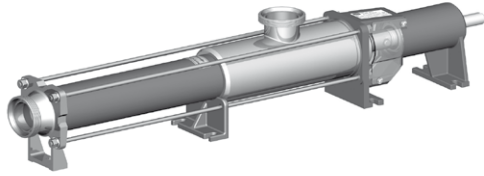


USE AND MAINTENANCE MANUAL

PROGRESSIVE CAVITY PUMPS

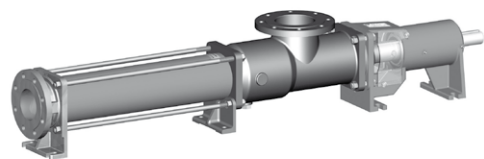
MA

EDP code: KMA



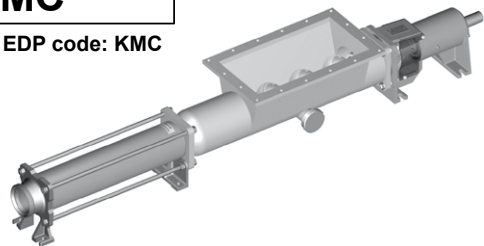
MI

EDP code: KMI



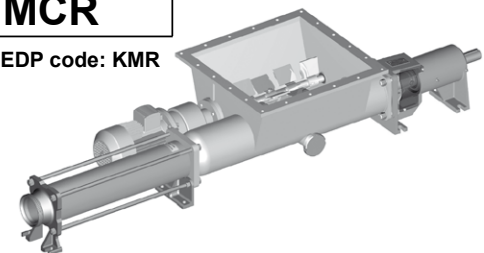
MC

EDP code: KMC



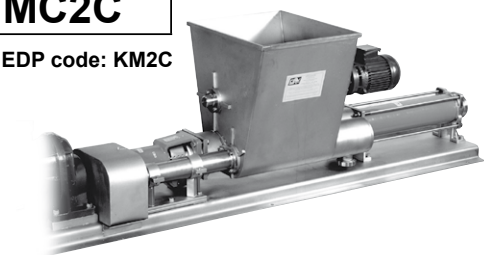
MCR

EDP code: KMR



MC2C

EDP code: KM2C



TECHNICAL SERVICE
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INTRODUCTION

- This manual contains the instructions for the C.S.F. MA, MI, MC, MCR, MC2R and MC2C series progressive cavity pumps relative to receiving delivery, installation and maintenance.

The information given herein is of a general nature. Specific information for each version is given in the respective annexes.

C.S.F. INOX SpA reserves the right to amend or modify the content of this manual without prior notice.



This instruction manual contains the information necessary to understand and use the progressive cavity pumps produced by C.S.F. INOX SpA. We recommend reading this manual and keeping it for future reference in a safe place near the pump itself.

- When requesting information, replacement parts or assistance, always specify the pump type (*) and serial number (**) indicated on the identification plate, or the complete part number given in the purchase documentation.

		POMPE - RACCORDERIA Montecchio E. - ITALY ☎ 0522869911 - http://www.csf.it	
<input type="radio"/> Modello		<input type="text" value="Item."/>	
<input type="text" value="(*)"/>			
<input type="text" value="N° (**)"/>		<input type="text" value="Giri"/>	
<input type="text" value="kW"/>	<input type="text" value="Volt"/>	<input type="text" value="Hz"/>	

Plate example

SYMBOLS

WARNING	Pay great attention to the text parts indicated by this symbol.
	Danger: the non-observance of instructions can cause serious damages to persons and/or objects.
	Danger: only skilled personnel is allowed to carry out operations concerning the electric parts.

1 DESCRIPTION

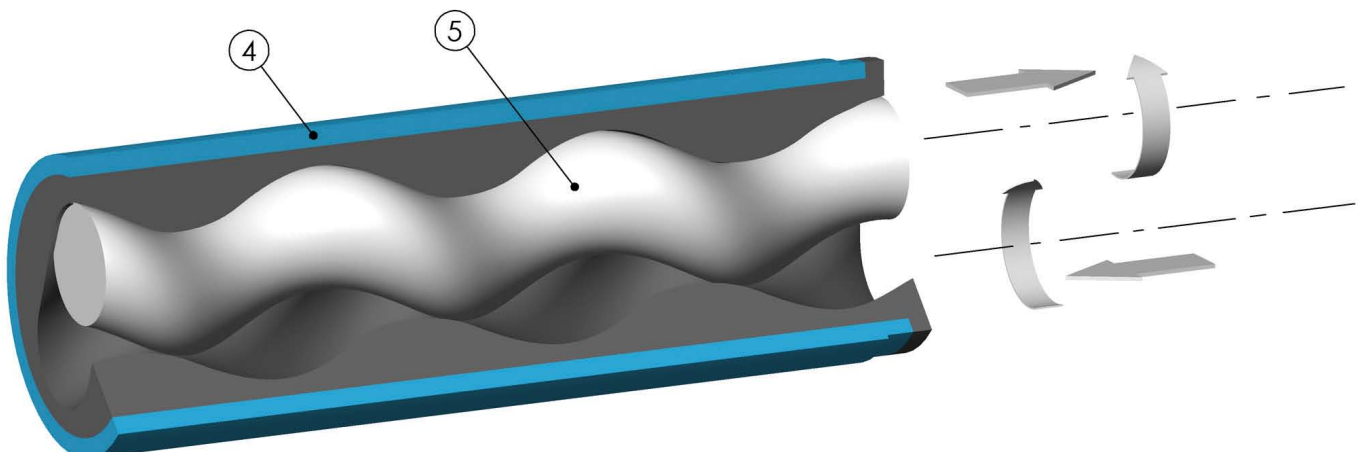
Progressive cavity pumps, also known as single screw pumps, are machines with a single rotating shaft assembly consisting of a steel helical rotor (5) (also available in different materials and with different surface coatings) installed in a vulcanised rubber stator (4), made from different rubber compounds for use with viscous, high density and abrasive liquids and with liquids containing material in suspension.

The main functional components of a progressive cavity pump are the rotor and the stator.

The rotor (5) is a circular cross section single-start screw with a very large pitch. The stator (4), which is normally made from rubber, is vulcanised inside a steel pipe. The stator has a hollow core in the shape of a two (or three) start screw, with the same circular cross section as the rotor and double the pitch of the rotor.

The rotor rotates within the stator in a hypocycloidal motion, during which the cavities between the rotor and the stator move in a helical motion, transporting the fluid trapped within from the suction end to the delivery end. The mechanism is illustrated schematically in the following picture, which shows the longitudinal profiles of the rotor and the stator and the significant cross sections for a given instant in their relative motion.

Inverting the direction of rotation swaps the suction and delivery ends.



2 APPLICATIONS

Progressive cavity pumps are predominantly used for pumping viscous (up to 800,000 centiPoise), delicate and abrasive products and liquids containing solid particulate in suspension. They are primarily used in the foodstuff and beverage, pharmaceutical, chemical, textile and ceramics industries and in water purification and treatment plants.

Progressive cavity pumps are self priming: these pumps are capable of aspirating a column of water approximately 7 metres high in standard operating conditions. The elastomer used determines the maximum temperature of the fluid pumped and the fluid itself is transported in constant, uniform quantities and without pulsing phenomena, meaning that it is not subjected to centrifuging or mistreatment and therefore maintains its quality and organoleptic characteristics intact.

N.B. Please consult the technical specifications sheet defined with the order for the correct applications for your pump.

2.1 CRITERIA FOR CHOOSING A PUMP

A diagram is used in which the operating conditions, determined by the sliding speed between the rotor and stator (in m/s), and the characteristics (abrasiveness and viscosity) of the fluid, must be entered. Once the theoretical flow rate (in m³/h) has been defined, the rotational speed (in rpm) and size of the pump may be determined from the line corresponding to the type of fluid used. For each type of pump, defined by size and number of stages, there are characteristic curves determined by the differential pressure between the delivery and suction ends, which may be used to derive the rotational speed and power absorption from the flow rate. This power value is with reference to operation with clean water at 20 °C (see diagram pict 1).

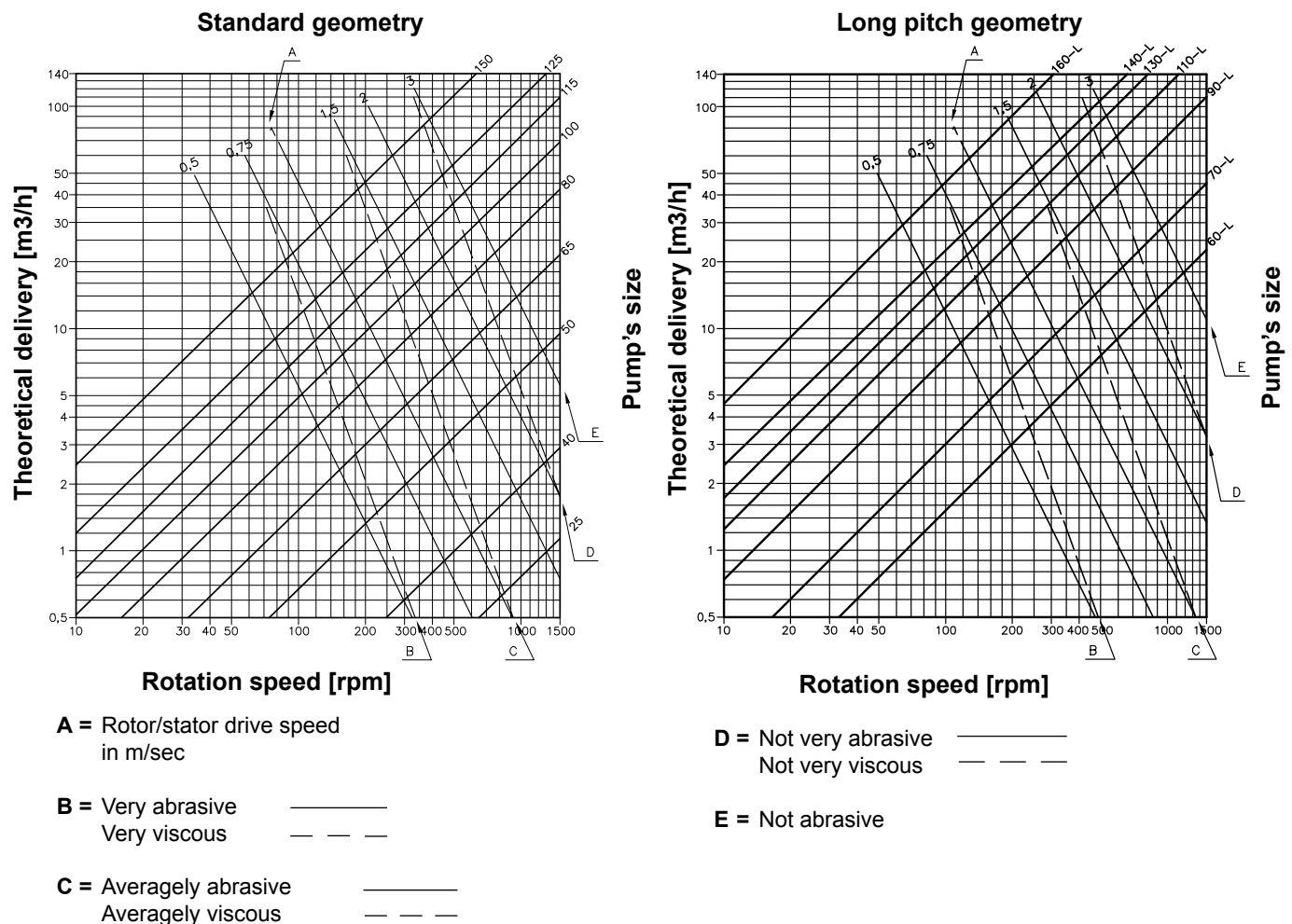
The number of stages chosen depends on the maximum permissible pressure per stage in relation to the abrasiveness of the product, quantified by the values given in the following table:

Abrasiveness of the product				Maximum admissible pressure for stage (bar)
Nil	Low	Medium	High	
6	4,5	3	2	

When aspirating from low pressure, a 2 stage pump must always be used, while inverting the direction of rotation of the rotor causes the pump to aspirate from the delivery end, offering improved suction and avoiding tightness problems associated with low pressures.

