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11 May 1979
SUPERSEDING
MIL-T-21038C
22 May 1970

MILITARY SPECIFICATION

TRANSFORMERS, PULSE, LOW POWER, GENERAL SPECIFICATION FOR

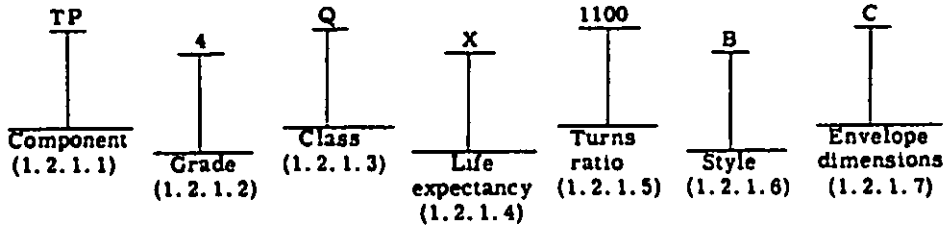
This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for low-power pulse transformers for use in electronic and communications equipment. This specification covers transformers where the peak pulse power is 300 watts or less and the average pulse power is 5 watts or less. Procurement of transformers of a specific design will require additional data in the form of complementary service documents giving detailed electrical and mechanical requirements and applicable additions and exceptions to the general requirements and tests specified herein. (See 6.1.)

1.2 Classification.

1.2.1 Type designation. The type designation shall be in the following form, and as specified (see 3.1, 6.1, and 6.3):



1.2.1.1 Component. Low-power pulse transformers are identified by the two-letter symbol "TP".

1.2.1.2 Grade. The grade is identified by a single digit denoting metal encased or encapsulated or open type of construction, and the ability of the transformers to withstand the environmental tests of table I.

1.2.1.2.1 Grade 4 and 6. These units are sealed, metal encased with separately fabricated headers and terminals. This grade does not include units which are encapsulated in a metal shell with an opening in either end or side of the shell, or with insulated lead wires exiting through the metal shell.

1.2.1.2.2 Grade 5 and 7. These units are encapsulated, including molded or embedded constructions, and units with a metal shell, open at one or both ends and filled with encapsulant material.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Electronic Systems Command, ATTN: ELEX 5043, Department of the Navy, Washington, D.C. 20360 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

TABLE I. Grade.

Test	Grade 4 metal-encased	Grade 5 encapsulated	Grade 6 metal-encased	Grade 7 encapsulated
Vibration, low frequency	X	X	-	-
Vibration, high frequency	-	-	X	X
Shock	X	X	X	X
Thermal shock	X	X	X	X
Immersion	X	X	X	X
Moisture resistance	X	X	X	X
Flammability	-	X	-	X

1.2.1.3 Class. The class is identified by a single letter in accordance with table II, denoting the maximum operating temperature (temperature rise (see 4.7.14) plus maximum ambient temperature) for realization of the life expectancy indicated in table III (see 6.5).

TABLE II. Class.

Symbol	Maximum operating temperature, °C
Q	85
R	105
S	130
T	155
U	170
V	>170, as specified

1.2.1.4 Life expectancy. The life expectancy is identified by a single letter in accordance with table III (see 6.5).

TABLE III. Life expectancy.

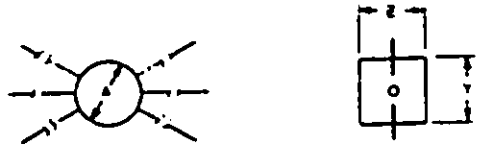
Symbol	Life (hours)
X	10,000 minimum
Y	2,500 minimum
Z	As specified (see 3.1)

1.2.1.5 Turns ratio (see 6.10). The turns ratio for the first four windings is identified by a four-digit number. For two-winding transformers, the last two digits shall be zero; for three-winding transformers, the last digit shall be zero. Examples of turns-ratio designations are as follows:

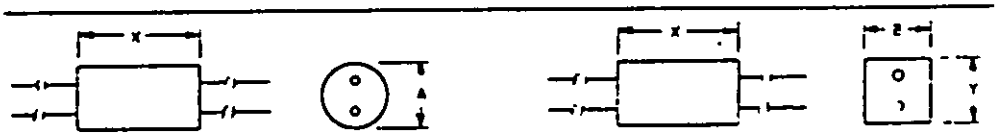
Turns ratio	Symbol
1:1 (two windings)	1100
1:2 (two windings)	1200
1:1:1 (three windings)	1110
1:1:1:1 (four windings)	1111
Nonstandard	NNNN

1.2.1.5.1 Nonstandard. For transformers with nonstandard ratios (for instance, 7.1:6, 7:5.3) or more than four windings, the identifying symbol shall be "NNNN".

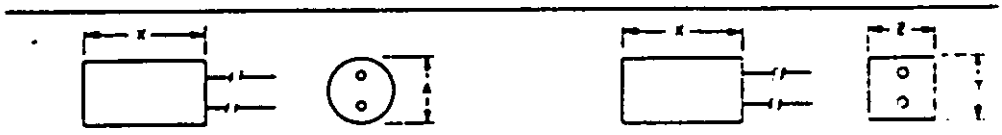
1.2.1.6 Style. The style is identified by a single letter in accordance with figure 1.



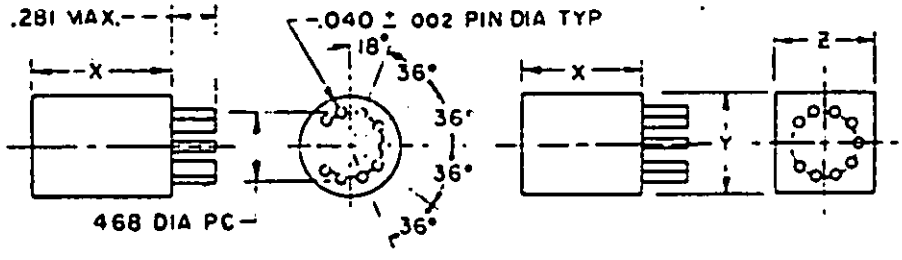
STYLE A - RADIAL TERMINATIONS



STYLE B - TERMINATIONS AT BOTH ENDS

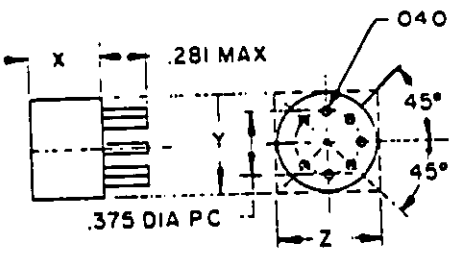


STYLE C - TERMINATIONS AT ONE END



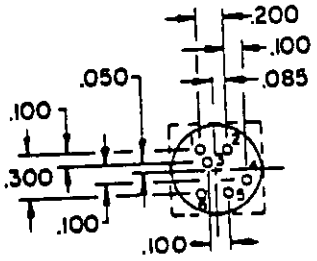
STYLE D - STANDARD 9 PIN BUTTON BASE E9-1

FIGURE 1. Style configuration.

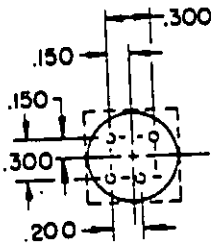


INCHES	MM	INCHES	MM
.002	.05	.200	5.08
.040	1.02	.281	7.14
.050	1.27	.300	7.62
.085	2.16	.375	9.53
.100	2.54	.468	11.89
.150	3.81		

Style E. Standard 7-pin button base E7-1.

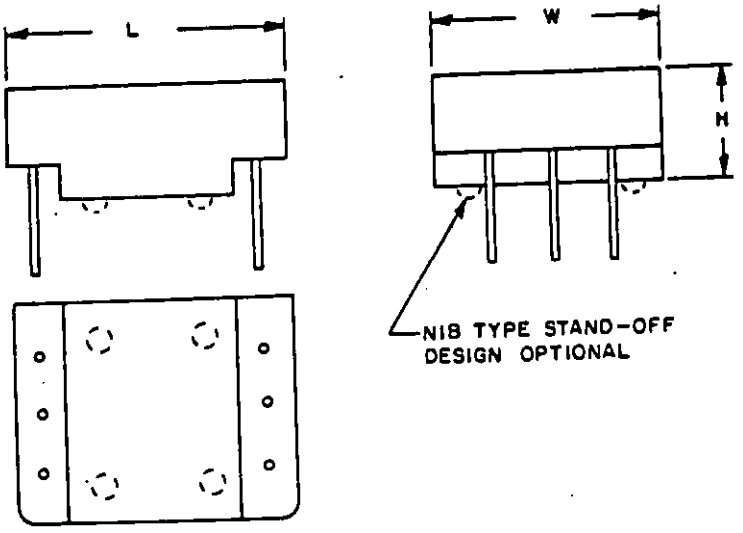


STYLE F-6-PIN
PRINTED CIRCUIT



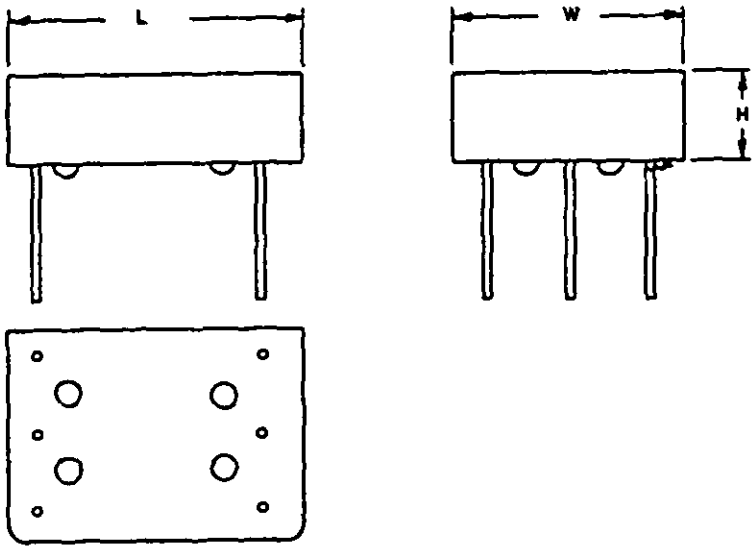
STYLE G-4-PIN
PRINTED CIRCUIT

STYLE H
NON-STANDARD
PRINTED CIRCUIT

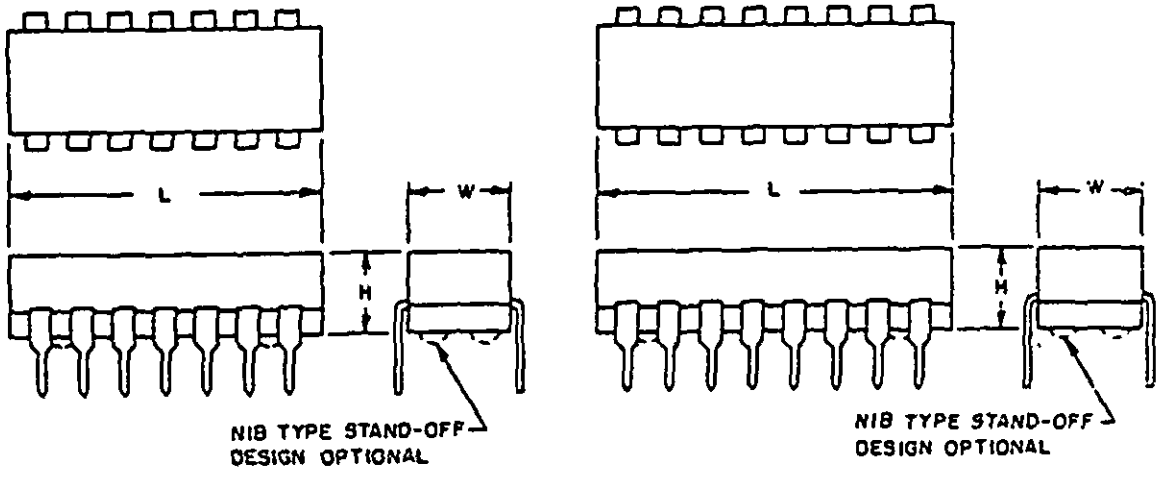


Style J. Printed circuit.

FIGURE 1. Style configuration - Continued.



Style K. Printed circuit.



Style M. 16 terminal printed circuit (dual-in-line).

Style L. 14 terminal printed circuit (dual-in-line).

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.
3. Except for styles D to G inclusive, the figures shown do not indicate the terminal spacing, type, or number of terminals that may be used.
4. The pin lay-outs are shown from bottom view.
5. For styles F, G, and H, the tolerance on pin to pin location shall be .010 (.25 mm), and the pin diameter shall be .042 (1.07 mm) maximum.
6. For envelope dimensions (see table IV).

FIGURE 1. Style configuration - Continued.

1.2.1.7 Envelope dimensions. The envelope dimensions are identified by one or two letters (see table IV). Specific physical configurations shall be as specified (see 3.1).

