

MIL-T-60206 (MU)  
26 February 1965  
SUPERSEDING  
FA(FC)-PD-141  
28 April 1961

MILITARY SPECIFICATION

TRANSFORMER, POWER, STEP-DOWN: 10525900

1. SCOPE

1.1 This specification covers one type of transformer (Type Designation: TF5RXO2ZZ) for voltage regulation in the Gun Direction Computer: M18

2. APPLICABLE DOCUMENTS

2.1 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

Military

MIL-T-27	Transformers and Inductors (Audio, Power, and High Power Pulse) General Specification for
MIL-F-13926	Fire Control Material, General Specification Governing the Manufacture and Inspection of
MIL-P-14232	Parts, Equipment and Tools for Ordnance Materiel: Packaging of
MIL-I-45607	Inspection Equipment, Supply and Maintenance of
MIL-C-46357	Computer, Gun Direction: M18; Manufacturing Processes and Inspection of

STANDARDS

Military

MIL-STD-105	Sampling Procedure and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts

DRAWINGS

U.S. Army Munitions Command

C10525900	Transformer, Power, Step-Down
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PACKAGING DATA SHEET

MIL-P-14232/P10525900	Packaging of Transformer, Power, Step-Down
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(Copies of specifications, standards, drawings, and packaging data sheets, required by the suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

3. REQUIREMENTS

3.1 Fabrication.- The transformer (Type Designation: TF5RX02ZZ) shall be manufactured in accordance with Drawing C10525900 and drawings pertaining thereto.

3.1.1 Case and potting.- The case shall be of molded flame resistant fiber glass and resin construction and shall be potted with a self-extinguishing, semi-flexible epoxy resin compound.

3.2 General specification.- The transformer shall meet the requirements of MIL-T-27 for its particular type designation or classification. The transformer shall also meet the specified requirements of MIL-C-46357:

- (a) Installation of hardware
- (b) Securing leads
- (c) Soldering
- (d) Solvent vapor degreasing
- (e) Marking ink for non-metals
- (f) Application of decals
- (g) Twenty-four hour test procedure for transformers and inductors

3.2.1 Order of precedence.- Should any conflict occur between the general specifications and the detailed specification the order of precedence shall be as follows:

- (a) Detailed specification
- (b) MIL-C-46357
- (c) MIL-T-27

3.3 Environmental service conditions.

3.3.1 Vibration.- The transformer shall be subjected to a simple harmonic motion having an amplitude of 0.03 inch (0.06 inch total excursion). The frequency shall be varied uniformly from 10 to 55 cycles per second (cps) and return to 10 cycles. This cycle shall be traversed in 1 minute  $\pm$  15 seconds. The motion shall be applied to the transformer for a period of 10 minutes in each direction of the 3 mutually perpendicular axes (total of 30 minutes), relative to its normal operational position. Subsequent to vibration, the transformer shall not be damaged or adversely affected and shall meet the requirements of 3.4.

3.3.2 Shock.- The transformer shall withstand 3 shock impulses in each of 3 mutually perpendicular directions. The acceleration of the shock impulses shall be 5 gravity units (G's). Pulse duration of each impulse shall be 11  $\pm$  1 milliseconds. Subsequent to shock the item shall not have been damaged or adversely affected and shall meet the requirements of 3.4.

### 3.3.3 Temperatures.

3.3.3.1 Operating.- The transformer shall meet the requirements of 3.4 while exposed to temperatures of -40°F and +135°F.

3.3.3.2 Storage.- The transformer shall meet the requirements of 3.4 at a temperature of between 60°F and 90°F after having been exposed to each temperature of -80°F and +220 F.

### 3.3.4 Humidity.

3.3.4.1 Operating.- The transformer shall meet the requirements of 3.4 while exposed to an atmosphere with a relative humidity (RH) up to 97% at a temperature of 135°F.

3.3.4.2 Non-operating.- The transformer shall meet the requirements of 3.4 after exposure to (and when thoroughly dried) an atmosphere with a RH of 100 percent including condensation, for a period of 4 hours.

3.3.5 Fungus resistance.- The transformer shall show no evidence of damage and shall meet the requirements of 3.4, after being inoculated with the composite spore suspension specified in MIL-F-13926 and incubated at an ambient temperature of between 77 F and 84 F with a RH of 97 ± 2%.

