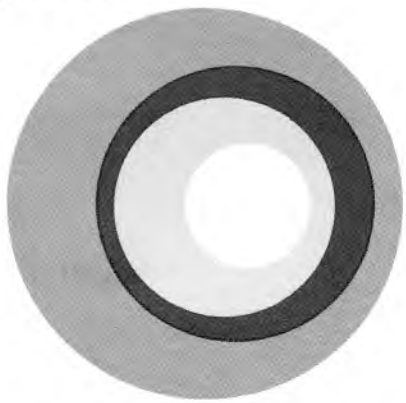
RCA nuvistors

Reference Guide to Commercial and Developmental Types

Single-and Double-Ended Types

Integral-Cavity Amplifiers



RADIO CORPORATION OF AMERICA
ELECTRONIC COMPONENTS AND DEVICES
HARRISON, N. J.

RCA NUVISTOR TUBES

ITEM	INDUSTRIAL AND MILITARY[a] — Commercial & Military-Specification Types									Developmental Types[b]			ENTERTAINMENT — Commercial Types						UNIT
RCA TYPE	**7586**	**7587**	**7895**	**8056**	**8058**	**8203**	**8393**	**8627**	**8628**	**A15274B**	**A15526[d]**	**A15533**	**2CW4[e] 6CW4 13CW4**			**2DS4[e] 6DS4**		**2DV4[e] 6DV4**	
Former RCA Dev. Type	(A15202)	(A2654F)	(A15246)	(A15247A)	(A15211)	(A15250)		(A15294B)	(A15460)	-	-	-	(A15217) (A15147N) (A15364)			(A15272) (A15251D)		(A15316) (A15300)	
Description	Medium-Mu Triode	Sharp-Cutoff Tetrode	High-Mu Triode	Medium-Mu Triode	High-Mu Triode	Power Triode	(A15342) Medium-Mu Triode	Power Triode	High-Mu Triode	Medium-Mu Extended-Cutoff Triode	Power Triode	High-Mu Triode	High-Mu Triodes			High-Mu Extended-Cutoff Triodes		Medium-Mu Triodes	
Intended Application	General Purpose	General Purpose	General Purpose	Low B+, Low-Noise RF or IF Amplifier; Multivibrator; or Cathode Follower	Grounded-Grid UHF Amplifier, or Oscillator	Low-Level Class-C RF Power Amplifier, Oscillator, or Frequency Multiplier; DC Pulse Amplifier	*Except for heater characteristics, identical to Type 7586*	Grounded-Grid, Low-Level Class-C RF Power Amplifier, Oscillator, or Frequency Multiplier;	For LF Applica-tions Requiring High Input Impedance & Low Grid Currents	RF Amplifier	Grounded-Grid Pulsed or CW Low-Level Class-C RF Power Amplifier, Oscillator, or Frequency Multiplier	For LF Applica-tions Requiring High Input Impedance & Low Grid Currents	RF Amplifier In VHF TV or FM Receivers		In An-tenna Boosters	RF Amplifier in VHF TV or FM Receivers		Local Oscillator in UHF TV Re-ceivers	
Military-Spec. Type	JAN-7586	JAN-7587	JAN-7895	JAN-8056	JAN-8058	-	-	-	-	-	-	-	-	-	-	-	-	-	
Military Specification[c]	MIL-E-1/1397B	MIL-E-1/1434B	MIL-E-1/1433B	MIL-E-1/1490A	MIL-E-1/1491A	-	-	-	-	-	-	-	-	-	-	-	-	-	
Electrical Characteristics:																			
E_f	6.3	6.3	6.3	6.3	6.3	6.3	13.5	6.3	6.3	6.3	6.3	6.3	2.1	6.3	13.5	2.1	6.3	2.1 6.3	volts
I_f	135	150	135	135	135	160	60	150	100	68	340	68	450	135	60	450	135	450 135	ma
P_f	0.85	0.95	0.85	0.85	0.85	1	0.81	0.95	0.63	0.42	2.14	0.43	0.95	0.85	0.81	0.95	0.85	0.95 0.85	watts
E_{bb}	26.5 75	125 (E_{cc2}, 50)	110	24	110	75 150		110	120	60	200	60	70	110		70	110	75	volts
R_k	- 100	68	150	100	47	100 560		47	200	100	68	100	-	130		-	130	100	ohms
R_g	0.5 -	-	-	-	-	- -		-	1	-	-	-	0.047	-		0.047	-	-	megohms
μ	31 35	-	64	11.5	70	35 30		70	127	35	100	125	68	65		88	63	35	
r_p	4400 3000	0.2 Meg	6800	1530	5600	2700 5000		5600	41000	3200	6400	2100	5440	6600		5440	7000	3100	ohms
