

Workmanship Acceptability Requirements

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1 PURPOSE

The purpose of this document is to establish BAE Systems' interpretation, acceptance criteria, and requirements with respect to the workmanship of fabricated mechanical parts and assemblies. Herein, workmanship refers to the level of quality imparted onto a finished part/assembly both during and at the completion of the manufacturing process. As there is often subjectivity when defining part workmanship/quality, the requirements established herein are intended to provide the user guidance for which workmanship acceptance judgments can be made in the absence of any other defining requirements.

1.1 Usage

The requirements contained herein are for use during the definition, manufacture, and/or inspection operations of parts and assemblies designed and procured by/for BAE Systems.

- Engineering is responsible for defining and documenting designs that meet project level requirements.
- Suppliers are responsible for fabricating and delivering parts that meet all requirements defined by the applicable drawings, specifications, and/or requirements herein as defined within the Purchase Order or Subcontracts.
- Inspection and Quality are responsible for ensuring delivered parts meet all defined requirements.

The requirements of this document provide a common reference for the preferred workmanship of parts where unspecified through other superseding requirements.

1.2 Document Maintenance

This document will be maintained by US ES Defense Supplier Quality Assurance (SQA). SQA will work with document stakeholders (Engineering, Operations, and Suppliers) as required to ensure the information and requirements contained herein remain relevant.

1.3 General

Dimensional information contained herein is for reference only. While not intended for formal inspection purposes, it is intended to define BAE Systems' interpretation of workmanship criteria.

1.4 Applicability

These requirements apply to all purchase orders with commodity codes MA* (mechanical assembly), FB* (fabrications), and MP* (machined parts) unless determined otherwise by the project team (* includes all sub-codes applicable to the base commodity code). These requirements are implemented via a Quality Assurance Code.

1.5 Order of Precedence

These requirements shall not override or supersede any applicable specification or drawing requirement.

2 RELATED INFORMATION

Parent Document:

DI6-015 Supplier Quality Requirements
UG6-007 Incoming Inspection Requirements Reference

Supporting Documents:

SAE AMS2422 Plating, Gold
ASME Y14.5 Dimensioning and Tolerancing
ASME Y14.6 Screw Threads
ASME Z1.4 Sampling Procedures and Tables
ASTM-B-488 Electrodeposited Coatings of Gold for Engineering Uses
ASTM-B-545 Standard Specification for Electrodeposited Coatings of Tin
AMS-STD-595 Colors Used in Government Procurement
AWS A3.0M/3.0 Standard Welding Terms and Definitions
AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination
AWS D17.1/D17.1M Specification for Fusion Welding for Aerospace Applications
MIL-A-8625 Anodic Coatings
MIL-C-22751 Application of Paint
MIL-DTL-5541 Conversion Coatings on Aluminum
MIL-STD-13231 Marking of Electronic Items
MIL-STD-130 Identification Marking of U.S. Military Property
MIL-STD-202 Test Methods for Electronic and Electrical Parts
MIL-STD-403 Preparation for and Installation of Rivets and Screws. Rocket and Missile Structure.
MIL-HDBK-454 Standard General Requirements for Electronic Equipment
MIL-STD-595 Colors Used in Government Procurement
NAS 1400 Rivet-blind, Self-Plugging Mechanically Locked Spindle
NASM 33537 Helical Screw Thread Inserts
NASM 45938 Nut, Plain, Clinch and nut, Self-Locking, Clinch
SAE-AMS-P-81728 Plating, Tin-Lead (Electrodeposited)
94117-8426799 Paint Finish Specification
MIL-DTL-53072 Chemical Agent Resistant Coating (CARC) System Application Procedures and Quality Control Inspection
FED-STD-H28/2 Screw-Thread Standards for Federal Services Section 2 Unified Inch Screw Threads- Un And Unr Thread Forms
FED-STD-H28/20B Screw-Thread Standards for Federal Services Section 20 Inspection Methods for Acceptability of UN, UNR, UNJ, M, AND MJ Screw Threads
ASME B1.3 Screw Thread Gaging Systems for Acceptability: Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ)

3 DOCUMENT CHANGE HISTORY

Date	Rev.	Description
28 December 2021	-	Initial Release

11 May 2022	A	<ul style="list-style-type: none">• Section 2: Captured AWS weld standards.• Sections 4.1.3, 4.1.4, 4.1.5, 4.1.6, 4.2, 4.3, 4.4.3, 4.9: Captured workmanship content from associated command media documents, DI6-072 (Inspection DI) and UG6-007 (Inspection UG).• Section 4.8.2.1: Revised visual inspection viewing distance of plating and surface treatments to 14-24 inches.• Section 4.8.4.1.2: Updated gloss reading to capture from a production part on paint and coatings CoC.• Newly added figures and sections numbered, and captured in Table of Contents. Minor formatting errors corrected.
12 June 2023	B	<ul style="list-style-type: none">• Section 2: Captured CARC paint and Screw Thread standards.• Section 4.4.2: Updated Screw Thread gaging section.• Section 4.7: Added objective statement of prevention of excessive tooling marks.• Section 4.8.4.1.1: Captured paint coupon prep method. Coupons to be processed through same steps along with the part. Test coupons shall not be reused.• Section 4.8.4.1.2: Updated CoC requirements for Paint gloss to be recorded as applicable.• Section 4.8.4.3.1: Updated visual inspection distance statement. Captured FOD prevention plan requirement.• Section 4.8.4.3.2: Captured Spots, Staining, and Exposed Primer as paint conditions.• Corrected minor formatting errors and section references.

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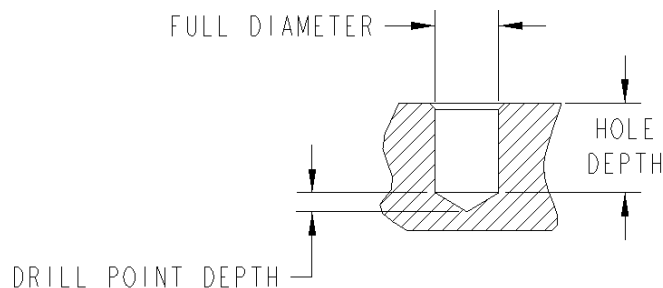
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4 REFERENCE

4.1 Hole Requirements

4.1.1 Hole Depth

Hole depth is the depth of the full diameter, including spot faces, countersinks, and counter bores diameters. Hole depth is interpreted as shown in Figure 4-1. Nominal hole depth must be addressed in some form on the drawing. Hole depth addressed without a tolerance shall conform to the drawing tolerance block.



NOTE: Drill point depth may vary depending on the drill point used for most efficient drilling for particular size of hole and material of part. A drill point depth of 0.3 times the nominal full hole diameter is typical for general purpose drills. Drill Point shall not break through any surface.

Figure 4-1 – Hole Depth Interpretation

4.1.2 Hole Perpendicularity

ASME Y14.5 defines *Fundamental Rules* for drawing features. Among them are:

- Each feature shall be toleranced and,
- Dimensioning and tolerancing shall be complete so that there is a full understanding of the characteristics of each feature.

