# SYLVANIA engineering data service 5643

## MECHANICAL DATA

| | |
|---|---|
| Bulb | T-3 |
| Base | E8-10, Subminiature Button Flexible Leads |
| Outline | JETEC 3-1 |
| Basing | 8DD |
| Cathode | Coated Unipotential |
| Mounting Position | Any |

### RATINGS[1] (Absolute Maximum)

| | |
|---|---|
| Impact Acceleration | 450 G |
| Uniform Acceleration | 1000 G |
| Fatigue (Vibrational Acceleration for Extended Periods) | 2.5 G |
| Bulb Temperature | 125° C Max. |
| | −55° C Min. |
| Altitude[2] | 80000 Ft. |

## ELECTRICAL DATA

### HEATER CHARACTERISTICS

| | Min. | Bogey | Max. | |
|---|---|---|---|---|
| Heater Voltage[3] | 6.0 | 6.3 | 6.6 | V |
| Heater Current | | 150 | | mA |

### DIRECT INTERELECTRODE CAPACITANCES

| | Shielded[4] | Unshielded |
|---|---|---|
| Grid No. 1 to Anode | 0.08 | 0.11 μμf |
| Grid No. 1 to All Other Electrodes | 1.70 | 1.60 μμf |
| Anode to All Other Electrodes | 1.60 | 1.50 μμf |

### RATINGS[1 & 5] (Absolute Maximum — Except as Noted)

| | |
|---|---|
| Absolute Minimum Cathode Heating Time | 10 Seconds |
| Peak Forward Anode Voltage | 500 v |
| Peak Inverse Anode Voltage | 500 v |
| Negative Grid No. 1 Voltage | |
| Before Conduction | 200 Vdc |
| During Conduction | 10 Vdc |
| Negative Grid No. 2 Voltage | |
| Before Conduction | 100 Vdc |
| During Conduction | 10 Vdc |
| Cathode Current | 16 mAdc |
| Peak Plate Current[6] | 100 ma |
| Peak Heater-Cathode Voltage | |
| Heater Positive with Respect to Cathode | 25 v |
| Heater Negative with Respect to Cathode | 100 v |
| Grid No. 1 Resistor | 10 Meg |

### CHARACTERISTICS

| | |
|---|---|
| Tube Voltage Drop for Ib = 20 mAdc | 10 Vdc |

### TYPICAL OPERATING CONDITIONS

| | |
|---|---|
| Anode Voltage | 150 Vac |
| Grid No. 2 Voltage[7] | 0 Vac |
| Grid No. 1 Voltage[8] | 5.0 Vac |
| Peak Grid No. 1 Signal Voltage | 5.0 v |
| Anode Resistor | 3750 Ohms |
| Grid No. 1 Resistor | 1.0 Meg |

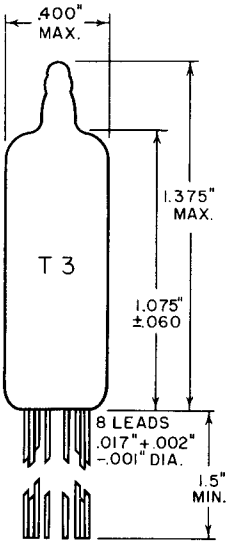
### NOTES:

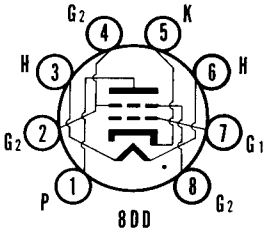
1. *Limitations beyond which normal tube performance and tube life may be impaired.*
2. *If altitude rating is exceeded, reduction of instantaneous voltages (Ef excluded) may be required.*
3. *Tube life and reliability of performance are directly related to the degree of regulation of the heater voltage to its center rated value of 6.3 volts.*
4. *External shield of 0.405 inch diameter connected to cathode.*
5. *Values shown are as registered with RETMA.*
6. *Averaged over three seconds maximum.*
7. *The No. 2 grid shall not be used for control purposes.*
8. *Bias voltage, 180° out of phase with anode voltage.*

## QUICK REFERENCE DATA

The Premium Subminiature Type 5643 is a tetrode thyratron designed for use in counters, control circuits, as a grid-controlled rectifier and other light duty applications under conditions of severe shock, vibration, high temperature and high altitude.

The Sylvania Type 5643 is manufactured to meet the applicable specification for reliable operation.




SYLVANIA ELECTRIC PRODUCTS INC.

RADIO TUBE DIVISION
EMPORIUM, PA.

