ITT

Lowara

Failure Analysis System Procedure

CO Centrifugal Electric Pump

1) Electric pump applications

• Washing of metal parts and/or surface treatment.
• Washing of produce in the packaging industry.
• Food industry washing equipment and systems.
• Dyeing plants and textile industry.
• Plants for the circulation and transfer of moderately viscous liquids, with light chemical aggressiveness.
• Industrial washing machines and commercial dishwashers.

2) Critical items of application

2.1) Electrical supply

• In running condition, max variation of supply voltage: ± 10%.
  - a too high voltage generates overheating and overload;
  - a too low voltage generates starting problems.
• Max frequency of start: 40 start/h
  - an excessive number of starting generates overheating and overload of motor;
  - frequents start and stop of pump can generate a rupture of the motor tie rods.

2.2) Liquid

• Pumps made in standard configuration (ceramic/coal/FPM) can pump clean water or water containing solid particles in suspension or in fall with the followings temperature limits: -10°C, +110°C.

• In case of applications with bigger range of temperature and pumping of other liquids, pumps must be configurated with attention.
Main configurations realized, based on the type of application, are wrote in the following table:

Application	Advised seal (*)	Remarks
Deionized water	Silicon carbide/Special coal/EPDM oFPM	Suitable for waters witch have just undergone by process of direct or reverse osmosis
Demineralized water	Silicon carbide/Special coal/EPDM oFPM	
Swimming pools	Widia/Special coal/EPDM	Waters witch contain chlorides with variable concentrations
Washing of systems for the food industry	Widia/Special coal/EPDM	Mixture of water and hard caustic: max conc. 20%, Tmax 80°C.
Generics washing systems	Widia/Special coal/EPDM	Products to alkaline base with Ph between 8 and 10. For greater Ph it is advised Widia/Silicon carbide/EPDM
Refrigeration systems	Widia/Special coel/EPDM or Widia/Silicon carbide/EPDM	Mixture of water and glycol with concentration from 10% to 100% and temperature from -55°C to +40°C
Tools lubrication	Standard seal Ceramics/Coal/FPM	In presence of chips Widia/Widia/FPM or Silicon carbide/Silicon carbide/FPM
Filtration of liquid of machine tool	Widia/Widia/FPM	Liquid witch contain chips
Transfer/pumping of generic chemical products	It is advised contact the sale net	Large tipology of acids

(*) Rotating part/fixed part/O-Ring

• Pumping of diesel oil or others inflammable liquids is concurred only with use of special version pumps and equipped with Atex motor.
• Pumping of abrasive liquids generates a rapid wear of hydraulic part and particularly the indents of seal holding disc.
• Pumping of sea water, brackishwater or with a great concentration of chlorine is not adviced because of priming of corrosive phenomena in hydraulic part.

2.3) Installation:
• Max environement temperature: 40°C.
• Max operating pressure: 8 bar.
• Max diameter or foreign matters:
CO 350 pumps: 11 mm;
CO 500 pumps: 20 mm;
- pumping of liquid containing the solid particles generates a rapid wear of hydraulic part (impeller, indents of seal holding disc,...).
• Installation of pump inside of environements with a great humidity causes damaging of motor bearings.
• Pump must never operates without water to avoid damages of mechanical seal and hydraulic part.
• The pump mustn't operates when the delivery outlet is closed (overheating of pumped liquid and motor).

• 1~ motors with power until 1.5 kW have an internal motor protection but they cannot operate without a operator supervision or insertion of additional protections inside of control board.
• 1~ motor with power > 1,5 kW and all 3~ motor, must be protected with a circuit breaker installed by a Customer (it is adviced use of Lowara control board).
• It is recommended installation of high sensibility differential switch (IΔn ≤ 0.03 A) inside of control board, to protect the people from possible electric contact with live parts.
• It is necessary guarantee a correct air flow to cool the motor. It is necessary the ventilation grid is not partially or totally obstructed; otherwise it generates overheating and overload of motor.
• Pump must be positioned correctly so that permit the disassembly of the motor and the hydraulic part without remove the pump body from pipe so that performe ease an inspection.

• Pump must be positioned and anchored to a plane surface. Moreover, suction and delivery pipes must be anchored to a wall and they mustn't charge to pump body; otherwise, suction and delivery pump cupling can break.
• It is necessary insert a non return valve inside of delivery for protect the pump from water hammer and reverse rotation.
• After the use of pump, it is advised a washing of hydraulic part to avoid the damages of pump caused by the residuals of pumped liquids.
• To get a correct priming of pump, in starting condition, it is necessary to fill the pump body and the delivery pipe with water; otherwise, the performance will be low and will generates damages of hydraulic part.

