

INCH POUND
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MILITARY SPECIFICATION

SLINGS> AIRCRAFT, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope This specification covers the general requirements for aircraft slings used to lift and transport aircraft or aircraft components which may be bulky or fragile.

1.2 Classification .The aircraft slings shall be classified in Table I as follows;

TABLE I. Classification of aircraft slings

Class	Type	Purpose
1	Aircraft Handling	Hoisting
2	Aircraft Maintenance	Hoisting and Installation of Major Components
3	Engine Handling	Hoisting and Installation
4	Engine Maintenance	Hoisting and Component Replacement

2. APPLICABLE DOCUMENTS

2.1 Government documents

* 2.1.1 Specifications standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the Issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Air Engineering Center, Systems Engineering and Standardization Department. (Code 53), Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 1730

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MIL-STD-883C

SPECIFICATIONS

FEDERAL

- V-T-295 - Thread, Nylon
- RR-C-271 - Chains and Attachments, Welded and weldless
- RR-W-410 - wire Rope and Strand
- CCC-C-419 - Cloth Duck, Cotton, Unbleached, Plied-Yarns, Army and Numbered
- PPP-B-636 - Box, Shipping, Fiberboard

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- MIL-P-116 - preservation, Methods of
- MIL-W-4088 - Webbing, Textile, Woven Nylon
- MIL-W-5665 - Webbing, Textile, Cotton Warp
- MIL-H-6875 - Heat Treatment of Steels, Process for
- MIL-T-8879 - Screw Threads, Controlled Radius Root with increased minor Diameter, General Specification for
- MIL-C-18375 - Wire Rope, Flexible, Corrosion-resisting Nonmagnetic for Aircraft Control
- MIL-W-27265 - Webbing, Textile, Woven Nylon Impregnated
- MIL-M-46032 - Fungus Resistant Treatment for Sandbags; Copper Processes
- MIL-W-83420 - Wire Rope, Flexible For Aircraft Control

STANDARDS

FEDERAL

- FED-STD-H28 - Screw-Thread Standards for Federal Services
- FED-STD-595 - Color
- FED-STD-751 - Stitches, Seams and Stitchings

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- DOD-STD-100 - Engineering Drawing Practices
- MIL-STD-109 - Quality Assurance Terms and Definitions
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-130 - Identification Marking of U.S. Military Property
- MIL-STD-209 - Slings and Tie Down Provisions for Lifting and Tying Down Military Equipment
- MIL-STD-808 - Finish, Protective and Codes for Finishing Schemes for Ground and Ground Support Equipment
- MIL-STD-810 - Environmental Test Methods and Engineering Guidelines
- MIL-STD-831 - Test Reports, Preparation of
- MIL-STD-970 - Standards and Specifications, Order of Preference for, the selection of
- MIL-STD-1189 - Standard Department of Defense Bar Code Symbolology
- MIL-STD-1190 - Minimum Guidelines for Level C Preservation, Packing, and Marking
- MIL-STD-1367 - Packaging, Handling, Storage and Transportability Program Requirements for Systems and Equipments
- MIL-STD-2073-2 - Packaging Requirements Codes
- DOD-STD-2101 - Classification of Characteristics
- MIL-STD-2175 - Castings, Classification and Inspection of
- MIL-STD-2219 - Fusion welding for aerospace applications

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MILITARY HANDBOOKS

MI MIL-HDBK-300 - Technical Information File of Support Equipment

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 40, 700 Robbins Avenue, Philadelphia, PA 19111-5094

* 2.1.2 Other government drawings. The following other Government drawings form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

Air Force Drawings

7545352 - Requirements for Finishes, Protective, and Codes for San Antonio ALC Ground and Ground Support Equipment

Naval Air Systems Command Drawings

4SE00726 - Test/Inspection Certification Tag

(Copies of drawings required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

* 2.2 Non-government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 8 - Tension testing of metallic material

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa 19103-1137)

(Non government standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

1 2.3 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

1 3.1 First article. When specified (see 6.4), a sample shall be subjected to first article inspection in accordance with 4.4.

1 3.2 Standardization of SLings. Before a new sling is designed it shall be mandatory that MIL-HDBK-300 be reviewed to verify that an existing sling cannot be used.

MIL-STD-970

3.3 Selection of specification and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-970.

3.4 Protective treatment for sling materials. Materials used in the construction of the slings shall be protected against deterioration when exposed to climatic and environmental conditions likely to occur during service. This protection against deterioration shall be accomplished in a manner which will not prevent compliance with the performance requirements of this specification. Protective coatings that will crack, chip, or scale with age or extremes of climatic and environmental conditions shall not be used. All fabric and webbing used in the slings shall be treated in accordance with MIL-M-46032. Finishes and protective coatings on all metal surfaces of the slings shall be in accordance with MIL-STD-808 and for USAF slings Drawing 7545352.

3.5 Standard steels. Steels complying with ASTM, AMS, Military, Federal or AISI standards shall be utilized in the design and fabrication of the slings and shall be corrosion resistant or treated to resist corrosion due to fuels, salt spray, or atmospheric conditions likely to be encountered during storage or normal service.

3.5.1 Heat treatment. Heat treatment of steel materials shall be in accordance with MIL-H-6875.

3.5.2 Welding Welding shall be accomplished and inspected in accordance with MIL-STD-2219 and shall only be accomplished by operators who are presently qualified.

3.5.3 Castings. When used, castings shall be designed and classified in accordance with the requirements of MIL-STD-2175.

3.5.4 Screw threads. Screw threads and threaded fasteners shall meet applicable requirements of FED-STD-H28 except those threads that are designed for a critical application. These threads and "safety" critical threads shall be in accordance with MIL-T-8879.

3.5.5 Standard parts: Standard parts (MS, AN, or NAS) shall be used wherever they are suitable for the purpose, and shall be identified on the drawing by their part numbers. Commercial utility parts such as screws, bolts, nuts, cotter pins, et cetera, may be used provided they possess suitable properties and are replaceable by the standard parts (MS, AN, or NAS) without alteration, and provided the corresponding standard-part numbers are referenced in the parts list as acceptable alternates and, if practicable, on the contractor's drawings. In the event there is no suitable corresponding standard part in effect on date of invitation for bids, commercial parts may be used provided they conform to all requirements of this specification.

