

SUBJ: **TECHNICAL STANDARD ORDER PROGRAM**

1. PURPOSE. This order explains to all offices of the Aircraft Certification Service how to administer the Technical Standard Order (TSO) program that is outlined in 14 Code of Federal Regulations (CFR) Part 21, Subpart O.

2. DISTRIBUTION. This order is distributed to the branch level in the Aircraft Certification Service and the Flight Standards Service; to the branch level in the Aircraft Certification Directorate offices and the regional Flight Standards Divisions; to the Federal Aviation Administration Academy and the Regulatory Support Division; to all Air Carrier; General Aviation, and Flight Standards District Offices; to all International Field Offices, International Area Offices; Aircraft Certification Field Offices; Manufacturing Inspection District and Satellite Offices.

3. CANCELLATION. Order 8150.1A, "Technical Standard Order Procedures," dated September 21, 1987, is canceled.

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5. BACKGROUND. This order is written to incorporate numerous policy and guidance changes, deletions, and additions that have occurred since publication of Order 8150.1A in 1987.

a. Before June 2, 1980, 14 CFR Part 37, Technical Standard Order Authorizations contained the procedures for the issuance of TSO authorizations and letters of TSO design approval for TSO articles and the text of all of the TSO's .

b. On June 2, 1980, the Federal Aviation Administration (FAA) revoked 14 CFR Part 37 and adopted new procedures to expedite the issuance of TSO authorizations and letters of TSO design approval. These new administrative procedures for TSO articles are in 14 CFR Part 21, Subpart O, and the text of TSO's have been removed from the body of the regulations.

c. Subpart O of 14 CFR Part 21 sets forth the general TSO procedural requirements for the issuance of TSO authorizations and letters of TSO design approval and the rules governing holders of those TSO authorizations and approvals.

d. Technical Standard Orders are available from the Aircraft Engineering Division, AIR-100, and all Directorate Aircraft Certification Offices (ACO's) and the FAA intranet website.

e. A list of manufacturers of all TSO articles is contained in Advisory Circular (AC) 20-36, Index of Articles (Materials, Parts, Processes, and Appliances) Certified Under the Technical Standard Order System, and a listing of all TSO's issued can be found in AC 20-110, Index of Aviation Technical Standard Orders.

6. EXPLANATION OF CHANGES.

CLARIFIED:	Evaluation of quality control data. Design changes to articles. Changes to TSO authorizations, letters of TSO design approval. Cancellation of TSO's and withdrawal of TSO authorizations. Identification of articles modified by other than the original holder of a TSO authorization or letter of TSO design approval.
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<p>ADDED:</p>	<p>Provisions for what is expected after an article’s performance has been audited. References to 14 CFR Parts and Sections. Appendix 1, 2 and 3, a format for preparation of new and revised TSOs, TSO authorizations, and letter of TSO design approval. Explanation of procedural differences of “parts TSO.” Recommendation to include Instructions for Continued Airworthiness (ICA) in the maintenance manuals where airworthiness approval under a type certificate or supplemental type certificate (STC) is likely. Statement instructing manufacturers to put details of deviations into manuals for continued airworthiness. Clarification that manufacturers unable to mark their articles according to 14 CFR § 21.607 must request an exemption. Provisions to use only primary TSO number in cases where multiple TSO’s apply. Statement encouraging manufacturers to publish vendor’s names and part numbers. Statement encouraging manufacturers to identify parts, assemblies or subassemblies used that require issue of (or have been awarded) PMA.</p>
<p>CHANGED:</p>	<p>To record retention requirements when TSO authorizations or letter of TSO design approvals are terminated or no longer in effect. Provisions for name and address changes for holders of TSO authorizations and letters of TSO design approval and sale of company or TSO design. References to current FAA Orders and forms. ACOs allowed to grant deviations to TSO applicants to use previously accepted environmental test procedures and conditions of earlier versions or revisions of RCTA Inc. Document DO-160 () in lieu of the most current, or those stipulated in the specific TSO. References to Federal Aviation Regulations (FAR) changed to CFR cites.</p>

7. RESPONSIBILITIES OF THE AIRCRAFT ENGINEERING DIVISION (AIR-100).

- a. Overall administration of the TSO program.
- b. Manage research to develop performance test criteria for new equipment.
- c. Develop minimum performance standards (MPS) for new equipment.

(1) Work with industry organizations such as Radio Technical Corporation of America (RTCA) and Society of Automotive Engineers (SAE) and other aviation authorities to assure harmonization.

(2) Consult with human factors engineers, flight test pilots, and the Air Transport Division, AFS-200, for operational and crew training considerations, as needed.

d. Prepare and issue proposed, revised, and new TSO's to the TSO format contained in **Appendix 1** of this order.

e. Cancel TSO's, as needed and maintain records of cancelled TSO's.

f. Provide final approval to ACO's to grant or deny deviations to TSO's within 30 days, pursuant to 14 CFR §§ 21.609 and 21.617, and record and monitor actions taken by ACO's on all requests for deviation.

g. Provide procedures, policy, and guidance to ensure both effectiveness and uniformity of the full TSO program.

h. Maintain a list of committees responsible for developing and revising TSO reference standards, including FAA representatives on committees, and the committee contact's name, address, and phone number.

i. Update AC 20-110 and AC 20-36 (see paragraph **5e** of this order), as needed.

j. Ensure that new TSO's and the AC's referenced in paragraph **7i** above are appropriately placed on the FAA website.

8. RESPONSIBILITIES OF DIRECTORATE ACO's AND MANUFACTURING INSPECTION DISTRICT AND SATELLITE OFFICES (MIDO/MISO).

a. Control and Monitor all manufacturers producing articles under a TSO authorization, including all holders of TSO authorizations previously issued by the FAA under 14 CFR Part 37. For TSO authorization holders with manufacturing facilities outside the US, this function will be performed only under agreement with the responsible MIDO and in consideration of "undue burden" to the FAA.

b. Receive and process applications for TSO authorizations and letters of design approval, as outlined in 14 CFR §§ 21.605 and 21.617.

c. Confirm the validity of applicants' certification of compliance with the applicable minimum performance standards.

d. Confirm the applicants' ability to produce duplicate articles, as required in 14 CFR § 21.605(c).

e. Issue TSO authorizations (reference **Appendix 2** of this order), letters of TSO design approval (reference **Appendix 3** of this order), or denials to applicants within 30 days, as required in 14 CFR § 21.605.

f. Create and maintain complete and accurate records on file of authorizations and design approvals granted, technical data, design changes approved, service difficulties, service bulletins, Airworthiness Directives (AD's), noncompliance actions, and terminations related to each TSO application.

g. Give AIR-100 and other Directorate's information, data, and recommendations, as specified in this order.

h. Conduct technical evaluations of all requests for deviation, per 14 CFR § 21.609, and make recommendations for grants or denials to AIR-100.

i. Report to the Delegation and Airworthiness Programs Branch (AIR-140) all new TSO authorizations and letters of design approval and any name or address changes.

j. Monitor all holders of letters of TSO design approval (ACO's only).

9. EVALUATION OF APPLICANT'S TSO COMPLIANCE DATA.

a. Incoming applications should be checked within seven days to determine that all of the documents and data comply with the provisions of 14 CFR § 21.605(a). Applications should include a statement of conformance, a copy of the technical data, and description of quality control system.

(1) Aircraft Certification Offices should accept and process only those applications from manufacturers within their geographical purview.

(2) Applications from authorized agents representing a manufacturer outside an ACO's geographic purview should be forwarded to the ACO with geographical purview over the manufacturing facility.

b. The technical data furnished should be examined within 30 days to ascertain compliance with the specific technical requirements in the current applicable TSO. The ACO should promptly notify the applicant in writing of any deficiencies or omissions, as prescribed by 14 CFR § 21.605(d).

c. The ACO should determine the adequacy and validity of technical data, procedures, processes, tests, and test results.

