ITT

Lowara

Failure Analysis System Procedure

4" 6" CANNED MOTORS

1) Motor applications

• drinking water feeding;
• wells;
• irrigation systems;
• industrial systems;
• fountains;
• water level control;

2) Critical items of application

2.1) Electrical supply
• In running condition, supply voltage must be into tolerance values.
A too high voltage can generate overheatings and overloads.
• In starting operation, drop voltage must be into limits declared by constructor to avoid damage on the motor windings.
• 1~ motors have an internal motor protection but they cannot operate without a operator supervision or insertion of additional protections inside of control board.
• 3~ motors must be protected with a circuit breaker installed by a Customer (it is adviced use of Lowara control board).

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2.2) Liquid

• Max liquid temperature and corresponding min liquid speed around the motor external sleeve, must respect limits indicates on the installation book.

- If temperature is too high or speed is too low, it can generate overheating. To guarantee a correct water speed, it have to installe an external sleeve, if necessary.
- If liquid temperature is greater than critical value, the motor must be derated according to coefficients supply by constructor.

• It is necessary guarantee a minimum distance of 1 m between pump and bottom of well in order to guarantee the correct cooling of the motor and to avoid the pump can suck deposited solid parts, witch obstruct the filter and damages the hydraulic part.

• Liquid must not be brackishwater, seawater or corrosive (for water witch contain chloride, see the attached diagram):

- corrosions are caused by incorrect applications (inadequate ground system, leakage current, stray current, unsuitable pumped liquid...) and they cannot be inputed to product or constructive materials.

2.3) Pump coupling

The coupling between motor and pump performed by Lowara guarantee their correct working. If it wants couple a motor and a pump, bought separately, it must respect a following prescriptions:

• Nominal motor power must be greater or equal than pump motor; otherwise, it can generate overheating or overload.

• Axial thrust value must be into tolerance values both in vertical and horizontal condition:

- axial thrust too high can generate frictions witch can damage thrust bearing;
- axial thrust too low can damage upper thrust washer.

• Before of coupling between motor and pump, it must check the motor shaft jut is into tolerance values; tolerance value of motor shaft jut according to Nema standard are the following:

4" motors: 38.05 ÷ 38.30 [mm];

6" motors: 72.65 ÷ 73.02 [mm];

- an excessive shaft jut determines a damage of motor thrust bearing and the wear of impellers witch slides on the diffusers.

2.4) Control of motor by inverter

• Min frequency of supply voltage: 30 Hz

• Starting ramp time: 3 - 5 s

• Stop ramp time: 3 - 5 s

Rotation speed or starting too low generates damaging to Mitchell thrust bearing caused by his lack of lubrication.

• In starting condition, inverter must guarantee a booster function, that is, it must apply a voltage pulse before to pass to current control for make easy the separation of thrust bearing pads.

• Max lenght of cable: 20 m.

If lenght is greater than limit, it must be installed an impedance board; otherwise, the cable and inverter cupling can generate overvoltage witch can go to motor and damage windings.

3) Equipments and tools required

• Megohmmeter with applicable voltage of 500 - 1000 V.

4) Inspection of defected product

4.1) Preliminary information

4.1.1) To receveing of defected product, require of Customer:
• purchase date (if possible, confirmed by bill or sale slip);
• installation date;
• conditions of installation.

4.1.2) Informations about the available versions
• Motors with stator sleeve filled by air:
- L4C: from 0.37 kW to 2.2 kW monophases;
- L4C: from 0.37 kW to 2.2 kW threephases;
- L6C: 4 kW.
• Motors with stator sleeve filled by silical oil:
- L4C: 3.7 kW monophases;
- L4C: from 3 kW to 7.5 kW threephases;
- L6C: from 5.5 to 37 kW.

4.2) External visual inspection

• External aspect of product
Corrosion on metal surface or on welds (with little holing) or overtemperature (motor sleeve with brown/blue colour) are an indication of incorrect or unsuitable use (see 2.1 ÷ 2.4) and exclude an acknowledgment of technical warrant.
Product analyse stop and repair (if required) is made for a fee.
If there are not elements of objection, go on with inspections in 4.3.

4.3) Preliminary inspections

• Data in plate:
- type of product and code;
- series number;
- stator number (only for F4-F6 motor);
- manufacturing date;
• Welds and dents in the jacket.
• Presence and condition of:
- whole supply cable;
• Condition of connector and its seat
• Diaphragm position respect to normal condition
• Check with hand if rotor rotate or is locked (bearings damaged)
• Measure a shaft jut and check the respect of tolerance (see 2.3)

4.4) Electrical resistence of windings

• Measure electrical resistance of windings and match values with those provided by Lowara.
If values are much different, it is possible there are damages of windings (interrupted/burnt).

