

INCH-POUND

MIL-DTL-25561B (USAF)

17 March 1995

SUPERSEDING

MIL-G-25561A (3) (USAF)

14 October 1983

DETAIL SPECIFICATION

GRIP ASSEMBLY, CONTROLLER, AIRCRAFT, TYPE MC-2

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

1. SCOPE

1.1 Scope. This specification covers the requirements for one type of aircraft controller grip assembly, designated Type MC-2.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are needed to meet the requirements specified in sections 3, 4, and 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, and 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, and standards. The following specifications and standards 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 for Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-C-5015	Connectors, Electrical, Circular Threaded, AN Type, General Specification for
MIL-W-5086	Wire, Electric, Polyvinyl Chloride Insulated, Copper or Copper Alloy
MIL-W-5088	Wiring, Aerospace Vehicle
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series: General Specification for
MIL-S-8805/3	Switches, Push, 10 Amperes or Low Level, Dusttight, General Specification for

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: the Resources and Logistics Services Division, SA-ALC/TILDD, Bldg 171, Post C-12, 485 Quentin Roosevelt Rd., Kelly AFB, TX 78241-6425 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 1680

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

MIL-S-9419	Switch, Toggle, Momentary, Four-Position on, Center- Off
MIL-S-9487	Switch, Trigger, Single Pole, Two Stage, Momentary

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking for Shipment and Storage (Part 1 of 4 Parts)
MIL-STD-130	Identification Marking Of US Military Property
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MS27708	Switch, Toggle, Four Position on, Center off

(Unless otherwise indicated, copies of the federal and military specifications and standards are available from the Defense Printing Service, Detachment Office, 700 Robbins Ave., Bldg 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS

AIR FORCE

53A4814	Ring, Coupling, Control Stick
53B4815	Fitting, Adapter, Control Stick
53B4816	Shell, Connector, Control Stick
56B3004	Trigger, MC-2 Grip Assembly
56C3002	Grip Assembly, Controller, Aircraft, Type MC-2, Assembly of
56C3005	Wiring Diagram, MC-2 Grip Assembly, Schematic
56D3003	Grip - External Shape, MC-2 Grip Assembly

(Application for copies of drawings required by the contractor in connection with specific acquisition functions should be obtained from the contracting activity or as specified in the contract.)

2.3 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications, specification sheets, or MS standards), the text of this documents 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 in accordance with 4.4.

3.2 Components. The grip assembly shall consist of an upper and a lower half, each of which can be identified separately (see 6.2). The upper half shall be a molded grip which shall house a trim switch, trigger switch, three separately located push-button switches, the male portion of the electrical connector, and associated wiring. The lower half of the grip assembly shall house the female portion of the electrical connector.

3.3 Design and construction. The grip assembly shall be designed in accordance with Drawing 56C3002 and shall be so constructed as to withstand the strains, jars, and vibration incident to shipment, storage and installation.

3.3.1 Service life. The grip assembly shall be designed for a minimum of 1,000 flight hours without failure.

3.3.2 Maintenance. The grip assembly shall be so designed and constructed as to permit ease of maintenance at field level, including replacement of switches, wiring, and associated equipment without the use of special tools and techniques.

3.3.3 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 MIL-STD-100 shall govern the manufacturer's part numbers and changes thereto.

3.4 Performance. The grip assembly shall operate as specified herein after subjection to the following conditions.

- a. Temperature - temperatures ranging from -65° to 160°F (-54° to 71°C)
- b. Humidity - relative humidity of 90%
- c. Altitude - Pressures ranging from 30 inches Hg down to 2.11 inches Hg (approximately 60,000-foot altitude)
- d. Salt fog - exposure to salt sea atmosphere
- e. Vibration - vibration incident to service use
- f. Fungus - Fungus growth as encountered in tropical climates
- g. Dust - Dust particles as encountered in desert areas
- h. Shock forces as encountered in service.

