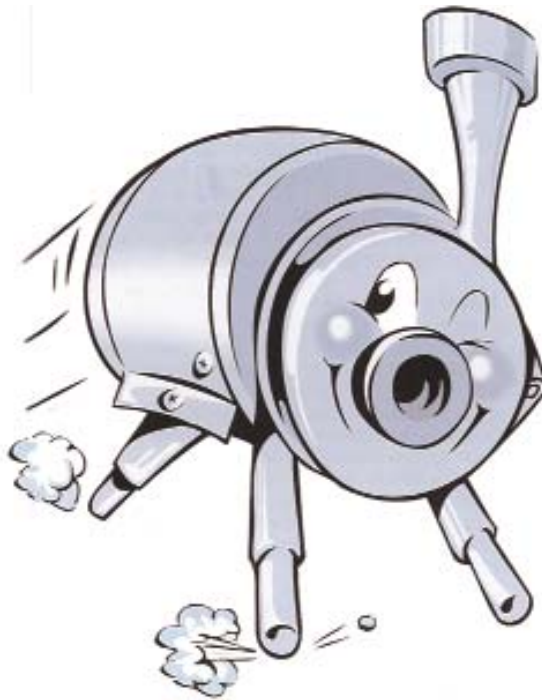


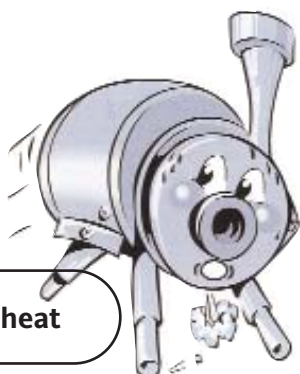
System in servicing - Servicing the system

Service concept for APV Centrifugal Pumps



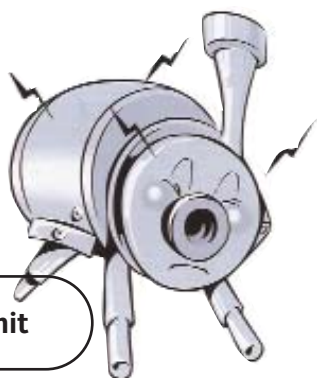
Pump components - Sketches
Status monitoring - Pumps
Status monitoring - Motor
Status monitoring - Shaft seal
Trouble-shooting

Identification of production disturbance types



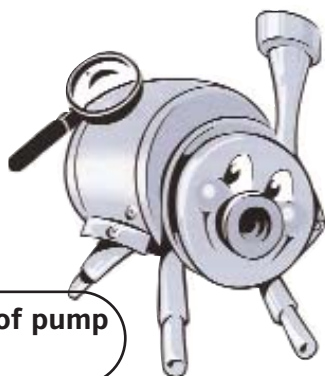
Vibrations and heat

- Pump unit vibratessee Item 1.e.
- Overheated motorsee Items 2.c., 2.d.



Noise in pump unit

- Screeching shaft sealsee Item 1.d.
- Scraping sound from pump housingsee Item 1.a.
- Knocking sounds from pump housingsee Items 1.b, 1.c
- Rumbling sounds from motorsee Items 2.a., 2.b., 2.c.
- Buzzing sound from motorsee Item 2.f.
- Rattling sounds from unitsee Item 2.g.



Visual inspection of pump unit

- Leaks from unitsee Item 3.
- Sedimentation of productsee Item 3.i
- Pump does not worksee Items 2.e., 3.j.
- Capacity problemssee Item 4



Service concept for APV Centrifugal Pumps

APV Fluid Handling tries throughout the whole development process to achieve high serviceability and to make the lifetimes of our components as long as the present state of technology permits. Of course, situations arise where the pumps are given tasks that could not possibly be foreseen. But in general one can say that if APV's centrifugal pumps have been fitted, serviced and used as prescribed, the only wearing parts in an APV centrifugal pump will be:

- The seals in the pump (the O-rings).
- Static seals between pump housing and rear flange at unions, etc.
- Shaft seals in the pump.

Item 7 in the manual shows an exploded drawing and a complete spare parts list of the accessories that can be used with the pump type in question.

To obtain optimum servicing conditions in and around the pump APV Fluid Handling recommends that the pumps are placed appropriately and correctly in the piping system so that access conditions around the pump are as good as possible.

