



AEROSPACE RECOMMENDED PRACTICE

ARP4048™**REV. A**

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Superseding ARP4048

(R) Balancing Machines - Description and Selection Horizontal, Two-Plane, Hard-Bearing Type for Gas Turbine Rotors

RATIONALE

Hard-Bearing Balancing Machines used to balance Gas Turbine Rotors in the Aerospace Industry have specific requirements that need to be maintained. This document provides these technical specifications required for horizontal rotating type, Hard-Bearing Balancing Machines used for unbalance measurement of Gas Turbine Rotors. The document's intention is to provide the Manufacturer with the minimum requirements that these machines need to provide and a guide for the specifications required by the End User.

This document has been revised to update the selection criteria and remove the evaluation criteria that is now contained in AS8617.

FOREWORD

Hard-Bearing Balancing Machines have been used for balancing Gas Turbine Rotors for many years and have largely replaced Soft-Bearing Balancing Machines. Hard-Bearing Balancing Machines have a balancing speed range below the Natural Frequency of the combined rotor and support system, while Soft-Bearing Machines operate above. Hard-Bearing Machines also provide a type of Permanent Calibration rather than the Rotor Specific Calibration required by Soft-Bearing Machines, which provide simpler operation to the Balancing Technicians.

This document was prepared to provide general specifications and requirements to ensure the capability of balancing equipment for balancing Gas Turbine Rotors. The standardization of rotor supports and drive systems is intended to enable an assortment of rotors and/or tooling to be used on a variety of machines in one capacity range.

This is a general specification document for the selection of balancing equipment to ensure suitability of horizontal balancing machines for Gas Turbine Rotors. Additional information on balancing equipment can also be referenced in ISO 21940-21.

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TABLE OF CONTENTS

1.	SCOPE.....	3
2.	APPLICABLE DOCUMENTS.....	3
2.1	SAE Publications.....	3
2.2	ISO Publications.....	3
3.	GENERAL PERFORMANCE REQUIREMENTS.....	4
4.	DIMENSIONS AND CAPACITIES	7
4.1	Machine Class.....	7
4.2	Load Capacity	7
4.3	Dimensions	7
4.4	Drive Requirements	7
5.	SUPPORT ENVELOPE	9
5.1	Legend	9
5.1.1	D1.....	9
5.1.2	D2.....	9
5.1.3	D3.....	9
5.1.4	L1	9
5.1.5	L2	9
5.1.6	L3	9
5.1.7	L4	9
5.1.8	L5	9
5.1.9	L6	9
6.	NOTES.....	11
6.1	Revision Indicator.....	11
Figure 1		10
Table 1		8
Table 2		10

1. SCOPE

1.1 This document provides the specifications of horizontal hard-bearing balancing machines, which make such machines suitable for gas turbine rotor balancing.

1.2 This document specifies:

- General Performance Requirements
- Rotor Support System Requirements
- Drive System Requirements
- General Machine Dimensions and Capacities

NOTE: Refer to ISO 21940-2 for any definitions of balance process specific descriptions used throughout this document.

2. 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 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.

AIR6975 Hard Bearing Balancing Machine Technology - Proper Use of Rotor Type-Specific Calibration

ARP4162 Balancing Machine Proving Rotors

ARP4163 Balancing Machines: Tooling Design Criteria

AS8617 Balancing Machines - Verification Test Requirements

2.2 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 21940-2 Rotor Balancing Vocabulary

ISO 21940-21 Balancing Machines - Description and Evaluation

ISO 21940-23 Balancing Machines - Enclosures and Other Safety Measures

3. GENERAL PERFORMANCE REQUIREMENTS

3.1 Gas Turbine Balancing Machines shall be able to pass the Performance Test Procedures as described in AS8617.

3.1.1 Proving Rotors and associated Test Mass requirements for the AS8617 Performance Tests are described in ARP4162.

3.2 Static and Couple Unbalance Separation

3.2.1 The balancing machine shall measure and indicate the magnitude and angular location of both the Static and Couple Unbalance for the rotor under test.

3.2.2 The measurement shall be displayed as a Dynamic Unbalance Measurement in Two Planes, or separately as a Static and/or Couple Unbalance Measurement, dependent on the user selected rotor configuration.

3.3 Plane Separation

3.3.1 The balancing machine shall indicate the amount and angle of the unbalance in each of one or more selected planes in the rotor.

3.3.2 The Machine OEM Calibration shall separate the rotor unbalance onto the selected correction planes and minimize the effect between each measurement plane.

3.3.3 The quality of Plane Separation is measured through Unbalance Reduction Ratio (URR) Testing in accordance with AS8617.

3.4 Unbalance Indication

3.4.1 Unbalance Measurement shall have a resolution of at least 10% of one A-unit. (Refer to AS8617 for A-Unit Calculations.)

3.4.2 Angle Resolution shall be at least 1 degree.

3.4.3 Magnitude and Angle Indication shall be simultaneous in two planes.

3.4.4 Measurement settings, such as but not limited to radius and length, shall be fully selectable and editable.

3.4.5 Measurements shall be available in Imperial units, SI units, or any combination thereof.

3.4.6 Unbalance indication shall be available for clockwise and counterclockwise direction of rotation.

3.5 Software Capabilities

3.5.1 Balancing Machines should include digital processors that provide multiple software capabilities.

3.5.2 Tooling Compensation should be included to remove error introduced using arbors to recreate the rotor spin axis.

3.5.3 The ability to document measurement results, program setups, and calibration data shall be available in digital or hard copy format.