2.4) Operation with inverter
• Usually operation with inverter of CO pumps is not performed but if it is done, it have not particularly limits (refers to inverter handbook).

3) Equipments and tools required

• Megaohmeter 500 - 1000 Vdc;

4) Inspection of defected product

4.1) Preliminary information
On receving of defective product, requirements from Customer:
• purchase date (if possible, confirmed by bill or sale slip);
• installation date;
• conditions of installation and operating.

4.2) External visual inspection
Check the external condition of product, in a particular manner check on the surface of pump body the presence of weld defects, and integrity of aluminum motor casing.

4.3) Preliminary inspections

• Data in plate:
  - type of product and code;
  - series number;
  - manufacturing date;
• Based on type of application witch is subject the pump, check if the configuration is right or wrong (see the table in 2.2).
• Condition of capacitor (if present) and connections on terminal board.

4.4) Electrical resistence of windings

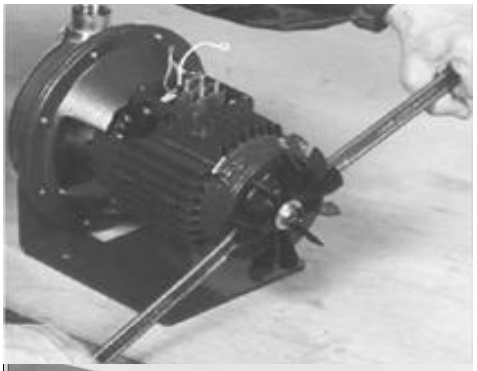
Check electrical continuity of windings and find possible interruptions or burnings.

4.5) Measure of insulation resistance

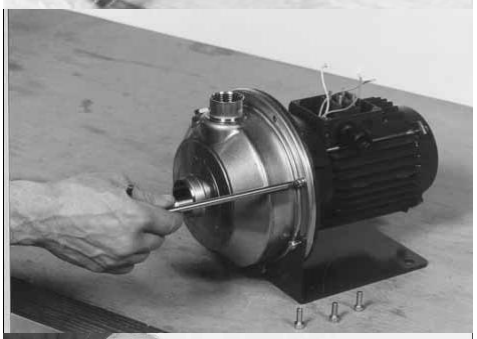
Performed in accordance with european standard EN 602 04-1 (500 Vdc between conductors and ground). Test is passed if insulation resistance is ≥ 10 MΩ.

5) Disassembly and analysis

• Remove the protection grid, depending on the motor type, extract the fan with 2 screwdriver or unsrew the screws on the hub and check:
  - the condition of fan;
  - the free rotation of the shaft with screwdriver (the impeller can crawls on the suction flange or foreign matters can be present.



• Unscrews the screws, remove the pump body and check:
  - conditions of surface of suction flange (presence of wear, defects of welds);
  - the presence of weld defects;
  - the presence of foreign matters.



• Unscrew the lock nut, extract the impeller and the spacer ring:
  - check the presence of wear or defects of welds.
• N.B. If subsequently it must assemble the pump, it is advised keep the spacer ring to position the impeller in the same place:
  - a wrong longitudinal position of impeller generates a low performance of pump.

• Remove O-Ring from his seat (on seal holding disc):
  - check the presence of wear or cuts.
• Extract the mechanical seal from shaft, taking care of not damage it, and remove the seal housing:
  - check condition of her surface and condition of wear;
  - positioning of fixed part of mechanical seal on the seal holding disc (if the mechanical seal is not positioned correctly, it reduces her operating life and her efficiency);
  - check the conditions of three indents on the seal holding disc (possible wear indicates the pumping of abrasive liquid).

• Remove the tie rods, the adaptor and extract the rotor:
  - check the conditions of bearings.

