TCOM Quality Codes

Rev: New 01/04/2021

Code	Requirements
1	CALIBRATION SYSTEM REQUIREMENTS Supplier shall maintain a calibration system to assure that all inspection, measuring, and test equipment used to determine compliance with specifications are calibrated to standards traceable to national or industry-accepted standards.
2	CHANGE AUTHORIZATION A Purchase Order Change Notice and a drawing/specification revision notice shall constitute change authorization.
3	SOURCE INSPECTION Source inspection required for this item before shipment. ***Contact TCOM's Buyer to schedule an inspection.***
4	IN-PROCESS INSPECTION In-process inspection required for this item prior to finishing and assembly. Welded assemblies require in-process inspection of welded joints and assembly dimensions prior to paint preparation and application. ***Contact TCOM's Buyer to schedule an inspection.***
5	NON-CONFORMING MATERIAL LIMITATIONS Non-conforming material shall not be used or shipped without written approval from TCOM Quality Assurance . Supplier shall notify TCOM, in writing, of non-conformity for formal Material Review Board action. The following requirements are effective as of June 18th 2018: For electronic components: The seller shall ensure that only new and authentic materials are used in products delivered to TCOM , LP. The seller may only purchase parts directly from Original Component Manufacturers (OCM), OCM authorized (franchised) distributors or authorized aftermarket manufacturers. Use of product that was not provided by these sources is not authorized unless first approved in writing by TCOM , LP. The seller must present compelling support for its request (e.g., OCM documentation that authenticates supply chain traceability of the parts to the OCM), and include in its request all actions to ensure the parts thus procured are authentic/conforming parts. The Organization shall disclose in writing at the time of each individual quotation, the source of supply by company name and location, whether or not the Organization is authorized (franchised) for the part(s) being quoted and whether or not providing full manufacturer's warranty on the quoted material. If the Organization considers that the name of the source of supply is proprietary to the Organization, the Organization and TCOM, LP shall negotiate an appropriate non-disclosure agreement. Non-OEM/non-authorized Sellers: The seller shall establish and implement test and inspection activities necessary to assure the authenticity of purchased product, in accordance to the requirements established by TCOM through its customer's requirements including: Supply chain traceability and documentation verification, visual examination, and other tests and inspections in accordance with defined accept/reject criteria provide or approved by TCOM (ref Appendix E of SAE AS5553). The seller shall prepare and provide to TCOM records evidencing tests and inspections performed and conformance of the produc t to the specified acceptance criteria. Tests and inspections shall be performed by persons that have been trained and qualified concerning the types and means of EEE parts fraud and counterfeiting and how to conduct effective product authentication. If suspect or confirmed fraudulent/counterfeit EEE parts are furnished under this purchase agreement, such items shall be impounded. The seller shall promptly replace such items with items acceptable to TCOM and the seller nay be liable for all costs relating to impoundment , removal and replacement. TCOM may turn such items over to the authority having jurisdiction (e.g., Office of Inspector General, FBI, etc.) for investigation and reserves the right to withhold payment for the items pending the results of the investigation.
6	Certificates of Compliance/Conformance A certificate of compliance/conformance is required to provide quality evidence of specific characteristics of the material supplied as indicated on the drawing, specification, or purchase order (e.g., test results, heat treatment, surface finish, material, standard specification, etc.). Valid certifications shall clearly identify the manufacturer or supplier of the certified characteristic, shall contain enough information to identify the C of C with the item or material supplied, shall reference the specific characteristic(s) being certified, and The following requirements are effective as of June 18th 2018: For electronic components: The Manufacturer and the seller of its products shall complete a C of C and full supply chain traceability for all parts. The C of C supplied by the Manufacturer shall be copied and passed through to the end customer . The seller's C of C shall also accompany each shipment of product to the end customer. In no case shall the manufacturer's C of C be altered or show signs of alteration . The seller shall retain copies of certificates with the lot records until the lot is completely shipped and shall retain the product and shipment traceability for a period consistent with the contract requirements. A manufacturer's C of C should include the Manufacturer's name and address, Manufacturer's and/or buyer's full part number and part description, batch identification for the item(s) such as date codes, lot codes, serializations or other batch identifications, signature or stamp with the title of seller's authorized personnel signing the certificate.
7	SOLDERING/ELECTRONIC WORKMANSHIP STANDARDS Unless specified otherwise on the TCOM purchase order, drawing, or specification, the manufacture and handling of soldered assemblies shall comply with the requirements of ANSI/J-STD-001 [Latest Revision], Class 2., Cleanliness Designator C-20. Quality acceptability requirements shall be in accordance with the Class 2 acceptance criteria of ANSI/IPC-A-610 [Latest Revision] for Electronic Assemblies and IPC/WHMA-A-620 for Cable and Wire Harness Assemblies. TCOM Suppliers doing A & W (assembly and wiring) work on TCOM kitted parts or providing completed assemblies that include electrical/electronic component soldering or wiring on TCOM purchase orders shall comply with PS-10052 [latest revision].
	WELDING REQUIREMENTS For the purposes of interpreting the welding codes on this contract, your firm is "the Contractor" and TCOM is the "Owner" and the "Engineer" is TCOM's duly appointed employee. Welding procedures, welders and weld inspectors shall be qualified in accordance with the welding code referenced in the drawing or specification. Welders and weld inspectors shall be certified in accordance with the welding code referenced in the drawing or specification. The use of any welding codes or specifications not referenced by the applicable drawings must be approved by TCOM prior to production. "Equivalent" codes are usually limited to: The ASME Pressure Vessel Code A Military (MIL-) Standard as modified by some particular branch of the Department of Defense (example: NAVSEA) The Supplier shall be prepared to show, by records, that successful welds can be made for the material type, joint types, material thicknesses and welding positions required while using the Supplier's facility, equipment and personnel. With rare exceptions (for some pre-qualified steel joints and for welders who perform a first PQR), TCOM will expect to have access to or copies of all the following documentation: A Welding Procedure Specification (WPS) – this describes the welding process and joints in detail. A Procedure Qualification Record (PQR) – this proves that the Supplier's equipment can make the joints. A Welder's Qualification -– based upon a separate test for any welder who did not perform the PQR. Data on filler metal certification – the alloy used should conform to the WPS. Data on shielding gas certification – the gas used should conform to the WPS. Letter of appointment and a Jaeger/Snellin Vision Test less than 1 years old for those Inspectors-on-staff NOT holding a valid AWS credential for SCWI/CWI/CAWI A written report of visual inspection, in the contractor's format, covering all welds and meeting the requirements of the applicable Code. (Inspectors are expected to regularly observe joint preparation, assembly practice, welder technique and performance to make certain that Code requirements are met during the fabrication/erection process.)

8	Minimum qualifications and visual inspections are as follows: AWS D1.1 2010 [Steel] – Section 6.1.4, 6.6.1 & C6. AWS D1.2 2008 [Aluminum] – Section 5.1.3, 5.6.1 & C5 AWS D1.3 2008 [Sheet Steel] – None {Section 6} and 6.1.1 AWS D17.1 2010 [Aerospace] – Section 6.1.2, 6.1.3, 6.3 & C5.21
9	SUBMISSION OF INSPECTION RECORDS A legible and reproducible copy of the Supplier's inspection report is to be submitted with this item. Each inspection document, in Supplier format, shall evidence compliance with the applicable drawing and/or specification requirements and shall include the part number, applicable drawing and/or specification with revision letter or number, and the signature on title of the responsible agent of the Supplier. All actual measurements of specified drawing dimensions shall be recorded - the Supplier's Engineer or Quality Manager shall have dispositioned any indications of "out-of-tolerance" conditions. Inspection records for welded assemblies shall reflect assembly dimensions after completion of welding. Unless otherwise noted, all drawing dimensions shall be recorded before painting and/or plating. When serialization is required by the drawing or specification, such serialization shall be a part of the inspection/test report data.
10	SUBMISSION OF TEST DATA SHEETS A legible and reproducible copy of the test data sheets are to be submitted with this item. If TCOM has supplied a test document then that document shall be used; otherwise the test report shall be in Supplier's format. Each test document shall evidence compliance with the applicable drawing and/or specification requirements and shall include the part number, applicable drawing and/or specification with revision letter or number, and the signature on title of the responsible agent of the Supplier. All actual measurements of specified test performance shall be recorded - the Supplier's Engineer or Quality Manager shall have dispositioned any indications of "test failure" conditions.
11	RETENTION OF INSPECTION/TEST RECORDS Inspection (Code 09) and test (Code 10) records shall be maintained at the Supplier's facility for a period of five years.
12	FAILURE ANALYSIS REPORT Failure analysis report shall be delivered with the item returned for repair and/or analysis.
13	REQUIREMENTS FOR AND RETENTION OF MATERIAL CERTIFICATION The bill of material or parts list for the items ordered include a requirement for particular metal alloys (or sometimes special non-metallic raw materials) whose physical properties depend upon chemical composition or processing. Such properties must be proven by providing a certificate of analysis (COA), usually obtained from the Sub-supplier that sold the raw material, which records actual chemical composition data. Supplier shall retain on file, for a period of five years, the certifications for raw materials used to manufacture this item. Suppliers should demand a substantial certificate from their raw material Sub-suppliers; a proper COA should include actual discrete data (physical and chemical analysis report) taken from the lot of material supplied and the actual quantity of each constituent measured should be listed and compared to the requirements of each constituent identified in the applicable specification. Unidentified and untraceable raw materials may not be used without TCOM's advance approval and if the Supplier's chosen raw material pedigree is indeterminate and the chemical composition is uncertain, TCOM may require the Supplier to have the material tested by a lab to determine its composition and properties before proceeding with the work. The COA should be checked and annotated by the Supplier to trace the Sub-supplier's raw material lot to the Supplier's TCOM's job and signed by a quality assurance or other assigned representative of the Supplier identified by name and job title. In some cases, TCOM has attempted to provide some latitude in material shape selection by specifying only the base alloy (and not the applicable specification) in the drawing parts list or bill of material. Where TCOM has not provided any particular specification, use the table below (for materials not listed, contact your TCOM buyer and provide the specification reference you plan to use to ensure conformance to requirements):
14	MRB AUTHORITY DELEGATION Supplier is authorized to disposition non-conforming material in accordance with established Material Review Board (MRB) procedures that have been approved by TCOM. This authority is limited to aspects of the item inside the boundary controlled by TCOM's configuration description (a.k.a. "Class II") that might otherwise be transparent to any customer or end-user. If this code appears on the purchase order, the Supplier was usually the Original Equipment Manufacturer (OEM) of a commercial part whose design was captured in a TCOM Source Control Drawing or else the Supplier participated substantially in the design of the product or its manufacturing process. In such cases, the Supplier is usually in possession of the superior knowledge necessary to determine dispositions; the intent here is grant the supplier latitude in dealing with manufacturing defects or sub-supplier material/service issues without unnecessary interference from TCOM. If a non-conforming material issue affects form, fit, function or any other TOP LEVEL (a.k.a. "Class I") requirement (in TCOM's drawing, specification or purchase order and QA-codes) then the Supplier must promptly notify TCOM in writing (prior to release of the part for shipment) and obtain: TCOM concurrence with any repair/rework disposition. TCOM permission to use-as-is and ship (if deemed fit-for-use). TCOM permission to scrap and replace (for LLTM items which may affect TCOM's schedule).
15	PACKAGING FOR LITHIUM BATTERIES Lithium batteries shall be packaged and transported per current OSHA/DOT regulations.
16	SHELF LIFE MATERIAL REQUIREMENTS Material susceptible to quality degradation due to aging shall be marked with the date of manufacture or when the useful shelf life will be expended. Upon receipt at TCOM, material shall have a minimum of 80% shelf life remaining.
17	HYDRAULIC COMPONENTS/SYSTEMS REQUIREMENTS Hydraulic components and/or systems shall be supplied with a cleanliness level of NAS 1638 Class 8 or better. Plumbing/manifold, tubing, hoses and similar assemblies shall have no residual interior corrosion by-products (loosely adhering rust or scale) or other foreign material; shall have been flushed clean with hydraulic fluid; and shall be capped before shipment. If the part requires pickling (acid cleaning followed by passivation and hydraulic oil coating) of piping/manifolds or tanks to remove corrosion then this shall be done before flushing. Items built to a TCOM drawing that require pressure testing shall be tested hydrostatically (using potable water) before flushing or in conjunction with flushing (using the flushing hydraulic oil) - calibrated gauging (Code 01) shall be used. Criteria, unless otherwise specified shall be "no leaks" following 10 minutes at the maximum test pressure - "no leak" means no discernable pressure drop or no formation of any droplet of oil within the tested boundaries (the supplied item).
18	CONTINUITY CHECK REQUIREMENTS All electrical circuits shall be continuity checked to the schematic.
19	ACCEPTANCE TEST REQUIREMENT The unit shall pass a performance acceptance test prior to acceptance by TCOM Receiving Inspection.
20	WITNESSED PREPARATION FOR SHIPMENT Supplier is responsible for the protective wrapping, boxing, and/or crating of all items as required to prevent physical and surface finish damage (including contamination/intrusion by foreign material) during shipping and handling from place of origin to destination. TCOM shall be notified prior to the loading phase. TCOM Representative shall be present and witness the loading, packing and securing of equipment to the vehicle.
21	FIT CHECK Supplier is required to Fit-Check/Assemble the items purchased following/in conjunction with Quality Assurance In-Process or Source Inspection.
22	MECHANICAL ASSEMBLY ONLY For items requiring both mechanical and electrical assembly operations, Supplier is to perform mechanical assembly only.
23	COMPRESSION SPRING TESTING Supplier will test a random sample (per MIL-STD-105 or equivalent ISO standard) for spring rate and for load at specific points per the drawing. If the drawing has no load points, test at 20% and 80% compression. A written report will be shipped with the parts.
	DOMESTIC SOURCES ONLY

