

Failure Analysis System Procedure

BG Centrifugal Electric Pumps



1) Electric pump applications

- Pumping of clean waters for domestic use
- Little irrigation
- Pressurization
- Washings and transfers

2) Critical items of application

2.1) Electrical supply

- In running condition, max variation of supply voltage $\pm 10\%$:
 - 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.

2.2 Liquid

- Max and min temperature of pumped liquid are -10°C , $+40^{\circ}\text{C}$.
- BG pump can pump water witch contain the gas.
- Pumping of water witch contain sand generates the wear of impeller and of all plastic components contained inside of pump body.
- Liquid must not be brackishwater, seawater or corrosive:
 - corrossions 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) Installation

- Max environment temperature: 40 °C.
- Max operating pressure: 8 bar.
- Max suction head: 8 m (with 1"¼ suction pipe, standing valve and temperature water 20 °C). An greater depth generates the cavitation, so the damage of hydraulic part.
- Installation of pump inside of environments with a great humidity causes damaging of motor bearings.
- To get a correct first starting of the pump, it is necessary to fill the pump body and the delivery pipe with water; otherwise, the pump operates in dry conditions and it generates damages of mechanical seal and hydraulic part.
- These pumps, after the first starting, not requires another total filling of pump body to priming. They can also primes if the impeller is partially out of water and if the pump is without standing valve but in this case the starting time can last some minutes.

- 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 advised use of Lowara control board).
- The pump mustn't operates when the delivery outlet is closed (overheating of pumped liquid and motor). The high temperature of the liquid generates a partial fusion of plastic components inside of pump body and their great deformation.
- 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.

2.4) Operation with electronic devices

- Operation with hydrovar not present particular limits (see the handbook).
- Installation of Domino/Genyo on the pump must be performed inserting between two parts a pipe with min lenght of 30 cm, witch guarantees its correct working; otherwise, it can generates troubles to internal sensors caused by the air balls contained inside of water.

3) Equipments and tools required

- Megaohmeter 500 - 1000 Vdc;

4) Inspection of defected product

4.1) Preliminary information

On receiving 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, on the pump bracket the presence of fusion defects and integrity of aluminum motor casing.

4.3) Preliminary inspections

- Data in plate:
 - type of product and code;
 - series number;
 - manufacturing date;
- Condition of capacitor and connections on terminal board (1~ motor).

4.4) Electrical resistance of windings

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

4.5) Measure of insulation resistance

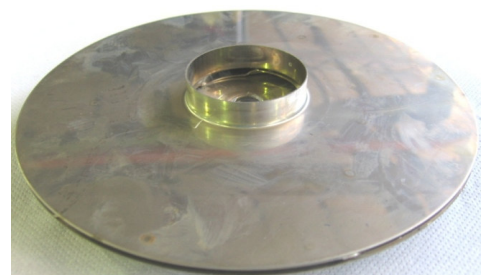
Performed in accordance with european standard EN 602 04-1 (500 Vdc between conductors and ground). Test is passed if insulation resistance is $\geq 10 \text{ M}\Omega$.

5) Disassembly and analysis

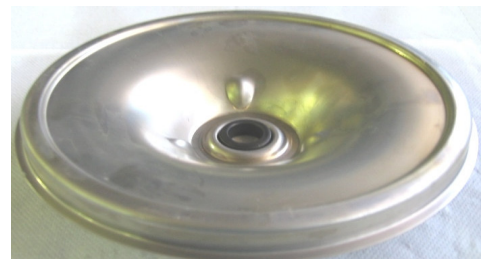
- Check with the screwdriver the free rotation of shaft.
- Unscrews the fixing screws, remove the pump body and check:
 - conditions of visible part of plastic diffuser inserted in the pump body (presence of wear, deformation caused by overheating of liquid);
 - conditions of O-Ring (pinching, cuts or wear caused by dry working).



- Remove the fixing nut and extract the impeller:
 - check the condition of wear and welds.
- Extract the mechanical seal from shaft, taking care of not damage it and check:
 - the conditions of its surface and condition of wear.



- Remove the seal holding disc and check:
 - the possible wear of surface;
 - the 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).

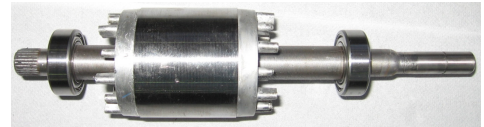


- Remove the protection grid, depending on the motor type, extract the fan with 2 screwdriver and check its condition.



- Unscrew the tie rods to separate the pump bracket and the motor cover from the motor. Check the condition of pump bracket (defects of fusion) and the condition of motor cover (possible deformation or dents).