(1) For an applicant known to have prior experience in meeting FAA requirements and demonstrated technical competence, the ACO may need to make only a cursory check of the applicant's capabilities to produce duplicate articles. Drawings, equipment installation procedures, and equipment limitations should be checked for completeness and adequacy, since these procedures and limitations are important in the evaluation of aircraft type designs and the determination of the TSO applicant's ability to produce duplicate articles, as specified in 14 CFR § 21.605(c).

(2) For a new applicant not known to have prior experience in meeting FAA requirements and demonstrated technical competence, the ACO engineer should thoroughly evaluate the technical data to verify compliance with the TSO. The engineer should also visit the applicant's facility to determine the applicant's competence to certify conformance with the TSO. The engineer should ensure that the prescribed compliance tests are being realistically conducted. This visit should take place within the 30-day period before a TSO authorization is granted.

(3) A program of annual visits by ACO engineers to specified TSO authorization holders in a directorate is desirable such that over a period of time (2-3 years) all holders are visited. This would include Aircraft Certification Service Evaluation Program (ACSEP) evaluations. During annual visits, the engineer should verify that articles continue to conform to the TSO MPS, particularly with respect to minor design changes, see paragraph 15 of this order.

(4) Both new and inexperienced applicants should be audited. If an ACO audit finds deficiencies, the manufacturer should be given the opportunity to correct them. In the case of existing TSO authorization or letter of TSO design approval holders, deficiencies found should be handled according to paragraph 14b(4) and (5) of this order.

d. The use of Designated Engineering Representatives (DER) by a TSO authorization applicant for the purpose of making a finding of compliance to all or part of a TSO MPS will be allowed at the discretion of the ACO. Approval for the use of a DER should be obtained in advance from the responsible ACO and before any testing or data collection has begun. To be considered, the DER must have an appropriate delegation to make findings of compliance to a TSO. The DER's delegation for data approval in support of a TSO application may be limited by the ACO. When DER's are used, compliance will be shown on FAA form 8110-3 and the purpose of data block will state "In support of TSO-CXXX application." Otherwise the manufacturer may use a DER's expertise in any other manner (reference Order 8110.37C).

10. EVALUATION OF APPLICANTS QUALITY CONTROL DATA.

a. The ACO will forward the description of the applicant's quality control (QC) system, required by 14 CFR § 21.605(a)(3) and detailed in 14 CFR § 21.143, to the appropriate Manufacturing Inspection District Office (MIDO) for evaluation (reference Order 8120.2A, Production Approval and Surveillance Procedures). The MIDO assigns a production project number, as specified in Order 1380.48A, Manufacturing Inspection Management Information System (MIMIS).

b. When the MIDO is satisfied that the QC data and QC system comply with the requirements of 14 CFR § 21.605(a)(3), the MIDO will notify the ACO in writing of the applicant's compliance with the QC system requirements. The MIDO should respond to the ACO within 30 days so that the applicant can be notified within the 30 days required by 14 CFR § 21.605(e). If the QC data submitted is incomplete or unsatisfactory, the MIDO will notify the applicant in writing and make all reasonable attempts to help them reconcile all unsatisfactory conditions. When differences cannot be resolved or otherwise rectified, the MIDO should notify the ACO of the applicant's inability to comply.

11. TSO AUTHORIZATIONS.

a. To ensure a consistent application of 14 CFR § 21.605(a)(1), for all applicants requesting a TSO authorization, "...the applicable TSO that is effective on the date of application for that article," means the applicant must use the latest version or revision of the applicable TSO. This interpretation applies in all cases whether or not a previous or earlier versions of that TSO has been cancelled.

(1) **Appendix 1** of this order presents a standardized format for all TSO's issued after the effective date of this order. Specifically, paragraph **2a, Applicability**, addresses the limitations of new applications and states that "All prior revisions to a TSO are no longer effective, and ...applications will not be accepted after the effective date of this TSO."

(2) In cases where an applicant desires approval to manufacture an article to an earlier version of a TSO (see paragraph 19 of this order), the appropriate means is via a request for an exemption, as outlined in 14 CFR Part 11.

b. The responsible ACO grants applicants a TSO authorization by letter (reference 14 CFR § 21.605(e)). All pertinent data submitted by the applicant should be specifically identified in the authorization letter. The authorization letter, as shown in **Appendix 2** of this Order, should state the following:

(1) The FAA authorizes the applicant to identify the articles with the applicable TSO marking.

(2) The authorization approval is based on the applicant's statement of conformance certifying that the article complies with TSO-CXX in effect on the date of application.

(3) The applicant has complied with the requirements of 14 CFR Part 21, Subpart O.

(4) The FAA has determined that the QC system complies with the requirements of 14 CFR § 21.605(a)(3).

(5) The applicant must submit minor design changes, as required by 14 CFR § 21.611, to their responsible ACO.

(6) The applicant should report failures, malfunctions, or defects, in accordance with 14 CFR § 21.3, and

(7) The applicant must notify the ACO and MIDO/MISO of name, address, or ownership changes, pursuant to 14 CFR § 21.621. Note that TSO's are not transferable and that commencement of production after a name, address, or ownership change is not allowed without further FAA approval, as described in paragraph **19** of this order.

c. A copy of all TSO authorizations and letters of TSO design of approval granted by an ACO must be sent to AIR-140, for record keeping purposes. Another copy should go to the MIDO responsible for inspection and surveillance over the manufacturer. Information on authorization denials need not be forwarded to AIR-140.

d. Unless otherwise stated in the applicability section of a TSO (see **Appendix 1**, paragraph 2 of this order), articles produced under a specific TSO authorization or letter of TSO design approval may continue to be manufactured under the authority of their original authorization even if the TSO is subsequently revised or canceled, as specified in 14 CFR § 21.603(b).

(1) A “Canceled TSO” means that an entire TSO or a particular TSO revision level has been rendered obsolete or inactive. In the case of a cancellation of a TSO or the most current TSO revision, it means the FAA will no longer issue new TSO authorizations against that particular TSO or TSO revision. However, any existing TSO authorizations or letters of TSO design approval obtained prior to the cancellation are still valid. TSO cancellation notices will be published in the *Federal Register* and copies of all cancelled TSO’s will be maintained by AIR-100.

(2) The “Withdrawal of a TSO Authorization or letter of TSO design approval” means that a specific authorization letter or letter of TSO design approval is withdrawn by the FAA and the approval to manufacture that particular article under the TSO is terminated. This action requires a letter withdrawing approval to be sent to the manufacturer and in the case of design approvals a copy to the manufacturer’s Civil Aviation Authority (CAA).

12. DEVIATION REQUESTS & MARKINGS.

a. A deviation from the minimum performance standards (MPS) of a TSO is any variation from the specified criteria, per the provisions outline in 14 CFR § 21.609. Normally, deviations are requested because the TSO minimum performance standards are too restrictive or are otherwise unsuitable due to developments and changes in a particular article.

b. Granting deviations requires prior approval from AIR-100 because the development of MPS for TSO's is AIR-100’s responsibility. In addition, AIR-100 generally has an in-depth knowledge of the basis and evolution of the specific criteria for a particular TSO or revision to a TSO, which could influence approval, and generally may not be known by the evaluating ACO engineers.

c. Generally, any deviations granted to an applicant, which have a broad application, should be considered by AIR-100 for incorporation into a revision of the MPS for that TSO.

d. The ACO with geographical purview over the applicant’s manufacturing facility is responsible for evaluating requests for deviations from the MPS.