Yet many drawings, especially older ones, do not control the perpendicularity of features of size (smooth holes, threaded holes, etc.), or control it in an ambiguous way, especially with respect to modern standards. For example, a threaded thru hole might have been located using two or three place decimal dimensions, where default tolerances in the title block apply. This practice leads to ambiguity, confusion, and argument over exactly how much perpendicularity error the drawing allows. To eliminate confusion, the following guidance is given.

Feature Depth (in)	Perpendicularity Tolerance (in)
Up to .100	.005
.101 to .200	.010
.201 to .500	.020
.500 and up	.060

These tolerances represent reasonably loose tolerances that shall be readily achievable by standard manufacturing methods. If tighter tolerances are warranted, the design authority shall revise the drawing to employ geometric tolerances (typically position) for controlling feature location and orientation.

4.1.3 Hole Diameters

Holes delineated on drawings without a specified hole diameter tolerance will conform to the drawing tolerance blocks.

4.1.4 Hole Gaging

The dimension and tolerance specified for a hole will not determine the actual size of the hole, but rather the size of the plug gages to be used to measure the hole. For a hole dimensioned $.250 \pm .005/.000$ a "go" measuring exactly $.2499$ will enter to the full depth of the hole with no greater force than two (2) finger hand push fit, while a "no-go" gauge measuring $.255$ will not enter the hole.

4.1.5 Hole Location

On drawings which define machining for, and assembly of threaded - in or pressed - in items such as threaded inserts, inserts, standoffs, cap nuts, etc., tolerance of location apply to the hole and not the item location. The assembled item will be within a tolerance of location not exceeding the sum of the hole location plus an assembly tolerance of either $\pm .005$ or the equivalent positional tolerance of $.014$ diameter.

4.1.6 Hole Surface Quality

Drilled holes will be machined with a maximum 250-roughness height rating.

4.2 Counter Bore Requirements:

- Counter bore Depth on Curved Surface - Counter bore depth on a curved surface will be measured from the lowest point on the surface.
- Counter bore Concentricity - Counter bore will be concentric to hole within one-half the sum of the tolerances of the hole/counter bore.
- Counter bore Surface Quality - Counter bored holes will be machined with a 250 maximum roughness height rating.

4.3 Countersink Requirements:

- Countersink Angles - All countersinks will be produced with an angular tolerance of ± 2 degrees (2°).
- Countersink Concentricity - Countersink will be concentric to hole within one-half tolerance of the hole diameter.
- Countersink Surface Quality - Countersink will be machined with a 125 maximum roughness height rating.
- Countersink stock thickness - When stock thickness and countersink tolerances combine to produce a hole diameter which exceeds drawing requirements, the countersink takes precedence.
- Countersink Curved surface - On a curved surface, the countersink will be measured at the smallest points for size conformance.

4.4 Screw Threads

4.4.1 Relief to Screw Head Shoulder Not Specified

A drawing delineating full threads to the screw head shoulder with no relief depicted or defined in accordance with separate specification, requires a relief so that a gage will thread tightly to the shoulder without interference.

4.4.2 Relief to Screw Head Shoulder Specified

A drawing delineating full threads to the screw head shoulder, with the term THREAD RELIEF called out and no direction for it to be in accordance with a separate specification, shall be manufactured with a relief shown in Figure 4-2. This also applies to threads delineated with a thread relief and no further dimensional requirements.

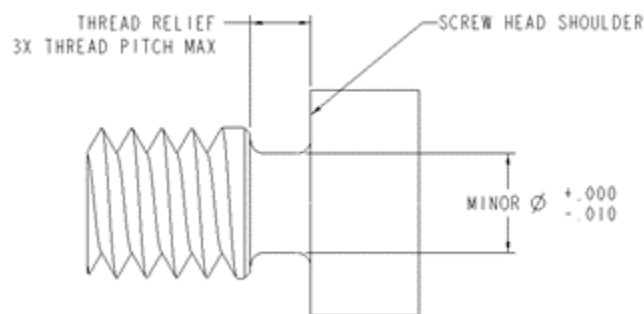


Figure 4-2 – Screw Relief Interpretation

- **Screw Thread Gaging** - Internal and external threads will be inspected using the appropriate class "GO", "NO-GO" thread gages. A maximum of 3 turns of the "no-go" gage will be allowed. Drag encountered with "no-go" will be considered nonacceptance of the gage and an acceptable thread. Unless otherwise specified, maximum minor diameters (internal threads) and minimum major diameters (external threads) shall be measured along with functional thread plug (go/ no-go) gages. For standard threads see ASME B 1.1 table 2a for external threads or table 2b for internal threads. For metric see ASME B 1.13 table 14 for external threads or table 15 for internal threads (tables C1 and C2 for inch translations). Helicoil/threaded insert preparation holes shall be checked for minor diameter and with functional (STI) thread plug (go/ no-go) gages per the applicable installation spec.
- **Screw Thread Chamfers** - External threads will be chamfered 45 degrees +/- 10 degrees to the minor diameter of the thread. Internal threads will be countersunk 100 degrees +/- 20 degrees to the major diameter of the thread. Diameter tolerance to be + .020 - .000.
- **Screw Thread Length** - Thread length shown or specified on an engineering drawing is for minimum gage fit. Two perfect or imperfect thread leads beyond this limit are permitted on external threads for lead of die. Five perfect or imperfect thread leads beyond this limit are permitted on internal

threads for lead of tap. Where parts are shown threaded to a shoulder, the length of perfect thread will be within two thread leads of the shoulder. Internal thread depth is measured from the base material surface for countersunk holes and from the flat machined surface of counter bore holes.

- Screw Thread Surface Quality - The finish on a screw thread will be machined with a 125-roughness height rating.
- Screw Lead Definition - Screw lead is defined as the amount of axial travel when the threaded part is turned one full turn or 360°. Reference Figure 4-3.

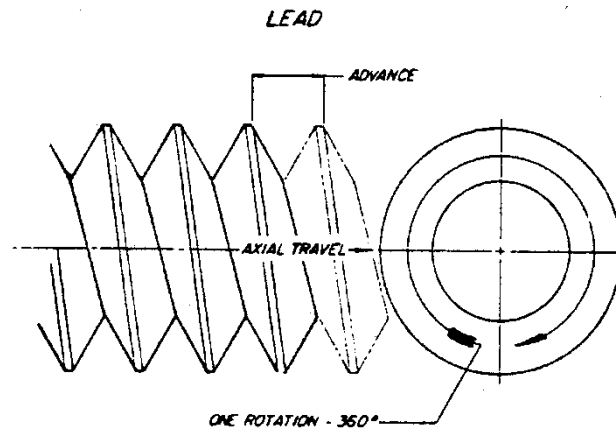


Figure 4-3 – Screw Thread Lead (Ref: DI6-072 rev. 10, Original source unknown)

4.4.3 Screw Thread Perpendicularity

The axis of the threaded part will be perpendicular with the shoulder or face within .010 inch of length (L) of threaded part. (See Figure 4-4) Computed allowable variation will be total for the length. Threaded holes will have a maximum permissible deviation of +/- 1 degree from true perpendicular.

