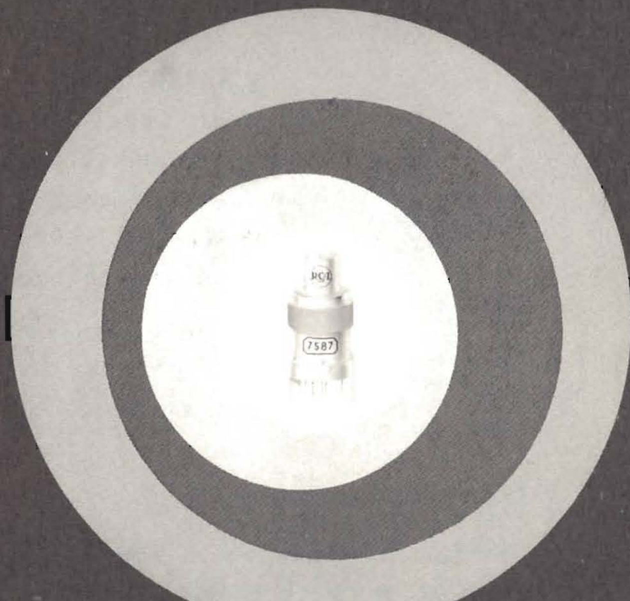
RCA nuvistor



GENERAL-PURPOSE INDUSTRIAL SHARP-CUTOFF TETRODE 7587

• Low heater drain • Very high transconductance at low plate current • Exceptional uniformity of characteristics from tube to tube • Operation at full ratings at all altitudes • Rigorously controlled and tested • All-metal-and-ceramic construction • High resistance to shock and vibration • Operation at metal shell temperatures up to 150° C • Sharp-cutoff characteristics • Approx. 1 inch long; less than ½ inch in diameter; weighs approx. 2.35 g

RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

RCA-7587

SHARP-CUTOFF TETRODE

Nuvistor Type for Industrial Applications

Actual Size

RCA-7587 is a sharp-cutoff, general-purpose tetrode of the nuvistor type. It is designed for use in a wide variety of industrial and military small-signal applications requiring compactness, low current drain, relatively low-voltage operation, exceptional uniformity of characteristics from tube to tube, and ability to withstand severe mechanical shock and vibration.

These features plus its small size and light weight make the 7587 particularly suitable for rf-if, video-amplifier, and mixer service.

General Features

The 7587 has an all-metal-and-ceramic envelope provided with two peripheral lugs of unequal width to facilitate insertion in a socket. It is only 1.05" long, less than 1/2" in diameter, and weighs approximately 2.35 g. The 7587 features (1) a very rugged structure of unique design (2) a 6.3-volt low-wattage heater, and a specially designed cathode to assure very low heater-cathode leakage, (3) high transconductance at low plate current (10600 micromhos at 10 milliamperes), (4) very high input impedance, (5) high perveance, and (6) ability to operate at full ratings at any altitude.

Structural Features

A major feature of the 7587 is its all-ceramic-and-metal construction utilizing a light-weight, cantilever-supported cylindrical electrode structure. This unique type of electrode structure, inherent in the nuvistor design, provides a structure of excellent mechanical stability and extreme ruggedness. All connections are brazed at very high temperatures in a hydrogen atmosphere to eliminate the structural strain and element distortion often caused by welding. The tube is also exhausted and sealed at very high temperatures to eliminate the gases and impurities which are generally present in electron devices processed at low temperatures.

The structure of the 7587 nuvistor tetrode also permits automatic assembly using parts made to extremely small tolerances, thus assuring exceptional uniformity of characteristics from tube to tube.

Special Tests and Controls

The 7587 is rigidly controlled during manufacture, and is subjected to rigorous tests for intermittent shorts; for early-hour, 100-hour, and 1000-hour life performance; for resistance to impact shock, low-frequency vibration, variable-frequency vibration, low-pressure breakdown, and heater cycling.