(1) An applicant's deviation request should be accompanied by substantiating data that specifically covers the compensating factors that ensure that an equivalent level of safety is provided by the proposed deviation from the TSO. The ACO engineer should return an applicant's request when insufficient or no supporting data are provided. The ACO engineer should refrain from recommending approval on that basis that the deviation meets the "intent" of the TSO.

(2) It is recommended that requests for deviations should be acknowledged by the ACO within seven days. Note that the 30-day response limitation prescribed in 14 CFR § 21.605(e) applies only to the original TSO authorization applications and not to deviation requests.

(3) The ACO will evaluate the merit and validity of a deviation request and submit a written recommendation to AIR-100 as to whether the deviation should be granted or denied, with supporting justification.

(4) After reviewing all information and data, AIR-100 will make a timely final determination on the acceptability of the deviation request and inform the ACO in writing or by email within 30 days from receipt of the request.

(5) The ACO will then notify the applicant of the decision to grant or deny the deviation. The ACO will handle the notification in one of the following ways: forward a copy of the letter or email generated by AIR-100 to the applicant with a cover letter from the ACO; ask AIR-100 to respond directly to the applicant with a copy to the ACO; or respond to the applicant and provide AIR-100 with a copy of the letter.

(6) The ACO can grant deviation requests against environmental test procedures without AIR-100 approval when applicants use RTCA/DO-160, including the latest revision, instead of the environmental test procedures and/or other RCTA criteria specified in the TSO. In general, environmental conditions and test procedures from different documents, such as part from RTCA/DO-160() and the remainder from an SAE document should not be mixed.

(a) When a new TSO application is based on the design of an existing TSO article and the design change is considered minor, the applicant may ask to use environmental test data from the existing article's TSO environmental qualification, based on similarity between the two articles. This deviation request must be fully supported with a detailed similarity assessment comparing the changes from the earlier TSO article to the article in the new TSO application. The ACO may grant the deviation, if the similarity assessment clearly shows that the design changes will not adversely affect the environmental qualification.

(b) If the environmental qualification test data for the existing TSO article is based on an earlier revision of RTCA/DO-160 than the revision specified for the new TSO article, the applicant must also compare the specific procedure and category changes, section by section, between the two RTCA/DO-160 versions. The applicant must show that the differences between the two test results will maintain an equivalent level of safety.

(c) For specific RTCA/DO-160 sections where there are significant category definition or test procedure differences between the two requirements, the applicant must perform environmental tests on the new article for those latest RTCA/DO-160 sections.

(7) Deviation requests against software development also may be granted by the ACO, without AIR-100 approval, if the TSO applicant proposes to use sections 2 through 11 of RTCA/DO-178B or its latest revision in place of an earlier version. Applicants requesting to use an alternate means of compliance, as defined in section 12.3 of RTCA/DO-178B, shall forward the request to their cognizant ACO which will in turn forward the request, with its recommendation, to AIR-100 for approval.

e. At a minimum, manufacturers must be instructed to put specific details of deviations granted that result in operational or installation limitations into their installation manual (IM) and/or component maintenance manual (CMM) for continued airworthiness concerns for articles that may be used in other applications. The details of these deviations should be sufficiently described such that any functional difference resulting from the deviation are fully described. In the case of deviations to

environmental test requirements and software used in the article, or any software changes made, such characterization should be included in the IM/CMM and should include the approved environmental categories, software part number, revision and criticality level and any applicable limitations. A summary statement of the deviations granted must be contained in the TSO authorization letter or letter of design approval as noted in **Appendix 2** and **3** of this order. This information is necessary to alert installers to the potential need to further evaluate the article for installation or operational limitations affected by the deviations to the MPS.

f. The minimum marking required for a TSO article is specified in 14 CFR § 21.607(d). Applicants unable to comply with the requirements of 14 CFR § 21.607(d) will need to request an exemption, per the provisions outline in 14 CFR Part 11 to permit an alternate marking method. In cases where multiple TSO's apply to an article, the marking of each individual TSO authorization number on the article's nameplate may prove impractical. In these situations, **if one TSO can be established as the primary or integrating TSO for the article, only the primary TSO number needs to be marked on the nameplate. The other supporting TSO's need only to be listed in the front of the IM for the primary TSO.** In addition, the primary article must be permanently and legibly marked with a statement identifying the IM as the location of the remaining TSO marking requirements, e.g. "See Inst Mnl for Addtl TSO's."

13. RECOMMENDATIONS FOR NEW TSO's OR REVISIONS TO EXISTING TSO's.

a. ACO's are encouraged to recommend the establishment of new standards for an article not already covered by a TSO. When an ACO determines there is a need for a new TSO, they should send a recommendation to AIR-100. Manufacturers also are encouraged to submit recommendations for the creation of new TSO's for articles and suggest performance standards to expedite TSO development. These standards could be in the form of procurement specifications, SAE or RTCA standards.

b. Requests for revisions to a specific TSO's MPS by either a manufacturer or an ACO should be accompanied by substantiating data to justify the change. When an ACO's service experience with a particular TSO article shows that the standards are inappropriate or inadequate in any respect, the ACO should submit a recommendation to revise the standards to AIR-100. If a new MPS needs to be developed for an article, AIR-1 will submit a written request to develop the new standards to the appropriate industry group such as SAE, RTCA or ARAC.

c. New and revised TSO MPS must conform to the format in **Appendix 1** of this order.

14. SERVICE DIFFICULTIES, NONCOMPLIANCE AND NONCONFORMANCE.

a. The requirement for a TSO authorization holder to report known failures, malfunctions, or defects occurring to their product is outlined in 14 CFR § 21.3. Those reports of service difficulties concerning a TSO article will be evaluated and possibly investigated by the ACO responsible for the TSO authorization holder for that article. Reports of deficiencies in a TSO manufacturer's QC system should be forwarded directly to the responsible MIDO for evaluation and possible investigation.

(1) ACO's and MIDO's will use statistical data, mechanical reliability reports, and related sources of information along with the manufacturer's data to determine and justify a recommended course of action.

(2) The ACO, after receiving recommendations from the manufacturer, will determine whether to direct a design change. An AD may be issued under the conditions specified in 14 CFR Part 39. Refer to Order 8040.1, "Airworthiness Directives," for details of AD preparation.

b. The ACO and/or MIDO/MISO will evaluate and investigate all reports or allegations of service difficulties and noncompliance with 14 CFR Part 21, Subpart O, and the applicable TSO MPS and will take corrective action when warranted.

(1) The ACO with geographical purview over the manufacturer should promptly and thoroughly investigate allegations of noncompliance.

(2) A complainant should be asked to fully disclose all the facts, data, names, places, etc., as evidence to support the allegation.

(3) Depending on the facts and circumstances, additional TSO article testing by the TSO authorization holder may be necessary to prove compliance with the TSO.

(4) When an unsafe condition exists, the manufacturer must take corrective action, as required by 14 CFR § 21.3. When the manufacturer does not voluntarily provide design changes and data necessary to correct an unsafe condition, the ACO shall consider appropriate AD action (see paragraph **14a(2)** of this order), enforcement action, or a combination of the two. The enforcement procedures in Order 2150.3, "Compliance and Enforcement Program," should be followed before considering withdrawal of the TSO authorization or letter of TSO design approval under 14 CFR § 21.619 (see paragraph **11c(2)** of this order).

(5) The ACO should withdraw TSO authorizations and letters of TSO design approval, as allowed in 14 CFR § 21.619, when an unsafe condition is found to exist and the TSO holder is unwilling or incapable of taking corrective action, once noncompliance has been established.

c. A TSO authorization or TSO letter of design approval holder violates 14 CFR § 21.607(a) when a TSO article or appliance is shipped incomplete, is missing parts or has non-conforming parts installed. Manufacturers should be instructed/warned not to ship incomplete or non-conforming articles.