24	In order to provide complete traceability, the parts supplied on this purchase order shall be procured only from domestic sources located in the United States of America. The vendor may supply parts made in his factories located in North American Free Trade Association (NAFTA) nations, as long as complete, traceable product data is established, maintained and accurate for certification of all materials and processes. When a certificate of compliance is also requested (Code 06), records will be provided showing that the parts were manufactured by a domestic source.
25	Sole Source Required for OEM The part numbers for items supplied on this purchase order contain identifying information for a particular Original Equipment Manufacturer (OEM). Suppliers may obtain parts from any authorized distributor of that OEM, but no substitution of source is allowed. Identical part numbers are necessary but are not sufficient evidence to prove the OEM source. When a certificate of compliance is also requested (Code 06), records will be provided showing the proper OEM Supplied the original parts delivered under this purchase order. The following requirements are effective as of June 18th 2018: For electronic components: The seller shall maintain a method of item supply chain traceability that ensures tracking of the supply chain back to the manufacturer of all Electrical, Electronic, and Electromechanical (EEE) parts included in assemblies and subassemblies being delivered per this contract. This supply chain traceability method shall clearly identify the name and location of all of the supply chain intermediaries from the manufacturer to the direct source of the product for the seller and shall include the manufacturer's batch identification for the item(s) such as date codes, lot codes, serializations, or other batch identifications.
26	VISCOSITY REQUIREMENTS Liquid raw materials or chemicals ordered on this Purchase Order are required to be within specified viscosity limits. The Supplier shall test that the viscosity of the liquid supplied meets the requirements of TCOM's Specification (the viscosity in thousands of cps is usually part of the TCOM part number following a dash). Material supplied under this item will be measured using a calibrated instrument (Code 01) and results of the viscosity test will be sent with the item purchased.
27	NONDESTRUCTIVE TEST/EVALUATION (NDT/E) REPORTS Supplier must have (on staff or under subcontract) a competent person to provide all nondestructive testing required for this work. Supplier must submit the credentials of this competent person showing qualification to a relevant standard (ASNTS NT-TC-1A Recommended Practice or NAS 410 or equivalent) along with a report on nondestructive tests conducted and the results thereof. Individuals casually nominated by the Supplier based on perceived skill or experience who are without documented formal training and Level II or III certification will NOT be accepted. The competent person performing this work must do it on a regular basis in support of the Supplier's own ongoing production or else shall be employed by a sub-contracted firm that specializes in providing NDT/E. Preferred NDT/E Suppliers shall have at least one audit-based approval by a major company or the Government that supports competency in the relevant technique (PT/UT/MT/RT/Eddy-Current) - examples of preferred Suppliers include: •Use a Raytheon-approved supplier in good standing. •Use a NADCAP-approved supplier. •Use a Northrop-Grumman-approved ASPL supplier. •Use a Lockheed-Martin-approved QCS-001 supplier. •Use a Boeing-approved D1-4426 supplier. If no existing approvals are in place, TCOM may choose to audit the Supplier/sub-supplier prior to awarding the work; if shortfalls are found, corrective/preventive actions must be taken (under a control plan) to become a TCOM supplier of the part requiring NDT. The Supplier (or sub-supplier) must have written procedures and any supporting technique sheets under document and revision control; these procedures must be on-site and available for review at each in-process or final inspection event and at other times (at the supplier's plant) upon request. The Supplier's findings shall be reported on an appropriate form, including the name of the NDT/E technician and the approval signature and title of a responsible agent of the Supplier. An adequate method of identifying and cross-referencing each film exposure, report, and item must be provided. When dye penetrant (PT) is specified, pre-cleaning shall be per ASTM-E-1417. When radiographic inspection is specified, certified personnel shall perform the Supplier's reading and interpreting of the X-ray film. The X-ray film shall accompany the shipment of the items and report.
28	VISUAL WELDING INSPECTION Supplier must have (on staff or under subcontract) a competent person to provide all visual welding inspection (including fit-up, in-process and final fabrication/erection inspections) required for this work. Supplier must submit the credentials of this competent person showing qualification (to AWS QC1 Standard for AWS Certification of Welding Inspectors or equivalent) along with a report of visual weld inspections conducted and the results thereof. “Competent person” means a person holding an active, valid American Welding Society CWI (or SCWI/CAWI) credential. “or equivalent” means a valid credential-in-force from a 3rd Party regulatory body or industry/trade association relevant to an alternate welding code that is accepted by TCOM (ASME Pressure Vessels, MIL-STD DoD Welding, etc.). Some NDT credentials (PT, UT, RT) may also include sufficient visual welding inspection training so that they will be accepted, too. It is NOT sufficient to appoint a Contractor’s inspector meeting only the minimum AWS Code standards for qualification (by asserting a Contractor-accepted combination of education, training and experience). TCOM‘s customary Owner/Engineer inspections (conducted at In-process or Source Inspection) by TCOM’s own staff CWI/CAWI will not fulfill this requirement.
29	TRACEABILITY REQUIREMENTS FOR TYPE-CERTIFIED AIRCRAFT Parts supplied under this purchase order to be used by TCOM in a type-certified aviation vehicle (one which is manned or operates over populated areas). The U.S. Federal Aviation Administration (or an equivalent international regulatory agency) requires TCOM to have part traceability information suitable for aircraft. Supplier must submit objective evidence (records) to TCOM with the parts of: 1. Complete raw material traceability (before processing operations) 2. Complete production traceability (following processing operations) 3. Certificate of conformance/compliance (to TCOM's purchase order/drawings/specifications) For raw materials, this means that the Supplier must pass onto TCOM the source and pedigree (batch/heat/lot number) of piece parts or raw materials provided to the Supplier by vendors. If not available, Supplier must perform and submit any physical or chemical test reports that prove the raw materials. For production traceability, this means that a batch/lot number must be assigned by the Supplier for his own processing/manufacturing operations that turned the raw materials into the finished parts/assemblies. The reason for these requirements is that the FAA must be able to trace back (through TCOM, L.P. and the Supplier) to the raw material and have an unbroken chain of inspection and test records that prove that all parts supplied on this purchase order are properly made from the correct materials and conform to approved drawings and specifications. The Supplier must certify that this is the case and submit the necessary records.
30	SMOOTH EDGE/DEBURRING REQUIREMENTS When notes on the drawing refer to deburring and removal of sharp edges, Suppliers make this voluntary, advance agreement per ANSI B46.1 regarding edge flaws. Parts without a specific radius or chamfer, but requiring deburring and removal of sharp edges, will meet the standard in this paragraph [loosely based on Class 1 criteria (depending on the part thickness) per un-adopted Mass Finishing Job Shops Association standard MFJSA Standard 1. 1992]. Class 1 applies to parts of thickness (t) of 0.100 or less and these shall have a radius of t/10 or greater while still meeting all other drawing criteria. Class 1 edges must also be burr-free at 5x magnification. Class 2 edges applies to parts of thickness (t) over 0.100in and these shall have a radius of 0.010in or greater while still meeting all other drawing criteria. Class 2 edges must be burr-free at no magnification (naked eye). Visual inspections shall not permit projections beyond the plane of adjacent surfaces. Edges defined to Class 2 level of finishing will be smoothed to the extent that hands will not be cut nor would electric wires or mating parts.
	QA/QC System Approval or Control Plan

