SPX®
WHERE IDEAS MEET INDUSTRY

INSTRUCTION MANUAL

APV Cavitator

FORM NO.: 456424-US REVISION: 07/2014

READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING OR SERVICING THIS PRODUCT.

APV®

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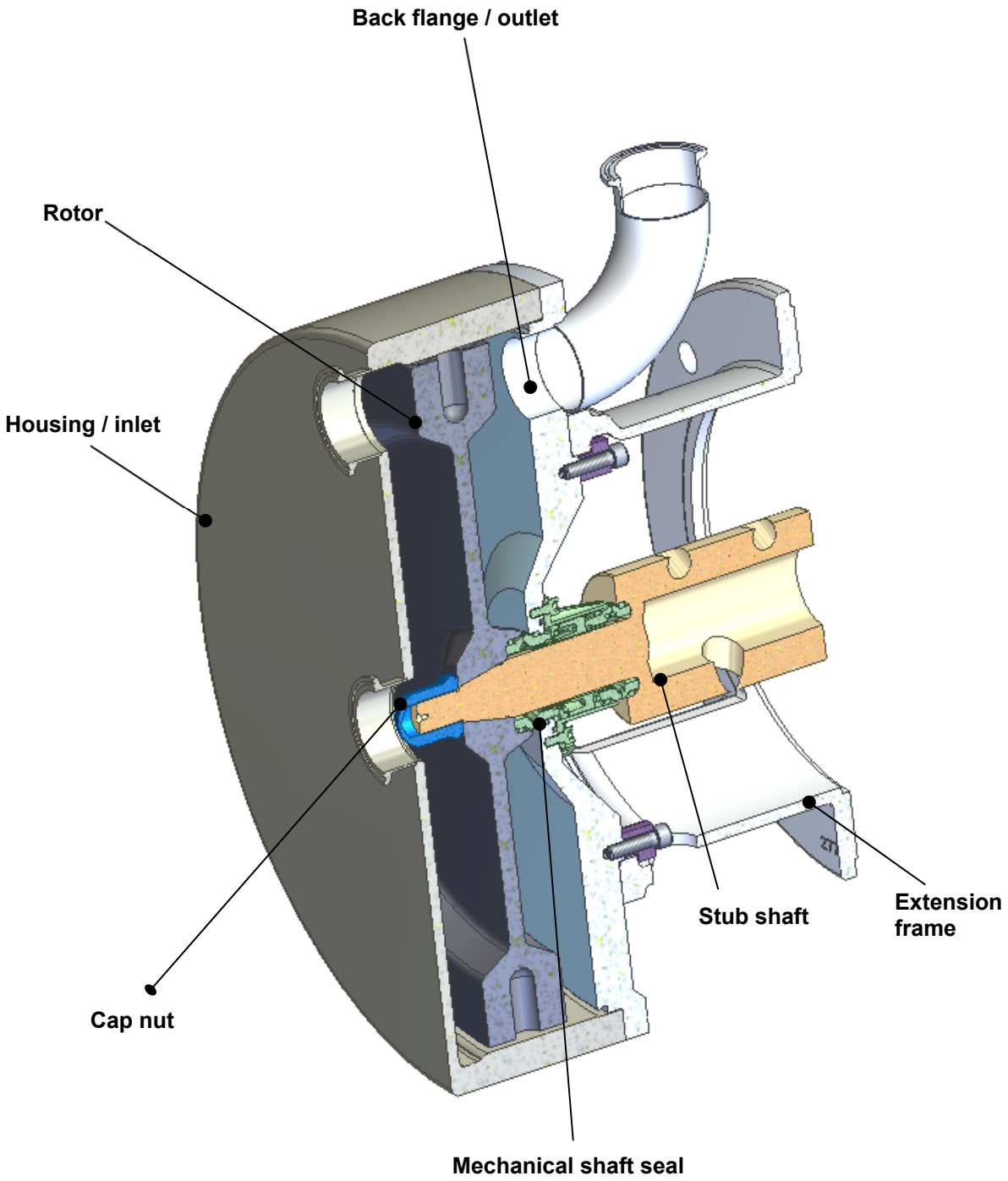
1. Sectional drawing



2. Warnings

Read this instruction carefully before installing and starting the Cavitator. Always follow the guidelines for assembly and disassembly in order to secure optimum operational reliability. The Cavitator can, due to its function, cause a risk of personal injury by incorrect assembly and use. Therefore only qualified staff must carry out assembling and operation. In case of doubt, contact your local SPX partner.

Electric Installations

- Check that the specifications of motor and motor control are correct. This particularly applies when operating in environments where there may be a risk of explosion.
- Never flush with water or cleaning fluids directly on the electric motor unless it is rated for washdown duty.
- Never dismantle the Cavitator before having interrupted the power supply to the motor using a locking device for which only the person involved in the maintenance procedure has possession of the key.
- All electrical installations need to be made by skilled and authorized electricians and must comply with all applicable codes and standards.

Personal injuries

- Never start the APV Cavitator before the guard above the Cavitator shaft has been securely mounted.
- The Cavitator contains rotating parts. Never put hands or fingers into a Cavitator while it is in operation.
- Never touch the motor guard during operation as it may be very hot.
- Never touch the Cavitator housing during operation if the Cavitator is being used for a heating application where there may be a risk of burning.
- Do not start the Cavitator until all pipe connections have been fitted carefully and tightened. If the Cavitator is to be used for hot and/or hazardous liquids, special precautions must be taken. In such cases follow the local regulations for personal safety when working with these products.
- Never dismantle the Cavitator before the feed tank has been drained. Remember that liquid will always collect in the Cavitator housing. If the Cavitator is to be used with hot and/or hazardous liquids, special precautions must be taken. In such cases follow the local regulations for personal safety when working with these products

Safety precautions

- Always remove assembly tools from the Cavitator before starting it up.
- Always ensure that no debris of any kind is present in the Cavitator.
- Always use securely fitted lifting straps when lifting the Cavitator with a crane or similar lifting tools.
- Do not exceed Max. 10 bar (150 psig) for the Cavitator outlet pressure.
  It is also important to remember that the values for max. outlet pressure apply to water at a temperature of 20°C (68 F).

3. Introduction to the Cavitator Program

3.1 Cavitator Program:

The Cavitator is a standalone unit intended for use in the following applications: Scale free heating, cavitation duty, and a combination of heating and cavitation duties.

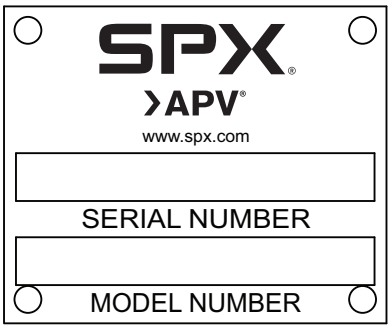
This manual covers all standard versions of the Cavitator.

3.2 Cavitator choices and optional equipment

As part of the Cavitator program there are a number of standard options, meaning that the Cavitator is available as follows:

- In 3A version
- With NEMA-norm motor
- With IEC norm motor
- With rotors with other hole formations
- With housing for larger radial clearance.
- With single or double mechanical shaft seal for SiC/C or SiC/SiC respectively
- With O-rings in EPDM or FPM (FKM) (Kalrez or others).
- The APV Cavitator can be delivered with all standard welded ferrules (S-Line, bevel seat, ISO, etc.) or with special aseptic connections prepared for sterile flushing.

3.3 Determination of Cavitator Type



On the intermediate flange, an identification label has been placed, as shown on Figure 1. This contains the serial number of the Cavitator, as well as the model number.

Figure 1

3.4 Determination of motor type

The motor is identified by removing the motor guard and reading the kW and building height on the identification

4. Installation of the Cavitator

4.1 Positioning

The Cavitator must be positioned so that the suction pipe is as short as possible and there is a falling gradient towards the suction nozzle. Keep the number of valves, bends and tee-fittings on the suction side at an absolute minimum. There must be sufficient space around the Cavitator for piping and access for maintenance.

4.2 Lining up the pipe systems

Carefully line up the pipes to the Cavitator suction and discharge nozzles. Make sure that the pipe systems are adequately supported by pipe supports so that the Cavitator body is not subject to strains and weights from the pipe system.

4.3 Power supply

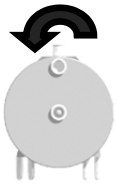
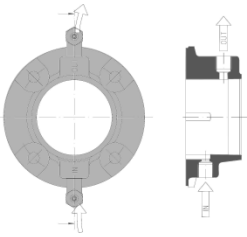


Figure 2

The motor should be connected to the mains via a motor isolator in accordance with local regulations. The motor should be connected in accordance with the instructions inside the cover of the motor's terminal box.

The motor should be connected so that the direction of rotation of the motor (and thus of the rotor) is counter-clockwise when viewed from the front towards the suction nozzle of the Cavitator housing. (Figure 2)

4.4 Water supply for water-flushed shaft seal



A Cavitator with a water-flushed shaft seal has two hose connectors on the seal flange. The hose connectors are 1/8" and fit an ø6 mm hose. The necessary liquid rate is 15-30 l/h. Max. pressure is 7 bar (100 psig).

The hose connection in the seal flange should always be positioned vertically with the fluid inlet underneath and the outlet on top.

