

# Guidelines to a Good Motor Repair

## A Good Motor Repair Is A Two-way Street

Having a clear understanding between you and the motor service center will produce a much more satisfactory experience.

It will help if you can provide the following information or answer the following questions:

1. Complete nameplate information including manufacturer, horsepower, speed, voltage, phase, enclosure, catalog, part and/or model number, frame size and serial number.
2. What does the motor operate (a fan, blower, conveyor belt, pump)?
3. How does the motor drive the load (direct drive, belted)?
4. Is there auxiliary equipment attached like a clutch, gearbox or brake?
5. Why do you think the motor needs repair (it smokes, it doesn't run, it needs preventive maintenance)?
6. What is the motor's past repair history? Is it a "problem motor"?
7. How is the motor started (across the line, soft start, adjustable speed drive (ASD), part winding start, wye start, delta run)?
8. What is the operating environment (indoors, outdoors, subject to hazardous fumes or dusts, water spray)?
9. When do you need the motor back? Will you authorize overtime work if necessary?
10. Is the motor still under manufacturer's warranty?

You should expect the motor service center you select to provide answers to these questions:

1. What are my repair/replacement options?

In the case of standard motors, repair may not always be the best option. The motor service center should be able to offer premium efficiency replacement alternatives to repair which may save you operating dollars. Bear in mind, however, that many motors are special and not readily available off the shelf. This may make repair the best option. Discuss this with your service center.

2. Do you have experience in repairing this type and size of motor?  
Do you have access to similar replacement motors?

The motor service center probably specializes in certain sizes and types of motors (AC and/or DC, vertical pump motors, single or three phase motors,

gear motors). If the motor is an ordinary one, they should be able to offer replacement models to meet your needs in a timely manner.

3. *How can we get the motor in for repair?*

Most service centers will pick up the motor. In some cases you will have to deliver it to them. In the case of a very large motor or a motor that is located at a remote site, some coordination with a crane or other material handling equipment may be necessary.

Some service centers are also licensed contractors and will install and/or remove the motors for you. If not, they may be able to suggest a qualified contractor who can perform these services, if you need them.

4. *What standards will you use when repairing my motor?*

*What is your warranty?*

Many motor service centers are members of the Electrical Apparatus Service Association (EASA) and perform repairs to the EASA Recommended Practice for the Repair of Rotating Electrical Apparatus. A clear understanding of the warranty offered will help avoid disagreements later. Remember that a warranty is only as good as the company behind it.

5. *Are you an authorized warranty shop for this motor?*

If the motor is under warranty, be sure the shop is authorized to perform warranty work.

*After the motor has been inspected, you should expect to be told:*

1. *What is involved in the repair.*

The service center should tell you if the motor needs rewinding or just bearing replacement and clean up. They should tell you what tests they performed to substantiate these findings.

2. *How long it will take to complete the repair.*

Remember, a good repair, including rewind, can take several days or more. Cutting corners on repair can cost you money and even result in premature motor failure.

3. *What the repair will cost.*

You should expect to receive an accurate cost estimate for the repair. Remember, however, that repair costs can vary once the shop actually starts the repair because they may find hidden problems that were not readily apparent on their first inspection. Be prepared to work with them to obtain the best repair possible.

4. *What your options are.*

Many service centers can offer repair/replacement options. In some cases the motor — because of its age or type — may not be readily or economically replaced. In other cases, a new motor may be the best way to go. If the motor was designed specifically for an OEM, the replacement may have to come from the OEM. Work with your service center to find the best solution for you.

