# RCA Developmental

# • Tricolor Kinescope
# • Associated Tubes
# • Components and
# • Circuits

RADIO CORPORATION of AMERICA
TUBE DEPARTMENT
HARRISON, N. J.



FORM NO. 1CE-111

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**TUBE DEPARTMENT**
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY



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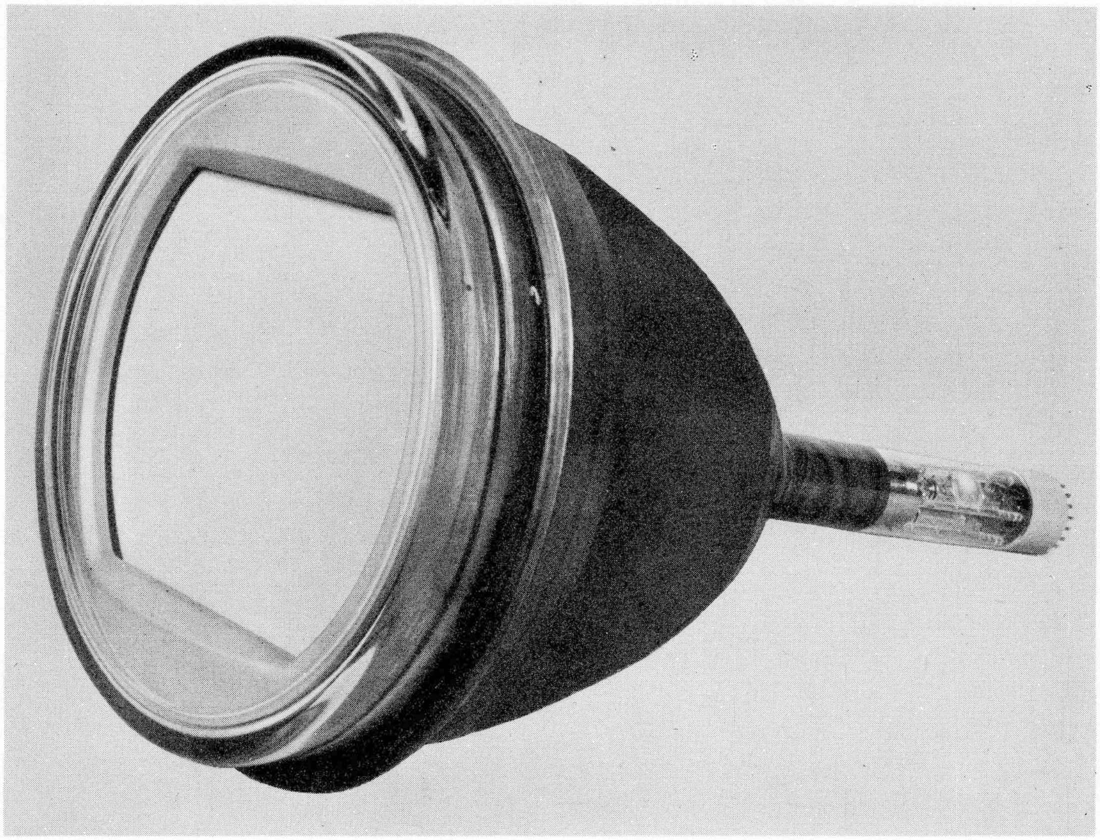

RCA Glass-Envelope Tricolor Kinescope

DEVELOPMENTAL № C-73599

# Contents

# Preliminary and Tentative Data on Following RCA Developmental Tube Types



* Each of these developmental numbers identify a particular laboratory design, but the number and identifying data are subject to change.

Preliminary and Tentative Data
on RCA Developmental

# Three-Gun Tricolor Kinescope

*Developmental No. C-73599*

RCA Developmental Type C-73599 is a directly viewed picture tube of the glass-envelope type for use in color television receivers. It is capable of producing either a full-color or a black-and-white picture 11-1/2" x 8-5/8" with rounded sides.

The C-73599 utilizes three electrostatic focus guns spaced 120° apart with axes parallel to the tube axis, and an assembly consisting of a shadow mask and a plane, tricolor, Filterglass phosphor-dot (screen) plate located between the shadow mask and a clear-glass faceplate.

The tricolor, phosphor-dot plate, which serves as the directly viewed screen, carries an orderly array of small, closely spaced, phosphor dots arranged in triangular groups (trios). Each trio consists of a green-emitting dot, a red-emitting dot, and a blue-emitting dot. The phosphor-dot plate has approximately 195,000 dot trios or 585,000 dots and is metalized after application of the phosphor dots to give increased light output and contrast as well as to prevent ion-spot blemish.

The metal shadow mask, interposed between the electron gun structure and the phosphor-dot plate, contains round holes equal in number to and centered with respect to the dot trios.

## DATA

**General:**

| | | |
|---|---|---|
| Electron Guns, Three | Blue, Green, Red | |
| Heater, for Unipotential Cathode of Each Gun, Paralleled with Each of the Other Two Heaters within Tube: | | |
| Voltage (AC or DC) | 6.3 | volts |
| Current | 1.8 | amp |
| Direct Interelectrode Capacitances (Approx.): | | |
| Grid No.1 of Any Gun to All Other Electrodes Except the No.1 Grids of the Other Two Guns | 7.5 | μμf |
| Cathode of Blue Gun + Cathode of Green Gun + Cathode of Red Gun to All Other Electrodes | 17.5 | μμf |
| Grid No.3 (Of Each Gun Tied within Tube to No.3 Grids of Other Two Guns) to All Other Electrodes | 12 | μμf |
| Grid No.4 (Common to the Three Guns) to All Other Electrodes | 7 | μμf |
| External Conductive Coating to Ultor● | 2500 max.<br>1500 min. | μμf<br>μμf |
| Faceplate, Spherical | Clear Glass | |
| Screen, Flat: | | |
| Type | Metal-Backed, Tricolor, Phosphor-Dot | |
| Plate | Filterglass | |
| Light Transmission (Approx.) | 70% | |
| Size (Rounded Sides—See *Dimensional Outline*) | 11-1/2" x 8-5/8" | |
| Area | 88.5 sq. in. | |
| Phosphor (Three Separate Phosphors, collectively) | P22 | |
| Fluorescence and Phosphorescence of Separate Phosphors, respectively | Blue, Green, Red | |
| Persistence of Group Phosphorescence | Medium | |
| Dot Arrangement | Approx. 195,000 triangular groups, each consisting of blue dot, green dot, and red dot (total of 585,000 dots) | |
| Focusing Method | Electrostatic | |
| Convergence Method | Electrostatic | |
| Deflection Method | Magnetic | |
| Deflection Angles (Approx.): | | |
| Horizontal | 45° | |
| Vertical | 35° | |
| Tube Dimensions: | | |
| Maximum Overall Length | 26-1/8" | |
| Greatest Diameter: | | |
| At faceplate | 14-5/8" ± 5/32" | |
| At metal flange | 15-3/4" max. | |
| Ultor● Terminal | Metal Flange | |
| Base | Small-Shell Bidecal 14-Pin (JETEC No. B14-103) | |
| Socket | Cinch Developmental No. 57C17902, or equivalent | |
| Mounting Position | Any | |
| Weight (Approx.) | 25 lbs | |

**Maximum Ratings,** *Design-Center Values*:

| | | |
|---|---|---|
| ULTOR● VOLTAGE | 20000 max. | volts |
| ULTOR INPUT | 15* max. | watts |
| GRID-No.4 VOLTAGE | 11000 max. | volts |
| GRID-No.3 VOLTAGE | 5000 max. | volts |
| GRID-No.2 VOLTAGE (Each Gun) | 500 max. | volts |
| GRID-No.1 VOLTAGE (Each Gun): | | |
| Negative bias value | 200 max. | volts |
| Positive bias value | 0 max. | volts |
| Positive peak value | 2 max. | volts |
| PEAK HEATER-CATHODE VOLTAGE (Each Gun): | | |
| Heater negative with respect to cathode: | | |
| During equipment warm-up period not exceeding 15 seconds | 410 max. | volts |
| After equipment warm-up period | 180 max. | volts |
| Heater positive with respect to cathode | 180 max. | volts |

**Characteristics Range Values for the Design of Experimental Receivers:**

*For ultor voltage ($E_{c5}$) of 18000 to 20000 volts and ultor input of 15 watts*

| | | |
|---|---|---|
| Grid-No.4 (Converging Electrode) Voltage† | 42.5% to 51% of $E_{c5}$ | volts |
| Grid-No.3 (Focusing Electrode) Voltage | 12% to 19% of $E_{c5}$ | volts |
| Grid-No.2 Voltage (Each Gun) when circuit design utilizes grid-No.1 voltage ($E_{c1}$) at fixed value for raster cutoff (each gun) | 2 to 4.5 times $E_{c1}$ | volts |
| Grid-No.1 Voltage for Visual Extinction of Focused Raster (Each Gun) when circuit design utilizes grid-No.2 voltage ($E_{c2}$) at fixed value (each gun) | 22.5% to 50% of $E_{c2}$ | volts |
| Grid-No.4 Current | -5 to +5 | μamp |
| Maximum Grid-No.3 Current | 300 | μamp |
| Grid-No.2 Current | -15 to +15 | μamp |
| Beam-Current Ratio to Produce Illuminant-C White (6500°K): | | |
| Red Gun to Green Gun | 4:1 to 1:1 | |
| Blue Gun to Green Gun | 1.5:1 to 0.5:1 | |
| Maximum Raster Shift in Any Direction from Screen Center□ | 1-1/4 | inches |

**Examples of Use of Range Values:**

*For ultor voltage of 20000 volts*

| | | |
|---|---|---|
| Grid-No.4 (Converging Electrode) Voltage†. . . | 8500 to 10200 | volts |
| Grid-No.3 (Focusing Electrode) Voltage. . | 2400 to 3800 | volts |
| Grid-No.2 Voltage (Each Gun) when circuit design utilizes grid-No.1 voltage of -70 volts (each gun) . . . . . . . | 140 to 315 | volts |
| Grid-No.1 Voltage for Visual Extinction of Focused Raster (Each Gun) when circuit design utilizes grid-No.2 voltage of 200 volts (each gun) . . . . . . . | -45 to -100 | volts |

**Circuit Values:**

| | | |
|---|---|---|
| Grid-No.1-Circuit Resistance (Each Gun). | 1.5 max. | megohms |
| Dynamic Converging Voltage (Approx.)**. | 900 | volts |
| Dynamic Focusing Voltage (Approx.)** . | 225 | volts |

● The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the C-73599, the ultor function is performed by grid No.5. Since grid No.5, grid No.6, and collector are connected together within the C-73599, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

\# This value is the product of ultor voltage and average current measured at the ultor terminal with a dc ammeter.

† This range does not include the dc component of the dynamic converging voltage.

□ Centering of the raster on the screen is accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for the raster shift resulting from optimum adjustments for convergence, color purity, and concentricity.

** Peak-to-peak value. This ac voltage having essentially parabolic waveform is synchronized with scanning and does not include any voltage developed during the blanking time.

## GENERAL CONSIDERATIONS

The *maximum ratings* in the tabulated data for the C-73599 are working design-center maximums established according to the standard design-center system of rating electron tubes. Tubes so rated will give satisfactory performance in equipment designed so that these maximum ratings will not be exceeded when the equipment is operated from ac or dc power-line supplies whose normal voltage including normal variations falls within ± 10 per cent of line-center voltage value of 117 volts.

*X-Rays.* As may occur in conventional black-and-white kinescopes, x-ray radiation is present at the face of the C-73599 when it is operated at its normal ultor voltage. Simple shielding should prove adequate to provide protection against personal injury from prolonged exposure at close range.

*Tube Handling.* Grasp the tube (1) with both hands by placing the thumb of each hand on the flange and the fingers on the faceplate or vice versa without touching the insulating coating on the glass; or (2) with one hand on the faceplate and the other on the cone section in the region of the conductive coating. Never handle the tube by the neck alone. Contamination of the insulating coating with finger prints or dust may cause electrical breakdown during humid weather. Do not strike or scratch the tube, or subject it to more than moderate pressure when installing in or removing from equipment. Such treatment may result in immediate or delayed cracking of the bulb. The same safety precautions against breakage should be employed for the C-73599 as are employed with similar-size glass picture tubes of the black-and-white type.

*Metal Flange.* The metal flange operates at high voltage and, as a safety measure, should be covered with a suitable insulator* having adequate insulation to prevent the possibility of

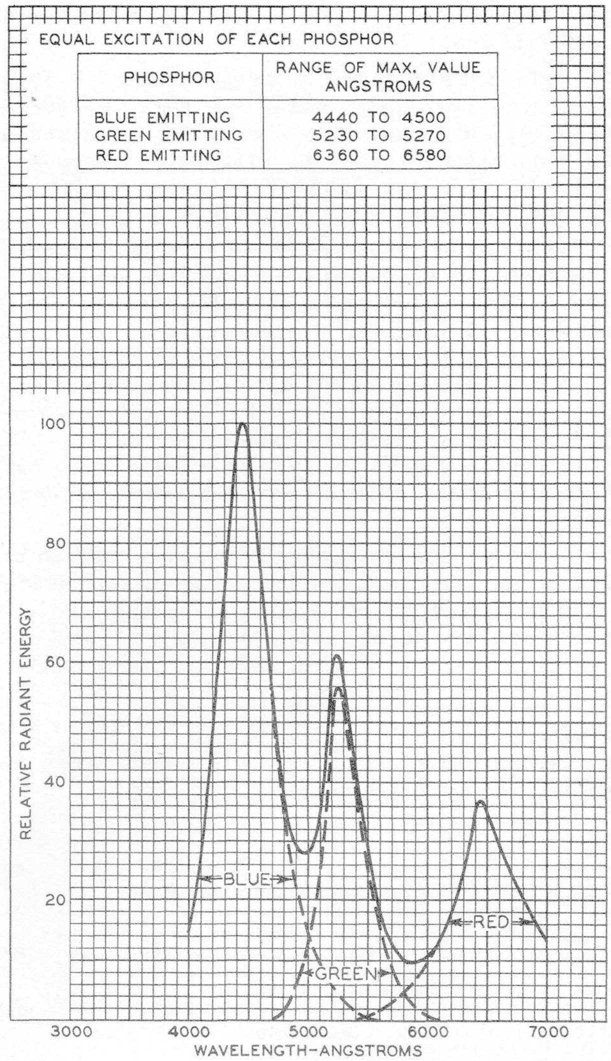


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*Fig.1 - Spectral-Energy Emission Characteristic of Group Phosphor P22.*

electrical leakage including corona between the flange and any grounded element in the receiver. It is recommended that the shape and width of the insulator be chosen so that the leakage path between the metal flange and the nearest grounded element shall be not less than 4 inches. Always ground the metal flange before touching after the

* Such an insulator having the manufacturer's designation Insulator Part No.15GCA1 may be obtained from Anchor Industrial Co., 36-36 36th St., Long Island City 6, N.Y.

power is turned off. The flange should not be scraped nor be allowed to bear against any sharp edge. Do not allow the metal flange to come in contact with a magnet and thus become permanently magnetized. A magnetized flange may produce localized color impurity.

*Insulating Material for External Mask.* The external mask should be made only of material providing insulation adequate for one half of the applied ultor voltage in order to minimize leakage across the surface of the glass between the metal flange and the external mask which is at ground potential. Mask material having the specified qualities can bear directly against the faceplate.

*Shatter-Proof Cover Over The Tube Face.* Following conventional kinescope practice, it is recommended that the cabinet be provided with a shatter-proof, clear glass or plastic cover over the face of the C-73599 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition.

*External Shielding.* External magnetic shielding is required for the C-73599 to prevent external magnetic fields from affecting tube performance. Further information on shielding considerations is given in the discussion of Mounting, Shielding, and Related Components on page 33.

*Support.* The C-73599 should be supported by any properly insulated arrangement at the face-plate end and by a suitable mechanism engaging the cone section of the envelope in the support region indicated on the Dimensional Outline. The tube should not be supported by the neck or by the base. It is also to be noted that support for the tube should not be provided, in accord with conventional practice for picture tubes, by the deflecting yoke because the latter must have flexibility of adjustment on the neck.