Water consumption can be limited by installing a solenoid valve for the flushing water on the supply side. The open/close function of the solenoid valve can be controlled by the Cavitator´ s start/stop sequence.

Do not use flushing water connectors for steam or steam condensate. If you want to use steam as the barrier medium a special aseptic piping is required, see section 2.5.

4.5 Connecting steam or steam condensate for aseptic use

Shaft seals for aseptic use are supplied with ø6/ø4 PTFE pipes for connections.

The connection for steam or steam condensate with static double seal in the Cavitator body is supplied with fittings for 8 mm steel pipes.

Steam can be used at temperatures up to 150°C (302°F) and pressures up to 5 bar (73 psig).

5. Before start-up

Before starting the Cavitator, dismantle and clean the suction pipe and remove any foreign material in the Cavitator.

5.1 Checking the Cavitator body for foreign material

Remove the Cavitator housing as described below. The assembly drawing is to be used for reference.

1. Disconnect the power supply. Make sure it is locked out using a locking device for which only the person involved in the maintenance procedure has possession of the key.
2. Remove the *Cavitator housing* by undoing the body screws and carefully pull off the *Cavitator housing*.
3. Turn the *rotor* to ensure that there is no foreign material behind it and in the holes
4. If there is any foreign material in the Cavitator, remove it.
5. When the Cavitator body is clean and free of foreign material, reassemble the Cavitator. Mount the Cavitator housing as described below.
6. Press the Cavitator housing carefully over the O-ring without damaging it, and fasten the housing screws, observing the correct tightening torque:

   M8: 30 Nm (22 lbf/ft)
   M10: 45 Nm (33 lbf/ft)
   M12: 74 Nm (53 lbf/ft)
7. Install suction and discharge pipes. Check that the pipe unions have been tightened properly and that pipe supports have been fitted.
8. To make the Cavitator housing easier to fit, we recommend that you give the O-ring a thin layer of food-approved, acid-free grease or soap.

5.2 Testing the Cavitator

Figure 3

To check the Cavitator, pour water into the double mechanical shaft seal and start it for a moment. Check the direction of rotation (Figure 3). Listen for any unusual noises.

Never let the Cavitator run without liquid in the double mechanical shaft seal as it will ruin the shaft seal.

6. Putting the Cavitator into service

Check the following before starting the Cavitator:

- Make sure that the shaft guard has been fitted properly.
- Make sure that there is free access for liquid.
- Make sure that the feed pump has been started.
- Make sure that a minimum of 20 – 30 psig back pressure is applied at the discharge side.
- Make sure that the seal flush fluid is flowing.

6.1 Flushing water/steam/condensate etc.

Check that the supply for flushing medium is open and that the flow of the medium is adequate (approx. 15-30 l/hour or 4-8 gal/hour).

7. Maintenance

General

In order to maintain and replace the different parts, dismantle the Cavitator as described below, using the sectional drawing as a reference.

Before the Cavitator is dismantled for inspection and replacements of new parts check the following:

1. Disconnect the power supply. Make sure it is locked out using a locking device for which only the person involved in the maintenance procedure has possession of the key.
2. Turn off the steam and flushing water supply
3. Close the inlet and discharge of the Cavitator and drain the Cavitator housing.
4. If the Cavitator is used for hot/or aggressive liquids, take special precautions. Observe the local regulations for personal protection when working with these products.

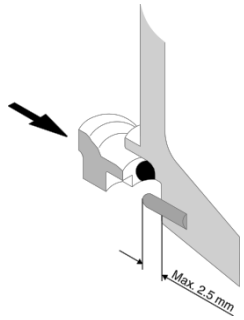
7.1 Shaft seal, inspection and replacement

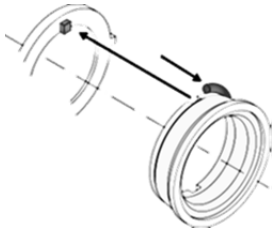
Check the shaft seal for leakage frequently. If the shaft seal is leaking, replace the ***internal shaft seal***, the ***external shaft seal*** or both as described below. It might also be necessary to replace the ***Fixing kit*** or parts of it.

After taking the sealing elements apart, inspect them to determine if they need replacing:

1. Examine the stator and rotor rings for signs of wear. If there are scratches, cracks, imperfection or other irregularities, replace the seal rings. Always replace the rotor and stator-ring in pairs.
2. Inspect the O-rings for cracks, lack of elasticity, brittleness and/or chemical attack. Replace worn or defected parts.
3. Check the parts in the Fixing kit. If there are there cracks, deformation or other irregularities affecting the functionality, replace the parts.

7.2 Internal shaft seal





Disassembly

1. Undo the housing screws and carefully remove the Cavitator housing. Unscrew the cap nut from the shaft and take off the rotor.
2. Remove the stationary seal face with the O-ring mounted in the back plate.
3. Remove the rotary seal face with the O-ring from the rotor.
4. Clean the stator and rotary seal face locations, if necessary with air or water.
5. Check the seal drive pins in the rotor for damage and for correct length: max. 2.5 mm / min. 2 mm (max. 0.98” / min. 0.79”).
6. New parts can now be mounted.

Assembly

1. Fit the stationary seal face with the O-ring in the back plate without using tools. Moisten the O-ring with water. The “notches” in the stationary seal face must mate with the drive pins on the carrier in the back plate.
2. Fit the rotary seal face with the O-ring in the rotor. Ensure that the slot in the seal ring is aligned with the pin in the rotor.

7.3 External shaft seal

Disassembly

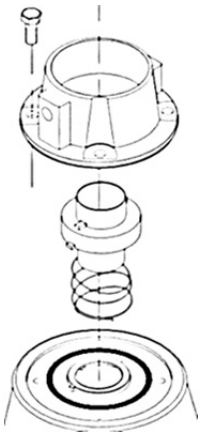
1. After the rotor has been dismantled, loosen the screws and bracket that fit the back plate to the extension frame. Carefully remove the back plate by taking it over the shaft.
2. Remove the stationary seal face with the O-ring from the fixing kit mounted on the back plate.
3. Remove the rotary seal face with the O-ring from the shaft.
4. Clean the stator and rotary seal face locations (if necessary) with air or water.
5. Mount the new parts.

Assembly

1. Fit the stationary seal face by hand with the O-ring in the fixing kit. Moisten the O-ring with water. The “notches” in the stationary seal face must mate with the driving dogs on the carrier in the back plate.
2. Fit the rotary seal face with the O-ring in the shaft.

NOTE: Do not use oil or grease when mounting the rotary seal face on the shaft.

7.4 Fixing-kit



Disassembly

1. After dismantling the back plate, remove the 4 screws that attach the fixing kit. The spring force will move the parts apart.
2. Remove the O-ring between the back plate and the fixing kit.
3. New parts can now be mounted.

Assembly

1. Put the O-ring in the back plate.
2. Place the pressure ring, spring, and pressure ring with tube on the back plate. Ensure that the dowels at the pressure rings mate the same plan as the tracks in the fixing kit.
3. Move the fixing kit over the pressure rings and press it against the back plate. Fasten with the screws.

7.5 Shaft seals, general assembly

After replacing the internal shaft seal or the external shaft seal (or both), and the fixing kit (if necessary), mount the back plate, the rotor and the Cavitator housing in the order below:

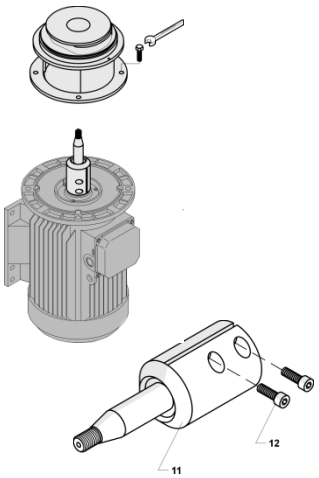
1. Mount the back plate with screws and brackets. Ensure that the in/outlet for the water flushing are in the correct position. Orient it so that the inlet is at the bottom and the outlet at the top.
2. Mount the rotor and fasten it with the cap nut.
   Tightening torque: M20: 200 Nm (132 lbf/ft.).
3. Mount the Cavitator housing and secure it with screws.
   Tightening torque: M10: 45 Nm (33 lbf/ft), M12: 74 Nm (53 lbf/ft.).

7.6 Motor- inspection and replacement

Check the motor performance frequently: the current consumption, noise and vibration level, temperature etc. See the motor supplier's instructions. For identifying the motor, see the motor nameplate.

The standard motor for the Cavitator has a drive-end located bearing. If the motor is replaced, the new motor must also have a drive-end located bearing. For replacement of motor bearings or lubrication requirements, see the motor supplier's service manual.

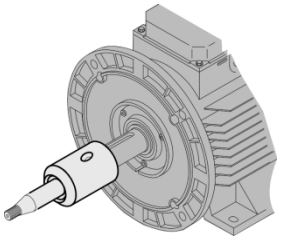
7.6.1 Replacement of the motor



In order to replace the motor, some parts of the Cavitator must be disassembled.

