MIL-C-6781B(ASG)
13 September 1960

Superseding
MIL-C-6781A(ASG)
3 February 1958

MILITARY SPECIFICATION

CONTROL PANEL: AIRCRAFT EQUIPMENT, RACK OR CONSOLE MOUNTED

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

1. SCOPE

1.1 Scope — This specification covers general requirements for the design and construction of two types of control panels for use with airborne equipment, and is intended primarily for mounting on a rack or control console in the pilot's cockpit.

1.2 Classification — Control panels shall be of the following types:

Type I — Standard dimension control panel
Type II — Nonstandard control panel

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Military

MIL-C-5015	Connectors, Electric, "AN" Type
MIL-W-5088	Wiring, Aircraft, Installation of
MIL-E-5272	Environmental Testing, Aeronautical and Associated Equipment, General Specification for
MIL-E-5400	Electronic Equipment, Aircraft, General Specification for
MIL-E-5556	Enamel, Camouflage, Quick Drying
MIL-E-5557	Enamel; Heat-Resisting, Glyceryl-Phthalate, Black
MIL-P-7788	Plate, Plastic, Lighting
MIL-P-8585	Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity
MIL-P-17555	Preparation for Delivery of Electronic Equipment: Miscellaneous Electrical Equipment (Except Rotating Electrical Equipment) and Associated Repair Parts
MIL-C-18012	Control Configuration and Markings; (for Plastic Lighting Plates, Control Panels and Placards)
MIL-K-25049	Knobs, Control, Equipment, Aircraft
MIL-F-25173	Fastener, Control Panel, Aircraft Equipment
MIL-C-26482	Connectors, Electric, Circular, Miniature, Quick Disconnect

FSC 1680

STANDARDS

Military

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking for U.S. Military Property
MS25010	Light, Panel, Plastic Plate Lighting
MS25176	Shaft, Control Knob
MS25212	Control Panel, Console Type, Aircraft Equipment, Basic Dimensions
MS25213	Control Panel, Aircraft Equipment, Typical Installations

Air Force-Navy Aeronautical

AN3502	Light Assembly-Control Panel, Plastic Lighting Plate

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

3. REQUIREMENTS

3.1 General specification — The requirements of Specification MIL-E-5400 apply as requirements of this specification, except as otherwise specified herein.

3.2 Design —

3.2.1 Type I control panel — Type I control panels shall be designed in accordance with Standard MS25212 so that installation can be made in accordance with Standard MS25213. The complete control panel shall consist of a plastic lighting plate, built-in red lighting, mounting plate, the necessary controls, components, and associated internal wiring, electrical receptacles, and a cover box. The design shall be such that several control panels can be mounted immediately adjacent to each other on a unilevel surface to present a console appearance and permit standardization of arrangement.

3.2.2 Type II control panel — Type II control panels are designed to be installed in specific aircraft where space precludes installation of the type I control panel or for use in equipment which cannot emply the type I control panel. Type II control panels shall be similar to type I control panels, except for width, length, panel depth, ease of removal, fastening provisions, cover box, and adjacent installation. Where practicable, captive fasteners as specified herein shall be used.

3.2.3 Controls — Each control panel shall incorporate a careful arrangement of the individual controls. All controls not required during a flight mission shall be omitted from the front face of the control panel. Test points and controls required for general maintenance shall be separated from the in-flight controls and made available on the control panel (but not on the front of the panel).

3.3 Construction —

3.3.1 Ease of removal — Each control panel shall be so constructed as to be easily and quickly removable from its mounting position.

3.3.2 Interconnecting cabling — Each control panel shall operate satisfactorily, using open wires for external interconnecting wiring in accordance with Specification MIL-W-5088. The use of shielded wire shall be held to the minimum necessary to comply with the applicable interference control requirements.

3.3.3 Lighting —

3.3.4 Plastic plate — The plastic lighting plate, plus the method of fastening it to the mounting plate, shall be in accordance with Specification MIL-P-7788. Where possible, all components shall be removable without removing the plastic lighting plate.

3.3.5 Light assembly — The light assembly shall be in accordance with Standard MS25010. Transparent red caps shall be used only with approval of the procuring activity. Where components behind the mounting plate preclude installation of the MS25010 light, the light assembly in accordance with Standard AN3502 may be employed.

