

INCH-POUND

MIL-S-16036K(SH)
AMENDMENT 3
26 August 1999
SUPERSEDING
AMENDMENT 2
4 May 1993

MILITARY SPECIFICATION

SWITCHGEAR, POWER, NAVAL SHIPBOARD

This amendment forms a part of MIL-S-16036K(SH), dated 4 August 1988, and 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.

PAGE 2

* 2.1.1: After "MIL-L-3661/65 - Lampholder, Lights, Indicator (Housing), Style LH98", Add: "MIL-C-11796 - Corrosion Preventive Compound, Petrolatum Hot Application."

Page 4

* 2.1.1: After "MIL-R-24563 - Relay, Alternating Current, Power Sensing", Add: "MIL-N-25027/1A - Nut, Self-locking, Heavy Hex, (Non-metallic Insert) 250 and 450 F, UNJC-3B, ¼ through 2-1/2 Inch Nominal Diameters, Nickel-Copper Alloy."

* 2.1.1: Delete "MIL-T-55156 - Terminals, Lugs; Splices, Conductor; Screw Type, General Specifications for."

PAGE 6

* 2.2: Delete "B 317 - Standard Specification for Aluminum-Alloy Extruded Bar, Rod, Tube, Pipe, and Structural Shapes for Electrical Purposes (Bus Conductor). (DoD adopted)"

PAGE 27

* 3.4.4.1: Delete "riser" and insert "back-connected."

PAGE 31

* 3.5.8: Delete the first sentence and substitute:

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"Each unit shall be internally subdivided by barriers of either sheet metal, nonconductive material, or a combination of both to form separate compartments for the circuit breakers to isolate them from the bus work and cable connections and eliminate gaps between compartments. There shall be no gap between the barrier and top enclosure of the switchboard. The gap between the barrier and the horizontal plane at the bottom of the switchboard shall not exceed 3/8 inch. Gaps on any switchboard barrier sections not covered above shall not exceed 1/16 inch. If necessary, barriers may overlap. The ACB stationary component is acceptable as a rear barrier in an ACB compartment."

* 3.6.2: Delete the last part of the second sentence: "the values shall....component stud." and substitute:

"and bus to component stud connections on circuit breaker bases which have a frame size greater than 100 amperes, values shall meet the applicable creepage and clearance distances in table I. See 3.10.19 for 100 ampere circuit breaker connection requirements."

PAGE 34

* 3.7.1: Line 17, after "...removable enclosing panels." Add:

"Removable sheets and panels on the front and rear shall be provided with lifting handles. All removable sheets and panels shall be provided with a minimum of two alignment pins."

PAGE 35

* 8.6.2: First sentence, delete "riser" and insert "back-connected."

PAGE 36

* 3.10.1: Delete and substitute:

"3.10.1 Bus connections. Bus connections shall be made with solid copper. See 3.10.19 for 100 ampere circuit breaker connection requirements."

PAGE 37

* 3.10.4: Delete in its entirety.

3.10.5: Delete the last sentence and add:

"Casualty power terminal shall be enclosure type similar to that depicted by method 2D32 in accordance with DOD-STD-2003 (EPISM). Cable connecting the casualty power circuit breaker and the casualty power terminal shall be type AWG 2 in accordance

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with MIL-W-16878/32."

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* TABLE II: Delete and substitute:

"TABLE II. Ampere rating of rectangular bus bars placed on edge.

Number Of bars Parallel	Size of Bars (inches)	Cross-Sectional Area (square inches)	Copper bus, Silver Surface, AC ampere Rating, 60 Hz	Copper bus, Silver Surface, DC ampere Rating
1	1/2 x 1/8	0.063	140	140
	5/8 x 1/8	.078	175	175
	3/4 x 1/8	.094	210	210
	1 x 1/8	.125	285	285
	1-1/2 x 1/8	.188	425	425
	2 x 1/8	.250	555	555
	3/4 x 3/16	.140	265	265
	1 x 3/16	.188	355	355
	1-1/2 x 3/16	.278	550	550
	2 x 3/16	.375	700	710
	3/4 x 1/4	.188	295	295
	1 x 1/4	.250	410	410
	1-1/2 x 1/4	.375	600	600
	2 x 1/4	.500	780	800
	2-1/2 x 1/4	.625	1,000	1,050
	3 x 1/4	.750	1,140	1,185
	4 x 1/4	1.000	1,425	1,490
	5 x 1/4	1.250	1,760	1,850
6 x 1/4	1.500	2,100	2,190	
2 (1/4-inch apart)	1 x 1/4	0.500	650	650
	1-1/2 x 1/4	.750	950	950
	2 x 1/4	1.000	1,350	1,370
	3 x 1/4	1.500	1,825	2,000
	4 x 1/4	2.000	2,280	2,530
	5 x 1/4	2.500	2,740	3,100
3 (1/4-inch apart)	3 x 1/4	2.250	2,200	2,620
	4 x 1/4	3.000	2,660	3,110
	5 x 1/4	3.750	3,200	3,830
	6 x 1/4	4.500	3,600	4,560
4 (1/4-inch apart)	3 x 1/4	3.000	2,650	3,130
	4 x 1/4	4.000	3,020	3,870
	5 x 1/4	5.000	3,450	4,750

