



communications

Electrodynamics, Inc.

1200 Hicks Road Rolling Meadows, IL 60008

Tel: 847-259-0740 | Fax: 847-255-3827

WORKMANSHIP MANUAL

✧ *W. Edwards Deming: "Quality is everyone's responsibility"* ✧

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I. RECORD OF CHANGES

Rev.	Pages Changed	Description Of Change	Date
NA	NA	Was Preliminary Issue.	03-14-05
--	NA	Released For Production.	11-01-05
A	I, 1-18	Incorporated Section 2, Renumbered Section 1 IAW CO 21468.	03-01-07
B	7	Added Acceptable Criteria Picture For Dual Finish IAW CO 22608.	09-04-08
C	All	Major Changes Throughout, Especially III, VI & Sections 2 – 5 IAW CO 24063.	07-21-10
D	Pages 4, 14, 15, 22, 34, 48-51, 53	Sect.III, Revised 5 & Added 6. Added Photos for Anodized ETI Bracket & Updated 1.2.3. Added Section 6 for E and F Flanges ETIs & Renumbered Subsequent Sections. Added Photos for Armature & ML1510 Case to Electroless Nickel Plating 1.6.3. Corrected Typo from IPC-A-610 to IPC/WHMA-A-620 in 2.2.4. Added Unacceptable Photo Sect. 7 D.2.2.4 IAW CO 24341.	12-07-10
E	47, 48, 52, & 55-61	Section 5 added (F) PN 999A0064 Accept and Reject photos and Removed an Accept photo from (D). Section 6 add photo of acceptable flange dent. Added new Section 8 soldering of fill tube ETI. Moved Section 8 to Section 9 IAW CO 24553	4-27-11

Any revision to this document requires the approval of L-3 EDI's Director of Quality Assurance.

This document is available on L-3 EDI's internet website. Any revision to this document requires the Workmanship Manual on our website to be updated.

Use or disclosure of data on this sheet is subject to the restriction on the title page of this document.

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III. ENGINEERING DRAWINGS

Unless otherwise specified:

1. Engineering drawings shall be interpreted in accordance with the revision of ASTM Y14.5 or ASME Y14.100 (Engineering Drawing Practices), as applicable, current at the time of its initial release; however, if a specific revision is cited then the specified revision shall govern.
2. Dimensional limits apply after plating, finishing, or coating.
3. For the purposes of determining conformance, all specified limits shall be absolute limits, as defined in ASTM E29 (Standard Practice for Using Significant Digits in Test Data to Determine Conformance to Specifications), unless authorized by L-3 EDI Quality Assurance.
4. When surface finish limits are specified on the engineering drawing, surface finish shall be in accordance ASME B46.1 (Surface Texture (Surface Roughness, Waviness, and Lay)). See Section VI for further details.
5. Any engineering drawing or workmanship interpretation questions within L-3 EDI shall be brought to the attention of the appropriate L-3 EDI personnel (i.e., supervisor, manufacturing engineering, quality assurance engineering, design engineering) for resolution by L-3 Quality Assurance.
6. Pursuant to L-3 EDI [Form 1002](#) Supplier Quality Assurance Requirements Clause 1A, 1B, or 1C, the requirements of this document is/shall be flowed down to our supplier partners. Any engineering drawing or workmanship interpretation questions by L-3 EDI's supplier partners shall be brought to the attention of the appropriate L-3 EDI buyer. [Form 1002](#) can be found on L-3 EDI's [website](#), or is obtainable through L-3 EDI's Buyer.

IV. ORDER OF PRECEDENCE

In event of conflict, the following Order of Precedence shall govern:

1. Engineering Drawing
2. Purchase Order
3. Referenced Specification
4. L-3 EDI Workmanship Manual

V. DEFINITIONS

The use of the words "may", "shall", "should" and "will" in this manual express mandatory and non-mandatory provisions as follows:

1. **May** – Used to express a non-mandatory provision.
2. **Shall** – Used to express a provision that is binding.
3. **Should** – Used to express a non-mandatory provision.
4. **Will** – Used to express a declaration of purpose on the part of the contracting agency.

Use or disclosure of data on this sheet is subject to the restriction on the title page of this document.

VI. GENERAL STANDARD VISUAL INSPECTION AND TEST

Unless otherwise specified, the following standard visual inspection and test conditions shall apply:

1. **Facilities and Environmental Controls:** Inspections shall occur in sufficiently clean and controlled environmental ambient conditions (e.g., in a foreign-object-debris-free environment at ambient temperature, humidity, and air pressure) to enable repeatable and reproducible results to be obtained commensurate with the required accuracy and criticality of the characteristic being verified. For items moved or transported from one environmental condition to another, consideration shall be given to allowing items to fully stabilize and acclimate, especially for critical inspection characteristics or those requiring a higher degree of accuracy, prior to verification.
2. **Normal Lighting Condition:** Inspection shall be made under adequate lighting conditions (e.g., 93 foot-candles (1000 lm/m^2) in white fluorescent light without shadows) that does not produce/cast shadows over the item being inspected. Supplemental lighting may be necessary to assist in visual inspection.
3. **Duration:** Typical normal visual inspection duration for cosmetic / workmanship acceptance should be 2 to 5 seconds per characteristic. Referee inspection may take longer.
4. **Magnification:**
Reference and related documents:
 - a. WI-10-01-11 (Inspection Procedures),
 - b. ANSI/IPC J-STD-001 (Requirements for Soldered Electrical and Electronic Assemblies).

There are two inspection classifications and associated typical magnifications:

- a. Normal Inspection, and
- b. Referee Inspection.

Magnification Power	
Normal Inspection	Referee Inspection
0 – 4X (0 – 16 Diopter)	4 – 10X (16 – 40 Diopter)

NOTE

When not otherwise specified in the Inspection Procedure or other governing requirements document (e.g., IPC/EIA J-STD-001, Workmanship Manual Section (X), etc), the magnification powers to be used shall be as specified above. The above typical magnification powers should be adequate for most current L-3 EDI items.

- a. Normal Inspection – Normal inspection includes Receiving Inspection, Manufacturing Inspection (in-process and final), and post-production inspections (e.g., customer returns). Unless otherwise specified, the magnification power used shall be 0 – 4X. For most non-critical characteristic inspections, if the presence of a defect cannot be determined at the specified magnification level and duration (see VI, Normal Lighting), then the item shall be deemed acceptable.

Most non-critical cosmetic / workmanship inspections should be verified without the use of a magnification aid. The item should be in direct line of sight 18 to 24 inches (approximately arms length) away. Items should be rotated to the left and right, or up and down, as required.

- b. Referee Inspection – The referee inspection magnification power of 4 – 10X shall be used only after a non-critical characteristic defect has been determined but is not completely identifiable as part of Normal Inspection, or if a defect of a critical characteristic is suspected.

5. **Visual Acuity:** L-3 EDI: Inspection personnel eye sight requirements shall be per WI-10-01-07 (Inspection and Test Personnel Eye Examination Requirements). L-3 EDI's Supply-Base: Inspection personnel shall possess adequate eye sight (corrected or uncorrected) to perform the visual inspections to the required degree of accuracy and repeatability.
6. **Surface Finish:** When surface finish limits are specified on the engineering drawing, surface finish shall be interpreted as specified in Section III. It is preferred to directly measure surface finish to obtain a variable measurement value using a calibrated surface finish measurement device, such as a calibrated profilometer. Alternatively, the usage of a comparative calibrated surface finish comparator gage may be used. Comparison may by eye or tactile means.
7. **Adhesion of Plating, Paint, Coatings, Markings, Varnish Overcoats, and the Like:** (Reference: IPC-TM-650, Test Method 2.4.1): The adhesion of plating, paint, coatings, markings, varnish overcoats, and the like shall be such that there shall be no visual evidence of removal on the tape's adhesive surface when the following test is performed.

Apply a strip of 3M Brand 600 tape or tape as specified in Commercial Item Description AA-113, Type 1, Class B (except tape may be clear) across the clean finished surface to be tested. The tape strip should be ½ inch wide by 2.0 inches long or of a size commensurate with the surface area to be tested, and shall be within the manufacturer's specified shelf-life and storage conditions. Lightly burnish the tape to ensure removal of entrapped air and complete uniform contact. The time between the application and removal of the tape shall be less than one minute. The tape shall then be removed by pulling the tape at a right angle (90°) to the item's surface in a single continuous, non-abrupt motion. The tape shall be examined for evidence of removal of the material being tested.

8. **Color and Gloss Matching:** Color and gloss matching evaluation shall typically be made via visual comparison to the specified paint chip or L-3 EDI authorized physical sample. If required, especially for referee inspections, a spectrophotometer, color meter, gloss meter or other acceptable variable measurement device may be used.

Paint chips and physical samples typically provide a reliable means of visual matching, but an intrinsic property of them is that their shades change over time. Moreover, the effect of ageing is usually not consistent across the range of colors, as some colors will change more than others.

Adequate controls shall be established for paint chips and samples, especially to minimize any potential color change. Color change can be minimized by observing the following procedures.

- a. Store the color chips or samples in a cool, dark place;
- b. Avoid exposure of the color chips or samples to direct or scattered UV light or chemicals;
- c. Minimize exposure of the color chips or samples to light from any source;
- d. Keep the color chips and samples covered when not in use; and
- e. Do not touch the face of the color chips or samples with bare hands.

9. **Foreign Object Debris/Damage (FOD):** Reference and related documents include:

- a. L-3 EDI [QOP-09-02](#), Foreign Object Damage
- b. [Form 1002](#) Supplier Quality Assurance Requirements, Clause 25, Foreign Object Debris/Damage (FOD) Prevention
- c. [NAS412](#), Foreign Object Damage/Foreign Object Debris (FOD) Prevention

Necessary controls (e.g., commensurate with the probability (i.e., risk) of FOD being introduced, the item's criticality, etc.) shall be established to prevent items containing FOD to be shipped. Special consideration shall be given to (a) control potential sources of FOD, and (b) visually inspect potential FOD entrapment/collection areas.



Potential sources of FOD include, but shall not be limited to:

- a. Weld and solder splatter, solder balls and slivers, flux residue;
- b. Metal cuttings, chips, and shavings;
- c. Burrs and flash;
- d. Hairs, fibers, and other forms of particulate matter;
- e. Finger oils and hand lotions;
- f. Cut leads of axial-leaded electronic component;
- g. Stripped wire insulation nibs and wire clippings;
- h. Threaded insert broken-off tang;
- i. Unsecured or unattached hardware such as screws, washers, nuts, bolts;
- j. Consumable items or administrative supplies such as popsicle stick and toothpick applicators, staples, paper clips;
- k. Food and beverages;
- l. Mold release compound, oils, lubricants and other forms of residue;
- m. Facility construction debris;
- n. Statically-charged / magnetized items. (Note: Some plastics are capable of becoming statically charged, and notwithstanding magnets, some metallic items are capable of becoming magnetically charged. These items when charged pose a potential deleterious effect of attracting oppositely charged items, including particulate matter.)
- o. Select packing materials, such as staples and packaging peanuts.



After fabrication, parts and assemblies should be cleaned of any foreign material which might detract from their intended operation, function, or appearance.

Areas in which FOD could collect (e.g., blind holes, pockets, wells, traps, etc.) should be visually inspected for cleanliness and FOD prior to being enclosed or packaged.

L-3 EDI's [QOP-09-02](#) (Foreign Object Damage) is compliant with the above prescribed FOD measures. Supplier's are encouraged to consult [QOP-09-02](#), which is obtainable through L-3 EDI's Buyer or [NAS412](#) (Foreign Object Damage/Foreign Object Debris (FOD) Prevention) for benchmarking purposes to facilitate the development of their own FOD Prevention Program or taking their existing program to the next level.

10. Counterfeit Parts:

Reference and related documents include:

- a. L-3 EDI [WI-02-01-02](#), Counterfeit Parts Risk Mitigation Plan,
- b. L-3 EDI [Form 1002](#) Supplier Quality Assurance Requirement (SQAR), Clause 1 regarding Suspect/Counterfeit/Substandard Parts/Items
- c. [SAE AS5553](#), Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition,

- d. Federal Aviation Administration (FAA) Advisory Circular [AC 21-29](#) (Detecting and Reporting Suspected Unapproved Parts).

All items shall meet the original manufacturers, government/industry or regulatory authority, L-3 EDI, or other applicable second or third party full specifications, inclusive of being qualified, approved, or authorized (e.g., listed on the Qualified Product List (QPL), Qualified Manufacturer List (QML), or Buyer's drawing/specification; NADCAP or customer special processor approved; FAA PMA/TSO approved, etc.) to manufacture or process such item(s), when required.

Examples of counterfeit parts include, but shall not be limited to:

- a. Items which do not contain the proper internal construction (die, manufacturer, wire bonding, etc.) consistent with the ordered part.
- b. Items which have been used, refurbished or reclaimed, but represented as new product.
- c. Items which have different package style or surface plating/finish than the ordered parts.
- d. Items which have not successfully completed the original manufacturer's full production and test flow, but are represented as completed product.
- e. Items sold as up-screened parts, which have not successfully completed up-screening.
- f. Items sold with modified labeling or markings intended to misrepresent the part's form, fit, function, or grade.
- g. Items which are required to be manufactured or processed by a qualified, approved, or authorized manufacturer or processor (e.g., listed on the Qualified Product List (QPL), Qualified Manufacturer List (QML), or Buyer drawing/specification; NADCAP or customer special processor approved, FAA PMA/TSO approved, etc.), but who is not at the time of manufacturing or processing.



