

Failure Analysis System Procedure

DOMO-DIWA Submersible Pumps for Dirty Waters



1) Electric pump applications

- Emptying of wine cellars, garages, basements.
- Drainage of building yard.
- Emptying of cisterns or tanks.
- Irrigation of gardens and vegetable gardens
- Supply of fountains
- Pumping of outlet waters from washing machines, shower, wash basin.
- Emptying of tanks in industrial and ecologic applications.

2) Critical items of application

2.1) Electrical supply

- In running condition, supply voltage must be into tolerance values $\pm 5\%$:
 - a too high voltage generates overheating and overload;
 - a too low voltage, generates starting problems.
- In starting operation, max drop voltage 5%:
 - a too high drop voltage generates starting problems.
- Max starting frequency 25 start/h:
 - if starting frequency is greater than limits, it generate overheating or overload problems.

2.2) Liquid

- Max liquid temperature with pump in continuous working and totally submerged 35°C:
 - if temperature is greater than max value, it generates overheating in motor.
- Max diameter of solids in suspension:
 - DIWA pump: 8 mm;
 - DOM 7, DOMO 7VX pumps: 35 mm;
 - DOM 10-15-20, DOMO 10VX-15VX-20VX: 50 mm;
- solid parts with diameters greater than limits, damages hydraulic part (stoppages) and motor (overload/overtemperature);
 - if the liquid contains filaments or suspension, it is advised to use of DOMO pump with VORTEX rotor.
- Liquid must not be brackishwater, seawater or corrosive:
 - corruptions are caused by incorrect applications (inadequate ground system, leakage current, stray current, unsuitable pumped liquid...) and they cannot be input to product or constructive materials.

2.3) Installation:

- Max depth of immersion:
 - DIWA pump: 7 m;
 - DOMO pump: 5 m.
- Min level of pumped liquid:
 - DIWA pump: 25 mm (in case of continuous working it is advised a total immersion);
 - DOMO pump: totally submerged.

A fluid level too low, generates problems of cooling of motor.

- If the pump is installed inside of a well, its dimensions must be so that to avoid continuous start and stop of the pump; otherwise, the motor is subjected to overheating.
- Immersion of DOMO pump, must be performed so that avoid a generation of air bell inside of it; it is advised immersion with oblique or horizontal axis.

- DOMO pump can be installed with horizontal axis too.
- Perform an adequate regulation of float, changing the free length of cable and avoid, it can change, fixing with care the cable to cable stop; an inadequate regulation generates continuous start and stop or dry working of pump.
- The pump must be positioned so that to let the float to move without obstacles (see the draw in the installation handbook).
- The pumps with fixed float must be installed only with vertical axis and must pump only clean water and not stagnant.
- The pump must never work in dry condition.

- 1~ motors have an internal motor protection but they cannot operate without an 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).
- It is recommended installation of high sensibility differential switch ($I\Delta n \leq 0.03 \text{ A}$) inside of control board, to protect the people from possible electric contact with live parts.
- It is necessary insert a non return valve in the delivery outlet at min distance of 1 m from pump to protect it from water hammer and reverse rotation.
- The possible substitution of mechanical seal must be performed using an adequate tool which allows the correct insertion of mechanical seal in the shaft without damage it.

3) Equipments and tools required

- Megaohmmeter 500 - 1000 Vdc;
- Threaded clutch (code 160600400) for test of pneumatic seal (see picture).



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;
- installation handbook;
- conditions of installation.

4.2) External visual inspection

- External condition 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, 2.2, and 2.3) and exclude an acknowledgment of technical warranty.

Product analysis stop and repair (if required) is done 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;
 - manufacturing date;

NOTE WELL: if rating plate on the pump is illegible or lost, it can be found in one copy in installation booklet or, if installed, on control board door.

- Presence and condition of:
 - whole supply cable;
 - float;
 - test screw of pneumatic seal on head and its O-Ring;
- Welds and possible dents in the jacket.

4.4) Electrical resistance of windings

- Measure electrical resistance of windings to find an interruption or burning.

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 $\geq 10 \text{ M}\Omega$.
 Lower values of $10 \text{ M}\Omega$ are indicative of insulation breakdown (with probable water infiltration), therefore is necessary pneumatic seal test (see 4.6).

NOTE WELL: if pneumatic seal test does not indicate leaks, is necessary unconnect all electrical parts (supply cable, wound stator and float if presente), and repeat the measure of insulation resistance on singular components.

