



Responsible Office: Quality Assurance Branch, Safety and Mission Assurance Office

SUBJECT: Langley Research Center (LaRC) Requirements for Safety-Critical Product Testing

1. POLICY

- a. This directive defines safety-critical products and prescribes policy and responsibilities for conducting receipt inspection and quality assurance testing on safety-critical products and spaceflight products prior to distribution or use at Langley Research Center (LaRC).
- b. Safety-critical products are subject to the following policy, unless such items fall under Attachment B, Exceptions:
 - (1) All safety-critical products, regardless of procurement method or source of supply, shall be sent to the Materials Analysis and Quality Assurance Laboratory (MAQAL) upon delivery.
 - (2) No safety-critical products shall be distributed or utilized at LaRC prior to receipt inspection and quality assurance testing by the MAQAL.
- c. Products used for Non-spaceflight safety-critical Applications:
 - (1) Prior to use, users of safety-critical products for non-spaceflight hardware applications shall assure that evidence of compliance to this policy is available for each safety-critical item.
 - (2) Alternatively, a sample of the product may be provided to the MAQAL prior to use if lot traceability has been maintained.
 - (3) A completed LF 248, "MAQAL Work Request" shall accompany samples provided to the MAQAL.
 - (4) When lot traceability has been lost, the product shall not be used in a safety-critical application.
 - (5) Fastener and related hardware products shall be inspected and tested following requirements identified in LMS-CP-4520.6, "Receipt Inspection for Fastener, Insert and Nut Products."
 - (6) Non-fastener products shall be inspected and tested following requirements identified in LMS-CP-4520.5, "Receipt Inspection for Safety-Critical Products."

d. Products used for Spaceflight Applications:

- (1) Non-fastener Products: These products shall be handled as required by the Product Assurance Plan (PAP).
 - (a) Unless indicated otherwise by the PAP, users of these safety-critical products, prior to their use in a spaceflight application, shall assure that evidence of compliance to this policy is available for each safety-critical item.
 - i. Alternatively, if such evidence is lacking, a sample of the product may be provided to the MAQAL prior to use if lot traceability has been maintained.
 - ii. A completed LF 248, "MAQAL Work Request" shall accompany samples provided to the MAQA Laboratory.
 - iii. When lot traceability has been lost, the product shall not be used in a safety-critical application.
 - (b) Non-fastener products shall be inspected and tested following requirements identified in LMS-CP-4520.5, "Receipt Inspection for Safety-Critical Products."
- (2) Fasteners and Related Hardware Products: All complete lots of fastener products, used for spacecraft applications, such as threaded bolts, nuts, inserts, washers, rivets, shear-pins and set-screws used in spaceflight hardware shall be provided to the MAQAL, together with a completed LF 290, "Fastener Work Request – MAQAL", for appropriate inspection and testing required by NASA-STD-6008, "NASA Fastener Procurement, Receiving Inspection, and Storage Practices for Spaceflight Hardware" and LMS-CP-4520.6, "Receipt Inspection for Fastener, Insert and Nut Products."
 - (a) Traceability requirements for these products are set forth in LAPD 5330.3, "Langley Research Center (LaRC) Standards for the Acquisition of Use of Threaded Fasteners." In order to correctly fill out LF 290, specific information as to the engineering design application destined for each fastener product shall be supplied by the appropriate engineering organization.
 - (b) Fastener application classifications such as "Fracture Critical," "Low-Risk Fracture," "Fail-Safe," "Low-Released Mass," and "Contained" shall be correctly identified for all spaceflight fastener products.
 - (c) Definitions of these engineering design application classifications for fastener products are given in LMS-CP-4520.6.

2. APPLICABILITY

- 2.1 This LAPD is applicable to all LaRC employees who use safety-critical products, as defined in Attachment B, procured by the Government at the NASA Langley Research Center. Safety-critical products procured by contractors and provided to the Government are subject to the quality assurance requirements defined within their respective contracts. Such products may be subject to quality assurance audits as provided by the terms and conditions of the contract.