- Extract the rotor and 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

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- 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:

BG 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
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 Motor shaft	401 Broken/cracked	101 Further:
		112 Not complying components tooling
		100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
200 Control device	200 Not operate	120 Excessive wear
		101 Further:
		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
300 Total hydraulic	300 Low performance	120 Excessive wear
		101 Further:
		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
300 Total hydraulic	104 Noisy / locked / vibrate	119 Normal wear
		120 Excessive wear
		101 Further:
		106 Uncorrect assembly/testing of components
		112 Not complying components tooling
		114 Hydraulic rotating part locked
		100 Further (supply detailed description of failure)
403 Pump sleeve	400 Leak	103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
		106 Uncorrect assembly/testing of components
		112 Not complying components tooling
		100 Further (supply detailed description of failure)
404 OR/Mechanical seal	400 Leak	103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
		106 Uncorrect assembly/testing of components
		112 Not complying components tooling
408 Pump shaft/joint	401 Broken/cracked	100 Further (supply detailed description of failure)
		103 Not complying/unsuitable applications
		119 Normal wear
		120 Excessive wear
		101 Further:
		106 Uncorrect assembly/testing of components
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: <ul style="list-style-type: none"> • no power; • unconnected or damaged cable; • supply voltage too low; Impeller locked because of oxide on the surface 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	Standing valve clogged Delivery outlet obstructed because of foreign matters; Dry working of pump
Incorrect performance	Delivery outlet partially clogged Pump run in the opposite way Pump is undersized Clogged standing valve Unsuitable liquid Wear of hydraulic part Cavitation of pump Mechanical seal damaged O-Ring pinched or cuts O-Ring wearred (pump worked in dry condition) System leaks
Noisy	Pump operates in cavitation condition Motor bearings damaged cause by condensate Presence of foreign matters
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)

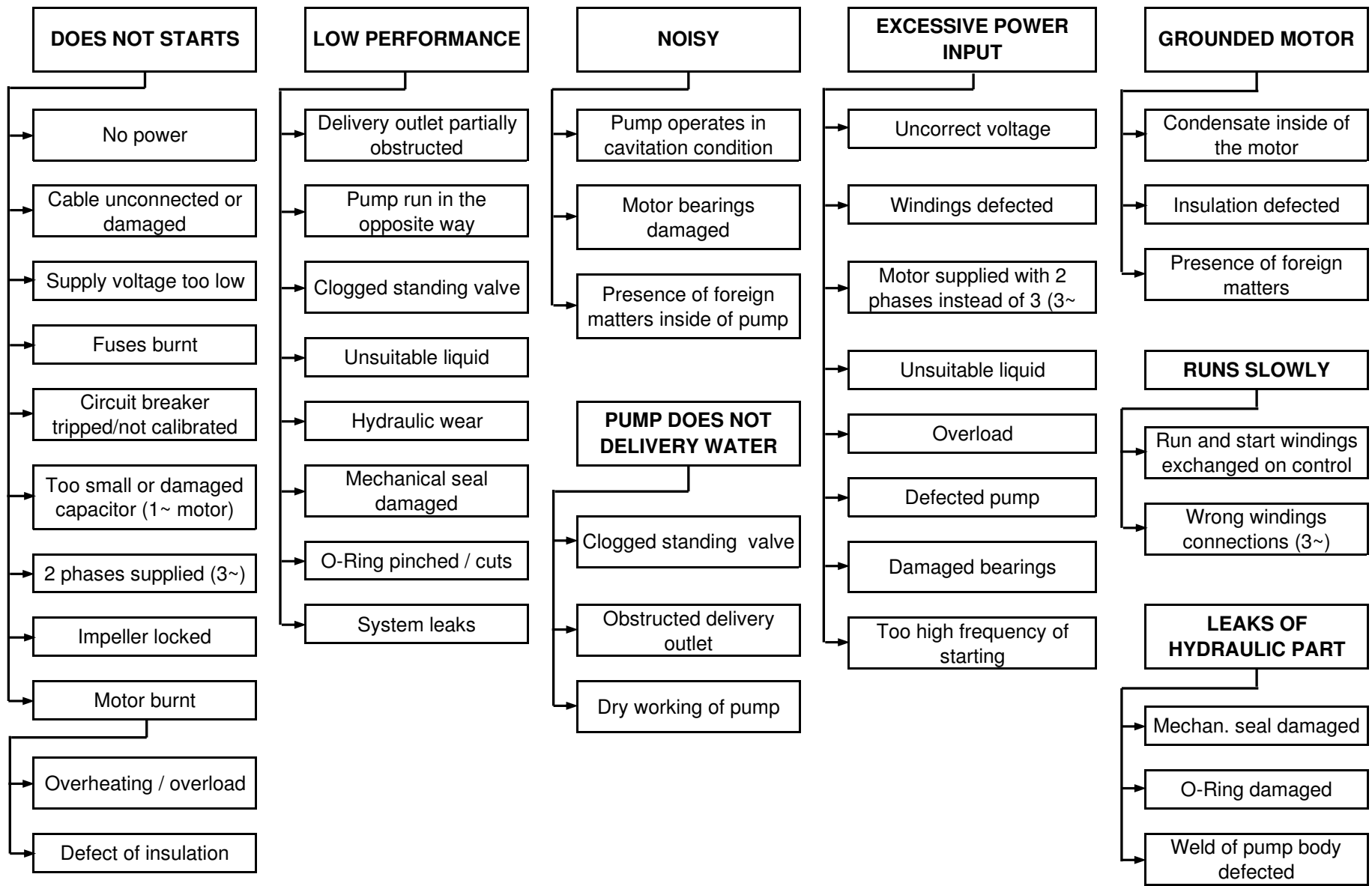


Excessive power input	Uncorrect voltage Windings defected Motor supplied with 2 phases (3~ motor) Unsuitable liquid Defected pump Defected bearings Too high frequency of startings
Hydraulic locked	Dry working Unsuitable liquid Presence of foreign matters inside of the pump Tolerance of tooling beyond the limits O-ring out of seat
Overheating/overload	Too high pumped liquid temperature Too high frequency of startings Wrong supply voltage Defected pump Thrust bearings damaged/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



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7) Failure tree (BG pumps)



Lowara