	Prior to award of a contract for the work described in this purchase order , the supplier's Quality System must be surveyed by and approved by TCOM. The survey will require an actual visit to the supplier's facilities where the work is to be done; examples of non-proprietary documents and records relevant to the supplier's management of quality must be made available for review; supplier personnel responsible for quality must be made available for discussions with TCOM QA . TCOM will use SAE AS9003, Inspection and Test Quality System, as the basis of comparison when evaluating the supplier's quality system. AS9003 is available from the SAE . When there are areas of the supplier's Quality System that do not generally meet AS9003, TCOM will require that contract- specific processes are implemented for this individual purchase order. TCOM will decide upon a Control Plan that may require additional effort from the supplier (expenditures for labor or materials/services) to provide documented proof that quality requirements are met. After the control plan is drafted, TCOM may need to obtain Prime Contractor or Customer approval of the supplier and any control plan; if other authorities disapprove of any part of TCOM's planned arrangements or if the supplier declines the additional controls, TCOM may choose not to award the purchase order and TCOM will find others to perform the work . Any Control Plan will, as a pre-condition for award, become a binding part of the contract for the supplies and services on this purchase order. The following requirements are effective as of June 18th 2018: For electronic components:
31	The seller shall have a quality management system that complies with ISO 9001 and when required SAE AS9120 or AS9100. Independent certification/registration is not required unless specified by TCOM. Organizations that obtain certification/registration to ISO9001 (AS9120, AS9100) and subsequently change certification/registration bodies (CRB), lose registration status or are put on notice of losing registration status, shall notify TCOM's purchasing department within three days of receiving such notice from its CRB.
	GOVERNMENT SOURCE INSPECTION
32	All items supplied under this Purchase Order are subject to inspection by a Government Quality Representative at the Seller's facility, or at the facility of a subcontractor to the Seller, prior to shipment. Detailed parts of assemblies are subject to Government inspection or Government witness of Seller inspection prior to assembly and of any tests after assembly. Intermediate Government inspection does not, however, negate requirements for the Seller's inspection/test of the finished item prior to shipment. The Seller shall make available his inspection records to the Government Quality Representative at the time of presentation of the produced items. The seller shall notify TCOM Purchasing no less than seventy-two (72) hours in advance of the time items are ready for inspection or test (if Government inspector resides at your facility) or no less than eight (8) days in advance (if Government not in residence). TCOM Quality Assurance will make notifications and arrange for the Government Quality Representative to attend with TCOM's inspector. The Supplier will provide calibrated gauging/instrumentation (Code 01) and labor required to move items and operate inspection/test equipment.
	FIRST ARTICLE INSPECTION/VERIFICATION (FAI/FAV)
33	The particular revision of the item ordered has never been manufactured by anyone or has never been manufactured by your company. TCOM will use SAE AS9102, Aerospace First Article Inspection Requirement, as a guide in developing the FAV/FAI requirements. The supplier should NOT need this standard, but AS9102 is available from the SAE. TCOM will require that data is provided by the supplier proving that all constituent raw materials, features, attributes, processes, key characteristics, interfaces and functions meet drawing and specification requirements. Such data may also require recording: 1. the evidence that any TCOM-directed sources of hardware/services was used as required. 2. the identification of special tooling used to make the item. 3. the S/N of all inspection, measuring and test equipment used to measure conformance. 4. the credentials of personnel carrying out critical operations. TCOM will create and provide in advance (with the RFQ and Purchase Order) the specific details of what data must be provided. If the supplier has sufficient quantity or dollar-value of TCOM work and adequate computer resources, the forms may be provided by granting the supplier access to a hosted internet web-site; in such cases, TCOM will provide training and software (DISCUS and/or Net-Inspect). For smaller orders or less sophisticated supplier computing situations, the forms may be provided as a Microsoft Excel Spreadsheet. If necessary, manual paper forms may be used (legibly completed in black or blue-black ink by the supplier). Any First Article data that is outside expected limits, reflects a failure or fault or is un-available must be treated as a Non-conformance and must be adjudicated by TCOM, L.P. before the data is approved. No item may be shipped until the supplier's First Article Data Package is provided to and approved (electronically or in writing) by TCOM, L.P..
	WAIVER OF PAINTING REQUIREMENT
34	Parts supplied need not be painted per any drawing notes that refer to TCOM Specification 950672. However, parts must be delivered in solvent-cleaned condition ready for painting with a primer. Parts must be clean and free of corrosion (except for minor flash rust on the surface of steel) and without slag splatter or any other surface contamination.
	WAIVER OF HOLE DRILLING
35	Supplier need not drill holes shown on drawings for this part. (TCOM must either match-drill with a mating assembly or requires a different hole pattern/location and we will complete all drilling.) However, all other portions of these parts must match their drawing configuration with materials and orientation/location tolerances as shown on those drawings.
	FIBER-OPTIC SERVICES
	This line item or purchase order involves work to splice/mechanically connect fiber-optic cables and components OR to measure fiber-optic continuity and attenuation OR to perform all of these services. Services shall be conducted using instruments that are either within their OEM's original standard warranty for new equipment OR are currently calibrated using standards traceable to NIST or to the accepted industry reference (Code 01). This calibration will be proven by traceable records presented with the instrument or by valid calibration stickers affixed thereto. Technicians or engineers who are trained and certified shall perform services. Certification may be made by the Supplier based on a combination of education, training and experience of the individual OR by applicable 3rd-Part certification by some relevant authority of the fiber-optic industry. The personnel qualifications will be provided in writing on company letterhead by the Supplier or by recognized credentials carried by the Supplier's technician. The Supplier should provide records of inspection of his own work and retain copies on file for 36 months. This should normally include "as released" traces showing attenuation of areas impacted, disturbed or bounded by the splicing/connectorization work. Traces must be identified to the fiber, direction, condition, frequency and wavelength. Traces must be legible. Traces should be provided (if possible) in a file format that is viewable by free viewing software [one example: EXFO OTDR Viewer 6.7 free at www.exfo.com]. Traces can also be supplied in other file formats if approved by TCOM. [These may include Adobe Acrobat PDF files and various JPG, TIFF and BMP files that can be read in the Microsoft Windows operating system environment with common software. Such files should be able to be viewed in a zoom mode where discontinuities can be seen.] Text reports of tests printed from instruments may be provided (in lieu of traces) if losses can be measured between cursors and cursor locations are clearly identified. Where there is no drawing or statement of work attached to the purchase order, or where the drawing or SOW is silent, the Supplier shall:

	A. Come prepared to do both multi-mode and single mode work. B. Have at least one power meter. C. Have at least one Optical Time Domain Reflectometer (OTDR). D. Have sufficient length of clean, temporary leader available so that the OTDR can see the leading/inbound end of the connection. E. Have all necessary splicing tools and supplies (raw materials) for at least one connector and two fusion splices. F. Plan to prove continuity and measure dB loss in each optical circuit in the UP and DOWN (e.g., both) directions. G. Make measurements at wavelengths of 850nm, 1310 nm and 1550 nm. H. Make measurements with a pulse width of 5 meters or less. I. Make connector attachments with a loss (attenuation) less than 0.50 dB J. Make fusion splices with a loss (attenuation) less than 0.25 dB K. Be able to provide dB/length traces of attenuation read with the OTDR (so that TCOM can determine if the finished optical circuit meets TCOM's optical loss budget). Traces must be provided within 24 hours of the completion of work.
36	ELECTROSTATIC DISCHARGE (ESD) PACKAGING
	The supplier shall take necessary precautions to ensure that static susceptible devices are adequately protected from electrostatic discharge (ESD) damage during packaging and shipping. Items received without proper ESD packaging, including ESD labeling, shall be cause for rejection at the Supplier's expense. IPC-A-610D (sections 3.1.4 and 3.1.3) summarizes minimum requirements. ESD sensitive parts and assemblies shall: Have an outer layer of "static shielding or static barrier" packaging material Have any inner packaging layers and all cushioning of "anti-static (low charging)" or "static dissipative" materials; care should be exercised in using packing materials that will not contaminate, corrode or affect the solderability of packed components. have a warning label applied The devices supplied under this contract shall be packaged in accordance with the latest revisions of MIL-STD-1686 (Electrostatic Discharge Control Program for Protection of Electronic Devices) and MIL-HDBK-263 (ESD Control Handbook for Protection of Parts, Assemblies and Equipment) or, if the Supplier chooses, the following equivalent industry standards: JEDEC JESD 625 [formerly ANSI/EIA-625] EIA-541 [Packaging]/CEA-556[Labeling] BS EN 61340-5-1 [General]/ 61340-5-2 [User Guide] Packaging shall be marked with an ESD cautionary note and symbol. The marking criteria used is changed frequently; although the current symbology of ANSI/ESD S8.1 is preferred, previous standard's (EIA-471 or other commercial) stickers/symbols may be used until stock is expired. A legible, high-contrast or bold color note shall be affixed on exterior and interior packaging saying something like: " CAUTION: CONTAINS PARTS AND ASSEMBLIES SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD). USE ESD PRECAUTIONARY PROCEDURES WHEN TOUCHING, REMOVING OR INSERTING!" Polymer barrier film, expanded or molded products, commonly referred to as "pink poly" does not provide acceptable electrostatic discharge (ESD) protection and are NOT to be used as primary outer packaging. If used at all, anti-static, static dissipative packing material (pink poly formulations) must comply with Contact Corrosivity Testing in accordance with MIL-STD-3010 Method 3005 (formerly Federal Standard 101, Method 3005) and may not be used in direct contact with Optics and Polycarbonates.
37	IRIDITING/ALODINING (CHROMATE CONVERSION COATING) REQUIREMENTS
	The item ordered has one or more aluminum or aluminum alloy parts that require anti-corrosion protection to MIL-DTL-5541F. This may be the final finish for the part or it may be a prerequisite required before painting. Check the TCOM drawing notes or part specification for the Class and Type of chromate conversion. If Class is not specified, use Class 1A. If Type is not specified then the Type is optional but Type I is preferred. TCOM considers >chromate conversion to be a "special process" that requires the use of approved suppliers. If you plan to apply this coating in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and a non-batch, continuous line process by a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort). If the iriditing company you choose has no dedicated quality function and/or plans to use brush application of retail commercial (auto-parts store) products then TCOM will NOT award you the work on this purchase order. TCOM approval is satisfied by one of the following: TCOM will audit your (or your sub-supplier's) facility for compliance to the Military Standard; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to this Code (below) as an approved supplier. Use a Raytheon-approved supplier in good standing; such suppliers may be found by searching the Q-note area for JY at http://qnotes.raytheon.com/index.cfm?show=all •Use a NADCAP-approved supplier. •Use a Northrop-Grumman-approved ASPL supplier. •Use a Lockheed-Martin-approved QCS-001 supplier. •Use a Boeing-approved D1-4426 supplier. The current list of TCOM-approved chromate conversion coating suppliers can be found here. Any TCOM audit will require that you or your sub-supplier follow MIL-DTL-4451F including (but not limited to) planned arrangements for: [3.1] qualified materials MIL-DTL-81706 (purchased off QPL-81706 and Amendments 1 and 2); proper use of replenishing chemicals (such as fluorides). [3.2] proper cleaning to a water-break free surface prior to coating; absence of prohibited abrasives; controls and procedures for re-cleaning, touch up and rejection. [3.3] application methods including pre-treatment masking. [3.4] (maximum) 5% touch-up. [3.5] requiring continuity in appearance; requiring discernable visibility in daylight; minimizing and touching up contact marks. [3.6.1/4.4.1] 168 hour 5% salt spray testing. [3.6.2/4.4.2] wet tape adhesion testing (ONLY if CARC or other paint system is called for. [3.7] electrical contact resistance testing (ONLY for Class 3 coatings). [3.8] chemical analysis of the conversion coating (concentration, pH and temperature) and comparison to manufacturer's requirements. [4.1a/4.2] process control inspection(tests and solution analysis); frequency of tests; test specimens; actions after failure. [3.9/4.1b/4.3] workmanship/conformance inspection; sampling; visual examination; actions after failure.
38	ANODIZING REQUIREMENTS
	The item ordered has one or more aluminum or aluminum alloy parts that require anti-corrosion protection (perhaps with cosmetic color for appearance enhancement) to MIL-A-8625F Amendment 1. This usually the final finish for the part buy may also be a prerequisite required before painting. TCOM considers anodizing to be a "special process" that requires the use of approved suppliers. If you plan to apply this coating in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort). TCOM will audit your (or your sub-supplier's) facility for compliance to the Military Standard; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to this Code (below) as an approved supplier.