4.5) Measure of insulation resistance

Performed in accordance with european standard EN 602 04-1 (500 Vdc between conductors and ground) on following singular parts:

• supply cable unconnected (3 wires in short circuit and each wire separately)
  - insulation resistence must be > 20 MΩ
• motor (on connector pins)
  - insulation resistence must be greater than following values depending of motor tipology:

TYPE OF MOTOR	NEW MOTOR	USED MOTOR
L4C - L6C	>200 MΩ	>50 MΩ
F4 -F6	>200 MΩ	>20 MΩ

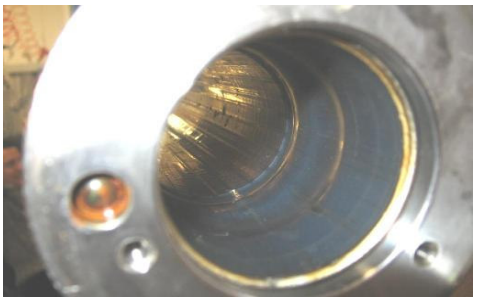
5) Disassembly phase and analysis

• Remove the lower bracket, the diaphragm and let out the cooling liquid contained inside of the motor; check the presence of holes, cuts or deposit of sand or earth on the diaphragm.

• Remove the bracket of thrust bearings, the pads, the thrust bearings and check his integrity and the conditions of their surface (slidings).
• Remove the lower bracket

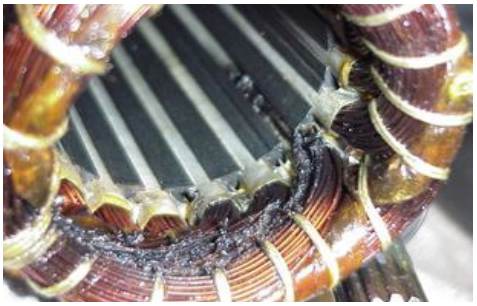
• Extract the sandslinger and check his integrity and his wear.
• Remove the upper bracket and extract the mechanical seal from the bracket (only for L6C); extract the rotor:
  - check the conditions of the surface of the mechanical seal;
  - check the conditions of the ground areas, the toothing, and possible excessive plays of the rotor.

• Check sleeve conditions:
  - holes / damagings caused by rotor sliding;
  - swellings caused by overheating.

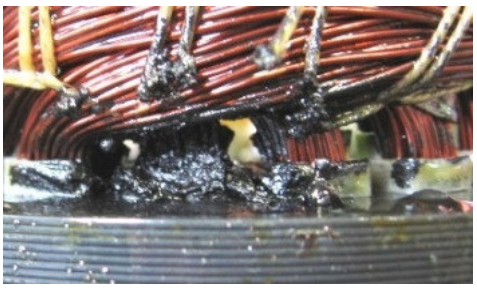


• Visual analysis of heads
In F4 - F6 motors it can not done because the stator is resin-bonded.
in L4C - L6C motors, cuts the sleeve at about 3 cm, from extremity between the flanges and winding taking care ti oil witch can be contained inside (see 4.1.2); performe a visual analysis of heads using the following cases for all motor tipology:
a) all motors:
- one or more winding coils burnt ----> shorted coil;

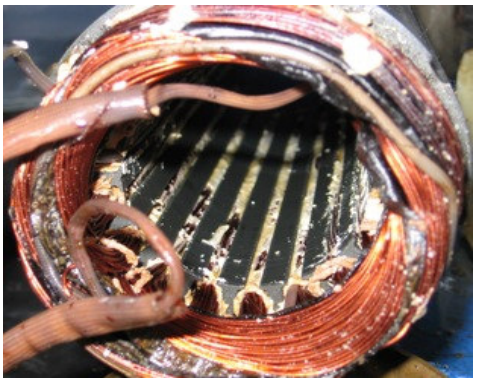
b) 1~ motor:
- run winding OK and start winding KO ----> capacitor defected;
- run winding KO and start winding OK ----> motor could not start;
- both windings faulty ----> overload;



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 starts
- ☐ Does not stops
- ☐ Starts and stops too frequently
- ☐ Grounded motor
- ☐ Excessive power input
- ☐ Runs slowly
- ☐ Further:

Motor data

Type:
Code:
Series number:
Stator number:
Installation date:
Manufacturing date:
Remarks:

Canned motors' failure causes required for claim opening

Where	What	Why	
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	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:	
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:	
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	Possible causes of the problem
Motor does not start	Power supply problems: • no power; • unconnected cable or damaged; • supply voltage too low; • starting drop voltage too high; Fuses burnt. Circuit breaker not calibrated. Capacitor too small or damaged. 2 phases powered (3~). Thrust bearing stuck. Stator slot interrupted. Activation of level probes. Excessive operating depht. Hydraulic locked. Faulty stator
Motor does not stops	Level probe defected Leaks in system
Motor runs slowly	Run and start windings exchanged on the control panel (1~). Wrong wire connections inside of the motor. Wrong voltage or frequency.
Starts and stops too frequently	Pump oversized Pressure switch not calibrated Liquid temperature too high Excessive power input Leaks in system
Excessive power input	Supply voltage uncorrect Defected winding. Motor supplied with 2 phases (3~ motor). Wrong pump Defected pump Thrust bearings and/or bushes damaged
Grounded motor	Grounded cable/jack. Grounded connection. Water leaks through holes in stator. Water leaks through supply cable. O-rings cut or outseat
Change of sleeve colour	Overheating/overload.

