

INCH-POUND

MIL-C-7958B
1 SEPTEMBER 1994
SUPERSEDING
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MILITARY SPECIFICATION

CONTROLS PUSH-PULL, FLEXIBLE AND RIGID

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

1. SCOPE

- 1.1 Scope. This specification covers flexible and rigid push-pull controls for use in activation remotely located equipment.
- 1.2 Classification. Push-Pull controls shall be furnished in the following types, as specified:

Type I Push-Pull controls with flexible tubular casing containing a moveable element.

Type II Push-Pull controls with rigid tubular casing containing a moveable element.

Type III Push-Pull controls with a combination of rigid and flexible tubular casing containing a moveable element.

In addition, push-pull controls shall be designated Grade A or B to indicate precision quality or general utility quality items as defined in Section 6 of this specification.

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 Specification 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: Oklahoma City Air Logistics Center/TICLA, Tinker AFB OK 73145-5990 by using the (Self Addressed) Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 2995

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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SPECIFICATIONS

Military

MIL-P-116	Preservation, Methods Of
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification For
MIL-A-8625	Anodic Coatings, For Aluminum And Aluminum Alloys
MIL-C-83488	Coatings Aluminum, Ion Vapor Deposited

STANDARDS

Military

MIL-STD-105	Sampling Procedures And Tables For Inspection By Attributes
MIL-STD-129	Marking For Shipment And Storage
MIL-STD-130	Identification Marking Of U.S. Military Property
MIL-STD-838	Lubrication Of Military Equipment
MIL-STD-970	Standards & Specifications, Order of Preference For The Selection Of
MIL-STD-2073-1	DOD Materiel Procedures For Development & Application Of Packaging Requirements
MS-27975	Clevis, Rod End-adjusting, Wide And Narrow Forks
AN-665	Terminal Threaded Clevis Type Tie Rod

HANDBOOKS

MIL-HBK-275	Guide For Selection Of Lubricants, Fluids, And Compounds For Use In Flight Vehicles And Components
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(Unless otherwise indicated, copies of federal military specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Ave, Building #4, Section D, Philadelphia, PA 19111-5094.)

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 solicitations. Unless otherwise specified, the issues of documents not listed in the DODISS are in the issues of the documents cited in the solicitation (see 6.2).

American Society For Testing and Materials (ASTM)
ASTM B1/17-90 Salt Spray (Fog) Testing
ASTM D3951 Packaging, Commercial
ASTM B633 Electrodeposited Coating of Zinc on Iron and Steel

(Application for copies should be address to: ASTM, 1916 Race St, Philadelphia, PA 19103.)

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

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2.3 Order of precedence. In the event of a conflict between the text of this document and the reference cited herein (except for related associated detail specifications, specification sheets, or MS standards), 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

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.2) in accordance with 4.2

3.1.1 Materials. Materials shall conform to applicable specifications as specified herein. Materials which are not covered by applicable specifications or which are not specifically described herein shall be of the best quality, of the lightest practicable weight, and suitable for the purpose intended.

3.1.2 Metals. All metals used in the construction of push-pull controls shall be a corrosion-resisting type, or shall be suitably protected to resist corrosion during the normal service life. The use of dissimilar metals, especially brass, copper, or steel, in contact with aluminum or aluminum alloy shall be avoided wherever practicable.

3.1.3 Selection of materials. Specifications and standards for all materials, parts, and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-970, except as provided in the following paragraph.

