



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, D.C.

TSO-C6e

Effective
Date: 04/24/08

Technical Standard Order

Subject: DIRECTION INSTRUMENT, MAGNETIC (GYROSCOPICALLY STABILIZED)

1. PURPOSE. This technical standard order (TSO) is for manufacturers of gyroscopically stabilized magnetic direction instruments applying for a TSO authorization or letter of design approval (LODA). In it, we (the Federal Aviation Administration, or FAA) tell you what minimum performance standard (MPS) your gyroscopically stabilized magnetic direction instruments must first meet for approval and identification with the applicable TSO marking.

2. APPLICABILITY. This TSO affects new applications submitted after its effective date.

a. Prior revisions to this TSO are no longer effective. Generally we will not accept applications submitted for prior revisions of this TSO after this TSO's effective date. However, we may do so up to six months after this TSO's effective date, if we know that you were working against the earlier MPS before this change became effective.

b. Gyroscopically stabilized magnetic direction instruments approved under a previous TSO authorization may still be manufactured under the provisions of their original approval.

c. Major design changes to gyroscopically stabilized magnetic direction instruments approved under this TSO will require a new authorization. See Title 14 of the Code of Federal Regulations (14 CFR) § 21.611(b).

3. REQUIREMENTS. New models of gyroscopically stabilized magnetic direction instruments, identified and manufactured on or after the effective date of this TSO must meet the MPS in SAE International's Aerospace Standard (AS) 8013A, *Direction Instrument, Magnetic (Gyroscopically Stabilized)*, dated September 1996, except for the FAA modification in appendix 1.

a. Functionality. This TSO's standards apply to equipment intended to provide magnetic heading during flight in all possible position combinations and sequences.

b. Failure Condition Classification. Failure of the function identified in paragraph **3.a** of this TSO is a *major* failure condition. You must develop the system to, at least, the design assurance level equal to this failure condition classification.

c. Functional Qualification. Demonstrate the required performance under test conditions in SAE AS 8013A.

d. Environmental Qualification. Test the equipment according to RTCA, Inc. document RTCA/DO-160E, *Environmental Conditions and Test Procedures for Airborne Equipment*, dated December 9, 2004. Use RTCA/DO-160E instead of DO-160A as cited in SAE AS8013A.

e. Software Qualification. If the article includes a digital computer, develop the software according to RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 1, 1992.

f. Electronic Hardware Qualification. If the article contains a complex custom micro-coded component, develop the electronic hardware according to FAA advisory circular (AC) 20-152, *RTCA, Inc., Document RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware*, dated July 5, 2005.

g. Deviations. We have provisions for using alternate or equivalent means of compliance to the criteria in the MPS of this TSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation under 14 CFR § 21.609 before submitting your data package.

4. MARKING.

a. Mark at least one major component permanently and legibly with all the information in 14 CFR § 21.607(d).

b. Mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the TSO number:

- (1) Each component that is easily removable (without hand tools);
- (2) Each interchangeable element; and
- (3) Each subassembly of the article that you determined may be interchangeable.

c. If the component includes a digital computer then the part number must include hardware and software identification. Or, you can use a separate part number for hardware and software. Either way, you must include a means to show the modification status.

NOTE: Similar software versions, approved to different software levels, must be differentiated by part number.

d. If applicable, identify deviations granted to the article by marking "Deviation. See installation/instruction manual (IM)" after the TSO number. You can abbreviate the marking to "Dev. See IM."

5. APPLICATION DATA REQUIREMENTS. As a TSO manufacturer-applicant, you must give the FAA aircraft certification office (ACO) manager responsible for your facilities a statement of conformance, as specified in 14 CFR § 21.605(a)(1) and one copy each of the following technical data to support our design and production approval. (Under 14 CFR § 21.617(a)(2), LODA applicants submit the same data through their civil aviation authority:)

a. Operating instructions and equipment limitations in an IM, sufficient to describe the equipment's operational capability. Describe any deviations in detail. If needed, identify equipment by part number, version, revision, and criticality level of software, classification for use, and environmental categories.

b. Preliminary installation procedures and installation limitations in an IM, sufficient to ensure that the gyroscopically stabilized magnetic direction instruments when installed according to installation procedures. Final installations procedures and limitations would be part of the installation approval and the installation should meet the intended airworthiness requirements for the specific aircraft. Finally, the limitations must include a note with the following statement:

The conditions and tests required for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only in accordance with the applicable airworthiness requirements and, if applicable, the requirements of 14 CFR part 43.

c. Schematic drawings of the installation procedures.

d. Wiring diagrams of the installation procedures.

e. List of components, by part number, that make up the gyroscopically stabilized direction magnetic instruments complying with the standards in this TSO. Include vendor part number cross-references, when applicable.