(Pict. 1)

DIAGRAM FOR THE CHOICE OF SCREW PUMPS



3 SAFETY WARNINGS

WARNING When the pump is working the following occurs:

- Electric parts are in tension.
- Mechanical parts are moving.
- Pump body, pipelines and articulations are under internal pressure. Therefore do not remove any protection or locking, do not loosen screws or clampings, as this can cause serious damages to persons or objects.
- Non-observance of inspection and maintenance can cause damages to persons and objects, especially when dangerous or toxic liquids are pumped.



- When pumping liquids at a temperature over 60° C, adequate protection and warning signals are required.

- When you buy a pump with bare shaft, motor coupling operations have to be carried out according to technical directions and law, providing adequate protections for joints, gear belts, etc.



- Operations on the electric parts have to be carried out by skilled personnel, according to technical directions and law, on authorisation of the responsible installer.

- Installation must ensure an adequate ventilation, in order to cool the engine, as well as enough space for maintenance operations.

Before carrying out any operation which requires to disassemble the pump (inspection, cleaning, seal replacement, etc.), the following preliminary operations have to be carried out:

- switch off engine tension and disinsert electric connection;
- close valves on suction and outlet pipelines, in order to avoid the risk of inundation;
- use adequate protections for hands and face, if the pump contains liquids which are injurious to health (for example acids, solvents, etc.);
- consider if the liquid which flows out of the pump when disassembling is dangerous and arrange for adequate safety measures.

Only suitably qualified personnel must carry out inspection, maintenance and assembly work.

3.1 GUARANTEE

All products manufactured by C.S.F. Inox are guaranteed to the purchaser, for one year from the date of purchase, against hidden defects in materials or manufacture, providing that they are installed and used according to instructions and recommendations of the manufacturer. Excluded from the guarantee other than distinctive wear and tear are repairs to damage caused by improper use, abrasion, corrosion, negligence, defect of installation, non-observance of inspection and maintenance, use of non-genuine spare parts, cause of accident or fortuity and from any action carried out by the purchaser not according to the normal instructions of the manufacturer.

WARNING Before returning to C.S.F. Inox S.p.A. any item to be substituted or repaired under guarantee, inform about the problem the Customer Assistance Office and follow instructions of the manufacturer.

Any item must be properly packed in order to avoid damages during the transferring and a technical report explaining the fault occurred, must accompany the returned item/s.

Any item with a presumed fault should be returned to C.S.F. Inox S.p.A. with shipment costs at purchaser's charge, unless different agreements are given.

C.S.F. Inox S.p.A. will examine, repair and/or replace the returned piece and then send it back to the purchaser on ex-works basis. Should the piece be found under warranty, no further costs will be debit the purchaser. If, on the contrary, the fault is not found under warranty, all necessary reparations and replacements will be charged at normal cost to the purchaser. Commercial parts incorporated in C.S.F. products are guaranteed by their corresponding manufacturers.

3.2 NON PERMITTED USES

The pump has to be installed in an environment adequate to the engine safety level; you can check the safety level on the engine plate before installation.



THEREFORE IT IS FORBIDDEN TO USE THE PUMP IN ENVIRONMENTS REQUIRING A HIGHER SAFETY LEVEL OF THE MOTOR AND OF THE ELECTRIC COMPONENTS.

In this case use only components which conform to safety measures according to the environment.

4 GOODS TRANSPORTATION, RECEIVING AND TRANSFERRING

4.1 TRANSPORTATION

The packings of all pumps manufactured by C.S.F. Inox S.p.A. are defined when placing the order. Unless prior arrangements are given, goods will be packed only for transit conditions and not for long-term storage; in case it should be necessary to store the pumps outside, you are requested to cover the pumps appropriately in order to protect the electrical parts (motor) from rain, dust, humidity etc.

4.2 RECEIVING

By goods receiving, the wholeness of packing must be verified, in order to identify possible damages to the content occurred during transferring and to claim them immediately to the carrier. Should any damage be ascertained, the following procedure must be observed:

- collect the goods with reservation;
- take the necessary pictures showing the damages;
- notify the suffered damages, by registered airmail, to the carrier by sending at the same time the pictures taken to show the damaged pieces.

4.3 TRANSFERRING

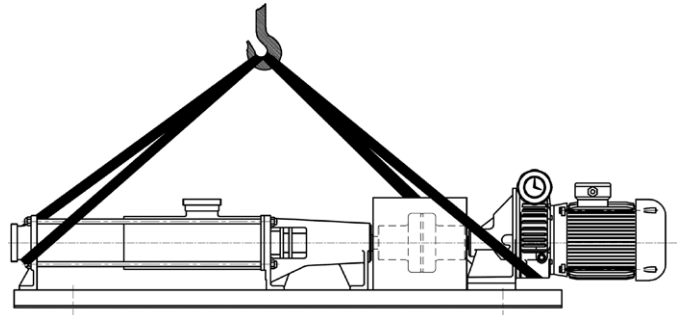


Carry the packed pumps as close as possible to the place of installation by means of appropriate lifting devices and unpack them. During this operation take care, as unsteady parts could fall down.

The material used for packing (wood, paper, cellophane, etc.) should be properly got rid, according to the corresponding rules in force in receiver's country.

After unpacking the pump, use special lifting belts and move the pump-motor-set to the place of installation; never use the eyebolts on the motor to move the pump, as the eyebolts are for moving the motor only.

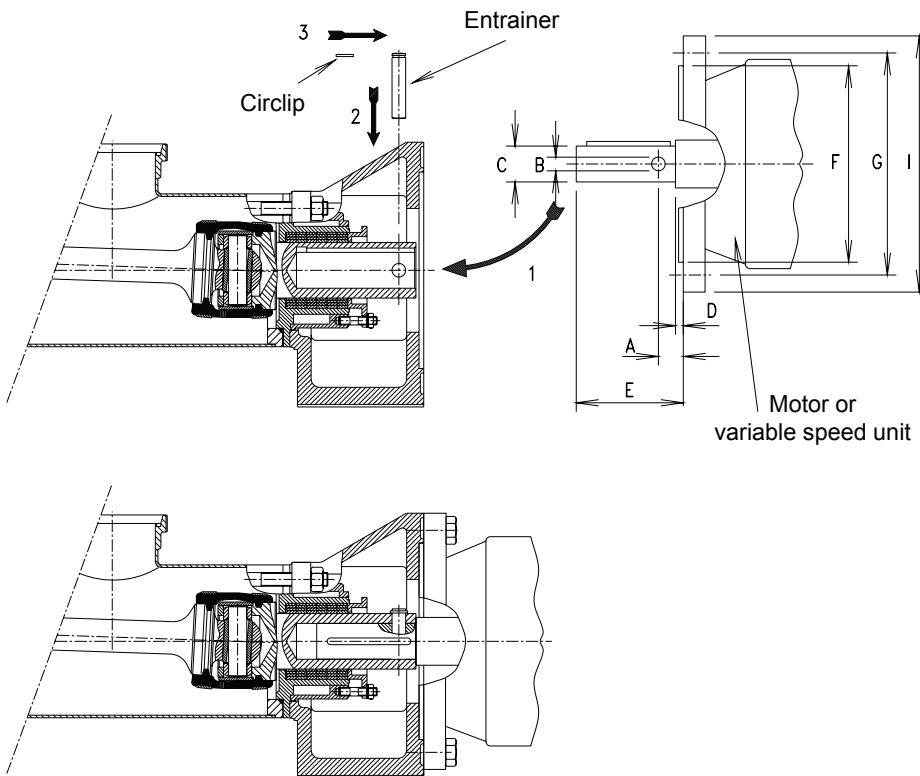
In versions complete with shroud, take the shroud off before moving the pump-motor-set, in order to avoid damages.



5 MOTOR INSTALLATION

5.1 MONOBLOCK "E" VERSION

The telescopic shaft assembly makes maintenance simply and quicker. In the "E" version, the shaft must project by the dimension specified in the following tables in order to mate the pump to the motor.



Flange dimension			
TYPE	F	G	I
M 25	70	85	105
M 40	110	130	160
M 50	130	165	200
M 55	130	165	200
M 60	130	165	200
M 65	180	215	250
M 70	180	215	250
M 80	180	215	250
M 90	180	215	250
M 100	230	265	300
M 110	230	265	300
M 115	230	265	300
M 125	230	265	300
M 130	230	265	300
M 140	230	265	300
M 150	230	265	300
M 151	230	265	300
M 160	230	265	300
<small>Mot. IEC 132</small>			
M 125	250	300	350
M 130	250	300	350
M 140	250	300	350
M 150	250	300	350
M 151	250	300	350
M 160	250	300	350
<small>Mot. IEC 160,180</small>			

Shaft projection

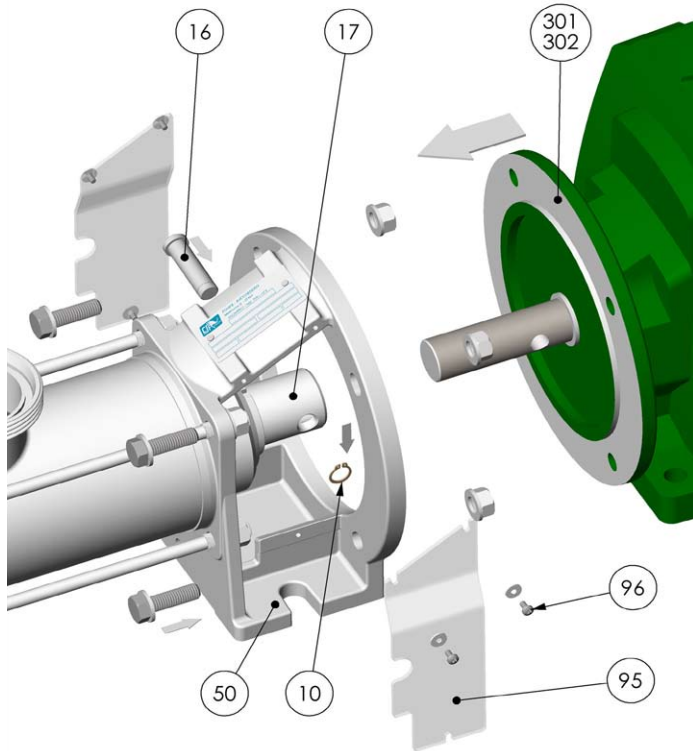
	M25	M40	M50	M55	M60	M63	M65	M70	M80	M83	M90	M100	M103	M110	M115	M125	M130	M140	M150	M151	M160
A	15	20	25	25	25	25	25	25	26	26	26	30	30	30	30	32	32	32	32	32	32
B (H7)	15	8	10	10	10	14	14	14	16	16	16	16	16	16	16	18	18	18	18	18	18
C (j6)	14	19	24	24	24	32	32	32	35	35	35	42	42	42	42	55	55	55	55	55	55
D	0	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
E	30	50	80	80	80	100	100	100	100	100	100	120	120	120	120	120	120	120	120	120	120

5.2 MOTOR ASSEMBLY

When mating the motor to the pump, spread anti-seize grease over the projecting portion of the motor shaft, then insert the motor shaft into the pump drive shaft (17), correctly aligning the hole in the pin (16).

Fasten the motor (301-302) to the lantern flange (50) with the bolts, then fit the pin (16) and the retainer circlip (10).

Failing to align the hole in the drive pin correctly will offset the internal pump shaft assembly and may cause it come into contact with the structure, causing damage to the pump or compromising pump function. Fasten the guards (95), tightening the screws (96) onto the lantern flange (50).



REMOVING THE MOTOR

Work in a clean area away from sources of dust, swarf etc. Ensure that the pump cannot move during disassembly.

Undo the screws (96) and remove the guards (95). Use suitable needle-nosed pliers to remove the retainer circlips (15) and use a pin punch to remove the drive pin (16). Undo the bolts on the lantern flanges (50) then ease out the motor (301-302).

Do not tilt the motor: the motor must be removed in a perfectly horizontal motion to prevent damaging the mechanical seal on the drive shaft (17).

N.B. When separating the motor from the pump, the pump must be supported with hoisting straps to prevent damage.