3.1.3.1 JAN and J Marking. The United States Government has adopted, and is exercising legitimate control over the certification marks "JAN" and "J", respectively, to indicate that items so marked or identified are manufactured to, and meet all the requirements of military specifications. Accordingly, items acquired to, and meeting all of the criteria specified herein and in applicable specifications shall bear the certification mark "JAN" except that items too small to bear the certification mark "JAN" shall bear the letter "J". The "JAN" or "J" shall be placed immediately before the part number except that if such location would place a hardship on the manufacturer in connection with such marking, the "JAN" or "J" may be located on the first line above or below the part number. Items furnished under contracts or orders which either permit or require deviation from the conditions or requirements specified herein or in applicable specifications shall not bear "JAN" or "J". In the event an item fails to meet the requirements of this specification and the applicable specification sheets or associated detail specifications, the manufacturer shall remove the "JAN" or the "J" from the sample tested and also from all items represented by the sample. The "JAN" or "J" certification mark shall not be used on products acquired to contractor drawings or specifications. The United States Government has obtained Certificate of Registration Number 504, 860 for the certification mark "JAN".

3.2 Design and construction. Push-pull controls shall be of the types and grades specified in paragraph 1.2, and shall be capable of transmitting tension and compression forces applied to either end of the moveable element. The moveable element may be either removable or permanently assembled. If removable, it shall be capable of being quickly and easily removed, without the use of special tools, for the purpose of inspection and relubrication.

3.2.1 Shape. Control units shall be shaped or formed as specified on the installation drawing or template furnished by the procuring activity.

3.2.2 Tubular casing. The tubular casing shall be of the types specified in paragraph 1.2. It shall be of metallic construction and may be encased by a suitable nonmetallic covering. The tubing casing may consist of detachable sections for ease in shipping.

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3.2.2.1 Seals. Seals shall be provided to keep the control unit moisture, dust, and lubrication-tight where necessary.

3.2.2.2 Ends. Unless otherwise specified, the tubular casing shall have self-aligning ends capable of any angular displacement of at least 10 degrees from the normal position in any plane.

3.2.3 Moveable element.

3.2.3.1 Terminal ends. The ends of the moveable element shall be threaded with an external thread, .250-28 UNF-3A, in accordance with MIL-S-7742, to accommodate the MS27975-3 or 4 rod end clevis, the AN665-34R terminal or other internal threaded antifriction or plain bearing self-aligning rod ends.

3.2.3.2 Stroke. The length of stroke of the moveable element shall be as specified by the procuring activity.

3.2.4 Weight. The weight of the push-pull control elements shall not exceed the weights shown in table I.

TABLE I
Weight of Controls

Item	Pounds(max)
Control per foot of length with rigid casing	0.30
End fittings for rigid casing (4-inch stroke)	0.47 (total-both ends)
Control per foot of length with flexible casing	0.58
End fittings for flexible casing (4-inch stroke)	0.62 (total - both ends)

3.2.5 Backlash. When the design of the control is such that lost motion can develop within the moveable member during normal service, a positive adjustment shall be provided in the moveable member capable of absorbing this lost motion.

3.2.6 Finish.

3.2.6.1 Aluminum-alloy parts. Exposed aluminum-alloy parts shall be anodized in accordance with MIL-A-8625.

3.2.6.2 Steel parts. All exposed steel parts, unless fabricated of corrosion resisting steel, shall be coated with ion vapor deposited aluminum in accordance with MIL-C-83488, or zinc plated in accordance with ASTM B633.

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3.3 Identification of product.

3.3.1 Each control shall be permanently and legibly marked with the following information in accordance with MIL-STD-130:

Design Activities FMSC No. _____
 Part Number _____
 Manufacturer's FMSC No. _____
 Date _____ Qtr _____ Year _____
 Contract No. _____

Additional information may be specified by the contracting activity.

3.3.1.1 Manufacturer's part number. The part number shall be the same as the number assigned to the manufacturer's assembly drawing, plus the applicable dash number if the drawing is tabulated. The part number shall distinctly identify the control from all similar controls which are produced against a basic design but varying in length, distance of travel, markings, etc.

