

Gas Turbine Engine Test Facility Audit Process

RATIONALE

Test facilities are frequently audited by various authorities, regulatory bodies, gas turbine engine OEMs and customers. The main purpose of the audit process is to ensure that the test cell operator/owner provides evidence that the facility is maintained in such a way that it meets the requirements set by the OEM and authorizing bodies and that the test cell meets the conditions set in the correlation process.

This document describes guidelines and criteria to audit a test facility both from an auditor perspective in addition to the user/owner's perspective.

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1. SCOPE

This SAE Aerospace Recommended Practice provides recommendations for:

- the audit process in general;
- a list of specific areas of attention to be audited;
- maintaining the test facility in such a manner that it meets audit requirements.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

ARP741 Turbofan and Turbojet Gas Turbine Engine Test Cell Correlation

ARP5758 Trend Analysis for Maintaining Correlation of Gas Turbine Engine Test Cells

ARP6028 Configuration Control for Maintaining Correlation of Gas Turbine Engine Test Cells

2.2 Other References

FAA Advisory Circular AC 43-207

Aviation Maintenance Management: McGraw - Hill, ISBN:0-00714251-X

Juran's Quality Handbook McGraw - Hill, ISBN 0-07-034003-X

ATA Specification 103, Standard for Jet Fuel Quality Control at Airports

ISO 9001, Quality management Chapter 4.0 Quality management system

2.3 Definitions and Abbreviations

AUDIT: An independent, objective assurance activity, designed to assess both the effectiveness and efficiency of an organization's operations.

FACILITY OPERATIONS MANUAL: Manual that describes the test cell layout, organization, and operation.

SLAVE EQUIPMENT: Equipment installed to the engine, solely for testing purposes, is removed after completion of test.

A4A: Airlines for America formerly known as ATA: Air Transport Association of America, Inc.

FADEC: Full Authority Digital Engine Control

FOM: Facility Operations Manual

OEM: Original Equipment Manufacturer

PMD: Precision Measurement Devices

3. AUDIT PROCESS IN GENERAL

3.1 General Information

Test facilities can be audited by:

- quality assurance or control from the maintenance organization;
- environmental, health, and safety organizations, both from the maintenance provider as well as from the local authorities;
- regulatory bodies of the local government;
- regulatory bodies of the customer governments;
- customers;
- OEMs.

3.2 Audit Intervals

The general interval for audits is 1 year, however, random audits are possible.

3.3 Repeat Audits

In case of findings requiring immediate follow up, repeat audits to monitor compliance of the corrective actions can be carried out.

3.4 Corrective Actions

Findings by the auditor are reported by a findings report submitted within a period of 4 weeks.

The findings are filed in the local quality defect reporting system and a process owner/responsible person is identified.

The quality defect reporting system requires:

- root cause identification;
- corrective action plan;
- action for related areas;
- preventative actions to avoid reoccurrence.

4. SPECIFIC AREAS OF ATTENTION

This section provides an overview of attention areas.

4.1 Correlation and Test Equipment

- Date of last correlation.
- Current correlation books status.
- Type of engines the test cell is correlated for and as necessary confirming the engines being tested at the facility.
- All the precision measurement devices (PMDs) per the applicable engine manuals present to perform all tests and measurements required to assure conformance to specifications.
- All PMDs included in the calibration program.
- All PMDs traced to standards of which they were calibrated.
 - Examples of such PMDs:
 - load cells
 - thermocouples
 - pressure probes
 - vibration sensors
 - speed sensors
- For instrumentation calibrations in house: the necessary standards available. Standards include the OEM or vendor instrumentation calibration requirements such as test procedures, test equipment, limits and accuracy requirements.
- Specified calibration intervals established for each PMD, related to the engine manual requirements or test equipment vendor requirements.
- In case of deviations to the engine manual requirements, approved alternate means of compliance.
- Records of calibrated PMDs containing repairs and accuracy tracking being maintained and available.
- All PMDs serialized and assigned to the facility.
- Responsible person/department responsible for calibration.
- Sample audit to prove that the facility is monitoring for compliance.
- Records showing performance data trending since last correlation(s) monitoring that the engine test cell and engine performance data is within correlation tolerances.