3.6 Fabric webbing. All fabric type materials used in the slings structure shall conform to CCC-C-419. All webbing straps used shall conform to MIL-W-5665 or MIL-W-4088. The fabric or webbing shall be constructed to prevent undue fraying of the edges and at attachment points. All ends or termination of nylon thread or webbing shall be secured by heat-searing.

3.6.1 Fabric threads. The threads used in the termination or assembly of the webbing shall be nylon thread in accordance with V-T-295 which is the preferred material. The thread size and class shall be determined by the design requirements.

3.7 Part numbering of interchangeable parts. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The item identification and part number requirements of DOD-STD-100 Shall govern the manufacturer's part numbers and changes thereto.

3.8 Design and construction. The slings shall be designed to support the specified aircraft or component part being hoisted and shall not interfere with or contact the part being hoisted at areas other than points of attachment. Unless otherwise specified, the design shall include a provision of adjustment for varying center of gravity locations of the hoisted items for improved stability during hoisting and limited transportation. The dimensions of slings shall be kept to a minimum consistent with design requirements. For aircraft hoisting slings, the maximum vertical height of the sling hoist attachment shall not exceed 24 feet or as otherwise specified when the aircraft is hoisted just clear of the ground with gears down.

3.8.1 Rated load. The rated load shall be the maximum load for which the slings are designed to handle. The term rated load or capacity is the same as the Safe Working Load (SWL). Those terms or loads shall not include the factor of safety and are the loads or forces applied under actual working conditions. The rated load is the maximum permissible applied load.

3.8.2 Design requirements. The design of the slings shall eliminate all unnecessary weight and shall reflect a constant effort toward weight-strength optimization. The stress level, under load condition, at any point in the structure shall be limited to a level that provides a safety factor of 3 against permanent deformation. When dynamic factors induce loads that exceed 1.5 times the rated load, the stress level at any point in the structure shall be limited to a level that provides a safety factor of 2 against permanent deformation induced by dynamic loads. Bolts, rivets, pins and all other attachment devices shall be designed to include a safety factor of 5 based on ultimate strength. The design of steel cables and fabric straps shall include a safety factor of 5 based on the breaking strength of the cable or strap. The sling assembly shall be capable of withstanding a static proof load of 200 percent of the rated load. In addition, fabric straps or webbing designed for use as bellyband slings shall be of sufficient width and softness to provide an even distribution of the load to the straps to prevent the straps from damaging the thin skinned surfaces. For those slings used for transporting cargo below a helicopter the frontal area of this cargo shall be calculated in accordance with Appendix A of MIL-STD-209. The maximum shipping weight and sling length shall also be calculated in accordance with MIL-STD-209.

3.8.3 Safety. The slings shall be so constructed and assembled as to withstand all conditions of service use without loss or loosening of parts, permanent deformation or loss of serviceability. The slings shall be designed to provide for servicing and use by personnel wearing heavy gloves, mittens, bulky clothing and chemical defense ensembles. Hazards that cannot be eliminated or controlled through design selection shall be controlled to an acceptable level through use of fixed, automatic, or other protective safety design features or devices. A proof load test shall be required for each sling assembly.

3.8.4 Interface capability. The slings shall provide an Interface capability with the following items:

- a. Hoisting unit as specified in 3.12 herein.
- b. Aircraft or component part as specified in Table I.

3.9 Reliability. The slings shall have a minimum Mean-Time-Between Failures (MTBF) of not less than 120 cycles with a reliability of not less than 0.990 for a one-cycle mission at 0.9 confidence.

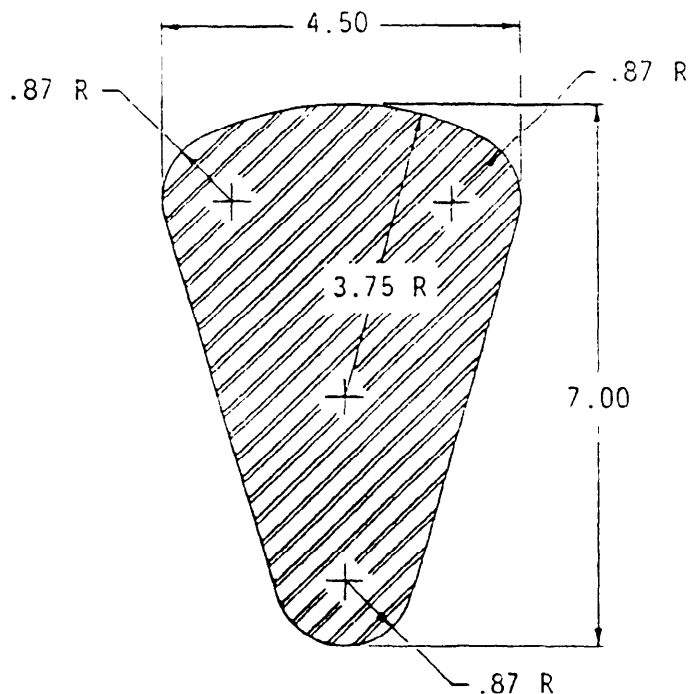
3.10 Maintainability. The slings shall be designed and constructed as specified herein to provide the following:

- a. Minimum number of parts consistent with reliability and performance specified herein.
- b. Minimum amount of training and time necessary for assembly, disassembly, location of trouble sources, and maintenance including servicing. Where practical, parts and components shall be located or positioned for rapid and simple inspection and recognition of excessive wear or potential failure.
- c. Permit adjustments, servicing, replacement of parts and components and other maintenance with minimum disturbance to other equipment parts or components. Parts and components shall be located for ample and rapid access unless performance or reliability will be appreciably degraded by the accessible location. In performing maintenance, if engineering reasoning or data determines that physical or visual interference between items cannot be avoided, the item predicted to require the most maintenance shall be located for best accessibility.
- d. Permit maintenance with general purpose tools and equipment normally available commercially. Use of special purpose tools and equipment shall be subject to approval of the procuring activity.
- e. Minimum number of tools required for maintenance by design practices such as reducing the variety of bolt head sizes to the practicable minimum.
- f. Foolproofness - Where improper Installation of an item could cause a malfunction of the item or the equipment in which It is installed, an unsymmetrical mounting means shall be provided where practical. That mounting shall allow the item to be installed only in its proper operating position. If an unsymmetrical mounting means is not practical, the item shall be so mounted that Its proper operating position can be readily and visibly determined by service maintenance personnel.