Parts which are not generally considered counterfeit are those whose characteristics or specifications have been modified, but are not knowingly misrepresented, such as refinished, up-screened, or up-rated parts.

In recent years, the increased levels of effort and sophistication of counterfeiters, in particular electronic part counterfeiters, have plagued the aerospace and defense electronics industry and their contractors, such as L-3 EDI. L-3 EDI and our customers take

this threat very seriously. To counter this elevated risk to L-3 EDI and our customers, [WI-02-01-02](#) (Counterfeit Parts Risk Mitigation Plan) was established, which primarily focuses on prevention. [WI-02-01-02](#) has been promulgated in support of L-3 Communications Corporate Material and Quality Operating Procedure, MQOP-001 (Counterfeit Parts Risk Mitigation), [SAE AS5553](#) (Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition), Federal Aviation Administration (FAA) Advisory Circular [AC 21-29](#) (Detecting and Reporting Suspected Unapproved Parts).

[WI-02-01-02](#) and [Form 1002](#) can be found on L-3 EDI's [website](#), or is obtainable through L-3 EDI's Buyer to facilitate benchmarking and development of our supply-base's Counterfeit Part Prevention and Detection Plans/Procedures or taking their existing program to the next level.

As with any other requirement, L-3 EDI expects our supply-base to be in full compliance with supplier flow-down, [Form 1002](#) Supplier Quality Assurance Requirement (SQAR), Clause 1 section regarding Suspect/Counterfeit/Substandard Parts/Items.

See Section 2 (Electrical And Electronic Items (Parts And Assemblies)) herein for further detailed information.

SECTION 1 - PLATING, COATINGS, AND FINISHES

1 PLATINGS, COATINGS, AND FINISHES

1.1 ELECTROPLATING TERMINOLOGY

These definitions correspond to interpretations as applied to electroplating and do not necessarily correspond to the definitions used in other plating, coating, and finish methodologies.

- a. **Anodizing** - An electrolytic oxidation process in which the surface of a metal, when anodic, is converted to a coating having desirable protective, decorative, or functional properties (reference: ASTM B 374 and 6310058)
- b. **Barrel Processing** - Mechanical, chemical, cleaning or electrolytic treatment of articles in bulk or in a rotating, oscillating, or otherwise moving container (reference: ASTM B 374).
- c. **Base (Basis) Metal** - Material upon which coatings are deposited (reference: ASTM B 374).
- d. **Black Oxide** - A finish on metal produced by immersing a metal in hot oxidizing salts or salt solution (reference: ASTM B 374 and 6310058)
- e. **Blister** - A dome-shaped imperfection or defect, resulting from loss of adhesion between a metallic deposit and the substrate (reference: ASTM B 374).
- f. **Bright Dip** - A solution used to produce a bright surface on a metal (reference: ASTM B 374).
- g. **Color Uniformity** - Surface color varying in uniformity resulting in spots, blotches and striations of different color.
- h. **Contamination** - An inclusion of foreign material detectable on surface of the item.
- i. **Conversion Coating** - A coating produced by chemical or electrochemical treatment of a metallic surface that gives a superficial layer containing a compound of the metal (reference: ASTM B 374).
- j. **Crack(s)** - A fracture passing completely through the thickness or section of an item.
- k. **Crazing** - A network of fine hairline cracks in a coating (reference: ASTM B 374).
- l. **Deformed** - A departure from normal shape greater than the dimensional tolerance. Items often deform out of round, out of square, twisted, warped, bent or flattened.
- m. **Dent** - A depression with no removal of material or change in surface texture.
- n. **Dual Finish** - An item that has two different finishes as specified on the drawing.
- o. **Electroplating** - The electro deposition of an adherent metallic coating upon an electrode for the purpose of securing a surface a surface with properties or dimensions different from those of the base metal (reference: ASTM B 374).
- p. **Flash** - Related to molded items - Excess material adhering to item.

- q. **Flash** – Related to electro parting – A very thin electro-deposit used for a final coat: for intermediate coatings of the same nature, use strike (reference: ASTM B 374).
- r. **Gouges** - The result of scooping out of material by another object.
- s. **Masking** - Various materials applied to specific areas of items to prevent coatings from being deposited (reference: ASTM B 374).
- t. **Nicks** - Sharp surface indentation caused by impact of a foreign object. Parent material is normally displaced, seldom separated. Non-fill/Void - An incomplete item due to insufficient material.
- u. **Orange Peel** - A finish resembling the dimpled appearance of an orange peel (reference: ASTM B 374).
- v. **Pickling** - The removal of oxides or other compounds from a metal surface by means of a pickle (an acid solution) (reference: ASTM B 374).
- w. **Pit** - A small depression or cavity produced in a metal surface during electrodeposition or by corrosion (reference: ASTM B 374).
- x. **Pin Hole** - A small sharply defined hole in surface of item.
- y. **Rack, Plating** - A frame for suspending and carrying current to articles during plating and related operations (reference: ASTM B 374 and 6310058).
- z. **Sealed (Anodic) Coating** – in anodized aluminum, an anodic oxide coating on aluminum that has been treated in an aqueous or steam medium resulting in reduced porosity of the coating (reference: ASTM B 374).
- aa. **Scuff** - A mark caused by abrasion, which changes surface smoothness or texture.
- ab. **Smut** – A black powdery finish that is easily removed with a mild abrasive.
- ac. **Strike** - A thin film of metal to be followed by other coatings (reference: ASTM B 374).
- ad. **Strip** - To remove a coating from the basis metal or undercoat (reference: ASTM B 374).
- ae. **Surface Discoloration** - An apparent surface inconsistency in material evidenced by the appearance of light to dark streaks.
- af. **Underplating** - Application of a metallic coating layer between the basis metal or substrate and the topmost metallic coating or coatings. The thickness of such an undercoating is usually greater than 0.8 μm (30 μin). This is in contrast to strikes or flashes, whose thicknesses are generally much smaller (reference: ASTM B 545).
- ag. **Void** – A defective area in which a part of the basis material or under layer is visible after final coating (reference: ASTM B 374).
- ah. **Whiskers** – Metallic filamentary growths, often microscopic, sometimes formed during electro-deposition and sometimes spontaneously during storage or service, after finishing.

1.2 **ANODIZING**

Reference: [MIL-A-8625F Amendment 1](#) (a.k.a. A1) - Anodic Coatings for Aluminum and Aluminum Alloys, Paragraph(s): 3.6 Class 2, 3.13, 3.13.1, 3.3.4 and 6.20.

1.2.1 **Acceptable Workmanship**

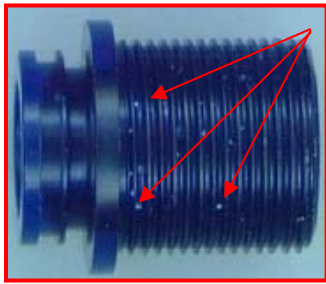
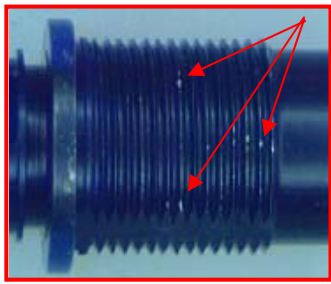
- a. MIL-A-8625: 3.6 Class 2. When class 2 is specified in the contract or purchase order (see 6.2 per MIL-A-8625), the anodic coating shall be uniformly dyed or pigmented by exposure to a solution of a suitable type dye or stain. The color on wrought alloys shall be uniform. Cast alloys may exhibit dye bleed-out or lack of color (or color uniformity) associated-with-the inherent porosity of the casting. The dyes and pigments used shall not be damaging to the anodic coatings.
- b. MIL-A-8625: 3.13 Workmanship. Except for touch up areas In accordance with 3.3.4 and as noted below, the applied anodic coating shall be continuous, smooth, adherent, uniform in appearance, free from powdery areas, loose films, breaks, scratches and other defects which will reduce the serviceability of anodized parts or assemblies. Differences in anodic coating appearance resulting from inherent base metal differences in a component such as the presence of welds, components containing cast and machined surfaces, and differences in grain size within a forging shall not be cause to reject the anodic coating unless otherwise specified in the contract or purchase order (see 6.2 per MIL-A-8625). Slight discoloration from dripping or rundown of the sealing solution from designed crevices in a component shall be allowed.
- c. MIL-A-8625: 3.13.1 Contact marks. The size and number of contact marks shall be at a minimum consistent with good practice (see 6.14 per MIL-A-8625). If a specific location for contact marks is desired; the-location shall be specified on the contract or purchase order (see 6.2 per MIL-A-8625).
- d. MIL-A-8625: 3.3.4 Touch UP (mechanical damage and contact marks). Unless otherwise specified (see 6.2 per MIL-A-8625), mechanically damaged areas from which the anodic coating has been removed without damage to the item may be touched up using chemical conversion materials approved on QPL-81706 for Class 1A coatings and the applicable method of application. Touch up shall apply only to inadvertent mechanical damage such as scratch marks. For Type I, IB and II coatings, touch up shall only be allowed in areas which will not be subjected to abrasion (see 6.1.1 per MIL-A-8625). The mechanically damaged area(s) shall not exceed 5 percent of the total anodized area of the item or touch up shall not be permitted. When specified in the contract or purchase order (see 6.2 per MIL-A-8625), contact marks shall be touched up using the above method required for mechanical damage.

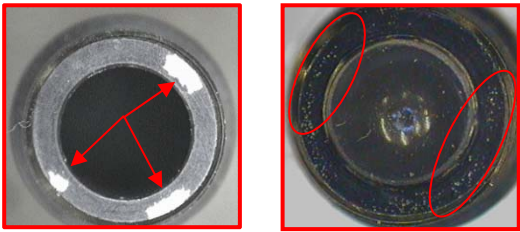
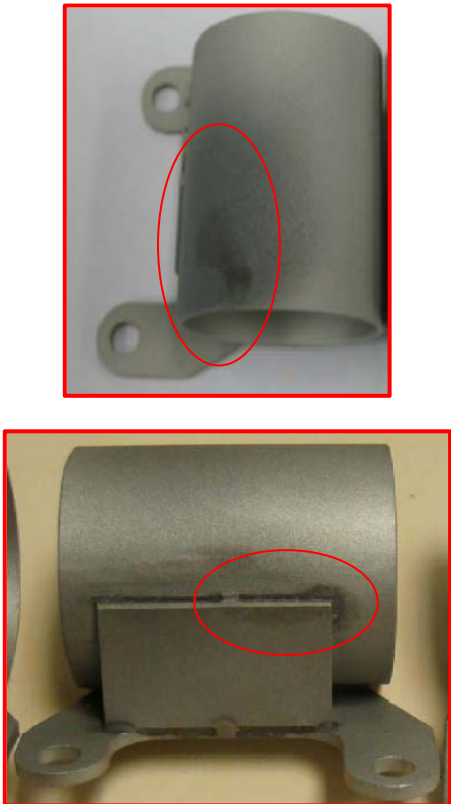
1.2.2 Packaging

- a. Coated surfaces shall be protected from damage during shipment and storage.
- b. When applicable, egg crate shipping containers are recommended during all storage and handling of the components. Each item should be individually packaged to prevent contact of adjacent items (e.g., in their own egg crate cell).

1.2.3 Illustrations

The following illustrations depict “Acceptable” and “Unacceptable” workmanship results.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Anodizing Uniform	 Anodizing Not Uniform
B	 No Foreign Material On Threads	 Foreign Material On Threads
C	 No Anodizing Missing On Threads	 Anodizing Missing On Threads

	Acceptable Workmanship	Unacceptable Workmanship
D	 Anodizing Not Scratched/Nicked/Peeling/Flaking or Pitted	 Scratched/Nicked Anodizing
E		 Peeling/Flaking Pitted
F	 No/Slight Dark Spots	 Dark Spots
Note: Part Shown Is Clear Anodized per MIL-A-8625, Type I, Class 1 (Ref. PN 098A60 & 098A61).		

1.3 **BLACK OXIDE**

Reference: [MIL-DTL-13924D Notice 1](#) – Coating, Oxide, Black, for Ferrous Metals, Paragraph(s): 3.7, 4.4.1.

1.3.1 **Acceptable Workmanship**

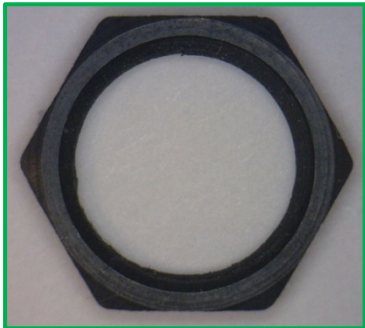
- a. MIL-DTL-13924: 3.7 Coverage and color. Class 1, 2, 3, and 4 coatings (see 1.2 per MIL-DTL-13924) shall cover the basis metal completely and shall pass the smut test. The color shall be a uniform black. A slight amount of smut, which is inherent in the process, shall not be cause for rejection. There shall be no indication of any reddish-brown or green smut when tested as in 4.4.1. Smut "spottiness" shall be classified as unsatisfactory and shall require reprocessing.
- b. MIL-DTL-13924: 4.4.1 Smut test. The test shall be made prior to application of corrosion preventive compound or after vapor degreasing. Each black oxide coated piece shall be inspected visually under strong light to assure a satisfactory appearance. Each sample shall also be wiped with a clean white cloth for indications of smut (see 3.7 MIL-DTL-13924). A slight amount of smut which is inherent in the process is acceptable for all classes of coatings and shall not be cause for rejection.

