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# WORKMANSHIP MANUAL

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### ORDER OF PRECEDENCE

1. Unless otherwise specified, interpret drawings in accordance with ASME Y14.5M-1994.
2. Unless otherwise specified, dimensional limits apply after plating.
3. In event of conflict, the following Order of Precedence shall govern:
  - A. Engineering Drawing
  - B. Purchase Order
  - C. Referenced Specification
  - D. L-3 EDI Workmanship Manual

### DEFINITIONS

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

**May** – Used to express a non-mandatory provision.

**Shall** – Used to express a provision that is binding.

**Should** – Used to express a non-mandatory provision.

**Will** – Used to express a declaration of purpose on the part of the contracting agency.

**SECTION 1**  
**PLATING, COATINGS, AND FINISHES**

## **1.0 PLATING, 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 fields.

**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)

**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)

**Base (basis) metal** - Material upon which coatings are deposited. (Reference: ASTM B 374)

**Black oxide** - A finish on metal produced by immersing a metal in hot oxidizing salts or salt solution. (Reference: ASTM B 374)

**Blister** - A dome-shaped imperfection or defect, resulting from loss of adhesion between a metallic deposit and the substrate. (Reference: ASTM B 374)

**Bright dip** – A solution used to produce a bright surface on a metal. (Reference: ASTM B 374)

**Color Uniformity** - Surface color varying in uniformity resulting in spots, blotches and striations of different color.

**Contamination** - An inclusion of foreign material detectable on surface of the part.

**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)

**Crack(s)** - A fracture passing completely through the thickness or section of a part.

**Crazing** - A network of fine hairline cracks in a coating. (Reference: ASTM B 374)

**Deformed** - A departure from normal shape greater than the dimensional tolerance. Parts often deform out of round, out of square, twisted, warped, bent or flattened.

**Dent** - A depression with no removal of material or change in surface texture.

**Dual Finish** - A part that has two different finishes as specified on the drawing.

**Electroplating** – The electrodeposition 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)

**Flash** – Related to molded parts - Excess material adhering to part.

**Flash** – Related to electroplating – A very thin electro-deposit used for a final coat: for intermediate coatings of the same nature, use **strike**. (Reference: ASTM B 374)

**Gouges** - The result of scooping out of material by another object.

**Masking** - Various materials applied to specific areas of parts to prevent coatings from being deposited. (Reference: ASTM B 374)

**Nicks** - Sharp surface indentation caused by impact of a foreign object. Parent material is normally displaced, seldom separated.

**Non-fill/Void** - An incomplete part due to insufficient material.

**Orange peel** - A finish resembling the dimpled appearance of an orange peel. (Reference: ASTM B 374)

**Pickling** - The removal of oxides or other compounds from a metal surface by means of a pickle (an acid solution). (Reference: ASTM B 374)

**Pit** - A small depression or cavity produced in a metal surface during electrodeposition or by corrosion. (Reference: ASTM B 374)

**Pin Hole** - A small sharply defined hole in surface of part.

**Rack, plating** - A frame for suspending and carrying current to articles during plating and related operations. (Reference: ASTM B 374)

**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)

**Scuff** - A mark caused by abrasion, which changes surface smoothness or texture.

**Smut** – A black powdery finish that is easily removed with a mild abrasive.

**Strike** - A thin film of metal to be followed by other coatings. (Reference: ASTM B 374)

**Strip** - To remove a coating from the basis metal or undercoat. (Reference: ASTM B 374)

**Surface Discoloration** - An apparent surface inconsistency in material evidenced by the appearance of light to dark streaks.

**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  $\mu\text{m}$  (30  $\mu\text{in}$ ). This is in contrast to strikes or flashes, whose thicknesses are generally much smaller. (Reference: ASTM B 545)

**Void** – A defective area in which a part of the basis material or underlayer is visible after final coating. (Reference: ASTM B 374)

**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-8625 - Anodic Coatings for Aluminum and Aluminum Alloys, Paragraph(s): 3.6, 3.13, and 3.13.1.