3.4. Performance.

3.4.1 General. The control unit as shown in FIGURE 1 shall meet the performance values specified in TABLE II for:

- (a) Backlash
- (b) Operating Force with no Load
- (c) Operating Force under Tension and Compression Loads
- (d) Break Away Force

3.4.2 Endurance. After 25,000 reversals of motion, the operating force, the friction under tension, and compression loads shall not exceed the value shown in TABLE II at room temperature. The change in backlash as a result of this test shall not exceed 0.005 inch.

3.4.3 Lubrication. For all controls except those permanently assembled during manufacture, lubrication shall be in accordance with MIL-STD-838. The lubricant shall be selected from MIL-HBK-275, and shall be of such quality that the control shall meet the requirements of TABLE II. The control shall show no leakage of lubricant after operation at a temperature of $88^{\circ} \pm 2^{\circ}\text{C}$ ($190 \pm 4^{\circ}\text{F}$) for a period of 30 minutes, and shall operate satisfactorily while at this temperature.

3.4.4 Corrosion resistance. After being subjected to salt fog for 50 hours, the operating force of the controls shall not exceed 50-percent (max) increase over the original operating force observed during the room temperature operating force of the particular control.

3.5 Workmanship. The push-pull control, including all parts shall be constructed and finished in a thoroughly workmanlike manner. Particular attention shall be given fits, retention of lubricant, and freedom of parts from burrs and sharp edges.

3.6 Approvals for production. The controls furnished under this specification shall be of a design, model, or type which has satisfactorily passed the first article tests.

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4.2 Classification of inspections. The inspection and inspections of push-pull controls shall be classified as follows:

- (a) First article inspection. (See 4.2).
- (b) Quality conformance inspection. (See 4.3).

4.3 Inspection conditions. Unless otherwise specified, all inspection shall be performed in accordance with the test conditions specified in this specification.

4.3.1 Room temperature. Where room temperature is specified, it shall be from 20° to 29°C (68° to 85° F).

4.3.2 Backlash adjustment. No adjustment of the controls shall be permitted during the entire test program.

4.4 First article inspection.

4.4.1 First article test sample. This test sample shall consist of a control of the type and grade for which approval is desired. Two samples will be required if the control is permanently assembled type. Samples shall be accompanied by two complete sets of detail and assembly drawings and a complete test report showing the following information:

- (1) Report on all examinations and tests, graphically presented when possible. In addition, the report shall indicate conformance to all inspection and performance requirements of this specification referring specifically to paragraph numbers of this specification.
- (2) Copies of test log sheets
- (3) Diagrams and descriptions of test set-ups.
- (4) Photographs when available.

Samples shall be identified in accordance with paragraph 3.3.1 and any additional identification required by the contracting activity.

4.4.2 Tests. The first article tests of push-pull controls shall consist of all the tests of this specification in the following order, as described under Test Methods (see paragraph 4.5)

- (a) Examination of Product
- (b) Backlash
- (c) Operating Force with No Lead
- (d) Operating Force under Tension and Compression Loads
- (e) Humidity (conduct prior to low temperature test)
- (f) Lubrication (conduct following high temperature (70 ± 1 C) test)
- (g) Break-Away Force
- (h) Endurance
- (i) Corrosion-Resistance

4.5 Quality conformance inspection. The quality conformance inspections tests shall consist of all sampling tests described in paragraph 4.3.1.

4.5.1 Quality conformance inspection sampling. A random sample shall be taken according to MIL-STD-105 using inspection level IV and AQL Class 1.2 to 2.2, and the rejection provisions contained therein. Each push-pull

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control in the sample shall be submitted to Examination of Product, as described under Test Methods. If the sample fails this test, the entire lot shall be examined in detail by the contractor, defectives discarded, and the lot resubmitted to the Government Inspector for sampling according to the above procedure, but using inspection level V and AQL Class 0.65 to 1.2. A lot shall consist of all controls of the same type and size submitted for inspection at the same time and place. If this second sample fails to pass, the lot shall be rejected.