3.4.1 Strength. The grip assembly shall withstand the following loads at room temperature (see 4.5.6):

- a. 300 pounds forward and aft through the reference point
- b. 150 pounds both right and left through the reference point
- c. 100 pounds vertically through the reference point
- d. Torsional force of 300 inch-pounds about the reference point.

3.4.2 Temperature shock. The grip assembly shall operate as specified herein after being subjected to a temperature of -65°F (-54°C) for 8 hours, immediately subjected to a temperature of 160°F (+70°C) for 8 hours, and again subjected to -65°F (-54°C) for a period of 8 hours (see 4.5.15).

3.5 Grip. The grip shall be in accordance with Drawing 56D3003 and shall be a plastic molding of one or more pieces with provisions for retaining the upper half of the connector. The grip material shall be black, shall have a dull nonreflecting finish, shall be of an insulating, nonbrittle, nonhygroscopic composition, shall have low-heat conductivity, and a natural resistance to environmental conditions (such as extreme temperatures, humidity, and fungus). The internal cavity, or cavities, shall be suitable for retaining the switches, trigger, and associated wiring. Grip knurling shall be course diamond suitable for the purpose.

3.6 Trim switch. The trim switch shall be designed in accordance with MIL-S-9419 (see 6.2) and MS27708 and shall be located within the grip as shown on Drawing 56C3002. The trim switch shall be mechanically retained within the grip housing, shall be readily placeable for maintenance purposes, and shall have a polarizing plug which shall so locate it that upward actuation of the trim switch knob will energize terminal P of the switch and electrical connector.

3.7 Push button switches. The three push button switches shall be in accordance with MIL-S-8805/3. They shall be firmly retained within the grip housing, either by press fit or mechanical means, and shall be readily removable and replaceable without damage to the housing or switches.

3.8 Trigger switch. The trigger switch shall meet the component performance requirements of MIL-S-9487. The size, shape, and mounting provisions are optional; however, adequate room shall be provided within the grip to pass the necessary wiring around the trigger switch. The switch shall be firmly mounted and shall be readily removable and replaceable. The switch actuating force and actuating travel shall be as follows:

a. Actuating force: The force required to engage the first stage shall be 2.25 ± 0.5 pounds. Between the first and second stages, a force of 7.5 ± 0.5 pounds shall be required to move the trigger through the detent to give a definite indication to the pilot that the second stage is being actuated. After passing through the detent, the trigger force shall drop to 6_{-2}^{+0} pounds at which time the second stage shall make contact (see 4.5.4).

b. Actuating travel: The actuating travel, measured at the bottom of the trigger, shall be 0.219 ± 0.031 inch for each stage. The first-stage contact shall not close with a movement of less than 0.125 inch. The detent shall provide a distinct force which must be overcome. The second stage contact shall close between the detent and point of maximum travel and shall have a minimum overtravel of 0.031 inch. The first stage shall remain actuated when the second stage is closed (see 4.5.5).

3.9 Trigger. The configuration of the trigger front surface shall be in accordance with Drawing 56B3004. The rear surface shall mate properly with the trigger switch actuator. The trigger shall be of such design as to provide for trigger force and trigger travel as specified (see 3.9).

3.10 Electrical connector. An electrical connector in accordance with MIL-C-5015 having MS electrical pin insert arrangement 20-29 in accordance with Drawing 56C3002 shall be located at the base of the grip assembly to provide a structural connection between the control stick and the grip assembly and to provide the necessary pin-type electrical disconnects.

3.10.1 Upper half. The upper half of the connector shell shall be in accordance with Drawing 53B4815 and shall be positively retained in the bottom of the grip assembly. The polarizing key which locates the connector receptacle shall be located at the front of the grip assembly as shown on Drawing 56C3002 so that the polarizing key within the connector will also be located at the front of the grip assembly.

