RADIOTRONICS

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A2087 NOISE DIODE

GENERAL DATA

Electrical:

Filament	Tungsten	
Filament Voltage	4.4	volts
Filament Current	0.64	amp.

Direct Interelectrode Capacitances:

Plate to Filament	0.8 µµF
Plate to All	2.3 µµF

Mechanical:

Maximum Overall Length	$2\frac{3}{16}''$
Maximum Seated Height	2″
Maximum Diameter	$\frac{3}{4}''$
Bulb	T-5-$\frac{1}{2}$
Base	Miniature Button 7-Pin

Base Connections for BOTTOM VIEW

Pin 1 — Plate
Pin 2 — Internal Conn. Do not use
Pin 3 — Filament
Pin 4 — Filament
Pin 5 — Plate
Pin 6 — No Conn.
Pin 7 — Internal Conn. Do not use

Ratings:

Plate Voltage	100	max.	volts
Plate Current (Saturated)	20	max.	mA
Plate Dissipation	2	max.	watts

Typical Operation:

Filament Voltage	3.7	volts
Filament Current	0.5	amp.
Plate Voltage	100	volts
Plate Current (Saturated)	5	mA

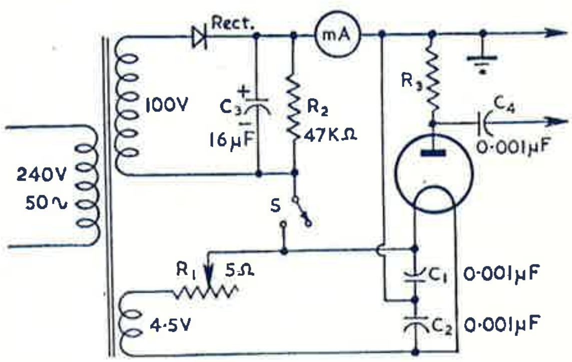
GENERAL:

The A2087 is a tungsten filament diode suitable for use as a noise generator at frequencies up to 500 Mc/s.

The valve has been designed to give a life of 1,000-2,000 hours at a saturated emission current of 5 mA; but higher currents may be obtained with shorter valve life. With a saturated emission of 20 mA the life is approximately 100 hours.

APPLICATION:

It is almost essential when designing sensitive receivers to have means of measuring the noise factor. The most straightforward way of doing this is by means of a diode noise generator.



A suitable circuit is shown above using the Radiotron A2087 and the following practical points should be observed:—

Resistor R_1 must be of a large diameter to give smooth control, i.e. about $3\frac{1}{2}''$.

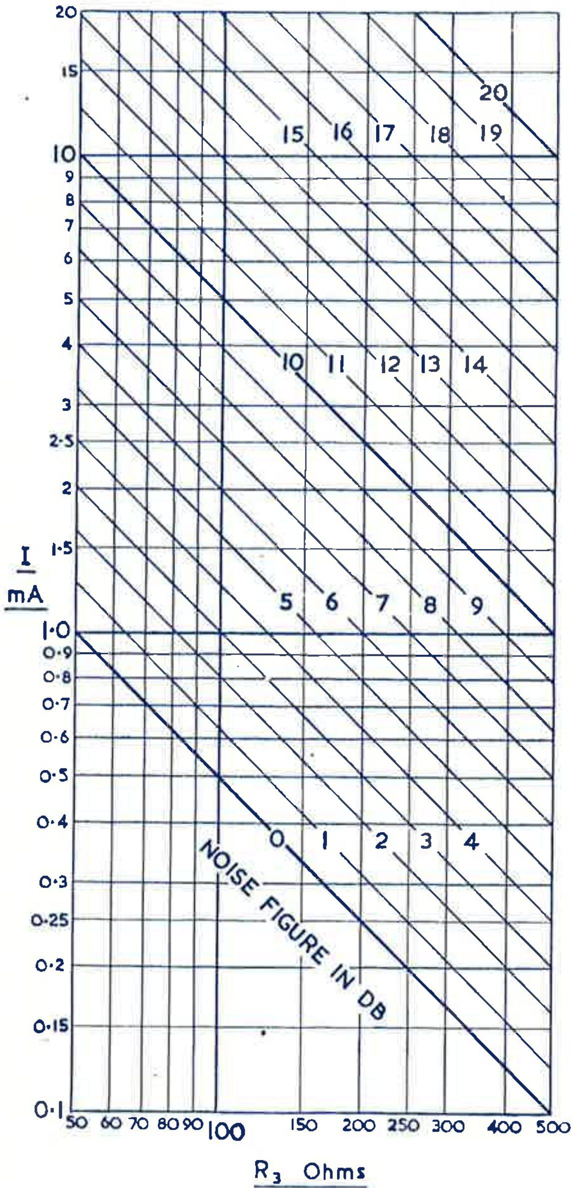
R_3 can conveniently be in log steps of 50, 80, 125, ~~300~~ 200, 320, 500 ohms.

Capacitors C_1, C_2 and C_4 must be of miniature non-inductive type, values not critical. The meter should be capable of reading 1 to 25 mA accurately.

Its use is very simple. The generator, with DC switched off and R_1 fully in, is connected to the input terminals of the receiver and R_3 is set to the value of the impedance of the aerial and feeder system used. The noise output of the receiver is noted. The DC switch is then closed and R_1 advanced until the noise output ~~voltage~~ power is doubled. The diode current is read and the noise factor is then calculated from the relationship. Noise factor (in db) $= 10 \log (20IR_3)$ where $I =$ diode current in amps. A set of curves has been prepared for ease of working.

The accuracy depends on the detector linearity and for the best results the B.F.O. should be switched on to ensure sufficient input for linear operation.

The A2087 is the commercial equivalent of the Services type CV2171.



RADIOTRON NOISE CHART FOR RESISTORS AND VALVES

The Radiotron Noise Chart shown on the opposite page gives rapidly the thermal agitation noise voltage at 20°C for any value of resistor from 1 ohm to 10 megohms for any value of bandwidth from 100 c/s to 10 Mc/s.

For example, take a 2.0 megohm resistor and a 10 Kc/s bandwidth — follow the 2 megohm horizontal line along to the vertical line corresponding to a bandwidth of 10 Kc/s, and then read the noise voltage by interpolating between the sloping lines; in this example the value is 18 microvolts.