Use a Raytheon-approved supplier in good standing; such suppliers may be found by searching the Q-note area for JY at http://qnotes.raytheon.com/index.cfm?show=all

•Use a NADCAP-approved supplier.
•Use a Northrop-Grumman-approved ASPL supplier.
•Use a Lockheed-Martin-approved QCS-001 supplier.

The current list of TCOM-approved anodizing suppliers can be found here.

Any TCOM audit will require that you or your sub-supplier follow MIL-A-8625F including (but not limited to) planned arrangements for:

[3.3.2] Proper cleaning to a water-break free surface prior to coating; absence of prohibited abrasives.
[3.3.4] 5% touch-up (maximum).
[3.7.1.1/3.7.2.1.1/4.5.2] Weight of Types I (unsealed), II (unsealed) & III coating.
[3.7.2.1/4/5/1] Thickness of Type III coating.
[3.6.1/4.5.3] 336 hour 5% salt spray testing.
[3.7.1.4/4.5.6] Wet tape adhesion testing (ONLY if CARC or other paint system is called for).
[3.8] Sealing.
[3.9] Final dimensions.
[3.12] Required wetness/rinse time limits for dyeing.
[3.13.1] Contact marks.
[4.2a/4.3] Document requirements; process control inspection (tests and solution analysis).
[4.2b/4.4] Quality conformance inspection; sampling; visual examination; dimensional measurements; actions after failure.

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CARC PAINTING REQUIREMENTS

The item ordered has one or more parts that require Chemical Agent Resistant Coating protection to TCOM 443A12 Section 1.

The drawing notes may say that the CARC paint color is specified on the purchase order; if so, refer to the table below (if any questions, contact TCOM's Buyer):

TCOM CARC Painting Colors

Drawing Note	Type	Description	Color No. FED-STD-595	Finish COAT Spec.
Exterior Surface	Type I	383 Green	34094	MIL-DTL-64159 Type II
Aerostat Painted Hardware	Type VI	Aircraft White (Exterior)	37875	MIL-DTL-64159 Type II
Interior Surface	Type V	White (Interior)	27875	MIL-PRF-22750
Avionic Equipment	Type I	383 Green	34094	MIL-DTL-64159 Type II
Exterior Walkway	Type I	383 Green	34094	MIL-DTL-64159 Type II
Interior Walkways	Type IV	Gray (Interior)	36300	MIL-PRF-22750
Exterior COTS Components	Type I	383 Green	34094	MIL-DTL-64159 Type II
Interior COTS Components	Type V	White (Interior)	27875	MIL-PRF-22750

TCOM considers CARC Painting to be a "special process" that requires the use of approved suppliers. If you plan to apply this coating in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort).

TCOM approval is satisfied by one of the following:

TCOM will audit your (or your sub-supplier's) facility for compliance to the Specification and referenced Military Standards; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to this Code (below) as an approved supplier.

Use a Raytheon-approved supplier in good standing; such suppliers may be found by searching the Q-note area for CT at http://qnotes.raytheon.com/index.cfm?show=all

Use a NADCAP-approved supplier (for Dry Film processes MIL-DTL-53022/MIL-PRF-22750/MIL-PRF-23377).

The current list of TCOM-approved CARC painting suppliers can be found here.

Any TCOM audit will require that you or your sub-supplier follow applicable portions of MIL-DTL-53072C including (but not limited to) planned arrangements for:

[3.2] Cleaning of ferrous and non-ferrous surfaces by chemical, electrochemical or mechanical means per TT-C-490.

[3.3] Pre-treating of metallic substrates with DOD-P-15328 or MIL-C-8514 wash primer [but not Anodizing to MIL-A-8625 or Iriditing to MIL-DTL-5541 which are covered by other audits].

[3.4] Priming by spray (plus brush touchup) with two-part anticorrosive epoxy primer (MIL-PRF-23377, MIL-P-53022, MIL-P-53030, MIL-P-53084, or MIL-PRF-85582) from purchase off the Qualified Products List through mixing, reduction, filtration, set time, pot life control, application, drying and dry film thickness measurement.

[3.5] Top Coating by spray (plus brush touchup) with polyurethane or epoxy (MIL-C-46168, MIL-C-53039, MIL-DTL-64159, MIL-PRF-22750) from purchase off the Qualified Products List through mixing, reduction/admixing, filtration, standing time, pot life control, mist coating/application, multi-coats for humidity control, drying and dry film thickness measurement.

[3.6] Touch-up and rework.
[3.7] Process control.

[3.8] Miscellaneous requirements (surfaces NOT to be painted, engine manifolds/hot surfaces, sealing of reservoirs/cases, electrical components, steel wool prohibition, plastic media blasting for weld repairs, paint handling, storage and shelf life control).

[4] Verification of quality (examination for common defects, test panels, water-break test, solvent wipe test, magnetic or eddy current dry film thickness measurements, avoidance of marring, lot/batch traceability and source, dry and wet adhesion tests, salt spray corrosion tests, workmanship inspection).

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HEAT TREATMENT

	Supplier (or Sub-contractor) must work to a relevant, recognized standard for all heat treatment required for this work; if a particular standard or specification is listed on TCOM's drawing, the Supplier shall either work to TCOM's choice or request a waiver in writing. The competent persons performing this work must do it on a regular basis in support of the Supplier's own ongoing production or else shall be employed by a sub-contracted firm that specializes in providing heat treatment. Heat treatment Suppliers shall have at least one audit-based approval by a major company or the Government that supports competency in the relevant technique (induction, flame, oven, etc.) - examples of approved Suppliers include: •Use a Raytheon-approved supplier in good standing. •Use a NADCAP-approved supplier. •Use a Northrop-Grumman-approved ASPL supplier. The current list of TCOM-approved Heat Treatment suppliers can be found here. If no existing approvals are in place, TCOM may choose to audit the Supplier/sub-supplier prior to awarding the work; if shortfalls are found, corrective/preventive actions must be taken (under a control plan) to become a TCOM supplier of the heat treated part being ordered. The Supplier (or sub-supplier) must have written procedures and any supporting technique sheets under document and revision control; these procedures must be on-site and available for review at each in-process or final inspection event and at other times (at the supplier's plant) upon request. Production/process equipment must have proven capability to measure and control the applied heat and methods must be in place to detect and mitigate problems. The Supplier's shall prepare a heat treatment report on an appropriate form, including the relevant process parameters and any post-treatment check (hardness); the report shall have the approval signature and title of a responsible agent of the Supplier. An adequate method of identifying and cross-referencing each treatment, report, and item must be provided.
41	PASSIVATION/DE-PASSIVATION REQUIREMENTS
	On this purchase order, TCOM requires that stainless steel parts of a specified alloy be passivated. If constructed using welding, parts will also have a known filler metal (either identified on TCOM's drawing or provided by the supplier who did the welding from the WPS). When parts are welded they may have scale or heat tint or both. TCOM requires removal of any scale to allow good passivation but TCOM does NOT require removal of heat tint. TCOM prefers processes compliant with ASTM-A-967 but will accept QQ-P-35C (or SAE-AMS-QQ-P-35) as equivalent. Chosen processes shall follow the recommended guidelines in the alloy tables (FIG X1.1 or Table II, as appropriate to the specification) or else shall be cleared with TCOM prior to use. For scale removal per ASTM-A-967 Paragraph 5.3.1, suppliers must have stainless steel wire brushes or grinding/blasting media that is totally free of iron/zinc to perform the mechanical cleaning per ASTM A-380-1999e1. Alternatively, suppliers may use a bead-blasting media that is assumed to contain iron IF a brief acid dip is performed per A380/5.3.4(+Annex A2) before passivation. If TCOM's drawing is silent regarding the test Practice, the supplier shall use at minimum at least Practice A (Water Immersion Test) discussed in sections 1.4.1, 13.3.1 and 14 of ASTM-A-967 (or 3.7.1 and 4.4.1 of QQ-P-35C). For each shipment, suppliers shall certify process conditions and performance of tests to the required practice as permitted by section 22.1 of ASTM-A-967. TCOM considers Passivation to be a "special process" that requires the use of approved suppliers. If you plan to perform this work in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort). TCOM approval is satisfied by one of the following: TCOM will audit your (or your sub-supplier's) facility for compliance to the ASTM-A-967 specification and its references; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to this Code (below) as an approved supplier. Use a Raytheon-approved supplier in good standing; such suppliers may be found by searching the Q-note area for JY at http://qnotes.raytheon.com/index.cfm?show=all •Use a NADCAP-approved supplier (AC7108 for "Surface Treatment/Passivation - AD 1033 or ASTM A380 or QQ-P-35 or Other). •Use a Northrop-Grumman-approved ASPL supplier. •Use a Lockheed-Martin-approved QCS-001 supplier. •Use a Boeing-approved D1-4426 supplier. The current list of TCOM-approved Passivation suppliers can be found here. Any TCOM audit will require that you or your sub-supplier follow applicable portions of ASTM-A-967 including (but not limited to) planned arrangements for: [5.2.1] Materials (chemicals) use including maintenance of adequate volume, concentration, purity, and temperature control. [5.2.2] Record keeping and availability (coded if necessary for proprietary processes). [5.3] Preparation including mechanical and chemical methods plus results (and avoidance of passivation after more aggressive treatments). [6] Conduct of passivation treatments Nitric 1 through Nitric 5 plus water rinse (including water cleanliness). [7] Conduct of passivation treatments Citric 1 through Citric 5 plus water rinse (including water cleanliness). [8] Conduct of passivation with other chemical solutions (with or without electricity). [9] Arrangements for neutralization (rinsing with or without separate treatment). [10] Post-Cleaning Treatments to accelerate passivation film formation (including sodium dichromate for ferritic and martensitic steel parts). [11] Finish including visual inspection for cleanliness, etching, pitting or frosting. [12-19] Planned arrangements for testing using Practices A through F.
42	[20] Rejection and re-test procedures (including lot traceability).
	EXTERIOR COMPONENT(S)
	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be an "Exterior Component"; select and apply the paint color designated for "EXTERIOR COMPONENT(S)". If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Exterior Components". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
43	
	INTERIOR COMPONENT(S)
	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Mooring System Interior Component"; select and apply the paint color designated for "INTERIOR COMPONENT(S)". If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Interior Components". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
44	
	AEROSTAT PAINTED H/W
	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Aerostat Painted Hardware"; select and apply the paint color designated for AEROSTAT PAINTED HARDWARE. If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Aerostat Painted Hardware". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
45	
	AVIONIC EQUIPMENT