4.2 Manuals and Documentation

- Facility operations manual in place and updated, to comply with current standards.
- Written correlation documentation on file.
- Document on site that describes calibration maintenance and slave equipment maintenance.
- All manuals current and conforming to the latest revision status, hardcopies as well as digital documentation.
- Responsible person on site and organization identified for documentation/manual control.
- All checklists being used and conformation to current revision status.
- Proof that the engine serial numbers of engines in process are related to the bill off work/work order.
- All paperwork completed and the correct entries made.

4.3 Procedures

- All personnel to have proper work instructions (not working under verbal instructions).
- Work is being accomplished in agreement with work instructions and manuals.
- The test cell procedures manual available to the test cell personnel.
- Operators aware and instructed to have no shadow toolboxes left in the test cell and no material in pockets or pocket protectors when entering the test cell while engine is operating.

4.4 Storage of Parts and Consumables

- Parts materials properly stored and identified.
- Lubrication and preservation fluids traceable by batch to supplier and delivery dates.
- Lubrication and preservation fluids properly stored in accordance with supplier and engine OEM requirements, separated from dust and debris, and supplied with filter elements, in the supply lines, tracked for replacement intervals.

4.5 Training

- All personnel trained in accordance with maintenance facility and local authority requirements.
- Operators licensed for the applicable engine types.

4.6 Safety

4.6.1 Facility

- All entrance and exit doors free from obstructions and in proper condition.
- All flammable and hazardous materials labeled/identified and stored properly .
- All ventilation systems operating properly.
- The test cell inspected periodically for integrity of critical mounting systems, thrust frame flex plates, thrust frame cone bolts, bolt support brackets, engine mounts and bolts, including slave equipment, intake and exhaust, electrical cables, hand cuffs and harnesses for chafing, hoist systems, engine saddle cables, oil and fuel lines for chafing.
- Fire extinguishers placards/identification clearly visible.
- Fire extinguishers in proper condition and inspection current.
- Engine fire suppression systems in proper condition and inspections current.
- Material data sheets information available to all personnel.
- First aid kit procedures and kit allocations available and up to date.

4.6.2 Operation

- All personnel aware of safety and emergency procedures and aware of emergency telephone numbers.
- Emergency procedure for engine operation in place, current and known to the operators.

4.7 Housekeeping

- Overall condition of the facility to be neat and orderly.
- Waste containers available and used.
- Preparation room as well as test cell free of debris.
- Cleaning schedule in place.
- Eating and drinking restricted to dedicated areas.

4.8 Fuel

- An identified standard like ATA 103 and/or local standard to monitor the fuel handling and fuel condition of the fuel used in the test cell.
- Identified responsible people/organization for fuel loading process.
- Loaded fuel of the proper grade.

- System in place to confirm the loaded fuel in the storage tank(s) is in compliance with OEM requirements.
- General condition of fuel storage area, tankard(s) and leakage including containment.
- Required safety, security and fire measures in place and current.
- Compliance with local safety and environmental requirements.
- Periodic white bucket (or equivalent) checks on fuel supply vessel.
- Periodic white bucket (or equivalent) checks on tank sumps.
- Fuel filter differential pressure measurement system in place and operational, proof of traceability.
- Filters/separators equipped with all required equipment.
- Millipore downstream of filter checks in place of the fuel/water coalescer system.
- Free water test down-stream of filter in place.
- All required placards and correct color coding in place.
- Check on operation of water defense system and emergency fuel shut off system.
- Verification that records are:
 - current;
 - complete;
 - meets ATA 103 or equivalent alternative
- Training records available for personnel involved with fuel loading, storage and handling.

4.9 Slave Equipment

- Overview of all current test cell slave equipment available.
- Slave equipment properly stored and identified as slave equipment.
- Maintenance and calibration program in place with records on file.
- Records of nacelle equipment including current records of serial numbers, repair history and flow path areas.