3.4 Performance.- Unless otherwise specified the transformer shall meet the performance requirements of this specification at ambient temperatures between 60 and 90 F; a barometric pressure of 28 to 32 inches of mercury; and a RH up to 90%.

3.4.1 Primary.- The primary rating shall be 208 volts, 3 phase 400 cps, on terminals 2-2-3. Maximum no load loss, 10 watts; Maximum no load current .100 amp; Wye connection. D.C. resistance shall be within the limits of 4.4 ohms maximum, and 3.2 ohms minimum.

3.4.2 Secondaries.- The rating of the secondaries shall be in accordance with the following tabulation.

<u>Terminal</u>	<u>Volts (Line to Line) rms</u>	<u>AMPS (rms)</u>	<u>Volts (no Load) Max.</u>	<u>Min.</u>	<u>Connecti- tion</u>	<u>DC. Res. Ohms Max.</u>	<u>Min.</u>	<u>Working Volts Max.</u>
4-5-6	177.	0.023	184	180	Delta	140.	93.	270.
7-8-9	177.	0.13	184	180	Delta	22.	16.	270.
10-11-12	44.	0.87	46	44	Delta	0.77	0.58	80.
13-14-15	11.2	1.25	11.6	11.2	Delta	0.19	0.15	20.
16-17-18	21.7	1.05	22.6	21.8	Delta	0.46	0.34	32.
19	Electro-static shield							
20	Core ground							

3.4.3 Insulation resistance.- The insulation resistance shall be 10,000 megohms minimum between each winding and the other windings and mounting inserts.

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3.4.4 Dielectric strength. - The dielectric strength at sea level between windings, electro-static shield and mounting inserts shall be as tabulated below:

<u>Terminal</u>	<u>Dielectric strength volts (rms)</u>
1-2-3	850
4-5-6	850
7-8-9	850
10-11-12	500
13-14-15	500
16-17-18	500
19	500
20 (core ground)	500

3.4.5 Induced voltage. - The induced voltage shall be 416 volts rms, 800 cps, 3 phase, applied to terminals 1-2-3.

3.4.6 Electro-static shield. - The shielding ratio shall be 4 to 1 or greater between any two windings at frequency of 20 Kc.

**4. QUALITY ASSURANCE PROVISIONS**

4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 General provisions. - The component inspection requirements of MIL-F-13926 form a part of the Quality Assurance Provisions of this specification. Definitions of inspection terms shall be as listed in MIL-STD-109.

4.2 Inspection provisions.

4.2.1 Submission of Product. - Unless otherwise specified herein, or by the contracting officer, inspection lot size, lot formation and presentation of lots shall be in accordance with "Submission of Product" as specified in MIL-STD-105.

4.2.2 Examinations and tests. - Except where otherwise specified herein, components and sub-assemblies shall be inspected in accordance with the "Inspection provisions for components and sub-assemblies" and the Sampling Plan Tables contained in MIL-F-13926. Examinations and tests related to Section 3 herein shall be performed in accordance with Tables I, II and III and the test methods and procedures in 4.5. Examinations and tests for packaging, packing and marking shall be in accordance with MIL-P-14232 and Section 5 herein.

4.2.3 Acceptance and rejection. - Rejected lots shall be screened for all defective characteristics. Removal or correction of defective units and resubmittance of rejected lots shall be in accordance with "Acceptance and Rejection" as specified in MIL-STD-105.

4.2.4 Functional tests. - The requirements and tests in Table I shall be inspected on a 100% basis. All examinations and tests shall be conducted at the standard ambient temperature (60° to 90°F).

TABLE I  
(100 percent inspection)

<u>Characteristic s</u>	<u>Requirement</u>	<u>Test Procedures</u>
101. Primary	3.4.1	4.5.2.1 and 4.5.2.1.1
102. Secondary	3.4.2	4.5.2.1.1 and 4.5.2.1.2
103. Insulation resistance	3.4.3	4.5.2.1.3
104. Dielectric strength	3.4.4	4.5.2.1.4
105. Induced voltage	3.4.5	4.5.2.1.5
106. Electro-static shield	3.4.6	4.5.2.1.6

4.3 Control test.

4.3.1 General. - One Transformer shall be selected at random by a Government representative as a control sample from each 100 produced. The control sample shall meet the requirements and tests in Table II.