46	For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Avionic Equipment"; select and apply the paint color designated for AVIONIC EQUIPMENT. If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Avionic Equipment". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
47	SUPPORT EQUIPMENT For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Support Equipment" item; select and apply the paint color designated for SUPPORT EQUIPMENT. If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Support Equipment" items. Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
48	EXTERIOR WALKWAY For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be an "Exterior Walkway"; select and apply the paint color designated for EXTERIOR WALKWAYs. If this PO line is for an assembly, consider that the assembly contains one or more parts that are an "Exterior Walkway". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
49	INTERIOR WALKWAY For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be an "Interior Walkway"; select and apply the paint color designated for INTERIOR WALKWAYs. If this PO line is for an assembly, consider that the assembly contains one or more parts that are an "Interior Walkway". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
50	STRUCTURE For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Structure"; select and apply the paint color designated for STRUCTURE. If this PO line is for an assembly, consider that the assembly contains one or more parts that are a "Structure". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
51	MOORING SYSTEM EXTERIOR COMPONENT(S) For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Mooring System Exterior Component"; select and apply the paint color designated for "MOORING SYSTEM EXTERIOR COMPONENT (S)". If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Mooring System Exterior Components". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
52	MOORING SYSTEM INTERIOR COMPONENT(S) For the purpose of determining paint color, where the TCOM drawing is silent, consider the PART on this PO line to be a "Mooring System Interior Component"; select and apply the paint color designated for "MOORING SYSTEM INTERIOR COMPONENT(S)". If this PO line is for an assembly, consider that the assembly contains one or more parts that are "Mooring System Interior Components". Submit any questions you have about painting of complex assemblies to your TCOM Buyer for resolution before you start to paint.
53	IUID MARKING REQUIRED This item requires Item Unique Identification (IUID) marking, in accordance with the latest revision of MIL-STD-130. The two dimensional Construct 2 IUID data matrix shall be machine-readable with common optical scanning devices and be accompanied by the corresponding human readable markings when practical. The data matrix shall be readily visible. Information contained in the machine-readable code shall be: Commercial and Government Entity (CAGE) Code, Manufacturer part number, and unique serial number. This information will be used for asset tracking during the life cycle of the item. The Supplier shall submit documentation with this item that identifies, at a minimum, the Nomenclature, Part Number, Serial Number, National Stock Number (NSN) (if applicable) and CAGE code.

Type-Certified Aircraft Quality Codes

TC01	Calibration Requirements The Supplier shall maintain a calibration system to assure that all inspection, measuring, and test equipment used to determine compliance with drawings and specifications are calibrated to standards traceable to national or industry-accepted standards. Minimum requirements are that tools are uniquely identified, have due dates when they must be recalled for calibration checks/re-calibration/condition inspection, are recalled when due/overdue, are calibrated to a master instrument/gauge traceable to a standard, and that records give evidence that this is done. No variable data (i.e., no measurements or other numerical data) offered to TCOM as objective evidence of conformance to inspection or test requirements may come from a non-calibrated instrument.
TC02	Changes and Change Authorization The drawings and specifications for this part/assembly may not be deviated from without approval. The Supplier shall notify the TCOM Buyer of any proposed changes/departures from drawings and specifications including changes in design, materials, parts, fabrication methods or production processes that the supplier considers necessary to perform the work. TCOM must approve any/all changes prior to the change incorporation. If an unexpected non-conformance to a drawing or specification is discovered, immediately stop work and notify the TCOM Buyer. A Purchase Order Change Notice and a drawing/specification revision notice shall constitute change authorization. Verbal changes are not permitted and all changes shall be written. Changes may not be authorized by anyone other than TCOM's Buyer or TCOM's Manager of Purchasing.
TC03	Final Inspection at Source Source inspection (final inspection at your facility of this item) is required before shipment. You must contact TCOM's Buyer about one week in advance to schedule the inspection. Parts should be as complete as possible, unpacked and available for comprehensive inspection - any necessary support shall be provided for TCOM's inspector. Any certificates/traceability, reports, inspection data, test data, configuration accounting and fit or operational checks relevant to the ordered parts/assemblies will be examined - the condition and completeness of the work will be reviewed. TCOM will provide a written document that either holds or permits shipment along with a summary of actions required before or after delivery to TCOM.
	In-Process Inspection at Source Source inspection (in-process inspection at your facility of this item) is required before continuing/completing work.

TC04	You must contact TCOM's Buyer about three workdays in advance of the relevant hold-point to schedule the inspection; where operations follow in close sequence, TCOM will arrange the series of in-process visits at one time. Any of the following hold points which are relevant to the items ordered will give rise to an in-process inspection: For woven cloth: After yarn twist/warp beam, at loom setup before start of weaving. For coated/laminated fabric: At line setup before the first coating/laminating operation on the process ticket. For weldments: at fit-up before the first pass of production welding. For post-weld NDT: after visual weld inspection (VT) following production welding. For heat treatment: before placing items in the oven/chamber for heating. For painting/coating: post-machining when parts are cleaned to a water-break-free surface before surface finish is applied. TCOM will provide a written document as evidence of the inspection and directing any actions arising wherefrom. If TCOM chooses to decline any opportunity for an in-process inspection, we will do so in writing and the Supplier will be directed to proceed independently to the next hold point.
TC05	Non-Conforming Material and Repairs Prohibited The parts/assemblies built on this purchase order must conform fully to all drawing/specification requirements as approved by the Federal Aviation Administration (FAA). Non-conforming material shall not be used or shipped without written approval obtained by the Supplier from TCOM Quality Assurance via TCOM's Buyer. The Supplier shall notify TCOM, in writing, of any detected non-conformity for possible formal Material Review Board (MRB) action. The Supplier is advised that neither TCOM nor the Supplier have Material Review Board (MRB) authority for the parts on this purchase order - TCOM has only Preliminary Review (PR) authority. Final decisions to use/accept or pay for the scrapping of non-conforming items may require Federal Aviation Administration (FAA) or Defense Contract Management Agency (DCMA) approval per MIL-HDBK-350 guidelines. The Supplier may replace sub-parts and may perform processes used in the original construction of this assembly so that remediation actions are REWORK and not REPAIR. Stop work and notify TCOM's Buyer if a potential repair situation develops.
TC06	Certificate of Compliance/Conformance (CofC) A certificate of compliance/conformance is required to provide objective quality evidence of specific characteristics of the material supplied as indicated on the drawing, specification, or purchase order (e.g., test results, heat treatment, surface finish, raw material, fidelity to process or standard specification, etc.). CofCs may be in the Supplier's customary format so long as all required information below is present and legible. CofCs for *commercial-off-the-shelf (COTS) or military-off-the-shelf (MOTS) parts* may be simple and need only certify: that the part supplied is the part TCOM ordered that the part was obtained from the original equipment manufacturer (OEM) identified by Cage Code on TCOM's Bill of Material or that OEM's authorized distributor any manufacturer's assigned lot or batch or serial number any shelf life expiration data CofCs *for TCOM parts/assemblies* shall: clearly identify the manufacturer or supplier of the certified process, material or other attribute. contain enough information to trace/relate the CofC to the particular group of items or material supplied. reference the specific attribute(s) being certified or the top level drawing/specification part number be signed by a Supplier quality assurance representative or another company executive identified by specific title If the part or assembly is a complex one with a multi-level bill of material or if the Supplier subcontracts part of the work, a CofC shall be the cover document for a data pack enclosing any other data required by this purchase order (including data from sub-suppliers). See in particular TCOM QA Code 29 (provided separately). If the Supplier takes any exceptions to TCOM's requirements, terms and conditions or if the Supplier was granted a concession to permit shipment with deviations, then the CofC should briefly state the circumstances and reference TCOM's approval document.
TC08	Welding Requirements For the purposes of interpreting the welding codes on this contract, your firm is “the Contractor” and TCOM is the “Owner” and the “Engineer” is TCOM's duly appointed employee. Welding procedures, welders and weld inspectors shall be qualified in accordance with the welding code referenced in the drawing or specification. The use of any welding codes or specifications not referenced by the applicable drawings must be approved by TCOM prior to production. “Equivalent” codes accepted by TCOM are usually limited to: The ASME Pressure Vessel Code A Military (MIL-) Standard as modified by some particular branch of the Department of Defense (example: NAVSEA) The Supplier shall be prepared to show, by records, that successful welds can be made for the material type, joint types, material thicknesses and welding positions required while using the Supplier's facility, equipment and personnel. With rare exceptions (Example: No PQR for some pre-qualified steel joints), TCOM will expect to have access to or to have copies of all of the following documentation: A Welding Procedure Specification (WPS) – this describes the welding process and joints in detail. A Procedure Qualification Record (PQR) – this proves that the Supplier’s equipment can make the joints. A Welder’s Qualification -– based upon a separate test for any welder who did not perform the PQR. Data on filler metal certification – the alloy used should conform to the WPS. Data on shielding gas certification – the gas used should conform to the WPS. If a CWI is not required (TCOM QA Code TC28), Suppliers shall have a "Letter of Appointment" and a Jaeger/Snellin Vision Test less than 1 years old for those Inspectors-on-staff NOT holding a valid AWS credential for SCWI/CWI/CAWI A written report of visual inspection, in the contractor's format, covering all welds and meeting the requirements of the applicable Code. Inspectors are expected to regularly observe joint preparation, assembly practice, welder technique and performance to make certain that Code requirements are met during the fabrication/erection process. Minimum qualifications and visual inspections are as follows: AWS D1.1 2010 [Steel] – Section 6.1.4, 6.6.1 & C6. AWS D1.2 2008 [Aluminum] – Section 5.1.3, 5.6.1 & C5 AWS D1.3 2008 [Sheet Steel] – None {Section 6} and 6.1.1 AWS D17.1 2010 [Aerospace] – Section 6.1.2, 6.1.3, 6.3 & C5.21
	Submission of Inspection Records/Sampling Plan Use for Inspection A legible and reproducible copy of the Supplier's inspection report is to be submitted with this item. If the Supplier subcontracts some portion of the work, the Supplier shall obtain and include the sub-supplier's report(s) of inspection along with the inspection records of the Supplier's own work.