3. AUTHORITY

None

4. APPLICABLE DOCUMENTS AND FORMS

- a. LAPD 5330.3. "Langley Research Center (LaRC) Standards for the Acquisition of Threaded Fasteners (Bolts)."
- b. LPR 1740.4, "Facility System Safety Analysis and Configuration Management."
- c. NASA-STD-6008, "NASA Fastener Procurement, Receiving Inspection, and Storage Practices for Spaceflight Hardware."
- d. LMS-CP-4520.5, "Receipt Inspection for Safety-Critical Products."
- e. LMS-CP-4520.6, "Receipt Inspection for Fastener, Insert and Nut Products."

5. RESPONSIBILITY

- a. Logistics Management Team, Center Operations Directorate shall: Ensure that all safety-critical stock and excess products received at the Center are tested prior to incorporation into Center stock or dissemination to users.
- b. All recipients of safety-critical products (regardless of procurement mechanism) shall:
 - (1) Ensure that the products are tested by the MAQAL prior to use or distribution of the products.
 - (2) Call the MAQAL (867-6887 or 864-6890) if unsure whether any given product requires MAQAL testing prior to use and distribution at LaRC.

6. DELEGATION OF AUTHORITY

None

7. MEASUREMENT/VERIFICATION

None

8. CANCELLATION

LAPD 4520.1 dated December 21, 2000

Original signed on file

Stephen G. Jurczyk
Deputy Director

APPENDIX A - DEFINITION

A.1 A **safety-critical product** is any item that meets any of the following conditions:

- a. Any high-strength fastener/nut/insert/retention-device used in non-spaceflight flight project hardware and associated ground support equipment as defined within the scope of LPR 5300.1 – “Product Assurance Plan”. These projects include all sub-orbital flight tests supporting space flight programs, low-risk flight projects, risk reduction flights or flight experiments; flights of opportunity that are sub-orbital; involve sounding rockets; un-crewed aerospace vehicles; and major drop models or Unmanned Aerial Vehicles (UAV) as decided by LaRC Center Management. Excluded from this definition are projects involving aircraft experiments.
- b. Any fastener or other component used in a Langley facility that is critically loaded/stressed (factor of safety is less than 4 on ultimate strength and 3 on yield strength) and whose failure can result in critical or catastrophic (Category I or Category II) injury/facility damage, as defined in LPR 1740.4, "Facility System Safety Analysis and Configuration Management." The factor of safety calculation shall be made by the appropriate engineering organization. The Facility Safety Head or Project Engineer shall contact cognizant center personnel (e.g., Model Systems SPE) for guidance to determine the appropriate engineering organization. A fastener is any single part which joins other structural elements and transfers loads from one element to another across a joint.
- c. All Pressure Vessel and System (PV&S) components which are not excluded by LPR 1710.40, "Langley Research Center Pressure Systems Handbook";
- d. Stock item designated with a “QC” code.

A.2 Examples of potential safety-critical items:

- a. Fasteners:
 - (1) Bolt-Machine
 - (2) Key-Socket Head Screw
 - (3) Nut-Plain, Hexagon
 - (4) Nut-Self-Locking, Extended
 - (5) Nut-Self-Locking, Hexagon
 - (6) Screw-Cap, Socket Head
 - (7) Screw-Cap, Hexagon Head
 - (8) Screw-Machine
 - (9) Screw-Self-Locking
 - (10) Setscrew

- (11) Washer-Flat
- (12) Washer-Lock

- b. High-Pressure Fittings include the following pipes, tubes, tube fittings, adapters, nuts, valves:
 - (1) Adapter-Straight, Pipe to Tube
 - (2) Adapter-Straight, Tube to Hose
 - (3) Bushing-Pipe
 - (4) Cap-Tube
 - (5) Coupling-Pipe
 - (6) Cross-Pipe
 - (7) Elbow-Pipe
 - (8) Elbow-Pipe to Tube
 - (9) Elbow-Tube
 - (10) Nipple-Pipe
 - (11) Nut Union
 - (12) Pipe-Metallic
 - (13) Plug-Tube Fitting, Threaded
 - (14) Reducer-Tube
 - (15) Sleeve-Flared, Tube Fitting
 - (16) Tee-Tube
 - (17) Thread Piece-Union
 - (18) Tube-Metallic
 - (19) Union-Pipe
 - (20) Union-Tube
 - (21) Valve-Angle
 - (22) Valve Assembly-Relief and Regulating
 - (23) Valve Ball
 - (24) Valve-Check
 - (25) Valve-Globe
 - (26) Valve-Regulating, Fluid Pressure
 - (27) Valve-Safety Relief