TABLE IV. Envelope dimensions. 1/ 2/

Symbol	Style	Dimensions (inches)				
		A (dia.) or (Y = Z)	X	L	W	H
A		.3125 (7.938)	.3125 (7.938)			
B		.3125 (7.938)	.4375 (11.112)			
C		.4375 (11.112)	.4375 (11.112)			
D		.4375 (11.112)	.5625 (14.288)			
E		.4375 (11.112)	.750 (19.05)			
F		.4375 (11.112)	.875 (22.22)			
G		.500 (12.70)	.4062 (10.317)			
H		.500 (12.70)	.500 (12.70)			
I		.500 (12.70)	1.000 (25.40)			
J		.500 (12.70)	1.250 (31.75)			
K		.5625 (14.288)	.750 (19.05)			
L		.5625 (14.288)	.8750 (22.225)			
M		.6250 (15.875)	.500 (12.70)			
N		.6250 (15.875)	.625 (15.88)			
O		.750 (19.05)	.500 (12.70)			
P		.750 (19.05)	.625 (15.88)			
Q		.750 (19.05)	.750 (19.05)			
R		.750 (19.05)	1.125 (28.58)			
S		.875 (22.22)	1.500 (38.10)			
T		1.000 (25.40)	1.000 (25.40)			

TABLE IV. Envelope dimensions - Continued. 1/ 2/

Symbol	Style	Dimensions (inches)				
		A (dia.) or (Y x Z)	X	L	W	H
U		1.125 (28.58)	1.500 (38.10)			
V		1.125 (28.58)	1.250 (31.75)			
W		1.500 (38.10)	1.500 (38.10)			
AA	J			.400 (10.16)	.300 (7.62)	.125 (3.18)
AB	J			.500 (12.70)	.350 (8.89)	.250 (6.35)
AC	J			.650 (16.51)	.425 (10.80)	.350 (8.89)
AD	J			.790 (20.07)	.495 (12.57)	.313 (7.95)
AE	K			.350 (8.89)	.350 (8.89)	.300 (7.62)
AF	K			.365 (9.27)	.235 (5.97)	.400 (10.16)
AG	K			.390 (9.91)	.390 (9.91)	.250 (6.35)
AH	K			.485 (12.32)	.350 (8.89)	.350 (8.89)
AI	K			.500 (12.70)	.350 (8.89)	.250 (6.35)
AJ	K			.650 (16.51)	.443 (11.25)	.400 (10.16)
AK	K			.940 (23.88)	.775 (19.68)	.800 (20.32)
AL	L			.780 (19.81)	.260 (6.60)	.200 (5.08)
AM	M			.880 (22.35)	.280 (7.11)	.200 (5.08)
Z	Others (see 3.1)					

1/ Tolerance for dimensions ≤ .625 inch (15.88 mm) shall be .031 inch (.79 mm).
2/ Tolerance for dimensions > .625 inch (15.88 mm) shall be .063 inch (1.60 mm).

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

L-P-513	- Plastic Sheet and Insulation Sheet, Electrical (Laminated Thermosetting, Paper-Base, Phenolic Resin).
J-W-1177	- Wire, magnet, Electrical.
QQ-S-571	- Solder, Tin Alloy: Tin-Lead Alloy; and Lead Alloy.
QQ-S-781	- Strapping, Steel, Flat and Seals.
PPP-B-566	- Boxes, Folding, Paperboard.
PPP-B-585	- Boxes, Wood, Wirebound.
PPP-B-601	- Boxes, Wood, Cleated-Plywood.
PPP-B-621	- Boxes, Wood, Nailed and Lock-Corner.
PPP-B-636	- Boxes, Shipping, Fiberboard.
PPP-B-676	- Boxes, Setup.
PPP-T-60	- Tape: Packaging, Waterproof.
PPP-T-76	- Tape, Pressure-Sensitive Adhesive Paper, (for Carton Sealing).

MILITARY

MIL-I-10	- Insulating Materials, Electrical, Ceramic, Class L.
MIL-M-14	- Molding Plastics and Molded Plastic Parts, Thermosetting.
MIL-P-116	- Preservation, Packaging, Methods of
MIL-P-997	- Plastic Material, Laminated, Thermosetting, Electrical-Insulation: Sheets, Glass Cloth, Silicone Resin.
MIL-F-14256	- Flux, Soldering, Liquid (Rosin Base).
MIL-P-15037	- Plastic Sheet, Laminated Thermosetting, Glass-Cloth, Melamine-Resin.
MIL-P-15047	- Plastic-Material, Laminated Thermosetting, Sheets, Nylon Fabric Base, Phenolic-Resin.
MIL-E-15090	- Enamel, Equipment, Light-Gray (Formula No. 111).
MIL-C-45662	- Calibration System Requirements.

STANDARDS

FEDERAL

FED-STD-595	- Colors.
FED-STD-H28	- Screw-Thread Standards for Federal Services

MILITARY

MIL-STD-794	- Parts and Equipment, Procedures for Packaging and Packing of.
MIL-STD-105	- Sampling, Procedures and Tables for Inspection by Attributes.
MIL-STD-129	- Marking for Shipment and Storage.
MIL-STD-147	- Palletized and Containerized Unit Loads 40" x 48" Pallets, Skids, Runners, or Pallet-Type Base.
MIL-STD-202	- Test Methods for Electronic and Electrical Component Parts.
MIL-STD-454	- Standard General Requirements for Electronic Equipment.
MIL-STD-810	- Environmental Test Methods.
MIL-STD-883	- Test Methods and Procedures for Microelectronics.
MIL-STD-1285	- Marking of Electrical and Electronic Parts.
MIL-STD-1188	- Commercial Packaging of Supplies and Equipment.

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

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between requirements of this specification and the specification sheet, the latter shall govern (see 6.1).

3.2 Qualification. Transformers covered by specification sheets furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for the opening of bids (see 4.5 and 6.2).

3.3 Materials. The materials shall be as specified herein; however, when a definite material is not specified, a material shall be used which will enable the transformers to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.3.1 Substitution of materials. If the contractor desires to substitute another material for a specified material or fabricated part, he shall submit a statement to the Government describing the proposed substitution, together with evidence to substantiate his claims that such substitute is suitable. At the discretion of the Government, test samples may be required to prove the suitability of the proposed substitute. Before such substitutions are made, approval for each substitution shall be obtained in writing from the Government.

3.3.2 Flammable materials. Insofar as practicable, materials used in the construction of transformers shall be nonflammable and nonexplosive.

3.3.3 Corrosive materials. Corrosive materials used in any of the manufacturing processes shall be removed or neutralized so that no corrosion will result from such use. Insofar as practicable, materials used in the construction of transformers shall be noncorrosive.

3.3.4 Insulating materials.

3.3.4.1 Laminated phenolic. Laminated phenolic materials shall conform to MIL-P-997, L-P-513, MIL-P-15037, or MIL-P-15047. When electrical characteristics are involved, only natural uncolored materials shall be used.

3.3.4.2 Molded phenolic or melamine. Molded phenolic or melamine materials shall conform to MIL-M-14.

3.3.4.3 Ceramic (external use). Ceramic materials shall conform to MIL-I-10.

3.3.5 Solder and soldering flux. Solder, when used, shall be in accordance with QQ-S-571. Soldering flux shall be in accordance with MIL-F-14256.

3.3.6 Wire.

3.3.6.1 Magnet wire. Magnet wire shall conform to J-W-1177, whenever possible. When types and sizes of magnet wire not covered by J-W-1177, are essential in a winding design, other wire may be used with the approval of the Government.

3.3.6.2 Solid-wire lead terminals (see 3.4.2.1). Solid-wire lead terminals shall be of a material having a minimum conductivity of 30 percent and shall be capable of passing all the tests specified in 3.5.

3.3.7 Screws, nuts, and washers. All external screws, nuts, and washers shall be of corrosion-resistant material or shall be protected against corrosion.

3.4 Design and construction.

3.4.1 Styles A, B, C, and D. Envelope dimensions, not including terminals or mounting devices, for styles A, B, C, and D shown on figure 1, are listed in table IV. For these styles, the case may be of any size or shape provided the envelope dimensions are not exceeded. Envelope dimensions X, Y, and Z are in accordance with table IV. Type designations shall be assigned so that the smallest applicable envelope dimension letter is used as shown in the following example: A style A, B, C, or D pulse transformer with X, Y, and Z envelope dimensions of .500 by .4375 by .500 inch, respectively, would be assigned the envelope dimension letter H, not M.

3.4.1.1 Mounting and terminal screws and mounting inserts. Screw threads shall be class 2A or 2B, as applicable (see 3.1), in accordance with FED-STD-H28. External screw threads, class 2 fit, shall, after receiving a finish, be capable of accepting a nut of class 2B fit and internal screw threads, class 2 fit, shall, after receiving a finish, be capable of accepting a screw of class 2A fit with a maximum installation torque in accordance with the following:

Screw size	Torque (pound-inches)
.112-40 UNC - - - - -	3
.138-32 UNC - - - - -	5
.164-32 UNC - - - - -	6
.190-32 UNF - - - - -	8
.250-20 UNC - - - - -	8
.312-18 UNC - - - - -	8

Nuts shall run down to within two threads of mounting surface.

3.4.2 Terminals. Terminals shall be in accordance with 3.4.2.1, 3.4.2.2, 3.4.2.3 or 3.4.2.4 as applicable. If other types of terminals are required they shall be as specified (see 3.1).

3.4.2.1 Solid-wire lead terminals. Uninsulated solid-wire lead terminals on styles A, B, and C (see figure 1) shall be 1.500 inches long, minimum. Unless otherwise specified (see 3.1), a lead wire not smaller than AWG size 24 shall be used for units with "X" envelope dimensions not greater than 0.625 inch; a lead wire not smaller than AWG size 22 shall be used for units with "X" envelope dimension greater than 0.625 inch.

3.4.2.2 Pin-type terminals. Pins used on styles D and E shall be as shown on figure 1. Unless otherwise specified (see 3.1), pins for use with electron tube type sockets shall conform to standard 7-pin button base E7-1 or standard 9-pin button base E9-1. Pins used on styles F, G, and H shall be 0.042-inch maximum diameter located as shown on figure 1. Pins used on styles J, K, L and M shall be as specified (see 3.1). Pin type terminals intended for solder attachment at next assembly (styles A, B, C, and E thru M) shall not use a gold plated finish.

3.4.2.3 Solder terminals. Solder terminals on styles A, B, and C may be of any shape, and shall be capable of being readily soldered. The height of the solder terminal shall be considered as the maximum distance from the terminal mounting surface to the highest point, including the additional height obtained when semiflexible terminals are straightened. (It is not intended that the "hook" type terminals should be straightened from its normal "hooked" position.) The type of terminal and the maximum size round wire which the terminal will accept externally shall be as specified (see 3.1). Solder terminals shall not use a gold plated finish.

3.4.2.4 Screw-thread terminals. When specified (see 3.1), external screw terminals shall be supplied with two nuts, two flat washers, and one lockwasher. For cased units, the height of the terminal assembly shall be the distance from the free end of the screw to the terminal mounting surface. The type of terminal, size of screw thread, and, for all screw terminals, the exposed length of threads, ± 0.0625 inch (1.59 mm) shall be as specified (that is, screw, No. 8-32 x 3/8) (see 3.1).

3.4.3 Mounting studs. When specified (see 3.1), external mounting studs shall be provided with a flat washer and locknut, or with a flat washer, a lockwasher, and a nut.

3.4.4 Internal lead wires. Internal lead wires shall be attached to the coils and other internal components and terminals or case by soldering, welding, brazing, or other methods (that is, lead-sweating of nylon-coated wires) in such a manner as to provide adequate electrical connection and mechanical strength. Where soft solder is used to provide the electrical connection, lead wires shall be anchored mechanically.

3.4.5 Paint color. When a paint finish is specified (see 3.1), the color of the paint shall be light-gray, semigloss as specified in FED-STD-595. Unless otherwise specified in the contract or order, (see 6.1) the manufacturer shall omit paint from the mounting area surface.

3.4.6 Case material. Unless otherwise specified (see 3.1), cases may be either of a metallic or nonmetallic material.

3.4.7 Core mounting. When specified (see 3.1), the core shall be grounded to the case and shall be electrically accessible.

3.4.8 Potting, filling, or encapsulating material. The amount and coverage of potting, filling, or encapsulating material used shall be essentially the same for all units of specific design. Potting, filling, or encapsulating material shall not flow from the case of the transformer during any of the applicable tests.

3.5 Solderability. When transformers are tested as specified in 4.7.2, they shall meet the applicable criteria for terminal evaluation in the test method.

3.6 Resistance to solvents. When transformers are tested as specified in 4.7.3 there shall be no evidence of mechanical damage and the markings shall remain legible. The paint or exterior finish shall not soften, peel or show other signs of deterioration.

3.7 Reliability conditioning (burn-in) (when specified (see 3.1)). When transformers are tested as specified in 4.7.4, there shall be no evidence of physical and mechanical damage, and meet the requirements of the specified electrical tests (see 3.1).

3.8 Resistance to soldering heat. When transformers are tested as specified in 4.7.5, there shall be no softening of the insulation or loosening of the windings or terminals.

3.9 Terminal strength. When transformers are tested as specified in 4.7.6 to 4.7.6.3 inclusive, there shall be no evidence of loosening, rupturing, or other mechanical damage. Bends shall not be considered as damage unless surface cracking is evident. Except for flexible leads, there shall be no rotation of the terminals. Rotation of the external portion of the metallic portion of a "hook" type terminal exceeding 10 degrees shall not consititute a failure.

3.10 Seal (see 4.7.7).

3.10.1 Liquid-filled units. When transformers are tested as specified in 4.7.7.1, there shall be no evidence of liquid leakage.

3.10.2 All other units. When transformers are tested as specified in 4.7.7.2, there shall be no continuous flow of air bubbles or leakage of compound from the body of the transformer.

3.11 Dielectric withstanding voltage. When transformers are tested as specified in 4.7.8, there shall be no arcing, flashover, breakdown of insulation, or other evidence of damage.

3.12 Induced voltage. When transformers are tested as specified in 4.7.9, there shall be no evidence of continuous arcing or breakdown of insulation; nor shall there be any abrupt changes in the input current or Q, as applicable.

3.13 Winding continuity. When transformers are tested as specified in 4.7.10, all windings shall be electrically continuous.

3.14. Insulation resistance. When transformers are tested as specified in 4.7.11, the minimum insulation resistance shall be one of the following values, as specified in the applicable table of tests:

a. 10,000 megohms.
b. 1,000 megohms.

3.15 Electrical characteristics (including waveform parameters) (as specified). When transformers are tested as specified in 4.7.12 the applicable electrical characteristics (including waveform parameters, as defined in 6.9) shall be as specified (see 3.1).

3.16 Temperature rise. When transformers are tested as specified in 4.7.13, the temperature rise of any winding above the specified maximum ambient temperature (see 3.1) shall not exceed the value specified (see 3.1), and there shall be no evidence of physical damage.

