

INCH-POUND

MIL-PRF-1/1361F
19 July 1999
SUPERSEDING
MIL-E-1/1361E
1 July 1976

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, THYRATRON
TYPES 7390 AND 7390A

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

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

DESCRIPTION: Triode, hydrogen, ceramic-metal.

See figures 1 and 1A.

Mounting position: Vertical, base down.

Weight: 9 pounds (4.1 kilograms) nominal.

ABSOLUTE RATINGS:

| | | | | | | | | | | |
|------------------|------|---------------|--------------|-------|-----------|-----|------|-------|------|------|
| Parameter: | Ef | epy | epx | Ebb | egy | egx | Ecc | ib | lb | lp |
| Unit: | V ac | kv | kv | kV dc | v | v | V dc | a | A dc | A ac |
| Maximum: | 6.6 | 3.3 <u>1/</u> | 33 <u>2/</u> | --- | <u>3/</u> | 650 | --- | 2,000 | 4.0 | 72 |
| Minimum: | 6.0 | 7 | 5% epy | 3.5 | --- | --- | --- | --- | --- | --- |
| Test conditions: | 6.3 | 3.3 | --- | --- | 1,100 | --- | 0 | --- | --- | --- |

ABSOLUTE RATINGS:

| | | | | | | | | | |
|------------------|---------|-----|------------|------------------|-----------|--------------|-----------|---------------|------|
| Parameter: | tj | pr | dik/dt | Pb | tk | TA | Cooling | Eres | Ires |
| Unit: | μ s | --- | a/ μ s | --- | sec | $^{\circ}$ C | --- | V ac | A ac |
| Maximum: | 0.01 | --- | 10,000 | 30×10^9 | <u>5/</u> | +75 | <u>6/</u> | 5.5 <u>8/</u> | 12 |
| Minimum: | --- | --- | --- | --- | 900 | -55 | --- | 3.5 | --- |
| Test conditions: | --- | 465 | --- | --- | 900 | --- | <u>7/</u> | <u>9/</u> | --- |

See footnotes at end of table I.

GENERAL:

Qualification: Required.

MIL-PRF-1/1361F

TABLE I. Testing and inspection.

| Inspection | Method | Notes | Conditions | Acceptance level | Inspection level or code | Symbol | Limits | | Unit |
|---|--------|---------------------------|---|------------------|--------------------------|--------|--------|-------|------|
| | | | | | | | Min | Max | |
| <u>Qualification inspection</u> | | | | | | | | | |
| Operation at elevated ambient temperature | 3246 | <u>7/ 10/ 12/</u> | TA = 75°C, except t = 5 hours | --- | --- | egy | --- | 1,100 | v |
| Life test (2) | --- | <u>7/ 13/ 14/</u> | epy = 25 kv; prr = 740; lb = 4.0 A dc (min); egy = 1,200 v; Zg = 50 ohms (min); t = 500 hours | --- | --- | --- | --- | --- | --- |
| Life-test (2) end points: | --- | | | | | | | | |
| Operation (1) | 3246 | --- | Zg = 50 ohms (min) | --- | --- | egy | --- | 1,200 | v |
| DC anode voltage for conduction (1) | 3247 | --- | egy = 1,200 v; Zg = 50 ohms (min) | --- | --- | Ebb | --- | 3,000 | V dc |
| Time jitter | 3261 | --- | egy = 1,200 v; Zg = 50 ohms (min) | --- | --- | tj | --- | 0.01 | μs |
| <u>Conformance inspection, part 1</u> | | | | | | | | | |
| Heater current (cathode) | 3241 | --- | | 0.65 | II | If | 22 | 35 | A ac |
| Heater current (reservoir) | 3241 | --- | Eres = 4.5 V ac | 0.65 | II | Ires | 8 | 10.0 | A ac |
| DC anode voltage for conduction (1) | 3247 | <u>15/</u> | Eres = 105 percent of optimum value | 0.65 | II | Ebb | --- | 2,500 | V dc |
| Instantaneous starting | 3267 | <u>7/ 10/ 16/</u> | Eres = 105 percent of optimum reservoir voltage; epy = 24 kv (min) | 0.65 | II | --- | --- | --- | --- |
| Operation (1) | 3246 | <u>7/ 10/ 11/ 17/ 18/</u> | epy = 36 kv; t = 1 hour | 0.65 | II | egy | --- | 1,100 | v |
| Operation of optimum reservoir voltage | 3246 | --- | Operation (1) | 0.65 | II | Eres | 3.5 | 5.5 | V ac |
| Pulse emission (method A) | 3251 | <u>20/</u> | ik = 2,000 a; tp = 5.0 μs ± 10 percent; prr = 60 ± 10 percent; tr = 0.5 μs (max) | 0.65 | II | egk | --- | 300 | v |

See footnotes at end of table.

