11. Motor Repair

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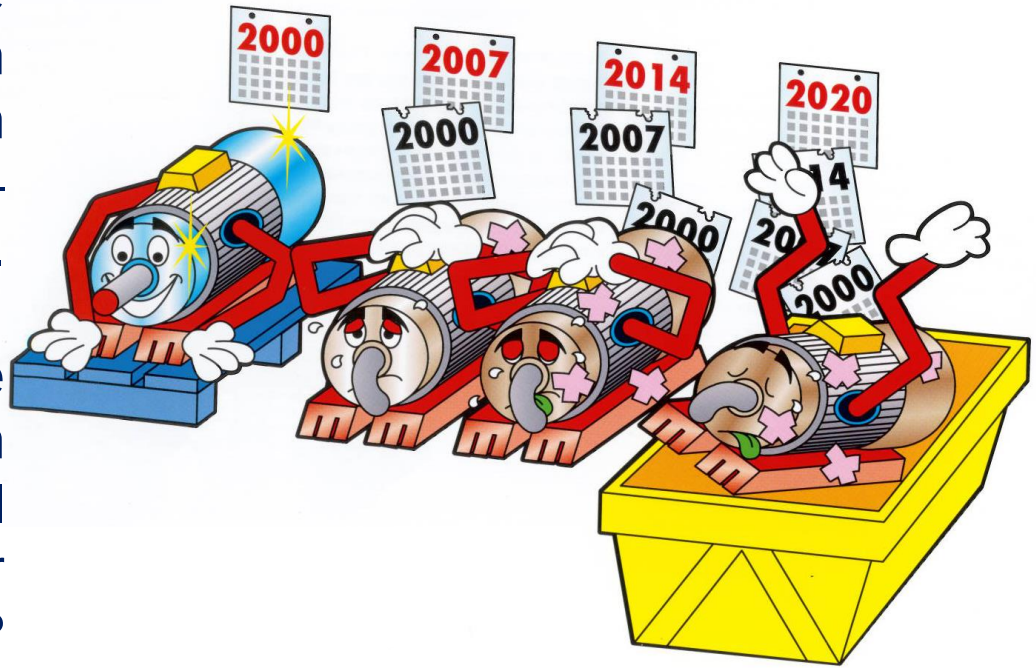
Life story of a typical motor

For a motor that is large enough to be re-wound when it fails, statistics show that in Europe it will be rewound 2 – 3 times in its life.

But when will it actually be better to replace rather than repair a motor, and what will happen to the life of a motor when it is repaired?



Why repair a motor ?

- Repairing an old motor is usually a lower cost “up front” option, and so is the default. As a “rule of thumb”, it may be 2/3rds the cost of a new one, but this varies.
- The maintenance engineer does not reap the future energy savings from buying a new and more efficient motor, and so opts for the lower up front cost option.
- Repairers would rather repair rather than replace, as there is more profit in this. (Although they will soon lose business if pushing uneconomic repairs).

Distress repairs

A motor will not always go wrong at a convenient time. Getting it working may take priority over the quality of repair. A good Motor Management policy (MMP) will take account of this.

Even when a motor is so badly damaged that it ought to be scrapped, it may be repaired as a temporary measure until a replacement can be found.

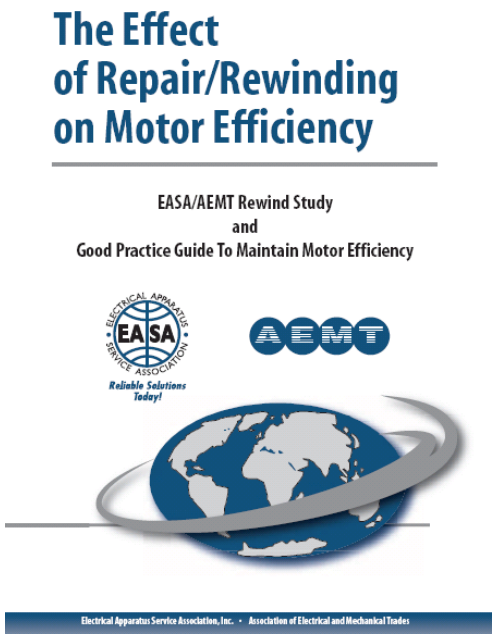
Poor Quality repairs

You can't always blame the repairer – if you demand a rapid service, then corners may be cut.

A 0.5-2.0% increase in losses is typical of a repair not done to high standards.