f. A component maintenance manual (CMM) covering periodic maintenance, calibration, and repair, for the continued airworthiness of installed gyroscopically stabilized direction magnetic instruments. Include recommended inspection intervals and service life.

g. Material and process specifications list.

h. The quality control system description (QCS) required by 14 CFR §§ 21.143 and 21.605(a)(3), including functional test specifications. The QCS tests each production article to ensure compliance with this TSO. (Not required for LODA applicants.)

i. Manufacturer's TSO qualification test report.

j. Nameplate drawing with the information required by paragraph 4 of this TSO.

k. List of drawings and processes (including revision level), to define the article's design. For a minor change, you only need to make the revision to the list available on request.

l. An environmental qualifications form as described in RTCA/DO-160E for each component of the system.

m. If the article includes a digital computer: a plan for software aspects of certification (PSAC), software configuration index, and software accomplishment summary. We recommend that you submit the PSAC early in the software development process. Early submittal allows us to quickly resolve issues, such as partitioning and determining software levels.

n. If the article includes a complex custom micro-coded component: a plan for hardware aspects of certification (PHAC), hardware verification plan, top-level drawing, and hardware accomplishment summary. We recommend that you submit the PHAC early in the software development process. Early submittal allows us to quickly resolve issues.

6. MANUFACTURER DATA REQUIREMENTS. Besides the data given directly to us, have the following technical data available for review by the responsible ACO or civil aviation authority:

a. The functional qualification specifications for qualifying each production article to ensure compliance with this TSO.

b. Equipment calibration procedures.

c. Corrective maintenance procedures within 12 months after TSO authorization.

d. Schematic drawings.

e. Wiring diagrams.

f. Material and process specifications.

g. The results of the environmental qualification tests conducted per RTCA/DO-160E.

h. If the article includes a digital computer, the appropriate documentation defined in RTCA/DO-178B including all data supporting the applicable objectives in Annex A, Process Objectives and Outputs by Software Level.

i. If the article contains a complex micro-coded component, the appropriate hardware life cycle data in combination with design assurance level, as defined in AC 20-152.

7. FURNISHED DATA REQUIREMENTS. If giving one or more articles to one entity (an operator or repair station), provide the following for each article manufactured under this TSO:

a. One copy of the data in paragraphs **5.a** through **5.f** of this TSO. Add any other data needed for the proper installation, certification, and use, or for continued airworthiness, or both, of gyroscopically stabilized magnetic direction instruments.

b. One copy of the data in paragraphs **5.k** through **5.n**, if the appliance performs functions beyond those described in paragraph **3.a** of this TSO.

8. HOW TO GET REFERENCED DOCUMENTS.

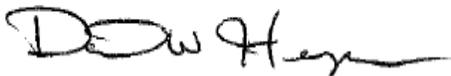
a. Order SAE documents from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Telephone (724) 776-4970, fax (724) 776-0790. You can also order copies online at: www.sae.org.

b. Order RTCA documents from RTCA Inc., 1828 L street NW, Suite 805, Washington, DC 20036-4001. Telephone (202) 833-9339, fax (202) 833-9434. You can also order copies online at: <http://www.rtca.org/>.

c. Order copies of 14 CFR parts from the Superintendent of Documents, Government Printing Office, P.O. Box 37154, Pittsburgh PA 15250-7954. Telephone (202) 512-1800, fax (202) 512-2250. You can also order copies from the Government Printing Office, electronic CFR Internet website at www.gpoaccess.gov/ecfr. Select "Title 14, Aeronautics and Space."

d. You can find a current list of technical standard orders on the FAA Internet website Regulatory and Guidance Library at www.airweb.faa.gov/rgl. You will also find the TSO Index of Articles at the same site.

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**APPENDIX 1. FAA MODIFICATION TO MPS FOR DIRECTION INSTRUMENT,
MAGNETIC (GYROSCOPICALLY STABILIZED)**

The FAA modification to AS8013A section 3.4 is as follows:

<i>SAE AS8013A reference:</i>	<i>Replace with:</i>
<p>Section 3.4: Except for small parts (such as knobs, fasteners, seals, grommets, and small electrical parts) that would not contribute significantly to the propagation of a fire, all materials must be self-extinguishing when tested in accordance with the requirements of Federal Aviation Regulation 25.1359 (d) and Appendix F thereto, with paragraph (b) of Appendix F or may be configured as used.</p>	<p>Except for small parts (knobs, fasteners, seals, grommets, and small electrical parts) that don't contribute significantly to the propagation of a fire, all materials must be self-extinguishing when tested according to 14 CFR § 25.869(a)(4). See further to Appendix F, Part I (b)(2), <i>Specimen configuration</i>, for current requirements.</p>