Parts washing
Chemical treatment
Heat treatment

Graphics:
Film washing
Cooling processes

Marine Sector:
Water on board ships

Computers:
Circuit board washing
Unit cooling

Laundry:
Commercial washers

Food and Drink:
Food processing
Bottle washing
Citrus processing
Dishwashing
Brewing
Sanitary ware

CEA - CA SERIES

standard configuration: carbon\ceramic mechanical seal, NBR O-rings

Compatibility chart for most commonly used liquids, for other compatible liquids refer to our web page www.lowara.com

LIQUIDO / LIQUID	FORMULA	CONCENTRAZIONE / CONCENTRATION %	TEMPERATURA / TEMPERATURE - MIN (°C) - MAX (°C)	PESO SPEC. / DENSITY kg/dm_	mechanical seal materials: mechanical seal	mechanical seal materials: o-ring	TENUTA MECCANICA / MECHANICAL SEAL: STD	number A	number P	number N / Numero N
Acido Acetico (1)	CH_3 CO OH	80	-5	1.05			3	3	1	3
Acetic acid			+70		Carb. di tung. - Carb. di sil.	EPDM				
configuration code					...XPB					
Acido Citrico	$C_6H_8O_7$	5	-5	1.54			2	1	2	2
Citric acid			+70		carbon - ceramic	FPM				
configuration code					...XAA					
Acido Fosforico (1)	H_3 PO_4	20	-5	1.33			3	2	1	1
Phosphoric acid			+30		Carb. di tung. - Carb. di sil.	EPDM				
configuration code					...XPB					
Acqua	H_2O	100	-5				1	1	1	1
Water			+85		carbon - ceramic	NBR				
configuration code					standard product					
Acqua Deionizzata		100	-5							
Water deionized			+85		carbon - ceramic	FPM				
configuration code					...XAA					
Acqua Demineralizzata		100	-5							
Water demineralized			+85		carbon - ceramic	NBR				
configuration code					standard product					
Acqua di mare (4)		/	-5							
Sea water (4)			+25							
configuration code					not recommended					
Alcool Butilico	CH_3 $(CH_2)_2CH_2OH$	100	-5	0.81			1	1	2	1
Butyl alcohol			+80		carbon - ceramic	NBR				
configuration code					standard product					
Alcool Etilico		100	-5	0.81						
Ethyl alcohol (Ethanol)			+40		carbon - ceramic	NBR				
configuration code					standar product					
Alcool Metilico	CH_3OH	100	-5	0.79			1	3	1	3
Methyl alcohol			+40		carbon - ceramic	NBR				
configuration code					standard product					
Cloroformio	$CHCl_3$	/	-5	1.48			3	2	3	1
Chloroform			+30		Carb. di tung. - Carb. di sil.	FPM				
configuration code					...XNA					
Freon 112	CCl_2FCCl_2F	100	-5	1.57			2	2	3	1

						+30		Carb. di tung. - Carb. di sil.	FPM				
configuration code								...XNA					
Freon 113		CCl_2FCClF_2			100	-5	1.42			1	2	3	1
Triclorotrifluroetano						+30		carbon - ceramic	NBR				
configuration code								standard prodict					
Glicole Etilenico		CH_2OHCH_2OH			50	-5	1.13			2	2	1	1
Ethylene glycol						+80		carbon - ceramic	NBR				
configuration code								standard product					
Ipoclorito di sodio (1)		Na O Cl			0.5	-5							
Sodium hypochlorite						+25							
configuration code								non raccomandato					
Olio di Ricino					100	-5							
Castor Oil						+85		carbon - ceramic	NBR				
configuration code								standard product					
Olio Minerale					100	-5	0.94						
Mineral oil						+85		carbon - ceramic	NBR				
configuration code								standard product					
Soda Caustica		Na OH			25	0	2.13						
Caustic Soda						+70		Carb. di tung. - Carb. di sil.	EPDM				
configuration code								...XPB					
Tricloroetilene /Trichloroethylene		$CHCl:CCl_2$			/	-5	1.46			3	1	3	1
(Trielina) (1)						+40		carbon - ceramic					
configuration code								...XAA					