- c. Metal plates and shapes include the following:
 - (1) Angle-Structural
 - (2) Blade-Band Saw
 - (3) Bar Metal
 - (4) Billet-Metal
 - (5) Sheet-Metal
 - (6) Strip-Metal
 - (7) Plate-Metal

- d. Electronic/electrical parts include the following adapters, cables, capacitor, clamps, connectors, jacks, leads, plugs, relays, retainers, resistors, switches, terminals, transistors, and wires:
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|--|---------------------------------------|
| (1) Adapter-Connector | (25) Null Modem Interface-Connector |
| (2) Adapter-Test | (26) Post-Binding, Electrical |
| (3) Cable-Power, Electrical | (27) Plug-Telephone |
| (4) Cable-Radio Frequency | (28) Plug-Tip |
| (5) Cable-Special Purpose, Electric | (29) Relay-Electromagnetic |
| (6) Capacitor-Fixed, Ceramic Dielectric | (30) Retainer-Electronic |
| (7) Capacitor-Fixed, Electrolytic | (31) Resistor-Adjustable |
| (8) Capacitor-Fixed, Mica-Dielectric | (32) Resistor-Fixed, Composition |
| (9) Capacitor-Fixed, Plastic Dielectric | (33) Resistor, Fixed, Film |
| (10) Clamp, Cable-Electrical Connector | (34) Resistor Fixed, Wire Wound |
| (11) Connector-Assembly-Electrical | (35) Resistor-Variable, Hybrid |
| (12) Connector Body-Plug, Electrical (BNC) | (36) Resistor-Variable, Nonwire Wound |
| (13) Connector-Components | (37) Resistor-Variable, Wire Wound |
| (14) Connector Plug, Electrical | (38) Semiconductor Device-Diode |
| (15) Connector Plug, Electrical (BNC) | (39) Semiconductor Device-Unitized |
| (16) Connector Plug, Electrical (KPT) | (40) Semiconductor Device-Zener Diode |
| (17) Connector Plug, Electrical (SMA) | (41) Shield-Electronic Connector |
| (18) Connector-Receptacle, Electrical | (42) Socket-Plug-In Electronic |
| (19) Detent-Switch | (43) Surge Protector |
| (20) Fuseholder-Extractor Post | (44) Switch-Mercury |
| (21) Jack-Telephone | (45) Switch-Push |
| (22) Jack-Tip | (46) Switch Section-Rotary |
| (23) Lead-Test | (47) Switch –Sensitive |
| (24) Lead Set-Test | (48) Switch-Toggle |
| | (49) Test Adapter |
| | (50) Terminal Board |
| | (51) Transistor |
| | (52) Wire-Electrical |

ATTACHMENT B - EXCEPTIONS

- B.1** System components (e.g., high-pressure piping systems) that are assembled into a system that is (1) designed, built, and tested in accordance with National Consensus Codes; (2) placed or to be placed into the Center's Configuration Management program; **and** (3) maintained in accordance with National Consensus Codes, and Agency and Center policies, are exempt from this policy.

NOTE: REPLACEMENT COMPONENT PARTS NOT TESTED WITH THE INITIAL ASSEMBLED SYSTEM ARE SUBJECT TO THIS POLICY.

- a. Spaceflight products/systems, manufactured and assembled at a site external to LaRC, which are undergoing design/specification reviews and government oversight shall be exempt from this policy.
 - b. Upon written request for exemption, safety officials from the Safety and Mission Assurance Office may review a specific product/system and grant a waiver from this policy. Users shall maintain the written waiver as evidence of compliance with this policy.
- B.2** All Electrical, Electronic or Electromechanical (EEE) parts and products are exempt from this policy and should be taken, together with associated specifications, to the Electronic Systems Branch, EEE Parts Receipt Inspection and Bonded Stores (RIBS) Facility, located in Building 1202.