TC09	Each inspection document, in Supplier format, shall give evidence of compliance with the applicable drawing and/or specification requirement - all actual measurements of specified drawing dimensions shall be recorded. If the Supplier prefers, a copy of the TCOM drawing(s)/specification(s) may be used to record the inspection data (by annotating on the drawing copy in the same area as each attribute is specified). Records shall include the part number, governing drawing and/or specification with revision letter or number, and the signature and title of the responsible agent of the Supplier. Since the Supplier has no authority to deviate from the drawing (See TCOM QA Code TC05) - the Supplier's Engineer or Quality Manager shall have dispositioned any indications of "out-of-tolerance" conditions by referring to the TCOM waiver or concession. Inspection records for welded assemblies shall reflect assembly dimensions after completion of welding. Unless otherwise noted, all drawing dimensions shall be recorded before painting and/or plating. When serialization is required by the drawing or specification, such serialization shall be a part of the inspection/test report data. If the purchase order calls for more than 13 identical items, the supplier may use the C=0 Acceptance Sampling plan, Single Sampling for Normal Inspection, General Level II, of ANSI/ASQ Z1.4 at a 1% AQL - in such plans, if 1 item in the randomly chosen lot is rejected then 100% inspection is required of the whole lot and no defective part is ever returned to the lot (defectives must be reworked or scrapped). Such acceptance sampling plans may not be used for fabrics, tapes, raw materials and bulk items but only for manufactured/fabricated structures, hardware parts and assemblies thereof. Where a part has been coded with both TCOM QA Code TC09 and TC33 First Article Inspection (FAI), Code TC09 applies only to the 2nd and all subsequent parts/assemblies/items provided by the Supplier. The requirements herein are slightly less burdensome and extensive than those of TCOM QA Code TC33.
TC10	Submission of Test Data Sheets A legible and reproducible copy of the test data sheets is to be submitted with this item. If TCOM has supplied a test document then that document shall be used; otherwise the test report shall be in Supplier's format. Each test document shall include the part number, governing drawing and/or specification with revision letter or number, and the signature and title of the responsible agent of the Supplier. When an item under test is an identifiable item (e.g. by serial number or lot number), the identification shall be a part of the test report data. All actual measurements of specified test performance shall be recorded - since the Supplier has no authority to deviate from the test requirements (See TCOM QA Code TC05) the Supplier's Engineer or Quality Manager shall have dispositioned any indications of "test failure" conditions by referring to the TCOM waiver or concession. Items requiring test must all be tested (100%) even if the number of inspected items was limited by a sampling plan (as allowed in TCOM QA Code TC09).
TC11	Retention of Inspection/Test/Raw Material Certification Records Inspection (TCOM QA Code TC09), Test (TCOM QA Code TC10) and Raw Material Certification (TCOM QA Code TC13) records shall be maintained at the Supplier's facility for a period of five years. These retained records shall be adequate to ascertain the quality level of production processes and of the raw material used in the manufacture of the item on this Purchase Order.
TC13	Raw Materials Certification The bill of material or parts list for the items ordered include a requirement for particular metal alloys or other non-metallic raw materials whose physical properties depend upon chemical composition. Such properties must be proven by providing a certificate of analysis (COA) that records actual chemical composition data. The COA shall include actual discrete data (physical and chemical analysis report) taken from the material supplied. The actual quantity of each constituent measured must be listed and compared to the requirements of each constituent identified in the applicable specification. The COA shall be signed by a quality assurance or other assigned representative of the Supplier identified by name and job title. In some cases, TCOM has attempted to provide some latitude in material shape selection by specifying, in the drawing parts list or bill of material, only the base alloy (and not the applicable specification). Where TCOM has not provided any particular material specification, use the table below - for materials not listed, contact your TCOM buyer and provide the specification reference you plan to use to ensure conformance to requirements:
TC16	Shelf Life Material Requirements Material susceptible to quality degradation due to aging shall be marked with the date of manufacture or when the useful shelf life will be expended. Upon receipt at TCOM, material shall have a minimum of 80% shelf life remaining.
TC19	Acceptance Test Requirement Regardless of any previous inspections or tests at the Supplier's facility, whether witnessed by the Buyer or not, the item(s) in this Purchase Order must pass an acceptance test by the Buyer at the Buyer's facility - this must occur prior to acceptance for payment by TCOM Receiving Inspection. Failure to pass the acceptance test shall be cause for rejection by the Buyer of the items ordered which may be returned at the Supplier's expense.
TC25	Sole Source Required for OEM The part numbers for items supplied on this purchase order contain identifying information for a particular Original Equipment Manufacturer (OEM). Suppliers may obtain the parts from any authorized distributor of that OEM, but no substitution of source is allowed. Identical part numbers are necessary but are not sufficient evidence to prove the OEM source. When a certificate of compliance is also requested (TCOM QA Code TC06), records will be provided showing that the proper OEM supplied the original parts delivered under this purchase order.
TC27	NONDESTRUCTIVE TEST/EVALUATION (NDT/E) REPORTS The Supplier must have (on staff or under subcontract) a competent person to provide all nondestructive testing required for this work. The Supplier must submit the credentials of this competent person showing qualification to a relevant standard (ASNTS NT-TC-1A Recommended Practice or NAS 410 or equivalent) along with a report on nondestructive tests conducted and the results thereof. Individuals who are without documented formal training and Level II or III certification will NOT be accepted. The competent person performing this work must do it on a regular basis in support of the Supplier's own ongoing production or else shall be employed by a sub-contracted firm that specializes in providing NDT/E. Preferred NDT/E Suppliers shall have at least one audit-based approval by a major company or the Government that supports competency in the relevant technique (PT/UT/MT/RT/Eddy-Current) - examples of preferred Suppliers include: •Raytheon-approved NDT suppliers. •NADCAP-approved NDT suppliers. •Northrop-Grumman-approved ASPL NDT suppliers. •Lockheed-Martin-approved QCS-001 NDT suppliers. •Boeing-approved D1-4426 NDT suppliers. If no existing approvals are in place, TCOM may choose to audit the Supplier/sub-supplier prior to awarding the work; if shortfalls are found, corrective/preventive actions must be taken (under a control plan) to become a TCOM supplier of the part requiring NDT. The Supplier (or sub-supplier) must have written procedures and any supporting technique sheets under document and revision control; these procedures must be on-site and available for review at each in-process or final inspection event and at other times (at the Supplier's plant) upon request. The Supplier's findings shall be submitted on an appropriate report form, including the name of the NDT/E technician and the approval signature and title of a responsible agent of the Supplier. The report shall be cross referenced to the serial or lot number of the part, else some other adequate method of identifying and cross-referencing each film exposure and/or report to the part must be provided. When dye penetrant (PT) is specified, pre-cleaning shall be per ASTM-E-1417. When radiographic inspection is specified, certified personnel shall perform the Supplier's reading and interpreting of the X-ray film. The X-ray film shall accompany the shipment of the items and report.
	Visual Weld Inspection by CWI

TC28	We expect that every inch of weld will have been inspected by a competent weld inspector using a bright flashlight and that all defects will have been found and corrected as rework before finishing and delivery. The Supplier must have (on staff or under subcontract) a competent person to provide all visual welding inspection required for this work. The Supplier must submit the credentials of this competent person showing qualification (to AWS QC1 Standard for AWS Certification of Welding Inspectors or equivalent) along with a report of visual weld inspections conducted and the results thereof. Specifically, “competent person” means a person holding an active, valid American Welding Society CWI (or SCWI/CAWI) credential; “or equivalent” means a valid credential-in-force from a 3rd Party regulatory body or industry/trade association relevant to an alternate welding code that is accepted by TCOM (ASME Pressure Vessels, MIL-STD DoD Welding, etc.). Some NDT credentials (PT, UT, RT) may also include sufficient visual welding inspection training so that they will be accepted, too. It is NOT sufficient to appoint a Contractor's inspector meeting only the minimum AWS Code standards for qualification (by asserting a Contractor-accepted combination of education, training and experience) - TCOM‘s customary Owner/Engineer inspections (conducted at In-process or Source Inspection) by TCOM's own staff CWI/CAWI will not fulfill this requirement. The extent of the Supplier's CWI work shall be the Welding Inspection Program per AWS B1.11 “Guide for the Visual Inspection of Welds” - this includes initial review, pre-welding checks, in-process inspections and post-weld activities. For Initial Review, the CWI should: •Review TCOM drawings and AWS codes •Develop all necessary inspection plans or joint maps •Check welding procedures and welder qualification status •Establish inspection documentation system •Confirm that a non-conforming product ID method is available •Confirm that a corrective action process is available For Pre-Welding Checks, the CWI should: •Check suitability and condition of welding equipment •Check conformity of base and filler materials •Check the positioning of members and of joints •Check joint preparation, fit-up, cleanliness •Check adequacy of alignment maintenance/distortion control methods •Check preheat (or initial) temperature and welding environment For In-Process Checks, the CWI should: •Check compliance with WPS provisions/critical variables •Check quality and placement of key/root weld passes •Check weld bead sequencing and placement •Check for spatter and undercut and correct •Check inter-pass temperature and cleaning •Check adequacy of back-gouging •Monitor any specified in-process NDT For Post-Welding Activities, the CWI should: •Check finished weld appearance (Overlap) and soundness/fusion •Check weld sizes and dimensions •Check dimensional accuracy of weldment •Monitor/evaluate specified NDE •Monitor any post-weld heat treatment or other post weld work •Finalize and certify inspection documentation
TC29	TRACEABILITY REQUIREMENTS FOR TYPE-CERTIFIED AIRCRAFT Parts supplied under this purchase order will be used by TCOM in a type-certified aviation vehicle (one which is manned or operates over populated areas). The U.S. Federal Aviation Administration or Military Service or another Aviation Authority requires TCOM to have part traceability information suitable for aircraft. This code provides overarching requirements for determining the extent of flowdown of requirements to the Supplier's sub-suppliers (a.k.a. "supply chain") and the extent of material and process certifications and other quality record sets to be assembled for delivery with the materials supplied on this purchase order. Individual TCOM Quality Codes on this Purchase Order may detail certain quality record/document/process requirements, but this code (TC29) emphasizes the criticality of assembling and never breaking a continuous and easily auditable chain of identity for parts and their associated documents. The Supplier must submit objective evidence (records) to TCOM with the parts of: 1. Complete raw material traceability (before processing operations) 2. Complete production traceability (following processing operations) 3. Accurate and complete configuration control for documents, processes and material For raw materials, this means that the Supplier must pass onto TCOM the source and pedigree (batch/heat/lot number) of piece parts or raw materials provided to the Supplier by vendors. If not available, Supplier must perform and submit any physical or chemical test reports that prove the raw materials. For production traceability, this means that a serial/batch/lot number must be assigned by the Supplier for his own processing/manufacturing operations that turned the raw materials into the finished parts/assemblies. The reason for these requirements is that the FAA must be able to trace back (through TCOM, L.P. and the Supplier) to the raw material and have an unbroken chain of inspection and test records that prove that all parts supplied on this purchase order are properly made from the correct materials and conform to approved drawings and specifications. The Supplier must certify that this is the case and submit the necessary records. Materials offered to TCOM which are of uncertain configuration, have gaps in their processing history or have an otherwise obscure pedigree will be unusable for type-certified aircraft and will be rejected by TCOM.
TC30	Smooth Edge/Deburring Requirements When notes on the drawing refer to deburring and removal of sharp edges, Suppliers make this voluntary, advance agreement per ANSI B46.1 regarding edge flaws. Parts without a specific radius or chamfer, but requiring deburring and removal of sharp edges, will meet the standard in this paragraph [loosely based on Class 1 criteria (depending on the part thickness) per un-adopted Mass Finishing Job Shops Association standard MFJSA Standard 1. 1992]. Class 1 applies to parts of thickness (t) of 0.100 or less and these shall have a radius of t/10 or greater while still meeting all other drawing criteria. Class 1 edges must also be burr-free at 5x magnification. Class 2 edges applies to parts of thickness (t) over 0.100in and these shall have a radius of 0.010in or greater while still meeting all other drawing criteria. Class 2 edges must be burr-free at no magnification (naked eye). Visual inspections shall not permit projections beyond the plane of adjacent surfaces. Edges defined to Class 2 level of finishing will be smoothed to the extent that hands will not be cut nor would electric wires or mating parts.
TC31	QA/QC System Approval or Control Plan Prior to award of a contract for the work described in this purchase order, the supplier's Quality System must be surveyed by and approved by TCOM. The survey will require an actual visit to the supplier's facilities where the work is to be done; examples of non-proprietary documents and records relevant to the supplier's management of quality must be made available for review; supplier personnel responsible for quality must be made available for discussions with TCOM QA. TCOM will use SAE AS9003, Inspection and Test Quality System, as the basis of comparison when evaluating the supplier's quality system. AS9003 is available, for approximately $65, from http://standards.sae.org/as9003. When there are areas of the supplier's Quality System that do not generally meet AS9003, TCOM will require that contract-specific processes are implemented for this individual purchase order. TCOM will decide upon a Control Plan that may require additional effort from the supplier (expenditures for labor or materials/services) to provide documented proof that quality requirements are met. Control plans will normally be limited to TCOM-chosen, specific goals for Parts Manufacturing Approval (PMA) found is selected, applicable areas of FAA Order 7100.7, the Aircraft Certification Systems Evaluation Program. This order is available free of charge at http://www.faa.gov/documentLibrary/media/Order/8100.7D.pdf.