1.3.2 **Packaging**

- a. Coated surfaces shall be protected from damage during shipment and storage.
- b. When applicable, egg crate shipping containers are recommended during all storage and handling of the components. Each item should be individually packaged to prevent contact of adjacent items (e.g., in their own egg crate cell).

1.3.3 **Illustrations**

The following illustrations depict "Acceptable" and "Unacceptable" workmanship results.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Black Oxide Is Uniform	

1.4 CHROMATE (A.K.A. IRRIDITE, ALODINE OR CHEMICAL CONVERSION COATING)

Reference: [MIL-DTL-5541F](#) - Chemical Conversion Coatings on Aluminum and Aluminum Alloys, Paragraph(s): 3.5 and 6.8.

1.4.1 Engineering Drawing Call Out: In the event the engineering drawing does not call out a specific chromate color, the color shall be yellow. Clear chromate shall only be used when explicitly specified on the engineering drawing primarily due to the inherent difficulties of visually discerning the presence of clear chromate.

1.4.2 Acceptable Workmanship

- a. MIL-DTL-5541: 3.5 Appearance. The chemical conversion coating shall be continuous in appearance and visibly discernible in daylight. It shall be free from areas of powdery or loose coating, voids, scratches, flaws, and other defects or damages which reduce the serviceability of items or are detrimental to the protective value and paint bonding characteristics. The size and number of contact marks shall be minimal, consistent with good practice. If specified in the contract or order, contact marks shall be touched up with MIL-DTL-81706 material approved on QPL- 81706 for the applicable type; class, form, and method to prevent localized corrosion (see 6.4 and 6.8 MIL-DTL-5541).
- b. MIL-DTL-5541: 6.8 Visual appearances. The simplest way to evaluate a conversion coating is to observe color, continuity in appearance; smoothness and adhesion to the base metal (see 3.5 MIL-DTL-5541). Visual examination is performed to ensure that proper cleaning and coating procedures were used such that a coating with sufficient protection exists over the entire item. Materials qualified under MIL-DTL-81706 produce coatings that range in color from clear/colorless to iridescent yellow, brown, gray, or blue. It may be possible to develop acceptable color levels for a particular coating system by use of color chips. The following circumstances may exist that relate to color uniformity:
 - a. When several alloys are processed with the same conversion chemical, color may vary from alloy to alloy.
 - b. Due to the high level of impurities and oxidation on the surfaces of aluminum welds and castings, color may not be as uniform as that obtained by treating wrought alloys.
 - c. Dark spots may result from dripping or rundown of the conversion chemicals when the items are lifted out of the treatment tank. A small amount of spotting does not result in coating degradation but must be minimized by quickly rinsing the items after treatment, and use of proper racking techniques (reference 6310058).

1.4.3 Packaging

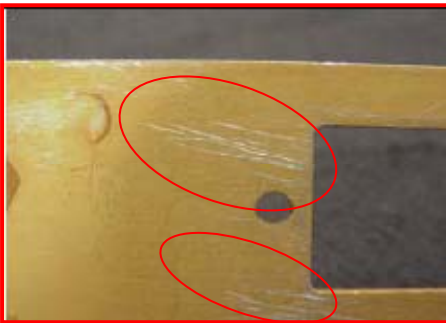
- a. Coated surfaces shall be protected from damage during shipment and storage.

Use or disclosure of data on this sheet is subject to the restriction on the title page of this document.

- b. When applicable, egg crate shipping containers are recommended during all storage and handling of the components. Each item should be individually packaged to prevent contact of adjacent items (e.g., in their own egg crate cell).

1.4.4 Illustrations

The following illustrations depict "Acceptable" and "Unacceptable" workmanship results.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Chromate Is Uniform	 Chromate Is Not Uniform
B	 Minor Dark Spots	 Excessive Amount of Scratches (No More Than 5 Isolated Spots)

1.5 DUAL FINISH

1.5.1 Definitions

- a. **Dual Finish** – An item that has two different types of finishes, coatings, or platings.

1.5.2 Acceptable Workmanship

- a. There shall be no contamination on the finish.
- b. The separating line for the finishes shall be as specified on the engineering drawing.
- c. Each finish shall be as specified in this manual.

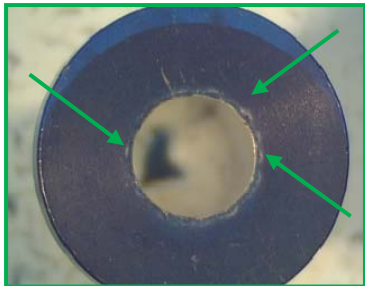
1.5.3 Packaging

- a. Coated surfaces shall be protected from damage during shipment and storage.
- b. When applicable, egg crate shipping containers are recommended during all storage and handling of the components. . Each item should be individually packaged to prevent contact of adjacent items (e.g., in their own egg crate cell).

1.5.4 Illustrations

The following illustrations depict “Acceptable” and “Unacceptable” workmanship results. Shown below are items that are dual finished with black anodized and clear chromate.

	Acceptable Workmanship	Unacceptable Workmanship
A	 No Foreign Material/Discoloration	 Foreign Material/Severe Discoloration
B	 Anodizing Completely Removed	 Anodizing Not Completely Removed

	Acceptable Workmanship	Unacceptable Workmanship
C	 Minor Discoloration Immediately Around Center Hole	

1.6 ELECTROLESS NICKEL

Reference: MIL-DTL-26074F Notice 1 – Coatings, Electroless Nickel, Paragraph(s): 3.6.2. (Note: Per Notice 1, MIL-DTL-26074F has been superseded by either MIL-DTL-32119 and SAE AMS-C-26074 depending upon the application. For L-3 EDI's applications, SAE AMS-C-26074 shall be the superseding specification.)

1.6.1 Acceptable Workmanship

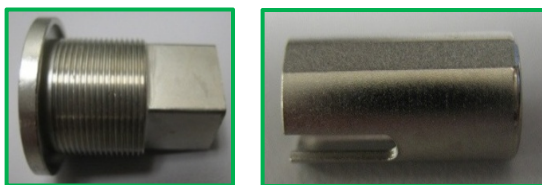
- The nickel coating shall be smooth, adherent, and free from visible blisters, pits, nodules, porosity, cracks and other defects.

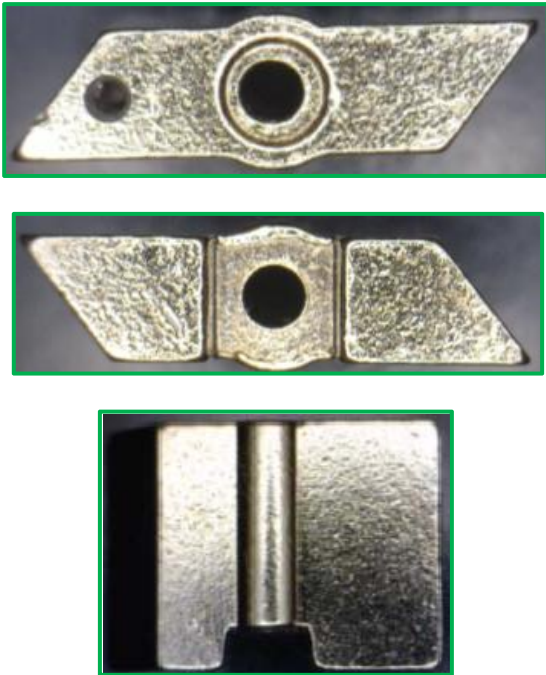
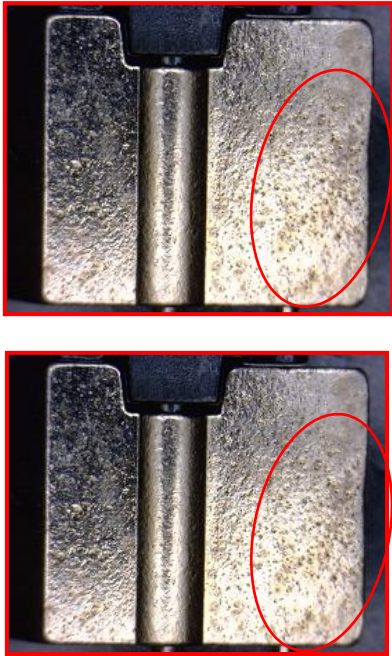
1.6.2 Packaging

- Coated surfaces shall be protected from damage during shipment and storage.
- When applicable, egg crate shipping containers are recommended during all storage and handling of the components. . Each item should be individually packaged to prevent contact of adjacent items (e.g., in their own egg crate cell).

1.6.3 Illustrations

The following illustrations depict "Acceptable" and "Unacceptable" workmanship results.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Nickel is Uniform	

	Acceptable Workmanship	Unacceptable Workmanship
E	 Slight Surface Abrasion Marks (ML1510 Case PN 400185 Example Shown)	
AMATURE PN 038C120		
F	 No Peeling, Pitting, Discoloration or Visible Oxidation (i.e., Corrosion)	 Moderate Plating Discoloration/Oxidation (Likely Substrate Bleed-Thru/Plating Too Thin)

	Acceptable Workmanship	Unacceptable Workmanship
G	 Slight Discoloration / Oxidation (i.e., Corrosion)	 Severe Discoloration / Oxidation (Likely Substrate Bleed-Thru/Plating Too Thin)

1.7 ELECTRODEPOSITED TIN

Reference: ASTM B 545 – Standard Specification for Electrodeposited Coatings of Tin, Paragraph(s): 6.3 - 6.5.

1.7.1 Engineering Drawing Call Out: In the event the engineering drawing does not call out a specific tin composition, the tin composition shall contain a minimum of 3% lead.

1.7.2 Acceptable Workmanship

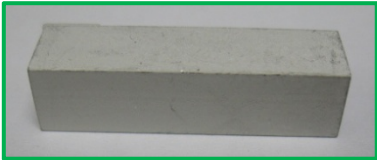
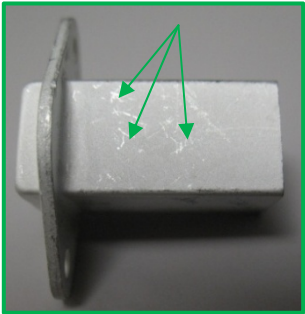
- a. ASTM B 545: 6.3 *Appearance* — Tin coatings shall have the characteristic appearance, including surface texture (4.3 per ASTM B 545), for the process used. The appearance shall be uniform throughout, insofar as the basis metal will permit. They shall be adherent and visually free of blisters, pits, peeled areas, cracks, nodules, and unplated areas. They shall not be stained or discolored. Flow-brightened coatings shall be free of dewetted areas and beads. All surfaces shall be substantially free of grease or oil used in the flow-brightening process.
- b. ASTM B 545: 6.4 All tin-coated articles shall be clean and undamaged. When necessary, preliminary samples showing the finish shall be supplied to and approved by the purchaser. Where a contact mark is inevitable, its location shall be subject to agreement between the supplier and the purchaser.
- c. ASTM B 545: 6.5 *Thickness of Coatings*—Tin coatings on articles shall conform to the thickness requirements specified in 4.2 of ASTM B 545 as to the minimum thickness on significant surfaces.
- d. Coatings shall be free of visible mechanical damage and similar gross defects when viewed at up to 4X magnification.

1.7.3 Packaging

- a. Coated surfaces shall be protected from damage during shipment and storage.
- b. When applicable, egg crate shipping containers are recommended during all storage and handling of the components. Each item should be individually packaged to prevent contact of adjacent items (e.g., in their own egg crate cell).

1.7.4 Illustrations

The following illustrations depict “Acceptable” and “Unacceptable” workmanship results.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Tin Is Uniform	
B	 Slight Surface Marring	

1.8 ELECTRODEPOSITED ZINC

Reference: ASTM B633 (& ASTM B86 for Zinc Die Castings) – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel, Paragraph(s): 7.2, 7.3, and 7.5.

1.8.1 Acceptable Workmanship

- a. ASTM B633: 7.2 *Adhesion* —The adhesion of the coating shall be such that when examined in accordance with 10.2 of ASTM B633, the coating shall not show separation from the basis metal at the interface.
- b. 7.3 *Luster* — Unless otherwise specified by the purchaser, a bright, semi-bright, or dull finish shall be acceptable.
- c. 7.4 *Corrosion Resistance* — Zinc coatings with Types II, III, V, and VI treatments shall show neither corrosion products of zinc nor basis metal corrosion products at the end of the test periods describe in Table 2 of ASTM B633 when tested by continuous exposure to salt spray in accordance with 10.3 of ASTM B633. The appearance of corrosion products when examined with 20/20 eyesight at normal reading distance shall be cause for rejection, except that white corrosion products 6 mm or less from the edges of specimens shall not constitute failure. For corrosion resistance requirements, see Table 2 of ASTM B633.
- d. *Workmanship* — The surface of the electroplated article shall be uniform in appearance, free of visible coating defects, such as blisters, pits, roughness, nodules, burning, cracks, or unplated areas, and other defects that will affect the function of the coating. The coating shall not be stained or discolored. However, superficial staining that result from rinsing or slight discoloration resulting from any drying or baking operation to relieve hydrogen embrittlement shall not be cause for rejection. On articles in which a visible contact mark is unavoidable, its position shall be that chosen by the purchaser. The electroplated article shall be clean and free of damage.

