5820-A

IMAGE ORTHICON

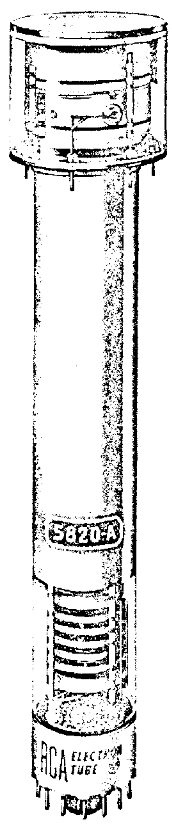
Magnetic Focus
Magnetic Deflection

For Outdoor and Studio Pickup
High Sensitivity

3"-Diameter Bulb
15.20" Length

The 5820-A is unilaterally interchangeable with the 5820.

RCA-5820-A is an image-orthicon type of television camera tube intended for both outdoor and studio pickup. It features extremely tight limits on such important performance characteristics as signal-to-noise ratio, resolution, sensitivity, and uniformity of sensitivity and background. The 5820-A is capable of providing pictures of very high quality and also of providing stable operation over a wide range of incident light levels on the object.



Stable performance is obtained with incident light levels on the object ranging from bright sunlight (several thousand footcandles) to a deep shadow (one footcandle or less). The sensitivity of the 5820-A is equivalent to photographic film having an ASA exposure index of 8000. Commercially acceptable pictures can be obtained at incident light levels greater than about 10 footcandles with appropriate setting of the camera lens stops. The 5820-A has an S-10 spectral response which approaches the response of the eye.

The photocathode utilized in the 5820-A is characterized by a spectral response having high blue sensitivity, high green sensitivity, good red sensitivity, and practically no infrared sensitivity. This latter characteristic of the response prevents any color-masking by infrared, and thus permits gray-scale rendition of colors in nearly their true tonal gradation.

Under proper operating conditions, the 5820-A has light transfer characteristics which do not require the use of gamma-correction circuits to provide normal tone rendition in black-and-white pictures on the picture-tube screen.

DATA

General:

Heater, for Unipotential Cathode:
  Voltage (AC or DC) . . . . 6.3 ± 10% volts
  Current . . . . 0.6 ampere
Direct Interelectrode Capacitance:
  Anode to all other electrodes . . 12 pf ←
Spectral Response S-10
Wavelength of Maximum Response. . . 4500 ± 300 angstroms
Photocathode, Semitransparent:
  Rectangular Image (4 x 3 aspect ratio):
    Useful size of. . . . . 1.8" max. Diagonal
      Note: The size of the optical image focused on the photocathode should be adjusted so that its maximum diagonal does not exceed the specified value. The corresponding electron image on the target should have a size such that the corners of the rectangle just touch the target ring.
    Orientation of. . . . .Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through center of faceplate and pin No.7 of the shoulder base.
Focusing Method . . . . Magnetic
Deflection Method . . . . Magnetic
Overall Length. . . . . 15.20" ± 0.25"
Greatest Diameter of Bulb . . . . 3.00" ± 0.06"
Shoulder Base . . . . Keyed Jumbo Annular 7-Pin
End Base. . Small-Shell Diheptal 14-Pin (JEDEC No.B14-45)
Operating Position. . . The tube should never be operated in a vertical position with the diheptal-base end up nor in any other position where the axis of the tube with the base up makes an angle of less than 20° with the vertical.
Weight (Approx.). . . . . 1 lb 6 oz
Minimum Deflecting-Coil Inside Diameter . . . . . 2-3/8"
Deflecting-Coil Length. . . . . 5"
Focusing-Coil Length. . . . . 10"
Alignment-Coil Length . . . . 15/16"
Photocathode Distance Inside End of
  Focusing Coil . . . . 1/2"

Contents

← Indicates a change.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Lancaster, Pa.

5820-A 11-63
Printed in U.S.A.

