EASA ACCREDITATION PROGRAM

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INTRODUCTION/OVERVIEW

It has been proven that electric motor efficiency can be maintained during repair and rewind by following defined good practices. The Electrical Apparatus Service Association (EASA) has developed an international accreditation program for service centers based on the sources of these good practices, namely *ANSI/EASA AR100 Recommended Practice for the Repair of Rotating Electrical Apparatus* and the Good Practice Guide of the 2003 study *The Effect of Repair/Rewinding on Motor Efficiency*, by EASA and the Association of Electrical and Mechanical Trades (AEMT).

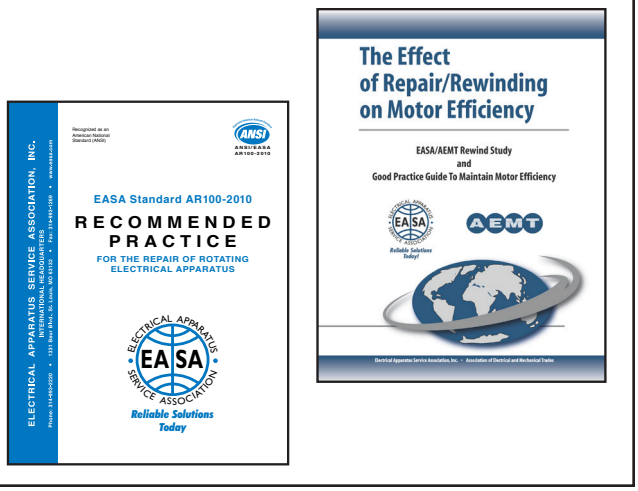
The 2010 edition of ANSI/EASA AR100 incorporated the remaining good practices from the 2003 rewind study that were not already in the AR100 document. Despite the findings and conclusions from that study, a significant number of end users continue to hear the myths that electric motors cannot be repaired without reducing efficiency and that reliability of a repaired motor is reduced by repair. As a proactive measure to dispel this misinformation, EASA embarked on an accreditation program to evaluate service center conformance to the good practices. The formal name of the program is the EASA Accreditation Program. Accredited service centers can display the logo for the program on their business stationery, website, brochures and presentations, etc. (Figure 1).

FIGURE 1: ACCREDITATION LOGO

Accreditation logo for EASA member service centers (left) and non-member service centers (right).

The intent of this groundbreaking accreditation program is to evaluate service centers for evidence of compliance to assure that they are using prescribed good practices to maintain motor efficiency and reliability during electrical and mechanical repairs of electric motors. Membership in EASA is not a prerequisite for participation in the accreditation program. The program will assess, by independent third-party auditing, that a service center has adopted the good practices as outlined in ANSI/EASA AR100 [1] which encompasses the Good Practice Guide portion of the 2003 rewind study [2] (Figure 2).

FIGURE 2: FOUNDATIONAL DOCUMENTS OF THE EASA ACCREDITATION PROGRAM



Independent external audits will be supplemented with internal audits by the participating service centers. In addition to maintaining (or improving) efficiency, the program objectives also include maintaining or improving

the reliability of the repaired motor. Products to which this program applies are three-phase, squirrel-cage motors repaired in accredited service centers. As such, the scope of the program includes mechanical repairs as well as electrical rewinding. Three audit firms based in North America and with global coverage availability have been selected; firms outside North America are expected to follow.

FIGURE 3: LABELS FOR MOTORS REPAIRED TO GUIDLELINES SET FORTH IN THE EASA ACCREDITATION PROGRAM

Motor repair labels for work performed by EASA member service centers (top) and non-member service centers (bottom).

Electric motors that conform to the requirements of the criteria in the associated checklists are to be labeled by the service center with an EASA label (Figure 3). Conversely, motors that do not meet the requirements cannot be labeled. The labels will be available for purchase by accredited service centers in quantities of 100 from EASA.

