

**INCH- POUND**

MIL-T-16315D(SH)

24 May 1994

SUPERSEDING

MIL-T-16315C(NAVY)

24 January 1955

(See 6.7)

## MILITARY SPECIFICATION

### TRANSFORMERS, POWER, STEP-DOWN (MISCELLANEOUS, NAVAL SHIPBOARD USE)

This specification 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.

#### 1. SCOPE

1.1 Scope. This specification covers small, dry type, step-down, power transformers for use on Naval ships.

1.2 Classification Transformers shall be of the following types, as specified (see 6.2):

- IL (Indicator light). (3.14)
- CC (Control circuit). (3.15)
- SL (Sight light). (3.16)
- GF (Gun and torpedo firing). (3.17)
- PR (Power rectifier). (3.18)
- TF (Torpedo firing). (3.19)
- SA (Special applications). (3.20)

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

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 03Q42, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

AMSC N/A

DISTRIBUTION STATEMENT A

Approved for public release; distribution is unlimited

FSC 5950

SPECIFICATIONS

FEDERAL

- PPP-F-320 Fiberboard, Corrugated and Solid Sheet Stock (Container Grade) and Cut Shapes
- J-W-1177 - Wire, Magnet, Electrical

MILITARY

- MIL-S-901 - Shock Tests, HI (High Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
- MIL-E-917 - Electric Power Equipment, Basic Requirements for (Naval Shipboard Use)
- MIL-E-2036 - Enclosures for Electric and Electronic Equipment.
- MIL-L-3661 - Lampholder, Indicator Lights, Indicator Light Housings, and Indicator Light Lenses, General Specifications For.
- MIL-L-3661/60- Lampholder, Transformer, Light Indicator, Style LH93
- MIL-L-3661/61- Lampholder, Light, Indicator (Housing), Style LH94.
- MIL-P-15024 - Plates, Tags and Bands for Identification of Equipment.
- MIL-L-19140 - Lumber and Plywood, Fire-Retardant Treated.
- MIL-E-24142 - Enclosure for Electrical Fittings and Fixtures, General Specifications For.
- MIL-E-24142/6- Enclosure, Submersible (15-Foot), Sizes 8 by 10 through 14 by 26.
- MIL-I-24718 - Insulating Resins Solventless, Vacuum-Pressure Impregnating, General Specification For.
- MIL-T-55164 - Terminal Boards, Molded, Barrier, Screw and Stud Types, and Associated Accessories, General Specification for.

STANDARDS

MILITARY

- MIL-STD-195 - Marking of Connections for Electrical Assemblies
- MIL-STD-45662- Calibration Systems Requirements.

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

2 1 2 Other Government documents, drawings, and publications The following other Government documents, drawings, and publications form a part of this document to the extent specified herein Unless otherwise specified, the issues are those cited in the solicitation

DRAWING

- NAVAL SEA SYSTEMS COMMAND (NAVSEA)
- NAVSHIPS S6202-73731 - Enclosure (SPT), for Gunfiring Transformers, Type GF

(Application for copies should be addressed to Commander, Portsmouth Naval Shipyard, Naval Engineering Drawing Support Activity, Code 202 2, Portsmouth, NH 03804-5000 )

2 2 Order of precedence In the event of a conflict between the text of this document and the references cited herein, the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained

3 REQUIREMENTS

3 1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.3.

3.2 General design features. Transformers shall be of the dry type. Transformer cores shall be made of separate laminations of nonaging steel, insulated from each other when assembled.

3.2.1 Electrostatic shielding. When specified, (see 6.2), an electrostatic shield, either an aluminum or copper sheet, shall be wound between the primary and secondary windings, and insulated from them. The ends of the shield shall be insulated from each other and a lead brought out from one end.

3 3 Basic requirements. Except as otherwise specified herein, transformers shall conform to MIL-E-917 and shall be of the following insulation classification:

Class 105, 130, 155, 180, 200, 220, 240.

3.3.1 Load test. Transformers shall withstand being operated at full load for 100 hours, at rated duty, under the conditions of nominal voltage, frequency and ambient temperature.

