

MIL-R-23098A(SH)
 AMENDMENT-6
 14 July 1976
~~SUPERSEDING~~
 Amendment-5
 18 July 1975

MILITARY SPECIFICATION
 REGULATORS, LINE VOLTAGE, SINGLE PHASE,
 400 HERTZ A.C.
 NAVAL SHIPBOARD

This amendment forms a part of Military Specification MIL-R-23098A(SHIPS), 30 November 1970 and is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

Page 1

1.1, line 4: Delete "or without".

Page 2

3.2.3, line 2: Delete "grade B" and substitute "grade C".

3.2.5: Delete.

Page 4

3.2.13, add: "Germanium diodes may be used in signal processing circuits which are not required to handle power."

Table I, delete and substitute:

Table I - Size and weight requirements.

Maximum line current rating (amperes)		Maximum dimensions, inches			Maximum weight (pounds)	
115V units	440V units	Height	Width	Depth	115V units	440V units
75	20	24	26	12	150	170
150	40	26	28	15	210	210
225	--	28	30	18	260	---

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Add as paragraph 3.3.2.3:

"3.3.2.3 When operated as a single phase unit in a 115V or 440V system, the equipments shall maintain output voltage within the specified steady-state voltage regulation band."

3.3.2.3, delete and substitute:

"3.3.3.2 Steady-state voltage regulation performance shall be as specified for the operational modes of 3.3.2(a) and (b), when equipments are connected in a three-phase delta configuration under the conditions of unbalanced line current specified in table II."

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3.3.3.3, delete and substitute:

"3.3.3.3 Steady-state voltage regulation shall be as specified for the operational modes of 3.3.2(a) and (b), when equipments are interconnected in a three-phase four-wire wye system (with grounded neutral) under the conditions of unbalanced line current specified in table II."

Page 6

3.3.4, last sentence: Delete and substitute: "The requirements on magnitude of output voltage compensation and permissible regulation error specified herein shall be satisfied when equipments are operated in a three-phase four-wire wye system (with grounded neutral) under conditions of balanced load."

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3.3.6, first sentence: Delete and substitute: "When equipments, operated in accordance with 3.3.2(a) are subjected to the step removal of load specified in 4.5.8.2, the maximum over-voltage transient excursion occurring in the output voltage, during the first six cycles after step change of load, shall not exceed by more than 10 percent of rated peak voltage, the peak magnitude of the input voltage transient. After six cycles following step load removal, the maximum overvoltage transient in output voltage shall not exceed by more than 5 percent of rated peak voltage, the peak magnitude of the overvoltage transient in the input voltage. Whenever equipments operated in accordance with 3.3.2(a) are subjected to the step applications of load specified in 4.5.8.2, the undervoltage transient excursion occurring in the output voltage, after three cycles following step increase of load, shall not exceed by more than 5 percent of rated peak voltage, the peak magnitude of the input voltage transient."

3.3.7.1, line 3: Delete "1 to 100 Hz" and substitute "10 to 100 Hz".

3.3.8, line 3: Delete "3.3.8.2" and substitute "3.3.8.3".

3.3.8.1, items (a) and (b): Delete and substitute:

- "(a) Single-phase or three-phase wye (4-wire); 3.5 percent for 150 ampere and 225 ampere regulators; 6 percent for 75 ampere regulators; 6 percent for 20 ampere and 40 ampere regulators.
- "(b) Three-phase delta: 6 percent for 150 ampere and 225 ampere regulators; 10 percent for 75 ampere regulators; 10.5 percent for 20 ampere and 40 ampere regulators."

3.3.8.2: Delete.

3.3.8.3, make the following changes:

- (a) Line 1, heading, after "slope", add: "(steady-state)."
- (b) Line 6, delete: "both"; delete "and dynamic".
- (c) Line 7, delete: "and 3.3.8.2".

Page 8

3.3.9, lines 2 and 8: Delete "35 milliseconds" and substitute "100 milliseconds".

3.3.11.1, delete and substitute:

"3.3.11.1 KVA efficiency.

"3.3.11.1.1 KVA efficiency of each equipment connected in a three-phase four-wire wye system shall be at least 70 percent at any load between 60 percent load and rated full load, at 0.75 lagging and unity power factor.

"3.3.11.1.2 KVA efficiency of each equipment connected in a three-phase delta system shall be at least 60 percent at any load between 60 percent load and rated full load, at 0.75 lagging and unity power factor."

Page 9

3.5.3, line 1: Delete "A" and substitute "F".