1.8.2 Packaging

- a. Coated surfaces shall be protected from damage during shipment and storage.
- b. When applicable, egg crate shipping containers are recommended during all storage and handling of the components. . Each item should be individually packaged to prevent contact of adjacent items (e.g., in their own egg crate cell).

1.9 PAINTING

Reference: MIL-PRF-22750F, Performance Specification, Coating, Epoxy, High-Solids (VOC – Compliant), Paragraph(s): 3.7.2.

1.9.1 Acceptable Workmanship

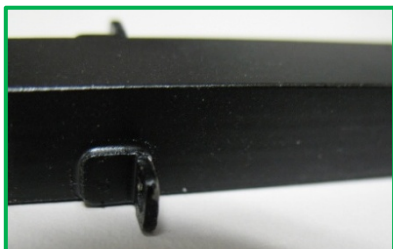
- a. MIL-PRF-22750F: 3.7.2 Surface appearance. The coating shall dry to a smooth, uniform surface, free from runs, sags, bubbling; streaks, hazing, seeding, dusting, floating, mottling, or other film defect when applied to test panels in accordance with 4.5 through 4.5.2 of MIL-PRF-22750.

1.9.2 Packaging

- a. Coated surfaces shall be protected from damage during shipment and storage.
- b. When applicable, egg crate shipping containers are recommended during all storage and handling of the components. Each item should be individually packaged to prevent contact of adjacent items (e.g., in their own egg crate cell).

1.9.3 Illustrations

The following illustrations depict "Acceptable" and "Unacceptable" workmanship results.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Paint Is Uniform	

SECTION 2 – ELECTRICAL AND ELECTRONIC ITEMS (PARTS AND ASSEMBLIES)

2. Electrical And Electronic Parts and Assemblies

Section 2 covers electrical and electronic parts and assemblies (e.g., Active and Passive Electronic Components, Cut-To-Length or Stripped Wire or Cable, Cable Assemblies, Wiring Harnesses, Interconnects, Printed Circuit/Wiring Boards (PCBs/PWBs), Tabbing Boards, Interconnect Assemblies, Printed Card/Printed Wiring Assemblies (PCAs/PWAs) and Tabbing Board Assemblies including their parent end-items, such as: Data Recorders, Electronic Safe Arm Devices, Hour Meters, Event Counters, Fault Indicators, Readers, Led Indicators, etc.). PCA's/PWA's are often also called Circuit Card Assemblies (CCA's).

2.1 **Active/Passive Electronic Component (A/PEC) Authenticity / Counterfeit Prevention And Detection**

2.1.1 Scope: This subsection applies to A/PECs that are later sold to our customers either as-is or incorporated into an end-item/finished good, regardless of whether such parts are procured as discrete items, or integrated into electronic assemblies or equipment by L-3 EDI or our supply-base.

While the primary focus of this subsection and [WI-02-01-02](#) (Counterfeit Part Risk Mitigation Plan) is to mitigate the risk of counterfeit A/PECs from entering our customers' supply chain, this shall not preclude the usage and tailoring of these documents to manage the risk of counterfeit parts of other commodities.

2.1.2 Definitions: See [WI-02-01-02](#), Counterfeit Part Risk Mitigation Plan, for definitions.

2.1.3 **Reference and Related Documents:**

- a. L-3 EDI Form 1002, Supplier Quality Assurance Requirements, Clause 1.*
- b. L-3 EDI [WI-02-01-02](#), Counterfeit Parts Risk Mitigation Plan.*
- c. IDEA-STD-1010, Acceptability of Electronic Components Distributed in the Open Market.
- d. [SAE AS5553](#), Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition (DoD Adopted).

* Note: External to L-3 EDI, these documents are available on L-3 EDI's website at http://www.l-3com.com/edi/supplier_info.htm or http://www.l-3com.com/edi/customer_info.htm.

2.1.4 **General**

See VI, Counterfeit Parts for further information.

Based on a determination of consumers risk, a representative sample (up to and including 100% inspection) should be visually examined from each lot (date code) of APECs procured from an Independent Distributor, as a minimum, at a recommended magnification of up to 40X dependent upon the part's size and characteristic being verified.

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L-3 EDI requires all Turn Key Contract Manufacturers buying APECS for Card/Printed Wiring Assemblies (CCAs/PWAs), Tabbing Board Assemblies, and other types of Electronic Assemblies to have an established Counterfeit Parts Risk Mitigation Plan documenting the risk mitigation strategy and methodologies to be employed that is acceptable to L-3 EDI. Turn Key Contract Manufacturers are encouraged to model their control plan based upon SAE AS5553 available from the Society of Automotive Engineers (SAE) at www.sae.org.

IDEA-STD-1010, Acceptability of Electronic Components Distributed in the Open Market, may be used as a best-practice guideline for conducting visual inspection and verification of APECS authenticity.

2.1.5 Criteria

Examples of visual accept/reject criteria and tell-tale counterfeit indications include, but shall not be limited to:

- a. Poor quality part marking. Marking is faded. Type style, font size or color change is evident or data on a single line is located at different heights.
- b. Item shows evidence of wear or prior use.
- c. Chips on the package which may indicate excessive or careless handling.
- d. Scratches on the surface of the package.
- e. Inconsistent lead/termination plating coverage.
- f. Leads/terminations bent.
- g. Leads/terminations show evidence of previous attachment (solder present, metal upset or marred).
- h. Leads/terminations show arcing, discoloration, pitting, or corrosion.
- i. Leads/terminations are loose, missing or show metal/plating upset.
- j. Lead/Termination finish designator in the part number not consistent with the terminal finish on the part.
- k. Inconsistent texture/color or unlevelled coating on the top and/or bottom sides of the part.
- l. Rough surface texture in the normally smooth Pin 1 indicators area.
- m. Cracks in the package that may signify thermal stress.
- n. Cracks in the seals around leads/terminations.
- o. Mold pin marking areas not smooth, clean, or from part-to-part not consistent.
- p. Presence of numerous date codes on one individual/unit container. i.e., reel, tube, tray, etc. or within the lot in general.
- q. Item is unusually boxed or packed.
- r. Markings inconsistent with standard OEM marking content and format.
- s. Originality and applicability of Certificates of Conformance or other certifications/data should be examined against the supplied item, including, but not limited to:
 - i. Lot and/or date codes on the packaging match the lot and/or date codes on the parts.
 - ii. Manufacturer's logo or label is absent, or does not match that which is shown on their website, on previous shipments, or on the parts.

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- iii. Poor use of English, misspelled words, alterations, or changes to the documentation.
- iv. The use of correction fluid or correction tape is evident.
- v. Type style, size or pitch change is evident.
- vi. The document is not signed, initialed when required, is excessively faded or unclear (indicating multiple, sequential copying) or data is missing.
- vii. The name of the document approver or his title cannot be determined, or typed approval name and approval signature do not match.
- viii. Certification or test results are identical between items when normal variations should be expected.
- ix. Document traceability is not clear. The documentation should be traceable to the items procured.
- x. Documentation is not delivered as required on the purchase order or is in an unusual format.
- xi. Data on a single line is located at different heights.
- xii. Documents copied.
- xiii. Corrections are not properly lined-out, initialed and dated.
- xiv. Text on page ends abruptly and number of pages conflicts with transmittal.
- xv. Lines on forms are bent, broken, or interrupted indicating data has been deleted or exchanged (cut and paste).

NOTE

A free website named [ic photos](#) providing photographs of A/PECs can be used for authentication comparison purposes.

For L-3 EDI personnel, report any suspect-counterfeit/counterfeit part to management.

For L-3 EDI supply-base, report any suspect-counterfeit/counterfeit part to L-3 EDI's Buyer.

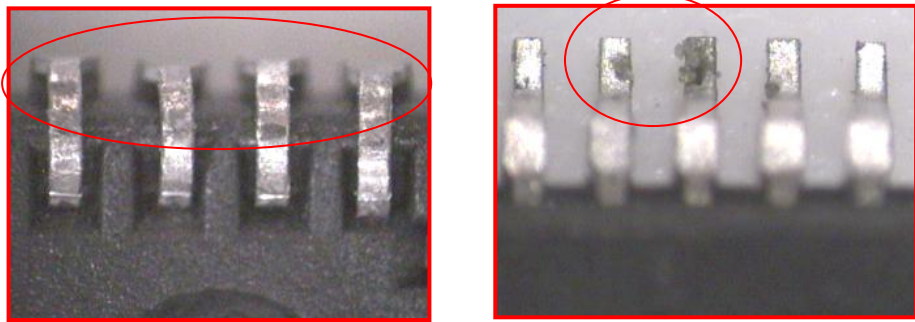
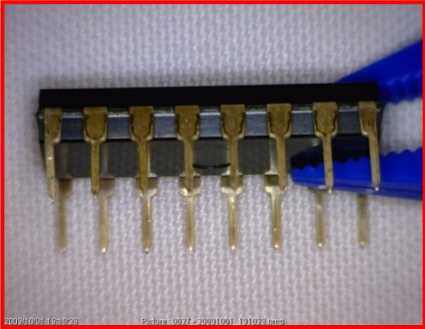
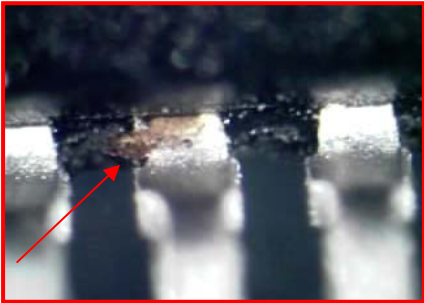
2.1.6 Illustrations

The following illustrations depict "Unacceptable" results.

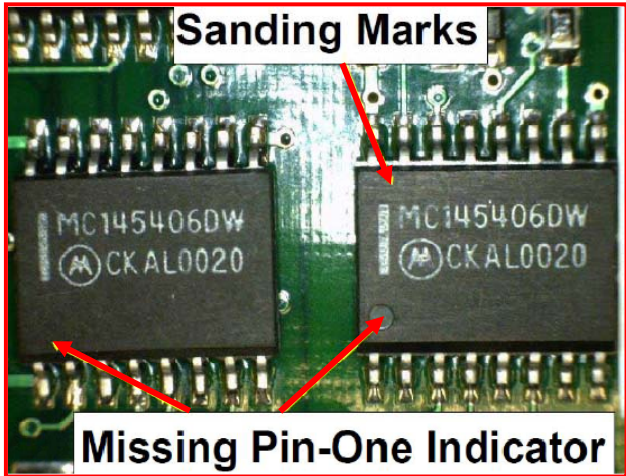
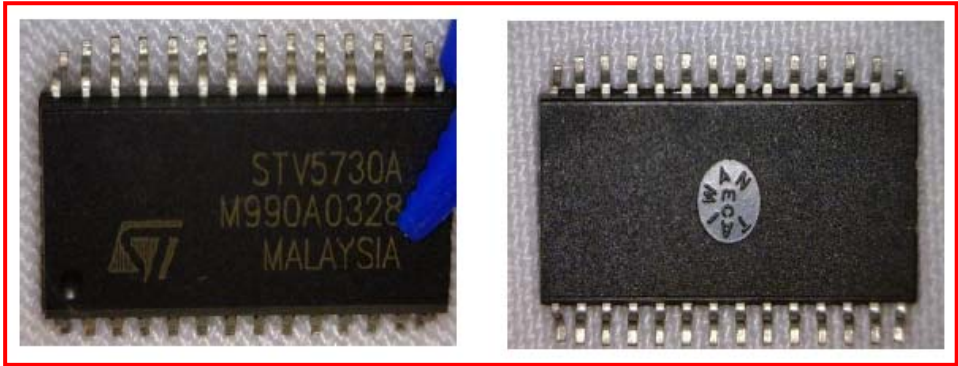
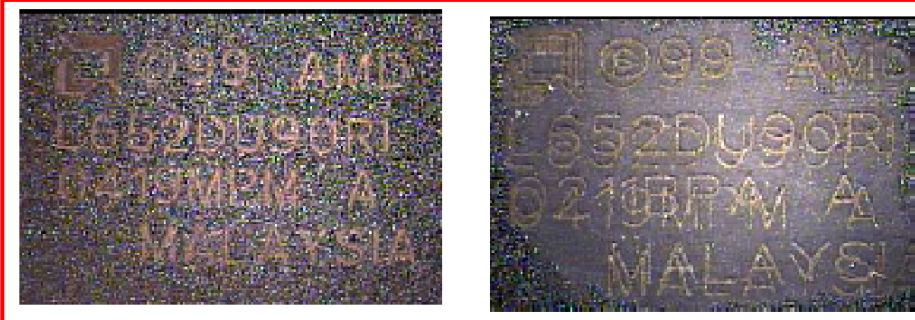
Photos Courtesy of L-3 Cincinnati Electronics