3.11 Components. The slings shall consist of the following major components:

<u>Component Name</u>	<u>Requirement Para</u>
Hoist attachment	3.12
Lifting attachment	3.13
Main body	3.14
Cable or strap clamps	3.15
Cable or strap terminals	3.16

3.12 Hoist attachment. The slings shall be provided with a hoist attachment capable of supporting the required load and compatible to interface with the hoisting unit. The hoist attachment shall be designed to be detachable for repair or replacement. When assembled into a complete sling, the hoist attachment or terminal ring of slings designed to support the complete aircraft shall have an unobstructed aperture of sufficient size to accommodate a crane hook of trapezoidal section with major dimensions and configuration as shown on Figure 1. (See 6.8) The maximum cross-sectional dimension of the ring shall not exceed 2-5/8 inches. The hoist attachment used on aircraft component slings shall have a 3-inch minimum inside clear opening for accepting the hoist. The hoist attachments shall conform to the following:



NOTES:

1. Dimensions in inches with tolerance $\pm .02$
2. Material - Steel

FIGURE 1. Trapezoidal section of crane hook

3.12.1 Ring-type attachments. Ring-type hoist attachments for all types of slings may be circular, pear, or oblong in shape and shall be forged or welded steel. The welded-type rings shall be accomplished under a closely controlled process which will consistently produce welds of such quality as to provide strength equivalent to at least 95 percent of that of the parent metal of the ring.

3.12.2 Plate-type attachments. Plate-type hoist attachments may be used on component slings only. Attachments of this type shall be properly heat-treated to withstand the work loads and tests specified in Section 4.

3.12.3 Bar-type sling. When a bar-type sling is required, the hoist attachment shall be designed to prevent the hoist from interfering with the bar. A forged-steel shackle or a ring and shackle shall be used for the hoist attachment.

3.13 Lifting attachment. The slings shall be equipped with forged-steel hooks or eyes, rings, or prefer-med, heat-treated steel plates for attaching to the aircraft or component part being hoisted. Simplicity in design shall be maintained in the attachments to facilitate installation or removal. Bolts, nuts, pins, et cetera, required for attaching the sling to the section being hoisted shall be formed into an integral part or securely attached to the lifting attachment.

3.13.1 Shackles. When shackles are used for the lifting attachment, they shall be of forged steel with removable, screw-type pins. The pins shall be chained to the shackles.

3.14 Main body. The main body of slings shall consist of frame and built-up sections, cables and fabric straps or webbing. The main body shall be so designed as to permit the optimum distribution of load to each lifting attachment.

3.14.1 Cables. Unless otherwise specified, cable used in the construction of slings shall be in accordance with MIL-W-83430, RR-W-410 or MIL-C-18375. The Chain shall be of the welded type in accordance with RR-C-271.

* 3.14.2 Fabric straps and webbing. Unless otherwise specified, fabric straps or webbing used in the construction of slings shall be in accordance with MIL-W-4088, MIL-W-5665, MIL-N-27265 or CCC-C-419.

* 3.14.3 Stitching. The webbing shall be assembled using threads with stitching as recommended as shown in Table No. II.

TABLE II. Stitches and seams

Stitch Number Per MIL-STD-751	Type of Stitch	Recommended Seams
301	Straight	Across the width of the webbing
304	ZigZag	
302	Straight	Across the width of wide webbing and 2 or more threads may be used
308	Zig Zag	

* 3.14.4 Seams. Complete and uninterrupted seams shall be used to secure webbing. For narrow webbing (less than 3 inches width) a box design may be used while large webbing (3 inches or greater in width) will require a "W" type of seam. In each of these seams an extra seam shall be placed before and after the complete box or "H" type seam.

* 3.14.5 Webbing and metallic assemblies. Since metallic components (shackles, attaching hooks) present a hard surface to the webbing it is recommended that a sleeve may be used for protection and Increase life. In addition, the stated minimum bend radius of the webbing shall not be exceeded and the thickness of the assembly shall be Increased with spacers. A typical assembly is shown in figure 2.

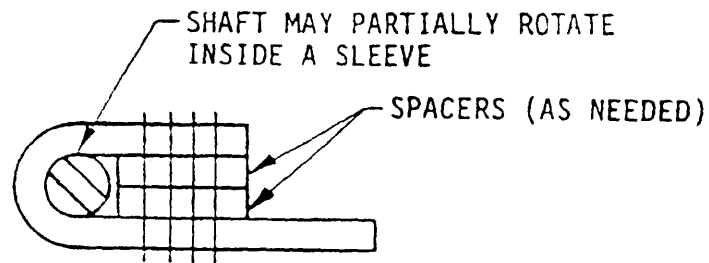
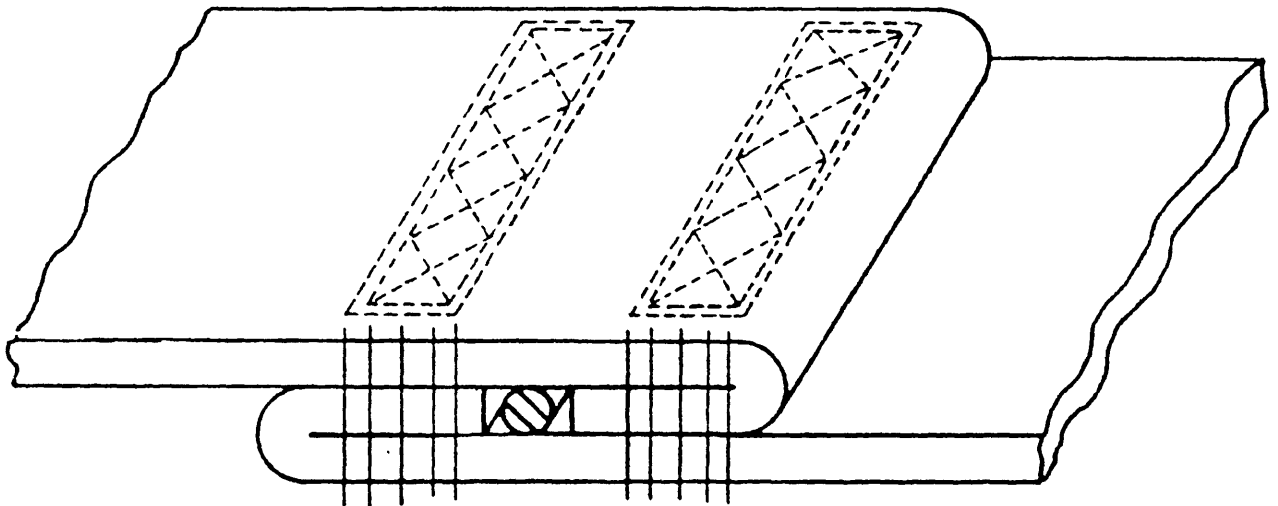