Maximum Ratings, ***Absolute-Maximum Values:***[a]

PHOTOCATHODE:		
Voltage	-550 max.	volts
Illumination	50 max.	fc
OPERATING TEMPERATURE:		
Of any part of bulb	50 max.	°C
Of bulb at large end of tube (Target section)	35 min.	°C
TEMPERATURE DIFFERENCE:		
Between target section and any part of bulb hotter than target section	5 max.	°C
GRID-No.6 VOLTAGE	-550 max.	volts
TARGET VOLTAGE:		
Positive value	10 max.	volts
Negative value	10 max.	volts
GRID-No.5 VOLTAGE	150 max.	volts
GRID-No.4 VOLTAGE	300 max.	volts
GRID-No.3 VOLTAGE	400 max.	volts
GRID-No.2 & DYNODE-No.1 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	125 max.	volts
Positive-bias value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts
ANODE-SUPPLY VOLTAGE[b]	1350 max.	volts
VOLTAGE PER MULTIPLIER STAGE	350 max.	volts

Typical Operating Values:

Photocathode Voltage (Image Focus)	-400 to -540	volts
Grid-No.6 Voltage (Accelerator)— (Approx. 75% of photocathode voltage)	-300 to -405	volts
Target-Cutoff Voltage[c]	-3 to +1	volts
Grid-No.5 Voltage (Decelerator)	0 to 125	volts
Grid-No.4 Voltage (Beam Focus)	140 to 180	volts
Grid-No.3 Voltage[d]	225 to 330	volts
Grid-No.2 & Dynode-No.1 Voltage	300	volts
Grid-No.1 Voltage for Picture Cutoff[f]	-45 to -115	volts
Dynode-No.2 Voltage	600	volts
Dynode-No.3 Voltage	800	volts
Dynode-No.4 Voltage	1000	volts
Dynode-No.5 Voltage	1200	volts
Anode Voltage	1250	volts
Minimum Peak-to-Peak Blanking Voltage	5	volts
Field Strength at Center of Focusing Coil[e]	75	gausses
Field Strenth of Alignment Coil	0 to 3	gausses

Performance Data:[f]

With conditions shown under Typical Operating Values and with camera lens set to bring the picture highlights one stop above the "knee" of the light transfer characteristic

	Min.	Average	Max.	
Cathode Radiant Sensitivity at 4500 angstroms	-	0.030	-	amp/watt
Luminous Sensitivity	30	60	-	μa/lumen
Anode Current (DC)	-	30	-	μa
Signal-Output Current (Peak to Peak)	3	8	24	μa
Ratio of Peak-to-Peak Highlight Video-Signal Current to RMS Noise Current for Bandwidth of 4.5 Mc.	35:1	40:1	-	
Photocathode Illumination at 2870° K Required to bring Picture Highlights One Stop above "Knee" of Light Transfer Characteristic	-	0.02	0.04	fc
Peak-to-Peak Response to Square-Wave Test Pattern of 400 TV Lines per Picture Height (Per cent of large-area black to large-area white)[g]	35	60	-	%
Uniformity:				
Ratio of Shading (Background) Signal to Highlight Signal	-	0.12	0.15	
Variation of Highlight Signal (Per cent of maximum highlight signal)[h]	-	20	25	%

→ Indicates a change.

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

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

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

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

b Dynode voltage values are shown under *Typical Operating Values*.

c Normal setting of target voltage is +2 volts from target cutoff. The target supply voltage should be adjustable from -3 to +5 volts.

d Adjust to give the most uniformly shaded picture near maximum signal.

e Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with indicator located outside of and at the image end of the focusing coil.

f With 5820-A operated in properly adjusted RCA TK-31 camera.

g Measured with amplifier having flat frequency response.

h Variation of response over scanned area.

INTERCHANGEABILITY

The 5820-A is directly interchangeable with the 5820 in all existing cameras. The information shown on the following pages under *Set-Up Procedure*, *Operating Considerations*, *Camera-Design Considerations*, and *Principles of Operation* is identical with that recommended for the 5820.

SET-UP PROCEDURE

The *set-up procedure* for operating the 5820-A is as follows: After the tube has been inserted in its sockets and the voltages applied as indicated under *Typical Operation*, allow it to warm up for 1/4 to 1/2 hour with the camera lens capped. Uncap the lens momentarily while adjusting the grid-No. 1 voltage to give a small amount of beam current. This procedure will prevent the mesh from being electrostatically pulled into contact with the glass disc. Make certain that the deflection circuits are functioning properly to cause the electron beam to scan the target.

Adjust the deflection circuits so that the beam will "overscan" the target, i.e., so that the area of the target scanned is greater than its sensitive area. This procedure during the warming-up period is recommended to prevent burning on the target a raster smaller than that used for on-the-air operation. Note that overscanning the target results in a smaller-than-normal picture on the monitor.