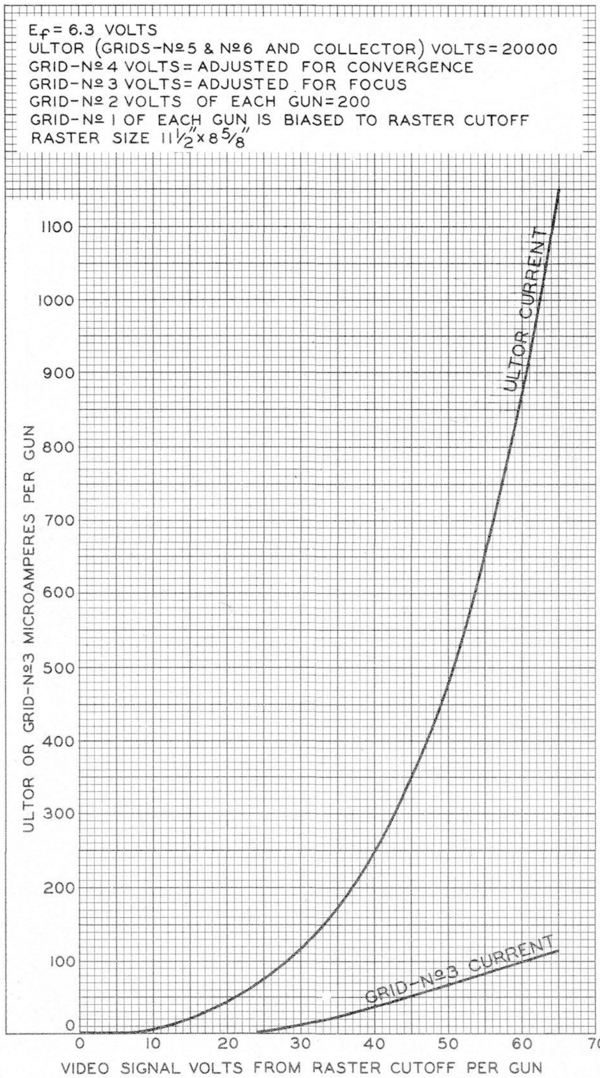



*Fig. 2 - Typical Drive Characteristic of Dev. Type C-73599.*

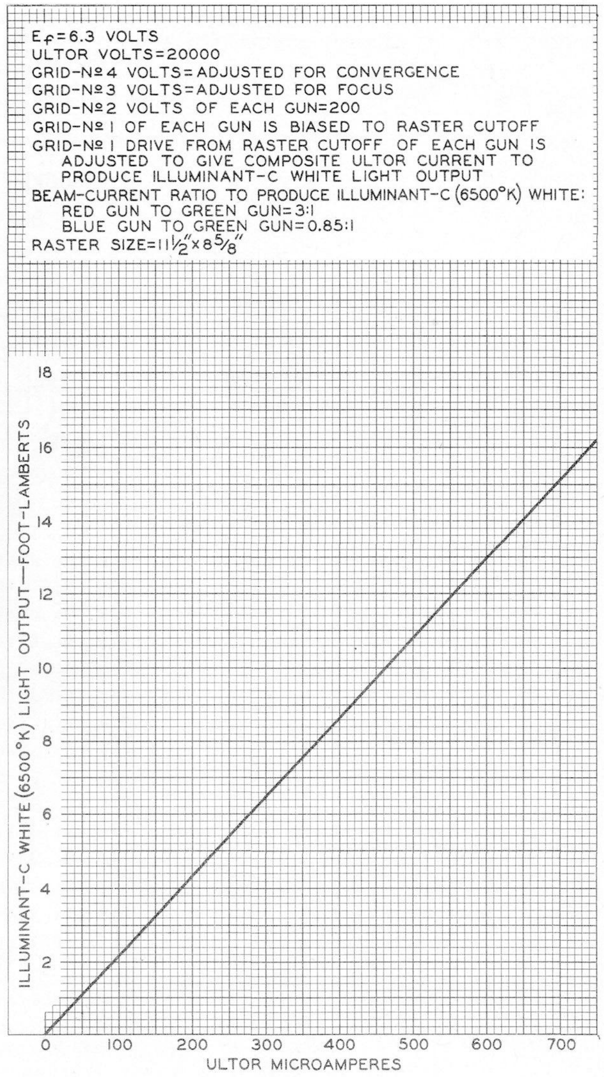



*Fig. 3 - Typical Light-Output Characteristic of Dev. Type C-73599.*

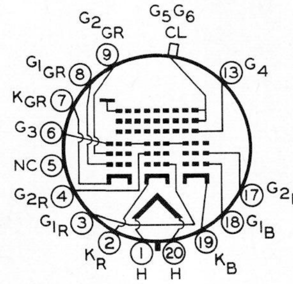
*High Voltages.* The high voltages at which cathode-ray tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

In the case of cathode-ray tubes, it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or to incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off and both terminals of any capacitors should be grounded.

## REFERENCE

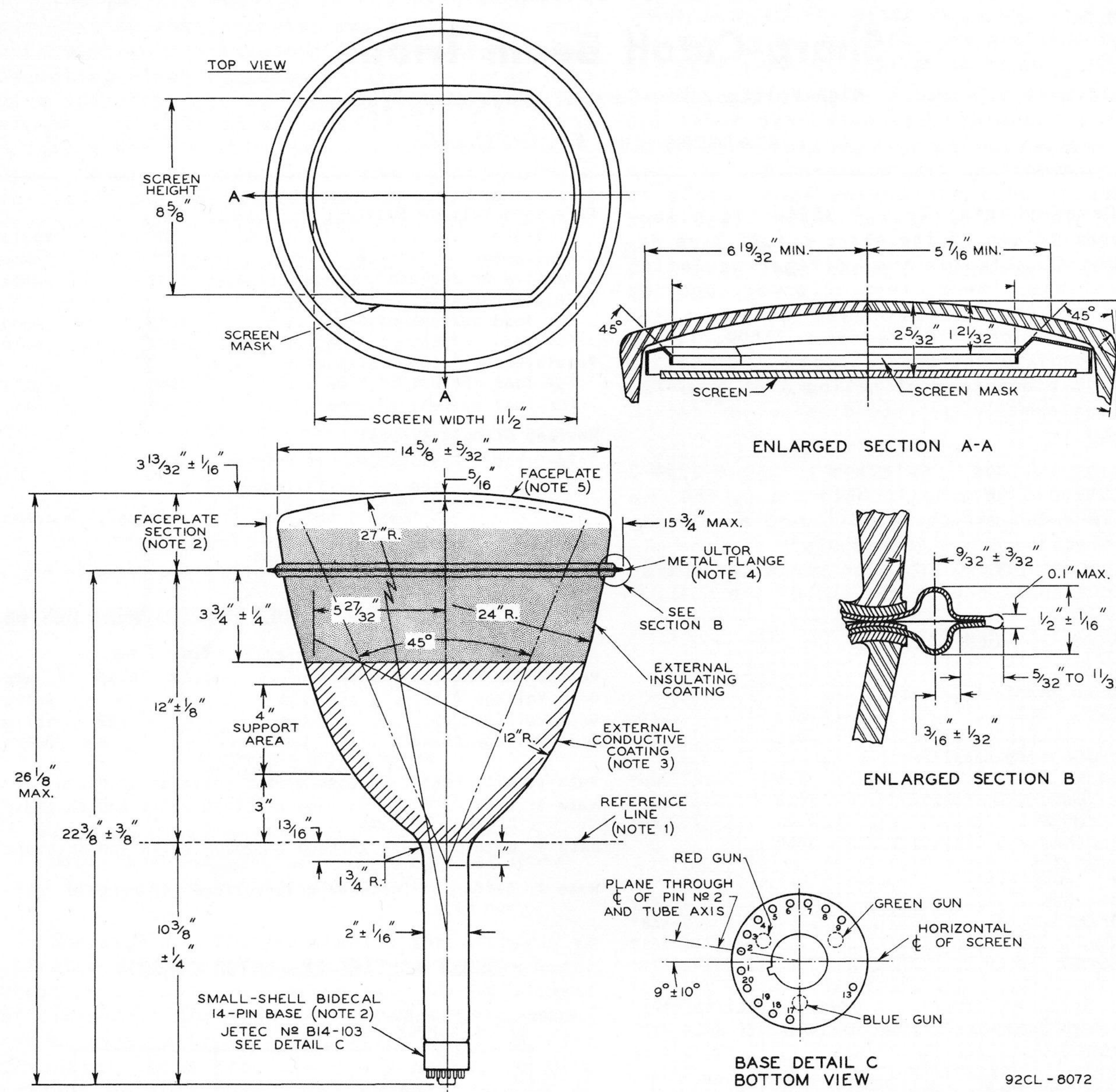

*IES Handbook (Second Edition)*, 1952, Section 3-3. Illuminating Engineering Society, 1860 Broadway, New York 23, N.Y.


## SOCKET CONNECTIONS
### Bottom View




PIN 1: HEATER
PIN 2: CATHODE OF RED GUN
PIN 3: GRID No.1 OF RED GUN
PIN 4: GRID No.2 OF RED GUN
PIN 5: NO CONNECTION
PIN 6: GRIDS No.3
PIN 7: CATHODE OF GREEN GUN
PIN 8: GRID No.1 OF GREEN GUN
PIN 9: GRID No.2 OF GREEN GUN
PIN 13: GRID No.4
PIN 17: GRID No.2 OF BLUE GUN
PIN 18: GRID No.1 OF BLUE GUN
PIN 19: CATHODE OF BLUE GUN
PIN 20: HEATER
METAL FLANGE: ULTOR (Grid No.5, Grid No.6, Collector)

## DIMENSIONAL OUTLINE




**NOTE 1:** REFERENCE LINE IS DETERMINED BY POSITION WHERE A CYLINDRICAL GAUGE 2.400" ± 0.001" I.D. WHICH IS HELD CONCENTRIC WITH TUBE NECK AXIS WILL REST ON FUNNEL.

**NOTE 2:** SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH FACEPLATE-SECTION AXIS AND HAVING A DIAMETER OF 3".

**NOTE 3:** EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

**NOTE 4:** METAL FLANGE OPERATES AT HIGH VOLTAGE. ADEQUATE INSULATION MUST BE PROVIDED BETWEEN THE FLANGE AND ANY GROUNDED ELEMENT IN THE RECEIVER TO PREVENT THE POSSIBILITY OF ELECTRICAL LEAKAGE INCLUDING CORONA.

**NOTE 5:** MASK MATERIAL BEARING ON THE FACEPLATE MUST HAVE INSULATING QUALITIES ADEQUATE FOR ONE HALF THE APPLIED ULTOR VOLTAGE TO MINIMIZE SURFACE LEAKAGE BETWEEN METAL FLANGE AND MASK.

Preliminary and Tentative Data
on RCA Developmental

# Sharp-Cutoff Beam Triode

## High-Voltage, Low-Current, Regulator Type

*Developmental No. A-2334-C*

RCA Developmental Type A-2334-C is a low-current beam triode of the sharp-cutoff type designed specifically for the voltage regulation of high-voltage, low-current dc power supplies such as the power supply used with the RCA Developmental Tricolor Kinescope C-73599. It has a maximum dc plate-voltage rating of 20000 volts, a maximum dc plate-current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 20 watts.

The high-voltage insulation in the A-2334-C for its intended service is obtained by the use of a double-ended structure utilizing a suitably designed electron gun which consists of a thermionic cathode and one grid. The plate connection is made to a small cap at the end of the bulb.

### GENERAL DATA

**Electrical:**

| | | |
|---|---|---|
| Heater, for Unipotential Cathode: | | |
| Voltage (AC or DC) | 6.3 | volts |
| Current | 0.6 | amp |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 1.0 | μμf |
| Grid to Cathode | 2.8 | μμf |
| Plate to Cathode | 0.01 | μμf |
| Amplification Factor | 1650 | |

**Mechanical:**

| | |
|---|---|
| Mounting Position | Any |
| Maximum Overall Length | 5-1/8" |
| Seated Length | 4-1/2" ± 1/8" |
| Maximum Diameter | 1-23/32" |
| Bulb | T-12 |
| Cap | Small (JETEC No.C1-1) |
| Base | Short Jumbo-Shell Octal 6-Pin (JETEC No.B6-73) |
| Weight (Approx.) | 2.7 oz |

### VOLTAGE-CONTROL SERVICE

**Maximum Ratings,** *Design-Center Values:*

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 20000 max. | volts |
| UNREGULATED DC SUPPLY VOLTAGE | 40000 max. | volts |
| GRID VOLTAGE: | | |
| DC value | -125 max. | volts |
| Peak value | -550 max. | volts |
| DC PLATE CURRENT | 1.5 max. | ma |
| PLATE DISSIPATION | 20 max. | watts |
| PEAK HEATER-CATHODE VOLTAGE: | | |
| Heater negative with respect to cathode | 180 max. | volts |
| Heater positive with respect to cathode | 180 max. | volts |

**Typical Operation As Shunt Voltage-Regulator Tube in Accompanying Circuit:**

| | | |
|---|---|---|
| Unregulated Supply: | | |
| DC voltage | 29800 | volts |
| Equivalent Resistance | 8 | megohms |
| Voltage Divider Values: | | |
| $R_1$ (5 watts) | 120 | megohms |
| $R_2$ (2 watts) | 1 | megohm |
| $R_3$ (1/2 watt) | 2 | megohms |
| Reference Voltage Supply: | | |
| DC value | 500 | volts |
| Equivalent Resistance | 1000 | ohms |
| Effective Grid-Plate Transconductance | 138 | μmhos |
| DC Plate Current: | | |
| For load current of 0 ma | 1055 | μamp |
| For load current of 1 ma | 100 | μamp |
| Regulated DC Output Voltage: | | |
| For load current of 0 ma | 20000 | volts |
| For load current of 1 ma | 19700 | volts |

**Maximum Circuit Values:**

| | |
|---|---|
| Grid-Circuit Resistance: | |
| With unregulated supply having an equivalent resistance of at least 8 megohms | 3 max. megohms |
| With unregulated supply having an equivalent resistance less than 8 megohms | See Curve in Fig.1 |

### CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

| | *Note* | *Min.* | *Max.* | |
|---|---|---|---|---|
| Heater Current | 1 | 0.54 | 0.66 | amp |
| Grid Voltage (1) | 1,2 | -2 | – | volts |
| Grid Voltage (2) | 1,3 | – | -25 | volts |
| Grid-Voltage Change | 1,4 | – | 8 | volts |

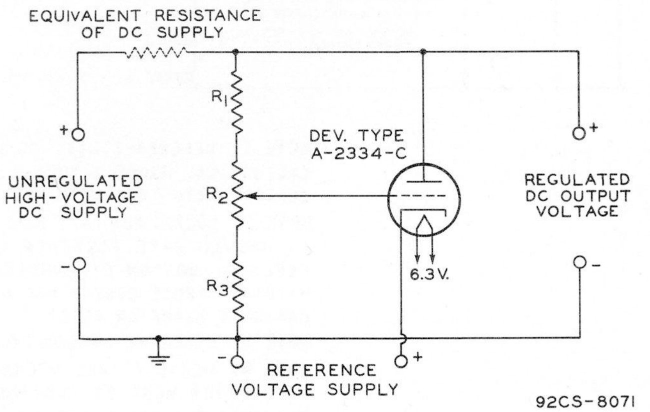
Note 1: With heater voltage of 6.3 volts ac or dc.

Note 2: With dc plate voltage of 20000 volts and dc plate current of 1 ma.

Note 3: With dc plate voltage of 20000 volts and dc plate current of 0.1 ma.

Note 4: Difference between grid voltage (1) and grid voltage (2).

### SHUNT VOLTAGE-REGULATOR CIRCUIT




Typical performance data for this basic circuit with certain characteristics of the unregulated dc supply and related voltage-divider values are given in the above tabulated data. Other combinations are feasible within the maximum ratings and the maximum circuit values for the A-2334-C.

## OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data are working design-center maximums established according to the standard design-center system of rating electron tubes. Tubes so rated will give satisfactory performance in equipment designed so that these maximum ratings will not be exceeded when the equipment is operated from ac or dc power-line supplies whose normal voltage including normal variations falls within ± 10 per cent of line-center voltage value of 117 volts.

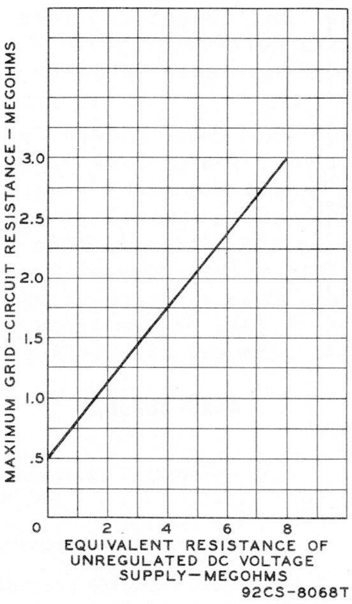



*Fig. 1 - Maximum Grid-Circuit Resistance for Dev. Type A-2334-C as a Function of Un-Regulated DC Voltage Supply Resistance.*

*The high dc voltages at which the A-2334-C is operated may be extremely dangerous to the user. Great care should be taken during the adjustment of circuits.* The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel cannot possibly come in contact with any high-potential point in the electrical system. The interlock devices should function to break the primary circuit of the high-voltage supply when any gate or door on the protective housing is opened, and should prevent the closing of this primary circuit until the door is again locked.

It should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or to incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off and both terminals of any capacitors should be grounded.

The *bulb* becomes hot during operation. To insure adequate cooling, it is essential that free circulation of air be provided around the A-2334-C.

The *plate* shows a dull red color when the A-2334-C is operated at maximum plate dissipation. Connection to the plate cap should be made by a suitable connector with flexible lead to prevent any strain on the seal at the cap.

*Operation of the A-2334-C with a plate voltage above approximately 16000 volts (absolute value) results in the production of x-rays* which can constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design (see *References 1 and 2*).

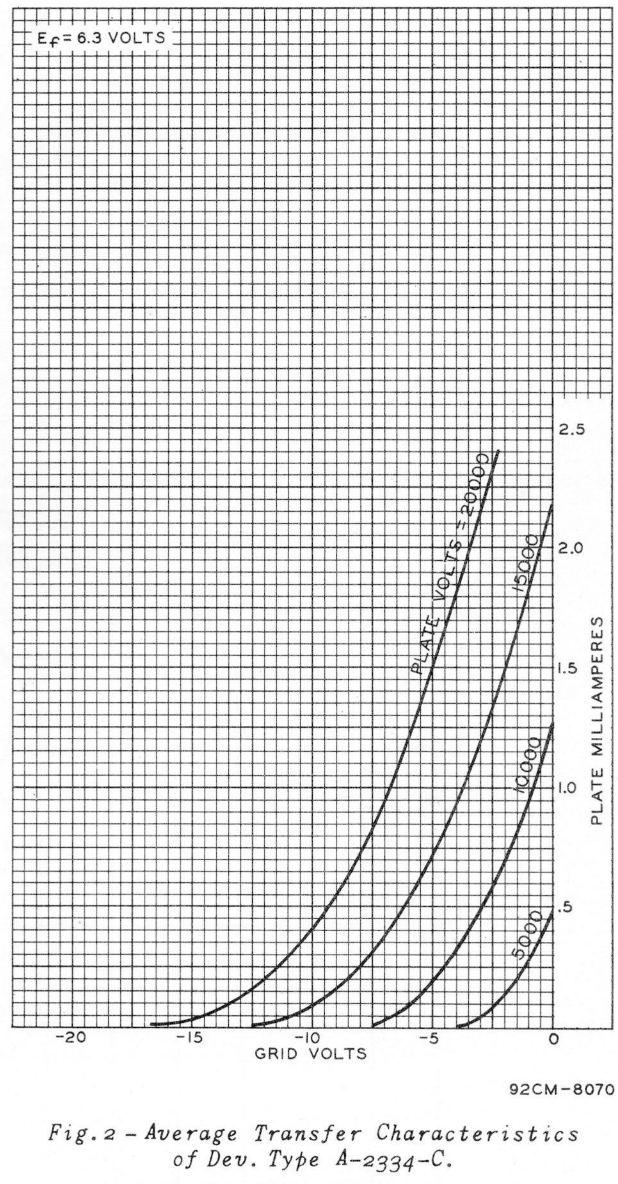


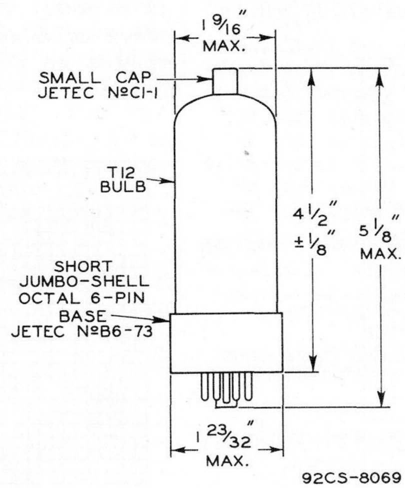

*Fig. 2 - Average Transfer Characteristics of Dev. Type A-2334-C.*

*The A-2334-C may exhibit a blue glow* on the upper half of the inner surface of the bulb wall under normal operating conditions. This effect is caused by fluorescence and is not to be mistaken for gas.