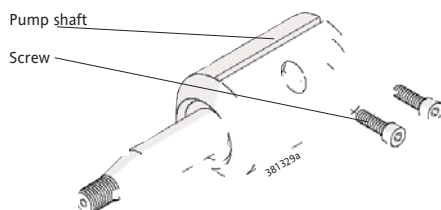
The piping system in the immediate vicinity of the pumps must be supported so that the pump housing is not exposed to forces from the feed and discharge pipes. APV Fluid Handling also recommends its customers to service the pumps at fixed intervals and only to use original spare parts from APV as support for any possible guarantee situation during the guarantee period.

Item 5.4 of the manual shows a list of the spare parts APV recommends its customers to keep in stock.



Status monitoring - Pumps

Purpose: Trouble-shooting and servicing the pump part of APV's centrifugal pumps to re-establish optimum performance in the operating situation.



- 1.a. Metallic screeching sounds from the pump housing may have the following causes:
- a skewed or damaged impeller running against the pump housing and/or rear flange
 - the pump shaft is not firmly attached to the motor shaft with the prescribed torque
 - the pump shaft has not been properly adjusted in the axial direction after a new impeller has been fitted (see also Item 4.e)
 - the spring in the shaft seal may have been caught between the cone and the impeller when the seal was fitted (only on the W+ classic pump).
 - the pump housing is being pulled sideways by loads from the piping system
 - the motor bearings may be worn, making the motor shaft vibrate.

APV recommends that you read through the manual for the pump in question and order new spare parts. You can use the parts list for this.

- 1.b: Knocking sounds from the pump housing are caused by cavitation due to over-low intake pressure, which means that the product is boiling inside the pump because the inlet pressure is too low.

APV recommends that you optimize the intake pressure, for example by placing the pump as close to the suction point as possible as well as reducing back-pressure sources such as valves, fittings etc. to an absolute minimum. The diameter of the suction pipe should never be less than that of the pump suction connection.

- 1.c: Loud noise from the discharge connection is caused by cavitation due to turbulence in the reducer between the outlet and the pipe on the discharge side.

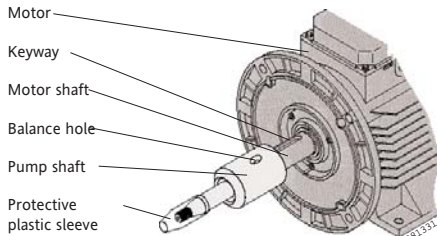
APV recommends that the outward angle of the reducer should not exceed 4-6° in relation to the discharge connection on the pump, since the outlet connection on APV's W+ pumps is specially adapted to the hydraulic design of the pump, which means that turbulence and the resulting noise are eliminated.

- 1.d: Squeaky sounds from the back of the pump housing are often caused by the shaft seal running "dry".

APV very strongly recommends that the pump should not be started until fluid has been added to the pump or the water connection with a water-flushed shaft seal has been properly established.

The situation is often that one forgets to connect water to a water-flushed pump seal before some time has passed. This can be seen from the fact that the secondary shaft seal (outermost shaft seal) has cracked and the O-ring has melted or perished.

Status monitoring - Pumps



1.e: If the pump vibrates, it is because of an imbalance which can have the following causes:

- one of the vanes of the impeller is broken / deformed
- sporadic precipitation of the product on the impeller
- the balance hole on the pump shaft has not been correctly positioned over the keyway on the motor shaft
- The motor shaft has not been balanced with a keyway by the supplier
- a vane on the ventilator has broken off.

APV recommends that you take the pump out of production for dismantling and servicing in accordance with the instructions in Item 5 of the manual.

Status monitoring - Motor

Purpose: To trouble-shoot and service the motor part of APV's centrifugal pumps such that the pump unit can re-establish optimum performance in the operating situation.