Special Tests and Controls (Cont'd)

These special controls and tests, together with high transconductance at low plate current and voltage, small power requirements, ability to operate at full ratings at any altitude, and extremely small size, make the 7587 nuvistor tetrode exceptionally desirable for critical industrial applications — for example, in communications equipment, control and instrumentation equipment, medical electronic equipment, TV cameras, and test and measurement instruments.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (ac or dc)	6.3 ± 10%	volts
Current at 6.3 volts	0.15	ampere
Direct Interelectrode Capacitances:		
Grid-No.1 to plate	0.012 max.	μμf
Grid-No.1 to cathode, grid-No.2, heater & shell	7.0	μμf
Plate to cathode, grid-No.2, heater & shell	1.4	μμf
Heater to cathode	1.4	μμf

Characteristics, Class A_1 Amplifier:

Plate-Supply Voltage	125	volts
Grid-No.2 Supply Voltage	50	volts
Cathode Resistor	68	ohms
Plate Resistance (Approx.)	0.2	megohm
Transconductance	10600	μmhos
Plate Current	10	ma
Grid-No.2 Current	2.7	ma
Grid-No.1 Voltage (Approx.) for plate current of 10 μa	4.5	volts

Mechanical:

Operating Position	Any
Maximum Overall Length	1.050"
Maximum Seated Length	0.840"
Maximum Diameter	0.440"
Envelope	Metal and Ceramic Shell
Cap	JEDEC No.C1-44
Base	Medium Ceramic-Wafer Twelvar 5-Pin (JEDEC No.E5-65)
Socket	Cinch Mfg. Co. No.133 65 10 001, or Equivalent

INDUSTRIAL SERVICE

Maximum Ratings, *Absolute-Maximum Values:*

For Operation at Any Altitude

PLATE SUPPLY VOLTAGE	330 max.	volts
PLATE VOLTAGE	250 max.	volts
GRID-No.2 (SCREEN-GRID) SUPPLY VOLTAGE	330 max.	volts
GRID-No.2 VOLTAGE	110 max.	volts
GRID-No.1 (CONTROL-GRID) VOLTAGE:		
Negative bias value	55 max.	volts
Peak positive value	2 max.	volts
CATHODE CURRENT	20 max.	ma
GRID-No.1 CURRENT	2 max.	ma

PLATE DISSIPATION	2.2	max.	watts
GRID-No.2 INPUT	0.2	max.	watt
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	100	max.	volts
Heater positive with respect to cathode	100	max.	volts

Maximum Circuit Values:

Grid-No.1 Circuit Resistance:[a]			
For fixed-bias operation	0.5	max.	megohm
For cathode-bias operation	1	max.	megohm

[a] For Operation at Metal-Shell Temperatures up to 150° C (See Dimensional Outline Drawing on Page 9).

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.140	0.160	ampere
Direct Interelectrode Capacitances:				
Grid-No.1 to plate	2		0.012	μμf
Grid-No.1 to cathode, grid No.2, heater & shell	2	6.0	8.0	μμf
Plate to cathode, grid No.2, heater & shell	2	1.2	1.6	μμf
Heater to cathode	2	1.1	1.7	μμf
Plate Current (1)	1,3	8.5	11.5	ma
Plate Current (2)	1,4	-	50	μa
Grid-No.2 Current	1,3	1.8	3.6	ma
Transconductance (1)	1,3	9000	12200	μmhos
Transconductance (2)	3,5	8000	-	μmhos
Transconductance Change:				
Difference between Transconductance (1) and Transconductance (2), expressed in per cent of Transconductance (1)	-	-	20	%
Reverse Grid Current	1,6	-	0.1	μa
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,8	-	5.0	μa
Heater positive with respect to cathode	1,8	-	5.0	μa
Leakage Resistance:				
Between grid No.2 and all other electrodes tied together	1,7	500	-	megohms
Between grid No.1 and all other electrodes tied together	1,9	500	-	megohms
Between plate and all other electrodes tied together	1,10	500	-	megohms

Note 1: With 6.3 volts ac or dc on heater.

Note 2: Measured in accordance with EIA Standard RS-191-A.