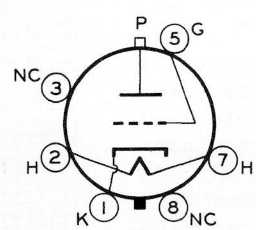
## REFERENCES

1. *"Medical X-ray Protection Up to Two Million Volts,"* National Bureau of Standards Handbook H41.
2. *"Safety Code for Industrial Use of X-rays,"* American Standards Association, ASA Code Z54.1-1946.

## DIMENSIONAL OUTLINE




## SOCKET CONNECTIONS
### Bottom View




PIN 1: CATHODE
PIN 2: HEATER
PIN 3: NO CONNECTION
PIN 5: GRID
PIN 7: HEATER
PIN 8: NO CONNECTION
CAP: PLATE

Preliminary and Tentative Data
on RCA Developmental

# Half-Wave Vacuum Rectifier

**(Equivalent to Commercial Type 6AU4-GT)**

*Developmental No. R-6424-A*

RCA Developmental Type R-6424-A is a half-wave vacuum rectifier tube of the glass-octal type. It is particularly suited for use as a damper diode in color television circuits utilizing the RCA tricolor kinescope developmental No. C-73599.

Rated to withstand a maximum peak inverse plate voltage of 4500 volts (absolute), the R-6424-A 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.

## GENERAL DATA

**Electrical:**

| | | |
|---|---|---|
| Heater, for Unipotential Cathode: | | |
| Voltage (AC or DC) | 6.3 | volts |
| Current | 1.8 | amp |
| Direct Interelectrode Capacitances (Approx.):° | | |
| Plate to Heater and Cathode | 8.5 | μμf |
| Cathode to Heater and Plate | 11.5 | μμf |
| Heater to Cathode | 4.0 | μμf |

**Mechanical:**

| | |
|---|---|
| Mounting Position | Any |
| Maximum Overall Length | 3-13/16" |
| Maximum Seated Length | 3-1/4" |
| Maximum Diameter | 1-9/32" |
| Bulb | T-9 |
| Base | Short Intermediate-Shell Octal 5- or 6-Pin with External Barriers (JETEC Nos. B5-85 or B6-60) |

## DAMPER SERVICE

**Maximum Ratings,** *Design-Center Values Except as Noted:*
*For operation in a 525-line, 30-frame system*▲

| | | | |
|---|---|---|---|
| PEAK INVERSE PLATE VOLTAGE (Absolute Maximum)# | 4500● | max. | volts |
| PEAK PLATE CURRENT | 1050 | max. | ma |
| DC PLATE CURRENT | 175 | max. | ma |
| PLATE DISSIPATION | 6.0 | max. | watts |
| PEAK HEATER-CATHODE VOLTAGE: | | | |
| Heater negative with respect to cathode (Absolute Maximum) | 4500●* | max. | volts |
| Heater positive with respect to cathode | 300† | max. | volts |

° With no external shield.

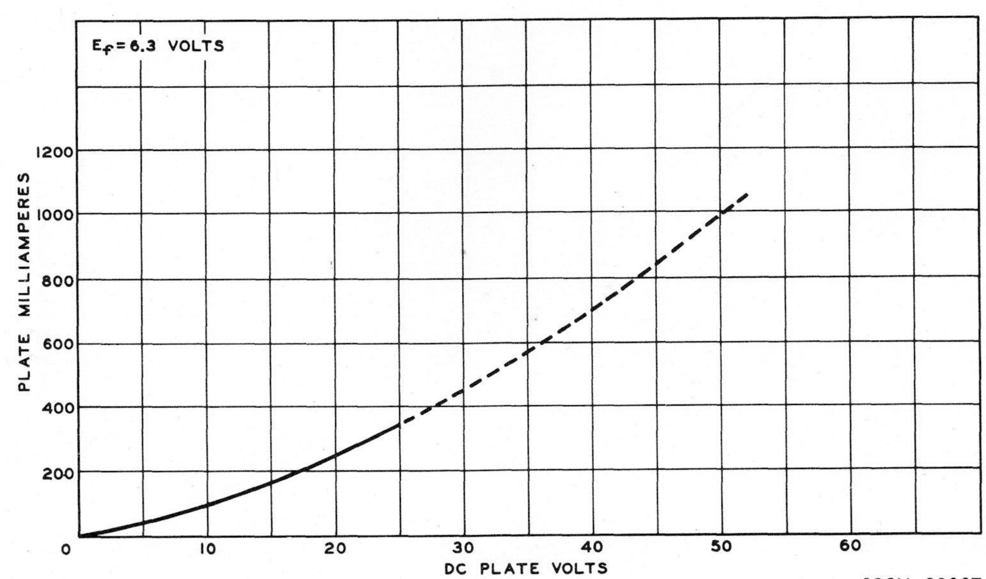
▲ As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

# This rating is applicable where the duty cycle of the voltage pulse does not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30-frame system, 15 per cent of one horizontal scanning cycle is 10 microseconds.

● Under no circumstances should this absolute value be exceeded.

* The dc component must not exceed 900 volts.

† The dc component must not exceed 100 volts.




*Average Plate Characteristic of Developmental Type R-6424-A*

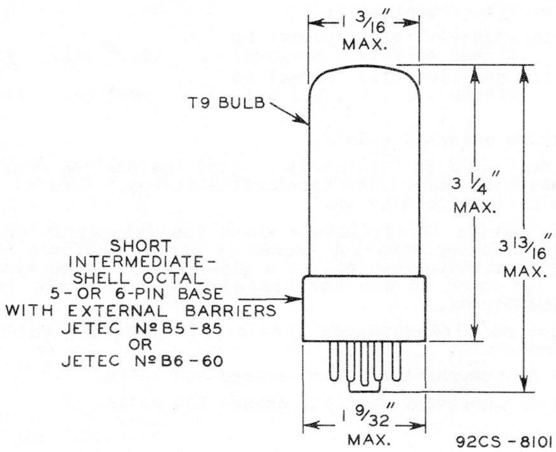
## OPERATING CONSIDERATIONS

The *maximum ratings* shown in the tabulated data for peak plate current, dc plate current, plate dissipation, and peak heater-cathode voltage with the heater positive with respect to cathode are working design-center maximums established according to the standard design-center system of rating electron tubes. Tubes so rated will give satisfactory performance in equipment designed so that these maximum ratings will not be exceeded when the equipment is operated from ac or dc power-line supplies whose normal voltage including normal variations falls within ± 10 per cent of line-center voltage value of 117 volts.

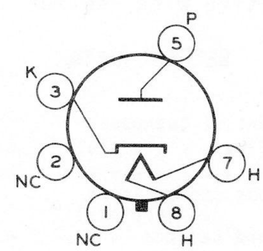
The *maximum ratings* shown in the tabulated data for peak inverse plate voltage and peak heater-cathode voltage with the heater negative with respect to cathode are limiting values above which the serviceability of the R-6424-A may be impaired from the viewpoint of life and satisfactory performance. 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 *base pins* of the R-6424-A fit the standard octal socket. Socket terminals for pins 1, 2, 4, and 6 should not be used for tie points. It is also recommended that socket clips for these pins be removed to reduce the possibility of arc-over and to minimize leakage.

## DIMENSIONAL OUTLINE




## SOCKET CONNECTIONS
### Bottom View




4CG

PIN 1: NO CONNECTION—DO NOT USE; OR OMITTED

PIN 2: NO CONNECTION—DO NOT USE

PIN 3: CATHODE

PIN 5: PLATE

PIN 7: HEATER

PIN 8: HEATER

Preliminary and Tentative Data
on RCA Developmental

# Half-Wave Vacuum Rectifier

*Development No. R-6433-B*

RCA Developmental Type R-6433-B is a half-wave vacuum rectifier tube of the glass-octal type designed for use in high-voltage, pulse-operated rectifying systems of color television receivers. In such systems it is particularly suitable as a rectifier of high-voltage pulses produced in the scanning system for the kinescope.

## GENERAL DATA

**Electrical:**

| | | |
|---|---|---|
| Heater, for Unipotential Cathode: | | |
| Voltage (AC) | 3.15 | volts |
| Current | 0.22 | amp |
| Direct Interelectrode Capacitance (Approx.):● | | |
| Plate to Heater, Cathode, and Internal Shield | 1.5 | μμf |

**Mechanical:**

| | |
|---|---|
| Mounting Position | Any |
| Maximum Overall Length | 4-1/16" |
| Seated Length | 3-5/16" ± 3/16" |
| Maximum Diameter | 1-9/32" |
| Bulb | T-9 |
| Cap | Small (JETEC No.C1-1) |
| Base | Intermediate-Shell Octal 6-Pin (JETEC No.B6-8) |

## PULSED-RECTIFIER SERVICE

**Maximum Ratings,** *Design-Center Values:*

*For operation in a 525-line, 30-frame system*▲

| | | |
|---|---|---|
| PEAK INVERSE PLATE VOLTAGE | 30000 max. | volts |
| PEAK PLATE CURRENT | 80 max. | ma |
| AVERAGE PLATE CURRENT | 1.5 max. | ma |
| VOLTAGE PULSE DURATION♦ | 10 max. | μsec |

● With no external shield.

▲ As described in "Standards of Good Engineering Practice Concerning Television Broadcast Stations," Federal Communications Commission.

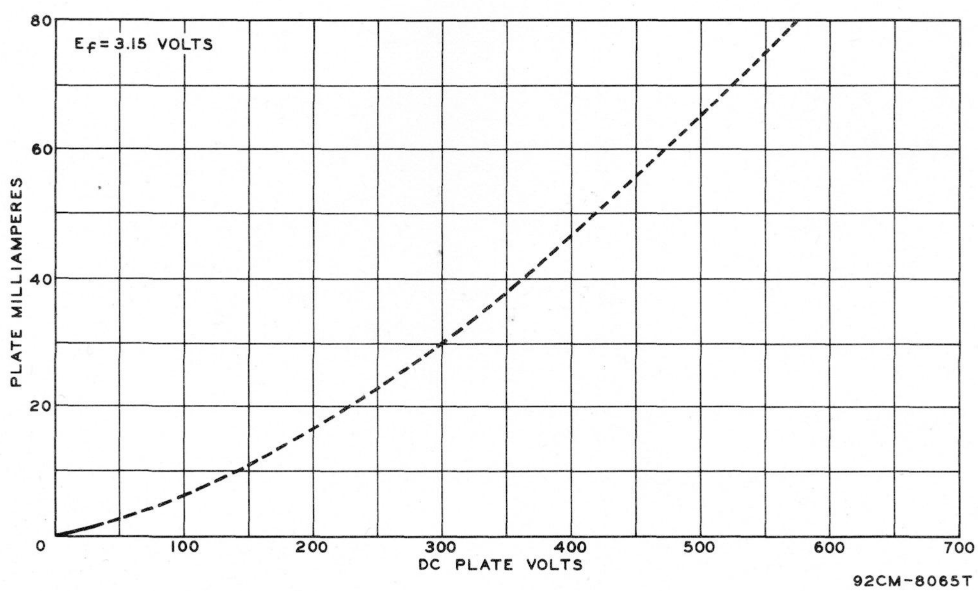
♦ The duration of the voltage pulse must not exceed 15 per cent of one horizontal scanning cycle. In a 525-line, 30 frame system, 15 per cent of one horizontal scanning cycle is the specified maximum value.

## OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data for the R-6433-B are working design-center maximums established according to the standard design-center system of rating electron tubes. Tubes so rated will give satisfactory performance in equipment designed so that these maximum ratings will not be exceeded when the equipment is operated from ac or dc power-line supplies whose normal voltage including normal variations falls within ± 10 per cent of line-center voltage value of 117 volts.

The *base pins* of the R-6433-B fit the standard octal socket. The socket terminals for pins 1,3,5, and 8 may be connected to the terminal for pin 7, but if not, they should not be used as tie points because tube performance may be adversely affected.

The *heater* of the R-6433-B is designed for operation at 3.15 volts. The heater windings on the pulse transformer should be adjusted to provide the rated voltage under average line-voltage conditions. When the heater voltage is measured,

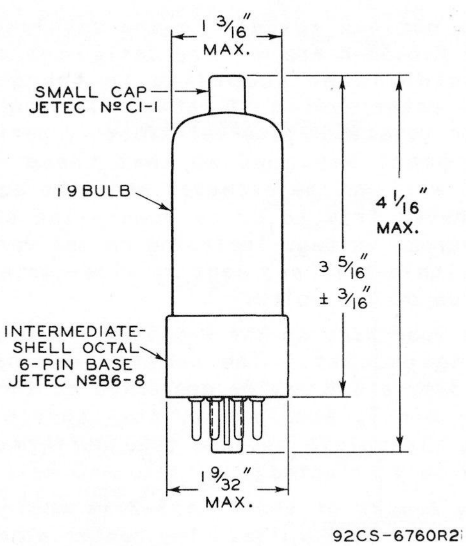



*Average Plate Characteristic of Developmental Type R-6433-B* it is recommended that a voltmeter of the thermocouple type calibrated in rms volts be used. The meter and its leads must be insulated to withstand 20000 volts and the stray capacitances to ground should be minimized.

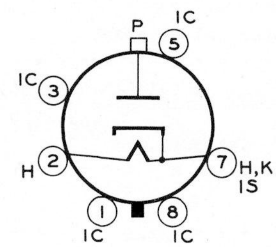
*The high voltages at which the R-6433-B is operated are very dangerous.* Great care should be taken in the design of apparatus to prevent the operator from coming in contact with these high voltages. Particular care against fatal shock should be taken in measuring the heater voltage. Under any circumstances, all circuit parts which may be at high potentials should be enclosed or adequately insulated.

The voltages employed in some television receivers and other high-voltage equipment is sufficiently high that high-voltage rectifier tubes may produce x-rays which can constitute a health hazard unless such tubes are adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

**DIMENSIONAL OUTLINE**




**SOCKET CONNECTIONS**
**Bottom View**




PIN 1: INTERNAL CONNECTION DO NOT USE
PIN 2: HEATER
PIN 3: INTERNAL CONNECTION DO NOT USE
PIN 5: INTERNAL CONNECTION DO NOT USE
PIN 7: HEATER, CATHODE, INTERNAL SHIELD
PIN 8: INTERNAL CONNECTION DO NOT USE
CAP: PLATE

# Preliminary and Tentative Data on RCA Developmental Components for Use with RCA Developmental Tricolor Kinescope Dev. No. C-73599



* Each of these developmental numbers identify a particular laboratory design, but the number and identifying data are subject to change.

\# Identifies RCA commercial item.

Preliminary and Tentative Data
on RCA Developmental

# Horizontal-Dynamic-Convergence Phase Control

*Developmental No. XL-582-C*

XL-582-C is a developmental variable inductor for use as a phasing control of the horizontal-dynamic voltage waveform applied to the converging electrode (grid No.4) of the RCA Tricolor Kinescope Developmental No.C-73599. Utilizing a ferrite core for high efficiency, this control is intended for operation in circuits using the Developmental No.XT-7648-F Horizontal Dynamic-Converging and Dynamic-Focusing Transformer.

## DATA

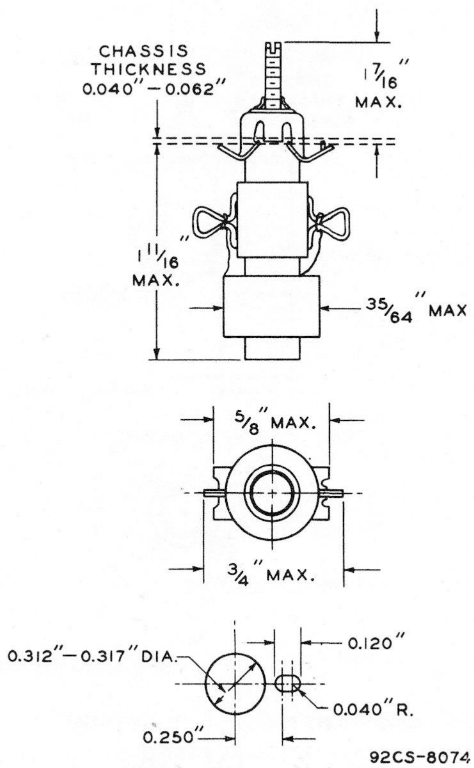
**Maximum Ratings:**

| | | |
|---|---|---|
| Coil Temperature . . . . . . . . . . . . | 90 max. | °C |

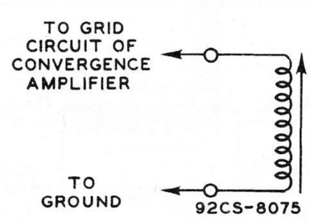
**Characteristics:**

| | | |
|---|---|---|
| Inductance: | | |
| With Core Adjusted for Least Inductance . . . . . . . | 5.7 max. | mh |
| With Core Adjusted for Greatest Inductance . . . . . . | 32.5 min. | mh |
| DC Resistance. . . . . . . . . . . . . . | 33 approx. | ohms |

## DIMENSIONAL OUTLINE




DIMENSIONS FOR CHASSIS CUTOUT




*Terminal Connections for Developmental No. XL-582-C.*

Preliminary and Tentative Data
on RCA Developmental

# Horizontal-Linearity Control

*Developmental No. XL-693-A*

XL-693-A is a developmental bifilar-wound variable-inductance transformer designed for adjusting the linearity of the horizontal-scanning beams in the RCA Tricolor Kinescope Developmental No. C-73599. It utilizes a ferrite core for high efficiency and is intended for use with Developmental No. XD-2165-J Horizontal-output and High-voltage Transformer and the Developmental No. XD-2071-D Deflecting Yoke.