MIL-PRF-1/1361F

TABLE I. Testing and inspection - Continued.

| Inspection | Method | Notes | Conditions | Acceptance level | Inspection level or code | Symbol | Limits | | Unit |
|---------------------------------------|--------|-----------------------|--|------------------|--------------------------|--------|--------|-------|------|
| | | | | | | | Min | Max | |
| <u>Conformance inspection, part 2</u> | | | | | | | | | |
| Vibration | --- | <u>24/</u> | MIL-STD-202, method 201 | --- | --- | --- | --- | --- | --- |
| Shock, specified pulse | 1042 | <u>4/ 24/</u> | | --- | --- | --- | --- | --- | --- |
| DC anode voltage for conduction (2) | 3247 | <u>21/</u> | Eres = 95 percent of optimum value | --- | --- | Ebb | --- | 2,500 | V dc |
| Operation (1A) | 3246 | <u>7/ 18/ 19/ 22/</u> | Operation (1) | --- | --- | egy | --- | 1,100 | v |
| Operation (2) | 3246 | <u>7/ 13/ 17/ 18/</u> | epy = 25 kv; t = 1 hour; prf = 740; Ib = 4.0 A (min) | --- | --- | egy | --- | 1,100 | v |
| Operation (2A) | 3246 | <u>7/ 18/ 22/</u> | Operation (2) | --- | --- | egy | --- | 1,100 | v |
| Anode delay time | 3256 | --- | Operation (1A); t = 2 minutes | --- | --- | tad | --- | 1.0 | μs |
| Anode delay time drift | 3256 | <u>23/</u> | Anode delay time | --- | --- | Δtad | --- | 0.1 | μs |
| Time jitter | 3261 | --- | Operation (1A), except epy = 7.0 kv; tj measured after 60 minutes of operation | --- | --- | tj | --- | 0.01 | μs |
| <u>Conformance inspection, part 3</u> | | | | | | | | | |
| Life test | --- | <u>7/ 10/ 14/</u> | Group C; epy = 1,200 v; Zg = 50 ohms (min); t = 500 hours | --- | --- | --- | --- | --- | --- |
| Life-test end points: | --- | | | | | | | | |
| Operation (1) | 3246 | --- | Zg = 50 ohms (min) | --- | --- | egy | --- | 1,200 | v |
| DC anode voltage for conduction (1) | 3247 | --- | egy = 1,200 v; Zg = 50 ohms (min) | --- | --- | Ebb | --- | 3,000 | V dc |
| Time jitter | 3261 | --- | egy = 1,200 v; Zg = 50 ohms (min) | --- | --- | tj | --- | 0.01 | μs |

See footnotes at top of next page.

TABLE I. Testing and inspection - Continued.

- 1/ Instantaneous starting is not recommended. When it is necessary, the maximum permissible epy is 22 kv and it shall not be attained in less than 0.04 second.
- 2/ In pulsed operation, the peak inverse voltage shall not exceed 5.0 kv during the first 25 μ s following the pulse.
- 3/ The driver pulse, measured at the tube socket with thyatron grid disconnected: 1,300 volts minimum; 2,500 volts maximum; $t_r = 0.35 \mu$ s maximum; grid pulse duration 2.0 μ s minimum. Impedance of drive circuit 10 to 25 ohms.
- 4/ Shock tests shall be performed in accordance with MIL-STD-202, method 213, except as noted. The tube shall be mounted on suitable rigid fixtures in the positions described below by means of its mounting flange. The tube shall not be clamped, braced, or supported by means other than its mounting flange.

