

## REM

Industrial Automation and repairing electric machines



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## SKF Certified Rebuilder Site Audit Report

### Company name

REM  
Automazione E Riparazione Motori Electrici

### Location

Vis Ferruccia 16/a -  
03010 Patrica  
Frosinone  
Italy

### Rebuilder web page

[www.rem-motori.it](http://www.rem-motori.it)

### Present from SKF

Tomasso Gribado  
Edoardo Corno  
Jim Fowlie

### Present from client

Carlo Spaziani (Owner)

### Auditor

Jim Fowlie

### Audit Type

Initial Audit

### Summary of the audit results

The rebuilder is requested to provide SKF with a documented response to address the areas indicated by "ACTIONS REQUIRED" items listed in the detailed audit report. Recommendations must be addressed and the company must confirm completion before the certification process can continue. The SKF Audit Team hopes these findings can serve as an opportunity to reinforce a continuous improvement atmosphere regarding quality and cleanliness that meets or exceeds customer expectations.

### Report Contents:

- Section 1 Scoring
- Section 2: Summary of Actions Identified
- Section 3: Detail of all Questions Recorded during the Audit
- Section 4: Details on Best Practice: Sample Forms, Best Practice References

## Scoring

**4,0** Best in Class, exceeds the requirements of the audit

**3,0 - 3,9** Fully compliant. Meets fully the requirements of the audit. Some recommendations can be given by SKF to be best in class

**1,0 - 2,9** Partially compliant. The requirement is fulfilled with deviation(s) which can influence the product or service quality to customers, or impact the environmental, health or safety reputation of SKF.

**ACTION IS REQUIRED** by the workshop to become fully compliant.

The workshop **CAN** be certified or recertified when the **ACTION REQUIRED** is submitted in writing from workshop senior management and a timely corrective action plan is agreed upon with the country program manager.

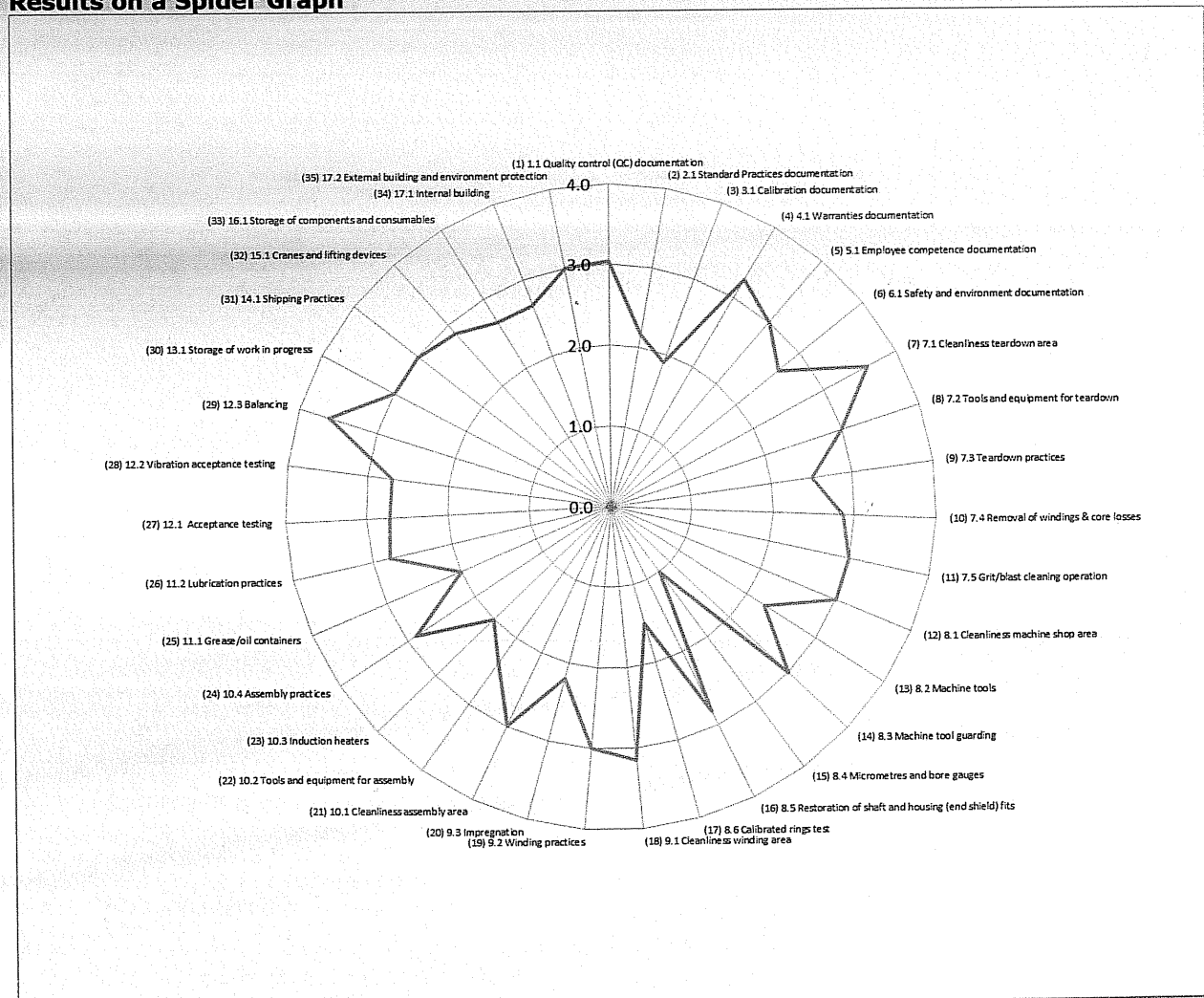
**0,0 - 0,9** Non-compliant, The requirement is not fulfilled.