ACCREDITATION PROGRAM CHECKLIST

The accreditation program utilizes a checklist consisting of 23 categories for the more than 70 mandatory criteria elements. (See “EASA Accreditation Program Checklist: Categories and Key Criteria” on Page 9.)

Even if not specifically noted, all electrical, mechanical and physical measurements are recorded in the service center repair record. The auditor evaluates each criteria line item for evidence of conformity by review of applicable service center repair documents or by observation of service center practices. Review of the calibration program and calibration status of associated equipment is also performed by the auditor. Note that calibration requirements apply to all instruments included in the Equipment List. However, instruments not in the Equipment List are not required to be calibrated because they are outside the scope of the program. To avoid confusion during audits, label all non-calibrated equipment as “For Reference Only.”

The checklist is supplemented with a list of equipment that the service center will need to have so as to be able to provide good practice repairs. Periodic external audits by an independent auditor will provide objective assessment of the service center’s conformance to the accreditation program criteria. Initial internal (self-) audits by a beta group of service centers found that the checklist is comprehensive and does assess maintaining efficiency and reliability during repair. Further, some of the internal audits revealed areas where the service center needed to improve its practices; or simply, to ensure the documented practices were being employed consistently.

The categories of the checklist are in outline form [3] and therefore an expanded text document has been provided for each category and the criteria within it [4]. The primary purposes of the expanded text are to provide explanations of the technical criteria so that external auditors that are not from the electric motor industry can comprehend and consistently interpret and assess each criterion element. A secondary purpose of the explanations is to provide a brief tutorial for service center managers and other personnel to likewise be better able to understand and apply the good practice requirements.

In addition to the accreditation checklist and explanations, the auditors and service centers will need to have copies of and be familiar with AR100 and the Good Practice Guide. The clauses of each document that apply to each of the 23 categories are identified in the checklist. Thus it will be clear as to what will be audited, how it will be assessed, and the specific reference sources for each of the requirements.

EXAMPLE CHECKLIST CATEGORIES AND CRITERIA

The primary source for the checklist criteria is ANSI/EASA AR100, which states what is to be done. It is supplemented by Good Practice Guide (GPG) information that expands into the reasons and importance of carrying out the prescribed actions. In a similar manner the criteria and equipment requirements of checklist categories are supplemented by expanded explanations for each category and associated criteria.

To better understand the example that follows, the “Notes” bullet list below provides supplementary details regarding the contents and the abbreviation used in the checklist.

TABLE 1: BEARINGS (BALL, ROLLER; SLEEVE)			
Criteria:		MI	Visually inspect bearings for evidence of fretting, fluting, scoring, or other damage.
		MA	As-received, and if repaired, post-repair bearing fit dimensions are documented.
		MA	If repaired, rolling bearing fits are rebuilt to applicable AR100 table size.
		MA	Replacement bearings are equivalent to the original, or better suited to the application; and original and replacement bearing numbers documented.
Equipment:	∅	∅	Confirm calibration and functionality of associated equipment.
		MA	Inside micrometers
		MA	Outside micrometers
Source references: AR100-2.2, GPG 2.3			

Notes:

- The symbol ∅ indicates a line item that is not audited; or a box that does not require an entry.
- Evaluate each criteria line item for evidence of conformance by review of applicable service center documents or by observation of service center practices while auditor is present, or both.
- There is to be indication of the outcome of each criteria line item in the service center repair records, such as “OK” (acceptable), or “UN” (unacceptable); and a description of any unacceptable condition(s).
- Where applicable, service center is to provide verification, documentation and records.
- Each check box (first column to the right of “Criteria”) is to be marked by the auditor with one of the following:
  - S .....for satisfactory
  - U .....for unsatisfactory
  - N .....for not observed*
  - n/a...for not applicable**
    - * Applicable mandatory criteria not observed in a prior audit must be observed at the next scheduled audit; and the auditor comments are to include the reason(s) that the criteria could not be observed.
    - ** Criteria that do not apply to a specific service center.
- Review of calibration program and calibration status of associated equipment is performed by auditor. See Table 2 for the list of equipment that must be calibrated.
- Criteria:
  - MA—Mandatory requirement; nonconformity to it is major
  - MI—Mandatory requirement; nonconformity to it is minor
- Corrective actions are measures taken to rectify conditions adverse to motor efficiency and reliability and where applicable, to prevent repetition.
- Outsourcing of some, but not all, repair activities is permitted. The outsource vendor must provide documentation to confirm that repairs meet the requirements of this program. If outsourced repair required measurements or testing, proof of use of calibrated equipment is also required. Excluded from the scope of this program are specific requirements, certification, and inspection required for listed explosion-proof, dust-ignition-proof, and other listed machines for hazardous locations and also excluded are specific or additional requirements for hermetic motors, hydrogen-cooled machines, submersible motors, traction motors, or Class 1E nuclear service motors.