(X) - Richiesto battente positivo / Positive suction head required

1 = COMPATIBILITA' BUONA
2 = COMPATIBILITA' MEDIOCRE
3 = NON COMPATIBILE

1 = GOOD COMPATIBILITY
2 = POOR COMPATIBILITY
3 = NO COMPATIBILITY

(1)-Liquido pericoloso (tossico,velenoso,ustionabile ecc.)
-Dangerous liquid (toxic,poisonous,attacks skin,irritant,etc.)
(2)-Liquido infiammabile ed esplosivo
-Flammable and explosive liquid
(3)-Solo versioni a 4 poli. Four poles versions only.
(4) La compatibilità dell'accaio inossidabile dipende dal contenuto di cloro in rapporto alla temperatura del liquido, è necessaria un'analisi più dettaglata

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 apartments with one bathroom and flush tank WC

$$f = \frac{1}{\sqrt{(0{,}857 \times Nr \times Na)}}$$ Coefficient for apartments with one bathroom and controlled flushing system WC

$$f = \frac{1{,}03}{\sqrt{(0{,}545 \times Nr \times Na)}}$$ Coefficient for apartments with two bathrooms and flush tank WC

$$f = \frac{0{,}8}{\sqrt{(0{,}727 \times Nr \times Na)}}$$ Coefficient for apartments with two bathrooms and controlled flushing system WC

f= coefficient; Nr= number of delivery points; Na= number of apartments

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

TABLE OF WATER REQUIREMENTS IN CIVIL USERS

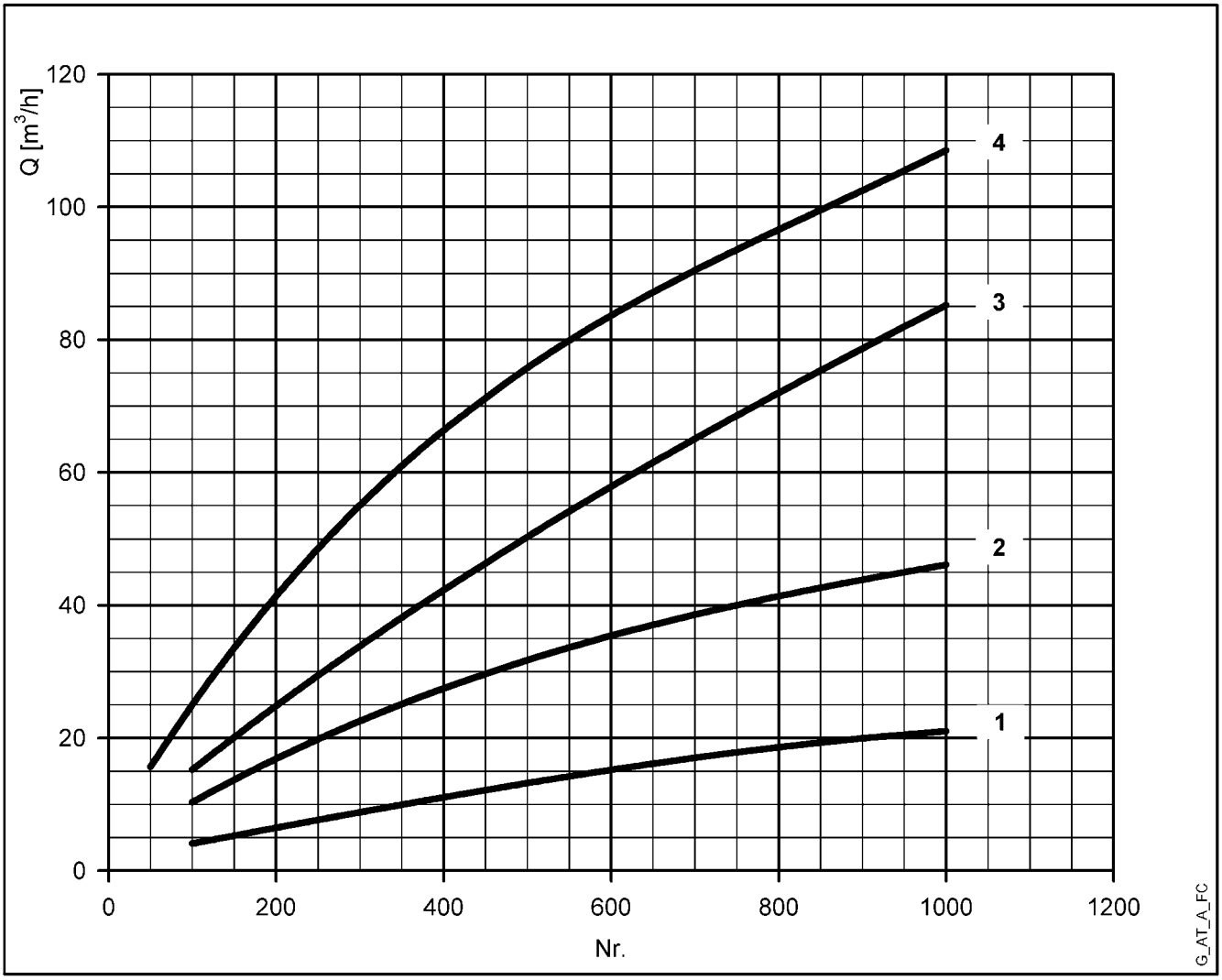
NUMBER OF APARTMENTS	WITH FLUSH TANK WC		WITH CONTROLLED FLUSHING SYSTEM WC	
	1	2	1	2
	FLOW RATE (l/min)			
1	32	40	60	79
2	45	56	85	111
3	55	68	105	136
4	63	79	121	157
5	71	88	135	176
6	78	97	148	193
7	84	105	160	208
8	90	112	171	223
9	95	119	181	236
10	100	125	191	249
11	105	131	200	261
12	110	137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