5.3 "N" VERSION

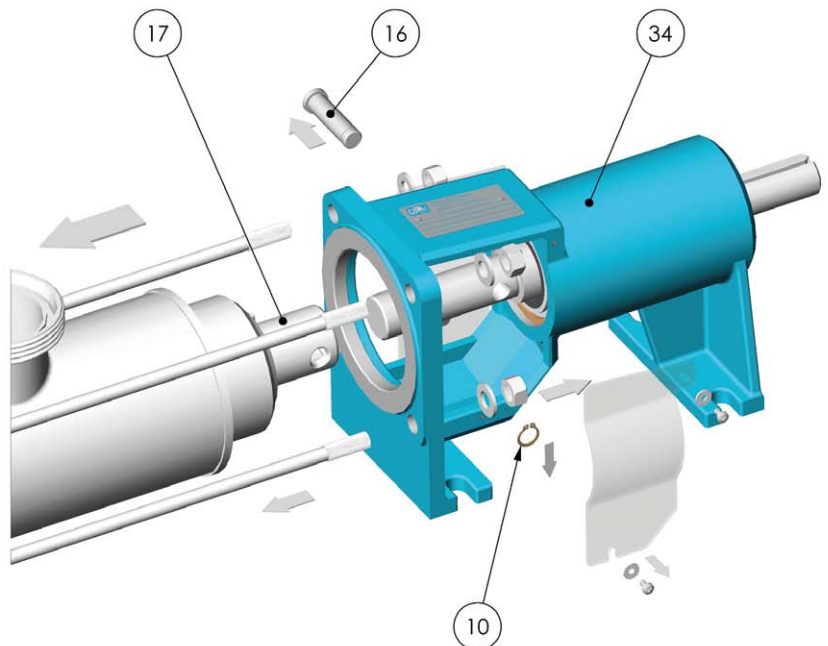
With dual bed mountings and greased bearings.

40, 50, 60, 65, 70, 80 and 90 sized models are sealed and lifetime lubricated.

100, 110, 115, 125, 130, 140, 150, 151, 160 and 200 sized models are equipped with lubricating nipples for periodically topping up the lubricant.

As with the "E" version, the shaft assembly is telescopic for rapid disassembly.

Using a suitable mounting base and flexible coupling, these pumps may be mated to any type of motor system (see page 18 - progressive cavity pump catalogue).



5.4 MOTOR TRANSMISSION COUPLINGS

Drive for independently mounted progressive cavity pumps is transmitted via flexible couplings designed to absorb impact and torsional vibration.

These couplings compensate for both angular and radial misalignment and can sustain variations in load and rotation inversion.

The couplings are sized in compliance with DIN 740/2 standards.

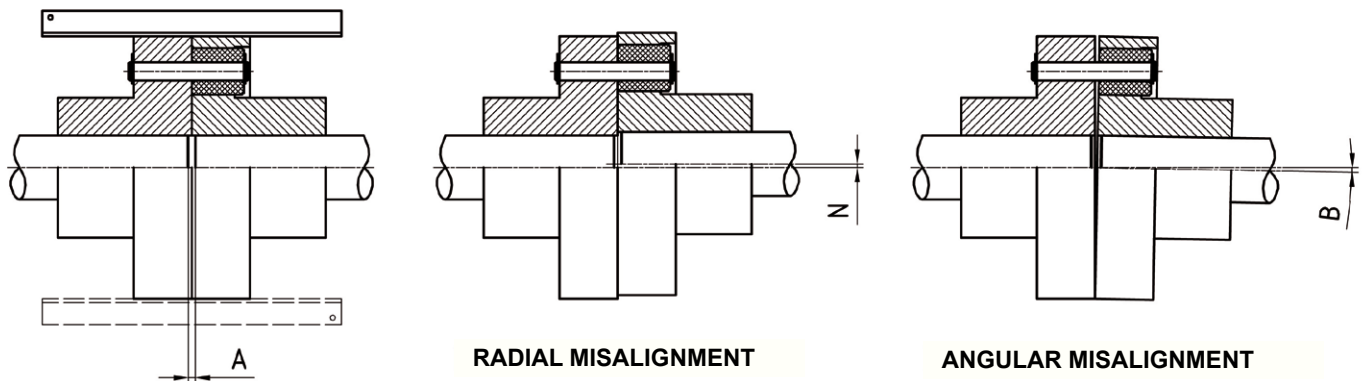
A coupling is sized so that the maximum moment transmitted by the coupling in different operating conditions is less than the maximum permissible strain for the coupling itself.

Transmission couplings with ATEX marking are available for machines for use in potentially explosive environments.

Pumps supplied complete with motor and base are delivered already aligned during assembly. The baseplate may be warped, however, if fixed to an uneven surface.

Perfect alignment between the pump and motor is essential for correct operation.

As a result, after installation, we recommend checking pump-motor alignment once again, using the values given in the following table as reference.

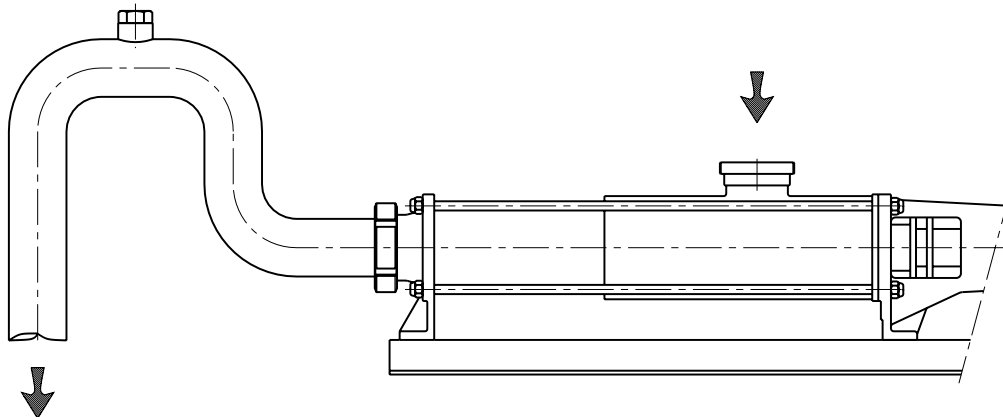


Coupling size	A (mm)	N (mm)	B (°)	Pmax. (kW)	Rated torque (N.m)
38/45	24	1	1,30	3	325
42/55	26	1	1,30	4	450
P155	5	0,4	1	5,5-7,5	650
P175	5	0,4	1	7,5-15	1300
P200	5	0,4	1	18,5-22	1800
P225	5	0,4	1	22-37	2500

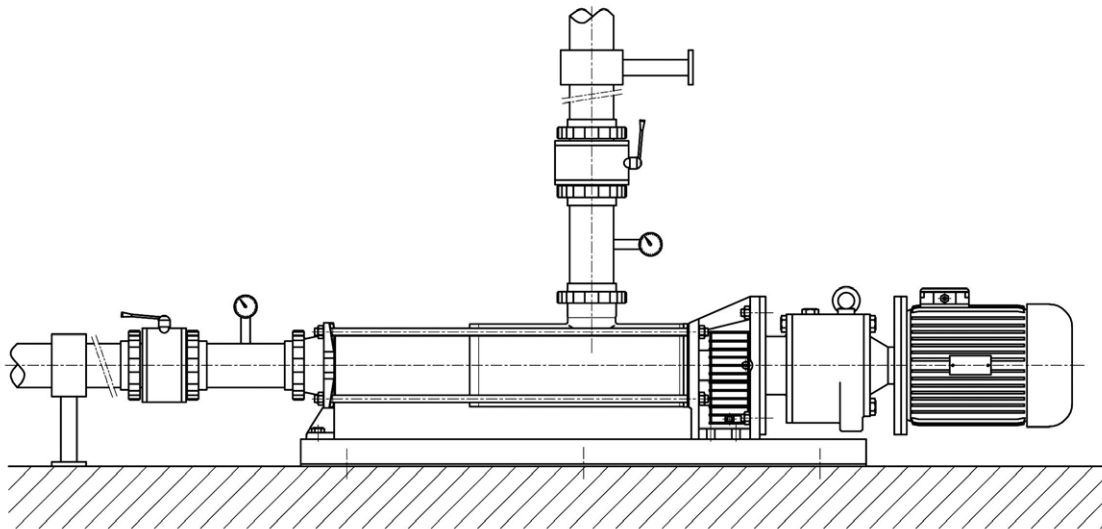
6 PIPING

1 - If the pump is installed with a negative head, to prevent the pump from running dry, include a siphon in the pipe with a section of pipe raised above the level of the pump. This ensures that there is always enough product in the pump to prime it at the subsequent start. A tap must be included at the highest point in the siphon to fill the pump before first usage or after the pump has been emptied.

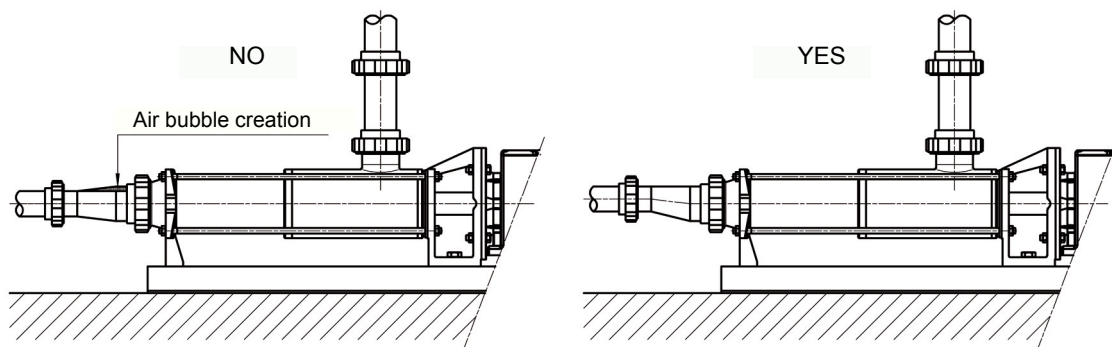
If there is a possibility of the suction intake of the pump emptying, at each start, the vertical section of pipe must contain a volume of product at least equal to the volume of air that must be expelled from the suction intake (or at least 10% more if the pump aspirates from the suction intake).



- 2 - To prevent harmful stress, the suction and delivery pipes must be connected to the pump inlet and outlets without forcing. These pipes must be replaceable independently without subjecting the pump to any strain.
 - 3 - The internal diameter of the pipes must match the diameter of the pump connectors. The pipe diameter must not be less than the connector diameter as this would cause an increase in head loss and reduced machine performance.
 - 4 - With very long pipes, install a valve at the pump inlet and outlet to permit pump inspection without having to drain the entire system.
 - 5 - Reduce the number of bends and constrictions in the system as much as possible.
 - 6 - Check the seal tightness of the suction pipe unions to prevent loss of suction capacity.
 - 7 - When pumping fluids at high temperatures, flexible expansion joints must be included to prevent strain caused by thermal expansion.
- Installing manometers on the piping and as close to the pump as possible is recommended in order to monitor the operating conditions of the pump.



- 8 - Installing a filter at the pump suction intake is recommended to prevent foreign bodies from entering the pump.
- 9 - The suction pipe should be as short as possible and should rise slightly toward the pump. Using eccentric reduction adaptors is recommended to prevent the formation of air pockets.



7 STARTING

7.1 ELECTRICAL CONNECTION

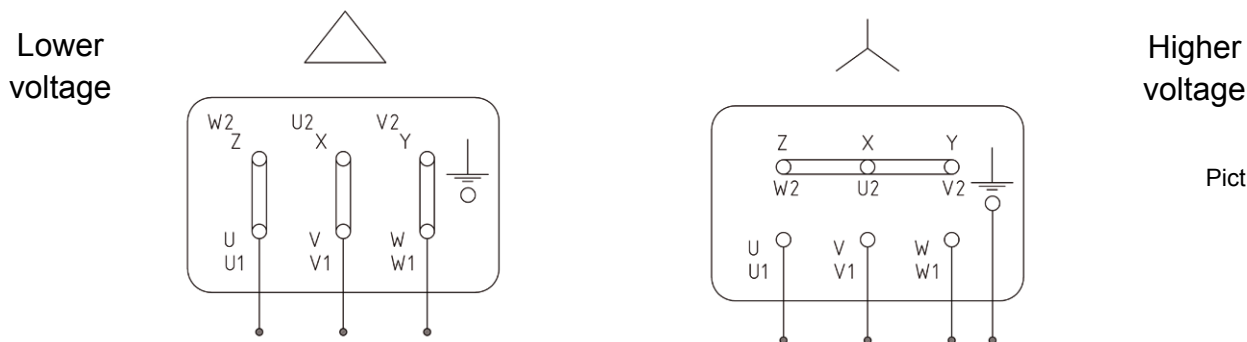


The connection to the electric system has to be carried out after the hydraulic connection; the motor drive system must be carried out according to technical directions and law (EN 60204-1). In particular a manual power supply disconnecting device with an adequate current breaking power must be installed; further install an overload and overcurrent protection (for example cut-outs, automatic switches, etc.) and in case provide for a proper device to avoid spontaneous restarting.