The chart also shows the range of valve equivalent noise resistance for the principal valve groups. For instance, it shows that converters have values of equivalent noise resistance between 53,000 and 290,000 ohms.

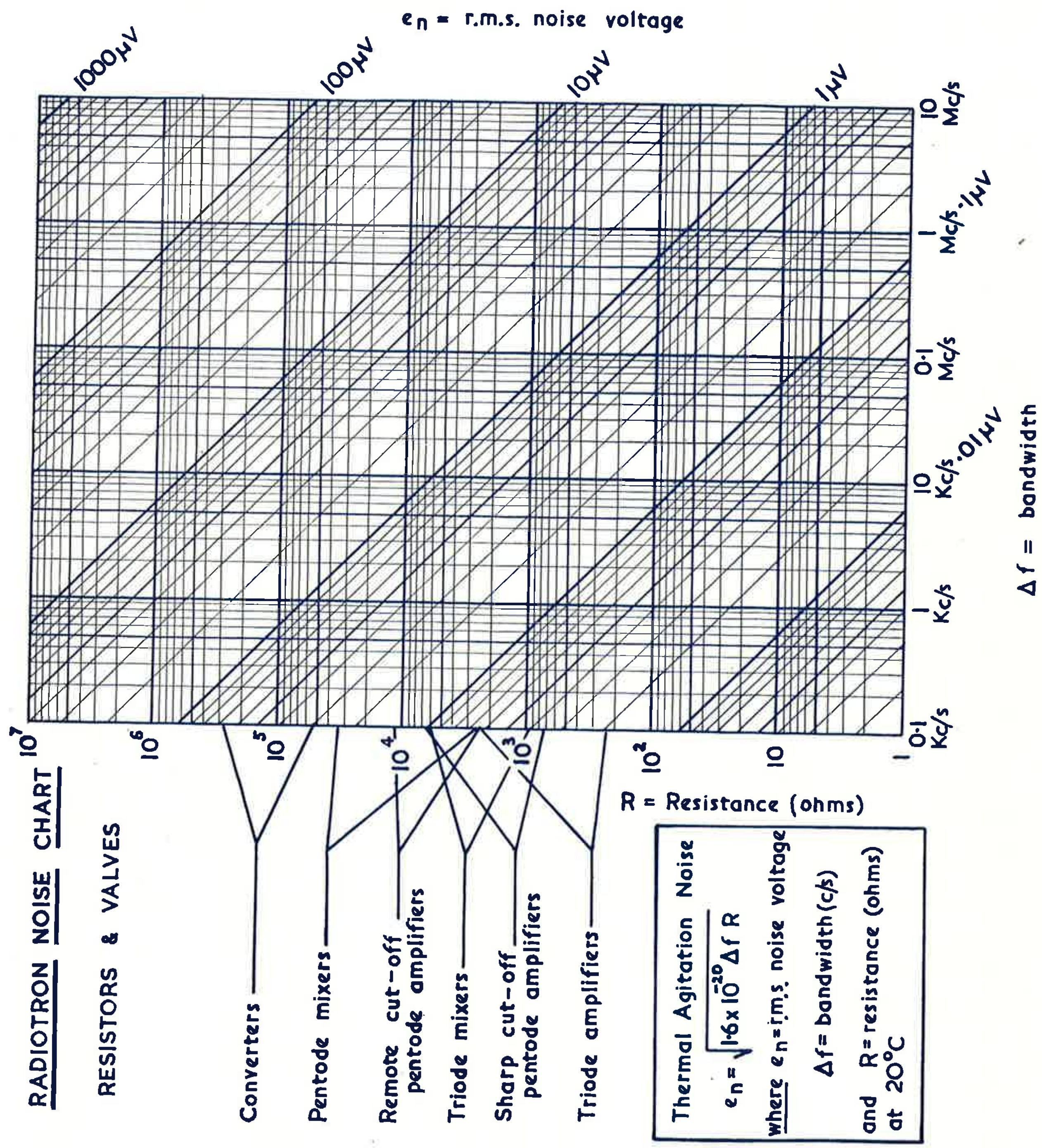
The limiting values of equivalent noise resistances for valves may also be read in terms of r.m.s. noise voltage for a specified bandwidth. As shown above, the limiting values for converter valves are 53,000 and 290,000 ohms. If the bandwidth is 5 Kc/s, then the chart gives the corresponding values of equivalent noise voltage as 2.1 and 4.8 microvolts respectively.

The equation on which this chart is based is shown in the panel on the chart and may be derived immediately from equation (2) on page 935 of the Radiotron Designer's Handbook, 4th edition, or the first equation on page 936.

The chart may be used as an alternative to Fig. 23.18 on page 936 of the Handbook, being more generally useful on account of the unlimited choice of bandwidths inside the limits of the chart. In addition, Fig. 23.18 does not give values of valve equivalent noise resistance.

The values of valve equivalent noise resistance tabulated on page 938 of the Handbook will be found to be inside the limits for the particular valve group in the Noise Chart.

The subject of valve and circuit noise is covered in pages 935 to 942 of the Handbook.


RADIOTRON NOISE CHART
RESISTORS & VALVES
e_n = r.m.s. noise voltage
1000µV
100µV
10µV
1µV
·1µV
·01µV
10 Mc/s
1 Mc/s
0·1 Mc/s
10 Kc/s
1 Kc/s
0·1 Kc/s
Δf = bandwidth
10^7
10^6
10^5
10^4
10^3
10^2
10
1
R = Resistance (ohms)
Converters
Pentode mixers
Remote cut-off pentode amplifiers
Triode mixers
Sharp cut-off pentode amplifiers
Triode amplifiers
Thermal Agitation Noise
$e_n = \sqrt{1{\cdot}6 \times 10^{-20} \Delta f R}$
where e_n = r.m.s. noise voltage
Δf = bandwidth (c/s)
and R = resistance (ohms) at 20°C

6328

Multiplier Phototube

9-STAGE TYPE WITH S-4 RESPONSE

FOR HEADLIGHT CONTROL SERVICE

Radiotron 6328 is a short, rugged multiplier photo-tube of the 9-stage type intended especially for automobile headlight-dimming service.