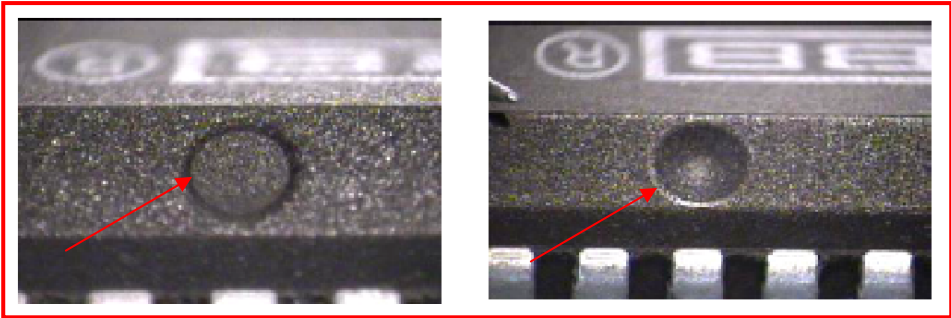
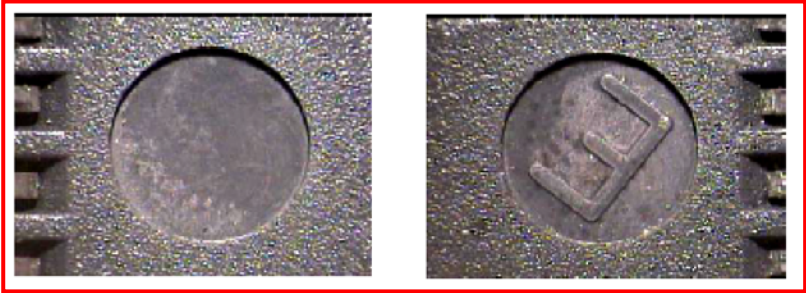
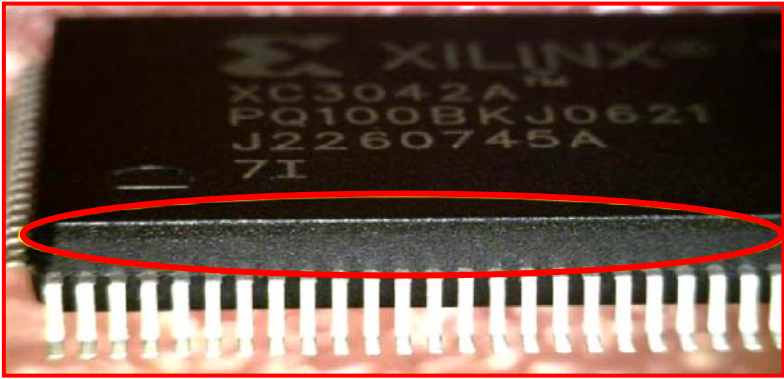
Unacceptable Workmanship	
A	
Remarking	

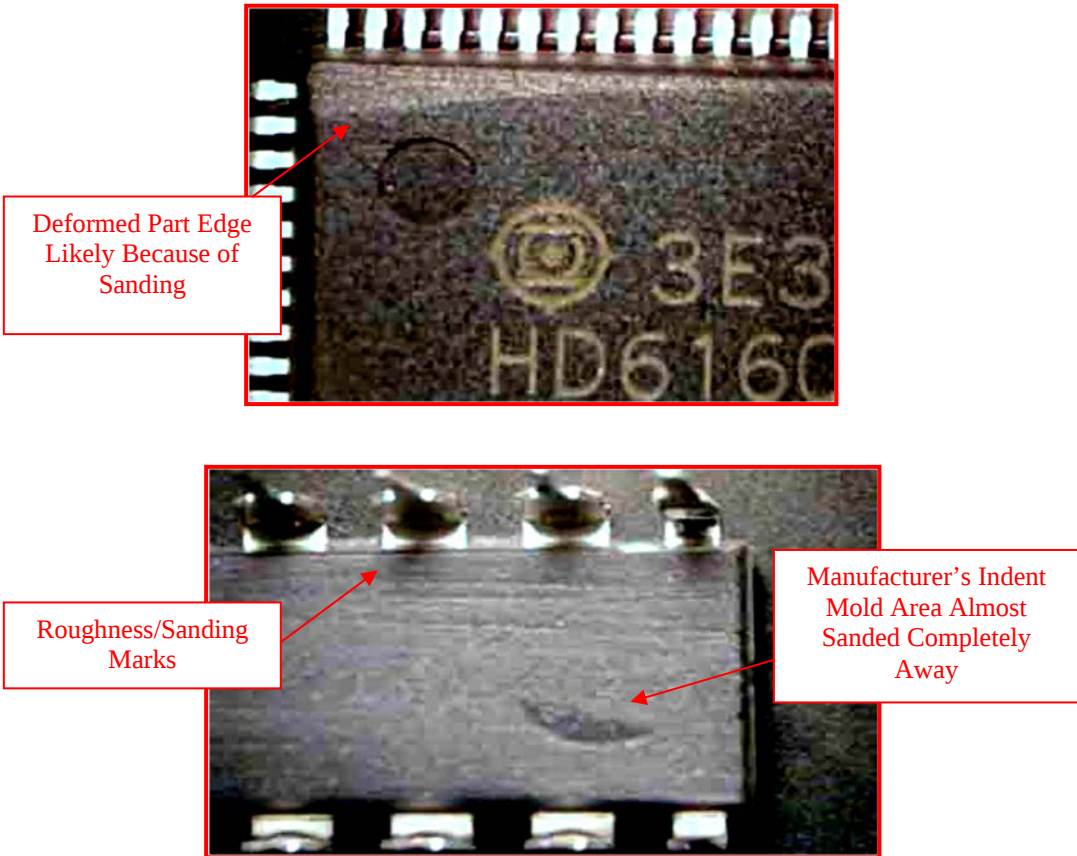
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	Unacceptable Workmanship
B	 Part Suspect of Previously Being Used; Residual Solder & Bent Leads
C	 Missing/Bent Leads
D	 Corrosion/Oxidation on Leads
E	 Exposed Copper on Leads

Use or disclosure of data on this sheet is subject to the restriction on the title page of this document.

Unacceptable Workmanship	
F	 Sanding Marks Missing Pin-One Indicator Suspect Counterfeit on Right
G	 Different Manufacturer Marking On Top and Bottom of Same Component
H	 Top Appears Recoated After Chemical Cleaning (Pay Close Attention to Consistency of Marking Font, Color & Alignment)

Unacceptable Workmanship	
I	 Inconsistent Mold Pins  Dirty Mold Pin Areas
J	 Suspect Black Topping; Noticeable Color/Gloss Difference Between Top & Side

	Unacceptable Workmanship
K	 Considerable Difference in Lead Thickness & Shape; Suggests Original Plating May Have Been Removed and Re-Plated
L	 Component Body Surface Roughness/Sanding Evident

2.2 Cut-To-Length or Stripped Wire or Cable, Cable Assemblies, Wiring Harnesses, and Other Interconnect Devices/Assemblies

2.2.1 Scope: This subsection applies to Cut-To-Length or Stripped Wire or Cable, Cable Assemblies, Wiring Harnesses, and Other Interconnect Devices/Assemblies, excluding those in 2.3 and 2.4 below.

2.2.2 Defect Definitions: Unless otherwise specified, defect definitions shall be as specified in ANSI/ IPC J-STD-001 (Requirements for Soldered Electrical and Electronic Assemblies (DoD Adopted)) and/or IPC / WHMA-A-620 (Requirements and Acceptance for Cable and Wire Harness Assemblies).

2.2.3 Reference and Related Documents:

- a. ANSI / IPC J-STD-001, Requirements for Soldered Electrical and Electronic Assemblies (DoD Adopted).
- b. IPC / WHMA-A-620, Requirements and Acceptance for Cable and Wire Harness Assemblies.

2.2.4 Applicability

The following applicability shall govern:

- a. If an L-3 EDI engineering drawing, specification or other governing document specifies ANSI / IPC J-STD-001 and does NOT specify IPC / WHMA-A-620, both ANSI / IPC J-STD-001 and ANSI / IPC-A-620 shall apply via virtue of this workmanship manual.
- b. If an L-3 EDI engineering drawing, specification or other governing document does NOT specify either ANSI / IPC J-STD-001 or IPC / WHMA-A-620, both ANSI / IPC J-STD-001 and IPC / WHMA-A-620 shall apply via virtue of this workmanship manual.
- c. The Testing Requirements in Section 19 (Testing) of IPC/WHMA-A-620 shall apply as follows:
 - i. L-3 EDI "Make" Items: Since L-3 EDI does not typically provide to our customers Cut-To-Length or Stripped Wire or Cable, Cable Assemblies, Wiring Harnesses, and other Interconnect Devices/Assemblies as a dedicated end-item, Section 19 shall be used as a guideline to develop our overall test program for a specific end-item.
 - ii. L-3 EDI "Buy" Items: Unless otherwise specified in writing by L-3 EDI's Buyer, L-3 EDI's suppliers shall comply with the test requirements specified therein ONLY for Cable Assemblies, Wiring Harnesses, and applicable similar Interconnect Devices/Assemblies.

2.2.5 Order of Precedence:

In the event of conflict, the following order of precedence shall apply

- a. Contract or purchase order.
- b. L-3 EDI engineering drawing or specification.
- c. ANSI / IPC J-STD-001.
- d. IPC / WHMA-A-620.

2.2.6 Workmanship Requirements:

Unless otherwise specified, the following workmanship requirements shall apply, as a minimum.

Workmanship Standard	Systems Product Group (SPG) Items (e.g., Data Recorders, ESAFs) [†]	Components Product Group (CPG) Items (e.g., Hour Meters, Event Counters, Fault Indicators, Readers, LED Indicators) [†]
ANSI / IPC J-STD-001	Class 3 (High Performance Electronic Products)	Class 1 (General Electronic Products)
IPC / WHMA-A-620 [¥]	Class 3 [¥] (High Performance Electronic Products)	Class 1 [¥] (General Electronic Products)

[†] L-3 EDI Purchase Orders (POs) for Systems Products Groups' (SPG) purchases can be readily distinguished from Components Products Groups' (CPG) POs by the presence of Project Numbers and often Contract Numbers in the body or line item of the SPG PO.

[¥] See 2.2.4.c.

2.3 Printed Circuit Boards

2.3.1 Scope: This subsection applies to Printed Circuit/Wiring Boards (PCBs/PWBs), and Tabbing Boards, including those classified as rigid, flex, or rigid-flex, and tabbing boards.

2.3.2 Defect Definitions: Unless otherwise specified, defect definitions shall be as specified in ANSI / IPC-A-600 (Acceptability of Printed Boards).

2.3.3 Reference and Related Documents:

- a) ANSI / IPC-A-600, Acceptability of Printed Boards
- b) IPC-2221, Generic Standard on Printed Board Design^{*†}
- c) IPC-2222, Rigid Organic Printed Board Structure Design^{*†}
- d) IPC-2223, Flexible Printed Board Structure Design^{*†}
- e) IPC-6011, General Performance Specification for Printed Boards^{**}

- f) IPC-6012, Qualification and Performance Specification for Rigid Printed Boards**
- g) IPC-6013, Qualification and Performance Specification for Flexible Printed Boards**

* Typical L-3 EDI engineering “baseline” design guidelines. Not intended to be all inclusive.
† Included as part of what is commonly known as the IPC-2220 series of design specifications.
‡ Included as part of what is commonly known as the IPC-6010 series of qualification and performance specifications.

2.3.4 Applicability

The following applicability shall govern:

- a. If an L-3 EDI engineering drawing, specification or other governing document specifies an IPC printed board specification (e.g., an IPC-6010 series specification) and does NOT specify IPC-A-600, both the cited IPC specification and ANSI / IPC-A-600 shall apply via virtue of this workmanship manual.
- b. If an L-3 EDI engineering drawing, specification or other governing document does NOT specify an IPC printed board specification (e.g., an IPC-6010 series specification), ANSI / IPC-A-600 should be used as a guidance specification.

2.3.5 Order of Precedence:

In the event of conflict, the following order of precedence shall apply:

- a. Contract or purchase order.
- b. L-3 EDI engineering drawing or specification.
- c. ANSI / IPC-A-600.

2.3.6 Workmanship Requirements:

Unless otherwise specified, the following workmanship requirements shall apply, as a minimum.

Workmanship Standard	Systems Product Group (SPG) Items (e.g., Data Recorders, ESAFs) [†]	Components Product Group (CPG) Items (e.g., Hour Meters, Event Counters, Fault Indicators, Readers, LED Indicators) [†]
ANSI / IPC -A-600	Class 3 (High Performance Electronic Products)	Class 1 (General Electronic Products)

[†] L-3 EDI Purchase Orders (POs) for Systems Products Groups' (SPG) purchases can be readily distinguished from Components Products Groups' (CPG) POs by the presence of Project Numbers and often Contract Numbers in the body or line item of the SPG PO.

2.4 Circuit Card Assemblies

2.4.1 Scope: This subsection applies to Circuit Card Assemblies (CCA's) which may also be called Printed Circuit /Printed Wiring Assemblies (PCAs/PWAs), and Tabbing Board Assemblies.

2.4.2 Defect Definitions: Unless otherwise specified, defect definitions shall be as specified in ANSI/ IPC J-STD-001 (Requirements for Soldered Electrical and Electronic Assemblies (DoD Adopted)) and/or IPC-A-610 (Acceptability of Electronic Assemblies (DoD Adopted)), as applicable.

2.4.3 Reference and Related Documents:

- a) ANSI / IPC J-STD-001, Requirements for Soldered Electrical and Electronic Assemblies (DoD Adopted).
- b) IPC-A-610, Acceptability of Electronic Assemblies (DoD Adopted).