FIGURE 2. Assembly of webbing to a metallic component

* 3.14.6 Webbing assembly. The webbing assembly shown in Figure 3 is designed to permit the force to the steel bar to be in either direction along the centerline of the webbing. The fold of the webbing will act as a buffer and under normal conditions this buffer will be in compression.



NOTES :

1. Force may be In either direction along the centerline of the webbing.
2. Only straight stitch shown.
3. The recommended double "W" configuration is shown.

FIGURE 3. Webbing assembly

3.15 Cable or strap clamps. Cables or strap clamps may be used for attaching the cable or strap to the hoisting attachment or the lifting attachment. A uniform pressure shall be maintained on the cable or strap throughout the length of the clamp. The loop shall be provided with an extra heavy cable thimble. The loop formed by the clamp shall have at least the same failure strength as the cable or strap.

3.16 Cable or strap terminals. The failure strength of swaged-type terminals using cable or strap assemblies shall be not less than the minimum allowable breaking strength for the type and size cable or strap to which the terminal is attached.

3.17 Color

3.17.1 Component colors. All parts or components of the slings, except the hoist attachment, wire cables, fabric or webbing, and the lifting attachments, shall be semigloss green color number 24052 in accordance with FED-STD-595.

3.17.2 Color of webbing. The color of the webbing shall be as manufactured unless a special application is mandated which would require a specific color.

3.17.3 Color of warnings or instructions. All warnings, cautions, or restrictions for safe operation shall be red, color number 38905, in accordance with FED-STD-595. All other markings shall be black, color number 37038, in accordance with FED-STD-595.

¹ 3.18 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130. Each sling shall also be tagged with the established proof load test data. (see proof load test tag, 4.10.1.1).

2.19 Packaging, handling, storage and transportability. Packaging, handling, storage, and transportability shall be developed in accordance with MIL-STD-1367. Level AA packaging data shall be developed and coded in accordance with MIL-STD-2073-2.

3.20 Workmanship. The slings, including all parts and accessories, shall be fabricated and finished in a thoroughly workmanlike manner. Particular attention shall be given to freedom from blemishes, defects, burrs, and sharp edges; accuracy of dimensions, radii of fillets, and marking of parts and assemblies; thoroughness of welding, brazing, painting, and riveting; alignment of parts and tightness of assembly screws, and bolts; et cetera.

3.20.1 Dimensions and tolerances. Dimensions and tolerances not specified shall be as close as is consistent with the best shop practices. Where dimensions and tolerances may affect the interchangeability, operation, or performance of the slings, they shall be held or limited accordingly.

* 3.20.2 Stitching Webbing Assemblies. The required webbing or fabric shall be assembled with the required stitch patterns, stitches per inch and size and type of threads. There shall be no loose top threads nor shall there be any excessively tight stitching resulting in the puckering of the materials sewn. Thread end shall be trimmed and the lock embedded in the materials sewn. When necessary over-stitching or backstitching shall be used to assure seam strength.

3.20.3 Inspection. In all respects, the workmanship shall be acceptable to the responsible assigned Inspector (for the Navy, the NAVPRO).

4. QUALITY ASSURANCE PROVISIONS

* 4.1 Responsibility for Inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all Inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the Inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

* 4.1.1 Responsibility for compliance. All items must meet all requirements of Sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling Inspection as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Test results. Reports on all tests shall be prepared in accordance with Standard MIL-STD-831 and submitted as required by the procuring agency. An opportunity shall be given to procuring agency representatives to witness all tests.

* 4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

4.3 Inspection or test conditions. Unless otherwise specified, inspections or tests shall be performed at prevailing ambient conditions. Basically, the test installation and methods shall simulate service conditions insofar as possible and shall be approved by the procuring agency prior to initiation of testing.

* 4.4 First article inspection. The first article inspection shall consist of all of the tests specified herein as well as the sequence of tests of Table III.

* 4.5 Quality conformance inspection. After the sample sling(s) have completed and passed all of the first article Inspections there shall be a reduced amount of testing (as shown in Table 111) required for those slings produced by the same manufacturer using the same production facilities and processes. Quality conformance testing will be accomplished in accordance with Table III.

4.5.1 Failure during test. Characteristics exhibited by the slings during any of the tests specified herein that would cause the slings to fail any of the requirements while in service shall constitute a failure and shall be the basis for rejection. The classification of the characteristics defined herein are in accordance with DOD-STD-2101.

4.5.2 In-process inspection. Inspection shall be made at the appropriate stages of fabrication to determine conformance to the requirements of this specification. The Government reserves the right to exclude from consideration for acceptance any materials for which In-process Inspection has indicated nonconformance.

