



AEROSPACE INFORMATION REPORT

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Test Facility Shakedown and Commissioning

RATIONALE

This SAE Aerospace Information Report (AIR) is intended to provide guidance and recommendations to future or existing users of turbofan, turbojet, and turboshaft/turboprop gas turbine engine test facilities regarding commissioning readiness of new, modified, or re-located facilities.

TABLE OF CONTENTS

1.	SCOPE.....	3
2.	REFERENCES.....	3
2.1	Applicable Documents	3
2.1.1	SAE Publications.....	3
2.1.2	Other Publications.....	4
2.2	Definitions/Acronyms	4
3.	PHASE 1 – OFF SITE (FACTORY) EQUIPMENT COMMISSIONING CHECKS	5
3.1	Introduction	5
3.2	Mechanical.....	6
3.3	Electrical.....	6
3.4	Software	7
4.	PHASE 2 – ON SITE STATIC EQUIPMENT COMMISSIONING CHECKS (NO ENGINE RUNNING)	8
4.1	Introduction	8
4.2	Handling and Hoisting Systems	9
4.3	Thrust Stand.....	9
4.4	Engine Test Adapters.....	9
4.5	Fuel System, including the Inhibiting Oil System (if installed)	9
4.6	Hydraulic System (Loading System, Pressure Power Pack ...)	9
4.7	Lubrication System (Engine and/or Drive Line Equipment)	10
4.8	Air Start System	10
4.9	Electrical Start System	10
4.10	Water System (TS/TP Applications)	10
4.11	Drive Line (TS/TP Applications)	10
4.12	Instrumentation	11
4.13	Control System.....	11
4.14	CCTV and Intercom	11
4.15	DAS.....	11

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Tel: 877-606-7323 (inside USA and Canada)
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5.	PHASE 3 – ON SITE DYNAMIC EQUIPMENT CHECKS (INCLUDES ENGINE RUNNING).....	11
5.1	General.....	11
5.2	Dynamic Commissioning.....	12
5.3	Documentation and training	13
6.	NOTES	13
6.1	Revision Indicator.....	13

1. SCOPE

The paper discusses in general terms the activities required to be undertaken or demonstrated during the establishment of the facility such as:

- the assessment checks prior to forwarding to the end users site for embodiment into the facility system
- the establishment of the facility such as trial installations of hardware, functionality checking of lifting transportation and access systems, centerline pull checks, pressure testing of fuel and air start systems, flushing of wet systems and electrical continuity checking.
- the commissioning of the facility such as instrumentation calibrations, engine starts, engine running, assessment of command and control system, assessment of DAS system, aerodynamic and acoustic surveys.

The paper will concentrate on the main engineering engine related aspects of the facility and will not necessarily contain information on the construction validation activities such as HVAC, electrical, facility fire system, waste water etc.

Risk analysis may be performed during the design phase whose results could lead to pay particular attention to some specific equipment / functionalities during the commissioning phase. If identified, these risks should be translated to specific tests and integrated into the validation plan, either at the factory or on site or both.

If the test cell is designed to test several engine types, the acceptance process should validate upon which engine the test cell will be commissioned → these discussions should take place at the early stage of the design process if not during the bidding phase. Moreover, an agreement between the Contractor and the Customer may have to be reached in order to clearly define how the scaling will be demonstrated in the case of the available engine types for commissioning are not representative of the full capacity upon which the facility is designed (e.g. the requirements are assessed based on future engine types). It is particularly relevant to air flow and acoustic levels and tones where effects aren't only linear.

Correlation activities are outside the scope of this document.

Document is primary intended for typical overhaul (MRO) test cells. Development/Production facilities may include additional and specific equipment that requires dedicated shakedown and commissioning processes and procedures issued directly from the OEMs. Outdoor test cell specifics are not covered by this document.

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 +1 724-776-4970 (outside USA), www.sae.org.

AIR4827	Physical Modeling Techniques for Jet Engine Test Cell Aerodynamics
AIR4869	Design Considerations for Enclosed Turbofan/Turbojet Engine Test Cells
AIR4951	Test Cell Thrust Measurement
AIR4989	Design Considerations for Enclosed Turboshift Engine Test Cells
AIR5026	Test Cell Instrumentation

AIR5295	Design Considerations for Enclosed Turboprop Engine Test Cells
ARP741	Turbofan and Turbojet Gas Turbine Engine Test Cell Correlation
ARP4755	Turboshaft/Turboprop Gas Turbine Engine Test Cell Correlation
ARP5435	APU Gas Turbine Engine Test Cell Correlation
ARP5758	Trend Analysis for Maintaining Correlation of Gas Turbine Engine Test Cells
ARP5759	Acoustical Considerations for Engine Test Cells
ARP6028	Configuration Control for Maintaining Correlation of Gas Turbine Engine Test Cells
ARP6068	Gas Turbine Engine Test Facility Vibration Measurement

2.1.2 Other Publications

"Measurement Uncertainty: Methods and Applications", 4th Edition, Dieck, Ronald H.; ISA – The International Society of Automation, 2007, ISBN-13: 978-55617-915-0.

2.2 Definitions/Acronyms

The following list defines certain terms and phrases used in this document:

ACOUSTIC TONE: Sound pressure at a constant frequency that can vary in amplitude. In the area of aero engine testing, the apparition of a tone in the exhaust section could be potentially problematic if it coincided with the natural frequency of any engine part and/or test cell equipment.

AIR: Aerospace Information Report

ARP: Aerospace Recommended Practice

BY-PASS RATIO: Cell by-pass ratio, known as well as entrainment ratio – ratio of the airflow that does not go through any part of the engine to the airflow that goes through the engine

COC: Certificate of Conformity

CORRELATION: The comparison of gas turbine engine performance parameters measured on a common engine tested in two test facilities, where one facility is the reference

DAS: Data Acquisition System

DYNAMIC TESTS: Tests performed with an engine running, meaning it includes both steady and transient sequences and the collection and analysis of high speed test data

FAT: Factory Acceptance Test

FDR: Final Design Review, happens generally at the final stage of the design at approx. 90% of progress

FOD: Foreign object damage (to engine)

GSE: Ground support equipment

H and S: Health and Safety

HVAC: Heating Ventilation and Air Conditioning