TABLE II

<u>Control Test</u>	<u>Requirement</u>	<u>Test Procedures</u>
301. Fabrication	3.1	Applicable drawings - Visual
302. General specifications	3.2	MIL-T-27 and MIL-C-4637

4.3.2 Environmental. - Three units shall be selected at random by a Government representative as a control sample from each 50 produced or from each month's production, whichever occurs first. The control samples shall have met the requirements and tests in Table I and shall then meet the requirements and tests in Table III.

TABLE III

<u>Control Test</u>	<u>Requirement</u>	<u>Test Procedures</u>
303. Vibration	3.3.1	4.5.1.1
304. Shock	3.3.2	4.5.1.2
305. Humidity-Operating	3.3.4.1, 3.4	4.5.1.3.2, 4.5.2
306. Humidity-Non-operating	3.3.4.2	4.5.1.3.1
307. Operating temperature	3.3.3.1, 3.4	4.5.1.4, 4.5.2
308. Storage temperature	3.3.3.2	4.5.1.5

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4.3.3 Failure of sample. - Should any one item of a control test sampling fail to meet the specified test requirements, acceptance of the product will be suspended by the Government until necessary corrections have been made by the contractor and the resubmitted samples have been approved (see 4.2.3).

4.4 Inspection equipment. - Except as otherwise provided for by the contract, the contractor shall supply equipment in accordance with the applicable requirements of MIL-I-45607. The Government reserves the right to use the test equipment for its own independent inspections to the extent that such use will not unduly interfere with the contractor's delivery schedule.

4.4.1 Contractor design. - The contractor shall provide inspection equipment compatible with the "Test Methods and Procedures" specified in 4.5 and with the "Component Inspection" and "Test facilities" requirements of MIL-F-13926. Since tolerance of test equipment is normally considered to be within 10% of the product tolerance for which it is intended, this inherent error in the test equipment design must be considered as part of the prescribed product tolerance limit. Thus, concept, construction, materials, dimensions and tolerances used in the design of test equipment shall be so selected and controlled as to insure that the test equipment will reliably indicate acceptability of a product which does not exceed 90% of the prescribed tolerance limit, and permit positive rejection when non-conforming. Construction shall be such as to facilitate routine calibration of test equipment.

4.4.1.1 Test equipment. - In conjunction with 4.4.1, the following test equipment shall be utilized in the performance of the applicable tests as specified in 4.5:

<u>Item Number</u>	<u>Description</u>
1.	Vacuum tube ac rms voltmeters, accuracy $\pm$ 1 percent of full scale.
2.	AC rms ammeters, accuracy $\pm$ 1 percent of full scale.
3.	AC voltmeters dynamometer type, accuracy $\pm$ 1/2 percent of full scale.
4.	AC wattmeters, dynamometer type, $\pm$ 20 percent power factor, accuracy $\pm$ 2 percent of full scale.
5.	Kelvin type resistance bridge.
6.	Wheatstone type resistance bridge.
7.	Oscilloscope, dual trace (two channel or switched): low frequency
8.	Megohmmeter, accuracy $\pm$ 10 percent at 10,000 megohms.
9.	Dielectric strength (hi - pot) tester to operate at 60 cps, see paragraph 4.5.2.1.4.
10.	Variable frequency generator, accuracy $\pm$ 5 percent.

4.5 Test methods and procedures.

4.5.1 Environmental.

4.5.1.1 Vibration.- The vibration test shall be made on a device with means provided for measuring and controlling the direction of vibration and adjusting the amplitudes and frequencies to keep them within the specified limits of 3.3.1. The measuring instruments of the testing device shall be capable of measuring the vibration amplitude within plus or minus 5 percent, and capable of measuring the frequency within plus or minus 2 percent. The test shall be performed in accordance with the requirements specified in 3.3.1 with the transformer rigidly mounted in its normal operating position. Subsequent to the vibration test, the unit shall show no damage or defect resulting from the test when examined by visual and tactile means. The unit shall then be inspected as specified in 4.5.1.2 prior to determining compliance with requirements specified under 3.4.