The example in Table 1 will be used to explain the content of the checklist categories and the associated criteria.

The first four row entries are the criteria for evaluating bearings. The second column is blank and is used to enter the auditor assessment of each criterion. The assessments can be satisfactory (S), unsatisfactory (U), not observed (N) or not applicable (n/a). The “N” category allows for the possibility that a repair activity associated with a particular criterion may not be observable or have been performed in the time period since the prior audit. Similarly, the “n/a” category allows for the possibility that a repair activity associated with a particular criterion is not performed in the specific service center.

In addition to the repair criteria, the necessary calibrated equipment associated with the category is also identified and assessed by the auditor. For example, in the bearing category the calibrated equipment consists of inside and outside micrometers. As indicated previoulsy, the “∅” symbol is used in the checklist to indicate a cell that does not require an entry.

The third column is used to designate the level of the criterion. Mandatory requirements for which a nonconformity would result in a major finding are labeled “MA” (mandatory major). Similarly, mandatory requirements for which a nonconformity would result in a minor finding are labeled “MI” (mandatory minor). Findings are on an exception basis (i.e., defects or nonconformities in repaired product are reported) and corrective actions documented.

Failure to implement corrective action in a timely manner for nonconformities to major criteria can result in rescinding or suspending the certification of the service center. Nonconformities for minor requirements would typically result in requiring that they be corrected either prior to the next audit or within a shorter time period.

The source references are clauses from ANSI/EASA AR100 *Recommended Practice for the Repair of Rotating Electrical Apparatus* and the Good Practice Guide of the 2003 EASA/AEMT study, *The Effect of Repair/Rewinding on Motor Efficiency*. Although there are no conflicts between them, the applicable clauses from AR100 take precedence over those from the Good Practice Guide (GPG). The rationale for this is that AR100, which presently is the 2010 edition, is a document that is reviewed and revised periodically per the ANSI (American National Standards Institute) standard approval process. The GPG is essentially a static (yet valid) document based on the findings of the 2003 study. Further, the 2010 edition of AR100 adopted the good practices for repair from the GPG that had not already been incorporated in it.

Continuing with the use of the criteria for bearings as an example, the following is the "Audit Criteria Explanation" for "Bearings (ball, roller; sleeve)." The explanations are similar to a handbook for a technical document, providing details and to aid auditors and users so that they can better understand, interpret and assess each criterion element.

