xylem

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# Failure Analysis System Procedure

## 6" to 12" PVC Submersible Water Filled Rewindable Motors. LW and CPW range.

**1) Motor applications**

• Water supply from deep wells.
• Pressure boosting and water distribution in civil and industrial systems.
• Supply of surge tanks and reservoirs.
• Firefighting and washing systems.
• Water table level control.
• Irrigation.
• Mines.
• Golf courses.

**2) Critical items of application**

2.1) Electrical supply
• When motor is running, max variation of supply voltage is: ±10%
  - a too high voltage generate overheatings and overloads;
  - a too low voltage, generate starting problems.
• When motor is starting, max drop voltage is:
  - DOL start: 15%
  - Y/Δ start: 10%
a too high drop voltage generate starting problems.
• Max starting frequency:
  - 6" motor: 15 start/hour
  - 8" motor: 10 start/hour
  - 10" motor: 8 start/hour
  - 12" motor: 4 start/hour
If starting frequency is greater than limits, it generate overheating or overload.

• Max voltagè unbalance: 1%
Unbalance% = (maximun deviation / average) * 100
If the voltage is unbalanced, currents are unbalanced too, so it generates irregular overheating and the burning of the motor.
It also generates a pulse torque that subject a big strees on the shaft until the rupture of mechanucal parts of the motor.

2.2) Liquid
• For Max liquid temperature compatibility of standard motors (PVC) refer to technical catalogue
• For Max liquid temperature for special winding (HT version) refer to technical catalogue
• Refer to technical catalogue for Min flow speed of liquid around motor sleeve:
If well size or installation not guarantee adequate water flow around the motor, it is recommendable the use of external sleeve.
A temperature too high or a speed to low, generate overheating of motor and consequent damaging of PVC insulation of windings.

• 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
- for aggressive water, it is available the AISI 316 or Duplex version.

2.3) Installation
• It must be garanteed a sufficient distance between motor and well bottom for avoid sanding and ensure an adequate cooling.
• Power of the motor must be greater or equal than max pump power; otherwise it generates overheating and overload.
• Horizontal installation is possible if the pump axial thrust is always directed from the pump to the motor. Uncorrect axial thrust can damages upper washer.
• Axial thrust value must be into tolerance values both in vertical and horizontal condition. Motor and pump cupling made by Lowara, assures respect of this requirement.
Axial thrust too high can damage thrust bearing.

2.4) Control of motor by inverter
• For motor operating with inverter, refer to VFD instruction.

**3) Equipments and tools required**

• Megohmmeter with applicable voltage of 500 - 1000 V

**4) Inspection of defected product**

4.1) Preliminary information

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

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;
  - manufacturing date.
• Presence and condition of whole supply cable.
• Welds and dents in the jacket.
• Check with hand if rotor rotate or is locked (bearing damaged).
• Measure the shaft jut from flange.

4.4) Check cooling water level

• With motor in vertical position, remove pressure relief valve and add clean water with syringe until complete filling for check the lacking quantity:
  - the lack of a great quantity of water, it means the motor have been subject to overheating;
  - it can happen the diaphragm is holed/bursted, in this case motor will be completely empty of water and stator windings will show probably signs of overload

4.5) Electrical resistence of windings

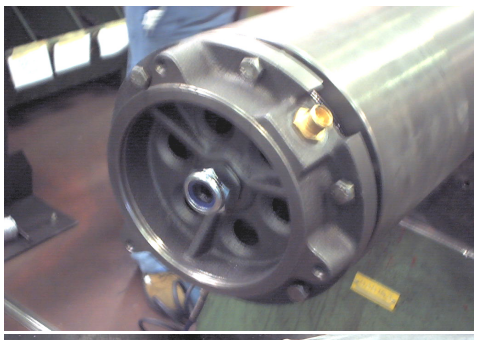
• Measure electrical resistance of windings and match values with those provided by Lowara.
If values are much different, it is possible there are damages of windings (interrupted / burnt).

4.6) Measure of insulation resistance

Performed in accordance with european standard EN 602 04-1 (500 Vdc between conductors and ground).
  - cold test is passed if insulation resistance is ≥ 50 MΩ;
  - if motor is inside of well, hot test is passed if insulation resistance is ≥ 1 MΩ.