4.5.1.1 Inspector. In addition, controls may be subjected to any of the other tests specified herein which the Inspector considers necessary to determine conformance with the requirements of this specification.

4.5.2 Rejection and retest. Failure of any sample control to conform to any one of the tests shall be cause for the rejection of the lot represented. Controls which have been rejected may be reworded or replaced to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the Inspector. Controls rejected after retest shall not be resubmitted without the specific approval of the procuring activity.

4.6 Examination.

4.6.1 Examination of product. The controls shall be carefully examined to determine conformance to the requirements of this specification not otherwise covered by tests and to the design activities drawings and specifications.

4.6.2 Backlash. Backlash shall be determined by securing the output end of the control unit and subjecting the input end to tension and compression loading of 5 pounds. The total travel of the input end shall be recorded as backlash and shall not exceed the limits specified in TABLE II.

4.6.3 Operating force with no load. The operating force required to push or pull the controls shall be measured by any suitable, accurate means and shall not exceed the limits specified in TABLE II.

4.6.4 Operating force under tension and compression loads. The operating force shall be measured by any suitable, accurate means and shall not exceed the limits specified in TABLE II. The specified loads shall be applied to the control by any suitable means. The operating force with the control in tension shall be measured by pulling the control. The friction with the control in compression shall be measured by pushing the control.

4.6.5 Humidity. The equipment shall be placed in the test chamber, and the temperature and relative humidity raised to $70 \pm 2^\circ\text{C}$ ($158 \pm 3.6^\circ\text{F}$) and 95 ± 5 percent, respectively, and maintained at such for a period of 6 hours. At the end of the 6-hour period, the heat shall be shut off. During the following 16-hour period, the temperature must drop to 38°C (100.4°F), or less. At the end of the 16-hour period, heat shall again be applied for an additional 2-hour period to stabilize to $70 \pm 2^\circ\text{C}$ ($158 \pm 3.6^\circ\text{F}$). This cycle shall be repeated five times for a total of 120 hours. At the end of the 120-hour period, the control shall meet the requirements of the low temperature provisions of TABLE II.

4.6.5.1 Test chamber. The test chamber shall be capable of maintaining an internal temperature of $70 \pm 2^\circ\text{C}$ ($158 \pm 3.6^\circ\text{F}$) and an internal relative humidity of 95 ± 5 percent. The test chamber shall be capable of being sealed so as to retain the total moisture content in the test space. The heat loss from the chamber shall be sufficient to reduce the internal temperature from the above specified operating temperature to not more than 38°C (100.4°F) within a period of 16 hours from the time of removal of the source of heat. Distilled or demineralized water shall be used to obtain the required humidity.

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4.6.6 Lubrication. After attaining the specified temperature, the control shall be operated through its full stroke at the rate of 20 cycles per minute for the specified time. The control shall then be examined for any sign of lubricant leakage.

4.6.7 Break-away force. The break-away force shall be measured at the end of the low temperature soaking period specified, and shall be the maximum force measured to pull the controls on the first movement after the soaking period.

4.6.8 Endurance. The test shall be conducted at room temperature. The reversals shall be applied at the rate of 20 cycles per minute with 4-inch stroke until the specified number of reversals have been completed. The loading shall be such that it imposes a 5-pound compression load on the assembly during the push stroke and a 5-pound tension load on the assembly during the pull stroke.

4.6.9 Corrosion resistance. The control shall be operated through its full stroke at half-hour intervals for the specified time during the Salt-fog treatment in accordance with ASTM B117-90. Following this test, the controls shall be subjected to the tests headed Backlash, Operating Force, and Friction Under Tension and Compression Loads, at room temperature. The controls shall be disassembled and examined for evidence of wear or distortion. The casing shall be sectioned the bends and examined for decrease in thickness.

5. PACKAGING

5.1 Preservation. Preservation shall be level A, C or industrial as specified. (see 6.2)

5.1.1 Level A. Unless otherwise specified by the procuring activity, each oil cooler shall be individually preserved and packaged according to MIL-STD-2073-1. The method of preservation shall conform to method 1C-1 of MIL-P-116.

