NOTE: MIL-STD-1657A has been redesignated as a Design Criteria Standard. The cover page has been changed for Administrative reasons. There are no other changes to this Document.

MIL-STD-1657A (SH)
2 MAY 1983
SUPERSEDING
MIL-STD-1657 (SH)
30 APRIL 1980

DEPARTMENT OF DEFENSE
DESIGN CRITERIA

SWITCHING EQUIPMENT, COMBAT SYSTEM, COMMAND AND CONTROL, FIRE CONTROL AND INTERIOR COMMUNICATION REQUIREMENTS FOR

AMSC N/A FSC 1290

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND

Washington, DC 20362

Switching Equipment, Combat System, Command and Control, Fire Control and Interior Communication Requirements for

MIL-STD-1657A(SH)

1. This Military Standard is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FOREWORD

1. This standard covers the requirements for the design of switching equipment used in conjunction with the combat system.

CONTENTS

TABLES

FIGURES

1. SCOPE, APPLICATION, AND CLASSIFICATION

1.1 Scope. This standard covers the requirements for the design of switching equipment used to control the interfaces and monitor the operation of equipment components of the combat system.

1.2 Application. This standard is applicable to new design switching equipment intended for new construction ships or modernized active fleet ships.

1.3 Classification. Requirements are classified by functional or application designs as shown in the individual requirements specified herein.

2. REFERENCED DOCUMENTS

2.1 See each individual requirement for reference to applicable documents contained therein.

2.1.1 The applicable issues shall be those in effect on the date of invitation for bids or request for proposal.

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

3. DEFINITIONS

Not applicable.

4. GENERAL REQUIREMENTS

Not applicable.

5. DETAIL REQUIREMENTS

5.1 Detail requirements for switching equipment shall be as shown in the individual requirements specified herein.

Preparing activity:
Navy - SH
(project 1290-N389)

REQUIREMENT 1

TERMINATION OF LARGE CONDUCTOR SHIP CABLES

1. Purpose. This requirement establishes the guidelines for use of jumper straps or alternate size terminal boards in terminating large conductor ship cables.

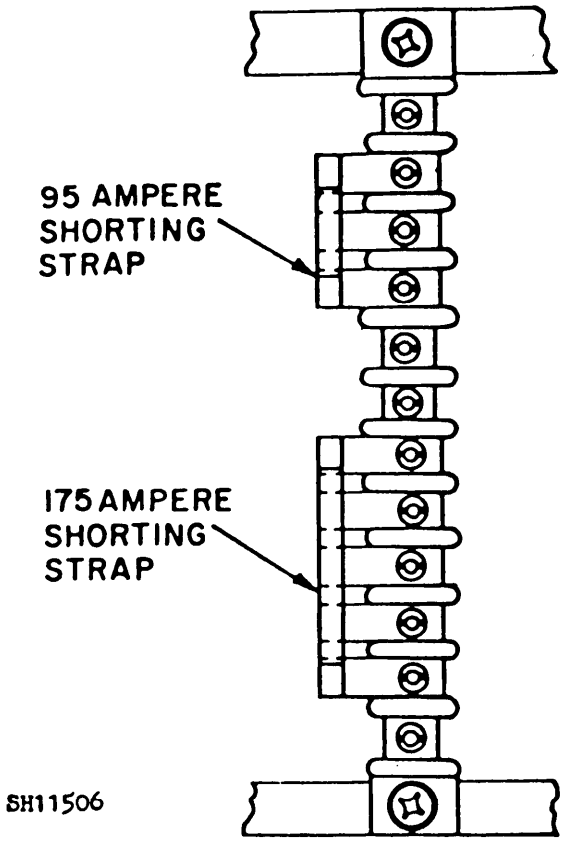
2. Documents applicable to requirement 1:

MIL-C-915/29 - Cable, Electrical, 1000 Volts, Type DSGU.
MIL-C-915/30 - Cable, Electrical, 1000 Volts, Type TSGU.
MIL-W-16878/19 - Wire, Electrical, Polyvinyl Chloride (PVC) Insulated 105°C, 3000 Volts, Polyamide Covering.
MIL-T-55164/11 - Terminal Boards, Molded, Barrier, Stud Type, Class 5TB.
MIL-T-55164/13 - Terminal Boards, Molded, Barrier, Stud Type, Class 7TB.
MIL-T-55164/21 - Terminal Boards, Molded, Barrier, Stud Type, Class 17TB.
NAVSEA 803-4680142 - Terminal Board Jumper Strap.
DDS 304-2 - Electric Cable Ratings and Characteristics.

3. REQUIREMENTS

3.1 Provision in the switchboard design shall be made for terminating the large conductor ship cables for supplies to switchboard buses by use of type 17TB10 (current rating 40 amperes (A) in accordance with MIL-T-55164/21) or type 5TB8 (current rating 50 A in accordance with MIL-T-55164/11) terminal boards in place of the type 7TB12 (MIL-T-55164/13) terminal boards specified in the applicable specification sheet. Provision shall also be made for terminating certain ship cables that may be increased in conductor size for voltage drop considerations. In some instances internal switchboard branch circuits may require the use of more than one terminal on a terminal board. Jumper straps, when required, shall be in accordance with Drawing 803-4680142 and shall be used to either connect one large ship conductor to two or more terminals or connect two or more terminals together for internal switchboard branching. These jumper straps, the associated switchboard wire sizes, ship cable types and sizes, and number of terminals to be strapped shall be as shown on figure 1-1.

3.2 The current rating and wire size combinations on figure 1-1 are based on the wire of MIL-W-16878/A with a nylon jacket as listed in DDS 304-2. Listing of types DSGU (MIL-C-915/29) and TSGU (MIL-C-915/30) cables is for terminal assignments, not load listings.



Schedule of cable and wire size and terminals

Internal switchboard circuit load	Internal switchboard wire size (AWG)	Ship cable size 1/		No. of terminals strapped		
		DSGU	TSGU	7TB12	17TB10	5TB8
A						
20	12	4	4	1	1	1
30	10	9	9	1	1	1
55	8	14	23	2	2	1
78	6	23	50	3	3	2
95	4	50	50	3	3	2
123	2	75	75	4	4	3
155	1	75	100	5	5	4
175	1/0	100	150	5	5	4
360	Not used	---	400	12	9	7

1/ Listed for terminal assignments, not load ratings.

FIGURE 1-1. Jumper straps for large conductor ship cables.

Requirement 1

REQUIREMENT 2

SYNCHRO CONNECTIONS

1. Purpose. This requirement establishes the criteria for synchro connections and wire marking.

2. Document applicable to requirement 2:

MIL-HDBK-225 - Synchros - Description and Operation.

3. REQUIREMENTS

3.1 Synchro connections and wire markings. Synchro transmitters shall be connected to the peripheral equipment terminal board and the ship wiring, (where either may be marked with typical ship circuit designations, terminal “111*’ to ship wiring "111", and so forth) in such a manner that an increasing value (angular displacement) in the peripheral equipment synchro shaft (counterclockwise rotation) would cause a counterclockwise rotation in a standard synchro receiver connected to the ship wiring through the peripheral equipment terminal board (terminal R1 to ship wiring “110”, R2 to "110R”, S1 to “111”, S2 to “112” and S3 to “113”). Direction of rotation is determined while facing the shaft end of the synchro. Synchro torque receivers and control transformers shall be connected to the peripheral “equipment terminal board in such a manner that, with direct connection between the peripheral equipment terminal board and the ship wiring, counterclockwise rotation of a standard transmitter having direct connection to the ship wire (R1 to "110”, R2 to “110R”, S1 to “111”, S2 to “112” and S3 to "113") shall cause counterclockwise rotation of the peripheral equipment dial or pointer. Conversely, for a synchro that requires clockwise rotation for increasing signal, synchro terminals S1, S2, and S3 will be connected to the peripheral equipment terminal board corresponding to ship wire numbers 113, 112, and 111, respectively. See figure 2-1 for the connections required for a clockwise rotating synchro. MIL-HDBK-225 provides additional connection data.

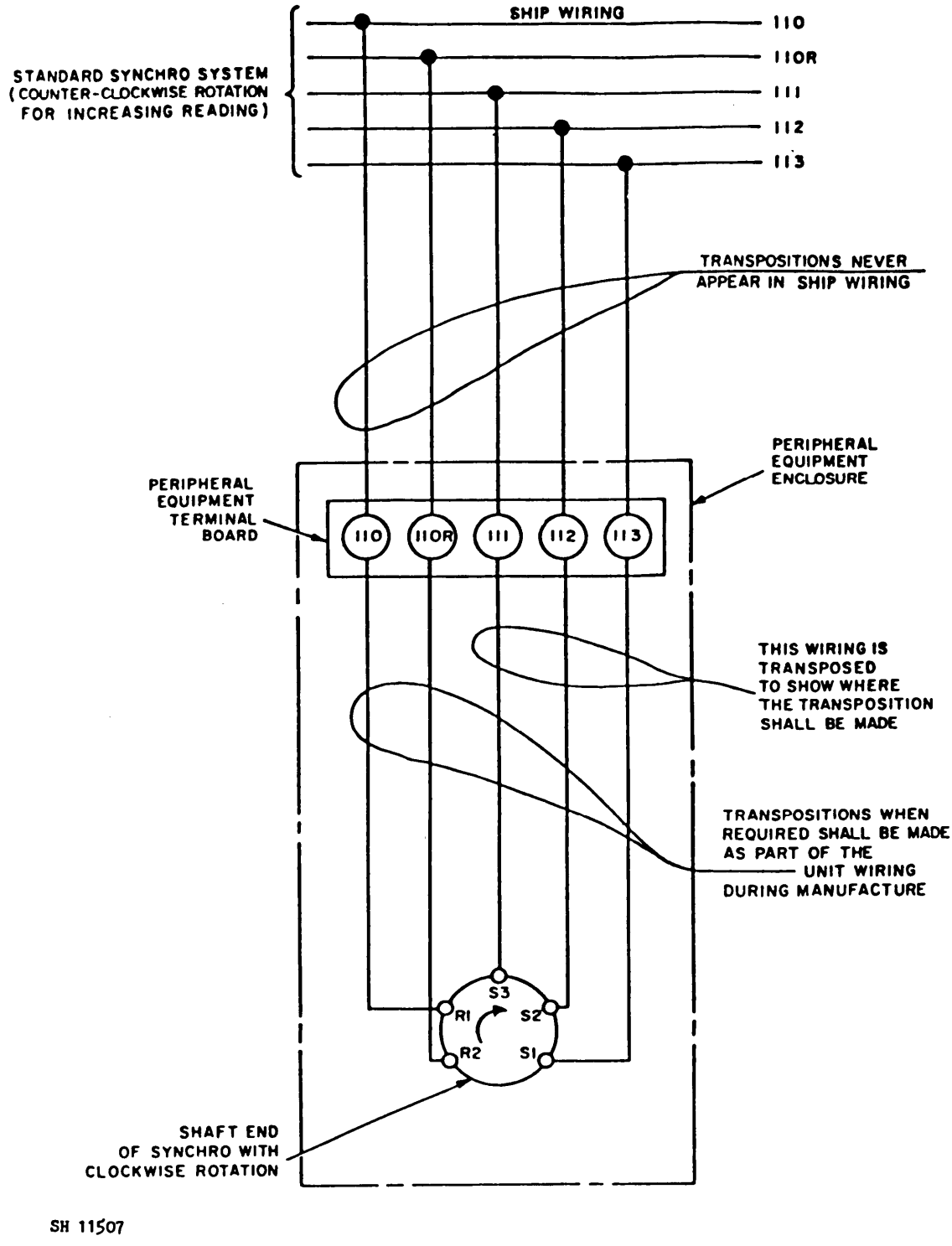


FIGURE 2-1. Connections for clockwise rotating synchro.

Requirement 2

REQUIRMENT 3

TAPER PIN BLOCKS

1. Purpose. This requirement establishes guidelines for use of taper pin blocks .

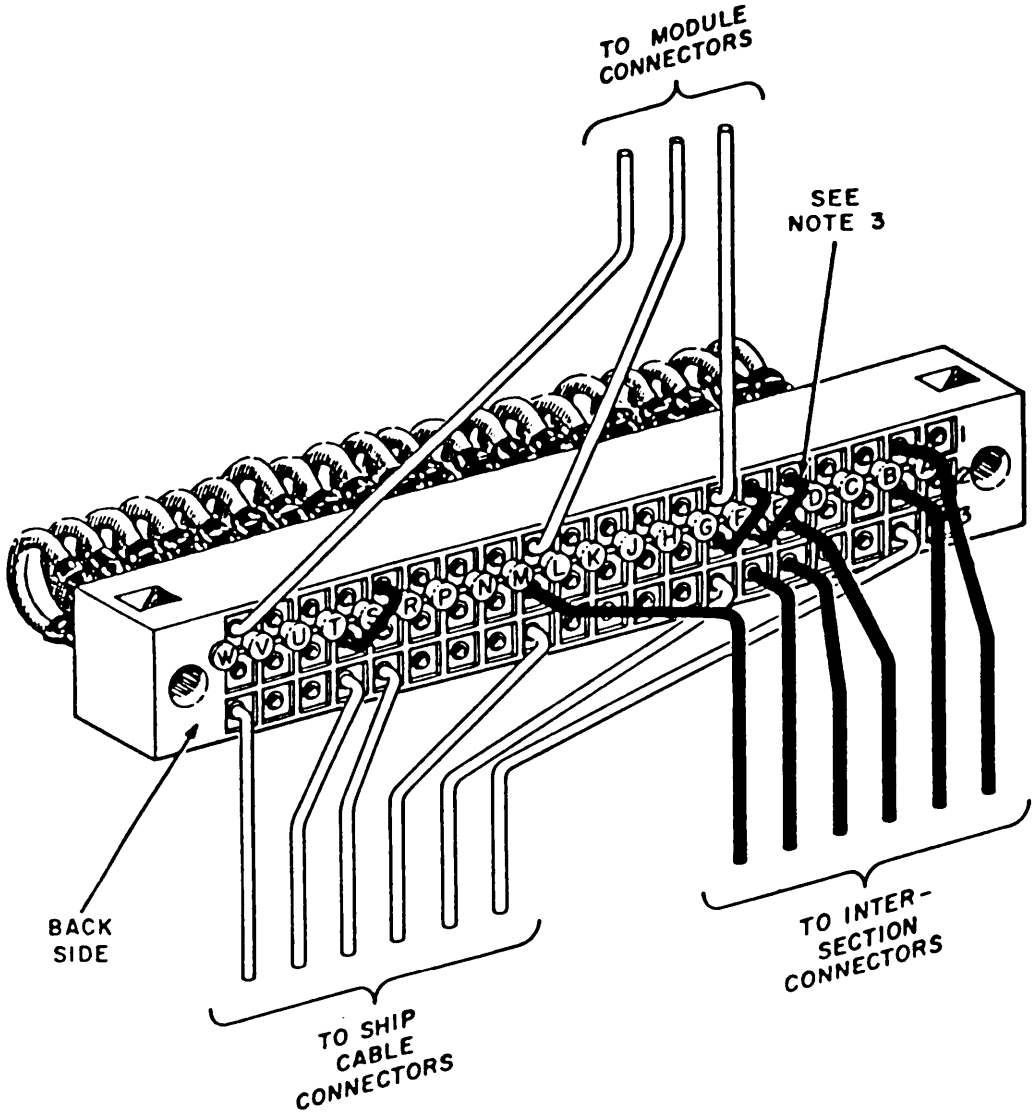
2. Document applicable to requirement 3:

NAVSHIP 803-4680148 - Taper Pin Block (Source Control Drawing).

3. REQUIREMENTS

3.1 Taper pin blocks shall be in accordance with Drawing 803-4680148. Each taper pin block shall have 60 separate cavities. Cavities shall be arranged so that there are 20 groups of three cavities each. The groups shall be lettered starting at “A” and continuing through “W”, omitting I, 0, and Q, The three cavities in each group shall be numbered 1 through 3 (top to bottom).

3.2 Cavity number 1 and number 2 (in all 20 groups) shall be connected by an internal strap, and cavity number 2 and number 3 (in all 20 groups) shall be connected by an external jumper of number 16 AWG wire located on the front side of the taper pin block (see figure 3-l).



NOTES :

1. The front side of pin 1 shall be open for test purposes.
2. Wires from ship connectors shall be connected to pin 3.
3. Jumpers between taper pin groups shall be from pin 2 (of the sending group) to pin 1 (of the receiving group).

SH 11508

FIGURE 3-1. Arrangement of taper pin block wiring.

Requirement 3

REQUIREMENT 4

TERMINAL JUNCTION SYSTEMS

1. Purpose. This requirement establishes guidelines for use of terminal junction systems.

2. Documents applicable to requirement 4:

MIL-T-81714/3 - Terminal Junction Systems Modules, Feedback Type, Size 16.
MIL-T-81714/8 - Terminal Junction Systems Modules, Feedthru Type, Size 16.
MIL-T-81714/9 - Terminal Junction Systems Modules, Feedthru Type, Size 12.

3. REQUIREMENTS

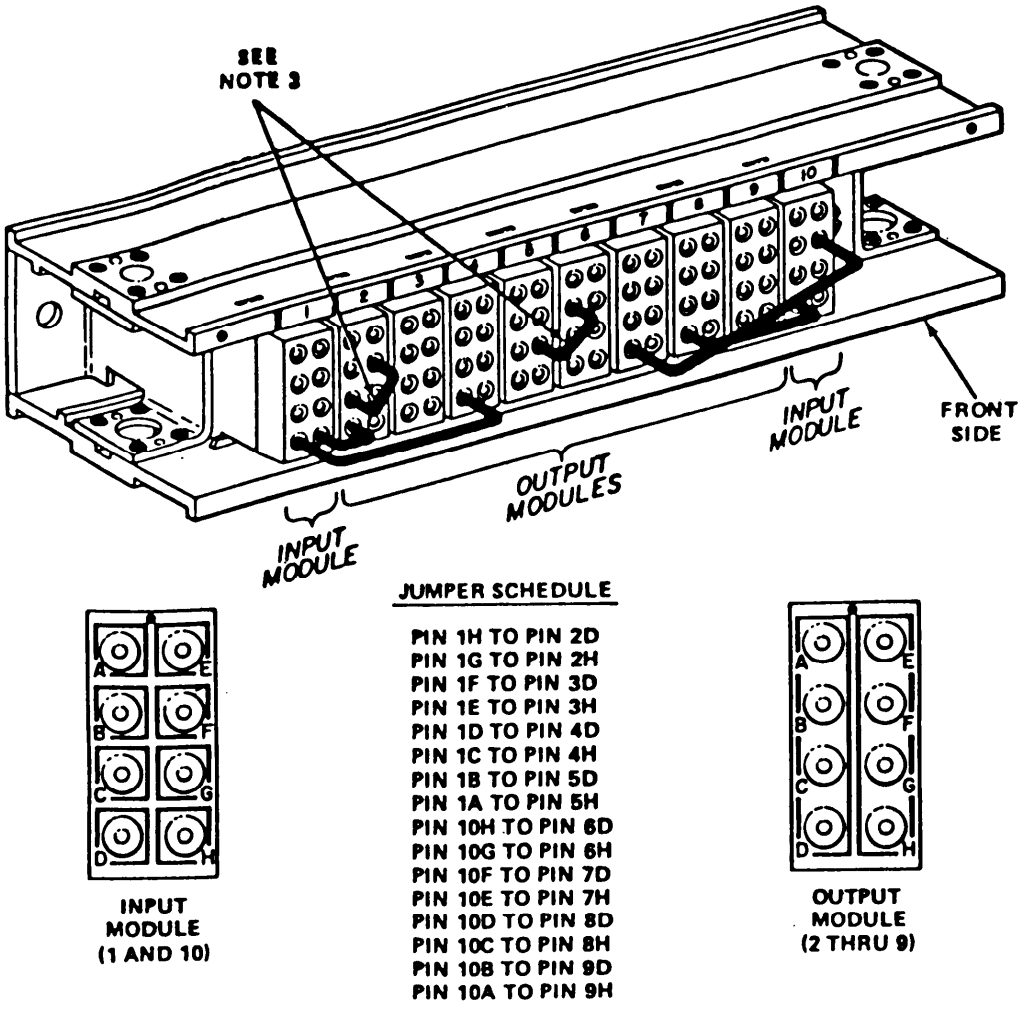
3.1 Feedthru types of terminal junction systems shall be wired and arranged as shown on figures 4-1 and 4-2 and as follows:

(a) For input wire sizes AWG 16, 18, or 20. A track shall be composed of ten modules in accordance with MIL-T-81714/8. Modules 1 and 10 shall be input modules using the H1 bussing arrangement, which accepts only wiring from ship connectors. Modules 2 through 9, using the B1 bussing arrangement, are output modules accepting wiring from rear module connectors. Each output modules consists of two rows of four pins, with each row being connected by an internal strap.

(b) For input wire sizes AWG 12 or 14. A track shall be composed of eight modules. Module 1 shall be in accordance with MIL-T-81714/9, which occupies rows 1 through 3 on the track and shall be the input module, using the H1 bussing arrangement, accepting only wiring from ship connectors. Modules 4 through 10 shall be in accordance with MIL-T-81714/8, using the B1 bussing “arrangement, and shall be the output modules accepting wiring from rear module connectors. Each row in modules 4 through 7 shall allocate specified pins for jumpering between respective output pins in module 1. The rows in modules 8 through 10 have no specific allocation and shall be available for additional output wiring as required.

3.2 Feedback types of terminal junction systems shall be wired and arranged as shown on figure 4-3 and as follows:

(a) A track shall be composed of ten MIL-T-81714/3 modules, using the B1 bussing arrangement. Each row (consisting of four pins per row) shall be connected by an internal strap. Wiring to and from the feedback type track may be from module connectors, panel connectors/panel terminal boards, or jumpers from other terminal junction systems.



NOTES:

1. Each pin on the Input modules (1 and 10), via the jumper schedule, shall be connected to a pre-assigned row on the output modules. (Jumpers on front side only.)

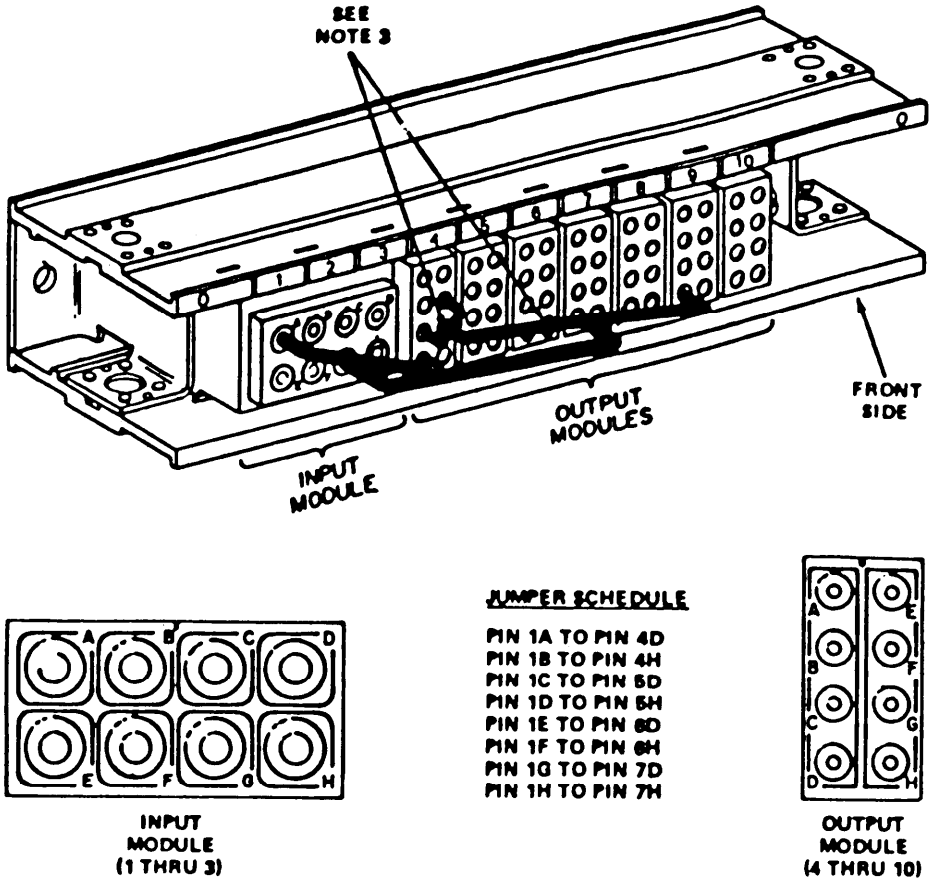
2. Wires from ship connectors will always be connected to the back side of modules 1 or 10. Ship wire size shall be AWG 16, 18, or 20.

3. Jumpers between output rows shall be from pin C to pin F when on the same module and pin G to pin B when jumpers between rows of different modules are used. (Jumpers on front side only.)

4. Pin A and pin E of each output module shall be used at test points. (Front side only.)

SH 11509

FIGURE 4-1. Arrangement of terminal junction systems feedthru type - AWG 16.



NOTES:

1. Each pin on the input module (1), via the jumper schedule, shall be connected to a pre-assigned row on the output modules. (Jumpers on front side only.)

2. Wires from ship connectors shall be connected to the back side of module 1. Ship wire size shall be AWG 12 or 14.

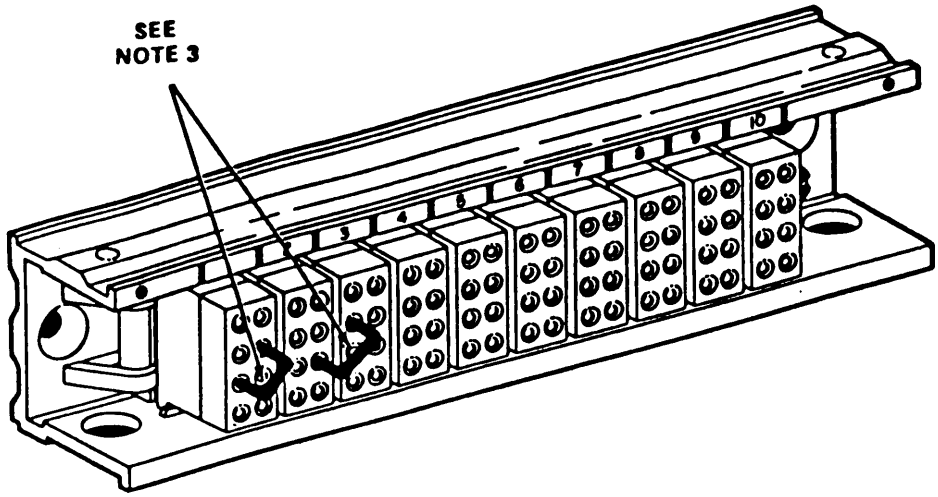
3. Jumpers between active output modules (4 thru 7) to spare output modules (8 thru 10) shall be from pin C or pin G of the active row to the first available pin D or pin H of the lowest spare row. Jumpers between spare output rows shall be from pin C to pin F when on the same module and pin G to pin B when jumpers between rows of different modules are used. (Jumpers on front side only.)

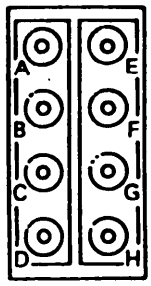
4. Pin A and pin E of each output module shall be used as test points. (Front side only.)