2.4.4 Applicability:

The following applicability shall govern:

- a. If an L-3 EDI engineering drawing or specification specifies ANSI / IPC J-STD-001 and does NOT specify ANSI / IPC-A-610, both ANSI / IPC J-STD-001 and ANSI / IPC-A-610 shall apply via virtue of this workmanship manual.
- b. If an L-3 EDI engineering drawing or specification does NOT specify either ANSI / IPC J-STD-001 or ANSI / IPC-A-610, both ANSI / IPC J-STD-001 and ANSI / IPC-A-610 shall apply via virtue of this workmanship manual.
- c. If a requirements document specifies a legacy or cancelled military or industry standard the following guidance should apply.
 - i. For L-3 EDI, this should be confirmed with our customer in advance.
 - ii. For L-3 EDI's supply-base, this should be confirmed with L-3 EDI in advance and written authorization should be provided before proceeding.

Legacy Standard (Any Revision)	Superseding Requirements (See 2.4.4c)	
	ANSI / IPC J-STD-001	ANSI / IPC-A-610
WS-6536	Class 3 (High Performance Electronic Products)	Class 3 (High Performance Electronic Products)
DOD-STD-2000		
MIL-STD-2000		
MIL-STD-454 [†]		
IPC-S-815		

[†] MIL-STD-454 has been superseded by MIL-HDBK-454. MIL-HDBK-454, Guideline 5 (Soldering) specifies soldering to be in accordance with ANSI / IPC J-STD-001 without citing a specific "Class". The same requirements above for MIL-STD-454 shall apply to any MIL-HDBK-454 citations.

2.4.5 Order of Precedence:

In the event of conflict, the following order of precedence shall apply

- Contract or purchase order.
- L-3 EDI engineering drawing or specification.
- ANSI / IPC J-STD-001.
- ANSI / IPC-A-610.

2.4.6 Workmanship Requirements:

Unless otherwise specified, the following workmanship requirements shall apply, as a minimum.

Workmanship Standard	Systems Product Group (SPG) Items (e.g., Data Recorders, ESAFs) [†]	Components Product Group (CPG) Items (e.g., Hour Meters, Event Counters, Fault Indicators, Readers, LED Indicators) [†]
ANSI / IPC J-STD-001	Class 3 (High Performance Electronic Products)	Class 1 (General Electronic Products)
ANSI / IPC-A-610	Class 3 (High Performance Electronic Products)	Class 1 (General Electronic Products)

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† L-3 EDI Purchase Orders (POs) for Systems Products Groups' (SPG) purchases can be readily distinguished from Components Products Groups' (CPG) POs by the presence of Project Numbers and often Contract Numbers in the body or line item of the SPG PO.

2.5 Rework, Repair and Modifications of Electronic Components, Printed Circuit Boards, and Circuit Card Assemblies

2.5.1 Scope: This subsection applies to Electronic Components, Printed Circuit/Wiring Boards (PCBs/PWBs), and Circuit Card Assemblies (CCA's), including Tabbing Boards and Tabbing Boards Assemblies. CCA's are often also called Printed Circuit/Wiring Assemblies (PCAs/PWAs).

2.5.2 Defect Definitions: Unless otherwise specified, defect definitions shall be as specified in 2.3 and 2.4 above.

2.5.3 Reference and Related Documents:

- a. IPC-7711, Rework of Electronic Assemblies.
- b. IPC-7721, Repair and Modification of Printed Boards and Electronic Assemblies.
- c. L-3 EDI Form 1002, Supplier Quality Assurance Requirements, Clause 4, Nonconforming Material (NCM) and Material Review Authority (MRA).
- d. QOP-13-01, Control of Nonconforming Product.

2.5.4 Applicability:

The following applicability shall govern:

- a. **Commercial Off-The-Shelf (COTS) Items:** Subsection 2.5 shall not apply to COTS items.
- b. **Rework:** Unless otherwise specified, any applicable required rework shall be accomplished in accordance with, or at the very least modeled after, IPC-7711.
- c. **Repair:** Repairs shall NOT be allowed without prior customer written authority or approval.
 - i. From an L-3 EDI Perspective: "Customer" shall mean the customer with whom L-3 EDI has a contract or purchase order. Unless otherwise specified, as a standard practice, L-3 EDI shall make every reasonable attempt to adopt or model to the maximum extent practical any applicable repair activities in accordance with IPC-7721.
 - ii. From an L-3 EDI Supply-Base Perspective: "Customer" shall mean L-3 EDI.
- d. **Modifications:** Modifications shall NOT be allowed without prior customer written authority or approval, or L-3 EDI Configuration Management authorization (e.g., a released engineering "modification" drawing), as applicable.

- i. From an L-3 EDI Perspective: "Customer" shall mean the customer with whom L-3 EDI has a contract or purchase order. Unless otherwise specified, as a standard practice, L-3 EDI shall make every reasonable attempt to adopt or model to the maximum extent practical any applicable modification activities in accordance with IPC-7721.
- ii. From an L-3 EDI Supply-Base Perspective: "Customer" shall mean L-3 EDI.

2.5.5 Order of Precedence:

In the event of conflict, the following order of precedence shall apply:

- a. Contract or purchase order.
- b. L-3 EDI engineering drawing or specification.
- c. IPC-7711 or IPC-7721.

2.5.6 Workmanship Requirements:

Unless otherwise specified, the following workmanship requirements shall apply, as a minimum.

- a. **Rework:** By definition, satisfactorily completed rework will meet the original specification and workmanship requirements specified in 2.3 and 2.4 above.
- b. **Repair:** By definition, the workmanship requirements specified in 2.3 and 2.4 above may not necessarily be applicable.
- c. **Modification:** By definition, the workmanship requirements specified in 2.3 and 2.4 above may not necessarily be applicable.
- d. **Process Controls:** Adequate process controls shall exist for any rework, modification, or repair activities, including post-rework or post-repair inspection and test.
- e. **Inspection and Test:** All reworks, modifications, and repairs shall be inspected and/or tested after completion of the rework, modification, or repair to established and documented criteria. Unless otherwise specified, inspection or test shall be to the original criteria to the maximum extent practical.

SECTION 3 – PLASTIC ITEMS

3 Plastic Items

3.1 Scope: This section covers both molded and machined plastic items.

3.2 Defect Definitions:

- a. **Blow-Hole** - A cavity or hole in the molded item typically formed due to the air or gas venting to the surface during curing process. In comparison to a pit, a blow-hole is characterized by either a continuous bottom or continuous (e.g., 360°) side wall NOT being evident.
- b. **Blush** - Discoloration or change in gloss.
- c. **Broken** - General damage. Example bent and broken tabs or ribs.
- d. **Bubbles** - Void pockets, bulge or protrusion.
- e. **Burns** - Brown marks and streaks.
- f. **Contamination** - Large areas of discoloration from foreign matter or foreign material embedded in the surface.
- g. **Cracking** - Stress induced splitting or fissures causing separation of material.
- h. **Crazing** - Multiple tiny cracks due to stress exerted on the item.
- i. **Delamination** - Separation of layers of plastic.
- j. **Discoloration** - Any change from original color. Unintended and inconsistent color.
- k. **Drag Marks** - Cluster of scratches from plastic dragging against mold detail.
- l. **Flash** - Excess plastic at parting line or mating surface of the mold. Normally very thin and flat protrusion of plastic along an edge of a item.
- m. **Gouge** - Surface imperfection due to abrasion that removes small amount of material.
- n. **Haze** - Cloudiness on a transparent item.
- o. **Nicks** - Like gouges but of short length.
- p. **Orange Peel** - Rippled or mottled appearance view able as concentric lines.
- q. **Pit** – A crater-like imperfection on the surface of the item. In comparison to a blow-hole, a pit is characterized by a continuous bottom and continuous (e.g., 360°) side wall being evident.
- r. **Scratch** - Surface imperfection due to abrasion that removes small amounts of material.
- s. **Short Shot** - Missing plastic due to incomplete filling of the mold cavity.
- t. **Sink** - Surface depression caused by non uniform material solidification and shrinkage.
- u. **Specks** - Small discolored points of matter embedded in the surface.
- v. **Splay** - Off color streaking.

3.3 Gate and Surface Conditions:

- a. The items gate location and size (e.g., length x width x height) shall be as specified on the engineering drawing.
- b. If a gate location and size (e.g., length x width x height) is not specified on the engineering drawing, it is the responsibility of the supplier to obtain in writing acceptable gate locations and size from L-3 EDI's buyer prior to producing the item.

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- c. Unless otherwise specified on the engineering drawing, ALL three of the following flash criteria shall be satisfied:

	Criteria	Engineering Drawings Specifying That "No Flash" Is Acceptable	Other Engineering Drawings
1.	Flash shall be within the specified limits of size for the item's feature (e.g., item's width)	Requirement, if any, as specified on the engineering drawing.	
2.	Flash itself shall be within its specified limits of size (i.e., L X W X H) and location.	$\leq .0002$ flash height permitted - - AND - - flash length, width and location requirements, if any, shall be as specified on the engineering drawing.	Requirement, if any, as specified on the engineering drawing.
3.	Flash shall be firmly attached along its entire length.	Requirement, as specified herein.	

- d. The item shall show no evidence of any surface imperfection, discoloration, contamination, or powdery residue (e.g., mold release), or other form of foreign material (reference Section VI, FOD).
- e. The item shall be provided to L-3 EDI in such a manner (e.g., packaged) to be essentially neutrally charged, and not be negatively or positively charged (e.g., polarized) so that it readily attracts or repels other items (reference Section VI, FOD).

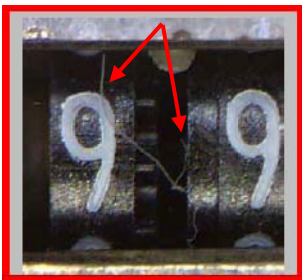
SECTION 4 – VIEWING WINDOW OF EVENT COUNTERS AND HOUR METERS

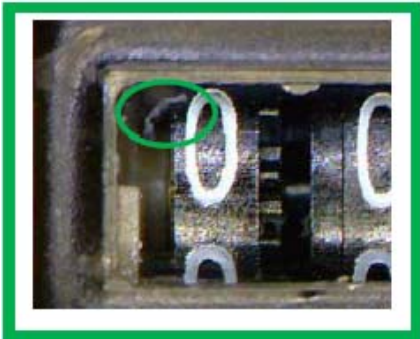
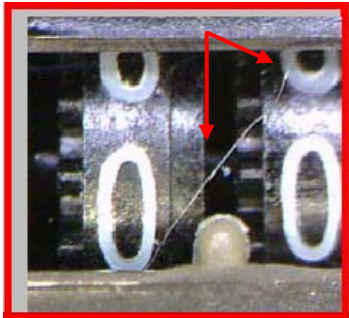
4 Viewing Window Of Event Counters And Hour Meters

- 4.1** This workmanship section covers all windows used to readily enable viewing of the Event Counters and Hour Meters readouts.
- 4.2** In general, Hour Meters workmanship criteria shall be in accordance with MIL-M-7793 (Meter, Time Totalizing), and Event Counters in accordance with MIL-I-8974 (Indicators, Event Counting).
- 4.3** The purpose of this workmanship standard is to provide specific criteria regarding what is acceptable related to streaks, smears, or markings.
- a. Streaks: See photographs below for detail illustrations of acceptable streaks. The viewing window shall be of such condition to readily enable clearly viewing the number wheel digits without visual distortion.
 - b. Foreign Objects: See photos below for detail illustrations of unacceptable foreign object debris (FOD). Viewing window shall be free from debris such as fibers, hairs, flux, solder, and/or any other type of debris that could possibly entangle in the internal gearing mechanisms (reference Section VI, FOD).

4.4 Illustrations

The following illustrations depict “Acceptable” and “Unacceptable” workmanship results.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Clear Streaks In Viewing Window Display NOT Distorting Number Wheels	 Foreign Material - Hair/Fiber In Viewing Window Display

	Acceptable Workmanship	Unacceptable Workmanship
B	 Partial Clear Streak in Viewing Window Display NOT Distorting Number Wheels	 Foreign Material - Hair/Fiber In Viewing Window Display
C	 Streak In Viewing Window NOT Distorting Number Wheels	  Foreign Material - Flux In Viewing Window Display
D		 Foreign Material - Particulate Matter In Viewing Window Display

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	Acceptable Workmanship	Unacceptable Workmanship
E		 Foreign Material - Solder Curl In Viewing Window Display

SECTION 5 – 999A SERIES ETI HOUR METER AND EVENT DOUBLE UNITS

5 999A SERIES ETI HOUR METER AND EVENT DOUBLE UNITS

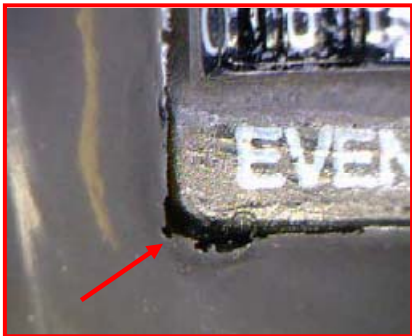
5.1 Potting Terminology:

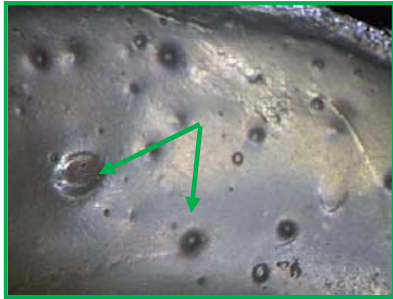
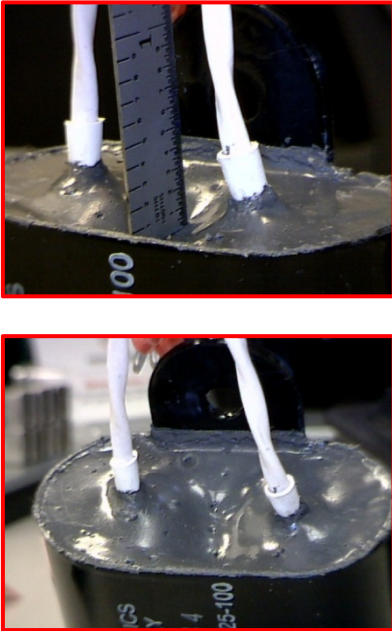
- a. **Blow-Hole** - A cavity or hole in the potting typically formed due to the air or gas venting to the surface during curing process. A blow-hole is characterized by a continuous bottom or 360° of side wall NOT being evident.
- b. **Pit** - A crater-like imperfection on the surface of the item. In comparison to a blow-hole, a pit is characterized by a continuous bottom and 360° of side wall being evident.
- c. **Sink** - Surface depression caused by non uniform potting solidification and shrinkage.