*Prepared and Released By The*
*TECHNICAL PUBLICATIONS SECTION*
*EMPORIUM, PENNSYLVANIA*
FEBRUARY 1957

# ACCEPTANCE CRITERIA

**Test Conditions**

Heater Voltage . . . . . 6.3 V
Grid No. 2 Voltage . . . . . 0 V
Heater-Cathode Voltage . . . . . 0 V

For the purposes of inspection, use applicable reliable paragraphs of MIL-E-1 and Inspection Instructions for Electron Tubes.

| MIL-E-1 Ref. | Test | AQL (%) | Limits | | | | | Units |
|---|---|---|---|---|---|---|---|---|
| | | | Min. | LAL | Bogey | UAL | Max. | |
| **Measurements Acceptance Tests, Part 1, Note 1** | | | | | | | | |
| 4.1.1.7<br>4.10.8 | (Method A)<br>Heater Current: ALD = 12 | — | — | 144 | 150 | 156 | — | mA |
| 4.10.8 | Heater Current: | 0.65 | 140 | — | — | — | 160 | mA |
| 4.10.15 | Heater-Cathode Leakage: | 0.65 | — | — | — | — | — | |
| | Ehk = +25 Vdc | — | — | — | — | — | 10 | μAdc |
| | Ehk = —100 Vdc | — | — | — | — | — | 10 | μAdc |
| 4.10.17.1 | Grid Voltage (1):<br>Epp = 350 Vac; Rg1 = 0.1 Meg;<br>Rp = 10,000 Ohms | 0.65 | -2.0 | — | — | — | -4.0 | Vdc |
| 4.10.17.1 | Grid Voltage (2):<br>Epp = 350 Vac; Rg1 = 10 Meg;<br>Rp = 10,000 Ohms | 0.65 | — | — | — | — | -6.0 | Vdc |
| 4.10.17.2 | Anode Voltage:<br>Vary Ebb; Ec1 = O V; Rg1 = 0.1 Meg;<br>Rp = 10,000 Ohms | 0.65 | — | — | — | — | 26 | Vdc |
| 4.7.5. | Continuity and Shorts (Inoperatives): | 0.4 | — | — | — | — | — | |
| 4.9.1 | Mechanical:<br>Envelope (8-1) | — | — | — | — | — | — | |
| **Measurements Acceptance Tests, Part 2** | | | | | | | | |
| 4.10.24 | Pulse Emission:<br>epy = eg1 = eg2 = 180 ±9 v; tp = 5 ±0.25 μs; tr = 0.5 μs max.; tf = 1.0 μs max.; prr = 120 ±5 pps; tk = 5 sec min.;<br>Ra = 150 Ohms ±5%, noninductive;<br>Rp = 100 Ohms ±5%, noninductive;<br>Dummy = 50 Ohms ±5%, noninductive | 2.5 | — | — | — | — | 76 | v |
| 4.9.20.3 | Vibration:<br>No Voltages; Post Shock and Fatigue Test End Points Apply | 10.0 | — | — | — | — | — | |
| **Degradation Rate Acceptance Tests, Note 3** | | | | | | | | |
| 4.9.5.3 | Subminiature Lead Fatigue: | 2.5 | 4 | — | — | — | — | arcs |
| 4.9.20.5 | Shock:<br>Hammer Angle = 30° | — | — | — | — | — | — | |
| 4.9.20.6 | Fatigue:<br>Fixed Frequency; F = 25 min., 60 max. | 6.5 | — | — | — | — | — | |
| - - - - | Post Shock and Fatigue Test End Points:<br>Heater-Cathode Leakage | | | | | | | |
| | Heater Positive | — | — | — | — | — | 20 | μAdc |
| | Heater Negative | — | — | — | — | — | 20 | μAdc |
| | Anode Voltage | — | — | — | — | — | 26 | Vdc |
| 4.9.6.3 | Glass Strain: | 6.5 | — | — | — | — | — | |