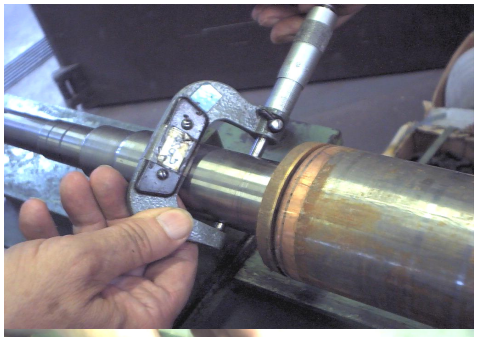
**5) Disassembly and analysis**

•Motor in horizontal position.
• Remove filling lower valve and unloose breather upper valve for empty cooling water .
• Remove sandslinger and check his integrity.
• Extract diaphragm
  - presence of holes, cuts or deposit of sand or earth;



• Extract thrust bearing:
  - check possible presence of slidings / damagings / ruptures.
NOTE WELL: create a numerical reference between pads and correspondent positions on the support of pads, in such way that, in a successive motor assembly, it is not changed their relative positions.
• For motor from 6" to 10", remove security dowels on the sleeve and unscrew the lower and upper support (security dowels are inserted to avoid an unscrewing if the pump rotation is counterclockwise).
In case of 12" motor it is necessary remove supports bolts):
  - check O-Rings condition and sleeve bearings.
• Extract the rotor
  - check ground areas, toothing.

• Dimensional checks (see attached drawing)
  - check shaft linearity with dial gauge;
  - measure diameter of journal bearings with micrometer gauge;



  - check sleeve bearings with the plug (in 6" motor, sleeve bearings are single and in others they are doubles).

• Performe an heads visual analysis:
- in case of overload, PVC insulation is poured and conductors are glued from each oder.
- if upper head presents sign of overload, while lower head is ok, it means the level of the water was too low because of previous ovreheating;
- if only lower head presents signs of overload check conditions of installation of the motor (diameter of well, presence or less of external sleeve, min distance of well);
- if there are one or more winding coils burnt ----> shorted coil;
- if all phases are burnt ----> overload;
- se one phase fine and two phases burnt (star connection) or two phases fine and one phase burnt (delta connection) ----> powered with only 2 phases;

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## 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:**

**Submersible motors failure causes required for claim opening**

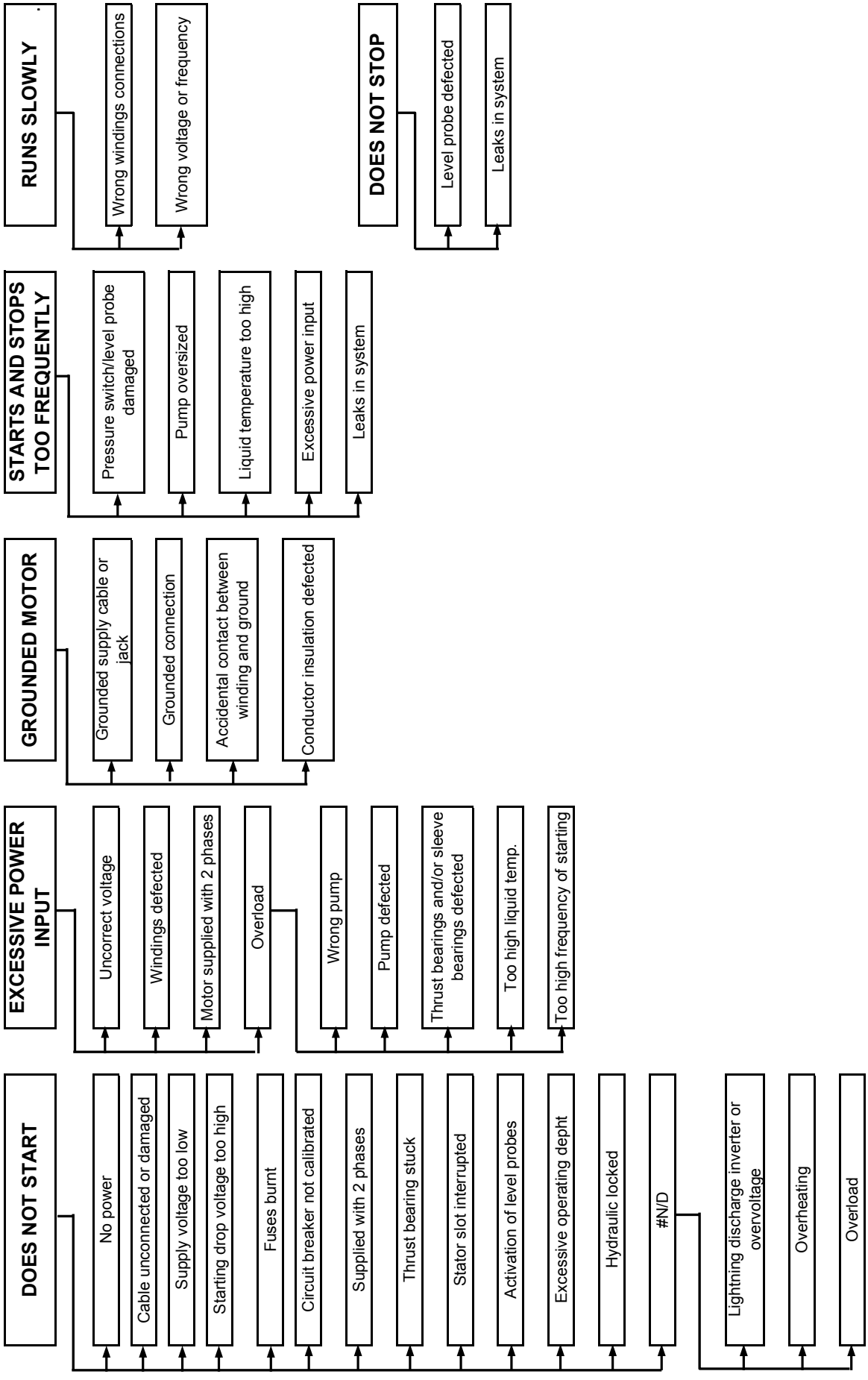
| Where | What | Why | |
|---|---|---|---|
| 100 Electric motor | 101 Excessive power input / overheating / burnt | 102 Motor shaft locket | |
| | | 104 Wrong internal electrical connections | |
| | | 106 Uncorrect assembly/testing of components | |
| | | 107 Bursted / unconnected capacitor | |
| | | 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 | |