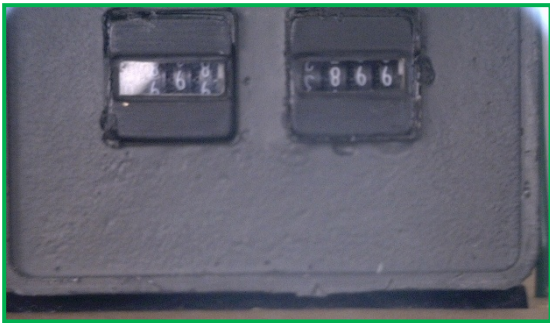
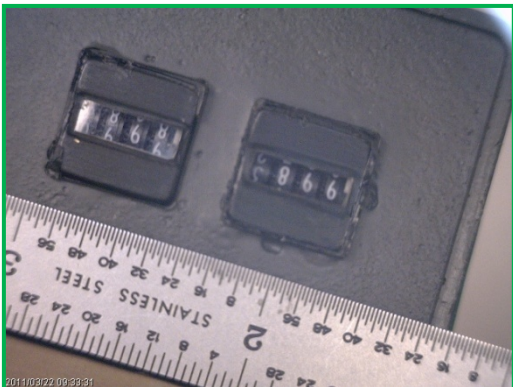
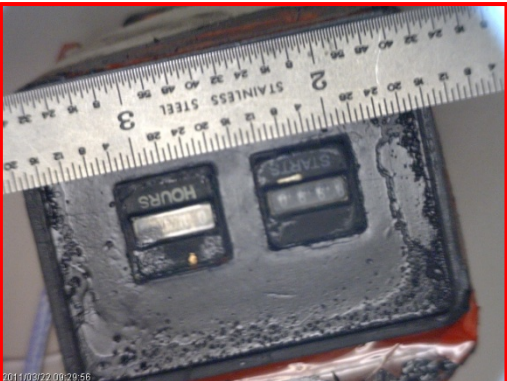
5.2 Potting workmanship requirements shall be as specified in Section 6. All other discrete individual workmanship requirements apply; see applicable sections.

5.3 Illustrations

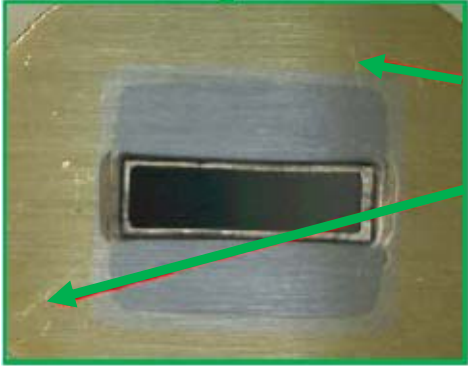
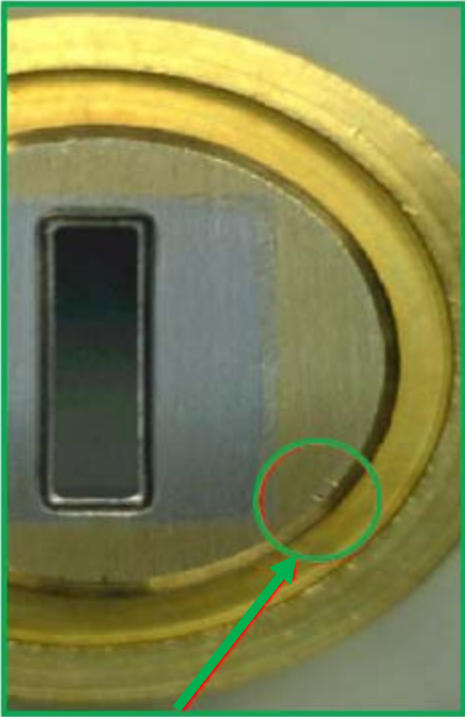
The following illustrations depict “Acceptable” and “Unacceptable” workmanship results.

	Acceptable Workmanship	Unacceptable Workmanship
A		 Corner Separation
B		 Severe Separation Around Face

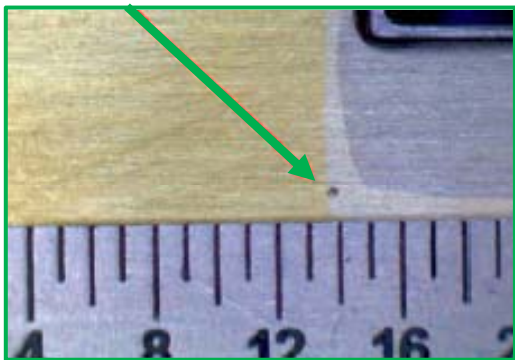
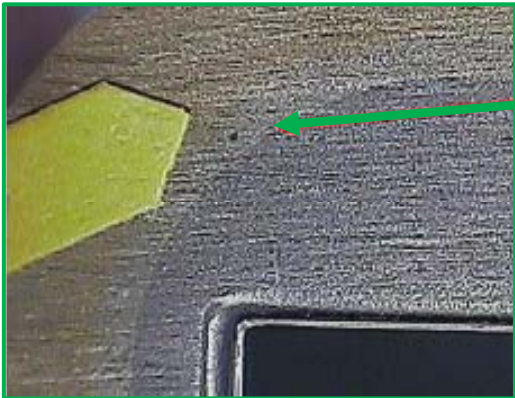
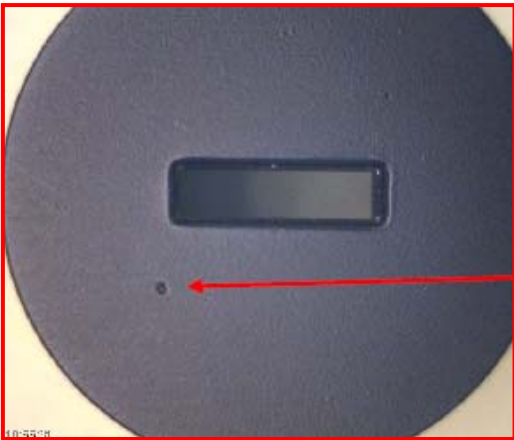
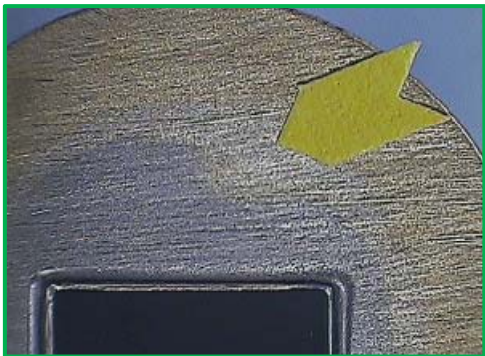
	Acceptable Workmanship	Unacceptable Workmanship
C	 Pits; Bottom & Sides Can Be Seen And Are Continuous. These must be < 1% of Surface Area	 Blow Hole With No Visible Bottom
D		 Blow Hole With No Visible Bottom
E		 Sink; Depth > .08

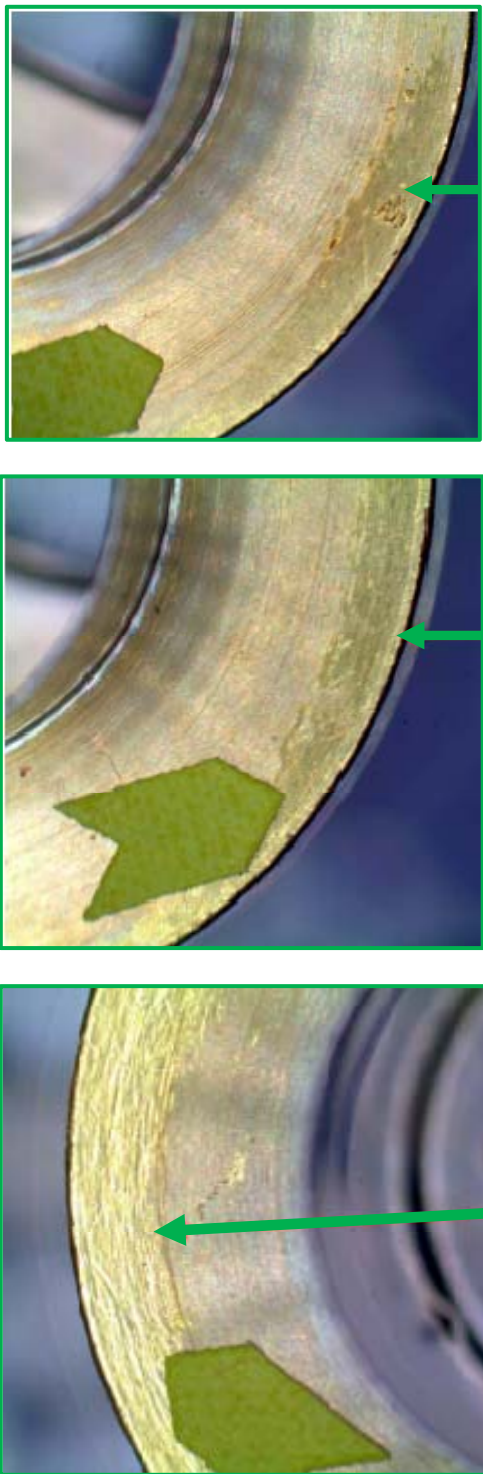
F	  PN 999A0064 Acceptable Potting Surface	  PN 999A0064 Unacceptable Potting Surface
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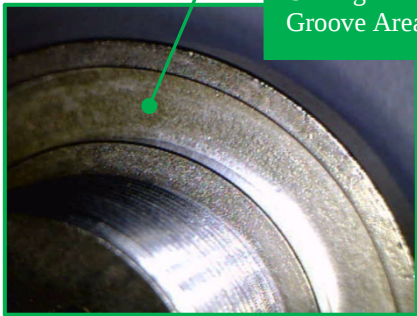
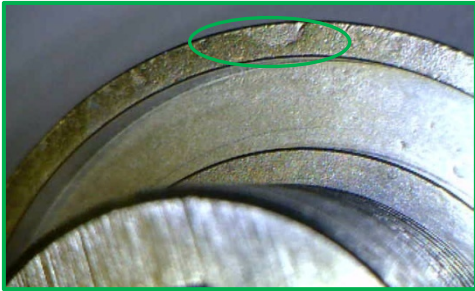
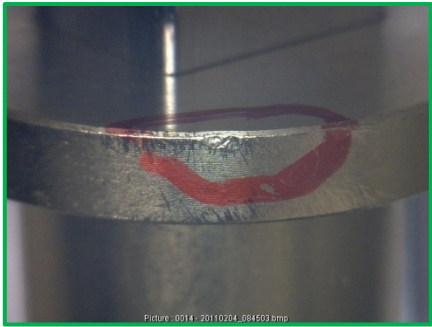
SECTION 6 – E AND F FLANGE ELAPSE TIME METER CASES (Ref: PN 400A000, 410A000, 430A000, 440A000, et. al.)

	Acceptable Workmanship	Unacceptable Workmanship
A	 Superficial Marring/Scratches on Face (No Metal Displacement)	
B	 Slight Dents Edge of Face (Slight Metal Displacement)	 Dents/Depressions on Face (Metal Displaced) Dents/Depressions on Face (Metal Displaced) & Pinhole > 1/32"

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	Acceptable Workmanship	Unacceptable Workmanship
C		 Pin Hole in Face > 1/32"
	 Pin Hole in Face $\leq$ 1/32"	 Pin Hole in Face > 1/32" (Painted to Illustrate Pin Hole)
D	 Discoloration	

	Acceptable Workmanship	Unacceptable Workmanship
E	 Color Variance/Discoloration (Pre-Plating)	

	Acceptable Workmanship	Unacceptable Workmanship
F	 O-Ring Groove Area No Nicks/Dings Evident Especially In O-Ring Groove	
	 Small Isolated Ding Outside of O-Ring Groove - NOT Exceeding Surface Finish/Dimensional Requirements	
	 Flange- 20X magnification small dent	
		 From Small Isolated Dings Inside of O-Ring Groove (Top) Progressing To Severe Scratches/Nicks (Bottom) –

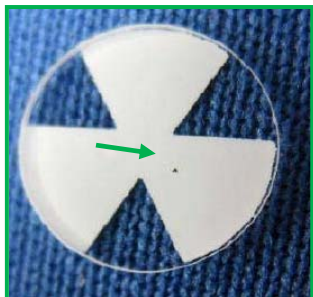
SECTION 7 - INDICATOR FLAGS

7 INDICATOR FLAGS

7.1 Scope: Workmanship standard covers all flag indicating components installed in end-items such as, but not limited to, CI70, CI75, MI51, MI57, and MI61 units.