3.17 Life. When transformers are tested as specified in 4.7.14, there shall be no evidence of physical or electrical damage as indicated by an open circuit (a break in the continuity of any electrical circuit within the transformer tested) or short circuit occurring within the transformer (such as shorted turns or faulty insulation between layers, between turns, between windings, between windings and case or core, or between windings and shield). In addition, transformers shall meet the following requirements:

Insulation resistance - - - - - - - Shall be as specified in 3.14.

Dielectric withstanding voltage
(at atmospheric pressure) - - - Shall be as specified in 3.11.

Induced voltage - - - - - - - - - - Shall be as specified in 3.12.

The electrical characteristics shall remain within the tolerance or limits specified (see 3.1).

3.18 Salt spray (corrosion) (when specified, see 3.1). When transformers are tested as specified in 4.7.15, there shall be no evidence of corrosion as exhibited by any visible degradation of the surfaces that can be attributed to flaking, pitting, blistering, or otherwise loosened protective coating or metal surface.

3.19 Vibration. When transformers are tested as specified in 4.7.16, there shall be no leakage of filling material and no evidence of other physical damage such as cracks or bursting or bulging of the case.

3.20 Shock. When transformers are tested as specified in 4.7.17, there shall be no leakage of filling material; and no evidence of other physical damage such as cracks, bursting or bulging of the case, or corrosion affecting the mechanical or electrical operation.

3.21 Thermal shock. When transformers are tested as specified in 4.7.18, there shall be no leakage of filling material; and no evidence of other physical damage such as cracks, bursting or bulging of the case, or corrosion affecting the mechanical or electrical operation.

3.22 Immersion. When transformers are tested as specified in 4.7.19, there shall be no leakage of filling material; and no evidence of other physical damage such as cracks, bursting or bulging of the case, or corrosion affecting the mechanical or electrical operation.

3.23 Moisture resistance. When transformers are tested as specified in 4.7.20, there shall be no leakage of filling material; and no evidence of other physical damage such as cracks, bursting or bulging of the case, or corrosion affecting the mechanical or electrical operation.

3.24 Overload. When transformers are tested as specified in 4.7.21, there shall be no leakage of filling material: and no evidence of other physical damage such as cracks or bursting or bulging of the case.

3.25 Visual and mechanical examination (post test). When transformers are examined as specified in 4.7.1.1.1, not more than 10 percent of the surface shall have peeling, flaking, chipping, cracking, crazing, or other impairment of the protective coating. There shall be no leakage of the filling material, no evidence of other physical damage, such as cracks, bursting, or bulging of the case or corrosion affecting the mechanical or electrical operation of the units.

3.26 Flammability. When transformers are tested as specified in 4.7.22 there shall be no evidence of violent burning which results in an explosive-type fire, and the coating material used on the transformers shall be self extinguishing. A transformer shall not be considered to have failed. In the event that it is consumed by the applied flame, unless dripping of flaming material or an explosive-type flame has occurred. A transformer shall be considered to have failed only if an explosion or dripping of flaming material occurs, an explosive-type flame is produced, or if visible burning continues beyond the allowable duration of 3 minutes after removal of the applied flame. Material will be considered self-extinguishing if the following conditions are met:

a. The duration of visible flame does not exceed 3 minutes after removal of the applied flame.
b. There is no explosion, nor any violent burning which results in an explosive-type flame.
c. There is no dripping of flaming material from the transformer under test.

3.27 Fungus. All external materials shall be nonnutrient to fungus growth or shall be suitably treated to retard fungus growth. The manufacturer shall certify that all external materials are fungus resistant (see 4.7.23) or shall perform the test specified in 4.7.23. There shall be no evidence of fungus growth on the external surfaces.

3.28 Marking. Transformers shall be marked with the military part number, manufacturer's part number, code symbol, terminal identification, date code and lot symbol in accordance with method 1 of MIL-STD-1285. The marking may be applied to more than one side of the case if the required marking necessitates more space than is available on the one side. Where the surface areas are insufficient for all of the required information, as many as possible of the markings shall be applied using the order of priority as listed above. Markings shall remain legible after all tests. Any markings of a classified nature shall not be included.

3.28.1 Terminal identification. Unless otherwise specified (see 3.1), terminals shall be identified by appropriate numbers. Where space does not permit numbering, color coding in accordance with table V shall be used.

TABLE V. Terminal color code.

Black - - - - - - 0	Green - - - - - - 5
Brown- - - - - - 1	Blue - - - - - - - 6
Red - - - - - - - 2	Violet - - - - - - 7
Orange - - - - - 3	Grey- - - - - - - 8
Yellow- - - - - 4	White - - - - - 9

3.29 Workmanship. Workmanship shall be in accordance with MIL-STD-454, requirement 9.

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 as specified herein. Except as otherwise specified in the contract or 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 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 contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-C-45662.

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

a. Materials inspection (see 4.3).
b. Qualification inspection (see 4.5).
c. Quality conformance inspection (see 4.6).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials listed in table VI, used in fabricating the transformers are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

TABLE VI. Materials inspection.

Materials	Requirement paragraph	Applicable specification
Insulating material:		
Laminated phenolic	3.3.4.1	MIL-P-997, L-P-513, MIL-P-15037, MIL-P-15047
Molded phenolic or melamine	3.3.4.2	MIL-M-14
Ceramic (external use)	3.3.4.3	MIL-I-10
Solder and soldering flux	3.3.5	MIL-F-14256, QQ-S-571
Wire:		
Magnet wire	3.3.6.1	J-W-1177

4.4 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-202.

4.4.1 Test frequency. When a nominal test frequency is specified herein, the frequency used shall be within ±2 percent of the nominal value.

4.4.2 Test voltage. For dielectric-withstanding-voltage tests, the peak of the test voltage applied shall not exceed by more than 5 percent the peak of the pure sine voltage.

4.5 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.2) on sample units produced with equipment and procedures normally used in production.

4.5.1 Qualification of transformers based on complete testing.

4.5.1.1 Sample size. The number of sample units comprising a sample of transformers to be submitted for qualification inspection shall be as specified in the appendix to this specification.

4.5.1.2 Inspection routine. The sample shall be subjected to the qualification inspection specified in table VII in the order shown and as specified in the appendix to this specification.

4.5.1.3 Failure. One or more failures shall be cause for refusal to grant qualification approval.

TABLE VII. Qualification inspection.

Examination or test	Grades				Requirement paragraph	Method paragraph
	4	5	6	7		
Group I (3 sample units)						
Solderability 2/	X	X	X	X	3.5	4.7.2
Resistance to solvents (3 samples) 1/	X	X	X	X	3.6	4.7.3
Group II (all sample units)						
Reliability conditioning (when specified)	X	X	X	X	3.7	4.7.4
Visual and mechanical examination (external)	X	X	X	X	3.1, 3.3 to 3.3.5 incl, 3.3.7, 3.4 to 3.4.2.3 incl, 3.4.5 to 3.4.7 incl, 3.28 to 3.29 incl.	4.7.1.1
Resistance to soldering heat 2/	X	X	X	X	3.8	4.7.5
Terminal strength	X	X	X	X	3.9	4.7.6
Seal	X	X	X	X	3.10	4.7.7
Dielectric withstanding voltage (at atmospheric pressure)	X	X	X	X	3.11	4.7.8.1
Dielectric withstanding voltage (at reduced barometric pressure) (when applicable)			X	X	3.11	4.7.8.2
Induced voltage	X	X	X	X	3.12	4.7.9
Winding continuity	X	X	X	X	3.13	4.7.10
Insulation resistance	X		X		3.14(a)	4.7.11
Insulation resistance		X		X	3.14(b)	4.7.11
Electrical characteristics (including waveform parameters)	X	X	X	X	3.15	4.7.12
Temperature rise (2 samples)	X	X	X	X	3.16	4.7.13
Group III (2 sample units)						
Life	X	X	X	X	3.17	4.7.14
Induced voltage	X	X	X	X	3.12	4.7.9
Winding continuity	X	X	X	X	3.13	4.7.10
Insulation resistance	X		X		3.14(a)	4.7.11
Insulation resistance		X		X	3.14(b)	4.7.11
Dielectric withstanding voltage (reduced voltage)	X	X	X	X	3.11	4.7.8.4
Electrical characteristics (including waveform parameters)	X	X	X	X	3.15	4.7.12
Visual and mechanical inspection (external)	X	X	X	X	3.1, 3.3 to 3.3.5 incl, 3.3.7, 3.4 to 3.4.2.3 incl, 3.4.4 to 3.4.7 incl, 3.28 to 3.29 incl.	4.7.1.1
Group IV (6 sample units)						
Salt spray (when specified)	X	X	X	X	3.18	4.7.15
Vibration (low frequency)	X	X			3.19	4.7.16.1
Vibration (high frequency)			X	X	3.19	4.7.16.2
Shock 2/	X	X	X	X	3.20	4.7.17
Winding continuity	X	X	X	X	3.13	4.7.10
Induced voltage	X	X	X	X	3.12	4.7.9
Dielectric withstanding voltage (reduced voltage)	X	X	X	X	3.11	4.7.8.4
Thermal shock	X	X	X	X	3.21	4.7.18
Winding continuity	X	X	X	X	3.13	4.7.10

TABLE VII. Qualification inspection - Continued.

Examination or test	Grades 4	5	6	7	Requirement paragraph	Method paragraph
Group IV (6 sample units) -Continued.						
Immersion	X	X	X	X	3.22	4.7.19
Moisture resistance	X	X	X	X	3.23	4.7.20
Induced voltage	X		X		3.12	4.7.9
Winding continuity	X		X		3.13	4.7.10
Insulation resistance	X		X		3.14(a)	4.7.11
Dielectric withstanding voltage (reduced voltage)	X		X		3.11	4.7.8.4
Overload		X		X	3.24	4.7.21
Induced voltage		X		X	3.12	4.7.9
Winding continuity		X		X	3.13	4.7.10
Insulation resistance		X		X	3.14(b)	4.7.11
Dielectric withstanding voltage (reduced voltage)		X		X	3.11	4.7.8.4
Visual and mechanical examination (external) (post test)	X	X	X	X	3.25	4.7.1.1.1
Electrical characteristics (including waveform parameters)	X	X	X	X	3.15	4.7.12
Flammability (2 sample units)		X		X	3.26	4.7.22
Visual and mechanical examination (internal) (3 sample units)	X	X	X	X	3.3 to 3.3.4.3 incl. 3.4.4, 3.4.7, 3.4.8 and 3.29.	4.7.1.2
Group V						
Fungus 3/	X	X	X	X	3.27	4.7.23

1/ Printed circuit type transformers only or when specified (see 3.1).
2/ Solderable type terminals only: If soldering iron method (4.7.2.2) of the solderability test is performed, the resistance to soldering heat test (4.7.5.2) need not be performed.
3/ Test shall not be performed if the manufacturer provides certification that all external materials are fungus resistant.

4.5.2 Qualification inspection of transformers based on similarity. *Qualification inspection* shall be performed only on those transformers which meet the requirements of paragraph 20.2.1 of the appendix.

4.5.2.1 Sample size. The number of sample units comprising a sample of transformers to be submitted for qualification inspection shall be as specified in the appendix to this specification.

4.5.2.2 Inspection routine. Sample units shall be subjected to *qualification inspection* specified in table VIII, in the order shown.

4.5.2.3 Failure. One or more failures shall be cause for refusal to grant qualification approval.

4.5.3 Retention of qualification. To retain qualification, the contractor shall forward, at 6-month intervals, to the qualifying activity, a summary of the results of groups A and B tests, indicating as a minimum the number of lots which passed and the number which failed, and a summary of the results of group C tests, including the number and type of any part failures. The summary shall include those tests performed during that 6-month period. If the summary of the test results indicates nonconformance with specification requirements, action shall be taken to remove the failing product from the qualified products list. Failure to submit the summary shall result in loss of qualification for that product. In addition to the periodic submission of inspection

data, the contractor shall immediately notify the qualifying activity at any time during the 6-month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification. In the event that no production occurred during the reporting period, a report indicating no production shall be submitted. However, an item out of production for a period of 36 months must be requalified or it will be removed from the qualified products list.

TABLE VIII. Qualification inspection for transformers similar to transformers that have been qualified.

Examination or test	Grades				Requirement paragraph	Method paragraph
	4	5	6	7		
Visual and mechanical examination (external)	X	X	X	X	3.1, 3.3 to 3.3.5 incl, 3.3.7, 3.4 to 3.4.2.3 incl, 3.4.5 to 3.4.7 incl, and 3.28 to 3.29 incl.	4.7.1.1
Dielectric withstanding voltage (at atmospheric pressure)	X	X	X	X	3.11	4.7.8.1
Dielectric withstanding voltage (at reduced barometric pressure) (when applicable)			X	X	3.11	4.7.8.2
Induced voltage	X	X	X	X	3.12	4.7.9
Insulation resistance	X		X		3.14 (a)	4.7.11
Insulation resistance		X		X	3.14(b)	4.7.11
Electrical characteristics (including waveform parameters)	X	X	X	X	3.15	4.7.12
Temperature rise	X	X	X	X	3.16	4.7.13
Overload	X	X	X	X	3.24	4.7.21
Dielectric withstanding voltage (reduced voltage)	X	X	X	X	3.11	4.7.8.4
Induced voltage	X	X	X	X	3.12	4.7.9
Insulation resistance	X		X		3.14 (a)	4.7.11
Insulation resistance		X		X	3.14 (b)	4.7.11
Winding continuity	X	X	X	X	3.13	4.7.10
Visual and mechanical examination(external)	X	X	X	X	3.1, 3.3 to 3.3.5 incl, 3.3.7, 3.4 to 3.4.2.3 incl, 3.4.5 to 3.4.7 incl, and 3.28 to 3.29 incl	4.7.1.1

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection.

4.6.1.1 Inspection lot. An inspection lot shall consist of all transformers which are similar as defined in 20.3.1, produced under essentially the same conditions, and offered for inspection at one time.

4.6.1.2 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table IX, in the order shown.