## ACCEPTANCE CRITERIA (Continued)

| MIL-E-1 Ref. | Test | AQL (%) | Allowable Defectives per Characteristic | | Limits | | Units |
|---|---|---|---|---|---|---|---|
| | | | 1st Sample | Combined Samples | Min. | Max. | |
| **Acceptance Life Tests, Note 3** | | | | | | | |
| 4.11.7 | Heater Cycling Life Test:<br>Ef = 7.0 V; 1 min. on, 4 min. off;<br>Eb = Ec1 = Ec2 = O V; Ehk = 18 Vac | 2.5 | — | — | 2500 | — | Cycles |
| 4.11.3.1 | Survival Rate Life Test: (100 Hours)<br>Notes 2 and 5<br>Ib = 16 mAdc; ib = 100 ma; Rg1 = 50,000 Ohms min.; Epp = 350 Vac; Ehk = 100/25 Vdc;<br>Rp = 5000 Ohms approx.; TA = Room | — | — | — | — | — | |
| 4.11.4 | Survival Rate Life Test End Points:<br>Continuity and Shorts (Inoperatives) | 0.65 | — | — | — | — | |
| 4.11.3.1<br>4.11.5 | Intermittent Life Test: Notes 2, 4 and 5<br>Survival Rate Life Test, tk = 10 sec max.;<br>T Envelope = +125°C min. | — | — | — | — | — | |
| 4.11.3.1<br>4.11.4 | Intermittent Life Test End Points: (500 Hours) | | | | | | |
| | Inoperatives | — | 1 | 3 | — | — | |
| | Heater Current | — | 2 | 5 | 138 | 164 | mA |
| | Grid Voltage (1) | — | 1 | 3 | -0.8 | -5.0 | Vdc |
| | Anode Voltage | — | 1 | 3 | — | 70 | Vdc |
| | Pulse Emission | — | 2 | 5 | — | 100 | v |
| | Heater-Cathode Leakage | — | 2 | 5 | — | — | |
| | Heater Positive | — | — | — | — | 20 | μAdc |
| | Heater Negative | — | — | — | — | 20 | μAdc |
| | Total Defectives | — | 4 | 8 | — | — | |

## ACCEPTANCE CRITERIA NOTES:

1: The AQL for the combined defectives for attributes in Measurements Acceptance Tests, Part 1, excluding inoperatives and mechanical, shall be one percent. A tube having one or more defects shall be counted as one defective.

2: Phase of grid voltage shall be adjusted to provide start of conduction at the peak of the applied anode voltage.

3: Tubes subjected to the following destructive tests are not to be accepted under this specification.

4.9.5.3 Subminiature lead fatigue
4.9.20.5 Shock
4.9.20.6 Fatigue
4.11.7 Heater cycling life test
4.11.5 Intermittent life test

4: Envelope temperature is defined as the highest temperature indicated when using a thermocouple of #40 BS or smaller diameter elements welded to a ring of 0.025 inch diameter phosphor bronze in contact with the envelope. Envelope temperature requirement will be satisfied if a tube, having bogey Ib (±5%) under normal test conditions, is determined to operate at maximum specified temperature at any position on the life test rack.

5: Cycling shall be 30 seconds positive voltage and 30 seconds negative voltage.

## APPLICATION DATA

The 5643 is a Premium Subminiature tetrode thyratron designed for use in counters, grid-controlled rectifiers and other control circuits. This tube has a control characteristic which is virtually independent of ambient temperature over a comparatively wide range.

The No. 1 grid circuit resistance may be as high as 10 megohms, if required to obtain maximum signal from a high impedance source. When this high resistance is used, the tube base must be kept clean and dry to reduce leakage currents to a minimum. If a socket is used, precautions must also be taken to keep socket leakage to a minimum. When a high No. 1 grid resistance is used with a c anode voltage, the grid-anode circuit capacitance should be reduced as much as possible to prevent erratic firing due to line voltage surges. For the usual application, it is recommended that lower values of grid resistance be employed. Values as low as 0.1 megohm are satisfactory for many applications.

As is customary for all gas tubes using oxide-coated cathodes, certain precautions must be observed. To prevent damage to the cathode, the heater voltage must not deviate more than ±5% from the rated value. Low voltage operation reduces cathode temperature and results in cathode sputtering, hot spots and eventual destruction of the cathode. Higher cathode temperatures, due to increased heater voltage, can cause erratic firing voltages.