Note 3: With dc plate volts = 125, dc grid-No.2 volts = 50, cathode resistor = 68 ohms, and cathode-bypass capacitor = 1000 μf.

Note 4: With dc plate volts = 125, dc grid-No.2 volts = 50, dc grid-No.1 volts = -6, and metal shell grounded.

Note 5: With 5.7 volts ac or dc on heater.

Note 6: With dc plate volts = 200, dc grid-No.2 volts = 70, grid-No.1 supply volts = -1.6, grid-No.1 resistor = 0.5 megohm, and metal shell grounded.

Note 7: With grid-No.2 100 volts negative with respect to all other electrodes tied together.

Note 8: With 100 volts dc applied between heater and cathode.

Note 9: With grid No.1 100 volts negative with respect to all other electrodes tied together.

Note 10: With plate 300 volts negative with respect to all other electrodes tied together.

SPECIAL RATINGS AND PERFORMANCE DATA

Shock Rating:

Impact Acceleration. . . . . 1000 max. g

This test is performed on a sample lot of tubes from each production run to determine ability of tube to withstand the specified impact acceleration. Tubes are held rigid in four different positions in a Navy Type, High-impact (flyweight) Shock Machine and are subjected to 20 blows at the specified maximum impact acceleration. At the end of this test, tubes are criticized for change in transconductance, reverse grid current, and heater-cathode leakage current, and are then subjected to the Variable-Frequency Vibration Test described later.

Fatigue Rating:

Vibrational Acceleration. . . . . 2.5 max. g

This test is performed on a sample lot of tubes to determine ability of tube to withstand the specified vibrational acceleration. Tubes are rigidly mounted, supplied with rated heater voltage only, and subjected for 48 hours to 2.5 g vibrational acceleration at 60 cycles per second in a direction perpendicular to the longitudinal axis of the tube. At the end of this test, tubes are criticized for the same characteristics and end-point values as in the Shock Rating Test described previously.

Variable-Frequency-Vibration Performance:

This test is performed on a sample lot of tubes from each production run. The tube is operated under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance (1) with the addition of a plate-load resistor of 2000 ohms. During operation, tube is vibrated in a direction perpendicular to the longitudinal axis of the tube through the frequency range from 50 to 15000 cycles per second with a constant vibrational acceleration of 1 g. During the test, tube must not show an rms output voltage across the plate-load resistor in excess of:

35 millivolts over the frequency range from 50 to 6000 cps
500 millivolts over the frequency range from 6000 to 15000 cps

Low-Pressure Voltage-Breakdown Test:

This test is performed on a sample lot of tubes from each production run. In this test tubes are operated with 240 rms volts applied between plate and all other electrodes and will not break down or show evidence of corona when subjected to air pressures equivalent to altitudes up to 100000 feet.

Heater Cycling:

Cycles of Intermittent Operation. . . . . 2000 min. cycles

This test is performed on a sample lot of tubes from each production run under the following conditions: heater volts = 7.5, cycled one minute on and two minutes off; heater 100 volts negative with respect to cathode; grid No.1, grid No.2, plate, and metal shell connected to ground. At the end of this test tubes are tested for open heaters and heater-cathode shorts.

Intermittent Shorts:

This test is performed on a sample lot of tubes from each production run. Tubes are subjected to the Thyratron-Type Shorts Test described in MIL-E-ID, Amendment 2, Par. 4.7.7, except that tapping is done by hand with a soft rubber tapper[b]. The Acceptance Curve for this test is shown in Fig.3. In this test tubes are criticized for permanent or temporary shorts and open circuits.

Early-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that tubes are properly stabilized. In this test tubes are operated for 20 hours at maximum rated plate dissipation. After two hours of operation and again after 20 hours of operation tubes are checked for transconductance under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance (1). A tube is rejected if its transconductance after two or 20 hours of operation has changed more than 10 per cent from the 0-hour value.