The tube shall be subjected to three blows in each of the following positions:

| <u>Position of tube in elevator assembly</u> | <u>Intensity and duration of blow</u> |
|--|---------------------------------------|
| Vertical: Base down | 80 G, 11 ms, half-sine shock pulse |
| Horizontal: Center line through heater terminals, vertical | 60 G, 11 ms, half-sine shock pulse |
| Horizontal: Center line through heater terminals, horizontal | 60 G, 11 ms, half-sine shock pulse |

The tests shall be performed with both heater and reservoir at substantially full operation temperatures. Means for detecting heater current variations and shorts between anode and grid and between grid and cathode shall be provided. No temporary or permanent changes in heater or reservoir currents or temporary or permanent shorts between electrodes shall occur.

- 5/ Standby operation, with heater and reservoir voltage on, is not recommended. Where standby operation is necessary, provisions shall be made to operate the tube at full equipment conditions for a minimum of 2 hours during each 12-hour period of standby.
- 6/ Maintain grid seal temperature within 225°C above ambient temperature by blower directed at seal and lower ceramic cylinder. Approximately 15 cfm of air is required at rated power levels.
- 7/ Approximately 15 cfm of air may be directed at grid seal and lower envelope.
- 8/ The optimum reservoir voltage for operation in accordance with operation (1) conditions is inscribed on the base of the tube and must be held within ± 2.5 percent. Applications involving other operation conditions will necessitate the redetermination of the optimum reservoir voltage.
- 9/ Adjust reservoir voltage to value indicated on the tube within ± 5 percent, except as otherwise specified.
- 10/ The anode circuit constants shall be chosen so that at epy = 33.0 kv; under resonant charging conditions; $i_b = 2,000$ a minimum; dik/dt shall be 10,000a/ μ s minimum; $t_p = 2.5 \pm 10$ percent μ s; $prr = 500$ minimum. Grid pulse measured at tube socket with thyatron grid disconnected: $t_r = 0.35 \mu$ s minimum, $t_p = 2.0 \mu$ s maximum; internal impedance of driver: 75 ohms minimum.
- 11/ This test is to be the first test performed at the conclusion of the instantaneous starting test.
- 12/ The tube shall be capable of operating under the following conditions:
 - a. Apply cathode heater voltage and adjust reservoir voltage to 95 percent of the optimum reservoir voltage and allow both to warmup for 15 minutes.
 - b. Raise anode voltage directly to the specified voltage at a rate of not less than 30 kv per minute.
 - c. The tube shall operate at the specified anode voltage for a total of 2 hours which may include one interruption. A total of four interruptions at any anode voltage is permitted provided that the total test time required to perform this part of the operation test does not exceed 135 minutes.
 - d. After the above operation is at full anode voltage, increase the reservoir to 105 percent of the optimum value. The tube shall continue to operate for an additional 2 hours with not more than one interruption.
 - e. After the above operation at full anode voltage, decrease the reservoir voltage to optimum value. The tube shall continue to operate for an additional hour without interruption.

TABLE I. Testing and inspection - Continued.