Disassembly

1. Undo the housing screws and carefully remove the Cavitator housing. Unscrew the cap-nut from the shaft and take off the rotor.
2. If possible, place the Cavitator on the motor's fan cover.
3. Undo the four motor flange bolts between the motor and extension frame and remove them.
4. Lift the still-assembled back plate, extension frame, and spacer flange (where fitted) up and off the shaft.
5. Loosen the screws in the stub shaft and pull off the shaft.
6. Remove the bracket/feet from the motor foot. The motor can now be replaced.



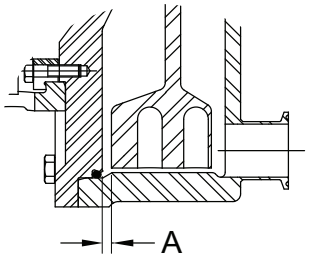


Figure 4

Assembly

1. Before remounting the Cavitator shaft, remove any dirt and grease from the motor shaft and the stub shaft's internal clamping surface.
2. Mount the Cavitator stub shaft loosely on the motor shaft. Position the balance holes at the stub shaft above the keyway on the motor shaft. Apply anti-seize to the stub shaft screws and thread them into the holes.
3. Install the back plate and the extension frame with the space flange over the motor shaft and set them on the motor flange. Bring them into the correct orientation of product and seal flush ports. Mount and tighten the four motor flange bolts.
4. Mount the Rotor and tighten with the cap nut.
   Tightening torque: M20, 200 Nm (148 lbf/ft)
5. While maintaining the distance between the back plate and the back of the rotor (see Table 1 below), tighten the stub shaft screws to the correct torque: M8, 30 Nm (22 lbf/ft) (IEC motors 132-180 only); M10, 55 Nm (40 lbf/ft).
6. Mount the Cavitator housing.

Table 1: Distance between back plate and back of rotor (Dimension "A" in Figure 4)

Cavitator Size	2- and 3-Row Rotors	4-Row Rotor
8" and 12"	0.82" (20.9 mm)	0.23" (5.9 mm)
14" and 16"	0.74" (18.9 mm)	0.15" (3.9 mm)

7.7 Recommended stock of spare parts

Seal set

We recommend that you keep seal kits and, optionally, service kits for the Cavitator in stock. The seal kit for the Cavitator consists of the wearing parts of the Cavitator, as specified on page 27.

Service kit

The service kit is made up of a number of the main components of the Cavitator which are not wearing parts, but which need replacement if they are damaged accidentally: shaft, rotor, stator, cap nut, and fixing kit.

The table below shows the recommended stocks of spare parts for normal operation and in cases where there are special needs, for example; 24-hour operation, operation with abrasive media, or processes that are sensitive to even the shortest production stoppage.

Wearing parts (seal kit, see page 27)

	No. of Cavitators in service		
	0-5	5-20	>20
	sets	sets	Sets / 10 Cavitators
Normal operation	2	3	1
Special needs	3	6	3

Service parts (Shaft, Housing, Rotor, cap nut: starting on page 22; Fixing kit: page 28)

	No. of Cavitators in service		
	0-5	5-20	>20
	set	set	Set / 10 Cavitators
Normal operation	0	1	1
Special needs	1	2	1

8. Technical data

8.1 Max. permissible discharge pressure of the Cavitator

Do not exceed these values for the Cavitator's discharge pressure (valid for water at 20°C (68°F).

The values are also valid for the corresponding models of the Cavitator.

Max. 10 bar (150 psig): Cavitator size: 8", 12", 14", and 16"

8.2 Tightening torque for impeller, inducer and shaft

Tightening torque required for the screws in the stub shaft and for housing screws:

- M8: 30 Nm (22 lbf/ft)
- M10: 55 Nm (41 lbf/ft)
- M12: 80 Nm (59 lbf/ft)
- M16: 180 Nm (132 lbf/ft)
- Tightening torque required for the cap nut:
  M20, 200 Nm (148 lbf/ft)

9. Operating guide

The Cavitator has two main operating functions.

- Scale-free heating duty
- Cavitation duty

The Cavitator does not create any pump work and it has to be fed by a pump. This pump can be a centrifugal pump or a positive displacement pump.

9.1 Scale-free heating duty

The heating is created by the internal disk friction between the rotor and the liquid. Because no hydraulic work is generated, almost all added energy is converted into heat. This will heat the product.

The heating is thus generated by electrical energy added to the motor which drives the rotor. It means that the motor load (net power consumption) is almost equal to the added energy. There is a small energy loss due to the heat radiating from the Cavitator and the energy consumption from the mechanical shaft seal.

The temperature rise can be calculated as

$$dt = P_s\ (1 - \mu/100)\ 3600 / C_p\ q\ \rho$$

where

dt = temperature rise in the Cavitator (^oC)

q = volume flow through the Cavitator (m^3/h)

P_s = added shaft power = motor power / motor efficiency (kW)

C_p = specific heat capacity of the fluid (kJ/kg^oC)

μ = Cavitator energy loses in %

ρ = fluid density (kg/m^3)

Example:

Temp. rise in Cavitator:	**5.67**	**°C**
Flow:	**3.00**	**m³/h**
Power:	**22.00**	**kW**
Specific heat:	**4.19**	**kJ/kg °C**
Energy losses %:	**10**	**%**
Fluid density:	**1000**	**kg/m³**

The added motor power is a function of the size of the Cavitator, the rotor type and the speed of the rotor.

When running, the power consumption will follow the law of affinity:

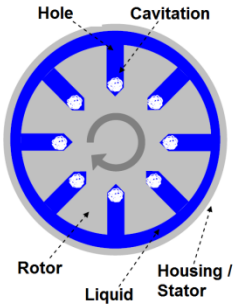
$P_1 / P_2 = (n_1 / n_2)^3$.

Where P = motor power in kW, n= motor speed in rpm, subscripts 1 and 2 denote the value before and after the change.

If the speed of the motor is increased by 10%, the power increases by 33%.

Recommendation: use the Scale free heating duty only for heating in the critical temperature range for the product. To pre-heat up to the critical temperature, e.g. the protein denaturation temperature, use traditional heating methods like plate or tubular heat exchanges.

9.2 Cavitation duty



The Cavitator produces cavitation in each of the radial holes in the rotor when it rotates. This means that the greater the numbers of holes, the more cavitation is produced. In each hole hydro dynamic forces are created which cause interchange of pressure and kinetic energy. The pressure will be lower than the vapor pressure for the product and formations of small cavities (bubble clouds) will be generated down in the holes. When these bubbles collapse, shear forces are generated. The collapse of the cavities will in general occur in the liquid and not on the metal surfaces of the rotor.

Depending on the need for the shear forces applied to the product, different types of rotors are available. There are optional rotors with 2, 3 and 4 rows of holes. The intensity of the cavitation in each hole will increase with increasing speed; larger hydro dynamic forces will be applied. The product passes through an annular zone between the stator and rotor, a kind of liquid tube. The total volume of the holes in the rotor related to the volume of this cylindrical tube defines the level of product exposed to cavitation. The more holes (larger cavitation volume) the more the entire product will be exposed to cavitation. The cross-sectional area between the rotor and stator determines the axial liquid velocity at a given flow and the rotor width determines the time for the product exposed to cavitation.

In case of high viscosity of the product, the radial gap between the rotor and stator can cause relative high power consumption (viscous resistance). Therefore, optional casings (housings) are available with different internal diameter, for radial gap between rotor / stator at 3 and 6 mm. The 6mm casing is intended for highly viscous fluids.

The following applications are typically Cavitation duties:

- Gas – Liquid Mixing. Aeration. Dissolve / mixing or partly dissolve gases like oxygen or carbon dioxide into water or other fluids than water.
- Solids - Liquid mixing. Particle size reduction, homogenization, hydration of gums and polymers. Fish eye removal.
- Liquid – liquid mixing. Emulsification, mixing viscous liquids

9.3 Operating parameters

9.3.1 Flow and back pressure

The Cavitator must be fed by either a centrifugal or a positive displacement pump. The product flow rate is controlled by the pump speed (positive displacement pump) or by a back pressure valve (centrifugal pump).

Position the back pressure valve downstream of the Cavitator.

With either pump, make sure that the Cavitator inlet pressure is at minimum **1.5 bar (22 psig).** Insufficient back pressure can cause cavitation erosion on the metal parts If the product temperature is above its atmospheric boiling point, make sure that the Cavitator back pressure is high enough to suppress any boiling.

9.3.2 Start and stop of the Cavitator

The start and stop of the Cavitator is very closely related to the start and stop of the feed pump.

When the Cavitator is running, it generates energy and heat to the product. If the product flow is stopped when the Cavitator is still running, the product left in the Cavitator will be heated quite extremely. This extreme heating may cause severe fouling/burning/solidification of the product in the Cavitator. In general, only run the Cavitator when there is a product flow through it. This means that the feed pump must be activated as follows:

- Start the feed pump before the Cavitator at production start
- Stop the Cavitator before the feed pump at production stop, or at least reduce the Cavitator speed to a very low level (low energy consumption)

9.4 System design and installation

The installation of the Cavitator is relative simple, in line with a normal pump installation.

The functionality of the Cavitator, the heating duty, and the cavitation duty, makes some demands on the associated system.