100-Hour Life Performance:

This test is performed on a sample lot of tubes from each production run to insure a low percentage of early-hour inoperatives. Tubes are operated for 100 hours at maximum rated plate dissipation, and then subjected to the Intermittent Shorts Test previously described. Tubes must then show a transconductance of not less than 7600 micromhos under the conditions specified in CHARACTERISTICS RANGE VALUES for Transconductance (1), and a value not greater than one microampere for reverse grid current.

1000-Hour Life Performance:

This test is performed on a sample lot of tubes from each production run to insure high quality of the individual tube and guard against epidemic failures due to excessive changes in any of the characteristics indicated below. In this test tubes are operated for 1000 hours at maximum rated plate dissipation and then criticized for inoperatives, reverse grid current, heater-cathode leakage current, and the leakage resistance. In addition, the average change in transconductance of the lot from the 0-hour value for Transconductance (1) specified in CHARACTERISTICS RANGE VALUES, must not exceed 20 per cent at 500 hours and 25 per cent at 1000 hours.

[b] Specifications for this tapper will be supplied on request.

OPERATING CONSIDERATIONS

The *base-pins* of the 7587 fit the Cinch Mfg. Co. socket No.133 65 10 001 or equivalent. The socket may be mounted to hold the tube in any position.

The *maximum ratings* in the tabulated data are established in accordance with the following definition of the *Absolute-Maximum Rating System* for rating electron devices.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

The device manufacturer chooses these values to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environment variations, and the effects of changes in operating conditions due to variations in device characteristics.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in device characteristics.

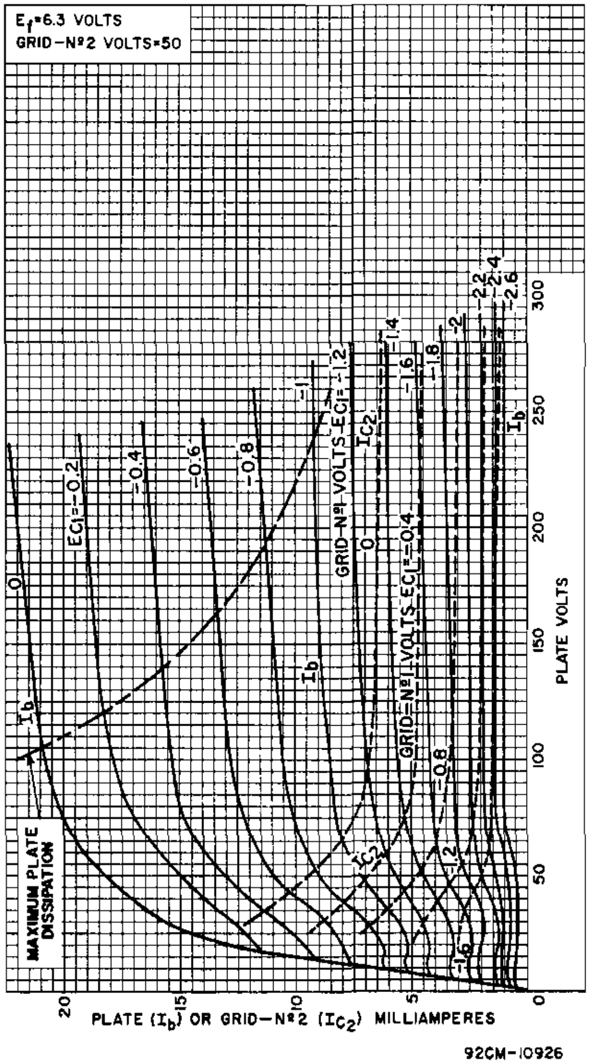


Fig.1 - Average Characteristics for Type 7587.