3.4 Magnet wire Round or rectangular wire shall be in accordance with J-W-1177

3.5 Preparation of electrical windings and core. The complete transformer shall be impregnated with a solventless resin per requirements of MIL-I-24718. The vacuum-pressure impregnation (VPI) method shall be used. After VPI process, the transformer shall receive an additional varnish treatment to provide a smooth finished surface. Impregnation shall be in accordance with MIL-E-917.

3.6 Temperature rise. The average winding temperature rise above an ambient temperature of 50 degrees C, when measured by the change of resistance method, shall not exceed the following values: See 4.7.3. The hot temperature rise shall be by the embedded detector method of MIL-E-917.

Insulation system temperature degrees C	Average winding temperature rises degrees C	Hot-Spot winding temperature rise degrees C
105	45	55
130	50	80
155	75	105
180	100	130
200	120	150
220	140	170
240	160	190

3.7 Dielectric strength, and induced voltage tests. Dielectric strength, and induced voltage tests shall consist of the following.

3.7.1 Applied potential test The applied potential test shall be made by applying between each winding and all other windings connected to ground a voltage from an external source in accordance with the below values when tested in accordance with 4.7.7.1 The test voltages apply to all types of transformers except the type PR See 3.18.3.

#### Applied Potential Test Voltages

Nameplate voltage rating, volts	Test potential, volts, minimum
0 - 125	1000
Above 125	1500

3.7.2 Induced voltage test. The induced voltage test shall be made by applying between the terminals of one winding a voltage of twice the normal voltage developed in the winding. See 4.7.7.2. This test shall not be performed on transformers with terminal voltages of less than 25 volts

3.8 Enclosure Unless otherwise specified, transformers shall be of open construction. When an enclosure is required (see 6.2), it shall conform to the dripproof and watertight types of MIL-E-2036.

#### 3.9 Leads, terminations, and markings.

3.9.1 Leads. Coil take-off wires for primary and secondary connections may be stranded or wire of coil winding leads. Wire of coil winding leads may be used only where connections are to be made to terminal boards or terminal posts, and must be at least number 18 AWG. Only stranded leads shall be used where there are no connections to be made, and the stranded leads themselves are to be used as leads. Connection wires whether used with terminal boards, terminal posts or terminal leads shall be adequately insulated and secured to the windings in such a manner that they will not become loosened or damaged by vibration or shock. The sheath used for lead wires shall be a tough grade and such that the effect of aging will be negligible. No braid or other covering shall be used as an outer sheath

3.9.2 Terminations. Integral terminal boards conforming to MIL-T-55164 shall be provided when available for the wire size used. When a terminal board cannot be used, the magnetic component windings shall be terminated at terminals or other acceptable means. Leads 10 AWG or smaller shall be provided with sufficient slack for two replacements of the terminal lug

3.9.3 Markings At the point on the transformer where the lead wire enters the case, or where terminal boards or terminal posts are located, the primary and secondary leads and their respective voltages shall be clearly marked. Markings shall be made in such a manner that they will not become obliterated in service, and shall be in accordance with MIL-STD-195

#### 3.10 Designation and marking

3.10.1 Identification plates Identification plates and other designating markings shall be in accordance with MIL-P-15024, except that plastic material shall not be used. These plates shall be placed in a readily accessible position where they can be read at all times without danger to personnel. Where identification plates are not practicable, the identifying information may be marked in a permanent manner on the case core or cover.

3 10.2 Identification plate markings Identifying data shall include the following items

- (a) Manufacturer's name, identification symbols, serial number and date of manufacture
- (b) Salient design characteristics, namely: type, or model, capacity, volt-amperes (VA), frequency, primary voltage, secondary voltage and the specification number under which purchased.
- (c) Blank space for inspector's official stamping. (Stamp approximately three-eighths inch in diameter.)
- (d) Government stock number.
- (e) Government contract number.

3 11 Shockproofness. Transformers shall withstand the high impact shock test specified in MIL-S-901 without mechanical damage or electrical failure of parts.

3.12 Short circuit. For GF and TF types only. Transformers shall withstand the short test specified in 4.7 6.1 and followed immediately by the insulation resistance test specified in 4.7.6.2.

3 13 Insulation resistance. Transformers shall meet the insulation resistance test in 4.7.6 2.

3 14 Type IL (indicator light).