4.6.1.2.1 Sampling plan. If, during the 100-percent inspection of subgroup 1, screening requires that over 5 percent of the transformers be discarded, the lot shall be rejected. Statistical sampling and inspection for subgroup II shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality levels (AQL) shall be as specified in table IX. Major and minor defects shall be as defined in MIL-STD-105.

4.6.1.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

TABLE IX. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph	AQL (percent defective)	
			Major	Minor
Subgroup I				
Reliability conditioning (burn in) (when specified)	3.7	4.7.4	100% inspection	
Subgroup II				
Visual and mechanical examination (external)	3.1, 3.3 to 3.3.5 incl, 3.3.7, 3.4 to 3.4.2.3 incl, 3.4.5 to 3.4.7 incl, and 3.28 to 3.29 incl	4.7.1.1	1.0	4.0
Seal	3.10	4.7.7	1.0	---
Dielectric withstanding voltage (at atmospheric pressure)	3.11	4.7.8.1	1.0	---
Dielectric withstanding voltage (at reduced barometric pressure) (when applicable) 1/	3.11	4.7.8.2		
Induced voltage	3.12	4.7.9		
Insulation resistance 2/	3.14 (a)	4.7.11		
Insulation resistance 3/	3.14 (b)	4.7.11		

1/ Grades 6 and 7 only.
2/ Grades 4 and 6 only.
3/ Grades 5 and 7 only.

4.6.1.3 Group B inspection. Group B inspection shall consist of the test specified in table X and shall be performed on sample units that have been subjected to and have passed the group A inspection unless it is more practical to select a separate sample from the lot for group B inspection.

4.6.1.3.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S4. Unless otherwise specified herein, normal inspection shall be used at the start of the contract. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection. The AQL shall be 4.0 percent defective.

TABLE X. Group B inspection.

Test	Requirement paragraph	Method paragraph
Electrical characteristics (including waveform parameters) (as applicable)	3.15	4.7.12

4.6.1.3.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.6.1.3.3 Disposition of sample units. Sample units which have passed all the group B inspection shall be delivered on the contract or order, if the lot is accepted.

4.6.2 Periodic check test. Periodic check test shall consist of group C. Except where the results of these tests show noncompliance with the applicable requirements (see 4.7.2.1.4), delivery of products which have passed groups A and B shall not be delayed pending the results of Group C inspection.

4.6.2.1 Group C inspection. Group C inspection shall consist of the examinations and tests specified in table XI, in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed the groups A and B inspection.

TABLE XI. Group C inspection.

Examination or test	Grades				Requirement paragraph	Method paragraph
	4	5	6	7		
Subgroup 1						
Resistance to soldering heat	X	X	X	X	3.8	4.7.5
Terminal strength 1/	X	X	X	X	3.9	4.7.6
Temperature rise (1 sample unit)	X	X	X	X	3.16	4.7.13
Vibration (low frequency)	X	X			3.19	4.7.16.1
Vibration (high frequency)			X	X	3.19	4.7.16.2
Shock	X	X	X	X	3.20	4.7.17
Winding continuity	X	X	X	X	3.13	4.7.10
Induced voltage	X	X	X	X	3.12	4.7.9
Dielectric withstanding voltage (reduced voltage)	X	X	X	X	3.11	4.7.8.4
Thermal shock	X	X	X	X	3.21	4.7.18
Winding continuity	X	X	X	X	3.13	4.7.10
Immersion	X	X	X	X	3.22	4.7.19
Moisture resistance	X	X	X	X	3.23	4.7.20
Induced voltage	X		X		3.12	4.7.9
Winding continuity	X		X		3.13	4.7.10
Insulation resistance	X		X		3.14 (a)	4.7.11
Dielectric withstanding voltage (reduced voltage)	X		X		3.11	4.7.8.4
Overload		X		X	3.24	4.7.21
Induced voltage		X		X	3.12	4.7.9
Winding continuity		X		X	3.13	4.7.10
Insulation resistance		X		X	3.14 (b)	4.7.11
Dielectric withstanding voltage (reduced voltage)		X		X	3.11	4.7.8.4
Visual and mechanical examination (external) (post test)	X	X	X	X	3.25	4.7.1.1.1
Flammability (2 sample units)		X		X	3.26	4.7.22
Visual and mechanical examination (internal) (3 sample units)	X	X	X	X	3.3 to 3.3.4.3 incl, 3.4.4, 3.4.7, 3.4.8 and 3.29	4.7.1.2
Subgroup 2						
Life	X	X	X	X	3.17	4.7.14
Induced voltage	X	X	X	X	3.12	4.7.9
Winding continuity	X	X	X	X	3.13	4.7.10
Insulation resistance	X		X		3.14 (a)	4.7.11
Insulation resistance		X		X	3.14 (b)	4.7.11
Dielectric withstanding voltage (reduced voltage)	X	X	X	X	3.11	4.7.8.4

See notes at end of table.

TABLE XI. Group C inspection - Continued.

Examination or test	Grades				Requirement paragraph	Method paragraph
	4	5	6	7		
Subgroup 2 - Continued.						
Visual and mechanical examination (external)	X	X	X	X	3.1, 3.3 to 3.3.5 incl, 3.3.4, 3.4 to 3.4.2.3 incl, 3.4.6 to 3.4.7 incl, 3.28 to 3.29 incl	4.7.1.1
Subgroup 3						
Solderability 3/	X	X	X	X	3.5	4.7.2
Resistance to solvents 2/	X	X	X	X	3.6	4.7.3

1/ Once a particular type of terminal has been subjected to the terminal-strength test, other transformers containing that terminal type need not be subjected to this test for the remainder of the 3-month period from which that terminal type was selected.
2/ Printed circuit type transformers only.
3/ Solderable type terminals only. (Once a particular type of terminal has been subjected to the solderability test, other transformers containing that terminal type need not be subjected to the for the remainder of the 6-month period from which that terminal type was selected.)

4.6.2.1.1 Sampling plan.

4.6.2.1.1.1 Subgroup 1. Every 3 months, 6 sample units of each grade shall be subjected to the tests in subgroup 1 in the order shown. If, during a 3 month period, qualification testing has been successfully completed on transformers of the same grade, same or lower class, and similar construction and materials (see 20.2.1), the test data may be submitted in lieu of subgroup 1 testing for that 3 month period.

4.6.2.1.1.2 Subgroup 2. Every 6 months, 2 sample units of each grade shall be subjected to the tests in subgroup 2 in the order shown. If, during a 6 month period, qualification testing has been successfully completed on transformers of the same grade, same or lower class, same life expectancy, and similar construction and materials (see 20.2.1), the test data may be submitted in lieu of subgroup 2 testing for that 6 month period.

4.6.2.1.1.3 Subgroup 3. Two sample units of each terminal type shall be selected during each 6-month period. Terminal types for the purpose of the solderability test shall be defined as terminals in which the following factors are identical: construction, material, and temper and plating. If, during a particular 6-month period, qualification has been received on transformers which conform to the above factors, the solderability test need not be performed during that 6-month period. Three sample units are required for resistance to solvents test.

4.6.2.1.2 Failures. If one or more sample units fail to pass group C inspection, the sample shall be considered to have failed.

4.6.2.1.3 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract or purchase order.

4.6.2.1.4 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the qualifying activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated

on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the qualifying activity). Groups A and B inspection may be reinstituted; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and the qualifying activity.

4.6.3 Inspection of packaging. Except when commercial packaging is specified, the sampling and inspection of the preservation and interior package marking shall be in accordance with the groups A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129. The inspection of commercial packaging shall be as specified in the contract or purchase order (see 6.1).

4.7 Methods of examination and test.

4.7.1 Visual and mechanical examination.

4.7.1.1 External. Transformers shall be examined to verify that the materials, external design and construction, physical dimensions, weight, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3 to 3.3.5 inclusive, 3.3.4, 3.4 to 3.4.2.3 inclusive, 3.4.5 to 3.4.7 inclusive, and 3.28 to 3.29 inclusive).

4.7.1.1.1 Post-test. Transformers shall be examined to verify that the protective coating, filling material, and case construction are in accordance with the applicable requirements (see 3.25).

4.7.1.2 Internal. Transformers shall be disassembled and examined to verify that the materials internal lead wires, internal mounting, impregnating, potting, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3 to 3.3.4.3 inclusive, 3.4.4, 3.4.7 and 3.4.8, and 3.29).

4.7.2 Solderability (see 3.5). Transformers shall be tested in accordance with 4.7.2.1 or 4.7.2.2, as applicable. The method in 4.7.2.1 is preferred and shall be specified whenever practicable, otherwise the method in 4.7.2.2 shall be used.

4.7.2.1 Solder bath method. Transformers shall be tested in accordance with method 208 of MIL-STD-202. The following details shall apply:

a. Special preparation of specimen - Sample units shall not have been soldered during any of the previous tests.
b. Number of terminations of each part to be tested - A minimum of two of each type of terminal.

4.7.2.2 Soldering iron method. The test shall be performed on solder terminations, attached to the transformer. The solder shall conform to type S, composition Sn60, of QQ-S-571. The flux shall conform to type A or W as applicable of MIL-F-14256. The temperature of the bit shall be 300° - 350° C. The iron and solder shall be applied to the termination for 10 seconds. The solder shall be applied for the first 2 seconds. Tinning, as evidenced by the free flowing of the solder with proper wetting of the termination, shall be completed within the first two seconds. The transformer or inductor under test shall remain under standard atmospheric conditions for recovery for 15 minutes, before final measurements are made.

a. Special preparation of specimen - The surface shall be smooth and properly tinned and the solder terminations shall not have been soldered during any previous test.
b. Number of terminations - In accordance with 4.7.2.1.
c. Examinations of terminations - In accordance with method 208 of MIL-STD-202.
d. Soldering irons - The soldering iron shall have one of the following bit sizes:

1. 0.3 inch diameter, 1.25 inch exposed length reduced to a wedge shape, over a length of approximately 0.4 inch.

2. 0.125 inch diameter, 0.5 inch exposed length, reduced to a wedge shape, over a length of approximately 0.2 inch.

e. Point of application of soldering iron - 1/4 inch from the nearest insulating material or to one-half the exposed length of the terminal, whichever point is closer to the insulating material.

4.7.3 Resistance to solvents (see 3.6). Transformers shall be tested in accordance with method 215 of MIL-STD-202. The following details shall apply:

a. The marked portion of the transformer shall be brushed.
b. The number of sample units shall be as specified in table VII.
c. Transformers and inductors shall be examined for mechanical damage.

4.7.4 Reliability conditioning (burn-in) (when specified) (see 3.7 and 3.1). Transformers shall be tested a -62° C for 10 hours with no excitation. The units shall be removed from the cold chamber and held at room ambient temperature for 4 hours. The units shall then placed in an 85° C oven, and energized at rated voltage and working voltage between windings for 20 hours. The units shall be deenergized and the oven shut off for 4 hours. Repeat for additional 20 hours, energized. The units shall then be removed from the oven and subjected to the applicable electrical tests (see 3.1).

4.7.5 Resistance to soldering heat (see 3.8). Transformers shall be tested in accordance with 4.7.5.1 or 4.7.5.2, as applicable. The method in 4.7.5.1 is preferred and specified whenever practicable, otherwise the method in 4.7.5.2 shall be used.

4.7.5.1 Solder bath method. Transformers shall be tested in accordance with method 210 of MIL-STD-202. The following details shall apply:

a. Special preparation of specimen - Sample units shall not have been soldered during any of the previous tests.
b. Depth of immersion in the molten solder - To a point 1/4 inch from the nearest insulating material or to one-half the exposed length of the terminal, whichever point is closer to the insulating material.
c. Test condition - A (350 ± 10° C; immersion, $3\ ^{+1/2}_{-0}$ seconds).
d. Examination after test - The transformers and inductors shall be visually examined and there shall be no seepage of the impregnant, loosening of the terminals or other mechanical damage. The windings of transformers or inductors shall be checked for continuity.

4.7.5.2 Soldering iron method. The test shall be performed on all solder terminations, attached to the transformer. The solder shall conform to type S, composition of Sn60 of QQ-S-571. The flux shall conform to type A or W as applicable of MIL-F-14256. The temperature of the bit shall be 300° - 350° C. The iron and solder shall be applied to the termination for 10 seconds. The solder shall be applied for the first 2 seconds. Tinning, as evidenced by the free flowing of the solder with proper wetting of the termination, shall be completed within the first 2 seconds. The transformer or inductor under test shall remain under standard atmospheric conditions for recovery for 15 minutes, before final measurements are made.

a. Special preparation of specimen - The surface shall be smooth and properly tinned and the solder terminations shall not have been soldered during any previous test.
b. Examinations after test - In accordance with 4.7.5.1.
c. Soldering irons - The soldering iron shall have one of the following bit sizes:

1. 0.3 inch diameter, 1.25 inch exposed length reduced to a wedge shape, over a length of approximately 0.4 inch.
2. 0.125 inch diameter, 0.5 inch exposed length reduced to a wedge shape, over a length of approximately 0.2 inch.

d. Point of application of soldering iron - 1/4 inch from the nearest insulating material or to one-half the exposed length of the terminal whichever point is closer to the insulating material.

4.7.6 Terminal strength (see 3.9). Transformers shall be tested as specified in 4.7.6.1 to 4.7.6.3 inclusive, as applicable. After each test, the terminals shall be examined for loosening, rupturing, and other mechanical damage. Unless otherwise specified, all terminals on each test sample shall be subjected to the applicable tests, up to a maximum of four identical terminals per sample.

4.7.6.1 Pull.

4.7.6.1.1 Solid-wire lead terminals (other than printed circuit terminals). Transformers shall be tested in accordance with method 211 of MIL-STD-202. The following details shall apply:

a. Test condition - A.
b. Points of measurement - A force shall be applied in the direction of the axis of termination and shall be increased gradually until the magnitude specified in table XII is reached, and shall be held at the value for at least 5 to 10 seconds.

