

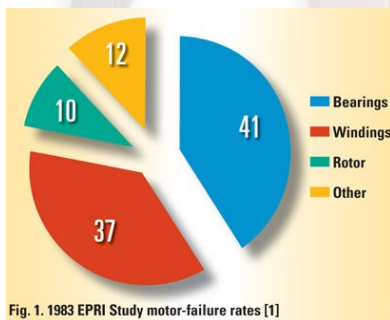
## Electric Motor Failures (37% of Motors are connected to Drives account for 82% of Winding Defects)

<http://www.3Phi-Reliability.com/> Implement Electrical Maintenance Programmes for industry which includes conducting Motor Circuit Analysis. This testing programme forms a database of tests from many sectors and over a range of Low Voltage Motor sizes.

I will reference 1983 Electric Power Research Institute (EPRI) project performed by General Electric (GE) [1] where 4797 motors were evaluated with 1227 failures. The title "Large Electric Motor Reliability" I'm not sure what Large is?

Here's a Snapshot of that Study

**"First it was noted that more than 90% of the failures occurred in 54% of the facilities evaluated, and half of the failures occurred in 17% of the facilities."**



**"The average failure rate of motors across all the facilities was 3.4% per unit annually, with some operations having a higher rate, and 46% of them having very low failure rates.**

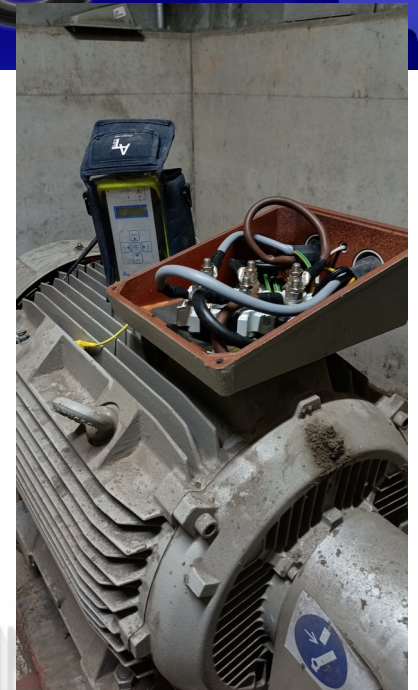
**In all, the study found that those plants at the extremes had a failure rate of 9.3% per year (17% of facilities) and 13% of the sites had about a 0.8% failure rate."**

So what's this telling you, Some Facilities have Motor Reliability others don't. The range is more than 12 times the failure rate between sites.

Motor Bearings 41% are the biggest issue, closely followed by Motor Winding at 37% of defects.

A dairy company in Australia with over 3500 rotating machines on the Vibration Analysis database had initial defects of 12% of Assets, and when Motor Circuit Analysis was conducted 8% of tested assets had defects. So this ratio is quite valid.

This data dating 1983 is quite old and in my view one thing that has changed dramatically, is the use of Variable Speed Drives. In 1983 (nearly forty years ago) drives weren't yet to be commercialised.



## So what does 3Phi Reliability data look like in 2022?

Keep in mind this data is not failures but detected defects before failure.

17% Stator Winding (Phase Angle, Current Frequency Response ALLTestPro )

22% Resistive Defects (Imbalances greater than 3%)

2.3% Insulation Resistance Defects (Lower than 100 MegaOhm)

Total 41.3% which up from the above study 1983 at 37% but close.

## This is the interesting part of the data

Totaling up the Assets 63.2% were started Direct on Line, Star Delta or Soft Starter.

36.8% were connected to a Variable Speed Drive.

Of the Motors with significant Winding defects 82% were connected to a variable speed drive. **So 37% of the assets (Drives) accounted for 82% of the Winding defects.**

## Summary

To date much focus has been on bearing currents emitted from Drives, but these numbers suggest Insulation & Windings defects suffer significant consequences of this failure mode.

Ensuring proper grounding of Variable Speed Drives is the first step, followed by Drive Emission testing at the Motor.

The above study indicates good Electrical Preventative Maintenance can have a 12 times reduction in “Median Hours Downtime per Failure”

Table II. Maintenance vs. Failure Rate, According to 1985 IEEE Survey [2]

| Level of Maintenance and Frequency | Failure Rate (FPU) | Median Hours Downtime/Failure (Impact on Production) |
|------------------------------------|--------------------|--|
| Excellent, <12 Months              | 0.1115             | 8  |
| Excellent, 12-24 Months            | 0.0364             | 24   |
| Excellent, >24 Months              | 0.0315             | 36   |
| Excellent, Average                 | 0.0708             | 16   |
| Fair, <12 Months                   | 0.0872             | 16   |
| Fair, 12-24 Months                 | 0.0403             | 54   |
| Fair, >24 Months                   | 0.0719             | 165  |
| Fair, Average                      | 0.0710             | 16   |
| Poor, 12-24 Months (All)           | 0.0563             | 96   |

96 hours to 8 hours. (12 Times the impact).

<http://www.3Phi-Reliability.com/blog>

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