Always make sure that:

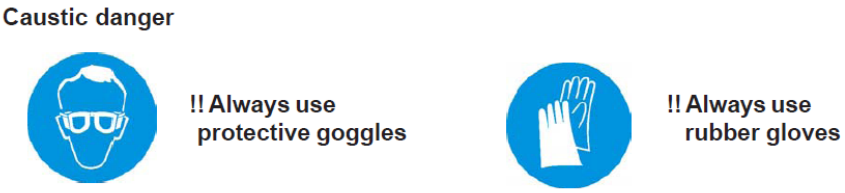
- The Cavitator is run by a frequency converter. This allows a very accurate temperature control when the Cavitator is used for heating. The Cavitation level can also be adjusted by varying the speed.
- The product temperature after the Cavitator is recorded. Use a fast-reacting type temperature sensor. The change in the temperature caused by Cavitator speed changes happens immediately, and the speed regulation depends on a fast and correct temperature signal.
- The feed pump is able to provide the pressure needed. At the minimum, the recommended back pressure and further system pressure drops.
- In many cases it will make sense to use a positive displacement pump type. This type will provide the system with a constant flow which makes temperature control of the product through the Cavitator, simpler.
- A back-pressure valve is installed after the Cavitator. This insures that the minimum back-pressure can be obtained.
- The pressure after the Cavitator is recorded.

9.5 Cleaning and sanitizing

9.5.1 Installation with CIP – systems, Cleaning in Place

Cavitators are constructed so that they can easily be cleaned with CIP-methods for cleaning of processing plants. To achieve the necessary fluid velocities within the pump when cleaning, we recommend a differential pressure of 2-3 bars (29 – 44 psi) across the Cavitator.

The best result will be achieved when the Cavitator is spinning at approximately 1200 rpm, as cavitation assists the cleaning process.



The recommended procedure for CIP cleaning of the Cavitator is as follows:

1. Thoroughly flush the Cavitator with ordinary cold water.
2. Circulate a basic cleaning agent, e.g. lye (NAOH) through the Cavitator:
   - Max. concentration: 1-2 % (percentage by weight)
   - Max. temperature: 70-80°C (160 – 175°F)
   - Circulation time: Approx. 30 min. or according to need
3. After finished circulation, flush the Cavitator with water.
4. Circulate nitric acid (HNO3) through the Cavitator:
   - Max. concentration: 1% (percentage by weight)
   - Max. temperature: 60°C (140°F)
   - Circulation time: Approx. 20 min. or according to need
5. After circulation is finished, flush the Cavitator with sufficient quantities of clean water.

   In order to achieve the best cleaning, do not exceed the temperatures and concentrations listed above. If using different concentrated chemicals for CIP, dilute these chemicals correspondingly before use, and ensure the temperature does not exceed 60 – 80°C (140 – 176°F) during CIP.
   - Do not use the Cavitator for heating of cleaning agents.
   - Never leave cleaning agents overnight in the Cavitator.
6. Disinfection: For use of disinfectants, the following demands and procedures must be observed:
   - Never use disinfectants containing chlorine (Cl) in heated condition
   - Never leave disinfectants in the Cavitator. After disinfection and before using the machine again, wash out the chemicals with water.

9.5.2 Manual cleaning

If desired, the APV Cavitator can also be cleaned manually; this can be done in conjunction with Disassembly for routine checks. Before starting up after idle periods of long duration, the machine should be cleaned manually and inspected. Please see section 7 on page 10 regarding inspection and maintenance. We recommend visually inspecting all rotating components at the same time.

9.5.3 Installation with SIP- systems, Sterilizing in Place

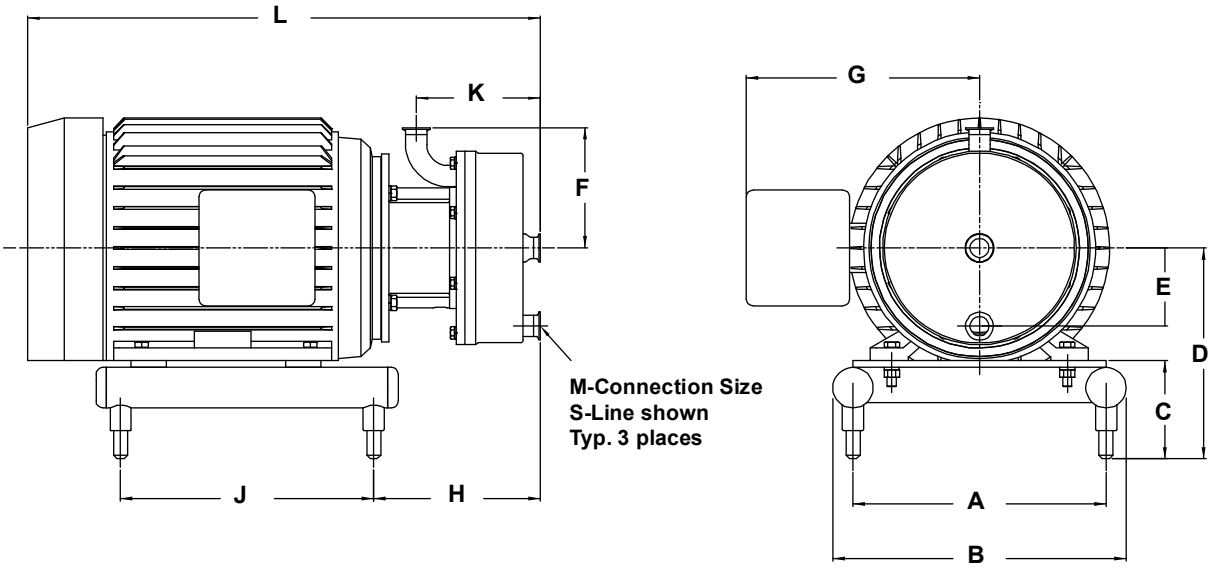
The Cavitator is capable of handling an SIP-process.

Equipment components may need sterilizing, i.e. heating to high temperatures (up to 140°C / 284°F) to kill organisms still remaining on the surface of the equipment. Sterilizing is done by using steam or pressurized, heated water.

Check that the elastomer seal materials (e.g. EPDM) can handle the high sterilizing temperature.