5.1.2 Level C. Each oil cooler shall be preserved and packaged in a manner which will afford adequate protection against corrosion, deterioration, and physical damage during shipments from supply source to the first receiving activity for immediate use.

5.1.3 Industrial. The industrial preservation of valve shall be in accordance with ASTM D3951.

5.2 Packing. Packing shall be level A, B and C, as specified (see 6.2)

5.2.1 Level(s) A, B, or C. The level of packing shall be specified by the procuring activity. The level of packing shall be accomplished in accordance with the requirements outlined in MIL-STD-2073-1.

5.2.2 Industrial. The packaged oil cooler shall be packed in accordance with ASTM D3951.

5.3 Marking. In addition to any special marking required by the contract or order, marking shall be in accordance with MIL-STD-129.

5.4 Inspection and test. Test of methods of preservation and packaging shall be accomplished in accordance with section 4 of MIL-P-116 to insure compliance with section 5 of this specifications.

6. NOTES

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

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6.1 Intended use. Push-pull controls covered by this specification are intended for use in aircraft for remote operation of equipment.

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) Drawing or template for the desired control installation showing length of control, radii and angle of bends, off-sets, length of stroke and number of self-aligning ends.
- (d) Type and grade of push-pull control required.
- (e) Level of packing that is required. (See section 5)
- (f) Additional information. (See 3.3.1 and 4.2.1)

6.2.1 Contract data. Data Item Description DI-T-3721A and data specified in paragraph 4.2.1 will be required. These Data Item Description numbers and data specified in paragraph 4.2.1 will be listed on DD Form 1423 incorporated into the contract for delivery of data.

6.3 Definitions.

6.3.1 Backlash. The term backlash as used in this specification shall be interpreted as follows: the motion lost within the assembly as a result of the clearance between the moveable member and the casing and to include the wear of the individual elements of the moveable member.

6.3.2 Grade A controls. Grade A controls are push-pull controls made of specially selected components which are individually tested by the contractor to insure that backlash and operating forces are reduced to the minimum values practicable.

6.3.3 Grade B controls. Grade B controls are push-pull controls made to high-quality commercial standards for applications not requiring Grade A controls.

6.4 Subject term (key word) listing.

Flight Control
Throttle Quadrant

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes

Custodians:
AIR FORCE - 99
Army - AV
Navy - AS

Preparing activity:
Air Force - 71

Project number:
2995-0177

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.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

1. DOCUMENT NUMBER <i>MIL-C-7958B</i>		2. DOCUMENT DATE (YYMMDD)	
I RECOMMEND A CHANGE:			
3. DOCUMENT TITLE <i>Controls, Push-Pull, Flexible And Rigid</i>			
4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.) <i>Revision</i>			
5. REASON FOR RECOMMENDATION <i>update</i>			
6. SUBMITTER			
a. NAME (Last, First, Middle Initial) <i>WINCHELL, THERON J</i>		b. ORGANIZATION <i>AFMC CASC/LBCA</i>	
c. ADDRESS (Include Zip Code) <i>74 N WASHINGTON AVE BATTLE CREEK, MI 49017-3094</i>		d. TELEPHONE (Include Area Code) (1) Commercial <i>616 961-5438</i> (2) AUTOVON <i>932-5458</i> (If applicable)	7. DATE SUBMITTED (YYMMDD) <i>99-08-24</i>
8. PREPARING ACTIVITY			
a. NAME <i>OC-AHC/TICLA</i>		b. TELEPHONE (Include Area Code) (*) Commercial <i>(405) 736-5960</i> (2) AUTOVON <i>336-5960</i>	
c. ADDRESS (Include Zip Code) <i>3001 Staff Drive TAFB, OK 73145-5990</i>		IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	