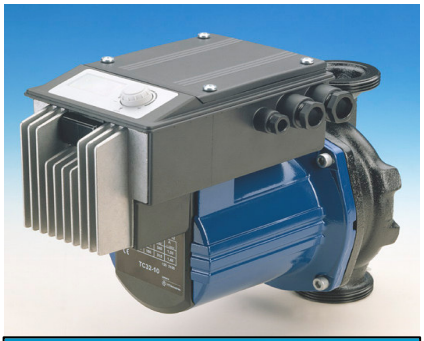
ITT

Lowara

Failure Analysis System Procedure



Electronics Circulators (ETC, EFC, EFCG)

1) Circulator applications

• Water circulation in heating, air-conditioning and refrigeration systems
• Pumping of hot or cold liquids chemically or mechanically not aggressive

2) Critical items of application

2.1) Electrical supply:
• In running condition, max supply voltage must be: ±10% for 50 Hz.
  - a too high voltage generates overheating and overload.

2.2) Liquid
• Max and min liquid temperature: +20°C, +110°C;
  - if temperature is greater than upper limit, motor is subject to overheating and it generates cavitation.
• Max mixture of water/glycol 50% (ratio 1:1):
  - ATTENTION! with volume concetrations of glycol ≥ 20%, it must check the possibility of circulator oversize (performance/ power input problem).
• Circulator must not pump brackishwater with suspenction (sand) or aggressive (es. corrosive liquids):
  - not respect of this prescription generates corrosions and exclude an acknowledgment of technical warrant.

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2.3) Installation:
• Max environment temperature: 40°C
• Max operating pressure 10 bar.
• Circulator must not be oversized (except for cases in 2.2); max flow rate must respect the limit wrote in plate:
  - working on bottom of operating curve or incorrect oversizing generates noise and a too low difference pressure between suction and delivery so damaging of bush bearings.
• Min suction head must respect limits wrote inside of installation handbook:
  - a value lower than limit generates cavitation, so damaging of impeller and bush bearings due to lack of lubrication.
• Circulator must never operates without water to avoid seizing of mobile parts and damaging of bush bearings graphite.

• Installation of circulator must always be performed with horizontal motor shaft axis;
  - a wrong positioning generates damages of bush bearings and problems of condensate drain.

• For circulators with P ≥ 500 W, cooling wings of electronic board must be vertical (see installation handbook).

• Positioning of terminal board on 6 o'clock is forbidden when it is pumped water with temperature min of environment (generation of condensate).
• In case of insulation, condensate evacuation notches must not be obstructed.
• For twin circulators installed on horizontal pipe it advised the periodic permutation for avoid generation of air lock in the upper part and rotor wear.

3) Equipments and tools required

• Megaohmeter 500 - 1000 Vdc

4) Inspection of defected product

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

4.2) External visual inspection
• The presence of insulation, performed obstructing evacuation notches in the motor flange, indicate an incorrect installation and exclude an acknowledgment of technical warrant.
Product analyse stop and repair (if required) is made for a fee.

4.3) Preliminary inspections
• Data in plate:
  - type of product and code;
  - series number;
  - manufacturing date (for ex. 063 = march 2006);

4.4) Electrical continuity of windings
Check electrical continuity of windings for find possible interruptions/burnings.

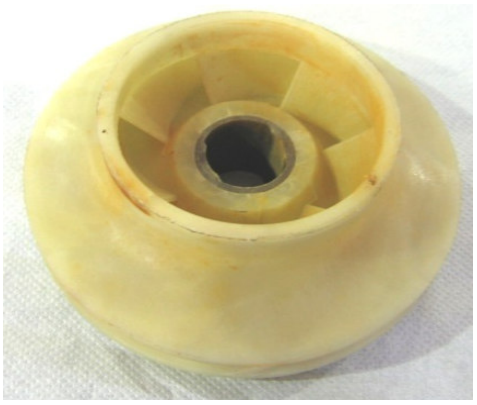
4.5) Measure of insulation resistance
Performed in accordance with european standard EN 602 04-1 (500 Vdc between conductors and ground).
Test is passed if insulation resistance is ≥ 10 MΩ

5) Disassembly and analysis

• Check inside of the terminal board:
- presence of water/condensate;
- presence of burnings;

• Remove motor/hydraulic block from pump casing and check:
- possible traces of wear/corrosion of internal surfaces of pump casing, caused by pumping of unsuitable liquids;
- condition of O-Ring (wear, cuts, pinching).

• Remove the segger, extract the impeller and check:
- presence of deformation or wear caused by cavitation with generation of steam.
- condition of O-Ring on the rotor (wear, cuts, pinching).



• Rotor should be extracted from his seat.
It should be following conditions:

• rotor totally locked (not rotation and not extraction), because:
- rotor sleeve inflated or stator plastic casing poured (overheating / overload);
- presence of limestone deposits inside of motor (unsuitable liquid).
• rotor run but it must not be extracted, because:
- rotor sleeve is inflated or stator plastic casing is poured (overheating / overload);
• rotor not run but it can be extracted, because:
- presence of limestone deposits inside of motor (unsuitable liquid).

• All back conditions excludes an acknowledgment of technical warrant.
• Check conditions of rotor sleeve for exclude possible defect in the welds witch causes leaks of water and shortcircuit of motor (acknowledgment of technical warrant).

• Check possible presence of rust in the stator, witch is caused by leak of water or generation of condensate in the motor.
• Remove plastic casing over the stator and performe visual analyse of heads to check presence of overheatings, burnings.
• All back conditions exclude an acknowledgment of technical warrant, with exclusion of the leak of water in the motor through a defected weld in the rotor sleeve.

6) Check list

Type of problem

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

Circulator data

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

Electronic circulators 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	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
Circulator does not start	Power supply problems: • no power; • unconnected cable or damaged; • supply voltage too low; Presence of anomaly witch are not corrected automatically with the electronic protection (for ex. seizing, clogging). Fuses burnt Hydraulic locking for: • bush bearing damaged caused by operating far to nominal condition. • deposits caused by a long period of shutdown • liquid unsuitable • temperature of pumped liquid out of predeterminated limits. Faulty stator Overheating/overload Presence of foreign matters
Excessive power input	Uncorrect supply voltage Windings defected Overload Circulator defected Liquid temperature too low Bush bearings damaged
Grounded motor	Condensate not drained in the motor Water/condensate leaks in terminal board (presscable unlocked)
Noisy	Presence of air Motor bush bearings damaged Wrong rotation of motor Wrong electronic set-up Suction pressure too low Excessive flow rate Presence of foreign matters in the impeller
Low performance	Wear of impeller Delivery outlet clogged Non return valve is locked (EFCG) Liquid unsuiteble System leaks Presence of foreign matters in the impeller
Impeller deformed/weared	Overheating caused by cavitation
Presence of water in the motor	Condensate evacuation notches obstructed Defected welds on the rotor sleeve
Overheating/overload	Liquid unsuitable Limestone deposits Temperature probe defected/damaged

7) Failure tree (electronic circulators)