Having instantaneous response to meet the critical timing requirements of head-light-control service, the 6328 is capable of providing stable performance over long periods. Its high luminous sensitivity allows use of an amplifier with relatively low-impedance input and fewer stages than required by a less-sensitive tube. Furthermore, the 6328 has low electrode dark current which makes feasible the use of high resistance voltage-divider networks to minimize power requirements and to improve not only operating stability but also life.

TENTATIVE DATA

General:

Spectral Response		S–4
Wavelength of Maximum Response		4000 ± 500 angstroms
Cathode:		
Minimum Projected Length*		$\frac{15}{16}''$
Minimum Projected Width*		$\frac{5}{16}''$
Direct Interelectrode Capacitances:		
Anode to Dynode No. 9	4.2	μμf
Anode to All Other Electrodes	5.5	μμf
Maximum Overall Length		$3\frac{1}{8}''$
Maximum Seated Length		$2\frac{11}{16}''$
Length from Base Seat to Centre of Useful Cathode Area		$1\frac{9}{16}'' \pm \frac{3}{32}''$
Maximum Diameter		$1\frac{5}{16}''$
Bulb		T–9
Base		Small-Shell Neosubmagnal 11-Pin, Non-hygroscopic (JETEC No. B11-104)
Mounting Position		Any

Maximum Ratings, *Absolute Values:*

Anode-supply Voltage (DC or Peak AC)	1250	max.	volts
Supply Voltage between Dynode No. 9 and Anode (DC or Peak AC)	250	max.	volts
Average Anode Current°	0.1	max.	ma
Ambient Temperature	75	max.	°C

* On plane perpendicular to the indicated direction of light *(see Dimensional Outline).*

Characteristics Range Values for Equipment Design:

Under conditions with supply voltage (E) across voltage divider providing 1/10 of E between cathode and dynode No. 1; 1/10 of E for each succeeding dynode stage; and 1/10 of E between dynode No. 9 and anode.

With E = 1000 volts.

	Min.	*Av.*	*Max.*	
Sensitivity:				
Radiant, at 4000 angstroms	–	32500	–	μamp/μwatt
Luminous:▲				
At 0 cps	5	35	250	amp/lumen
At 100 Mc	–	33	–	amp/lumen
Electrode Dark Current (at 25°C):				
Anode	–	–	0.1	μamp
Any other electrode	–	–	0.75	μamp

° Averaged over any interval of 30 seconds maximum.

▲ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A light input of 10 microlumens is used. The load resistor has a value of 0.01 megohm.

Definitions

Radiant Sensitivity. The quotient of output current by incident radiant energy of a given wavelength, at constant electrode voltages.

Luminous Sensitivity. The quotient of output current by incident luminous flux, at constant electrode voltages.

Electrode Dark Current. The electrode current which flows when there is no radiant flux incident on the photocathode.

GENERAL CONSIDERATIONS

An *electron multiplier* is a vacuum tube which utilizes the phenomenon of secondary emission to amplify signals composed of electron streams. In the 6328 multiplier phototube, represented in Fig. 3, the electrons emitted from the illuminated cathode are directed by fixed electrostatic fields to the first dynode (secondary emitter). The electrons impinging on the dynode surface produce many other electrons, the number depending on the energy of the impinging electrons. These secondary electrons are then directed by fixed electrostatic fields along curved paths to the second dynode where they produce more new electrons. This multiplying process is repeated in each successive stage, with an ever-increasing stream of electrons, until those emitted from the last dynode (dynode No. 9) are collected by the anode and constitute the current utilized in the output circuit.

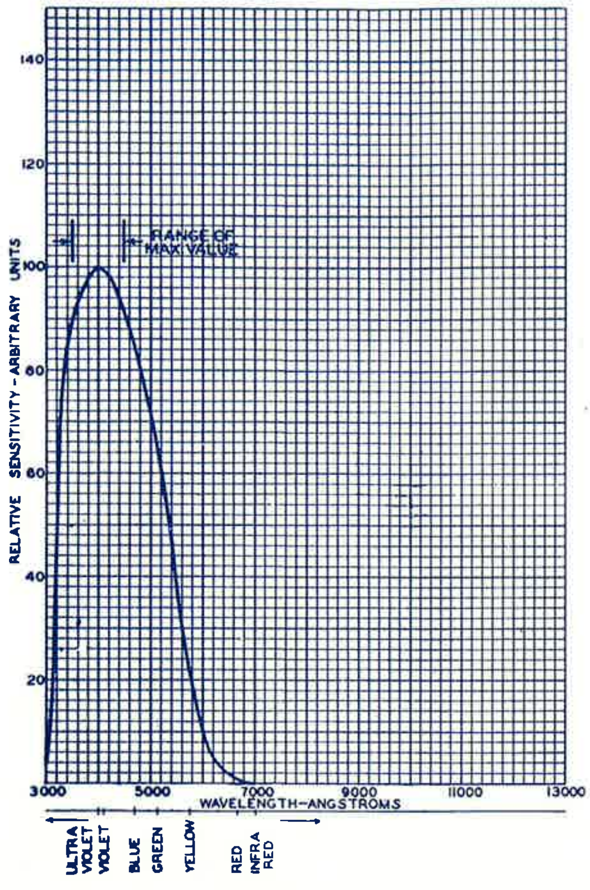


Fig. 1. Spectral Sensitivity Characteristic of Type 6328 which has S-4 Response. Curve is shown for Equal Values of Radiant Flux at All Wavelengths.