## APPLICATION DATA (Continued)

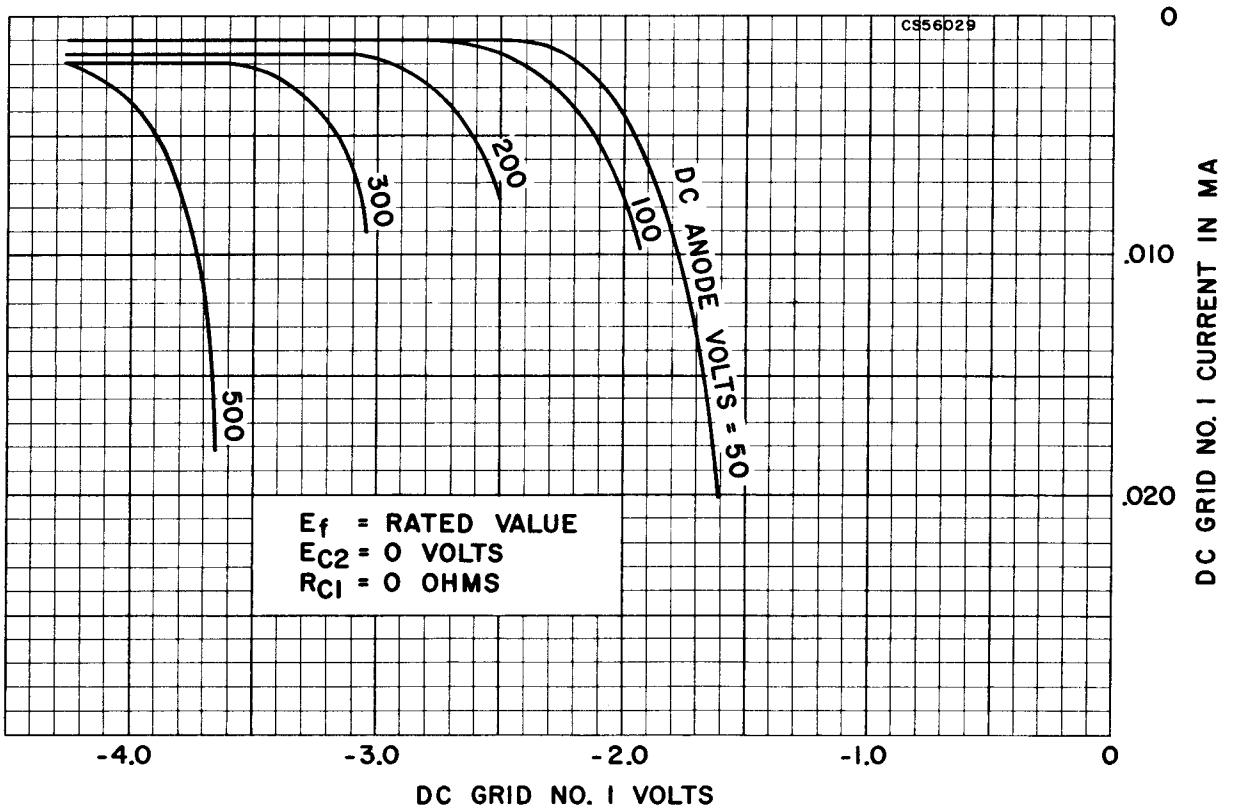
At least 10 seconds should be allowed to permit the cathode to reach normal operating temperature before anode voltage is applied.

Whenever possible, it is recommended that no difference of potential exist between cathode and heater. In circuits where the cathode is not directly connected to the heater, the potential difference between them should not exceed recommended peak values shown in the tabulated data.

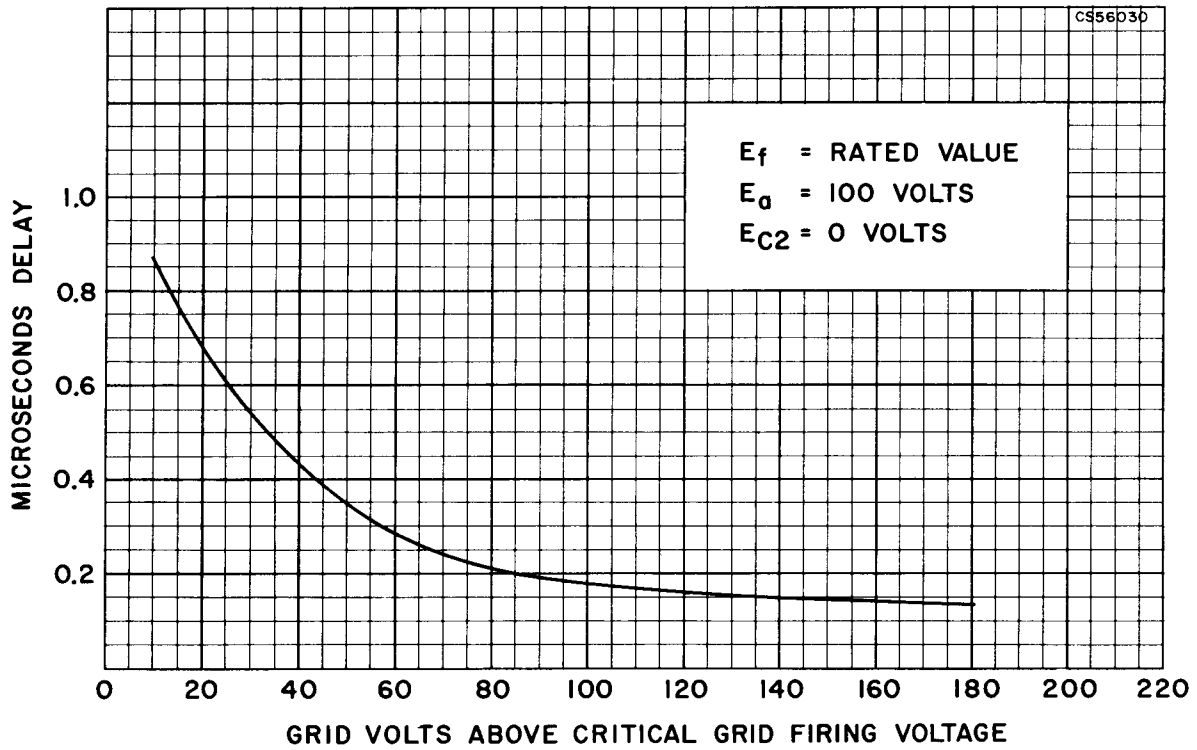
The 5643 is designed to provide long life and stable operation under conditions of severe shock, vibration, high altitude and high temperature. The 5643 is manufactured and inspected to meet the applicable MIL-E-1 specification for reliability. Life expectancy is described by the life tests specified on the attached pages and/or individual MIL-E-1 specifications. The actual life expectancy of the tubes in an operating circuit is affected by both the operating and environmental conditions involved. Likewise, the life tests specified indicate performance under certain operating criteria to a set of specified end points. Performance at conditions other than those specified can usually be estimated only roughly as giving better or poorer life expectancy. For further discussion of life expectancy, reference should be made to the frontal section of this manual.

