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StandardSpecification for Manufacturer Quality Assurance Program for Light Sport Gyroplane Aircraft[1]

This standard is issued under the fixed designation F2449; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification sets minimum requirements for light sport gyroplane or gyroplane component quality assurance and production acceptance programs.

1.2 This specification applies to light sport gyroplane aircraft seeking civil aviation authority approval in the form of flight certificates, flight permits, or other like documentation. This specification applies to kit and ready to fly aircraft.

1.3 Certification of compliance with specific individual processes in CEN UNI EN 9100, version 2005 or later, may be presented as compliance with similar representative individual requirements of this ASTM Quality Assurance standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F2352 Specification for Design and Performance of Light Sport Gyroplane Aircraft

F2415 Practice for Continued Airworthiness System for Light Sport Gyroplane Aircraft

2.2 *CEN Standard:*[3]

CEN UNI EN 9100 Quality Management Systems – Aerospace Series

3. Terminology

3.1 *Definitions:*

3.1.1 *LSG (light sport gyroplane)*—used in this specification to refer to both light sport gyroplanes and gyroplane kits.

3.1.2 *LSGA (light sport gyroplane aircraft)*—rotary-wing aircraft designed in accordance with Specification F2352 that is manufactured and delivered ready to fly.

3.1.3 *LSG kit (light sport gyroplane kit)*—complete or gyroplane or gyroplane accessory designed in accordance with Specification F2352 that is manufactured and delivered as a kit.

3.1.4 *manufacturer*—any entity engaged in the production of a LSG.

3.1.5 *permanent record*—where specified in this specification, applicable quality assurance records shall be kept for each LSGA produced for as long as the relative airworthiness certificate remains in effect.

3.1.6 *reserved holding area*—for rejected parts, materials, and assemblies, an area for the containment of rejected non-airworthy items awaiting proper disposition, where such rejected items shall not be distributed for use on a LSGA.

3.1.7 *satellite manufacturing, assembly, and distribution facilities*—refers to facilities being operated by commercial or private entities that, though authorized by the original manufacturer, are not directly associated with or controlled by the original manufacturer.

3.1.8 *secure storage area*—for accepted parts, materials, and assemblies, an area of storage where the preservation of the contents to required design specifications is reasonably assured until distributed for use on a LSGA.

3.2 *Acronyms:*

3.2.1 *AOI*—Aircraft Operating Instructions

3.2.2 *MRB*—Materials Review Board

3.2.3 *QAM*—quality assurance manual; the documentation of the quality assurance program that prescribes the methods of inspections and acceptance criteria

3.2.4 *QAP*—quality assurance program; describes the planned actions used by the manufacturer of a LSGA to verify and ensure the proper production thereof

3.2.5 *QAR*—quality assurance record; the quality assurance record associated with each LSGA produced.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from European Committee for Standardization (CEN), 36 rue de Stassart, B-1050, Brussels, Belgium, http://www.cenorm.be.

4. Significance and Use

4.1 The purpose of this specification is to provide the minimum requirements necessary for the establishment of a quality assurance program for a light sport aircraft manufacturer or component supplier.

5. Quality Assurance Program (QAP)

5.1 Manufacturers of LSG shall develop a Quality Assurance Program (QAP) in accordance with the criteria of this specification.

5.2 *Quality Assurance Manual (QAM)*—Each manufacturer shall document the QAP in the form of a Quality Assurance Manual (QAM).

5.3 *Quality Assurance Administration (QAA)*—The manufacturer's administration charged with QAP implementation may include employees, officials, agents, consultants, or assigns. The QAM shall identify the person(s) within the manufacturing QAA.

5.4 *Quality Assurance Record (QAR):*

5.4.1 The acceptance date, origin, and certifications of materials fabricated into structurally critical LSGA airframe components shall be recorded (see Note 1).

NOTE 1—The intent of this record is to provide a means for the manufacturer to identify and reduce the number of LSG within a fleet that may be affected by a materials anomaly that would require corrective action, thereby reducing the economic impact of such corrective action. This paragraph should not be construed as a requirement for specific parts traceability.