3.14 1 Rating. Transformers shall be capable of operating continuously with rated voltage impressed across the primary and rated output on the secondary without exceeding the limiting temperature rise specified in 3.6. The standard ratings shall be as follows:

<u>Voltage ratio</u>	<u>Volt-ampere output</u>
450/4/2	0.8 and 0 4
117/4/2	0.8 and 0.4

3 14 2 Voltage regulation. With rated voltage impressed on the transformer primary, the secondary voltage shall be  $2.0 \pm 0.1$  volts with both 2.5 volts, 0.2 ampere lamps burning and  $2.5 \pm 0.3$  volts with one lamp removed. Load conditions are 0 (no load) and 0.5 ampere full load.

3 14.3 Dimensions The dimensions shall be per MIL-L-3661/60 for indicator light LH93 and MIL-L-3661/61 for indicator light LH94.

3 15 Type CC (control circuit)

3 15 1 Rating Transformers shall operate continuously with a rated voltage impressed across the primary and a rated output on the secondary without exceeding the limiting temperature rise specified in 3 6 The standard ratings shall be as follows

<u>Voltage ratio</u>	<u>Volt-ampere output</u>
450/115	10, 25, 50, 75, 100, 150, 200
230/115	10, 25, 50, 75, 100, 150, 200
450/6	10, 25
115/6	10, 25
120/78	100
115/12	50

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3 15 1 1 Transformers having a voltage ratio of 120/78 are intended as synchro zero-setting transformers and may be an auto-transformer type.

3 15 2 Voltage regulation The voltage regulation shall be as follows with rated voltage and frequency applied to the primary

<u>Capacity (volt-amperes)</u>	<u>Regulation (percent)</u>
10	21.00
25	15 00
50	10 00
75	10.00
100	8 00
150	7.00
200	6 00

3 16 Type SL (sight light).

3.16 1 Rating. Transformers shall operate continuously at 115 volts primary voltage with the specified output, without exceeding the limiting temperature rise specified in 3.6. The standard ratings shall be as follows:

<u>Voltage ratio</u>	<u>Volt-ampere output</u>
115/7	5, 10, 25
115/5-6-7-8	75, 150, 300, 500

The 75, 150, 300 and 500 volt-ampere sizes shall be provided with taps to obtain 5, 6, 7, and 8 volts

3 16 2 Voltage regulation.

3.16 2 1 Volt-ampere sizes 5, 10, and 25. With a constant voltage of 115 volts impressed on the primary, the voltage on the secondary shall not exceed 7 volts at no load At full load, this value shall not be less than 5.5 volts

3.16.2 2 Volt-ampere sizes 75, 150, 300 and 500 With a constant voltage of 115 volts impressed on the primary, the voltage on the secondary between any tap and the common terminal at full load shall be not less than the rating of that tap and at no load shall not exceed the rated voltage by more than 1.0 volt.

3 16 3 Dimensions The transformer dimensions shall be in accordance with table I

TABLE I. Dimensions - for type SL transformers.

Volt-ampere output	Overall dimensions <sup>1/</sup> (maximum)			Maximum volume exclusive of projecting mounting legs and bushings (not exclusive of terminal board)	Mounting hole <sup>2/</sup> center-to-center spacing	
	ht	Width	Length		Paralell to length	Paralell to width
	In	In	In		Inches	Inches
5	----	---	----	10	----	----
10	----	----	----	24	----	----
25	----	----	----	35	----	----
75	4-1/4	3-5/8	4-7/8	60	4-3/8	2-5/8
150	5-7/8	4-1/4	6-1/8	100	5-3/8	3-1/8
300	----	----	----	500	----	----
500	----	----	----	800	----	----

1/ In cases where the installation permits, transformer dimensions other than those specified may be approved by NAVSEA, if the maximum volume requirement is met.

2/ Unless otherwise specified by NAVSEA, the mounting holes on the transformers shall be so arranged that sufficient clearance around the case of the transformer itself will be provided for the use of 1/4 inch fillister-head screws having a head diameter of 0.40 inch outside diameter.