SH 11510

FIGURE 4-2. Arrangement of terminal junction systems feedthru type - AWG 12.

Requirement 4





OUTPUT
MODULE
(1 THRU 10)

NOTES:

1. Each module shall consist of two rows of four pins A, B, C and D or E, F, G and H. The pins within each row shall be connected by an internal strap.

2. Wiring to and from the terminal junction shall be as specified in 3.2 feedback AWG, size 16.

3. Jumpers between rows shall be from pin C to pin F when on the same module and pin G to pin B when jumpers between rows of different modules are used.

4. Pin A or E of the lowest row in each group shall be used for a test point. A group may consist of one or more rows. (See note 1.)

SH 11511

FIGURE 4-3. Arrangement of terminal junction systems feedback type - AWG 16.

Requirement 4

REQUIREMENT 5

PANEL-MOUNTED ASSEMBLIES

1. Purpose. This requirement establishes the basic configuration for panel-mounted assemblies.

2. Documents applicable to requirement 5:

QQ-A-250/8	- Aluminum Alloy 5052, Plate and Sheet.
QQ-A-250/11	- Aluminum Alloy 6061, Plate and Sheet.
MIL-F-15160/77	- Fuses (Indicating), Style F77A.
MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-F-19207/38	- Fuseholders, Extractor Post Type, Blown Fuse Indicating, Type FHL57G.
MIL-S-22885/87	- Switch, Push Button, Illuminated, 4-Lamp, Solid Mount, Modular Constructed, High Impact Shock.
MIL-L-28731/11	- Connector, Electrical Insert (Insulator), Male Rectangular, Polarized, Center Screwlock, for 38 Removable Contacts.
MIL-C-28748/9	- Connectors, Electrical, Rectangular, Rack and Panel, Polarized Center Jackscrew or Guidepin Style, Crimp Type Removable Pin Contacts, Size 16.
MIL-T-55164	- Terminal Boards, Molded, Barrier, Screw and Stud Types, and Associated Accessories, General Specification for.
MS15795	Washer, Flat-Metal, Round, General Purpose (in./mm).
MS24693	Screw, Machine, Flat Countersunk Head, 100°, Cross Recessed, UNC-2A and UNF-2A (in./mm).
MS33558	Numerals and Letters, Aircraft Instrument Dial, Standard Form of.
MS35338	Washer, Lock-Spring, Helical, Regular (Medium) Series, (in./mm).
MS35649	Nut, Plain-Hexagon, Machine Screw, UNC-2B.
MS51957	Screw, Machine-Pan Head, Cross-Recessed, Corrosion-Resisting Steel, UNC-2A.
NAVSHIPS 815-1853048	- Switch Linear Movement Style LS.

3. REQUIREMENTS

3.1 Panel-mounted assemblies are for use in switchboards designed in accordance with MIL-S-17000.

3.2 Enclosure design. Basic enclosure used for the panel-mounted assemblies shall be as specified in 3.2.1 through 3.2.7.1 and as shown on figure 5-1.

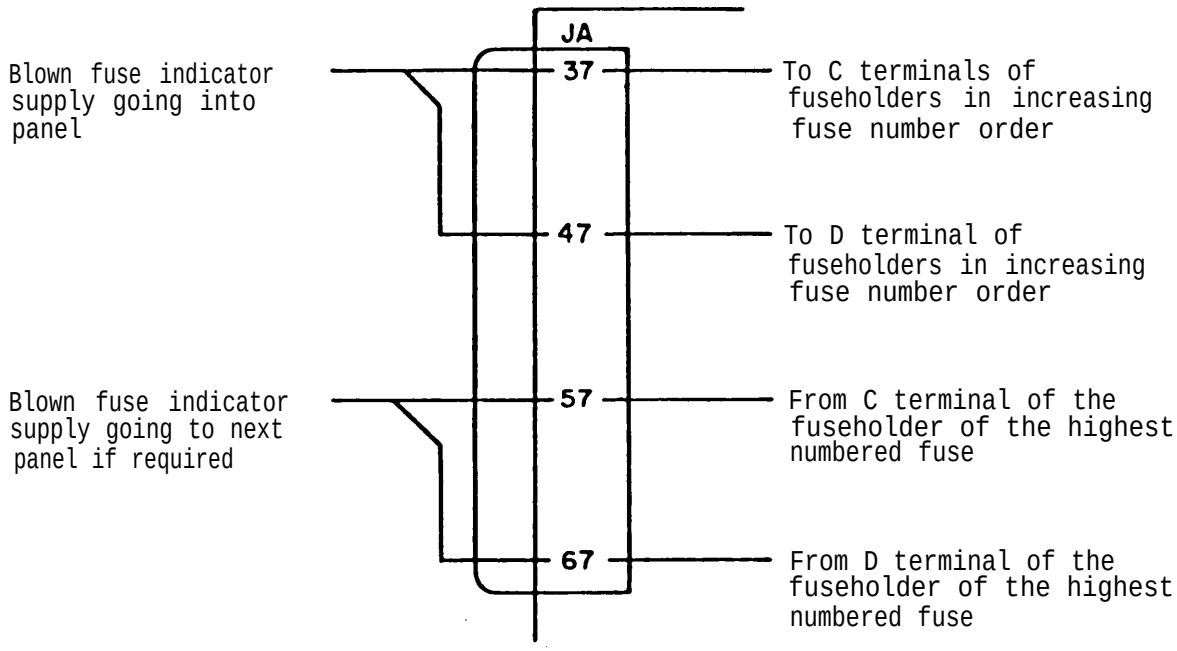
3.2.1 Front plate and internal mounting plate (where required) shall be punched to accommodate the maximum number of devices (that is, 10 fuseholders, 15 indicator light assemblies, 10, 15, or 20 relay sockets, and so forth). Unused holes in the front plate shall be covered by the panel description plate. Cutouts for indicator light or pushbutton switches shall conform to the dimensions shown on figure titled “Recommended panel cutouts” of the applicable specification sheet of MIL-S-22885/87.

3.2.2 The required number of devices to be used in each panel assembly (such as the number of fuseholders, relays, indicator lights, connector(s), or terminal board(s), on the rear panel, and so forth) and the actual wiring and wire size to be installed will be defined in the acquisition technical data package.

3.2.3 When any of these assemblies require a larger assembly, the panel utilized on the larger assembly shall be a multiple of the 4 inch width of the basic panel (see figure 5-1 sheet 3).

3.2.4 When any of these panel-mounted assemblies are located in the vertical column of panel spaces next to the door handles on the front panel layout drawings, the “short depth” (length) dimensions as shown on figure 5-1 and related figures in requirements 6 through 15, 17, and 18 shall apply.

3.2.5 Blown fuse indicator supply shall be wired in all panels with fuses and type MIL-C-28748/9 connector, (except power available panel) as follows:



SH 11541

3.2.5.1 When a B connector, in accordance with MIL-C-28731/11 is specified in the acquisition technical data package, the circuit shall be wired as follows: Blown fuse indicator supply, wired to contact(s) "TT”, then to “C” terminal(s) of fuseholders. Blown fuse indicator return wired to contact(s) "PP", then to “D” terminals of fuseholders.

Requirement 5

3.2.6 Circuit symbols shown on panel views in requirements 6 through 19 indicate the position of each device and the numbering sequence. These symbols shall be marked on the back of the front panel and on both sides of the connector/back plate of each assembly.

3.2.7 Other lettering shown in requirements 6 through 19 indicates the description plate markings and their approximate placement.

3.2.7.1 Lettering sizes. Characters shall be in accordance with MS33558 or comparable type styles. See figure 5-2 for typical lettering sizes and additional lettering required on style LS switches.

4. PARTS

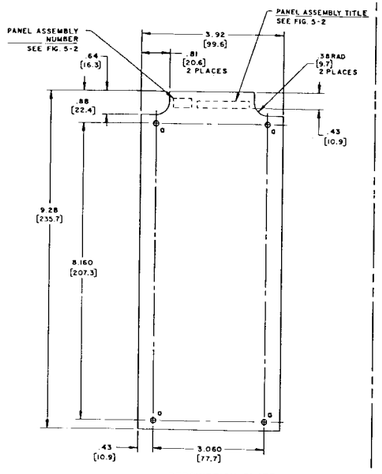
4.1 Part numbers of the various components used in the various panel mounted assemblies shall be in accordance with the following:

	Circuit symbols
(a) Panel connector(s) shall be part number M28748/09FON0lA in accordance with MIL-C-28748/9.	JA, JB, JC
(b) Terminal board(s) shall be in accordance with MIL-T-55164 as specified in the individual requirements.	TB1, and so forth
(c) Fuseholder(s) type FHL57G shall be in accordance with MIL-F-19207/38.	XF1, and so forth
(d) Fuse(s) style F77A shall be in accordance with MIL-F-15160/77.	F1, and so forth
(e) Indicator light(s) shall be in accordance with MIL-S-22885/87 or equal.	DS1 and XDS1, and so forth

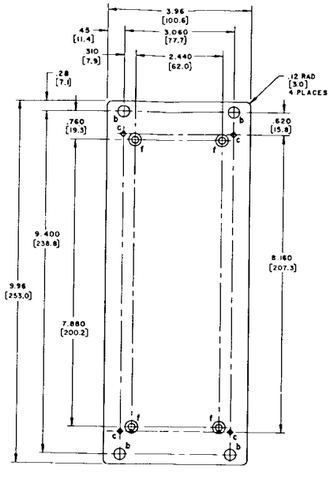
4.2 Additional parts shall be as specifically listed for each type of panel-mounted assembly (see requirements 6 through 15, 17, and 18).

Requirement 5

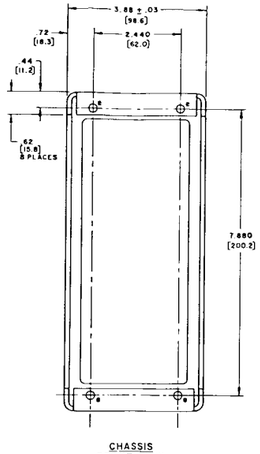
NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ± .02 AND .XXX ± .010.
3. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
4. FINISH - CHEMICAL CONVERSION COATING CONFORMING TO MIL-S-17000.
5. MINIMUM .187 [4.7] THK ALUMINUM ALLOY - 6061-T6 OF QQ-A-250/11.
6. .125 [3.2] THK ALUMINUM ALLOY - 5052 - H32 OF QQ-A-250/8.
7. MATERIAL .062 [1.6] THK LAMINATED PLASTIC OR ALUMINUM ALLOY, COLOR IN ACCORDANCE WITH MIL-S-17000.
8. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED IN AREAS SHOWN. SEE PARA 3.2.6 & 3.2.7 OF TEXT.
9. REMOVE ALL SHARP CORNERS, EDGES AND BURRS.
10. BEND RADII: .09 [2.3]
11. EQUIPMENT SHALL BE IN ACCORDANCE WITH MIL-S-17000.
12. METHOD AND DESIGN OF ATTACHMENT OF CHASSIS TO FRONT PANEL IS OPTIONAL. INDICATED DESIGN AND DIMENSIONING WILL PROVIDE NECESSARY CLEARANCE AND MOUNTING OF COMPONENTS FOR REQUIREMENTS 6 THRU 15 AND 17 AND 18.



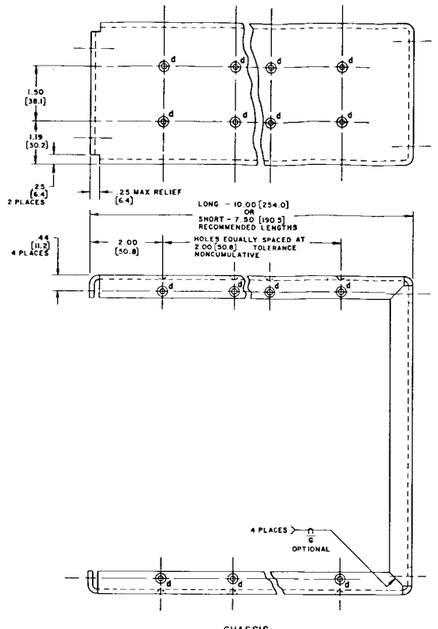
DESCRIPTION PLATE
MATERIAL - NOTE 7



FRONT PANEL
MATERIAL - NOTE 5
FINISH - NOTE 4



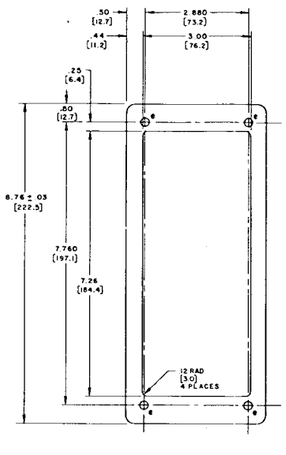
CHASSIS
FRONT VIEW



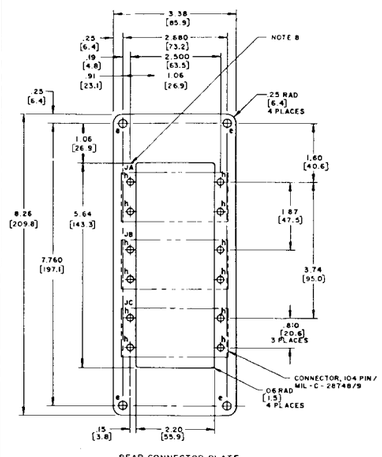
CHASSIS
MATERIAL - NOTE 6
FINISH - NOTE 4

HOLE DATA TABLE

HOLE	DESCRIPTION	QTY REQD
a	.144 [3.7] +.005 -.001 DIA	4
b	.312 [7.9] +.006 -.001 DIA	4
c	.112 - 40UNC - 2B	4
d	.144 [3.7] +.003 -.001 DIA B CSK .82° TO .280 [7.1] +.010 -.000 DIA	A/R
e	.221 [5.6] +.005 -.001 DIA	12
f	.193 [4.9] +.005 -.001 DIA B CSK 100° TO .340 [8.6] +.010 -.000 DIA	4
h	.177 [4.5] +.005 -.001 DIA	12



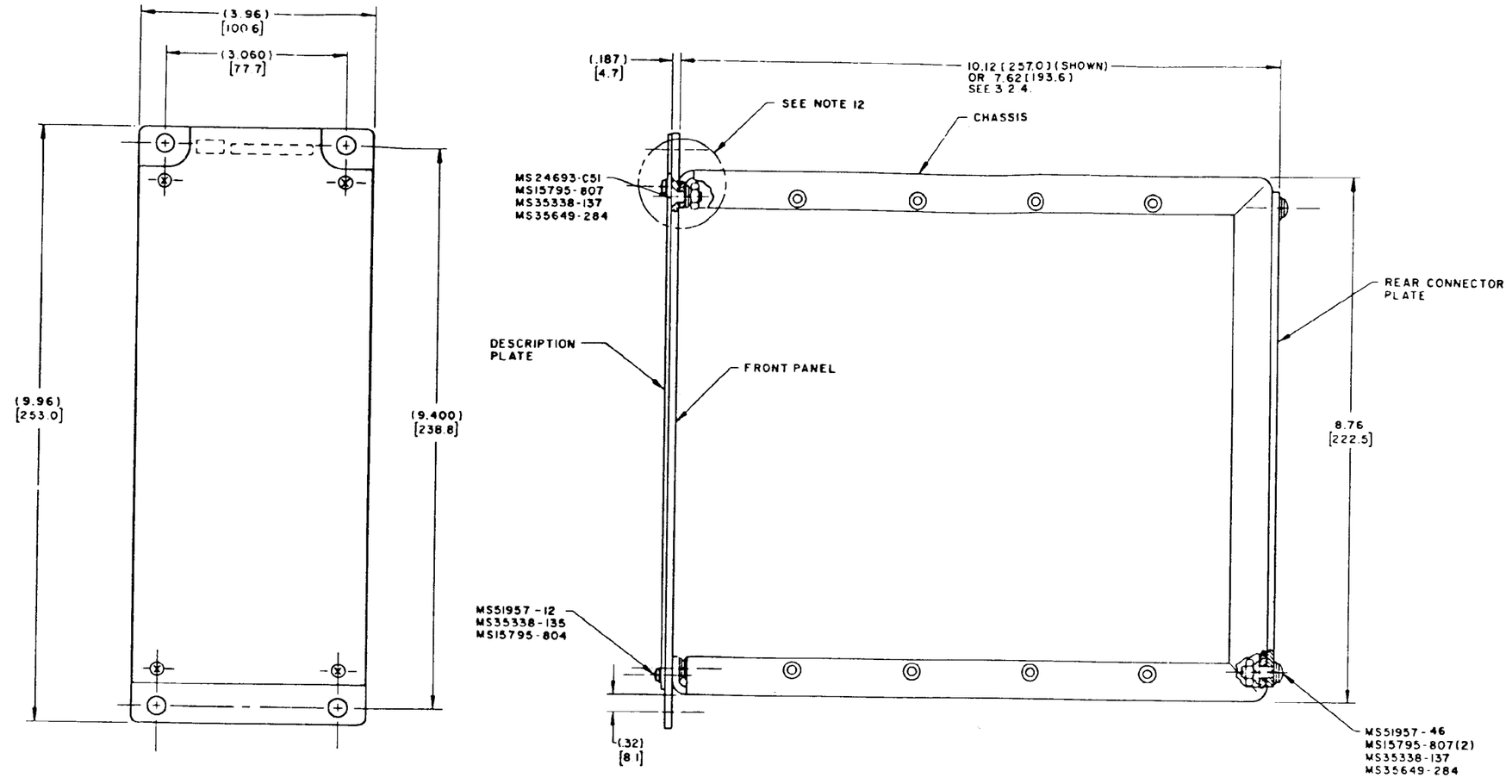
CHASSIS
REAR VIEW



REAR CONNECTOR PLATE
MATERIAL - NOTE 6, FINISH - NOTE 4

REQUIREMENT 5

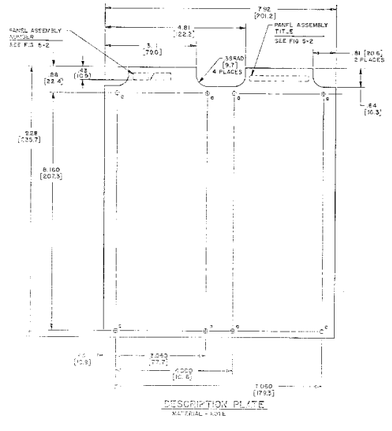
FIGURE 5-1. Panel-mounted assembly (sheet 1).

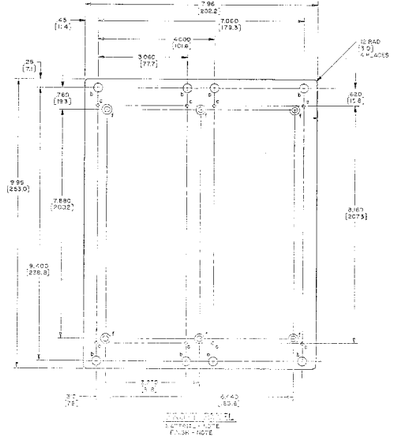


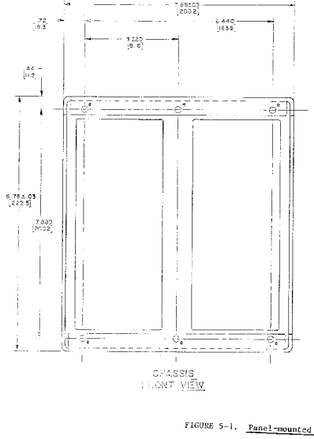
SH 11512-1

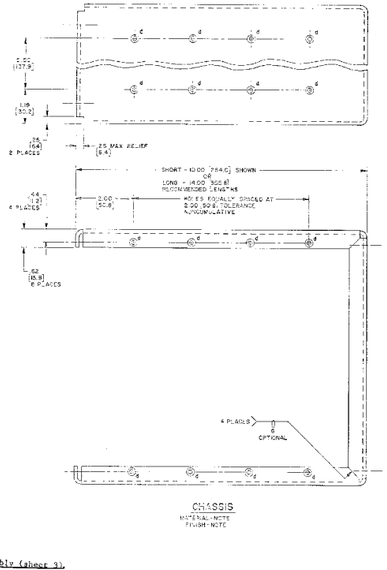
REQUIREMENT 5

FIGURE 5-1. Panel-mounted assembly (sheet 2).









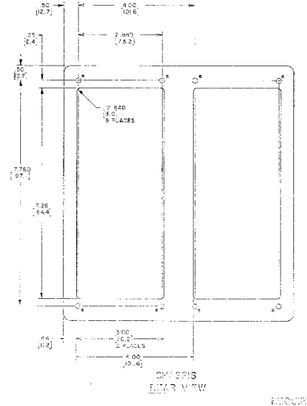
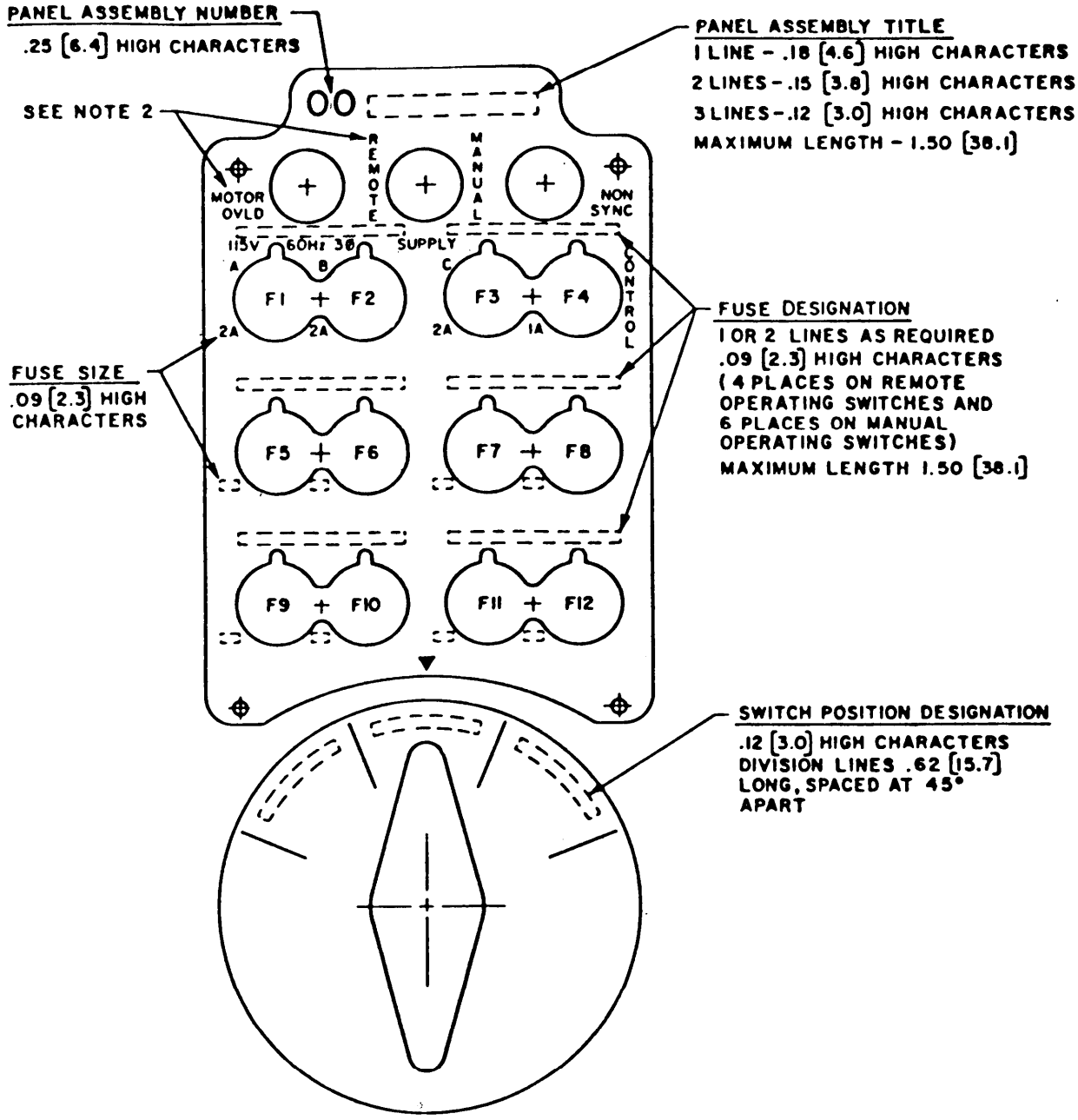


FIGURE 5-1. Panel-mounted assembly (sheet 3).



NOTES :

1. Spacing between lines shall be .06 [1.5].

2. Lettering shown applies to remote operated switch only and is provided by switch manufacturer reference Drawing 815-1853048, PC 12.

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FIGURE 5-2. Lettering sizes.

REQUIREMENT 6

RELAY OR RELAY AND FUSE PANEL ASSEMBLY

1. Purpose. This requirement establishes the configuration for relay or relay and fuse panel assembly.

2. Documents applicable to requirement 6:

MIL-R-6106	- Relays, Electromagnetic (Including Established Reliability (ER) Types), General Specification for.
MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-T-55164/12	- Terminal Boards, Molded, Barrier, Stud Type, Class 6TB.
MS27400	Relay, Permanent Magnet Drive, 10 Amp, 4PDT, All Welded, Hermetically Sealed.
MS27745	Relay, Magnetic Latch, 10 Amp, 4PDT, All Welded, Hermetically Sealed.