10. Cavitator Dimensions

10.1 Cavitator Dimension with NEMA Motor

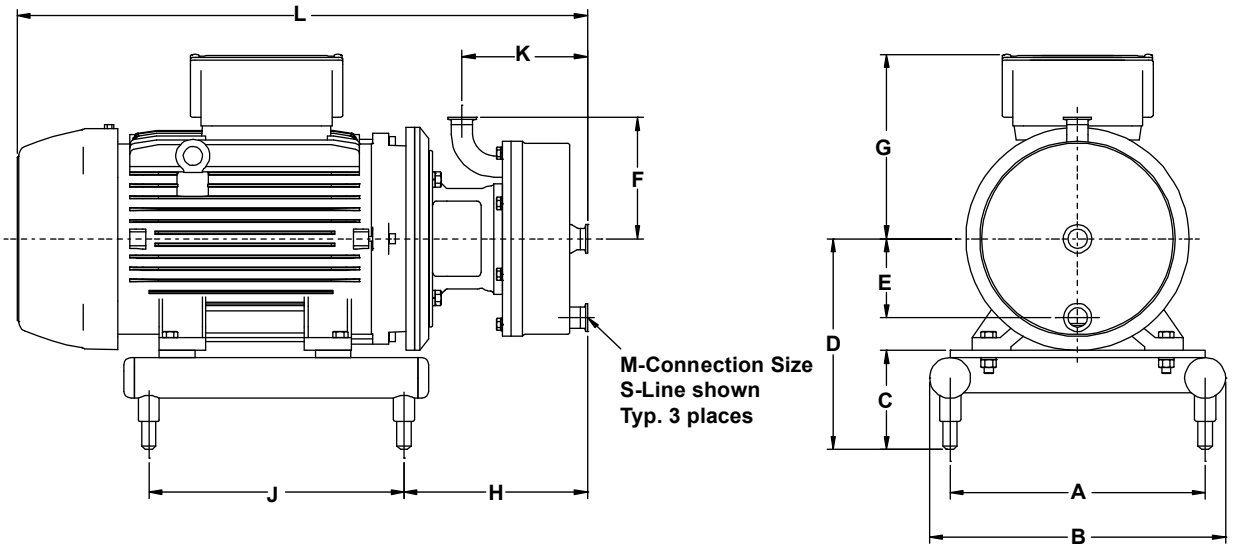


Sizes mm (in.) and Model Number

	8” 215TC	12” 284TSC	12 326TSC	14” 326TSC	14” 365TSC	16” 326TSC	16” 365TSC	16” 405TSC
A	215.9 (8.50”)	457.2 (18.00”)	457.2 (18.00”)	457.2 (18.00”)	533.4 (21.00”)	257.2 (18.00”)	533.4 (21.00”)	533.4 (21.00”)
B	254 (10.00”)	530.4 (20.88”)	530.4 (20.88”)	530.4 (20.88 ”)	606.5 (23.88”)	530.4 (20.88”)	606.5 (23.88”)	606.5 (23.88”)
C	82.9 (3.26”)	177.8 (7.00”)	177.8 (7.00”)	177.8 (7.00”)	177.8 (7.00”)	177.8 (7.00”)	177.8 (7.00”)	177.8 (7.00”)
D	216.3 (8.51”)	355.6 (14.00”)	381 (15.00”)	381 (15.00”)	406.4 (16.00”)	381 (15.00”)	406.4 (16.00”)	431.8 (17.00”)
E	98.1 (3.86”)	141.1 (5.56”)	141.1 (5.56”)	166.1 (6.54”)	166.1 (6.54”)	185.3 (7.29”)	185.2 (7.29”)	185.2 (7.29”)
F	136.1 (5.36”)	217.4 (8.56”)	217.4 (8.56”)	247.4 (9.74”)	247.4 (9.74”)	290.8 (11.45”)	290.8 (11.45”)	290.8 (11.45”)
G	204.5 (8.05”)	323.9 (12.75”)	358.8 (15.19”)	385.8 (15.19”)	459.2 (18.08”)	385.8 (15.19”)	459.2 (18.08”)	490.5 (19.31”)
H	227.8 (8.97”)	269.4 (10.61”)	307.5 (12.11”)	312.4 (12.30”)	341.1 (13.43”)	312.4 (12.30”)	341.1 (13.43”)	385.3 (15.17”)
J	352.6 (13.88”)	457.2 (18.00”)	457.2 (18.00”)	457.2 (18.00”)	257.2 (18.00”)	457.2 (18.00”)	457.2 (18.00”)	457.2 (18.00”)
K	181.1 (7.13”)	224.3 (8.83”)	224.3 (8.83”)	217.6 (8.57”)	217.7 (8.57”)	246.2 (9.69”)	246.2 (9.69”)	246.2 (9.69”)
L	711 (27.99”)	876.2 (34.50”)	917.9 (36.14”)	922.8 (36.33”)	917.2 (36.11”)	922.8 (36.33”)	917.2 (36.11”)	1082.3 (42.61”)
M	19.5 (.75”)	38.1 (1.50”)	38.1 (1.50”)	38.1 (1.50”)	38.1 (1.50”)	50.8 (2.00”)	50.8 (2.00”)	50.8 (2.00”)

10.2 Cavitator Dimension – with IEC Motor

Adjustable Feet (only for 12”, 14” and 16”)

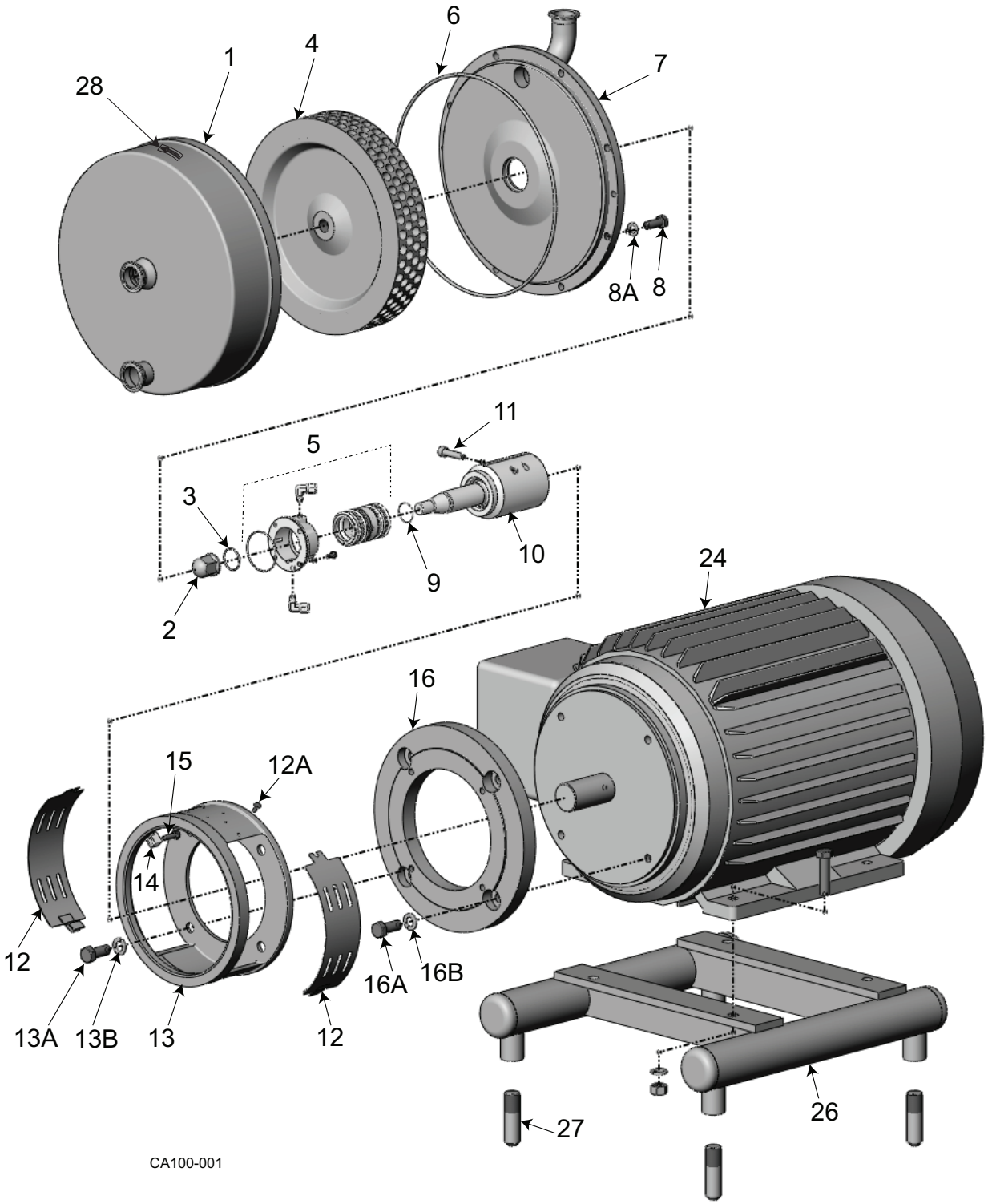


Sizes mm (in.) and Model Number

	8" IEC 132	12" IEC 160	12" IEC 180	12" IEC 200	14" IEC 160	14" IEC 180	14" IEC 200	16" IEC 160	16" IEC 180	16" IEC 200	16" IEC 225
A	216 (8.50")	457.2 (18.00")	457.2 (18.00")	457.2 (18.00")	457.2 (18.00")	457.2 (18.00")	457.2 (18.00")	457.2 (18.00")	457.2 (18.00")	457.2 (18.00")	533.4 (21.00")
B	254 (10.00")	530.4 (20.88")	530.4 (20.88")	530.4 (20.88")	530.4 (20.88")	530.4 (20.88")	530.4 (20.88")	530.4 (20.88")	530.4 (20.88")	530.4 (20.88")	530.4 (23.88")
C	82.9 (3.26")	177.8 (7.00")	177.8 (7.00")	177.8 (7.00")	177.8 (7.00")	177.8 (7.00")	177.8 (7.00")	177.8 (7.00")	177.8 (7.00")	177.8 (7.00")	177.8 (7.00")
D	214.9 (8.46")	337.8 (13.30")	357.8 (14.09")	377.8 (14.87")	337.8 (13.30")	357.8 (14.09")	377.8 (14.87")	337.8 (13.30")	357.8 (14.09")	377.8 (14.87")	402.8 (15.86")
E	98.1 (3.86")	141.1 (5.56")	141.1 (5.56")	141.1 (5.56")	166.1 (6.54")	166.1 (6.54")	166.1 (6.54")	185. (7.29")	185. (7.29")	185. (7.29")	185. (7.29")
F	136.1 (5.36")	217.4 (8.56")	217.4 (8.56")	217.4 (8.56")	247.4 (9.74")	247.4 (9.74")	247.4 (9.74")	290.8 (11.45")	290.8 (11.45")	290.8 (11.45")	290.8 (11.45")
G	187 (7.36")	261.0 (10.28")	281.0 (11.06")	328.0 (12.91")	261.0 (10.28")	281.0 (11.06")	328.0 (12.91")	261.0 (10.28")	281.0 (11.06")	328.0 (12.91")	348.0 (13.70")
H	226 (8.90")	263.4 (10.37")	276.4 (10.88")	338.8 (13.34")	262.3 (10.33")	275.3 (10.84")	337.7 (13.30")	262.3 (10.33")	275.3 (10.84")	337.7 (13.30")	371.4 (14.62")
J	330.2 (13.00")	352.6 (18.00")	352.6 (18.00")	352.6 (18.00")	352.6 (18.00")	352.6 (18.00")	352.6 (18.00")	352.6 (18.00")	352.6 (18.00")	352.6 (18.00")	352.6 (18.00")
K	181.1 (7.13")	224.3 (8.83")	224.3 (8.83")	224.3 (8.83")	217.6 (8.57")	217.6 (8.57")	217.6 (8.57")	246.2 (9.69")	246.2 (9.69")	246.2 (9.69")	246.2 (9.69")
L	696 (27.40")	866 (34.09")	911 (35.87")	1031 (40.59")	865 (34.06")	910 (35.83")	1030 (40.55")	865 (34.06")	910 (35.83")	1030 (40.55")	1063 (41.85")
M	19.5 (.75")	38.1 (1.50")	38.1 (1.50")	38.1 (1.50")	38.1 (1.50")	38.1 (1.50")	38.1 (1.50")	50.8 (2.00")	50.8 (2.00")	50.8 (2.00")	50.8 (2.00")