With the lens still capped and the target voltage set at approximately 2 volts negative, adjust the grid-No.1 voltage until noise or a rough-textured picture of dynode No.1 appears on the monitor. Then adjust the alignment-coil current so that the small white dynode spot does not move when the beam-focus control (grid No.4) is varied, but simply goes in and out of focus. During alignment of the beam, and also during operation of the tube, always keep the beam current as low as possible to give the best picture quality and to prevent excessive noise.

Next, uncap the lens and open the lens iris partially. Focus the camera on a test pattern. The target voltage is then advanced until a reproduction of the test pattern is just discernible on the monitor. This value of target voltage is known as the "target cutoff voltage". The target voltage should then be raised exactly 2 volts above the cutoff-voltage value, and the beam-current control adjusted to give just sufficient beam current to discharge the highlights.

Then adjust the lens to produce best optical focus, and the voltage on the photocathode as well as the voltage on grid No.4 to produce the sharpest picture.

At this point, attention should be given to the grid-No.5 and grid-No.3 voltage controls. Grid No.5 is used to control the landing of the beam on the target and consequently the uniformity of signal output. The grid-No.5 voltage control should be adjusted to produce a picture that has most uniform shading from center to edge with the lens iris opened sufficiently to permit operation with the highlights above the knee of the light transfer characteristic. The value of grid-No.5 voltage should be as high as possible consistent with uniform shading. Grid No.3 facilitates a more complete collection by dynode No.2 of the secondaries from dynode No.1. The grid-No.3 voltage control should be adjusted to produce the maximum signal output.

Now with a test pattern consisting of a straight line centered on the face of the 5820-A adjust the voltage on grid-No.6 along with the voltage on the photocathode to produce a sharply focused straight line on the monitor. Improper adjustment of the grid-No.6 voltage control will result in the straight-line pattern being reproduced with a slight S-shape.

The above adjustments constitute a rough set-up of the 5820-A. Final adjustments necessary for the 5820-A to produce the best possible picture are as follows: With the lens capped, realign the beam. Beam alignment is necessary after each change of the grid-No.5 voltage control and sometimes after each adjustment of the grid-No.3 voltage control.

The proper illumination level for camera operation should next be determined. Adjust the target voltage accurately to 2 volts above the target-cutoff value. Remove the lens cap and focus the camera on a test pattern. Open the lens iris just to the point where the highlights of the test pattern do not rise as fast as the low-lights when viewed on a video waveform oscilloscope.

Next, cap the lens and adjust the grid-No.3 voltage control so that the video signal when viewed on a video waveform oscilloscope has the flattest possible trace consistent with high signal output. This represents the black level of the picture.

The lens iris setting should then be noted, and the lens stop opened not more than one position beyond this point, unless extreme scene-contrast ranges necessitate opening the lens stop beyond this point.

The use of a higher value of target voltage than that recommended will shorten the life of the 5820-A. The target-voltage control should not be used as an operating control to match pictures from two different cameras. Matching of cameras should be accomplished by control of the lens iris openings.

Retention of a scene by the 5820-A sometimes called a "sticking picture", may be experienced if the 5820-A is allowed to remain focused on a stationary bright scene, or if it is focused on a bright scene before reaching operating temperature in the range from 35° to 45° C. Often the retained image will disappear in a few seconds, but sometimes it may persist for long periods before it completely disappears. A very persistent image can generally be removed by focusing the 5820-A on a clear white screen and allowing it to operate for a period of time with an illumination of about 1 footcandle on the photocathode.

To avoid retention of a scene, it is recommended that the 5820-A always be allowed to warm up in the camera for 1/4 to 1/2 hour with the lens iris closed and with a slight amount of beam current. Never allow the 5820-A to remain focused on a stationary bright scene, and never use more illumination than is necessary.

OPERATING CONSIDERATIONS

New 5820-A's should be placed in service immediately upon receipt. They should be operated for several hours before being set aside as spares.

Spare 5820-A's should be placed in service for several hours at least once a month in order to keep them free from traces of gas which may be liberated within the tube during prolonged storage.

