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| NEXT ASSY | USED ON | SYM | DESCRIPTION | CN | DATE | APVD |
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| | | V | REFORMATTED W/CHANGE. | 83465, 83542 | 09/10/97 | S. MYERS |
| | | W | EXTENSIVELY REVISED. | 85126 | 06/03/99 | S. MYERS |
| | | Y | REVISED SHEETS 2 & 11 AS MARKED. | 86548 | 09/13/00 | S. MYERS |
| | | AA | REVISED SHEETS 2, 3, 5, AND 9 AS MARKED. | 87054 | 04/10/01 | A. PETERSON |
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| | | AC | REVISED SHEET 6 AS MARKED. | 95028 | 02/08/11 | S. MYERS |
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| APPROVAL | | |



| SIZE | CAGE CODE | |
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| **A** | **99251** | **ST1637803** |
| REVISION LEVEL **AE** | | SHEET **1 OF 11** |

## 1. PURPOSE AND SCOPE

The purpose of this Manufacturing Quality Standard is to define the minimum requirements and acceptable quality for parts and assemblies manufactured by or for CLSS when the engineering drawing or applicable documents do not otherwise indicate specific requirements. In case of uncertain or conflicting requirements, the Engineering Department of CLSS shall be consulted for interpretation or drawing revision before proceeding with any manufacture. In cases where this standard is more restrictive than the applicable government or military specifications, the requirements of this document shall prevail. CLSS, as used herein, refers to refers to Carleton Life Support Systems Inc. doing business as Cobham Mission Systems.

## 2. APPLICABLE DOCUMENTS

The following documents form a part of this standard to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bid or request for proposals shall apply. When a specific document issue is indicated below, references to the document in subsequent sections of this standard shall consist of the basic document number without repetition of the pertinent issue designations.

### 2.1 Government documents.

SPECIFICATIONS

Military

| | |
|---|---|
| MIL-A-8625 | Anodic Coatings for Aluminum and Aluminum Alloys |
| MIL-C-5541 | Chemical Conversion Coatings for Aluminum and Aluminum Alloys |
| MIL-P-25995 | Pipe, Aluminum Alloy, Drawn or Extruded |
| MIL-S-7742 | Screw Threads, Standard, Optimum Selected Series, General Specification for |
| MIL-S-8879 | Screw, Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for |
| QQ-A-200/16 | Aluminum Alloy, Structural Shapes, Extruded, 6061 |
| QQ-A-200/8 | Aluminum Alloy 6061, Bar, Rod, Shapes, Tube and Extruded |
| QQ-A-225/8 | Aluminum Alloy 6061, Bar, Rod, Wire and Special Shapes, Drawn or Cold Finished |
| QQ-A-250/11 | Aluminum Alloy 6061, Plate and Sheet |
| WW-T-25995 | Pipe, Aluminum Alloy, Drawn or Extruded |

2.2 Non-Government documents.

STANDARDS

American Society for Testing of Materials

| | |
|---|---|
| ASTM A967 | Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts |

American Society of Mechanical Engineers Engineering Drawings and Related Documentation Practices

| | |
|---|---|
| ASME Y14.5 | Dimensions and Tolerancing for Engineering Drawings |
| ASME B46.1 | Surface Texture |

American National Standards Institute Engineering Drawings and Related Documentation Practices

| | |
|---|---|
| ANSI Y14.5 | Dimensioning and Tolerancing for Engineering Drawings |
| ANSI B46.1 | Surface Texture |
| ANSI (IPC) J-STD-001 | Requirements for Soldered Electrical and Electronic Assemblies |
| AWS A2.4 | Symbols for Welding and Nondestructive Testing |

Society of Automotive Engineers

| | |
|---|---|
| AS478 | Identification Marking Methods |
| AMS 2700 | Passivation of Corrosion Resistant Steels |

OTHER PUBLICATIONS

CLSS

| | |
|---|---|
| PD1634800 | Sewing Quality Guide for Restraints, Procedure for |
| PD1635250 | Materials List |

(Copies of specifications, standards, drawings, and publications required by suppliers should be obtained by the supplier, except CLSS-controlled documents, which will be furnished by CLSS. If a supplier is unable to obtain any document listed herein, he should immediately contact CLSS for assistance.)