4.7.6.1.2 Solder terminals. Transformers shall be tested in accordance with method 211 of MIL-STD-202. The following details shall apply:

a. Test condition - A.
b. Points of measurement - A force as specified in table XII shall be applied to each terminal at the point where the lead from the external circuit connects to it. The force shall be applied in any direction, including the weakest, and shall be increased gradually to the specified magnitude and shall be held at that value for at least 5 to 10 seconds.

TABLE XII. Pull.

Cross sectional area of electrode at its smallest point at which lead from external circuit connects	Force
Circular mils	Pounds
≤2,000	2.5
>2,000	5.0

4.7.6.1.3 Printed-circuit and pin-type terminals (see 3.4.2.2). Transformers shall be tested for terminal secureness in accordance with method 211 of MIL-STD-202. The following details and exceptions shall apply:

a. Test condition - A.
b. Applied force - Terminal secureness shall be tested by gradually applying a force of 2.5 pounds to each pin terminal in the direction of the axis of the terminal as shown on figure 2.

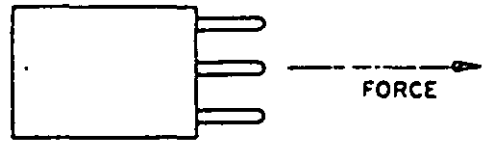


FIGURE 2. Direction of force to be applied to each pin on unit.

4.7.6.2 Twist or bend.

4.7.6.2.1 Solid-wire lead terminals (other than printed circuit terminals) (see 3.4.2.1). Following the test specified in 4.7.4.1.1, transformers shall be tested in accordance with method 211 of MIL-STD-202. The following details and exceptions shall apply:

a. Test condition - D.
b. Application of torsion - The body of the part or the clamped terminal shall be rotated through 360 degrees about the original axis of the bent terminal, in alternating directions, for a total of five rotations, at the rate of approximately 3 seconds per rotation.

4.7.6.2.2 Flat solder terminals. Any terminal that shows permanent deformation greater than 15 degrees of the metal portion of the terminal in the terminal-pull test specified in 4.7.4.1 shall be tested in accordance with method 211 of MIL-STD-202. This test does not apply to terminals which show permanent deformation, but are not designed to be bent 45 degrees. The following details and exceptions shall apply:

a. Test condition - B.
b. Number of bending operations - Five times through an angle of 90 degrees (45 degrees each side of center).

4.7.6.3 Torque.

4.7.6.3.1 Screw-thread terminals (see 3.4.2.4). Transformers shall be tested in accordance with method 211 of MIL-STD-202, test condition E.

4.7.6.3.2 All other terminals. All other terminals shall be subjected to the torque specified in table XIII. The torque shall be applied to the terminal at the point where the external lead wires normally connect to it. The motion shall be applied clockwise and counterclockwise in a plane perpendicular to the axis of the terminal. The equivalent diameter is equal to two times the distance from terminal center to point of wire connection after maximum permanent deflection due to the pull test. The equivalent diameter for "hook" type terminals, is the diameter of the wire from which the terminal is formed.

TABLE XIII. Torque.

Equivalent diameter	Torque
Inch	Ounce-inches
<1/8	8
>1/8 to 3/16 incl	18
>3/16 to 5/16 incl	40

4.7.6.4 Lead integrity of dual-in-line transformer terminals. Dual-in-line transformer leads shall be tested in accordance with method 2004 of MIL-STD-883.

4.7.7 Seal (see 3.10). Transformers shall be tested in accordance with 4.7.7.1 or 4.7.7.2, as applicable. Any transformer which shows evidence of leakage may be given remedial treatment. After completion of the treatment, the seal test shall be repeated as evidence that such remedial treatment is adequate. All other units in the lot which have been given similar satisfactory remedial treatment shall be acceptable.

4.7.7.1 Liquid-filled units. Transformers shall be heated in an oven maintained at a temperature equal to or not more than 5 °C greater than the sum of the specified maximum ambient temperature and the allowable temperature rise (see 3.1) for not less than 3 hours for transformers weighing 20 pounds or less, and for not less than 6 hours for transformers weighing over 20 pounds.

4.7.7.2 All other units. Transformers shall be immersed for 2 to 3 minutes in a bath of water (or other suitable liquid of no greater density or surface tension) maintained at a temperature of 85° $^{+5}_{-0}$ C. The temperature of the transformer shall not exceed 40° C at the time of immersion. (Or when specified, see 3.1, the following alternate test may be used; the transformers shall be immersed in a container of water containing approximately 1 percent wetting agent such as Aerosol which shall then be placed in a vacuum chamber. The pressure shall be reduced to 3.4 inches of mercury and maintained at this pressure for a period of at least 3 minutes).

4.7.8 Dielectric withstanding voltage (see 3.11). Transformers shall be tested in accordance with 4.7.8.1 and 4.7.8.2 (as applicable).

4.7.8.1 At atmospheric pressure. Transformers shall be tested in accordance with method 301 of MIL-STD-202. The following details shall apply:

a. Magnitude of test voltage - As specified in table XIV for transformer windings not grounded internally; however, where there is a high voltage center-tap winding and another adjacent winding operated at a dc potential, the peak voltage that may be present between the windings should be considered in computing the test voltages. Test voltages greater than 1,000 volts rms shall be applied gradually at a rate not exceeding 500 volts rms per second.
b. Nature of potential - Alternating current (ac).
c. Duration of application of test voltage - Minimum of 5 seconds for quality conformance inspection.
d. Points of application of test voltage:
   1. Winding to case or core - Between each winding and the case or core with all windings not under test grounded to the case (if cased) or to the normal mounting means (if uncased) and to the core (if accessible).
   2. Between windings - The voltage shall be applied between each winding and each of the other windings with all windings not under test grounded to the case (if cased) or to the normal mounting means (if uncased) and to the core (if accessible). These tests need not be made if the winding-to-case or -core test voltage of either winding under consideration is equal to, or greater than, the winding-to-winding test voltage. The method used to perform the between-windings dielectric withstanding voltage test shall consist of two sources of test voltage, so proportionated and phased, that the winding-to-winding test voltages shall be according to table XIV. One terminal of each source shall be grounded to the case (if cased), or to the normal mounting means (if uncased), and to the core (if accessible). The test voltages applied shall not exceed the test voltages required for each of the windings to ground, and shall be applied so that the required test voltage appears between the windings. Multiple-section windings designed for operation only in series or parallel shall be considered as a single winding. In no case shall the test voltage applied between the windings exceed the sum of the test voltages for each of these windings to the the case (if cased), or to the normal mounting means (if uncased), and to the core (if accessible).
e. The high voltage source shall have a volt-ampere capacity capable of supplying the specified voltage across the dielectric while under test.
f. Examination during and after test - Transformers shall be examined for evidence of arcing, flashover, breakdown of insulation, and damage.

TABLE XIV. Dielectric withstanding voltage at atmospheric pressure.

Working voltage 1/	Rms test voltage (at 28 to 32 inches of mercury)
≤50	100
>50 to 100 inclusive	300
>100 to 175 inclusive	500
>175 to 700 inclusive	2.8 X working voltage
>700	1.4 X working voltage, +1,000

1/ The working voltage is defined as the maximum instantaneous voltage stress that may appear under normal rated operation across the insulation being considered. This insulation may be between windings or between a winding and the case or core.

4.7.8.2 Barometric pressure (reduced) (when applicable). Transformers designed for operation above 10,000 feet shall be tested as specified in 4.7.8.1 and in accordance with method 105 of MIL-STD-202. The following details shall apply:

a. Test condition letter or altitude in feet if below 30,000 feet - As specified (see 3.1).
b. Magnitude of test voltage - As specified in table XV. A greater potential may be used at the option of the contractor.
c. Examination during and after test - Transformers shall be examined for evidence of arcing, flashover, breakdown of insulation, and damage.

TABLE XV. Dielectric withstanding voltage at reduced barometric pressure.

Working voltage 1/	Test voltage
Volts ≤25	Volts, rms 50
≥25	100 or 1.25 X working voltage, whichever is greater

1/ The working voltage is defined as the maximum instantaneous voltage stress that may appear under normal rated operation across the insulation being considered. This insulation may be between windings or between a winding and the case or core.

4.7.8.3 For special designs. Dielectric withstanding voltage tests shall be as specified (see 3.1).

4.7.8.4 At reduced voltage. Transformers shall be subjected to the dielectric withstanding voltage tests specified in 4.7.8.1 and 4.7.8.2 (when applicable) except that test voltages shall be 90 percent of the values shown in tables XIV and XV, respectively, and shall be applied for a period of 5 seconds, or 75 percent of the values shown in tables XIV and XV, respectively, applied for a period of 1 minute, as specified.

4.7.9 Induced voltage (see 3.12). Transformers shall be subjected to the tests specified in 4.7.9.1 or 4.7.9.2, as applicable. During this test, the transformers shall be examined for evidence of continuous arcing, breakdown of insulation, and abrupt changes in the input current. Means shall be provided to indicate fluctuations of input current or changes in Q, as applicable.

4.7.9.1 Metallic and nonmetallic core transformers. A test pulse voltage shall be applied for 1 minute to the lowest voltage winding at the specified repetition rate (see 3.1) sufficient to induce a voltage across any winding of twice the rated amplitude and between 25 and 50 percent of the rated pulse duration. This test shall be performed in air and at load conditions equal to or less than specified (see 3.1).

4.7.9.2 Nonmetallic core transformers. If the transformer is to be used at more than one load condition and pulse duration, it should be tested as specified in 4.7.9.1 with the smaller load and the greater pulse duration, except that the volt-microsecond value shall be as specified (see 3.1). The volt-microsecond product shall determine the maximum pulse voltage that may be used without saturating the core when operating at a given pulse width.

4.7.10 Winding continuity (see 3.13). All windings of transformers shall be tested for electrical continuity by any suitable means.

4.7.11 Insulation resistance (see 3.14). Transformers shall be tested in accordance with method 302 of MIL-STD-202. The following details and exceptions shall apply:

a. Test condition - B for qualification inspection, and dc test potentials from 500 volts to 1,000 volts for quality conformance inspection. For quality conformance inspection, rejection shall be based on measurements made at 500 volts. For both qualification and quality conformance inspection, the test voltage shall be 100 volts if the working voltage is less than 175 volts.

b. Points of measurement:

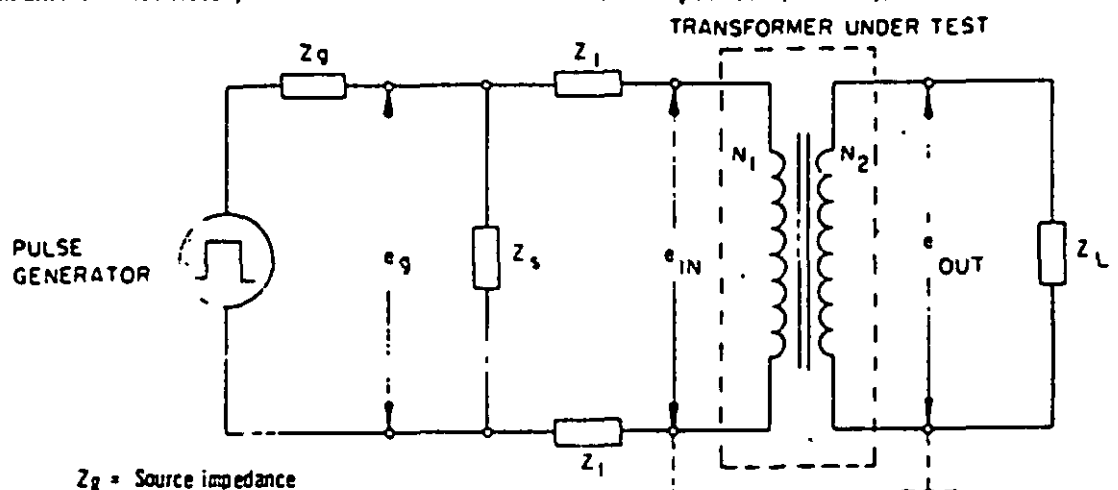
1. Winding to case or core - The potential shall be applied between each winding and the case or core (if core is normally grounded) with all windings not under test grounded to the case (if cased) or to the normal mounting means (if uncased) and to the core (if core is normally grounded) (if accessible).

2. Between windings - The potential shall be applied between each winding and all other windings connected together.

The measurements may be made at any temperature above 20° C and at ambient room humidity, but rejections shall be based on measurements made at 25 $^{+10}_{-5}$ C. and at a relative humidity not greater than 80 percent.

c. Electrification time - One minute maximum.

4.7.12 Electrical characteristics (including waveform parameters (see 3.15 and 3.1)). Waveform parameters shall be measured as specified in 4.7.12.1 and 4.7.12.4 inclusive. Unless otherwise specified (see 3.1), the network shown on figure 3 shall be used to determine the parameters. For parameters not listed, means of measurement shall be as specified (see 3.1).



Z_g = Source impedance
Z_s = Shunt impedance
Z_1 = Current limit and balance impedance
Z_L = Load impedance

FIGURE 3. FIGURE 3. Network for testing and determining waveform parameters.

4.7.12.1 Pulse rise time. The method of measurement for the pulse rise time (see figure 4) shall be as follows:

a. Obtain a calibrated (time and amplitude) picture of the waveform including the pulse. Delineate the pulse by excluding those portions of the waveform determined to be unwanted or nonpertinent.
b. Draw the zero axis of the pulse.
c. Find the peak pulse amplitude.
d. Draw two lines parallel to the zero axis and spaced on each side of the zero axis by 90 percent, or other specified fraction (see 3.1), of the peak pulse amplitude and two parallel lines spaced on each side of the zero axis by 10 percent, or other specified fraction (see 3.1), of the peak pulse amplitude. The time interval between the first joint of intersection of the pulse trace and either 10 percent line and the first point of intersection of the pulse trace and either 90 percent line is the pulse rise time.