Check that voltage, network frequency and number of phases conform to the technical features shown on the electric motor. The safety level of all components used for electric connection (cables, cable presses, switches and protections) must conform to the environment where the unit is installed; further it is important to use electric cables of suitable section corresponding to the current values indicated on the motor plate, in order to avoid the overheating of the electrical conductors.

First carry out the motor grounding, using the clamp on the motor and an electric conductor of suitable section.

The cable connection to the terminal box can both be star or delta connection, according to the values indicated on the motor plate and to the network voltage shown below in Pict. 2; the clamps must be clean and carefully tightened; do not force the clamps.



Pict. 2

When starting the motor, current absorption raises (5-6 times the nominal value) for a very short period; if the network can not bear this absorption increase, we advise to use star or delta starters or other systems (for example auto-transformer). C.S.F. Inox S.p.A. is not liable for damages to persons and/or objects in case of non-observance of technical directions and laws.

7.2 PRELIMINARY OPERATIONS

- Check the direction of rotation indicated on the pump.
- Suction pipeline and pump must be filled with liquid; it is possible to distinguish two cases:
 - a) When the pump must work with a negative suction height, fill the pump by filling liquid in its pipelines.
 - b) When the pump must work with a positive charge, open suction and outlet valves until the manometer on the outlet side of the pump indicates a pressure corresponding to the positive suction charge.



The pump must never run dry; only few seconds of dry working are enough to damage the stator.

- If the seal box is externally cooled, open the cooling water feeder and adjust the water circulation.
- Check that suction and outlet valves are completely opened.



The progressive cavity pump is a volumetric pump and, as a result, must never run with a closed valve on the delivery pipe.

The single screw progressive cavity pump is a volumetric pump capable of producing theoretically infinite pressure. If the delivery pipe is closed, the pressure generated by the pump may exceed the maximum pressure limits for the system.

Installing adequate safety devices such as pressure switches and bypasses is recommended.

- Start the pump and check the direction of rotation again.

7.3 OPERATION

Progressive cavity pumps do not create themselves the pressure to be transferred to the fluid, but transport the fluid from the suction end to the delivery end. Depending on the pump model, pressures of up to 24 bar may be attained. The maximum pressure per stage is influenced by the abrasiveness of the product handled. The greater the abrasiveness, the lower the maximum permissible pressure.

The following table (Pict.3) indicates the maximum permissible pressure for the pump.

Pump	Permissible max. pressure	Pump	Permissible max. pressure	Pump	Permissible max. pressure
M 25 - 1	6 bar	M 80 - 1	6 bar	M 125 - 1	6 bar
M 25 - 2	12 bar	M 80 - 2	12 bar	M 125 - 2	12 bar
M 40 - 1	6 bar	M 80 - 2S	22 bar	M 125 - 2S	20 bar
M 40 - 2	12 bar	M 80 - 4	24 bar	M 125 - 4	24 bar
M 50 - 1	6 bar	M 90 - L	6 bar	M 130 - L	6 bar
M 50 - 2	12 bar	M 83	6 bar	M 140 - L	6 bar
M 55 - 4	24 bar	M 100 - 1	6 bar	M 150 - 1	6 bar
M 60 - L	6 bar	M 100 - 2	12 bar	M 150 - 1S	10 bar
M 63	4 bar	M 100 - 2S	22 bar	M 150 - 2	12 bar
M 65 - 1	6 bar	M 100 - 4	24 bar	M 151 - 1,5	9 bar
M 65 - 2	12 bar	M 103	4 bar	M 160 - L	6 bar
M 65 - 2S	20 bar	M 110 - L	6 bar	M 200 - 2	12 bar
M 65 - 4	24 bar	M 115 - 1	6 bar	M 200 - L	4 bar
M 70 - L	6 bar	M 115 - 2	12 bar		

Pict. 3

8 SEALS

Progressive cavity pumps may be fitted with **packing gland seals** and **mechanical seals**. The type of seal or packing and the material used are determined by the product pumped.

8.1 MECHANICAL SEALS

A mechanical seal is a device intended to retain fluid and prevent it from escaping from the pump.

The seal consists of two sliding surfaces, with one rotating relative to the other, held in axial contact by the pressure generated by the fluid (hydraulic force) and by components such as springs or bellows (mechanical force).

Mechanical seals are generally cooled by the fluid itself. The materials used are selected in relation to the characteristics of the fluid used, the operating conditions in which the seal is installed and the performance required. Seals installed on progressive cavity pumps may either permit only one direction of rotation or be reversible: the direction of rotation of the pump is always indicated by an arrow.

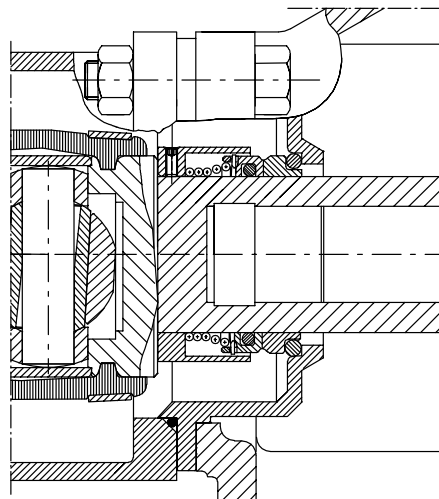
WARNING Before using the pump with products which are not mentioned in your order, check that the seal type suits the new product to be pumped.

Different types of seal are available with progressive cavity pumps:

EXEC. "T"

- Type "T" reversible internal mechanical seal.

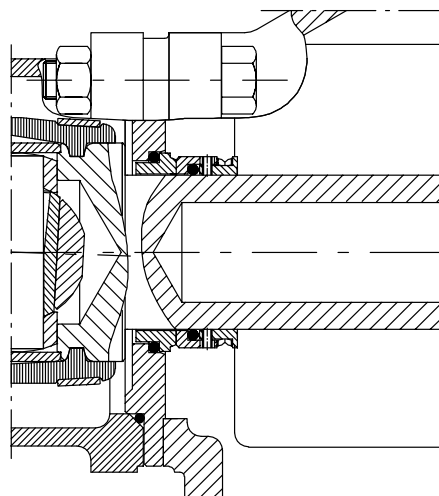
The seal is installed on the interior of the suction chamber and immersed in the product for better cooling and increased durability of the seal itself.



EXEC. "Y"

- Type "Y" reversible external mechanical seal.

This mechanical seal is installed outside the suction chamber. This seal type is used where flushing is not possible or where the seal must not come into contact with the pumped product due to sanitary, corrosion or abrasion problems.



EXEC. "U" - "Y1"

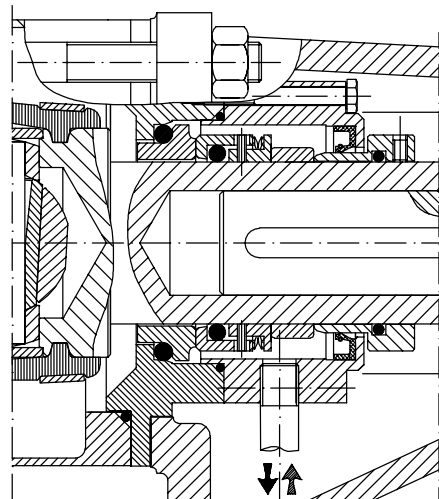
- Type "U" reversible external mechanical seal.

This type consists of an axial mechanical seal plus a radial seal that works against a bushing with a ceramic coating.

- Type "Y1" external mechanical seal.

This type, designed for less severe applications, consists of an axial mechanical seal plus a flanged ring that works against a stainless steel bushing.

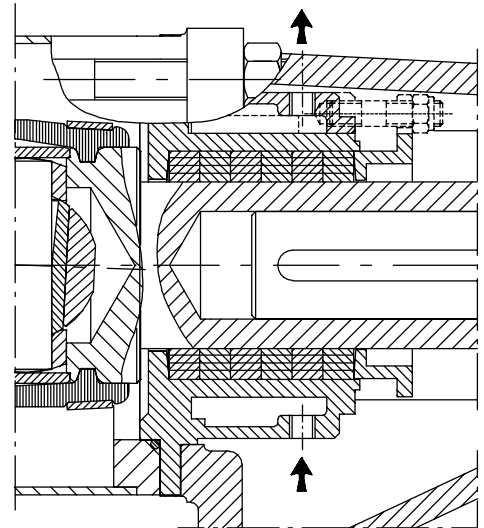
These two types use a flow of flushing fluid to clean, lubricate and cool the seal. These seals are used with products that tend to crystallise, gum and harden, resulting in highly abrasive characteristics.



8.2 PACKING GLAND SEAL

A packing gland seal is meant to limit the leaks of the pumped product, but not to prevent them completely. A slight leakage is necessary, in order to avoid excessive friction and, consequently, the over-heating of the parts in contact. By starting the pump, the packing gland has to be slightly tightened. At the beginning, let drip some 30 -50 drops/min. (depending on the pumped product), until the packing gland has adjusted and conformed to the existing temperature conditions (approximately 10-15 min.). Then tighten the packing gland moderately and evenly until you get a min. leaking. This leakage will depend on product, pressure, pump rotation speed and temperature. Min. leakage is approximately 10-20 drops/min. The packing gland seal works properly if lubricated by the pumped product. An excessive compression of the packing gland inhibits such lubrication and causes the following consequences: dry working, packing gland burnt out, shaft highly scored with consequent product loss.

- Externally cooled packing gland seal: a cooling flushing fluid is circulated in the gland chamber to limit temperature increases.



9 WORKING IRREGULARITIES

We are herewith listing some of the possible working irregularities which may occur using the pumps, with a table allowing to find out the possible causes and the way to remove the trouble.

Trouble:

		TROUBLE										
		A	B	C	D	E	F	G	H	I	L	M
POSSIBLE CAUSES AND NECESSARY OPERATIONS TO REMOVE THEM	1	●							●			
	2			●		●	●	●	●	●	●	
	3	●	●	●		●		●	●	●		
	4	●	●	●	●	●	●	●	●	●		●
	5				●							
	6				●		●				●	●
	7				●		●				●	●
	8				●							●
	9				●						●	●
	10				●		●				●	●
	11							●	●			
	12				●			●	●			
	13				●			●	●			
	14		●	●				●				
	15		●	●								
	16		●	●				●				
	17	●	●	●				●				
	18				●	●	●			●	●	●
	19				●	●	●					●
	20	●	●	●		●	●					
	21	●	●	●		●		●	●	●	●	
	22	●	●	●				●	●			
	23	●	●	●					●	●	●	●
	24				●	●	●	●		●	●	●
	25		●	●		●	●	●	●	●		●
	26				●	●	●	●				●
	27				●	●	●					●
	28				●	●	●					●

-pump not turning because:

- A) it does not start
- B) it gets locked
- C) the magneto-thermic switch releases

- pump turning but:

- D) it does not self prime
- E) delivery is inadequate
- F) flow is not uniform
- G) pump is noisy
- H) stator gets worn out too quickly
- I) rotor gets worn out too quickly
- L) shaft seal leaks
- M) outlet pressure is poor.

