RCA-6571 is a storage tube designed primarily for use in binary-digital computer systems. It is of the single-beam type, utilizes electrostatic focus and deflection, has its storage surface on the inner surface of the faceplate, and requires an external signal-output electrode shaped to conform to and placed in contact with the entire area of the faceplate. Redistribution writing and capacitance-discharge reading are employed.

Design features which make the 6571 particularly suitable for computer service include (1) a storage-surface having relatively uniform secondary emission to prevent "bad spots" on which information can not be stored, (2) a focused beam having an exceptionally small effective area including the fringe of low-density beam current and a well-defined boundary which is especially significant whenever a single storage element is addressed several times before neighboring elements are regenerated, and (3) separate external connection for the collector to serve as an effective shield to prevent cross-coupling between the electron gun and the external signal-output electrode.

DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector Voltage</td>
<td>40.0 volts</td>
</tr>
<tr>
<td>Grid No. 3 Voltage</td>
<td>1.0 volts</td>
</tr>
<tr>
<td>Grid No. 1 Voltage</td>
<td>1000 volts</td>
</tr>
<tr>
<td>Peak Collector Voltage</td>
<td>150 volts</td>
</tr>
<tr>
<td>Peak Grid No. 3 Voltage</td>
<td>2500 volts</td>
</tr>
<tr>
<td>Peak Grid No. 1 Voltage</td>
<td>750 volts</td>
</tr>
<tr>
<td>Peak Deflection</td>
<td>500 volts</td>
</tr>
<tr>
<td>Beam-Current Cutoff</td>
<td>250 volts</td>
</tr>
<tr>
<td>Deflection Factors</td>
<td>150 volts</td>
</tr>
<tr>
<td>Focused-Beam Position</td>
<td>150 volts</td>
</tr>
<tr>
<td>Examples of Use of Design Ranges</td>
<td></td>
</tr>
<tr>
<td>For Collector Voltage</td>
<td>1000 to 2500 volts</td>
</tr>
<tr>
<td>For Grid No. 3 Voltage</td>
<td>1000 volts</td>
</tr>
<tr>
<td>For Grid No. 1 Voltage</td>
<td>2500 volts</td>
</tr>
<tr>
<td>For Deflection</td>
<td>2500 volts</td>
</tr>
<tr>
<td>For Focused-Beam Position</td>
<td>2500 volts</td>
</tr>
<tr>
<td>For Examples of Use of Design Ranges</td>
<td></td>
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</tbody>
</table>

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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TMA @,Marca Registrada

6571-2-55
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Examples of Use of Design Ranges (Cont'd):

For voltage of 2500 volts:

Deflection Factors:
- $D_1$ and $D_2$ ... 39 to 53 
- $D_3$ and $D_4$ ... 35.5 to 48.5

Storage Characteristics for Tube Voltage of 2500 Volts:

Storage-Surface Boundary (in terms of deflection voltage):
- In the $D_1-D_2$ direction from position of undeflected focused beam ... $\pm 109$ volts
- In the $D_3-D_4$ direction from position of undeflected focused beam ... +109 volts

Blemish Factors, for storage surface within indicated boundary ... 0.5 max.

Spill (determined for Double-Dot Pattern):

** Under conditions involving 255 references to "spill" element and 1 reference to "test" element

Separation Between Storage Elements, in either the $D_1-D_2$ or $D_3-D_4$ direction in terms of deflection voltage:
- At center of storage surface ... 8 max. volts
- At midpoint on each side of storage surface boundary ... 10 max. volts

Maximum Circuit Values:

- Grid-No.4-Circuit Resistance ... 1.5 max. megohms
- Resistance in any Deflecting-Electrode Circuit ... 1.0 max. megohms

* The "ullor" in a storage 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 6571, the ullor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 6571, they are collectively referred to simply as "ullor" for convenience in presenting data and curves.

** The center of the undeflected focused beam will fall within a circle having a 15-mm radius concentric with the center of the tube face.

* Blemish factor is defined as the factor by which the normal positive signal is reduced by the blemish.

** Spill is indicative of the amount of binary data in each time that the electron beam will be directed to another part of the cathode. The storage capability is determined by the separation between two storage elements at which the signal from one element is changed by no more than a specified amount after repeated references to the other element. For the 6571, the separation is measured in terms of deflection voltage, when the amplitude of the negative signal of the "test" element has decreased to 50% of its maximum negative amplitude. The maximum negative amplitude is determined by separating the two elements far enough to eliminate the effects of secondary electron redistribution from the "spill" element.

It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING CONSIDERATIONS

Handling. The 6571 should always be handled and transported with the face up in order to prevent possible damage to the storage surface caused by any loose particles striking the storage surface and adhering to it.

The maximum ratings in the tabulated data for the 6571 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.

Support for the tube should be provided by a padded mechanism about the neck and by a cushioned ring or saddle arrangement near the large end of the tube. The tube should not be supported by the socket nor by a clamping arrangement on the base.

Shielding. In typical applications, the 6571 is mounted in a compartment having effective magnetic and electrostatic shielding. It is recommended that the bulb be provided with a tight-fitting electrostatic shield extending from the base to the collector coating (see Dimensional Outline). This external shield supplements the shielding action of the collector in preventing cross-coupling between the electron gun and the external signal electrode.

