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MQM Case Studies

CASE 1.

2 MQM systems operational since 1999, used by an appliance manufacturer (washing machines) for 100% testing of electric motors produced internally.

Comparing average service return rates for the years before MQM becomes operational to the values after 1999, a 66% drop (in warranty period) is observed in returns due to motor faults. This drop was initially due to extensive fault detection capabilities of MQM. Then, manufacturing process-monitoring tools of MQM were also implemented in this plant in parallel to six-sigma production quality policy. As a result of this study, further and permanent reduction in service return rate was achieved with increased production quality.

ROI calculation:

Cost of a washing machine motor including labor cost 117 $

Service return rate due to motor faults before MQM 0.7 %
Service return rate due to motor faults after MQM 0.24 %

Contribution of MQM 0.46%= 4600 ppm

Savings:
Number of machines produced in 1999 855245
Number of machines prevented to be failed due to motor failures:
855245 x 0.46 / 100 =3934

3934 x 117 = 460,000 $ p.a.

CASE 2.

1 MQM system operational since 1999 at a vacuum cleaners manufacturing plant, used by the customer for incoming quality control.

Following receipt of a large shipment of motors (50,000), an abnormally high rate of rejection (35 % compared to around 1% normal rate) was observed. To analyze the situation, the customer conducted an extensive study and found that the motors rejected by MQM were burning rapidly in the accelerated life test experiments. The problematic party of motors was returned to the motor manufacturer, and the epidemic was averted.

ROI calculation:

Cost of a vacuum cleaner motor including labor cost 82 $
Assuming 25% failure for 50,000 motors in the field 12,500 motors

Savings: **12,500 x 82 = 1 Million $!**

motor mqm quality monitor

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The same system also helped the customer to achieve a general reduction in service return rates.

ROI calculation:

Service return rate before MQM	1.4 %
Service return rate after MQM	0.9 %
Reduction	0.5 % = 5000 ppm.
Total production p.a.	567,192

Savings: **0.5x 567,192 x 82 = 180,000 $ p.a.**

CASE 3.

1 MQM system used at a discharge pump motors manufacturing line running as an end-of-line test system. An epidemic warning provided by MQM, and further analysis of the motors, identified a defect in magnets provided by the supplier. The shipment was replaced.

CASE 4.

1 MQM system operational as an end-of-line test system at a hermetic compressor manufacturing line since 2000. The customer also uses two other test systems before MQM test point to screen faulty compressors. However, MQM was still detecting a significant amount of faulty motors and the analysis study conducted on these motors identified defects related to air-gap, piston-crank, windings and iron core. It was proven by dismantling study on MQM Faulty Compressors that in 75% of the compressors failed at the MQM test there exists a real-fault, which could cause field returns.

The same systems also prevented two important epidemics. Both of these epidemics were detected after an abnormally high rate of rejection was observed in MQM test. The customer conducted extensive studies and found that the first epidemic was due to a malfunctioning in discharge valve and the second was due to a performance degradation, which causes compressors failed at start-up under load.

Table : Types of Faults Detected by MQM Compressor Test System

Fault Type	MQM Test Result
Non-uniform Air-Gap	FAULTY
Rotor-Stator Pull	FAULTY
Start-Up Failure at Low Voltage	FAULTY
Winding Faults (Auxiliary and Main)	FAULTY
Rotor Related Faults	FAULTY
Stator Related Faults	FAULTY
Faults related with piston-crank group	FAULTY
Discharge valve related faults	FAULTY

CASE 5.

1 MQM system operational at a motor manufacturing plant, which produces universal motors with built-in tacho-generator for automatic washing machines, since 1999. An abnormally high rate of rejection was observed at the MQM test during normal production. To analyze the situation, the customer conducted an extensive study using MQM's fault parameters. MQM was rejecting that production party due to low Inductance parameter. This parameter was expected to show information about magnetic properties of the motor. Therefore, the manufacturer checked the quality of the iron-core (stator body) and observed that magnetic losses were increased which was detected by analyzing a stator under electron microscope for its carbon structure. A couple of performance tests were also conducted and noticed that the temperature rise in these motors reaches to its critical limit. Then, the manufacturer went back to production process to find the source of the problem. Finally, it was understood that problem occurred due to improper annealing process since the controller, which provides a stable temperature distribution in the oven, was not functioning well.

This example is a good example of MQM's epidemic prevention capability. In addition, it shows how MQM can help the manufacturer to pinpoint the root-cause of the epidemic and provide feedback to production by its physically meaningful fault parameters.

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