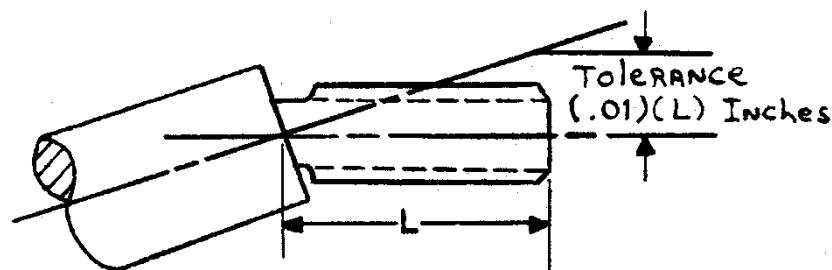


Figure 4-4 – Screw Thread Perpendicularity (Ref: DI6-072 rev. 10, Original source unknown)

4.5 Burrs / Edges

4.5.1 Machined Edges

Breaking of edges is applicable to all machining operations (e.g.) milling, turning, punching, shearing, forming, and grinding) except for holes where rivets and pressed hardware are to be installed.

4.5.2 Sharp Edge

A machined edge designated by the note "sharp edge," shall be interpreted to mean either a chamfer or radius up to .003" (0.08 mm) is acceptable – the low limit shall be understood to be .000.

4.5.3 Other

All internal and external machined edges not specifically designated by a dimension shall be dulled or broken to a .003" (0.08 mm) minimum and .030" (0.76 mm) maximum chamfer or radius (see Figure 4-5). Exceptions are drawing specifications of "SHARP CORNER" in which case refer to Section 4.5.4.

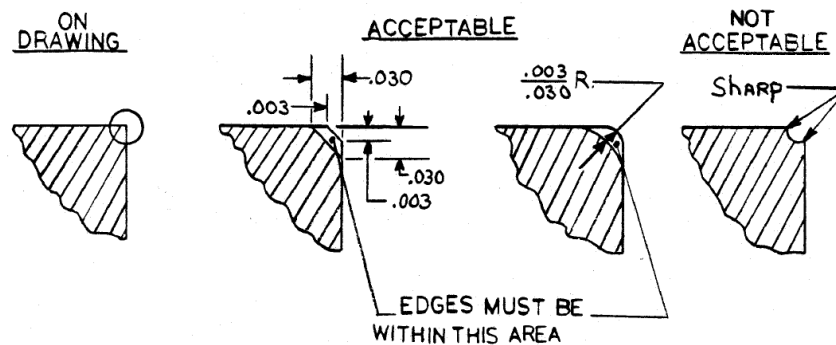


Figure 4-5 – Edge Treatments

4.5.4 Sharp Corners

When specified on the drawing, "SHARP CORNER" indicates a burr-free edge that may be dulled to a maximum radius or chamfer of .003 inches (0.08 mm) as the result of burr removal.

4.5.5 Louvers

Where louvered openings are punched/sheared, removal of sharp edges normally left in the opening is required only where such edges constitute a safety hazard or compromise the drawing requirements.

4.5.6 Connecting Surfaces

All connecting surfaces, curved and plane surfaces, shown as tangent, shall blend smoothly unless otherwise shown. Internal or external radii shown tangent to each other or tangent to a surface or edge shall not have a step at the function which exceeds one half the tolerance of the radius. (See Figure 4-6)

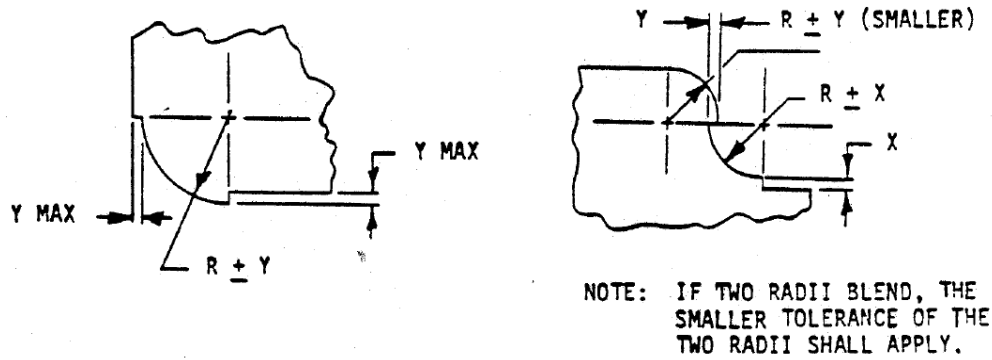


Figure 4-6 – Connecting Surfaces

4.5.7 Mismatch Between Adjacent Machined Features

Steps caused by mismatch between adjacent machined features shall be limited to 24 times the largest surface texture value specified for the features and shall fall within the tolerance of size or form for the features. See Figure 4-7 and Table 4-1.

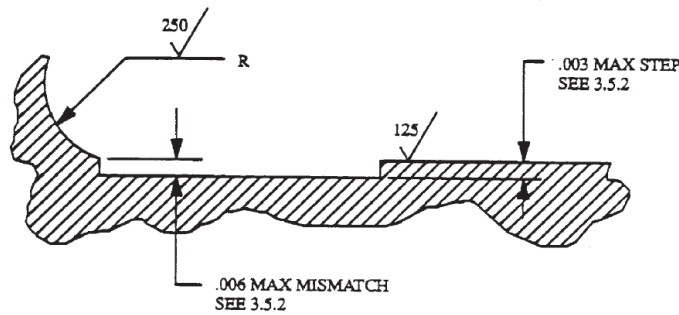


Figure 4-7 – Adjacent Feature Mismatch Example

Table 4-1 – Allowable Surface Steps and Mismatch Within Specified Size (or Form) Tolerances

Specified Surface Texture for Machined Feature(s) (microinches)	Maximum Step or Mismatch (inches)
1	0.00003
2	0.00005
4	0.0001
8	0.0002
16	0.0004
32	0.0008
63	0.0016
125	0.003
250	0.006
500	0.013
1000	0.025

4.5.8 Burrs / Sharp Edges

Parts shall be free from burrs or sharp edges that could make the part (or equipment) unsatisfactory for the purpose intended.

4.5.8.1 Definition of a Burr

- Burrs are protruding irregularities which cannot be considered part of the designed contour. This includes undefined/unintentional material extending beyond the intersection of two surfaces. (See Figure 4-8)
- A loose or hanging burr is one which can be bent or removed by manual fingernail pressure or air blast.
- A tight burr is one that cannot be bent or removed by applying manual pressure.
- Swelling of material, such as that caused by displacement of material, shall not be considered a burr and shall be judged with respect to its effect on dimensional and functional limitation on the part and appearance.