	Any Control Plan will, as a pre-condition for award, become a binding part of the contract for the supplies and services on this purchase order. If the supplier declines the additional controls, TCOM may choose not to award the purchase order and TCOM will find others to perform the work. All actions above are PRIOR to the award of a Purchase Order; if the supplier is awarded a P.O. by TCOM then the Supplier may assume that their QA/QC System is adequate for the work awarded without need for any Control Plan. In such cases TCOM's existing approved supplier list and the Supplier's past performance on similar work will have been accepted as adequate proof of competency.
TC32	Government Final Inspection at Source This requirement applies in conjunction with TCOM Quality Code TC03 for Final Inspection at Source (provided separately) All items supplied under this Purchase Order are subject to inspection by a Government Quality Representative (FAA or DCMA) at the Supplier's facility, or at the facility of a subcontractor to the Supplier, prior to shipment. Detailed parts of assemblies are subject to Government inspection or Government witness of Supplier inspection prior to assembly and of any tests after assembly. Intermediate Government inspection does not, however, negate requirements for the Supplier's inspection/test of the finished item prior to shipment. The Supplier shall make available his inspection records to the Government Quality Representative at the time of presentation of the produced items. TCOM Quality Assurance will make notifications and arrange for the Government Quality Representative to attend with TCOM's source inspector. The Supplier will provide calibrated gauging/instrumentation (TCOM Quality Code TC01 - provided separately) and labor required to move items and operate inspection/test equipment for the Government. If the Government declines to schedule or fails to attend a Final Source Inspection, TCOM and the Supplier will proceed together.
TC33	First Article Inspection Requirement The first time the Supplier manufactures any revision of the part/assembly on this purchase order, not withstanding any other TCOM QA Codes applied to this part, the Supplier shall submit a First Article Inspection/Verification (FAI/FAV/FAIR) as defined in SAE AS 9102 (latest version). If the Supplier has made an earlier revision of the part/assembly before, then the Supplier may submit a simpler "DELTA" FAI/FAV/FAIR which addresses only the changes from the earlier revision to the current revision. It is customary to provide one FAI/FAV/FAIR for each drawing with the drawing "ballooned" so that characteristics, notes and dimensions can be identified with entries on the forms. This may require one or more "detail" FAI/FAV/FAIR forms and a single "assembly" FAI/FAV/FAIR form where more than one drawing is needed to manufacture a particular item. AS9102 identifies fields on the FAI/FAV/FAIR form as required (R), conditionally required (CR) or optional (O) - TCOM only requires data designated (R) and (CR) but not (O). Forms other than those contained in AS9102 may be used, however they must contain all “Required” information and have the same field reference numbers. All forms shall be completed either electronically or in permanent ink. Continuation sheets using the same form are acceptable or insert additional rows if completing electronically. Reference characteristics on the drawing may be omitted. Results from inspection shall be expressed in quantitative terms (variables data) when a characteristic is expressed by numerical limits. Attribute data (e.g., go/no-go) may be used if no inspection technique resulting in variables data is feasible. Attribute data is permitted when the characteristic does not specify numerical limits - it is also permitted where qualified tooling is consistently used as a check feature and a go/no-go feature has been established for the specific characteristic. By the use of FAI/FAV/FAIR constituent forms known as Form 1(Part Accountability), Form 2 (Product Accountability) and Form 3 (Characteristic Accountability), TCOM will require that data is provided by the supplier proving that all constituent raw materials, features, attributes, processes, key characteristics, interfaces and functions meet drawing and specification requirements. Any First Article data that is outside expected limits, reflects a failure or fault or is un-available must be treated as a Non-conformance and must be adjudicated by TCOM, L.P. before the data is approved. No item may be shipped until the Supplier's First Article Data Package is provided to and approved (electronically or in writing) by TCOM, L.P.. If the part ordered includes source inspection at the Supplier's plant (TCOM QA Code TC03) then the FAI/FAV/FAIR should be completed and presented at Final Source Inspection. Suppliers are encouraged to contact TCOM Quality Assurance via the TCOM Buyer to explore options for use of TCOM-provided tools and data systems for efficiently creating and capturing/submitting FAI/FAV/FAIR data - these tools and software may be available at no charge to the Supplier. This should be done during planning (before work starts) to enjoy the full benefit of this support.
TC38	Chromate Conversion (Iridite/Alodine) Coating Requirements The item ordered has one or more aluminum or aluminum alloy parts that require anti-corrosion protection to MIL-DTL-5541F. This may be the final finish for the part or it may be a prerequisite required before painting. Check the TCOM drawing notes or part specification for the Class and Type of chromate conversion. If Class is not specified, use Class 1A. If Type is not specified then the Type is optional but Type I is preferred. TCOM considers chromate conversion to be a "special process" that requires the use of approved Suppliers. If you plan to apply this coating in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and a non-batch, continuous line process by a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort). If the processor you choose has no dedicated quality function and/or plans to use brush application of commercial (auto-parts store/boat marina) Iridite or Alodine then TCOM will NOT award you the work on this purchase order. TCOM approval is satisfied by one of the following: TCOM will audit your (or your sub-supplier's) facility for compliance to the Military Standard specification and its references; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to TCOM's lists as a TCOM-approved chromating Supplier. The current list of TCOM-approved chromating suppliers can be found on TCOM's website at http://www.tcomlp.com/quality. Use a Raytheon-approved chromating Supplier. Use a NADCAP-approved chromating Supplier. Use a Northrop-Grumman-approved ASPL chromating Supplier. Use a Lockheed-Martin-approved QCS-001 chromating Supplier. Use a Boeing-approved D1-4426 chromating Supplier. Any TCOM audit will require that you or your sub-supplier follow MIL-DTL-4451F including (but not limited to) planned arrangements for: [3.1] qualified materials MIL-DTL-81706 (purchased off QPL-81706 and Amendments 1 and 2); proper use of replenishing chemicals (such as fluorides). [3.2] proper cleaning to a water-break free surface prior to coating; absence of prohibited abrasives; controls and procedures for re-cleaning, touch up and rejection. [3.3] application methods including pre-treatment masking. [3.4] (maximum) 5% touch-up. [3.5] requiring continuity in appearance; requiring discernible visibility in daylight; minimizing and touching up contact marks. [3.6.1/4.4.1] 168 hour 5% salt spray testing. [3.6.2/4.4.2] wet tape adhesion testing (ONLY if CARC or other paint system is called for). [3.7] electrical contact resistance testing (ONLY for Class 3 coatings). [3.8] chemical analysis of the conversion coating (concentration, pH and temperature) and comparison to manufacturer's requirements. [4.1a/4.2] process control inspection (tests and solution analysis); frequency of tests; test specimens; actions after failure. [3.9/4.1b/4.3] workmanship/conformance inspection; sampling; visual examination; actions after failure.
	ANODIZING REQUIREMENTS

TC39

The item ordered has one or more aluminum or aluminum alloy parts that require anti-corrosion protection (perhaps with cosmetic color for appearance enhancement) per MIL-A-8625F Amendment 1. This is usually the final finish for the part but may also be a prerequisite before painting.

TCOM considers anodizing to be a "special process" that requires the use of approved Suppliers. If you plan to apply this coating in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort).

TCOM approval is satisfied by one of the following:

TCOM will audit your (or your sub-supplier's) facility for compliance to the Military Standard specification and its references; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to TCOM's lists as a TCOM-approved anodizing Supplier. The current list of TCOM-approved anodizing suppliers can be found on TCOM's website at http://www.tcomlp.com/quality.

- Use a Raytheon-approved anodizing Supplier.
- Use a NADCAP-approved anodizing Supplier.
- Use a Northrop-Grumman-approved ASPL anodizing Supplier.
- Use a Lockheed-Martin-approved QCS-001 anodizing Supplier.
- Use a Boeing-approved D1-4426 anodizing Supplier.

Any TCOM audit will require that you or your sub-supplier follow applicable portions of MIL-A-8625F including (but not limited to) planned arrangements for:

[3.3.2] Proper cleaning to a water-break free surface prior to coating; absence of prohibited abrasives.
[3.3.4] 5% touch-up (maximum).
[3.7.1.1/3.7.2.1.1/4.5.2] Weight of Types I (unsealed), II (unsealed) & III coating.
[3.7.2.1/4/5/1] Thickness of Type III coating.
[3.6.1/4.5.3] 336 hour 5% salt spray testing.
[3.7.1.4/4.5.6] Wet tape adhesion testing (ONLY if CARC or some other paint system is called for).
[3.8] Sealing.
[3.9] Final dimensions.
[3.12] Required wetness/rinse time limits for dyeing.
[3.13.1] Contact marks.
[4.2a/4.3] Document requirements; process control inspection (tests and solution analysis).
[4.2b/4.4] Quality conformance inspection; sampling; visual examination; dimensional measurements; actions after failure.

TC40

Commercial (Non-CARC) Painting Requirement

TCOM will subject the topcoat paint applied on parts in this purchase order to water exposure by 24 hour application of distilled water patches placed on the paint surface followed by a tape adhesion test using 3M Brand 250 masking tape - if any paint is lifted by this wet tape test the part will be rejected and require repainting. Other accept/reject criteria is contained in paragraphs 15 and 16 of TCOM 443A12 Section 2.

Most aluminum parts will have undergone chromate conversion (TCOM QA Code TC38) before painting - surface preparation by the paint Supplier shall not damage/compromise the chromated surface. The paint supplier is advised that chromate surfaces older than 24 hours may not have adequate paint adhesion unless a wash primer (DOD-P-15328) is applied directly on the chromate before primers in 443A12. The paint supplier is responsible for ensuring that the paint adheres to any chromated part. Similar rules apply to passivated stainless steel surfaces.

TCOM considers painting to TCOM 443A12 Section II to be a "special process" that requires the use of approved Suppliers. If you plan to apply paint in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort).

TCOM approval is satisfied by one of the following:

TCOM will audit your (or your sub-supplier's) facility for compliance to the commercial best practices in TCOM 443A12 Section II and the Manufacturer's requirements of the chosen paint; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to TCOM's lists as a TCOM-approved painting Supplier. The current list of TCOM-approved painting suppliers can be found on TCOM's website at http://www.tcomlp.com/quality.