The coefficient of coupling is approximately unity with the core adjusted for maximum inductance and it is more than 0.95 with core adjusted for minimum inductance. The individual coils have approximately the same range of inductance.

## DATA

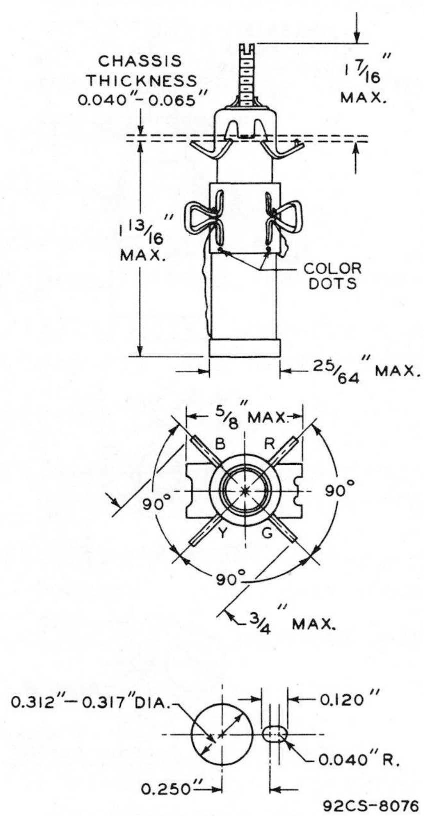
**Ratings:**

| | | |
|---|---|---|
| Coil Temperature | 90 max. | °C |

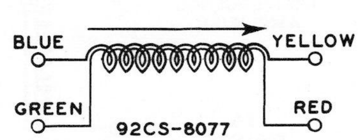
**Characteristics:**

| | | |
|---|---|---|
| Inductance: | | |
| With Core Adjusted for Least Inductance (Core Out) and Windings Connected Series Aiding | 0.48 max. | mh |
| With Core Adjusted for Greatest Inductance (Core In) and Windings Connected Series Aiding | 2.9 min. | mh |
| DC Resistance (Coils connected in series) | 7.6 approx. | ohms |

## DIMENSIONAL OUTLINE




DIMENSIONS FOR CHASSIS CUTOUT




*Terminal Connections for Developmental No. XL-693-A.*

Preliminary and Tentative Data
on RCA Developmental

# Width Control

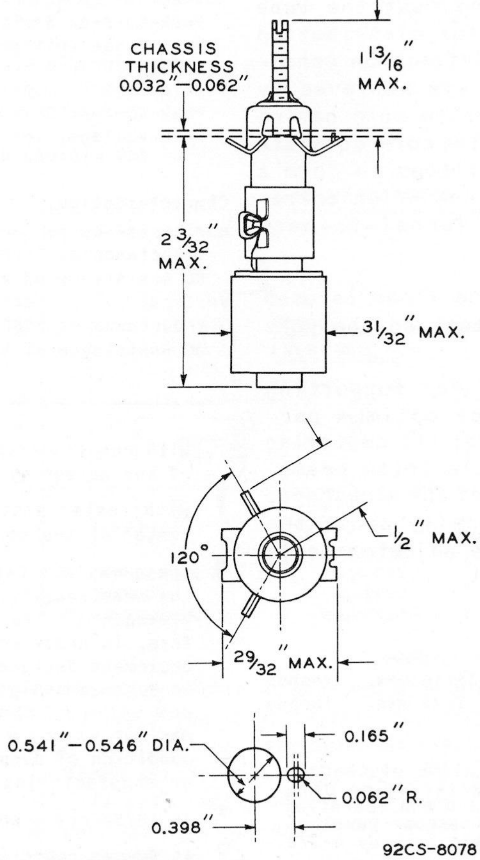
*Developmental No. XL-696-A*

XL-696-A is a developmental variable inductor with a ferrite core for adjusting the picture width on the RCA Tricolor Kinescope Developmental No. C-73599. It is intended for operation with the Developmental No. XD-2165-J Horizontal-Output and High-Voltage Transformer and the Developmental No. XD-2071-D Deflecting Yoke.

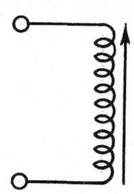
## DATA

| | | |
|---|---|---|
| **Ratings:** | | |
| Coil Temperature . . . . . . . . . . . . | 90 max. | °C |
| **Characteristics:** | | |
| Inductance: | | |
| With Core Adjusted for Least Inductance (Core Out) . . . . . . . . | 18.5 max. | mh |
| With Core Adjusted for Greatest Inductance (Core In) . . . . . . . . | 68.9 min. | mh |
| DC Resistance. . . . . . . . . . . . . . | 31.8 approx. | ohms |

## DIMENSIONAL OUTLINE




DIMENSIONS FOR CHASSIS CUTOUT



92CS-7092RI

*Terminal Connections for Developmental No. XL-696-A.*

**Preliminary and Tentative Data on RCA Developmental**

# Deflecting Yoke

*Developmental No. XD-2071-D*

XD-2071-D is a developmental deflecting yoke for use with the RCA Tricolor Kinescope Developmental No. C-73599 having a horizontal deflection angle of 45°. It is designed to operate efficiently with the developmental No. XD-2165-J Horizontal-Output and High-Voltage Transformer and to provide full deflection, good uniformity of focus, optimum convergence, and high deflection sensitivity.

The horizontal and vertical coils of this yoke are especially wound to produce proper magnetic fields for simultaneous deflection of the three beams and, in addition, are flared widely at the end of the yoke placed nearest the tube funnel to provide the desired flux distribution for optimum convergence. High deflection sensitivity and good field symmetry are achieved by the use of a precision-shaped ferrite core having unique design characteristics. The core consists of 8 separate ferrite sections fitted to form a single unit having a chamfered front which corresponds with the shape of the funnel-to-neck section of the kinescope.

A flame-retardant polyethlyene liner is used to provide adequate insulation between the yoke coils and the grounded coating.

The yoke should not be used for supporting the kinescope-neck section since optimum performance requires three adjustments; (1) centering the yoke on the axis common to the three beams, (2) moving the yoke along the neck of the kinescope, and (3) moving the yoke rotationally about the neck. Further information on yoke adjustments is presented on Pages 43 and 44.

## DATA

**General:**

| | | |
|---|---|---|
| Outside Diameter | 7-13/16 max. | inches |
| Inside Diameter | 2.22 min. | inches |

**Performance:**

Percentage tolerances indicate deviation of characteristics from corresponding characteristics of a specimen yoke established as a standard and operating in a circuit with an RCA Tricolor Kinescope Developmental No. C-73599 to provide an 11-3/4 inch by 8-7/8 inch raster.

| | | |
|---|---|---|
| Horizontal Deflection | +5 / -5 | per cent |
| Vertical Deflection | +5 / -3 | per cent |
| Departure from Linearity* (Vertical or Horizontal) | ±10 | per cent |
| Pincushion or Barrel† | ±2 | per cent |
| Trapezoid (Horizontal or Vertical Departure from Rectangularity)† | ±2 | per cent |

**Maximum Ratings:♦**

| | | |
|---|---|---|
| Peak Voltage Between Horizontal and Vertical Coils, for maximum duration of 8 microseconds⊕ | 3500 max. | volts |
| Ambient Temperature | 50 max. | °C |
| Horizontal Coils (Series Connected): | | |
| Peak-to-Peak Sawtooth Current⊕ | 1100 max. | ma |
| Peak Pulse Voltage, for maximum duration of 8 microseconds⊕ | 3000 max. | volts |
| Vertical Coils (Series Connected): | | |
| Peak-to-Peak Sawtooth Current° | 300 max. | ma |
| Peak Voltage, for maximum duration of 650 microseconds° | 800 max. | volts |

**Characteristics:**

| | | |
|---|---|---|
| Horizontal Coils (Series Connected): | | |
| Inductance at 1000 cps | 11.8 approx. | mh |
| DC Resistance at 25°C | 7.3 approx. | ohms |
| Vertical Coils (Series Connected): | | |
| Inductance at 1000 cps | 125 approx. | mh |
| DC Resistance at 25°C | 54 approx. | ohms |

---

* With non-linearity equally distributed about the center of the screen by means of circuit adjustments.

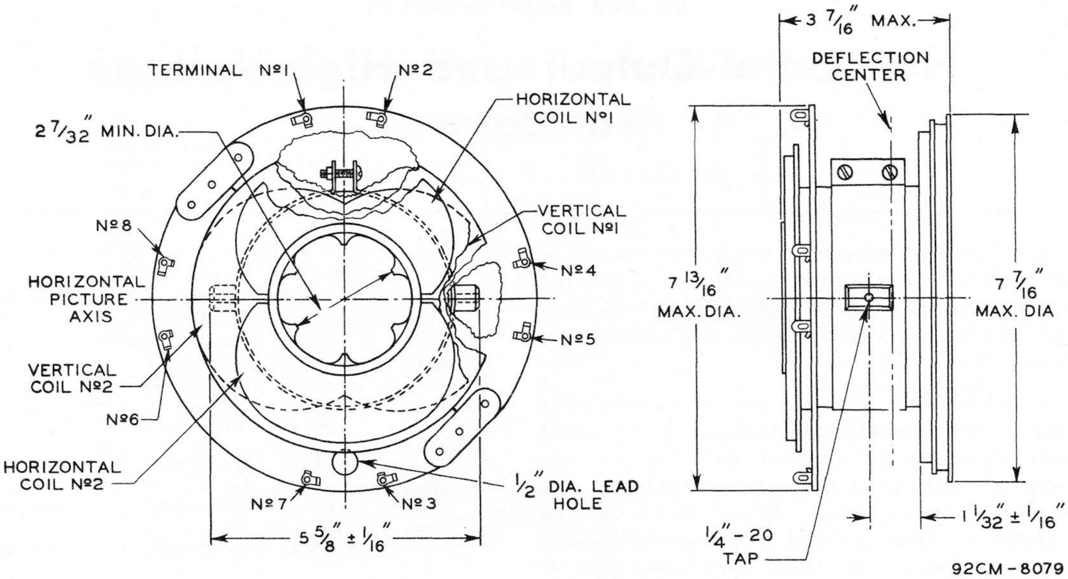
† With raster distortion equally distributed about the center of the screen by circuit adjustments.

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

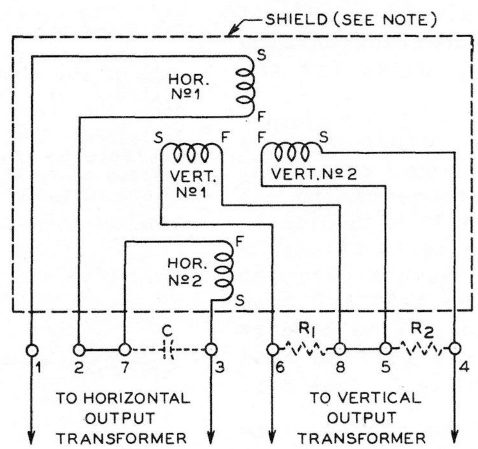
⊕ At 15750-cps scanning rate.

° At 60-cps scanning rate.

## DIMENSIONAL OUTLINE




92CM-8079




92CS-8081

**NOTE:** PROVISION SHOULD BE MADE FOR GROUNDING THE SHIELD WHICH IS INTERNALLY CONNECTED TO THE MOUNTING LUGS. RESISTORS AND CAPACITOR SHOWN ARE TYPICAL VALUES AND ARE NOT SUPPLIED WITH THE XD-2071-D. C1 = 250 TO 300 $\mu\mu$f, 1800 VOLTS. R1, R2 = 1000 OHMS ± 10%, 0.5 WATT.

*Terminal Connections for Developmental No. XD-2071-D.*

Preliminary and Tentative Data
on RCA Developmental

# Horizontal-Output and High-Voltage Transformer

*Developmental No.XD-2165-J*

XD-2165-J is a developmental horizontal-output and high-voltage transformer for use with the Developmental No.XD-2071-D Deflecting Yoke in circuits employing the RCA Tricolor Kinescope Developmental No.C-73599.

This transformer has an auto-transformer winding and seven isolated windings. The auto-transformer winding is tapped to provide deflecting-yoke, damper-tube, driver-tube, and width-control connections. Other taps on the winding supply voltage pulses for keyed AGC and voltage for the rectifier tube supplying the dc voltage to the focusing electrode of the kinescope. Voltage for the converging electrode of the kinescope is obtained from a bleeder resistor in the high-voltage supply. The isolated windings supply filament power to the high-voltage and focusing-voltage rectifiers as well as voltage pulses for the color-synchronizing circuit and a peaking voltage pulse for the horizontal-driver circuit.

When used in a regulated, diode-coupled voltage-doubler circuit, the XD-2165-J can supply up to 20 kilovolts at 750 microamperes to the ultor of the kinescope, up to 4.75 kilovolts to the focusing electrode, and up to 10 kilovolts to the converging electrode. Such a circuit, utilizing the Developmental No.A-2334-C Beam Triode Tube as a shunt regulator, is capable of maintaining regulation within ± 2% from full load to no load and is shown in Fig.3, Page 36.

A ferrite core is used in the construction of the XD-2165-J to provide high efficiency. The coils are impregnated to assure high resistance to moisture absorption.

## DATA

**Characteristics:**

DC Resistance (Approx.) at 25°C:

| | | | |
|---|---|---|---|
| Between term. #1 and #2 | | 1.0 | ohm |
| Between term. #2 and T | less than | 1.0 | ohm |
| Between term. T and #3 | | 1.7 | ohms |
| Between term. #3 and #4 | less than | 1.0 | ohm |
| Between term. #4 and #5 | | 2.7 | ohms |
| Between term. #5 and #7 | | 2.0 | ohms |
| Between term. #7 and HV Lead▲ | | 27.3 | ohms |
| Between term. A and B | less than | 1.0 | ohm |
| Between term. C and D | less than | 1.0 | ohm |
| Between term. E and F | less than | 1.0 | ohm |
| Between term. F and G | less than | 1.0 | ohm |

**Typical Operation:**

| | | |
|---|---|---|
| Operating Temperature● | 100 max. | °C |
| High-Voltage DC Output at 750-ua | 20 | kv |
| Focusing-Voltage DC Output at 0-ua | 4.7 | kv |
| Peak Pulse Voltage for Keyed AGC: Between term. #2 and ground | 800 approx. | volts |
| Peak Pulse Voltage for Horizontal-Driver Circuit: Between terminals A and B (with terminal B grounded) | -60 approx. | volts |
| Peak Pulse Voltage for Color-Synchronizing Circuit: Between terminals C and D (with terminal C grounded) | 114 approx. | volts |
| Between terminals E and G (with terminal G grounded) | -230 approx. | volts |
| Between terminals F and G (with terminal G grounded) | -55 approx. | volts |

**Test Conditions:**

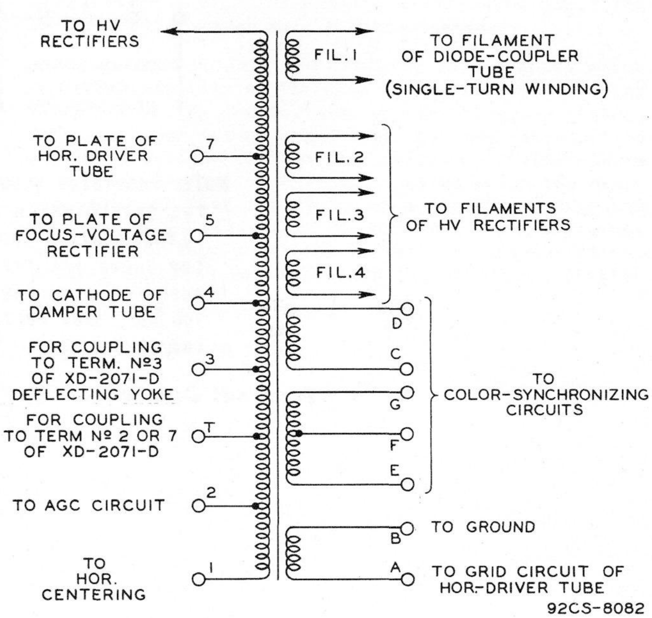
| | | |
|---|---|---|
| High Voltage (60 cps) Applied Between Each Winding and Core° | 2.0 rms | kv |
| Induced Output Voltage | * | |

▲ The high-voltage lead and the lead from terminal No.7 should be dressed away from each other, the chassis, and other wiring.

● Includes effects of ambient temperature and temperature rise of the winding measured by the resistance method (A.I.E.E. Rule No.13-207) during Underwriters Laboratory, Inc. type of heat run in a complete receiver.

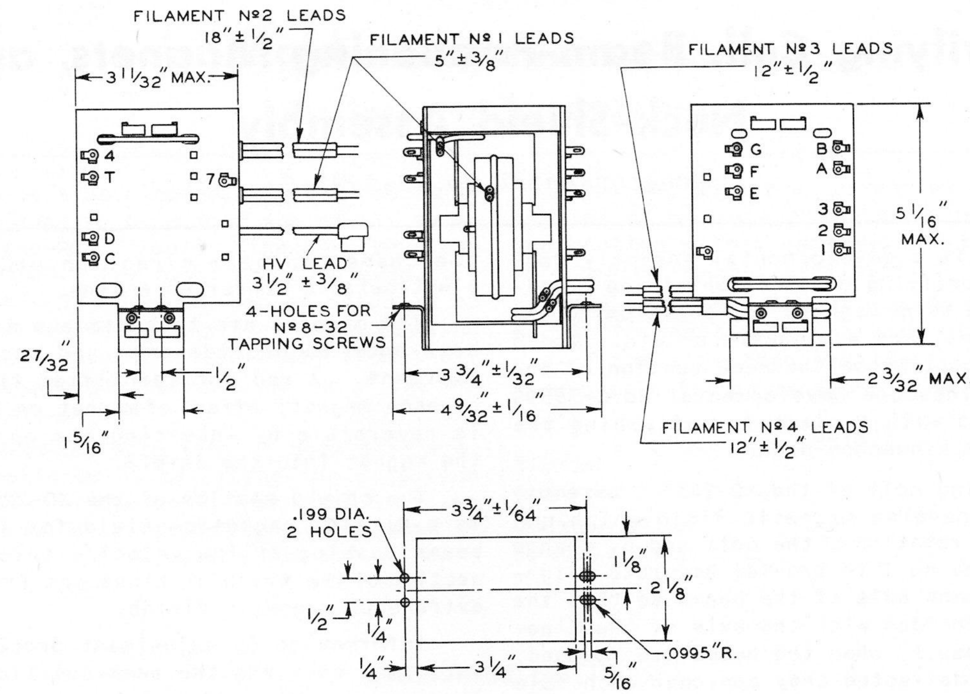
* Transformer will withstand voltage overload produced by overdriving its deflection circuit to develop a dc voltage of 36 kilovolts (at zero beam current) measured at the output of the high-voltage rectifier circuit.