3. DEFINITIONS

3.1 Finished surfaces. A finished surface is a surface produced by bringing a tool in contact with a workpiece and then moving or removing material on the workpiece by motion either of the workpiece or the tool or both. All surfaces shown on drawings will be considered as finished surfaces unless evidence to the contrary is contained on the drawing; e.g., by specification or reference to a process or by symbology which differentiates finished and unfinished surfaces.

When the drawing does not require a specific process, any method of manufacture may be used that will produce a product that meets the requirements of the drawing and this document.

3.2 Arithmetic average (Ra). The definition of arithmetic average (Ra) in paragraph 1.4.1.1 of ASME B46.1M, or paragraph 3.8.1 of ANSI B46.1 shall apply, as applicable.

3.3 Drawing format tolerance standards. These are the tolerance standards, which are listed on drawings as a part of the preprinted format.

3.4 General dimensioning. All definitions listed in ASME Y14.5M or ANSI Y14.5, as applicable, issue noted on the face of the drawing, apply to this document.

4. GENERAL REQUIREMENTS

4.1 Temperature. All dimensions and tolerance stated herein apply at 68 $\pm$8 °F. Measurements can be made at other temperatures if proper compensation is made for differences in temperature of the part and measuring tools.

4.2 Reference dimensions. Drawing dimensions and notes identified as "reference" (REF) are intended as information for processing and manufacturing and do not require verification for acceptance of the part or assembly.

4.3 Releases and Restraints (R&R) product line requirements.

In addition to the requirements herein, products in the R&R product line shall be subject to the requirements of PD1634800. These products include machine-sewn harnesses and parachute releases. In the event of a discrepancy between this document and PD1634800, the requirements of PD1634800 shall take precedence.

5. DETAILED REQUIREMENTS

5.1 Surface roughness quality.

5.1.1 Surface roughness is related to size tolerances according to the following table:

| Size Tolerance | Maximum Surface Roughness in Microinches Ra |
|---|---|
| To and including 0.001 inch | 32 |
| Greater than 0.001 inch, but not greater than 0.002 inch | 63 |
| Greater than 0.002 inch on any machined surface | 125 |

For size tolerances over 0.002 inch on surfaces not produced by machining, the roughness produced by the process is satisfactory.

5.1.2 The surface roughness of areas of transition such as fillets, chamfers, etc., shall conform to the roughest adjacent area.

When the roughness of a surface does not exceed 1/2 of the maximum allowable roughness specified on the print, any lay direction is acceptable, regardless of any specific direction callout on the print. For example:

If $\sqrt[32]{c}$ is specified on the drawing, $\sqrt[20]{\ }$ is not acceptable.

If $\sqrt[32]{c}$ is specified on the drawing, $\sqrt[16]{\ }$, $\sqrt[16]{m}$, and $\sqrt[16]{\perp}$ are all acceptable.

5.1.3 Roughness word descriptions.

5.1.3.1 Burnish. Where the note "burnish" is shown, the surface must be produced by a burnishing process and have a surface roughness of 8 Ra (microinches) maximum.

5.1.3.2 Smooth Finish. This requires a maximum surface roughness of 16 Ra (microinches). The manufacturing process is optional.

5.1.3.3 Polish. Where the word "polish" is specified, the operation or process is optional, but the surface produced must have a surface roughness of 6 Ra (microinches) or better and must be reflective when viewed with the unaided eye.

5.1.3.4 Tumble to polish. This note requires the roughness to be produced by the tumbling process. A surface roughness of 4 Ra (microinches) or better is required.

5.2 Surface coating.

5.2.1 Effect on dimensions and finish. All dimensional limits and surface roughness specifications apply after surfaces are coated by plating, painting, chemical films, etc., with the following exceptions:

a. When electro film or Molykote is used, all dimensions and surface roughness apply before the film or Molykote is applied.

b. For rotating electrical parts such as stators and rotors, dimensions and surface roughness apply before the application of any nonmetallic coatings.

c. Internal and external threads shall not be painted unless specifically required by the drawing.

d. When paint and/or primer are used and the drawing specifies "dimensions apply before application of the coatings", comply with drawing.