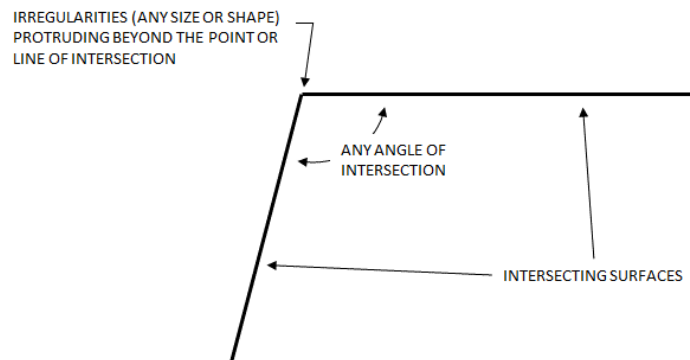


Figure 4-8 – Burr Definition

4.5.8.2 Treatment of Burrs

- All burrs shall be removed and the bases blended to the existing surface without exceeding the allowable tolerance.
- Unless otherwise specified, all external surfaces and edges shall be free of burrs. Features internal to the product part which would not constitute a safety hazard may exhibit sharp edges. In general, any feature whereby the longest dimension is 3/8" or greater (hole diameters and/or cutouts) shall have its edges broken to .003" (0.008 mm) minimum and .030" (0.76 mm) maximum chamfer or radius. (See Figure 4-5)

4.6 Sheet Metal

The act of bending results in both tension (see Section 4.6.1) and compression (see Section 4.6.2) in the sheet metal. The outside portion of the sheet undergoes tension and stretches to a greater length, while the inside portion experiences compression and reduces in length.

4.6.1 Bend Tension (Crazing)

Crazing is the phenomenon that produces a network of fine cracks on the outside bend radius surface due to metal stretching and expanding. Crazing occurs in regions of high hydrostatic tension, or in regions of localized yielding, which leads to the formation of interpenetrating micro-voids and small fibrils. Surface crazing is permissible, but the aggregate length in any plane and depth of any imperfection shall not exceed limits shown in Figure 4-9.

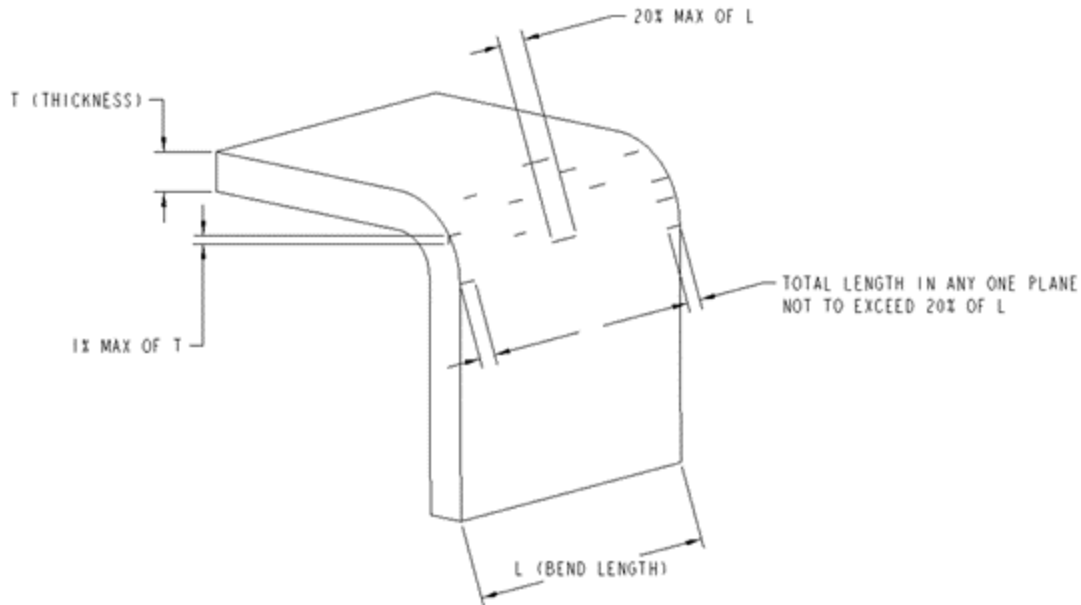


Figure 4-9 – Bend Tension

4.6.2 Bend Compression (Flares)

Flares are the result of material extension due to metal compression on the inside of a bend radius (see Figure 4-10). Flares less than the maximum inside bend radius are permissible providing the metal protrusion(s) do not exceed part dimensional limits.

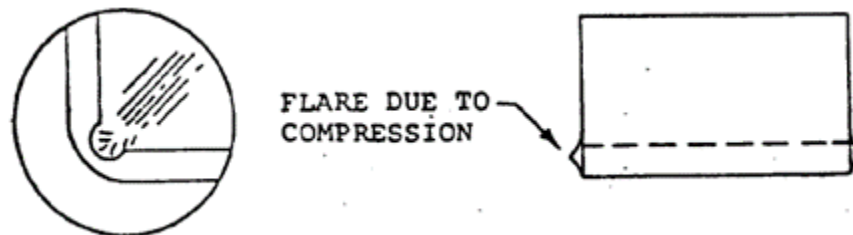


Figure 4-10 – Bend Compression

4.7 Tooling Marks

Tooling marks are typically caused by relative motion occurring between the part material and forming die during the bending / forming process. While blemish free parts are preferred, unless otherwise specified,

tooling marks are acceptable as long as they do not violate specified surface finish requirements or otherwise compromise the integrity of the part. Objective should be to prevent excessive tooling marks resulting from poor workmanship practices or worn out tooling.

4.8 Finishes

4.8.1 Finish Optional

When specified on the drawing, the words "FINISH OPTIONAL" indicate that conformance to coating thickness, smoothness, gloss, and coverage requirements is not required for the finish specified on the surface(s) indicated.

4.8.2 Plating and Surface Treatments

4.8.2.1 Visual Inspection

Plated and coated parts shall be uniform, smooth, fine grained, adherent, and free from powdery areas, blisters, pits, nodules, voids, and other defects which could be detrimental to their utilization. (See Section 4.8.3.1) The size and number of contact marks shall be, at a minimum, consistent with good practice, and shall not be rejectable. Unless otherwise specified or required in the plating/finish specification, final inspections shall be performed at normal viewing distances of 14-24 inches with the unaided eye.

4.8.2.1.1 Chemical Conversion Coatings (Alodine) on Aluminum

Color levels may range from clear to iridescent yellow or brown. Uniformity of color may vary from alloy to alloy on aluminum welds, castings, and brazements. Clear (colorless) coating shall only be used when specifically authorized by the procuring activity. Touch-up, if allowed by the drawing requirements or procurement activity, shall be in accordance with the governing specification.

Acceptable Conditions

- Variation in color, hue, or tint of the Alodine coating on a single part/assembly due to differences in surface finish (cast, grained, textured, etc.), welds, brazements, and machining features are acceptable as long as the finish meets the requirements of the governing specification. Requirements may include conductivity, thickness, no exposed base metal, etc.

Rejectable Conditions

- Uncoated areas, breaks, scratches, flaws, or other defects where the surface of the base metal has been exposed (See Figure 4-11).