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

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)

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 36-37 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 y = 1 kg/dm³
Flow rate required: 30 m³/h
Head for required delivery: 43 m.
Suction lift: 3.5 m.
The selection is an FHE 40-200/75 pump whose NPSH required value is, at 30 m³/h, 2.5 m.

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

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

The Hf flow resistance in the suction line with foot valves is ~1.2 m.
By substituting the parameters in formula ① with the numeric values above, we have:

$$10.33 + (-3.5) \geq (2.5 + 0.5) + 1.2 + 0.17$$

from which we have: $6.8 > 4.4$

The relation is therefore verified.

TECHNICAL APPENDIX VAPOUR PRESSURE 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	221,20	0,3154

G-at_npsh_a_sc

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

FLOW RATE			NOMINAL DIAMETER in mm and INCHES																
m^3/h	l/min		15 1/2"	20 3/4"	25 1"	32 1 1/4"	40 1 1/2"	50 2	65 2 1/2"	80 3"	100 4"	125 5"	150 6"	175 7"	200 8"	250 10"	300 12"	350 14"	400 16"
0,6	10	v	0,94	0,53	0,34	0,21	0,13												
		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 100m of straight pipeline (m)
V = water speed (m/s)

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

G-a-pcv_a_th

The table is valid for the Hazen Williams coefficient C = 100 (cast iron pipework). For steel pipework, multiply the values by 1.41. For stainless steel, copper and coated cast iron pipework, multiply the values by 1.85.
When the **equivalent pipeline length** has been determined, the flow resistance is obtained from the table of flow resistance.
The values given are guideline values which are bound to vary slightly according to the model, especially for gate valves and non-return valves, for which it is a good idea to check the values supplied by the manufacturers.

VOLUMETRIC CAPACITY

Litres per minute l/min	Cubic metres per hour m^3/h	Cubic feet per hour ft^3/h	Cubic feet per minute ft^3/min	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**
16,6667	**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**

PRESSURE AND HEAD

Newton per square metre N/m^2	kilo Pascal kPa	bar bar	Pound force per square inch psi	metre of water m H_2O	millimetre di mercury mm Hg
1,0000	0,0010	1×10^{-5}	$1,45 \times 10^{-4}$	$1,02 \times 10^{-4}$	**0,0075**
1000,0000	**1,0000**	0,0100	0,1450	0,1020	7,5000
1×10^{5}	100,0000	**1,0000**	14,5000	10,2000	**750,1000**
6895,0000	6,8950	0,0690	**1,0000**	0,7030	**51,7200**
9789,0000	9,7890	0,0980	1,4200	**1,0000**	**73,4200**
133,3000	0,1333	0,0013	0,0190	0,0140	**1,0000**

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 litro	millilitre ml	imp. gallon imp. gal.	US gallon US gal.	cubic foot ft^3
1,0000	1000,0000	1×10^{6}	220,0000	264,2000	**35,3147**
0,0010	**1,0000**	1000,0000	0,2200	0,2642	0,0353
1×10^{-6}	0,0010	**1,0000**	$2,2 \times 10^{-4}$	$2,642 \times 10^{-4}$	$\mathbf{3,53 \times 10^{-5}}$
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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ITT

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