A major deviation(s) was found and would influence the product or service quality to customers and/or damage the environmental, health or safety reputation of SKF.

**URGENT ACTION IS REQUIRED** by the workshop to become fully compliant.

The workshop **CANNOT** be certified or recertified until the **ACTION REQUIRED** is fully completed and approved by the country program manager

## Results on a Spider Graph



Values of each category	
(1) 1.1 Quality control (QC) documentation	3.0
(2) 2.1 Standard Practices documentation	2.2
(3) 3.1 Calibration documentation	1.9
(4) 4.1 Warranties documentation	3.3
(5) 5.1 Employee competence documentation	3.0
(6) 6.1 Safety and environment documentation	2.7
(7) 7.1 Cleanliness teardown area	3.6
(8) 7.2 Tools and equipment for teardown	3.0
(9) 7.3 Teardown practices	2.5
(10) 7.4 Removal of windings & core losses	2.9
(11) 7.5 Grit/blast cleaning operation	3.0
(12) 8.1 Cleanliness machine shop area	3.0
(13) 8.2 Machine tools	2.3
(14) 8.3 Machine tool guarding	3.0
(15) 8.4 Micrometres and bore gauges	1.0
(16) 8.5 Restoration of shaft and housing (end shield) fits	2.8
(17) 8.6 Calibrated rings test	1.5
(18) 9.1 Cleanliness winding area	3.1
(19) 9.2 Winding practices	3.0
(20) 9.3 Impregnation	2.2
(21) 10.1 Cleanliness assembly area	3.0
(22) 10.2 Tools and equipment for assembly	2.4
(23) 10.3 Induction heaters	2.0
(24) 10.4 Assembly practices	2.9
(25) 11.1 Grease/oil containers	2.0
(26) 11.2 Lubrication practices	2.8
(27) 12.1 Acceptance testing	2.7
(28) 12.2 Vibration acceptance testing	2.7
(29) 12.3 Balancing	3.6
(30) 13.1 Storage of work in progress	3.0
(31) 14.1 Shipping Practices	3.0
(32) 15.1 Cranes and lifting devices	2.9
(33) 16.1 Storage of components and consumables	2.7
(34) 17.1 Internal building	2.7
(35) 17.2 External building and environment protection	3.0

The 3 areas highlighted in red require immediate action – others areas below 3.0 to be improved on an ongoing bases, and the items detailed in the following Action List to be done before the time of the next audit, which will be at the time of Certification renewal.

## SUMMARY OF ACTIONS REQUIRED BY SKF

### 1.1 Quality control (QC) documentation

Create a written agreement on methods used to restore defective or damaged core components and review and obtain a written approval with key customers.

SKF suggests to develop processes to regular documented the inspection and evaluation of machine tools

### 2.1 Standard Practices documentation

All working procedures, step-by-step instructions and checklists for rebuilding steps must be completed

SKF suggests to upload in the company server the receiving and inspection working procedure to be used by appointed employees.

Receiving and inspection working procedure must be written

Instructions for cleaning and tear down must be written, SKF suggests to upload in the company server the instructions for cleaning and tear down to be used by appointed employees .

Instructions for preservation of disassembled components must be written, SKF suggests to upload in the company server the instructions for preservation of disassembled components to be used by appointed employees .

Instructions for bearing fit selection and dimensional check of shaft and housing seats must be written, SKF suggests to upload in the company server the instructions for bearing fit selection and dimensional check of shaft and housing seats to be used by appointed employees .

Data entry form for bearing seats must be created. Eight (8) measurements and accepted tolerance values must be included, The Data entry form for bearing seats must be redesigned to allow eight (8) measurements (4 measurements per plane) and include accepted tolerance values

Instructions for must Core loss testing must be written

Data entry form for Core Loss testing must be created showing accepted tolerance values, Core loss measurements taken after stripping should be no more than 110% of the pre-stripping value. Any hot spots of more than 15°C (60°F) above the average temperature must be repaired.