30 REQUIREMENTS

3.1 Relay panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.4.

3.2 Relay or relay and fuse panel assembly shall be arranged as shown on figure 6-1.

3.3 Relay mounting bracket shall be punched for 10, 15 or 20, relay sockets, as applicable (see figure 6-l).

3.4 Relay sockets shall be located and numbered as shown on figure 6-1.

4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

Circuit symbols

(a) Relay sockets shall be DAN-L, Inc. part numbers or equal as follows: XK1, and so forth

Relay type	DAN-L, Inc. Part number
2PDT - d.c.	4223-2
4PDT - d.c.	6200 - 104SH (with #6254-3 mounting hardware)
4PDT - a.c.	6200 - 104SXH (with #6254-3 mounting hardware)
4PDT - latching	32823 - 17SH (with #6254-3 mounting hardware)

Circuit symbols

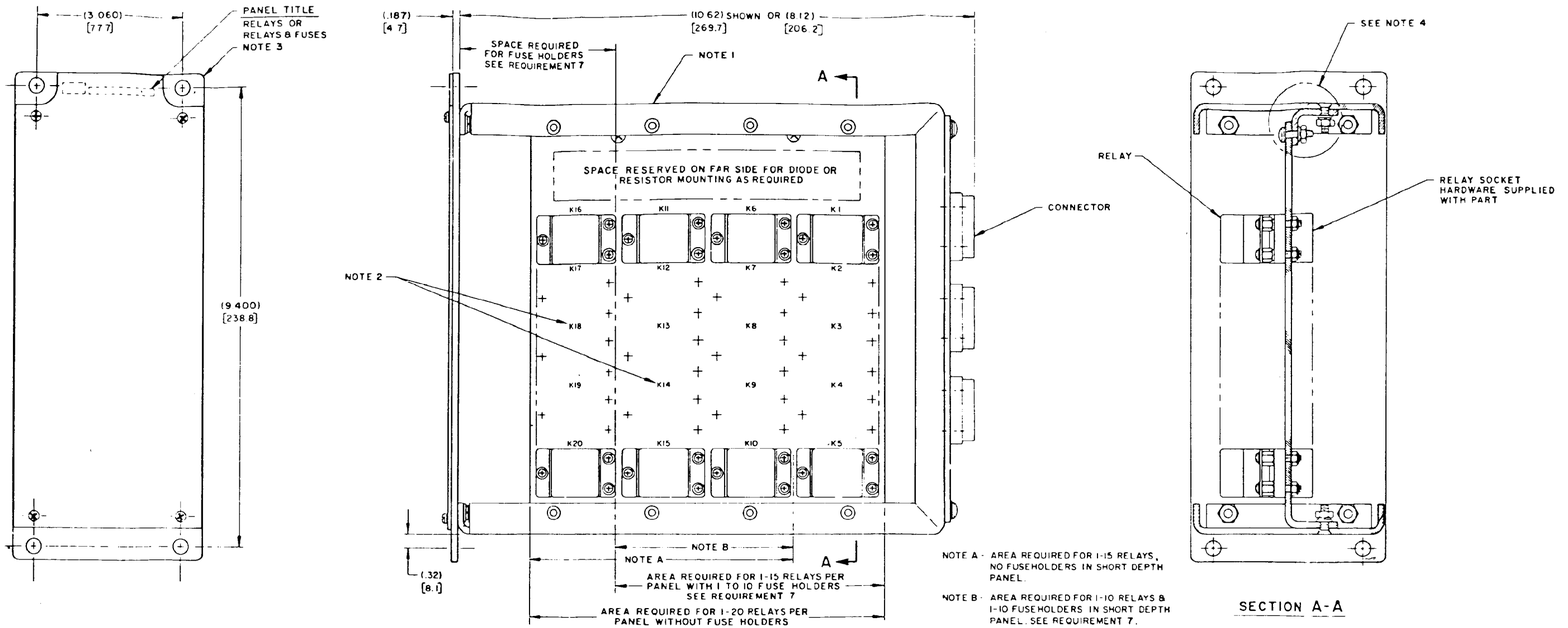
(b) Relays shall be in accordance with MIL-R-6106 as follows: — K1, and so forth

Relay type	MS part numbers
28 V d.c. relay, 4PDT	MS27400-17
115 V a.c. 400 Hz relay, 4PDT	MS27400-28
50 V d.c. relay, 4PDT	MS27400-18
115 V a.c. 60 Hz relay, 4PDT	MS27400-28
28 V d.c. latching relay, 4PDT	MS27745-5

(c) Terminal board shall be type 6TB10 in accordance with MIL-T-55164/12. — TB1

Requirement 6

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. REFERENCE DESIGNATION MARKING SHALL BE 12.30 HIGH IN AREA INDICATED. NEAR SIDE AS SHOWN, FAR SIDE SHALL HAVE PREFIX "X". (XK1 THRU XK15 OR XK201).
3. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
4. METHOD OF ATTACHMENT AND ASSEMBLY OF RELAY SUB-CHASSIS IS OPTIONAL.
5. ALL DIMENSIONS ARE IN INCHES.
6. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE XX ± .02 AND XXX ± .010.
7. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
8. THE USE OF INTERNAL TERMINAL BOARDS FOR JUMPERS SHALL BE IN ACCORDANCE WITH TECHNICAL DATA PACKAGE.



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REQUIREMENT 6

FIGURE 6-1. Relay or relay and fuse panel assembly.

REQUIREMENT 7

FUSE PANEL ASSEMBLY

1. Purpose. This requirement establishes the configuration for relay and fuse panel assemblies or fuse panel assemblies.

2. Documents applicable to requirement 7:

MIL-S-17000 - Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-T-55164/12 - Terminal Boards, Molded, Barrier, Stud Type, Class 6TB.

3. REQUIREMENTS

3.1 Relay and fuse panel assembly or overflow fuse panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.4.

3.2 Relay and fuse panel assembly shall be arranged as shown on figure 6-1. Overflow fuse panel assembly shall be arranged as shown on figure 7-1.

3.3 Front panel shall be punched for 10 fuseholders and the relay mounting bracket shall be punched for 10 or 15 relay sockets, as applicable.

3.4 Fuseholders shall be located and numbered as shown on figures 6-1 and 7-1. Relay sockets shall be located and numbered as shown on figure 6-1.

4. PARTS

4.1 Parts shall be as follows:

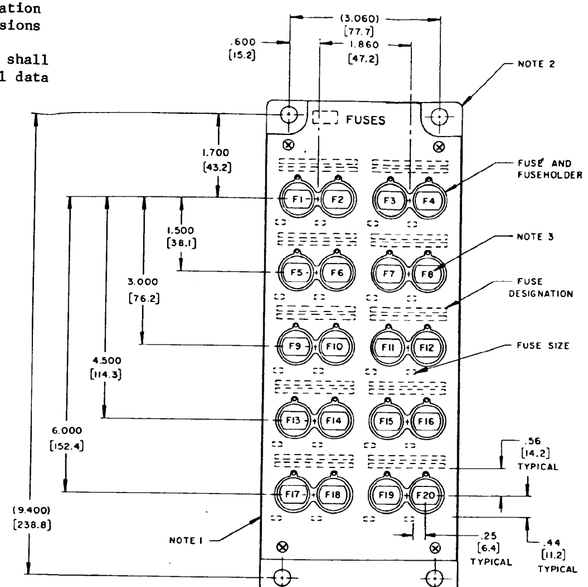
(a) Relay and relay sockets shall be as specified in requirement 6.
(b) Fuseholders and fuses shall be as specified in the acquisition technical data package.

Circuit symbol

(c) Terminal board shall be type 6TB10 in accordance with MIL-T-55164/12. TB1

NOTES:

1. Description plate, front panel, chassis and rear plate shall be in accordance with requirement 5.
2. Front panel shall be painted in accordance with MIL-S-17000.
3. Prefix "X" to precede ref designation of fuseholders on far side of front panel. Characters shall be .12 [3.0] high located adjacent to fuseholders.
4. All dimensions are in inches.
5. Unless otherwise specified, tolerances shall be .XX ± .02 and .XXX ± .010.
6. Metric equivalents are given for general information only and are based upon 1 inch = 25.4 mm dimensions in [ ] are millimeters.
7. The use of internal terminal boards for jumpers shall be in accordance with the acquisition technical data package.



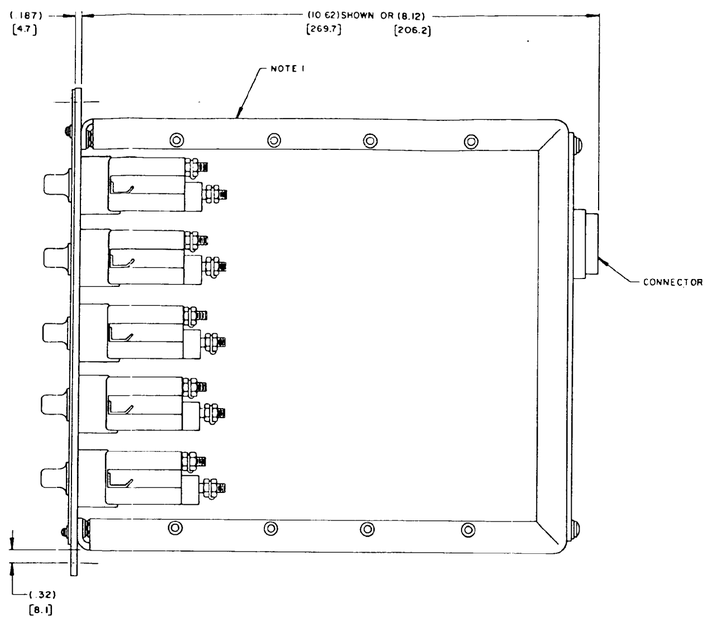


FIGURE 7-1. Fuse panel assembly.

REQUIREMENT 8

INDICATOR LIGHT PANEL

1. Purpose. This requirement establishes the configuration for indicator light panel assemblies.

2* Documents applicable to requirement 8:

MIL-F-15160/77	-	Fuses (Indicating), Style F77A.
MIL-S-17000	-	Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-F-19207/38	-	Fuseholders, Extractor Post Type, Blown Fuse Indicating, Type FHL57G.
MIL-S-22885/87	-	Switch, Push Button, Illuminated 4-Lamp, Solid Mount, Modular, Constructed, High Impact Shock.
MIL-T-55164/12	-	Terminal Boards, Molded, Barrier, Stud Type, Class 6TB.

3. REQUIREMENTS

3.1 Indicator light panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.6.

3.2 When only one indicator light panel assembly is specified on the front panel layout, the panel assembly shall be arranged as shown on figure 8-1 and the fuseholder and indicator lights shall be wired as shown on figure 8-2. When more than one indicator light panel assembly is specified, the fuseholder (and wiring shown on figure 8-2) shall be omitted and replaced with an additional row of indicator lights in the higher numbered panel assemblies.

3.3 Front panel shall be punched for one fuseholder and 15 indicator light assemblies or 18 indicator light assemblies as required.

3.4 Fuseholder, when installed, and indicator lights shall be located and numbered as shown on figure 8-1.

3.5 Fuseholder, when installed, is for fusing blown fuse indicator supply (see figure 8-2).

3.6 For a one or two-section switchboard, the terminal board shall be omitted and the wires from the load terminals of the fuseholder shall be run directly to the panel connector.

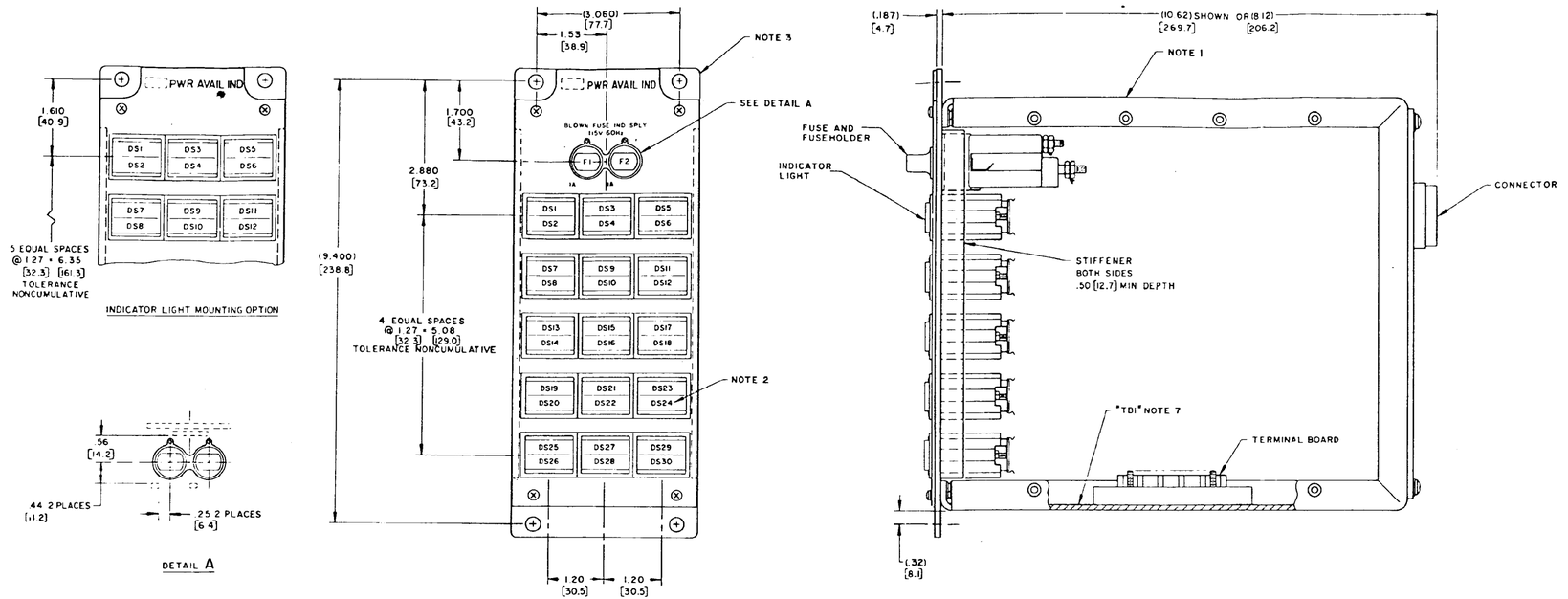
4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

	Circuit symbols
(a) Two l-ampere style F77A fuses in accordance with MIL-F-15160/77 shall be used in the type FH57G fuseholder which shall be in accordance with MIL-F-19207/38.	XF1, XF2, F1, F2
(b) Terminal board shall be type 6TB10 in accordance with MIL-T-55164/12.	TB1
(c) Indicator light shall be part number M22885/87-A-E-WWWW in accordance with MIL-S-22885/87 or equal.	XDS1, DS1

Requirement 8

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. PREFIX "X" SHALL PRECEDE REFERENCE DESIGNATIONS OF FUSEHOLDER & LIGHT SOCKETS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH
3. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
4. ALL DIMENSIONS ARE IN INCHES.
5. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ± 02 AND .XXX ± .010.
6. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
7. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS .12 [3.0] HIGH AS REQUIRED IN AREAS SHOWN.



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REQUIREMENT 8

FIGURE 8-1. Indicator light panel assembly.

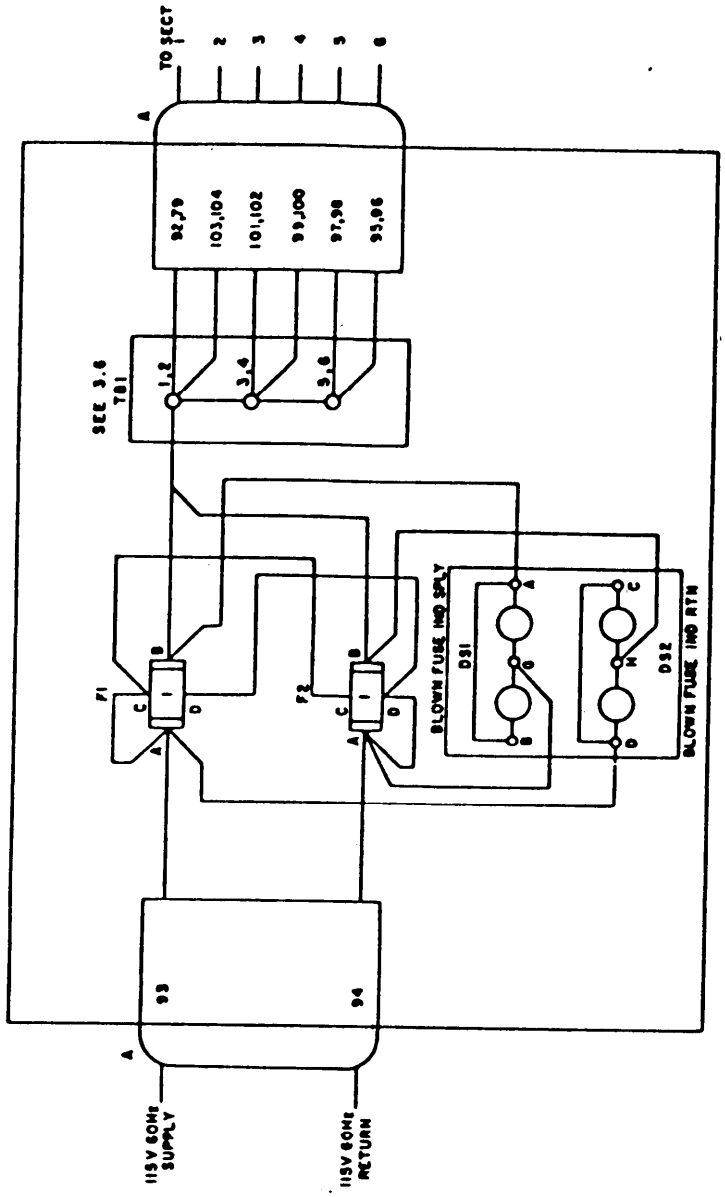

FIGURE 8-2. Blown fuse indicator wiring diagram.

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Requirement 8

REQUIREMENT 9

BUS SELECTOR SWITCH PANEL

1. Purpose. This requirement establishes the configuration of the bus selector switch panel assembly.

20 Documents applicable to requirement 9:

MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-S-21604/2	- Switch, Rotary, Multipole and Selector, 5 Ampere, Style JK.
MIL-S-22473	- Sealing, Locking, and Retaining Compounds; Single-Component.
MS24693	- Screw, Machine, Flat Countersunk Head, 100°, Cross Recessed, UNC-2A and UNF-2A (in./mm).

3. REQUIREMENTS

3.1 Bus selector switch panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.4.

3.2 Bus selector switch panel assembly shall be arranged as shown on figure 9-1.

3.3 Front plate of the panel assembly shall be punched for two switches.

3.4 Marking. Marking shall be as shown on figure 9-1. When the panel contains both a.c. and d.c. bus select switches the panel title shall be "BUS SEL", the stop switch shall be marked “DC” and the lower switch shall be marked “AC”. When the panel assembly contains only one bus select switch, the panel title shall be "AC BUS SEL" or "DC BUS SEL" and the switch shall be mounted in the lower position and shall be designated “S1”. Actual marking for switches and switch positions will be specified in the acquisition technical data package.

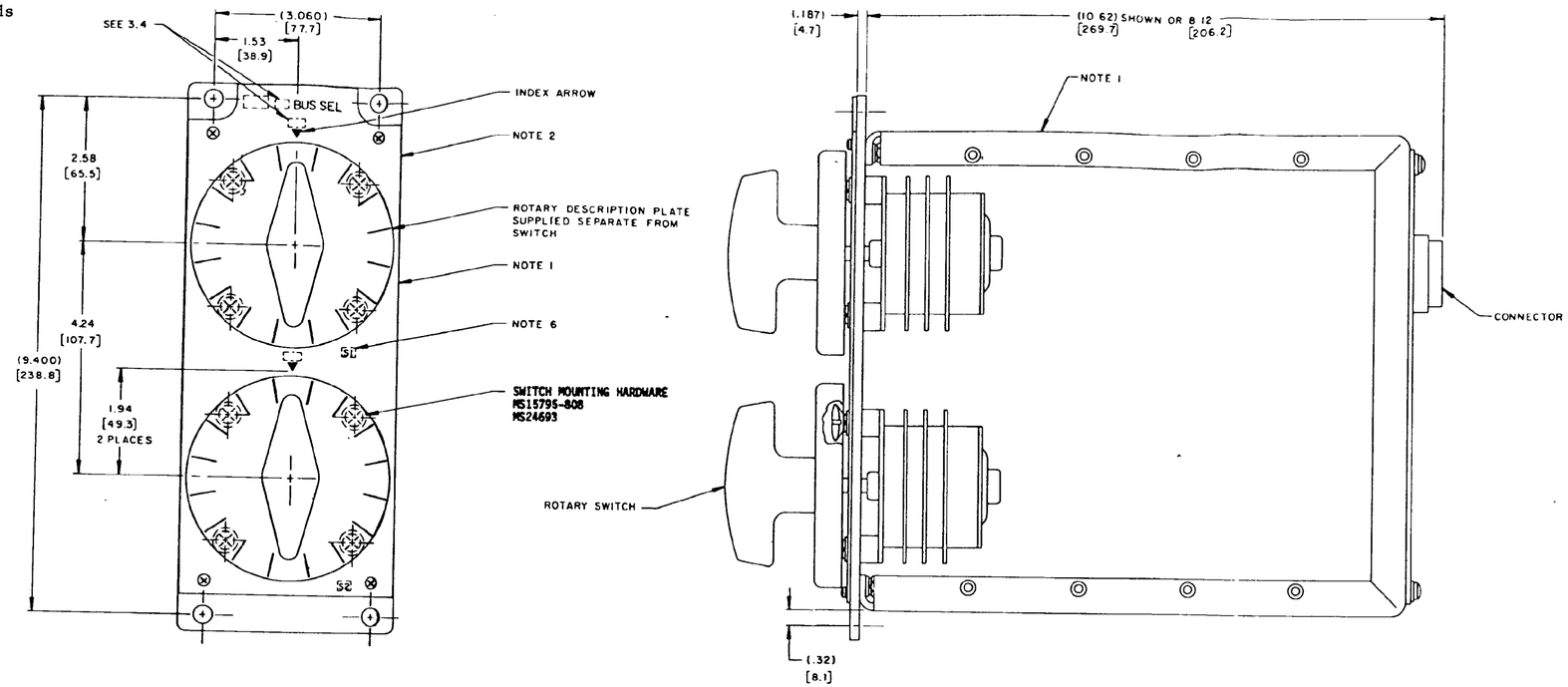
4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

	Circuit symbols.
(a) Switch shall be type S3JK3 in accordance with MIL-S-21604/2.	S1, S2

NOTES:

1. Description plate, front panel, chassis and rear plate shall be in accordance with requirement 5.
2. Front panel shall be painted in accordance with MIL-S-17000.
3. All dimensions are in inches.
4. Unless otherwise specified, tolerances shall be .XX ± .02 and .XXX ± .010.
5. Metric equivalents are given for general information only and are based upon 1 inch = 25.4 mm. Dimensions in [ ] are millimeters.
6. Stencil or rubber stamp reference designations required .12 [3.0] high on far side in areas shown.
7. Apply locking compound conforming to MIL-S-22473 to threads when mounting switch.



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REQUIREMENT 9

FIGURE 9-1. Bus selector switch panel assembly.

REQUIREMENT 10

METER PANEL

1. Purpose. This requirement establishes the configuration for a.c. and d.c. voltmeter panel assemblies.

2. Documents applicable to requirement 10:

MIL-M-10304/11 - Meters, Electrical Indicating, Panel Type, Ruggedized: Voltmeter, DC (Flush Mounting, Round Flange, 3-1/2 Inch), Style 36.
MIL-M-10304/26 - Meters, Electrical Indicating, Panel Type, Ruggedized: Rectifier-Type Voltmeter, AC (Flush Mounting, Round Flange, 3-1/2 Inch), Styles 34 and 36.
MIL-S-15291 - Switches, Rotary, Snap Action and Detent/Spring Return Action General Specification for.
MIL-S-17000 - Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-S-22473 - Sealing, Locking, and Retaining Compounds; Single-Component.
MS24693 Screw, Machine, Flat Countersunk Head, 100°, Cross Recessed, UNC-2A and UNF-2A (in./mm).

3. REQUIREMENTS

3.1 Meter panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.5.

3.2 Panel assembly shall be arranged as shown on figure 10-1 and wired as shown on figure 10-2.

3.3 Marking shall indicate “AC” or “DC” as appropriate for either an a.c. or a d.c. meter panel.

3.4 Terminals "A" and "B” on meter are used only to define the meter terminals. “A” is the positive (+) terminal and “B” is the negative (-) terminal.

3.5 Voltmeter scales shall be as follows:

Highest nominal supply voltage	Scale reading
120 V a.c.	0 - 150
120 V d.c.	0 - 150
50 V d.c	0-75
28 V d.c	0-30

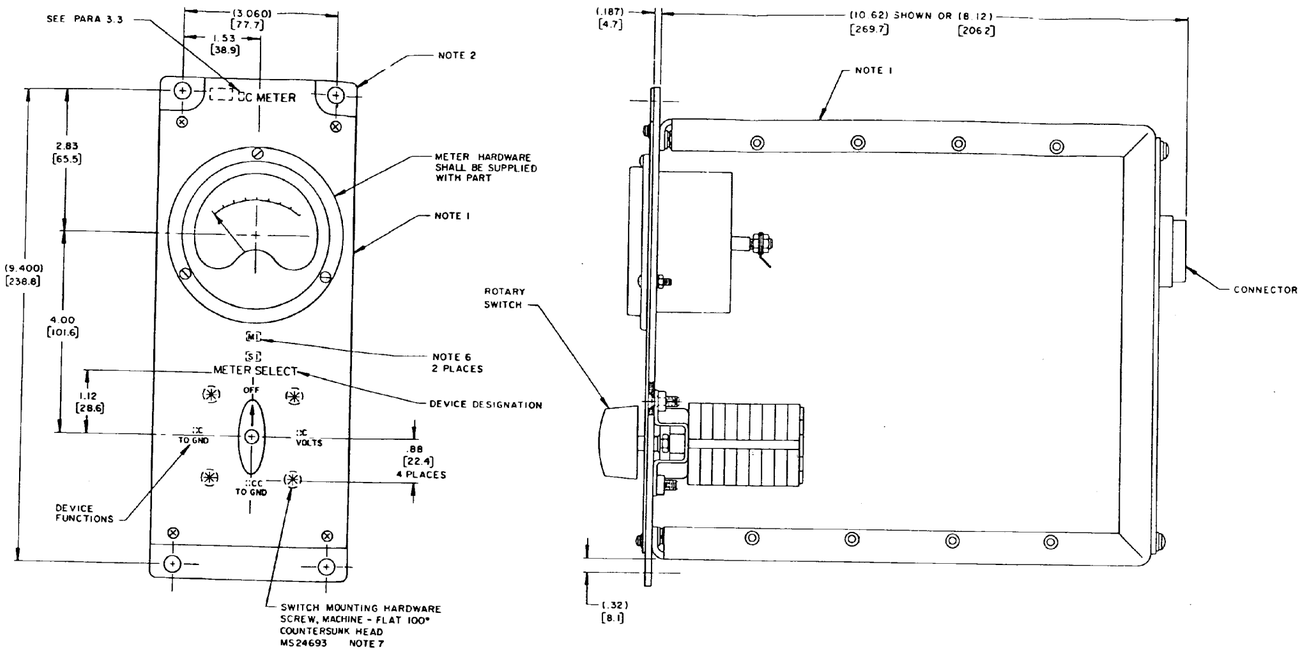
4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

	Circuit symbols
(a) A.c. meter shall be type MR36WXXXARVVR in accordance with MIL-M-10304/26 (see note).	M1
(b) D.c. meter shall be type MR36WXXXDCVVR in accordance with MIL-M-10304/11 (see note).	M1
(c) Switch shall be type 1SR2E2 in accordance with MIL-S-15291.	S1

NOTE : In meter type number replace XXX with proper scale designation in accordance with 3.5 (i.e., for 50 volt scale use 050). For submarine applications change "W" to "B".

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ± .02 AND .XXX ± .010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
7. APPLY LOCKING COMPOUND CONFORMING TO MIL-S-22473 TO THREADS WHEN MOUNTING SWITCH.



SH 11519

REQUIREMENT 10

FIGURE 10-1. Meter panel assembly.