MIL-S-16036K(SH)
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- Continued

Number Of bars Parallel	Size of Bars (inches)	Cross-Sectional Area (square inches)	Copper bus, Silver Surface, AC ampere Rating, 60 Hz	Copper bus, Silver Surface, DC ampere Rating
4 (2 pairs/phase 3/4-inch between pairs)	6 x 1/4	6.000	4,000	-----
4 (2 pairs/phase 2-1/2 inches between pairs)	5 x 1/4	5.000	4,200	-----
	6 x 1/4	6.000	5,000	-----
	8 x 1/4	8.000	6,400	-----

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* 3.10.9: Delete the first sentence and substitute:

"Flat bends for 1/8 inch bus bar shall have an inside radius 1.5 times the thickness of the bus bar, and the ends of the bus bars shall be neatly finished. Flat bends for bus bar greater than 1/8 inch shall have an inside radius of not less than the thickness of the bus bar, and the ends of the bus bars shall be neatly finished."

* 3.10.9: Delete the last sentence.

PAGE 40

* 3.10.10.2: Delete (a) and substitute: "(a) Apply a thick film of corrosion preventive paste in accordance with MIL-C-11796 to both the hardware and the joint (see 6.2.1)."

* 3.10.10.2: Delete (d).

* 3.10.12: Second sentence, after "lubricated", insert "(see 3.10.10.2)". Delete the first table in its entirety and substitute:

MIL-S-16036K(SH)
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<u>Bolt diameter</u> <u>(inches)</u>	<u>CRS and zinc plated</u> <u>steel</u>		<u>Silicon bronze/copper</u>	
	<u>Minimum</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Maximum</u>
1/4	2	3		
5/16	6	7		
3/8	14	16	10	11
1/2	30	33	21	23
5/8	50	55	35	39"

In the second table, add the following entry:

<u>Copper stud</u> <u>size</u>	<u>Steel cap</u> <u>screw size</u>	<u>Torque (foot-pounds)</u>	
		<u>Minimum</u>	<u>Maximum</u>
"5/16 - 24	-----	5	6"

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* 3.10.12.1: After the last sentence, Add: "Plastic insert self-locking nuts used as fasteners shall be in accordance with MIL-N-25027/1 and rated for 450 F. Plastic insert self-locking fasteners shall be torqued to 100 percent of 3.10.12 values, plus the prevailing torque that is measured when the nut is turned on the bolt in its unloaded state."

* 3.10.15: Delete and substitute:

"3.10.15 Bus bar insulation. When specified (see 6.2.1), bus bars shall be insulated with MIL-E-22118 materials or other approved electrical insulating materials or compounds to improve creepage distances. Joints, except for those requiring disassembly in order to install the switchboard aboard ship, shall be insulated at the switchboard manufacturer's facility. A hard copy of installation instructions shall be provided by the switchboard manufacturer and installation instructions shall include a list of joints that are required to be insulated during installation, with procedures for insulating same, so that all current-carrying parts will be insulated upon completion of final shipboard assembly."

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* 3.10.16: Delete the first three sentences and substitute:

"Cable lug terminals installed on all cables entering or within the switchboard shall be crimp type CLC or CLCG in accordance with MIL-T-16366. Prior to assembly and crimping, a light coating of corrosion preventive paste in accordance with MIL-C-11796 shall be applied to the conductor and the interior of the terminal lug barrel (see 6.2.1)."

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- * 3.10.18: Delete the first two sentences and substitute:

"Cables shall enter the switchboard from either the top or bottom. Cables entering through the top dripshield shall not compromise the watertight integrity of the dripshield."