Occasionally, a *white spot* which does not change in size when the beam-focus voltage is varied, may be observed in the center of the picture. Such a spot, especially if it is visible on the monitor with the camera lens capped, is probably an ion spot. If the spot begins to grow in size with continuous operation, the 5820-A should be removed from service at once, and returned for re-processing. Continued operation of an image orthicon with an ion spot will eventually damage the target permanently.

The *spectral response* of the 5820-A is shown in Fig.1.

The *operating temperature* of any part of the glass bulb should never exceed 50° C, and no part of the bulb at the large end of the tube (target section) should ever fall below 35° C during operation. The temperature of the target is essentially the same as that of the adjacent glass bulb and can, therefore, be determined by measuring the temperature of the glass bulb adjacent to the target. For best results, it is recommended that the temperature of the entire bulb be held between 35° and 45° C. Operation of too low a temperature will be characterized by the appearance of a rapidly disappearing "sticking picture" of opposite polarity from the original when the picture is moved. Operation at too high a temperature will cause loss of resolution and possibly permanent damage to the tube. Resolution is regained by waiting for the temperature to drop below 45° C. *No part of the bulb should run more than 5° C hotter than the target section to prevent cesium migration to the target.* Such migration will result in loss of resolution and in probable permanent damage to the tube. Like other photosensitive devices employing cesium, the 5820-A may show fluctuations in performance from time to time. Strict observance of the above recommendations with respect to operating temperature will not completely eliminate these variations but will greatly improve the stability of the characteristics during the life of the tube.

Full-size scanning of the target should always be used during on-the-air operation. Full-size scanning can be assured by first adjusting the deflection circuits to overscan the target sufficiently to cause the corners of the target to be visible in the picture, and then reducing the scanning until the corners just disappear. In this way, the maximum signal-to-noise ratio and maximum resolution can be obtained. Note that overscanning the target produces a smaller-than-normal picture on the monitor.

Underscanning the target, i.e., scanning an area of the target less than its sensitive area, should never be permitted. Underscanning produces a larger-than-normal picture on the monitor. If the target is underscanned for any length of time, a permanent change in target cutoff voltage of the underscanned area takes place with the result that the underscanned area thenceforth is visible in the picture when full-size scanning is restored.

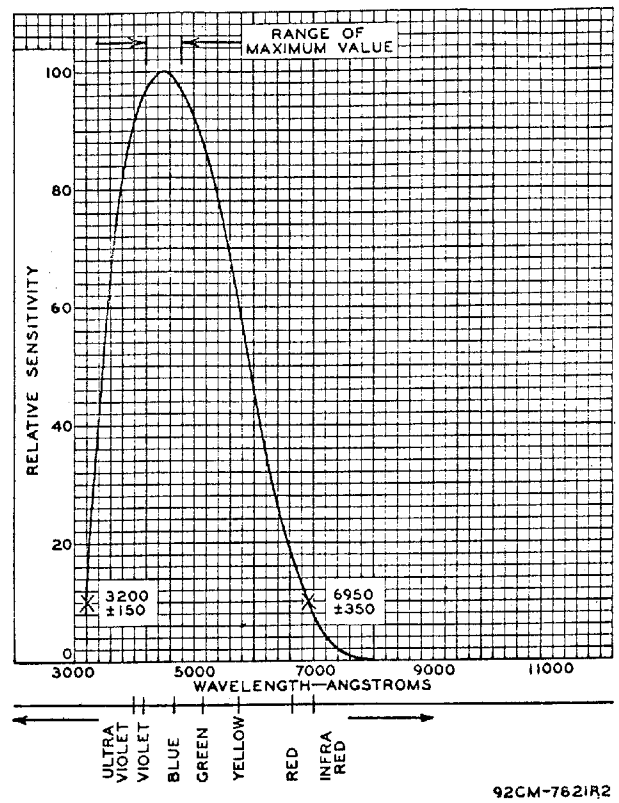


Fig. 1 - Spectral Sensitivity Characteristic of Type 5820-A which has S-10 Response. Curve is shown for Equal Values of Radiant Flux at All Wavelengths.

To utilize the *resolution capability* of the 5820-A in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a bandwidth of at least 6 megacycles.

Even with a wide-band amplifier, the resolution may be limited in the image section by "cross talk" caused by the scanning fields. Unless prevented by proper shielding from extending into the image section (see *Proper Shielding* under *Camera-Design Considerations*), these fields will cause the electron image on the target to move at scanning frequency. As a result, the picture will lack definition.