15. DESIGN CHANGE/MODIFICATION TO A TSO ARTICLE.

a. The TSO authorization holder may make minor design changes without further approval. However, when an ACO has determined that a change of design may not be in accordance with the provisions of 14 CFR § 21.611(a), the manufacturer holding the TSO authorization must demonstrate that the "minor design change" has little or no effect on the article's ability to meet the requirements of the applicable TSO and that the change is not extensive enough to require a substantially complete investigation of compliance.

(1) Manufacturers of TSO articles must be instructed that all minor design changes must be properly and adequately substantiated and that the revised data must be forwarded to the appropriate ACO within 180 days of making the minor change and preferably before shipment of the articles. The applicant's minor change notification letter should state that the new article complies with 14 CFR Part 21, Subpart O.

(2) The ACO should evaluate and confirm that the design change data submitted, in fact, constitutes a minor change, as defined in 14 CFR § 21.611(b).

(3) If the ACO determines that a minor design change submittal is insufficiently or improperly substantiated, the ACO should officially request the manufacturer to provide sufficient substantiation or any other data necessary to justify its claim. Depending on the extent of the design change, such substantiation may necessitate a complete retest to show compliance with the TSO standard.

(4) Once a minor change is confirmed, the ACO notifies the responsible MIDO. The MIDO will verify that the manufacturer's QC manual is appropriate.

b. If an ACO determines that a minor design change submittal is really a major design change, as defined in 14 CFR § 21.611(b), the ACO must act as follows:

(1) Immediately notify the manufacturer that it may now reapply for a new TSO authorization, under the TSO currently in effect, as required in 14 CFR § 21.611(b).

(2) Notify the MIDO, to take appropriate action regarding the change in type or model number necessitated by the major change and the potential for a marking discrepancy, if some articles have already been manufactured. The MIDO will determine if the QC manual needs revisions.

c. An application for a TSO article design change, whether major or minor, by a person other than the original manufacturer will be handled pursuant to 14 CFR § 21.611(c). If the person seeking approval is a manufacturer they should apply under a separate TSO authorization, and the application should be treated as a new TSO application. If approval is sought under 14 CFR Part 43, specifically 14 CFR § 43.3, Appendix A(a)(4), or the applicable airworthiness regulations the design change is considered a major alteration. When the design change is made to an article that is currently in service or has been on the shelf long enough to have experienced deteriorated due to aging, it is important to determine by inspection and testing that the altered article continues to meet the original TSO standards. See paragraph **20** of this order for appropriate marking requirements.

d. When an ACO deems it necessary to impose a design change on an article to correct an unsafe condition, the ACO can do the following:

(1) Issue an AD against that article. This action is intended to reestablish the level of safety of a particular article and must be accomplished through the AD rulemaking process.

(2) Withdraw TSO authorization approval, as stated in paragraph **14b(5)** of this order. This option should be seldom exercised, and only on those rare occasions when the manufacturer cannot provide adequate assurance of its ability to produce a safe article, and should only be for safety reasons to improve the inadequate performance of the article. Notice should be in writing and limited to the article(s) in question.

(3) For design changes that are considered major changes under 14 CFR § 21.611(b), the TSO holder is required to demonstrate compliance with that version of the TSO referenced in the TSO authorization letter. Compliance with the most recent TSO in effect at the time of the major change is optional at the discretion of the ACO, as the particular situation may not support advancing to the most current revision level. The manufacturer may wish to use a new type or model number designation, which would eliminate the need for a completely new authorization per 14 CFR § 21.605.

e. All major design changes to TSO or letters of TSO design approval articles, and minor design changes requested by the manufacturer that have been determined by the ACO to be major changes require new applications, as stated in 14 CFR § 21.611(b). When new applications for TSO authorization are submitted, as a result of a major change, for which final approval is pending, and prior to that approval a revision to the applicable TSO is issued, the applicant need only demonstrate compliance with the TSO in effect at the time of the original application, not the revised TSO. A relief period will be provided to applicants with pending applications having difficulty complying with the newer TSO standards. That period should not exceed one year from the date of the new application to the approval date. If approval is not gained within this time, the ACO should consider making the applicant comply with the most recent TSO revision.

16. RECORD KEEPING.

a. A TSO authorization holder master file will be retained by the ACO issuing the authorization. The file will contain all of the data submitted by a manufacturer in connection with obtaining and maintaining an authorization. A TSO authorization holder may be permitted to keep the master file, provided the ACO and TSO authorization holder have a formal memorandum of agreement (MOA) to that regard. The MOA must contain a clause requiring the TSO authorization holder to provide copies of records from the master file upon request. Only one copy of the technical data specified in the data requirements section of the applicable TSO needs to be submitted and maintained by the manufacturer. The ACO responsible for an authorization will furnish, upon request, copies of the technical data to other ACO's. When distributing technical data the responsible ACO should state in the transmittal, which TSO applies.

b. Each ACO or the TSO authorization holder on the ACO's behalf, as allowed above must adequately maintain records. Proper records maintenance guarantees continued airworthiness support for TSO articles that remain in service and are no longer in production. Therefore, whenever a TSO authorization holder goes out of business or no longer operates under the provisions of its TSO approval, copies of all required data, per 14 CFR §§ 21.605 and 21.613(a), and any other technical data deemed necessary by the ACO, must be sent by the manufacturer to the ACO. The ACO must retain this data, per 14 CFR § 21.613(b), for as long as there are approved articles in service.

c. All technical data retained by the FAA may be subject to Freedom of Information Act (FOIA) requests. ACO's should keep only that information clearly relevant and necessary to TSO authorization. The ACO's should notify the manufacturer of the potential release of any commercial or proprietary data; in the event a FOIA request is received.

17. INCOMPLETE SYSTEMS AND MULTIPLE-USE SYSTEMS.

a. A component of a complete system may be approved and a TSO authorization issued for only that component, under all of the following conditions:

(1) The TSO specifically provides appropriate minimum performance standards for the evaluation of the component as it relates to the system.

(2) The component provides a major function of the complete system or the principal function of the component is essential to complete system function.

(3) The article is marked as an "Incomplete System."

(4) Detailed instructions and limitations for the installation and use of the article are made available to the user of the article, as generally required by the TSO.

b. An incomplete system is defined as any system that provides a portion of the functionality specified in the MPS of the applicable TSO. It also must perform a function or feature specifically identified as optional in the TSO. Applications for TSO authorizations for incomplete systems are evaluated on their own merits via a deviation request. See paragraph 12 of this order. The following procedures apply:

(1) In the request for deviation, the applicant must specify the exact MPS contained in the TSO, by paragraph, that apply to the incomplete system. If appropriate test procedures are not specified for the incomplete system, the applicant is expected to define test procedures and submit them along with the required data. Installation procedures and limitations, which ensure that the incomplete system can be integrated into a complete system, also must be addressed.

(2) The ACO will conduct the technical evaluation of the application, make a recommendation to grant or deny the deviation request and forward the deviation package, along with supporting technical evaluation, to AIR-100. A recommendation for approval must specifically identify the TSO requirements, which form the basis for the approval. The deviation must also address installation procedures and limitations adequate to ensure that the incomplete system can be integrated into a complete system.

(3) AIR-100 will approve or deny the applicant's request and return the complete package to the originating ACO. AIR-100 will retain a record of each request and will review those requests to identify functions for which a new TSO should be developed.

(4) The ACO will notify the applicant of the disposition of the deviation request per paragraph 12d(5) of this order.