° Windings not under test should not be grounded.




*Terminal Connections for Developmental No.XD-2165-J*

## DIMENSIONAL OUTLINE




DIMENSIONS FOR CHASSIS CUTOUT

92CS-8081

Preliminary and Tentative Data
on RCA Developmental

# Purifying Coil, Beam-Positioning Magnets, and Neck-Shield Assembly

*Developmental No. XD-2233-C*

XD-2233-C is a developmental assembly consisting of a purifying coil for obtaining multi-beam alignment, three magnets for positioning the individual beams, and a magnetic shield. It is designed for mounting on the neck section of the RCA Tricolor Kinescope Developmental No. C-73599 and is equipped with a clamp for attaching the assembly to the kinescope neck.

The purifying coil of the XD-2233-C assembly produces a transverse magnetic field which can be adjusted by rotation of the coil and by change of current in the coil to provide accurate alignment of the common axis of the beams so that the common axis coincides with the axis of the kinescope. As a result, when the beams are focused, converged, and deflected they approach each hole in the shadow mask at the proper angle to strike the centers of their appropriate color dots thus producing color purity.

The beam-positioning magnets of the XD-2233-C assembly are supported by the shield of the XD-2233-C and are spaced at 120° intervals to correspond with the positions of the kinescope guns. They provide accurate positioning of their associated beams in a direction perpendicular to the change in beam direction produced by the electrostatic convergence lens.

The magnets are threaded and are slotted at both ends to provide ease and accuracy of adjustment. A red dot identifies the north pole of each magnet; effect of magnet on beam position is reversible by inserting the opposite end of the magnet into the shield.

The shield section of the XD-2233-C assembly is a Nicaloi magnetic shield for isolating the beams passing at low velocity through the neck section of the tricolor kinescope from effects of extraneous magnetic fields.

Information on adjustment procedure for the purifying coil and the beam-positioning magnets is given on Pages 43 and 44 of the Application Material.

## DATA

### Purifying Coil:

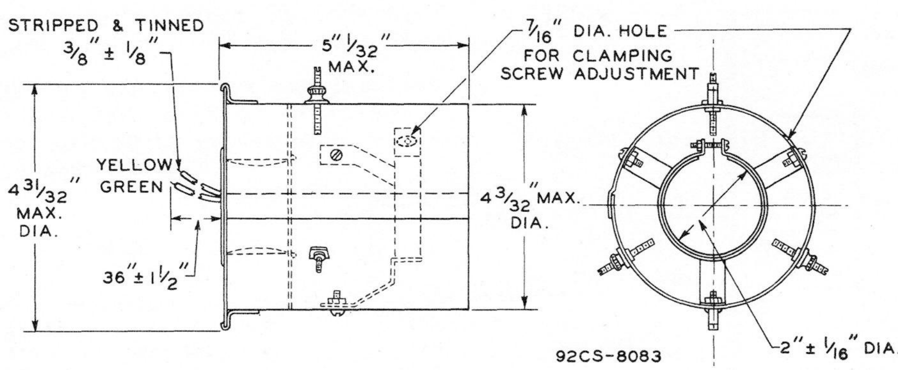
**Ratings:**

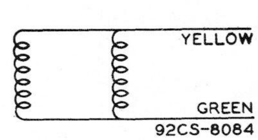
| | | |
|---|---|---|
| DC Current | 200 max. | ma |
| DC Voltage (Coil to Shield) | 500 max. | volts |

**Characteristics:**

| | | |
|---|---|---|
| DC Resistance at 25°C | 17.5 ± 10% | ohms |

## DIMENSIONAL OUTLINE




*Terminal Connections for Developmental No. XD-2233-C.*

**Preliminary and Tentative Data**
**on RCA Developmental**

# Field-Neutralizing Coil

*Developmental No. XD-2315-A*

XD-2315-A is a developmental field-neutralizing coil designed to be placed around the faceplate end of the RCA Tricolor Kinescope Developmental No.C-73599. Its function is to produce a uniform magnetic field which can be adjusted to neutralize extraneous magnetic fields causing tangential displacement of the beams from their color centers as explained on Page 35 of the Application Material.

Correction of the direction of beam displacement is accomplished by adjusting the direction of current flow in the coil; correction of the magnitude of beam displacement is accomplished by adjusting the current value. A convenient means of adjusting both the current value and the direction of current flow is to use the coil in conjunction with a center-tapped potentiometer in a centering-supply circuit.

The XD-2315-A has an inside diameter large enough to facilitate mounting at the faceplate end of the kinescope and the insulating of the kinescope's flange section.

## DATA

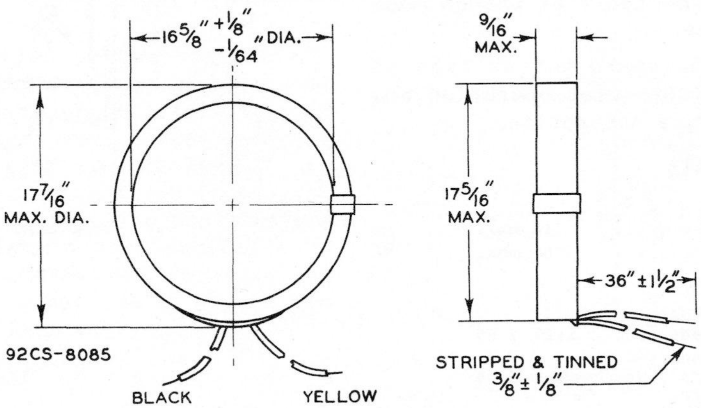
**Ratings:**

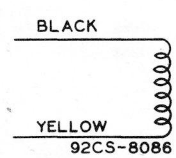
| | | |
|---|---|---|
| DC Current . . . . . . . . . . . . . . . | 150 max. | ma |

**Characteristics:**

| | | |
|---|---|---|
| DC Resistance at 25°C . . . . . . . . | 28.5 ± 10% | ohms |

## DIMENSIONAL OUTLINE




*Terminal Connections for Developmental No. XD-2315-A.*

Preliminary and Tentative Data
on RCA Developmental

# Vertical Dynamic-Converging and Dynamic-Focusing Transformer

*Developmental No. 5XT-7610-C*

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5XT-7610-C is a developmental vertical dynamic-converging and dynamic-focusing transformer with a tapped secondary winding for coupling the vertical-dynamic output of the convergence amplifier to both the converging electrode (grid No.4) and the focusing electrode (grid No.3) of the RCA Tricolor Kinescope Developmental No.C-73599.

This transformer supplies vertical dynamic-correcting voltages for combining with the dynamic-correcting voltages supplied by the Developmental No.XT-7648-F Horizontal Dynamic-Converging and Dynamic-Focusing Transformer. These combined dynamic-correcting voltages are superimposed on the dc voltages for grid Nos.3 and 4 to provide changing electrostatic fields which maintain proper focus and convergence of the beams as they traverse the flat shadow mask of the tricolor kinescope.

This transformer employs a potted type of construction which provides quiet operation and high resistance to moisture absorption.

## DATA

**Ratings:**

| | | |
|---|---|---|
| DC Primary Current . . . . . . . . . | 18 max. | ma |
| Ambient Temperature. . . . . . . . . | 50 max. | °C |

**Characteristics:**

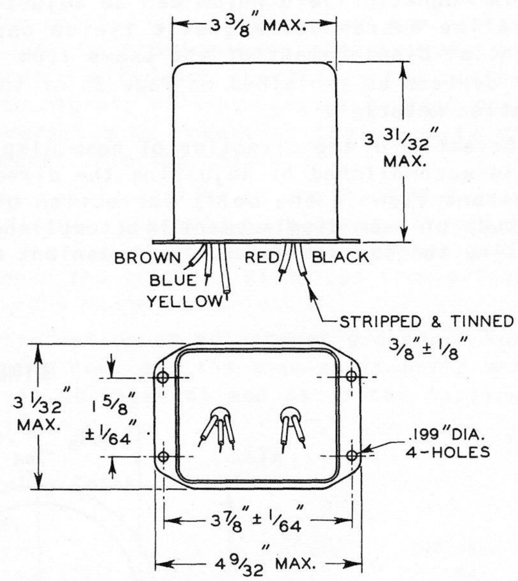
| | | |
|---|---|---|
| Turns Ratio of Primary to Secondary (Between brown and yellow leads) . . | 1:10 ± 5% | |
| Turns Ratio of Primary to Secondary (Between brown and blue leads). . . | 1:3.3 ± 5% | |
| Primary Impedance (With 10-volt, 60-cps signal superimposed on dc current of 18 ma) . . . . . . . | 5000 min. | ohms |
| Leakage Inductance (With 1-volt, 1000-cps signal on primary and with secondary shorted). . . . . . | 500 max. | mh |
| DC Resistance at 25°C: | | |
| Primary Winding. . . . . . . . . . | 1145 approx. | ohms |
| Secondary Winding. . . . . . . . . | 29200 approx. | ohms |

**Test Conditions:**

| | | |
|---|---|---|
| High-Voltage Test: | | |
| Between Primary Winding and Core . . | 1500 rms | volts |
| Between Secondary Winding and Core . | 5000 rms | volts |
| Induced Voltage Test . . . . . . . . | * | |

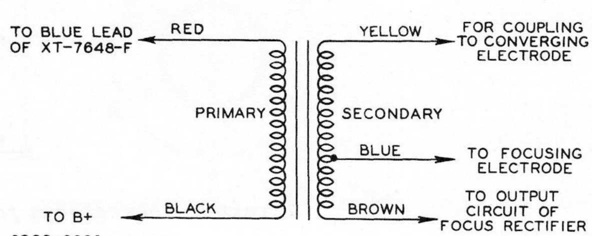
* This transformer will withstand the effects of 5500 dc volts on the secondary winding plus an rms voltage induced on the secondary winding by applying 170 volts at 800 cps to the primary winding. The red lead of the primary winding is grounded during the test.

**DIMENSIONAL OUTLINE**




ALL LEAD LENGTHS
14" ± 1/2"

92CS-8087




92CS-8088

*Terminal Connections for Developmental No. 5XT-7610-C.*

Preliminary and Tentative Data
on RCA Developmental

# Horizontal Dynamic-Converging and Dynamic-Focusing Transformer

*Developmental No.XT-7648-F*

XT-7648-F is a developmental variable-inductance transformer with a tapped secondary winding for coupling the horizontal-dynamic output of the convergence amplifier to both the converging electrode (grid No.4) and the focusing electrode (grid No.3) of the RCA Tricolor Kinescope Developmental No.C-73599.

This transformer can be adjusted to supply horizontal dynamic-correcting voltages for combining with the dynamic-correcting voltages supplied by the Developmental No.5XT-7610-C Vertical Dynamic-Converging and Dynamic-Focusing Transformer. These combined dynamic-correcting voltages are superimposed on the dc voltages for grid Nos.3 and 4 to provide changing electrostatic fields which maintain proper focus and convergence of the beams as they traverse the flat shadow mask of the kinescope.

Designed for operation at the horizontal-scanning frequency of 15750 cycles per second, the XT-7648-F utilizes an adjustable ferrite core to permit tuning the transformer to the scanning frequency. The output of the XT-7648-F, as observed on an oscilloscope, is tuned to maximum by adjusting the ferrite core. The oscilloscope probe should be connected to the insulation of the green lead of the transformer and the adjusting is done with the transformer installed in the circuit given in Fig.6, Page 41.

## DATA

**Ratings:**

| | | |
|---|---|---|
| DC Primary Current . . . . . . . . . | 18 max. | ma |
| Ambient Temperature. . . . . . . . . | 50 max. | $^{o}C$ |

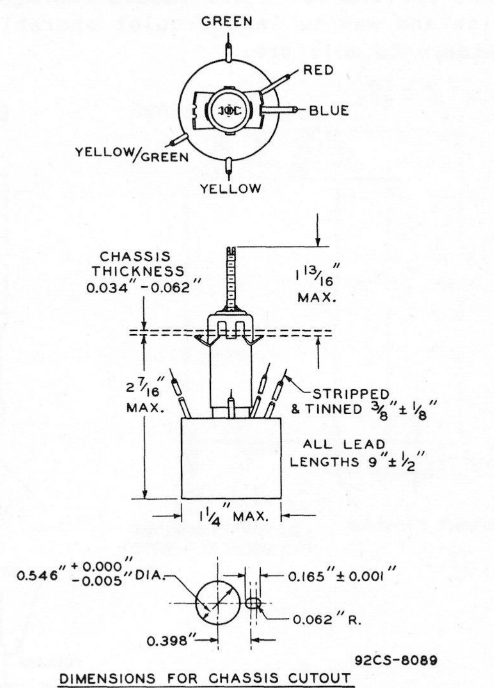
**Characteristics:**

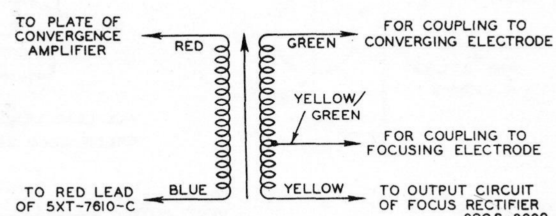
| | | |
|---|---|---|
| Turns Ratio of Primary to Secondary (green and yellow leads) . . . . | 1:9.4 ± 5% | |
| Turns Ratio of Primary to Secondary (yellow/green and yellow leads) . | 1:3 ± 5% | |
| Primary Inductance (with 1-volt, 1000-cps signal and no dc): | | |
| With Core In . . . . . . . . . . . | 10.7 approx. | mh |
| With Core Out. . . . . . . . . . . | 2.3 approx. | mh |
| Secondary Inductance (With 1-volt, 1000-cps signal and no dc): | | |
| With Core In . . . . . . . . . . . | 900 approx. | mh |
| With Core Out. . . . . . . . . . . | 352 approx. | mh |
| DC Resistance at $25^{o}C$: | | |
| Primary (Between blue and red leads) . | 94 approx. | ohms |
| Secondary (Between green and yellow leads) . . . . . . | 2070 approx. | ohms |

**Test Conditions:**

| | | |
|---|---|---|
| High-Voltage Test: | | |
| Between Primary Winding and Core. . | 2500 rms | volts |
| Between Primary and Secondary Winding . . . . . . | 7500 rms | volts |
| Between Secondary Winding and Core. | 7500 rms | volts |

## DIMENSIONAL OUTLINE




*Terminal Connections for Developmental No.XT-7648-F.*

**Preliminary and Tentative Data on RCA Developmental**

# Vertical-Deflection-Output Transformer

*Developmental No. XT-7898-A*

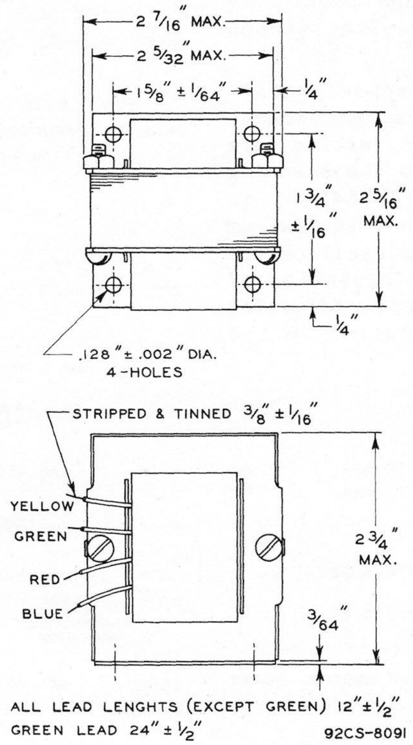
XT-7898-A is a developmental vertical-deflection-output transformer for use with the Developmental No. XD-2071-D Deflecting Yoke in TV receivers employing the RCA Tricolor Kinescope Developmental No. C-73599. Designed to operate with one-half of a 6BL7-GT as the driver tube, this transformer provides good sweep linearity, ample deflection, and efficient coupling between the driver tube and the vertical coils of the deflecting yoke.

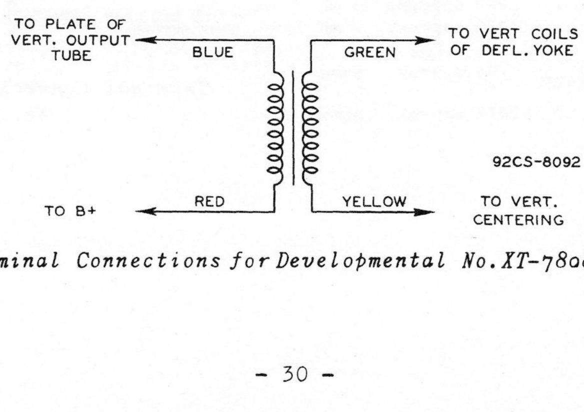
The XT-7898-A is carefully constructed to provide long life under adverse humidity conditions and the coils are vacuum impregnated in varnish and wax to insure quiet operation, and resistance to moisture.