g_m	7000 11500	10600	9400	7500	12400	13000 6000		12400	3100	10800	18000	6000	12500	9800		12500	9000	11500	umhos
I_b	2.8 10.5	10	7	8.7	10	11.5 7		10	1.5	8	15	1.7	7.2	7		7	6.5	10.5	ma
I_{c2}	- -	2.7	-	-	-	- -		-		-	-	-	-	-		-	-	-	ma
$E_{c1(co)}$ @ I_b = 10 μa	- -7	-4.5	-4	-5 @ 50 μa	-5	-6.5 -15		-5	-1.7	-6	-5 @ 100 μa	-1	-	-4		-	-6.8	-7	volts
Maximum Ratings;	*Class A*	*Class A*	*Class A*	*Class A*	*Class A*	*Class C* CCS ICAS		*Class C* CCS ICAS	*Class A*	*Class A*	*Class C* CW Pulsed	*Class A*	*Class A*			*Class A*		*Class A*	
E_{bb}	330	330 (E_{cc2},330)	330	- -	330	400 400		500 500	330	330	- -	330	300			300		300	volts
E_b	110	250 (E_{c2},110)	110	50	150	250 300		250 300	250	110	300 1000	110	135			135		125	volts
E_{c1}	-55	-55	-55	-55	-55	{+0 +0 / -100 -100		{+0 +0 / -100 -100	-55	-55	{+0 +0 / -100 -100	-55	-55			-55		-55	volts
e_{c1m}	4	2	2	2	+0	5 5		4 5	+0	+0	10 30	+0	+0			+0		2	volts
e_{hkm}	±100	±100	±100	±100	±100	±100 ±100		±100 ±100	±100	±100	±100 ±100	±100	±100			±100		±100	volts
$I_{c1(av)}$	2	2	2	2	0	5 6		5 6	0	0	- i_{km}=1amp[k]	0	0			0		5	ma
$I_{k(av)}$	15	20	15	15	15	25 30		25 30	2	15	75 75	10	15			15		15	ma
P_{g2}	-	0.2	-	-	-	- -		- -	-	-	P_{g1} 200[m] 200[m] mw	-	-			-		-	watts
P_b	1	2.2	1	0.45	1.5	1.5 1.8		2.5 2.7	0.3	0.75	6[n] 6[n]	0.75	1.5[p]			1.5[p]		1	watts
R_{g1} (circuit)[f]	0.5/1	0.5/1	0.5/1	10/10	0.5/1	0.05 0.05		0.05 0.05	50/100	0.5/1	0.5 0.5	-	0.5/2.2			0.5/2.2		0.1/0.2	megohms
Altitude	100,000	100,000	100,000	100,000	100,000	100,000		100,000	100,000	100,000	100,000 50,000	100,000	-			-		-	ft
f_m (useful): As amplifier	400	250	400	300	1200	250		1200	200 kc	1200	1200	-	-			-		-	Mc
As oscillator	1000	850	1000	800	1200	800		1200		-	1200	-	-			-		-	Mc
Typical Operation:	NF @ 200 Mc	R_{eg} @ ≈ 30 Mc	NF @ 200 Mc	NF @ 200 Mc	NF @ 1000 Mc	P_o(useful) @ 160 Mc		P_o(useful) @ 1000 Mc		NF @ 1000 Mc	P_o(useful) @ 1000 Mc								
Amplifier	4.3 db	1500 ohms	4.3 db	4 db	11 db	1.55 w		1.4 w	I_c = -1 na	10 db	5 w	-	-		-	-		I_c @ 950 Mc	-
Oscillator	-	-	-	-	-	0.8 w		1.25 w	@ P_b = 0.3 w	-	4 w	-	-		-	-		350 μa	-
Doubler	-	-	-	-	-	0.85 w		0.5 w		-	3 w	-	-		-	-		-	-
Mechanical:																			
l_m(overall)	0.800	1.050	0.800	0.800	0.985	0.800		0.985	0.800	0.775	0.985	0.775	0.800			0.800		0.800	inch
(seated)	0.625	0.840	0.625	0.625	0.780	0.625		0.780	0.625	0.575	0.780	0.575	0.625			0.625		0.625	inch
d_m	0.440	0.440	0.440	0.440	0.440	0.440		0.440	0.440	0.275	0.440	0.275	0.440			0.440		0.440	inch
Base	5-Pin	5-Pin	5-Pin	5-Pin	5-Pin	5-Pin		5-Pin	5-Pin	4-Pin In-Line	6-Pin	4-Pin In-Line	5-Pin			5-Pin		7-Pin	-
Top-Cap Diameter	-	0.250	-	-	0.250	-		0.250	-	0.165	0.312	0.165	-			-		-	inch
Other Developmental Versions:[b]																			
Long-Lead Types[g]	A15212	A2702	A15321	A15319	A15320	A15317	A15343	A15318	A15478	A15388	-	-	-			-		-	-
13.5-V-Heater Types[h]	See 8393 above	A2708	A15348	A15305	A15353	A15346	-	A15355	A15493	-	-	-	-			-		-	-