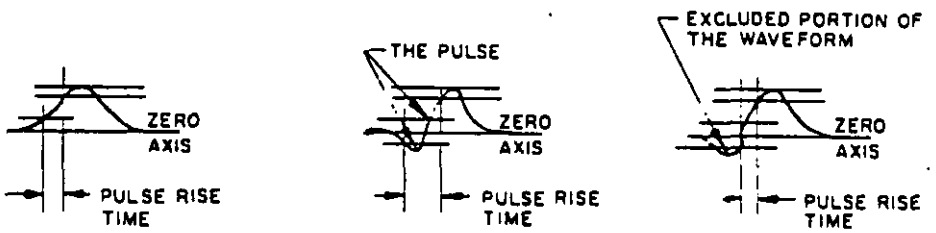


FIGURE 4. Examples of pulse-rise-time determination.

4.7.12.2 Pulse duration. The method of measurement for the pulse duration (see figure 5) shall be as follows:

a. Obtain a calibrated (time and amplitude) picture of the waveform including the pulse. Delineate the pulse by excluding those portions of the waveform determined to be unwanted or nonpertinent.
b. Draw the zero axis of the pulse.
c. Find the peak pulse amplitude.
d. Draw two lines parallel to the zero axis spaced on each side of the zero axis at 50 percent, or other specified fraction (see 3.1), of the peak pulse amplitude. The time interval between the first and last points of intersection of the pulse trace and either line is the pulse duration.

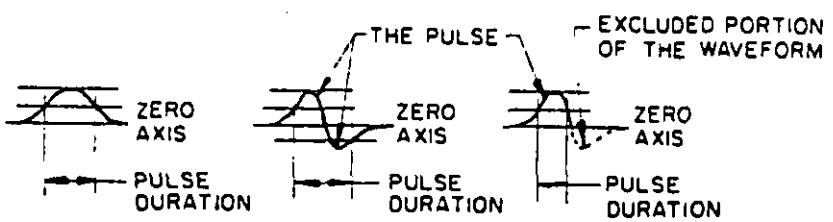


FIGURE 5. Examples of pulse-duration determination.

4.7.12.3 Peak pulse amplitude. The method of measurement for the peak pulse amplitude (see figure 6) shall be as follows:

a. Obtain a calibrated (time and amplitude) picture of the waveform including the pulse. Delineate the pulse by excluding those portions of the waveform determined to be unwanted or nonpertinent.
b. Draw the zero axis of the pulse.
c. Find the maximum departure of the pulse trace from the zero axis (regardless of polarity sign). This departure is the peak pulse amplitude.

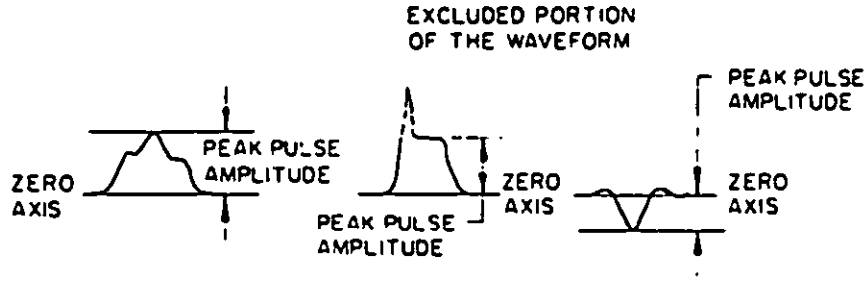


FIGURE 6. Examples of peak-pulse amplitude determination.

4.7.12.4 Pulse decay time. The method of measurement for the pulse decay time (see figure 7) shall be as follows:

a. Obtain a calibrated (time and amplitude) picture of the waveform including the pulse. Delineate the pulse by excluding those portions of the waveform determined to be unwanted or nonpertinent.
b. Draw the zero axis of the pulse.
c. Find the peak pulse amplitude.
d. Draw two lines parallel to the zero axis spaced on each side of zero axis by 90 percent or other specified fraction (see 3.1), of the peak pulse amplitude, and two parallel lines spaced on each side of zero axis by 10 percent or other specified fraction (see 3.1), of the peak pulse amplitude. The time interval between the last point of the intersection of the pulse trace and either 90 percent line and the last point of intersection of the pulse trace and either 10 percent line is the pulse decay time.

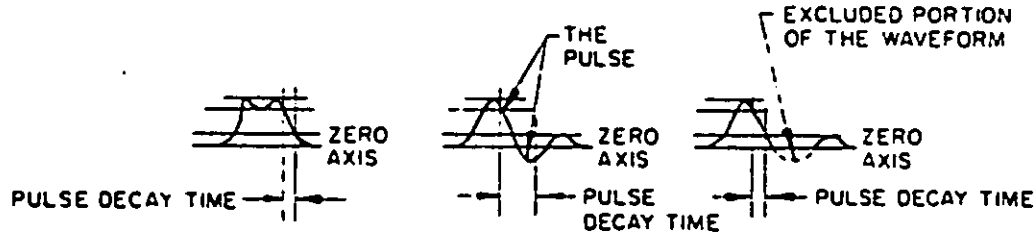


FIGURE 7. Example of pulse-decay-time determination.

4.7.12.5 Volt-microsecond product (ET constant) (see 6.9.14). The method of measurement for the volt-microsecond product (see figure 8) shall be as follows:

a. Obtain a calibrated (time and amplitude) picture of the magnetizing current. Delineate the pulse by excluding those portions of the waveform determined to be unwanted or nonpertinent.
b. Draw the zero axis of the magnetizing current waveform.
c. Find the pulse duration measured at "t_2" where the resultant pulse exciting current has increased to a certain value which is a specified percentage (see 3.1) above the linearly extrapolated value of the linear ramp waveform. The amplitude of the applied pulse voltage multiplied by pulse duration t_2 shall be the volt-microsecond product.

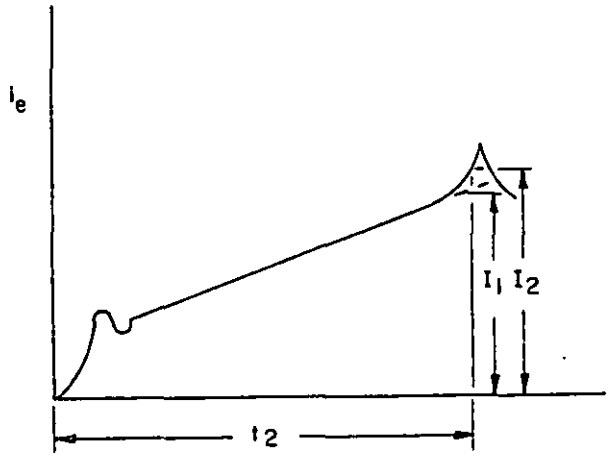


FIGURE 8. Method of determining volt-microsecond product.

d. The following details shall apply:

1. Magnetic preconditioning shall be performed on the transformer core prior to making this test (e.g. placing the core flux in a demagnetized state). Disaccommodation effects shall be considered in determining the time after preconditioning that the measurement is made, especially in the case of ferrite cores.
2. The measurement shall be made on a specified winding with all other windings open circuited.
3. The droop of the applied voltage pulse shall be less than 2 percent.
4. The applied pulse voltage amplitude shall not exceed the test voltage used in the dielectric withstanding voltage test.
5. The applied voltage pulses shall be unipolar or bipolar as appropriate for the transformer application.
6. If the transformer application involves a direct current in any of the windings, the measurement shall be made with rated direct-current ampere-turns applied, through a suitable inductor to prevent pulse loading effects.

4.7.12.6 DC resistance (primary and secondary). The primary and secondary resistance of the windings shall be measured at or corrected to 20°C.

4.7.12.7 Primary inductance. The primary inductance of the windings shall be measured at the specified pulse amplitude and pulse repetition rate (see 3.1).

4.7.12.8 Ratio of transformation (turns ratio). The ratio of transformation of two windings shall be determined by connecting the windings series aiding in the production of magnetic flux, applying a sinusoidal voltage to the series configuration, and measuring the voltage ratio using a calibrated potentiometer and null meter (see figure 9). The following details shall apply:

a. The test frequency shall be high enough so that the effect of any winding resistance unbalance will be negligible.
b. The variable element used to obtain a null shall be a calibrated potentiometer.

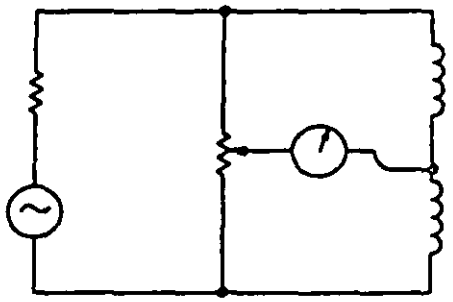


FIGURE 9. Network for determining transformation ratio.

4.7.12.9 Polarity. Winding polarity shall be determined by comparing the voltages or impedances of transformer windings when connected series aiding and series opposing and shall be determined during the test for ratio of transformation.

4.7.13 Temperature rise (see 3.16). Unless otherwise specified (see 3.1), the temperature rise test shall be performed on transformers rated at more than 0.8-watt average output. The temperature rise of each winding shall be based on the change-in-resistance method and shall be computed by the following formula:

$$\Delta T = \frac{R - r}{r} (t + 234.5) - (T - t)$$

Where:

ΔT = temperature rise in degrees centigrade above specified maximum ambient temperature (see 3.1).
R = resistance of winding in ohms at temperature (T + ΔT).
r = resistance of winding in ohms at temperature (t).
t = specified initial ambient temperature in degrees centigrade.
T = maximum ambient temperature in degrees centigrade (at time of power shut-off). "T" shall not differ from "t" by more than 5°C.

The transformers shall be conditioned for at least 8 hours at temperature (t) in a location free from drafts before resistance (r) is measured. Rated voltage shall be applied to the primary with the specified loads across the secondaries (see 3.1). Transformers shall be operated until two consecutive resistance readings on the highest resistance winding, taken 30 minutes apart, are the same. The resistance measurements (R) shall be made as soon as possible, but not more than 20 seconds after shut-off of power. The transformers shall then be examined for evidence of physical damage.

4.7.13.1 Test procedure. The transformers shall be supported centrally by means of two low-thermal-conductivity cleats 3 inches in height in a test cabinet of low thermal capacity and free of test area drafts and direct thermal radiation. The cabinet used shall provide a minimum clearance of 8 inches between the sides and top of the transformer under test and the internal planes of the test cabinet. Any closure approved by the Government which gives equivalent performance may be substituted for the above.

4.7.14 Life (see 3.17 and 3.1).

4.7.14.1 Transformers with life expectancy "X" (see 1.2.1.4). Unless otherwise specified (see 3.1), transformers shall be subjected to five life cycles a week for 12 weeks. Four of the cycles each week shall consist of 20 hours at an oven temperature equal to the specified maximum ambient temperature (see 3.1) for the transformers under test, and 4 hours at room ambient temperature. The fifth cycle of the week shall be 68 hours at the specified maximum ambient temperature (see 3.1) for the transformers under test, and 4 hours at room ambient temperature. When the transformers are subjected to the maximum ambient temperature, they shall be loaded with pulse and dc voltages, as specified in the electrical characteristics (see 4.7.12). After the test, the transformers shall be examined for evidence of physical and electrical damage.

4.7.14.2 Transformers with life expectancy "Y" (see 1.2.1.4). Transformers shall be subjected to the same procedure as described in 4.7.14.1 for life expectancy "X" except that the duration shall be a minimum of 6 weeks (1,008 hours).

4.7.14.3 Transformers with life expectancy "Z" (see 1.2.1.4). Unless otherwise specified (see 3.1), transformers shall be subjected to a life test consisting of a number of cycles, whereby the total time that the transformers are subjected to an oven temperature will be equivalent to the rated life of the transformer under test. Each cycle shall consist of 20 hours at an oven temperature equal to the specified maximum ambient temperature (see 3.1) and a minimum of 4 hours at room ambient temperature. When the transformers are subjected to the maximum ambient temperature they shall be loaded with rated pulse and dc voltages as specified in the electrical characteristics (see 4.7.12). After the test, the transformers shall be examined for evidence of physical and electrical damage.

4.7.15 Salt spray (corrosion) (see 3.18). When specified (see 3.1). Transformers shall be tested in accordance with method 101 of MIL-STD-202.

a. Test condition - B.
b. Salt solution concentration - 5 percent.
c. Examination after exposure - Transformers shall be thoroughly washed. The temperature shall not exceed 38° C. The transformers shall be placed in an oven maintained at 50° ±3° C for a period of 24 ±4 hours. At the end of this period, the transformers shall be removed from the oven and examined for corrosion.

4.7.16 Vibration (see 3.19). Transformers shall be tested in accordance with 4.7.16.1 or 4.7.16.2 as applicable.

4.7.16.1 Vibration, low frequency (grades 4 and 5 only). Transformers shall be tested in accordance with method 201 of MIL-STD-202. The following details and exceptions shall apply:

a. Test and measurements prior to vibration - Not applicable.
b. Method of mounting - Transformers shall be rigidly mounted by their normal mounting means.
c. Procedure - When specified (see 3.1), transformers shall be placed in a test chamber and preheated to the specified maximum ambient temperature (see 3.1) plus one-half the allowable temperature-rise for the class. Vibration in each plane shall begin 5 minutes after removal of transformers from test chamber.
d. Examinations after vibration - Transformers shall be examined for evidence of leakage and physical damage.

4.7.16.2 Vibration, high frequency (grades 6 and 7 only). Transformers shall be tested in accordance with method 204 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting of specimen - As specified in 4.7.16.1 b.
b. Test condition - B.
c. Procedure - As specified in 4.7.16.1 c.
d. Examinations after vibration - As specified in 4.7.16.1 d.

4.7.17 Shock (see 3.20). Transformers shall be tested in accordance with 4.7.17.1, or when specified (see 3.1), in accordance with 4.7.17.2.

4.7.17.1 Specified pulse. Transformers shall be tested in accordance with method 213 of MIL-STD-202. The following details and exceptions shall apply:

a. Test condition - H or I, as specified (see 3.1).
b. Examinations after shock - Transformers shall be examined for evidence of leakage and physical damage.