## DATA

| | | |
|---|---|---|
| **Ratings:** | | |
| DC Primary Current (Limited by Iron Saturation) | 19 max. | ma |
| Ambient Temperature | 60 max. | °C |
| **Characteristics:** | | |
| Turns Ratio of Primary to Secondary | 9:1 ± 5% | |
| Primary Impedance (With 30-volt, 60-cps signal superimposed on dc current of 19 ma) | 15000 min. | ohms |
| DC Resistance at 25°C: | | |
| Primary Winding | 555 approx. | ohms |
| Secondary Winding | 15.7 approx. | ohms |
| **Test Conditions:** | | |
| Between Windings and Core | 2500 rms | volts |

## DIMENSIONAL OUTLINE



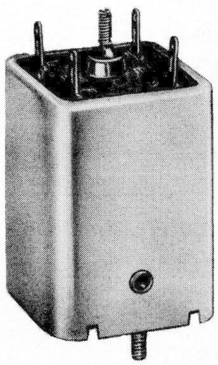

*Terminal Connections for Developmental No. XT-7808-A.*

# 205RI

## HORIZONTAL-OSCILLATOR AND SYNC-STABILIZER COIL

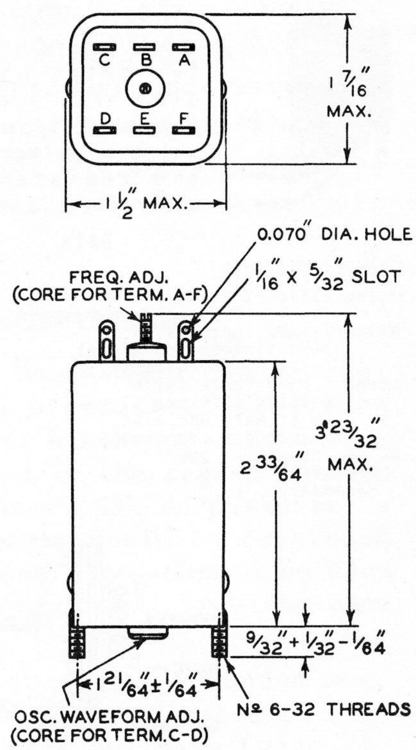
TENTATIVE DATA

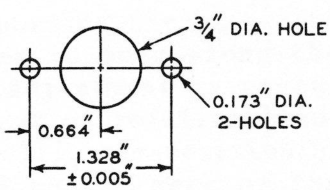
RCA-205RI consists of a horizontal-blocking oscillator coil and a shock-excited frequency-stabilizing coil for use in television receivers employing a 6SN7-GT as a combination horizontal blocking-oscillator and synchronizing-control tube.



When the low-capacitance probe of an oscilloscope is connected at terminal C in a typical circuit such as that shown in Fig. 3, Page 36, the oscillator waveform adjustment should be set so that the wide and narrow peaks of the waveform observed are of the same height.

### DIMENSIONAL OUTLINE




92CS-7236R1

*Dimensions for Chassis Cutout for Type 205R1.*

### DATA

**Characteristics:**

| | *Term. A-F* | *Term. C-D* |
|---|---|---|
| DC Resistance (Approx.) | 81 ohms | 47 ohms |
| Coil Inductance | 13.5▲ max. mh to 33● min. mh | 7.75▲ max. mh to 11.0● min. mh |
| | *With Core For Term. A-F Set For 33.0 mh At 1000 cps* | *With Core For Term. A-F Set For 13.5 mh At 1000 cps* |
| Ratio of Inductance of Winding (Term. A-F) to Inductance of Winding (Term. A-C) at 1000 cps | 7.81 ± 3% | 10.28 ± 3% |
| Coefficient of Coupling Between Sections (Term. A-C & Term. C-F) | 89.2 ± 2% | 76.9 ± 2% |
| Q of Winding at 50 Kc (Term. A-F) | 55 ± 10% | 35 ± 10% |
| Distributed Capacitance of Winding (Term. A-F) | 14.9 ± 2.5 $\mu\mu f$ | 17.3 ± 2.5 $\mu\mu f$ |
| | *With Core For Term. C-D Set For 7.75 mh At 1000 cps* | *With Core For Term. C-D Set For 11.0 mh At 1000 cps* |
| Q of Winding (Term. C-D) Tuned with 0.01-$\mu f$ Capacitor | 17.5 ± 10% | 20 ± 10% |

▲ With core adjusted for least inductance.
● With core adjusted for greatest inductance.

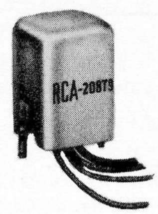
# 208T9

## VERTICAL-BLOCKING-OSCILLATOR TRANSFORMER

**Quiet Operation** **Moisture Resistant**

TENTATIVE DATA

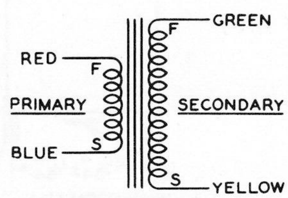
The RCA-208T9 is a vertical-blocking-oscillator transformer for television receiver circuits. It is used in typical blocking-oscillator circuits which generate pulses for driving the grids of the vertical-discharge tubes. It employs a potted type of construction which provides quiet operation and resistance to moisture absorption.




### DATA

**Characteristics:**

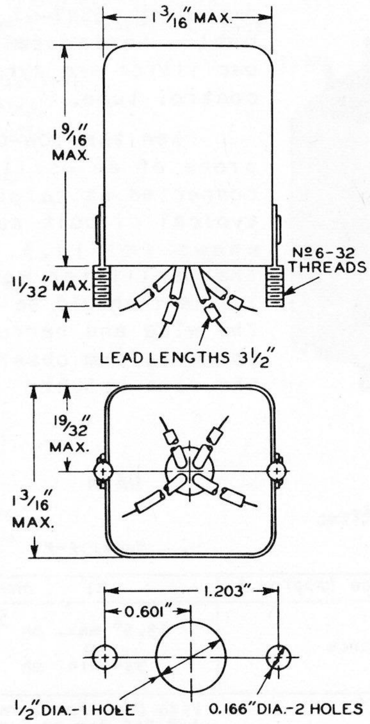
| | | |
|---|---|---|
| Turns Ratio of Primary to Secondary. . . | 1:4.2 ± 5% | |
| Primary Inductance (with 3-volt, 1000-cps signal & no dc current). . . | 1.15 ± 20% | henries |
| Leakage Inductance (with 1-volt, 1000-cps signal on primary and with secondary shorted). . . | 0.008 + 25% − 15% | henry |
| DC Resistance at 25°C: | | |
| Primary . . . . . . . . . . . | 165 | approx. ohms |
| Secondary . . . . . . . . . . | 1310 | approx. ohms |




92CS-7026

*Polarity is additive with red connected to yellow. Insulation on leads designed to withstand continuous operation at 75°C.*

**DIMENSIONAL OUTLINE**




DIMENSIONS FOR CHASSIS CUTOUT

92CS-7027

# Application of RCA Developmental Tricolor Kinescope Dev. No. C-73599 and Associated Tubes and Components

This material discusses the operation and adjustment of components for the RCA Developmental Tricolor Kinescope Dev. No.C-73599. Included is information on (1) mounting, shielding, and related components; (2) deflection, high-voltage, and dynamic-focus and convergence circuits; and (3) kinescope component adjustment procedure. Obviously, the circuits given are not the only ones that can be used, but are suggested as a starting point in experimental designs because they do not require unusual circuit arrangements.

## 1. MOUNTING, SHIELDING, AND RELATED COMPONENTS

The glass tricolor kinescope Developmental No.C-73599 can be supported by any of numerous methods, but certain precautions should be taken into consideration when the mounting for this kinescope is designed. The front end of the kinescope should be supported in the region between the metal flange and the faceplate in such a manner that no pressure is exerted directly on the flange. The front support should be cushioned with shock-absorbing material. A high-voltage insulator* should be used to insulate the metal flange, which is the ultor terminal, from the magnetic shield and other grounded elements.

The rear support of the kinescope can consist of the grounded magnetic shield supporting the kinescope in the cone area indicated in Fig. 1 or on the dimensional outline drawing in the tube bulletin (page 9). Neither the neck nor the base should be used to support the tube. The magnetic shield may be supported from the chassis or the receiver cabinet. Pads of neoprene-base rubber or similar material should be provided between the magnetic shield and the glass envelope.

The deflecting yoke should not be used for supporting the kinescope because it should be centered on the neck and free to move along the neck for a distance of approximately one inch for adjustment purposes. The yoke mount should also provide for a small amount of rotational adjustment. An assembly consisting of the purifying coil, beam-positioning magnets, and neck shield is preferably supported by the neck of the kinescope.

### Shielding and Extraneous-Field Neutralization

Proper operation of the tricolor kinescope requires shielding of the electron beams from the earth's magnetic field and other extraneous magnetic fields. Shielding and effective neutralization of external magnetic

* A suitable insulator having the manufacturer's designation Insulator Part No. 15GCA1 may be obtained from Anchor Industrial Co., 36-36 36th St., Long Island City 6, N.Y.

fields may be accomplished by the use of two shields and two coils. One shield, which may be used as part of the rear support of the kinescope, is located on the conical section of the kinescope envelope. The other shield is located on the tube neck. One coil is located around the periphery of the faceplate; the other coil is located on the tube neck.

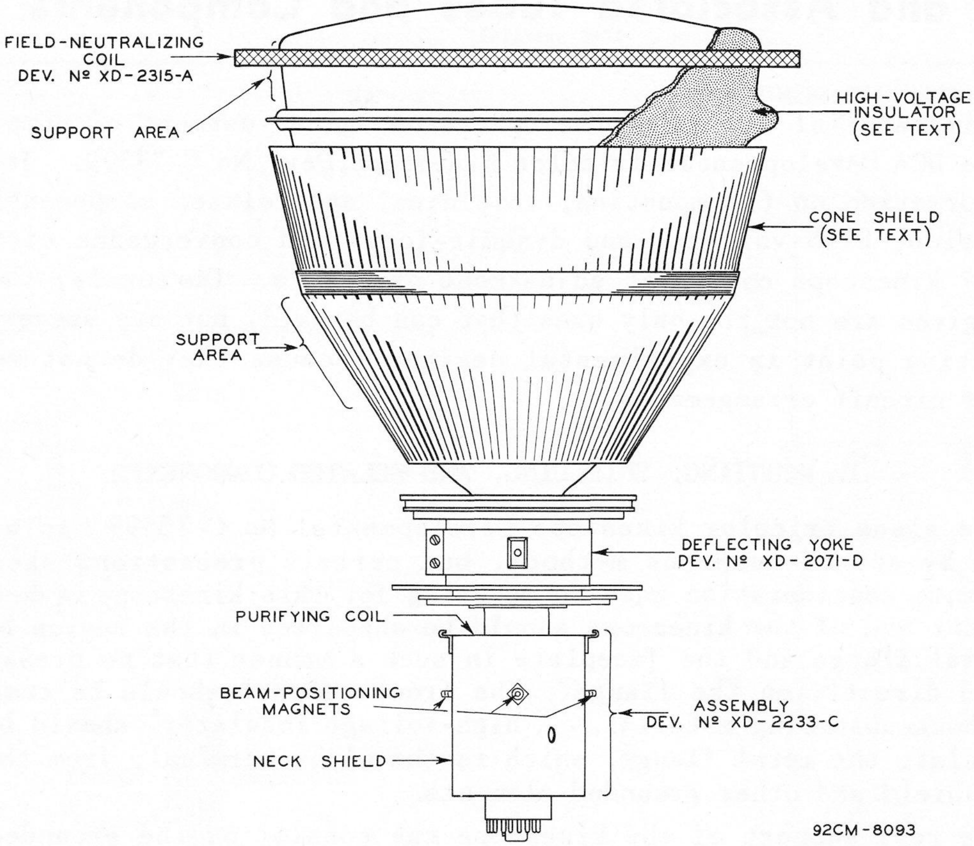



*Fig. 1 - Sketch showing the relative placement of components and the support regions on faceplate section and cone area.*

For the conical section, the magnetic shield● may be made of Mumetal. Fig. 2 is a dimensional outline for a typical cone shield made of this material. Although effective shielding is provided with high-nickel alloys such as Mumetal, Nicaloi, or equivalents, lower-cost shielding can be obtained with the use of multiple shields of 3.5 to 4 per cent annealed silicon steel. The most effective shielding is provided by the use of annealed material having high permeability and low coercive force.

Properties of materials suitable for shields are:

| *Material* | *Permeability at 10 Gauss (approx.)* | *Coercive Force (Hc)* |
|---|---|---|
| Mumetal | >10000 | 0.05 - 0.07 |
| Nicaloi | 4000 - 5000 | 0.1 |
| 3.5% - 4.0% Silicon Steel | 1000 | 0.5 |

● A suitable cone shield having the manufacturer's designation Sketch No. SO-333 (HYMU 80) may be obtained from the Magnetic Metals Co., Hayes Avenue at 21st St., Camden 1, N.J.

In addition to rubber pads for cushioning, the shield may be conveniently equipped with a spring of beryllium-copper or other suitable material to provide the electrical contact for grounding the external conductive coating on the kinescope.

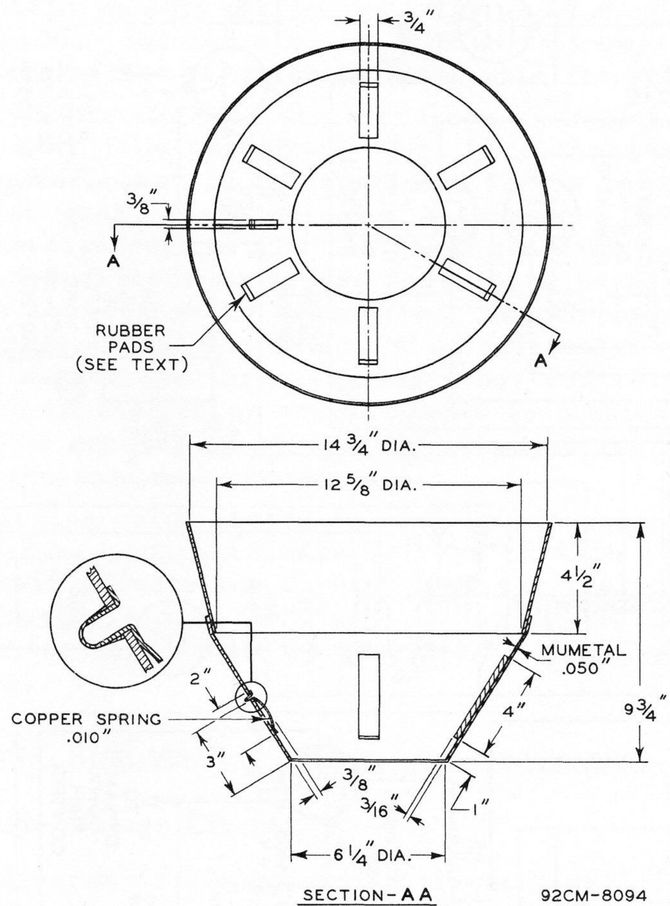



*Fig. 2 - Dimensional outline of typical cone shield made of Mumetal.*

## Field-Neutralizing Coil

For producing an adjustable magnetic field to neutralize the effects of extraneous fields the use of a coil around the faceplate section of the kinescope is recommended. Such a coil is the Field-Neutralizing Coil RCA Developmental No. XD-2315-A. This coil is positioned around the periphery of the faceplate as shown in Fig. 1. It may be supported in any convenient manner. The field of this coil is controlled in both amplitude and direction by adjustment of the current through it. It is recommended that the current be adjusted by a center-tapped potentiometer so that easy reversal of the direction of the current may be obtained. This control should provide a minimum of 100 milliamperes in either direction through the coil. This current value will produce approximately 15 ampere turns. Adequate high-voltage insulation between this coil and the metal flange of the kinescope is provided by the high-voltage insulator previously mentioned.

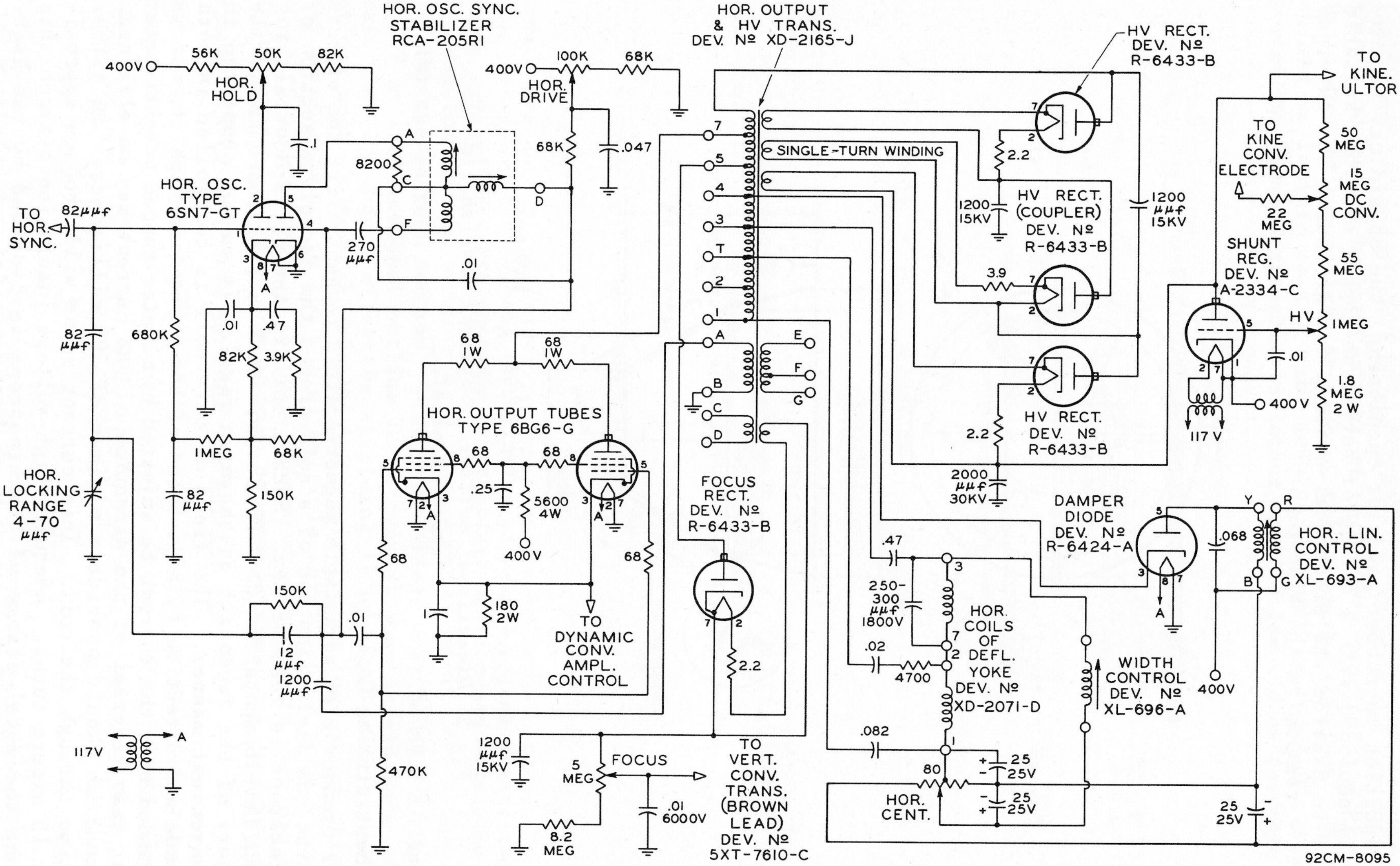



*Fig. 3 - Horizontal-deflection and high-voltage circuit for RCA Developmental Tricolor Kinescope Dev. No. C-73599. Capacitor values are in microfarads, resistor values in ohms, and resistor rating is 0.5 watt, unless otherwise indicated. K = 1000 ohms.*

## Purifying Coil, Beam-Positioning Magnets, and Neck-Shield Assembly

The neck shield may be part of an assembly including the purifying coil and the beam-positioning magnets. Such an assembly is the Purifying Coil, Beam-Positioning Magnets, and Neck-Shield Assembly, RCA Developmental No. XD-2233-C. The purifying coil provides for proper alignment of the three beams with respect to the phosphor-dot plate and the shadow mask; the neck shield shields the low-velocity section of the beams from stray magnetic fields; the three beam-positioning magnets help to provide proper alignment of each of the three beams with respect to the others.