3.10.2 Lower half. The lower half of the connector shell shall be in accordance with Drawing 53B4816.

3.10.3 Coupling ring. The coupling ring which connects the upper and lower halves of the connector shell shall be in accordance with 53A4814.

3.11 Electrical wiring. The electrical wiring circuit shall be in accordance with Drawing 56C3005. Insofar as practicable, internal wiring shall be in accordance with MIL-W-5086 and MIL-W-5088; however, special wiring may be used if required for size and flexibility provided it is suitable for the intended use and is resistant to all environmental conditions specified herein. All connections shall be soldered and shall be insulated to prevent short circuits; however, the wire to pin M is a ground wire and need not be insulated from ground.

3.12 Screw threads. Unless otherwise specified screw threads shall be in accordance with MIL-S-7742.

3.13 **Identification of product.** Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

3.14 **Workmanship.** The grip assembly shall be constructed and finished in a thoroughly workmanlike manner. Particular attention shall be given to neatness and thoroughness of soldering, wiring, marking of parts and assemblies, plating, painting, riveting, machine screw assembly, welding, brasing, and freedom of parts from burrs and sharp edges.

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

4. VERIFICATION

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

- a. First article inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.2 **Inspection conditions.**

4.2.1 **Standard atmosphere conditions.** Wherever the pressure and temperature existing at the time of the test are not specified definitely, it is understood that the test is to be made at atmospheric pressure (approximately 29.92 inches Hg) and at room temperature 77°F (approximately 25°C). When tests are made with atmospheric pressure or room temperature differing materially from the above values, proper allowance shall be made for the difference from the specified condition.

4.2.2 **Test fixture.** The test fixture shall be so constructed that it will subject the grip assembly to simulated aircraft operating conditions during testing as specified herein.

4.3 **First article.** The first article inspection shall consist of all the tests specified (see 4.5).

4.3.1 **First article samples.** Unless otherwise specified (see 6.2.1), the first article samples shall consist of 5 grip assemblies representative of the production equipment. The samples shall be identified with the manufacturer's part number and such other information as required by the procuring activity.

4.3.2 **Order of tests.** Five of the samples shall be subjected to the first article inspection in the order specified in Table I.

4.4 **Quality conformance.** Quality conformance inspection shall consist of:

- a. Individual tests (see 4.4.1).
- b. Sampling tests(see 4.4.2).

4.4.1 **Individual tests.** Each grip assembly shall be subjected to the following examination and tests:

- a. Examination of product (see 4.5.1).
- b. Operational check (see 4.5.2).
- c. Insulation (see 4.5.3).

4.4.2 Sampling tests.

4.4.2.1 Sampling plan A. One grip assembly selected at random from every 400 or less produced on the contract or order shall be subjected to the following tests as specified:

- a. Individual tests (see 4.4.1).
- b. Trigger actuating force (see 4.5.4).
- c. Trigger actuating travel (see 4.5.5).
- d. Strength test (see 4.5.6).

4.4.2.2 Sampling plan B. Unless otherwise specified, the first 5 items of the contract or order shall be subjected to the following tests as specified in the sequence shown in Table I.

- a. Sampling plan A tests (see 4.4.2.1).
- b. Vibration (see 4.5.7).
- c. Shock (see 4.5.8).
- d. Salt fog (see 4.5.9).
- e. Altitude (see 4.5.10).
- f. Humidity (4.5.11).
- g. Dust (see 4.5.12).
- h. High temperature (see 4.5.13).
- i. Low temperature (see 4.5.14).
- j. Temperature shock (see 4.5.15).
- k. Fungus (see 4.5.16).

4.4.2.3 Rejection and retest. When one item selected from a production run fails to meet the specification, no items still on hand or later produced shall be accepted until the extent and cause of failure are determined. After corrections have been made, all necessary tests shall be repeated.