• Performe an heads visual analysis for finding possible problems with following cases:
a) all motors:
- one or more winding coils burnt ----> shorted coil;
b) 1~ motor:
- run winding OK and start winding KO ----> capacitor defected;
- run winding KO and start winding OK ----> motor could not start;
- both windings faulty ----> overload;
c) 3~ motor:
- 1 phase fine and 2 phases burnt ----> powered with only 2 phases;
- all phases burnt ----> overload;

6) Check list

Type of problem

- ☐ Does not delivery water
- ☐ Low performance
- ☐ Does not starts
- ☐ Noisy
- ☐ Grounded motor
- ☐ Excessive power input
- ☐ Runs slowly
- ☐ Further:

Pump data

Type:
Code:
Series number:
Installation date:
Manufacturing date:
Liquid pumped:
Temperature:
Remarks:

CO pumps failure causes required for claim opening

Where	What	Why
100 Electric motor	100 Flooded/full of water	106 Uncorrect assembly/testing of components
		110 holes of drain condensate, obstructed/closed
		111 Pinched gasket screws
		112 Not complying components tooling
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
100 Electric motor	101 Excessive power input / overheating / burnt	102 Motor shaft locket
		104 Wrong internal electrical connections
		106 Uncorrect assembly/testing of components
		107 Bursted / unconnected capacitor
		108 Short circuit for contact with mobile parts
		109 Short circuit between coils/windings
		114 Hydraulic rotating part locked
		115 Presence of external matters between windings
		100 Further (supply detailed description of failure)
		121 Inadequate power supply
		103 Not complying/unsuitable applications
		113 Inadequate size of motor
		116 Inadequate cooling
		119 Normal wear
		120 Excessive wear
		101 Further:
100 Electric motor	102 Runs slowly / does not starts	106 Uncorrect assembly/testing of components
		107 Bursted / unconnected capacitor
		117 Defected/wrong rotor
		118 Not operating level sensors
		119 Water full level sensors
		100 Further (supply detailed description of failure)
		121 Inadequate power supply
		103 Not complying/unsuitable applications
		113 Inadequate size of motor
		101 Further:
100 Electric motor	103 Does not stops	105 Defected/not operating electrical/electronic components
		118 Not operating level sensors
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		101 Further:
101 Motor shaft	104 Noisy / locked / vibrate (ok windings)	102 Locked motor shaft
		106 Uncorrect assembly/testing of components
		112 Not complying components tooling
		114 Hydraulic rotating part locked
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:

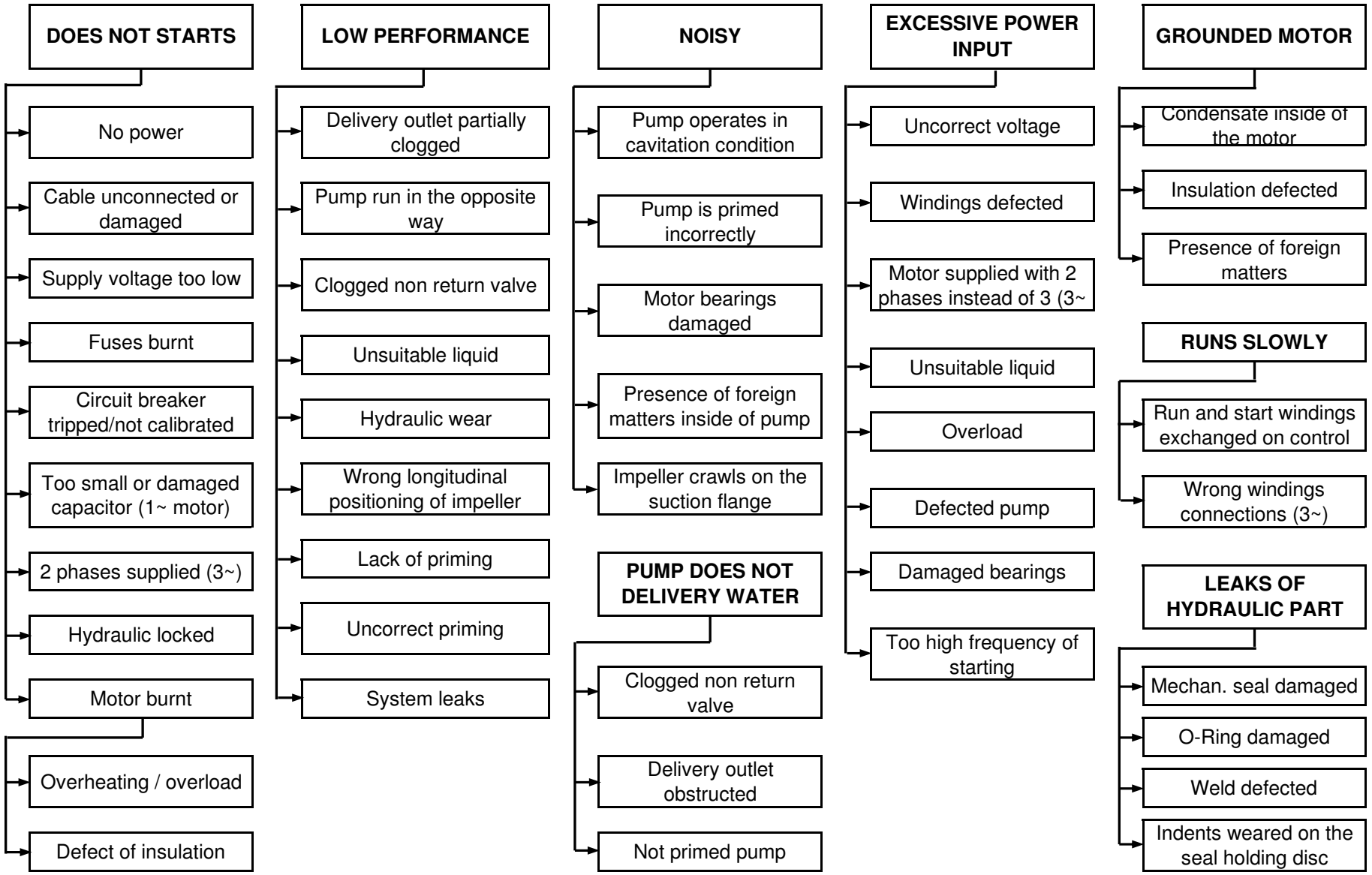
101 Motor shaft	102 Shaft / toothing jut	112 Not complying components tooling
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
101 Motor shaft	401 Broken/cracked	112 Not complying components tooling
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
200 Control device	200 Not operate	105 Defected/not operating electrical/electronic components
		200 Lack of technical / commercial information
		118 Not operating level sensors
		119 Water full level sensors
		100 Further (supply detailed description of failure)
		121 Inadequate power supply
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
300 Total hydraulic	300 Low performance	106 Uncorrect assembly/testing of components
		112 Not complying components tooling
		300 Wrong rating plate/packing
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
300 Total hydraulic	104 Noisy / locked / vibrate	106 Uncorrect assembly/testing of components
		112 Not complying components tooling
		114 Hydraulic rotating part locked
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
403 Pump sleeve	400 Leak	106 Uncorrect assembly/testing of components
		112 Not complying components tooling
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
404 OR/Mechanical seal	400 Leak	106 Uncorrect assembly/testing of components
		112 Not complying components tooling
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
408 Pump shaft/joint	401 Broken/cracked	106 Uncorrect assembly/testing of components
		112 Not complying components tooling
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
600 Product	600 Wrong rating plate packing	106 Uncorrect assembly/testing of components
	601 Wrong product document	200 Lack of technical / commercial information
	602 Not acknowledgment of warranty	600 Out of legal warranty period
		601 Product tampering

