

Issued 1958-02
Revised 2001-07
Reaffirmed 2008-02

Superseding ARP427

Pressure Ratio Instruments

FOREWORD

Changes in this Revision are format/editorial only.

1. SCOPE:

This Aeronautical Recommended Practice covers two types of two unit Pressure Ratio Instruments each of which consist of a Transducer and an Indicator. The Transducer computes the ratio of two pressures and converts this ratio to a synchro electrical signal which is transmitted to the Indicator.

Type I - All material in this document applies to this classification only.

Type II - Additional material for this classification will be added to superseding issues as the state of the art permits.

1.1 Purpose:

To recommend requirements for electrical Pressure Ratio Indicating Instruments for use in aircraft, the operation of which may subject the instruments to the environmental conditions specified in Paragraph 3.3.

This recommended practice is to be considered as being currently applicable and necessarily subject to revision from time to time due to rapid development in the aircraft industry.

2. REFERENCES:

NACA Report 1235

3. GENERAL REQUIREMENTS:

3.1 Materials and Workmanship:

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2008 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

3.1.1 Materials: Materials should be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2 Workmanship: Workmanship should be consistent with high-grade aircraft instrument manufacturing practice.

3.2 Identification:

The following information should be legibly and permanently marked on the instrument or attached thereto:

- a. Name of instrument - Pressure Ratio Transducer, or Indicator
- b. SAE Aeronautical Recommended Practice ARP427A
- c. Manufacturer's part number
- d. Manufacturer's serial number or date of manufacture
- e. Manufacturer's name and/or trademark
- f. Range
- g. Rating

3.3 Environmental Conditions:

The following conditions have been established as design requirements only. Tests should be conducted as specified in Sections 5, 6, and 7.

3.3.1 Temperature: When installed in accordance with the instrument manufacturer's instructions, both transducer and indicator should function over a range of ambient temperatures from -55 °C to 70 °C. The indicator should not be adversely affected by exposure to temperatures of from -65 °C to 80 °C. The transducer should not be adversely affected by exposure to temperatures of from -65 °C to 120 °C.

3.3.2 Humidity: The instrument should function and should not be adversely affected when exposed to any relative humidity in the range from 0 to 95% at any temperature up to 70 °C.

3.3.3 Vibration: When installed in accordance with the instrument manufacturer's instructions, the instrument should function and should not be adversely affected when it is subjected to vibrations of the following characteristics.

TABLE 1

<u>Instrument Location in Airframe</u>	<u>Cycles per Second</u>	<u>Maximum Double Amplitude (Inches)</u>	<u>Maximum Acceleration</u>
Fuselage Forward-of spar area	5-500	.036	2 g
Panel or Rack (with shock mounts)	5-500	.02	2 g

3.3.4 Altitude: The instrument should function and should not be adversely affected when subjected to a pressure and temperature range equivalent to -1000 to 50,000 feet standard altitude per NACA Report 1235, except as limited by application of Paragraph 3.3.1. The indicator should not be adversely affected when subjected to a pressure of 50 in Hg absolute.

3.4 Explosive Atmosphere:

All instruments located in the uninhabited areas of non-pressurized aircraft or in non-pressurized areas of pressurized aircraft should not cause an explosion when operated in an explosive mixture.

3.5 Radio Interference:

The instrument should not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feedback, in the radio equipment installed in the same aircraft as the instrument.

3.6 Magnetic Effect:

The magnetic effect of the instrument should not adversely affect the operation of other instruments installed in the same aircraft.

4. DETAILED REQUIREMENTS:

4.1 Rating:

4.1.1 Pressure: The engine inlet pressure (PT_2) limits are 7.0 to 60.0 inches of mercury absolute. The engine exhaust pressure (PT_7) limits are 8.4 to 180.0 inches of mercury absolute.

4.1.2 Electrical: The instrument should be designed to operate on 115 plus or minus 10% volts a-c, 400 plus or minus 5% cycles per second power.

4.2 Mounting:

The mounting rack, if used, should be such that it will satisfy the conditions necessary for shock and vibration tests.

4.3 Indicating Range:

The indicating range should be graduated from 1.2 to 3.4.

4.4 Filling Medium:

When hermetically sealed, the case should be filled with an inert gas at least 10 percent helium, of at least 98 percent purity, free of dust particles, and sufficiently dry so that fogging of the dial glass (indicator) does not occur during the low temperature tests of this ARP.

4.5 Finish:

Unless otherwise specified by the user, matte white material should be applied to all major graduations, numerals and pointer. Non-functional surfaces should be durable dull black.

4.6 Visibility:

The indicating means and all significant dial markings should be readable from any point within the frustrum of a cone whose sides make an angle of not less than 30 degrees with the perpendicular to the dial, and whose small diameter is the aperture of the instrument case. The distance between the dial and the cover glass should be a practical minimum and should not exceed 0.250 of an inch.

5. TEST CONDITIONS:

5.1 Atmospheric Conditions:

Unless otherwise specified, all tests required by this ARP should be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 25 °C, and at a relative humidity of not greater than 85%. When tests are conducted with the atmospheric pressure or the temperature differing materially from these values, allowance should be made for the variation from the specified conditions.

5.2 Power Conditions:

Unless otherwise specified, the instrument should be tested with an applied voltage of 115V plus or minus 2 percent, AC single phase, 400 cps plus or minus 2 percent.

5.3 Transmitting and Indicating Standards:

Each synchro transmitter in the transducer and each synchro receiver in the indicator should be connected to an indicating standard and a transmitting standard, respectively, when readings must be taken except as otherwise specified. The indicating standard should be completely calibrated, and should have a maximum error of plus or minus 0.50 circular degrees when tested against a primary transmitting master. The primary transmitting master should have a maximum error of plus or minus 0.10 circular degrees. The tolerances of the standards may be added to those indicated for the applicable tests.

5.4 Position:

Unless otherwise specified, all tests should be conducted with the instrument in its normal operating position.

5.5 Vibration Equipment:

Vibration equipment should be used which will provide frequencies and amplitudes consistent with the requirements of Paragraph 3.3.3 with the following characteristics:

5.5.1 Linear Motion Vibration: Vibrating equipment should be such as to allow vibration to be applied along each of three mutually perpendicular axes of the test instrument.

5.5.2 Circular Motion Vibration: Vibration equipment should be such that a point on the instrument case will describe a circle in a plane inclined 45 degrees to the horizontal plane, the diameter of which is equal to the double amplitude specified.

6. INDIVIDUAL PERFORMANCE REQUIREMENTS:

All instruments should be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this ARP, including the following requirements where applicable.

6.1 Scale Error:

With the transducer connected under the conditions of Paragraphs 5.1 and 5.2 pressures should be applied to the engine exhaust pressure and engine inlet pressure connections per Table 1. The engine inlet pressure is to be stabilized. The engine exhaust pressures should be brought up to, but should not exceed the value given; a reading taken; the transducer tapped or gently vibrated, and another reading taken. The procedure should be repeated for decreasing engine exhaust pressures. Each reading taken after tapping should not differ from the theoretical reading by more than the tolerances given in Table 2A.

The indicator scale errors should not exceed the tolerances given in Table 2B.