

Long Term Storage Procedure - Large AC Motors

Storage

Storage requirements for motors that will not be placed in service for at least six months from date of shipment. Improper motor storage will result in seriously reduced reliability and failure. An electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to develop rust in the bearings or rust particles from surrounding surfaces may contaminate the bearings. The electrical insulation may absorb excess moisture leading to motor winding failure.

Preparation for Storage

If the motor is to be stored for any period of time prior to installation, it should be placed in an area that is clean, dry and warm.

1. Motors are to be kept in their original containers or provided with equivalent protection and stored in a location that is free from extremes in temperature, humidity and corrosive environments. If the storage location is cold, damp or severe humidity changes exist, the space heaters must be energized.
2. Motor must be stored in an environment with low vibration levels (less than 2 mils). If unusual vibration levels exist at the storage location, the motor should be protected with isolation pads

Note: High environmental vibration can result in bearing damage or failure.

3. All breathers and drains are to be operable while in storage and/or the moisture drain plugs removed. Motors must be stored so the drain is at the lowest point.
4. Lubrication Requirements
 - a. Motors with grease lubricated anti-friction bearings are shipped with the correct amount of grease in the bearings and do not require lubrication during storage periods up to 12 months.
 - b. Motors with oil lubricated anti-friction bearings are shipped without oil. Fill bearing reservoirs to the proper levels as soon as the motor is received and prior to rotating the shaft. The oil level is shown on the sight gauge for each bearing oil reservoir.
 - c. Motors with hydrodynamic bearings are shipped without oil. Fill bearing reservoirs to the proper levels as soon as the motor is received and prior to rotating the shaft. Information on lubricant quantity, type and lubrication interval is provided in the motor operator manual. Prior to rotating the shaft, pour 4 to 6 ounces of oil onto the bearing liner to prevent possible oil starvation during manual rotation of the shaft. Failure to observe this precaution could result in damage or failure of the equipment.

Note: It may not be possible to rotate the shafts of vertical motors equipped with hydrodynamic bearings. Care must also be taken to drain some oil from the reservoir to prevent the oil level from rising past the top of the oil sight glass as leakage into the machine may result from over-filling the bearing.

5. The oil must be drained prior to moving the motor to prevent spillage into the motor.
6. If the motor is stored and directly exposed to weather conditions such as humidity, it is important that the bearing lubrication system be inspected for the presence of water at the drain prior to operating the motor. If water is detected in the lubricant, the bearing housing will need to be flushed out and re-lubricated.

Bearing Re-lubrication

Hydrodynamic Bearings

1. Remove drain plug and drain oil.
2. If oil appears to be contaminated, filling with fresh oil and draining again can flush out the housing.
3. Replace plug and fill through filler cap to the oil level indicated on oil sight gauge.
4. Tighten caps and plugs; fill constant level oiler if provided (horizontal motors only).
5. If the unit is equipped with insulated bearings, the condition of the insulation system should be checked when the oil is changed.
6. The insulation system should be checked as follows:
7. Remove the ground (strap or stud) from the bearing.
8. Slowly rotate the shaft by hand using a bar and eyebolt in the end of the shaft.
9. With an ohmmeter making sliding contact on the shaft, the resistance to ground or the motor frame should be checked.
10. If the insulation resistance is not infinite on an X 1000 scale there could be a fault in the insulation system.
11. Make certain the oil rings are not touching the bracket sidewalls during the test (horizontal motors only).

Anti-Friction Bearings (Grease Lubricated)

1. Locate the grease inlet, clean the area and replace the pipe plug with a grease fitting, if the motor is not equipped with grease fittings.
2. Remove the relief plug. If the grease appears to be caked, use a clean tool to remove all dried grease possible.
3. Add the recommended volume of the recommended lubricant per the motor lubrication nameplate using a hand operated grease gun.
4. Remove the shaft blocking and rotate the shaft at least fifteen revolutions to coat the bearings with fresh grease.
5. Replace the plugs and wipe off any excess grease.

Anti-Friction Bearings (Oil Lubricated)

1. Remove drain plug and drain the oil in each end.
2. If oil appears to be contaminated, filling with fresh oil and draining again can flush out the housing.
3. Replace drain plug and fill through the filler cap to the specified oil level marked on the sight gauge.

Preparation for Storage

Improper storage of electric machines will result in seriously reduced reliability of that equipment. For example, an electric motor that does not experience regular usage while being exposed to normally humid atmospheric conditions is likely to cause the bearings to rust or rust particles from surrounding surfaces to contaminate the bearings. The electrical insulation may absorb an excessive amount of moisture leading to the motor winding failing to ground.