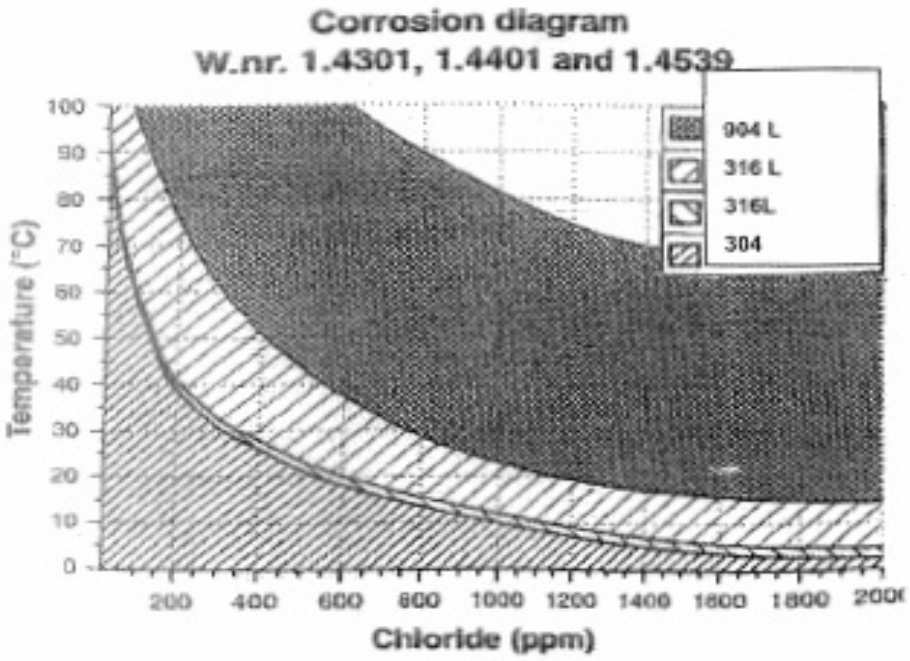
**8) FAQ** .