### 3 17 Type GF (gun and torpedo firing).

3 17.1 Rating Transformers shall operate for 1 hour at 115 volts, 60 Hz primary voltage, with the specified output, without exceeding the limiting temperature rise specified in 3.6. The standard ratings shall be:

<u>Voltage ratio</u>	<u>Volt-ampere output</u>
115/20	200
115/35	200

3 17 2 Voltage regulation With a constant voltage of 115 volts, 60 cycles, impressed on the 115/20 and the 115/35 primaries, the voltages on the secondaries shall be not less than 18 volts and 32 volts respectively at full load, 100 percent power factor. The secondary voltages at no load shall not exceed 20 volts and 35 volts respectively

3 17 2 1 Windings A tolerance of plus or minus 2 percent in direct current (dc) resistance of the primary and the secondary shall be maintained on all gun-firing transformers supplied to any one ship

3 17 3 Weight The transformer complete with the enclosure shall weigh not more than 20 pounds

3 17 4 Enclosing case Each transformer shall be supplied in an enclosing case in accordance with NAVSHIPS Drawing S6202-73731

3.18 Type PR (power rectifier).

3.18.1 Rating. Transformers shall have the primary and secondary voltage, frequency and output ratings as required by the power rectifier with which they are used. They shall operate continuously at rated primary voltage and frequency with rated output without exceeding the limiting temperature rise specified in 3.6

3.18.2 Voltage regulation The voltage regulation of the transformer shall be as required to obtain the characteristics of the rectifier with which used.

3.18.3 Dielectric strength Transformers for use in anode circuits shall be tested as specified in 4.7.7.1.1

3.19 Type TF (torpedo firing).

3.19.1 Rating Transformers shall operate for 30 minutes at 115 volts, 60 Hz, primary voltage, with the specified output, without exceeding the temperature rise specified in 3.6. The standard rating shall be:

<u>Voltage ratio</u>	<u>Volt-ampere output</u>
115/115	600

3.19.2 Voltage regulation With a constant voltage of 115 impressed on the primary, the voltage on the secondary shall be not less than 110 volts at full load, 100 percent power factor. The secondary voltage at no load shall not exceed 115 volts

3.19.3 Each transformer shall be supplied in an enclosure in accordance with MIL-E-24142/6, Mil part number M24142/6-001 (8X10).

3.20 Type SA This applies to transformers and other devices using the basic transformer principles which have characteristics and features needed for special applications and cannot be covered by any of the other types specified herein

3.20.1 Rating Transformers shall have winding voltages, frequency and output ratings as required by the ordering activity (see 6.2). They shall perform the maximum designed duty without exceeding the temperature rise specified in 3.6

3.20.2 Voltage regulation. The voltage regulation of the transformers shall be as specified by the ordering activity (see 6.2)

3.20.3 Mounting and construction The transformer mounting shall be as specified by the ordering activity (see 6.2). Transformers of open type construction shall be furnished with adequate protection against electrical shock, mechanical damage and moisture by the equipment in which they are used

3.21 Workmanship Metal surfaces shall have a smooth finish, and all details of manufacture, including the preparation of parts and accessories, shall be in accordance with the best of practices for high quality electrical equipment. Particular attention shall be given to neatness and thoroughness of wiring, varnish impregnation uniformity over coils and core, marking of parts, transformer plates and final surface finishes, riveting, welding, clearances between connections and ease with which connections can be made, ruggedness of construction, and suitability of the enclosure, when required, for its intended use

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the inspection facility. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

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

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

4.3 First article inspection. First article tests applicable to types GF and TF only shall be conducted at a laboratory designated by NAVSEA (see 6.2). When first article tests are conducted at the contractor's plant or at other than a Government laboratory, they will be performed or witnessed by the Government inspector. One sample of each type transformer shall be subjected to the examinations and tests specified in 4.6 and 4.7.

4.3.1 First article acceptance. The result of each test shall be compared with the specification requirements. In the event of failure to conform to this specification, the contractor shall correct the cause of failure in the first article samples and on future first article units. First article samples of the power transformers, types GF and TF only furnished under this specification shall be submitted for performance of the tests.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the inspections and tests shown in table II. Quality conformance inspections shall be performed on every lot of transformers acquired under this specification.

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TABLE II Quality conformance inspection and tests.