4.5.1.2 Shock.- This test shall be conducted in accordance with the conditions of 3.3.2 and Procedure II of the shock test defined in MIL-F-13926 except that impact shocks shall not exceed 5G's. The transformer shall be subsequently inspected for physical damage or defects in compliance with 3.3.2. The unit shall then be inspected as specified in 4.5.1.3 prior to determining compliance with the requirements of 3.4 as required by 3.3.2.

4.5.1.3 Humidity.

4.5.1.3.1 Non-operating.- This test shall be conducted in accordance with the conditions in 3.3.4.2 and the humidity test defined in Procedure I of MIL-F-13926 except that the 4-1/2 hour period shall be reduced to 2 hours, the 6 hour period reduced to 2 hours, and the total test period shall not exceed 5.5 hours per cycle. The unit shall then be thoroughly dried and then subjected to the test in 4.5.1.3.2 prior to meeting the specified requirements of 3.4 as required by 3.3.4.2.

4.5.1.3.2 Operating.- This test shall be conducted in accordance with the conditions in 3.3.4.1 and the humidity test defined in Procedure III of MIL-F-13926 except that the humidity shall be maintained at  $97 \pm 5$  percent for the 24 hour period and the test shall cease at the end of that period (Method 106 of MIL-STD-202 shall be excluded). Throughout the test the unit shall be operated in accordance with 4.5.2 to determine compliance with 3.3.4.1.

4.5.1.4 Temperature.-(operating and storage): After being subjected to all environmental tests specified above, the unit shall be subjected to Test Procedure I specified in MIL-F-13926, except the temperatures specified in 3.3.3 shall apply. While at the operating temperature of 3.3.3.1 the unit shall be tested in accordance with 4.5.1.4 to determine compliance with the requirements of 3.4 as required by 3.3.3.1. The temperature shall then be returned to standard temperature (60° to 90°F) and the unit shall be tested in accordance with 4.5.2 to determine compliance with 3.3.3.2.

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4.5.1.5 Fungus. - To determine compliance with 3.3.5, one of the first 5 transformers produced shall be submitted for testing in accordance with the fungus test defined in MIL-F-13926. After approval, subsequent acceptance for fungus requirements may be by certification.

4.5.2 Performance. - The transformer shall be tested for conformance with the general test requirements of MIL-T-27 and this specification for conformance with 3.2 and 3.4.

4.5.2.1 Primary. - The watts loss (no load) and no load currents shall be determined by using the circuit and equipment characteristics shown in Figure 1 to measure watts loss (no load) and no load (exciting) current. Apply 208 volts, 400 cps, 3 phase, to terminals 1-2-3, with all secondary windings open circuited. Values of watts loss obtained after subtracting instrument losses, and no load current, shall be within the limits defined in 3.4.1.

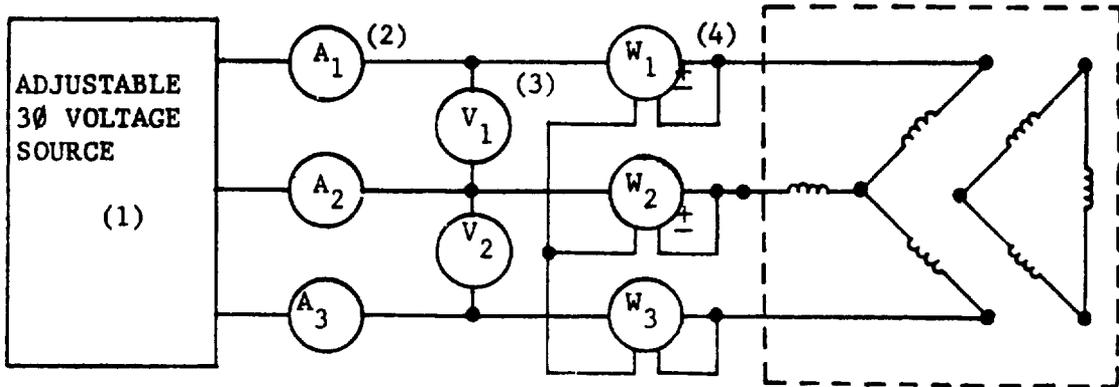
4.5.2.1.1 D.C. resistance test. - The dc resistance shall be measured on a resistance bridge of the type specified for the applicable resistance range as listed below, and shall be within the limits defined in 3.4.1 and 3.4.2.