- **Criterion:** Visually inspect bearings for evidence of fretting, fluting, frosting, scoring, or other damage.
  Explanation: If visual inspection reveals evidence of damage to the bearings, it is to be recorded. It is not a requirement that ball and roller bearings be dissected to determine the apparent failure mode. However, the apparent mode of failure is to be recorded for sleeve bearings.
- **Criterion:** As-received, and if repaired, post-repair bearing fit dimensions are documented.
  Explanation: The as-received bearing fit dimensions for the journals and housings are to be recorded even if they do not require repair. If bearing journals or housings are repaired, the repair record is to indicate the before and after bearing fit dimensions for the applicable journal(s) and housing(s). These provisions apply to motors equipped with ball, roller or sleeve bearings. If sleeve bearings are repaired (i.e., rebabbitted), the before and after inside and outside diameters of the repaired bearings are to be recorded.
- **Criterion:** If repaired, rolling bearing fits are rebuilt to applicable AR100 table size.
  Explanation: Ball or roller bearing journals, if rebuilt, are to conform to the fits of the applicable tables in AR100. The recorded values for repaired ball or roller bearing fits can be compared to the applicable AR100 fit to verify that this criterion is met. **Note:** There are no standards for sleeve bearing fits, thus fits for sleeve bearings are not audited for conformance. However, if sleeve bearing journals or housings are repaired, the before and after measurements of the repaired fits are to be recorded.
- **Criterion:** Replacement bearings are equivalent to the original or better suited to the application; original and replacement bearing numbers are documented.
  Explanation: The repair record is to indicate the manufacturer and bearing number observed on each original bearing in the motor. Similarly, the repair record is to indicate the manufacturer and bearing number observed on each replacement bearing in the motor. If the replacement bearing identification does not match the original, the service center is to provide evidence to the auditor indicating that the replacement bearing is equivalent to or better suited to the application than the original.

The auditor and the service center should both have copies of, and be familiar with the content of, the applicable clauses that are specifically referenced in the criteria. For example, note that the bearing category references AR100 clause 2.2, and GPG clause 2.3. To illustrate the content of a specific category, the pertinent contents of these clauses for the bearing category are given below. Although not apparent in the bearing category, in most cases AR100 provides prescriptive recommendations and the GPG expands on the topic to provide implementation guidance.

[AR100] 2.2 BEARINGS

Bearings should be inspected for fretting, fluting, frosting, scoring or other damage.

2.2.1 Ball or Roller Bearings

Bearing housing and shaft bearing fits should be measured and compared to design specifications (Reference: ANSI/ABMA Stds. 7 as a guide). Any fits that are not within tolerance should be restored. See AR100 Tables 2-13 and 2-14 [not reproduced in this document]. Replacement bearings should be equivalent to the original manufacturer's specifications.

2.2.2 Sleeve Bearings

When sleeve bearings are remanufactured or replaced by new bearings, the fit in the housing and the diametral clearance should be set to original equipment manufacturer's specifications if available. See Section 8 of the EASA *Technical Manual* for guidance on diametral clearances for oil-lubricated horizontally-mounted sleeve bearings. Measure the new bearing dimensions. Sleeve bearings should be uniform in diameter, of proper fit in the housing, smooth internally, and suitably grooved for adequate distribution of lubricant.

TABLE 2: REQUIRED EQUIPMENT LIST		
Electrical	**Mechanical**	**Physical**
Milli-ohmmeter	Inside micrometers	Temperature meters
Ohmmeter	Outside micrometers	Burnout oven part temperature control
Voltmeter (AC)	Dial indicators (verification by service center)	Burnout oven water mist (verification by service center)
Ammeter (AC)	Digital tachometer (verification byservice center)	Burnout oven analog or digital recorder
Wattmeter (AC)	Terminal crimpers (verification by service center)	Bake oven temperature control
Megohmmeter	Vibration measurement	Winding machine with turns counter (verification by service center)
High potential tester	Balancing machine***	VPI system vacuum gauge*****
Surge tester*	Gauge blocks (if applicable)****	VPI system pressure gauge*****
Core tester**	—	—
Loop test**	—	—
Growler (functional; ammeter calibrated)	—	—
Test panel (to motor rated voltage; individual instruments calibrated)	—	—

* Only applies if service center has a surge tester
** Must have either one or both of these items
*** Outsourcing permissible
**** Periodic verification by gauge block manufacturer or other qualified external source
***** Only applies if service center has VPI system (VPI process outsourcing permissible)

Notes:

- Unless noted otherwise, all equipment listed must be on site and functional.
- Except for gauge blocks, all instruments must be calibrated at least annually to applicable national standards.
- Service center is to have a documented list of all calibrated equipment including unique identification of each item and retain at least a 3 year record of previous calibrations.
- Verification: Confirming, through the use of objective evidence, that specified requirements have been fulfilled.