a Subjected to special controls on critical characteristics, environmental tests (shock, fatigue, vibration, altitude), and special life tests.

b The number identifies a particular laboratory tube design but the number and identifying data are subject to change. No obligations are assumed as to future manufacture unless otherwise arranged.

c Copies are available from: Specifications Division, Naval Supply Depot, 5801 Tabor Ave., Philadelphia, Pa. 19120.

d Developed under Buships, U.S. Navy contract.

e Bogey heater warm-up time = 8 sec. for series-heater-string applications.

f For fixed-bias/cathode-bias operation; single values are for either. For industrial and military types, at T_{shell} = 150° C; max. T_{shell} with R_{g1} derating = 250° C. For entertainment types, at T_{shell} = 135° C.

g Intended for applications where it is desired to avoid use of a tube socket (such as printed-circuit-board applications; short-life, no-replacement applications; and applications at frequencies where reactances caused by use of a socket would result in substantially-lowered tube performance). These types differ primarily from their respective prototypes in that they do not have either indexing lugs or base skirt, and in place of base pins have leads of length 0.750 inch min. RCA will entertain requests for other versions of specific prototypes having any number of long leads up to a maximum of 3 per electrode.

h Intended for hybrid-equipment applications. RCA will entertain requests for other versions of specific prototypes having a bogey $E_f \leq 13.5$ V with a corresponding bogey I_f such that cathode temperature is held constant.

k For DF ≤ 0.01; for DF > 0.01 and ≤ 0.5, i_{km} derating is required.

m For metal-shell-to-ceramic-insulator seal temperatures up to 100° C. Higher temperatures permissible with P_{g1} derating.

n For top-cap-to-ceramic-insulator seal temperatures up to 150° C. Higher temperatures permissible with P_b derating.

p With series plate-circuit resistance = 5000 ohms min.

RCA INTEGRAL-CAVITY TRF AMPLIFIERS[q]

ITEM	Commercial Type	Developmental Types[b]			UNIT
RCA TYPE	**FD-2200**	**A15474D**	**A15515**	**A15528**	
Former RCA Dev. Type	(A15477E)	-	-	-	
Description	1030-Mc, 3-Stage Amplifier & 3-Section Filter (Preselector)	1030-Mc, 1-Stage Amplifier	1090-Mc, 3-Stage Amplifier & 3-Section Filter (Preselector)	1030-Mc, 2-Stage Amplifier	
Intended Application	Aircraft Transponder Equipment & Other Fixed-Cavity Applications				
Military Specification[c]	Meets Specification for Class-2 Electronic Equipment as Covered in Military Specification MIL-E-5400G				
Electrical Characteristics:					
E_f/stage	6.3	6.3	6.3	6.3	volts
I_f (total)	405	135	405	270	ma
P_f (total)	2.55	0.85	2.55	1.70	watts
E_{kkp}/stage	-100	-100	-100	-100	volts
R_{1k}	3.9	22	3.9	47	ohms
R_{2k}	22	-	22	47	ohms
R_{3k}	47	-	47	-	ohms
R_g (common)	1500	4700	1500	1500	ohms
I_k (total)	34	12	34	21	ma
$E_{gk(co)}$/stage @ I_k/stage = 10 μa	-5	-5	-5	-5	volts
Maximum Ratings:					
RF Input: e_m @ $P_{(av)}$ = -20 dbm	10	10	10	10	volts
E_{kkp}/stage	-150	-150	-150	-150	volts
E_{kp}/stage	-110	-110	-110	-110	volts
E_{gk}/stage	{+0 / -100	{+0 / -100	{+0 / -100	{+0 / -100	volts
e_{hkm}/stage	+150	±150	±150	±150	volts
E_f/stage	{6.6 max / 6.0 min	{6.6 max / 6.0 min	{6.6 max / 6.0 min	{6.6 max / 6.0 min	volts
I_b/stage	20	20	20	20	ma
R_g (common)	0.1	0.5	0.1	0.5	megohm
T_{shell}	115	115	115	115	°C
Altitude	Any	Any	Any	Any	-
Typical Operation:[r]					
A_o[s]	45.5	15	45.5	28	db
NF @ f_o	11.5	10.5	12	10.5	db
Bandwidth @ -3 db level	-	15	-	19	Mc
-6 db level	8	-	8	-	Mc
-40 db level	22.3	-	23	-	Mc
Attenuation @ f_o -25 Mc	70	-	70	-	db
f_o +25 Mc	77	-	70	-	db
P_{total}	6.2	2	6.2	< 4	watts
Initial Chars. Limits:					
Stability, T_A = -54 to +95° C: Δf_o[t]	±1 max	-	±1 max	-	Mc
ΔA_o[u]	+2 max	±2 max.	±2 max	±2 max	db
RF-Input VSWR @ f_o	1.5 max	1.5 max.	1.5 max	1.5 max	-
Mechanical:		*Ampl Filter*		*Ampl Filter*	
l_m (shell)[v]	7.80 8.75	2.68	7.20 8.26	5.23	inch
d_m (shell)[v]	0.892 0.873	0.892	0.892 0.873	0.892	inch
Weight (total, approx.)	7	1.6	7	3	oz