2.a: If noise is heard in the form of rumbling sounds at the shaft ends of the motor, it is an indication that the motor bearings are damaged. There can be the following reasons for the failure of the bearings:

- too many shocks in the form of blows or periodical imbalance on the impeller can cause unintentional loads on the bearings, resulting in extraordinary wear
- abnormally high operating temperatures can make the bearing grease dry out, thus losing its lubricating qualities.
- a leaky shaft seal, which means that in special cases fluid can get into the motor and/or contribute to extraordinary wear on the motor bearings.
- Non-lifetime-lubricated bearings have not been lubricated with the grease or at the lubrication intervals recommended by the supplier

2.b: There may be a rattling noise from the ventilator side of the motor because

- one of the ventilation vanes is scraping against the cover or a foreign body has got stuck in the cooler grid of the motor.

APV recommends inspection of the free end of the motor for foreign bodies and/or other damage, and replacement of any defective parts.



Status monitoring - Motor

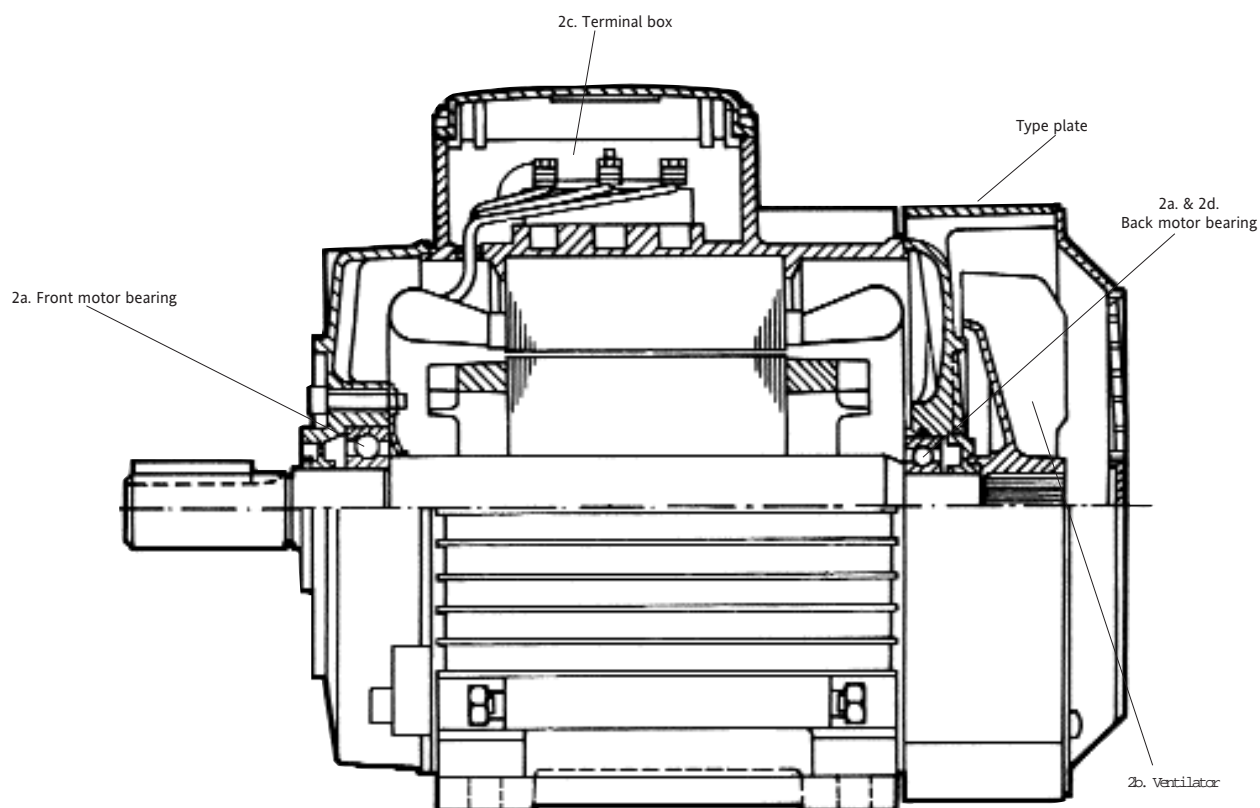
2.c: Buzzing sounds from the motor are caused by

- periodic failure of one the motor's three phases, which means, if the installation is correct, that the thermo relay will cut out the motor before it is damaged.

APV recommends that you call an electrician to take a closer look at the electrical installations.