3.3.6 Panel lighting — Panel lighting shall be integral with each panel in accordance with Specification MIL-P-7788. The power to the illuminating lamps shall be controlled by an external switch with the brilliance control on a separate lighting control panel. No lighting controls shall be mounted on individual equipment control panels. The ON-OFF power switch for the equipment controlled by the individual control panel shall not control the illuminating lamp circuit. One side of the light assemblies circuit shall be connected to the power system through a single connection. The other side of the light assemblies circuit shall be grounded to the mounting plate of the control panel and to a connection. The panel design shall permit the use of either alternating current (AC) or direct current (DC) power for the lighting circuit.

3.3 Indicator lights — Indicator lights shall not be included on the control panel, except when specifically approved by the procuring activity. The necessity for the use of any proposed indicator light and the color of such lights shall be determined by the procuring activity after full consideration of each particular case in which use of an indicator light is proposed.

3.4 Performance — Control panels shall operate under the following conditions.

3.4.1 Environmental conditions — The applicable environmental requirements of Specification MIL-E-5400 for the class stated in the detail specification shall apply as requirements of this specification. Additions or exceptions to the general specification may be required by the detail specification.

3.4.2 Explosive decompression — Control panels shall withstand explosive decompression as follows:

(a) From 30,000 feet to 50,000 feet pressure altitude at a rate of change of 300 pounds per square inch (PSI) per second.
(b) From 8,000 feet to 35,000 feet pressure altitude in 0.5 second.

3.5 Mounting plate — The mounting plate shall be of aluminum alloy of 0.064-inch thickness. Where additional strength is required, 0.065-inch stainless steel or greater thickness of aluminum alloy or stainless steel shall be used; the maximum thickness shall be 0.095 inch. When the mounting plate is thicker than 0.064 inch and fasteners in accordance with Specification MIL-F-25173 are used, metal from the face of the mounting plate under the fastener studs shall be removed by any suitable process to such depth that the remaining thickness is 0.064 inch. The plastic lighting plate, the electrical receptacle, the captive fastener studs which serve to attach the control panel to the aircraft structure, and other various controls and components, as required, shall be attached to the mounting plate or to brackets or supports attached to the mounting plate, as applicable. These controls and components shall not be mounted to either the plastic lighting plate or the cover box. Component fastenings, except those extending all the way through the plastic plate (such as control shafts and switches) shall not extend beyond the front surface of the mounting plate. Dimensions for type I panels shall be as specified on Standard MS25212. Designers of control panels shall consider that the strength of the mounting plate is related to the amount of material removed for the location of dials, parts, controls, etc. In this respect, due consideration shall be given to the specified vibration and shock requirements.

3.6 Fasteners — Fastening provisions for type I control panels shall be as specified by Standard MS25212. Fasteners shall be in accordance with Specification MIL-F-25173. For control panels larger than 6 inches, additional studs shall be located so that no more than 4-7/8 inches of panel exists between stud centers. On any one panel, the studs shall be spaced at approximately equal intervals in the length direction. Installation provisions will be in accordance with Standard MS25213. Other type fasteners may be used for type II control panels.

3.7 Configuration of controls — The arrangement, location, operation, and marking of controls shall be in accordance with Specification MIL-C-18012. The function of each control panel shall be concisely indicated by letters arranged vertically in the area between the mounting fasteners near the left edge of the control panels. The letters shall be 5/32 inch in height. Where ambiguity will not result, controls may be ganged or driven from a single control knob. Unless otherwise specified, ON-OFF power switches shall be located near the right edge of the control panel. The arrangement shall be such that no part of any control will extend beyond the edge of the control panel on which it is mounted in order not to interfere with any on adjacent control panels.

3.7.1 Control knobs — Control knobs shall conform to Specification MIL-K-25049, unless otherwise authorized. Shafts employed for rotary controls shall conform to Standard MS25176. The lighting for illuminated control knobs shall be provided by the lamps used to light the plastic lighting plate markings.

3.7.2 Control index — Rotary controls shall be keyed to the mounting plate so as to be positively indexed with respect to plate markings.