The *dynode aperture* appears as a small white spot near the center of the image of the dynode surface. The white spot is most evident when it falls within dark areas of the scene. Little defocusing of the beam is required to minimize the effect of dynode aperture when the scene is brightly illuminated, but in dark scenes, the effect of dynode aperture is a limiting item on resolution.

Dynamic focusing may be employed to give more uniform focus from center to edge of picture, and to eliminate dynode pattern or texture in low-light portions of a scene. Dynamic focusing is accomplished by applying to the beam-focus electrode (grid No.4) a voltage with parabolic waveform consisting of mixed horizontal and vertical scanning frequencies. The peaks of the parabolic waveform should be negative and coincident with those of the blanking signal. The dynamic-focusing voltage should have a peak-to-peak value of about 5 volts.

The *light transfer characteristics* of the 5820-A change for different illumination levels (see Reference 2). The basic light transfer characteristic of the 5820-A is shown in Fig.2. This curve is representative only for small-area highlights. For larger-area highlights, the bend or "knee" is not quite as abrupt as shown in Fig.2.

Sensitivity and Illumination: The image orthicon is an ultra-sensitive device exceeding in relative sensitivity most high-speed photographic film. When related to photographic film and compared at shutter speeds of 1/60 second which is the field rate of the television system, the 5820-A with proper illumination will have an equivalent ASA exposure index of 8000. This equivalent film-speed rating can be used in conjunction with a photographic exposure meter to determine the approximate light level or lens-stop setting necessary for operating the 5820-A.

The illumination on the photocathode of the 5820-A in relation to the scene illumination, can be determined by the following relationship:

$$I_s = \frac{4f^2\ I_{pc}\ (m + 1)^2}{TR}$$

where

I_s = scene illumination in footcandles
f = f-number of lens
I_{pc} = photocathode illumination in footcandles
m = linear magnification from scene to target
T = total transmission of lens
R = reflectance of principal subject in scene

Except for very close shots, the linear magnification (m) from scene to target may be neglected.

For example, assume that the lens is f:11 having a transmission (T) of 80%, that the photocathode illumination is 0.020 footcandle, and that the scene to be televised has a highlight reflectance (R) of 75%.
Then,

$$I_s = \frac{4 \times 11^2 \times 0.020}{0.8 \times 0.75} = 16 \text{ footcandles}$$

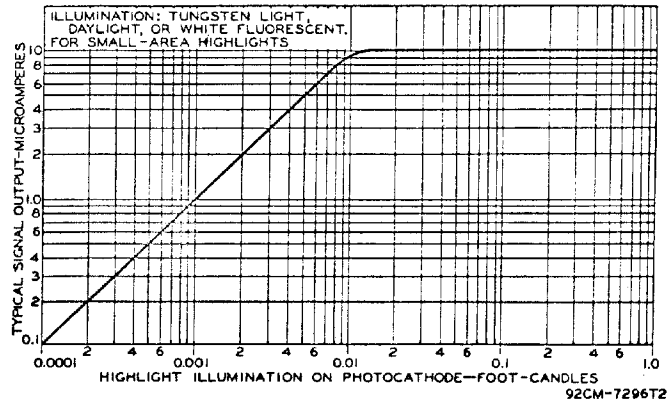


Fig.2 - Basic Light Transfer Characteristic of Type 5820-A.

The exact illumination for each 5820-A as finally set up on the scene should be determined by observing the video waveform on an oscilloscope. First adjust the lens setting of each camera to that level of light necessary to reach the knee of the light transfer characteristic. The camera lens is then normally set to bring picture highlights one stop above the knee of the transfer characteristic.

For very high illumination or for individual tubes with exceptionally high photocathode sensitivity, it may not be possible to stop the lens down far enough to reduce the highlight illumination on the photocathode to a value near the knee of the transfer characteristic. When such a condition is encountered, the use of a Wratten neutral filter selected to give the required reduction in illumination is recommended. Ordinarily, two filters—one having 10% transmission and the other 20%—will give sufficient choice. Such filters with lens-adapter rings can be obtained at photographic-supply stores.

The low illumination level needed on the photocathode of the 5820-A makes it necessary that no stray light from without or within the camera falls on the face of the tube.