Figure 4-11 – Example of Alodine scratch exposing base metal

- Chips
- Pits
- Corrosion
- Loss of adhesions
- Incorrect plating
- Missing plating in required areas
- Plating in areas not to be plated

4.8.2.1.2 Anodize

Acceptable Conditions

- Non-Dyed (Ref MIL-A-8625 Class 1): Any natural coloration resulting from anodic treatment with the various alloy compositions shall not be considered coloration.
- Dyed (Ref MIL-A-8625 Class 2): The color on wrought alloys shall be uniform. Cast alloys may exhibit dye bleed-out or lack of color associated with the inherent porosity of the casting.
- Holes: Small holes and tapped holes under ¼ inch diameter may vary from no film to a full normal coating.

Rejectable Conditions

- Powdery areas
- Incorrect plating
- Missing plating in required areas
- Plating in areas not to be plated
- Corrosion
- Loss of adhesions

4.8.2.1.3 Tin and Tin Lead

Appearance shall be matte or bright lustrous.

4.8.2.1.4 Passivated Parts

Appearance shall be free of etching, frosting, iron contamination and other foreign materials.

4.8.3 Other Plated or Chemically Treated Surfaces

(Such as Black Oxide, etc.)

The following will be inspected as applicable per the plating/finish specification, under normal inspection lighting.

- a. Finish shall be smooth, continuous and firmly bonded to the base material.
- b. There shall be no untreated areas, except those indicated per print.
- c. Scratches or gouges exposing base metal are not acceptable.
- d. Verify that all chemical residue have been complete removed.
- e. The following conditions are rejectable:
 1. Scratches
 2. Chips
 3. Pits
 4. Corrosion
 5. Loss of Adhesion
 6. Incorrect Plating
 7. Missing plating in required areas
 8. Plating in areas not to be plated

4.8.3.1 Plating Definitions

- Pits - Pits are small holes located randomly in the plating, not exposing base metal or underplate. (See Figure 4-12)

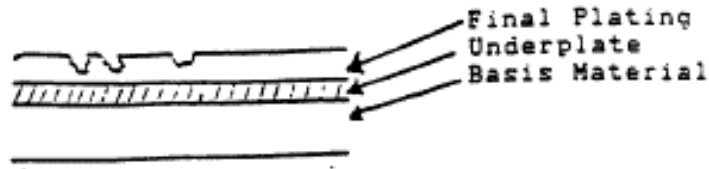


Figure 4-32 - Pits

- Porosity - Similar to pits, except that there are minute holes (these holes are not normally visible) allowing the passage of liquids to underplate or basis material. Where the condition becomes severe enough to be visually evident, the holes are defined as voids. (See Figure 4-13)



Figure 4-43 - Porosity

- Voids - The absence of plating on a specific area. (See Figure 4-14)

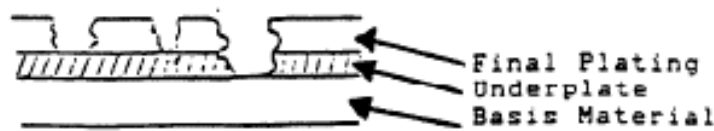


Figure 4-54 - Voids

- Nodules - Small or large mass of rounded or irregular-shaped lumps, bumps, or peaks. (See Figure 4-15)

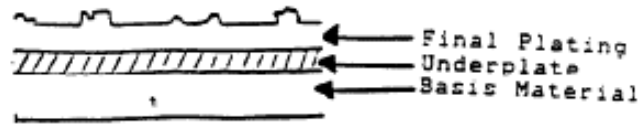


Figure 4-65 - Nodules

- Burned Areas - Areas of plating that show considerable discoloration or roughness due to excessive current during plating.
- Blisters - A lifting of plating in a small area (appearing as a small bubble or bubbles), a blister shall not be adherent to the basic material and/or underplate when subjected to test.
- Scratches - Lines/breaks in plated or chemical film surfaces that expose the base material or underplate.
- Excessive build-up of plating - A condition where the thickness of the plating is excessive in certain areas, such as: around holes, inside holes, along the edges and surfaces, etc., of the basis material.
- Rough Plating - A condition where the plating is not continuous, smooth and fine grained.
- Peeling or Lifting of Plating - A condition where the plating separates from the underplate and/or basis material, exposing the underplate and/or the basis material. The plating is not adherent to underplate and/or the basis material when subjected to adhesion testing.
- Powdery Areas - A condition of anodized or chemical film (Alodine) coatings exhibiting a dull appearance and loose adherence to the base aluminum.
- Smutty Areas - A condition where the coating has a dull appearance and can be removed by rubbing with a Kim-wipe or doe-pac.

4.8.4 Paint and Coatings

4.8.4.1 Supplier Deliverables

4.8.4.1.1 Paint Coupons

Requirements for Paint Coupons (if applicable) are as follows:

- Paint coupons, painted along with process lot of deliverable parts, shall be utilized for verification of paint adhesion, primer thickness, and paint thickness. Paint coupons may be processed by coating entirely, or by using a “stepping method” where incremental masking is used so that each finish layer is partly exposed for inspection.
- All paint coupons shall be processed through all the cleaning, pretreating, painting, and drying steps along with the parts being processed. Test coupons shall not be reused.
- Paint coupons shall be traceable to the vendor at which paint/primer was applied. The paint/primer material, lot numbers, date of application, and Nadcap certification number if applicable shall be documented for each coupon for each respective paint lot.
- The coupon shall be traceable to the applicable lots including part numbers and serial numbers if applicable to the painted/primed parts.
- Perform Adhesion Tape Test using one of the following two methods:
 - IAW FED-STD-141 M 6301.3 (Wet)
 - No paint removal is allowed.
 - Or, ASTM D3359 (Dry) on coupon(s) from the same lot. Use appropriate Test Method from D3359 based on paint film thickness.

- Classification level 4A or 4B (less than 5%) minimum required.
- Capture test method used and results on CoC.

4.8.4.1.2 Certificate of Conformance

The Certificate of Conformance (C of C) shall contain at a minimum:

- Certification to paint color chip matching paint coupon per AMS-STD-595
- Certification to Primer and Paint as defined by drawing (IAW standard list on drawing)
- Paint Gloss reading from a production part, as applicable
- Primer thickness from associated paint coupon – List requirements from drawing and results directly thereafter
- Paint thickness from associated paint coupon – List requirements from drawing and results directly thereafter
- Certification of tape test and method used with result

4.8.4.2 Color

The appropriate paint chip shall be used while inspecting finished parts and viewed with the unaided eye. Base coat shall not be visible.

4.8.4.3 Workmanship

4.8.4.3.1 Visual Inspection

Samples of painted parts shall be inspected for color, proper masking, and workmanship at normal viewing distances (36 inches). Light sources used for inspection shall be in accordance with AMS-STD-595. Ensure that the painted surfaces is a smooth, continuous, adherent film, and uniform in appearance when viewed at 36 inches with an un-aided eye. The paint and/or coating provides the hiding power as required by the drawing or specification.

Note: 36 inches is a recommended visual inspection distance. In some circumstances, a closer viewing distance as close as 18 inches may be necessary based on size of the part/requirement to confirm the anomaly.