**1.2.1 Acceptable Workmanship**

- a. When Class 2 is specified, the anodic coating shall be uniformly dyed.
- b. The applied anodic coating shall be continuous, smooth, adherent, uniform in appearance and free from areas of powdery or loose coating, voids, scratches, flaws and other defects or damages which reduces the serviceability of the parts or assembly.
- c. Slight discoloration from dripping or rundown of the sealing solution shall be allowed.
- d. The size and number of contact (e.g., rack) marks shall be at a minimum consistent with good practice.

**1.2.2 Illustrations**

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

	Acceptable Workmanship	Unacceptable Workmanship
A		
B		
C		

### 1.3 BLACK OXIDE

Reference: MIL-C-13924 – Coating, Oxide, Black, for Ferrous Metals, Paragraph(s): 3.7, 4.4.1.

#### 1.3.1 Acceptable Workmanship

- a. The coating shall cover the basis metal completely and shall pass the smut test.
- b. The color shall be a uniform black.
- c. A slight amount of smut is acceptable and shall not be cause for rejection.

#### 1.3.2 Illustrations

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

	Acceptable Workmanship	Unacceptable Workmanship
A		
B		

**1.4 CHROMATE**





Reference: MIL-C-5541 - Chemical Conversion Coatings on Aluminum and Aluminum Alloys, Paragraph(s): 3.5, 6.6, and 6.6.c

**1.4.1 Acceptable Workmanship**

- a. The coating shall be uniform in appearance.
- b. The coating shall be continuous and free from areas of powdery or loose coating, voids, scratches, flaws and other defects or damages which reduces the serviceability of the parts or is detrimental to the protective value and paint bonding characteristics.
- c. The size and number of contact marks shall be at a minimum consistent with good practice.
- d. Clear (colorless) coating shall only be used when specifically authorized by the procuring activity, L-3 Electroynamics and/or customer.
- e. When the color of chemical film is NOT specified on the engineering drawing, then the default color shall be yellow.
- f. When yellow chemical film is used, its visual appearance may range from an iridescent yellow to brown, which is acceptable.
- g. Minor amounts of discoloration, streaking or dark spots as a result of drips or runs are acceptable.

**1.4.2 Illustrations**

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

	Acceptable Workmanship	Unacceptable Workmanship
A		
B		

## 1.5 DUAL FINISH

### 1.5.1 Acceptable Workmanship

- a. There shall be no contamination on the finish.
- b. The separating line for the finishes is per engineering drawings.
- c. Each finish is coated as referenced in this manual.

### 1.5.2 Illustrations

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

	Acceptable Workmanship	Unacceptable Workmanship
A		
B		

**1.6 NICKEL**

Reference: MIL-C-26074 – Coatings, Electroless Nickel, Paragraph(s): 3.6.2.

**1.6.1 Acceptable Workmanship**

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

**1.6.2 Illustrations**

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

	Acceptable Workmanship	Unacceptable Workmanship
A		
B		

## 1.7 PAINTING

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

### 1.7.1 Acceptable Workmanship

- a. The paint shall dry to a uniform smooth surface free from runs, sags, bubbling, streaking, hazing, seeding, dusting, floating, mottling, orange-peel, or other film defects.

### 1.7.2 Illustrations

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

	Acceptable Workmanship	Unacceptable Workmanship
A		
B		

**1.8 TIN**

Reference: B 545 – Standard Specification for Electrodeposited Coatings of Tin,  
Paragraph(s): 6.3, 6.6.

**1.8.1 Acceptable Workmanship**

- a. Tin coatings shall have the characteristic appearance, including surface texture, for the process used.
- b. The appearance shall be uniform throughout, insofar as the basis metal will permit.
- c. They shall be adherent and visually free of blisters, pits, peeled areas, cracks, nodules and unplated areas.
- d. They shall not be stained or discolored.
- e. All tin-coated articles shall be clean and undamaged.
- f. Coatings shall be free of visible mechanical damage and similar gross defects when viewed at up to 4X magnification.