(5) The 30-day limitation specified in 14 CFR § 21.605(e) does not apply to applications for incomplete systems, as the applicant has chosen not to comply with all of the requirements of the TSO. Since incomplete systems are handled as deviation requests, every effort should be made to process the application in a timely manner.

c. The following presents two examples of a component:

(1) A VHF communications antenna may be properly used with any TSO-C37 VHF transmitter. If specific items must be used with an approved component (i.e. the antenna) to make up a complete working system (the transmitter), then the manufacturer should provide appropriate instructions and limitations regarding such use. An example is a "Model ABC antenna" that due to practical interface limitations, may be used only with a "Model XYZ area navigation system."

(2) An Electronic Flight Instrument System (EFIS) may be properly used with a TSO-C4, "Bank and Pitch Instruments." The EFIS displays "bank and pitch" information, but does not include a vertical gyro. Since the EFIS provides a major part of the TSO-C4 functions, an authorization may be granted to label components "TSO-C4."

d. A complete system that performs multiple functions may be considered as follows:

(1) Functional compliance with a TSO. Approval may be granted and a TSO authorization issued for each function, for which there is a TSO, that meets all the requirements of that TSO, if the function being performed is one of the principal functions required by the TSO.

(2) Functional noncompliance with a TSO. If a function provided by the system does not meet all requirements of a TSO that apply to that function, the system limitations should be noted. The article may be labeled to indicate that fact, i.e., "NOT TSO-CXX approved," but the limitations must be described in the installation drawings, IM and/or CMM.

(3) No applicable TSO for a function. When there is no TSO appropriate to a function provided by the system, the TSO authorization for the other functions should not refer to that non-TSO function, and that function must be evaluated for safety and performance of its intended function under the appropriate airworthiness certification procedures when seeking aircraft installation approval. The manufacturer should be instructed to list functions that are not covered by any TSO in the IM and/or CMM.

18. LETTER OF TSO DESIGN APPROVAL-IMPORT APPLIANCE.

a. Letters of TSO design approval, as required by 14 CFR § 21.617(a), are issued to applicants, i.e. manufacturers, in other countries for appliances that the United States has approved and agreed to accept for export and import. Letters of TSO design approval are issued through a country's civil aviation authority (CAA) by the ACO responsible for that specific bilateral country provided:

(1) There is a bilateral airworthiness agreement (BAA) or a bilateral aviation safety agreement (BASA) between the United States and the country that manufactures the appliance. Either of these agreements must include provisions for acceptance of appliances by the US in accordance with 14 CFR § 21.502(a).

(2) The country's CAA submits to the FAA on behalf of the manufacturer an application certifying compliance with the applicable TSO, per 14 CFR §§ 21.617(a)(1) and 21.305(b), and a copy of the technical data, as required by 14 CFR § 21.617(a)(2).

(3) The ACO responsible for the country manufacturing the appliance does a technical review of the data submitted to assure compliance with the applicable TSO.

(4) The ACO notifies the country's CAA that the performance of the appliance or article complies with the applicable FAA TSO or other standards found by the FAA to provide an equivalent level of safety. The FAA may issue the letter of TSO design approval (see **Appendix 3** of this order) without further investigation when the TSO and Joint TSO (JTSO) are identical, unless there are deviations to the TSO, or it is a first-of-a-kind article.

b. A Certificate of Airworthiness for Export issued by the CAA of the country of manufacture must accompany each appliance, as specified in 14 CFR § 21.502(a).

c. The marking of an appliance approved under a letter of TSO design approval shall comply with 14 CFR § 21.607(d) and in the applicable TSO.

d. TSO deviation requests from an appliance manufacturer in another country are evaluated by the ACO responsible for that country.

(1) Requests for approval to deviate from a TSO and all pertinent technical substantiating data must be submitted to the ACO responsible for that country through the CAA of the country of manufacture.

(2) The ACO reviews each requested deviation and forwards its recommendation along with the substantiating data to AIR-100. AIR-100 determines the adequacy of the ACO's recommendation and either concurs or non-concurs in writing, as outlined in paragraphs **12(b)** and **12(d)** of this order.

e. Major changes to a TSO design require re-validation of the new design and a new letter of design approval. For minor changes to a TSO design by the manufacturer who holds the letter of design approval, the CAA of that country will send a list of changes for the TSO articles immediately to the ACO responsible for that country. See paragraph **15** of this order for additional information.

f. The civil aviation authority of the exporting country is responsible for both the design and production approval of the TSO article.

19. NAME, ADDRESS, OR OWNERSHIP CHANGES. The meaning of 14 CFR § 21.621 is that TSO's are non-transferable. A company undergoing a name change or one that has relocated is not considered a transfer. However, the sale of a company, or the sale of TSO design rights is considered a transfer and continued production under the original TSO authorization would require the new owners to submit an application for an exemption per the procedures specified in 14 CFR Part 11. In either case, the intent is to permit continued production, in most cases of older TSO articles used on existing type certificated aircraft. The following provides guidance for the

continued production of TSO articles under their original approvals, under the aforementioned circumstances when further evaluation can be used to substantiate continued QC system compliance.

- a.** For name and address changes and exemptions granted for changes in ownership, the TSO authorization holder will inform the appropriate ACO of any name, address, or ownership changes, identifying the relevant TSO number and part/model number.
- b.** The ACO will forward this information immediately to the responsible MIDO/MISO. Conversely, the MIDO/MISO will immediately notify the responsible ACO of any changes reported to them.
- c.** The ACO will advise the TSO authorization holder of the re-issue process outlined in paragraph **19d** below. The TSO holder also must be instructed that no new articles may be shipped from a new facility until the MIDO has inspected and approved the new facility and the ACO has reissued their TSO authorization.
- d.** The responsible MIDO will evaluate the TSO holder's QC system to determine whether there has been any changes in either the TSO holder's process and procedures or the TSO holder's ability to comply with 14 CFR § 21.143.

(1) If the MIDO finds no changes to the QC system, a TSO authorization holder undergoing a name or address change with no change to the internal structure of the company, or who changes ownership, may be eligible for the re-issuance of its TSO authorization(s). A name or address change is considered an administrative change requiring a reevaluation approval to re-issue TSO authorization at the same level as the original TSO. The ownership change should be considered a reevaluation with an approval to sustain the existing TSO authorization for the new owners.

(2) If the MIDO finds that the change has brought about deficiencies in the QC system process and procedures, a new TSO holder must substantiate compliance of its QC system with the regulations before re-issue of the TSO authorization. If issues cannot be quickly and satisfactorily resolved, the MIDO should recommend the ACO terminate the TSO authorization process.

(3) After receiving written confirmation from the MIDO assuring a TSO holders meets the production requirements, the ACO will forward all information regarding name, address, or ownership changes to AIR-140 to update AC 20-36, as mentioned in paragraph **7i** of this order.

20. IDENTIFICATION OF TSO ARTICLES MODIFIED BY PERSONS OTHER THAN MANUFACTURER. Design changes to a TSO article by a person other than the manufacturer who submitted the statement of conformance is permitted by 14 CFR §§ 21.303 and 21.611(c). The modified TSO articles must be approved under 14 CFR Part 43 or the provisions of the applicable airworthiness regulations. If the modified TSO article is reviewed by the ACO for airworthiness approval, the ACO should require the modifier of the TSO article to comply with the following essential identification requirements:

- a.** The modifier should permanently mark the modified article with his name, address, means of approval of the design change (for example, STC No. or Drawing No.), date of approval, description of the modifications that have been performed, and any other information pertinent to

operating parameters (for example, environmental categories, class, maximum range, etc.). The marking should be part of the design change data.

b. The original TSO identification on the manufacturer's nameplate may remain on the article only if it is demonstrated to the FAA that the modified article continues to meet all requirements of the original TSO as follows:

(1) The original manufacturer of the article has notified the FAA of the modified article's compliance with the TSO; or

(2) Based on tests and evaluations the modifier certifies compliance with the TSO to the FAA.

c. The modifier should permanently obliterate TSO identification on the original manufacturer's nameplate when the modified article cannot be demonstrated to continue to meet the requirements of the original TSO. These types of modified articles are no longer approved for installation in the original aircraft type design. A separate approval must be obtained as part of the aircraft type design.

d. When a modified TSO article is produced under the Parts Manufacturer Approval (PMA) provisions of 14 CFR § 21.303, "Replacement and modification parts," the article must be marked in accordance with the requirements of 14 CFR § 45.15.