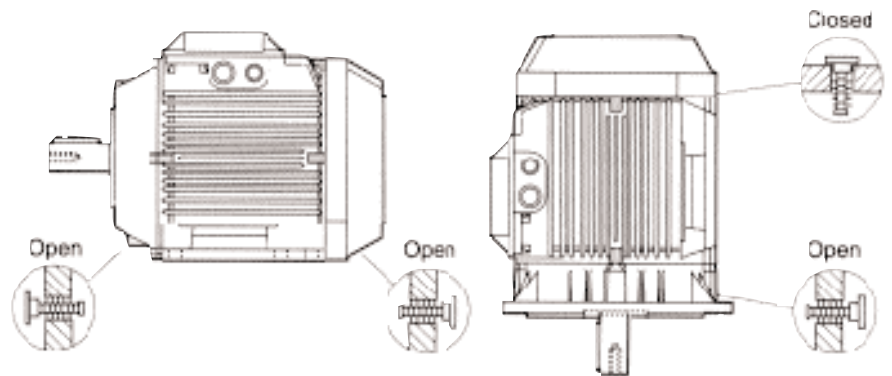
2.d: If the motor gets very hot, the motor may be wrongly dimensioned, i.e. too small. If the maximum current is correctly set this will normally result in the thermo relay cutting out.
On frequency-regulated pumps of the FreCon type at very low speeds situations can arise where the motor's built-in ventilator cannot cool the motor unit down enough.

***APV recommends that you select a larger motor because of the wrongly dimensioned motor.
In frequency-regulated motors a separate ventilator can be used to advantage.***

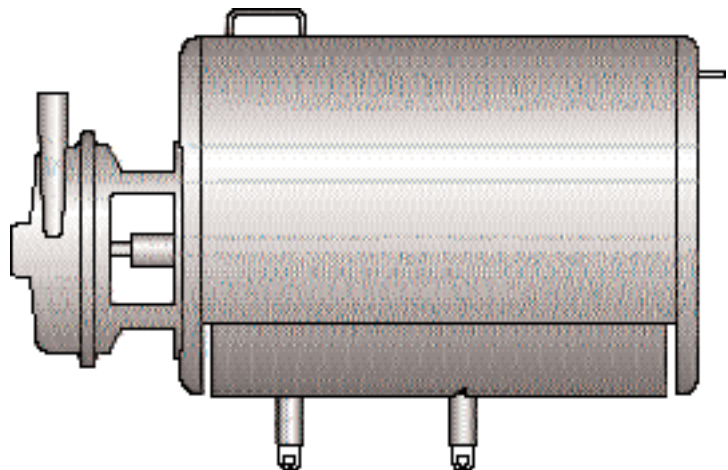


Status monitoring - Motor

- 2.e: If the thermo relay of the motor cuts out it may be because, besides the above-mentioned reasons, the drainage hole of the motor is blocked, which can lead to a short-circuit in the motor.



- 2.f: In frequency-regulated motors the voltage frequency resonate, which results in unwanted noise.
- 2.g: If the noise level is abnormal, check that the motor shroud is attached firmly and does not rattle.



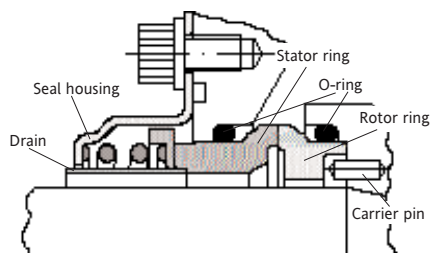


Status monitoring - Shaft seal

Purpose: To trouble-shoot and service the replaceable shaft seal parts on APV's centrifugal pumps to re-establish optimum performance in the operating situation.

NOTE: A shaft seal must always be in contact with fluid to avoid dry-running, which will destroy the seal instantly!