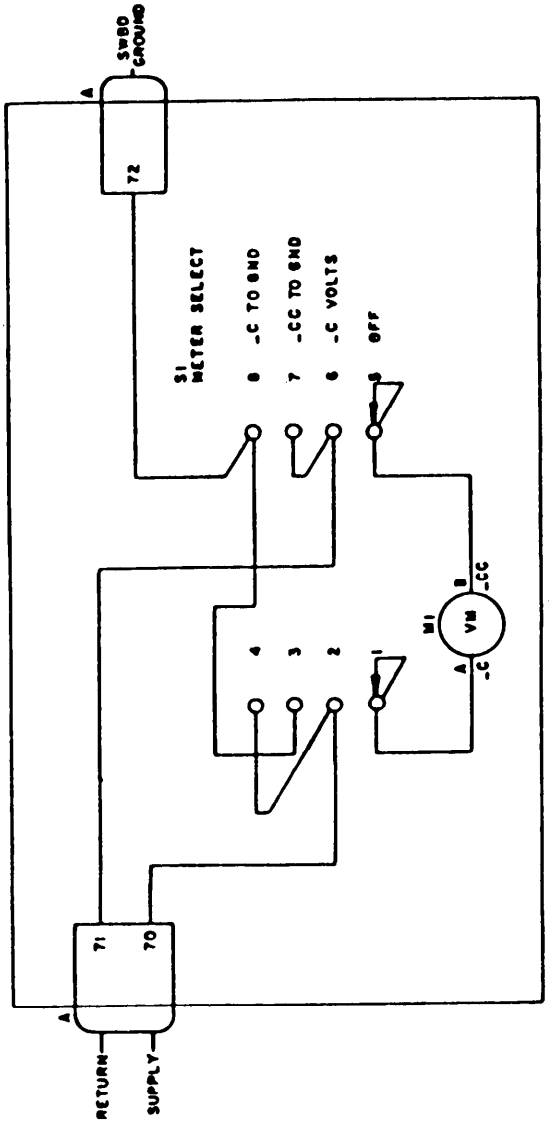


FIGURE 10-2. Meter panel wiring diagram.

SH 11520

REQUIREMENT 11

SWITCH POTENTIAL TRANSFORMER PANEL

1. Purpose. This requirement establishes the configuration of the switch potential transformer panel assembly.

2. Documents applicable to requirement 11:

MIL-S-3786/4 - Switch, Rotary, Closed Construction, 2 Amperes, Style SR04.
MIL-F-15160/77 - Fuses (Indicating), Style F77A.
MIL-S-15291 - Switches, Rotary, Snap Action and Detent/Spring Return Action General Specification for.
MIL-S-17000 - Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-F-19207/38 - Fuseholders, Extractor Post Type, Blown Fuse Indicating, Type FHL57G.
MIL-S-22473 - Sealing, Locking, and Retaining Compounds; Single-Component.
MIL-C-28731 - Connectors, Electrical, Rectangular, Removable Contact, Formed Blade, Fork Type (for Rack and Panel and Other Applications), General Specification for.
MIL-T-55164/12 - Terminal Boards, Molded, Barrier, Stud Type, Class 6TB.
MS15795 Washer, Flat-Metal, Round, General Purpose (in./mm).
MS24693 Screw, Machine, Flat Countersunk Head, 100°, Cross Recessed, UNC-2A and UNF-2A (in./mm).
MS35338 Washer, Lock-Spring, Helical, Regular (Medium) Series (in./mm).
MS51957 Screw, Machine-Pan Head, Cross-Recessed, Corrosion-Resisting Steel, UNC-2A.
NAVSHIPS 803-4680147 - Switching Equipment, Command and Control, and Fire Control, Test Receptacle and Plugs (Source Control Drawing).
NAVSEA 803-5002567 - Panel-Mounted Assembly Test Cables.
NAVSHIPS 9000-S6202-74004 - Switch Control Transformer Type Drawing (For Remote Operation Type JR Switch Assemblies).

3. REQUIREMENTS

3.1 The switch potential transformer panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.5.

3.2 Switch potential transformer panel assembly shall be arranged as shown on figure 11-1 and wired as shown on figure 11-2.

3.3 Fuses 9 and 10 are for 115 Volts (V), 60 hertz (Hz), phase BC switch control supply. Fuses 1 through 8 are for potentials A through H, respectively, to protect individual taps to remote operated switches.

3.4 Wiring from the transformer to line side of appropriate fuseholders shall be provided for all potentials. Wiring from load side of fuseholders to panel connector will be defined in the acquisition technical data package. Up to three separate potential distribution circuits from one fuseholder may be accommodated. For four or more potential distribution circuits, a type 6TB10 terminal board conforming to MIL-T-55164/12 shall be provided.

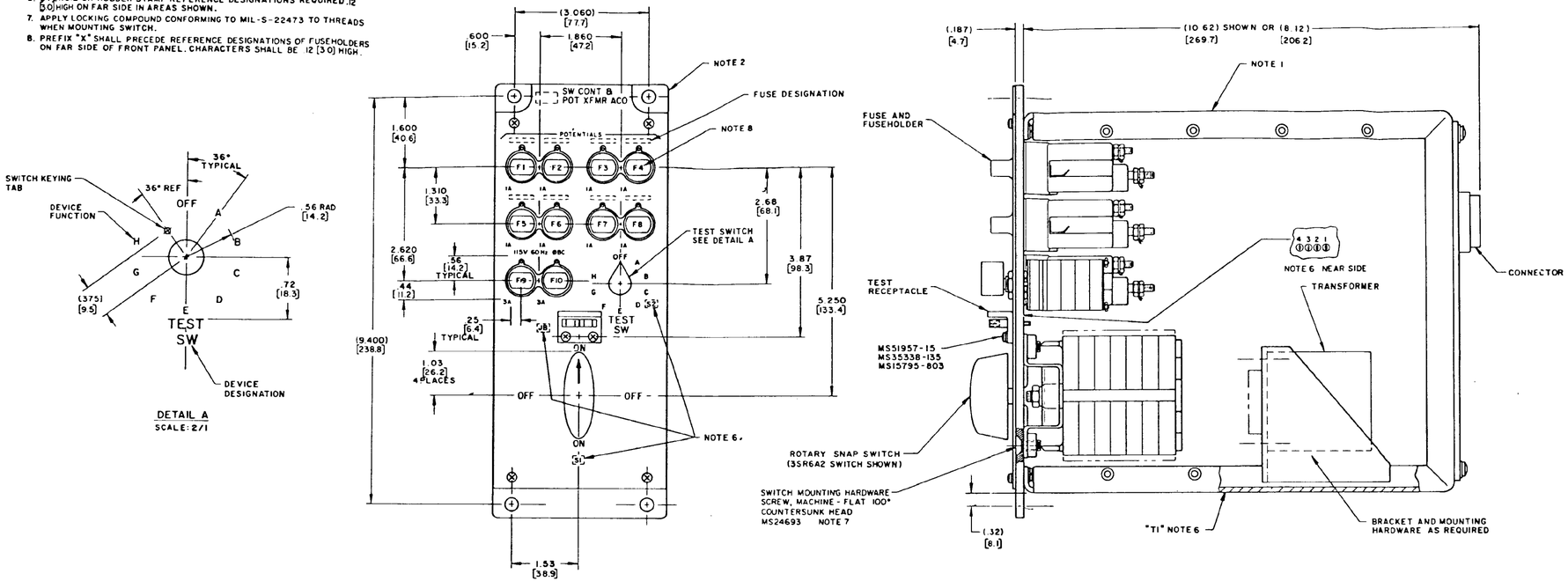
3.5 Test switch (S2) and test receptacle (JB) are for use in testing remote operated style LS or DLS switches. Test cable required is in accordance with Drawing 803-5002567 (part number 5002567-103).

4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

	Circuit symbols
(a) The five fuseholders shall be type FHL57G in accordance with MIL-F-19207/38, using two 3-ampere (A) and eight 1-A style F77A fuses in accordance with MIL-F-15160/77 (see figure 11-2).	XF1-10 and F1-10
(b) Power switch shall be type 1SR6A2 in accordance with MIL-S-15291 for up to 18 remote operated switches or type 3SR6A2 in accordance with MIL-S-15291 for up to 50 remote operated switches.	S1
(c) Test switch shall be type SR04E36B1MP0 (part number M3786/4-0383) in accordance with MIL-S-3786/4.	S2
(d) Potential transformer shall be of the required capacity and identical in circuit design to that shown on Drawing 9000-S6202-74004.	T1
(e) Test receptacle shall be in accordance with MIL-C-28731 and Drawing 803-4680147 (part number 803-4680147-1).	JB
(f) Terminal board (if required) shall be type 6TB10 in accordance with MIL-T-55164/12.	TB1

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ±.02 AND .XXX ±.010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1INCH=25.4mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
7. APPLY LOCKING COMPOUND CONFORMING TO MIL-S-22473 TO THREADS WHEN MOUNTING SWITCH.
8. PREFIX "X" SHALL PRECEDE REFERENCE DESIGNATIONS OF FUSEHOLDERS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH.



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REQUIREMENT 11

FIGURE 11-1. Switch potential transformer panel assembly.

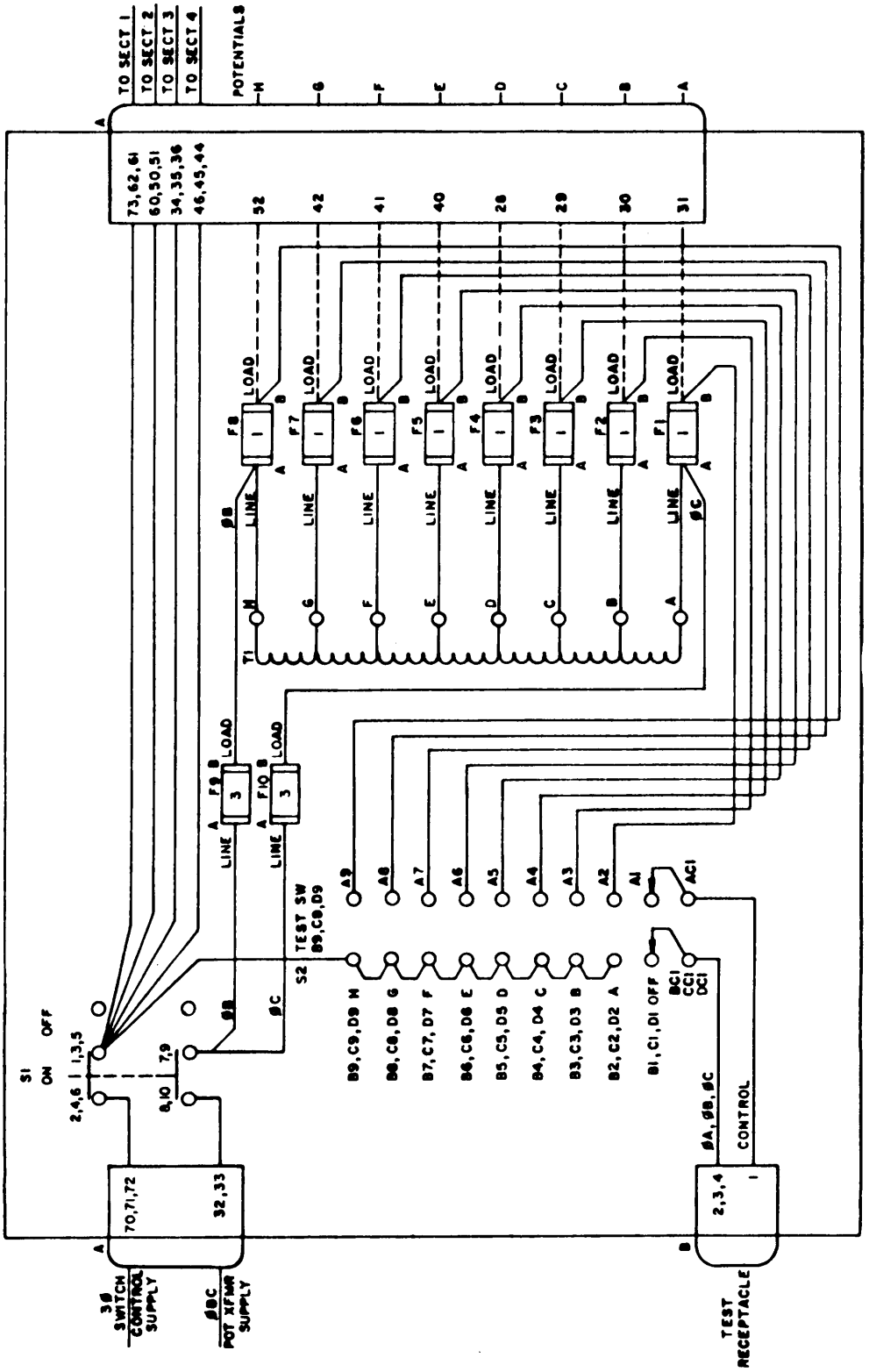


FIGURE 11-2. Switch potential transformer panel wiring diagram.

REQUIREMENT 12

FUSE TESTER PANEL

1. Purpose. This requirement establishes the configuration of the fuse tester panel assembly.

2. Documents applicable to requirement 12:

MIL-F-15160/77	- Fuses (Indicating), Style F77A.
MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-F-19207/38	- Fuseholders, Extractor Post Type, Blown Fuse Indicating, Type FHL57G.
MIL-S-22885/87	- Switch, Push Button, Illuminated, 4-Lamp, Solid Mount, Modular Constructed, High Impact Shock.
MS15795	Washer, Flat-Metal, Round, General Purpose (in./mm).
MS24693	Screw, Machine, Flat Countersunk Head, 100°, Cross Recessed, UNC-2A and UNF-2A (in./mm).
MS35338	Washer, Lock-Spring, Helical, Regular (Medium) Series, (in./mm).
MS35649	Nut, Plain-Hexagon, Machine Screw, UNC-2B.

3* REQUIREMENTS

3.1 Fuse tester panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.5.

3.2 Fuse tester panel assembly shall be arranged as shown on figure 12-1 and wired as shown on figure 12-2.

3.3 Terminals 1 through 4 on T1 are used only to define the connections required.

3.4 Terminals 1 and 2 on left and right test bars as viewed from front of panel are used only to define the connections required.

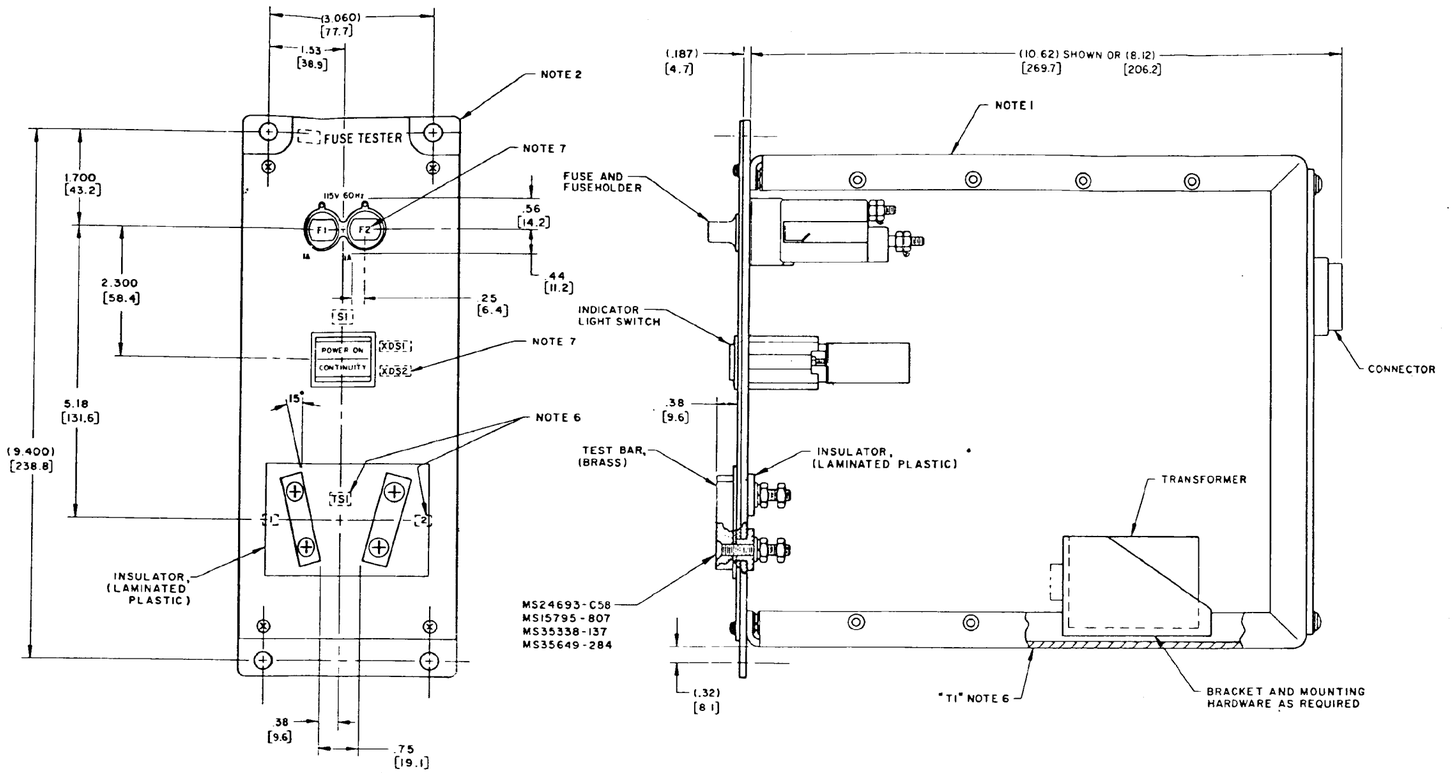
3.5 Poles 1 and 2 of S1 are assigned left to right as viewed from front of panel.

4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

	Circuit symbols
(a) Fuseholder shall be type FHL57G in accordance with MIL-F-19207/38 using two l-ampere F77A fuses in accordance with MIL-F-15160/77.	XF1-2 and F1-2
(b) Illuminated pushbutton switch shall be part number M22885/87-E-D-WWGG in accordance with MIL-S-22885/87 or equal.	S1 and XDS1-2
(c) Fuse testing contact strips shall be designed by manufacturer.	TS1
(d) Transformer (115 volts (V)/6V step down).	T1

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ± .02 AND .XXX ± .010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
7. PREFIX "X" SHALL PRECEDE REFERENCE DESIGNATIONS OF FUSEHOLDER AND LIGHT SOCKET ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE 12 [3.0] HIGH



SH 11523

REQUIREMENT 12

FIGURE 12-1. Fuse tester panel assembly.

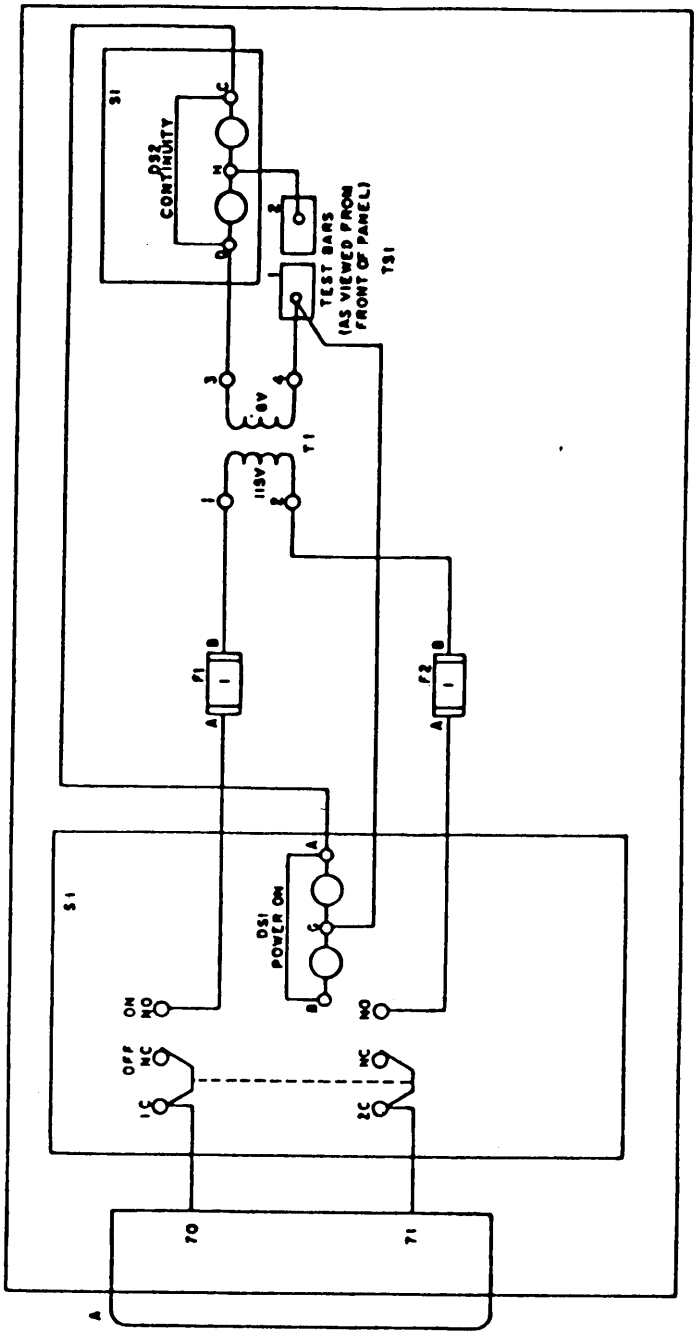


FIGURE 12-2. Fuse tester panel wiring diagram.

SH 11524

Requirement 12

REQUIREMENT 13

RELAY TESTER PANEL

1. Purpose. This requirement establishes the configuration of the relay tester panel assembly.

2. Documents applicable to requirement 13:

MIL-T-7928	- Terminal, Lug, Splices, Conductor; Crimp Style, Copper, General Specification for.
MIL-F-15160/77	- Fuses (Indicating), Style F77A.
MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-F-19207/38	- Fuseholders, Extractor Post Type, Blown Fuse Indicating, Type FHL57G.
MIL-S-21604/3	- Switch, Rotary, Multipole and Selector, 5 Ampere, Style JL.
MIL-S-22473	- Sealing, Locking, and Retaining Compounds; Single-Component.
MIL-S-22885/87	- Switch, Push Button, Illuminated, 4-Lamp, Solid Mount, Modular, Constructed, High-Impact Shock.
MIL-R-39007/11	- Resistors, Fixed, Wirewound (Power Type) Established Reliability, Style RWR89.
MIL-R-39008/5	- Resistor, Fixed, Composition (Insulated), Established Reliability Style RCR42.
MIL-T-55164/12	- Terminal Boards, Molded, Barrier, Stud Type, Class 6TB.
MS17143	- Terminal, Lug, Crimp Style, Copper, Insulated, Rectangular Tongue, Type II, Class 1 for 105°C Total Conductor Temperature.
MS24525	- Switch, Toggle, Four Pole, Environmentally Sealed.
MS24693	- Screw, Machine, Flat Countersunk Head, 100°, Cross Recessed, UNC-2A and UNF-2A (in./mm).
MS25036	- Terminal, Lug, Crimp Style, Copper, Insulated, Ring Tongue, Bell - Monthed, Type II, Class 1 (for 105°C Total Conductor Temperature).

3* REQUIREMENTS

3.1 Relay tester panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.6.

3.2 Relay tester panel assembly shall be arranged as shown on figure 13-1 and wired as shown on figure 13-2.

3.3 Starting at the off position, voltages selected by S1 shall be in ascending order of magnitude in order to prevent damaging a relay.

3.4 The DPDT relay (used only if remote operated switches are used In the switchboard) shall be tested using 28 volts (V) d.c.

3.5 Resistors R1 through R8 shall be used to drop 50 V d.c. to 24 V d.c. for XDS1 through XDS8.

3.6 If 28 V d.c. is not available to the relay tester, 50 V d.c. shall be used with voltage dropping resistors R9 and R10 to drop 50 V d.c. to 28 V d.c. R9 is required to limit current to K2.

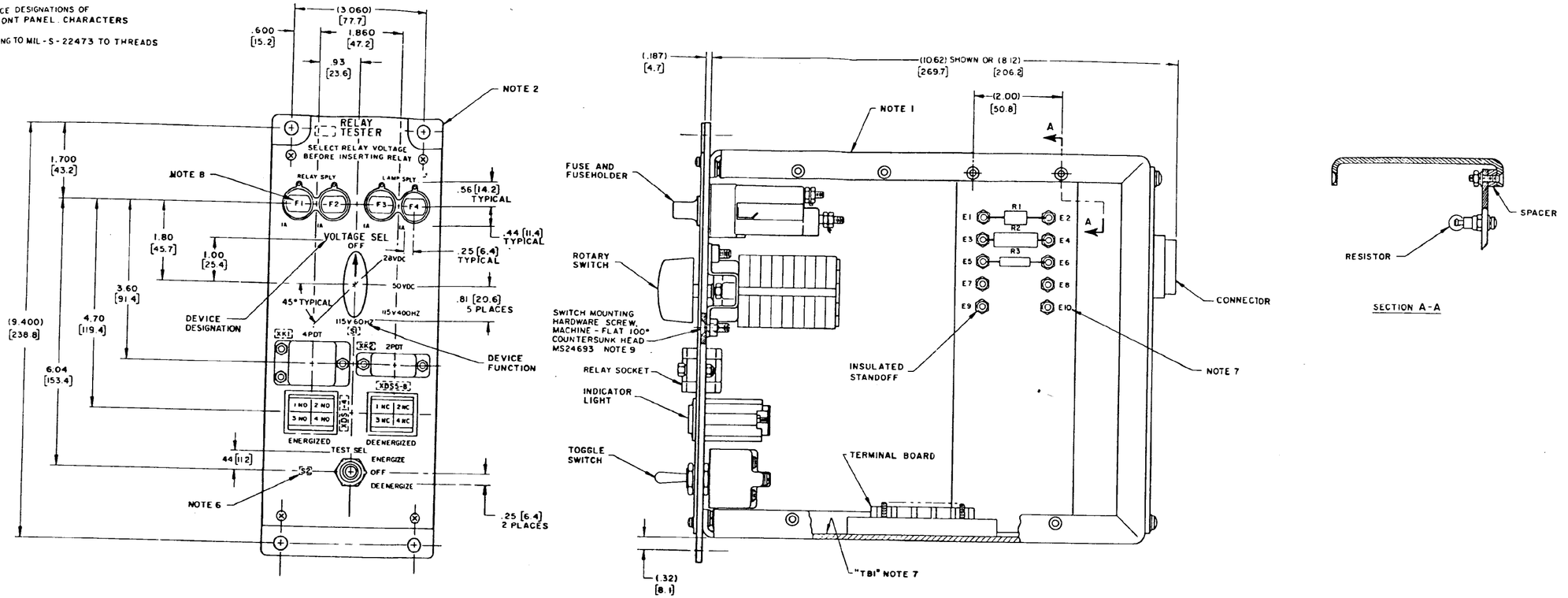
4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

	Circuit symbols
(a) Rotary selector switch shall be type S3JL5 in accordance with MIL-S-21604/3.	S1
(b) Toggle switch shall be 4PDT, center off, momentary contact in both "ON" positions, part number MS24525-27 in accordance with MS24525.	S2
(c) Indicator light shall be part number M22885/87-A-U-GGGG in accordance with MIL-S-22885/87 or equal with four way split lens.	XDS1-4
(d) Indicator light shall be part number M22885/87-A-U-YYYY in accordance with MIL-S-22885/87 or equal with four way split lens.	XDS5-8
(e) No fuseholders shall be type FHL57G in accordance with MIL-F-19207/38 using four 1-ampere F77A fuses in accordance with MIL-F-15160/77.	XF1-4 and F1-4
(f) Relay sockets shall be DAN-L, Inc., or Armel part numbers (or equal) as follows: The DPDT relay socket shall be part number DAN-L 4223-2 or Armel HRC-5J. The 4PDT relay socket shall be DAN-L part number 32823-17SH.	XK1 and XK2
(g) Terminal board shall be type 6TB10 in accordance with MIL-T-55164/12.	TB1
(h) Resistor R9 shall be part number RCR42G472KM in accordance with MIL-R-39008/5.	R9

	Circuit symbols
(i) Resistors R1 through R8 shall be part number RCR42G621JM with plus or minus 5 percent tolerance in accordance with MIL-R-39008/5.	R1 through R8
(j) Resistor R10 shall be part number RWR89S3010M with plus or minus 1 percent tolerance in accordance with MIL-R-39007/11.	R10
(k) Insulated standoff shall be commercial.	E1-20
(1) MS 17143-4 Terminal Lug for use with TB1.	
(m) M7928/4-149 Terminal Lug for use with fuseholders itemized in (e).	