The completed assembly shall be clean of all contaminants, such as lubricating oils, corrosive products, solder fluxes, metal chips, loose/splattered solder, clippings, etc., or any foreign material that could loosen or become dislodged. The coated surface shall be smooth, continuous, adherent, and uniform in appearance. It shall provide the hiding power and color (4.8.4.2) as required by the drawing or specification.

Incomplete cure, evidenced by a soft, tacky or liquid condition is unacceptable.

Clearance holes for fasteners, hardware, and mating of parts normally shall not be painted, but may have evidence of paint to an extent that shall not interfere with correct assembly.

Table 4-2 – Appearance of painted surfaces (X = Unacceptable surface condition)

CONDITION		Acceptability
Orange Peel		X
Runs or Sags		X
Wrinkling		X
Crazing, Cracking	1	X
Blistering		X
Peeling, Flaking, and Chipping	1	X
Pin Holes		X
Scratches, Gouges	1	X
Scuff Marks	1	X
Touch-up Paint		2
Embedded FOD		3

1/ Any of these conditions that expose base material is not acceptable for any class of paint surface.

2/ Touchup area(s) must be virtually undistinguishable when viewed at approximately 3 feet from the surface.

3/ Embedded Foreign Object Debris (FOD) Accept / Reject Criteria:

Foreign Object (FO) Debris and Damage is defined in NAS 412 and a FOD prevention program shall be in place at the supplier IAW NAS 412, or other plan available for review by BAE Systems.

Total surface area shall not have more than approximately 5% of suspect embedded FOD, (i.e., collective area of a top or bottom, or each side, shall not have more than 5% embedded FOD).

Any embedded FOD shall not adversely affect the appearance of the unit under normal lighting, and shall not show non-conformances such as un-attached bubbles, or delamination that may later separate from the product causing potential Foreign Object (FO) damage.

Embedded FOD shall not be larger than an approximate diameter of 0.050 inches maximum within one square inch. No more than 10 pieces of 0.050 inches maximum diameter foreign objects within one square inch is acceptable

More than one fibre, greater than one inch long and thicker than 0.010, within one square inch is rejectable.

Any combination of the above that exceeds one square inch in a localized area is a rejectable condition.

Suspect foreign objects embedded in the finish that are smaller than approximately 0.030 in diameter are acceptable as long as they don't exceed the 5% maximum surface area.

4.8.4.3.2 Definitions of Conditions

Unless otherwise noted, all images are definitions of Rejectable conditions.

- Orange Peel - An irregularity textured in the surface of a paint film. Orange peel occurs as an uneven or grainy surface to the eye, but usually feels smooth to the touch; appearance resembles the skin on an orange. (See Figure 4-16)

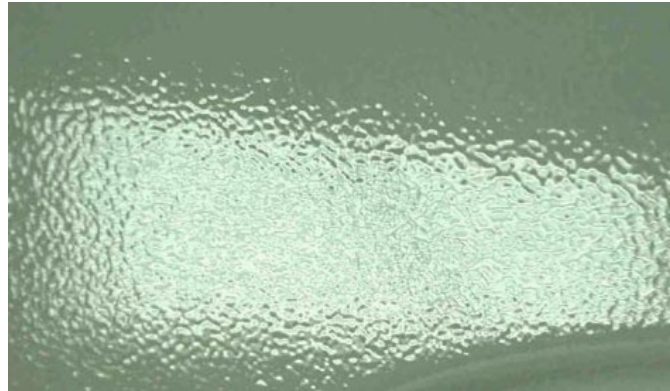


Figure 4-76 – Orange Peel

- Runs or Sags - A flow of excess paint. (See Figure 4-17)

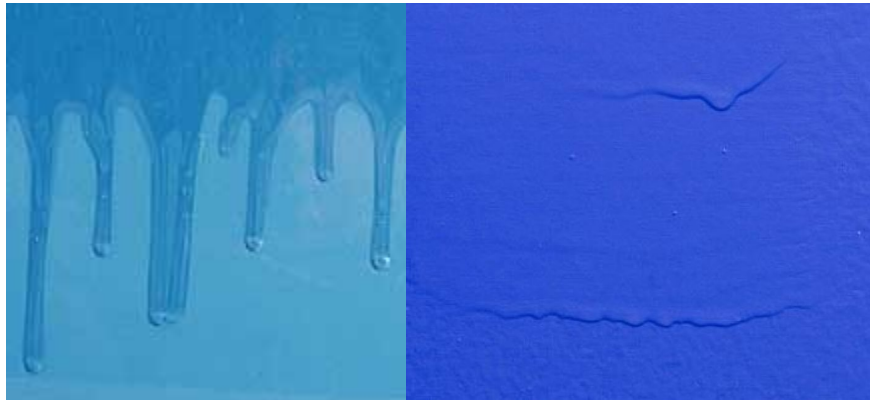


Figure 4-87 – Runs and Sags

- Wrinkling - A surface condition of excessively thick paint causing a wrinkling effect. (See Figure 4-18)

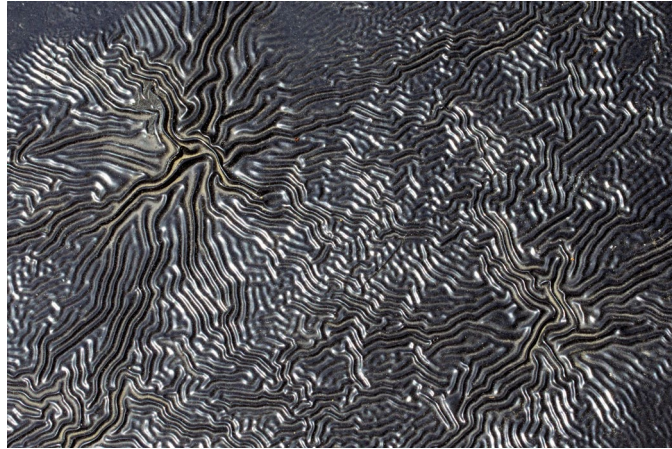


Figure 4-98 – Wrinkling (Source: Jessica Rosenkrantz)

- Crazing, Checking, and Cracking - These defects are lines which appear in the paint film. They may be straight or crooked, long or short, interconnected or completely separate. Crazing and checking are surface effects, while cracks penetrate through the film. Checks often take the form of straight lines, while crazing may form a maze of interconnected wavy lines. (See Figure 4-19)