4.6) Pneumatic seal test

- Blow in compressed air 0.6 bar in test hole on higher head with help of threaded clutch.
- NOTE WELL: pressures greater than 0.6 bar can generate damage to components and people.
- With pump immersed in water check absence of air balls from: delivery side, presscable plaques, bottom and welds.
 - If pneumatic seal test not indicate leaks, see NOTE WELL in 4.5.

5) Disassembly and analysis

NOTE WELL The pictures refers to the DIWA pump.

- Check the free rotation of the shaft. If shaft rotation is difficult, the mechanical seal can be stuck.
- Remove the filter and the suction flange (DIWA) or remove the support feet and the suction flange (DOMO) and check:
 - presence or not of a great quantity of solid material witch can have obstructed the pump;
 - condition of wear of syction flange. The wear is caused by normal working of pump and possible replacement can not be considered under warranty.



- Remove the fixing screw and extract the impeller:
 - check the conditions of rotor welds and condition of V-Ring.
- Remove the closing screw and empty the oil chamber, checking the oil quantity contained and the presence of water in emulsion (indicate penetration of water through mechanical seal).
- Performe a pneumatic seal test through the hole of oil chamber like described in 4.6.



- Unscrew the fixing screws, remove the upper head and the upper cover with a hammer and a chisel:
 - check possible damages of sleeve surface and head;
 - check the condition of presscables and O-Ring (this is cause of lack and water infiltrations).



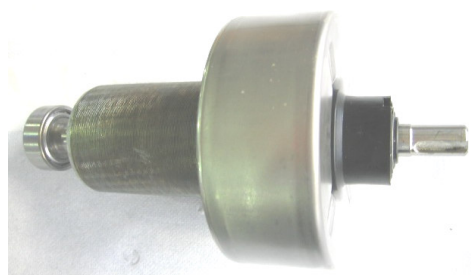
- Check in the terminal board:
 - electric connections and the condition of capacitor (if present);
 - possible presence of water or deposit witch indicate infiltration of liquid through the O-Ring of head, the presscables or the seal test hole.



- Remove the diffuser (DIWA) or the fixing disc (DOMO) and separate the motor body to pump body:
 - check the condition of pump body and O-Ring.
- Extract from the shaft the oil conveyor and the mobile part of mechanical seal and check:
 - condition of surface of fix and mobile part.



- Extract the rotor with adjusting ring and check:
 - the condition of bearings and wear of adjusting ring.



- Performe a heads visual analysis of stator to find 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

<input type="checkbox"/>	Does not delivery water
<input type="checkbox"/>	Low performance
<input type="checkbox"/>	Does not starts
<input type="checkbox"/>	Does not stops
<input type="checkbox"/>	Starts and stops too frequently
<input type="checkbox"/>	Noisy
<input type="checkbox"/>	Grounded motor
<input type="checkbox"/>	Excessive power input
<input type="checkbox"/>	Runs slowly
<input type="checkbox"/>	Further:

Pump data

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

DOMO-DIWA 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 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:		



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101 Motor shaft	102 Shaft / tothing 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
404 OR/Mechanical seal	400 Leak	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
408 Pump shaft/joint	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:
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