- 13/ The anode circuit constants shall be chosen so that at $e_{py} = 25.0$ kv under resonant charging conditions; $i_b = 1,000$ a minimum; rate of rise of dik/dt shall be $5,000$ a/ μ s minimum; $t_p = 5.0 \pm 10$ percent μ s; $prr = 500$ minimum. Grid pulse measured at tube socket with thyatron grid disconnected: $t_r = 0.35$ μ s minimum; $t_p = 2.0$ μ s maximum; internal impedance of driver: 75 ohms minimum.
- 14/ During every 96-hour period, the life test shall be shut off for a minimum of 30 minutes.
- 15/ This test shall be conducted within 60 seconds after the operation (1) test.
- 16/ The tube shall operate satisfactorily on pushbutton starting within three attempts when the e_{py} is applied to the tube under test in such a manner as to rise from 0 to 24 kv minimum within 0.04 second. (The filter in the rectifier shall be designed so that the e_{py} reaches at least 9.0 kv within 0.015 second.) Any tube failing to start within three attempts will be considered a failure.
- 17/ The tube shall be capable of operating under the following conditions:
- Apply cathode heater voltage and adjust reservoir voltage to 105 percent of the optimum value and allow both cathode and reservoir to warmup for 15 minutes.
 - Raise anode voltage directly to the specified voltage at the rate of not less than 30 kv per minute.
 - The tube shall operate at the specified anode voltage for a total of 60 minutes which may include one interruption. A total of six interruptions at any anode voltage is permitted provided that the total test time required to perform the operation test does not exceed 120 minutes.
- 18/ No anode or grid voltage other than that required for an instantaneous start test shall have been applied to the tube for a minimum period of 2 hours prior to this test.
- 19/ Type 7390A only.
- The temperature indicator shall be such that a green field is visible in the indicator window when the tube is operating properly within its ratings and a red field indicated when conditions exist that produce deleterious anode hearing.
 - During operation (1A), the thermometer shall indicate the green background throughout the test, and the dividing line between the green and red zones shall be at least .188 inch (4.77 mm) to the right of the pointer at the center of the windows.
 - Any external forced-air cooling of the tube shall be directed on the tube in such a manner that it will not affect the calibration of the temperature indicator.
- 20/ Measure the voltage between grid and cathode not more than 2.5 μ s maximum after the beginning of the current pulse. The average voltage shall not rise during the last 4.0 μ s.
- 21/ This test shall be conducted within 60 seconds after the operation (1A) test.
- 22/ The tube shall be capable of operating at the following conditions:
- Apply cathode heater voltage and adjust reservoir voltage to 95 percent of the optimum reservoir voltage and allow both to warmup for 15 minutes.
 - Raise anode voltage directly to the specified voltage at a rate of not less than 30 kv per minute.
 - The tube shall operate at the specified anode voltage for a total of 60 minutes which may include one interruption. A total of six interruptions at any anode voltage is permitted provided that the total test time required to perform the operation test does not exceed 120 minutes.
- 23/ During the interval between 2 and 60 minutes of the anode delay time test, the Δt_{ad} relative to the t_{ad} value observed on the anode delay time shall not exceed the specified value.
- 24/ Tube shall be vibrated as described for 2 hours each in the vertical direction, in the horizontal direction parallel to the heater connections, and in the horizontal direction perpendicular to the heater connections. After shock and vibration tests, the tube shall meet all the conformance inspection, part 1 and part 2, test requirements except the provisions of 19/. An aging period not to exceed 1 hour is permitted after mechanical tests.