Quality repair procedures

- ✓ Avoid damage to the stator core when removing old windings
- ✓ Rewind with the correct wire gauge, number of turns and insulation
- ✓ Use the right fan
- ✓ Use the right bearings and lubricate correctly



In the UK,(80%+) undertaken are done to this code (with other motors really being beyond technically satisfactory repair)

Stator core – burn out temperature

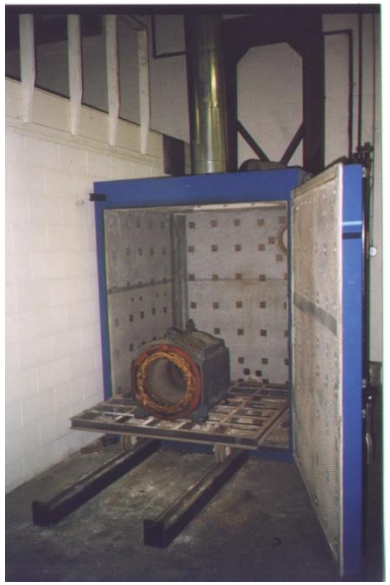
Iron Loss:

Burnout temperature must be closely controlled.

< 360°C the core may not be clean, requiring additional cleaning and risk of mechanical damage.

> 360°C can damage organic interlaminar insulation.

> 400°C can damage inorganic interlaminar insulation.



Reliance Electric

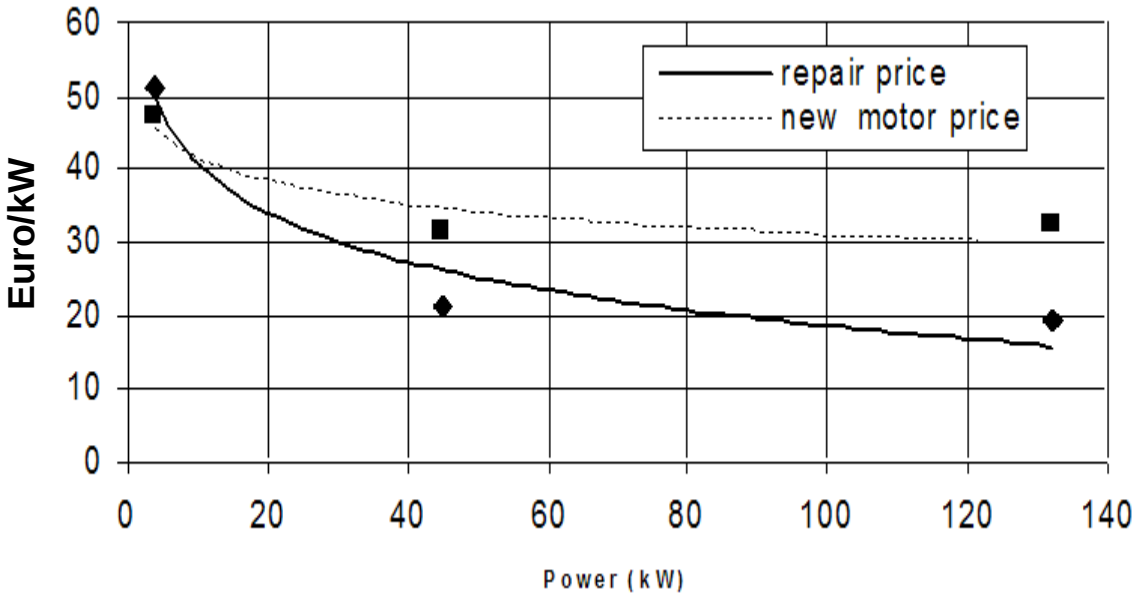
Selecting a Motor Repairer

- In the absence of any accreditation scheme, you are on your own. Things to look for:
- **Stocks.** Do they have adequate spares inventories? Do they have a good range of wire gauges?
- **Winding removal.** Do they have an oven in good condition with good controls?
- **Quality control.** What evidence is there of quality control system?
- **Motor testing.** What tests do they do on repaired motors?
- **Personnel.** What experience do their staff have?

Costs of repair

This diagram shows the typical cost (Euros) of repair vs new price as motor size varies.

The crossover point is at circa 10kW



Ref EUP Lot 11 study P.59

Repair / Replace decision making

- **Consider the whole life costs of motors in purchasing decisions**
- Usually more cost effective to replace small motors than to rewind. Use opportunity to upgrade to higher efficiency.
- Different organisations have different maximum thresholds for automatic replacement
  - Ranges from 11kW – 55kW
- Rewound motors efficiencies vary and can be as much as 2% less efficient.
  - Running costs will increase as a result

Repair / Replace decision making

Life cost = Capital cost + (n x Annual running cost)

Annual running cost = (kW/eff) x L x hrs x $€_{elec}$

Where:

n = time frame in years over which the payback is assessed

kW = rated kW of the motor

L = typical loading, (use 0.75 as a default)

hrs = annual operating hours

$€_{elec}$ = cost of electricity (€/kWh)

eff = motor efficiency (%)

