

MIL-S-8959 (ASG)

14 JUNE 1965

MILITARY SPECIFICATION

SPRING, HYDRAULIC: GENERAL SPECIFICATION FOR

This specification has been approved by the Department of the Air Force and by the Bureau of Naval Weapons.

1. SCOPE

1.1 Scope. - This specification covers the general requirements for hydraulic springs of class 1 or 2.

1.2 Classification. - The springs shall be furnished in the following classes, as specified (see 6.2):

- Class 1 - Emergency operation
- Class 2 - Other uses

2. APPLICATION DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposals form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

QQ-C-320	Chromium Plating (Electrodeposited)
PPP-B-636	Box, Fiberboard

Military

MIL-B-121	Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-S-5002	Surface Treatments and Metallic Coatings for Metal Surfaces of Weapons Systems
MIL-P-7936	Parts and Equipment, Aeronautical, Reparation for Delivery
MIL-C-11796	Corrosion Preventive Compound, Petrolatum, Hot Application

FSC 1620

MIL-S-8959(ASG)

STANDARDS

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of US Military Property
MIL-STD-143	Specifications and Standards, Order of Precedance for the Selection of
MIL-STD-831	Test Reports, Preparation of
MS33586	Metals, Definition of Dissimilar
MS33656	Fitting End, Standard Dimensions for Flared Tube

PUBLICATIONSAir Force-Navy Aeronautical Bulletin

No. 438 Age Controls of Age-Sensitive Elastomeric Items

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS3.1 Preproduction.- This specification provides for preproduction inspection.3.2 Data.- Unless otherwise specified in the contract or order, no data are required by this specification or any of the documents listed in section 2 (see 6.2).3.3 Materials.-3.3.1 Dissimilar metals.- The use of dissimilar metals, as defined in MS33586, in contact with each other shall be avoided insofar as possible.3.3.2 Protective treatment.- When materials are used in the construction of hydraulic springs that are subject to corrosion they shall be protected against such corrosion in a manner that will not prevent compliance with the performance requirements of this specification. Metallic coatings and surface treatments shall be in accordance with MIL-S-5002.3.3.3 Selection of specifications and standards.- Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143, except as provided in 3.3.3.1 and 3.3.3.2.3.3.3.1 Military standard parts Military standard parts (MS and AN) shall be used wherever they are suitable for the purpose, and shall be identified on the drawing by their part numbers, In the event there is no suitable corresponding standard part in effect on date of invitation forbids, commercial parts may be used, provided they conform to all requirements of this specification.

MIL-S-8959(ASG)

3.3.3.2 Commercial parts. - Commercial utility parts, such as screws, bolts, nuts, and cotter pins may be used, provided they possess suitable properties and are replaceable by the MS or AN parts without alteration, and provided the corresponding MS or AN part numbers are referenced in the parts list and, if practicable, on the contractor's drawings.

3.4 Design and construction .-

3.4.1 Filling and charging. - Filling of hydraulic springs may be by disassembly of the unit or through a filling port. If pressure charging is accomplished by pumping, the pump-attaching port shall conform dimensionally to MS33656-2. The pressure-charging port shall be located so that charging can be accomplished while the unit is installed.

3.4.2 Bleeding. - If pressure charging is used, a bleed port shall be provided and shall be so located that bleeding can be accomplished while the unit is installed.

3.4.3 Spring hysteresis. - When used solely as an energy-storing device, the minimum unloading cycle load-stroke curve shall be defined by the procuring activity. The cycling rate shall be 1 inch per second, unless otherwise specified by the design requirements.

3.4.4 Piston rod plating. - Where piston rods are chromium plated, they shall be plated in accordance with class 2, type I of QQ-O-320. The minimum thickness shall be 0.001 inch for land-based aircraft and 0.0035 inch for carrier-based aircraft.

3.4.5 Leakage. -

3.4.5.1 Gland leakage. - The gland design shall be such that under normal operating conditions of the unit, no leakage shall occur. Glands shall pass the functional and life tests specified in 4.5.4 and 4.5.5. Rubber sealing elements shall conform to the requirements of ANA Bulletin No. 438.