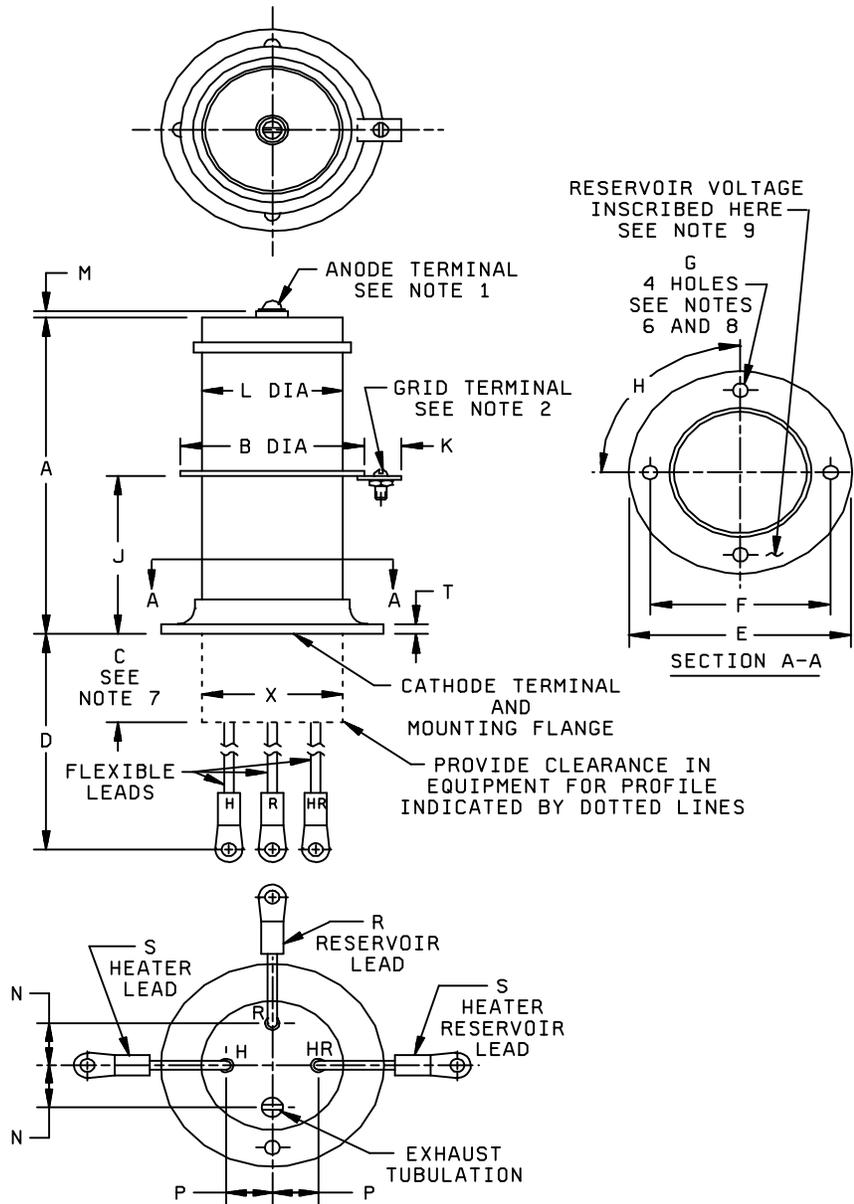


FIGURE 1. Outline drawing of electron tube type 7390.

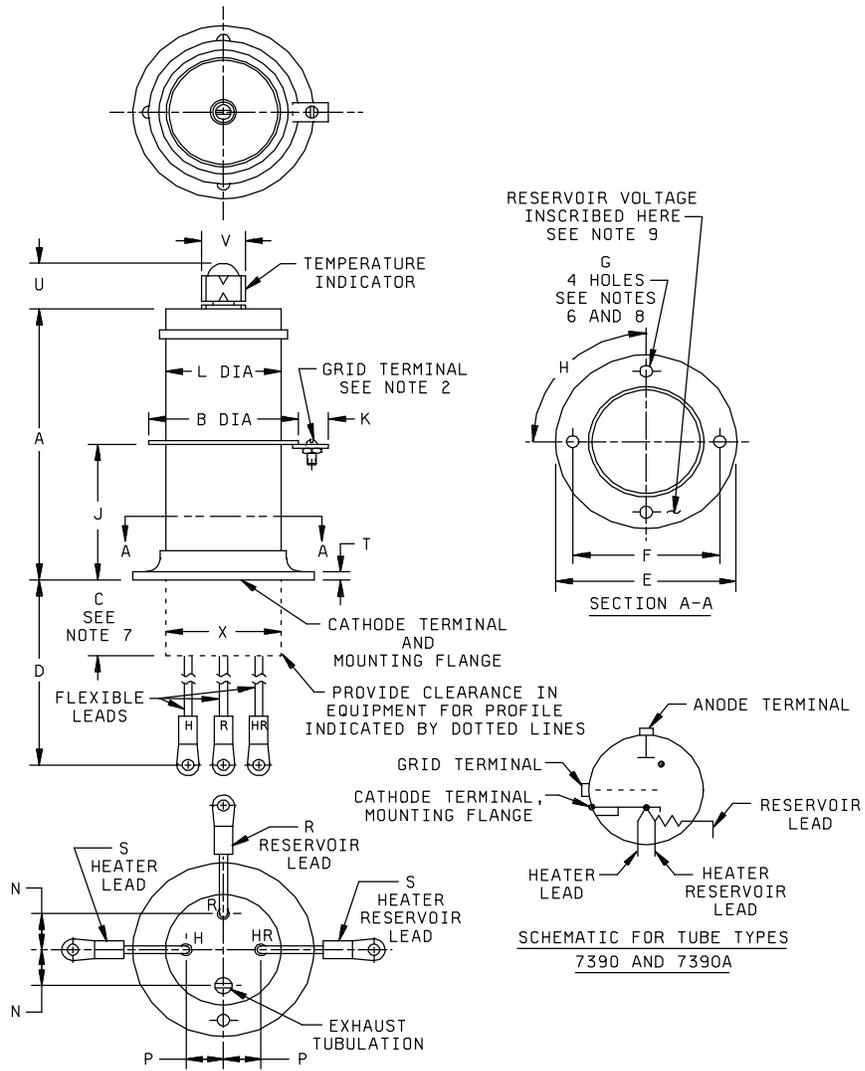


FIGURE 1A. Outline drawing of electron tube type 7390A.