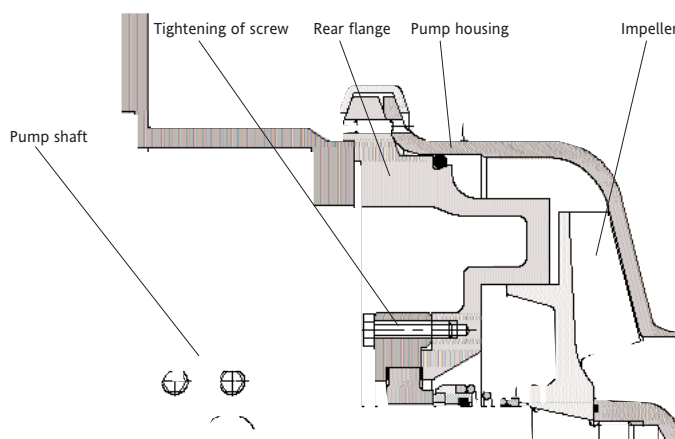
W+ series



3. a: If leaks can be traced around a newly replaced shaft seal, we can recommend

- tightening the screws around the seal flange to ensure that the seal surfaces between the seals are parallel.
- (W+ series) The carrier pin for the rotating part of the seal may be higher than the corresponding notch in the seal, which will mean that the wearing surfaces of the seal parts are not parallel. The rotating seal part must not be able to tilt when placed without the O-ring. The presence of foreign bodies will have the same effect. It can be seen clearly on the seal flange if the seal has not been placed correctly, since deep grooves are quickly formed in it, causing loss of spring tension and a leaky seal.

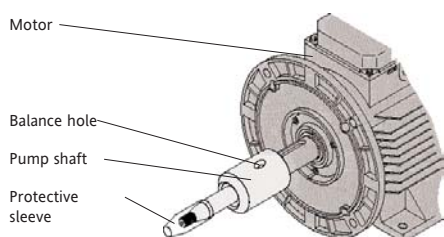
W - Classic Series



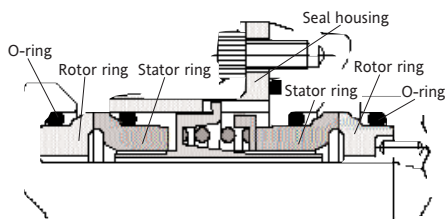
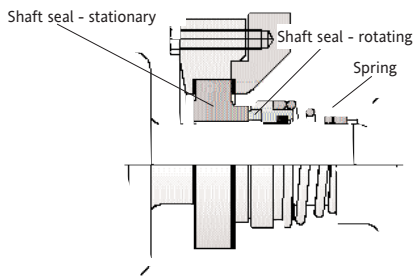
APV recommends, if the above instructions have not remedied the problem, that you call an APV service fitter for a closer inspection.

3. b: If a visual inspection shows that the edges have been knocked off the seal, this indicates that it has suffered physical damage. This usually happens during fitting of the rear flange on the intermediate flange, since this is where the static seal part has to be guided over the pump shaft and thus happens to strike the shaft.

APV recommends the use of a plastic protective sleeve as physical separation between the seal and the shaft.



Status monitoring - Shaft seal



3. c: In the W classic type the spring around the seal may face the wrong way, break or twist around the shaft, for example if the pump has rotated against the prescribed direction. This can happen during start-up of the pump or during CIP running in the opposite flow direction.

APV recommends that you always check the direction of rotation of the pump during both CIP running and motor start-up before operationalizing the system. If the seal surfaces stick together because of the pump medium, it may be useful to use a water-flushed shaft seal.

3. d: A shaft seal may become leaky after just a short period of operation if the correct static pressure in the pump during operation had not been defined accurately enough in the dimensioning phase.

APV recommends that you read about the choice of shaft seal in the manual.

3. e: If an O-ring has hardened, cracked or melted in the operating situation, this indicates that the pump has been running without fluid and the frictional heat that has thus arisen has vulcanized the seal material.

APV recommends that you ensure that the pump is filled with pump medium and/or flushing water throughout operation. The O-rings should be replaced to obtain the sealing effect again.

3. f: If the fluid contains an aggressive material, the O-rings may soften and swell because the sealing material is dissolved.

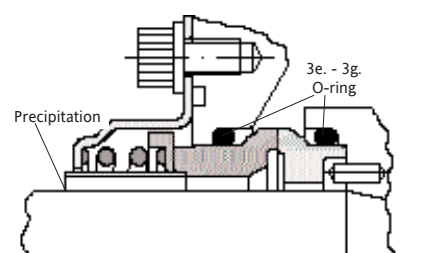
APV recommends that all medium-touching O-rings should be replaced by O-rings of medium-resistant quantity. If necessary, contact an APV service office for guidance.