3.4.5.2 Static seal leakage. - There shall be no leakage at static seals.

3.5 Performance. -

3.5.1 Seal compatibility. - When tested as specified in 4.5.4, the packings and the metals they contact shall show no signs of sticky or gummy residue and there shall be no discoloration or corrosion of the metals.

3.5.2 Endurance. - Hydraulic springs shall pass the cyclic operation tests specified in 4.5.5.

3.5.3 High-temperature operation. - When tested as specified in 4.5.6., there shall be no evidence of binding, chatter, or leakage.

3.5.4 Low-temperature operation. - When tested as specified in 4.5.7, there shall be no evidence of binding, chatter, or leakage.

3.5.5 Proof pressure. - When tested as specified in 4.5.8, there shall be no evidence of yield, leakage, or permanent deformation of the assembly.

MIL-S-8959(ASG)

3.6 Identification of product.- Each hydraulic spring shall be marked for identification in, accordance with MIL-STD-130, and shall include, as a minimum, the following:

HYDRAULIC SPRING
 Manufacturer's part No.
 Manufacture's serial No.
 Servicing fluid
 Charging pressure or preload
 Class of unit

Decalcomanias shall not be considered as permanent marking.

3.7 Workmanship.- All details of workmanship shall be of sufficient quality to ensure proper operation and service life.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein, Except as otherwise specified, the supplier may utilise his own facilities or any commercial laboratory acceptable to 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 assure supplies and services conform to prescribed requirements.

4.2 Classification of inspections.- The examining and testing of the hydraulic springs shall be classified as:

- (a) Preproduction inspections (4.3)
- (b) Quality conformance inspections (4.4)

4.3 Preproduction inspections, -

4.3.1 Sampling. - Unless otherwise specified (see 6.2), two sample hydraulic springs shall be prepared to the tolerance conditions specified in 4.3.1. and 4.3.1.2. In case of waiver of the adverse tolerance samples, tests shall be conducted using representative samples of the production item, and the test report prepared in accordance with MIL-STD-831, shall analyze the effects of adverse tolerance conditions.

4.3.1.1 Specimen No. 1- This specimen shall be assembled of parts which have been selected to provide that the clearances, with regard to diametral tolerances between moving and nonmoving members conducive to malfunctioning at extreme temperatures, will not exceed 110 percent of the minimum clearance permitted by the manufacturer's drawings. Lapped or selectively fitted parts or seal elements need not be made to adverse limits.

4.3.1.2 Specimen No. 2.- This specimen shall be assembled of parts which have been selected to provide that the clearances, with regard to linear and diametral tolerance between moving members conducive to malfunctioning as a result of wear associated with prolonged operation, will be not less 90 percent of the maximum permitted by the manufacturers drawings. Lapped or selectively fitted parts or seal elements need not be made to adverse limits.

MIL-S-8959(ASG)

4.3.1.3 Adverse tolerance units.- To facilitate fabrication of adverse tolerance units, it will be permissible for one of the mating parts required to make up the critical clearance be outside of drawing tolerance, provided that the clearance, as established, meets the requirements.

4.3.2 Inspections.- The preproduction inspections shall consist of all the examinations and tests specified herein and in the applicable detail specification.

4.4 Quality conformance inspections.- Quality conformance inspections shall consist of the examination and tests specified in sampling plans A and B.

4.4.1 Sampling plan A.- Sampling plan A shall consist of:

- (a) Material inspection (4.5.1)
- (b) End item inspection (4.5.2)

4.4.2 Sampling plan B.- Samples shall be selected at random from assemblies that have passed the sampling plan A inspections and shall be subjected to the test specified in 4.5.3. The selection of samples shall be made as follows:

- (a) One from the first 10 production items.
- (b) One from the 70th to 80th production items.
- (c) One from each 100 thereafter until the 500th item.