The following preparations should be followed:

1. Minimize condensation in and around the motor by use of desiccants or other humidity control methods.
2. Motor space heaters when specified are to be energized where there is a possibility that the storage ambient conditions will reach the dew point.
3. Coat all external machined surfaces with a material to prevent corrosion. An acceptable product for this purpose is Exxon Rust Ban #392.
4. Measure and record the electrical resistance of the winding insulation with a megger or an insulation resistance meter. Minimum accepted $M\Omega$ level is the insulation kV rating + 1 $M\Omega$. If levels fall below this, contact the nearest District Sales Office. The recorded data will be required when removing from storage.
5. All motors have shaft blocking attached to the shaft to prevent damage during transportation. The shaft blocking must be removed before the shaft is rotated. It must be reinstalled after the shaft is rotated while the motor is in storage or if the motor is moved.
6. All breather drains should be fully operable while in storage. The motors must be stored so the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow venting at points other than through the bearing fits.
7. The space heaters when specified are to be connected and operable while in storage.
8. Where motors are not stored in the original containers, but are removed and mounted on other pieces of machinery, the mounting must be such that drains and breathers and space heaters are fully operable. In this respect, the drains must be kept at the lowest point in the motor so that all condensation can automatically drain out.

Storage for periods not exceeding 1 month

1. Store the motor in an environment meeting the criteria detailed in the preceding section. If the relative humidity of the storage environment is greater than 60%, the shaft must be rotated 10-15 revolutions per week. The shaft blocking must be removed before the shaft is rotated and replaced when this operation is complete. Prior to rotating the shaft, 4 to 6 ounces of oil should be poured onto the bearing liner of a horizontal motor if it is supplied with sleeve bearings. Note that the shaft does not need to be rotated on vertical motors equipped with hydrodynamic bearings, but the bearing reservoirs should be filled to the proper level with oil.
2. It is recommended that the vapor bag always be re-sealed after it is opened (e.g. shaft turning.) Also, add new desiccant inside the vapor bag before closing it, then place the shell over the motor and replace the lag bolts.
3. Ensure that new desiccant is added inside the bag after each periodic inspection.

Storage for periods not exceeding 12 months

Follow the Storage for periods not exceeding 1 month procedure with the following additional requirements:

1. The motor should be inspected monthly and stator winding insulation resistance measured and recorded.
2. Checking Winding Insulation Resistance.

If the motor has been in storage for over a month or has been subjected to adverse moisture conditions, check the insulation resistance of the stator winding with a megger or an insulation resistance meter.

The minimum insulation resistance (R_m) can be determined from the following formula:

Minimum resistance of motor winding insulation is 5 $M\Omega$ or the calculated minimum, whichever is greater. Minimum resistance is calculated as follows: $R_m = kV + 1$

R_m = Minimum insulation resistance in $M\Omega$ at 40°C of the entire machine winding

kV = Rated machine potential in kilovolts.

Example: For a 480VAC rated motor $R_m = 1.48 M\Omega$ (use 5 $M\Omega$).

For a 4160VAC rated motor $R_m = 5.16 M\Omega$.

For machines in good condition, insulation and resistance readings of 10 to 100 times R_m are not uncommon. If the insulation resistance is less than that calculated from the formula, the winding should be dried out in either of two ways:

- a. Bake in an oven (preferably a circulating air oven) at a temperature not over 90°C until insulation resistance remains constant.
- b. With the rotor locked, apply low voltage and gradually increase the current through the winding (do not exceed 50% full load amps) until the winding temperature, measured with a thermometer, reaches 90°C. Do not exceed this temperature.

If a significant change in insulation resistance is observed, it should be investigated and immediate action taken. Consult your local District Sales Office for additional suggestions.

Once per month the shaft blocking must be removed and the shaft rotated 10-15 revolutions to redistribute the lubricant and prevent corrosion of interior surfaces. Prior to rotating the shaft, 4 to 6 ounces of oil should be poured onto the bearing liner of a horizontal motor if it is supplied with sleeve bearings.

If the relative humidity of the storage environment is greater than 60%, the shaft must be rotated 10-15 revolutions once per week. After rotating the shaft, replace the shaft blocking and the protective packing.

Note that the shaft does not need to be rotated on vertical motors equipped with hydrodynamic bearings, but the bearing reservoirs should be filled to the proper level with oil.