### A good motor service center SHOULD:

1. **Conduct a stator core test before and after winding removal.** This will assure that the core has not been damaged during repair.
2. **Repair or replace defective stator core laminations.**
3. **Calibrate all test equipment and measuring devices at least annually** against standards traceable to the National Institute of Standards and Technology (NIST) or an equivalent standards laboratory. This will insure the accuracy of the readings taken during repair.
4. **Measure and record winding resistance and room temperature.** The resistance measured in all three phases should be balanced. If it is unbalanced by more than 5 percent, the motor should be tested further. It may need rewinding.
5. **Have the appropriate power supply for running the motor at rated voltage.** Measure and record no-load amps and voltage during the final test. Tests at reduced voltage may not reveal certain motor problems.
6. **Have a quality assurance program.** This will ensure that you get the same quality of repair each time.
7. **Have and use, at a minimum, the following test equipment: ammeter, voltmeter, wattmeter, ohmmeter, megohmmeter, high potential tester.** Other useful test instruments include surge testers, core loss testers, dynamometers, tachometers, vibration meters and milliohmmeters.
8. **Balance the rotor.** Out-of-balance rotors can cause vibration, which wears out bearings prematurely and increases friction losses, resulting in loss of motor efficiency and higher operating costs.
9. **Repair or replace all broken or worn parts and fits.** Bearing fits should be measured and if worn should be restored to manufacturer's specifications. In the absence of manufacturer's guidelines, EASA has published bearing fit charts to aid the motor service center.

### A good motor service center SHOULD NOT:

1. **Overheat the stator.** The safe limit for organic lamination insulation is 680°F and 750°F for inorganic material measured at the core. Most service centers use heat to soften the old windings for removal. Overheating the stator during stripping can cause core damage.
2. **Sandblast the core iron.** Blasting with sand or other hard materials can cause short circuits between laminations.
3. **Knurl, peen or paint bearing fits.** Knurling, peening or painting these fits could cause them to become loose in service.
4. **Use an open flame for stripping.** Using uncontrolled heat causes loss of core plating and can warp the core.
5. **Short the laminations when grinding or filing.** Excessive grinding and filing can increase core losses resulting in decreased motor efficiency.
6. **Increase the air gap.** Increased air gap produces higher magnetizing current, which increases stator and rotor copper losses and decreases power factor.

This document was prepared with assistance from the following organizations:

Advanced Energy

Baldor

Brithinee Electric

California Energy Commission

Diagnostic Solutions

ITT Flygt

Imperial Irrigation District

Pacific Gas & Electric

Sacramento Municipal Utility District

San Diego Gas & Electric

Southern California Edison

U.S. Department of Energy

U.S. Electrical Motors

7. **Increase the resistance of the stator windings.** Increased resistance results in increased stator copper losses and decreased motor efficiency.
8. **Make mechanical modifications without your prior approval.** This includes, among other things, changing fans, types of bearings, shaft material and seals. Making changes in the manufacturer's original design can decrease motor efficiency.
9. **Change the winding design without your prior approval.** This change can affect the overall efficiency, torque and other characteristics of the motor.

*Reference:* EASA Tech Note 16 Guidelines for Maintaining Motor Efficiency During Rebuilding and the EASA Recommended Practice for the Repair of Rotating Electrical Apparatus

*Decreased motor efficiency translates into higher electricity use and higher energy bills.*

In short, don't cut corners in the repair of your motor. A good motor repair takes time. Cutting corners can result in a poor repair which can cause higher operating costs and premature motor failure.

*In addition you should expect that the motor service center will:*

1. **Maintain an inventory of motors and parts to service your needs.**
2. **Maintain a stable, knowledgeable and well trained work force to service your needs.**
3. **Maintain a sound financial condition.**
4. **Be environmentally responsible.**
5. **Utilize the best available technology in the repair of your motor.**
6. **Provide complete documentation of the cause of failure, before and after tests and measurements, and the repairs made.**
7. **Provide prompt and accurate quotations.**
8. **Provide repair/replacement alternatives.**
9. **Provide prompt and courteous service.**
10. **Treat your motor problems with concern.**

## *Remember:*

The best way to ensure that you will always get the best repair/replacement advice is to

**Know Your Motor Service Center**