11. Drawing and Parts List

11.1 Cavitator

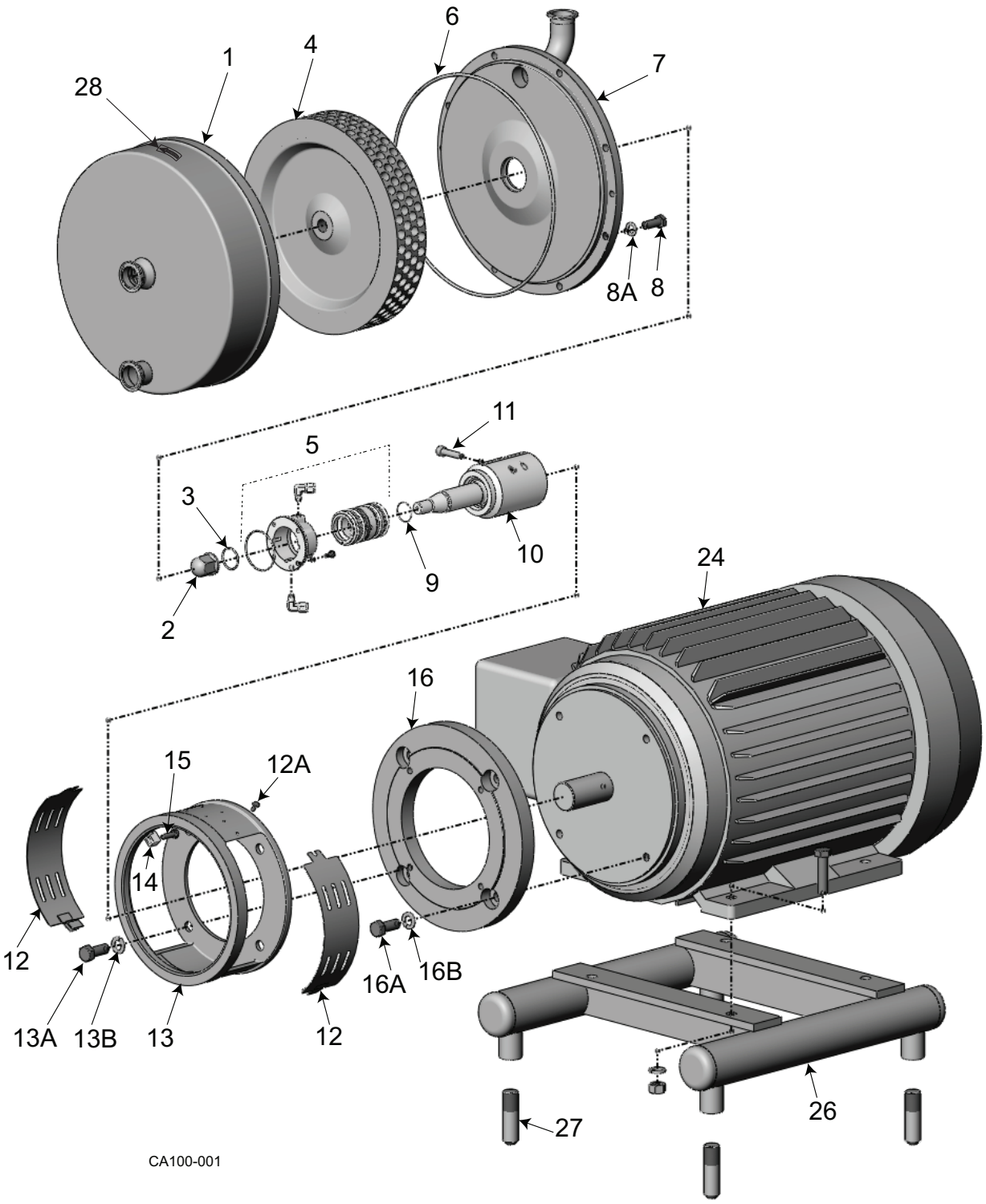


NEMA motor shown; IEC motor available.

Double Mechanical Seal shown. See pages 28 and 29 for seal options.

Item	Qty.	Description	Part Number by Cavitator Size			
			8"	12"	14"	16"
1	1	Housing				
		3mm Clearance, Clamp Connections	132482+	132483+	132484+	132485+
		6mm Clearance, Clamp Connections	132505+	132506+	132507+	132508+
2	1	Cap Nut	L274213	L274214	L274214	L274214
3	1	O-ring (Cap Nut), EPDM	L772489	L772491	L772491	L772491
		O-ring (Cap Nut), FKM	L772490	L772492	L772492	L772492
4	1	Rotor: See page 30				
5		Shaft seal: see pages 28 and 29				
6	1	O-ring (Housing), EPDM	L771627	L771714	L771717	P901698
		O-ring (Housing), FKM	L771628	L771715	L771718	P901690
7	1	Back Plate, Clamp Connection	132486+	132487+	132488+	132489+
8	8	Screw (Housing to Back Plate)				
		M10 - 1.5 x 25mm Lg	070084B	not required	not required	not required
		M12 - 1.75 x 30mm Lg	not required	132470+	132470+	132470+
8A		Lockwasher (Housing to Back Plate)				
		M10	43-183	not required	not required	not required
		M12	not required	43-185	43-185	43-185
9	1	O-ring (Stub Shaft), EPDM	L771621	L771624	L771624	L771624
		O-ring (Stub Shaft), FKM	L771622	L771625	L771625	L771625
10	1	Stub Shaft				
		NEMA Motor, 213-215 TC	L267335	not available	not available	not available
		NEMA Motor, 284-286 TSC	not available	L267342	L267342	not available
		NEMA Motor, 324-326 TSC	not available	L267343	L267343	L267343
		NEMA Motor, 364-365 TSC	not available	not available	L267343	L267343
		NEMA Motor, 404-405 TSC	not available	not available	not available	L267357
		IEC Motor, 132	L261547	not available	not available	not available
		IEC Motor, 160	not available	L261551	L261551	L261551
		IEC Motor, 180	not available	L261563	L261563	L261563
		IEC Motor, 200-225	not available	L261552	L261552	L261552
11	2	Screw (Stub Shaft)				
		NEMA 213-286 (M10 x 30)	135664+	135664+	135664+	not available
		NEMA 324-405 (M10 x 30)	not available	135664+	135664+	135664+
		IEC 132-180 (M8 x 30)	L771199	L771199	L771199	L771199
		IEC 200-225 (M10 x 40)	not available	L701700	L701700	L701700
12	2	Shaft Guard				
		NEMA Motor, 213-215 TC or IEC Motor, 132	L188334	not available	not available	not available
		NEMA Motor, 284-286 TSC	not available	L188811	L188816	not available
		NEMA Motor, 324-326 TSC	not available	P815904	L188816	L188816
		NEMA Motor, 364-365 TSC	not available	not available	L188816	L188816
		NEMA Motor, 404-405 TSC	not available	not available	not available	L188816
		IEC Motor, 160-225	not available	L188335	L188335	L188335
12A	2	Screw (Shaft Guard), M6 x 12	132472+	132472+	132472+	132472+
13	1	Extension Frame				
		NEMA Motor, 213-215 TC	P285140	not available	not available	not available
		NEMA Motor, 284-286 TSC	not available	P286132	P286138	not available
		NEMA Motor, 324-326 TSC	not available	P286171	P286138	P286138
		NEMA Motor, 364-365 TSC	not available	not available	P286138	P286138
		NEMA Motor, 404-405 TSC	not available	not available	not available	P286138
		IEC Motor, 132	P285156	not available	not available	not available
		IEC Motor, 160-200	not available	P286151	P286133	P286133
		IEC Motor, 225	not available	not available	not available	P286133

Cavitator, continued



NEMA motor shown; IEC motor available.