4.4.3 Rejection and retest.- When one item selected from a production run fails to meet the specification, no item on hand or later produced shall be accepted until the extent and cause of failure are determined and corrective action taken on all affected parts. Rejected assemblies shall not be resubmitted for inspection without furnishing the procuring activity the reason for rejections and full particulars concerning measures taken to correct the defects.

4.5 Inspection methods.-

4.5.1 Material inspection.- When specified (see 6.2), the material used in the manufacture of the hydraulic springs shall be inspected to determine conformance to the applicable material specification.

4.5.2 End item inspection.- Each hydraulic spring assembly shall be inspected to determine conformance to the applicable detail specification or drawings. There shall be no evidence of leakage when serviced with the proper fluid and pressurized to the normal unloaded pressure for not less than 24 hours.

4.5.3 Cycling.- The samples selected as specified in 4.4.2 shall be filled with the proper fluid and pressurized to the normal unloaded pressure. The assembly shall then be placed in a machine capable of stroking it through full design travel. The machine shall stroke the assembly at the frequency rate specified by the procuring activity. A full cycle is defined as one loading stroke and one unloading stroke, each stroke being at least 90 percent of the full stroke of the spring. After 20 complete cycles, the spring shall conform to the design requirements of the average load-stroke curve for the applicable class (see 3.4.3).

MIL-S-8959(ASG)

4.5.4 Seal compatability.- The sample specimen prepared as specified in 4.3.1.2 shall be maintained at $160 \pm 10^\circ$ F for 6 days prior to performing the test specified in 4.5.5 for the applicable class. After completion of the endurance tests, all packings and the metals in contact with the packings shall be examined for sticky or gummy residue and discoloration or corrosion of the metals.

4.5.5 Endurance cycling.- The same assembly and packings used in 4.5.4 shall be used for this test. Prior to testing, the unit shall be serviced to the precharge pressure with the proper fluid. The assembly shall be installed in a test stand-capable of alternately loading and unloading it. The assembly shall be subjected to cyclic operation which simulates the loading and duplicates the swiveling and bending loads, if any, which would occur in service. All tests shall be conducted at room temperature.

4.5.5.1 Procedure for class hydraulic springs.- The procedure for class 1 hydraulic springs shall be:

- (a) Cycle the unit 1,000 full design strokes from zero load to 100 percent applied load.
- (b) Unless otherwise specified by the procuring activity, maintain the unit at installed load for a 24-hour period after the cycling test.

4.5.5.2 Procedure for class 2 hydraulic springs.- The procedure for class 2 hydraulic springs shall be:

- (a) Cycle the unit 1,000 full design strokes from zero load to 100 percent applied load.
- (b) Cycle the unit 10,000 times, ± 25 percent of full stroke, about its normal installed position. The maximum compressed stroke shall not exceed 95 percent of the full stroke.
- (c) Cycle the unit 50,000 times, ± 12.5 percent of full stroke, about its normal installed position. The maximum compressed stroke shall not exceed 95 percent of the full stroke.
- (d) Maintain the unit at the installed load specified by the procuring activity for four 24-hour periods. The periods shall be after the 10,000 cycles of 4.5.5.2(b) and at approximately equal intervals during and after the 50,000 cycles of 4.5.5.2(c). There shall be no external leakage during each of these 24-hour periods.

The cycling tests of 4.5.5.2(a), (b), and (c) may be conducted in any convenient order.

4.5.5.3 After completion of the cycling tests for the applicable class of hydraulic spring, a load-stroke test shall be conducted. At 90 percent of full stroke, the supporting load shall be within 10 percent of the design requirements,

MIL-S-8959(ASG)

4.5.6 High temperature. - The sample specimen prepared as specified in 4.3.1.1 shall be compressed to the installed load specified by the procuring activity. The specimen shall then be placed in a controlled temperature chamber and the temperature raised to $160^{\circ} \pm 10^{\circ}$ F within 60 minutes. The specimen shall remain in the chamber at this temperature for 24 hours. The specimen shall then be subjected to the following cycling and holding procedure in the order specified:

- (a) Ten complete cycles at 90 percent of stroke.
- (b) Allow the specimen to set for 30 minutes at the normal installed position.
- (c) Allow the specimen to set for 30 minutes fully extended.