Possible causes and necessary operations to remove them:

- 1) The pump being new, there is too much friction or the rotor gets stuck on the stator.
 - Fill the pump, if necessary with lubricating liquid, and make it turn manually by means of a suitable tool.
- 2) Outlet pressure is too high.
 - Check pressure by means of a manometer and compare it with the features mentioned in your order.
 - Check that there are no obstructions along outlet pipelines.
- 3) The stator got swollen and it does not withstand the product to be pumped.
 - Check if the pumped product corresponds to the one mentioned in your order. Change stator material.
- 4) The product to be pumped contains too big solid particles.
 - Increase liquid percentage. Reduce dimension of solid particles. Install a bigger pump.
- 5) Inlet pipeline is obstructed.
 - Remove the obstruction and take measures to avoid the formation of other obstructions.
- 6) O-rings of mechanical seal are damaged.
 - Change O-rings. Check compatibility of O-rings material with the product to be pumped. In case, change O-rings material.
- 7) Mechanical seal rings have seized.
 - Change rings. Check technical features mentioned in your order. In case, use rings made of a material, which is more suitable to the product to be pumped.
- 8) Direction of rotation is wrong.
 - Change electric connection.
- 9) Gland seal does not fit to the product to be pumped.
 - Change packing gland seal with a different type.
- 10) Packing gland seal compression is badly adjusted.
 - Adjust compression: in case change packing gland seal.
- 11) Pump is turning too fast.
 - Reduce revolution number. In case you want to get the same delivery, use a bigger pump.
- 12) Product to be pumped is too viscous.
 - Increase temperature, avoiding inlet cavitation.
- 13) Product to be pumped is too heavy.
 - Dilute it by means of a lighter fluid or use a more powerful motor.
- 14) Articulated joints are worn out.
 - Change worn out parts and grease the joints by means of adequate grease.
- 15) Pump and motor are not aligned.
 - Reset alignment.
- 16) Coupling joint is damaged.
 - Change damaged parts, taking care not to alter the pump-motor alignment.
- 17) Rolling bearings are damaged.
 - Change and lubricate bearings. If the product temperature is very high, increase bearing slack and use a lubricator suitable for high temperatures.
- 18) Stator is damaged.
 - Change stator. Check compatibility of stator material with product to be pumped. In case, change stator material.
- 19) Rotor is worn out.
 - Change rotor. In case, change rotor material or coating.
- 20) Motor works in two phases.
 - Electric features of motor do not correspond to network features. Check electric system and electric features of motor.
- 21) The product is too hot and there are dilatations of the stator.
 - If it is not possible to decrease the product temperature, install a rotor with a smaller diameter.
- 22) A foreign body got into the pump.
 - Take the foreign body off and check if rotor and stator got damaged.
- 23) With pump stopped the product to be pumped gets hard or settles.
 - Clean pump and repeat cleaning after every working cycle.
- 24) Inlet suction is too high (available NPSH is lower than requested NPSH).
 - Reduce the inlet losses of charge, install the pump in lower level (increase available NPSH).
- 25) Pump is working dry.
 - Fill the pump and install a dry running protection device.
- 26) Air is getting into the suction pipeline.
 - Increase the level of product in the suction intake, eliminate vortexes in the inlet, check the seal and check for air infiltration via the pipe unions.
- 27) Pump is turning too slowly.
 - Install an adjustment device and increase revolution number.
- 28) By using reduced diameter rotors, working temperature is not reached.
 - Heat stator and set it to working temperature.

10 WASHING CYCLE FOR PUMPS USED TO HANDLE FOODSTUFF PRODUCTS

WARNING Pumps intended for handling foodstuff products must be thoroughly cleaned before commissioning. A CIP (cleaning in place) procedure is carried out to clean the pump.

CIP PROCEDURE

- 1) Wash with clean water to empty the pump of any product
- 2) Basic wash with 1 to 2% solution of caustic soda at 60 to 80°C for approximately 10 to 20 minutes
- 3) Intermediate wash with clean water for 5 to 10 minutes
- 4) Wash with 1 to 1.5% solution of nitric acid at 50 to 70°C for 5 to 10 minutes
- 5) Final wash with clean water for approximately 10 minutes

NB: The flow rate of the cleaning fluids used must not be less than 1.5 m/sec.

During the CIP cycle, the stator is subjected to significant chemical and thermal stress. As a result, the pump should be run in short bursts (2 to 4 starts per minute lasting just 1 or 2 revolutions). This will clean the interior of the pump while limiting mechanical stress.

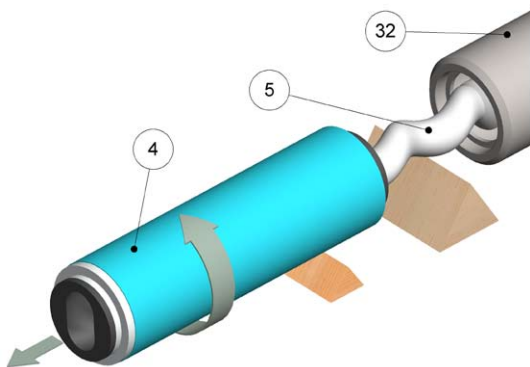
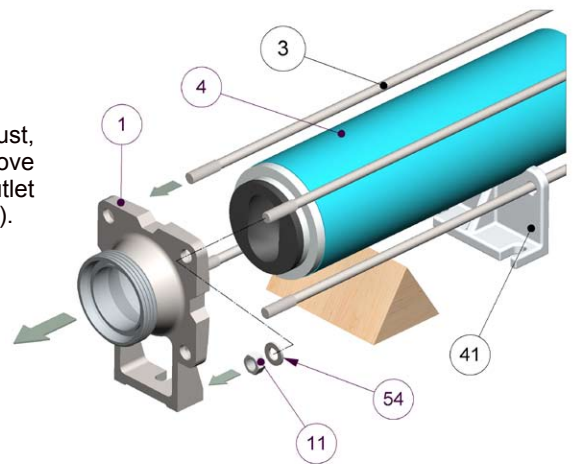
11 MAINTENANCE

11.1 STATOR INSPECTION

WARNING The pump must be checked for wear after 700-1000 operating hours. The frequency of subsequent inspections is determined in relation to the degree of wear noted – however, the interval between inspections must not exceed 1500 operating hours.

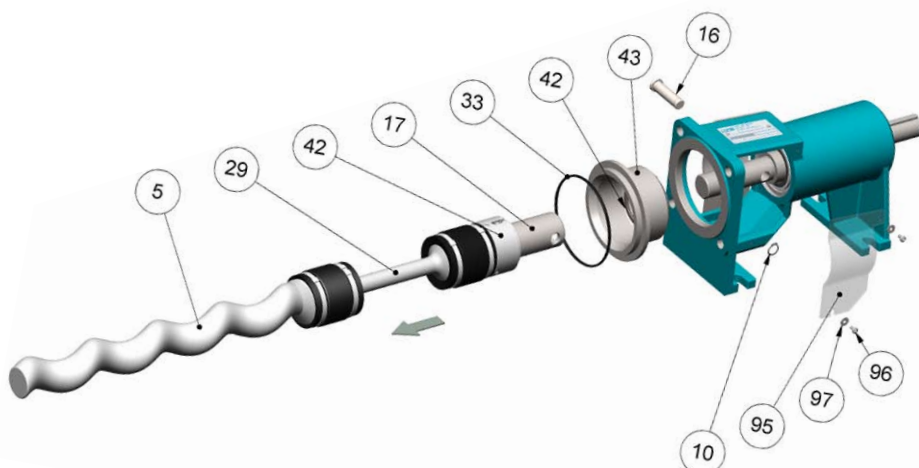
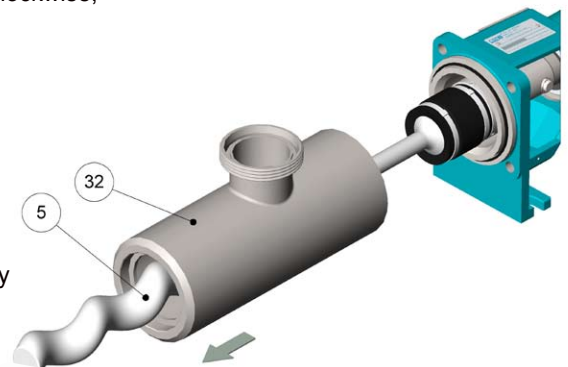
11.2 DISASSEMBLING THE PUMP (Ref. MA series)

- Work in a clean area away from sources of dust, swarf etc. Ensure that the pump cannot move during disassembly. Remove the delivery outlet (1) and the tie-rods (3), undoing the nuts (11).



Using a chain wrench, remove the stator (4), turning anticlockwise;

remove the suction chamber (32). Take care not to strain the shaft assembly and damage the mechanical seal.

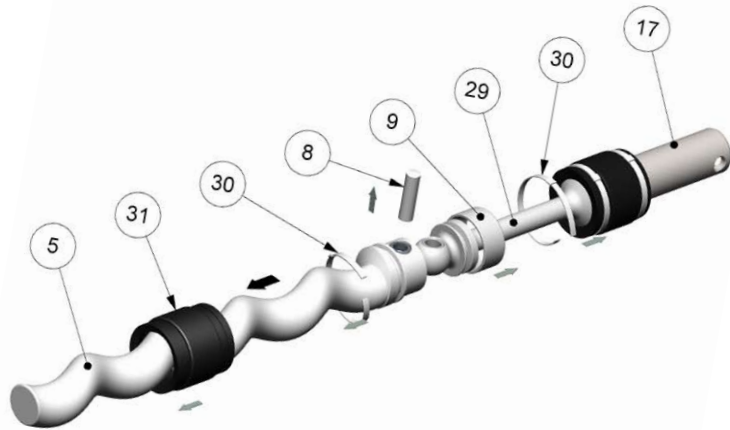


Undo the screws (96) and remove the guards (95).

Use suitable needle-nosed pliers to remove the retainer circlips (10) and use a pin punch to remove the drive pin (16). Remove the entire shaft assembly [rotor (5) – connecting rod (29) – drive shaft (17)].

Remove the seal chamber (43), containing the fixed element of the mechanical seal (42), and remove the O-ring (33).

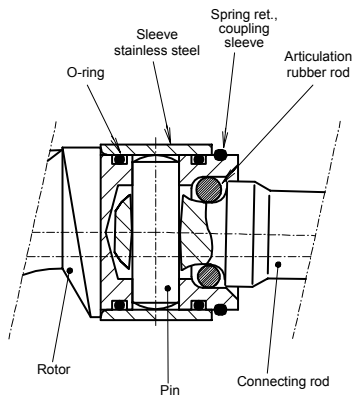
Immobilise the complete pump shaft assembly in a vice. Undo the fastener dowels (40) on the rotating element of the mechanical seal (42) (applicable for reversible seals) then ease the seal off the drive shaft (17).



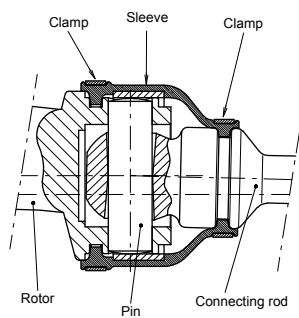
Remove the knuckle joints covered with the rubber sleeves (31) (not applicable on 25, 40 and 50 sized models). Remove the ring clamps (30) (cut with scissors or a hacksaw), clean around the sleeve and spray detergent into the slots if necessary. Insert two screwdrivers under the sleeve (31) and push forcefully to detach the sleeve from the recesses retaining it.

Remove the steel sleeve (9) then use a pin punch to push the pin (8) out of the hole in the bushings, releasing the rotor (5).

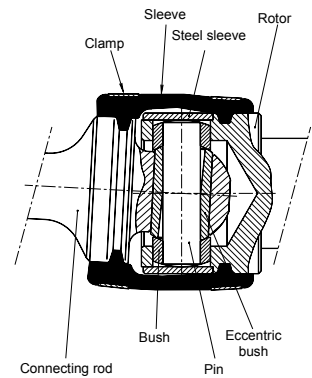
Repeat the procedure for the second sleeve, releasing the drive shaft (17).