5.4.2 Manufacturer maintains a Quality Assurance Record (QAR) for each LSG produced. Each QAR consists of:

5.4.2.1 Applicable final inspection records, check, and test documentation from the production acceptance procedures (see Section 8),

5.4.2.2 A copy of the Manufacturers Statement of Compliance, and

5.4.2.3 The aircraft configuration at delivery point including associated parts lists and installed equipment lists for continued safety monitoring.

NOTE 2—Each item in 5.4.1 includes the LSG serial number and manufacturing date.

5.5 *Quality Assurance Revisions*—A system shall be implemented to ensure that only the latest revisions to the QAM are in use.

5.6 *Quality Assurance Audits*—The manufacturer shall conduct an annual QAP audit. The manufacturer maintains audit records. The manufacturer resolves any non-compliance issues found in the QAP audit and makes revisions to the QAM where appropriate.

6. Engineering and Manufacture

6.1 *Compliance Record*—The manufacturer records and keeps design compliance documentation for each configuration of light sport gyroplane aircraft or product manufactured in accordance with Specification F2352. Each record shall consist of the following.

6.1.1 A description of the configuration, including installed equipment list and associated parts, and

6.1.2 The current revision of required documentation provided with the aircraft.

6.2 *Configuration Control*—All LSG configurations in production must have a Compliance Record for the current Specification F2352.

6.3 *Production Documentation*—The manufacturer maintains a production documentation record including any revisions. Examples of production documentation include:

6.3.1 Parts lists,

6.3.2 Process routes,

6.3.3 Component and assembly drawings,

6.3.4 Manufacturing instructions and specifications, and

6.3.5 Tooling and gage drawings.

6.4 *Special Processes*—The QAP controls all special processes and services used to produce structurally critical LSGA airframe components, such as welding, brazing, heat treatment, plating, structural composites, adhesives bonding, and so forth. Each process and service must be in accordance with appropriate recorded specifications detailing quality standards and requirements for periodic inspection of solutions, gages, and other critical equipment.

7. Quality Assurance Inspections

7.1 Manufacturers implement and document an inspection procedure verifying product conformity to production specifications in accordance with 6.1.

7.1.1 Conforming, non-conforming, and items awaiting inspection must be separated or clearly distinguishable. Items found nonconforming are evaluated by a Material Review Board (MRB) in accordance with 7.4 or rejected in accordance with 7.5.

7.2 *Receiving Inspection*—The manufacturer implements a purchase procedure that ensures clear specification of all items ordered. Items from outside vendors are inspected for conformance to specifications immediately when received.

7.3 *Acceptance of Conforming Items*—Conforming items are distributed as required or placed in a secure storage area for future use.

7.4 *Evaluation of Non-Conforming Items by a Materials Review Board*—A Materials Review Board (MRB) may determine the nature of non-conforming items. The MRB consists of one or more manufacturer-designated technical representatives. The QAM identifies all MRB representatives. If analysis, additional inspection, functional checks, repair, rework, adaptation, and so forth assure item meets design requirements, the MRB may authorize usage of the item. If not, the item is rejected in accordance with 7.5. The manufacturer keeps a permanent record on the nature of non-conforming items evaluated and accepted by the MRB.

7.5 *Rejection of Non-Conforming Items*—The manufacturer documents and implements a process for disposing of non-conformance items. Examples of how an item may be deemed non-conformant includes damage, shelf life-limits, and other deviations. Otherwise serviceable but non-conforming items may be returned to the supplier. Unserviceable items must be mutilated, destroyed, or sufficiently marked as rejected. This

process must ensure the item can no longer be used on any aircraft. The item can be held in a reserved area prior to disposal.

8. Production Acceptance

NOTE 3—The following criteria should not be construed as requirements for specific features to be included on a LSGA. When a requirement specifies a feature that does not exist on a LSGA, the requirement does not apply.

8.1 *Final Inspections*—Manufacturer shall verify and record that a shop order for each LSGA produced has been completed prior to conducting the following production acceptance procedures.

8.2 *LSG Kit*—Manufacturer shall verify and document the proper production process completion prior to the distribution of any LSG kit or subsystem kit. The manufacturer provides LSG kit builder appropriate production acceptance flight and ground test procedures described below.