4.4.2.3.1 Individual tests may continue. For operational and production reasons, individual tests may be continued pending the investigation of a sampling test failure. But final acceptance of items on hand or later produced shall not be made until it is determined that items meet all the requirements of the specification.

4.4.3 Defects in items already accepted. The investigation of a test failure could indicate that defects may exist in items already accepted. If so, the contractor shall fully advise the procuring activity of all defects likely to be found and methods of correcting them.

4.5 Test methods.

4.5.1 Examination of product. The grip assembly shall be examined to determine compliance with the requirements specified herein with respect to design and construction, material, mounting provisions, marking, workmanship, and conformance to the detail drawings.

4.5.2 Operational check. The grip assembly shall be connected to the test fixture (see 4.2.2) with each switch electrically connected to its rated voltage and current supply. Each switch shall then be operated to ensure correct and secure connections.

4.5.3 Insulation. Each switch in the grip assembly shall be subjected to a standard commercial frequency having a potential of twice the maximum rated voltage plus a 1,000V rms commercial frequency as follows: For first article testing, the length of time shall be 1 minute and for acceptance testing, the length of time shall be 1 second.

a. Between line and load terminals for each switch with the switches in the OFF position

b. Between each switch terminal and parts normally grounded (such as frame, shell, and mounting plate) and tested for all pole closures of each switch. Current flow above 1 milliampere caused by the test voltage shall be an indication of failure. Creepage distances between current carrying parts and portions of the switch other than insulating materials, as checked by measurement, shall be not less than 0.062 inch.

4.5.4 Trigger actuating force. The trigger actuating force shall be measured using a jig with a dead weight which will provide actuating force parallel to the direction of the trigger travel at the tip. The trigger actuating force shall be as specified (see 3.8).

4.5.5 Trigger actuating travel. The trigger actuating travel shall be measured and the travel shall be as specified (see 3.8).

4.5.6 Strength test. The grip assembly shall be mounted in the test fixture by the lower half of the connector and subjected to the loads specified (see 3.4.1) at room temperature. The load applications need not be point applications but may be spread over a small area centered about the reference point. The torsional load may be distributed around the grip near the reference point.

4.5.7 Vibration. The vibration test shall be conducted in accordance with MIL-STD-810, method 514.4, category 5. Use vibration spectrum of figure 514.4-8 with $w_0 = 0.01 \text{ g}^2/\text{Hz}$, var = 80Hz. Vibration cycling shall be conducted at room temperature. Suitable indicating devices shall be connected to the electrical receptacle while the grip assembly is under vibration to determine that the switch contacts do not close. Test duration shall be 1.5 hours. Vibrate along three mutually perpendicular axis, 0.5 hour per axis. At the conclusion of this test, the tests specified (see 4.5.1 thru 4.5.3) shall be conducted to determine that all switches, screws and other parts are firmly in place and that no failure has occurred.

4.5.8 Shock. The shock test shall be conducted in accordance with MIL-STD-810, method 516.4, procedure II. Use Flight Vehicle Equipment category with maximum peak value of 100g's. At the conclusion of this test, the grip assembly shall be subjected to the tests specified (see 4.5.1 and 4.5.2). There shall be no failure nor loosening of parts. The shocks shall be applied as follows:

a. Vertically - two shocks in each direction

b. Parallel to the major horizontal axis - two shocks in each direction

c. Parallel to the minor horizontal axis - two shocks in each direction

4.5.9 **Salt fog.** The salt fog test shall be conducted in accordance with MIL-STD-810, method 509.3, for a period of 100 hours. At the conclusion of this test, the grip assembly shall be subjected to the tests specified (see 4.5.2). No failure shall occur.

4.5.10 **Altitude.** The altitude test shall be conducted in accordance with MIL-STD-810, method 500.3. The grip assembly shall be subjected to the test specified (see 4.5.3) at a pressure altitude of approximately 60,000 feet (2.1 inches Hg) and a reduced potential of 500 V. It shall then be examined and there shall be no mechanical or electrical failure.