Inspection/test	Requirement	Test	Sampling plan code letter
<u>Group A</u>			
Dimensional	3 8, 3.14.3, 3.16.3 3.17 4	4.6	A
Visual	3.10, 3.20.4, 3.21	4.6	A
Resistance	TBD	4.7.1	A
Voltage ratio	3 14 1, 3 15 1, 3 16.1, 3.17 1, 3 19 1, 3 20.1	4 7.2	A
Insulation resistance	3.13	4.7.6	A
Dielectric strength	3 7, 3.18.2	4.7.7	A
<u>Group B</u>			
Temperature rise	3 6	4 7.3	B
Voltage regulation	3.14 2, 3.15.2, 3.16.2, 3.17.2, 3.18.2, 3.19.2 3 20.2	4.7.4	B
Short circuit test	3.12	4.7.6	B

4 4 1 Sampling for quality conformance inspection. As a minimum, the contractor shall randomly select a sample quantity from each lot of completed transformers in accordance with tables II and III and inspect them in accordance with 4 4. Sample size depends on the sampling plan code letter shown in table II. If one or more defects are found in any sample, the entire lot shall be rejected. The contractor has the option of screening 100 percent of the lot for the defective characteristic(s) or providing a new lot which shall be inspected in accordance with the sampling plan contained herein. The contractor shall maintain for a period of three years after contract completion records of inspections, tests, and any resulting rejections.

TABLE III. Sample size for quality conformance inspections and tests.

Lot size	Sampling plan code letter A	Sample size Sampling plan code letter B	Sampling plan code letter C
1 to 8	All	3	1/
9 to 15	13	3	1/
16 to 25	13	3	1/
26 to 50	13	5	1/
51 to 90	13	6	1/
91 to 150	13	7	1/
151 to 280	20	10	1/
281 to 500	29	11	1/

1/ One complete transformer (type GF and TF only) when the basic design of the transformer or the material of a vital part has been changed

4 5 Lot For purposes of quality conformance inspection a lot shall consist of not more than 500 transformers of the same type, voltage, ratio, volt-ampere rating, produced in the same facility, using the same materials and production processes and being offered for delivery at one time

#### 4 6 Inspection

4 6 1 General examination Each transformer shall be subjected to a thorough examination to ascertain that the material, workmanship and design are in conformance with this specification

#### 4.7 Test procedures.

4.7.1 Resistance. The resistance of both the primary and the secondary shall be accurately measured. The temperature at which the resistance readings are taken shall also be recorded.

4.7.2 Ratio. The turns ratio between the primary and the secondary shall be accurately determined by either of the following methods at the contractor's option:

4 7 2 1 Voltmeter method The ratio test shall be made with rated or lower voltage at rated or higher frequency applied to either the high or low voltage leads of the transformer. Simultaneous readings of a voltmeter across the high voltage windings and a voltmeter across the low voltage winding shall be taken and recorded. The meters shall be interchanged and another set of readings obtained, the average of these two sets of readings shall be used in checking the ratio.

4 7.2.2 Standard transformer method. The primary of the transformer to be tested shall be connected in parallel with the primary of a standard transformer of the same nominal ratio. The secondaries shall also be connected in parallel but with a voltmeter or detector in the connection between two terminals of similar polarity and so arranged as to read the difference between the two secondary voltages. If the manufacturer desires, the voltages in each secondary winding may be obtained. Where this method is used, however, the voltmeters shall be interchanged and a second set of readings shall be obtained. The average of the results shall be used in determining the ratio.

4 7.2.2.1 The connections for the ratio test by comparison with a standard transformer are shown on figures 1 and 2.

4 7 2.2 2 The variation of the value of ratio between transformers of the same size, design, and type shall be within plus or minus half of 1 percent

#### 4.7.3 Temperature rise.

4 7 3 1 General Temperature rise tests on transformers shall be made under normal operating conditions, that is, rated voltage, rated frequency, rated current and the duty cycle specified. The test methods to be employed shall be as specified in 4 7 3 2 through 4 7 3 5. The SA transformer shall be tested by operating at rated full load and voltage under conditions for which designed and in an environment equivalent to that in which it will operate.

4 7 3 2 Assembly of transformer The temperature rise test shall be made only on a completely assembled transformer

4 7 3 3 Duration of test. On transformers with continuous duty, the test shall be continued until constant temperatures have been attained in all parts of the transformer. For transformers with intermittent duty, the measurements shall be made after the first duty cycle.