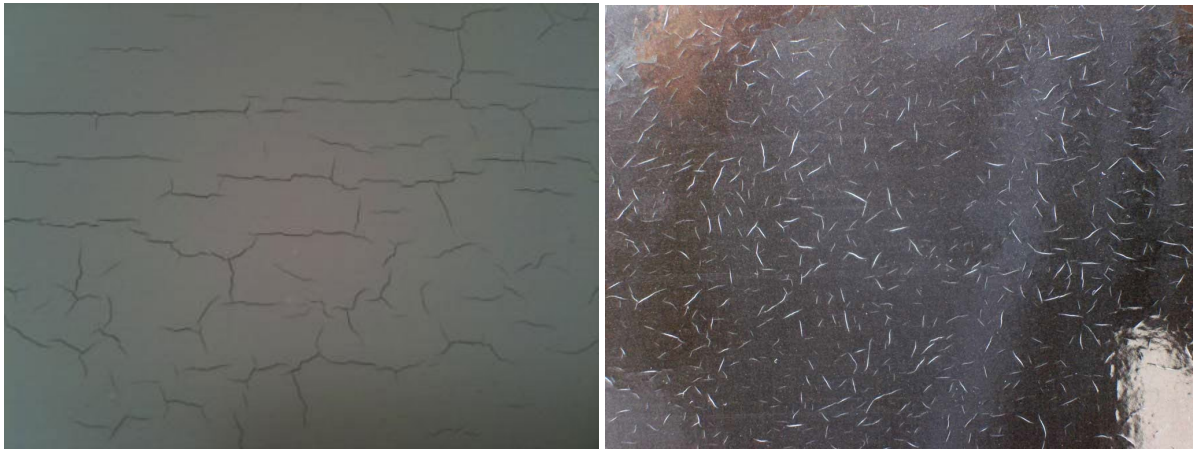


Figure 4-109 – Cracking, Checking

- Blistering - A hollow raised spot/bubble on the surface. These blisters are not adherent to the base material. (See Figure 4-20)



Figure 4-20 - Blistering

- Peeling, Flaking, Chipping - Are identified by actual detachment of pieces of paint from lower surfaces. (See Figure 4-21)



Figure 4-21 – Peeling, Flaking, Chipping

- Pinholes - Pits or depressions which expose base metal or primer surface. (See Figure 4-22 - Pinholes). When viewed at a distance of approximately 3 feet, pinholes are acceptable, providing that no base material is exposed and no more than six pin holes exist in any 1-foot square.



Figure 4-22 – Pinholes (Image demonstrates appearance only, scale unknown)

- Scratches/Gouges - Marks on the surface exposing primer and/or base metal.
- Scuff Marks - A difference in the tone or shade of the paint, caused by rubbing.
- Chipping along tape lines - Minor chipping along tape edges is acceptable provided no paint line or any finish keep out areas are violated (see Figure 4-23)



Figure 4-23 – Tape line chipping

- Chipping along tape lines – Major chipping along tape lines, which extends past the edge break and onto the painted surface, is a rejectable condition. (see Figure 4-24)



Figure 4-24 – Tape line chipping

- Edge buildup – Buildup along the edges in features such as pockets or along the radius within the pockets is allowable. Minor paint buildup on edge, corners and appear to be rounded (not sharp) is acceptable. Excessive paint buildup/run at the edges is a rejectable condition. (see Figure 4-25 and Figure 4-26– Edge build up)



Figure 4-115 – Edge buildup - Minor paint buildup on edge, corners and appear to be rounded (not sharp) is acceptable



Figure 4-126 – Edge buildup - Excessive buildup/run at the edges (rejectable condition)

- Spots and Staining – Paint to be clean and free of spots and staining. (see Figure 4-27 and Figure 4-28)



Figure 4-27 – Spots



Figure 4-28 – Staining

- Exposed Primer: Paint shall be smooth, continuous and uniform meeting the minimum coverage requirements and hiding power with no exposed primer or substrate. (see Figure 4-29)



Figure 4-29 – Exposed Primer

The following conditions are also rejectable:

- Blushing
- Cratering or Fish Eyes
- Faulty spray patterns are unacceptable, if they result in roughness, orange peel or sags.
- Sandy appearance and roughness
- Particle or spray onto areas that are not supposed to be painted.
- Overspray or spray onto areas that are not supposed to be painted.
- Chalking, evidenced by the presence of a loose removable powdery pigment.
- Coating is soft, tacky or has hard skin over soft center.
- Color, texture or gloss not to process summary, drawings or specification requirement.
- Finish damaged from improper handling practices or inadequate protective covering.
- Threaded parts, threaded inserts, holes and areas as specified on the drawing or specification contaminated with undercoat or paint.

4.8.4.4 Paint Adhesion Acceptance Test

Test for paint adhesion on finished hardware by pressing a 1-inch long strip of masking tape (3M Co. code 250) against the finish. Pull straight up and away. No paint removal allowed. This test is intended to be performed at BAE incoming inspection for painted parts received from suppliers.

4.8.5 Marking

Ensure marking is correct and in accordance with the drawing or other governing documentation. Marking shall be checked for proper location, legibility, adherence, as well as no damage. Bar code and Unique

Item Identification (UID) markings shall be scanned with an appropriate device to make sure it reads the required human readable text.

4.8.6 Marking Methods

Marking shall be accomplished by one of the following methods as defined by the drawing / specification:

- Labels - If specified on the drawing and per the Bill of Material.
- Rubber Stamping - To make an impression using a stamp made of rubber.
- Silk Screening - A method of stenciling using a flat piece of silk, fine cloth, or metal screen, on which all parts not to be printed have been stopped off by an impermeable film.
- Etching - Marks consisting of letters or numbers formed by selective chemical etching of the surface.
- Engraving - Marks consisting of letters or numbers or other characters or lines formed by cutting the pattern into a surface by means of a mechanical tool or laser.
- Metal Stamping - The process of impressing marks of letters or numbers into a surface by means of a metal die.

4.8.7 Character Style / Height

Character style and height are governed by the applicable drawing requirements.

4.8.8 Character Locations

Character location shall be as specified on the drawing.

4.8.9 “Approximately As Shown”

"Approximately as shown" with no specified dimensions allows the marking to be within the general area and not necessarily at the location shown on the drawing pictorials, provided it does not interfere with or is not obscured by other features.

Note:

Rules governing "Approximately as shown" are:

- The characters shall be within the quadrant of the part shown in the drawing/pictorial
- The characters shall be in the same relative position to other features on the drawing

4.8.10 Marking Legibility

Marking shall be sharp, well defined and easily readable. Blurring, smearing, or other imperfections that impair the legibility are unacceptable.

4.8.10.1 Marking Legibility Accept / Reject Examples

Examples of acceptable and rejectable marking legibility is as shown in Figure 4-30 through Figure 4-35.

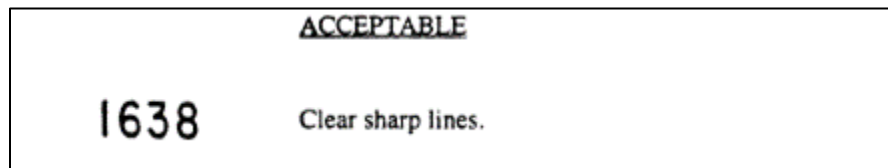


Figure 4-30 – Acceptable Legibility Examples (1 of 2)