TABLE III. Application of tests

TEST TITLE	REQUIREMENTS PARA.	TEST PARA	FIRST ARTICLE 4.4	QUALITY CONFORMANCE PARA 4.5
Group A Nondestructive Inspections				
Individual Tests	-	4.5.3	X	X
Visual Examination	3.2	4.6	X	X
Hardness	3.5.1	4.6.1	X	X
Forging Integrity	3.5.1	4.6.2	X	
Safety Critical	3.5.4	4.6.3	X	
Screw Threads				X
Critical Welds	3.5.2	4.6.4	X	X
Webbing & Seams	3.6	4.5.3	X	X
Group B Complex Nondestructive Tests				
Serviceability	3.9	4.7	X	X
Maintainability	3.10	4.7	X	
Environmental Tests		4.9		
Vibration	3.4	4.9.1	X	
High Temperature	3.4	4.9.2	X	
Low Temperature	3.4	4.9.3	X	
Proofload test	3.8.2	4.10.1	X	X
Group C Generally Destructive Tests				
Salt-Spray	3.4	4.9.4	X	
Sand and Dust	3.4	4.9.5	X	
Immersion	3.4	4.9.6	X	
Shock	3.4	4.9.7	X	
Reliability	3.9	4.11	X	
Maintainability	3.10	4.12	X	
Packaging	5.1	4.13	X	X
Group D Destructive Tests				
Ultimate load test	3.8.2	4.10.2	X	X

4.5.3 Individual tests. Each sling shall be subjected to the following tests as described herein.

- Visual examination of sling assembly (see 4.6)
- Critical safety screw threads (see 4.6.3)
- Static proof load. (see 4.10)
- Visual examination of welds (see Table IV)
- Inspection and tests (see table V)

4,6 Visual examination of sling assembly. The slings shall be examined to determine conformance to the requirements of this specification with respect to dimensions, quality of workmanship, materials, design, finishes, markings, and the functional operation of all components, assemblies and accessories. The visual inspection and tests shall be accomplished in accordance with Table IV and V.

TABLE IV. Visual inspection of welds

WELD IMPERFECTION OR DEFECT	MAXIMUM LIMIT	CLASSIFICATION		
		CRITICAL	MAJOR	MINOR
Craters				
Max depth	0.20T or 0.030 inch whichever is less.	X		
Min depth	1 T	X		
Cracks	none	X		
Surface Porosity				
Individual size -Max.	0.25T or 0.030 inch whichever is less.	X		
Spacing-Min.	8 times the size of the larger adjacent imperfection		X	
Accumulated length in any 3 inches of weld	0.20 inch max.			X
Undercut				
Individual Defect	0.07 T or 0.030 inch whichever is less	X		
Max depth				
For full length of weld	0.002 inch Max Depth		X	
accumulated length in any 3 inches of weld	0.20 inch Max			X
Underfill-concavity				
Individual defect max. depth	0.07 T or 0.03 inch whichever is less	X		
Full length in any 3 inches of weld	0.005 max depth		X	
Accumulated length in any 1 inch of weld	0.20 inch max			X

4.6.1 Hardness testing. Samples shall be selected from each lot of steel components including forgings, as required herein and subject to hardness testing after heat treatment in an area to be subsequently removed by machining. Acceptable hardness shall be as stated on the respective detail drawings Or specification sheets.

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TABLE V. Inspection and tests

EXAMINE	DEFECT	CLASSIFICATION		
		CRITICAL	MAJOR	MINOR
Materials	Any components not of specified material processed improperly or wrong color	X		
Design	Any characteristics not as specified		X	
Cleanliness	Dirt, grease, oil or foreign matter		X	
Workmanship	Burrs, sharp edges, surface roughness poor stitches & seams, Tears or ends not seared		X	
Assembly	Components missing, not welded properly or joined operation omitted or not correct		X	
Component Dimensions	Perpendicularity, parallelism, or concentricity out of specified tolerance, hardware not type or size specified		X	
All Load Tests	Evidence of permanent set, distortion, elongation tears or separation after loads are applied in the following tests; Dynamic Load Test Proof Load	X	X	
Proofload Tag	Missing or incomplete	X		
Identification	Not as specified on components or IPB or omitted, illegible or improper size			X
Stitching	One stitch per inch less than or more than the minimum or maximum specified or			X
	Two or more maximum stitches per inch less than or more than the minimum or maximum specified		X	
	Stitching ends backstitched less than 1/2 inch (except where ends are turned under in a hem or held down by other stitchings)		X	
	Any missing or incomplete row of stitching Wrong type or any open seam		X	
	Tension loose resulting in any loose thread or tension too tight resulting in puckering		X	
	Runoff at edge and not restitched or needle chews or holes			X
	Thread breaks and skips not over stitched as specified. Thread ends not trimmed, correct type, or size		X	

4.6.2 Forging integrity. One forging from each heat treat lot shall be sectioned for the purpose of preparing tensile test specimens by the supplier. At least two specimens shall be taken and machined to conform to the largest types described in ASTM E 8, Figure 8, which can be accommodated. The supplier shall identify the location on the parent forging from which the marked specimens are taken in a sketch. One specimen shall be parallel to forging flow direction and a second at another identifiable angle. Conformance to strength requirements stated on the drawings shall be accomplished in supplier performed tensile tests. All forging, data shall be documented in supplier certification of material composition and strength.

4.6.3 Critical Thread Inspection For those threads classified as critical and produced in accordance with MIL-T-8879 their inspection shall be conducted as required by this specification.

4.6.4 Non Destructive Examination (NDE) of Critical Weld (s) Welds which are classified as critical by the cognizant engineering organization shall be subjected to additional nondestructive examinations as listed in Table VI. These classifications of defects in the following tables are as defined in MIL-STD-109. The specific NDE required shall be defined in the applicable drawing(s).

4.7 Serviceability and maintenance. The slings shall be inspected and evaluated from the standpoint of ease of maintenance, servicing, and operation. Particular attention shall be given to maintenance with a minimum number of tools, maintenance with general-purpose tools and equipment, servicing and operation by personnel wearing heavy gloves, and provisions made to prevent accumulation of decontamination residue, dirt, snow, ice, et cetera, that may hinder servicing and operation.

* **4.8 Order of testing.** Unless otherwise specified, the order of testing shall be as listed in Table 111. If the manufacturer desires a different sequence of testing or a combination of tests, a prior approval shall be obtained from the procuring agency.

4.9 Environmental Test Procedures. All environmental test(s) shall be completed as specified or modified in the contract.