**1.8.2 Illustrations**

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

	Acceptable Workmanship	Unacceptable Workmanship
A		
B		

## 1.9 ZINC

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

### 1.9.1 Acceptable Workmanship

- a. The coating shall not show separation from the basis metal at the interface.
- b. Unless otherwise specified, a bright, semi-bright, or dull luster shall be acceptable.
- c. 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 that will affect the function of the coating.
- d. The coating shall not be stained or discolored.
- e. Superficial staining from rinsing or slight discoloration from drying or baking operation to relieve hydrogen embrittlement, shall not be cause for rejection.
- f. The electroplated article shall be clean and free of damage.

### 1.9.2 Illustrations

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

	Acceptable Workmanship	Unacceptable Workmanship
A		
B		

**SECTION 2**  
**PACKAGING CONTAINERS**

## 2.0 Packaging Containers

### 2.1 49CFR 173.28 Reusable Plywood Shipping Crates

#### 2.1.1 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 nailings 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.

### 2.1.2 Definitions

**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 results in stresses building up near the surfaces which, if they become too great, cause the wood to check.

**Cleats** – See Figure 1.

**Panel** – See Figure 1.

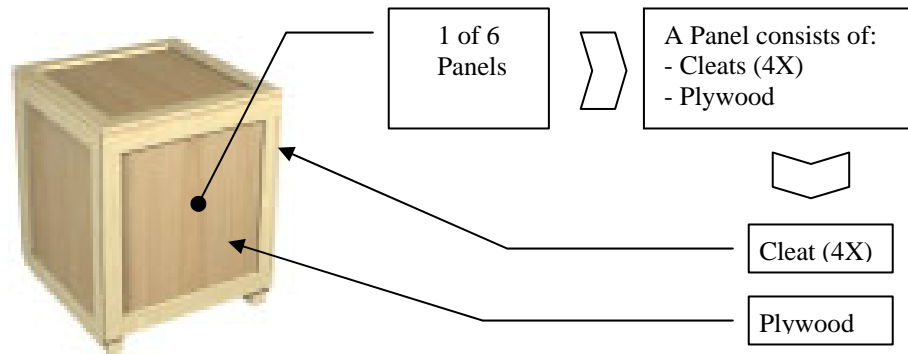
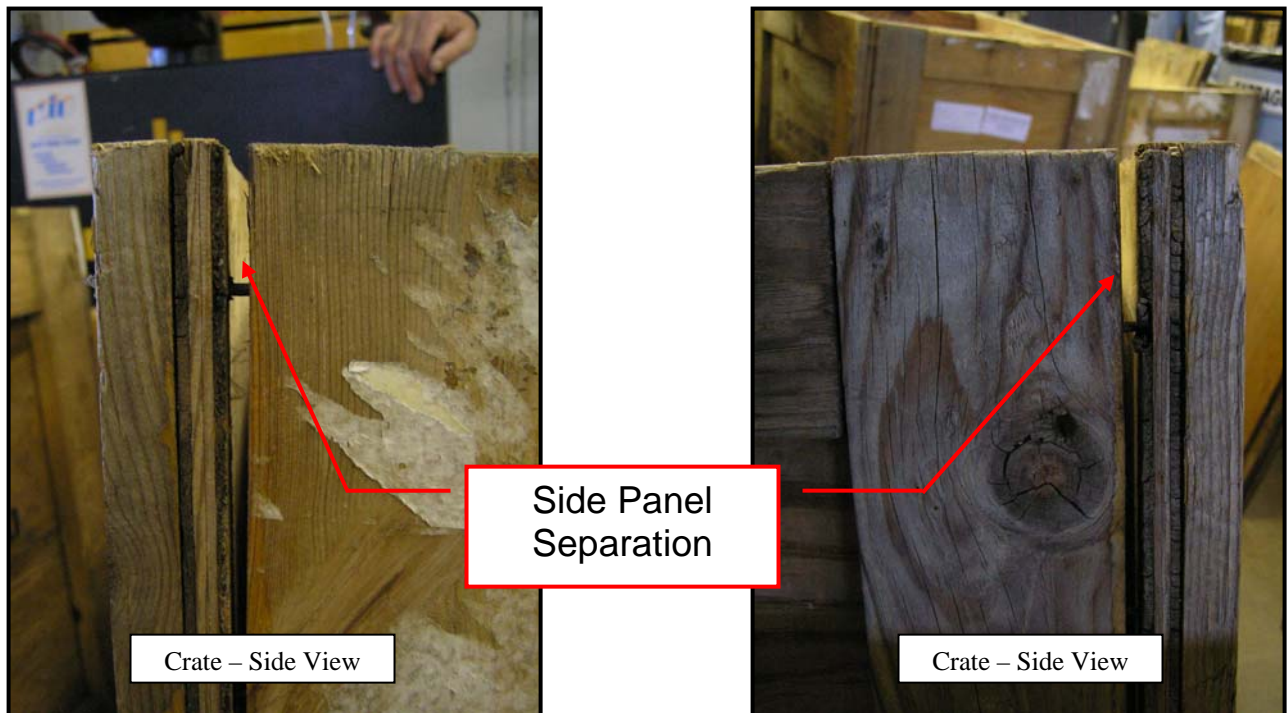
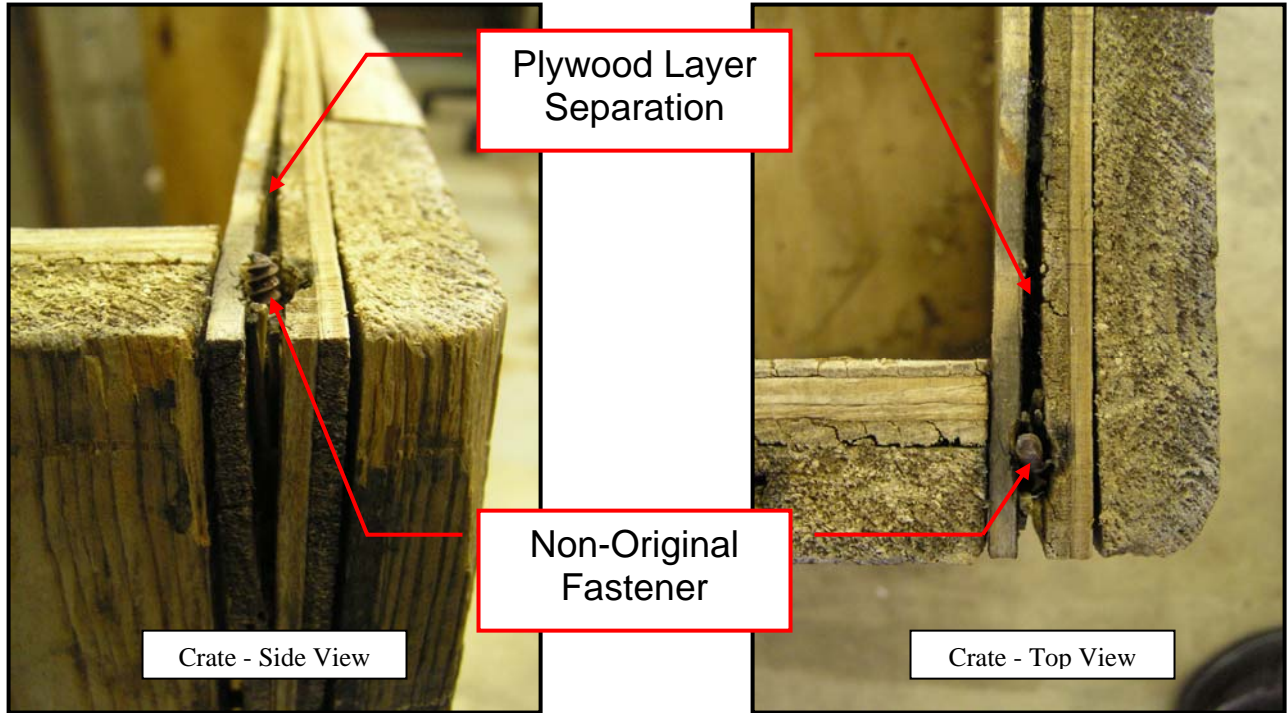