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ±.02 AND .XXX ±.010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
7. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS IN AREAS SHOWN.
8. PREFIX "X" SHALL PRECEDE REFERENCE DESIGNATIONS OF FUSEHOLDERS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH.
9. APPLY LOCKING COMPOUND CONFORMING TO MIL-S-22473 TO THREADS WHEN MOUNTING SWITCH.

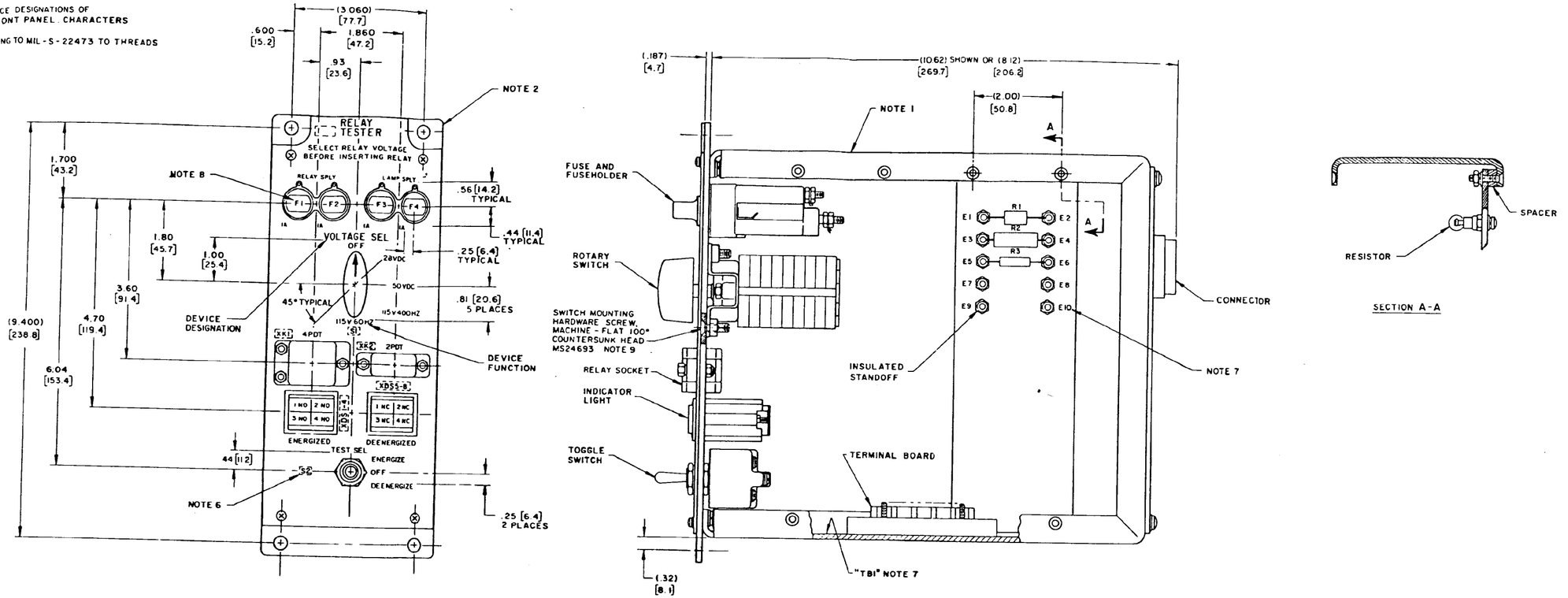


SH 11525

REQUIREMENT 13

FIGURE 13-1. Relay tester panel assembly.

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ±.02 AND .XXX ±.010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
7. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS IN AREAS SHOWN.
8. PREFIX "X" SHALL PRECEDE REFERENCE DESIGNATIONS OF FUSEHOLDERS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH.
9. APPLY LOCKING COMPOUND CONFORMING TO MIL-S-22473 TO THREADS WHEN MOUNTING SWITCH.



SH 11525

REQUIREMENT 13

FIGURE 13-1. Relay tester panel assembly.

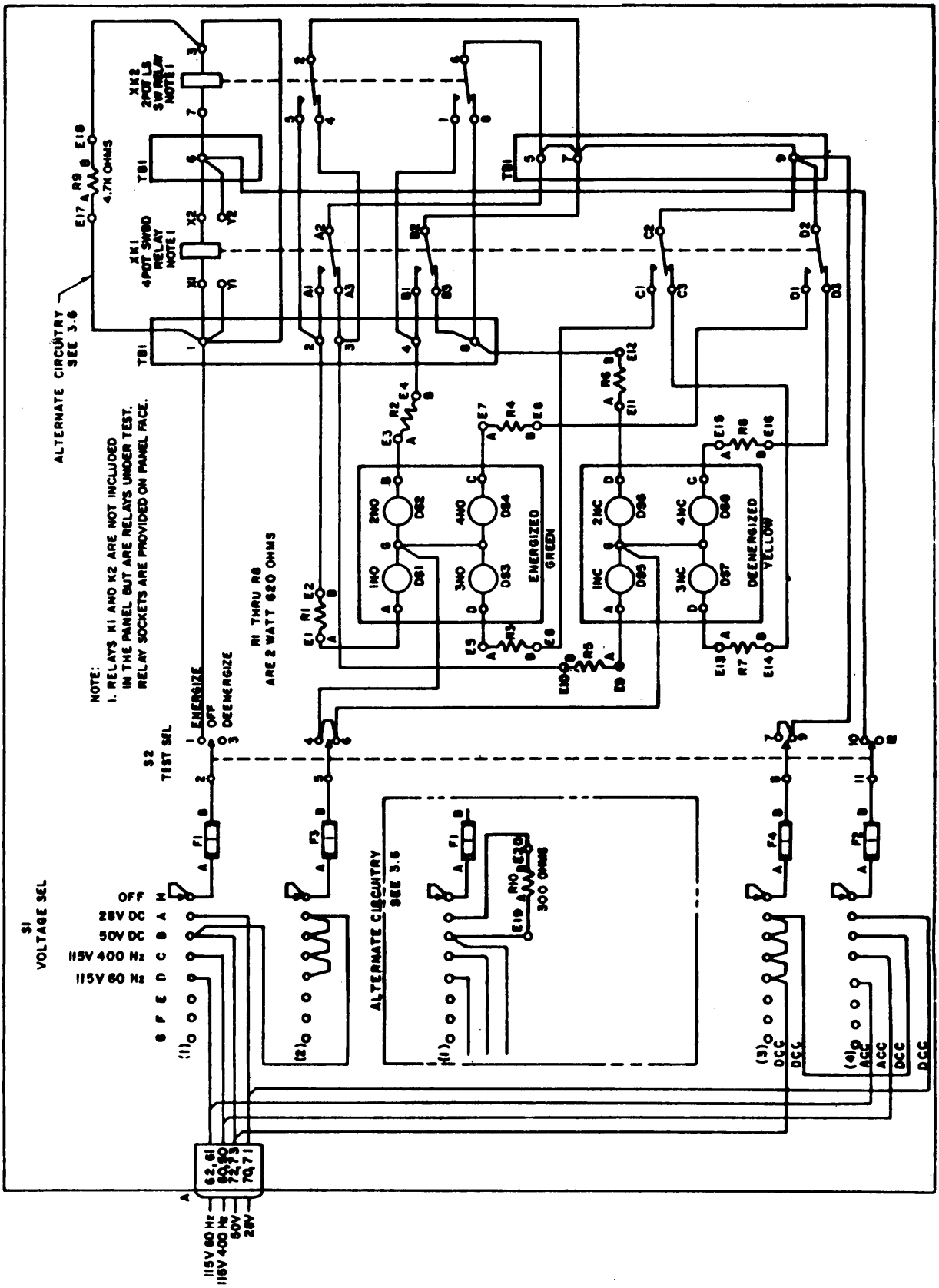


FIGURE 13-2. Relay tester panel wiring diagram.

REQUIREMENT 14

FLASHER PANEL

1. Purpose. This requirement establishes the configuration for flasher panel assemblies.

2. Documents applicable to requirement 14:

MIL-S-8805/l	- Switches, Sensitive, SPDT, Unsealed.
MIL-F-15160/77	- Fuses (Indicating), Style F77A.
MIL-R-15472	- Relays, Motor Driven.
MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-F-19207/38	- Fuseholders, Extractor Post Type, Blown Fuse Indicating, Type FHL57G.
MIL-S-22885/87	- Switch, Push Button, Illuminated, 4-Lamp, Solid Mount, Modular Constructed, High Impact Shock.
MIL-R-39008/3	- Resistor, Fixed, Composition (Insulated), Established Reliability Style RCR32.
MIL-R-39008/5	- Resistor, Fixed, Composition (Insulated) Established Reliability, Style RCR42.
MIL-T-55164/12	- Terminal Boards, Molded, Barrier, Stud Type, Class 6TB.
NAVSHIPS 803-4680143	- Switching Equipment, Command and Control, and Fire Control, Motor, Electric, Flasher Panel (Source Control Drawing).
NAVSEA 803-5476797	- Solid State Flasher Panel.

3. REQUIREMENTS

3.1 Flasher panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.8.

3.2 General design of a mechanical flasher shall be in accordance with MIL-R-15472. Motor driven cams shall be steel, case hard mold. If the acquisition technical data package specifies a Solid State Flasher, it shall be in accordance with Drawing 803-5476797, (DL 5476796 and associated drawings).

3.3 Flasher panel assembly shall be arranged as shown on figure 14-1 and wired as shown on figure 14-2.

3.4 Front plate of the panel assembly shall be punched for two fuseholders and three switch/light units.

3.5 Terminals “A” and “B” on B1 are used only to define the two motor leads.

3.6 Fuse ratings for XF3 and XF4 shall be as defined in the acquisition technical data package.

3.7 Poles of S1 and S2 shall be assigned left *to* right as viewed from front of panel.

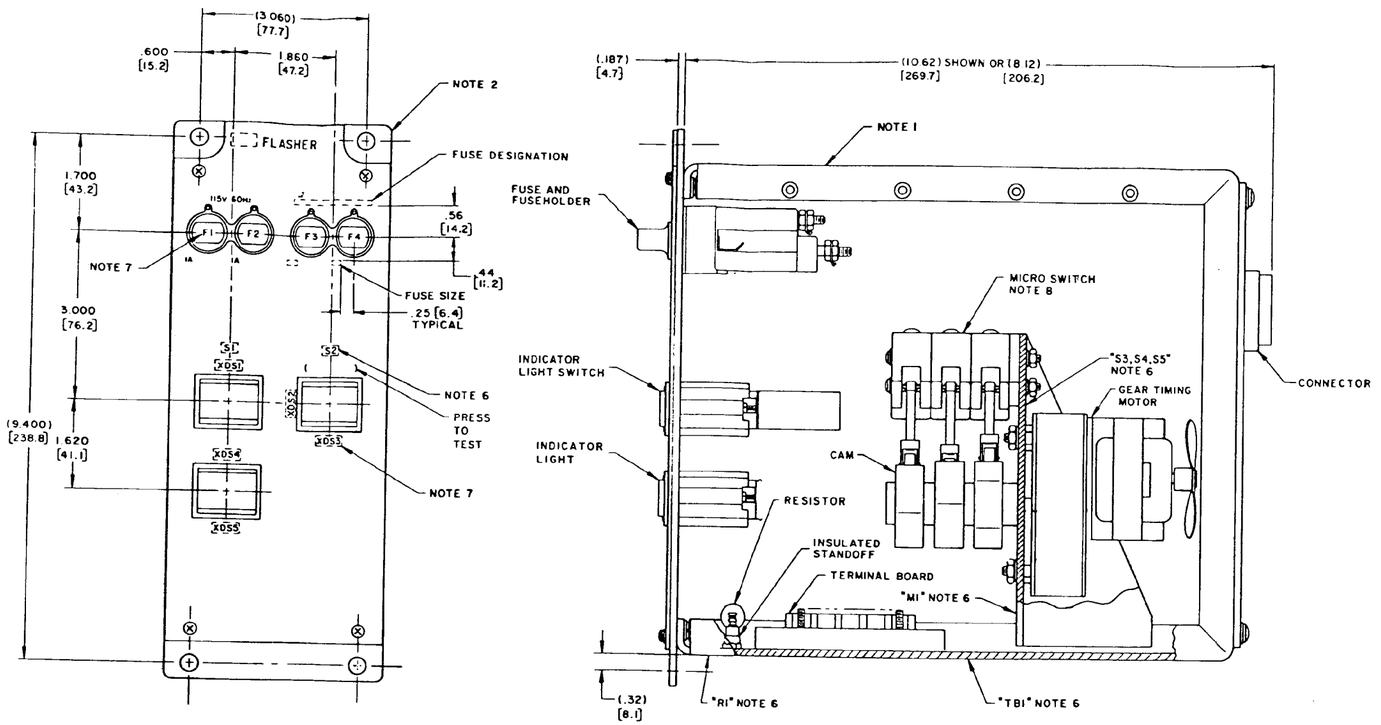
3.8 Switch contacts shall be rated at 10 amperes (A), 125 volts (V) a.c. and 5 A, 50 V d.c. Flasher shall be designed for continuous operation.

4. PARTS

4.1 In addition to the parts listed in requirement 5, the following parts may be required as specified in the acquisition technical data package:

		Circuit symbols
(a)	Fuseholder(s) (as required) shall be type FHL57G in accordance with MIL-F-19207/38 using style F77A fuse(s) (as required) in accordance with part number MIL-F-15160/77.	XF1-XF4 F1-F4
(b)	Illuminated pushbutton switch (S1) shall be part number M22885/87-A-E-GGGG in accordance with MIL-S-22885/87 or equal. Illuminated pushbutton switch (S2) shall be part number M22885/87-E-E-WWWW in accordance with MIL-S-22885/87 or equal.	S1, XDS1 S2, XDS2, XDS3
(c)	Motor shall be in accordance with Drawing 803-4680143.	B1
(d)	Sensitive switch shall be part number M8805/1-054 in accordance with MIL-S-8805/1.	S3-S5
(e)	Resistor shall be part number RCR32G101KM with 10 percent tolerance in accordance with MIL-R-39008/3.	R1, R2, R3, R4
(f)	Resistor shall be part number RCR42G621JM with 5 percent tolerance in accordance with MIL-R-39008/5.	R5, R6
(g)	Indicator light (if required) shall be part number M22885/87-A-E-WWWW in accordance with MIL-S-22885/87 or equal.	XDS4, XDS5
(h)	Terminal board shall be type 6TB10 in accordance with MIL-T-55164/12.	TBl
(i)	Insulated standoff shall be commercial.	E1-12

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ± 02 AND .XXX ± .010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
7. PREFIX "X" SHALL PRECEDE REFERENCE DESIGNATIONS OF FUSEHOLDERS AND LIGHT SOCKETS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH.
8. MOUNTING BRACKET AND ARRANGEMENT OF SWITCHES AND CAMS IS A DESIGN OPTION.



SH 11527

REQUIREMENT 14

14-1. Flasher panel assembly.

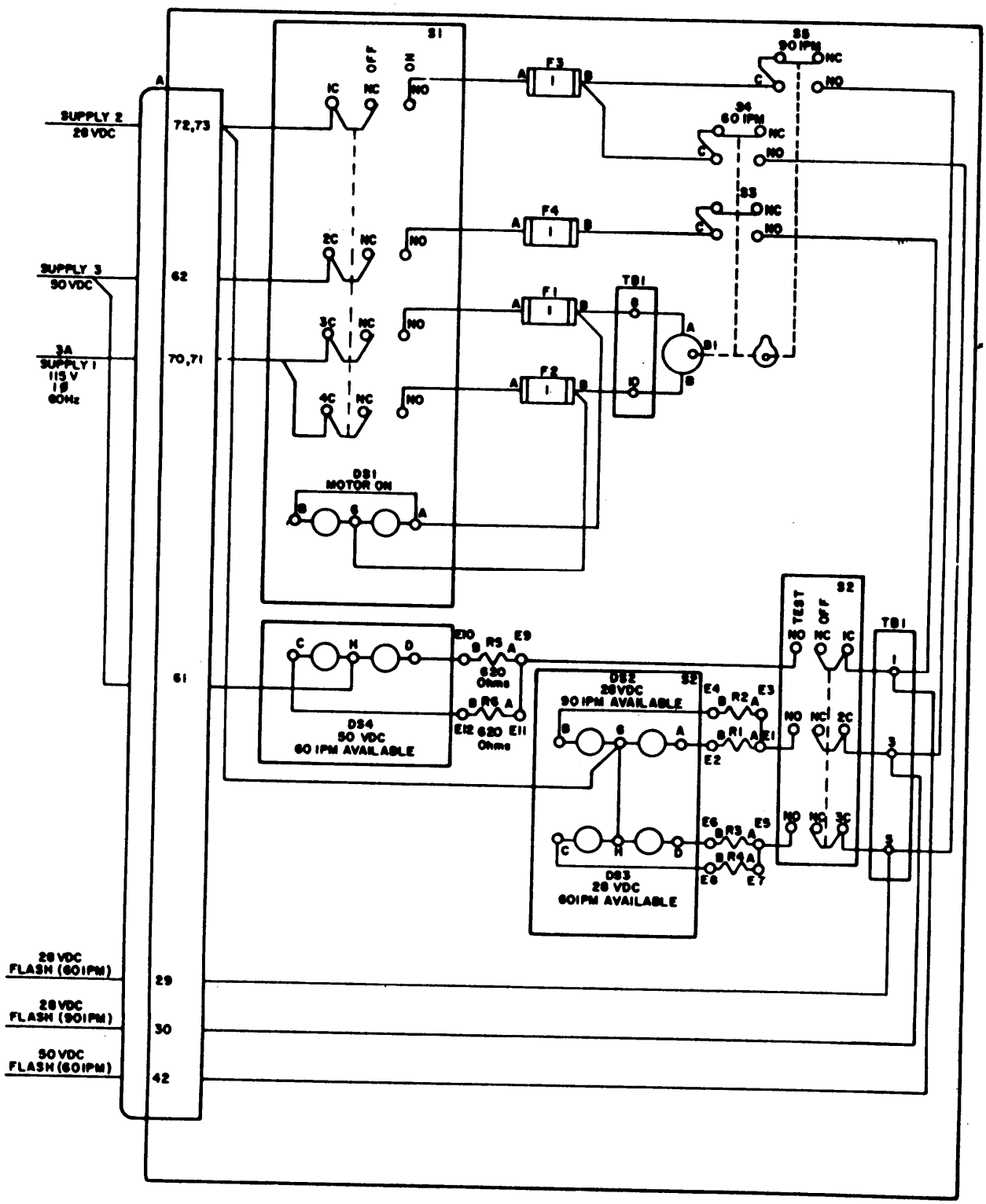


FIGURE 14-2. Flasher panel wiring diagram.

REQUIREMENT 15

TRANSFORMER PANEL

1. Purpose. This requirement establishes the configuration for transformer panel assemblies.

2. Documents applicable to requirement 15:

MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-S-22885/87	- Switch, Push Button, Illuminated, 4-Lamp, Solid Mount, Modular Constructed, High Impact Shock.
MIL-T-55164/12	- Terminal Boards, Molded, Barrier, Stud Type, Class 6TB.

3. REQUIREMENTS

3.1 The transformer panel assembly shall be in accordance with requirement 5 and as specified in 3.2 through 3.5.

3.2 Panel assembly shall be arranged as shown on figure 15-1.

3.3 Front plate of the panel assembly shall be punched for four fuseholders and two illuminated pushbutton switches or indicator lights.

3.4 Panel shall accommodate two transformers.

3.5 Poles 1 through 4 of S1 and S2 are assigned left to right as viewed from front of panel.

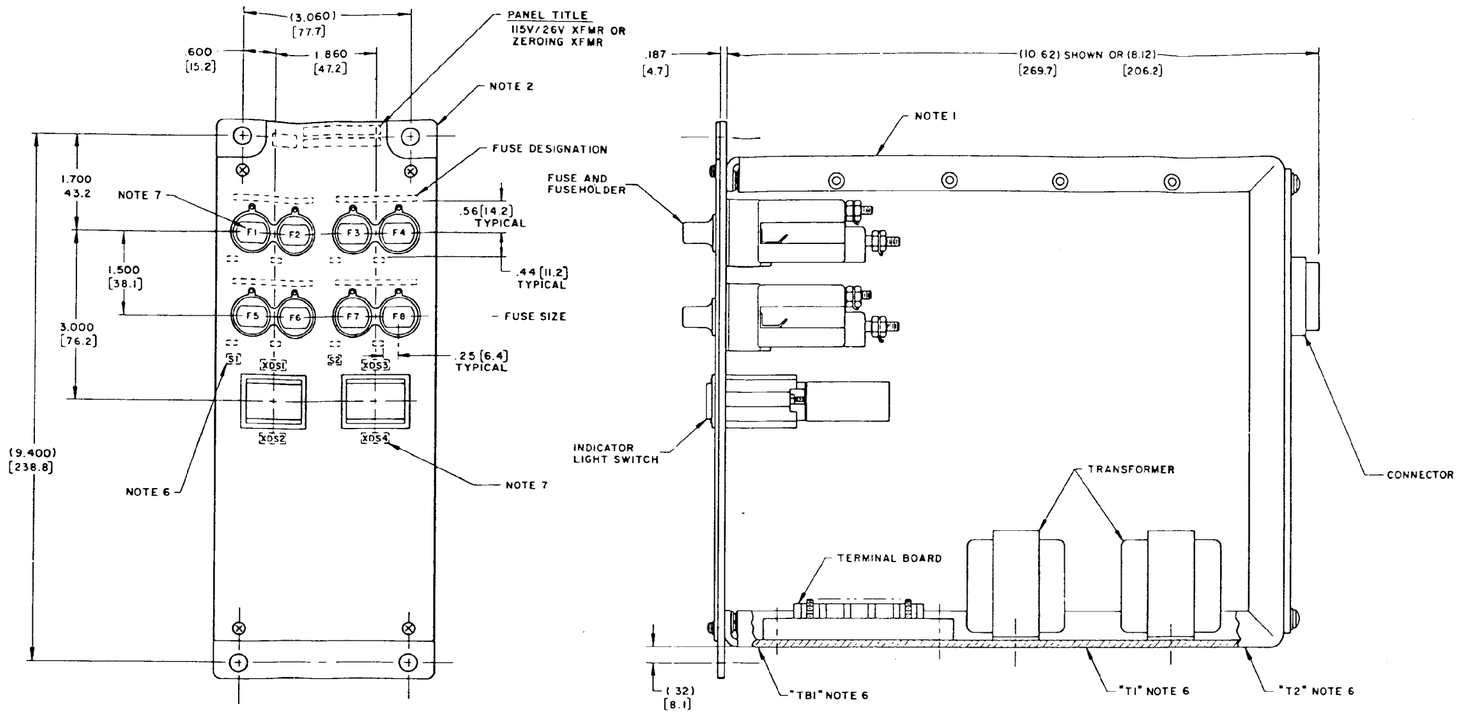
4. PARTS

4.1 In addition to the part's listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

	Circuit symbols
(a) Illuminated push button switches or indicator lights (depending on circuit design) shall be in accordance with MIL-S-22885/87 or equal.	S1, XDS1-2 S2, XDS3-4

	Circuit symbols
(b) Transformers shall be as required and as specified in the acquisition technical data package.	T1, T2
(c) Terminal board shall be type 6TB10 in accordance with MIL-T-55164/12.	TB1

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ± .02 AND .XXX ± .010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
7. PREFIX "X" SHALL PRECEDE REFERENCE DESIGNATIONS OF FUSEHOLDERS AND LIGHT SOCKETS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH.



SH 11529

REQUIREMENT 15

FIGURE 15-1. Transformer panel assembly.

REQUIREMENT 16

SYNCHRO SIGNAL CONVERTER

1. Purpose. This requirement establishes the configuration of synchro signal converters.

2. Documents applicable to requirement 16:

MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-F-19207/38	- Fuseholders, Extractor Post Type, Blown Fuse Indicating, Type FHL57G.
MIL-S-22473	- Sealing, Locking, and Retaining Compounds; Single-Component.
MIL-C-24105	- Converters, Synchro Signal (Panel Mounted).
NAVSHIPS 803-4680145	- Switching Equipment, Command and Control, and Fire Control, servtorqs (Source Control Drawing).

3. REQUIREMENTS

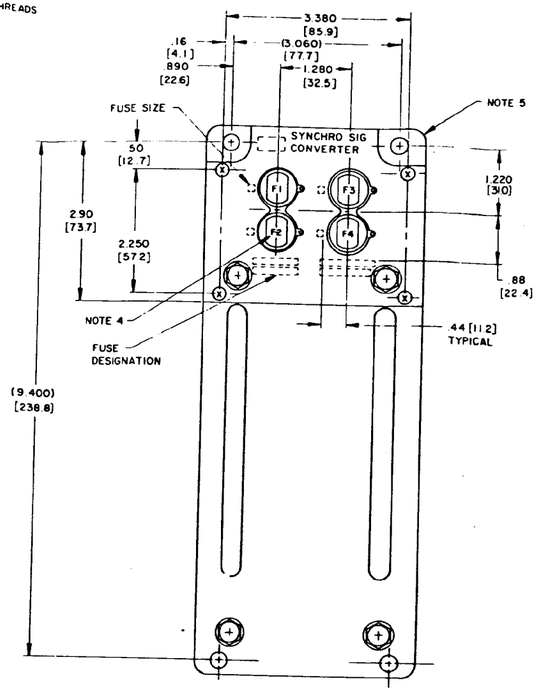
3.1 Synchro signal converters shall conform to the requirements of MIL-C-24105 and shall provide the output signals as specified in the acquisition technical data package.