This assembly is mounted on the kinescope neck with the purifying coil at the end away from the base. The three threaded magnets are spaced at 120-degree intervals to correspond to the three positions of the three electron guns of the tricolor kinescope. The clamp of the assembly should be tightened around the kinescope neck. Each positioning magnet provides deflection of its associated beam in a direction perpendicular to the change in beam direction produced by the electrostatic convergence lens. The direction of deflection can be reversed by reversing the magnet and threading its other end into the assembly. Proper convergence in the center of the raster is obtained by adjusting the position of the magnets in or out and by adjusting the voltage on the convergence electrode as required.

The adjustment for color purity is made by simultaneously rotating the purifying coil and adjusting the current through it as required. Rotation of the coil affects the direction of the field; adjustment of current affects the magnitude of the field. A minimum of 150 milliamperes through the purifying coil should be provided at the maximum setting of the current control.

## 2. DEFLECTION, HIGH-VOLTAGE, FOCUS, AND CONVERGENCE CIRCUITS

### Deflection and High-Voltage Circuit

A schematic diagram of a suggested horizontal-deflection and high-voltage circuit is given in Fig. 3. Correct operation of this circuit can be obtained with a conventional oscillator-discharge circuit, such as the one shown, which is capable of delivering a driving voltage of the amplitude and waveform shown in Fig. 4. Two RCA-6BG6's in parallel

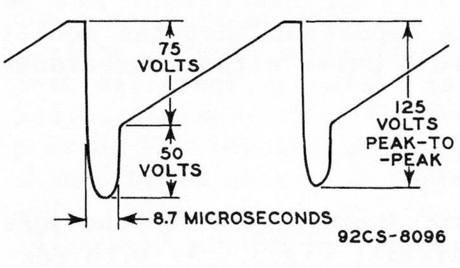



*Fig. 4 - Typical waveform of input to grid-No. 1 circuit of horizontal-deflection-output tubes type 6BG6-G measured across 470,000-ohm grid resistor.*

are used as horizontal-output tubes. In order that circuit efficiency be maintained, the output tubes must be cut off rapidly at the end of each scanning cycle and kept cut off during the entire retrace interval. To assure complete cutoff, it is desirable to add a negative peaking pulse to the sawtooth driving voltage during retrace. The winding between terminals A and B of the Horizontal-Output Transformer RCA Developmental No.XD-2165-J may be used to provide the necessary peaking pulse. A method of using this winding for peaking is shown in Fig.3.

### Width Control and Linearity Control

An inductive Width Control, RCA Developmental No.XL-696-A, is connected in parallel with the horizontal windings of the Deflecting Yoke RCA Developmental No.XD-2071-D. This type of width control is best suited for this circuit because it does not entail a serious loss in ultor power.

Horizontal—Linearity Control RCA Developmental No.XL-693-A is used to provide for linearity adjustment. Electrical centering is provided by an 80-ohm center-tapped potentiometer which controls the dc current through the horizontal coils of the deflecting yoke.

### Plate Pulse Voltage

During the retrace interval, a positive voltage pulse of 5500 volts appears on the plate of the horizontal-output tube. A portion of this pulse is fed back to the control grid through the grid-plate capacitance of the tube and the associated wiring. This pulse opposes the action of the peaking pulse and, if it is too large, will prevent the maintenance of plate-current cutoff during the retrace interval. In order that the effect of this feedback pulse be kept at a minimum, the wiring must be dressed to reduce as much as possible the grid-plate capacitance in the external circuit.

If the insulation or spacing of the plate-circuit components of the 6BG6-G's is inadequate, the 5500-volt pulse on the tube plate during retrace may cause corona or arc-over. To minimize the possibility of corona and arc-over, soldered joints should be smooth and free from projecting points, and adequate spacing should be provided between the plate circuit components and the chassis or other grounded components.

### Damper-Tube Considerations

The developmental type No.R-6424-A is used as the damper diode. The cathode of the diode receives a positive peak voltage of approximately 3200 volts during the retrace interval. Because this value is within the 4500-volt peak-pulse heater-cathode rating, the heater may be grounded at either of its terminals. It is important that the socket also be capable of withstanding this 3200-volt pulse without breakdown or leakage.

### Deflecting-Yoke Considerations

A neutralizing capacitor of 250 to 300 micromicrofarads for the yoke is shown on the diagram of the deflection circuit, Fig.3. As with conventional yokes, improper neutralization causes the appearance of vertical bands on the left side of the raster, together with an uneven vertical displacement of the scanning lines. In the yoke for the tricolor kinescope, however, the effect of improper neutralization will be more severe because each beam may be displaced a different amount and it will therefore be impossible to obtain proper beam convergence on the left side of the picture. Tying the center tap of the horizontal winding of the deflecting yoke back to the horizontal-output transformer by the network (4700 ohms and 0.02 microfarads) also helps to improve the neutralization.

### High-Voltage Power Supply

The high-voltage output required for the kinescope ultor is supplied by a diode-coupled voltage-doubling circuit using three RCA developmental tubes Developmental No.R-6433-B. A shunt-regulator tube RCA Developmental No.A-2334-C is used to regulate the ultor voltage supply at 20 kilovolts. This voltage is maintained with loading up to approximately 750 microamperes. The high-voltage lead of the output transformer and the leads of the 1200-micromicrofarad coupling capacitor in the plate circuit of the two high-voltage rectifiers should be kept as short as possible and away from the chassis to maintain optimum efficiency. The single-turn heater winding around the high-voltage winding of the horizontal-output transformer should be used for the coupling diode; the heater leads should be kept as short as possible and away from the chassis. Part of the 4000-micromicrofarad output capacitance may consist of the 2000-micromicrofarad capacitor formed by the kinescope ultor and the grounded coating. Because the cathode of the shunt regulator tube Developmental No.A-2334-C is tied to B+ (400 volts), a value which is greater than the heater-cathode rating of ±180 volts, a separate heater winding should be used for this tube.

The dc convergence-voltage control may be part of the regulator bleeder as shown in Fig.3 because the current collected by the converging electrode is only leakage current. Special precautions should be taken to minimize leakage currents in this bleeder circuit.

The dc focus voltage is obtained from a tap (terminal 5) on the horizontal-output transformer. A diode RCA Developmental No.R-6433-B is used as the focus rectifier. Adjustment of the focusing voltage is provided by means of a 5-megohm potentiometer in a voltage-divider network.

### Adjustment of Horizontal-Deflection and High-Voltage Circuit

Adjustment of the horizontal-deflection and high-voltage circuit is conventional. The first step is the adjustment of the horizontal-oscillator-discharge circuit. When this adjustment is completed, the horizontal drive should be adjusted for efficient operation of the output circuit. The appearance of a bright vertical bar near the center of the raster is an indication that the driving voltage is more than sufficient. It is important that this condition be attainable because the most efficient operation is usually obtained just before this overdrive indication appears. The high-voltage adjustment should now be made to provide 20 kilovolts at the kinescope ultor terminal. Width and linearity should be adjusted for approximately a one-fourth inch over-scan on each side. After these adjustments have been completed, the horizontal-drive adjustment should be repeated.

### Vertical-Deflection Circuit

Vertical-deflection power is provided by the circuit shown in Fig. 5. The signal from the combined vertical-oscillator and discharge circuit is sufficient to drive the output stage. One-half of an RCA-6BL7-GT is used in the output stage with the Vertical-Deflection Output Transformer

RCA Developmental No. XT-7898-A. Electrical centering is provided by a center-tapped potentiometer which should provide a minimum of 50 milliamperes in either direction through the vertical winding of the yoke.

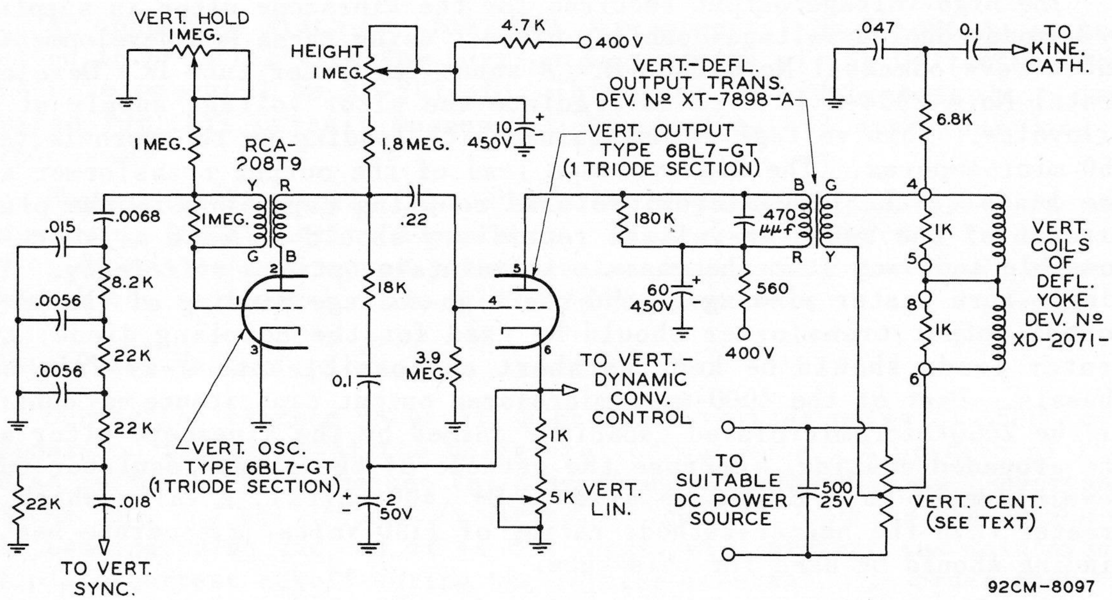



*Fig. 5 - Vertical-deflection circuit for RCA Developmental Tricolor Kinescope Dev. No. C-73599. Capacitor values are in microfarads, resistor values in ohms, and resistor rating is 0.5 watt, unless otherwise indicated. K = 1000 ohms.*

## Dynamic-Convergence-and-Dynamic-Focus Circuit

In addition to the approximately 3000-volt dc focus voltage and 9000-volt dc convergence voltage obtained from the high-voltage supply, dynamic-focus and convergence voltages are superimposed on the dc components to maintain uniform focus and convergence over the entire raster. A diagram of the dynamic-convergence-and-dynamic-focus circuit is given in Fig. 6.

For the horizontal-dynamic-focus-and-convergence circuit, a voltage, having the approximate waveform shown in Fig. 7a, is taken from the cathode circuit of the horizontal-output tube and applied through an amplitude control and the Horizontal-Dynamic-Convergence Phase Control, RCA Developmental No. XL-582-C to the grid of the convergence amplifier RCA-6BL7-GT. For the vertical-dynamic-focus-and-convergence circuit, a voltage as shown in Fig. 7b is taken from the cathode circuit of the vertical-output tube and applied through an amplitude control to the grid of the convergence amplifier tube. The shape of the waveform of the vertical-dynamic-convergence-and-focus voltage is adjusted by means of the vertical-convergence-phase control. The Horizontal Dynamic-Converging and Dynamic-Focusing Transformer, RCA Developmental No. XT-7648-F, in the plate circuit of the RCA-6BL7-GT is tuned by means of the adjustable core to give maximum output at the horizontal-scanning frequency. Although this adjustment results in rounding off the sharp peaks of the parabolic wave, which becomes almost sinusoidal in appearance, the resultant distortion does not adversely affect performance because the sharp peaks occur during horizontal blanking. The secondary of the transformer is tapped to provide the proper ratio of dynamic-focus voltage to dynamic-convergence voltage.

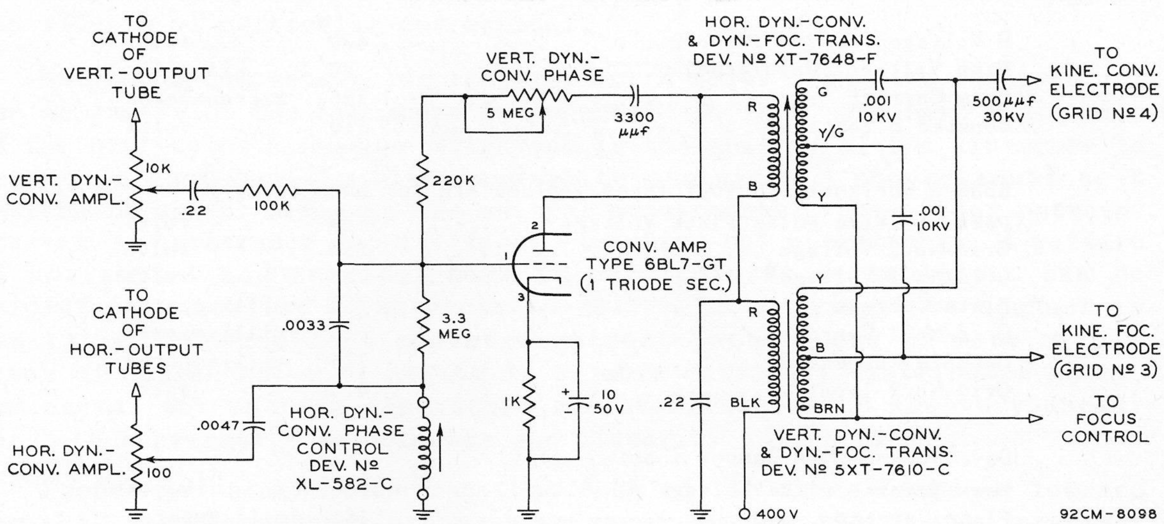



*Fig.6 - Dynamic-convergence-and-focus circuits for RCA Developmental Tricolor Kinescope Dev. No.C-73599. Capacitor values are in microfarads, resistor values in ohms, and resistor rating is 0.5 watt, unless otherwise indicated. K = 1000 ohms.*

The Vertical Dynamic-Converging and Dynamic-Focusing Transformer, RCA Developmental No.5XT-7610-C has its primary connected in series with the primary of the horizontal dynamic-converging-and-focusing transformer in the plate circuit of the RCA-6BL7-GT. The secondary of the vertical-

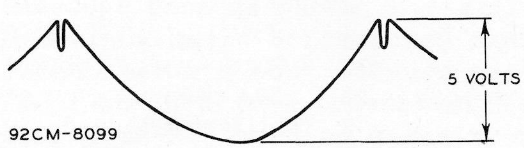



*Fig.7a - Waveform of voltage at cathode of horizontal output tube.*

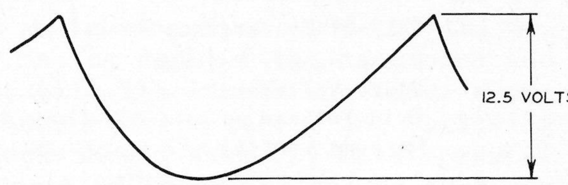



*Fig.7b - Waveform of voltage at cathode of vertical output tube.*

transformer is tapped to provide the proper ratio of dynamic-focus voltage to dynamic-convergence voltage. The dynamic-convergence voltages are coupled by a capacitor to the converging electrode and added to the dc convergence voltage; the dynamic-focus voltages are series fed to the focusing electrode and added to the dc focus voltage.

*Table I: Typical Operating Values for the Deflection and High-Voltage Circuits Given in Figs. 3, 5, and 6.*

| | | |
|---|---|---|
| B Voltage | 400 | volts |
| High Voltage (Regulated) | 20 | kilovolts |
| Beam Current | 0-750 | microamperes |
| Boosted B Voltage▲ | 610 | volts |
| **6BG6-G Horizontal Output Tubes (Values are for both tubes):** | | |
| Peak Positive-Pulse Plate Voltage | 5500 | volts |
| Grid-No.2 Voltage | 290 | volts |
| Grid-No.1 Voltage● | -36 | volts |
| Plate Current | 160 | milliamperes |
| Grid-No.2 Current | 15 | milliamperes |
| Cathode Current | 175 | milliamperes |
| Grid-No.2 Input | 4.5 | watts |
| **Dev. No. R-6424-A Damper Tube:** | | |
| Peak Inverse Plate Voltage | 2800 | volts |
| Plate Current | 160 | milliamperes |
| Peak Heater-Cathode Voltage | 3200 | volts |
| **Dev. No. XD-2165-J Horizontal-Output and High-Voltage Transformer:** | | |
| Pulse Voltage at Terminals (Measured to Ground)□ | | |
| Terminal T | 1770 | volts |
| Terminal 2 | 1400 | volts |
| Terminal 3 | 2800 | volts |
| Terminal 5 | 4700 | volts |
| **6BL7-GT Vertical Output Tube:** | | |
| Plate Supply Voltage | 400 | volts |
| Plate Voltage | 360 | volts |
| Peak Positive-Pulse Plate Voltage | 1300 | volts |
| Grid Voltage | -21 | volts |
| Cathode Current | 13 | milliamperes |
| **6BL7-GT Convergence Amplifier:** | | |
| Plate Supply Voltage | 400 | volts |
| Plate Voltage | 360 | volts |
| Grid Voltage | -20 | volts |
| Cathode Current | 19 | milliamperes |

▲ Measured at terminal 1 of horizontal-output and high-voltage transformer Dev. No. XD-2165-J, to ground.