Figure 1. Crate Anatomy

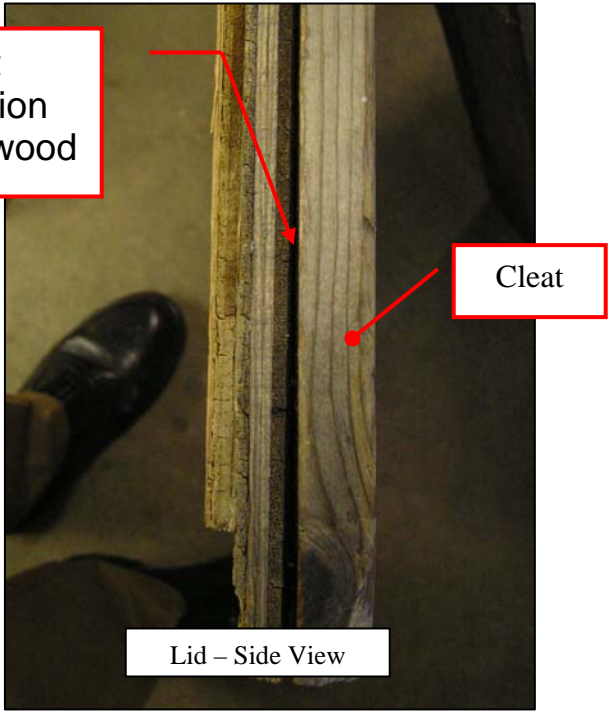
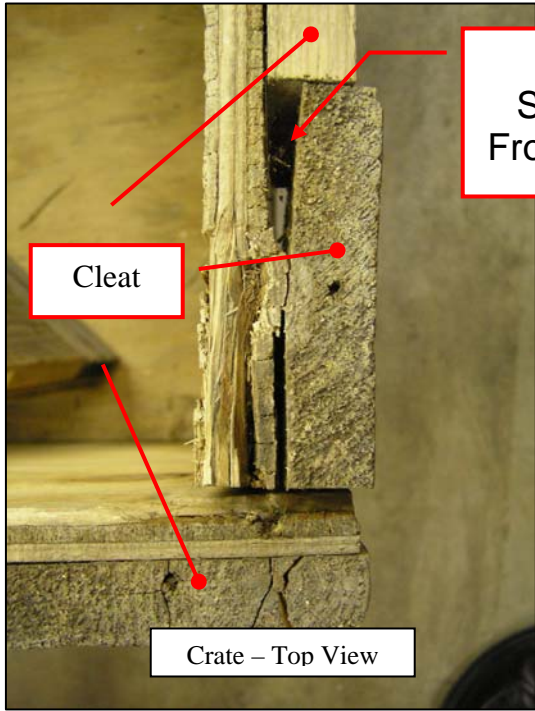
### 2.1.3 Illustrations

The following illustrations depict "Unacceptable" workmanship.