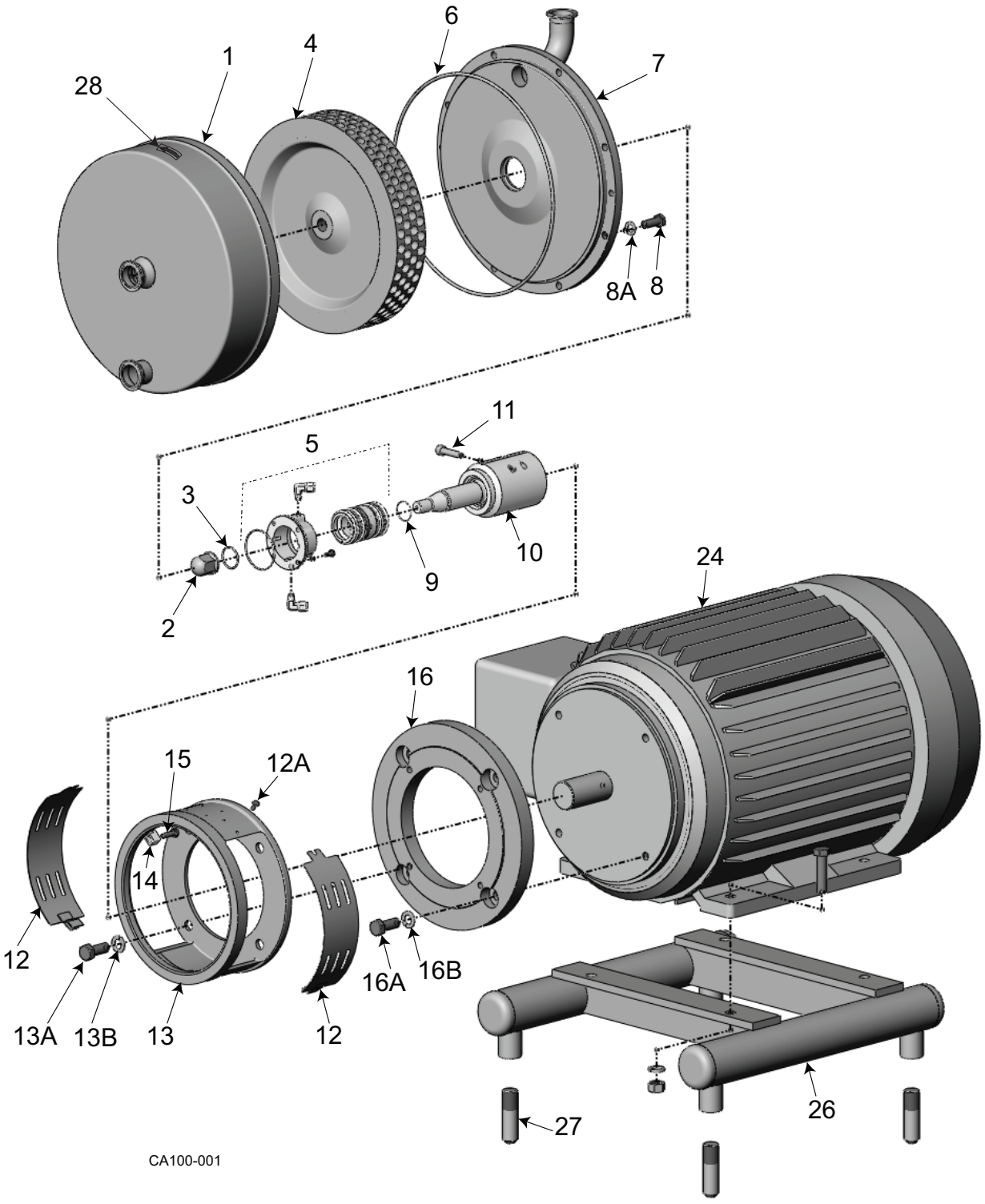
Double Mechanical Seal shown. See pages 28 and 29 for seal options.

Items 13C, 15A, 16C, 19-23, 25 not shown.

Item	Qty.	Description	Part Number by Cavitator Size			
			8"	12"	14"	16"
13A	4	Screw (Extension Frame to Motor, or Motor Flange)				
		NEMA Motor, 213-286 and 364-405 (1/2 - 13UNC x 1.25" Lg)	30-36X	30-36X	30-36X	30-36X
		NEMA Motor, 324-326 Only (5/8 - 11UNC x 1.5" Lg)	not required	30-105	not required	not required
		IEC Motor, 132 (M8 - 1.25 x 25mm Lg)	132756+	not available	not available	not available
		IEC Motor, 160-180 (M16 - 2 x 60mm Lg)	not available	132795+	132795+	132795+
		IEC Motor, 200 (M16 - 2 x 35mm Lg)	not available	30-472	30-472	30-472
		IEC Motor, 225 (M16 - 2 x 30mm Lg)	not available	not available	not available	132794+
13B	4	Lockwasher (Extension Frame to Motor, or Motor Flange)				
		NEMA Motor, 213-286 and 364-405 (1/2")	43-16	43-16	43-16	43-16
		NEMA Motor, 324-326 Only (5/8")	not required	43-33	not required	not required
		IEC Motor, 132 (M8)	CNG127362	not required	not required	not required
		IEC Motor, 160-200 (M16)	not required	43-184	43-184	43-184
		IEC Motor, 225 (M16)	not required	not required	not required	43-184
13C*	4	Nut (Extension Frame to Motor)				
		IEC Motor, 160-180, M16	not required	36-114	36-114	36-114
14	4	Bracket	not required	L268499	L268499	L268499
15	4	Screw (Extension Frame to Back Plate)				
		M8 - 1.25 x 20mm Lg	30-272X	not required	not required	not required
		M8 - 1.25 x 25mm Lg	not required	132756+	132756+	132756+
15A*	4	Lockwasher (Extension Frame to Back Plate), M8	M523SR348E	not required	not required	not required
16	1	Motor Flange (Not required for 284-286 TC NEMA motor or 132-180 IEC motor)				
		NEMA Motor, 324-365 TSC	not required	not required	L267097	L267097
		NEMA Motor, 404-405 TSC	not required	not required	not required	132702+
		IEC Motor, 200	not required	L267666	L267666	L267666
		IEC Motor, 225	not required	not required	not required	L267667
16A	4	Screw (Motor Flange to Motor)				
		NEMA Motor 324-365 (5/8-11UNC x 1.5" Lg)	not required	not required	30-105	30-105
		NEMA Motor 404-405 (5/8-11UNC x 2.0" Lg)	not required	not required	not required	30-128
		IEC Motor, 200, (M16 - 2 x 65mm Lg)	not required	132796+	132796+	132796+
		IEC Motor, 225, (M16 - 2 x 65mm Lg)	not required	not required	not required	132796+
16B	4	Lockwasher (Motor Flange to Motor)				
		NEMA Motor, 5/8”	not required	not required	43-33	43-33
		IEC Motor, 200, M16	not required	43-184	43-184	43-184
		IEC Motor, 225, M16	not required	not required	not required	43-184
16C*	4	Nut (Motor Flange to Motor)				
		IEC Motor, 200, M16	not required	36-114	36-114	36-114
		IEC Motor, 225, M16	not required	not required	not required	36-114
19*	1	Label, 3-A	125100+	125100+	125100+	125100+
20*	1	Label, Warning - Keep Fingers Out	33-63	33-63	33-63	33-63
21*	1	Label, Warning - Rotating Shaft	33-33	33-33	33-33	33-33
22*	1	Label, Warning - Read Manual	121694	121694	121694	121694
23*	1	Label, SPX/APV	M681P442154	M681P442154	M681P442154	M681P442154
24	1	Motor	Specify at time of order			
25*	1	Leg Kit (Side Bars with Adjustable Legs)				
		NEMA Motor, 213-215 TC	110254+	not available	not available	not available
		IEC Motor, 132	60637+	not available	not available	not available

* Not shown

Cavitator, continued



NEMA motor shown; IEC motor available.

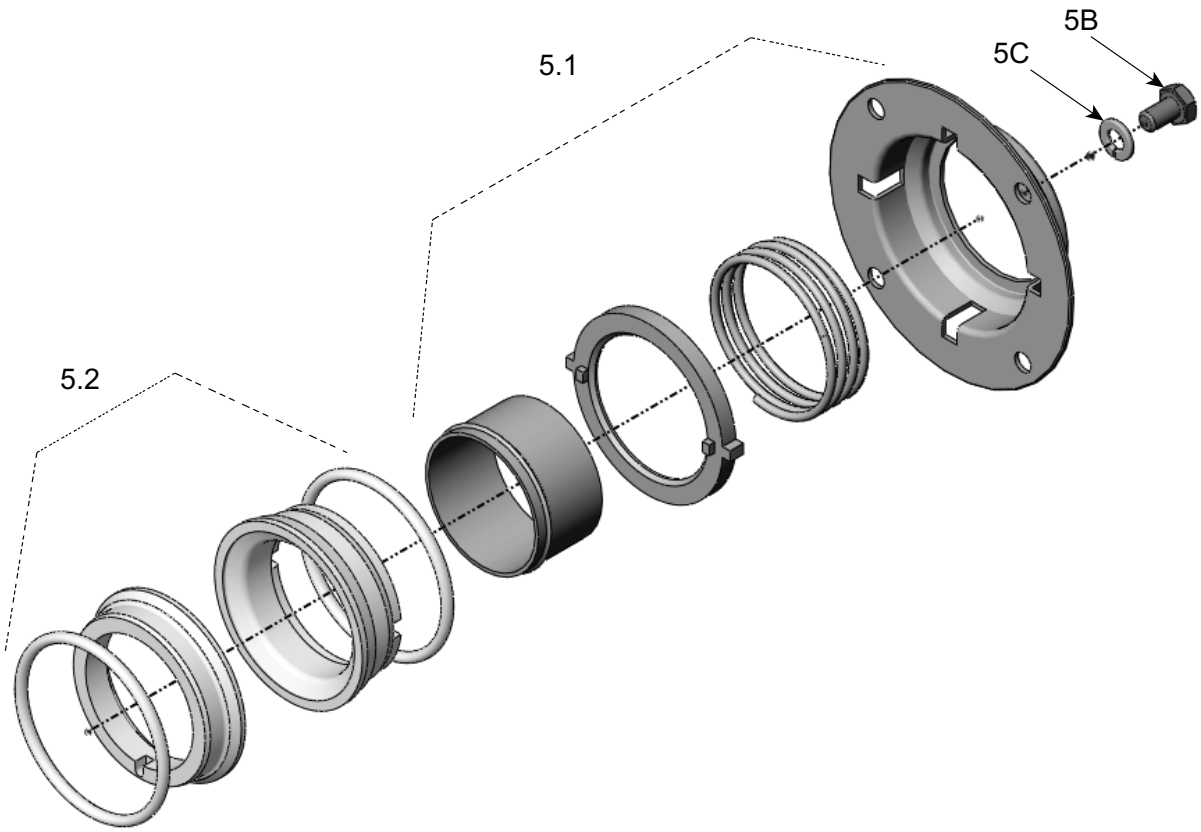
Double Mechanical Seal shown. See pages 28 and 29 for seal options.