5.2.2 Anodic coating. The following restrictions apply to all aluminum parts which are anodized per MIL-A-8625 and supersede any conflicting allowances in that document:

NOTE

Section 7 of this document outlines acceptable touchup procedures for anodized parts.

a. The preferred location for racking is in holes with a tolerance greater than 0.002 inch and no surface finish requirement.

b. Racking is not permissible on any internal or external surface that has a surface finish callout or a tolerance of 0.002 inch or less.

c. Racking is not permissible on any exterior surface of parts that are dyed.

d. Small contact marks from the racks are permissible on the allowable racking surfaces. Scratches created by dragging the part off the rack without removing the contact pressure are not permissible on any surface.

5.2.3 Passivation substitution. The following materials are allowed to be passivated per ASTM A967, Citric 1, 2, or 3, or AMS 2700, Method 2 (Citric), in place of any Nitric passivation called out:

a. Stainless Steel 303 in any form
b. Stainless Steel 17-4PH in any form
c. Stainless Steel A286 in any form
d. Stainless Steel 301 in any form
e. Stainless Steel 304 in any form
f. Stainless Steel 316 in any form
g. Stainless Steel 321 in any form

5.3 Parallelism. When a parallelism condition exists between two surfaces less than 12 inches in length, a tolerance of 0.006 inch per linear inch of length will be allowed, not to exceed a total of 0.030 inches or the tolerance of the locating dimension, whichever is less. Surfaces greater than 12 inches in length are required to be produced within the prescribed dimensional boundaries.

5.4 Perpendicularity. When a perpendicular condition exists between two surfaces less than 12 inches in length, a tolerance of 0.006 inch per linear inch will be allowed, not to exceed a total of 0.030 inch or the tolerance of the locating dimension, whichever is less. Surfaces greater than 12 inches in length are required to be produced within the prescribed dimensional boundaries.

5.5 Flatness. All machined flat surfaces less than 12 inches in length (or diameter) must be flat within 0.006 inch per linear inch, not to exceed 0.030 inch total, or the tolerance of the locating dimension, whichever is less. This applies with the part unrestrained. Surfaces greater than 12 inches in length (or diameter) are required to be produced within the prescribed dimensional boundaries.

5.6 True position. All machined circular features shown about a common axis, and not subject to feature position control by the drawing, shall be produced with a mutual true position of not more than 0.010 inch, regardless of feature size (RFS).

5.7 Die break. When die break is permitted by the applicable drawing, a maximum of 80% of the thickness (T) of the die finished (i.e. sheared or punched) surfaces may exceed the tolerance of the locating or size dimension up to a maximum of 10% of the thickness. (See figure 1.)

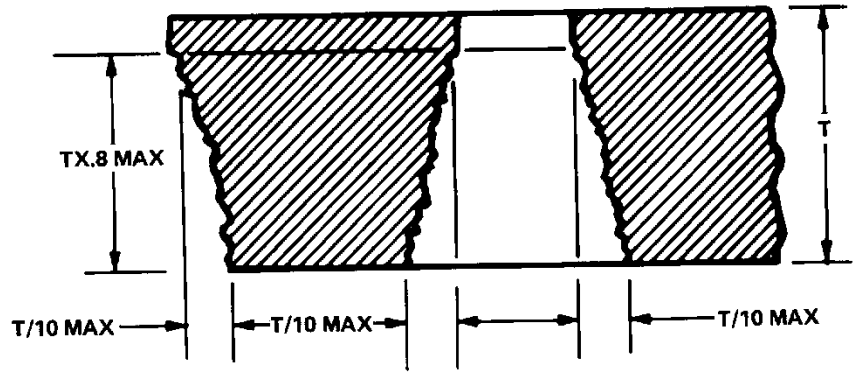



Figure 1

5.8 Corner breaks, chamfers, countersinks, and radii.

5.8.1 All chamfers and countersinks of less than 0.040 inch width are allowed a tolerance on the angle of $\pm$5 degrees.

5.8.2 Unless otherwise specified on the drawing, all outside corners must be broken with a chamfer or radius of 0.001 inch minimum to 0.010 inch maximum. On thin flanges, short hubs, shallow counterbores, or other applicable situations, the corner break cannot reduce the length or width of the remaining surface to less than 1/2 of the minimum allowable dimension.