#### Unacceptable Workmanship



**Unacceptable Workmanship**

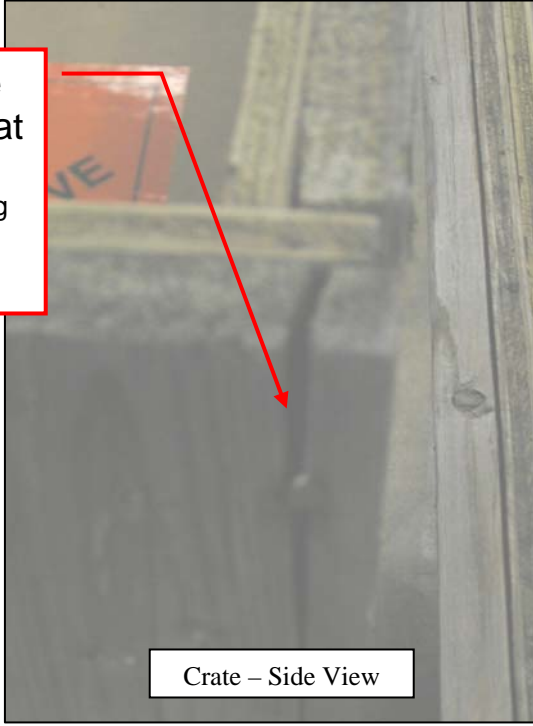


**Unacceptable Workmanship**

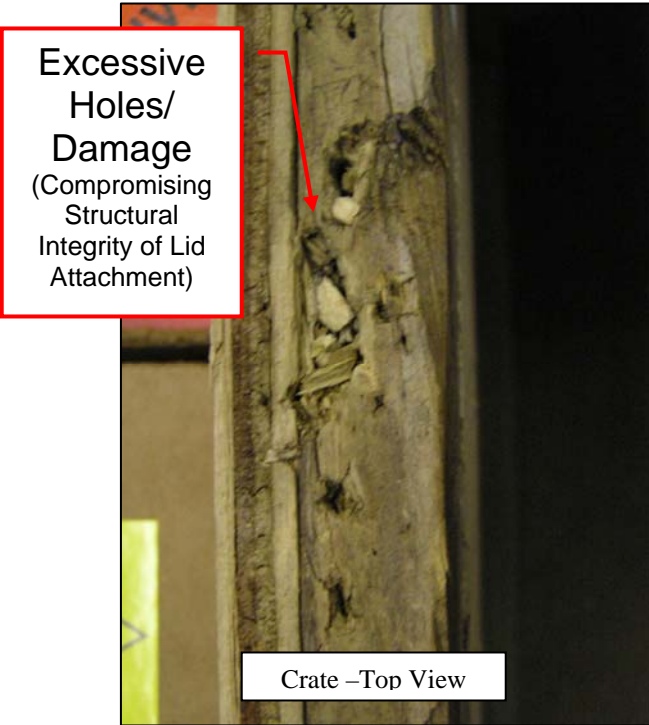


**Excessive  
Cleat Split at  
Nail**  
(Compromising  
Structural  
Integrity)

Crate – Side View

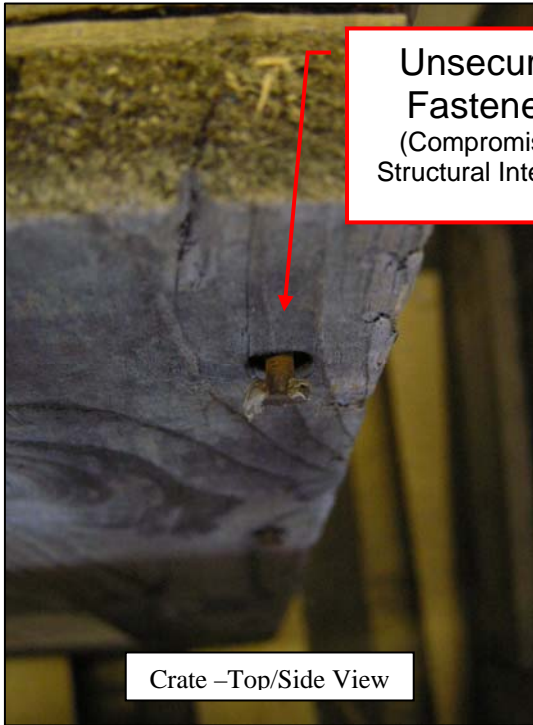


Crate – Side View



**Excessive  
Holes/  
Damage**  
(Compromising  
Structural  
Integrity of Lid  
Attachment)

Crate –Top View



**Unsecured  
Fasteners**  
(Compromising  
Structural Integrity)

Crate –Top/Side View

**Unacceptable Workmanship**