Item	Qty.	Description	Part Number by Cavitator Size			
			8"	12"	14"	16"
26	1	Frame (Tubular with Adjustable Legs), Glass Bead Finish (Polished finish is available)				
		NEMA Motor, 284 TSC	not available	132428+	132428+	not available
		NEMA Motor, 286 TSC	not available	132516+	132516+	not available
		NEMA Motor, 324 TSC	not available	132518+	132518+	132518+
		NEMA Motor, 326 TSC	not available	132332+	132332+	132332+
		NEMA Motor, 364 TSC	not available	not available	132520+	132520+
		NEMA Motor, 365 TSC	not available	not available	132333+	132333+
		NEMA Motor, 404 TSC	not available	not available	not available	132522+
		NEMA Motor, 405 TSC	not available	not available	not available	132334+
		IEC Motor, 160	not available	132694+	132694+	not available
		IEC Motor, 180	not available	132696+	132696+	not available
		IEC Motor, 200	not available	132332+	132332+	132332+
		IEC Motor, 225	not available	not available	not available	132333+
27	4	Adjustable Leg (for Item 26 Tubular Frames only)	not required	ACC156000	ACC156000	ACC156000
28	1	Direction Arrow	33-34	33-34	33-34	33-34

11.2 Seal Kits

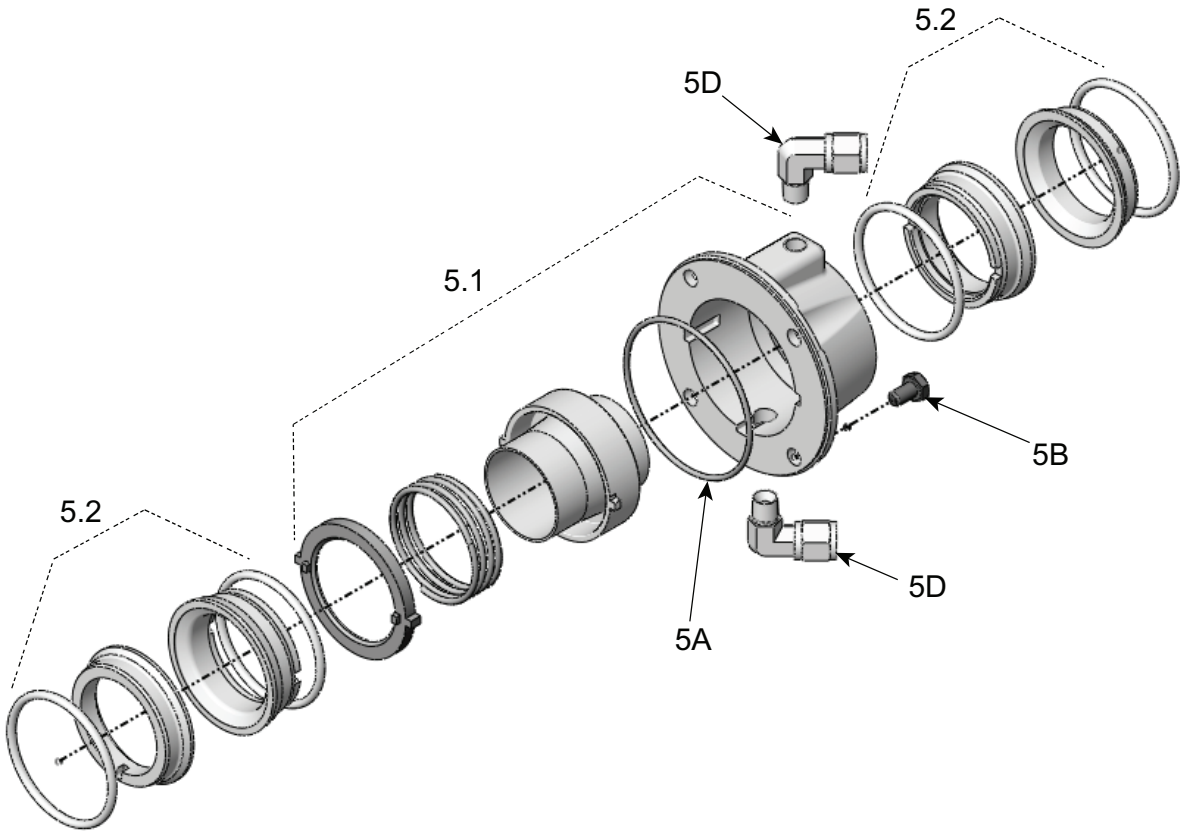
Description	Part Number by Cavitator Size			
	8"	12"	14"	16"
Seal Kit, O-Rings				
EPDM	132913+	132914+	132915+	132916+
FKM	132917+	132918+	132919+	132920+
Seal Kit, Single Mechanical Seal				
Sic/Sic, EPDM	132921+	132922+	132923+	132924+
Sic/Sic, FKM	132925+	132926+	132927+	132928+
Seal Kit, Double Mechanical Seal				
Sic/Sic - Sic/Car, EPDM	132929+	132930+	132931+	132932+
Sic/Sic - Sic/Sic, EPDM	132933+	132934+	132935+	132936+
Sic/Sic - Sic/Car, FKM	132937+	132938+	132939+	132940+
Sic/Sic - Sic/Sic, FKM	132941+	132942+	132943+	132944+

11.3 Single Mechanical Shaft Seal



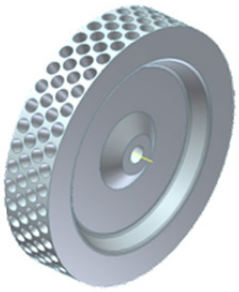
Item	Qty	Description	Part Number by Cavitator Size	
			8”	12”, 14”, 16”
5.1	1	Fixing kit, Single Mechanical Shaft Seal	L772460	L772465
5.2	1	Face kit, Single Mechanical Shaft Seal, Sic/Sic, EPDM	L782466	L782468
		Face kit, Single Mechanical Shaft Seal, Sic/Sic, FKM	L782464	L782469
5B	4	Screw (Seal Housing to Back Plate), M6 - 1.0 x 10mm Lg	132469+	132469+
5C	4	Lockwasher, M6 (Single Mechanical Seal Only)	M523SR348D	M523SR348D

11.4 Double Mechanical Shaft Seal

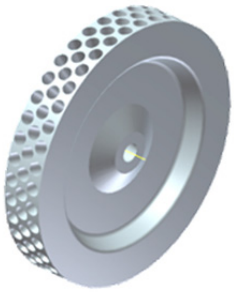


Item	Qty	Description	Part Number by Cavitator Size	
			8”	12”, 14”, 16”
5.1	1	Fixing kit, Double Mechanical Shaft Seal	L194448	L194449
5.2	1	Face kit, Double Mechanical Shaft Seal, Sic/Car, EPDM	L782461	L782466
	1	Face kit, Double Mechanical Shaft Seal, Sic/Sic, EPDM	L782463	L782468
	1	Face kit, Double Mechanical Shaft Seal, Sic/Car, FKM	L782462	L782467
	1	Face kit, Double Mechanical Shaft Seal, Sic/Sic, FKM	L782464	L782469
5A	1	O-ring (External, Double Mechanical Seal), EPDM	E70139	E70144
5B	4	Screw (Seal Housing to Back Plate), M6 - 1.0 x 10mm Lg	132469+	132469+
5D	2	Fitting, Seal Flush (Double Mechanical Seal Only)	M568SS066A	M568SS066A

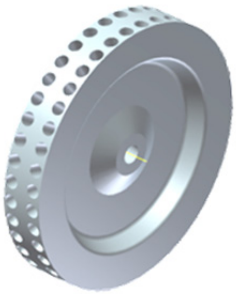
11.5 Rotors



4 rows of holes



3 rows of holes



2 rows of holes

	Rotor		Rotor data				
Cavitator Size:	Part No.	Type	Diameter mm (inch)	Rows of holes	Width of rotor mm (inch)	Number of holes	Area ratio %
8”	P285151	R4	200 (7 7/8”)	4	65 (2 9/16”)	88	56
	P285150	R3		3	50 (2”)	66	42
	P285149	R2		2	50 (2”)	44	28
12”	P286184	R4	305 (12”)	4	65 (2 9/16”)	160	52
	P286185	R3		3	50 (2”)	120	50
	P286186	R2		2	50 (2”)	80	34
14”	P286188	R4	355 (14”)	4	65 (2 9/16”)	180	50
	P286189	R3		3	50 (2”)	135	49
	P286190	R2		2	50 (2”)	90	33
16”	P286196	R4	406 (16”)	4	65 (2 9/16”)	232	56
	P286197	R3		3	50 (2”)	174	55
	P286198	R2		2	50 (2”)	116	37

APV Cavitator

WHERE IDEAS MEET INDUSTRY

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