● Consists of 11 volts cathode bias and 25 volts grid-resistor bias.

□ Consists of positive voltage pulse having a dc component equal to the boosted B voltage.

## 3. KINESCOPE COMPONENT ADJUSTMENT PROCEDURE

This section gives a suggested procedure for the adjustment of the kinescope components to provide color purity and optimum convergence of the three beams over the entire area of the screen. Once the preliminary adjustments have been made, final "touch-up" becomes a matter of experience not requiring a set procedure, but rather an understanding of the effects of particular corrections.

Neither a complete color receiver nor a color signal is required for the alignment of the kinescope components. In fact, the best indication of the quality of kinescope alignment is the ability of the kinescope to produce a good-quality black-and-white picture. A conventional test pattern is useful in making the initial adjustments. Some other pattern, however, is preferable for the final "touching-up" operations. A pattern of horizontal and vertical bars is particularly suitable and can be helpful in linearity adjustments as well. If a flying-spot scanner is available, an excellent convergence test pattern can be made with a slide of opaque material having 15 or more uniformly distributed holes. Commercial dot-pattern generators are available which are very useful for both convergence adjustments and linearity adjustments.

Proper adjustment requires that each of the three beams be focused and that all three beams properly converge so that their axes intersect in the plane of the shadow mask. It is important to distinguish between these two operations. Each of the beams is brought to a focus by a separate electrostatic lens in the appropriate gun. All of these focusing lenses are adjusted by the voltage applied to the focusing electrodes through base pin No. 6. The three beams are adjusted to proper convergence by the use of an electrostatic lens common to all three guns. Proper convergence is established when the three color images produced by the application of the same video signal to all three guns appear superimposed on one another.

### Placement of Components

After the kinescope is mounted with the blue gun uppermost (i.e. base pin 17 on top), the first step is placement of the components on the kinescope neck as shown in Fig. 1. The Deflecting Yoke Developmental No. XD-2071-D should be centered radially on the neck of the kinescope and placed near its most forward position, with its insulating liner about 3/8 of an inch from contact with the funnel of the tube. The Purifying Coil, Beam-Positioning Magnets, and Neck-Shield Assembly Developmental No. XD-2233-C should be clamped on the neck of the kinescope so that any one of the beam-positioning magnets is located vertically above the blue gun. It is advisable to ground this assembly. The beam-positioning magnets should be unscrewed so that they have a minimum effect on the beams.

The Field-Neutralizing Coil Developmental No. XD-2315-A should be placed around the kinescope faceplate section. The inside diameter of this coil is about two inches greater than the outside diameter of the tube at the faceplate to facilitate the mounting of the kinescope at the faceplate section and the insulation of the metal flange. The socket may now be placed on the kinescope.

## Initial Adjustments

Before the application of deflection power and high voltage to the kinescope, the kinescope bias control (background or brightness) should be adjusted for maximum bias. The dynamic-convergence adjustments (amplitude and phase controls) should be at their mid positions, and the controls for the purifying coil and for the field-neutralizing coil set so that no current is flowing through either. After deflection power and high voltage are applied, the beam currents should be increased gradually to minimize the possibility of tube damage in the event of circuit trouble. In addition, it is important that the high-voltage input (product of ultor voltage and ultor current) be kept within the tube rating of 15 watts. If color changes in bright areas of the test pattern are observed, the ultor current is too high and should be reduced immediately to prevent permanent damage to the shadow mask. The high-voltage adjustment should be made to provide approximately 20 kilovolts to the ultor. With the application of a test signal, initial adjustment of focus and convergence should be made. At this point it is convenient to adjust the horizontal oscillator and make the conventional adjustments of height, vertical linearity, horizontal linearity, width, drive, and electrical centering.

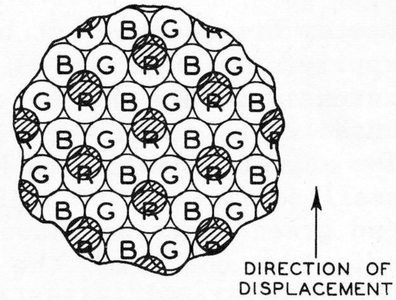
## Color-Purity Adjustments

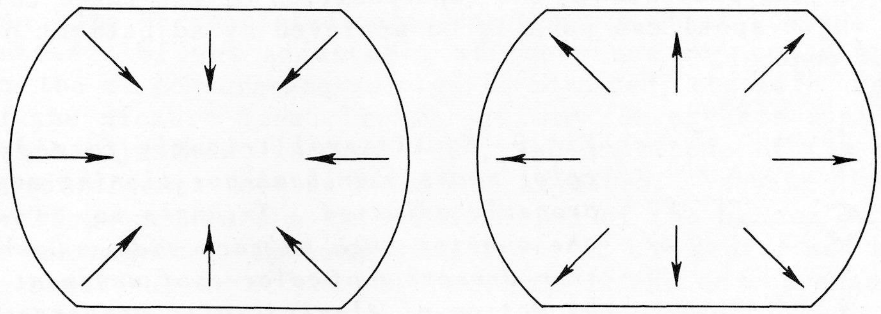
Adjustment for color purity is the next step. The normal sequence of adjustments involves first the purifying coil, then the axial position of the deflecting yoke, and last the field-neutralizing coil. Any color dilution may be best seen with the blue and green beams cut off. With a beam current of approximately 100 microamperes from the red gun and with no video signal applied, the purifying coil should be rotated on the tube neck simultaneously while the current through it is varied until a uniform red field appears in the center of the screen.

Adjust edge purity first by sliding the deflecting yoke axially on its mount and then by varying the amplitude and direction of the current in the field-neutralizing coil in such a way as to produce the most uniform red field. The blue and green fields should now be checked separately. If the field purity is not acceptable on either or both of these two fields, a compromise in adjustment settings must be reached to give the best simultaneous red, blue, and green field purity. After these adjustments, it may be necessary to recenter the raster by means of the electrical centering adjustments.

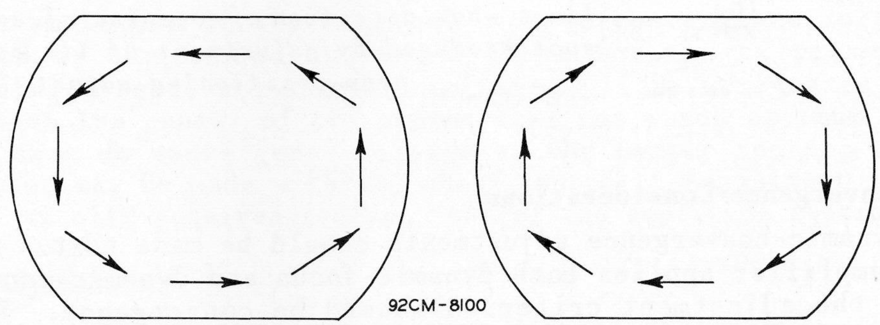
If difficulty is encountered in obtaining purity by means of the adjustments outlined in the foregoing paragraph, the use of a wide-field microscope having a magnification of approximately 20 can be very helpful. Purity errors can be analyzed by observing with a microscope the excited areas of the red phosphor dots while the red field only is turned on. The relative displacements of the centers of the excited area with respect to the centers of the phosphor dots should be noted in the center of the viewing screen. These displacements as observed with the microscope are shown in Fig. 8a. The arrow indicates the direction of displacement. If there is any displacement, such as shown in Fig. 8a, a readjustment of the position of the purifying coil and the current through it should be made until the excited area is in the center of the phosphor dots in the center of the screen. Adjustment of the position of the coil affects the direction the excited area will move when the coil current is changed.

*a - Magnified view of screen showing uniform displacement of red beam. Arrow indicates direction of displacement.*



*b - Radial displacements*




*c - Tangential displacements*

*Fig. 8 - Purity displacement diagrams.*

The relative displacements should then be observed along the periphery of the viewing screen. If the displacements have radial components as indicated by the arrows in Fig. 8b, the yoke should be readjusted axially until the excited area of the phosphor dots along the periphery are centered or have only a tangential displacement component as shown in Fig. 8c. At the center of the left and right edges of the screen, for example, the excited areas of the phosphor dots should either be centered or have only a vertical component. If the displacements are essentially tangential, a readjustment of the current in the field-neutralizing coil should be made. If difficulty in obtaining purity is still encountered, a compromise adjustment of these components after the convergence adjustments have been made will possibly be helpful in providing optimum purity.

**Adjustment of Beam-Positioning Magnets**

After the adjustments for color purity, the beam-positioning magnets should be adjusted. The kinescope control should be set to adjust the raster brightness just below visibility, and a video dot-pattern signal applied and adjusted so that each color is of approximately the same intensity. The dc convergence voltage should be adjusted so that the three color spots are visible separately in the center of the screen. The magnets should then be adjusted so that the three color spots form a small equilateral triangle, the ends of the base being formed by the red and green spots as shown in Fig.9. Although each magnet has its major effect on one beam, the other beams are also affected slightly. When this equilateral triangle is obtained, complete convergence in the center of the screen (as indicated by the superposition of the three color spots to form a white spot) can usually be achieved by adjustment of the dc convergence control.

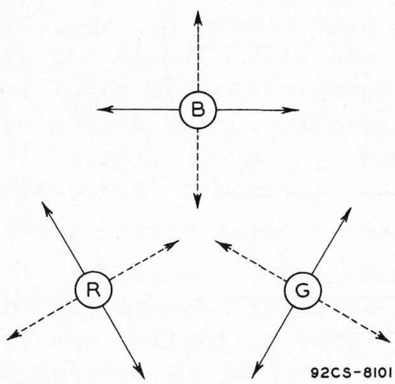



*Fig. 9 - Equilateral triangle formed by three color spots when beam-positioning magnets are properly adjusted. Triangle may be as much as one quarter inch on each side. Dashed lines show direction of color-spot movement produced by action of electrostatic convergence lens. When the dc convergence voltage is decreased, for example, all three beams converge. Solid lines show direction of movement of each color spot produced by adjustment of its associated beam-positioning magnet.*

## Dynamic-Convergence Considerations

The dynamic-convergence adjustments should be made next. Although the same amplifier applies both dynamic-focus and dynamic-convergence voltages, the adjustment criterion should be convergence. When the dynamic-convergence adjustment is correct, the uniformity of dynamic focus is satisfactory also. Because focus and convergence are interdependent, a dc focus adjustment should be made each time a dc convergence adjustment is made.

In the adjustment of dynamic convergence, a technique which will be found very helpful is that of frequently varying the dc convergence control and noting its position for optimum convergence at various parts of the screen. With a particular setting of the beam-positioning magnets, optimum convergence can be obtained at any point on the screen simply by adjusting the dc convergence voltage. The purpose of the dynamic-convergence voltages is to establish the voltage of the converging electrode at each instant so that, for each point on the picture area, no improvement could be made by further adjustment of the dc convergence voltage.

The criterion for dynamic-convergence adjustment is that optimum convergence is achieved at all points on the picture area with a single setting of the dc convergence control. If optimum convergence at particular areas of the picture is obtained at different settings of the dc convergence control, the nature of the correction of dynamic-convergence voltage is indicated by the direction of rotation of the dc convergence control required to change from the optimum value at the center of the picture to the optimum value at another point. If the dc convergence voltage is set for optimum convergence at the center of the picture area and the convergence at the right and left edges of the screen is improved by increasing (or decreasing) the dc convergence voltage, the horizontal-dynamic-convergence amplitude control should be adjusted to increase (or decrease) the horizontal-dynamic-convergence voltage.

### Horizontal-Dynamic-Convergence Adjustment

The first step in the dynamic-convergence adjustment is to set the horizontal-dynamic-convergence amplitude control at approximately mid position. The horizontal-dynamic-convergence phase control should then be adjusted. Slight adjustment of the phase control should be made until, as the dc convergence voltage is adjusted, the left edge and right edge of the picture pass through optimum convergence simultaneously. After this adjustment is completed, the amplitude of the horizontal-dynamic-convergence voltage should be adjusted. Varying the dc convergence voltage provides a good indication of the proper adjustment of dynamic convergence. Optimum convergence at the center and sides of the picture should occur at the same setting of the dc convergence voltage control.

### Vertical-Dynamic-Convergence Adjustment

The amplitude of the vertical-dynamic-convergence voltage may be adjusted by the method suggested above for the adjustment of the horizontal-dynamic-convergence voltage. If in some cases the region just above the center of the screen does not reach optimum convergence at the same dc convergence voltage as the center and top and bottom, correction may be made with the phase control. Adjustment of the phase control usually requires readjustment of the amplitude control.

### Final Adjustments

Because the dynamic-convergence adjustments require adjustment of the dc convergence voltage, readjustment of the focusing voltage is also required. The focus and convergence adjustments are somewhat interdependent and several successive trials are usually required.

After these adjustments, convergence and focus should be optimum at all areas of the screen. The application of the dynamic convergence and focus voltages, however, may have affected purity. If necessary, compromise adjustments of the purifying coil, the field-neutralizing coil, and the axial position of the deflecting yoke should be made to provide optimum purity of all color fields.

Although considerable time and patience may be required initially to adjust the kinescope components properly, the techniques are straightforward and, as a result, skill is not difficult to acquire.

RADIO CORPORATION OF AMERICA
RCA VICTOR DIVISION
HARRISON, NEW JERSEY

TUBE DEPARTMENT

October 7, 1953

RCA DEVELOPMENTAL
GLASS-ENVELOPE TRICOLOR KINESCOPE,
ASSOCIATED TUBES AND COMPONENTS

Gentlemen:

We are pleased to offer for color television developmental work the RCA Developmental Glass-Envelope Tricolor Kinescope C-73599; an associated developmental components kit; and associated developmental tubes for high-voltage pulsed-rectifier service, damper service, and high-voltage regulator service.

The attached list identifies these developmental items by developmental numbers, gives brief descriptions, and includes prices. Technical information--ratings, characteristics, and dimensions--for each of the items as well as a detailed discussion on the application of the color kinescope and associated components is given in the accompanying booklet "RCA Developmental Tricolor Kinescope, Associated Tubes, Components, and Circuits: Form No. ICE-111".

In accepting this offer, please send your purchase order to our District Equipment Sales Office nearest you. District offices are located at: 744 Broad Street, Newark 1, New Jersey; 589 East Illinois Street, Chicago 11, Illinois; and 420 South San Pedro Street, Los Angeles 13, California.

As is usual with our developmental items, which are subject to change, we ask that you do not crystalize any commercial equipment designs using these developmental items before consulting us.

Your attention is directed to sources of supply for the kinescope cone shield, metal-flange insulator, and socket, which are not included in the attached list.

A cone shield, made according to the specification drawing in the Application Section of the accompanying booklet, may be obtained from Magnetic Metals Company, Hayes Avenue and 21st Street, Camden, New Jersey by ordering shield according to the manufacturers's designation of Sketch No. SO-333 (HYMU 80).

A suitable metal-flange insulator may be obtained from Anchor Industrial Company, 36-36 36th Street, Long Island City 6, New York by ordering Insulator Part No. 15GCA1.

A socket to fit the bidecal base of the kinescope may be ordered under Developmental No. 57C17902 from Cinch Manufacturing Corporation, 1026 South Homan Avenue, Chicago 24, Illinois.

Any questions you may have about the offered items may be addressed to our district office serving you.

Very truly yours,

M. J. Carroll

Manager
Equipment Sales

MJCarroll:mp

# LIST OF DEVELOPMENTAL ITEMS
## Offered for Color Television Development Work

### TUBES

| Dev. No. | Description | Equipment Price |
|---|---|---|
| C-73599 | Glass-Envelope Tricolor Kinescope . . . | $ 200.00 |
| R-6424-A | Half-Wave Vacuum Rectifier. . . . . . . . . . . for Damper Service | 5.00 |
| R-6433-B | Half-Wave Vacuum Rectifier. . . . . . . for High-Voltage Pulsed-Rectifier Service (4 required) | 6.80 |
| A-2334-C | Sharp-Cutoff Beam Triode. . . . . . . . for High-Voltage Regulation Service | 10.75 |

### COMPONENTS

| Kit No. | Description | Total Kit Price |
|---|---|---|
| 410126 | Kit consisting of the following components:<br>Deflecting Yoke Dev. No. XD-2071-D<br>Horizontal-Output and High-Voltage Transformer Dev. No. XD-2165-J<br>Horizontal Dynamic-Converging and Dynamic-Focusing Transformer Dev. No. XT-7648-F<br>Horizontal Dynamic-Convergence Phase Control Dev. No. XL-582-C<br>Horizontal-Linearity Control Dev. No. XL-693-A<br>Width Control Dev. No. XL-696-A<br>Horizontal-Oscillator and Sync-Stabilizer Coil RCA-205R1*<br>Vertical Dynamic-Converging and Dynamic-Focusing Transformer Dev. No. 5XT-7610-C<br>Vertical-Deflection-Output Transformer Dev. No. XT-7898-A<br>Vertical Blocking-Oscillator Transformer RCA-208T9*<br>Purifying Coil, Beam-Positioning Magnets, and Neck Shield Assembly Dev. No. XD-2233-C<br>Field-Neutralizing Coil Dev. No. XD-2315-A | $ 230.00 |

**Commercial Type Number*

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Your purchase order should be send to the District Equipment Sales Office nearest you. District offices are located at:

744 BROAD ST.
NEWARK 1, NEW JERSEY

589 E. ILLINOIS ST.
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420 SOUTH SAN PEDRO ST.
LOS ANGELES 13, CALIFORNIA