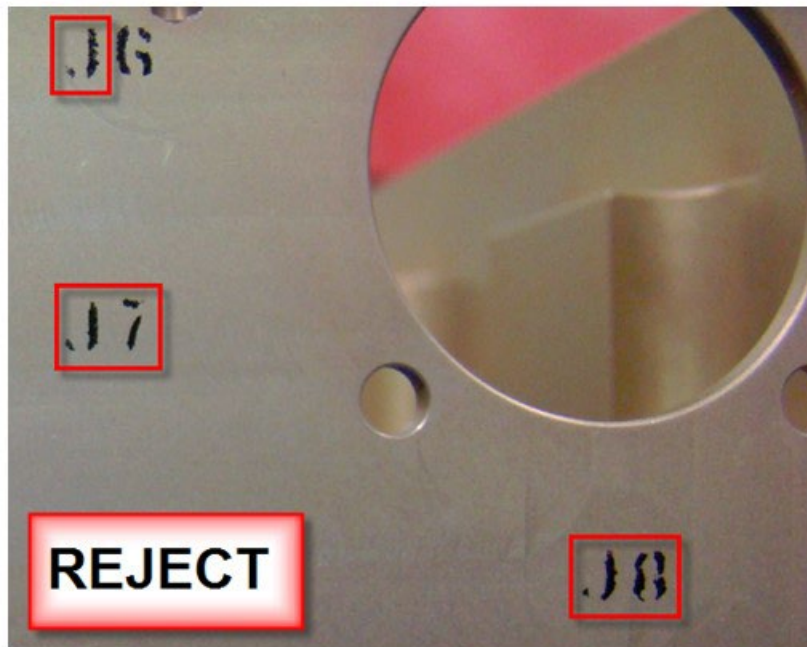
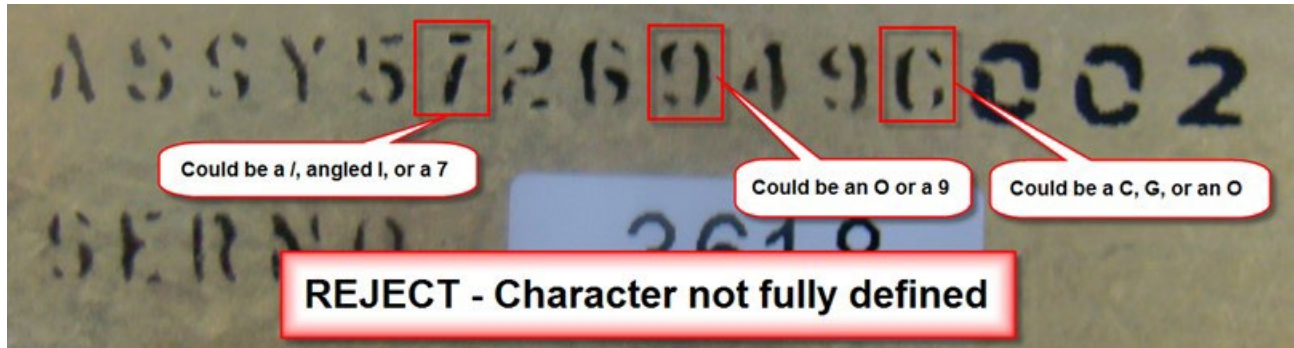
Figure 4-31 - Acceptable Legibility Examples (2 of 2)

<u>REJECTABLE</u>	
1234000	NUMBERS FILLED IN
1234000	TOO LIGHT
1234000	HALF THE NUMBER MISSING
1234000	BLUR AND SMEAR
1234000	POOR CONTRAST
1234000	WRINKLED OR SCRATCHED MARKING SURFACE
1234000	FOREIGN MATERIAL ON MARKING SURFACE
1234000	POOR REGISTRATION UPON REMARKING

Figure 4-32 – Rejectable Legibility Examples (1 of 4)

<u>REJECTABLE</u>	
!638	Vertical registration. Greater than 1/2 character.
!638	Tipped tool.
/638	Skewed numbers.
!6?8	Broken numbers.
1638	Ambiguous numbers.
1638	Variable indentations.
16 38	Poor spacing.

Figure 4-33 - Rejectable Legibility Examples (2 of 4)



Characters smeared and not fully defined.

Figure 4-34 - Rejectable Legibility Examples (3 of 4)

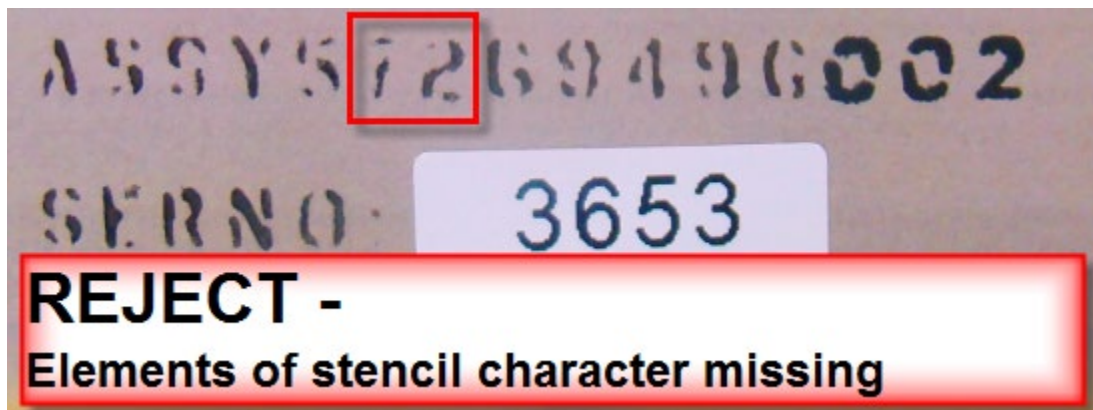


Figure 4-35 - Rejectable Legibility Examples (4 of 4)

4.8.11 Marking Color

The marking color shall provide a contrast with the background for readability if the color is not specified on the drawing.

4.8.12 Character Orientation

Characters shall read as depicted on the drawing.

4.8.13 Testing of Epoxy Marking for Adhesion and Resistance to Solvents

Unless otherwise defined by the drawing, recommendations for testing of marking on plated or painted surfaces for adhesion and resistance to solvents is as follows:

- Dip cotton tip applicator into the solvent (isopropyl alcohol – American Chemical Society reagent grade or in accordance with TT-I-735, Grade A or B; or equivalent). Place applicator directly on marking to be tested. Apply pressure and draw the applicator across the marking, making three passes. Do not scrub!
 - Acceptable: Marking is clear, and legible. Slight lightening of the color of marking is permissible
 - Rejectable: Marking exhibits blurring, fading, complete removal, or other imperfections that impair legibility

4.9 Welding

- Refer to AWS 3.0 (Standard Welding Terms and Definitions), AWS 2.4 (Standard Symbols for Welding, Brazing, and Nondestructive Examination) and AWS D17.1 (Specification for Fusion Welding for Aerospace Applications) for the acceptance criteria.
- Fusion Welding:
 - General
 - Marking
 - Fillet Welds
 - Beads
 - Dressing
 - Weld Quality
- Discontinuity Definitions:
 - Surface Porosity
 - Undercut
 - Overlap
 - Underfill
 - Incomplete Fusion
 - Crater
 - Cracks
 - Inclusions
 - Concavity
 - Weld Symbols including Size, Length/Pitch, Size
 - Length/Pitch
 - Bead Contour
 - Basic weld symbols and joint representations
- Spot Welding
 - External Imperfections
 - Visible Criteria
 - Surface Indentation
 - Acceptance Factor
 - Sum of Imperfections