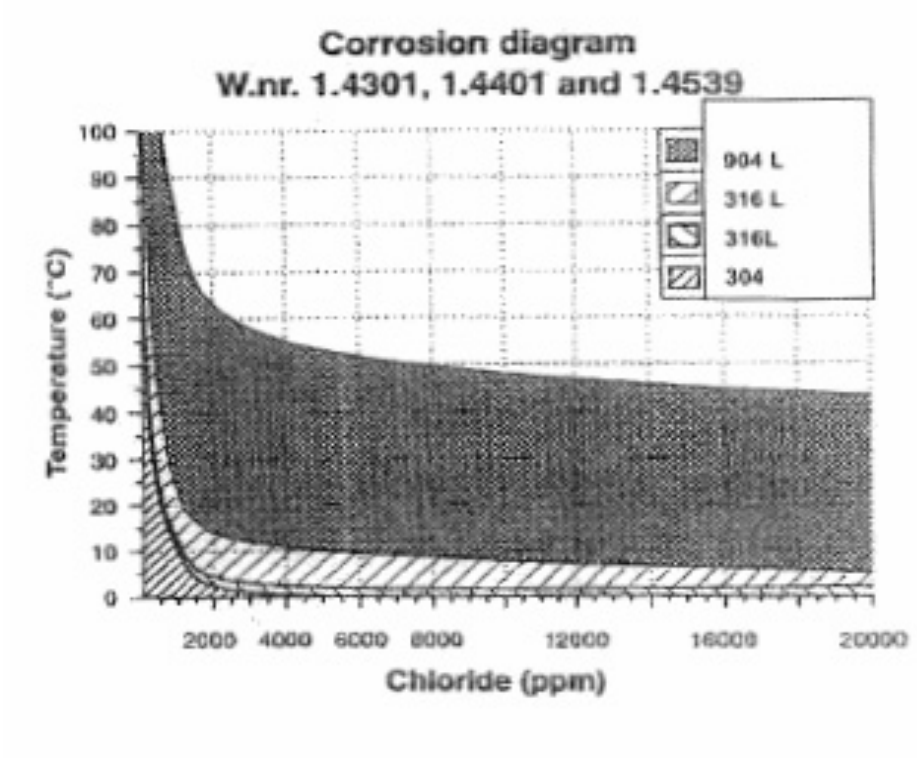
| Problem | Possible causes of the problem |
|---|---|
| Motor does not start | Power supply problems:<br>• no power;<br>• unconnected cable or damaged;<br>• supply voltage too low;<br>• starting drop voltage too high.<br>Fuses burnt<br>Circuit breaker not calibrated<br>2 phases powered<br>Thrust bearing stuck<br>Stator slot interrupted<br>Activation of level probes<br>Excessive operating depht<br>Hydraulic locked<br>Faulty stator |
| Motor does not stops | Level probe defected<br>Leaks in system |
| Motor runs slowly | Wrong wire connections inside of motor<br>Wrong voltage or frequency |
| Starts and stops too frequently | Pump oversized<br>Pressure switch<br>Liquid temperature too high<br>Excessive power input<br>Leaks in system |
| Excessive power input | Voltage uncorrect<br>Defected winding.<br>Motor supplied with 2 phases<br>Wrong pump<br>Defected pump<br>Thrust bearings and/or sleeve bearings damaged |
| Grounded motor | Grounded cable/jack<br>Grounded connection<br>Accidental contact between winding and ground<br>Conductor insulation defected |
| Change of sleeve colour | Overheating/overload |
| Rotor locked | Degreased / seized / broken bearing<br>Bearing stuck caused by a long inactivity period<br>Material deposit<br>Pump sanding<br>Presence of foreign matters inside of pump |

| | |
|---|---|
| Damaged / burnt windings | Overheating / overload<br>Motor supplied with 2 phases<br>Inadequate size of fuses<br>Circuit breaker not calibrated<br>Overvoltage caused by lightning discharge<br>Rupture / defect of insulation |
| Thrust bearing damaged / broken | Water hammer and consequent cracking or rupture of graphite disk<br>Excessive axial thrust<br>Pumping of unsuitable liquid (sandy)<br>Abnormal heating of motor cooling liquid<br>Infiltration of sand caused by rupture of diaphragm or sandslinger<br>Vibrations originated by pump |
| Overheating / overload | Motor operated outside of water<br>Too high frequency of startings<br>Too high liquid temperature<br>Too low liquid flow around the sleeve.<br>Too low quantity of cooling liquid in the motor<br>Wrong supply voltage.<br>Wrong pump<br>Pump defected<br>Thrust bearings damaged/seized<br>Pump sanding |


DOES NOT START
No power
Cable unconnected or damaged
Supply voltage too low
Starting drop voltage too high
Fuses burnt
Circuit breaker not calibrated
Supplied with 2 phases
Thrust bearing stuck
Stator slot interrupted
Activation of level probes
Excessive operating depht
Hydraulic locked
#N/D
Lightning discharge inverter or overvoltage
Overheating
Overload
EXCESSIVE POWER INPUT
Uncorrect voltage
Windings defected
Motor supplied with 2 phases
Overload
Wrong pump
Pump defected
Thrust bearings and/or sleeve bearings defected
Too high liquid temp.
Too high frequency of starting
GROUNDED MOTOR
Grounded supply cable or jack
Grounded connection
Accidental contact between winding and ground
Conductor insulation defected
STARTS AND STOPS TOO FREQUENTLY
Pressure switch/level probe damaged
Pump oversized
Liquid temperature too high
Excessive power input
Leaks in system
RUNS SLOWLY
Wrong windings connections
Wrong voltage or frequency
DOES NOT STOP
Level probe defected
Leaks in system