3. g: Abrasive particles in the product which are deposited around the O-rings may cause mechanical (abrasive) wear, resulting in leaks, evident for example from wear traces on the shaft (only seen on shaft seals where the O-ring seals around the shaft).

APV recommends replacement of the pump shaft and O-rings as described in Item 5.2 of the manual.

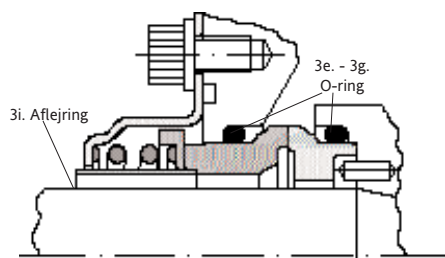
3. h: Crack formation on the wearing surfaces of the shaft seals arises when the pump is "run idle", i.e. without fluid.

APV recommends replacement of the shaft seal as described in Item 5.2 of the manual.





Status monitoring - Shaft seal



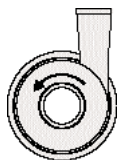
3. i: Normally one can find very small precipitations of the medium on the outside part of the shaft seal, because the smallest dry-matter particles in the fluid (around 0.001 mm in size) can pass the wearing surfaces of the shaft seal, after which the particles crystallize and accumulate as the fluid content evaporates.

APV recommends that you fit a shaft seal with water-flushing if such precipitation is unacceptable.

3. j: If there is any sign of transport damage, contact APV before operationalizing the pump.

Trouble-shooting

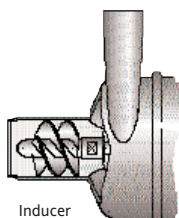
Purpose: To trouble-shoot and remedy capacity problems in plants that use APV's centrifugal pumps, and re-establish optimum efficiency in the operating situation.



4. a: Rotation direction of the motor

It is important that the rotation direction of the impeller is as recommended in the pump manual.

APV recommends that you call an electrician who can check that the phase leads of the motor are correctly fitted as per instructions.



4. b: Feed pressure too low

If the feed pressure to the pump is too low this will cause cavitation in the fluid, which means that the fluid boils inside the pump.

APV's universal inducer can often solve this problem. Contact APV for further information.

4. c: False air in the pump housing

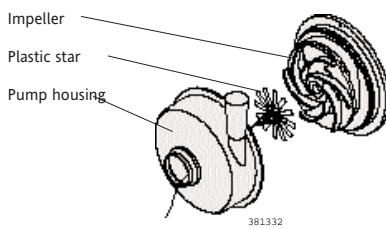
Centrifugal and fluid cycle pumps must always be full of fluid when started up to begin pumping; otherwise the air pocket will block the inlet to the pump and reduce the feed to the pump. During operation a leaky shaft seal may cause "false air" to be sucked into the pump.

APV recommends that at extremely low plant pressures you use a double shaft seal, which has the great advantage that the durability of the seal is extended substantially, since dry-running cannot arise because the seal is water-flushed.

4. d: Wrong pump size

It is very important that one knows all the conditions in which the pump has to run before dimensioning and installing a new pump in a plant.

Trouble-shooting



4.e: Efficiency too low

If the distance between the pump housing and the impeller is more than 0.5 mm, the efficiency of the pump can drop by about 3% for each 0.1 mm the gap increases. So be very careful when positioning the rear flange and pump housing when the pump shaft has been loosened from the motor shaft. Always use the special plastic star that comes with all W+ and W classic pumps from APV.

4.f: Check that the piping and filters are not partly blocked.

4.g: Check that the measuring instruments fitted on the unit work properly.

4.h: The pump does not pump although there is fluid in the pump housing

The fluid is forced out of the pump, but runs back into it when it is stopped. When the pump is emptied there is no fluid to create enough underpressure in the suction pipe because the air content in the suction pipe is higher than the pump volume. As an example, when a check valve is placed too far from the discharge of the pump and with too high a fluid column in the closing direction, the air before the check valve is not compressed enough to lift the flap in the valve.

4.i: With frequency-regulated pumps problems can arise with pressure variations if the PID regulator is not correctly adjusted.

APV recommends re-adjustment of the regulator according to the "Ib Holm Nielsen method" described on pages 5 and 6 of the FreCon manual.