*The information presented on this data sheet is furnished without assuming any obligation.*

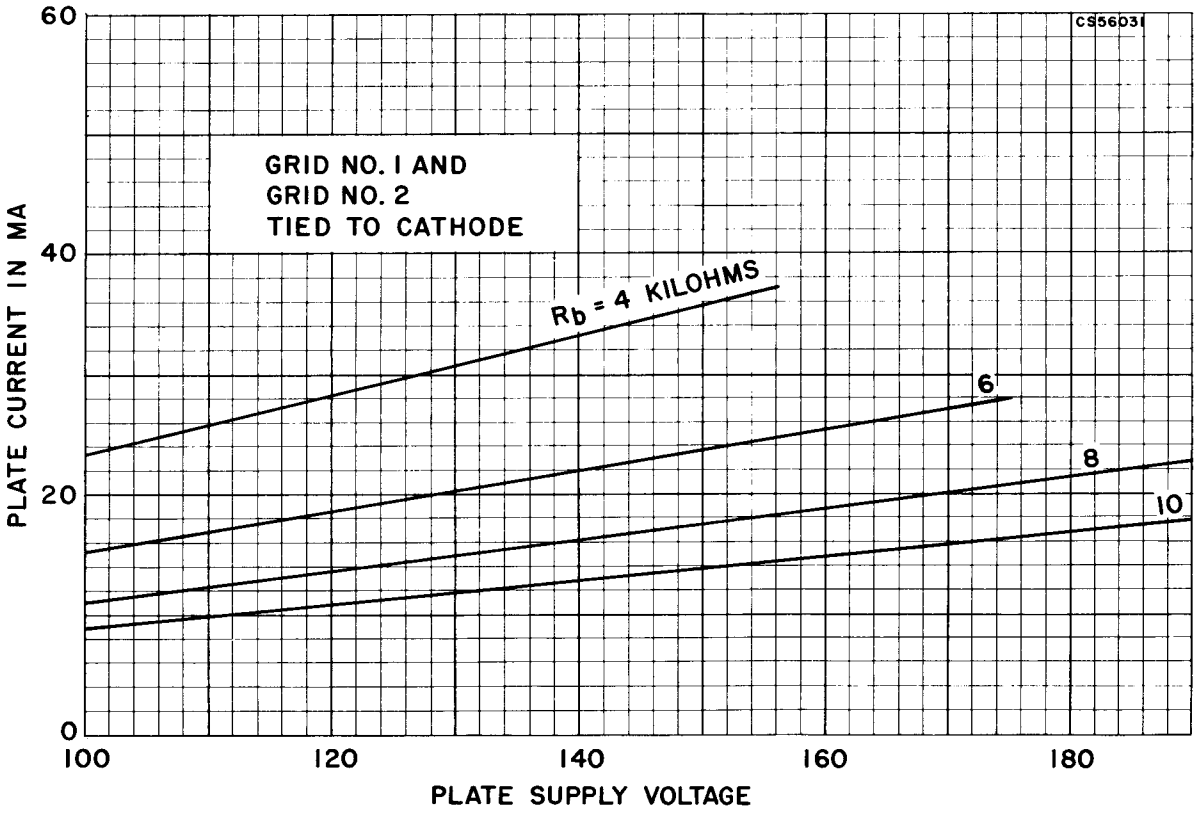
## AVERAGE GRID CHARACTERISTICS BEFORE