[GPG] 2.3 Bearing sizes, types and clearances

Most motors have a ball bearing at each end. Some may have a roller bearing at the drive end to increase the radial load capacity, or thrust bearing(s) for high axial loads.

Always fit new bearings of the same type as those removed, unless they were misapplied.

Note in the above that AR100 states what is to be done, and that the GPG information expands into the reasons and importance of carrying out the prescribed actions. In a similar manner the criteria and equipment requirements of checklist categories are supplemented by expanded explanations for each category and associated criteria.

EQUIPMENT LIST

The implementation of the accreditation program requires key pieces of equipment such as a temperature controlled, water mist burn-off oven, and test panel. However, since many EASA members and other program candidate service centers have already invested in this important equipment, additional outlays to bring equipment into conformity is expected to be minimal.

The complete list of required equipment can be found in Table 2. Unless noted otherwise, all equipment listed must be on site and functional. Also, unless noted otherwise all instruments must be calibrated at least annually to applicable national standards.

ACHIEVING ACCREDITATION

There are five primary areas to focus on during the accreditation process. These are:

- Service center policies and procedures
- Training of personnel
- Equipment needs
- Beta internal audit
- Initial external audit

Beginning with the first area, service center policies and procedures do not need to be written. However, those that need to follow them must have a clear and correct understanding of the requirements. Use a limited scope audit process to confirm that everyone that needs to understand the policies and procedures truly does. If

certain policies or procedures are too complex for verbal instructions, these should be documented. Conversely, if service center management finds that compliance can be effected with verbal policies and procedures, those may be used. It is therefore acceptable to have a mix of verbal and written policies and procedures. Also, documenting as many policies and procedures as possible is not in itself assurance that compliance will result.

The most productive method of having personnel understand and comply with policies and procedures is training. Applicable technical training includes topics related to electric motor rewinding, machining, mechanical disassembly and assembly; motor theory, principles and applications; and failure analysis and design/redesign. Applicable training also includes shop or group meetings. When training is performed it should be documented. Doing so provides evidence to an accreditation auditor that training has been carried out, and identifies the topics that were addressed by training.

The training need not be formal. An inexperienced or less-skilled person can be trained by a more skilled person; that is, the "buddy system" of one-on-one informal training. More formal training, such as by having someone instruct a group in a classroom style environment can be performed using internal trainers, or by bringing in an outside source to provide training. A side benefit of training is that it often raises morale as well as competence. In general, people appreciate that the company cares enough to increase their skills and knowledge. Note: External (off-site) training is not a requirement of the accreditation program. That is, training that is all done on an internal basis (by internal or external trainers, or both) is acceptable.

A limited scope audit can be used to identify equipment needs. It is suggested that a person in authority in the service center, such as the owner, plant manager or shop manager perform the initial equipment audit. A person with less management responsibility may not recognize the implications of inadequate or non-compliant equipment. The primary issue is that if there are deficiencies in equipment, procuring the necessary equipment after the accreditation process has begun can delay accreditation; and may hinder procuring equipment on a more economical basis. For example, a last-minute purchase of a core tester may result in a higher purchase price and less than (or more than) optimum desired equipment features.

The steps that are needed to determine if a service center is ready to achieve accreditation can most simply be identified by a beta internal audit using the accreditation checklist. By beta internal audit is meant an audit that is as objective and as broad and deep in scope as would be performed by an external auditor for the purpose of service center accreditation. In essence the beta internal audit is a "mock" accreditation audit. As such it should be an audit of the complete service center checklist, coupled with the equipment audit. The audits of the checklist and equipment can be performed concurrently or consecutively and preferably by the same personnel. In general, the steps that apply to the beta internal audit also apply to all subsequent internal audits.

A properly executed beta internal audit that is followed up with any needed corrective action should result in "no surprises," and near or full compliance, when the accreditation audit is performed. A note about internal auditors: If the service center has an ISO-9001 quality system, the internal auditors for that program should be the prime candidates to perform a beta-audit for the accreditation program.