7.2 Illustrations

The following illustrations depict “Acceptable” and “Unacceptable” workmanship results. Criteria based on visual examples shown with a maximum 10X magnification per VI, Magnification.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Minor Single Speck - Colored	
B	 Minor Single Speck – Not Colored	
C	 Minor Color Variation Across Item	

	Acceptable Workmanship	Unacceptable Workmanship
D	 Rough Edge (Within Limits of Size)	 Rough Edge

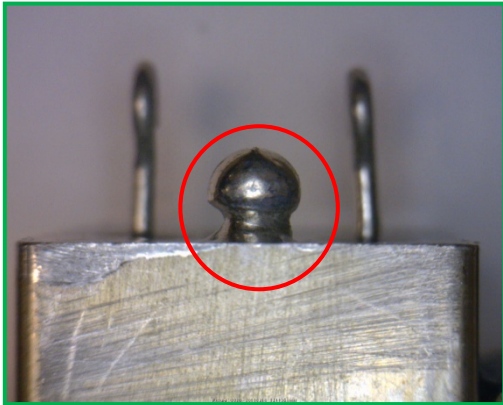
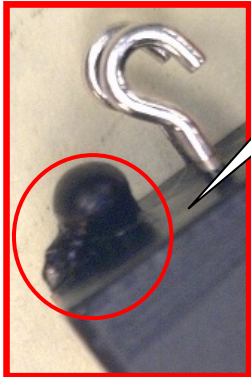
SECTION 8 - EVENTS & HOUR METER ETI FILL TUBE SOLDER BALL

8 EVENTS & HOUR METER ETI FILL TUBE SOLDER BALL

8.1 Scope: Workmanship standard covers all solder ball configuration which is acceptable for the Elapsed Time Indicator (ETI) Event / Hour Meter Fill Tube.

8.2 Illustrations

The following illustrations depict "Acceptable" and "Unacceptable" workmanship results. Criteria based on visual examples shown with a maximum 10X magnification per VI, Magnification.

	Acceptable Workmanship	Unacceptable Workmanship
A	 Solder Ball On Top Of Fill Tube	 Header Solder May Flow Down The Fill Tube But Shall Not Touch The Header Surface

SECTION 9 – PACKAGING CONTAINERS

9 PACKAGING CONTAINERS

9.1 Scope: 49CFR 173.28 Reusable Plywood Shipping Crates.

9.2 Acceptable Workmanship (Reference: 49CFR 173.28).

Prior to container reuse, containers shall be verified to satisfy the following conditions:

- a. NO panel separation. Panels shall be firmly secured. See Note 1.
- b. NO cleat separation. Cleats shall be firmly secured. See Note 1.
- c. NO water damage or rot reducing the container's structural integrity. See Note 1.
- d. NO wood rupture or plywood layer separation reducing the container's structural integrity. See Note 1.
- e. NO excessive splits, breaks or cracks, or wood checking especially around fasteners, or other wood damage reducing the container's structural integrity. See Note 1.
- f. NO excessive fastener holes (e.g., nail holes from previous nailing of the lid) or other damage that would compromise the secure fastening of the lid. See Note 1.
- g. NO unsecured fasteners. Fastener heads shall not be raised above the surrounding surface (e.g., nail head popping). See Note 1.
- h. NO fasteners that appear NOT to be original (i.e., not consistent with the other fasteners indicating possible rework). See Note 1.
- i. NO incompatible residue. The interior and exterior shall free from residue, including mold or fungi. Staining is acceptable as long as it does NOT reduce the container's structural integrity. (Note: wood discoloration to a gray color is natural.) See Note 1.
- j. NO sharp objects protruding into the interior of the container. See Note 2.
- k. NO particulate material in the interior of the container. See Note 3.

Notes:

- 1. *NOT* reconditionable / reworkable.
- 2. May be reconditioned / reworked ONLY if NOT part of the original container.
- 3. May be reconditioned / reworked.

9.3 Definition

9.3.a.1.1 **Checking** - Cracks that occur on the ends and surfaces of wood during drying are known as checks. Since the ends and surfaces dry first, they tend to shrink first but are restrained by the swollen core. This result in stresses building up near the surfaces which, if they become too great, will cause the wood to check.

9.3.a.1.2 **Cleats** – See Figure 1.

9.3.a.1.3 **Panel** – See Figure 1.

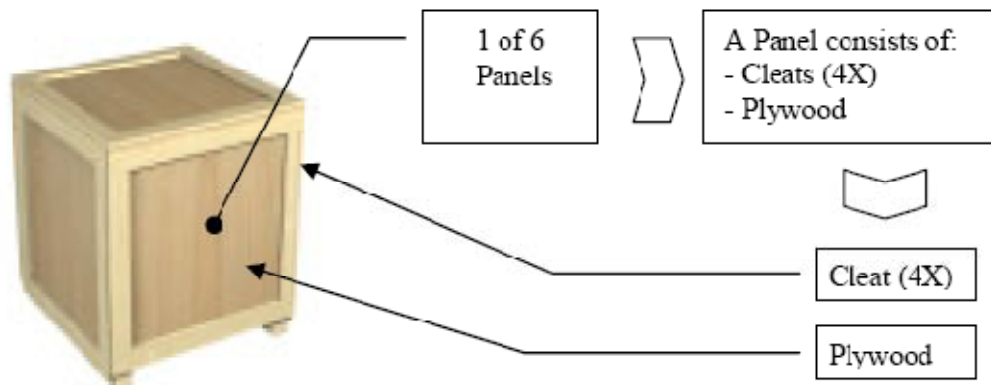
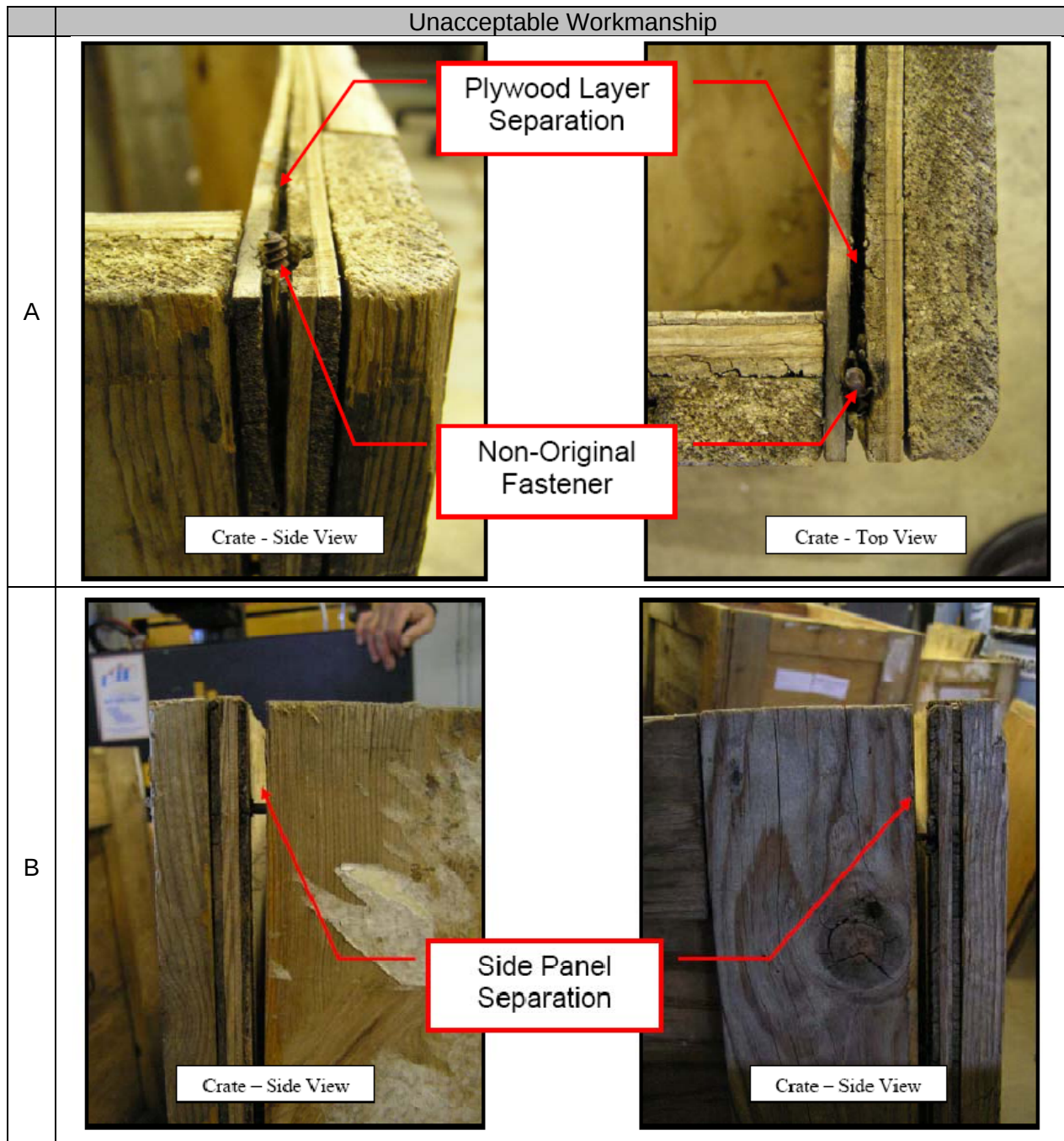
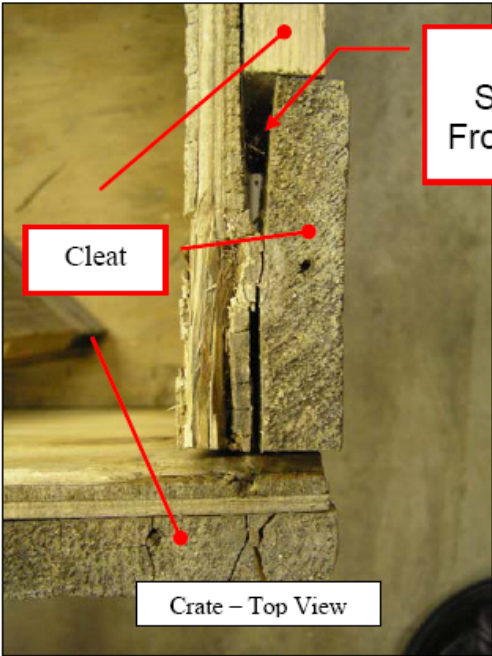
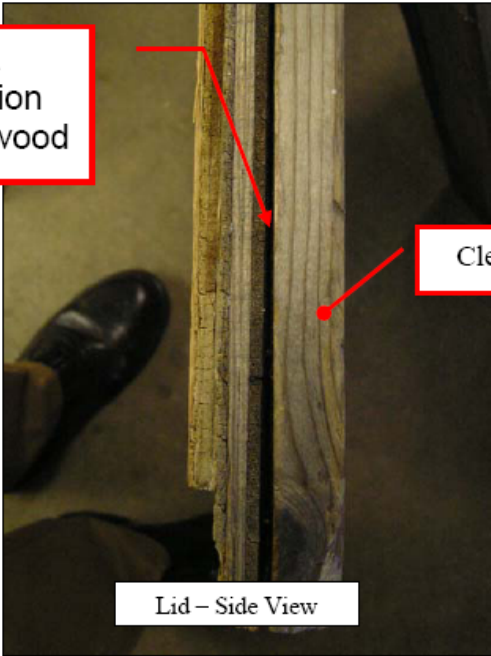


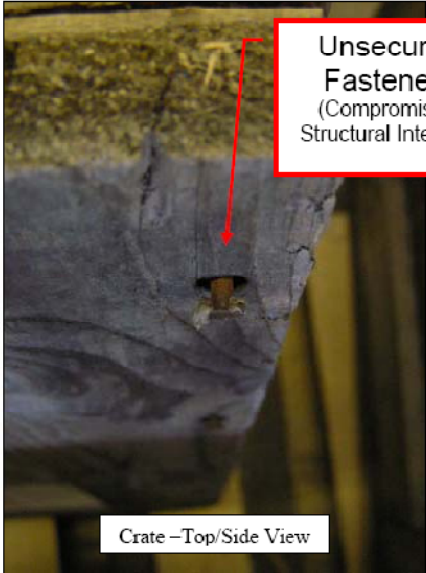
Figure 1. Crate Anatomy.

9.3.1 Illustrations

The following illustrations depict “Unacceptable” workmanship.



Unacceptable Workmanship	
C	 Crate - Top View Cleat Cleat Separation From Plywood  Lid - Side View Cleat
D	 Crate - Top View Plywood Layer Separation (likely caused by moisture)  Crate - Top View

Unacceptable Workmanship	
E	 Excessive Cleat Split at Nail (Compromising Structural Integrity) Crate – Side View  Crate – Side View
F	 Excessive Holes/ Damage (Compromising Structural Integrity of Lid Attachment) Crate –Top View  Unsecured Fasteners (Compromising Structural Integrity) Crate –Top/Side View