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4 7 3 4 Method of loading The following methods of loading transformers for the heating test are acceptable

- (a) The transformer may be loaded directly with rated voltage applied to the primary and sufficient load on the secondary to load the transformer to rated kVA capacity
- (b) Duplicate single-phase transformers may be tested in banks of two by connecting both the high-voltage and low-voltage windings in parallel and by applying rated excitation voltage at rated frequency to one set of parallel windings. Connections of the other pair of windings shall be opened at one point and a voltage impressed across the break just sufficient to circulate rated currents through the windings. The circulated current should preferably be at rated frequency.

Note. If other than rated frequency is applied to the opened windings the value of current should be adjusted to yield the true impedance watts of the transformer.

4 7.3 5 Measurement of the ambient temperature. Measurement of the ambient temperature shall be in accordance with the requirements of MIL-E-917.

4 7 4 Voltage regulation. Voltage regulation shall be determined while the transformer is still hot, immediately following the heat run.

4.7 5 Shock The transformers shall be subjected to class HI shock in accordance with MIL-S-901. The features of test shall be as follows.

- (a) Type - Type C
- (b) Weight designation - Light.
- (c) Cause for rejection - Breakage of any part of the transformer tested, or cracks indicating incipient breakage.
- (d) Mounting - The transformers shall be mounted as shown on figure 4A of MIL-S-901.
- (e) Exceptions to MIL-S-901 - None.
- (f) Number to be tested - See 4.4.1.3.
- (g) Place of test - Designated laboratory.
- (h) Transformers shall be energized under full load during shock test

4 7 6 Short circuit and insulation resistance test.

4 7.6.1 Short circuit test. A voltage of 115 volts at 60 Hz shall be applied to the primary winding with the other winding short-circuited. The transformer shall withstand the short circuit for 5 seconds

4 7 6 2 Insulation resistance test The insulation resistance measured at 500 volts dc shall be not less than 100 megohms

4 7 7 Dielectric tests

4 7 7 1 Applied potential test Test voltage shall approximate a true sine wave. Insulation of each high-voltage winding shall withstand a dielectric test voltage (rms) of not less than 1500 volts, a.c., 60 Hz for a period of 1 minute with all the other windings and case, if applicable, and core grounded. The insulation of each low-voltage winding shall withstand a dielectric test voltage (rms) of 1000 volts, a.c., 60 Hz for a period of 1 minute with all other windings and case, if applicable, and core grounded

4 7 7 1.1 Applied potential test for PR transformers only. Transformers shall withstand the dielectric voltages in accordance with table IV for one minute

TABLE IV Dielectric test voltages for PR transformers.

Voltage of winding to be tested	RMS value of dielectric test voltage
Less than 60 volts	450
60 to 120	900
Above 120 and less than 240	1200
240 to 480	1500
Above 480	Twice rated plus 1000

4 7 7.2 Induced voltage test. The test voltage shall be applied to either winding and shall approximate a true sine wave. Insulation of the high-voltage and the low-voltage windings shall withstand a voltage applied to either winding of twice the normal operating voltage at a frequency of not less than 120 Hz or a period of not less than 7200 cycles at the frequency of the applied test voltage.

4 7 8 Watertightness. Where watertight enclosure is required, the watertightness of the enclosure shall be tested in accordance with MIL-E-2036.

4.8 Load test. Transformers shall operate at full load for a minimum of 100 hours, at rated duty, under conditions of nominal voltage, frequency and ambient temperature.

4 9 Inspection of packaging. Sample packs, and the inspection of the preservation, packing and marking for shipment, stowage and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

## 5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the preparation for delivery or packaging requirements of referenced documents listed in section 2, see 6.6.)

5.1 Packaging requirements. The packaging (preservation, packing and marking) requirements shall be in accordance with MIL-E-17555 for the level of preservation (A, B, C or commercial), level of packing (A, B, C or commercial) and marking including bar coding and other packaging acquisition options therein as specified (see 6 2). In addition, for Navy acquisitions the following applies.