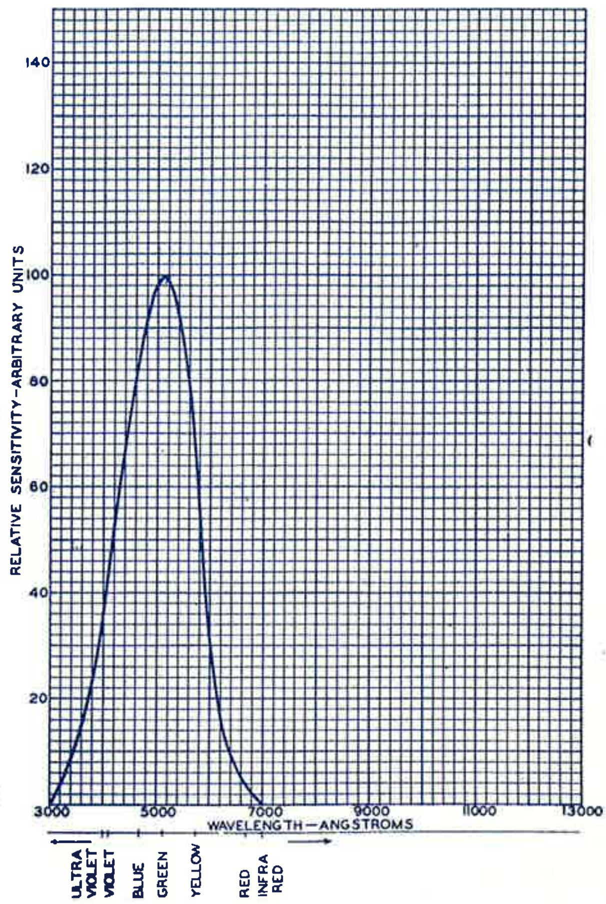


Fig. 2. Sensitivity Characteristic of Type 6328 Obtained by Multiplying Its Special Sensitivity Characteristic in Fig. 1 by the Relative Energy Distribution Characteristic of a Tungsten Lamp at 2870°K.

Dynode No. 9 is so shaped as to enclose partially the anode and to serve as a shield for it in order to prevent the fluctuating potential of the anode from interfering with electron focusing in the interdynode region. Actually the anode consists of a grating which allows the electrons from dynode No. 8 to pass through it to dynode No. 9. Spacing between dynode No. 9 and anode creates a collecting field such that all the electrons emitted by dynode No. 9 are collected by the anode. Hence, the output current is substantially independent of the instantaneous positive anode potential over a wide range. As a result of this characteristic, the 6328 can be coupled to any practical load impedance.

The shield which extends between the photocathode and the anode shields the photocathode from the anode and prevents ion feedback. If positive ions produced in the high-current region near the

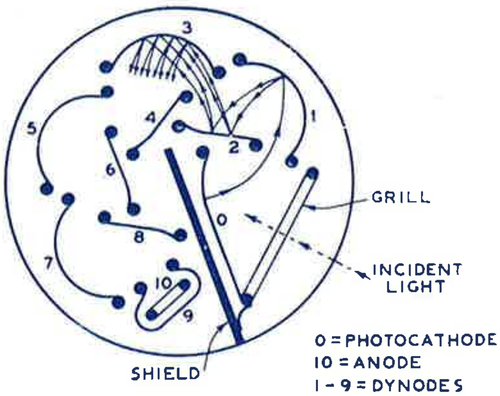


Fig. 3. Schematic Arrangement of Type 6328 Structure.

anode were allowed to reach the photocathode or the initial dynode stages, they would cause the emission of spurious electrons which after multiplication would produce undesirable and often uncontrollable regeneration.

The grill through which the incident radiation reaches the photocathode, is connected to the photocathode and serves as an electrostatic shield for the open side of the electrode structure.

INSTALLATION AND APPLICATION

The *maximum ratings* shown in the tabulated data are limiting values above which the serviceability of the 6328 may be impaired from the viewpoint of life and satisfactory performance. Therefore, in order not to exceed these absolute ratings, the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by an amount such that the absolute values will never be exceeded under any usual condition of supply-voltage variation, load variation, or manufacturing variation in the equipment itself.

The *maximum ambient temperature* as shown in the tabulated data is a tube rating which is to be observed in the same manner as other ratings. This rating should not be exceeded because too high a bulb temperature may cause the volatile cathode surface and dynode surfaces to evaporate with consequent decrease in the life and sensitivity of the tube.

The *base pins* of the 6328 fit the neosubmagnal 11-contact socket. The socket should be made of high-grade, low-leakage material, and should be installed so that the base key of the tube faces the incident radiation.

In general, the *operating voltages* for the 6328 are as follows. The successive stages are operated at voltages increasing in equal steps from the photocathode to the 9th dynode. The steps are generally chosen as 50 to 100 volts per stage. The voltage between dynode No. 9 and the anode should be kept as low as will permit operation with anode-current saturation. Referring to the anode characteristic curves, shown in Fig. 4, it will be seen that saturation occurs in the approximate range of 50 to 100 volts.

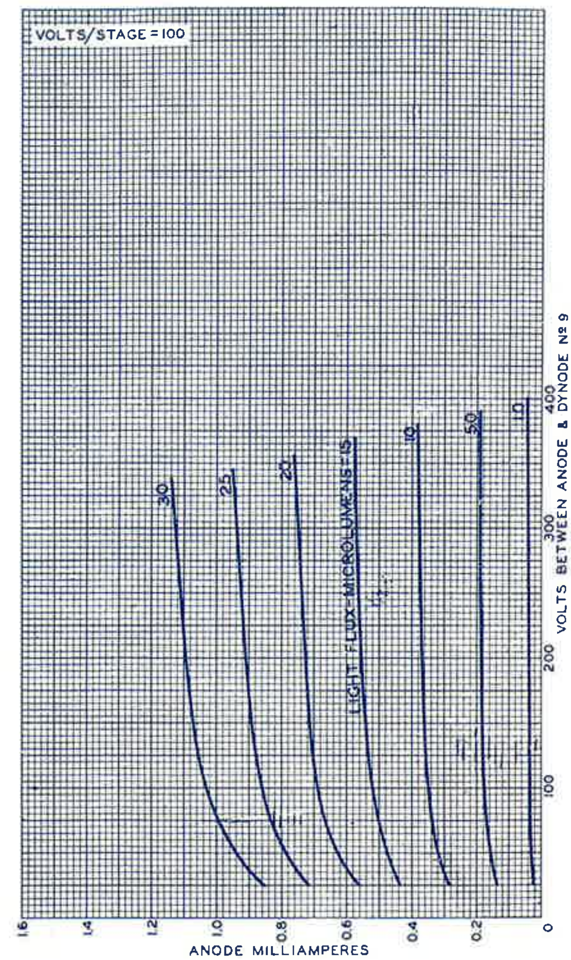


Fig. 4. Average Anode Characteristic of Type 6328.

Low operating voltage between dynode No. 9 and anode reduces the dark current. As a result, the operating stability of the 6328 is improved without sacrifice in sensitivity. To obtain the indicated operating voltage between dynode No. 9 and anode, it will be necessary to increase the supply voltage between these electrodes above the operating voltage by an amount to allow for the signal-output voltage desired.