MIL-PRF-1/1361F

| Ltr | Dimensions | | | |
|---|--------------------------------------|--------|-------------|--------|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| Conformance inspection, part 2 | | | | |
| A | 8.000 | 10.500 | 203.20 | 266.70 |
| B | --- | 5.625 | --- | 142.88 |
| D | 9.500 | 10.500 | 241.30 | 266.70 |
| E | 5.938 | 6.063 | 150.83 | 154.00 |
| F | 5.324 | 5.364 | 135.23 | 136.25 |
| U | --- | 2.500 | --- | 63.50 |
| V | --- | 1.500 | --- | 38.10 |
| Conformance inspection, part 3 (see note 10) | | | | |
| C | --- | 3.000 | --- | 76.20 |
| G | .307 | .323 | 7.80 | 8.20 |
| J | 3.750 | 5.750 | 95.25 | 146.05 |
| K | --- | .500 | --- | 12.70 |
| L | 4.375 | 4.625 | 111.13 | 117.48 |
| M | --- | .375 | --- | 9.53 |
| N | .875 | 1.875 | 22.23 | 47.63 |
| P | 1.000 | 2.000 | 25.40 | 50.80 |
| X | --- | 4.563 | --- | 115.90 |
| Reference dimensions | | | | |
| H | 89°30' | 90°30' | 89°30' | 90°30' |
| R | 5,000 CM (see notes 3, 4, and 5) | | | |
| S | 10,000 CM (see notes 3, 4, 5, and 6) | | | |
| T | .125 | | 3.18 | |

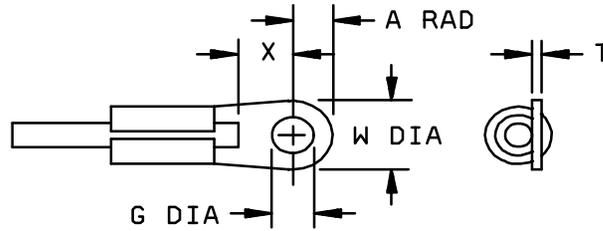
NOTES:

- Anode terminal shall be .25-20UNC-2A roundhead machine screw .50 inch (12.7 mm) long with washer .250 inch (6.35 mm) clearance diameter and .50 inch (12.7 mm) outside diameter.
- Grid terminal shall be 6-32UNC-2A roundhead machine screw .50 inch (12.7 mm) long with washer, .188 inch (4.77 mm) inside diameter and .375 inch (9.53 mm) outside diameter, and with 6-32UNC-2B hex nut.
- Lead terminals shall be in accordance with figure 2.
- Insulation sleeving shall be as specified in MIL-PRF-3190.
- Leads shall be flexible. Dimensions S and R define cross sectional area of lead conductors. Lead connections shall be suitably identified. Lead connections, lead identification, lead insulation, and lead insulation sleeving shall be inspected under qualification and shall be as follows:

| <u>Lead</u> | <u>Color</u> | <u>Lead insulation Type</u> | <u>Sleeving color</u> |
|-----------------------|--------------|-----------------------------|-----------------------|
| H (heater) | Yellow | HA-1 | Other than black |
| HR (heater-reservoir) | Yellow | HA-1 | Black |
| R (reservoir) | Red | HA-1 | Other than black |

- Heater leads, 2 mounting holes as applicable, and grid terminals shall be aligned within $\pm 10^\circ$.
- Dimension C and X defines extent of rigid portion of tube below mounting flange. Clearance for this part of tube shall be provided in equipment.
- Holes G shall be inspected for orientation by using the base gauge outlined on figure 3.
- The optimum reservoir voltage shall be inscribed permanently on the top surface of mounting flange, as shown.
- Dimensions shall be checked during the initial production and once each succeeding 12-calendar months in which there is production. A regular double sampling plan shall be used, with the first sample of three tubes with an acceptance number of zero, and a second sample of three tubes with a combined acceptance number of one. In the event of failure, the test will be made as a part of conformance inspection, part 2, code level D, with an acceptance level of 6.5. The regular "12-calendar month" double sampling plan shall be reinstated after three consecutive samples have been accepted.