CAMERA-DESIGN CONSIDERATIONS

The 5820-A has two complementary guides for inserting the tube correctly in the annular socket, i.e., the large pin (No.7) on the annular base, and the white radial line on the face of the bulb. The annular socket should be positioned so that the key pin (No.7) of the annular base is in a vertical plane through the common axis of the deflecting-coil assembly and the focusing coil assembly, and is at the bottom of the pin circle of the annular base.

The 5820-A is installed by inserting the diheptal-base end of the tube through the coil assembly and then turning the tube until the annular-base pins, keyed by pin No.7, can be inserted in the annular socket. Proper insertion aligns the white radial line on the face with center of the key-pin hole in the annular socket. The diheptal socket is then put on the 14-pin base.

A *mask* having a diagonal or diameter of 1.8 inches should always be used on the photocathode to set limits for the maximum size of scan, and to reduce the amount of light reaching unused parts of the photocathode.

The *optical system* used with the 5820-A should be designed according to basic optical principles and should incorporate an iris to control the amount of light entering the television camera lens. The entire optical system should have all inside surfaces finished in mat black to prevent internal reflections from reaching the photocathode. Under almost all conditions, the use of a lens shade is beneficial.

Proper shielding of the image section can be provided by wrapping around the outside of the focusing coil directly over the center of the deflecting coils a triple layer of Mumetal strip 0.006" thick and 5" wide, or equivalent. Then, wrap another triple layer of Mumetal strip 0.006" thick and 3" wide around the focusing coil directly over the image section of the 5820-A. Additional shielding is provided by fitting the inside of the focusing coil directly over the image section with a copper cylinder having a length of approximately 2-1/4" and a wall thickness of 1/32". The Mumetal shielding effectively shunts the field-rate deflection field, while the copper cylinder shields the higher frequency line-scanning field from the electron path in the image section. Unless proper shielding is provided, "cross talk" from the deflecting yoke into the image section will result in loss of picture sharpness.

A *blanking signal* should be supplied to the target to prevent the electron beam from striking the target during the return portions of the horizontal and vertical deflecting cycles. Unless this is done, the camera-tube return lines will appear in the received picture.

The blanking signal is a series of negative voltage pulses. The voltage between pulses must be constant to prevent fluctuation of the target voltage. During the blanking periods, the full beam current without video-signal modulation is returned to the multiplier and its multiplied output flows through the load resistance. Excessive amounts of blanking voltage applied to the target will impair resolution, since during retrace the target is out of focus to the continuously flowing photocathode current. A desirable amount of target blanking is 6 volts peak to peak.

Shading may be required even with optimum adjustment of voltage on grid No.3 in order to obtain a uniformly shaded picture. Sawtooth and parabolic waveforms of adjustable amplitude and polarity at both the vertical- and horizontal-scanning frequency should be provided for insertion in the video amplifier to aid in obtaining a flat background. The shading signal should be introduced in the amplifier after clamping is performed, since clamping circuits will remove the vertical-frequency shading component if added previous to the clamp-circuit location.

Failure of scanning even for a few minutes when light is incident on the photocathode may permanently damage the surface of the target. The damaged area shows up as a spot or line in the picture during subsequent operation.

To avoid damaging the 5820-A during scanning failure, provision should be made to prevent automatically the scanning beam from reaching the target. The scanning beam can be prevented from reaching the target by (1) cutting off the scanning beam, or (2) making the target sufficiently negative. The scanning beam can be cut off by a relay which applies -115 to -125 volts bias to grid No.1. The target can be made sufficiently negative by a relay which applies a bias of -10 volts to it. Either relay is actuated by a tube which is controlled by a portion of the scanning pulse voltage developed across either the horizontal or the vertical deflecting coils, or both. It is important to insure that in the event of failure of either the horizontal scanning pulse or the vertical scanning pulse, the circuitry should be capable of actuating the protection relay.

PRINCIPLES OF OPERATION

The 5820-A has three sections—an image section, a scanning section, and a multiplier section.

Image Section

The image section contains a semitransparent photocathode on the inside of the faceplate, a grid to provide an electrostatic accelerating field, and a target which consists of a thin glass disc with a fine mesh screen very closely spaced to it on the photocathode side. Focusing is accomplished by means of a magnetic field produced by an external coil, and by varying the photocathode voltage.