ANODE CONDUCTION



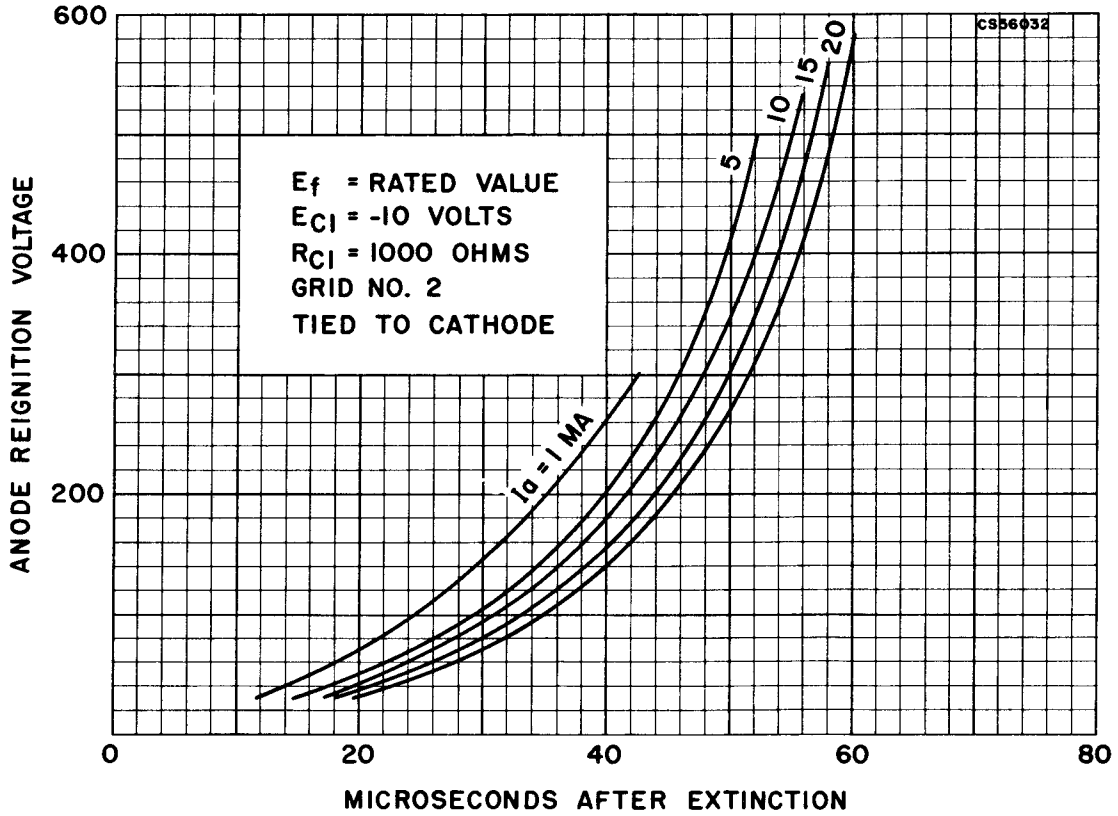
## AVERAGE IONIZATION CHARACTERISTICS



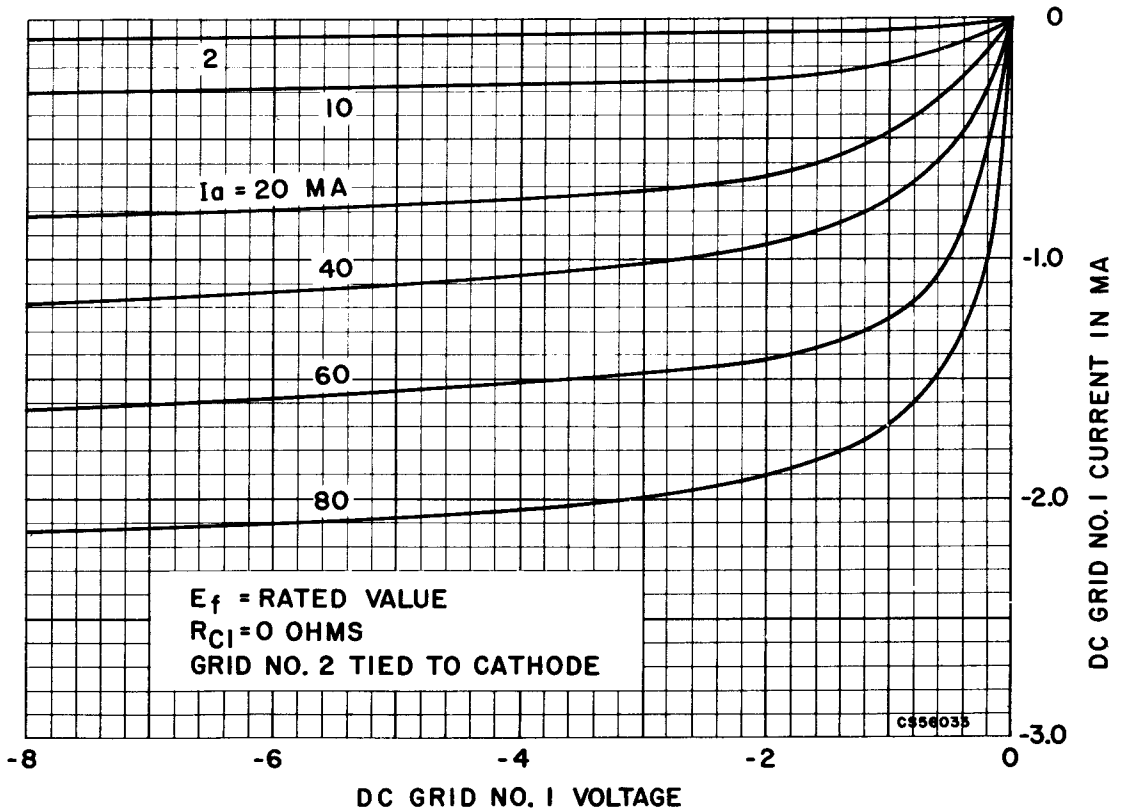

## AVERAGE REGULATION