q A mechanically-modified Type 8058 nuvistor tube is utilized in each amplifier stage. The plate and one end of the heater of each tube are connected to a common dc-ground terminal (tab) on the metal shell of the amplifier; the cathode and other end of the heater are brought out to separate terminals through 470-pF feed-thru capacitors; the grid has a separate terminal and is bypassed with a 1000-pF capacitor. Each amplifier or amplifier-filter combination has an input impedance of 50 ohms, and is designed for use with a load having an impedance of 50 ohms. RF terminals on each filter or amplifier are designed to mate with screw-on connectors (Sealectro Corp. (225 Hoyt St., Mamaroneck, N.Y. 10544) Part No. 50 007 0000, or equivalent. For rigid filter-to-amplifier interconnection, Sealectro 50 073 000, 50 073 0029, or equivalent, may be used; for flexible interconnection, RG 188/U coaxial cable is recommended. RCA will entertain requests for other TRF Amplifiers having a center frequency within the range of 470 Mc to 1200 Mc.

r At T_A = 25°C and under same conditions as shown for Electrical Chars.

s Amplification (voltage gain) at center frequency f_o.

t Change in f_o; measured as average of Δf_L and Δf_U at -6 db level.

u Change in A_o from its value at T_A = 25°C.

v Exclusive of terminals.

NUVISTOR-TUBE SOCKET & CONNECTOR INFORMATION[a]

NUVISTOR TYPE		SOCKET			
		Mounting	Body Material[b]	Cinch Mfg. Co.[c] No.	Cinch-Jones Sales-Division[d] Distributor No.
2CW4	7586	Crimp	MFP	133 65 10 001	5NS
2DS4	7587		DIALL ▲	133 65 92 025	-
6CW4	7895		TEFLON	133 65 91 034	-
6DS4	8056	Flange	MFP	133 65 10 003	5NS-1
13CW4	8393	Printed-Board (Stand-Off)	MFP	133 65 10 009	5NS-2
8058 8203 8627		Crimp	MFP	133 65 10 041	5NS-3
2DV4 6DV4 A15526		Crimp	HALON □	133 67 90 040	5NS-4
8628		Crimp	DIALL	133 65 92 025	-
			TEFLON ●	133 65 91 034	-
A15274B		Swaged	MFP	131 35 10 014	-
A15533		Spring	MFP	131 35 10 014 with Mounting Spring 441 00 23 094	-

NUVISTOR TYPE	TOP-CAP CONNECTOR	
7587 8058 8627	Cinch Mfg. Co.[c] No. 422 03 22 017 or 422 03 22 024, or equivalent "1/4-inch" connector.	
A15274B A15533	International Electronic Research Corp.[e] Part No. TXB2P-019-028G	
A15526	For Distributed-Constant Circuit	International Electronic Research Corp.[e] Therma-Link Retainer Part No.TXBE-032-031G
	For Lumped-Constant Circuit	Wakefield Engineering, Inc.[f] Semiconductor Cooler Type NF207

[a] Information on sockets or connectors having different materials or finishes may be obtained from the manufacturers listed. Sockets or connectors having comparable mechanical and electrical characteristics may be available from other manufacturers.