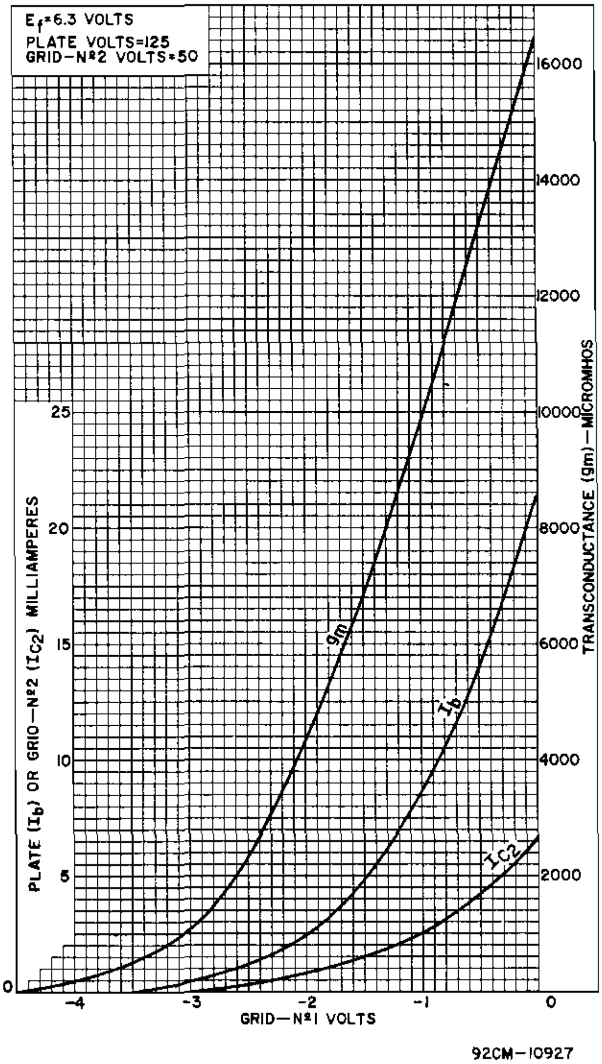


Fig.2 - Average Characteristics for Type 7587.

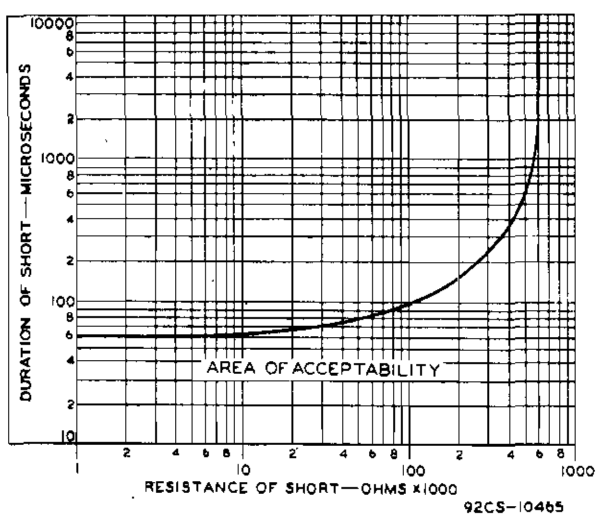
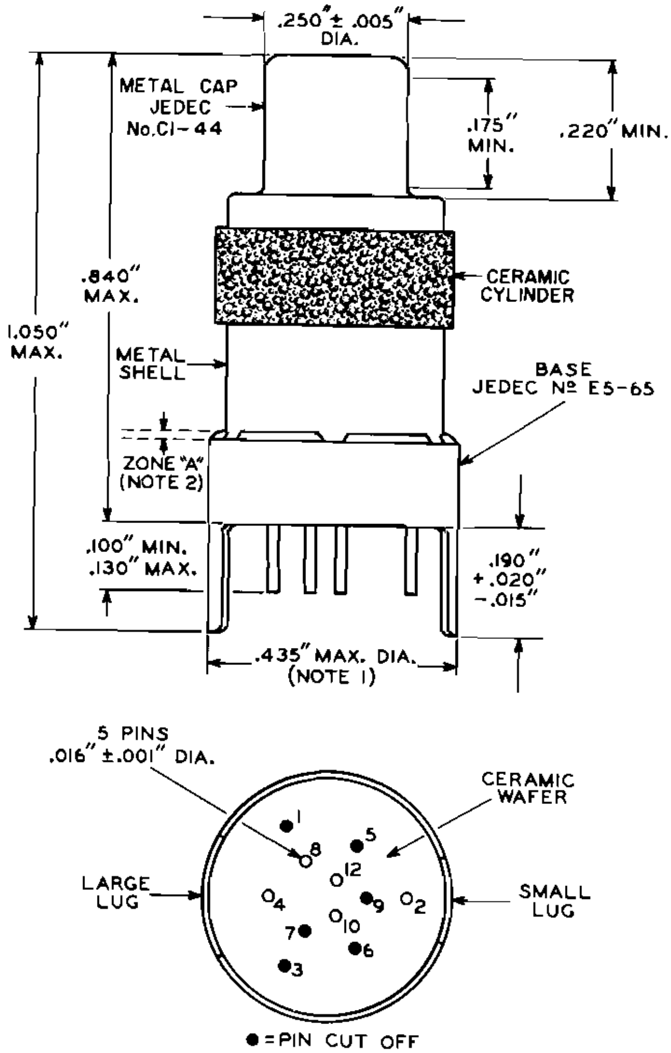