Instructions for winding removal (stripping) and burnout oven operation must be written, The uncontrolled temperature could severely damage the core. Protection of the stator core must be taken into consideration for Mechanical Stripping e.g. Chemical stripping, Dreisiker/Thumm method, Water Blasting and Dry ice blasting. Burn-out ovens must have precision temperature controls and be equipped with a water spray temperature suppression system to avoid overheating the stator. Exceeding temperatures above 400°C (750°F) will damage the stator core and frame distortion may result.

Instructions for motor rewinding must be written, SKF Tech. Req. (3.3) Stator conductor losses: Use the same wire size or keep the same cross-sectional area. Motors should not have winding changed from Lap to Concentric. Insulations systems must include as a minimum: Turn insulation, Slot liner insulation, Separator insulation, Phase barrier insulation. Insulation material shall be of sufficient dielectric strength for the electrical design of the motor.

Specific rewind procedures for motors with voltages above 5000 Volts AC must be written

Specific rewind procedures for Variable Speed Motors must be written

Instructions for impregnation of windings (varnishing) must be written, SKF Tech. Req. (3.3) Stator conductor losses: The rewound stator shall be impregnated with a double dip and bake cycle, Vacuum Pressure Impregnation (VPI), or a trickle impregnation system. The company shall regularly test the quality of varnish and take any indicated actions from such tests.

Instructions for drying and bake oven operation must be written

Instructions for insulation resistance testing (megohm test) must be written

Data entry form for insulation resistance testing (megohm test) must be created showing accepted tolerance values, elapsed time and temperature correction, A common error is to take the reading after just a few seconds; the insulation resistance value should be taken after applying and maintaining constant test voltage on the winding for one minute. Winding temperature affects the megohm value test result. As temperature increases, insulation resistance decreases.

Instructions for phase-to-phase resistance testing must be written

Data entry form for phase-to-phase resistance must be created showing accepted maximum accepted line current variation for Form and Random Wound motors, In Form Wound Motors, maximum accepted line current variation is 3% at controller and 1% at motor leads.

In Random Wound Motors, maximum accepted line current variation is 4% at controller and 2% at motor leads

Instructions for phase-to-phase resistance testing must be written, SKF Tech. Req. (9.5.1) The PI minimum alarm should be set at 2.0 for class B, F and H insulation and 1.5 for class A insulation

Data entry form for Polarization Index (PI) testing must be created showing minimum accepted values based on insulation class, SKF Tech. Req. (9.5.1) The PI minimum alarm should be set at 2.0 for class B, F and H insulation and 1.5 for class A insulation

Instructions for DC-HiPot step voltage testing must be written, SKF Tech. Req. (9.6.1) Test must be performed to prove that insulation has the dielectric strength to withstand typical over voltages that a motor can see while in service due to transients, lightning strikes, loss of a phase, etc.

Data entry form for DC-HiPot presenting test voltages applied, hold time and accepted tolerance values must be created, Test voltage is twice the AC line voltage plus 1000 volts continuously for one minute.

Instructions for impulse/Surge testing must be written; SKF Tech. Req. (9.7) Surge testing must be performed to detect insulation damage between turns within a motor's winding (turn to turn shorts within the coil). Step surge testing with rotor removed is the preferred test. Test voltage is twice the AC line voltage plus 1000 volts Comparison of two superimposed waveforms must be properly supported, To avoid operator errors by just looking at two superimposed waveforms; SKF Recommends the use of Error Area Ratio (EAR) method to detect changes in waveforms obtained from surge testing motor. "Line-to-Line" and "Pulse-to-Pulse" EAR is a method of mathematically comparing the surge wave from three phase windings against each other

Instructions for shaft extension run out measurement (TIR) must be written, SKF suggests to upload in the company server the instructions for dimensional check of impeller, wear rings and sleeves to be used by appointed employees.

Instructions for bearing mounting must be written, SKF suggests to upload in the company server the instructions for bearing mounting to be used by appointed employees.

Instructions for coupling/sheave mounting must be written, SKF suggests to upload in the company server the instructions for coupling/sheave mounting to be used by appointed employees.

Instructions for seal assembly installation must be written, SKF suggests to upload in the company server the instructions for seal assembly installation to be used by appointed employees.

Instructions for lubrication and lubricants handling must be written, SKF suggests to upload in the company server the instructions for lubrication and lubricants handling to be used by appointed employees.

Instructions for motor soft foot checking must be written or updated, SKF suggests to upload in the company server the instructions for motor soft foot checking to be used by appointed employees.

Instructions for vibration testing must be written, SKF suggests to upload in the company server the instructions for vibration testing to be used by appointed employees.