Those who perform the beta internal audit should be as objective as possible. An individual or individuals who are not directly responsible for the repair activities will be far more objective than, say, the shop foreman or possibly even the plant manager. However, the auditor should have at least a basic understanding of the repair process and procedures. A retiree with experience in repair would be an example of a potential good candidate for carrying out the internal audit.

Even if the beta internal audit reveals nonconformities, or areas that can or should be improved, it is a positive step in the path to achieving accreditation. The weak or deficient areas that are identified and then corrected will make for a more efficient and productive operation. Steps that should be taken to foster success with the internal audit and subsequent accreditation include having policies and procedures, trained personnel, and the required equipment.

In preparation for the accreditation audit, make certain that housekeeping is addressed as well as the technical processes and procedures. In general, if the auditors see a clean environment it fosters a more positive perspective and outcome. Auditors typically disclose findings immediately during the audit. Therefore, have an action plan prepared for the possibility that the accreditation auditors may have findings. Also, don't be argumentative, but do make certain that the auditor correctly assessed the criteria; and that you understand the rationale for the auditor's finding.

One of the goals of an audit is to not only correct nonconformities, but to improve processes and procedures. Thus, the action taken by service center management should consider not only corrective action, but preventive action, and process improvement. As has been suggested here, service center management should take a lead role in preparing for and participating in the accreditation audit.

The internal audit process is rather straightforward. Select the audit team, and audit annually, covering the entire checklist during each audit. Since the external audits are every 3 years, the formal annual internal audits

need to be performed toward the end of years 1 and 2. The formal internal audit results need to be reported to the auditing firm that will perform the next external audit. The accredited company must have the internal audits and any subsequent external audits completed/approved and submitted to EASA from the auditor within 60 calendar days following the anniversary date of accreditation. The external audit firm has 10 business days to respond to your email, so you must work in advance to ensure that the auditor can submit the completed audit to EASA within the prescribed time.

Appoint one person (sometimes two) as the auditor. The auditor should prepare a summary document of what was covered in the audit, identify any nonconformities and opportunities for improvement and acknowledge areas that were in compliance. Service center management should meet with the auditor as soon as possible after the auditor submits their report to management.

It is imperative that service center management direct and document corrective and preventive actions taken as a result of an internal audit. Similarly, following an external audit it is important that service center management direct and document corrective and preventive actions taken as a result of the audit. During the next internal audit the internal auditor(s) should follow-up on any findings of nonconformity from the previous external audit and the previous internal audit.

For the external audit findings it is suggested that these findings of nonconformity be included during the internal audit of the applicable topic. For example, if there was an external audit finding of nonconformity regarding calibration, the effectiveness of the corrective action should be assessed during the planned internal audit of the calibration criteria. Note: Selection of calibration as an example of a potential criterion that will need additional attention was not a random choice. The beta internal audits by members of the Ad Hoc Committee that worked on the accreditation program found that the calibration criteria elements were the area that most often resulted in nonconformities and in opportunities for improvement.

Among the benefits of accreditation are that external entities such as government agencies, energy advocates and end users will have a more positive view of service centers, including yours. Further, objective external auditing will indicate that the service center not only says it uses good practices, it has proved that. Internal to the service center, the benefits include cost reduction and productivity improvement. By using good practices there will be more things done right the first time, thus reducing cost. Also, by following one set of rules there will be more consistency and fewer errors in the work processes. Productivity will also be enhanced by an improvement in morale as service center technicians take more pride in their work, aided by the recognition (and possible increased volume of repairs) associated with accreditation. Further, it is another tool for evaluating employees because it ensures that they perform various procedures according to good practices. As such, it can also be used as a reference for their performance.