In sturdy stainless steel with OR seals and stainless steel safety sleeves.
Execution from pump's size M 25 to M 50

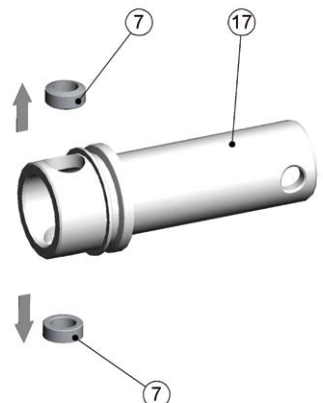
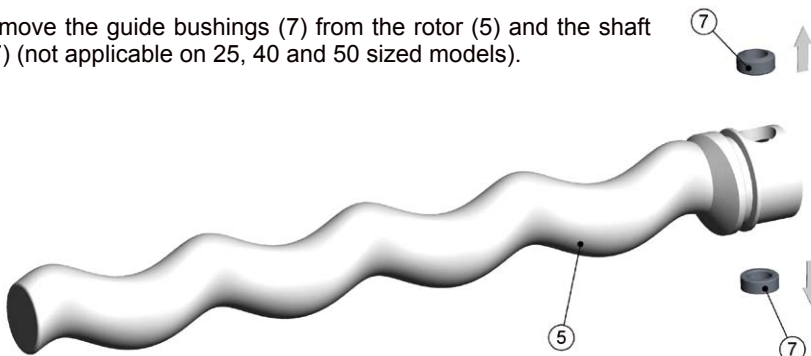


In sturdy stainless steel with NBR (EPDM-FPM) safety sleeves.
Execution from pump's size M 55 to M 60L

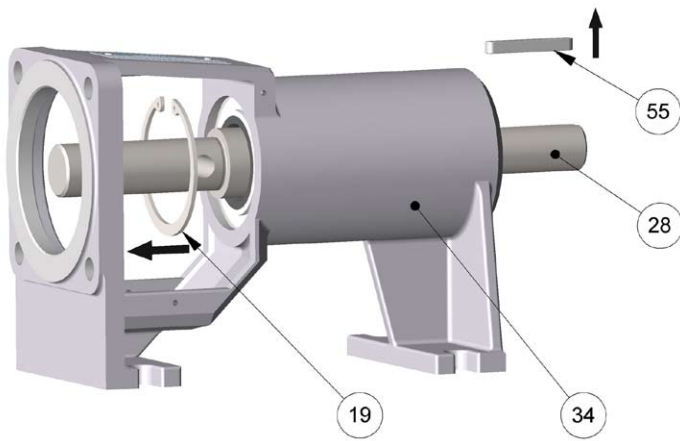


In wear-resisting version with hardened bushes for heavy duty conditions and loads and NBR (EPDM-FPM) safety sleeves.
Execution from pump's size M 65 to M 200

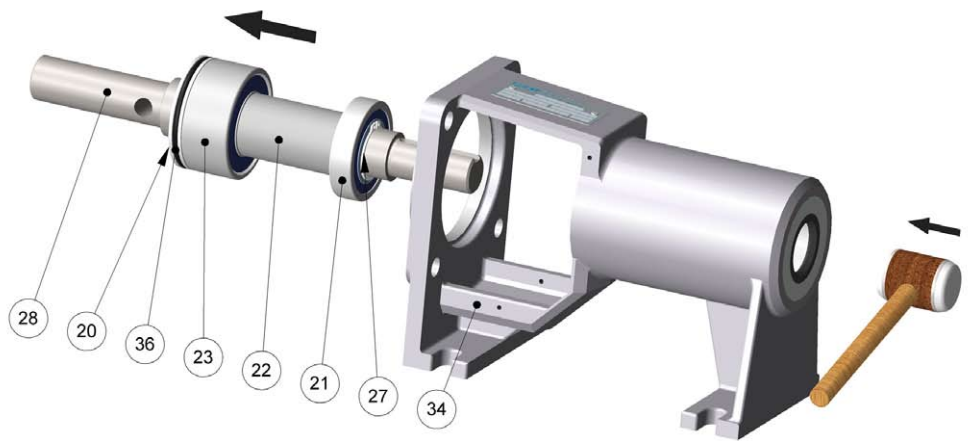
Remove the guide bushings (7) from the rotor (5) and the shaft (17) (not applicable on 25, 40 and 50 sized models).



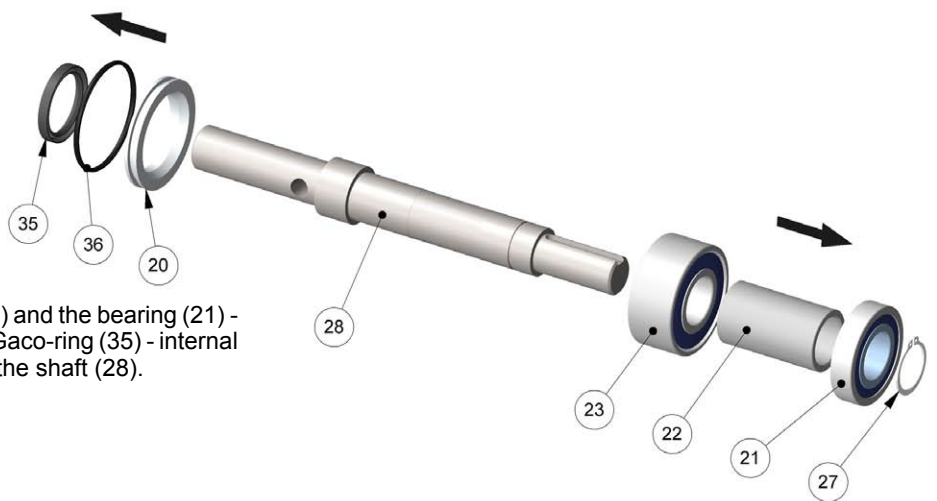
11.3 DISASSEMBLING THE BEARING HOUSING



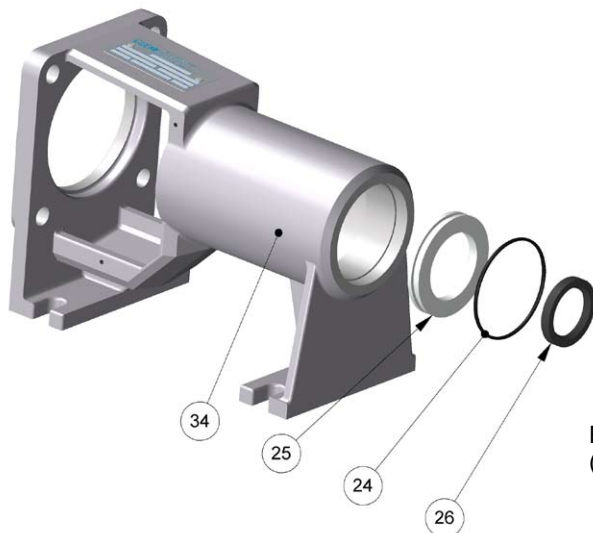
Remove the key (55) from the shaft (28); remove the seeger-ring (19) from the housing seat (34).



Use a rubber or Teflon hammer to remove the shaft unit (28) complete with bearings (23-21) - spacer (22) - seeger-ring (27) - internal ring (20) - Gaco-ring (35) and OR (36) from the housing (34).



Remove the seeger-ring (27) and the bearing (21) - spacer (22) - bearing (23) - Gaco-ring (35) - internal ring (20) and OR (36) from the shaft (28).



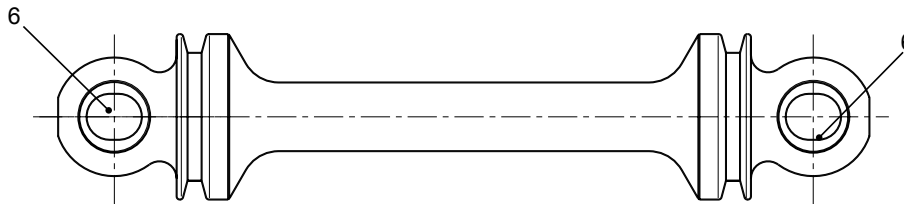
Remove the Gaco-ring (26), external ring (25) and OR (24).

12 REASSEMBLY

After having carefully cleaned with detergent, check condition of the eccentric bushes (6) on the connecting rod (29). The eccentric bush has not to be damaged or worn out. Then assemble a new rotor (5) complete with two pilot bushes (7) and filled with proper grease (fill the grease in adequate quantity into the special hollow). First assemble the entrainment pin (8), then cover it with the steel sleeve (9). To assemble the rubber sleeve (31) easily, it is advisable to soften it with warm water. In this way you will be able to push it manually into the corresponding notches. Finally lock the two clamps (30) (it is advisable to use the proper tool), then cut the exceeding part.

WARNING While locking the clamps, remember to pull them gradually and alternately, before giving the final pull.

WARNING When replacing the eccentric bushes on the connecting rod, pay attention to the following operations:
1- As they are hot assembled, it is necessary to heat the end of the spherical part, in order to make the expulsion of the worn-out bush easier and to allow the introduction of the new one.
2- The bushes must be positioned with the eccentric part in axis with the connection rod (see picture) and perfectly aligned with the spherical part.



The bushes must be positioned with the eccentric part in axis with the connection rod.
 To reassemble the pump, follow the instructions given on previous paragraphs inversely.

13 LUBRICATION

C.S.F. Inox progressive cavity pumps are already equipped with the necessary lubricants to ensure correct working conditions for 3000-4000 hours (2 years). You do not need to refill the lubricant in the articulated joints, but you will replace it while servicing or changing worn-out parts for maintenance. For the bearings assembled on the support (Version E excepted) there are two lubricators to refill the grease every 4 or 5 months; pay attention not to overdo it. Otherwise replace grease while servicing; before reassembling clean seats and bearings carefully.

Recommended lubricants for articulated joints:

Grease "Mobil" TEMP S.H.C. 100 or equivalent.

Vaseline grease or similar for pumps for food industry.

Recommended lubricants for rolling bearings:

see table:

Pos.	Make	Type	N.L.G.I.
1	DANKELL	BEARING 3	3
2	ROL	MERCURY 3	3
3	AGIP	GR MU 3	3
4	IP	ATHESIA 3	3
5	ESSO	BEACON 3	3
6	MOBIL	MOBILUX 3	3
7	BP	LT 3	3

14 DISPOSAL OF THE PUMP

For disposing the pump please observe the following instructions:

- disconnect electrical and hydraulic connections according to technical rules and laws in force.
- Disassemble all components of the pump for separate dismantling; wash the components and clean the structure accurately.

The main components of the pump are made from the following materials:

- suction chamber – delivery outlet – bearing lantern ring or mount – connecting rod – rotor in 304 or 316 stainless steel
- elastomers NBR - EPDM - FLUOROCARBON (FPM)
- motor Aluminium - Cast iron - Copper

Components made from amianthus or lead are not used in our production.

WARNING The components of the pump should be properly got rid, according to the corresponding rules in force in receiver's country.

15 ACCESSORIES

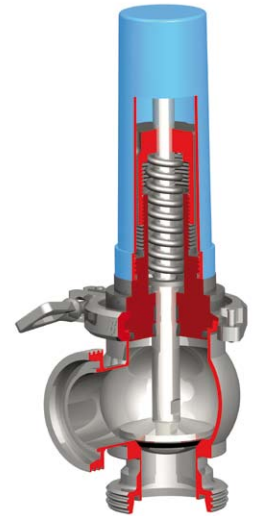
A range of optional accessories for controlling the pump is available for progressive cavity pumps:

15.1 AUTOMATIC BY-PASS

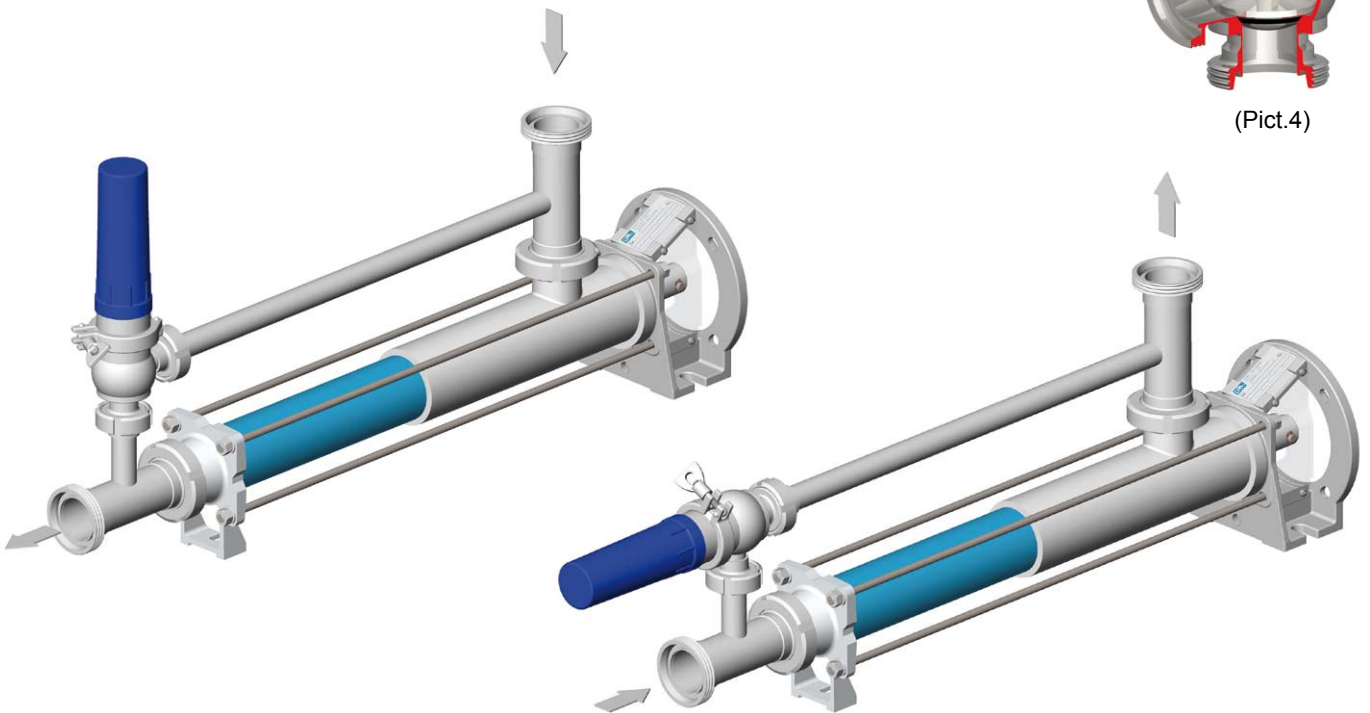
The by-pass is a device consisting of a spring valve (see Pict.4) mounted on a pipe connecting the pump delivery outlet to the suction inlet. The by-pass may be used as a safety device, to prevent overpressure from developing in the system, or as a pump flow rate regulator. The automatic by-pass is manually adjusted with the safety valve, in which a spring provides the seal pressure.

The bypass is a unidirectional system. If the direction of rotation of the pump is inverted, the position of the safety valve must also be inverted, as shown in the pictures.

Note: Upon request the bypass can be supplied with a manual valve instead of an automatic one.



(Pict.4)



Different spring types may be fitted to the safety valve, depending on the operating pressure of the pump (see table below).

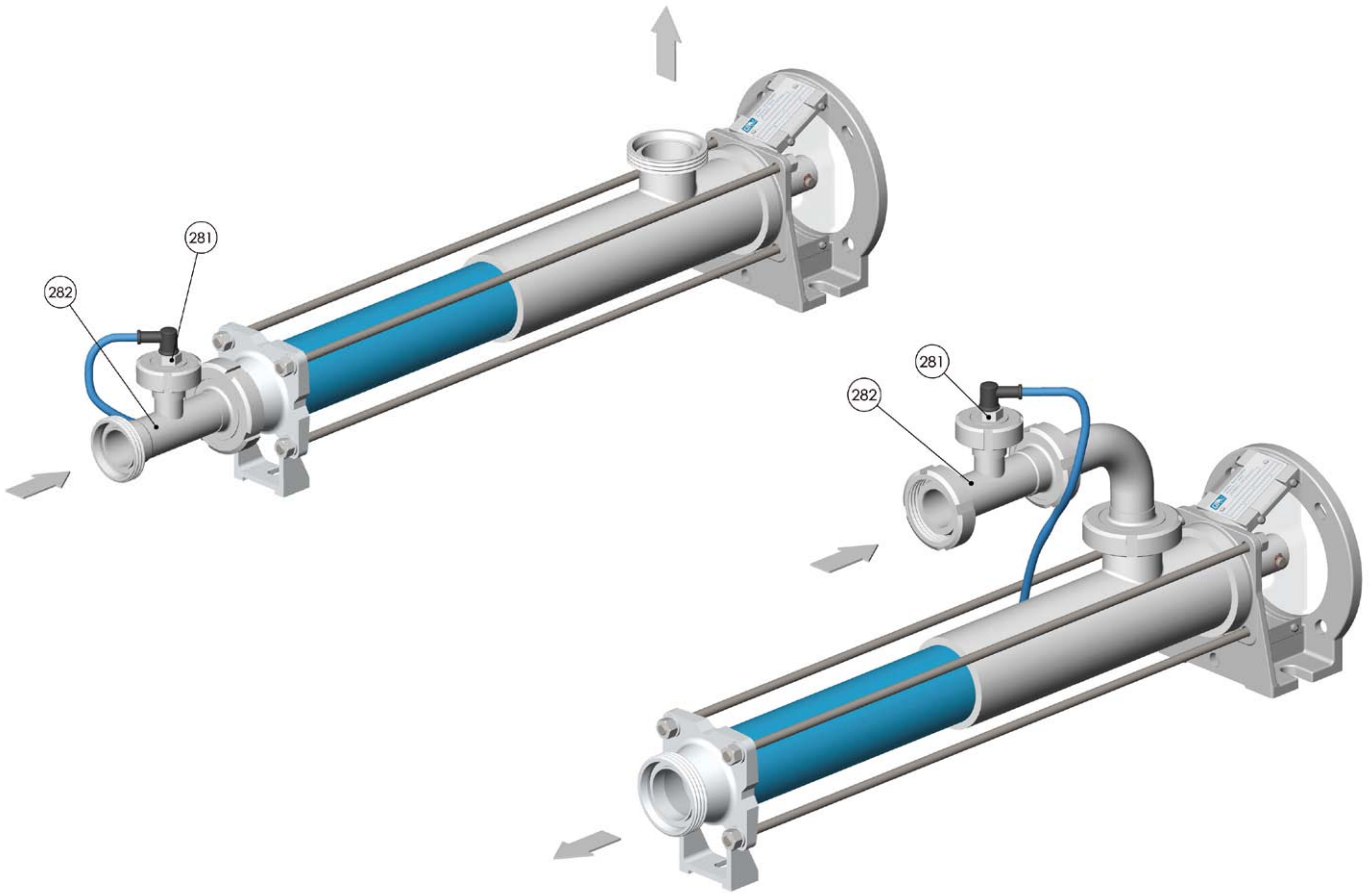
Dimensions Ø mm	P bar				
	Spring Ø 3,5 mm Type A Bar	Spring Ø 4 mm Type B Bar	Spring Ø 4,5 mm Type C Bar	Spring Ø 5 mm Type D Bar	Spring Ø 6 mm Type E Bar
DN 25	0,5 ÷ 4	1 ÷ 6,5	1 ÷ 10		
DN 32	0,5 ÷ 2,3	1 ÷ 3,5	1 ÷ 6,5	1 ÷ 10	
DN 40	0,5 ÷ 2,3	1 ÷ 3,5	1 ÷ 6,5	1 ÷ 10	
DN 50		0,5 ÷ 2	1 ÷ 3,8	1 ÷ 7	1 ÷ 10
DN 65			0,5 ÷ 2	1 ÷ 3,3	1 ÷ 7,7
DN 80				0,5 ÷ 2,3	1 ÷ 5
DN 100				0,5 ÷ 1,3	1 ÷ 4

Dimensions Ø mm	P psi				
	Spring Ø 3,5 mm Type A Psi	Spring Ø 4 mm Type B Psi	Spring Ø 4,5 mm Type C Psi	Spring Ø 5 mm Type D Psi	Spring Ø 6 mm Type E Psi
DN 25	7 ÷ 58	14,5 ÷ 94	14,5 ÷ 145		
DN 32	7 ÷ 33	14,5 ÷ 50	14,5 ÷ 94	14,5 ÷ 145	
DN 40	7 ÷ 33	14,5 ÷ 50	14,5 ÷ 94	14,5 ÷ 145	
DN 50		7 ÷ 29	14,5 ÷ 55	14,5 ÷ 101	14,5 ÷ 145
DN 65			7 ÷ 29	14,5 ÷ 48	14,5 ÷ 111
DN 80				7 ÷ 33	14,5 ÷ 72
DN 100				7 ÷ 18	14,5 ÷ 58

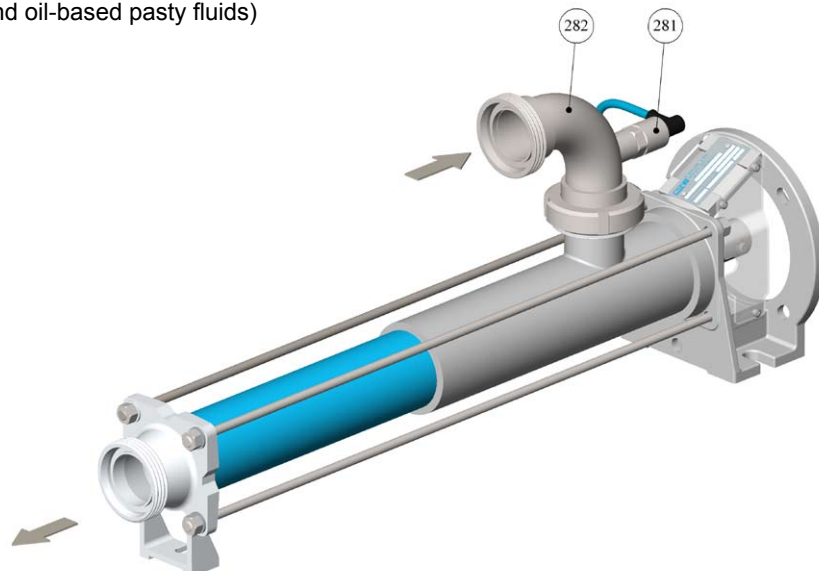
15.2 FLOW SWITCH

The flow switch is normally used to control the flow of a fluid in a circuit, and sends an ON-OFF signal to an electrical panel depending on whether or not flow is detected. In progressive cavity pumps, the flow switch is installed on the pump suction inlet and is used to stop the pump if no product is detected.

CONDUCTIVITY TYPE FLOW SWITCH
(not suitable for liquids containing quantities of air)

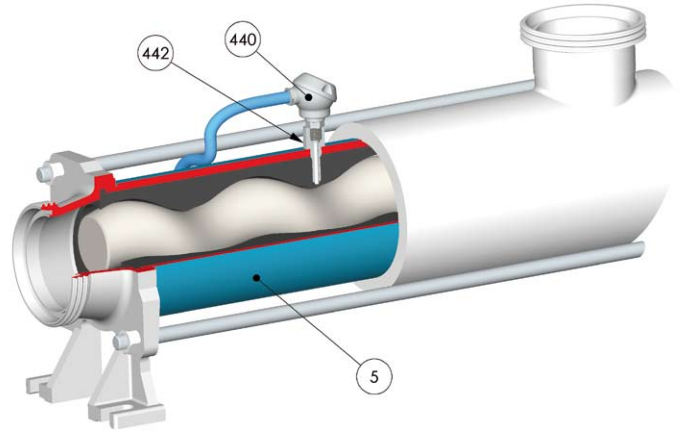


ELECTRONIC FLOW SWITCH
(for liquid, water-based and oil-based pasty fluids)



15.3 TEMPERATURE PROBE

System made by a temperature probe, installed on the pump stator and connected to a thermostat, with the function to set the maximum permissible temperature for correct pump operation. When the stator exceeds the set temperature, the temperature probe transmits a signal to the electrical panel to stop the pump.