CHARACTERISTICS



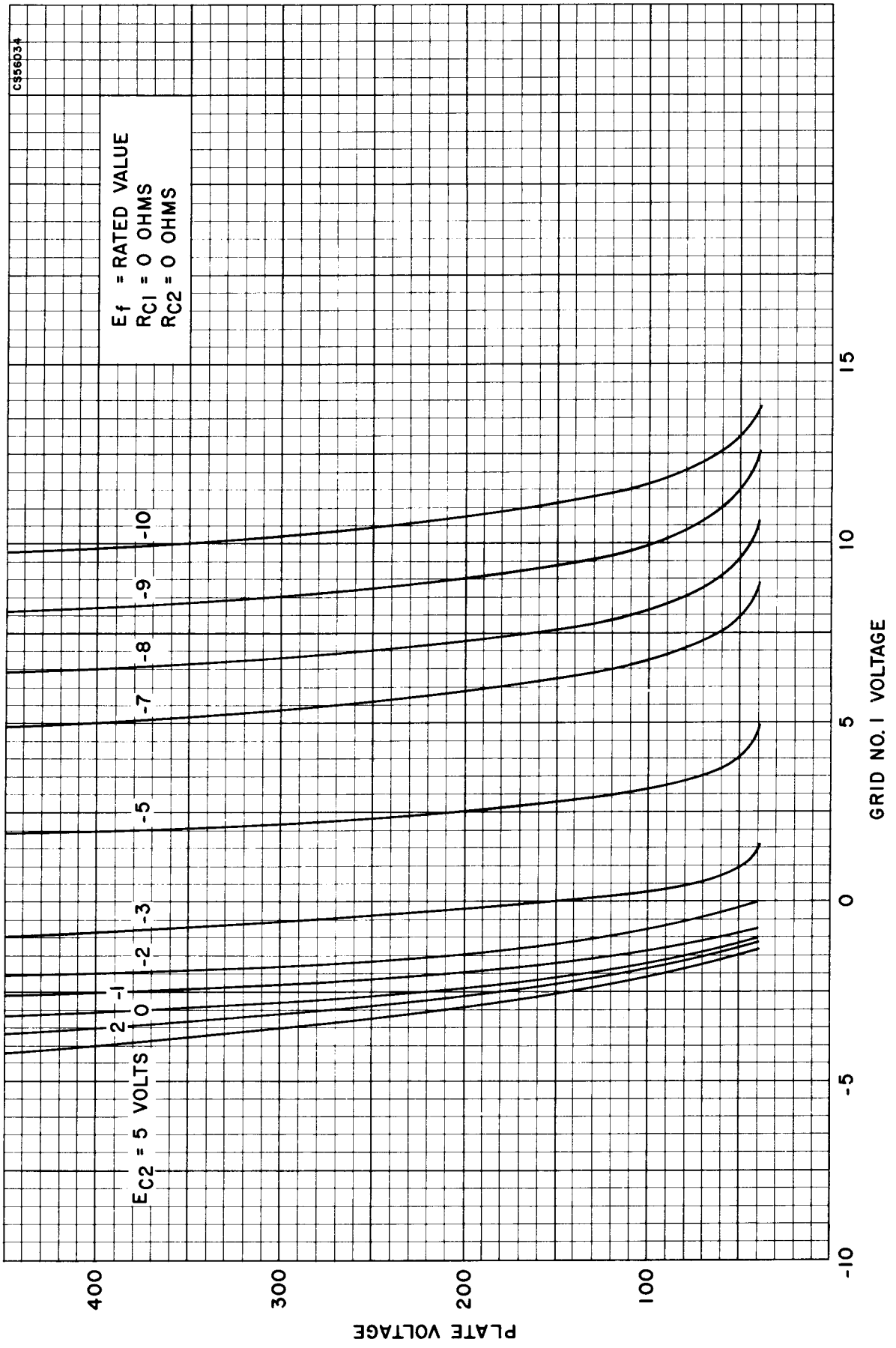
## AVERAGE DEIONIZATION CHARACTERISTICS



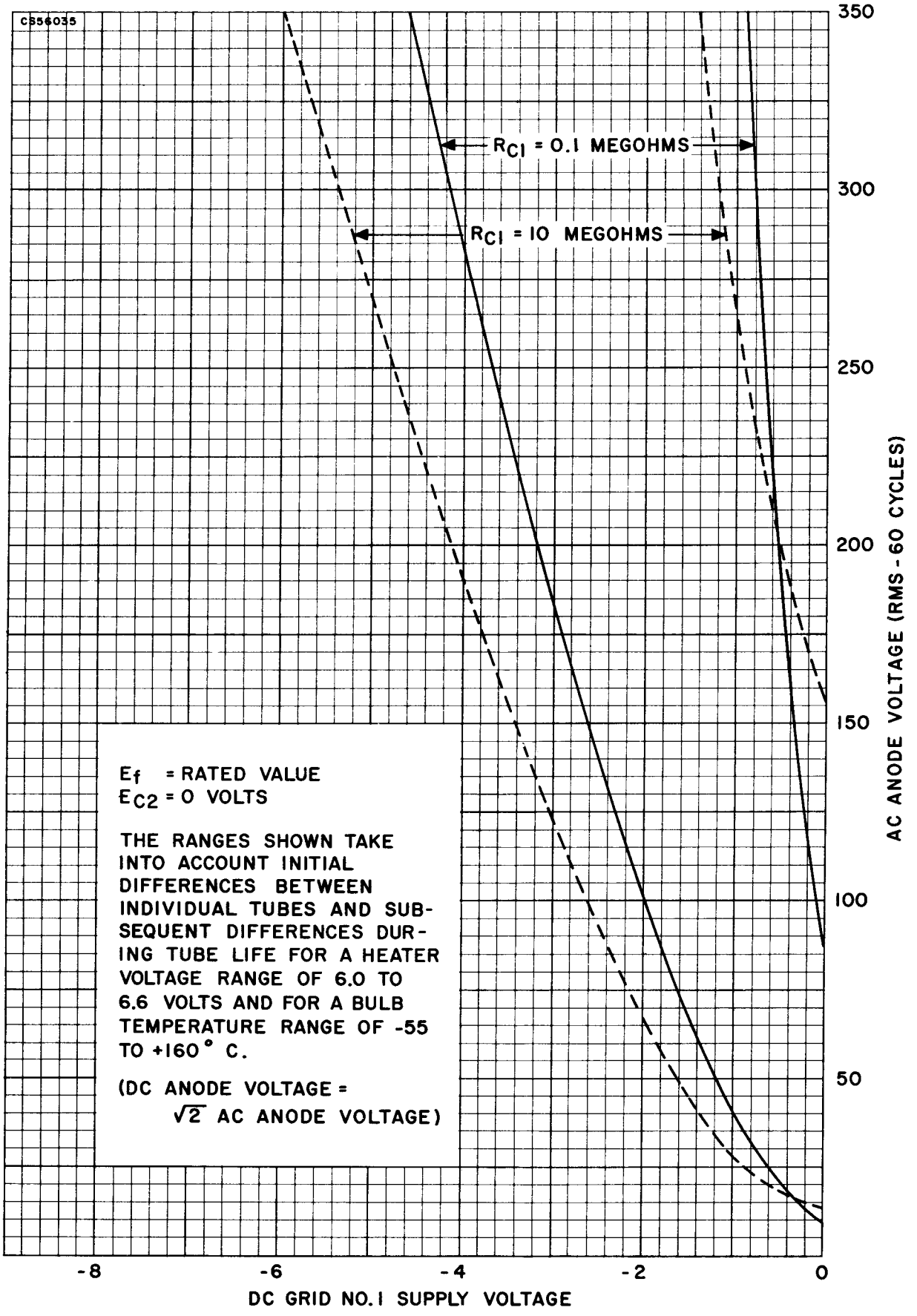

## AVERAGE GRID CHARACTERISTICS BEFORE ANODE CONDUCTION



# AVERAGE CONTROL CHARACTERISTICS



# OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE



# INITIAL OPERATING RANGE OF CRITICAL GRID VOLTAGE