The *operating stability* of the 6328 is dependent on the magnitude of the anode current and its duration. When the 6328 is operated at high values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6328 usually recovers a substantial percentage of such loss in sensitivity.

The use of an average anode current well below the maximum rated value of 0.1 milliampere is recommended when stability of operation is important.

The *sensitivity of the photocathode surface* varies with respect to the position of the light spot on the surface. Fig. 5a shows the variation in sensitivity of the surface as the position of a 1-mm light spot is moved from one end of the photocathode to the other. Similarly, the curve in Fig. 5b shows how the sensitivity of the photocathode surface varies across its projected width in the plane of the grill.

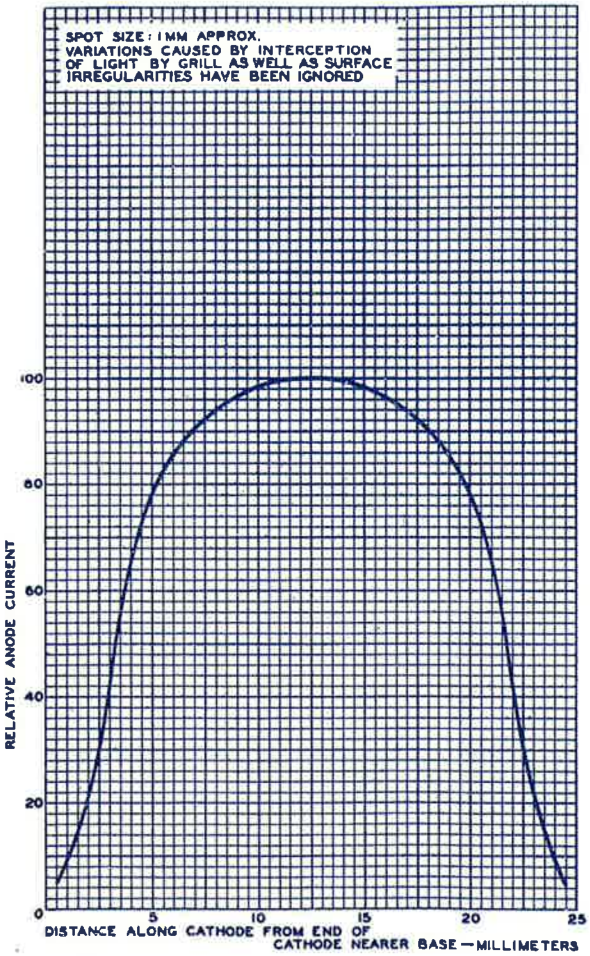


Fig. 5a. Variation in Sensitivity of Photocathode Along Its Length.

From these curves, the equipment designed can readily determine the optimum position of any light spot on the photocathode surface to give the highest sensitivity.

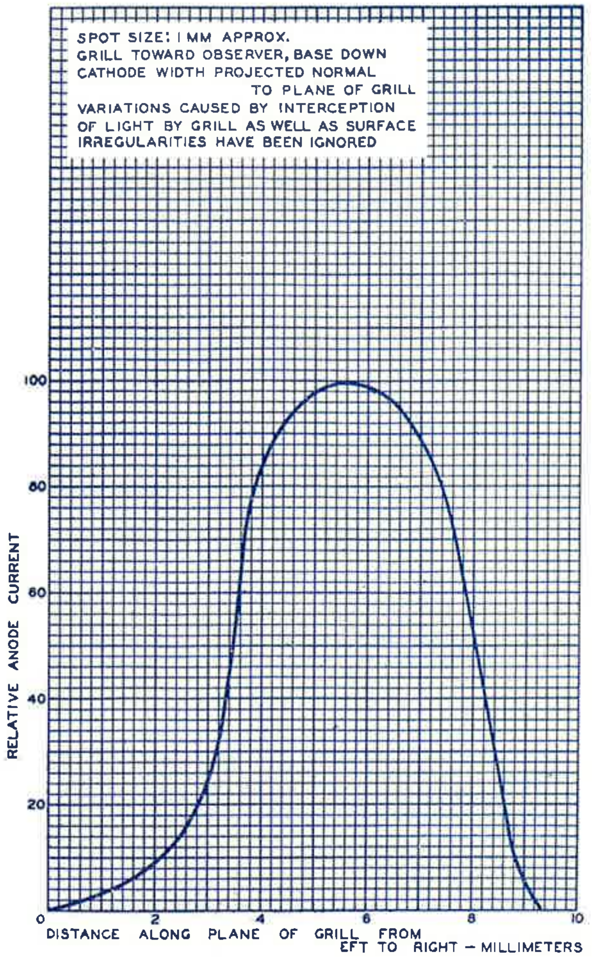


Fig. 5b. Variation in Sensitivity of Photocathode Across Its Projected Width in Plane of Grill.

Fig. 6 shows the range of luminous sensitivity versus the dc voltage per stage for the 6328.

The *range of sensitivity values* is dependent on the respective amplification of each dynode stage. Hence, large variations in sensitivity can be expected between individual tubes of a given type. The overall amplification of a multiplier phototube is equal to the average amplification per stage raised to the *n*th power, where *n* is the number of stages. Thus, very small variations in amplification per stage produced very large changes in overall tube amplification.

Because these overall changes are very large, it is advisable for the equipment designer to provide adequate adjustment of the supply voltage so that the amplification of individual tubes can be adjusted to the desired design value. It is suggested that an overall voltage-adjustment range of 2 to 1 be provided.