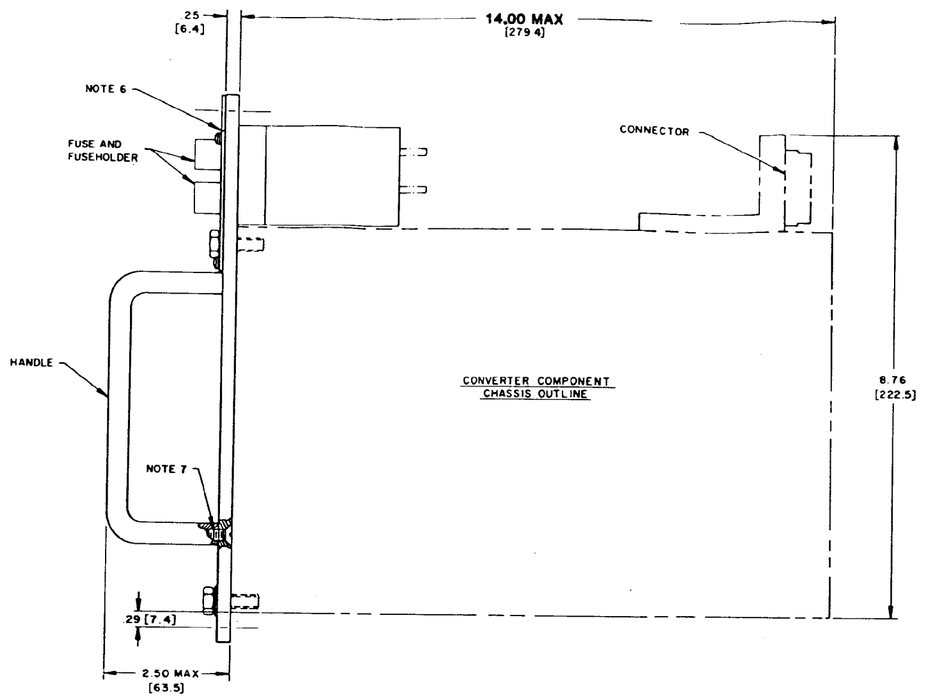
3.1.1 Input devices of the converters shall be servtorqs in accordance with Drawing 803-4680145.

3.2 Synchro signal converter panel assembly shall be arranged as shown on figure 16-1.

3.3 Typical wiring of a "Two speed input/three speed output" synchro signal converter is shown on figure 16-2.

NOTES
1. ALL DIMENSIONS ARE IN INCHES.
2. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE XX ± 02 AND XXX ± 010
3. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS
4. PREFIX "X" SHALL PRECEDE REFERENCE DESIGNATIONS OF FUSEHOLDERS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE 12 [30] HIGH.
5. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
6. UNLESS OTHERWISE SPECIFIED, FRONT PANEL AND DESCRIPTION PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
7. APPLY LOCKING COMPOUND CONFORMING TO MIL-S-22473 TO THREADS





SH 11530

REQUIREMENT 16

FIGURE 16-1. Synchro signal converter panel assembly.

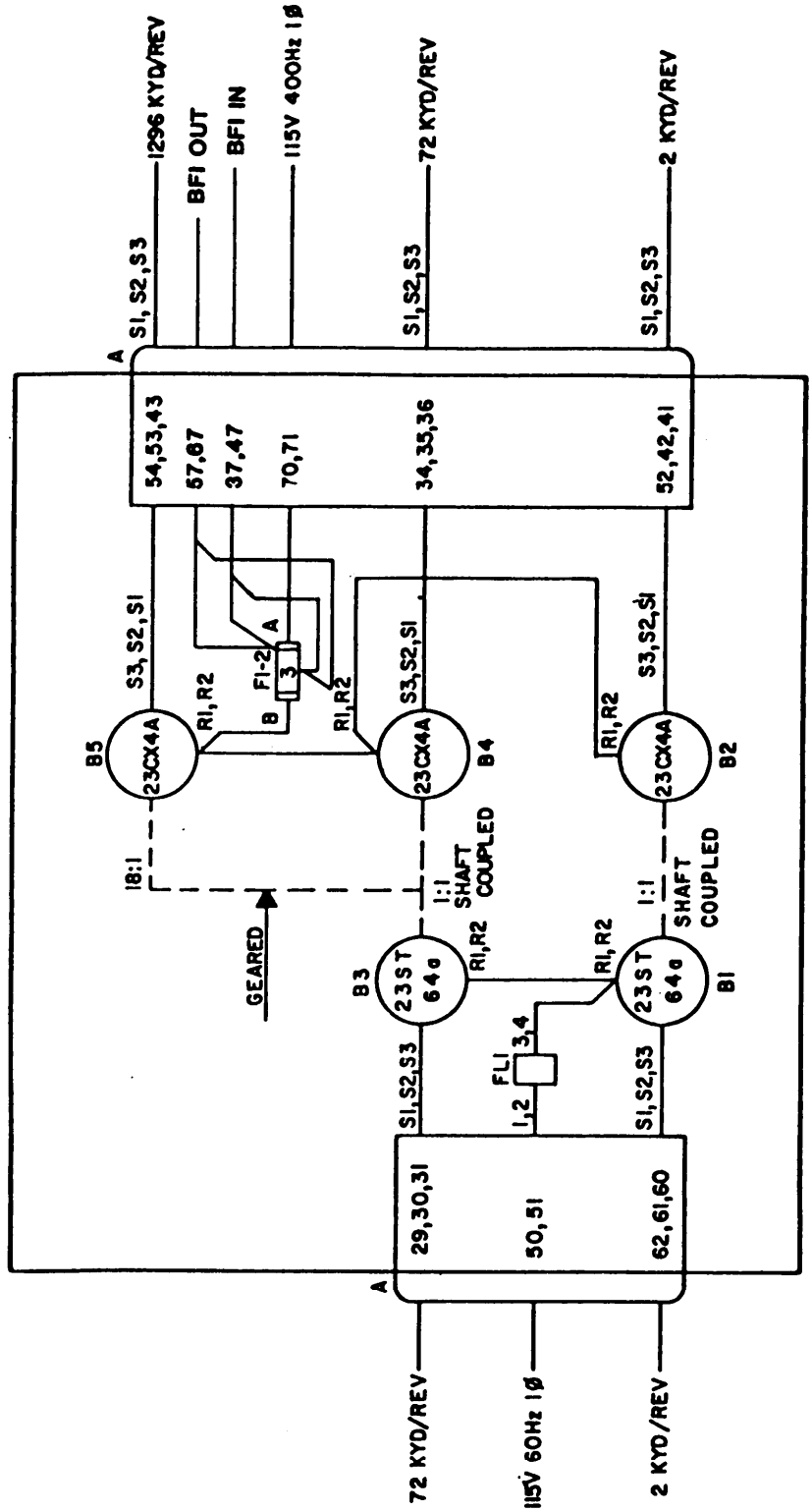


FIGURE 16-2. Typical synchro signal converter wiring diagram.

SH 11531

Requirement 16

REQUIREMENT 17

SIGNAL GENERATOR

1. Purpose. This requirement establishes the configuration for signal generators

2. REQUIREMENTS

2.1 Signal generator shall fit into the basic panel assembly shown in requirement 5.

2.2 Design of the signal generator shall be as approved by NAVSEA.

2.3 Signal generator shall operate from an input power source of 115 volts (V), 60 hertz (Hz), 50 V d.c. or 28 V d.c. as determined by the manufacturer's approved design.

2.4 Output signals shall be isolated from the signal generating voltages by transformers.

2.5 Signal requirements shall be as defined in the acquisition technical data package.

REQUIREMENT 18

SWITCH PANEL

1. Purpose. This requirement establishes the configuration for switch panel assemblies.

2. Documents applicable to requirement 18:

MIL-F-15160/77	- Fuses (Indicating), Style F77A.
MIL-S-15291	- Switches, Rotary, Snap Action and Detent/Spring Return Action General Specification for.
MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-F-19207/38	- Fuseholders, Extractor Post Type, Blown Fuse Indicating, Type FHL57G.
MIL-S-21604/5	- Switch, Rotary, Multipole and Selector, 10 Ampere, Style JR.
MIL-S-22473	- Sealing, Locking, and Retaining Compounds; Single-Component.
MS24693	- Screw, Machine, Flat Countersunk Head, 100°, Cross Recessed, UNC-2A and UNF-2A (in./mm).

3. REQUIREMENTS

3.1 Switch panel assembly shall be in accordance with requirement 5 and as specified in 3.2.

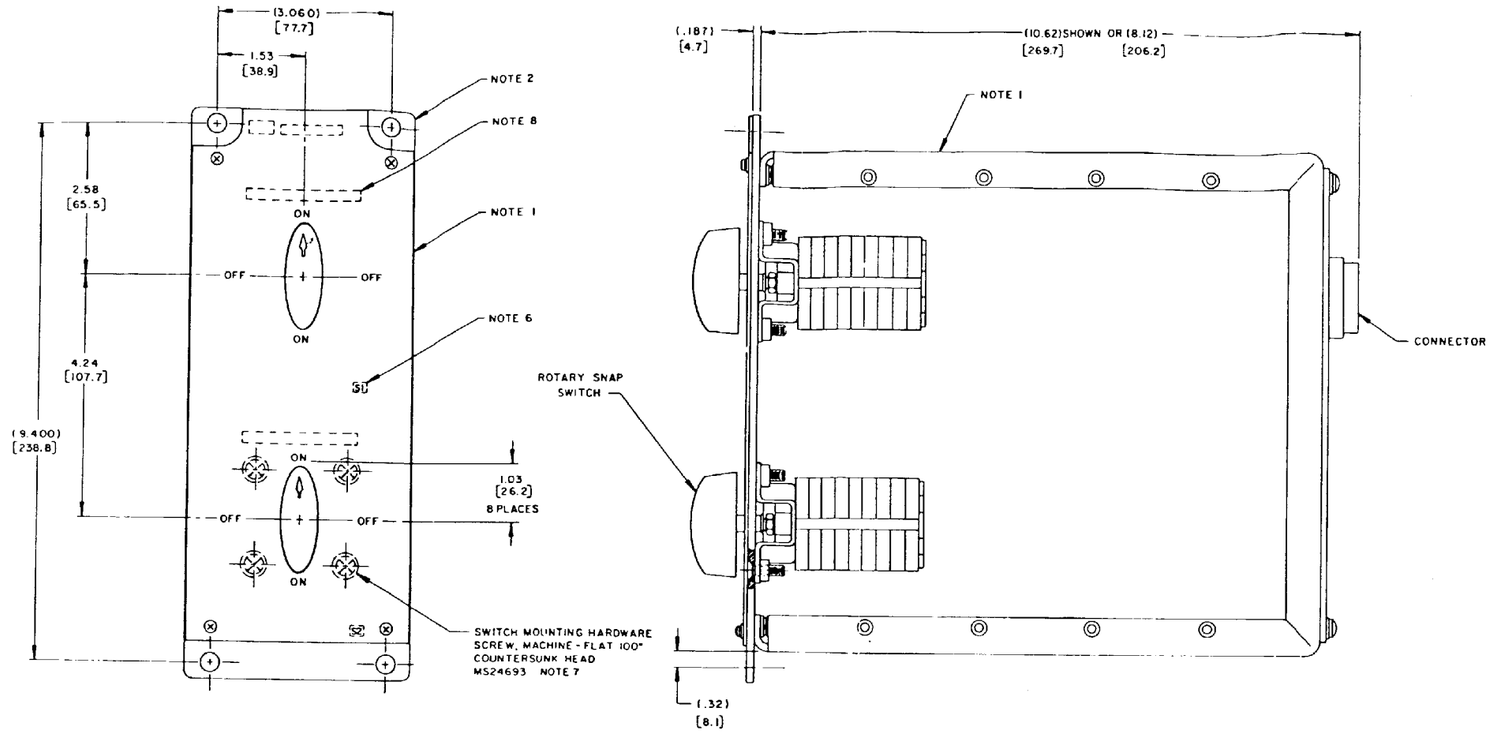
3.2 Switch panel assembly shall be arranged as shown on figure 18-1.

4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

(a) One or two snap switches in accordance with MIL-S-15291.
(b) One or two rotary switches, type S2JR10 in accordance with MIL-S-21604/5.
(c) One snap switch (see 4.l(a)) and one rotary switch (see 4.1(b)).
(d) Combination of fuseholders in accordance with MIL-F-19207/38 and switches (see 4.1(a) and 4.1(b)).
(e) MIL-F-15160/77 fuseholders as required.

NOTES
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE XX ± .02 AND .XXX ± .010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
7. APPLY LOCKING COMPOUND CONFORMING TO MIL-S-22473 TO THREADS WHEN MOUNTING SWITCH.
8. MARKING TO BE SPECIFIED IN ACQUISITION TECHNICAL DATA PACKAGE.



SH 11532

REQUIREMENT 18

FIGURE 18-1. Switch panel assembly.

NOTES SEE SHEET 1

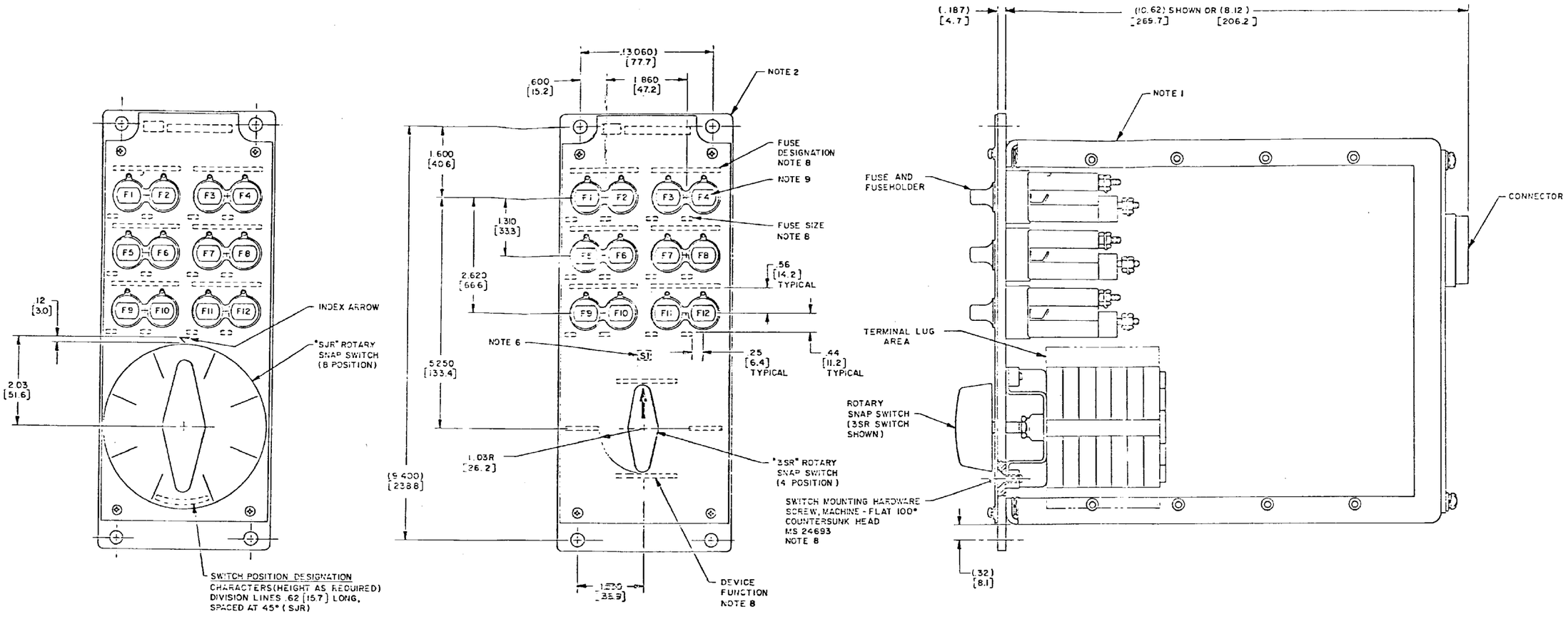
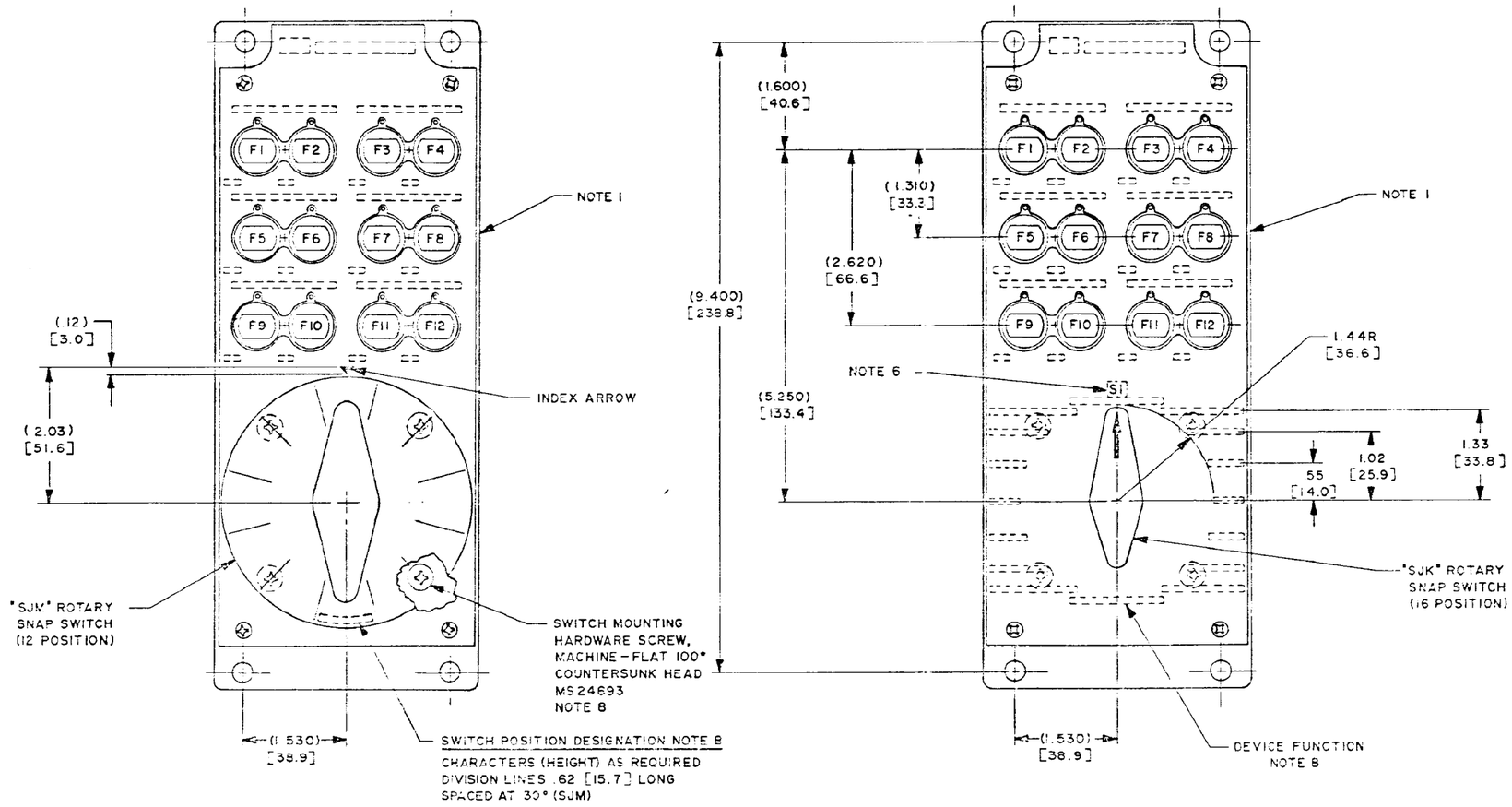


FIGURE 18-2. Switch and fuse panel assembly (sheet 2).

NOTES: SEE SHEET 1



SH 12336

REQUIREMENT 18

FIGURE 18-3. Switch and fuse panel assembly (sheet 3).

NOTES: SEE SHEET 1

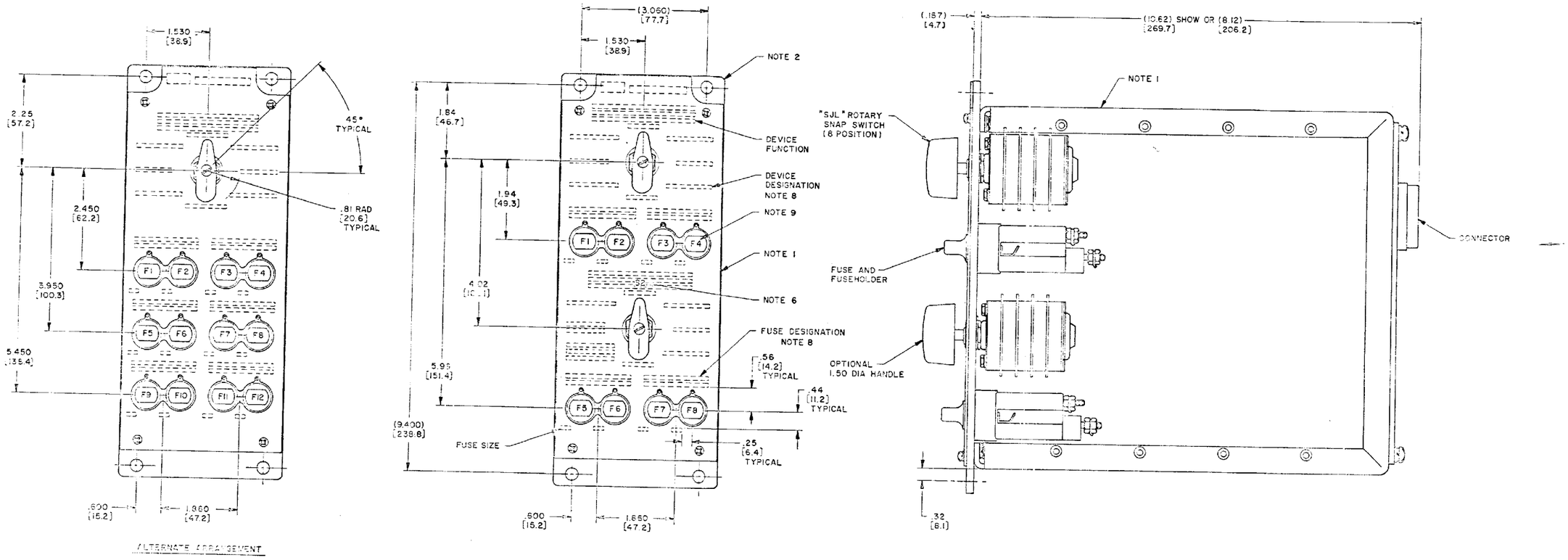


FIGURE 18-4. Switch and fuse panel assembly (sheet 4).

REQUIREMENT 13

REQUIREMENT 19

SWITCH CONTROL AND RELAY PANEL

1. Purpose. This requirement establishes the configuration of the switch control and relay panel assembly as used in type VIII switchboards of MIL-S-17000.

2. Documents applicable to requirement 19:

QQ-A-250/8	- Aluminum Alloy 5052, Plate and Sheet.
QQ-A-250/11	- Aluminum Alloy 6061, Plate and Sheet.
MIL-S-3950	- Switches, Toggle, Environmentally Sealed, General Specification for.
MIL-S-15291	- Switches, Rotary, Snap Action and Detent/Spring Return Action General Specification for.
MIL-S-17000	- Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-S-22473	- Sealing, Locking, and Retaining Compounds; Single-Component.
MIL-S-22885/87	- Switch, Push Button, Illuminated, 4-Lamp, Solid Mount, Modular Constructed, High Impact Shock.
MS15795	- Washer, Flat-Metal, Round, General Purpose (in./mm).
MS35338	- Washer, Lock-Spring, Helical, Regular (Medium) Series (in./mm).
MS51957	- Screw, Machine-Pan Head, Cross-Recessed, Corrosion-Resisting Steel, UNC-2A.
NAVSHIPS 9000-S6202-74004	- Switch Control Transformer Type Drawing (For Remote Operation Type JR Switch Assemblies).

30 REQUIREMENTS

3.1 Switch control and relay panel assembly shall be in accordance with requirement 5 and as specified in 3.2.

3.2 Switch control and relay panel assembly shall be arranged as shown on figure 19-1. The quantities and function of switches, indicator lights, fuses, and relays shall be as specified in the acquisition technical data package.

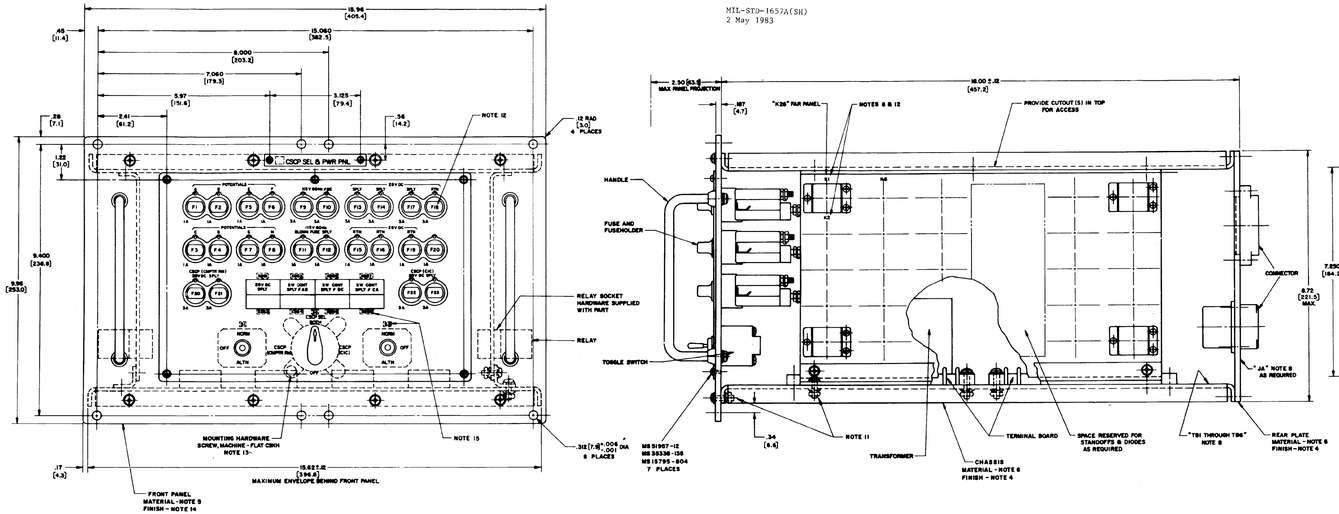
4. PARTS

4.1 In addition to the parts listed in requirement 5, the following additional parts may be required as specified in the acquisition technical data package.

(a) Relays and relay sockets shall be as specified in requirement 6.

(b) Power switch shall be type 1SR6A2 in accordance with MIL-S-15291.
(c) Potential transformer shall be of the required capacity and identical in circuit design to that shown on Drawing 9000-S6202-74004 .
(d) Indicator light push button switches shall be in accordance with MIL-S-22885/87 or equal.
(e) Toggle switches shall be in accordance with MIL-S-3950.
(f) Ship cable connectors shall be as specified in the acquisition technical data package.

NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ±.02 AND .XXX ±.010.
3. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
4. FINISH - CHEMICAL CONVERSION COATING CONFORMING TO MIL-C-17000.
5. MINIMUM .187 [4.7] THK ALUMINUM ALLOY-5052-T6 OF QQ-A-250/11.
6. .125 [3.2] THK ALUMINUM ALLOY - 5052-H32 OF QQ-A-250/8.
7. MATERIAL .063 [1.6] THK LAMINATED PLASTIC OR ALUMINUM ALLOY.
8. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED IN AREAS SHOWN.
9. REMOVE ALL SHARP CORNERS, EDGES AND BURRS.
10. EQUIPMENT SHALL BE IN ACCORDANCE WITH MIL-S-17000.
11. METHOD AND DESIGN OF ATTACHMENT OF CHASSIS TO FRONT PANEL IS OPTIONAL.
12. PREFIX "A" SHALL PRECEDE REFERENCE DESIGNATIONS ON FAR SIDE IN AREAS SHOWN. CHARACTERS SHALL BE .12 [3.0] HIGH.
13. APPLY LOCKING COMPOUND CONFORMING TO MIL-S-22473 TO THREADS WHEN MOUNTING SWITCH.
14. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
15. REFERENCE DESIGNATIONS ON FAR SIDE ONLY.