5.8.3 Unless otherwise specified on the drawing, all inside corners shall have a radius of 0.010 inch maximum. On short hubs, shallow counterbores, or other applicable situations, the inside corner radius cannot reduce the length or width of the remaining surface to less than 3/4 of the minimum allowable dimension.

5.9 Hole locations.

5.9.1 Undimensioned centerlines. When a hole is shown on a drawing as located on the intersection of two centerlines, but is dimensioned on only one of the centerlines, the tolerance on the location of the undimensioned centerline shall be the same as the tolerance on the location of the dimensioned centerline.

5.9.2 Bolt circles. When holes are specified as being equally spaced on a bolt circle diameter, the spacing shall be within a true position diameter equal to the total (diametral) tolerance of the bolt circle.

5.10 Threads.

5.10.1 Threads may be accepted if all complete threads can enter in or be entered by the "not go" gauge, provided that a definite drag results from metal to metal contact on or before the third turn of entry.

5.10.2 Where material thickness or length will not allow more than four full threads, the "not go" gauge shall not enter the threads more than 1/3 the total thread length.

5.10.3 Gauging of unified (UNF and UNC) class 3 threads shall be accomplished in accordance with Method A shown in Table III of MIL-S-7742.

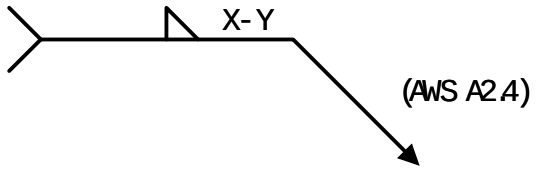
5.10.4 Gauging of unified (UNJ) threads shall be accomplished in accordance with Method A shown in Table IX of MIL-S-8879.

5.11 Tapped hole chamfers. When a tapped hole must be chamfered and no size is specified, the maximum diameter chamfer shown in the table below shall apply:

| Thread size | Maximum Chamfer Diameter (inches) | Thread size | Maximum Chamfer Diameter (inches) |
|---|---|---|---|
| 00 | 0.067 | 8 | 0.184 |
| 0 | 0.080 | 10 | 0.210 |
| 1 | 0.093 | 12 | 0.236 |
| 2 | 0.106 | 1/4 | 0.270 |
| 3 | 0.119 | 5/16 | 0.333 |
| 4 | 0.132 | 3/8 | 0.395 |
| 5 | 0.145 | over 3/8 | 0.030 larger |
| 6 | 0.158 | | than O.D. of thread |

5.12 Intermittent welds.

5.12.1 Definitions. An intermittent weld is a weld wherein the continuity of the weld is broken by recurring unwelded spaces. This type weld is designated on the weld symbol as illustrated here.




"X" is the length of the weld, and "Y" is the centerline dimension of the intermittent welds. (Weld symbols other than fillet welds are allowed.)

5.12.2 Acceptance criteria.

a. Intermittent welds which have more than required by the drawing ("Y" centerline dimension less than specified) will be accepted as exceeding the requirements of the drawing with regard to the "Y" dimension.

b. Intermittent welds which have fewer welds than required by the drawing ("Y" centerline dimension greater than specified) are not acceptable.

c. Weld lengths which are shorter than required by the drawing ("X" dimension less than specified) are acceptable if the total length of weld is greater than or equal to the total weld length specified on the drawing (i.e. only if the number of welds is proportionally increased via a smaller "Y" dimension).

d. Weld lengths which are longer than those required by the drawing ("X" dimension greater than specified) will be acceptable as exceeding the drawing requirements with regard to the "X" dimension.

In general, if there are at least as many welds as specified, and if the total weld length is as long or longer than specified on the drawing, the welds will be accepted with regard to the "X" and "Y" dimensions (since the weld strength is greater than drawing requirements).