Light from the scene being televised is picked up by an optical lens system and focused on the photocathode which emits electrons from each illuminated area in proportion to the intensity of the light striking the area. The streams of electrons are focused on the target by the magnetic and accelerating fields.

On striking the target, the electrons cause secondary electrons to be emitted by the glass. The secondaries thus emitted are collected by the adjacent mesh screen which is held at a definite potential of about 2 volts with respect to target-voltage cutoff. Therefore, the potential of the glass disc is limited for all values of light and stable operation is achieved. Emission of the secondaries leaves on the photocathode side of the glass a pattern of positive charges which corresponds with the pattern of light from the scene being televised. Because of the thinness of the glass, the charges set up a similar potential pattern on the opposite or scanned side of the glass.

Scanning Section

The opposite side of the glass is scanned by a low-velocity electron beam produced by the electron gun in the scanning section. This gun contains a thermionic cathode, a control grid (grid No.1), and an accelerating grid (grid No.2). The beam is focused at the target by the magnetic field of an external focusing coil and the electrostatic field of grid No.4.

Grid No.5 serves to adjust the shape of the decelerating field between grid No.4 and the target in order to obtain uniform landing of electrons over the entire target area. The electrons stop their forward motion at the surface of the glass and are turned back and focused into a five-stage signal multiplier, except when they approach the positively charged portions of the pattern on the glass. When this condition occurs, they are deposited from the scanning beam in quantities sufficient to neutralize the potential pattern on the glass. Such deposition leaves the glass with a negative charge on the scanned side and a positive charge on the photocathode side. These charges will neutralize each other by conductivity through the glass in less than the time of one frame.

Alignment of the beam from the gun is accomplished by a transverse magnetic field produced by an external coil located at the gun end of the focusing coil.

Deflection of the beam is accomplished by transverse magnetic fields produced by external deflecting coils.

The electrons turned back at the target form the return beam which has been amplitude modulated by absorption of electrons at the target in accord with the charge pattern whose more positive areas correspond to the highlights of the televised scene.

Multiplier Section

The return beam is directed to the first dynode of a five-stage electrostatically focused multiplier. This utilizes the phenomenon of secondary emission to amplify the modulated beam current more than 500 times. The electrons in the beam impinging on the first-dynode surface produce many other electrons. These secondary electrons are then directed to the second dynode and knock out more new electrons. Grid No.3 facilitates a more complete collection by dynode No.2 of the secondaries from dynode No.1. The multiplying process is repeated in each successive stage, with an ever-increasing stream of electrons until those emitted from dynode No.5 are collected by the anode and constitute the current utilized in the output circuit.

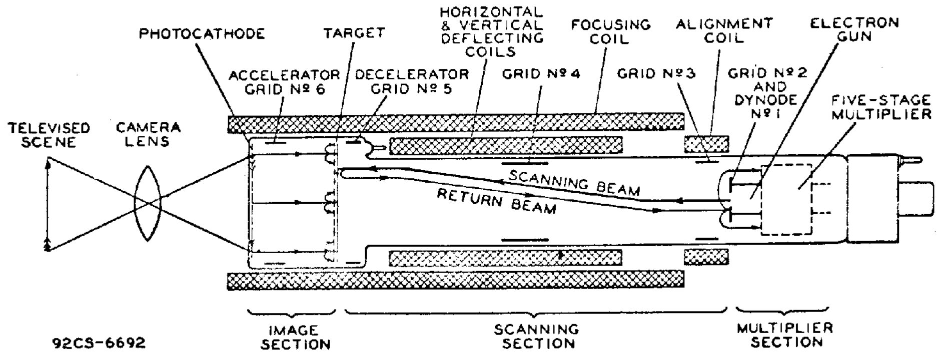


Fig.3 - Schematic Arrangement of Type 5820-A.

The signal-to-noise ratio of the output signal from the 5820-A is high. The gain of the multiplier is such as to raise the output signal sufficiently above the noise level of the video-amplifier stages so that they contribute no noise to the final video signal. The signal-to-noise ratio of the video signal, therefore, is determined only by the random variations of the modulated electron beam.