- * Add the following paragraphs:

"3.10.19 Special requirements for 100 ampere frame circuit breaker base connections.

3.10.19.1 Insulation distances. Bus to component stud connections on 100 ampere frame circuit breaker bases shall meet the creepage and clearance distances of MIL-E-917 within 4 inches of the bus/component stud connection. The creepage and clearance values of table I shall be used at greater than 4 inches from the bus/component stud connection.

3.10.19.2 Bus connections. The ends of bus bar connections to the studs of 100 ampere circuit breakers shall be trimmed to a radius equal to one half the width of the bus bar.

3.10.19.3 Holes in bus bars. All 1/8 X 3/4 inch bus work that connects to 100 ampere circuit breaker bases shall be manufactured with 13/32 inch holes."

- * 3.11.1: After the second sentence, insert: "Control cable for low level signals for electronic devices and load sharing shall be shielded type."

PAGE 45

- * 3.12.1: Delete the second sentence.

PAGE 46

- * 3.14: After the last sentence, Add: "Fuses, fuseholders and fuseclips shall be silver plated in accordance with MIL-F-15160 and MIL-F-21346. Fuseholders shall be dead front type with blown fuse indicator."

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- * Add the following paragraph:

"3.20.7.1 Application requirements for circuit breakers with electronic trip elements. In addition to the information specified in 3.20.7; label plates for circuit breakers with electronic trip elements shall contain the short time pickup setting in amperes, the short time delay range in seconds, the short time delay band setting, the instantaneous pickup setting in amperes, and, where applicable, the long time pickup setting in amperes and the long time delay in seconds."

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Table IV: Delete and substitute:

"TABLE IV. First article and quality conforming inspection.

Inspection	First article	Quality conformance	Requirement paragraph	Inspection paragraph
General examination	X	X	3.4	4.6.3.1
Maintainability	X	---	3.23	4.6.3.2
Vibration	X	---	3.5.10	4.6.3.3
Shock	X	---	3.5.14	4.6.3.4
Dielectric strength	X	X	3.25	4.6.3.5
Waterspray	X	---	3.17.4	4.6.3.6.1
Ambient temperature and heat	X	---	3.26	4.6.3.6.2 4.6.3.7
Electromagnetic comparability	X	---	3.24	4.6.3.8
Insulation resistance	X	X	3.6.2.2	4.6.3.10

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* 4.6.3.4: Lines 1 through 7: Delete the first three sentences: "Equipment required by..... that unit." and substitute:

"The switchboards, with all equipment installed, shall pass high-impact testing. Equipment which has not been individually qualified to high-impact shock may be used in the switchboard. However, the complete switchboard shall pass high-impact shock testing, regardless of whether the installed equipment was individually shock qualified."

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* 6.2.1: Add: "(nn) corrosion preventive paste for hardware and joints."

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Figure 7, table "A": Delete and substitute:

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TABLE A. Standardized switchgear units.