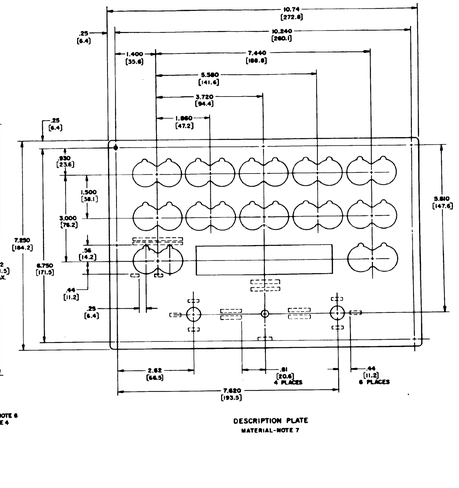


FIGURE 19-1. Switch control and relay panel assembly.

REQUIREMENT 20

DETAIL SCHEMATIC WIRING DIAGRAMS

1. Purpose. This requirement establishes the format for detail schematic wiring diagrams (DSWD'S) and provides guidance for use in drafting the DSWD's.

2. Documents applicable to requirement 20:

MIL-S-17000 - Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
OP 1700 - Standard Fire Control Symbols.

3. INTRODUCTION

3.1 DSWD's shall be prepared as specified herein. They shall have functional guidance information and shall include complete internal details reflecting a completely engineered switchboard design and shall be assigned Government drawing numbers.

3.2 MIL-S-17000 specifies the various types of switchboards with various combinations of internal equipments. Other requirements of this standard describe the configuration of various panel assemblies that will be used in the manufacture of the switchboards. It is the intent of this requirement to show the various combinations of internal parts and switchboard types on figures 20-1 through 20-4.

3.3 The typical DSWD's (figures 20-1 through 20-4) of this requirement are drawn, as specified in 3.2, to delineate the various combinations of detailed circuit information, switchboard types, and internal parts used. Each switch block shown on these drawings has the switch type identified just below the panel number symbol that is located in the upper right hand corner. The various combinations of information shown on the drawings are identified on figures 20-1 through 20-4.

4. SYMBOLS AND LETTERING

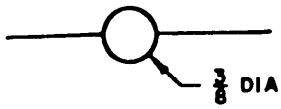
4.1 The following symbols and symbol sizes shall be used in drawing the DSWD's. Deviations from these symbol sizes shall not be permitted without prior approval of the contracting activity.

4.2 Lettering sizes to be used on the DSWD's (including title block markings) shall be not less than 0.140 inch high.

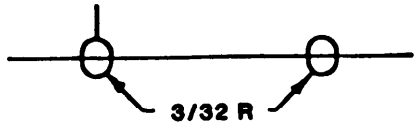
4.3 Fire control circuit nomenclature used on figures 20-1 through 20-4 is in accordance with Publication OP 1700.

SYMBOLS

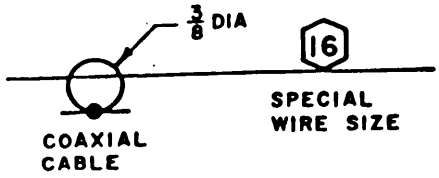
INDICATOR LAMP



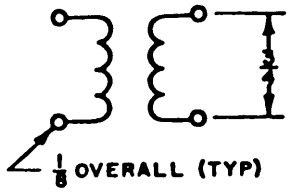
CABLE SHIELD



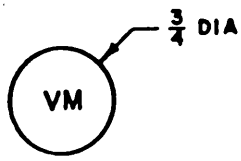
WIRING



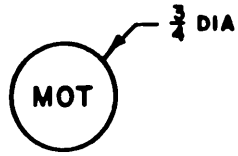
TRANSFORMER



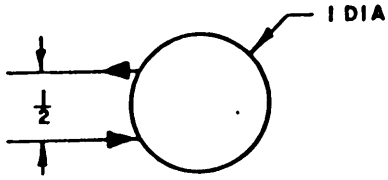
METER



MOTOR

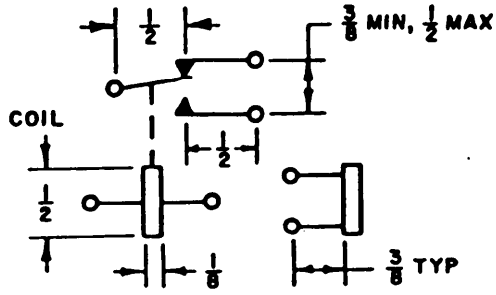


SYNCHRO

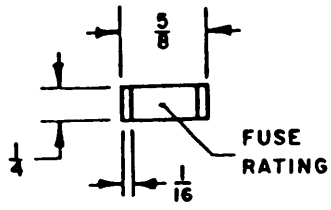


RELAY

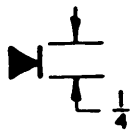
CONTACT



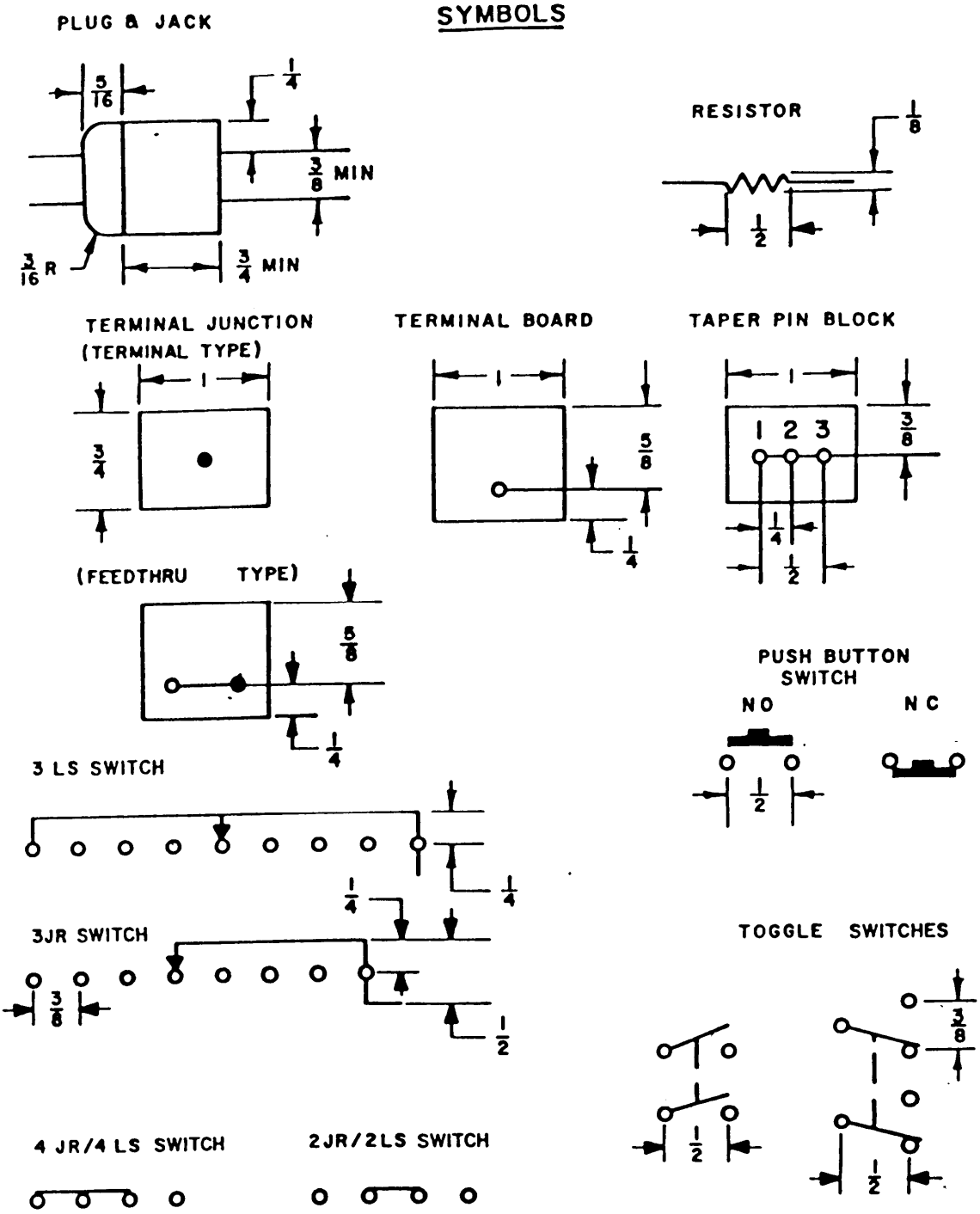
FUSE



DIODE



SYMBOLS



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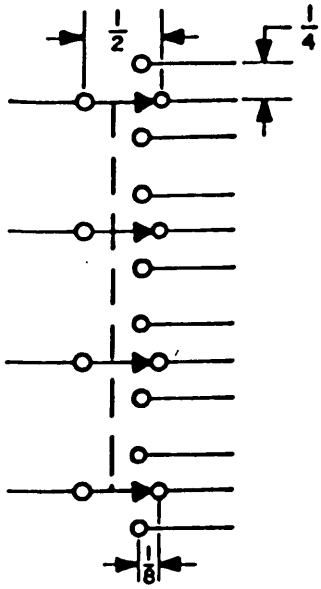
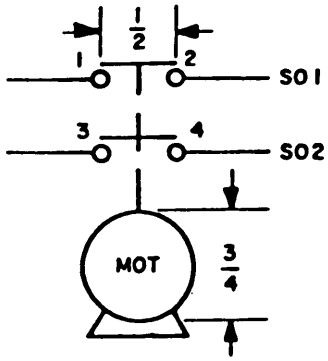
Requirement 20

SYMBOLS

DOUBLE THROW
4 POLE, CENTER OFF

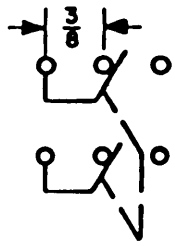


MOTOR OPERATED (MICRO)

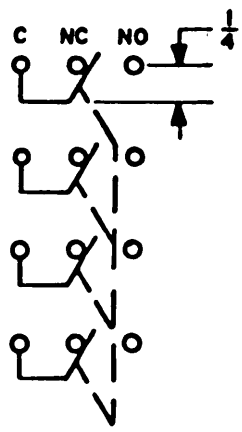


ILLUMINATED PUSH BUTTON, DOUBLE THROW

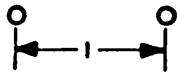
(2 POLE)



(4 POLE)

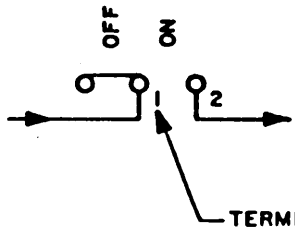


BUS SEL

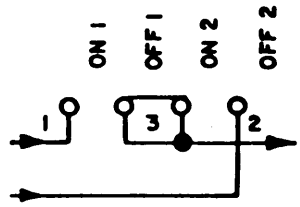


SNAP SWITCHES

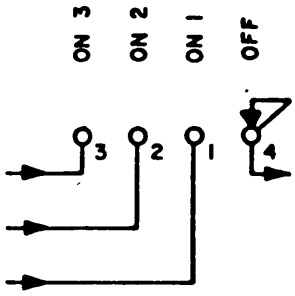
SINGLE THROW 4 POS.



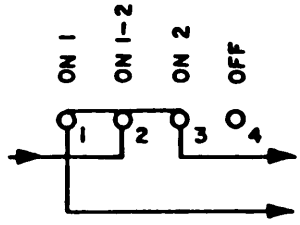
DOUBLE THROW 4 POS.



TRIPLE THROW 4 POS.



SPECIAL 4 POS.



SH 11534-2

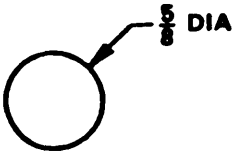
Requirement 20

SYMBOLS

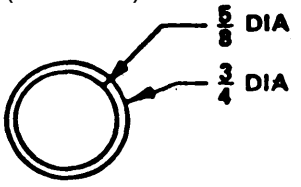
PANEL IDENTIFICATION

POWER/EXCITATION SUPPLY

MANUAL OPERATED
(SNAP/JR)

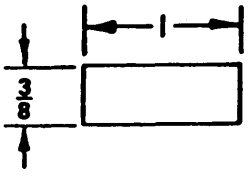


REMOTE OPERATED
(SNAP/RJR)

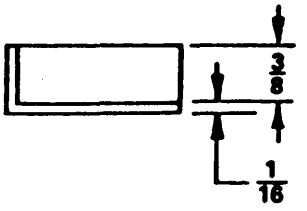


SYSTEM SWITCHING

MANUAL OPERATED
(JR/LS)

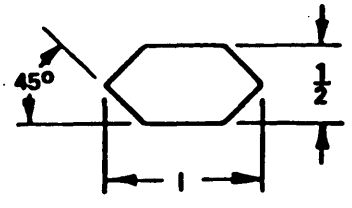


REMOTED OPERATED
(RJR/RLS)

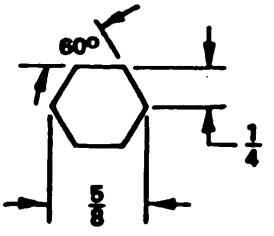


MISCELLANEOUS PANELS

FUSE, RELAY,
LIGHTS, ETC.



SVNCHROSIGNAL
CONVERTER



SH 11534-3

Requirement 20

5. NOTES

5.1 Drawing types. A set of DSWD's shall be developed for each specific switchboard and shall be divided into the following categories. A separate drawing number shall be assigned to each of the categories for each switchboard.

(a) Index, notes, and tabulations (see tables 20-1 and 20-11).
(b) Supply and test circuits.
(c) Synchro circuits (also included pulsed (steeped) transmissions for Mhox and Mhoy).
(d) Scaled voltage circuits.
(e) Digital circuits.
(f) Control and status circuits.
(g) Power distribution.

TABLE 20-1. Typical drawing index.

Drawing number	Revision status	Title
2857954	Rev	Index, notes and tabulations
Sheet 1	B	Index and notes
2	B	Panel tabulations
2857955	Rev	Supply and test circuits
Sheet 1	B	50 V d.c. supply and return, 115V, 60 Hz, 3 PH, MK 74 supply, 115 V, 400 Hz PH BC, own ship heading (critical) excit and 360 degrees and 10 degrees/rev, own ship speed excit and 100 and 10KN/rev, switch control potentials
2857956	Rev	Synchro circuits
Sheet 1	B	Own ship heading, own ship speed, dir train, dir elevation, LCHR train, LCHR elevation, gun train, gun elevation, desig train (TDT 1 & 2)
2857957	Rev	Scaled voltage circuits
Sheet 1	B	CV 1A1 backup/rebound, VASIM channels 1 and 9
2857958	Rev	Control and status circuits
Sheet 1	B	MR 4 NTDS alert 2-9, TDT 3 request assign, XMTR frequency select/inhibit, MR 4 (Bit 0 thru Bit 7), 50 V d.c. return (MR 4, KCMX MR 4, test set 2, M WC SWBD FWD), MK 74 50 V d.c. supply

5.2 Drawing layout. Drawing shall show the input functions to the switchboard and all the required connections, and switching through the switchboard to point of exit. Equipment external to the switchboard shall be depicted in functional form only. Functional flow shall be from left to right on each drawing except in those special cases where circuit requirements necessitate a right to left flow. Where possible, functions which follow parallel paths or are related, shall be grouped on the same sheet. The number of functions per sheet shall be kept at a level to show clearly the circuitry without crowding.

5.3 Ship wire markings. Wire numbers appearing outside the switchboard area for input and output functions shall follow the format specified by the contracting activity.

5.4 Internal equipment designations. Nomenclature used to identify each device within the switchboard shall be as specified in MIL-S-17000.

5.5 Title blocks and drawing titles. Title blocks shall be those of the preparing activity or as specified by the contracting activity. Drawing titles shall contain the appropriate information and shall be structured and arranged as shown in the following example:

CGN-38 CLASS
MISSILE FIRE CONTROL SWITCHBOARD
MK 7 MOD 15
DETAILED SCHEMATIC WIRING DIAGRAM
INDEX, NOTES, AND TABULATIONS

5.5.1 Function block. Functions appearing on a particular drawing shall be listed above the title block as well as on the drawing index.

5.6 Switches. Switches shall be shown in the position in which the switch handle is vertical, which has been determined as the “normal” position of the switch.

5.7 Relays. Relay contacts shall be shown for the coil in the de-energized (relaxed) position. Latching relays shall be shown in one position for which polarity is shown by a note.

5.8 Symbols (2-1) or (l). These symbols indicate the number of conductors and shield in an external function line. The appropriate symbol shall be used at the input of the connector or terminal point to which the external function connects. It shall also be shown at the output to the connector or terminal point when the function leaves the switchboard. The number before the hyphen denotes the number of conductors and the number after the hyphen denotes the number of shields or wires required for shield continuity. The symbol shall also be used to denote the number of signal poles used to switch a function through a switch.

5.9 Bus lines. Bus lines shall be used for depicting the routing of signals through the switchboard.

5.9.1 Signal inputs (one wire or several) to the bus line shall be shown as an arrow and outputs as a solid dot.

5.9.2 Inputs to the bus line shall be numbered and tabulated at the right hand side of each DSWD. Bus lines shall be indexed on the index, notes and tabulations DSWD, and reference all sheets required to circuit trace each bus.

5.9.3 Signal outputs from a bus line shall have the same number and suffix as their corresponding inputs.

5.9.4 Letters shall follow signal input numbers where there are several inputs of the same signal, for example, 34A, 34B, 34C.

5.9.5 Bus lines that are continued at some other location on the same sheet shall be referenced to the zone number of the other location.

5.9.6 Signal inputs and outputs to the bus line from another drawing number shall be referenced by the drawing number followed by a dash and sheet number, for example: from 2857956-5 to 2857957-5. References from another sheet of the same drawing number shall state the sheet number, for example: from Sh 5 to Sh 6.

5.9.7 Supply and test circuits and ship parameter functions shall be numbered from 1 through 99 and these numbers shall maintain their identity across each drawing category. Signal circuits (control and status, synchro, scaled voltage, and digital) shall be numbered starting at 100 and continuing upwards for each drawing category. Spare numbers shall be designated on each sheet of each category.

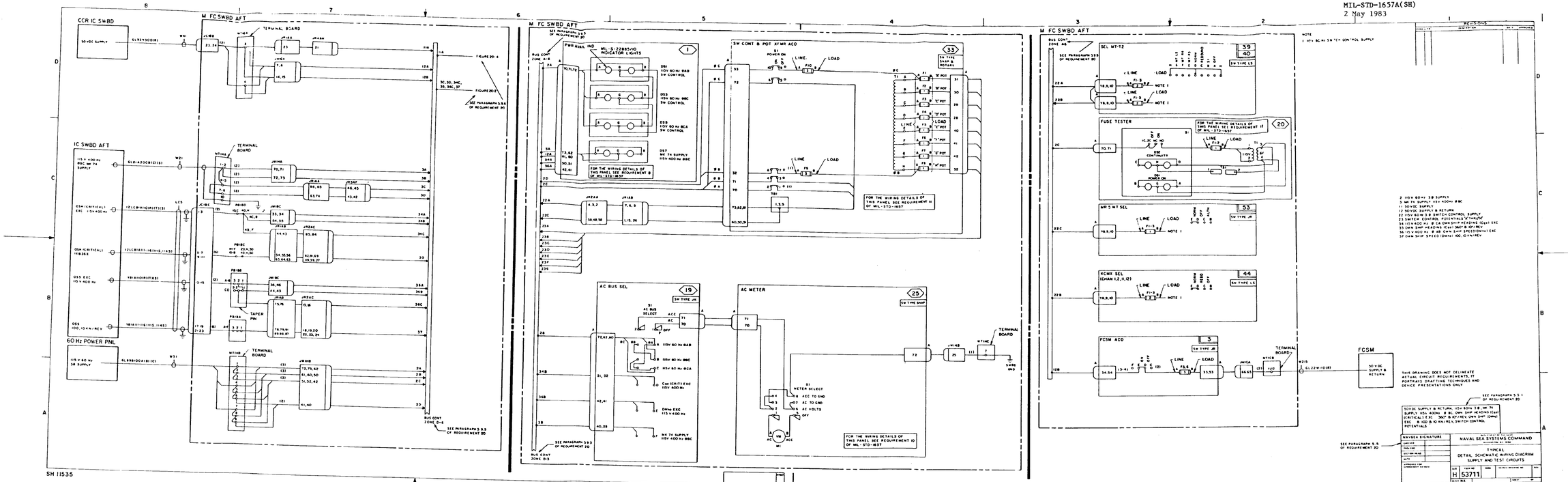
5.10 Jumpers. Jumpers on parts (relay, terminal boards, connectors, and so forth) or jumpers between parts shown on more than one drawing shall be referenced to a specific sheet, zone, and part.

5.11 Cable numbers. Cable numbers may be assigned for reference purposes only. If required, the actual cable numbers shall be obtained from the ship-building activity and will be entered at a later date.

TABLE 20-II. Typical panel tabulation.

PANEL NO.	PANEL TITLE	SWITCH TYPE OR COMPONENT	SWITCH POSITIONS	METHOD OF OPERATION (M) MANUAL (R) REMOTE	SWITCH POLES USED	COMPONENTS REQUIRED					REFERENCE SHEETS; LAST DIGIT OF DRAWING NUMBER, FOLLOWED BY SHEET NUMBER
						LIGHTS	FUSES	RELAYS	DIODES	RESISTORS	
1	Pwr Avail. Ind. Pnl	LIGHTS				6					3-15
2	SPARE										
3	SCCC 2 ACO	2JR	ON-OFF	R	8		6				3-15
4	SPARE										
5	SPARE										
6	SPARE										
7	VASIM No. 4 CH 1-8 SEL	3JR	OFF-CASU-NORM-MT-L2-MT-R4	R	24		4				3-17
8	VASIM No. 4 CH 9-16 SEL	3LS	OFF-BACKUP-NORM-MT-T2-MT-R5	R	24		4				3-17
9	VASIM No. 5 CH 1-8 SEL	3JR	OFF-BACKUP-NORM-MT-T2-MT-T4	R	24		4				3-17
10	VASIM No. 5 CH 9-16 SEL	3LS	OFF-CASU-NORM-MT-L2-MT-R5	R	24		4				3-17
11	SPARE										
12	SPARE										

NOTE: Panel Numbers are in numeric order listing all spares.



REQUIREMENT 20

FIGURE 20-1. Typical detail schematic wiring diagram supply and test circuits.

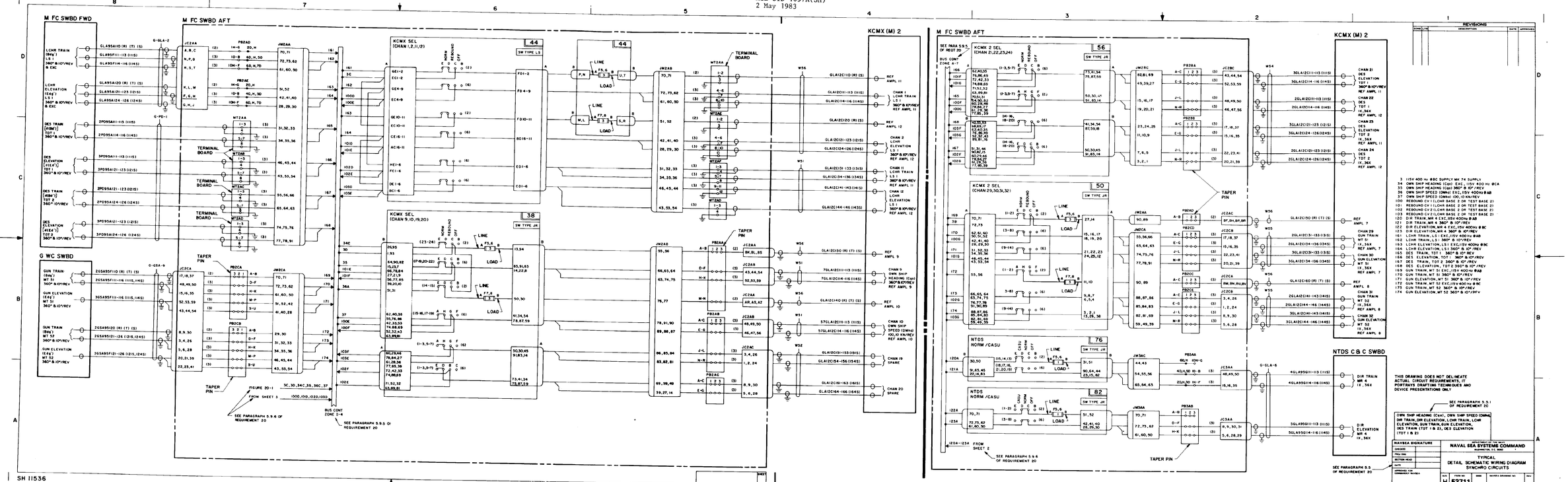
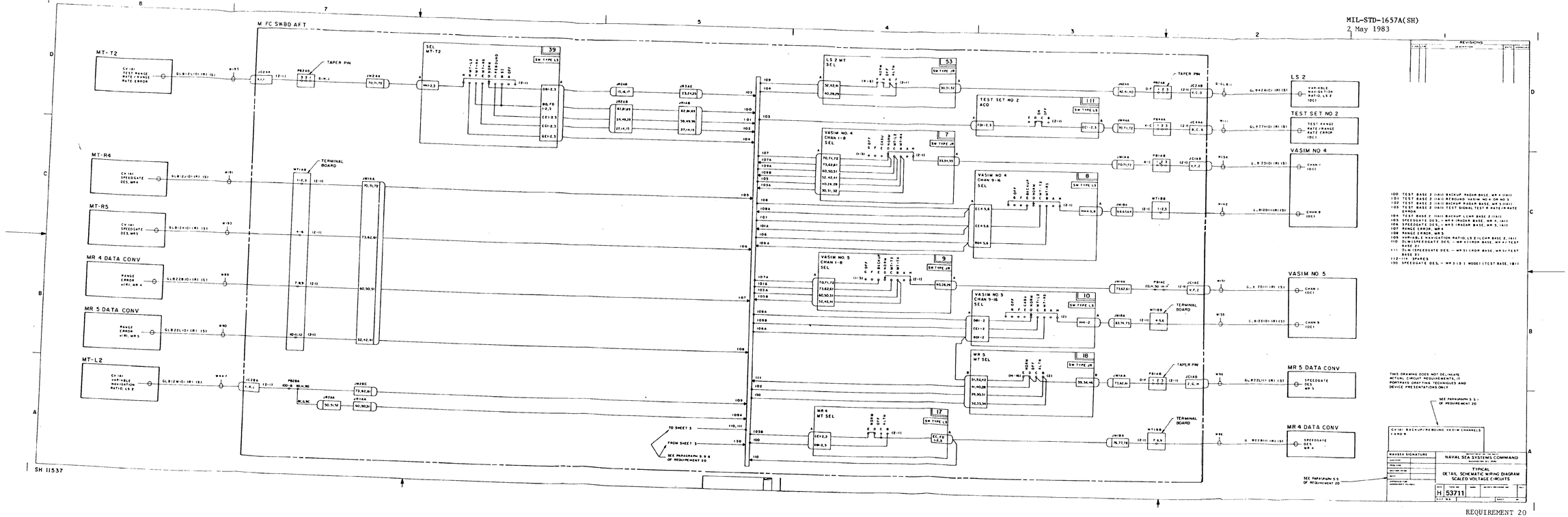


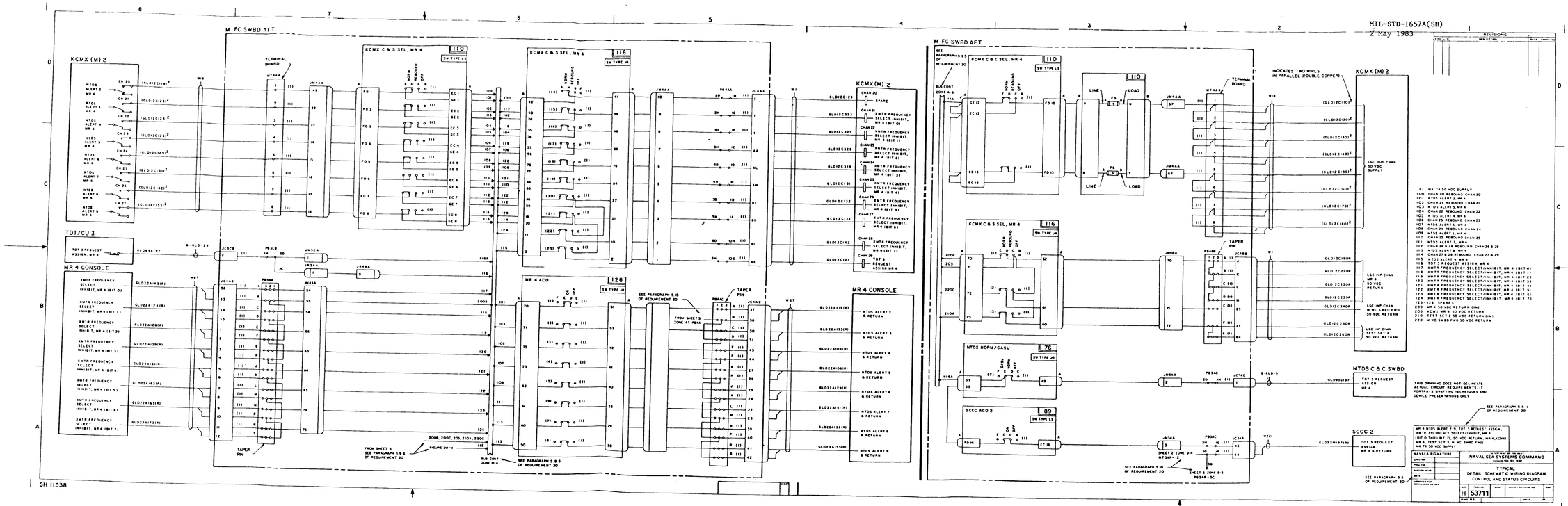
FIGURE 20-2. Typical detail schematic wiring diagram synchro circuits.



