



# Technical Standard Order

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**Subject: TSO-C45a, MANIFOLD PRESSURE INSTRUMENTS**

a. Applicability.

(1) Minimum Performance Standards. This technical standard order (TSO) prescribes the minimum performance standard that manifold pressure instruments must meet in order to be identified with the applicable TSO marking. New manifold pressure instruments that are to be so identified and that are manufactured on or after the date of this TSO must meet the standards set forth in the Society of Automotive Engineers, Inc. (SAE), Aerospace Standard (AS) Document No. 8042, "Manifold Pressure Instruments," dated December 1, 1985, as amended and supplemented by this TSO.

(2) Exceptions.

(i) Disregard the marking requirements of SAE AS 8042 paragraph 3.30.

(3) Additions.

(i) Paragraph 3.24.2 of SAE AS 8042 refers to 14 CFR Section 25.1359(d) and the current reference has changed. Consequently, the paragraph should read as follows: "...all material used must be self-extinguishing when tested in accordance with the requirements of 14 CFR Section 25.869(a) (4) and the applicable portions of Part I, Appendix F."

(4) Environmental Standards. The environmental test procedures specified in Radio Technical Commission for Aeronautics, Inc. (RTCA), Documents No. RTCA/DO-160C, "Environmental Conditions and Test Procedures for Airborne Equipment," dated December 1989, shall be used. RTCA/DO-160C is an updated version of RTCA/DO-160B, dated July 1984, which is incorporated by reference in AS 8042.

(5) Software. If the equipment design includes a digital computer, the software must be developed in accordance with RTCA Document No. DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," dated December 1992. In accordance with RTCA/DO-178B, the applicant must submit a Plan for Software Aspects of

Certification (RTCA/DO-178B, Paragraph 11.1) to the Manager Aircraft Certification Office (ACO), Federal Aviation Administration, having geographical purview of the manufacturer's facilities, for review and approval.

**NOTE 1:** The Federal Aviation Administration (FAA) recommends that this plan be submitted early in the software development process. Early submittal will allow the applicant to resolve FAA issues with the Software Aspects of Certification Plan (e.g., partitioning, determination of software levels, etc.)

**NOTE 2:** The applicant should substantiate software levels in the safety assessment process outlined in RTCA/DO-178B. As an alternative to substantiating the software level(s) in a safety assessment, the applicant may develop all software that contains or affects navigation and integrity functions to at least the Level C criteria, as defined in RTCA/DO-178B.

b. Marking. Each manifold pressure instrument must be marked in accordance with 14 CFR Section 21.607(d). In addition, the following information shall be legibly and permanently marked on each separate major equipment component:

(1) The name of the manufacturer and the TSO number.

(2) The part number which is to include hardware and software identification, or a separate part number may be utilized for hardware and software. Either approach must include a means for showing the modification status.

(3) The software level or levels in accordance with RTCA/DO-178B.

**NOTE:** If multiple software levels are marked, the installation instructions must clearly identify the software level for each function.

(4) The type of instrument: Type I - Direct Indicating, or Type II - Remote indicating; comprised of separate transmitter and indicator.

(5) Compatibility: If components of Type II instruments require matching for proper operations, they shall be so identified.

(6) Nominal power input (electrical voltage and frequency, vacuum, or air pressure) or electrical rating.

c. Data Requirements.

(1) In addition to 14 CFR Section 21.605, the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration, having geographical purview of the manufacturer's facilities, one copy each of the following technical data:

- (i) Operating instructions and limitations.
- (ii) Installation procedures and limitations.
- (iii) Schematic drawings applicable to installation.
- (iv) Wiring diagrams applicable to the installation.
- (v) Specifications.
- (vi) List of the major components (by part number) that make up the equipment system complying with the standards prescribed in this TSO.
- (vii) An environmental qualification form as described in RTCA/DO-160C.
- (viii) Manufacturer's TSO qualification test report.
- (ix) Nameplate drawing.
- (x) The appropriate documentation as agreed upon between the ACO having geographical purview of the manufacturer's facilities and the applicant. As a minimum, the plan for Software Aspect of Certification (RTCA/DO-178B, Paragraph 11.1) and the Software Accomplishment Summary (RTCA/DO-178B, Paragraph 11.20) will always be required to be submitted.

(2) In addition to those data requirements that are to be furnished directly to the FAA, each manufacturer must have available for review by the Manager of the ACO having purview of the manufacture's facilities, the following technical data:

- (i) A drawing list, enumerating all of the drawings and processes that define the article's design.
- (ii) The quality control functional test specification used to test each production article to ensure compliance with this TSO.
- (iii) Equipment calibration procedures.
- (iv) Corrective maintenance procedures (within 12 months after TSO authorization).
- (v) Periodic maintenance and calibration procedures.
- (vi) Schematic drawings.
- (vii) Wiring diagrams.

(viii) The results of the environmental qualification tests conducted in accordance with RTCA/DO-160C.

(ix) The appropriate software documentation as agreed upon between the ACO having purview of the manufacture's facilities and the applicant. The documentation available should be identified in the Plan for Software Aspects of Certification (RTCA/DO-178B, Paragraph 11.1) and the Software Accomplishment Summary (RTCA/DO-178B, Paragraph 11.20).

(3) In addition, the manufacturer must furnish to the user of the article one copy of the data and information specified in paragraphs (c) (1) (i) through (c) (1) (vii) and paragraph (c) (2) (v) of this TSO. This data and information is necessary, for proper installation and use and for continued airworthiness of the product or article. The manufacturer also must furnish the user a note with the following statement:

“The conditions and test required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install the article either on or within a specific type or class of aircraft to demonstrate that the aircraft installation conditions are within the TSO standards. The article may be installed only if further evaluation by the applicant (user/installer) documents an acceptable installation and is approved by the Administrator.”

(e) Availability of Reference Documents.

(1) Copies of SAE AS 8042 may be purchased from the Society of Automotive Engineers Inc., Department 331, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096.

(2) Copies of RTCA Document No. DO-160C and DO-178B may be purchased from the RTCA, Inc., 1140 Connecticut Avenue, NW, Suite 1020, Washington, DC 20036-4001.

(3) Federal Aviation Regulations, Part 21, Subpart O and Part 25, Subpart D, may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325.

(4) Advisory Circular 20-110, "Index of Aviation Technical Standard Orders," may be obtained from the U.S. Department of Transportation, General Services Section, M-443.2, Washington, DC 20590.

/S/ Abbas A. Rizvi  
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