Page 2 of 6

3.5.3.1, lines 1 and 2: Delete and substitute:

"3.5.3.1 Category F, evaluation, and procurement. Category F drawings shall contain the following minimum data:"

Page 11

3.6, line 2: Delete "type II" and substitute "type I".

Pages 12 and 13

3.7, delete and substitute:

"3.7 Maintainability.

"3.7.1 Primary corrective maintenance. The equipment shall be designed so that primary corrective maintenance can be performed by replacement of subassemblies. In the event that special tools are required for removal or insertion of subassemblies, all such tools shall be supplied by the equipment manufacturer. Special tools are defined as those tools not listed in the Federal Supply Catalog (copies of this catalog may be consulted in the office of the Defense Contract Administration Service (DCAS)). Equipment design shall conform to the design-for-maintainability requirements of MIL-STD-470 (see 6.6) and NAVSHIPS 0967-312-8010 (formerly NAVSHIPS 94324). The arithmetic mean-time-to-repair (MTTR) shall be 1 hour and shall be demonstrated in accordance with MIL-STD-471 (see 6.6).

"3.7.2 Secondary corrective maintenance. The subassemblies intended as replaceable items for primary corrective maintenance actions in case of equipment failure shall be designed to facilitate shipboard repair. Any subassembly repairs requiring higher echelon corrective maintenance (as defined in NAVSHIPS 0967-312-8010) shall be so identified in the approved technical manual (see 3.6). Except for irreplaceable parts (see 3.4), replaceable subassemblies shall be capable of repair by Navy personnel through replacement of individual parts. Where special tools are required for subassembly repair, all such tools shall be furnished by the equipment manufacturer."

3.8, item (i), lines 2 and 3: Delete "MTTR_C" and substitute "MTTR".

4.1.1, delete and substitute:

"4.1.1 Inspection system. The supplier shall provide and maintain an inspection system acceptable to the Government for supplies and services covered by this specification. The inspection system shall be in accordance with MIL-I-45208 (see 6.1 and 6.6)".

Pages 14 and 15

4.3.2.1, line 5: Delete "400 volts" and substitute "440 volts"

Table IV, make the following changes:

- (a) Opposite "Airborne Noise", group A column delete "-" and substitute "X".
- (b) Opposite "Output voltage modulation" group B column delete "X" and substitute "-".
- (c) Opposite "Slope of no load input excitation current versus input voltage", reference paragraph test column, delete "4.5.13.3" and substitute "4.5.1.3".
- (d) Delete "inclined operation" and all references thereto.

Pages 15 and 16

Table V, under column "1 phase", opposite "Dielectric strength" delete "-" and substitute "X"; under column "3 phase delta", opposite "Dielectric strength" delete "X" and substitute "-"; make the following changes under column "3 phase wye^{1/3}":

- (a) Opposite "Input voltage transient" delete "-" and substitute "X".
- (b) Opposite "Output voltage transient" delete "-" and substitute "X".
- (c) Opposite "Output voltage build-up" delete "-" and substitute "X".
- (d) Opposite "Output voltage modulation" delete "-" and substitute "X".
- (e) Opposite "Output voltage modulation gain" delete "-" and substitute "X".
- (f) Opposite "No load input excitation current" delete "-" and substitute "X".
- (g) Opposite "Slope of no load input excitation current versus input voltage" delete "-" and substitute "X".

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- (h) Opposite "Waveform distortion" delete "-" and substitute "X".
- (i) Opposite "Efficiency" delete "-" and substitute "X".
- (j) Delete "Inclined operation", and all references thereto.

Page 17

4.5.2, line 2: Delete "MIL-E-2306" and substitute "MIL-E-2036".

4.5.5.1, first sentence: Delete and substitute: "Heating tests shall be performed in accordance with the operational configuration of 3.3.2(a), with line voltage regulators interconnected in a balanced three-phase delta system at 105 percent rated input voltage under conditions of rated full load output line current (balanced) at unity power factor."

Page 18

Add as paragraph 4.5.6.1:

"4.5.6.1 Group A. When steady-state voltage regulation tests are performed at test condition Nos. 2 and 23 of table VII, in accordance with the group A procedure of 4.5.7.1, a broadband measurement of sound pressure level shall be conducted by means of a microphone positioned at a single point 3 feet in front of the regulator equipment. Instrumentation used in the performance of broadband measurement of sound pressure level shall conform to MIL-STD-740. The single point observation of broadband noise shall demonstrate that the equipment does not produce any acoustic noise emission in excess of 65 decibels (db) referred to 0.0002 microbar sound pressure level. In the event that this noise level is exceeded, a noise test in accordance with 4.5.6 shall be conducted to determine conformance with the requirements of 3.2.3."

