



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

TSO-C164

Effective
Date: 9/30/2004

Technical Standard Order

Subject: Night Vision Goggles

- 1. PURPOSE.** This Technical Standard Order (TSO) is for manufacturers of head-mounted, binocular assembly, night vision goggles applying for a TSO authorization or letter of design approval. In it, we tell you what minimum performance standards (MPS) your night vision goggles must first meet for approval and identification with the applicable TSO marking.
- 2. APPLICABILITY.** This TSO affects new applications submitted after this TSO's effective date.
- 3. REQUIREMENTS.** New models of night vision goggles identified and manufactured on or after the effective date of this TSO must meet the MPS set forth in Section 2 of RTCA Document No. (RTCA/DO)-275, Minimum Operational Performance Standards for Integrated Night Vision Imaging System Equipment, dated October 12, 2001.

 - a. Functionality.** The standards of this TSO apply to equipment intended to provide the pilot with enhanced vision outside the aircraft in night visual meteorological conditions (VMC) operations, conducted under the basic visual flight rules (VFR) weather minimums specified in Title 14 of the Code of Federal Regulations (14 CFR) § 91.155. Note that the equipment is portable (battery powered), with no interface with aircraft systems. Manufacturers wishing to develop night vision goggles that utilize alternate power sources must apply for a deviation as defined in paragraph **3f** of this TSO.
 - b. Failure Condition Classification.** When operating with the night vision goggles under the premise of RTCA/DO-268, Concept of Operations – Night Vision Imaging System for Civil Operators, dated March 27, 2001, the total loss of the function defined in paragraphs **3** and **3a** of this TSO is a major failure condition. Develop the equipment to at least the design assurance level commensurate with this failure condition classification.

Note: The premise of RTCA/DO-268 is that the goggles are to be used as an aid to night VFR flight where the safety of the flight path does not depend solely upon the external view through the night vision goggles. For missions and tasks that rely solely upon the night vision goggles for safe flight operations, a higher failure classification may be required.

c. Functional Qualification. Demonstrate the required performance under the test conditions in RTCA/DO-275, Section 2.4. In addition, design the night vision goggle power source so simultaneous loss of battery power to both tubes is minimized. This requirement can be met through separate and independent power sources to each tube, or by providing the user with a visual-alert of pending power loss. If you meet this requirement by providing a visual-alert, then the time available between the alert and actual loss of power to the tubes must be a minimum of 30 minutes. You must demonstrate that performance of this alert requirement is not affected when the night vision goggles are operated or stored within the environmental conditions for which the equipment is qualified.

Note: Battery technologies utilizing different chemical compositions could have significantly different discharge characteristics. Therefore, manufacturers should specify which battery models/types have been evaluated in meeting the above visual-alert requirement. This limitation should be documented as required by paragraph **5a** of this TSO.

d. Environmental Qualification. Test the equipment to the conditions stated in RTCA/DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment, through Change 3, dated December 5, 2002, or as otherwise specified in RTCA/DO-275, Sections 2.3 and 2.5.

Note: RTCA/DO-275, Sections 2.3 and 2.5 also provide guidance for environmental testing to Military Standards (Mil-Std) 810C and 461. In this case you must provide an environmental qualification form similar to that required by paragraph **5i** of this TSO.

e. Software Qualification. If the night vision goggle includes airborne software, develop the software in accordance with RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, dated December 1, 1992. The RTCA/DO-178B software level should be consistent with the failure condition classification defined in paragraph **3b** of this TSO.

f. Deviations. We provide for alternative or equivalent means of compliance to the MPS of this TSO. If you invoke these provisions, you must do so in accordance with the provisions outlined in 14 CFR § 21.609.

4. MARKING. Under 14 CFR § 21.607(d), mark articles manufactured under this TSO as follows:

a. At least one major component must be permanently and legibly marked with all of the information listed in 14 CFR § 21.607(d).

b. Also, mark the following permanently and legibly, with at least the name of the manufacturer, manufacturer's 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 night vision goggle includes airborne software, 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 for showing the modification status.