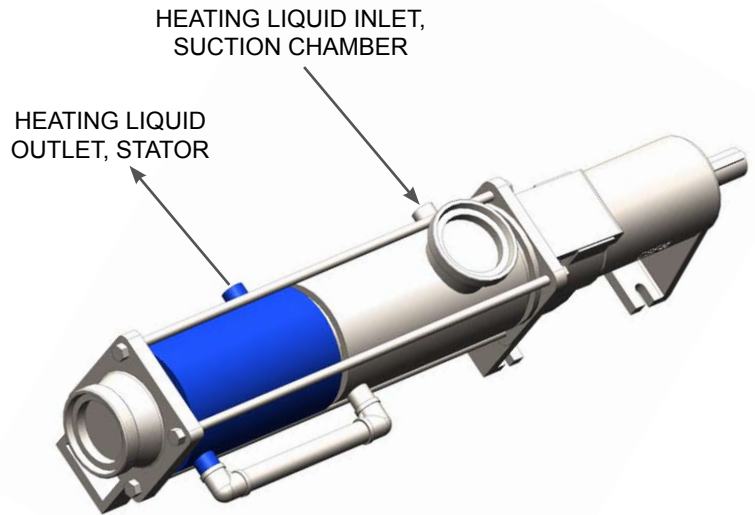


15.4 HEATING CHAMBERS, STATOR-HOPPER

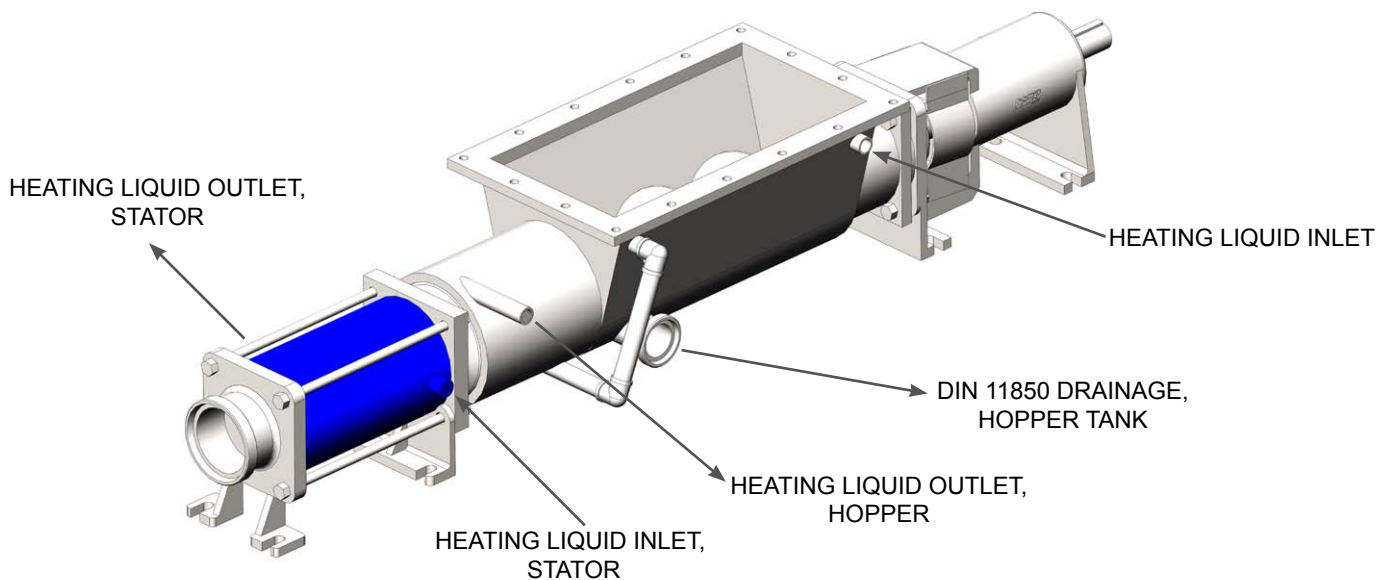
Flushing connecting diagram for MA series pumps

With high viscosity products that tend to harden or to keep the temperature of processing, it can be applied an interspace for the circulation of heated water on the stator and on the hopper.

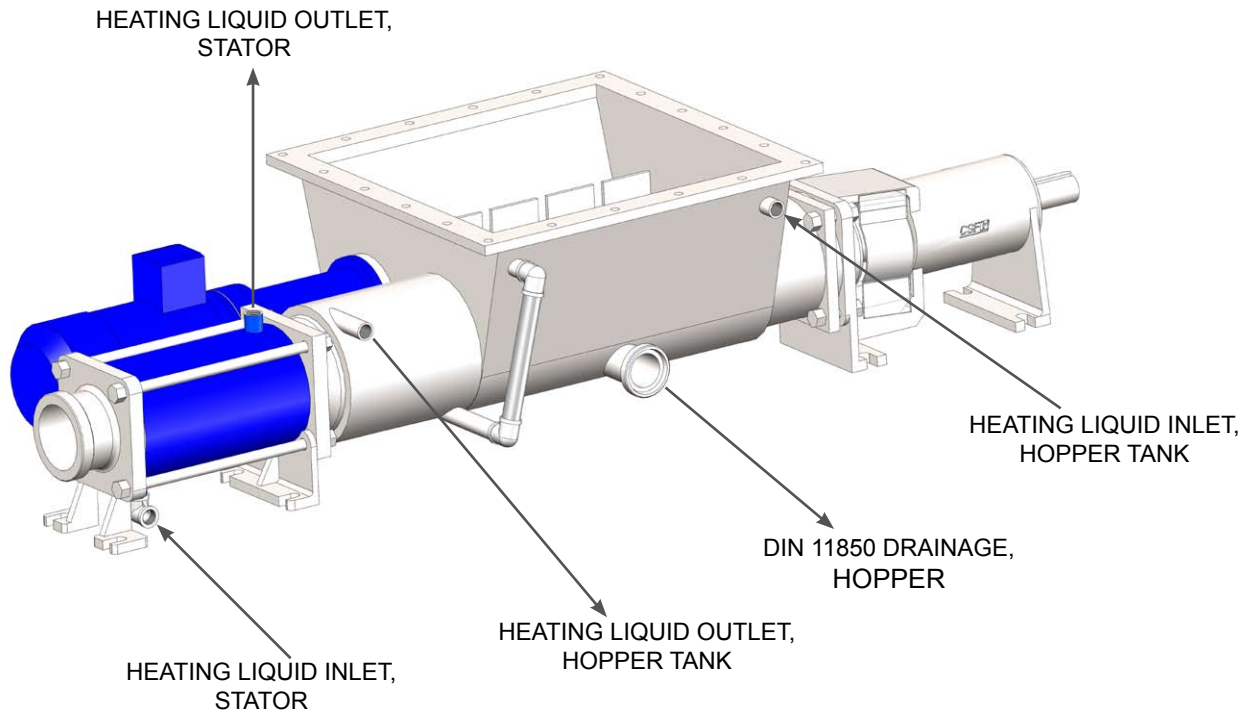
Max. temp. = 85°C
Max. pressure = 1,5 Bar



Flushing connecting diagram for MC series pumps



Flushing connecting diagram for MCR series pumps



PORTS DIMENSIONS FOR HOPPER AND STATOR HEATING

Pump size	Sleeve dimension
40	3/8" G.
50/60-L	3/8" G.
65/70-L	1/2" G.
80/90-L	1/2" G.
100/110-L/115	1/2" G.
125/130-L	1/2" G.
150/151/160-L	3/4" G.

16 SPARE PARTS

RECOMMENDED SPARE PARTS FOR 1 (ONE) PUMP		IN CASE OF EXCEPTIONAL SUPPLY DIFFICULTIES, WE DO RECOMMEND THE FOLLOWING SPARES:	
Denomination	Quantity	Denomination	Quantity
Stator	2	Stators	Some
Complete articulated joint	2	Complete transmission axis (rotor, joints, shaft)	1
Seals	2	Seals	Some
		O-rings for the seal box	Some
		Set of bearings and support seal rings (type E excepted)	1

C.S.F. Inox declines all responsibility for damage or injury resulting from the use of non-original spare parts.

17 SAFETY INSTRUCTIONS FOR INSTALLING THE PUMPS WITH HOPPER AND SCREW MC-MCR-MC2R-MC2C

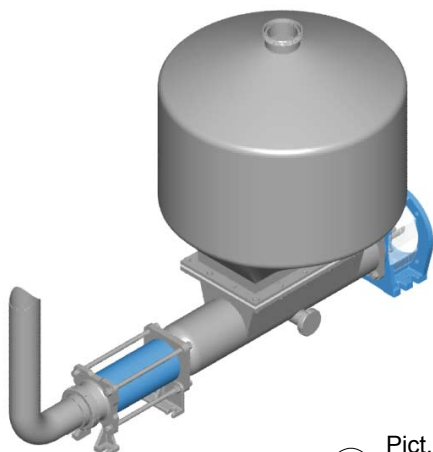
All pumps equipped with a hopper, pre-feeding screw and any rotary crushing devices, are classed as “partly-completed machinery” under the 2006/42/EC directive; these pumps are to be incorporated into the system on the basis of the process requirements, and thus they are not CE-marked.

These pumps cannot therefore be put into operation before the specific safety measures have been put in place for the process or system into which they are incorporated, as specified in the following examples.

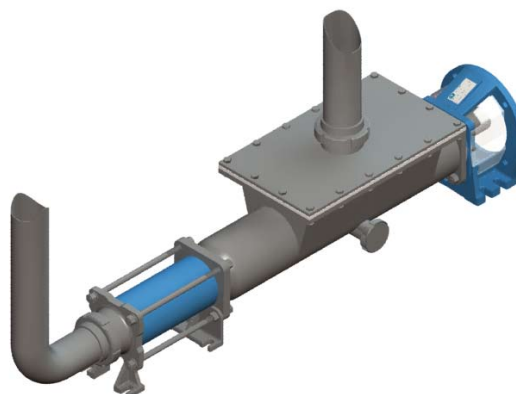
The pump hopper must be connected to the system as illustrated in pictures 1 and 2, in order to protect operators from the pump's rotating parts (the screw and crushing blades).

If system operating requirements make it impossible to make the connection in the way shown in pictures 1 and 2, and the hopper must be left open to allow the product to be pumped to fall freely, then the protective equipment must be installed with minimum distances from the hazard as shown in pict. 3, in conformance with the EN ISO 13857 standard. This equipment must be designed and built in accordance with EN 953.

Pict. 1 (tank connection)

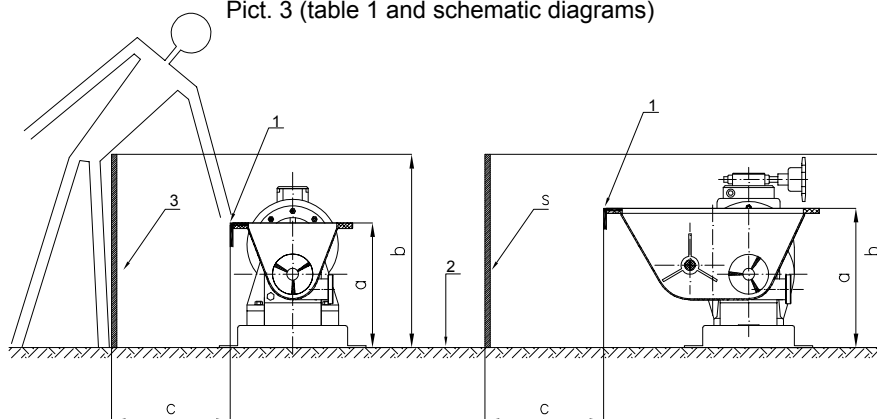


Pict. 2 (connection to the closure plate)



Pict. 3 (table 1 and schematic diagrams)

- 1) Danger zone
- 2) Reference plane
- 3) Protection design



Height of danger zone a	Height of protection design b ¹⁾									
	1000	1200	1400 ³⁾	1600	1800	2000	2200	2400	2600	2700
Horizontal distance towards danger zone c										
2700 ²⁾	-	-	-	-	-	-	-	-	-	-
2600	900	800	700	600	600	500	400	300	100	-
2400	1100	1000	900	800	700	600	400	300	100	-
2200	1300	1200	1000	900	800	600	400	300	-	-
2000	1400	1300	1100	900	800	600	400	-	-	-
1800	1500	1400	1100	900	800	600	-	-	-	-
1600	1500	1400	1100	900	800	500	-	-	-	-
1400	1500	1400	1100	900	800	-	-	-	-	-
1200	1500	1400	1100	900	700	-	-	-	-	-
1000	1500	1400	1000	800	-	-	-	-	-	-
800	1500	1300	900	600	-	-	-	-	-	-
600	1400	1300	800	-	-	-	-	-	-	-
400	1400	1200	400	-	-	-	-	-	-	-
200	1200	900	-	-	-	-	-	-	-	-
0	1100	500	-	-	-	-	-	-	-	-

¹⁾ Protection designs with a height below 1.000 mm are not included as they do not restrict the movement satisfactorily.

²⁾ For danger zones exceeding 2.700 mm, see EN ISO 13857.

³⁾ Protection designs lower than 1.400 mm should not be used without additional safety measures, refer to EN ISO 13857.



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