3.8 Electrical receptacles — Except as otherwise specified, one or more electrical receptacles in accordance with Specification MIL-C-26482 shall be mounted to the control panel, preferably behind the center area of the front panel and facing directly away from the front plate. Where contacts not provided in receptacles conforming to Specification MIL-C-26482 are required, a receptacle in accordance with Specification MIL-C-5015 shall be employed. The receptacle shall be located so as to allow for the exit of wiring and dressing of the wires as specified on Standard MS25212. All electrical connections to the control panel shall be made through the receptacles. Where the control panel would require a receptacle with six or less pins, the receptacle may be omitted and the connections made directly to the components or to a terminal board. Connections shall be made only to screw terminals when a receptacle is not employed. Where resultant overall depth of the control panel would exceed 6-1/2 inches because of the inclusion of disconnect plugs and receptacles, a cable shall be brought out at the central area of the back of the panel and shall be attached to a connector receptacle in accordance with Specification MIL-C-26482. The overall length from the back of the front panel to the wire end of the cable clamp shall be 24 inches. The pin contact (male) portion of the connector shall be the part associated with the control panel. If shielded wires are used in such cable, they shall be adequately insulated for 500V AC by individual or overall insulating sheeving.

3.9 Cover box — Each control panel shall include a cover box which shall adequately shield the equipment from external interfering fields, shall adequately confine the internal fields, and shall provide required mechanical protection during storage, handling, and installation. The cover box for type I control panels shall be contained within the outside dimensions of Standard MS25212. Exceptions to this requirement may be granted by the procuring activity for panels on which a cover box would serve no useful purpose; for example, a control panel on which only toggle switches requiring no additional electrical shielding are mounted. The cover box shall be attached

to the body of the control panel by means of quarter-turn quick fasteners at a minimum number of points. It shall be possible to completely remove the cover box from the control panel without disassembling the control panel in any other respect. The cover box shall be as light in weight as practicable, and shall have a cutout so the nameplate will be easily visible with cover box in place on the control panel, except that a cutout is not required when the nameplate is permitted to be located on the cover box (see 3.20). Nonmetallic cover boxes may be used when shielding the equipment is not a requirement.

3.10 Fuses and circuit-protecting devices — No fuses nor circuit-protecting device shall be mounted on a control panel with other controls. These circuit-protecting devices shall be in the equipment controlled by the control panel, on a special panel for circuit-protecting devices, or as otherwise specified in the detail specification for the individual equipment.

3.11 Toggle switches — Toggle switches shall be so mounted that the handle of the switch operates from top to bottom of the control panel. Any OFF position shall be in the center or bottom position. Where clarification of a control function or convenience of operation would result (for example, a left-right function control), toggle switches may be mounted so that the handle of the switch operates from side to side. Switch guards shall be used in cases where it is necessary to prevent inadvertent operation of a switch.

3.12 Interchangeability — All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respect to installation and performance.

3.13 Interference — Interference control requirements shall be as specified in the detail specification.

3.14 Dimensions — Each type I control panel and component mounting space dimensions shall be as shown on Standard MS25212.

3.14.1 Length — The length dimension shall be the minimum required in accordance with Standard MS25212. The minimum length for a panel shall be 1-1/8 inches. The maximum length shall be 9 inches unless specific Government approval for a greater length is obtained. When practicable, control panels requiring a length greater than 9 inches shall be divided into two or more control panel sections. Specific details of such division shall be determined by agreement between the Government and the contractor, however, each section shall comply with all the requirements for an individual control panel.

3.14.2 Depth — The depth dimension shall be the minimum required within the limits shown on Standard MS25212.

3.14.3 Width — The width dimension shall be as shown on Standard MS25212.

3.15 Weight — The installed weight of each control panel shall be confined to the minimum required, but shall not exceed 1 pound per inch of length. The installed weight shall include the control panel and the cover box, but shall not include the external cable. The distribution of weight and the location of the center of gravity shall be such that the control panel will meet the specified vibration and shock requirements.