21. PARTS LIST. Persons who maintain, alter or perform preventative maintenance on aircraft shall do so in such a manner that the condition of the altered product is at least equal to its original or properly altered condition per 14 CFR § 43.13(b). To adhere to 14 CFR § 43.13(b), holders of TSO authorizations are encouraged to cross-reference all part numbers with identical vendor part numbers within the parts list and the component maintenance manual (CMM). This will permit persons performing maintenance and alterations to TSO articles to more easily ensure the article is equal to its original or properly altered condition.

22. CONTINUED AIRWORTHINESS. The holder of a design approval, including holders of TSO authorizations, must provide at least one complete set of instructions for continued airworthiness (ICA) to the owner of each article, as required by 14 CFR § 21.50(b). In the event that the TSO article does not require any specific ICA, the applicant will comply with 14 CFR § 21.50(b) by providing a written statement within the application that specifies that no ICA are required for this article.

23. AUDITING PERFORMANCE. Units that are subjected to qualification and acceptance tests and are later identified with a TSO number should be able to meet performance requirements in service or when audited as new production stock. When there is evidence that TSO production stock articles do not meet the TSO MPS, the FAA may elect to perform a production audit of the manufacturer's facility per 14 CFR § 21.615.

24. PARTS MANUFACTURER APPROVAL (PMA) REPLACEMENT PARTS. FAA

Order 8110.42, Parts Manufacturer Approval Procedures, defines the process for evaluating and approving PMA replacement and modification parts for installation on a type certificated product. Note that the rule governing the procedural requirements for PMA replacement and modification parts, 14 CFR § 21.303(c)(1), requires each PMA part to contain the identity of the product on which the part is to be installed.

a. For PMA parts approved on the basis of tests and analysis (see Order 8110.42A paragraphs 8a(2) and 9a(3)(c)), the parts must be marked per 14 CFR § 45.15 and have a TSO modifier’s nameplate as described in paragraph 20 of this order.

b. For PMA parts approved on the basis of identity and/or an assist letter (see Order 8110.42A paragraphs 8a(1) and 9a(3)), the parts also must be marked per 14 CFR § 45.15. The TSO modifier’s nameplate is not necessary because the replacement part is not considered a design change provided the original identification markings remain for traceability.

c. To allow PMA parts to be used within a TSO article without limiting their eligibility for installation in other qualified assemblies and subassemblies, manufacturers are encouraged to identify those PMA parts, assemblies and subassemblies in the applicable installation instructions and component maintenance manuals for the TSO article.

25. PROCEDURAL DIFFERENCES FOR PARTS TSO’s. Currently there are three parts TSOs, aircraft mechanical fasteners (TSO-C148), aircraft bearings (TSO-C149) and aircraft seals (TSO C-150). Each of the parts TSO’s uniquely defines the MPS for that particular part. Based on sample testing, the part manufacturer establishes the actual MPS value for each part size within a particular part’s TSO and states those values in its application for TSO authorization.

a. The following table summarizes the unique marking requirements for parts TSO’s:

PART TYPE	LOCATION OF MARKING	MARKINGS REQUIRED
TSO-C148 Fasteners	<ul style="list-style-type: none"> • Each package/container • Each fastener 	Type & mfg. inspection lot number. Name or symbol of mfg. & part identification. SEE NOTE BELOW.
TSO-C149 Bearings	<ul style="list-style-type: none"> • Each package/container • Each bearing 	Type, lube date (if applicable) & mfg. inspection lot number. Name or symbol of mfg., part number & TSO number.
TSO-C150 Seals	<ul style="list-style-type: none"> • Each package/container • Each seal 	Expected shelf life & mfg. inspection lot number. Name or symbol of mfg., part number & TSO number.

NOTE: When marking fastener is not practical, marking may be done in a way approved by the Administrator

Kim Smith
Acting Manager, Aircraft Engineering Division
Aircraft Certification Service

APPENDIX 1. FORMAT AND GUIDANCE FOR THE PREPARATION OF TSO



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

TSO-C{No.}

Effective
 Date: {XX/YY/ZZ}

Technical Standard Order

Subject: *{Enter title of TSO article}*

1. PURPOSE. This Technical Standard Order (TSO) tells persons seeking a TSO authorization or letter of design approval what minimum performance standards (MPS) their *{enter type of equipment}* must first meet in order to obtain approval and be identified with the applicable TSO marking.

2. APPLICABILITY.

a. This TSO is effective for new applications submitted after the effective date of this TSO. *[For TSO revisions use the following Statement]:* All prior revisions to this TSO are no longer effective and, in general, applications will not be accepted after the effective date of this TSO. However, applications submitted against the previous version of this TSO may be accepted up to six months after the effective date of this TSO, in cases where we know that the applicant was working against the earlier MPS before the new change became effective.

b. *[To clarify that previously approved articles may continue to be manufactured, use the following statement]:* *{Insert type of equipment}* approved under a previous TSO authorization may continue to be manufactured under the provisions of their original approval, as specified in 14 CFR § 21.603(b). *[To stop the manufacture of previously approved articles requires the withdrawal of approval, which requires a Federal Register notification, when approvals have been withdrawn use the following statement]:* Effective *{enter date}* pursuant to 14 CFR § 21.621, each TSO authorization, to the extent it authorizes the holder to identify or mark *{insert type of equipment}* with *{insert applicable versions of TSO}* is withdrawn.

However, major design changes to *{insert type of equipment}* approved under previous versions of this TSO requires a new authorization under this TSO, per Title 14 of the Code of Federal Regulations (14 CFR) § 21.611(b).

Key: *Shaded areas offer optional sections. Information in parenthesis {Italics} requires additional data entry. Information in brackets [Italics] provides guidance information.*

{Example: The standards of this TSO apply to equipment intended to provide position information to a navigation management unit that outputs deviation commands referenced to a desired flight path. These deviations will be used by the pilot or autopilot to guide the aircraft. These standards do not address integration issues with other avionics, such as the potential for the sensor to inadvertently command an autopilot hardover. These standards also do not address the use of position information for other applications such as automatic dependent surveillance}.

3. REQUIREMENTS. New models of *{Enter type of equipment}* that are to be so identified and that are manufactured on or after the effective date of this TSO must meet the MPS *{insert qualification and documentation requirements when applicable}* in *{insert APPENDIX 1, if an FAA MPS is used or site the applicable SAE, RTCA etc. document, name, title, date, etc., as amended by APPENDIX 1 of this TSO, when applicable}*

a. Functionality. The standards of this TSO apply to equipment intended to *{state intended function, either by reference to standard, to appendix, or state function here}*.

b. Failure Condition Classification. Failure of the function defined in paragraphs **3** and **3a** of this TSO has been determined to be a *{insert appropriate classification: minor, major, hazardous, catastrophic}* failure condition, and the applicant must develop the system to at least the design assurance level commensurate with this failure condition classification.

c. Functional Qualification. *{Choose the appropriate statement: (1) The required performance shall be demonstrated under the test conditions specified in {insert reference}. (2) The required performance shall be demonstrated under the test conditions specified in APPENDIX {insert no.}. (3) Not applicable}.*

d. Environmental Qualification. The equipment shall be subject to the test conditions specified in *{insert the following: RTCA Document No. RTCA/DO-160D, "Environmental Conditions and Test Procedures for Airborne Equipment", Change 4, dated July 29, 1997, or the most current revision. The standards appropriate to these test procedures are specified in APPENDIX {insert no.}}*.

e. Software Qualification. If the article includes a digital computer, the software must be developed in accordance with *{{insert appropriate sections} of RTCA Document No. RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification", dated December 1, 1992, or the most current revision}*.

f. Deviations. The FAA has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MPS of this TSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation per 14 CFR § 21.609.