Storage for periods not exceeding 24 months

Follow the Storage for periods not exceeding 12 months procedure with the following additional requirements:

1. Grease lubricated bearings should be re-lubricated per the motor nameplate.
2. Oil lubricated bearings should have the oil changed once per year to prevent contamination from gases that may be present in the storage environment.
3. After the bearings are re-lubricated the shaft should be rotated. Note that the shaft does not need to be rotated on vertical motors equipped with hydrodynamic bearings.

Storage for periods exceeding 24 months

Follow the Storage for periods not exceeding 24 months procedure with the following additional requirements:

1. When the motor is removed from storage, a thorough bearing disassembly and inspection is required. The assembly and disassembly must be done in accordance with the procedures detailed in this manual. After this has been completed, the bearings can be relubricated.
2. When the motor is removed from storage, a thorough visual winding and motor lead inspection is required.

Storage for motors that have been disassembled and individual components vacuum sealed.

1. To meet the long term storage requirements for certain motors disassembly and vacuum sealing of individual components is required. This helps to prevent oxidation as well as remove the load from the bearings to prevent any damage that could result from having a stationary load applied to a bearing surface. The intent of this type of storage is to minimize the amount of maintenance required during storage while maximizing the protection for the motor. It is mandatory that all components stay in their original packaging and that the packages are not opened. This type of storage requires assembly by qualified personnel and proper testing before the motor is fit for use.
2. Once the motor is received at site the packaging should be thoroughly inspected. Look for damage to the wooden crates. In particular look for signs of impact or moisture. If there is any concern with the state of the packaging it must be documented and Baldor should be contacted immediately so that the necessary action can be taken. Check that all of the items on the bill of lading have been received. Contact Baldor immediately if there are any concerns or missing components.
3. Check the moisture indicators on each crate (see step 4). If moisture is present the seal has been compromised. Contact Baldor immediately.
4. Each crate has been outfitted with a moisture indicator. This moisture indicator is in contact with the air inside the vacuum sealed package and a window has been provided in the crate so that it is visible without opening the crate. If no moisture is present the colour of the indicator will be blue. If the seal on the packaging is compromised moisture will be present and the indicator will turn pink. If this happens Baldor must be contacted. If the indicator only senses a slight amount of moisture, this could have been present during the packaging, the sensor may turn white. If this is the case the desiccant in the bag has taken care of the moisture and the seal has not been compromised. Only if the indicator turns pink is it necessary to contact Baldor and have the packaging repaired. If the indicator has turned white more frequent checks must be made to ensure the humidity level inside the crate isn't still changing. An example of the moisture indicator has been provided in Figure 1.

Figure 1



5. The environment where the motor is placed must be clean, dry and warm. The motor is to be kept in its original packaging and the vacuum seal must be maintained to prevent oxidation of the motor components. The environment must be temperature and humidity controlled and free of corrosive agents. See Table 1 for acceptable temperature and humidity levels.

Table 1 Storage Area Temperature and Humidity Levels

Temperature	50°F to 90°F
Relative Humidity	Less than 60%

The components must be stored in an environment with low vibration levels (less than 2 mils). If unusual vibration levels exist at the storage location isolation pads should be used to support the different motor components.

6. The packaging has been designed to minimize maintenance during storage and since the motor has been disassembled there is very little that needs to be done. However, it is very critical that the packaging be checked on a regular basis as stated below to ensure proper protection of the motor components.

Each individual package has been fitted with a humidity sensor (see step 4). This sensor will read high levels of humidity if the vacuum seal has been compromised. The sensor of each package must be checked when the motor components are received and placed into storage. These sensors should then be checked after 3 months and after 6 months. After the 6 month point the sensors should be checked every 6 months for the duration of the storage to ensure the vacuum seal hasn't broken.

If one or more humidity sensors reveal a break in the vacuum seal Baldor will need to be contacted. In most cases a representative from the packaging company will be sent to site to inspect and reseal the packaging. In some cases a representative from Baldor may be sent as well to inspect the items in the ruptured package to ensure that there have been no adverse effects to the components. The costs associated with resealing the package and any rework to the components is the responsibility of the end user.

7. When it comes time to put the motor into service it will need to be assembled by qualified personnel and tested to ensure trouble free operation. Check packaging carefully for damage before opening. If when the packaging is opened the components show signs of oxidation or damage Baldor will need to review the components and rework or replacement parts may be required before use.



BALDOR®
A MEMBER OF THE ABB GROUP

Baldor Electric Company

P.O. Box 2400, Fort Smith, AR 72902-2400 U.S.A., Ph: (1) 479.646.4711, Fax (1) 479.648.5792, International Fax (1) 479.648.5895

www.baldor.com