5.13 Default torque requirements. All threaded fasteners used on production hardware are to be assembled to the specified torque values. The following values shall be used when the drawing does not specify torque requirements for a fastener. These values are applicable for all steel fasteners, regardless of whether a locking compound is being used:

Torque Values

| Fastener Size | Required Torque | Tolerance |
|---|---|---|
| 4-40 | 5.5 in-lb | ±0.5 |
| 4-48 | 6.9 in-lb | ±0.5 |
| 5-40 | 8.1 in-lb | ±0.5 |
| 5-44 | 9.8 in-lb | ±0.5 |
| 6-32 | 10.1 in-lb | ±0.5 |

Torque Values — CONTD

| Fastener Size | Required Torque | Tolerance |
|---|---|---|
| 6-40 | 12.7 in-lb | ±0.5 |
| 8-32 | 20.7 in-lb | ±1.0 |
| 8-36 | 23.0 in-lb | ±1.0 |
| 10-24 | 23.8 in-lb | ±1.0 |
| 10-32 | 33.1 in-lb | ±1.0 |
| 1/4-20 | 78.8 in-lb | ±3.0 |
| 1/4-28 | 99.0 in-lb | ±3.0 |

5.14 Part mark. When AS478-[ ] is called out on the drawing for marking parts, method AS478-2F may be substituted provided the following conditions are met:

a. Markings are clearly visible after plating or finishing
b. Markings will not change the form, fit, or function of the part

5.15 Stitches per inch. When measuring a sewn part for stitches per inch, the preferred method of measurement should be taken for a length of several inches and/or in multiple places, if possible, and the average stitches per inch used for the value. Use the longest measurements that are easily possible. If such an averaging method cannot be used, a single measurement can be used.

5.16 Sew pattern size. When measuring a sewn pattern on a sewn part, the measurements should be taken in multiple locations on the sew pattern and the average value used.

5.17 Sewing glue/adhesive. Hot melt adhesive and fabric glue are acceptable to be used to hold webbing/fabric together during sewing operations. Excess glue that is visible after sewing should be removed to the maximum extent possible without damaging the webbing/fabric. Suggested hot melt is AD-TECH Formula 2030. Suggested fabric glue is DRITZ/PRYM Fabric Glue Stick.

6. USAGE OF ALUMINUM ALLOY 6061

6.1 The following paragraphs explain the typical usage of aluminum alloy 6061 at CLSS, and apply only to aluminum alloy 6061.

6.2 Aluminum alloy 6061 is a precipitation-hardening aluminum alloy which possesses the following characteristics:

a. Medium strength (~38 Ksi UTS in temper T6)
b. Fair elongation (~8 to 10% temper in T6)
c. Fair machinability
d. Good weldability
e. Good dimensional stability
f. Excellent corrosion and stress corrosion resistance
g. Relatively low cost

6.3 Due to its many desirable properties, this alloy is used extensively in many CLSS products. It is used extensively in breathing regulators where strength is not an issue. Generally, it is not and should not be used for high-stress or fatigue-critical applications unless weight is of little concern, or unless the operating environment is very corrosive. Better choices of aluminum in high-stress applications are the high-strength alloys 7075-T73, 2024-T8, or another 2000 or 7000 series alloy in a similar temper.

6.4 Since 6061 is so rarely used in high-stress applications and because it has excellent intergranular and general corrosion resistance, the form of the product used for most applications in not particularly important. However, CLSS Materials List PD1635250 designates alloy 6061 only in terms of its form. The most commonly used are rolled bar per QQ-A-225/8 or extruded bar per QQ-A-200/8. Some sheet and plate stock to various specifications are also used (see table I).

6.5 For the typical usage of 6061 at CLSS, extruded bar and rolled bar of the same temper series (T6, T61, T651, T6510, T6511, etc.) may be used interchangeably with no adverse effect on the design. Likewise, rolled plate of the same temper series (T6---) are also perfectly acceptable for most applications calling for rolled or extruded bar stock. Table I shows functionally interchangeable forms of 6061.

Table I

| Specification | Form | Temper Design | Min. UTS |
|---|---|---|---|
| QQ-A-225/8 | Bar, rolled, drawn, or cold finished | T6, T62, T651 | 42 Ksi |
| QQ-A-200/8 | Bar or tube extruded | T6, T6510, T6511, T62 | 38 Ksi |
| QQ-A-200/16 | Extrusion, general shapes | T6, T6510, T6511, T62 | 38 Ksi |
| QQ-A-250/11 | Sheet and plate | T6, T651, T62 | 42 Ksi |
| WW-T-700/6 | Drawn tube, seamless | T6, T62 | 42 Ksi |
| MIL-P-25995 Alloy 6061 | Pipe | T6 | 38 Ksi |

6.6 Every effort should be made to comply with the material requirements of each drawing. When interchangeability options are utilized, PPR or MRB activity shall not be required to make form substitutions for this alloy of the same temper series in any of the forms listed above. If there is any doubt or there are any questions concerning the appropriate selection of aluminum alloy for a particular application, the CLSS Engineering Department shall be consulted for an evaluation.