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

5. APPLICATION DATA. Under 14 CFR § 21.605(a)(2), the manufacturer must furnish the Manager of the Aircraft Certification Office (ACO), responsible for the manufacturer's facilities, one copy each of the following technical data to support FAA design and production approval:

a. Operating instructions and equipment limitations, sufficient to describe the operational capability, identify any unique operational aspects, and ensure that the night vision goggles, when used and stored in accordance with the manufacturer's instructions, continue to meet the requirements of this TSO. Include a note with the following statement:

“The conditions and tests required for TSO approval of this portable appliance are minimum performance standards, and may not be adequate to address the use of the appliance in an aircraft operational environment. The user should refer to Advisory Circular (AC) 27-1B, Chapter 3, Miscellaneous Guidance (MG) 16, or AC 29-2C, as appropriate, for certification guidance on determining compatibility of the appliance with the aircraft environment.”

b. List of the components, by part number, that make up the night vision goggle equipment complying with the standards prescribed in this TSO. Manufacturers should include vendor part number cross-references when applicable.

c. Instructions covering periodic maintenance, calibration, repair, and continued airworthiness of the night vision goggles, including recommended inspection intervals and service life.

d. Material and process specifications list.

e. The quality control system description required by 14 CFR §§ 21.605(a)(3) and 21.143(a) including functional test specifications to be used to test each production article to ensure compliance with this TSO.

f. Manufacturer's TSO qualification test report on the results of the testing required by paragraph 3c of this TSO.

g. Nameplate drawing providing the information required by paragraph 4 of this TSO.

h. A list of all drawings and processes, including revision level, necessary to define the article's design. With a minor change, any revisions to the drawing list need only be made available upon request.

i. An environmental qualification form as described in RTCA/DO-160D, Appendix A, for each component of the system.

j. If the night vision goggle includes airborne software: a Plan for Software Aspects of Certification (PSAC); Software Configuration Index; and Software Accomplishment Summary. We recommend that the PSAC be submitted early in the software development process. Early submittal allows timely resolution of issues such as partitioning and determination of software levels.

6. MANUFACTURER DATA. Besides the data given directly to the FAA, a manufacturer must have the following technical data available for review by the responsible ACO:

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 in accordance with RTCA/DO-160D, or as otherwise specified in RTCA/DO-275, Sections 2.3 and 2.5.

h. If the night vision goggle includes airborne software, the appropriate documentation as defined in RTCA/DO-178B, including all data supporting the applicable objectives found in Annex A of RTCA/DO-178B, Process Objectives and Outputs by Software Level.

7. FURNISHED DATA. If furnishing one, or multiple articles to one source (such as an operator or repair station), provide the following for each article manufactured under this TSO:

a. One copy of the data in paragraphs **5a** through **5c** and **5i** of this TSO. Add any other data needed for the proper operation, storage, or continued airworthiness of the night vision goggles.

b. One copy of the data in paragraphs **5h** through **5j** of this TSO, if the night vision goggle performs functions beyond those described in paragraphs **3** and **3a** of this TSO.

8. HOW TO GET REFERENCED DOCUMENTS.

a. You can buy copies of RTCA Document Nos. DO-160D, DO-178B, DO-268 and DO-275 from RTCA Inc., 1828 L Street, N.W., Suite 805, Washington, D.C. 20036. You may also buy copies through the RTCA Internet website at <http://www.rtca.org/>

b. You can buy copies of 14 CFR part 21, Subpart O from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402-9325. You can also get copies from the Government Printing Office (GPO), electronic CFR Internet website at <http://www.gpoaccess.gov/ecfr/>

c. You can get FAA Advisory Circular (AC) 20-110L, Index of Aviation Technical Standard Orders, AC 27-1B, Certification of Normal Category Rotorcraft, and AC 29-2C, Certification of Transport Category Rotorcraft, from the U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785, telephone (301) 322-4477 or FAX (301) 386-5394. You can also get copies from our Regulatory and Guidance library (RGL) at www.faa.gov/avr/air/airhome.htm. On the RGL website, click on "Advisory Circulars."

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