4.7.17.2 High-impact. Transformers shall be tested in accordance with method 207 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting fixtures - Figure "Standard mounting fixtures for electrical controller parts" of method 207.
b. Examinations after shock - As specified in 4.7.17.1b.

4.7.18 Thermal shock (see 3.21). Transformers shall be tested in accordance with method 107 of MIL-STD-202. The temperature for step 3 shall be the maximum operating temperature for the class. The following details and exceptions shall apply:

a. Test condition - A.
b. Examinations after thermal shock - Transformers shall be examined for evidence of leakage and other visible damage.
c. Number of cycles - 10.

4.7.19 Immersion (see 3.22). Transformers shall be tested in accordance with method 104 of MIL-STD-202. The following details and exceptions shall apply:

a. Test condition - B, for qualification inspection on grades 4 and 6; A, for qualification inspection on grades 5 and 7, and for quality conformance inspection on all grades.
b. Examinations after final cycle - Transformers shall be washed under running tap water and dried, and shall then be examined for evidence of leakage and other visible damage.

4.7.20 Moisture resistance (see 3.23). Transformers shall be tested in accordance with method 106 of MIL-STD-202. The following details and exceptions shall apply:

a. Mounting - On racks.
b. Initial measurements - Not applicable.
c. Polarization - Unless otherwise specified (see 3.1), polarization is applicable. The polarizing voltage shall be applied during steps 1 to 6 inclusive, between all windings not connected directly to the core, and the core or case. When the dielectric-withstanding-test voltage is less than 100 volts rms, a 25 volts rms, a 25 volts dc polarizing voltage may be used. The polarizing voltage shall be positive with respect to the core and the case.
d. Final examinations:
   1. Grades 4 and 6 - Upon completion of step 6 of the final cycle, transformers shall be removed from the humidity chamber and shall be conditioned for 4 to 24 hours at standard inspection conditions (see 4.4). After this conditioning period, transformers shall be examined for evidence of leakage and other visible damage.
   2. Grades 5 and 7 - Upon completion of step 6 of the final cycle, transformers shall be removed from the humidity chamber and shall be conditioned for 24 hours in a test chamber at 85° ± 5°C. After this conditioning period, transformers shall be examined for evidence of leakage and other visible damage.

4.7.21 Overload (see 3.24). The overload test shall be performed for a period of 48 hours for qualification inspection and 8 hours for quality conformance inspection at the specified ambient temperature or higher (see 3.1). When transformers attain an operating temperature of less than the maximum specified for the class during the temperature -rise test specified in 4.7.13, ambient temperature for the overload test shall be increased above that specified to a value that results in an operating temperature equivalent to the maximum specified for the class. The overload shall be applied as specified in 4.7.21.1. During the overload test, transformers rated at less than 0.8 watt average need not have loads applied but all rated dc and pulse voltages shall be applied. All transformers shall then be examined for evidence of leakage and other visible damage. Transformers shall be allowed to cool for approximately 8 hours at standard inspection conditions (see 4.4) before performing any additional test. Where special cooling features are employed, the overload test methods and conditions shall be as specified (see 3.1).

4.7.21.1 Voltage to be applied. Rated voltage at maximum rated pulse duration shall be applied at the rated duty cycle to the primary, and with rated load connected to the secondary to set the load impedances. The input voltage shall then be raised to 112 percent of rated voltage. When applicable, the rated dc current shall be applied during this test (see 3.1).

4.7.22 Flammability (see 3.26). Transformers shall be tested in accordance with method 111 of MIL-STD-202. The following details and exceptions shall apply:

a. Point of impingement of applied flame - One of the lower free corners, so that the flame is just in contact with the transformer. The free corners of the transformer are those corners which are the greatest distance from the mounting brackets. However, the flame shall be applied so that it will impinge upon the corner or area containing the encapsulating compound.
b. Allowable time for burning of visible flame on specimen - 3 minutes maximum.
c. Examinations during and after test - Transformers shall be examined for evidence of violent burning which results in an explosive type fire, dripping of flaming material, and visible burning which continues beyond the allowable duration after removal of the applied flame.

4.7.23 Fungus (see 3.27). Unless certification is provided, transformers shall be tested in accordance with method 508 of MIL-STD-810.

5. PACKAGING

5.1 Preservation. Preservation shall be level A or C, or as specified (see 6.1).

5.1.1 Level A.

5.1.1.1 Cleaning. Transformers shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Transformers shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. Preservatives shall not be used.

5.1.1.4 Unit packs. Each transformer shall be individually unit packed in accordance with the method or submethod of MIL-P-116 specified herein insuring compliance with the applicable requirements of that specification. Leads and terminals less than 0.03 inch (0.762 mm) in smallest dimension shall be protected by container design, die-cut inserts, vials or suitable noncorrosive supporting materials or devices. Leads or terminals shall extend outward and be maintained in the manufactured configuration without causing damaging loads or stresses.

5.1.1.4.1 Metal encased transformers. Metal encased, sealed transformers (grades 4 and 6) shall be unit packed in accordance with method III.

5.1.1.4.2 Encapsulated transformers. Encapsulated transformers (grades 5 and 7) shall be unit packed in accordance with submethod IA-8.

5.1.1.5 Intermediate packs. Transformers, packaged as specified in 5.1.1.4, shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size, shape and quantities, shall be of minimum tare and cube and shall contain multiples of five unit packs, not to exceed 100 unit packs. No intermediate packs are required when the total quantity shipped to a single destination is less than 100 unit packs.

5.1.2 Level C. The level C preservation for these transformers shall conform to the MIL-STD-794 requirements for this level.

5.2 Packing. Packing shall be level A, B, or C, or as specified (see 6.1).

5.2.1 Level A. The packaged transformers shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. In lieu of the closure and waterproofing requirement in the appendix of PPP-B-636, closure and waterproofing shall be accomplished by sealing all seams, corners and manufacturer's joint with tape, two inches minimum width, conforming to PPP-T-60, class 1 or PPP-T-76. Banding (reinforcement requirements) shall be applied in accordance with the appendix to PPP-B-636 using nonmetallic or tape banding only.

5.2.2 Level B. The packaged transformers shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto.

5.2.3 Level C. The level C packing for these transformers shall conform to the MIL-STD-794 requirements for this level.

5.3 Marking. In addition to any special marking required by the contract (see 6.1), each unit pack, intermediate and exterior container shall be marked in accordance with MIL-STD-129.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2 and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Packaging inspection. The inspection of these packaging requirements shall be in accordance with 4.6.3.

5.4.3 Army procurements.

5.4.3.1 Level A unit and intermediate packs. Unit containers shall be either weather (or water) resistant or overwrapped with waterproof barrier materials (see 5.1.1.4.1). Intermediate containers shall either be overwrapped with waterproof barrier materials or conform to PPP-B-566 or PPP-B-676, variety 2 (see 5.1.1.5).

5.4.3.2 Level A and level B packing. For level a packing the fiberboard containers shall not be banded but shall be placed in a close fitting box conforming to PPP-B-601, overseas type; PPP-B-621, class 2 style 4 or PPP-B-585, class 3, style 2 or 3. Closure and strapping shall be in accordance with applicable container specification except that metal strapping shall conform to QQ-S-781, type I finish A. When the gross weight exceeds 200 pounds or the container length and width is 48 X 24 inches or more and the weight exceeds 100 pounds, 3 X 4 inch skids (laid flat) shall be applied in accordance with the requirements of the container specification. If not described in the container specification, the skids shall be applied in a manner which will adequately support the item and facilitate the use of material handling equipment. For level B packing, fiberboard boxes shall be weather resistant as specified in level A and the containers shall be banded (see 5.2.1 and 5.2.2).

5.4.3.3 Commercial packaging. Commercial packaging (including unit and intermediate packs, packing and marking) shall be in accordance with MIL-STD-1188.

6. NOTES

6.1 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.
b. Title, number, and date of the applicable specification sheet, and the complete type designation (see 1.2.1 and 3.1).
c. Whether hardware is required for screw terminals or for mounting studs, or for both (see 3.4.2.4 and 3.4.3).
d. If mounting area surface is to be painted (see 3.4.5).
e. Inspection of commercial packaging (see 4.6.3).
f. Levels of preservation and packing required (see 5.1 and 5.2).
g. Special marking, if required (see 5.3).

6.2 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractors is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the qualified products list is the Naval Electronic Systems Command, Department of the Navy, Washington, D.C. 20360; however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center (DESC-E), Dayton, Ohio 45401 (see 3.2). Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.2.1).

6.2.1 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

6.3 Assignment of type designation. Type designation for specification sheets will be assigned by DESC upon the request of the Army, the Navy, or the Air Force, accompanied by the data needed to establish a specification sheet.

6.4 Envelope and mounting dimensions. Equipment designers should give first consideration to using the various style configurations shown on figure 1 and the envelope and mounting dimensions in table IV.

6.5 Temperature and life expectancy. The class designation noted in table II refers solely to maximum operating temperature and has no relation to types of insulation material. Any insulation material may be used in any class of transformer, depending entirely upon the maximum operating temperature and life expectancy. The nominal ambient temperature for life expectancy of 10,000 hours minimum is generally 65°C for classes O and R; 75°C for class S; 85°C for class U; and as specified for class V. (See 1.2.1.3 and 1.2.1.4).

6.5.1 Grades 4 and 6. Grade 6 transformers are the same as grade 4 transformers except for the ability of grade 6 transformers to withstand high-frequency vibration and reduced barometric pressure.

6.5.2 Grades 5 and 7. Grade 7 transformers are the same as grade 5 transformers except for the ability of grade 7 transformers to withstand high-frequency vibration and reduced barometric pressure.

6.6 Notes for airborne applications.

6.6.1 Laminated phenolics. Laminated phenolics should not be used in locations where they would be exposed to heavy electrical discharges in normal operations, or fault conditions because of the inflammable conditions that might occur.

6.6.2 Transformer sizes. Contractors should strive to provide the smallest and lightest transformers possible.

6.7 Mounting. It is intended that some type of retaining clamp be used to securely fasten style configurations A, B, C, and D, as necessary.

6.8 Ambient temperature increase. Ambient temperature increase allowed during the overload tests (see 4.7.21) will be derived on an assumed linear extrapolation. For example: A class R unit operated under 4.7.14 at an ambient of 65° C with a 20° C rise would be operated during the overload test (see 4.7.21) at an ambient temperature of 85° C (105° C - 20° C = 85° C).

6.9 Waveform definitions.

6.9.1 Pulse rise time (see 4.7.12.1). Pulse rise time is the interval between the instants at which the instantaneous amplitude first reaches specified lower and upper limits; namely 10 percent and 90 percent of the peak pulse amplitude.

6.9.2 Pulse duration (see 4.7.12.2). Pulse duration is the time interval between the first and last instants at which the instantaneous amplitude reaches 50 percent of the peak pulse amplitude.

6.9.3 Peak pulse amplitude (see 4.7.12.3). Peak pulse amplitude is the maximum absolute peak value of the pulse, excluding those portions considered to be unwanted or nonpertinent, such as spikes (see 3.1).

NOTE: Where such exclusions are made, it is desirable that the amplitude chosen be illustrated pictorially. One method of determining the peak pulse amplitude is shown on figure 10. In this case, it is determined by the intersection of a line tangent to the leading edge of the pulse and a line target to the "flat top" of the pulse.

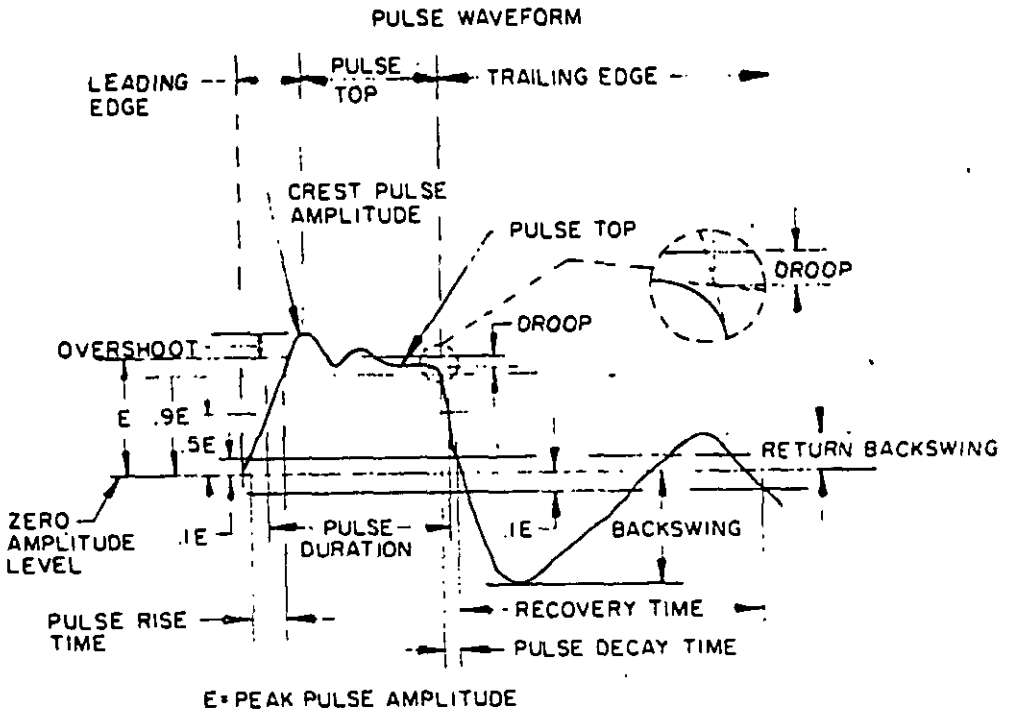


FIGURE 10. Pulse waveform.

6.9.4 Pulse decay time (see 4.7.12.4). The pulse decay time (sometimes referred to as the fall time) is the interval between the instants at which the instantaneous amplitude last reaches 90 percent, and next reaches 10 percent of the peak pulse amplitude.

6.9.5 Crest pulse amplitude. The crest pulse amplitude is the maximum value of the pulse relative to the zero amplitude level (see figure 10).