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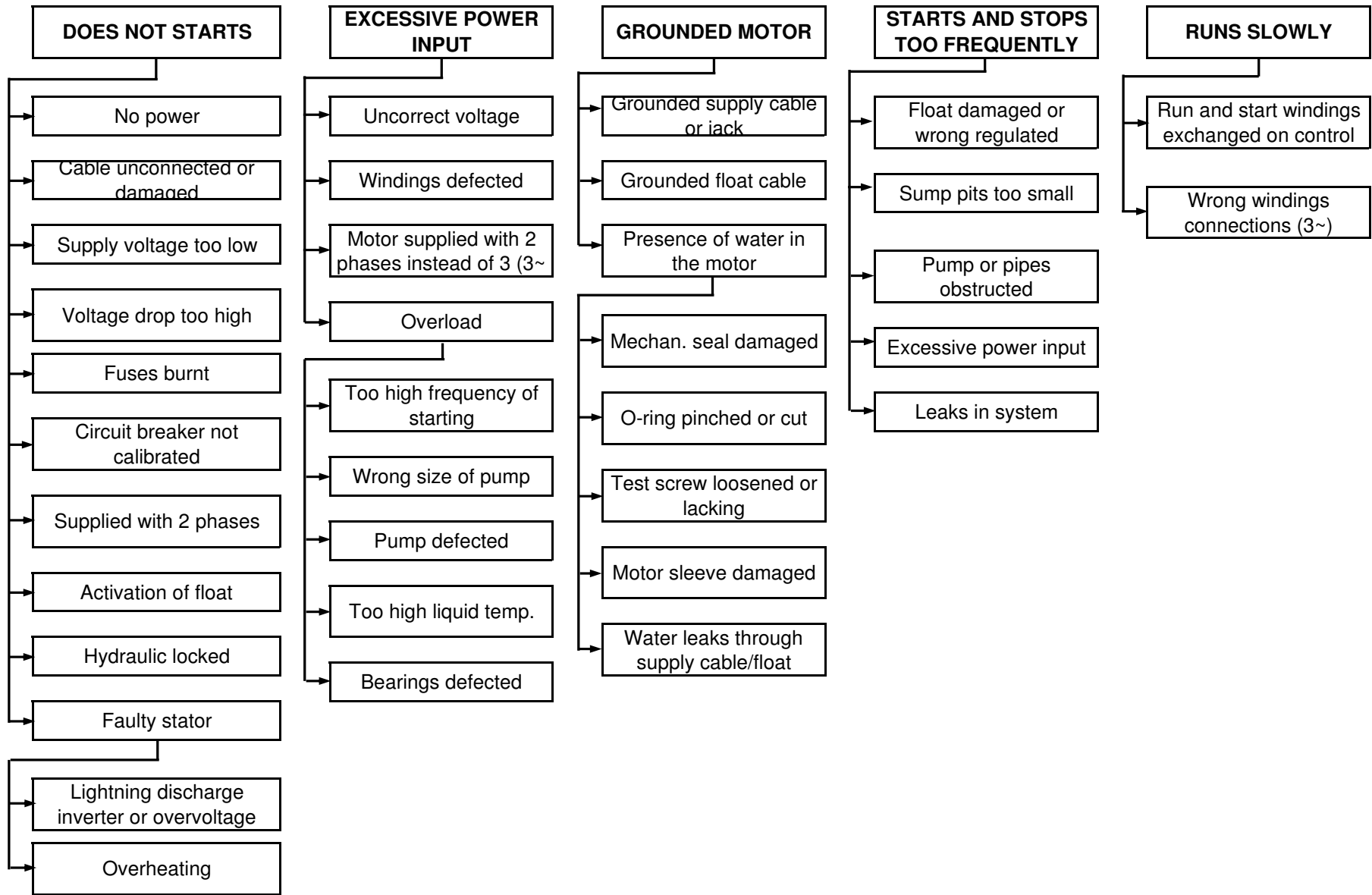


9) Faq

Problem founded	Possible causes of the problem
Pump does not start	Power supply problems: <ul style="list-style-type: none">• 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 (1~). 2 phases powered (3~). Activation of float. Hydraulic locked (solid parts between the impeller and the suction flange) Faulty stator.
Pump does not delivery water	Delivery outlet obstructed Water level too low Non return valve clogged
Low performance	Delivery outlet obstructed Clogged non return valve Water level too low System leaks Dirty filter Wear of hydraulic part Pump run in the opposite way Wrong pump, undersized O-Ring damaged
Noisy	Motor bearings damaged Unbalanced hydraulic
Starts and stops too frequently	Float damaged or wrong regulated Well too small Pump or pipes obstructed Excessive power input Leaks in system
Runs slowly	Run and start windings exchanged on control panel (1~) Wrong windings connections inside the motor (3~)

Grounded motor	<p>Grounded supply cable or jack Grounded float cable Water leaks through holes in stator Water leaks through supply cable or float cable Water leaks through mechanical seal Water leaks through upper head O-ring pinched or cut</p>
Excessive power input	<p>Uncorrect voltage Windings defected Motor supplied with 2 phases (3~ motor) Wrong pump Pump defected Overload Bearings defected Starting frequency too high</p>
Faulty stator	<p>Lightning discharge inverter or overvoltage Overheating Overload</p>
Presence of water in motor	<p>Mechanical seal damaged O-Ring pinched or cut Test screw loosened or lacking Motor sleeve damaged</p>
LEAKS OF HYDRAULIC PART	<p>O-Ring pinched or cut Mechanical seal damaged Test screw on head loosened or lacking</p>
Hydraulic locked	<p>Liquid unsuitable Presence of foreign matters between the impeller and the suction flange (DIWA)</p>
Overheating/overload	<p>Too high frequency of startings Too high liquid temperature. Wrong supply voltage. Wrong size of pump Defected pump Motor thrust bearings damaged/seized</p>