# Usefulness Range of Steel in Chlorinated Liquids



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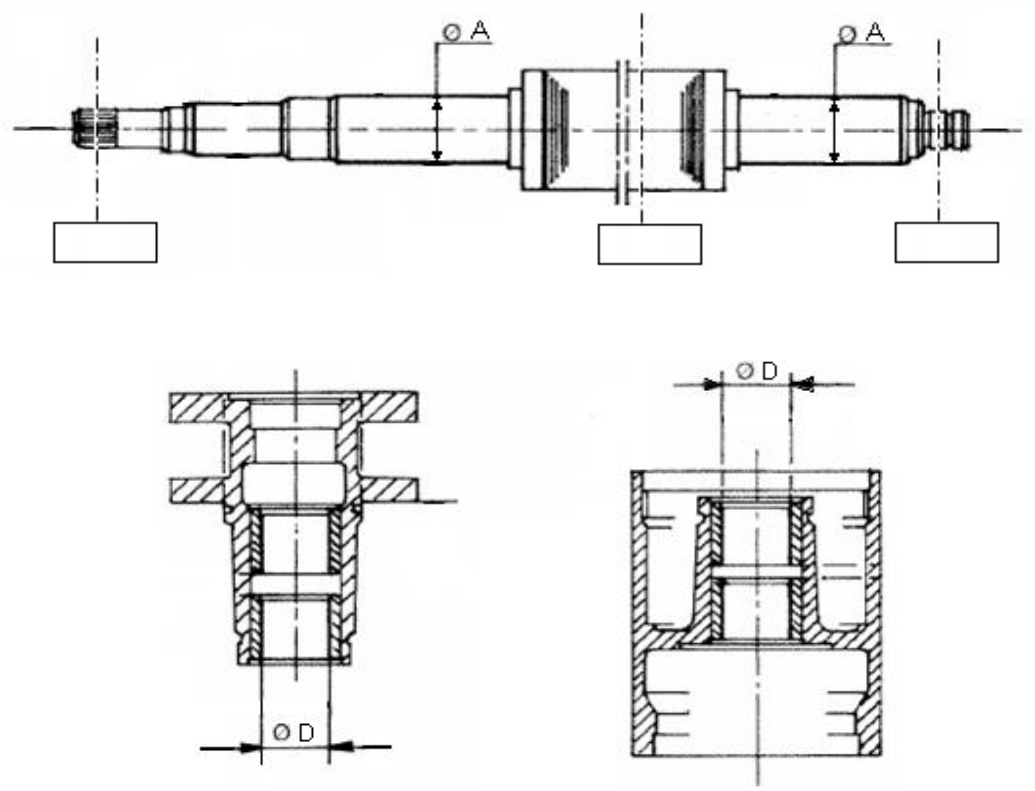
# Dimensional Checks




**L.W. MOTOR SERIES: BUSH BEARINGS RADIAL CLEARANCE**

| MOTOR TYPE | RATED POWER | | SHAFT DIAMETER Ø MIN | SHAFT DIAMETER Ø MAX | BEARINGS DIAMETER Ø MIN | BEARINGS DIAMETER Ø MAX | RADIAL CLEARANCE MIN | RADIAL CLEARANCE MAX |
|---|---|---|---|---|---|---|---|---|
| | kW | HP | [mm] | [mm] | [mm] | [mm] | [mm] | [mm] |
| L6W | 4 ÷ 18.5 | 5.5 ÷ 25 | 29,889 | 29,91 | 30 | 30,021 | 0,090 | 0,132 |
| L6W | 22 ÷ 37 | 30 ÷ 50 | 37,925 | 37,95 | 38 | 38,025 | 0,050 | 0,100 |
| L8W | 30 ÷ 93 | 40 ÷ 125 | 54,91 | 54,94 | 55 | 55,03 | 0,060 | 0,120 |
| L10W | 93 ÷ 150 | 125 ÷ 200 | 67,91 | 67,94 | 68 | 68,03 | 0,060 | 0,120 |
| L12W | 185 ÷ 300 | 250 ÷ 400 | 67,91 | 67,94 | 68 | 68,03 | 0,060 | 0,120 |