4. MARKING. Under 14 CFR § 21.607(d), articles manufactured under this TSO must be marked 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), except for the following: the option in 14 CFR § 21.607(d)(2), where the name, type and part number must be used in lieu of the optional model number; and the option in 14 CFR § 21.607(d)(3), where the date of manufacture must be used in lieu of the optional serial number.

b. In addition to the requirements of 14 CFR § 21.607(d), each separate component that is easily removable (without hand tools), each interchangeable element, and each separate sub-assembly of the article that the manufacturer determines may be interchangeable must be permanently and legibly marked with at least the name of the manufacturer, manufacturer's subassembly part number, and the TSO number.

c. If the component includes a digital computer, the part number must 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. Note that similar software versions, which have been approved to different software levels, must be differentiated by part number.

d. When applicable, identify the equipment as an incomplete system or that the appliance accomplishes additional functions beyond that described in paragraphs **3** And **3a** of this TSO.

e. {Include other marking requirements that are unique to this TSO and/or that are specified in APPENDIX 1.} [Example: Optional marking is permitted to allow the use of aircraft specific or operational specific installation limitations, such as the following: “FOR USE ON {insert aircraft type or serial number} ONLY” or reference specific installation drawing number which contains limitations or “FOR USE ON AIRCRAFT USED IN PART {insert number} OPERATIONS ONLY.”]

f. {Consider placing the additional permanent marking, “(Dev)”, after the TSO number, when any deviations have been granted. Any deviations that have been identified by part number, version, revision, and criticality level in the case of software used in the article, classification for use, and environmental categories, and applicable limitations and are described in the installation drawings, IM and/or CMM would qualify.}

5. DATA REQUIREMENTS.

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

[The following is a standard list of applicable data. Other documents deemed essential in addition to those specified in 14 CFR § 21.605(a)(1) and (3) may be included.]

(1) Operating instructions and equipment limitations. The limitations shall be sufficient to describe the operational capability of the equipment. In particular, operational or installation limitations resulting from specific deviations granted must be described in detail.

(2) Installation procedures and limitations. The limitations shall be sufficient to ensure that the *{enter type of equipment}*, when installed according to the installation procedures, continues to meet the requirements of this TSO. The limitations shall identify any unique aspects of the installation. Finally, the limitations also shall include a note with the following statement:

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to 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 if performed under 14 CFR part 43 or the applicable airworthiness requirements.

(ii) When applicable, identify the appliance as an incomplete system or a multi-use system and describe the functions that are intended to be provided by the appliance.

(3) Schematic drawings, as applicable to the installation procedures.

(4) Wiring diagrams, as applicable to the installation procedures.

(5) List of the components, by part number, that make up the *{enter type of equipment}* system complying with the standards prescribed in this TSO. Manufacturers should include vendor part number cross-references when applicable.

(6) Instructions, in the form of a Component Maintenance Manual (CMM) containing information on the periodic maintenance, calibration and repair, for the continued airworthiness of installed *{enter type of equipment}*, including recommended inspection intervals and service life. Details of deviations granted, as noted in paragraph 5a(1) of this TSO, may also be described in the CMM

(7) Material and process specifications list.

(8) 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.

(9) Manufacturer's TSO qualification test report.

(10) Nameplate drawing providing the information required by paragraph 4 of this TSO.

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

(12) An environmental qualifications form as described in *{insert RTCA/DO-160D or the most current revision}* for each component of the system.

(13) If the article includes a digital computer: Plan for Software Aspects of Certification (PSAC); Software Configuration Index; and Software Accomplishment Summary. The FAA recommends that the PSAC be submitted early in the software development process. Early submittal will allow timely resolution of issues such as partitioning and determination of software levels.

b. Manufacturer Data. In addition to the data to be furnished directly to the FAA, each manufacturer must have available for review by the manager of the ACO responsible for the manufacturer's facilities the following technical data:

[The following is a standard list of the generally applicable data. The applicability of each item will vary by TSO and other data may be called out as needed.]

(1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this TSO.

(2) Equipment calibration procedures.

(3) Corrective maintenance procedures within 12 months after TSO authorization.

(4) Schematic drawings.

(5) Wiring diagrams.

(6) Material and process specifications.

(7) The results of the environmental qualification tests conducted in accordance with *{insert RTCA/DO-160D or the most current revision}*.

(8) If the article includes a digital computer, the appropriate documentation as defined in *{insert RTCA/DO-178B or the most current revision}*, including all data supporting the applicable objectives found in *{insert Annex A of RTCA/DO-178B, Process Objectives and Outputs by Software Level or the most current revision}*.

c. Furnished Data. *{Data required will vary with each TSO.}*

(1) One copy of the technical data and information specified in paragraphs *{insert 5a(1) through (6)}* *[These data are generally considered the minimums.]* of this TSO and any other data or information necessary for the proper installation, certification and use and/or for continued airworthiness of the *{insert type of equipment}*, must accompany each article or multiple articles, if furnished to one source, i.e. operator, repair station, etc., manufactured under this TSO.

(2) If the appliance accomplishes any additional functions beyond that described in paragraphs 3 and 3a of this TSO, then a copy of the data and information specified in paragraphs *{enter 5a(11) through (13) as deemed appropriate}* must also go to each person receiving for use one or more articles manufactured under this TSO.

6. AVAILABILITY OF REFERENCED DOCUMENTS. *[List the name and address of all referenced documents.]*

a. You may buy copies of RTCA Document Nos. DO-160D, DO-178B, and DO-229 may be purchased from the RTCA Inc., 1140 Connecticut Avenue, N.W., Suite 1020, Washington, D.C. 20036.

b. You may buy copies of SAE AS XXXX may be purchased from the Society of Automotive Engineers Inc., Department 331, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Copies also can be obtained through the SAE Internet website @ www.sae.org.

c. You may buy copies of Federal Aviation Regulations 14 CFR part 21, Subpart O, *{list other applicable Parts, as needed}* from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402-9325. Copies also can be obtained from the Government Printing Office (GPO), electronic CFR Internet website @ www.access.gpo.gov/ecfr/.

d. Advisory Circular (AC) 20-110 *{or current revision}*, "Index of Aviation Technical Standard Orders," and AC 20-36 *{or current revision}*, "Index of Articles Certified under the Technical Standard Order System" *{list other applicable or referenced ACs, as needed}* may be obtained 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. Copies also may be obtained from the FAA Internet website at www.faa.gov/avr/air/airhome.htm and select from the "Available Information" drop down list.

{enter name}
Manager, Aircraft Engineering Division
Aircraft Certification Service

[APPENDIX 1 for a TSO will take one of the following forms depending on whether the TSO sites an FAA developed standard or references an SAE, RTCA, etc. industry standard.]