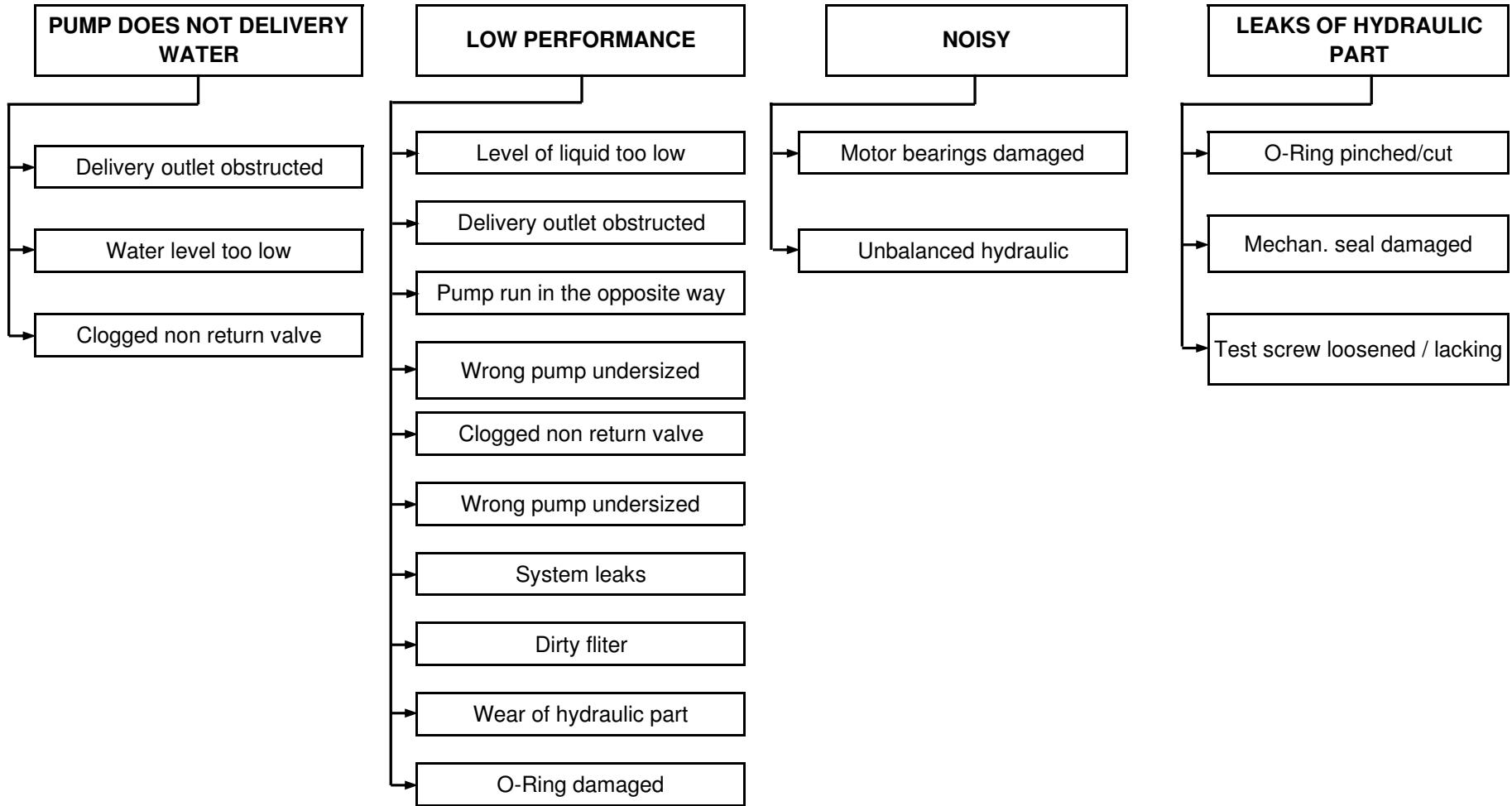
7) Failure tree (DOMO-DIWA pumps)



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8) Failure tree: hydraulic part (DOMO-DIWA pumps)



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