[b] MFP =general-purpose, low-loss Mica-Filled Phenolic; DIALL = glass-filled Diallyl Phthalate for missile, satellite, and other high-vacuum applications; TEFLON and HALON are for low-rf and low-leakage loss, high-temperature applications.

▲ TRADE MARK: Mesa Plastics Co., Los Angeles, Calif.

□ TRADE MARK: Allied Chemical Corp., Morristown, N.J.

[c] 1026 South Homan Ave., Chicago, Illinois 60624. Tel: (312) NE 2-2000.

[d] This number appears in many distributors' catalogs.

[e] 135 West Magnolia Blvd., Burbank, Calif. 91502.Tel: (213) 849-2481.

[f] 139 Foundry St., Wakefield, Mass. 01880. Tel: (617) 245-5900

● TRADE MARK: E.I. DuPont de Nemours & Co., Inc., Wilmington, Del.

FIELD OFFICES

EQUIPMENT SALES

East	*Newark*	32 Green St., Newark, N.J. 07102	(201) 485-3900
	Syracuse	731 James St., Room 402, Syracuse, N.Y. 13203	(315) 474-5591
	Needham	64 "A" St., Needham Heights, Mass. 02194	(617) 444-7200
Mid-Atlantic	*Haddonfield*	605 Marlton Pike, Haddonfield, N.J. 08034	(609) 428-4802
	Orlando	200 East Marks St., Orlando, Fla. 32803	(305) 425-5563
Central	*Chicago*	446 East Howard Ave., Des Plaines, Ill. 60018	(312) 827-0033
	Detroit	714 New Center Bldg., Detroit, Mich. 48202	(313) 875-5600
	Minneapolis	5805 Excelsior Blvd., Minneapolis, Minn. 55416	(612) 929-0676
Mid-Central	*Indianapolis*	2511 East 46th St., Bldg. Q2, Atkinson Square, Indianapolis, Ind. 46205	(317) 546-4001
West	*Hollywood*	6363 Sunset Blvd., Hollywood, Calif. 90028	(213) 461-9171
	Los Altos	4546 El Camino Real, Suite P, Los Altos, Calif. 94022	(415) 948-8996
	Seattle	2250 First Ave. South, Seattle, Wash. 98104	(206) MAin 2-8816

GOVERNMENT SALES

Harrison	415 South Fifth St., Harrison, N.J. 07029	(201) 485-3900
Dayton	224 North Wilkinson St., Dayton, Ohio 45402	(513) 461-5420
Washington	1725 "K" St., N.W., Washington, D.C. 20006	(202) 337-8500

1CE-317 3-65
Printed in U.S.A.

NUVISTOR-TUBE RELIABILITY

Production Tests (At Max.-Rated P_b)

Based on over 1,662,000 tube-hours of regular-production life tests, nuvistor type 7586 has had an observed Failure Rate of 0.54% per 1000 hours during the first 5000 hours of operation at maximum-rated plate-dissipation conditions (E_f = 6.3 volts, E_b = 100 volts, E_c = -1.85 volts, R_g = 0.5 megohm, E_{hk} = 100 volts, P_b = 1 watt and T_E = 150°C min).

Engineering-Evaluation Tests (At Reduced P_b)

Based on over 1,541,000 tube-hours of engineering-evaluation life tests, nuvistor type 7586 has had an observed Failure Rate of 0.065% per 1000 hours out to 20,000 hours of operation at reduced plate-dissipation (normal-operation) conditions (E_f = 6.3 volts, E_{bb} = 75 volts, R_k = 100 ohms, R_g = 0.5 megohm, P_b = 0.75 watt, and T_E = 150°C min).

UNIFORMITY OF NUVISTOR-TUBE CHARACTERISTICS

The critical characteristics of RCA nuvistor tubes have an extremely high degree of uniformity from tube to tube, both initially and throughout life when compared to conventional electron tubes. This exceptional uniformity results from the unique nuvistor-tube design, the special methods of assembly and processing, and a rigorous Quality-Assurance Program. Industrial and Military types are subjected, on a statistical-lot-sampling basis, to Initial Variables Controls to assure that the spread of critical characteristics is narrow and that the sample average is close to the established bogey value. In addition, Life-Test end-points assure that (1) the Transconductance Change with Operating Time for an individual sample tube and the Sample Average of these individual changes, are small and (2) the Useful Power Output for class C types is above an established minimum value.