The heater is designed to be operated at 6.3 volts. The transformer winding supplying the heater power should be designed to operate the heater at the rated voltage under average line-voltage conditions. If the circuit design is such as to cause a high voltage between heater winding and ground, the heater transformer should be adequately insulated to withstand the high voltage.

Although maximum values of peak heater-cathode voltage are specified in the tabulated data, it is recommended that the mid-tap or one side of the heater winding be connected directly to the cathode to minimize the possibility of damage to the tube produced by arcing between heater and cathode when a possible momentary internal arc causes the voltage between heater and cathode to exceed the maximum heater-cathode ratings. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data.

Grid No.2, connected within the tube to grid No.4 and operated at grid-No.4 potential, is incorporated in the electron-gun design so that the beam current and grid-No.1 cutoff voltage will not be affected by focusing adjustment. Because of the effect of grid No.2, and the negligible current taken by grid No.3, the beam can be sharply focused on the storage surface and remains sharp when beam current is varied over a wide range.

Grid No.3, the focusing electrode, is so designed that it takes negligible current. This feature makes possible the use of a low-current voltage-divider system. Focusing of the beam is controlled by adjustment of the ratio of grid-No.3 voltage to grid-No.4 voltage. Ordinarily, the ratio is adjusted by variation of grid-No.3 voltage. For this purpose, a potentiometer adequately insulated is required in the voltage-divider circuit; the necessary range of adjustment is indicated under Equipment Design Ranges.
The collector connection should be made by a flexible lead to the recessed small cavity cap on the side of the bulb. The separate connection to the collector permits operation of the collector at a voltage slightly different from that of the ultor and enables the collector to serve as an effective shield to prevent cross-coupling between the electron gun and the external signal electrode. Normally, the collector is connected to the common ground of the system.

Two pairs of electrostatic deflecting electrodes, producing fields approximately at right-angles to each other, are located within the bulb neck to provide for deflection of the electron beam in the directions of the respective fields.

Each pair of deflecting electrodes is normally operated at an average potential the same as that of grid No. 4. The grid-No.4 voltage may be adjusted with respect to the average deflecting-electrode potential to provide control of astigmatism. Each electrode of each pair should be connected through a resistor of not more than 1 megohm to the grid-No.4 socket terminal.

A signal-output electrode shaped to conform with the external contour of the faceplate and placed in contact with the entire area of the faceplate, is required. The signal-output electrode is connected to a low-noise, video amplifier having sufficient gain to amplify signals from a fraction of a millivolt to the desired level.

The dc voltages for grid No.1, grid No.3, and ultor should be obtained from an extremely well-regulated power supply essentially free of ripple.

In most applications, it is recommended that the ultor (grid No.2 and No.4) be grounded in order that the deflecting electrodes may be operated at essentially ground potential. With this method, the cathode and heater are at high negative potential with respect to ground.

The high voltages at which this tube is 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. Safety 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 desired. In most applications, it is recommended that the ultor terminal be grounded rather than the cathode terminal. With this method, which places the heater and cathode at high negative potential with respect to ground, the dangerous voltages can more easily be made inaccessible.

In the use of high-voltage tubes, it should always be remembered that high voltages may appear at normally low-potential points in the circuit as a result of capacitor breakdown or 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 grounded.

The undeflected focused beam is normally close to the geometric center of the tube face. However, to compensate for variation from tube to tube, designers should provide an adjustable and reversible supply of at least 12 volts dc per kilovolt of ultor voltage (balanced to ultor) for application between the two deflecting electrodes of each pair. By adjustment of this dc voltage on each pair of the deflecting electrodes, the beam may be centered.

The amount of information that can be stored by the 6571 is dependent on the manner in which it is operated, and is affected by the stability of the deflecting system, freedom from noise in the associated output circuit, the number of regenerations compared with the number of ad-
addresses, and the effectiveness of the electrostatic and magnetic shielding.

In general, the number of storage elements is proportional to the operating voltage. For the greatest number of storage elements, the 6571 should be operated at the rated maximum voltage and so that the peak grid-No.1 drive is less than that required for the maximum positive amplitude but high enough to provide a satisfactory output signal.

It is recommended that the beam current be limited to the minimum value which provides satisfactory signal amplitude. As shown by the curve in Fig.1, an increase in beam current or grid-No.1 drive beyond the peak of the curve (i.e., saturation of the positive signal) does not increase the amplitude of the positive signal.

The storage characteristics in the tabulated data and the curve in Fig.1 are based on the use of a double-dot pattern. In this method of storage, the positive signal is produced by adjusting the beam current and the distance between two dot storage elements so that the optimum positive signal is produced when the "test" element is addressed. Other methods of storage such as superimposed focused and defocused spots or dots and dashes may be used equally well with the 6571.

REFERENCES


SOCKET CONNECTIONS

Bottom View

PIN 1: HEATER
PIN 2: GRID NO.1
PIN 3: CATHODE
PIN 4: GRID NO.2
PIN 5: DEFLECTING ELECTRODE DJ1
PIN 6: DEFLECTING ELECTRODE DJ2
PIN 8: ULTR (GRIDS NO.2 & NO.4)
PIN 9: DEFLECTING ELECTRODE DJ3
PIN 10: DEFLECTING ELECTRODE DJ4
PIN 12: HEATER CATHODE (CL)
SS: STORAGE SURFACE TO WHICH EXTERNAL SIGNAL-OUTPUT ELECTRODE IS CAPACITIVELY COUPLED (SEE DATA)

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