Generator Size in kw	Type Unit	AQB 250 or 400	AQB- A101 A102	AQB 800 or ACB 900,902	ACB 1600	ACB 3200	ACB 4000	Dimensions of units (All dimensions in inches)											Diagrams figure 8 and 9		
								A	B	C	D	E	F	G	H	K	M				
30-60-100-200	G1	1						74	20	33-1/2						26-3/4	13-1/8	20-5/8	5-3/16	2,5,7,8	
200-300-500	2			1				81	20	40-1/2	9	14	13				13-1/8	20-5/8		1,6,7,9	
750-1000	3				1			81	27	40-1/2	9	14	13				13-1/8	20-5/8		1,6,7,9	
1500-2000	5					1		81	33	44-1/2	13	11	16				12-1/4	23-1/2	11-11/16	1,6,7,10	
2500	7						1	81	39	49-1/2	18	11	16				17-1/4	25-1/2	14-11/16	1,6,7,11 or 12	
30-60 (DC)	10	1						74	20	33-1/2						26-3/4	13-1/8	20-5/8	5-3/16	2,5,7,8	
150-200 (DC)	11			1				81	20	40-1/2	9	14	13				13-1/8	20-5/8		1,6,7,9	
	B20			2				81	18	40-1/2	9	14	13				13-1/8	21-7/8	3-7/8	1,4,7,9	
	21				2			81	27	40-1/2	9	11	16				13-1/8	21-7/8	8-3/8	1,4,7,9	
	22				2			81	27	44-1/2	13	11	16				12-1/4	26-3/4	8-3/8	1,4,7,10	
	25					2		81	33	49-1/2	18	11	16				17-1/4	26-3/4	3-7/8	1,4,7,11 or 12	
	26					2		81	33	44-1/2	13	11	16				12-1/4	26-3/4	11-11/16	1,4,7,10	
	D50			3				81	18	40-1/2	9	14	13				13-1/8	21-7/8	11-11/16	1,4,7,9	
	51				2			81	27	40-1/2	9	11	16				13-1/8	21-7/8	8-3/8	1,4,7,9	
	52				2			81	27	44-1/2	13	11	16				12-1/4	26-3/4	8-3/8	1,4,7,10	
	55				2			81	27	49-1/2	18	11	16				17-1/4	26-3/4	8-3/8	1,4,7,11 or 12	
	56					2		81	33	49-1/2	18	11	16				17-1/4	26-3/4	11-11/16	1,4,7,11 or 12	
	D60																				
	61					2		81	18	40-1/2	9	14	13				13-1/8	21-7/8	3-7/8	1,4,7,9	
	62			1	or 1	2		81	18	40-1/2	9	14	13				13-1/8	21-7/8	3-7/8	1,4,7,9	
	63			1		1		81	20	40-1/2	9	11	16				13-1/8	20-5/8	3-7/8	1,6,7,9	
	64			2		1		81	22-1/2	40-1/2	9	11	16				13-1/8	20-5/8	3-7/8	1,6,7,9	
				4		1		81	22-1/2	40-1/2	9	11	16				13-1/8	20-5/8	3-7/8	1,6,7,9	

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"TABLE A. Standardized switchgear units. -Continued

Generator Size in kw	Type Unit	AQB- A101 A102	AQB- A101 A102 fused	AQB 250	AQB 400	ACB 900,90 2	ACB 1600	Dimensions of units (All dimensions in inches)										Diagrams figure 8 and 9		
								A	B	C	D	E	F	G	H	K	M			
70				6			2	81	27	40-1/2	9	11	16				13-1/8	21-7/8	8-3/8	1,4,7,9
71				2	or 2		2	81	27	40-1/2	9	11	16				13-1/8	21-7/8	8-3/8	1,4,7,9
72			16				1	81	27	40-1/2	9	11	16				13-1/8	21-7/8	8-3/8	1,4,7,9
73			12				1	81	27	40-1/2	9	11	16				13-1/8	21-7/8	8-3/8	1,4,7,9
74			6				1	81	27	40-1/2	9	11	16				13-1/8	21-7/8	8-3/8	1,4,7,9
80		14	or 10					74	14-1/2	33-1/2	9	11	16		26-3/4		13-1/8	21-7/8	8-3/8	2,5,7,8
D81			12					81	14-1/2	31-1/2					24-3/4					3,5,7
82		22	or 15					74	20	33-1/2					26-3/4					2,5,7,8
83			18					81	20	31-1/2					24-3/4					3,5,7
85				10				81	22-1/2	31-1/2					24-3/4					3,5,7
86				15				74	32	33-1/2					26-3/4					2,5,7,8
87				15				81	32	31-1/2					24-3/4					3,5,7
88				5				74	14-1/2	33-1/2					26-3/4					2,5,7,8
89				5				81	14-1/2	31-1/2					24-3/4					3,5,7
90		24	or 16					74	22-1/2	33-1/2					26-3/4					2,5,7,8
91			20					81	22-1/2	31-1/2					24-3/4					3,5,7
92		16	or 12					74	22-1/2	33-1/2					26-3/4					2,5,7,8
93			12					81	22-1/2	31-1/2					24-3/4					3,5,7
95			18					81	32	31-1/2					24-3/4					3,5,7
96		8	or 6					74	14-1/2	33-1/2					26-3/4					2,5,7,8
97			6					81	14-1/2	31-1/2					24-3/4					3,5,7
E40								74	20	33-1/2					26-3/4					2,5,7,8
40A								74	22-1/2	33-1/2					26-3/4					2,5,7,8
41								81	36	40-1/2	9	11	16				13-1/8	21-7/8	3-7/8	1,4,7,9
42								81	54	40-1/2	9	14	13				13-1/8	21-7/8	8-3/8	1,4,7,9

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