Fig.3 - Thyratron-Type Shorts Test for Type 7587.

DIMENSIONAL OUTLINE



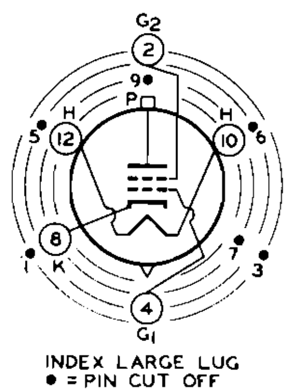
92CS-10852

NOTE 1: MAXIMUM O.D. OF 0.440" IS PERMITTED ALONG 0.190" LUG LENGTH.

NOTE 2: SHELL TEMPERATURE SHOULD BE MEASURED IN ZONE "A" BETWEEN BROKEN LINES.

BASING DIAGRAM (Bottom View)

PIN 1: ▲
PIN 2: GRID No. 2
PIN 3: ▲
PIN 4: GRID No. 1
PIN 5: ▲
PIN 6: ▲

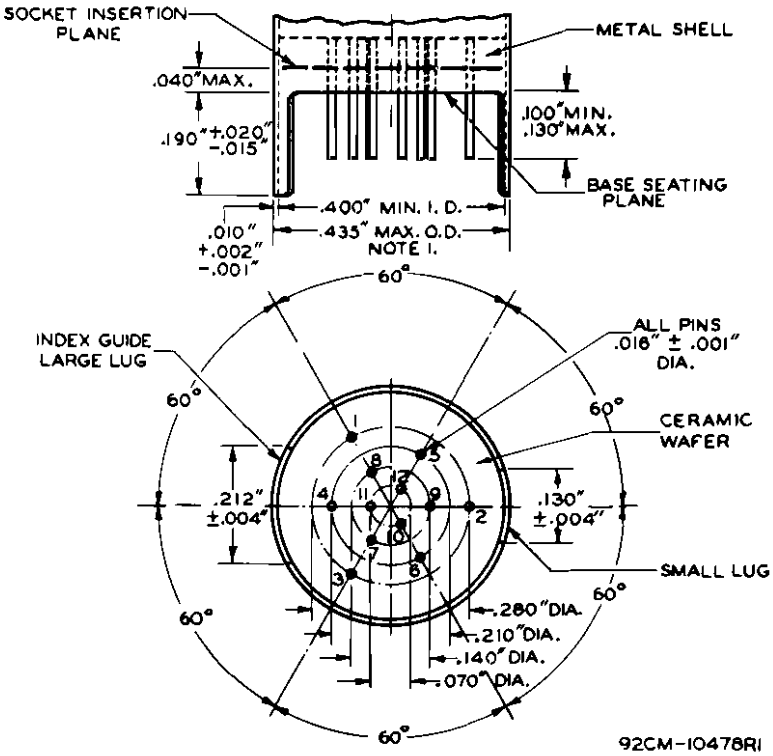


PIN 7: ▲
PIN 8: CATHODE
PIN 9: ▲
PIN 10: HEATER
PIN 11: OMITTED
PIN 12: HEATER
CAP: PLATE

12AS

▲ Pin has internal connection and is cut off close to ceramic wafer--Do Not Use.