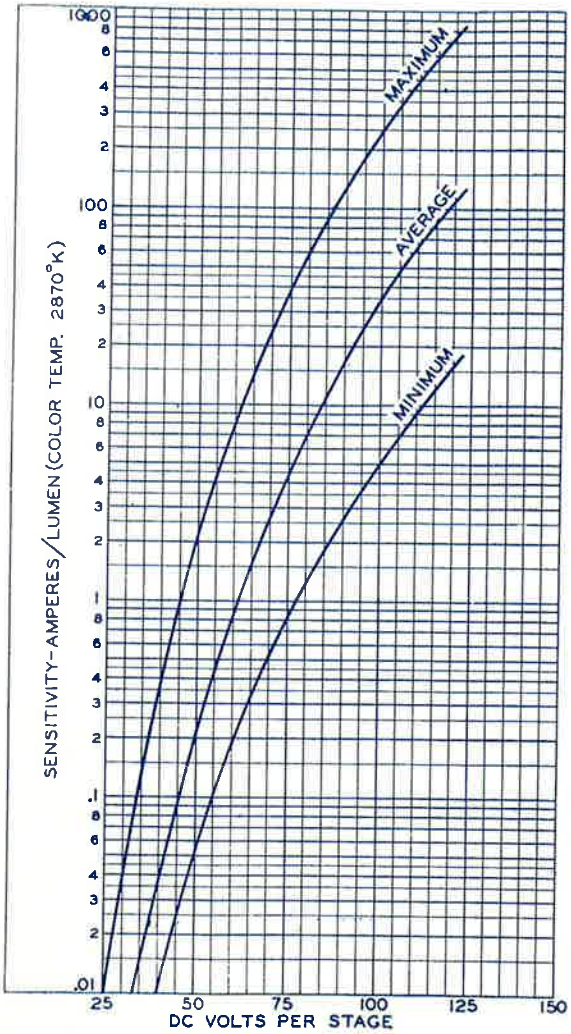
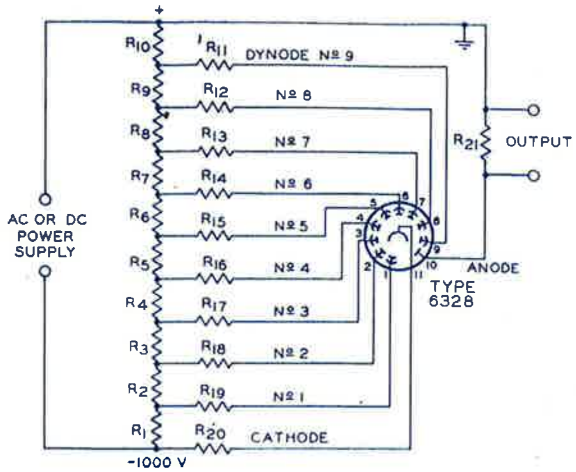


Fig. 6. Range of Luminous Sensitivity of Type 6328.

When the 6328 is operated with an ac supply, its effective sensitivity is reduced because appreciable anode current flows only near the peak of the positive cycle. The amount of the reduction is dependent on the ac waveshape. For an ideal square wave, the sensitivity is reduced by a factor of 2.

The *electrode voltages* may be obtained from an adequately regulated ac or dc power supply. An *ac supply* may be conveniently obtained from a high-voltage transformer operated from a suitable vibrator. A *dc supply* may be obtained by employing a high-voltage, vacuum tube rectifier operated from a high-voltage transformer fed by a vibrator. The voltage for each dynode and for the anode can be supplied by fixed taps on a voltage divider across the power supply.



R1, R2, R3, R4, R5,
R6, R7, R8, R9, R10: 1 megohm, ½ watt
R11: 2 megohms, ½ watt
R12: 5.1 megohms, ½ watt
R13, R14, R15, R16
R17, R18, R19, R20: 8.2 megohms, ½ watt
R21: 820,000 ohms, ½ watt

Fig. 7. Recommended Voltage-Divider Network for Use with Type 6328 in Headlight Dimming Service.

A recommended design of voltage-divider network for use with the 6328 to provide stable operation and long tube life is shown in Fig. 7. This design provides linear operation within the range normally required for dimming. At higher light levels, the network design limits the tube output to a safe value. The indicated design values provide dimming operation for an anode current in the range between 5 and 10 microamperes.

It is recommended that the positive high-voltage terminal be grounded in order that the output will be produced between anode and ground. This method prevents power-supply fluctuations from being coupled directly into the signal-output circuit.

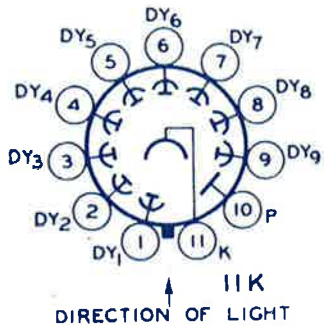
The high voltages at which the 6328 is operated are very dangerous. Care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Precautions should include the enclosure of high-potential terminals and the use of interlock switches to break the primary circuit of the high-voltage power supply when access to the apparatus is required.

In the use of the 6328, as with other tubes requiring high voltages, it should always be remembered that these high voltages may appear at points in the circuit which are normally at low potential, because of defective circuit parts or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power supply should be disconnected and both terminals of any capacitors grounded.

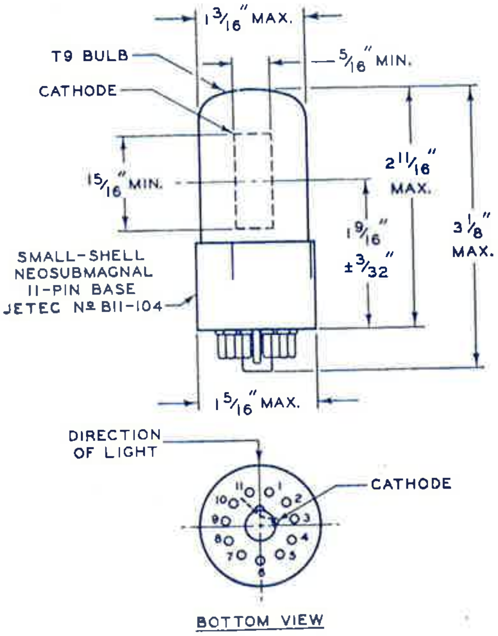
PIN CONNECTIONS

Pin 1: Dynode No. 1
Pin 2: Dynode No. 2
Pin 3: Dynode No. 3
Pin 4: Dynode No. 4
Pin 5: Dynode No. 5
Pin 6: Dynode No. 6
Pin 7: Dynode No. 7
Pin 8: Dynode No. 8
Pin 9: Dynode No. 9
Pin 10: Anode
Pin 11: Cathode