7. SURFACE TOUCH-UP PROCEDURES

7.1 The following paragraphs pertain to the surface rework required to ensure corrosion protection and piece-part aesthetics.

7.2 Surface preparation. All surfaces requiring touch-up shall be wiped with isopropyl alcohol and/or methyl ethyl keotone (MEK) and wiped dry.

7.3 Anodic coatings. Anodic coatings cannot be reworked, except by replating, on any surface which is exposed to oxygen at a pressure of 100 psi or greater.

7.3.1 Clear anodize (MIL-A-8625, Type I or Type II, Class 1 Water Seal) Using an applicator, apply iridite (conversion coat per MIL-C-5541) to aluminum surfaces. Remove excess iridite and wipe surfaces clean with distilled water. Anodic coatings cannot be reworked, except by replating, on any surface which is exposed to oxygen at a pressure of 100 psi or greater.

7.3.2 Black anodize (MIL-A-8625, Type I or Type II, Class 2, Dyed Black). Using an applicator, apply chemical blackening process, such as Aluma Black A-14 from Birchwood Casey, to aluminum surfaces and allow to dry for at least 10 minutes. Wipe surfaces clean with distilled water. Anodic coatings cannot be reworked, except by replating, on any surface which is exposed to oxygen at a pressure of 100 psi or greater.

Alternate method: For black anodized surfaces requiring touch-up to an area smaller than 0.30 inches wide, iridite may be applied and allowed to dry. Permanent black marking ink may then be applied and allowed to dry.

7.3.3 Obliterate part mark. When the drawing says to "obliterate part mark" on a vendor part, the preferred method of obliteration is to stamp the letter "X" over the existing characters, making them unreadable.

7.3.3.1 Meaningless numbers. Meaningless numbers do not have to be removed. If there is an MS, AN, or AS with no number after it, the MS, AN, or AS does not have to be removed. Care must be taken to not damage the face of the fitting or “X” too close to the edge that may cause burrs.

7.3.3.2 Plastic or electronic components. For plastic parts or electronic components that could be damaged by the “X”-ing method above, a vibrating engraver may be used to only scratch out enough to make the markings unreadable.

7.3.3.3 Vendor markings. When the print says “obliterate the vendor markings,” part marks and any other markings that identify the vendor must be removed. Meaningless numbers do not have to be removed.

7.3.3.4 Bare metal. Bare metal created by the operations mentioned above shall be touched up per paragraph 7.3.1, regardless of the color of the anodize.

7.4 Painted surfaces.

7.4.1 Black paint. Using a brush, apply a matching black paint, such as Dulac Optical Black L-300, to surfaces, and allow to dry for at least 5 minutes.

7.4.2 White paint. Using a brush or toothpick as required, apply a white ink or paint, such as Marco Ink #S-1141, and allow to dry for at least 5 minutes.

7.4.3 Colored paint. Apply same primer, color, etc., as required in accordance with blueprint. (For spray painting, use one part paint to one part lacquer thinner.)

7.5 Miscellaneous black surfaces. For nonaluminum black surfaces requiring touch-up that have an area smaller than 0.03 inches wide, permanent black marking ink may be applied and allowed to dry.

## 8. ELECTRICAL AND ELECTRONIC ASSEMBLIES

8.1 Soldering. Unless otherwise specified on the drawing, soldered electrical and electronic assemblies shall meet the requirements of ANSI J-STD-001, Class 3 (High Performance Electronic Products).

## 9. REPORTS

Formal reports shall be in accordance with contractual requirements.

## 10. NOTES

Changes to this document shall be made using the applicable procedures described in ST1637815. Changes shall be reviewed and approved in accordance with Section 9.0 of ST1637815.