- Use a Raytheon-approved painting Supplier.
- Use a NADCAP-approved painting Supplier.
- Use a Northrop-Grumman-approved ASPL painting Supplier.
- Use a Lockheed-Martin-approved QCS-001 painting Supplier.
- Use a Boeing-approved D1-4426 painting Supplier.

In order to pass the audit, a painting Supplier must have adequate painting facilities where temperature, humidity, foreign object exclusion and lighting are all suitable. A prerequisite to the audit is submission of stepped paint test panels showing an original substrate surface, the prepared/cleaned substrate, primer(s) and topcoat in such a way that thickness of each layer can be measured and destructive tests (ASTM D6677 or ASTM D3359) performed on the paint films. Painting must be controlled by use of a "traveler" or other integrated process control and inspection document that is used both for the test panel above and, subsequently, for production painting. The "traveler" shall cover the same areas that an audit will cover including:

Paint Ordering and Storage Methodology
Facilities for Blasting/Power Tool Cleaning
Facilities for Pressure Washing and Solvent Cleaning
Check of Paint Booth for Foreign Object Debris/Cleanliness Actions
"Tissue Test" for Dry Compressed Air Supply
Temperature Measurement/Control
Humidity Measurement/Control
Ability to Mix Paint per Instructions and Measure Viscosity
Paint Part Numbers, Lot Numbers Recording
Shelf Life and Pot Life Control
Water-Break-Free Pre-Painting Cleanliness Testing
Production Stepped Panel Use
Wet Film Thickness Measurement
Inter-Coat and Between Coat Drying Time Control
Drying/Force-Drying Facilities
Dry-Film Thickness Measurements
Tests of the Production Stepped Panel
Color and Specular Gloss Measurements
Dry Tape and Wet Tape Adhesion Testing of parts Painted
Final Inspection and Defect Recording
Corrective Action and REWORK Management

The supplier shall submit a Certificate of Conformance (TCOM QA Code TC06) to certify that painting followed TCOM 443A12 Section 2 and the Manufacturer's paint application guidelines. Paint raw material traceability shall be the same as any other raw material (TCOM QA Code TC13).

Airship Commercial Paint Color for Purchase Order

Drawing Note	Type	Description	Color No. FED-STD-595	Finish COAT Spec.
Paint per 443A12	Carbothane 133 HB or LH	Aircraft White (Exterior)	37875	TCOM 443A12 Section 2

TC41	**HEAT TREATMENT REQUIREMENTS** Supplier (or Sub-contractor) must work to a relevant, recognized standard for all heat treatment required for this work; if a particular standard or specification is listed on TCOM's drawing, the Supplier shall either work to TCOM's choice or request a waiver in writing. The competent persons performing heat treatment must do it on a regular basis in support of the Supplier's own ongoing production or else shall be employed by a sub-contracted firm that specializes in providing heat treatment. Heat treatment Suppliers shall have at least one audit-based approval by TCOM or a major defense/aerospace company or the Government that supports competency in the relevant technique (induction, flame, oven, etc.) - examples of approved Suppliers include: TCOM has audited your (or your sub-supplier's) facility for compliance to the appropriate SAE AMS or other specification and its references; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to TCOM's lists as a TCOM-approved heat treatment Supplier. The current list of TCOM-approved heat treatment suppliers can be found on TCOM's website at http://www.tcomlp.com/quality. •Use a Raytheon-approved heat treatment Supplier. •Use a NADCAP-approved heat treatment Supplier. •Use a Northrop-Grumman-approved ASPL heat treatment Supplier. •Use a Lockheed-Martin-approved QCS-001 heat treatment Supplier. •Use a Boeing-approved D1-4426 heat treatment Supplier. The Supplier (or sub-supplier) must have written procedures and any supporting technique sheets under document and revision control; these procedures must be on-site and available for review at each in-process or final inspection event and at other times (at the supplier's plant) upon request. Production/process equipment must have proven capability to measure and control the applied heat and methods must be in place to detect and mitigate problems. Controls during heat treatment shall hold temperature variations to +/- 20 DEGF of required/specified set points and temperatures/transfer times of parts moving from heating to quench shall monitored and managed effectively. The Supplier shall prepare a heat treatment report on an appropriate form, including the relevant process parameters and any post-treatment check (hardness); the report shall have the approval signature and title of a responsible agent of the Supplier. An adequate method of identifying and cross-referencing each treatment, report, and item must be provided.
TC42	**PASSIVATION/DE-PASSIVATION REQUIREMENTS** On this purchase order, TCOM requires that stainless steel parts of a specified alloy be passivated. TCOM prefers passivation processes compliant with ASTM-A-967 but will accept QQ-P-35C (or SAE-AMS-QQ-P-35) as equivalent. Chosen processes shall follow the recommended guidelines in the alloy tables (FIG X1.1 or Table II, as appropriate to the specification) or else shall be cleared with TCOM prior to use. If constructed using welding, parts will also have a known filler metal (filler may either be identified on TCOM's drawing or chosen by the Supplier who did the welding from the Welding Procedure Specification's Code). When parts are welded they may have scale or heat tint or both. TCOM requires removal of any scale to allow good passivation but TCOM does NOT require removal of heat tint. For scale removal per ASTM-A-967 Paragraph 5.3.1, Suppliers must have stainless steel wire brushes or grinding/blasting media that is totally free of iron/zinc to perform the mechanical cleaning per ASTM A-380-1999e1. Alternatively, Suppliers may use a bead-blasting media that is assumed to contain iron provided that a brief acid dip is performed per A380/5.3.4(+Annex A2) before passivation. If TCOM's drawing is silent regarding the test Practice, the Supplier shall use at minimum Practice A (Water Immersion Test) discussed in sections 1.4.1, 13.3.1 and 14 of ASTM-A-967 (or 3.7.1 and 4.4.1 of QQ-P-35C). For each shipment, the Supplier shall certify process conditions and performance of tests to the required practice as permitted by section 22.1 of ASTM-A-967. TCOM considers Passivation to be a "special process" that requires the use of approved Suppliers. If you plan to perform this work in-house, your firm must be approved by TCOM to perform this process; if you will subcontract this work to a sub-supplier, that sub-supplier must be approved by TCOM. All such approvals must be in advance. Approvals will generally require both an adequate Quality Control system and use of a company who specializes in this work as a service for sale (or performs it regularly in support of their own manufacturing effort). TCOM approval is satisfied by one of the following: TCOM will audit your (or your sub-supplier's) facility for compliance to the ASTM-A-967 specification and its references; if your process complies (or you take appropriate corrective and preventive actions TCOM may require) then the facility will be added to TCOM's lists as a TCOM-approved passivation Supplier. The current list of TCOM-approved Passivation suppliers can be found on TCOM's website at http://www.tcomlp.com/quality. •Use a Raytheon-approved passivation Supplier. •Use a NADCAP-approved passivation Supplier. •Use a Northrop-Grumman-approved ASPL passivation Supplier. •Use a Lockheed-Martin-approved QCS-001 passivation Supplier. •Use a Boeing-approved D1-4426 passivation Supplier. Any TCOM audit will require that you or your sub-supplier follow applicable portions of ASTM-A-967 including (but not limited to) planned arrangements for: [5.2.1] Materials (chemicals) use including maintenance of adequate volume, concentration, purity, and temperature control. [5.2.2] Record keeping and availability (coded if necessary for proprietary processes). [5.3] Preparation including mechanical and chemical methods plus results (and avoidance of passivation after more aggressive treatments). [6] Conduct of passivation treatments Nitric 1 through Nitric 5 plus water rinse (including water cleanliness). [7] Conduct of passivation treatments Citric 1 through Citric 5 plus water rinse (including water cleanliness). [8] Conduct of passivation with other chemical solutions (with or without electricity). [9] Arrangements for neutralization (rinsing with or without separate treatment). [10] Post-Cleaning Treatments to accelerate passivation film formation (including sodium dichromate for ferritic and martensitic steel parts). [11] Finish including visual inspection for cleanliness, etching, pitting or frosting. [12-19] Planned arrangements for testing using Practices A through F. [20] Rejection and re-test procedures (including lot traceability).
TC43	**Quality Flowdown to Sub-Suppliers** The Supplier's Quality System shall assure all relevant Purchase Order requirements are flowed down to their sub-tier suppliers. The Supplier's sub-tier suppliers are responsible to comply with the same specifications, drawings and technical requirements specified on this Purchase Order. The extent of flowdown to sub-suppliers shall be determined by extent of type-certified aircraft traceability defined in TCOM Quality Code TC29 (provided separately). In general, flowdown stops at the ordering of a commercial-off-the-shelf (COTS) or military-off-the-shelf (MOTS) part, commodity or raw material - such common parts only need flowdown of a Certificate of Conformance to authentic the identity (correct part), the source (manufacturer/supplier), the lot/batch/heat number traceability and any shelf life dates.
	Documentation Revision/Configuration Control The Supplier shall assure he has the revision of the drawing matching the revision noted on this Purchase Order.

TC44	If an item on this Purchase Order is controlled by a drawing that lists or references a Parts List (PL) or a Bill of Materials (BOM), the Supplier must assure that he has the revisions in effect for the entire drawing tree below the ordered part as of the date of this Purchase Order. The supplier should contact the TCOM Buyer for the current drawing-tree revision level listing of the subsidiary drawings and specifications on the PL or BOM. If an item on this Purchase Order invokes by reference a military specification/standard/handbook or other revision-controlled commercial requirement documents, the revisions in effect are as of the date of this Purchase Order. Revisions of non-commercial military documents are generally available free of charge from https://assist.daps.dla.mil/quicksearch/ along with any associated Qualified Products Lists (QPL). Non-military commercial standards must generally be purchased by the Supplier, however TCOM's Buyer will entertain written requests to provide access to a TCOM copy if TCOM holds a copy of the reference.
TC45	Foreign Object Debris/Damage Elimination The material supplied on this purchase order shall be manufactured in an environment that is free of foreign objects. Material supplied shall be free of foreign objects. The Seller shall establish and maintain an effective Foreign Object Damage (FOD) Prevention Program to reduce FOD using NAS412 as a guideline. A free presentation and study guide that gives an adequate explanation of the basics of FOD awareness can be obtained from http://ncatt.org/foe-resources.php and selecting "NCATT FOE - Elements of Basic Awareness Certification" and/or its associated "Instructional Guide". The Seller's program shall utilize effective FOD prevention practices. The program shall be proportional to the sensitivity of the design of the product(s) to FOD, as well as, to the FOD generating potential of the manufacturing methods. The written procedures or policies developed by the Seller shall be subject to review and audit by the TCOM Buyer and/or Government (FAA/DCMA) representative, and to disapproval when the Seller's procedures or policies do not accomplish their objectives. The intent of this Quality Note is not to necessarily change manufacturing processes but maintain continual awareness of the need to eliminate foreign objects for all material supplied.
TC46	Manufacturer's Part Numbers Recommended If an item on this Purchase Order is controlled by a drawing that references a "Suggested Source of Supply" and/or "Manufacturer's Part Number", this shall not be construed as a guarantee that the suggested supplier and/or manufacture's part number meets the requirements of the drawing. It is the Sellers responsibility to assure that the "Suggested Source of Supply" and/or "Manufacturer's Part Number" meets applicable drawing/specification requirements identified on this Purchase Order.
	Revision: New