8.3 *LSGA*—Manufacturer verifies proper production process completion prior to distribution of flight-ready LSGA. The following ground check and flight test procedures shall be conducted and documented for each flight-ready LSGA.

8.3.1 *Ground Check*—Prior to flight testing, the manufacturer conducts a thorough ground inspection of each LSGA produced to verify at least the following:

8.3.1.1 *Weight and Balance*—Load distribution limits and weight and balance conforming with the AOI and Practice F2415.

8.3.1.2 *Systems Check*—The proper function of all switches and circuits, instrumentation, brakes, and any other appropriate systems shall be verified.

8.3.1.3 *Flight Controls Check*—All flight controls shall be checked for smooth and proper function and proper maximum deflections. Control system connections and safeties shall be checked and verified intact.

8.3.1.4 *Seats and Safety Belts*—Seats and pilot restraint system shall be checked for security and visual defects.

8.3.1.5 *Engine Check*—Engine checks and procedures shall be performed to verify:

(1) Proper engine installation,

(2) Proper servicing of all engine fluids,

(3) No apparent fuel, oil, or coolant leaks, as appropriate,

(4) Propeller installation and pitch adjustment, as applicable,

(5) Performance of an engine "run-in" with adjustments, as required,

(6) Tachometer indicates engine idle RPM and maximum static RPM within manufacturer's published limits,

(7) Proper function of engine instrumentation,

(8) Proper function of ignition system(s), and

(9) Proper function of induction heating system.

8.3.1.6 *Placards Check*—A check verifies all required placards, switch, and instrument markings in place.

8.3.2 *Preflight Inspection*—Verifies the following:

8.3.2.1 All required documentation on board,

8.3.2.2 All visible surfaces free of deformation, distortion, or other evidence of failure or damage,

8.3.2.3 Inspection of all visible fittings and connections for defective or insecure attachment, and

8.3.2.4 Complete walk-around inspection in accordance with the AOI.

8.3.3 *Taxi Test*—After completion of the ground check, a taxi test shall verify:

8.3.3.1 Brake function,

8.3.3.2 Landing gear tracking and steering, and

8.3.3.3 Proper compass readings, verified by a reference, and corrected with compass card if needed.

8.3.4 *Flight Test*—After completion of the taxi test, a flight test shall be conducted.

8.3.4.1 *Operational Safety Flight Test*—Safe flight operation of each completed LSGA shall be verified to include acceptable handling and control characteristics, engine operation, airspeed indications, and overall suitability for normal flight in accordance with the AOI. The flight test procedure at least includes recorded verification of:

(1) Takeoff runway wind, outside air temperature, and pressure altitude,

(2) Verification that takeoff distance meets that published in the AOI,

(3) Verification that the climb rate meets or exceeds that published in the AOI,

(4) Appropriate response to flight controls in all configurations,

(5) Handling and control characteristics,

(6) No unusual performance or handling characteristics, and

(7) Proper engine operating temperatures.

8.3.4.2 *Design Confirmation Flight Test*—Each completed LSG or a random sample at frequency determined by manufacturer, and for the first production unit of each configuration, a test flight will verify production uniformity and compliance with Specification F2352.

8.4 *Instrument Calibration*—Any aircraft instrument requiring periodic calibration shall have a current calibration.

8.5 *Resolution of Discrepancies*—Manufacturer develops and implements correction procedure for anomalies found during ground checks or flight testing.

8.5.1 *Non-Compliance*—Any aircraft which fails a production acceptance test shall be physically tagged as non-compliant. Anomalies can be reworked in accordance with resolution of discrepancies procedures. Each reworked anomaly must be re-evaluated.

8.5.1.1 *Non-Compliance Tag*—A non-compliance notice must be attached to the aircraft in clear view of a potential operator.

8.6 *Production Acceptance Documentation*—A written checklist may be used as a method of documenting production acceptance inspections, checks, and tests.

9. Assignment of QA Duties and Responsibilities

9.1 LSG Manufacturers may assign QA duties and responsibilities to outside parties for the purpose of establishing satellite manufacturing, assembly, or distribution facilities, or a

combination thereof. However, this does not relieve the manufacturer of overall QA responsibility for the accomplishment of these activities.

10. Keywords

10.1 gyroplane; light sport aircraft