### (a) Navy fire-retardant requirements

- (1) Treated lumber and plywood Unless otherwise specified (see 6 2), all lumber and plywood including laminated veneer materials used in shipping containers and pallet construction, members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows

Levels A and B - Type II - weather resistant.  
 Category 1 - general use  
 Level C - Type I - non-weather resistant  
 Category 1 - general use

- (2) Fiberboard Unless otherwise specified (see 6.2), fiberboard used in the construction of class-domestic, non-weather

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resistant fiberboard and cleated fiberboard boxes including interior packing forms shall meet the flamespread index and the specific optic density requirements of PPP-F-320 and amendments thereto

6 NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory).

6.1 Intended use. The small transformers covered by this specification are intended for use in the following applications

6 1 1 Type IL. Type IL transformers are intended for 6 volt power supply for indicator lamps on switchboard such as the bull's-eye type. These transformers are also used in ordnance applications.

6 1.2 Type CC Type CC transformers are intended for use in control circuit applications such as zeroing synchros and input to closing coils for circuit breakers and contactors, where the proper voltage for these appliances is not directly available on the bus.

6 1.3 Type SL. Type SL transformers are intended for use in ordnance applications, specifically for illumination of gun sights, for instrument illumination, and for interior communication and fire control applications.

6.1.4 Type GF. Type GF transformers are intended for use in gun, torpedo, rocket, and depth charge firing systems

6.1.5 Type PR Type PR transformers are intended for use as anode transformers, interphase transformers, cathode transformers, and auxiliary transformers for power rectifiers

6 1 6 Type TF. Type TF transformers are intended for use in isolation of grounds in torpedo firing circuits

6 1 7 Type SA. Type SA transformers are intended for use as internal components of equipment and having performance characteristics, mounting and size most suited for the specific application

6.2 Acquisition requirements Acquisition documents must specify the following:

- (a) Title, number, and date of this specification.
- (b) Type required (see 1 2)
- (c) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2 1 1)
- (d) When first article testing is required (see 3 1)
- (e) Whether enclosures are required (see 3.8).
- (f) Volt-ampere output required (see 3.14 1, 3 15 1, and 3.16 1)
- (g) Whether terminal leads, terminal boards or terminal posts are required (see 3 9)
- (h) Whether type PR transformers should include frequency, regulation, specific use in the rectifier, limiting and mounting dimensions, required (see 3 18).
- (i) For type SA transformers, specify voltages, frequency, output rating, voltage regulation, and mounting (see 3.20)
- (j) Laboratory where first article testing will be conducted (see 4 3)
- (k) Level of preservation, packing and other packaging options required (see 5 1)

(1) When fire-retardant materials are not required (see 5.1).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DIDs) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DIDs are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
3.2, and appendix A	DI-DRPR-80651	Drawings, engineering and associated lists	----
3 2, and appendix B	DI-MISC-80678	Certification/data report	----
4.3 and 4.4	DI-T-5072	Test reports	----

The above DIDs were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD Form 1423.

6.4 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6 5 Sub-contracted material and parts. The preparation for delivery or packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6 6 Subject term (key word) listing

Magnet wire  
Megohms  
Rating  
Volt-ampere output  
Voltmeter  
Windings

6 7 Changes from previous issue Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes

Preparing activity  
Navy - SH  
(Project 5950-N223)

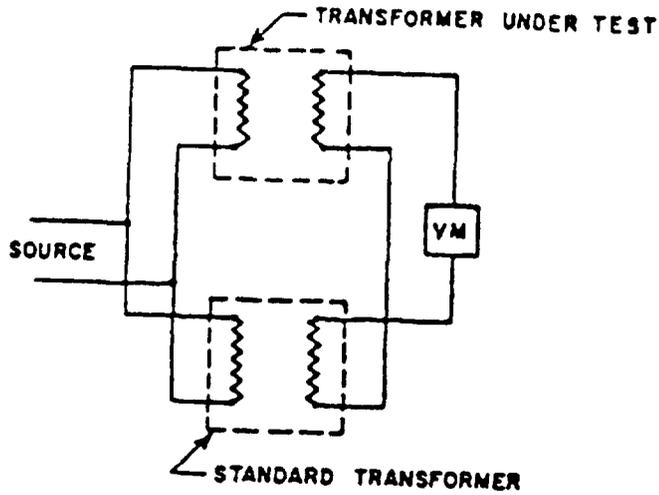


FIGURE 1 Voltmeter arranged to indicate the difference between the two secondary voltages.