4.5.11 **Humidity.** The humidity test shall be conducted in accordance with MIL-STD-810, Method 507.3. No deterioration shall result. At the conclusion of the humidity test, and prior to drying operations, the grip assembly shall be tested as specified (see 4.5.1 and 4.5.2). After drying operations, the grip assembly shall be tested as specified (see 4.5.3) within 1 hour after completion of the humidity test.

4.5.12 **Dust.** The grip assembly shall be subjected to a dust test in accordance with MIL-STD-810, method 510.3, Procedure I, blowing dust (small particle) only, after which it shall meet the test specified (see 4.5.2).

4.5.13 **High temperature.** The high temperature test shall be conducted in accordance with MIL-STD-810, method 501.3, procedure I. Subject the grip to a temperature of 160°F (71°C) for a period of not less than 48 hours while insuring that the relative humidity is not in excess of 15%. At the completion of testing, the grip assembly shall be removed from the 160°F (71°C) test chamber and immediately subjected to the strength test. The strength test shall be completed within 10 minutes after the grip assembly is removed from the 160°F (71°C) temperature.

4.5.14 **Low temperature.** The low temperature test shall be conducted in accordance with MIL-STD-810, method 502.3. The grip assembly shall be subjected to a temperature of -65°F (-54°C) for 72 hours after which it shall be removed from the low temperature test chamber and immediately subjected to the strength test. The strength test shall be completed within 10 minutes after the grip assembly is removed from the -65°F (-54°C) temperature.

4.5.15 **Temperature shock.** The temperature shock test shall be conducted in accordance with MIL-STD-810, method 503.3. The grip assembly shall be subjected to the temperatures and time periods specified (see 3.4.2). At the conclusion of this test, the grip assembly shall meet the tests specified (see 4.5.2 and 4.5.6).

4.5.16 **Fungus.** The fungus test shall be conducted in accordance with MIL-STD-810, method 508.4. Test duration shall be not less than 42 days. At the conclusion of this test, the grip assembly shall meet the tests specified (see 4.5.2 and 4.5.3).

5. PACKAGING

5.1 **Packaging.** Packaging requirements shall be as specified in the contract or order (see 6.2).

5.2 **Marking.** Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-STD-129.

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 grip assembly covered by this specification is intended for mounting on the control stick of aircraft to provide a handgrip for the pilot and to contain the switches necessary for operation of subsystems within the aircraft.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 2.2.2 and 2.3).
- c. That the current issue of MIL-S-9419(USAF) be used in conjunction with this specification.
- d. When first article is required (see 3.1).
- e. When sampling plan B tests will not be conducted.
- f. When only the upper half of the grip assembly is required (see 3.2).

6.2.1 Test samples. When specified (see 4.3.1), a sixth test sample will be subjected to specified tests required by the procuring activity to determine compliance with the requirements specified herein.

6.3 Subject term (key word) listing.

Altitude
Dust
Fungus
Humidity
Insulation
Strength
Temperature
Trigger
Vibration

6.4 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.

TABLE I. Order of testing.

Tests	Test Sequence				
	Sample Numbers				
	1	2	3	4	5
Examination of product	2	1	1	1	1
Operational check	2(8)	2(5)(7)	2(6)	2(5)(8)	2(8)
Insulation	3(9)	3(8)(11)	3	3	3(9)
Trigger actuating force	4	9			
Trigger actuating travel	5				
Strength	6			7	5(7)
Vibration		6			
Shock		4			
Salt fog			5		
Altitude			4		
Humidity		10			
Dust				4	
High temperature					4
Low temperature					6
Temperature shock				6	
Fungus	7				

NOTE: Numbers in parenthesis indicate repeat tests to be conducted in specified sequence.

Custodian:
Air Force - 99

Preparing activity:
Air Force - 82

Agent:
Air Force - 99

(Project No. 1680-F615)