4.9.1 Vibration test. The sling shall be subjected to a vibration test conforming to Method 514 of MIL-STD-810. Upon completion of this test the sling shall be rigidly attached to a supporting fixture and loaded. A vibrator, capable of producing resonant frequencies in the slings under the loads, shall be attached to the fixture or the sling. All tests shall be conducted so as to produce a $2\frac{1}{2} \pm \frac{1}{2}g$ acceleration level at the centerline. The sling shall be vibrated for the times, and under the loads, noted along each of its three mutually perpendicular axes. The noted times are totals and shall be equally divided among testing on each of the three axes. The tests shall consist of Cycling vibration and resonant vibration with test time divided equally between them. The cycling vibration shall be conducted between 20 and 300 cycles per second and resonant frequencies in the load shall be noted. Resonant vibration shall be performed at all of the major resonant points with equal time being used for each point when more than one resonant point is found.

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TABLE VI. Nondestructive examination (NDE) of welds

WELD IMPERFECTION OR DEFECT	MAXIMUM LIMIT	CLASSIFICATION		
		CRITICAL	MAJOR	MINOR
Incomplete penetration Max. depth	0.20 T or 0.03 whichever is less	X		
Subsurface porosity and inclusions Individual size Max.	0.33 T or 0.060 inch whichever is less	X		
Spacing min.	4 times the size of the larger adjacent imperfection		X	
Accumulated length in any 3 inches of weld max.	1.33 T or 0.24 inch whichever is less			X
Cold shut <u>1/</u>	1 T or 0.1 inch <u>2/</u> whichever is less		X	

NOTES:

1/ If the defects exhibit sharp radii, sharp termination, or are cracklike, they shall be removed by grinding. If the depression is not larger than permitted, they need not be rewelded.

2/ Where possible to determine, by metal removal, the depth of cold shut shall not cause joint thickness to be less than the thinner material being welded.

4.9.2 High temperature test. The sling assembly shall be tested as specified in Method 501 of MIL-STD-810 and the sling assembly shall be tested through one (1) cycle of the test listed in 4.10.1 herein.

4.9.3 Low temperature test. The sling assembly shall be tested as specified in Method 502 of MIL-STD-810 and the sling shall be tested through one (1) cycle of the tests listed in 4.10.1 herein.

4.9.4 Salt-spray test. The sling shall be tested as specified in Method 509 of MIL-STD-810 and, without any removal of any salt deposits, etc. resulting from the test, shall be operated satisfactorily at the conclusion of the test through one (1) cycle of the test listed in 4.10.1 herein.

4.9.5 Sand and dust test. The sling shall be tested as specified in Method 510 of MIL-STD-810 except that the sand and dust velocity through the test chamber shall be maintained at 2500 +500 feet per minute through the first half of the test and between 100 and 500 feet per minute through the second half of the test. Upon completion of the test, the sling shall be Inspected for deterioration and shall be operated satisfactorily through one (1) cycle of the test in 4.10.1 herein.

4.9.6 Immersion tests. The sling shall be tested by Immersion In sea water or water of equivalent salinity, to a depth of five (5) feet for fifteen (15) minutes and after being withdrawn, the sling shall be operated (loaded) satisfactorily through one (1) cycle of each test condition listed in 4.10.1 herein.

4.9.7 Shock test. The sling metal components only shall be tested in accordance with Method 516 of MIL-STD-810. The equipment crash-safety portion of this test shall be omitted. Upon completion of this test, a load shall be attached to the component and dropped so as to include a shock loading equivalent to Capacity at 3 g.s. The component under test shall successfully sustain ten (10) such shocks.

4.10 Load test(s). The proofload test shall verify the capability of the sling while the ultimate load test shall verify the limitations of the design. During this test the load shall be applied in a smooth manner only. Both of these tests are static tests.

* 4.10.1 Proofload test. Every sling assembly shall be given a proofload test and the sling assembly tagged after passing this test. For this test the slings shall be subjected to 200 percent of the rated load as specified in the detail specification. The configuration of the sling relative to the center of gravity of the hoisted item shall also be as specified in the detail specification. The proofload shall be held for a period of not less than 3 minutes. Any evidence of slipping, loosening of fittings, fraying, permanent structural deformation, or other signs of failure shall be cause for rejection.

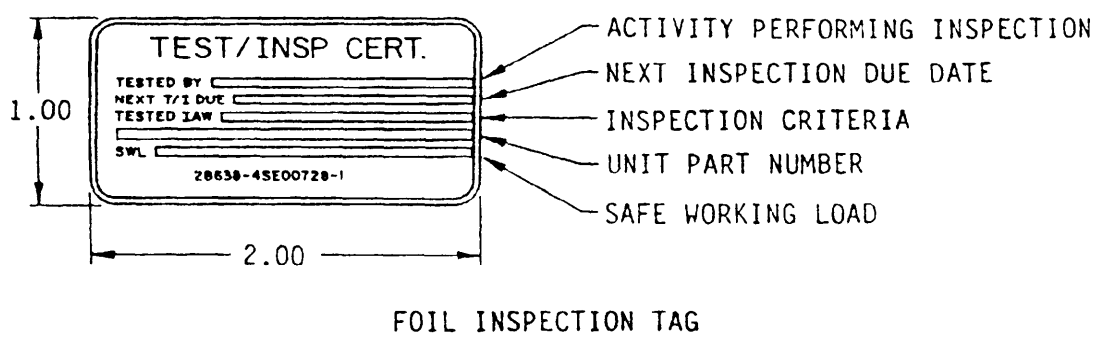
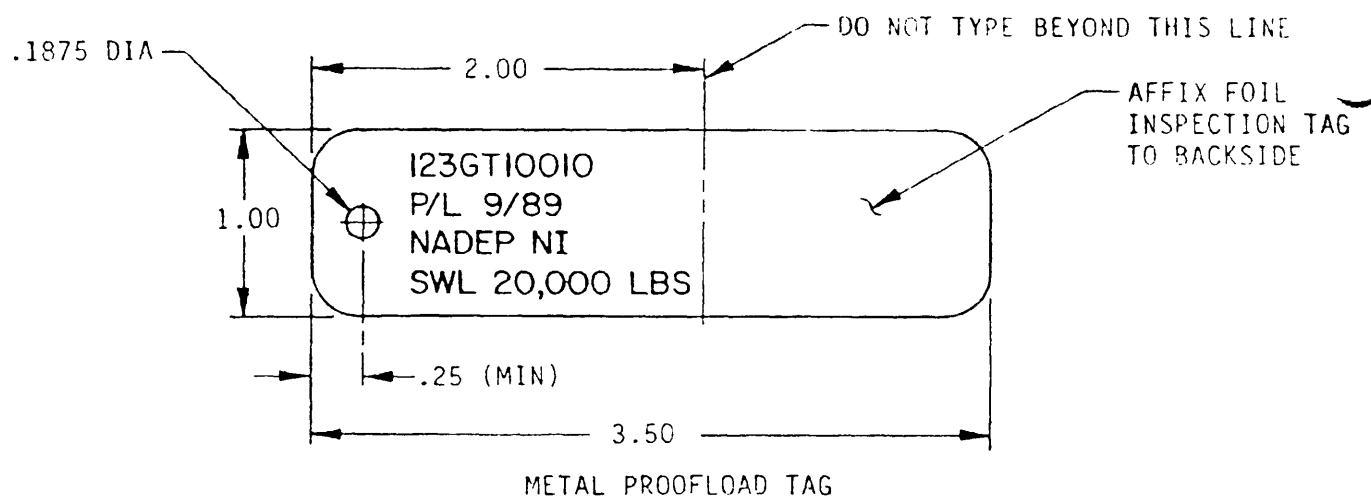
* 4.10. 1.1 Metal Proofload Tag. Upon successful completion of the proofload test a Metal Proofload Tag, Figure 4, shall be fastened to the sling. All pertinent information shall be impression stamped on the tag. This tag shall be of aluminum composition with a thickness of 1/16 (0.0625) inches. The tag shall be affixed to the sling by means of a metallic or other suitable lanyard.