6.9.6 Leading edge. The leading edge is that portion of the pulse in which the amplitude rises from zero to its crest pulse amplitude (see figure 10).

6.9.7 Trailing edge. The trailing edge is that portion of the pulse in which the amplitude descends from its value at the end of the pulse top to its ultimate zero level (see figure 10).

6.9.8 Pulse top. Unless otherwise specified (see 3.1), the pulse top shall be the flat part of the pulse shown on figure 10.

6.9.9 Droop. Unless otherwise specified (see 3.1), droop is that displacement of the peak pulse amplitude shown on figure 10. Droop is expressed in volts or as a percentage of the peak pulse amplitude.

6.9.10 Overshoot. Overshoot is the amount by which the crest pulse amplitude exceeds the peak pulse amplitude (see figure 10). Overshoot is expressed in volts or as a percentage of the peak pulse amplitude.

6.9.11 Backswing. Backswing is that portion of the trailing edge extending below the zero amplitude level (see figure 10). Backswing may be expressed in volts or as a percentage of the peak pulse amplitude.

6.9.12 Return backswing. Return backswing is that portion of the trailing edge which has a polarity reversed to that of the backswing, and occurs later in time than the backswing (see figure 10).

6.9.13 Recovery time. Recovery time is that time interval between the time and trailing edge of the pulse first crosses a line representing 10 percent of the peak pulse amplitude and the last time the pulse shape crosses either a positive or negative line corresponding to 10 percent of the peak pulse amplitude (see figure 10).

6.9.14 Volt-microsecond product (ET constant)(see 4.7.12.5). Volt-microsecond product is the time integral of a voltage pulse applied to a transformer winding and is considered to be a constant. It is a rating of the maximum usable flux density of the winding based upon the maximum allowable non-linearity of magnetizing current (ramp or exciting current) in the region of core saturation.

6.10 Turns ratio (see 1.2.1.5). The turn ratio of a transformer is the ratio of the number of turns in the high-voltage winding to that in the low voltage winding.

6.11 International standardization agreement. Certain provisions of this specification are the subject of international standardization agreement (NEPR No. 20). When amendment, revision, or cancellation of this specification is proposed which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

Custodians:
Army - ER
Navy - EC
Air Force - 11

Review activities:
Army - AM, MI
Navy - OS, SH, AS
Air Force - 17, 99

User activities:
Army - ME
Navy - MC
Air Force - 19

Preparing activity:
Navy - EC

Agent:
DLA - ES

(Project 5950-0553)

APPENDIX

SUBMISSION FOR QUALIFICATION INSPECTION

10. SCOPE

10.1 This appendix details the procedures for submission of samples, with required data, for qualification testing and approval of transformers covered by this specification.

20. SUBMISSION

20.1 Qualification of transformers based on complete testing.

20.1.1 Identification data required.

a. Type designation of the transformer described on a specification sheet. (Transformers covered by existing specification sheets.)
b. For transformers that are comparable with an item covered by an existing specification sheet and the requirements of which can be added to the sheet, the information of figure 11 shall be submitted. For transformers that cannot be added to an existing specification sheet, a complete specification sheet shall be submitted, encompassing the information required by figure 11. The specification sheet shall be in the format of existing specification sheets and shall be suitable for reproduction by the photo-offset method.

20.1.2 Sample. A sample consisting of eight of each type of transformers for which qualification is sought shall be subjected to the tests of table VII. Three sample units shall be subjected to the inspections of group I. Eight sample units which includes the three units from group I shall be subjected to the inspections of group II. Two sample units shall be subjected to the inspections of group III. The six remaining sample units from group II shall be subjected to the inspections of group IV. Two additional sample units will be required for group V, if the fungus test is performed.

20.2 Qualification of transformers based on similarity to qualified transformers. Only transformers which have passed the complete tests of table VII shall be used as a basis for comparison for qualification based on similarity.

20.2.1 Similar transformers. A similar transformer is defined as a transformer which when compared to the qualified transformer, meets the following criteria:

a. Same or lower operating temperature.
b. Same or lower ambient temperature.
c. Same type of external and internal mountings; similar shape; same type of case construction; nominal wall thickness within 25 percent when a case is used.
d. Linear envelope dimensions not greater than 150 percent nor less than 70 percent of the corresponding dimensions; total volume of envelope not greater than 250 percent.
e. To be used at same or lower operating voltages, and same or lower dielectric stress per mil of same insulation.
f. Same or greater wire size (cross sectional area) and same wire coating material for corresponding windings.
g. Same processing material for case, finish, marking.
h. Same processing of material for potting, insulation, impregnating, and filling.
i. Same grade.
j. To be used at same or lower altitudes.
k. Same terminal construction and material, including insulating and gasketing parts; same or lower terminal strength requirements for the same size terminals.
l. Same life expectancy.

20.2.2 Identification data required. The data required shall be in accordance with 20.1.1(b) and that required by figure 12 shall also be submitted.

20.2.3 Sample. A sample consisting of 3 sample units of each type for which qualification is sought shall be subjected to the inspection specified in table VIII.

Identification data (to be completed by manufacturer):

1. Name of manufacturer:
2. Address of manufacturer:
3. Manufacturer's part number:
4. Federal supply code assigned to manufacturer:
5. Date entries completed:

Instructions for use of this form:

Enter all information, including numerical values as required by this form, using as your guide applicable MIL-T-21038 scope, requirement, and methods of examination and test paragraphs.

MIL-T-21038 specification sheet, if any, to which the transformer can be added:

MIL-T-21038/_____. (enter slash number)

☐ This item cannot be added to any existing MIL-T-21038.

Type designation (see MIL-T-21038, 1.2.1 thru 1.2.1.7): TP _____ (enter symbols).

Federal Stock Number (FSN) (check applicable block):

☐ Existing FSN assigned to this transformer is 5950 - _____ - _____ (enter numerals)

☐ No FSN is presently assigned to this transformer.

Application of transformer:

1. Military equipment identification (Joint Electronics Type Designation System): _____ (enter identification No.)
2. Military documents (check all applicable blocks and enter information requested):

☐ Technical Order (T.O.) _____ (identification No.).

☐ Technical Manual (T.M.) _____ (identification No.).

☐ Military drawing _____ (identification No.).

FIGURE 11. Transformer data sheet.

In the space below, provide outline drawings in as many views as are required to show all of the principle exterior features of this transformer, including case, mounting and terminal dimensions 1/ and tolerances 2/, and terminal identification (see MIL-T-21038, figure 1 and table IV, as applicable, and the figure on sheet 1 of the MIL-T-21038 specification sheet to which this transformer is applicable): Test circuit for testing waveform parameters if different than figure 3.

1/ Dimensions shall be given in decimal values, accurate to two or three decimal places, as applicable.
2/ Specify dimensions with tolerances or as maximum or minimum, as applicable.

Examples: $1.750^{+0.000}_{-0.125}$, 2.500 ± 0.016.

FIGURE 11. Transformer data sheet - Continued.

REQUIREMENTS:

Case.

Material (check applicable block): ☐ Metal. ☐ Other. _____ (specify material)

Maximum weight: _____ (enter value) ounces. pounds. (cross out one)

Terminals.

Check applicable block:

☐ Solder terminal. ☐ Pin and printed circuit type. ☐ Screw thread.

☐ Solid wire lead other than printed circuit. ☐ Special: _____ (specify type).

Reliability conditioning (burn-in) (see MIL-T-21038, 4.7.4).

Check applicable block:

☐ Applicable ☐ Not applicable

Resistance to soldering heat (see MIL-T-21038, 4.7.5), method 210, MIL-STD-202.

Check applicable block:

☐ Bath (4.7.5.1) ☐ Iron (4.7.5.2)

Terminal strength (see MIL-T-21038, 4.7.6), method 211, MIL-STD-202.

Check applicable blocks:

Equivalent diameter at cross section as defined in table XIII of MIL-T-21038C:

_____ (enter value) inches.

☐ Condition A (pull), applied force (in accordance with MIL-T-21038, table XII):

☐ 2.5 pounds. ☐ 5 pounds. Other: _____ (specify pounds).

☐ Condition B (bend)

☐ Condition D (twist)

☐ Condition E (torque)

☐ Screw-thread terminals: Torque: _____ (enter value) pound-inches.

☐ Other non-wire, rigid type terminals, if equivalent diameter is greater than 1/2 inch:

Torque: _____ (enter value) ounce-inches:

FIGURE 11. Transformer data sheet - Continued.

Seal (see MIL-T-21038, 4.7.7).

Check applicable block:

☐ 4.7.7.1 ☐ 4.7.7.2

Dielectric withstanding voltage test.

Check applicable blocks:

☐ At atmospheric pressure (see MIL-T-21038, 4.7.8.1), method 301, MIL-STD-202:

Magnitude of test voltage: _____ (enter value) volts, rms.

Duration of application of test voltage:

☐ Sixty seconds.

☐ Other than 60 seconds (specify time): _____ (enter value) seconds.

Points of application of test voltage: Between _____ (specify points).

☐ At reduced barometric pressure (see MIL-T-21038, 4.7.8.2). In accordance with 4.7.6.1, and method 105, MIL-STD-202, test condition:

_____ (specify condition letter).

Magnitude of test voltage: _____ (enter value) volts, rms.

Duration of application of test voltage: 5 seconds.

Points of application of test voltage: Between _____ (specify points).

Insulation resistance (see MIL-T-21038, 4.7.9), method 302, MIL-STD-202, test condition B.

Check applicable block:

☐ 10,000 megohms.

☐ 1,000 megohms.

FIGURE 11. Transformer data sheet - Continued.

Electrical characteristics (waveform parameters) (see MIL-T-21038, 4.7.12).

Turns ratio _____

Pulse duration _____

Pulse rise time _____

Overshoot _____

Droop _____

Backswing _____

Decay time _____

Inductance _____ uh, Not applicable ☐

ET constant _____ Vμs

Impedance:

Output _____

Input _____

Pulse repetition frequency _____

Capacitance (winding to winding) _____

Primary winding:

Pulse voltage _____

Pulse current _____

DCR _____, Not applicable ☐

Secondary winding(s):

Number _____

Pulse voltage, each _____

Pulse current, each _____

DCR _____, Not applicable ☐

Solderability (see MIL-T-21038, 4.7.2), method 208, MIL-STD-202.

Check applicable block:

☐ Bath (4.7.2.1) ☐ Iron (4.7.2.2)

Life (see MIL-T-21038, 4.7.14).

Check applicable block:

☐ X (10,000 hours min)

☐ Y (2,500 hours min)

☐ Z (As specified (see 3.1)) _____ (number of hours)

FIGURE 11. Transformer data sheet - Continued.

Temperature rise (see MIL-T-21038, 4.7.13).

Check applicable block:

☐ Temperature rise: _____ degrees C.
Ambient temperature _____ degrees C.
☐ Temperature rise not applicable (temperature rise is negligible):

Vibration (see MIL-T-21038, 4.7.16).

Check applicable block:

☐ Low frequency (see MIL-T-21038, 4.7.16.1), method 201, MIL-STD-202.

☐ High frequency (see MIL-T-21038, 4.7.16.2), method 204, MIL-STD-202.

Shock (see MIL-T-21038, 4.7.17).

Check applicable block:

☐ Specified pulse (see MIL-T-21038, 4.7.17.1), method 213, MIL-STD-202, test condition I or specify condition letter_____.

☐ High impact (see MIL-T-21038, 4.7.17.2), method 207, MIL-STD-202.

Thermal shock (see MIL-T-21038, 4.7.18), method 107, MIL-STD-202.

Check applicable block:

☐ 10 cycles.

☐ other, specify No. of cycles _____.

Immersion (see MIL-T-21038, 4.7.19), method 104, MIL-STD-202, test condition.

Check applicable block:

☐ A (for grades 5 and 7). ☐ B (for grades 4 and 6).

Moisture resistance (see MIL-T-21038, 4.7.20), method 106, MIL-STD-202.

Check applicable block:

Polarizing voltage:

☐ Applicable

☐ Not applicable.

FIGURE 11. Transformer data sheet - Continued.

Resistance to solvents (see MIL-T-21038, 4.7.3., method 215, MIL-STD-202):

Check applicable block:

☐ Applicable ☐ Not applicable

Flammability (see MIL-T-21038, 4.7.22. method 111, MIL-STD-202:

Check applicable block:

☐ Applicable ☐ Not applicable

Salt spray (see MIL-T-21038, 4.7.15, method 101, MIL-STD-202:

Check applicable block:

☐ Applicable ☐ Not applicable

FIGURE 11. Transformer data sheet - Continued.

Characteristic	Characteristic of transformers being submitted for qualification based on similarity	Characteristic of transformers having qualification
Operating temperature	85°C ☐ 155°C ☐ 105°C ☐ 170°C ☐ 130°C ☐ >170°C ☐	85°C ☐ 155°C ☐ 105°C ☐ 170°C ☐ 130°C ☐ >170°C ☐
Ambient temperature (operating temperature-temperature rise)		
External mounting Internal mounting Nominal wall thickness Envelope dimensions Case volume Grade	Grade 4 ☐ Grade 6 ☐ Grade 5 ☐ Grade 7 ☐	Grade 4 ☐ Grade 6 ☐ Grade 5 ☐ Grade 7 ☐
Wire size Coating material		
Case material	Metal ☐ Other (specify) ☐	Metal ☐ Other (specify) ☐
Case finish	Light-gray, semigloss ☐	Light-gray, semigloss
Case marking	Type designation ☐ Manufacturers name ☐ Trademark or code symbol ☐ Terminal identification ☐	Type designation ☐ Manufacturers name ☐ Trademark or code symbol ☐ Terminal identification ☐
Life expectancy		
Operating voltage		
Potting Insulation Impregnation Filling		
Altitude	10, 000 ft ☐ 50, 000 ft ☐	10, 000 ft ☐ 50, 000 ft ☐
Terminal construction, material and finish (including insulating and gasketing parts)		

FIGURE 12. Transformer similarity comparison sheet.

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Workmanship	3.29

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