- (a) For 0.01 ohm to 1.0 ohm, use Kelvin type bridge.
- (b) For 1.0 ohm to 1000 ohms, use Wheatstone type bridge.

4.5.2.1.2 Voltage ratio, no load test. - Apply  $208 \pm 2$  volts rms,  $400 \pm 4$  cps, 3 phase to terminals 1-2-3. The secondary no load voltages shall be measured with an electronic, rms voltmeter of  $\pm 1$  percent accuracy or better and shall be within the limits tabulated in 3.4.2.

4.5.2.1.3 Insulation resistance test. - This test shall be made using a source potential of  $500 \pm 10$  vdc and a megohmmeter having an accuracy of  $\pm 10$  percent or better. The resistance shall be 10,000 megohms or more between each winding and the other windings and mounting inserts connected together to conform to the requirement of 3.4.3. The voltage shall be applied for a period not to exceed 1 minute.

4.5.2.1.4 Dielectric strength test. - This test shall be performed in accordance with the dielectric strength test of Specification MIL-T-27, after the transformer has been encapsulated, and shall meet the requirements of 3.4.4 of this specification. All tests shall be made by means of equipment expressly designed for high potential testing. The equipment shall include a calibrated leakage current indicator. Indications of leakage current on the 60 cycle dielectric strength test equipment (when adjusted per manufacturer's recommendations) shall establish the need for further diagnostic tests such as DC dielectric strength test (set to 1.4 times the required AC test voltage) or DC leakage current tests performed at the same peak voltage level as the dielectric strength test. The additional tests shall be considered as final authority for acceptance or rejection of units that have indications of AC leakage current. AC leakage current can be expected on this transformer because of the electrostatic shields.



#### EQUIPMENT CHARACTERISTICS

- (1) Regulate  $\pm 1\%$  for line variations, regulation of output frequency  $\pm 1\%$ , harmonic content not in excess of 3%, phase voltage  $\pm 2\%$ .
- (2)  $A_1, A_2, A_3$  Accuracy  $\pm 2\%$  of full scale, ammeters.
- (3)  $V_1$  &  $V_2$  Dynamometer type,  $\pm 1/2\%$  full scale, voltmeters.
- (4)  $W_1, W_2, W_3$  Dynamometer type,  $\pm 20\%$  power factor, accuracy  $\pm 2\%$  full scale, wattmeters.

NOTE: The full scale ranges of the instruments shall be suitable for the requirements of paragraph 3A.1.

#### THREE PHASE

#### WATTS LOSS AND EXCITING CURRENT

#### TEST CIRCUIT

FIGURE 1

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4.5.2.1.5 Induced voltage test.- With all other windings open-circuited, gradually apply 416 volts  $\pm$  2 percent, 800 cps minimum to terminals 1-2-3. The voltage shall be applied for 9 seconds minimum. During the application of voltage the input current shall be monitored for fluctuation or for noise which shall be cause for rejection of the transformer as required in 3.4.5.

4.5.2.1.6 Electro-static shield test.- This test shall be conducted in accordance with the electrostatic shielding test of MIL-T-27. The ratio of generator voltage applied with switch closed, to the voltage applied with switch open, shall be 4 to 1 or greater at generator frequency of 20 Kc as specified in 3.4.6. Voltage applied shall not exceed 400 volts rms.

**5. PREPARATION FOR DELIVERY**

5.1 Packaging, packing and marking.- Packaging, packing and marking shall be in accordance with MIL-P-14232 and Packaging Data Sheet MIL-P-14232/Pl0525900. The level of protection shall be as specified in the procurement document.

**6. NOTES**

6.1 Intended use.- The transformer supplies voltages required for the +165, +35 and +15 volt series voltage regulators of the Computer, Gun Direction M18.

6.2 Ordering data.- Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Applicable packaging data sheet (see 5.1).
- (c) Selection of applicable level of preservation, packaging and packing.
- (d) A block of serial numbers to identify each transformer.

Custodian:

Army - MU

Preparing activity:

Army - MU

Project No. 5950-A014