DOS and DON'TS
on Use of RCA-5820-A

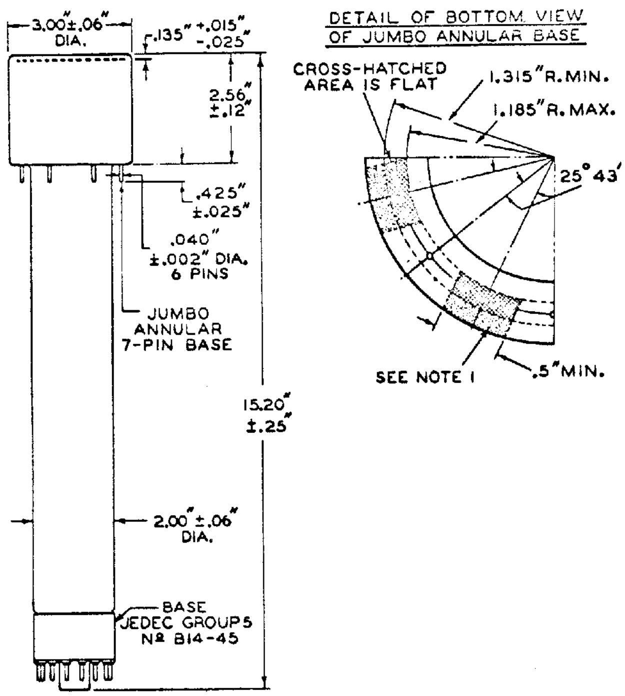
Here are the "dos"—

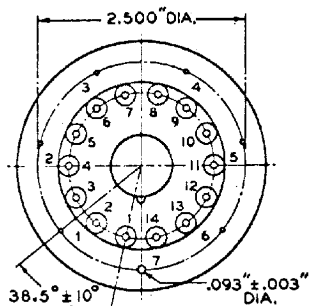
1. Allow the 5820-A to warm up prior to operation.
2. Hold temperature of the 5820-A within operating range.
3. Make sure alignment coil is properly adjusted.
4. Adjust beam-focus control for best usable resolution.
5. Condition spare 5820-A's by operating several hours once each month.
6. Determine proper operating point with target voltage adjusted to exactly 2 volts above target cutoff.
7. Keep beam current as low as possible for best picture quality and to prevent excessive noise.
8. Cap lens during standby operation.

Here are the "don'ts"—

1. Don't force the 5820-A into its shoulder socket.
2. Don't operate the 5820-A without scanning.
3. Don't underscan target.
4. Don't operate a 5820-A having an ion spot.
5. Don't focus the 5820-A on a stationary bright scene.
6. Don't turn off beam while voltages are applied to photocathode, grid-No.6, target, dynodes, and anode during warmup or standby operation.

DIMENSIONAL OUTLINE





ENLARGED BOTTOM VIEW

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAUGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAUGE WITH:

a. SIX HOLES HAVING DIAMETER OF 0.065" ± 0.001" AND ONE HOLE HAVING DIAMETER OF 0.150" ± 0.001". ALL HOLES HAVE DEPTH OF 0.265" ± 0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51°26' ± 5' ON CIRCLE DIAMETER OF 2.500" ± 0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187" ± 0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

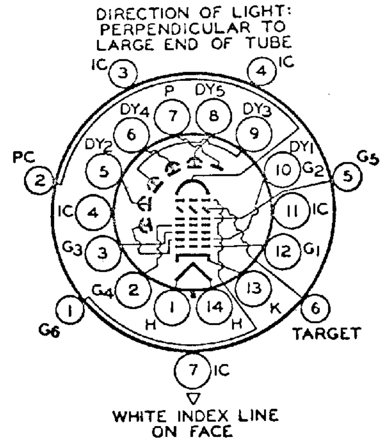
c. RIM EXTENDING OUT A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126" ± 0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200" ± 0.001".

92CM-8293R3

BASING DIAGRAM

Bottom View



SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO.4
PIN 3: GRID NO.3
PIN 4: INTERNAL CONNECTION—DO NOT USE
PIN 5: DYNODE NO.2
PIN 6: DYNODE NO.4
PIN 7: ANODE
PIN 8: DYNODE NO.5
PIN 9: DYNODE NO.3
PIN 10: DYNODE NO.1 GRID NO.2
PIN 11: INTERNAL CONNECTION—DO NOT USE
PIN 12: GRID NO.1
PIN 13: CATHODE
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO.6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION—DO NOT USE
PIN 4: INTERNAL CONNECTION—DO NOT USE
PIN 5: GRID NO.5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION—DO NOT USE