Repair / Replace decision making

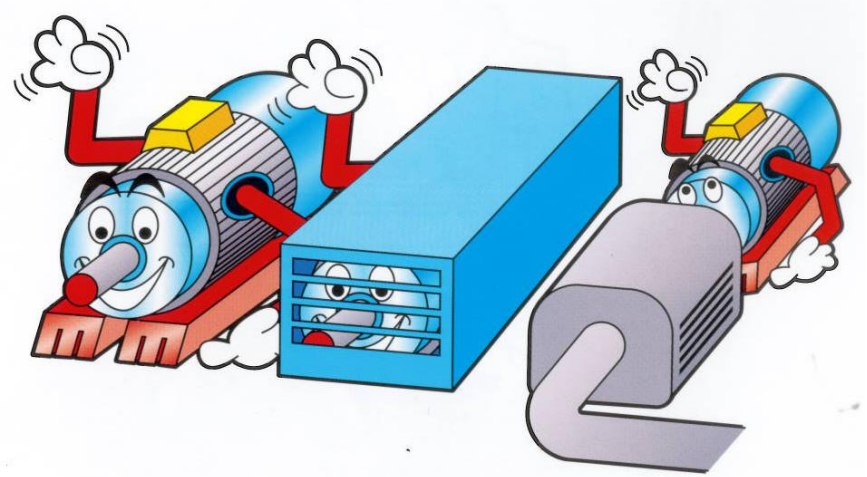
Workshop Exercise

Motor management policy

- Provides mechanism to improve motor efficiency over time
- Provides structured approach to repair and maintenance of motors
- Engages senior management – endorsement
- Defines roles & responsibilities
  - Purchasing dept have buying guidelines
  - Engineers empowered to influence purchasing decisions in favour of efficiency

The need for a Motor Management Policy (MMP)

A Motor management policy lays down rules to be followed when purchasing a new motor or deciding whether to repair or replace a failed motor. This is usually based on the financial difference in costs, based on the difference in up front costs + ongoing energy costs.



With motors using 2/3rds of the electricity in industry - many hidden away and forgotten – proper management can save a lot of money and inconvenience

Who has a motor management policy?

Large organisations with many process-critical motors – e.g. petrochemicals and water utilities.

Others may also have a MMP, but in practice it will rarely be adhered to.

The threshold for repair rather than replacement typically varies from <11kW – 55kW

Low labour costs mean that small motors are much more likely to be repaired.

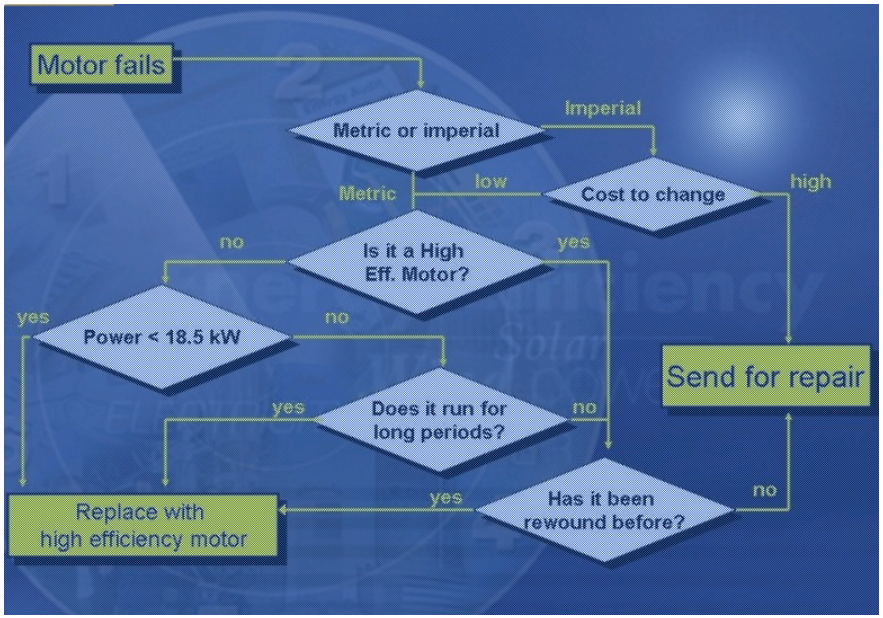
Romtec utilities

Example of a Repair/Replace decision chart

This involves several key questions relating to what happens when a motor fails:

- Efficiency
- Size
- Running hours
- Past rewind history
- Metric / Imperial
- Other costs to change

Note that bearing replacement does not figure in this.



Source: ABB Motors – others produce similar diagrams

Motor repair and Energy Management Systems

- Motor repair is an ongoing process of many smaller events, and so relies on a system being adhered to.
- Check that it is adhered to, and if not, take action to make it easier to comply.

Outside help

- A maintenance partner can undertake regular condition monitoring that will predict problems in advance.
- Use of an outside organisation whose interest is fulfilling the terms of a Motor Management Policy will avoid problems due to internal conflicts.
- Stocks of key motors could be held at a local supplier.

Lifetime of repaired motors

Good motor practice

- A good repair will return the repaired item to “as new” condition. It might even make it better.
- No limit to the number of rewinds.

Poor repair practice

- A poor repair will reduce the efficiency by up to 2.0%.
- Motor manufacturers suggest 1 or 2 rewinds before replacement.

Your approach to Motor management will be determined by the quality of repair that you pay for.