EASA WEBSITE AND ACCREDITATION PORTAL

The EASA website will contain all of the Accreditation Program information and related downloads, including:

- Explanation of the Accreditation Program
- Application form with instructions
- Most current Accreditation Program criteria checklist
- Most current Accreditation Program criteria checklist explanation
- List of EASA-approved auditors with contact information
- Current list of Accredited Service Centers

The online portal will be secure and will serve as a repository for applications and all internal and external audits for each accredited service center. The portal page for each company will only be accessible to that company and the EASA staff maintaining the portal. Information included on the portal pages includes:

- Company name and location (information will reside on company's account with EASA)
- Completed application (fillable form available on EASA website)
- Payment date and amount
- Company contact for accreditation-related activities
- Name of audit company (not necessarily known until auditor submits approval)
- Completed external and internal audit checklists
- Secured copy of auditor's signed approvals for on-site audits and internal audits with approval dates
- PDF of accreditation certificate
- Accreditation logos for download

CONCLUSION

With continued discussion of energy efficiency and reliability, it is logical that there are concerns about maintaining the efficiency and reliability of repaired electric motors. Although most of the outspoken concern has been about the energy efficiency of rewound electric motors, the Electrical Apparatus Service Association has developed an accreditation program for service centers that is more holistic. It achieved that by addressing reliability as well as efficiency.

The accreditation program elements are good practices that provide objective proof that efficiency and reliability are maintained (or sometimes improved) in repaired motors, including mechanical rebuilding as well as electrical rewinding. The sources of these good practices are ANSI/EASA AR100 *Recommended Practice for the Repair of Rotating Electrical Apparatus* and the Good Practice Guide of the 2003 study, *The Effect of Repair/*

Rewinding on Motor Efficiency. Independent external auditing supplemented by internal auditing will be used to evaluate service centers for evidence of compliance to assure that they are using prescribed good practices to maintain motor efficiency and reliability during electrical and mechanical repairs of electric motors.

Although seeking accreditation may appear to be daunting at first, after the initial beta internal audit, management may be surprised at how close the service center is to being in compliance. That is, the equipment needs are probably less than anticipated and the work practices are probably more in line with good practices, especially if the service center previously adopted ANSI/EASA AR100 as its source document for procedures.

REFERENCES

[1] Recommended Practice for the Repair of Rotating Electrical Apparatus. Electrical Apparatus Service Association. (EASA), AR100. 2010. Available for download at: www.easa.com/accreditation

[2] The Effect of Repair/Rewinding on Motor Efficiency. Electrical Apparatus Service Association. 2003. Available for download at: www.easa.com/accreditation

[3] EASA Service Center Accreditation Checklist. Electrical Apparatus Service Association. 2013. Available for download at: www.easa.com/accreditation

[4] EASA Service Center Accreditation Checklist With Audit Criteria Explanations. Electrical Apparatus Service Association. 2013. Available for download at: www.easa.com/accreditation