NUVISTOR TUBES and NUCLEAR RADIATION

Pulse Nuclear Irradiation

Nuvistor tubes have been operated as af-amplifier tubes and monitored before, during, and after exposure to pulse nuclear radiation having a Peak Fast-Neutron Flux of 10^{15} neutrons per square centimeter per second and a Peak Gamma Intensity of 10^7 roentgens per second.

The transient response of all tubes monitored followed the nuclear-radiation pulse and returned to normal, with no permanent damage to the tubes.

Steady-State Nuclear Irradiation

Type 7586 nuvistor tubes have been operated, for 3 hours, in a nuclear-radiation environment having a constant Fast-Neutron Flux of 10^{13} neutrons per square centimeter per second and a Gamma Intensity of 10^8 roentgens per second.

During the 3-hour exposure to nuclear radiation, the tubes continued to operate with no permanent damage.

ADDITIONAL TECHNICAL INFORMATION

Additional technical information on the RCA Nuvistor Tubes and Integral-Cavity TRF Amplifiers listed in this abbreviated Reference Guide is available, in the following forms, from your nearest RCA Field Office, or from Commercial Engineering, Electronic Components and Devices, RCA, Harrison, New Jersey 07029.

Technical Bulletins

For each commercial type.

Preliminary and Tentative Data Sheets

For each developmental type.

Brochure

1CE-280 RCA Nuvistor Tubes for Industrial and Military Applications.

Application Notes

AN-191 RCA-6CW4 and 2CW4 Nuvistor Triodes as RF Amplifiers in VHF Television Tuners.

AN-193 Use of RCA-7587 Industrial Nuvistor Tetrode in RF and IF Applications.

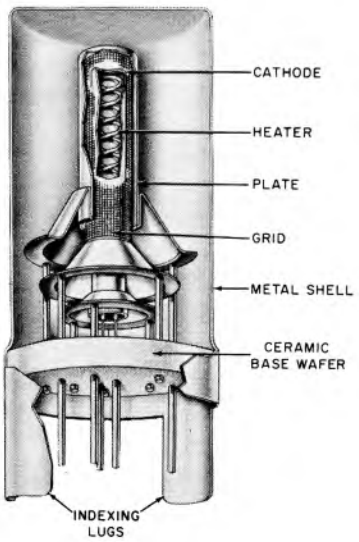
AN-195 Noise and Gain of the RCA-8056 Nuvistor Triode at 200 Mc.

AN-196 Temperature Ratings and Thermal Considerations for Nuvistor Tubes.

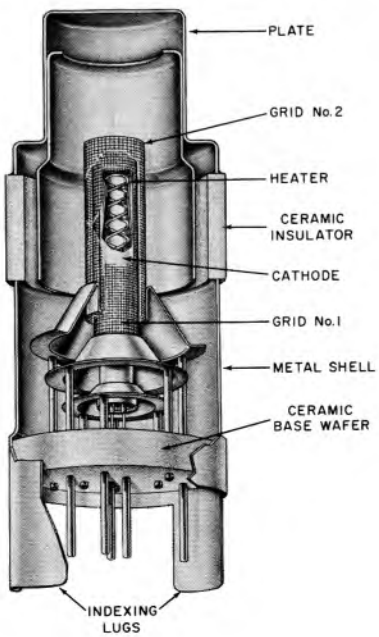
Preliminary and Tentative Application-Information Reports

ST-2296 Nuvistor Nuclear-Radiation Testing.

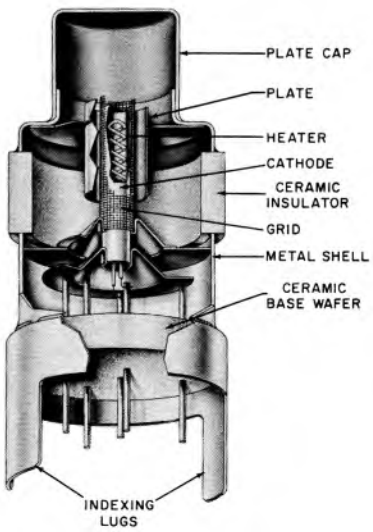
ST-2474 Nuvistor Environmental Performance.



Typical Single-Ended Nuvistor Triode



Typical Double-Ended Nuvistor Tetrode



Typical Double-Ended Nuvistor Triode