Page 19

Table VII: Add the following:

Condition numbers	Load	Power factor	Input voltage	Frequency	Ambient temperature (Degrees C.)
25	(Unbalanced lines A, E, C) { Full load Full load 10% load	Unity	(Unbalanced line-to-neutral, AN, BN, CN)	Rated +1/2%	23
26	{ 10% load Full load Full load	0.75 lagging	Each line-to-neutral voltage within steady-state band of table II	Rated	50
27	{ Full load 10% load Full load	Unity		Rated -1/2%	23
28	(Unbalanced, lines A, E, C) { 80% load 80% load 20% load	0.75 lagging	(Unbalanced, line-to-line, AB, BC, CA)	Rated -1/2%	23
29	{ 20% load 80% load 80% load	Unity	Each line-to-line voltage within steady-state band of table II	Rated +1/2%	23
30	{ 80% load 20% load 80% load	Unity		Rated	50

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4.5.7.2, item (a) (2): Delete "The equipments shall be adjusted for maximum output voltage compensation."

Item (a) (3): Delete and substitute:

"(3) Using the operational configuration specified in 3.3.2(a), output line-to-neutral voltages shall be measured at the regulator terminals under condition Nos. 25, 26 and 27 of table VII."

Item (a) (4): Delete.

Page 20

4.5.8.2, item (a) (2): Delete and substitute:

"(2) Equipments shall be operated on a steady-state basis in accordance with test condition Nos. 25, 26 and 27 of table VII. The equipments shall be subjected to a single phase step increase in load extending from 10 percent load to rated full load on the lightly loaded phase."

Item (b), line 1: Delete "4.5.8.2(a)" and substitute "4.5.8.2(a) (1)"; lines 3 and 4: Delete "and step change in load on lightly loaded phase shall extend from 20 percent load to rated full load."

Page 21

4.5.10.1, second sentence: Delete and substitute: "The harmonic content of the output voltage waveform of the 400 Hz source used to provide power to the regulator equipments under test shall not exceed the limits specified below, when the source supplies a resistive load equal to the rating of the line voltage regulators:

- (a) 3 percent of rated rms voltage, total harmonic distortion.
- (b) 2 percent of rated rms voltage, for any single harmonic component."

4.5.11, delete and substitute:

"4.5.11 Phase balance. Equipments shall be connected in three-phase delta, and shall be operated in accordance with steady-state condition Nos. 28, 29 and 30 of table VII. Equipment operation shall conform to 3.3.2(a). The three-phase delta configuration shall be tested for voltage balance at equipment output terminals. Output line-to-line voltages shall be measured to determine conformance with 3.3.3."

4.5.12, lines 5 and 8: Delete "1 to 100 Hz" and substitute "10 to 100 Hz".

Page 22

4.5.13.1, last line: Delete "3.3.8.2" and substitute "3.3.8.3".

4.5.13.3: Delete.

4.5.14: Delete.

Page 23

4.5.16, second sentence: Delete and substitute:

"After each 100 hours of operation, the initially impressed load shall be changed in a single step from the 20 percent - 80 percent - 80 percent configuration to a balanced rated line current condition."; line 8, delete "at each step application of single phase load" and substitute "at each step change of load"; line 9, delete "3.3.6 and"; line 12, delete "and 3.3.6".

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4.5.18, item (a), second sentence: Delete and substitute: "Equipments rated at 225 amperes shall be energized and operated at 45 percent of rated load during shock test. Equipments of all other ratings shall be energized and operated at rated full load during shock test."

Item (a), lines 6 and 7: Delete "Condition Nos. 22 through 24"

Page 24

4.5.21, line 4: Delete "MTTR_G" and substitute "MTTR".

Page 25

6.1, add as item (g):

"(g) Quality assurance requirements (see 4.1.1)."

Page 27

Add as paragraphs 6.4.29 and 6.4.30:

"6.4.29 Primary corrective maintenance. Primary corrective maintenance is that maintenance performed on an as-required basis to return an equipment to service in the shortest possible time after a failure or malfunction has occurred.

"6.4.30 Secondary corrective maintenance. Secondary corrective maintenance is a maintenance action, performed independently of primary corrective maintenance, which restores a malfunctioning subassembly, removed from the equipment, to the status of an operating spare."

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