MEDIUM CERAMIC-WAFER TWELVAR BASE



JEDEC No.	NAME	PINS
E12-64	12-Pin Base	1,2,3,4,5,6,7,8, 9,10,11,12
E5-65	5-Pin Base	2,4,8,10,12, (Note 2)

Note 1: Maximum O.D. of 0.440" is permitted along the 0.190" lug length.

Note 2: Pins 1,3,5,6,7, and 9 are cut off to a length such that their ends do not touch the socket insertion plane. Pin 11 is omitted.

PIN-ALIGNMENT GAUGE

Base pin positions and lug positions shall be held to tolerances such that entire length of pins and lugs will without undue force pass into and disengage from flat-plate gauge having thickness of 0.25" and twelve holes of 0.0350" ± 0.0005" diameter located on four concentric circles as follows: Three holes located on 0.2800" ± 0.0005", three holes located on 0.2100" ± 0.0005", three holes located on 0.1400" ± 0.0005", three holes located on 0.0700" ± 0.0005" diameter circles at specified angles with a tolerance of ± 0.08° for each angle. In addition, gauge provides for two curved slots with chordal lengths of 0.2270" ± 0.0005" and 0.1450" ± 0.0005" located on 0.4200" ± 0.0005" diameter circle concentric with pin circles at 180° ± 0.08° and having a width of 0.0230" ± 0.0005".

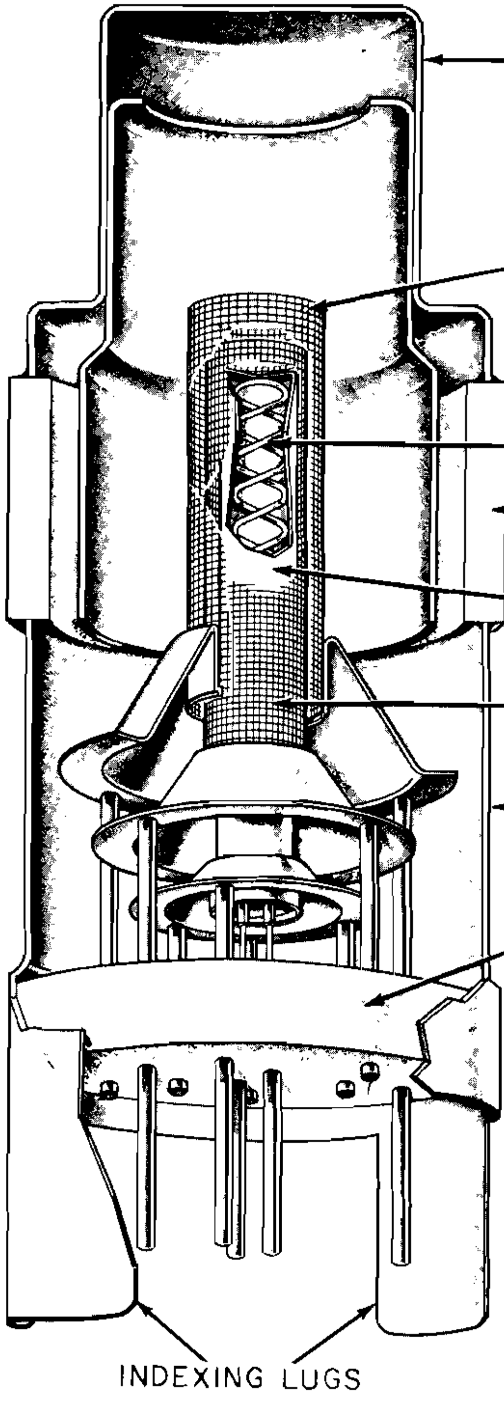


Fig.4 - Illustration of a nuvistor tetrode showing cylindrical electrodes and tripod-like supports.