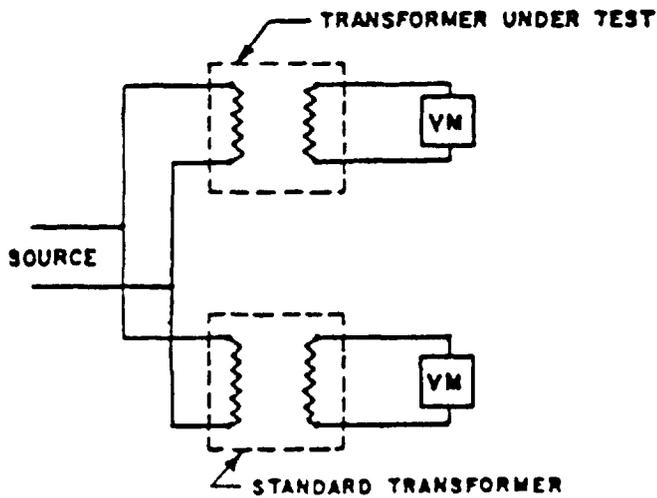


FIGURE 2 Voltmeters arranged to indicate the two secondary voltages  
The readings are repeated after interchanging voltmeters

APPENDIX A

ENGINEERING DRAWINGS TECHNICAL CONTENT REQUIREMENTS

10 SCOPE

10.1 Scope This appendix covers the technical requirements that should be included on drawings when required by the contract or purchase order. This appendix is mandatory only when data item description DI-DRPR-80651 is cited on the DD Form 1423

20 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30 DRAWINGS

30.1 Master drawings. When required by the contract or purchase order, master drawings should contain the following information as a minimum.

- (a) Outline, overall principal dimensions, and weight of the transformer
- (b) The core and the coil assembly shall be shown in sufficient detail to give a clear understanding of the construction. The space between the case and the core or winding shall be indicated. Sectional views or a cutaway view showing a representative portion of these details should be utilized where necessary to show the required information.
- (c) Coil data shall be shown for each transformer, and shall include insulation data as well as size and type of wire, its insulation, number of turns, resistance and other coil winding data for both the primary and the secondary.
- (d) Schematic wiring diagram This view shall give complete electrical ratings and show the proper hookup on the terminal board.
- (e) Identification plates and other designating plates and their markings

APPENDIX B

CERTIFICATION/DATA REPORT TECHNICAL CONTENT REQUIREMENTS

10 SCOPE

10.1 Scope. This appendix covers the technical requirements that should be included on certification/data reports when required by the contract or purchase order. This appendix is mandatory only when data item description DI-MISC-80678 is cited on the DD Form 1423.

20. APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30 REPORTS

30.1 Certification data reports. When required by the contract or purchase order, certification data reports should contain at least the following information

- (a) Volt-ampere rating
- (b) Primary volts
- (c) Secondary volts
- (d) Temperature rise in degrees Celsius

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1 The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

The submitter of this form must complete blocks 4, 5, 6, and 7.

3 The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

<b>I RECOMMEND A CHANGE:</b>	1 DOCUMENT NUMBER MIL-T-16315D(SH)	2 DOCUMENT DATE (YYMMDD) 94/05/24
3 DOCUMENT TITLE TRANSFORMERS, POWER, STEP-DOWN (MISCELLANEOUS, NAVAL SHIPBOARD USE)		
4 NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed)		
5 REASON FOR RECOMMENDATION		
6 SUBMITTER		
a NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c ADDRESS (Include Zip Code)	d TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (if applicable)	7. DATE SUBMITTED (YYMMDD)
8 PREPARING ACTIVITY TECHNICAL POINT OF CONTACT (TOPC):		
a NAME Mr. Chuck Collins SEA 03Y3 EASE SEND ALL CORRESPONDENSE TO:	b TELEPHONE (Include Area Code) (1) Commercial 703 602-0367 (2) AUTOVON 8-332-0367	
c ADDRESS (Include Zip Code) Commander, Naval Sea Systems Command SEA 03R42, 2531 Jefferson Davis Hwy., Arlington, VA 22242-5160	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT Defense Quality and Standardization Office 5203 Leesburg Pike Suite 1403 Falls Church VA 22041-3466 Telephone (703) 756 2340 AUTOVON 289 2340	