100 TEST BASE 2 (1A1) BACKUP RADAR BASE, WR 4 (1A1)
101 TEST BASE 2 (1A1) REBOUND VASIM NO 4 OR NO 5
102 TEST BASE 2 (1A1) BACKUP RADAR BASE, WR 5 (1A1)
103 TEST BASE 2 (1A1) TEST SIGNAL TEST R RATE/R RATE ERROR
104 TEST BASE 2 (1A1) BACKUP LCHR BASE 2 (1A1)
105 SPEEDGATE DES, — WR4 (RADAR BASE, WR 4, 1A1)
106 SPEEDGATE DES, — WR5 (RADAR BASE, WR 5, 1A1)
107 RANGE ERROR, WR 5
108 RANGE ERROR, WR 5
109 VARIABLE NAVIGATION RATIO, LS 2 (LCHR BASE 2, 1A1)
110 DLW(SPEEDGATE DES, — WR 4 (FROM BASE, WR 4/ TEST BASE 2)
111 DLW (SPEEDGATE DES, — WR 5) (FROM BASE, WR 5/ TEST BASE 2)
112-114 SPARES
150 SPEEDGATE DES, — WR 3 (3 1 MODE) (TEST BASE, 1B1)

THIS DRAWING DOES NOT DELINEATE ACTUAL CIRCUIT REQUIREMENTS, IT PORTRAYS DRAFTING TECHNIQUES AND DEVICE PRESENTATIONS ONLY

FIGURE 20-3. Typical detail schematic wiring diagram scaled voltage circuits.



REQUIREMENT 20

FIGURE 20-4. Typical detail schematic wiring diagram control and status circuits.

REQUIREMENT 21

TOGGLE SWITCH OR TOGGLE SWITCH AND FUSE PANEL

1. Purpose. This requirement establishes the configuration for toggle switch or toggle switch and fuse panel assemblies.

2. Documents applicable to requirement 21:

MIL-S-17000	-	Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MS24523	-	Switch, Toggle, One Pole, Environmentally Sealed.
MS24525	-	Switch, Toggle, Four Pole, Environmentally Sealed.
MS24659	-	Switch, Toggle, Two Pole, Environmentally Sealed, Lever Lock.
MS24660	-	Switch, Toggle, Four Pole, Environmentally Sealed, Lever Lock.

3. REQUIREMENTS

3.1 Toggle switch or toggle switch and fuse panel assemblies shall be in accordance with requirement 5 and as specified in 3.2.

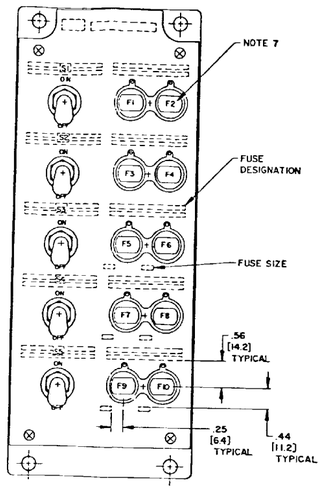
3.2 Toggle switch or toggle switch and fuse panel assemblies shall be arranged as shown on figure 21-1. The quantities and functions of switches or switches and fuses shall be as specified in the acquisition technical data package.

4. PARTS

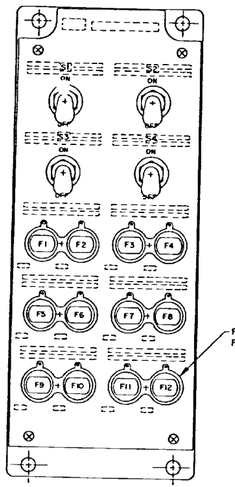
4.1 In addition to the parts listed in requirement 5, additional parts may be required as specified in the acquisition technical data package.

(a) Toggle switch 4PDT, Alternate Action Lever Lock MS24660-23D.
(b) Toggle switch 4PDT, 3 Position, center OFF, momentary contact in both ON position MS24525-27.
(c) Toggle switch SPDT, 3 position, center OFF, momentary contact in both ON position MS24523-27.
(d) Toggle switch SPDT MS24523-23.
(e) Toggle switch 2PST MS24659-22D.

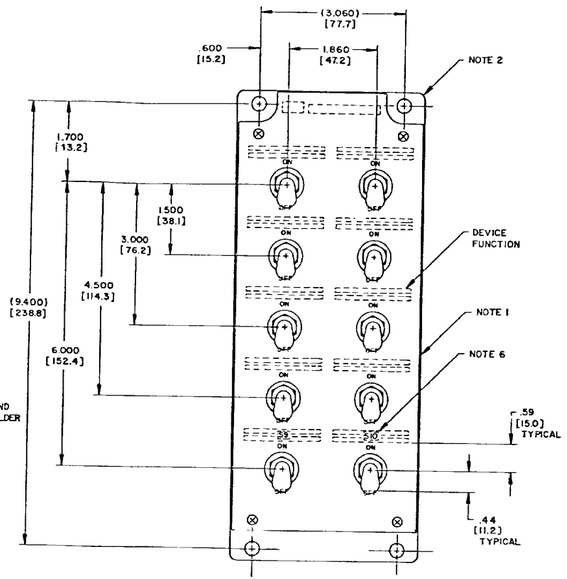
NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ±.02 AND .XXX ±.010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED 12 [3.0] HIGH ON FAR SIDE OF AREA SHOWN.
7. PREFIX "X" TO PRECEDE REF DESIGNATION OF FUSEHOLDERS ON FARSIDE OF FRONT PANEL. CHARACTERS SHALL BE 12 [3.0] HIGH LOCATED ADJACENT TO FUSEHOLDERS.



ALTERNATE ARRANGEMENT
1Ø POWER



ALTERNATE ARRANGEMENT
3Ø POWER



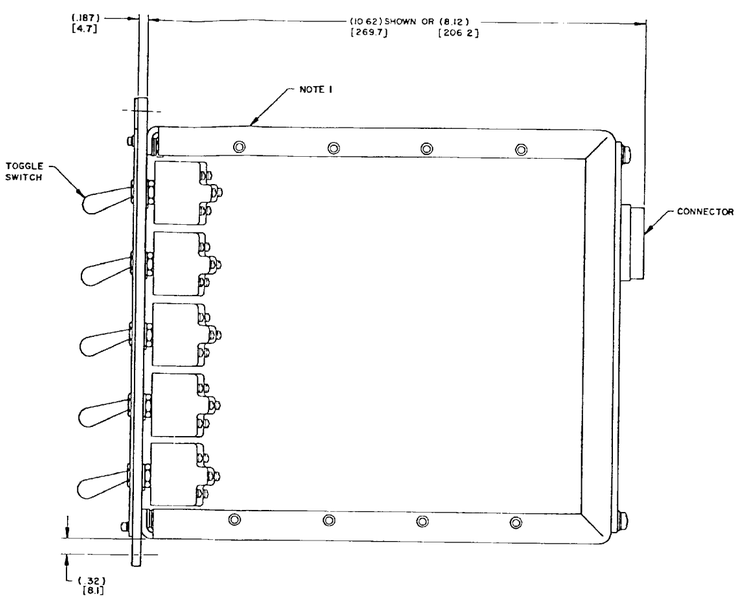
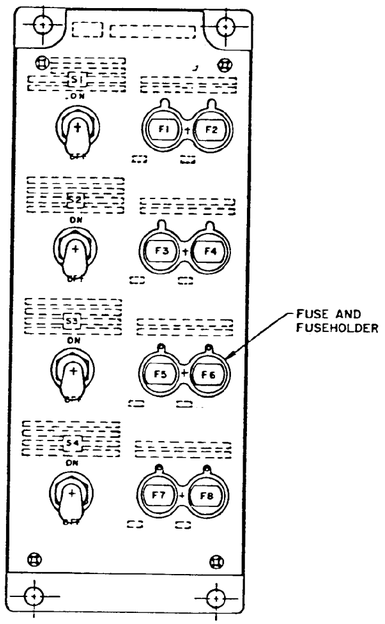
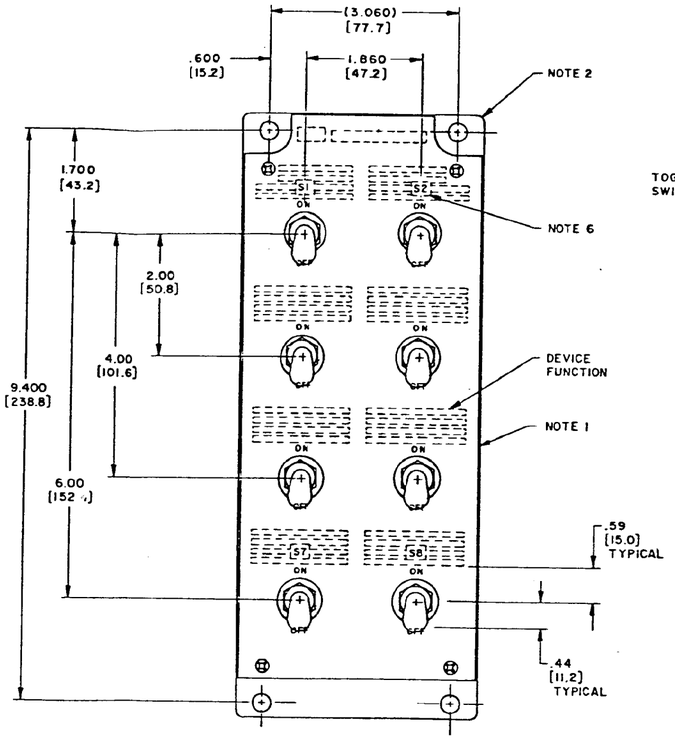


FIGURE 21-1. Toggle switch/fuse panel (sheet 1).

NOTES
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ± .02 AND .XXX ± .010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4 mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREA SHOWN.
7. PREFIX "X" TO PRECEDE REF DESIGNATION OF FUSEHOLDERS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH LOCATED ADJACENT TO FUSEHOLDERS.



ALTERNATE ARRANGEMENT



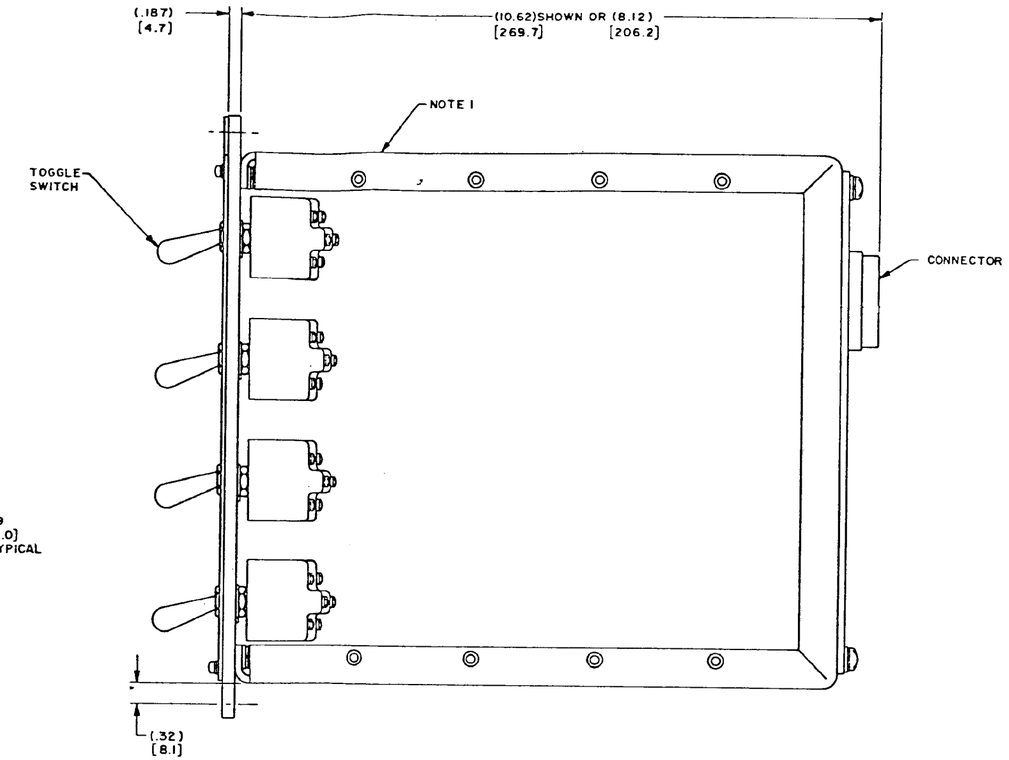


FIGURE 21-2. Toggle switch/fuse panel (sheet 2).

REQUIREMENT 22

MOTOR GENERATOR (M/G) SWITCH PANEL

1. Purpose. This requirement establishes the configuration for motor generator switch panel assembly as used in type X switchboards of MIL-S-17000.

2. Documents applicable to requirement 22:

MIL-S-17000 - Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.
MIL-S-22473 - Sealing, Locking, and Retaining Compounds; Single Component.
MS24693 - Screw, Machine, Flat Countersunk Head, 100°, Cross Recessed, UNC-2A and UNF-2A (in./mm).

3. REQUIREMENTS

3.1 Motor Generator switch panel assembly shall be in accordance with requirement 5 and as specified in 3.2.

3.2 Motor Generator switch panel shall be arranged as shown on figure 22-1. The quantities and function of switches, indicator lights, and terminal boards shall be as specified in the acquisition technical data package.

4. PARTS

4.1 In addition to the parts listed in requirement 5, additional parts may be required as specified in the acquisition technical data package.

NOTES:

1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ±.02 AND .XXX ±.010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH = 25.4mm. DIMENSIONS IN [] ARE MILLIMETERS.
6. PREFIX "X" TO PRECEDE REF DESIGNATION OF LIGHT SOCKETS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH LOCATED ADJACENT TO LIGHT SOCKETS.
7. APPLY LOCKING COMPOUND CONFORMING TO MIL-S-22473 TO THREADS WHEN MOUNTING SWITCH.
8. ALL DIMENSIONS ARE IN INCHES.

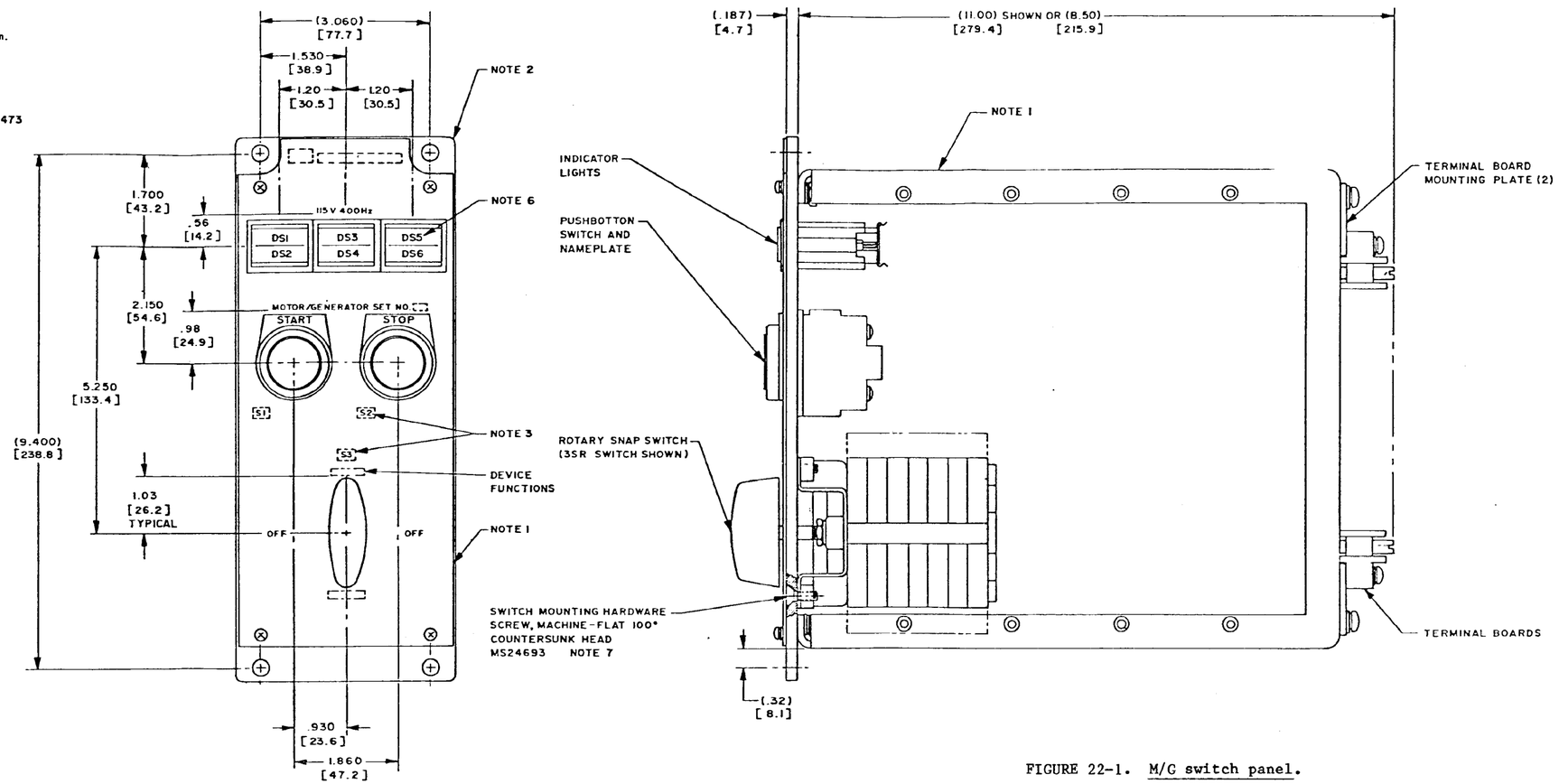


FIGURE 22-1. M/C switch panel.

REQUIREMENT 23

BUS FAILURE ALARM PANEL

1. Purpose. This requirement establishes the configuration for a bus failure alarm panel assembly.

2. Documents applicable to requirement 23:

MIL-S-17000 - Switching Equipment, Combat System, Command and Control, Fire Control, and Interior Communication General Specification for.

3. REQUIREMENTS

3.1 Bus failure alarm panel assemblies shall be in accordance with requirement 5 and as specified in 3.2.

3.2 Bus failure alarm panel assemblies shall be arranged as shown on Figure 23-1. The quantities and function of fuseholders shall be as specified in the acquisition technical data package.

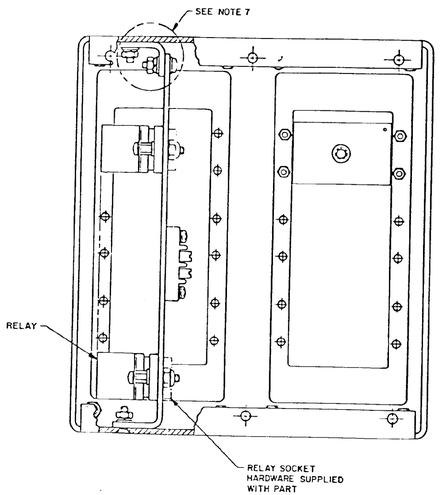
4. PARTS

4.1 In addition to the parts listed in requirement 5, additional parts may be required as specified in the acquisition technical data package.

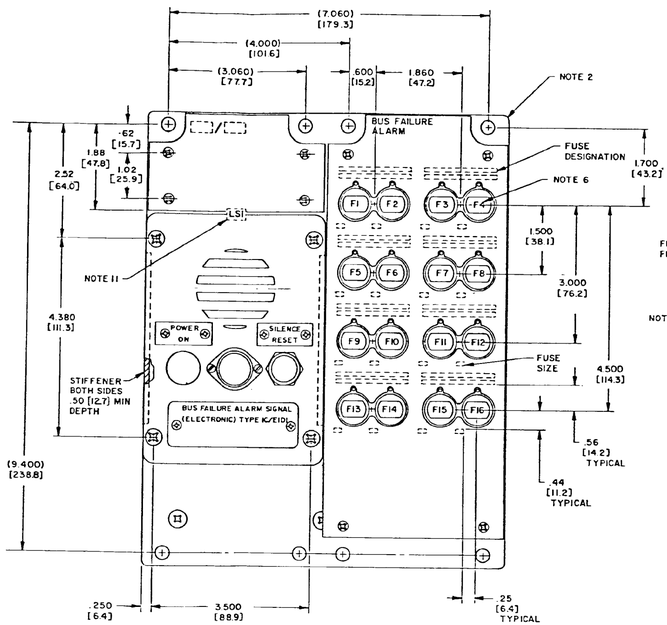
(a) Relay and relay sockets shall be as specified in requirement 6.

✪U.S. GOVERNMENT PRINTING OFFICE: 1983-605-019/7157

NOTES:
1. DESCRIPTION PLATE, FRONT PANEL, CHASSIS AND REAR PLATE SHALL BE IN ACCORDANCE WITH REQUIREMENT 5.
2. FRONT PANEL SHALL BE PAINTED IN ACCORDANCE WITH MIL-S-17000.
3. ALL DIMENSIONS ARE IN INCHES.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCES SHALL BE .XX ± .02 AND .XXX ± .010.
5. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY AND ARE BASED UPON 1 INCH=25.4mm. DIMENSIONS IN [ ] ARE MILLIMETERS.
6. PREFIX "X" TO PRECEDE REF DESIGNATION OF FUSEHOLDERS ON FAR SIDE OF FRONT PANEL. CHARACTERS SHALL BE .12 [3.0] HIGH LOCATED ADJACENT TO FUSEHOLDERS.
7. METHOD OF ATTACHMENT AND ASSEMBLY OF RELAY SUB-CHASSIS IS OPTIONAL.
8. THE USE OF INTERNAL TERMINAL BOARD FOR JUMPERS SHALL BE IN ACCORDANCE WITH TECHNICAL DATA PACKAGE.
9. MOUNT ALARM TYPE IC/EIDI WITHOUT HOUSING(TYPE 356-T4).
10. REMOVE TERMINAL BOARD FROM HOUSING (TYPE 356-T4) TYPE 8TB2 AND MOUNT TO RELAY SUB-CHASSIS.
11. STENCIL OR RUBBER STAMP REFERENCE DESIGNATIONS REQUIRED. .12 [3.0] HIGH ON FAR SIDE IN AREAS SHOWN.



CHASSIS - FRONT VIEW
FRONT PANEL REMOVED FOR CLARITY



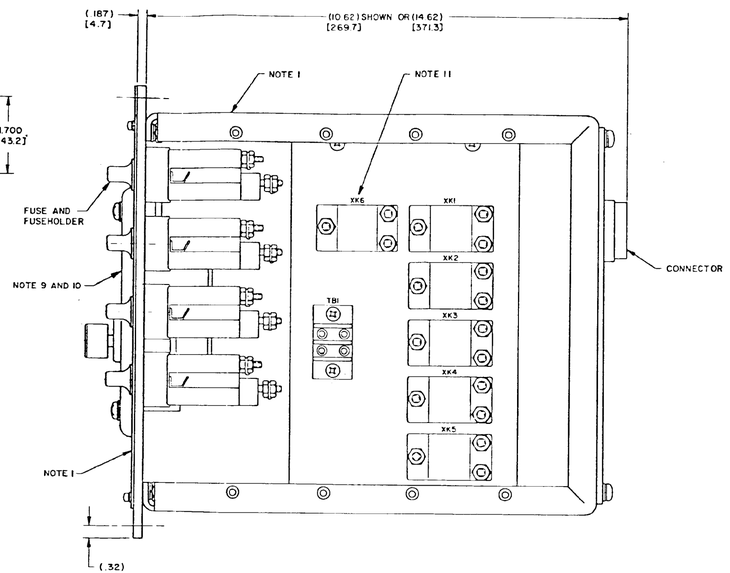


FIGURE 23-1. Bus failure alarm panel.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-STD-1657A(SH)	Switching Equipment, Combat System, Command And Control, Fire Control And Interior Communication

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*:

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

PREVIOUS EDITION IS OBSOLETE.