FIGURES 1 AND 1A. Outline drawing of electron tube types 7390 and 7390A - Continued.

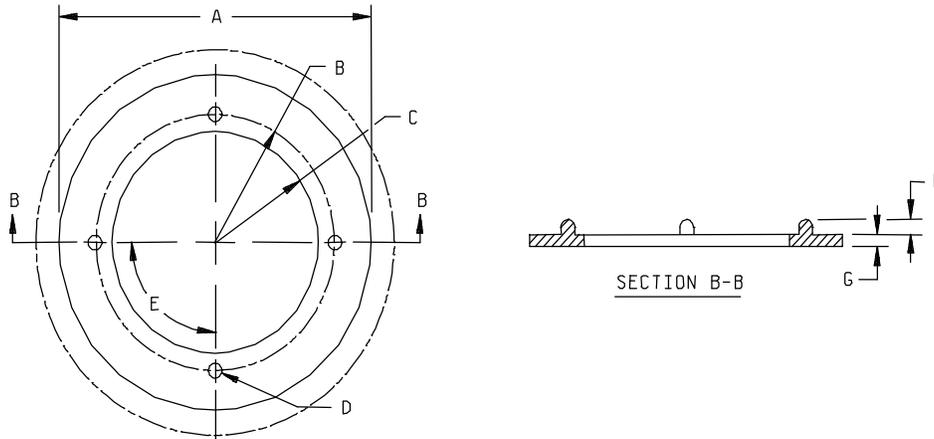


| Lead | Lug designations | G | | | | W | | A | | X | | T | |
|---------------|------------------|--------|------|-------------|------|------|-------|------|------|------|------|------|------|
| | | Inches | | Millimeters | | In. | mm | In. | mm | In. | mm | In. | mm |
| | | Min | Max | Min | Max | Max | Max | Max | Max | Min | Min | Max | Max |
| Reservoir | #10 | .187 | .207 | 4.75 | 5.26 | .395 | 10.03 | .200 | 5.08 | .275 | 6.99 | .060 | 1.52 |
| Heater-reserv | 1/4 | .260 | .313 | 6.60 | 7.95 | .605 | 15.37 | .305 | 7.75 | .380 | 9.65 | .060 | 1.52 |
| Heater | 1/4 | .260 | .313 | 6.60 | 7.95 | .605 | 15.37 | .305 | 7.75 | .380 | 9.65 | .060 | 1.52 |

NOTES:

1. Dimensions are in inches.
2. There shall be no obstruction within the distance X from the center of the lug screw hole.
3. Lugs or terminals shall be permanently marked as follows: H (heater), HR (heater-reservoir), and R (reservoir).

FIGURE 2. Pressure type terminal lugs with insulating sleeves.



NOTES:

1. Dimension are in inches.
2. Metric equivalentents are provided using 1.00 inch = 25.4 mm.

| Ltr | Dimensions | | | |
|-----|------------|-----------|-------------|----------|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | 7.000 DIA | | 177.80 DIA | |
| B | 2.671 R | 2.673 R | 67.84 R | 67.89 R |
| C | 2.312 R | 2.314 R | 58.72 R | 58.77 |
| D | .2765 DIA | .2775 DIA | 7.02 DIA | 7.05 DIA |
| E | 88° | 92° | 88° | 92° |
| F | .296 | .328 | 7.52 | 8.33 |
| G | .250 STOCK | | 6.25 STOCK | |

FIGURE 3. Base gauge for electron tube types 7390 and 7390A.

MIL-PRF-1/1361F

Custodians:

Army - CR
Navy - EC
Air Force - 11
DLA - CC

Review activities:

Army - AR
Navy - AS, CG
Air Force - 17, 99

Preparing activity:

DLA - CC

(Project 5960-3546-13)