* 4.10. 1.2 Foil Inspection Tag. After the yearly inspection of the sling assembly is successfully completed the Foil Inspection Tag shall be affixed to the right portion of the Metal Proofload Tag. This Foil Inspection Tag shall be in accordance with drawing 4SE00726-1, (NSN 9905-01-023-4226).

4.10.2 Ultimate load test. Each of the first article samples shall be pull tested to the specified ultimate load plus 2000 lb or destruction (whichever comes first) and the load recorded. This test shall be performed on the same item which has previously been subjected to proofload testing as required and only after examination for proofload defects has resulted in acceptance. This test is applicable to each of the types of components listed with the specified load applied in the manner described on the subject part number drawing. Successful completion of the ultimate load test (no breakage or separation below ultimate load) is required before production will be authorized. For production a Quality Conformance-Ultimate Load Test for one of each sling shall be selected at random from each production quantity of fifty or less and pulled to the specified ultimate load plus 2000 lb or destruction, (whichever comes first) and the load recorded. This test shall be performed on the same sling which has previously been subjected to proof load testing and only after examination for proof load defects has resulted in acceptance. Loads shall be applied in straight tension slowly. Successful completion of this test (no breakage or separation below ultimate load) is required before acceptance of any sling assemblies.

4.11 Reliability demonstration and test. Satisfactory completion of all tests specified herein shall be a demonstration of compliance with the quantitative reliability requirements of this specification. The reliability of the design of the sling shall be established.

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NOTES :

1. Dimension in inches with tolerance $\pm .02$
2. Data on the Metal Proofload Tag is an example only

FIGURE 4. Metal Proofload and Foil Inspection Tags.

4.12 maintainability evaluation. The slings shall be inspected and evaluated from the standpoint of ease of maintenance, servicing, and operation. Particular attention shall be given maintenance with a minimum number of common tools, servicing, and operation by personnel wearing heavy gloves, and provisions made to prevent accumulation of dirt, snow, ice, et cetera, that may hinder servicing and operation.

4.12.1 Preventive maintenance, servicing, and unit replacement. Maintenance tests shall be conducted to determine the adequacy and ease of performing preventative maintenance, servicing, and unit replacement. The frequency of servicing required for the various components shall be determined by study of existing supplier's recommendations and by servicing required during the preproduction tests. Interferences or obstructions to servicing shall be noted. Any tendency of the slings to pick up mud, snow, and ice which interferes with servicing and operation shall be noted. Removal and installation of major components and assemblies to demonstrate ease of replacement shall be accomplished. Particular attention shall be given to time required difficulties encountered, and the tools and skills required in conducting maintenance, servicing, and replacement.

* **4.13 Packaging inspection.** A visual examination shall be made to determine compliance with the preservation, packing and marking requirements specified in Section 5. The defects shall be evaluated as specified in Table VII. Lots submitted for examination shall be fully packaged, with the exception that containers shall not be palletized and need not be sealed or closed.

TABLE NO. VII Packaging inspection

EXAMINE	DESCRIPTION OF DEFECT	CLASSIFICATION		
		CRITICAL	MAJOR	MINOR
MARKING	Omitted; incorrected; illegible, of improper size, location, sequence or method of application			X
MATERIAL	Any component missing, damaged, defective, or not as specified materials; or any incorrect assembly	X		
WORKMANSHIP	Inadequate coiling, folding, or tying; bulging or distortion of containers; or contents loose or not snug fitting		X	
CONTENT	Number of interior pack or exterior container not as specified	X		

4.14 Test report. After completion of the preproduction tests, a test report shall be prepared in accordance with MIL-STD-831 and three complete copies of the report covering the Qualification Testing shall be furnished to the procuring activity.

4.14.1 Reliability and maintainability information. The following information shall be included as an appendix to the test report:

- a. All failures, servicing, adjustments, maintenance, and Irregular functioning shall be identified by accumulated operating time, cycles, miles, or position in the test procedure, as appropriate. Test conditions at the time of the events identified shall be recorded.
- b. A summary of the engineering analysis and of any test conducted to determine assignable causes for any failure or irregular functioning.
- c. A summary of the engineering analysis leading to any corrections made to design, construction, quality control, or other procedures, or leading to any corrections to be made or proposed to be made to production items. The summary shall also include an analysis of the predicted effectiveness of such corrections.
- d. Clock time and man-hours required for each maintenance and servicing action taken during the tests. A brief description of the experience and qualifications of the personnel taking such actions.

- e. Test activity or contractor comments on item features or requirements that, if modified, should improve the sling.
- f. Test activity or contractor comments on use or maintenance conditions to be avoided or cultivated to increase the reliability or useful life of the sling.
- g. Any of the above information that is already included in the test report body need not be repeated in the information required by this paragraph, but clear references to the location of the data shall be included.