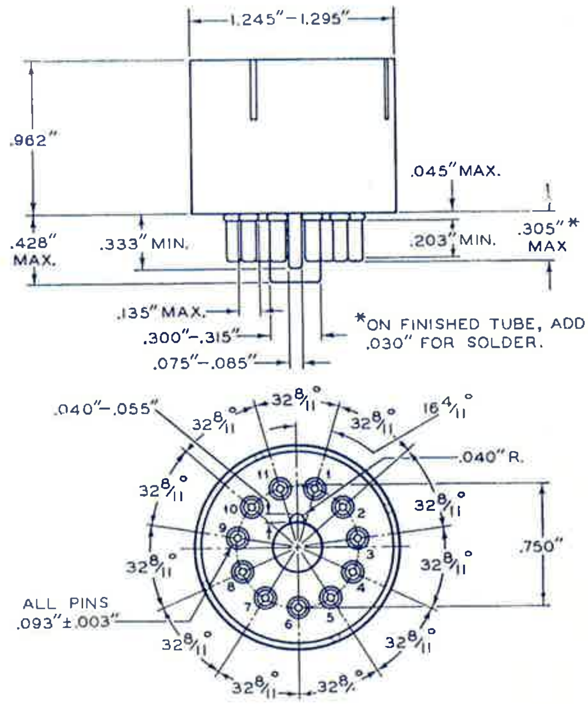
SOCKET CONNECTIONS
Bottom View



DIMENSIONAL OUTLINE



SMALL-SHELL NEOSUBMAGNAL
11-PIN BASE
JETEC No. B11-104



C/L of bulb will not deviate more than 2° in any direction from the perpendicular erected at the centre of bottom of the base.

NOTE: The maximum angular variation between the plane through Pins No. 1 and No. 11 and the plane of the grill will not exceed 6°.

Base-pin positions are held to tolerances such that pins will fit flat-plate gauge having thickness of ¼ inch and eleven 0.1030"-0.1035" holes so located on a 0.7500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centres is 0.2125" ± 0.0005". Pin fit in gauge shall be such that entire length of pins will enter gauge, and on withdrawal, they will become disengaged without lifting gauge and supplementary weight totalling 3 pounds.

New RCA Releases

Radiotron 2C39-A is a high-mu transmitting triode of the planar-electrode type designed for use as an r-f power amplifier, oscillator, or frequency multiplier at frequencies up to 2500 Mc/s and above. It has a maximum plate-dissipation rating of 100 watts, low interelectrode capacitances, and exceptionally high transconductance.

Employing a small rugged structure having ring-type seals with graduated diameters, the 2C39-A is particularly useful in either cavity or parallel-line circuits of compact fixed and mobile equipment. The structural design provides low-inductance, large-area, electrode terminals for insertion into coaxial-cylinder circuits, and permits effective isolation of the plate from the cathode. The latter feature makes the 2C39-A especially suitable for grounded-grid circuits.

As a class C r-f power amplifier operating at 500 Mc/s, the 2C39-A is capable of delivering a useful power output of 27 watts with a driver-output power of about 6 watts; and as an oscillator at 2500 Mc/s, it can deliver a minimum initial useful power output of 12 watts.

Radiotron 3E29 is a power amplifier tube consisting of twin beam units in one envelope. It is designed for pulse modulator service employing rectangular-wave modulation. Because of its high perveance, the 3E29 can be operated at high efficiency and with low driving power. Compact in design, the 3E29 has a balanced structure of the beam power units, excellent internal shielding, and close interelectrode spacing. The internal leads are short and heavy. The terminal arrangement provides excellent insulation. The heaters are arranged to allow operation from either a 6.3 or a 12.6-volt supply.

Radiotron 4X150A is a very small and compact, forced-air cooled, power tetrode intended for use in power amplifier or oscillator service at frequencies up to 500 Mc/s. It is also useful as a wide-band amplifier in video applications. The 4X150A has a maximum plate dissipation of 150 watts.

The terminal arrangement of the 4X150A facilitates use of the tube with tank circuits of the coaxial type. Effective isolation of the output circuit from the input circuit is provided at the higher frequencies by the contact-ring terminal for grid No. 2. A base-pin termination for grid No. 2 is also available for operation of the 4X150A at the lower frequencies.

Radiotron 6AU4-GT is a glass-octal type of half-wave vacuum rectifier intended for use as a damper diode in television receivers. It is particularly useful in those receivers utilizing picture tubes which have 90° deflection.

Rated to withstand a maximum peak inverse plate voltage of 4500 volts, the 6AU4-GT can supply a maximum peak plate current of 1050 milliamperes and a maximum dc plate current of 175 milliamperes. Furthermore, negative peak pulses between heater and cathode of as much as 4500 volts with a dc component of as much as 900 volts may be used when the heater is operated negative with respect to cathode.

Radiotron 21ZP4-A is a rectangular glass picture tube utilizing magnetic focus and magnetic deflection. It has a screen size of $19\frac{1}{8}$" X $14\frac{3}{16}$" with slightly curved sides and rounded corners; a spherical Filterglass faceplate a diagonal deflection angle of 70°; an external conductive bulb coating; an ion-trap gun; and a maximum ultor-voltage rating of 18,000 volts.

Radiotron 6130/3C45 is a hot cathode, three-electrode, hydrogen thyratron designed for pulsing service involving high repetition rates, high peak currents, and low average currents in low-impedance circuits. It is especially useful for pulsing magnetron oscillators and other oscillators having a power input up to 50 kilowatts.

Features of the 6130/3C45 include a design permitting operation with full ratings at altitudes corresponding to pressures down to 70 mm of mercury (corresponding to about 50,000 feet), very short deionization time, low voltage drop, high peak anode current capability, ambient-temperature operating range of —50° to + 90°C, and positive-control characteristic which permits zero-bias operation utilizing positive triggering pulses.

The "high-altitude" type 6130/3C45 is directly interchangeable with and supersedes the "low-altitude" type 3C45.

Two "pencil-type" triodes with external plate radiators have just been announced. Designated **Radiotrons 6263** and **6264**, these small uhf tubes are designed for use in low-power mobile transmitters, and in aircraft transmitters at altitudes up to 60,000 feet without pressurized chambers. They have a maximum plate-dissipation rating of 13 watts (ICAS) and can be operated with full ratings at frequencies up to 500 Mc/s and with reduced ratings at frequencies as high as 1700 Mc/s. The 6263 has a mu of 27; the 6264 has a mu of 40. Both types are identical in size and appearance.