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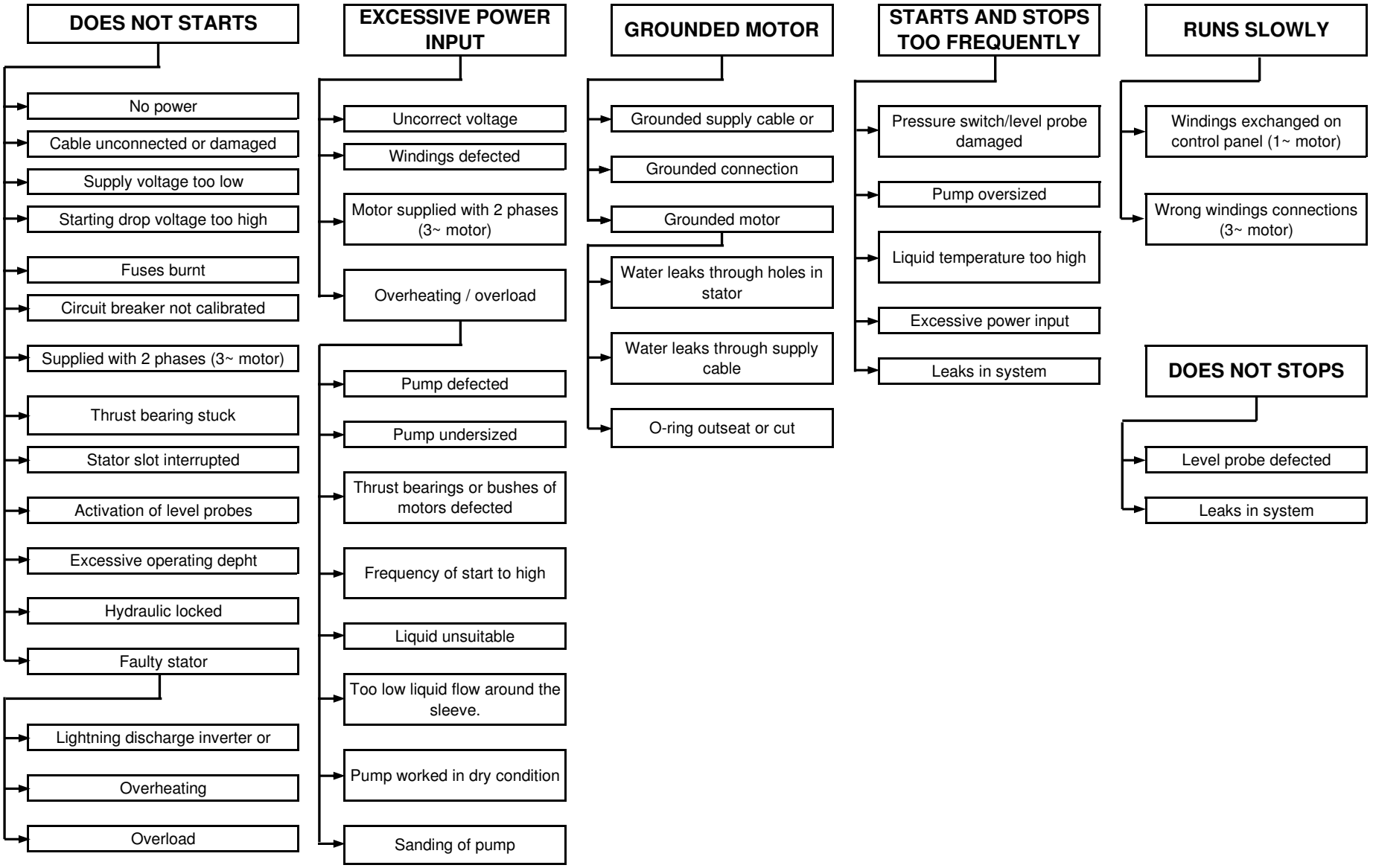
Rotor locked	Thrust bearing degreased or seized Thrust bearing stuck caused by a long inactivity period. Thrust bearing broken. Material deposit. Inflated sleeve.
Short circuit	Overvoltage caused by lightning discharge. Overtemperature. Insulation breaking or defect.
Windings damaged / burnt	Overload. Motor supplied with 2 phases (3~ motor). Inadequate size of fuses. Circuit breaker not calibrated. Overvoltage.
Thrust bearings damaged	Wrong coupling with pump, caused by: • excessive axial thrust; • motor shaft jut out of tolerance; • wrong size of the motor. Pumping of unsuitable liquid (sandy). Abnormal heating of motor cooling liquid Lack of bearing lubrication caused by wrong setting of min rotation speed of inverter.
Overheating / overload	Pump defected Pump undersized Thrust bearings or bushes of motors defected Too high frequency of startings Liquid unsuitable Too low liquid flow around the sleeve. Pump worked in dry condition. Sanding of pump

7) Failure tree (canned motors)



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Usefulness Range of Steel in Chlorinated Liquids