8) Faq

Problem founded	Possible causes of the problem
Pump does not start	Power supply problems: • no power; • unconnected or damaged cable; • supply voltage too low. Hydraulic locked Fuses burnt Circuit breaker tripped/not calibrated. Capacitor too small or damaged (1~ motor). 2 phases powered (3~ motor). Motor is burnt because of insulation defected, overheating or overload (unsuitable liquid)
Pump does not delivery water	Non return valve clogged Delivery outlet obstructed because of foreign matters. Pump not primed correctly Pump operates in cavitation
Low performance	Delivery outlet partially clogged Pump run in the opposite way Clogged non return valve Unsuitable liquid (density or specific weight) Wear of hydraulic part Lack of priming Uncorrect priming Wrong longitudinal positioning of impeller. System leaks
Noisy	Pump operates in cavitation condition Pump is primed incorrectly Motor bearings damaged cause by condensate Presence of foreign matters Impeller crawls on the suction flange
Runs slowly	Run and start windings exchanged on control panel (1~ motor) Wrong windings connections inside the motor (3~ motor)
Grounded motor	Generation of condensate inside of the motor Insulation defected Presence of foreign matters (swarfs or bolts and screws)

Excessive power input	Uncorrect voltage Windings defected Motor supplied with 2 phases instead of 3 (3~ motor) Unsuitable liquid Defected pump Defected bearings Too high frequency of startings
Hydraulic locked	Unsuitable liquid Presence of foreign matters inside of the pump Tolerance of tooling beyond the limits O-ring out of seat
Overheating / overload	Too high pumped liquid temperature Too high frequency of startings Wrong supply voltage Wrong size of pump o motor Defected pump Thrust bearings damaged o seized Lack of adequate protection inside of control board (for motors without internal protection, see 2,3) Lack of ventilation of the motor Too high environment temperature

7) Failure tree (CO pumps)



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