The 6263 is intended for service as a r-f power amplifier and cw oscillator. When operated in a cathode-drive circuit under ICAS conditions at a frequency of 500 Mc/s, the 6263 can deliver a power output to the load of approximately 10 watts as an unmodulated class C rf power amplifier, or 7 watts as an unmodulated class C oscillator, with a plate input of only 14 watts.

The 6264 is intended for service primarily as a frequency multiplier but may be used as an r-f power amplifier and cw oscillator. When operated as a frequency tripler to 510 Mc/s in a cathode-drive circuit under ICAS conditions, the 6264 can deliver a power output to the load of approximately 3.4 watts.

While retaining the basic "pencil-type" construction with its many desirable features for good uhf operation, these types are provided with an efficient, 9-pin radiator for cooling the plate by convection or, in confined spaces, with forced air.

Radiotron 6323 is a 9-stage multiplier phototube intended especially for automobile headlight-dimming service. Small in size and ruggedly constructed, the 6323 features high luminous sensitivity which allows use of an amplifier with relatively low-impedance input and fewer stages, and provides instantaneous response to meet the critical timing requirements of headlight-control service. In addition, the 6323 has low electrode dark current which permits the use of high-resistance voltage divider networks. When thus used, the 6323 is capable of providing stable performance over long periods in headlight-dimming service.

Radiotron 6342 is a head-on type of high-vacuum multiplier phototube intended for use in scintillation counters for the detection and measurement of nuclear radiation, and in other applications involving the measurement of low-level, large-area light sources. Its relative freedom from after-pulses and its small spread in electron-transit time make it particularly useful for fast coincidence scintillation counting.

The spectral response of the 6342 covers the range from about 3000 to 6200 angstroms. Maximum response occurs at approximately 4000 angstroms. The 6342, therefore, has high sensitivity to blue-rich light and negligible sensitivity to red radiation. Because of its spectral response, the 6342 is well suited for use with organic phosphors such as anthracene as well as with inorganic materials such as thailium-activated sodium iodide.

Design features of the 6342 include a semi-transparent cathode having a diameter of $1\frac{1}{2}$ inches on the inner surface of the face end of the bulb; a face with a flat surface having a minimum diameter of $1\frac{1}{2}$ inches to facilitate the mounting of flat phosphor crystals in direct contact with the surface; ten electrostatically focused multiplying (dynode) stages; and a focusing electrode with external connection for shaping the field which directs photoelectrons from the cathode on to the first dynode. The relatively large cathode area permits very efficient collection of light from excited phosphor crystals, such as are employed in scintillation counters. The material of which the dynodes are made has stable, high-current-carrying capabilities and permits tube processing to minimize regenerative effects, such as after-pulses.

The 6342 is capable of multiplying feeble photoelectric current produced at the cathode by an average value of 125,000 times when operated with a supply voltage of 1250 volts; of 600,000 times when operated with a supply voltage of 1500 volts. The output current of the 6342 is a linear function of the exciting illumination under normal operating conditions.

For certain nuclear radiation measurements, the 6342 offers the advantage of small spread in electron transit time, and consequently a fast pulse rise time. For an input pulse having a rise time of 1 millimicrosecond or less, the rise time of the pulse at the anode is about 5 millimicroseconds as measured between its 10 and 90 per cent magnitude points when the supply voltage is 1500 volts and the focusing electrode is connected to dynode No. 1.

In the scintillation type of nuclear radiation detector, the 6342 is particularly useful because of its relatively large, flat-cathode area which permits excellent optical coupling between the phosphor and the cathode. As a result, a maximum number of photoelectrons are produced for each scintillation. This feature is important in nuclear radiation spectroscope because it offers the advantage of minimum statistical spread in output-pulse heights. Furthermore, the focusing electrode permits optimizing the magnitude, uniformity, or speed of the response in critical applications.

The various outstanding features of the 6342 commend its use in the design of a scintillation counter with high efficiency and a resolving time of only a small fraction of a microsecond.

RCA APPLICATION NOTE **AN-158**

USE OF UHF MINIATURE TUBE SOCKETS FOR UHF TELEVISION APPLICATIONS

This Note discusses the advantages and disadvantages resulting from the use of special uhf sockets for seven- and nine-pin miniature tubes in uhf television tuners and converters, and gives recommendations as to when such sockets should be used. These special uhf sockets are designed to make contact with the tube base pins in a region very close to the glass button, usually within $\frac{1}{16}$ inch from the bottom of the seated tube. Because these sockets, compared with conventional miniature sockets, provide appreciable reduction in lead lengths and lead inductances, they can be used to advantage in uhf television equipment for applications such as r-f amplifiers and mixers, which must operate satisfactorily at frequencies up to 890 megacycles, and oscillators, which may be required to operate at frequencies as much as 40 megacycles higher.

The use of these sockets, however, presents disadvantages along with the advantages. The design specifications for sockets for miniature tubes, as given in the General Section of the RCA Tube Handbook HB-3, were intended to ensure a minimum of difficulty from glass strains, which may cause cracks in the glass base, and from poor contact between tube and socket resulting from oxidation of base pins in the vicinity of the glass button during tube processing. The specifications follow:—

"The socket design should be such that circuit wiring cannot impress lateral strain through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than $\frac{1}{8}$ inch from the bottom of a seated tube."*

Because the region of contact between the special uhf socket and the tube base pins is so close to the glass button, the pressure of the socket contacts on the pins places additional lateral strain on the glass and may cause cracks in the tube base. In addition to problems of glass strain, there may also be problems resulting from poor r-f contact. Because of the heat used in the tube manufacturing process to seal the tube base pins into the glass button stem, the base pins may exhibit discolorations, which appear as stem burns, close to the stem of the tube, but in the area which makes contact with the special uhf sockets. When these discolorations are due to actual burning-off of the silver plating on the base pins, it may be difficult to obtain satisfactory high-frequency contact.

Because of the problems of glass strain and poor r-f contact, the use of the special uhf sockets should be restricted to those applications in which good uhf performance is the paramount consideration. When they are used, it is further recommended that wiring jigs be inserted in each socket before it is wired to minimize the possibility of lateral strain which could be transmitted through the socket contacts and cause glass breakage.

*BASES, 7-pin types (Dec. 1, 1942); BASES, 9-pin types (Dec. 20, 1946).

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Amalgamated Wireless Valve Co. Pty. Ltd.,
Technical Publications Department,
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