4.14.2 Test Data and Evaluation(s). Each test report shall include all of the relevant data and test results as well as the evaluation(s). These evaluations(s) as a minimum shall address the following:

- a. Worthiness of test result and the test concept
- b. Overall accuracy and relevant aspects of the test results
- c. Conclusions derived from the test results
- d. Operational or functional capabilities in the anticipated service environment
- e. Conclusions and Qualifications confirmed
- f. The evaluation(s) included in the test report shall be considered one of the most important parts of the test report.

5. PACKAGING

5.1 Preservation and packaging

5.1.1 Level A

5.1.1.1 Cleaning, drying, and preservation. Prior to the application of a contact preservative, metal surfaces of parts involved shall be cleaned and dried in accordance with MIL-P-116. Preservatives specified shall conform to the applicable specification listed therein and shall be applied according to MIL-P-116 MIL-STD-2073-2.

5.1.1.2 Unprotected metal surfaces. Unprotected metal surfaces of component parts of the sling subject to corrosion shall be coated with type P-1 grade preservative in accordance with MIL-P-116.

5.1.1.3 Packaging. Unless otherwise specified, the sling and its components shall be intermediate in containers conforming to PPP-B-636. The containers shall be closed in accordance with the appendix to PPP-B-636.

5.1.2 Level C. Cleaning, drying, preservation, and packaging shall be in accordance with the manufacturer's commercial practice or in accordance with MIL-STD-1190 as specified in the contract.

5.2 Packing

5.2.1 Level A. Unless otherwise specified, slings preserved and packaged in accordance with 5.1.1 shall be packed in overseas-type containers conforming to PPP-B-636. The containers shall be closed and strapped in accordance with the appendix to PPP-B-636.

5.2.2 Level B. Unless otherwise specified, slings preserved and packaged in accordance with 5.1.1 shall be packed in domestic-type containers conforming to PPP-B-636. The container shall be closed and strapped in accordance with the appendix to PPP-B-636.

5.2.3 Level C. Packages which require overpacking for acceptance by the carrier shall be packed in exterior-type shipping containers in a manner that will insure safe transportation at the lowest rate to the point of delivery. Containers shall meet Consolidated Freight Classification rules or regulations of other common carriers as applicable to the mode of transportation.

5.3 Marking of shipments. Interior and exterior containers shall be marked in accordance with MIL-STD-129. Bar coding shall be in accordance with MIL-STD-1189.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory).

6.1 Intended use. The slings covered by this specification are intended for use in the handling and hoisting of aircraft and their specified components. Aircraft as used in this specification applies to airplanes, helicopters, guided missiles, and target drones.

* 6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of the specification.
- b. Issue of DODISS to be cited in the solicitation and if required, the specific issue of individual documents referenced (see 2.1).
- c. Location and conditions for first article testing.
- d. Applicable levels of preservation, packaging, packing, and when palletization is required, (see 5.1, 5.2, and 5.4).

¹ 6.3 Data Requirements. The following Data Item Descriptions (DID's) must be listed, as applicable, on the Contract Data Requirements List (DD Form 1423) when this specification is applied on a contract, in order to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Referenced Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
3.19	DI-PACK-80120	Preservation and Packaging	Develop level A data only
3.19	DI-PACK-80877	Transportation Plan	Provide transportation data only
4.6.2 & 4.15	DI-T-2072	Test Reports	Wherever possible, use the contractor's standard test report format.

The above DID's were those cleared as of the date of this specification. The current issue of DOD 5010. 12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

* **6.4 First-article.** When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the Item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first 5 production items, a standard production item from the contractor's current inventory (see 3.1.1), and the number of items to be tested as specified in 4.4. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders shall not submit alternate bids unless specifically requested to do so in the solicitation.

* **6.5 Definitions.**

6.5.1 Open Seam. A seam shall be classified as open when one or more stitches joining a seam are broken or two or more consecutive skipped stitches occur. However, repairs of open seams shall not be scored as a defect.

6.5.2 Proof Load. The maximum force applied in testing components or assemblies to demonstrate that these load levels cause no permanent deformation or yielding. For nylon assemblies, the deformation after proof load may be residual up to 24 hours after test. Following this time, no deviation will be acceptable for Section 4 requirements.

6.5.3 Rated capacity. The term rated capacity or rated load is interchangeable with the term safe working load (SWL).

6.5.4 Safe Working Load (SWL). The safe working load (SWL) is the load for which the sling is designed. This load is the permissible load to be used under actual working conditions.

6.5.5 Ultimate load. The maximum force applied in testing components or assemblies in order to demonstrate a margin of safety above proof loads. Permanent deformation is allowed. Complete breakage or separation is not allowed. Failure is not allowed.

6.5.6 Variation of stitches. Variation in number of stitches per inch caused by the machine operator speeding up the machine and pulling the fabric to sew over heavy places, heavy seams, or in turning corners shall be classified.

- a. If within the major defect classification - Minor defect
- b. If within the minor defect classification - No defect

1 6.6 Subject term (key word) listing.

Engine handling or removal, maintenance equipment

Hoisting alrplane,equipment

Jet engine, removal equipment

Transportation, webbed assemblies equipment

* 6.7 International Interest, agreements Certain provisions of this specification (see 3.12) are the subject of international standardization agreements, STANAG 3237 and ASCC Air Standard 11/5A. When amendment, revision or cancellation of this specification is proposed that will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations. .

. 6.8 Changes from previous Issue. The margins of this specification are marked with asterisks to indicate where previous changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to-evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Air Force - 99
Army - AV
Navy - AS

Preparing activity:

Navy - AS
Project No. 1730-0311

Reviewers:

Army - GL
Navy - MC

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
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I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER

MIL-S-5944C

2. DOCUMENT DATE (YYMMDD)

20 November, 1990

3. DOCUMENT TITLE

Sling, Aircraft, General Specification For

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

7. DATE SUBMITTED (YYMMDD)

(1) Commercial

(2) AUTOVON

(If applicable)

8. PREPARING ACTIVITY

a. NAME

Commanding Officer
NAEC (SESD) Code 53

b. TELEPHONE (Include Area Code)

(1) Commercial

908/323-7709

(2) AUTOVON

624-7709

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