EASA ACCREDITATION PROGRAM CHECKLIST

CATEGORIES AND KEY CRITERIA

Category	Key Criteria
Housekeeping	Evaluates the cleanliness and orderliness of work areas and equipment in the service center since these are indicators of professionalism and a controlled (and safe) repair environment.
Training	Evidence of internal training of technicians is required; external training is encouraged but not mandated. Technical training includes topics related to electric motor rewinding, machining, mechanical assembly or disassembly; theory, principles, applications, failure analysis and design/redesign.
Internal audits	Annual internal audits are performed and documented. Annual internal audit reports are submitted to external auditor for review. If applicable, corrective actions for internal audit findings are taken and documented.
Identification and condition assessment	Among the requirements are that original nameplate data (if present) is recorded; incoming inspection findings recorded; primary apparent cause of failure determined and recorded; and repair records retained for at least 3 years.
Terminal leads, connectors and boxes	The terminal leads are labeled for identification; terminal lugs (if used) properly crimped; and terminal box integrity checked. Confirm terminal crimpers function checked at least quarterly for wear and proper crimp.
Cooling system	Internal and external cooling fans and cooling fan cover (if applicable) integrity is checked; a check is also performed for damaged or missing cooling system components.
Shafts	Before and after repair shaft dimensions are recorded; shaft integrity checked; and shaft orientation (e.g., NEMA F1 versus F2) verified. Confirm outside micrometers calibration is current.
Bearings (ball, roller; sleeve)	Replacement bearings are equivalent to the original or better suited to the application; original and replacement bearing numbers documented; as-received, and if rebuilt, post repair bearing fits documented; and if possible, the mode of failure documented. Confirm inside and outside micrometers calibration is current.
Lubrication	The service center is to have documentation indicating that the lubricant used in the motor is compatible with the customer's lubricant; and the service center is to identify the lubricant used in the motor.
Frame and bearing housings	Frame and bearing housing integrity is checked; a check performed for damaged or missing components; and parts are match marked in accordance with service center policy. Confirm inside and outside micrometers calibration is current.
Squirrel cage rotors	Check is performed for evidence of rotor damage or overheating; rotor is growler and/or single-phase tested; and if repaired, original electrical and mechanical characteristics are maintained. Confirm growler is function tested, and that ammeter is functional and calibration is current.
Balancing	Dynamic balancing of the rotating element is to the level specified by the customer; or in the absence of a requested level, dynamic balance is to ISO quality grade G2.5 or better; and original and final balance values are documented. Confirm calibration and functionality of balancing machine.
Accessories	Check is performed for evidence of damaged or defective components; if replaced, components are identical with or equivalent to the original devices. Confirm calibration and functionality of associated test equipment.
Winding removal and core integrity	Core testing is performed before burnout or other equivalent process, and after winding removal, and the results documented. Evaluation assessment of core acceptability (watts per lb (kg) and temperature rise) is documented. Burnout oven has part temperature control set to 700°F (370°C) or less; analog or digital recorder; and water mist is functional.
Rewind data (specification)	Details of as-received winding are documented; data is verified for accuracy; any winding changes made to maintain or improve efficiency of a rewound motor are documented.
Stator windings, insulation system, conductors and coils	Voltage rating and insulation class of winding system are equal to or greater than the original unless redesigned by agreement with, or at the instruction of, the customer; coil extension lengths are not to exceed original; and winding wire cross-sectional area per amp (CMA) is at least equal to original. Confirm calibration and functionality of associated equipment including outside micrometers and verification of winding machine turns counter.

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EASA ACCREDITATION PROGRAM CHECKLIST

CATEGORIES AND KEY CRITERIA
(CONTINUED)

Winding impregnation	Windings of rewound motors are preheated, varnish/resin treated and cured in accordance with varnish/resin manufacturer instructions; bake oven temperature control set in accordance with varnish/resin manufacturer instructions; and varnish maintenance tested in accordance with manufacturer instructions. Confirm calibration and functionality of temperature meters.
Winding insulation and coil tests	Stator winding insulation resistance is tested and results documented; and stator winding resistance, phase balance or surge test is performed. Confirm calibration and functionality of associated equipment including megohmmeter, milli-ohmmeter, ammeter and surge tester.
High-potential tests	New and reconditioned windings and accessories are high potential tested and results documented. Windings and accessories of windings not reconditioned are insulation resistance tested and results documented. Confirm calibration and functionality of megohmmeter and high potential tester.
Bearing insulation	If applicable, bearing insulation is insulation resistance tested and results documented. Confirm calibration and functionality of megohmmeter.
No load tests	No-load running test using test panel is performed at rated voltage. No-load currents and voltages, and vibration levels, are measured and documented. Evaluation assessment of acceptability is documented (e.g. “OK to ship”). Confirm calibration and functionality of associated equipment including voltmeter, ammeter, and vibration meter.
Finish and handling	Motor is packed or packaged in a manner suitable for the form of transportation to be used. Oil-lubricated motors are shipped without oil, and the need for lubricant clearly identified. Motor is externally clean and painted (if applicable).
Calibration	Proof of current calibration to applicable national standard is available for all applicable instruments. Proof of current certification for gauge blocks (if applicable) is available. Calibration requirements apply to all instruments included in the equipment list. (See Table 2, Page 5.)