3.16 Finish — The front surface of the control panel shall consist of the plastic lighting plate conforming to Specification MIL-P-7788. The front face and edges of the mounting plate shall be finished with black nonreflecting enamel conforming to Specification MIL-E-5556, or type IV enamel conforming to Specification MIL-E-5557. All other exterior surfaces, including the outside of the cover box, shall be primed with one coat of zinc-chromate primer conforming to Specification MIL-P-8585, or with primer material approved by the procuring activity. The primer, paint, or other insulating material shall not interfere with essential electrical contacts. The mounting surfaces on which grounded electrical components are mounted shall be kept free of paint or other insulting material in order to produce a good grounding surface.

3.17 Drainage — Each control panel shall incorporate adequate drainage provisions for any moisture condensing within the unit. When the control panel is mounted in any usable position, including horizontal, oblique, vertical, overhead, and sidewise mounting, all closed corners, channels, etc, which would collect and hold water, shall be eliminated or be provided with adequate means for drainage. A properly located round hole of 1/4-inch diameter shall be considered satisfactory drainage for a corner of a cover box.

3.18 Critical circuits — For interphone and radio set control panels, both sides of voice frequency circuits shall be brought out to separate ungrounded contacts on the electrical connector in lieu of using a ground connection as a common return circuit. Similar procedures shall be followed in the case of other critical circuits.

3.19 Grounding — The metal mounting plate and frame of the control shall be electrically bonded and connected to one pin of the connector for the purpose of externally grounding the unit. In the case where a connector is not used, a separate ground lead shall be furnished.

3.20 Identification of products — Control panels, subassemblies, and parts shall be marked for identification in accordance with Standard MIL-STD-130. When space and design permits, the nameplate shall be installed on the back side (side opposite the front panel) of the control panel in a location that is visible, through a cutout in the cover box when necessary, with the cover box in place. If such an arrangement is not possible, the nameplate shall be located on the back side of the cover box.

3.21 Workmanship — The control panel, including all parts and accessories, shall be fabricated and finished in a thoroughly workmanlike manner. Particular attention shall be given to the following:

(a) Freedom from blemishes, defects, burrs, and sharp edges.

(b) Accuracy of dimensions, radii of fillets, and marking of parts and assemblies.

(c) Neatness and thoroughness of soldering, cleaning of excess flux after soldering, welding, brazing, painting, wiring, and riveting.

(d) Alignment of parts and tightness of assembly screws and bolts, etc.

4. QUALITY ASSURANCE PROVISIONS

4.1 General — The quality assurance provisions of Specification MIL-E-5400 apply as requirements of this specification, except that for the plastic lighting plates, the sampling, inspection, and test requirements of Specification MIL-P-7788 shall apply.

4.2 Test procedures — The test procedures shall be as specified in the detail specification. If the detail specification does not specify a test procedure, the following test procedure shall apply.

4.2.1 Environmental tests — The control panel shall be tested for conformance with the following tests of Specification MIL-E-5272:

Temperature-altitude test	Procedure I
Vibration test	Procedure XII
Shock test	Procedure V
Humidity test	Procedure I
Salt spray test	Procedure I
Explosion test	Procedure III
Sand and dust test	Procedure I
Fungus resistance test	Procedure I

4.2.2 Explosive decompression — The control panel shall be placed in an altitude chamber and the altitude changed from 30,000 to 50,000 feet pressure altitude at a rate of change of 300 PSI per second. The control panel shall then be subjected to a change from 8,000 to 35,000 feet pressure altitude in 0.5 second. There shall be no mechanical failure or degradation in performance. The control panel shall operate satisfactorily after having been subjected to this test.

4.2.3 Interference tests — Interference tests shall be as specified in the detail specification.

5. PREPARATION FOR DELIVERY

5.1 General — The control panels covered by this specification shall be preserved, packaged, packed, and marked for shipment in accordance with Specification MIL-E-17555 and Standard MIL-STD-129. Preservation method shall be as specified in the detail specification.

6. NOTES

6.1 Intended use — The control panels covered by this specification are for use with airborne equipment and are intended primarily for mounting on a control console, or rack, in aircraft. This specification is intended for use to incorporate, by reference, in detail specifications, those requirements which are common to most rack or console mounted control panels used with aircraft equipment.

6.2 It is to be understood that control panels supplied under contract to the Government will be identical in every respect to the sample tested and found to be satisfactory, and to the detail drawings thereof except for changes previously approved by the Government. Any unapproved changes from the sample, or from the drawings, will constitute cause for rejection.

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