This procedure shall be repeated five times in the order specified. The temperature of the unit at the start of each loading sequence shall be not less than 140° F. Cycling shall be conducted in the high temperature environment.

4.5.7 Low temperature. - The sample specimen prepared as specified in 4.3.1.1 shall be compressed to the installed load specified by the procuring activity. The temperature of the specimen shall then be lowered to $65^{\circ} \pm 10^{\circ}$ F within 20 minutes and held at this temperature for at least 72 hours. The specimen shall then be subjected to the following cycling and holding procedure in the order specified. The unit may be recharged prior to testing.

- (a) Ten complete cycles at 90 percent of stroke.
- (b) Allow the specimen to set for 30 minutes at the normal installed position.
- (c) Allow the specimen to set for 30 minutes fully extended.

This procedure shall be repeated five times in the order specified. The temperature of the unit at the start of each loading sequence shall be not higher than -45° F. Cycling shall be conducted in the low temperature environment.

4.5.8 Proof pressure. - The pressure chambers of the specimen shall be subjected to a hydraulic pressure of 125 percent of that produced by maximum spring deflection for 15 minutes. The test fluid used for pressurization shall be that used for servicing the unit. The test may be made with the assembly end loaded. There shall be no evidence of leakage.

4.6 preservation, packaging, packing, and marking. - Preparation for delivery shall be examined and tested to determine conformance to section 5.

5. PREPARATION FOR DELIVERY

5.1 Serviceing. - The hydraulic spring shall be filled with the fluid approved by the procuring activity.

5.2 Preservation. - The hydraulic spring shall be protected with a preservative conforming to MIL-C-11796, and wrapped in grade A paper Conformance to MIL-B-121.

5.3 Packaging. - Each cylinder shall be adequately cushioned with a suitable material and packaged in a unit container conforming to PPP-B-636.

MIL-S-8959(ASG)

5.4 Packing .- Packing shall be in accordance with MIL-P-7936, level A, B, or C, as specified see 6.2).

5.5 Marking.- Interior, packages and exterior shipping containers shall be marked in accordance with MIL-STD-129. The identification shall contain the following information listed in the order shown:

Fed, Stock No.
SPRING, HYDRAULIC
MIL-S-8959
Quantity
Date of manufacture and' date of preservation
Manufacturers serial No.
Manufacturer's part No.
Manufacturer's name or trademark
Name of contractor (if different from manufacturer)

6. NOTES

6.1 Intended use.- Hydraulic springs conforming to this specification are intended for use in undercarriages and landing gear of aircraft.

6.2 Ordering data.- Procurement documents should specify:

- (a) Title, number, and date of this specification.
- (b) Class of hydraulic spring required (see 1.2).
- (c) Data requirements (see 3.2).
- (d) Whether material inspections are to be preformed (see 4.5.1).
- (e) Level of packing required {see 5.4).
- (f) Whether the test specimens are to be prepared to the tolerance conditions specified in 4.3.1.1 and 4.3.1.2; if the test samples are to be forwarded to the procuring activity.

custodians:
Navy - WP
Air Force - (11)

Preparing activity:
Air Force - (n)

Reviewer activities:
Navy - WP
Air Force - (11)

Review/user information is current as of the date of this document. For future coordination of changes to this document, draft circulation should be based on the information in the current Federal Supply Classification Listing of DoD) Standardization Documents.

SPECIFICATION ANALYSIS SHEET

Form Approved Budget
Bureau No. 119-RO04INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

MIL-S-8959(ASG) Spring, Hydraulic: General Specification for

ORGANIZATION

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT
\$MATERIAL PROCURED UNDER A Direct Government Contract Subcontract

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

 YES NO

IF "YES" IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)

DATE