APPENDIX 1. FEDERAL AVIATION ADMINISTRATION MINIMUM PERFORMANCE STANDARD FOR *{insert type of equipment}*

1. Purpose. This standard provides the MPS for *{insert type of equipment}*.
2. Scope. This standard covers *{describe the different types or classes of equipment when applicable}*.
3. Detail Requirements. *{Describe in detail the requirements.}*
4. Tests. *{Specify the material, operational, environmental, performance test requirements.}*
5. Pass/Fail Criteria. *{Outline the required pass/fail criteria for each test required in paragraph 4. above.}*

or

APPENDIX 1. MINIMUM PERFORMANCE STANDARD FOR *{insert type of equipment}*

This appendix prescribes the MPS for *{insert type of equipment}*, modified by the FAA in this TSO. The applicable standard is *{State the SAE, RTCA etc. document, name, title, date, etc. of the required standard.}*, and is modified with FAA additions in italics as follows:

1. *[For revisions]* Page *{enter page number}*, **replace** paragraph *{enter paragraph number}* reads as follows:

{Enter the entire paragraph of the referenced MPS with the revised content in italics.}

2. *[For additions]* Page *{enter page number}*, new paragraph *{add new paragraph number}* reads as follows:

{Enter the new paragraph to be added in italics.}

3. *[For deletions]* Page *{enter page number}*, disregard paragraph *{enter paragraph number to be deleted}*. *[Explanation for deletion may be added if needed.]*

APPENDIX 2. STANDARDS APPLICABLE TO ENVIRONMENTAL TEST PROCEDURES

{List the required standard environmental tests and/or the referenced environmental tests in the applicable referenced MPS.}

APPENDIX 3. TEST CONDITIONS

{List the required tests and/or the referenced tests in the applicable referenced MPS.} [Example: SAE AS 8049A incorporates, as a reference, the following test standards for which a more recent revision may be substituted, if approved by the FAA ACO manager having geographic purview over the manufacturers facilities.

- 1. SAE J211 – Instrumentation for Impact Tests*
- 2. 49 CFR 572 – Anthropomorphic Test Dummies]*

APPENDIX 2. FORMAT AND GUIDANCE FOR THE PREPARATION OF TSO AUTHORIZATION LETTER



U.S. Department
of Transportation
**Federal Aviation
Administration**

{enter appropriate ACO}
{enter ACO address}

{enter date}

In reply refer to: *{enter reference number}*

{enter name of applicant point of contact(POC)}
{enter POC's title}
{enter name of company}
{enter street address}
{enter city and mail code}

Dear *{Mr./Mrs./Ms. enter name of applicant POC}*:

This is in reply to your letter of *{enter date of application}* requesting TSO authorization for your *{insert type of article}*. The statement of conformance to TSO-C*{enter applicable TSO number}* and the submitted data are accepted. Effective this date, you are authorized to identify the following *{insert type of article}* with the marking requirements defined in 14 CFR § 21.607(d) and in TSO-C*{enter applicable TSO number}*.

<u><i>{Enter Part/Model} Number</i></u>	<u><i>{Enter type of article} Description</i></u>
<i>{list each part number, with open brackets to allow for minor changes, model number or if both are necessary use two separate columns}</i>	<i>{enter a basic description of equipment, major features that distinguish this part or model number from other part or model numbers in the list}</i>

Your Quality Control System, as defined in your Quality Control Manual, *{insert date of manual}*, is considered satisfactory for production of this article at your *{enter location of applicant's manufacturing facility}* facility.

As required by the TSO, the following statement must be furnished with each manufactured unit:

"The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to 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 if performed under 14 CFR part 43 or the applicable airworthiness requirements.

{A summary statement must be included to describe any approved deviations.}

Any design change to this TSO article must be forwarded to this office as outlined in 14 CFR § 21.611 with minor change submittal intervals not to exceed six months. Also, as recipient of this authorization, you are required to report any failure, malfunction, or defect relating to this authorization in accordance with the provisions of 14 CFR § 21.3.

This authorization is not transferable to another person or location and is effective until surrendered, withdrawn, or otherwise terminated by the Administrator.

Please note that technical data retained by the FAA may be subject to Freedom of Information Act (FOIA) request. As such, this office will notify you of all such request pertaining to your data and afford you the opportunity to defend the release of the data.

If you have any questions regarding this authorization, contact *{enter FAA ACO contact and phone number}*

Sincerely,

{insert name of ACO manager}
{enter appropriate FAA ACO}

cc: AIR-140; *{insert routing symbol of responsible MIDO/MISO}*

APPENDIX 3. FORMAT AND GUIDANCE FOR THE PREPERATION OF LETTER OF TSO DESIGN APPROVAL



U.S. Department
of Transportation
**Federal Aviation
Administration**

{enter date}

In reply refer to: *{enter reference number}*

{enter name of CAA Type Certification Contact}
{enter contact title}
{enter name of authority}
{enter street address}
{enter city and mail code}
{enter country}

Dear *{Mr./Mrs./Ms. enter name of CAA Type Certification Contact}*:

This letter refers to *{insert applicant's company name}* letter Ref. *{if applicable, enter applicant's letter reference number}*, dated *{insert date of letter}*, by which they made application for Technical Standard Order (TSO) design approval. This letter also acknowledges receipt of *{enter name of applicant}* Statement of Conformance dated *{insert date}* and of *{enter name of CAA}* letters Ref. *{insert reference letters numbers}*, dated *{insert letter date}*, certifying in accordance with 14 CFR § 21.617, that *{enter type of appliance}* listed below complies with the requirements of TSO-C*{insert number}*, as designated in 14 CFR § 21.305(b).

Based on the *{insert name of CAA}* certification and receipt of the required data, we hereby accept *{enter name of applicant}* TSO design approval to include the *{insert type of appliance}* listed below for manufacture at *{insert name of applicant}*, located at *{enter complete applicant address}*.

<u><i>{EnterPart/Model} Number</i></u>	<u><i>{Enter type of appliance} Description</i></u>
<i>{list each part number, with open brackets to allow for minor changes, model number or if both are necessary use two separate columns}</i>	<i>{enter a basic description of equipment, major features that distinguish this part or model number from other part or model numbers in the list}</i>

This letter of TSO design approval, together with the *{enter name of CAA}* Certificate of Airworthiness for Export, will authorize *{enter name of applicant}* to identify *{enter type of equipment}* with the TSO marking requirements described in 14 CFR § 21.607(d) and in TSO-C*{insert number}* and is issued in accordance with 14 CFR § 21.617, governing issuance of TSO design approval for import appliances. Each item must be accompanied by a Certificate of Airworthiness for Export issued by the *{enter name of CAA}* or a duly authorized designee/organization (14 CFR § 21.502(a)).

Any deviations from the established design approval should be accomplished in accordance with 14 CFR § 21.609. The request for approval to deviate, together with all pertinent data, should be submitted to the Federal Aviation Administration (FAA) through the *{enter name of CAA}* and should contain information to show that the particular deviation is compensated for by factors or design features providing an equivalent level of safety.

As required by the TSO, the following statement must be furnished with each manufactured unit:

"The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to 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 if performed under 14 CFR part 43 or the applicable airworthiness requirements.

{A summary statement must be included to describe any approved deviations.}

A letter of TSO design approval issued under 14 CFR § 21.617 is not transferable and is effective until surrendered, withdrawn or otherwise terminated by the FAA (14 CFR § 21.621).

The FAA may, upon notice, withdraw the letter of TSO design approval of any manufacturer who identifies with a TSO marking any article not meeting the performance standards of the applicable TSO (14 CFR § 21.619). The *{enter name of CAA}* airworthiness certification is essential to the determination that the item meets the performance standards of the applicable TSO.

Please note that technical data retained by the FAA may be subject to Freedom of Information Act (FOIA) request. As such, this office will notify you of all such request pertaining to your data and afford you the opportunity to defend the release of the data.

If there are any questions, please feel free to have your staff contact *{insert name of ACO point of contact and phone number}*.

Sincerely,

{insert name of appropriate ACO manager}
Manager, *{enter appropriate FAA ACO}*

Enclosures

cc: AIR-140; *{insert routing symbol of responsible MIDO/MISO}*