

# BEAM SWITCHING TUBE



engineering data report

## 6703

### Magnetron Beam Switching Tube (BD-301) HIGH VACUUM, TEN OUTPUT

#### ELECTRICAL

|                   |                              |
|-------------------|------------------------------|
| Heater, Voltage   | 6.3 $\pm$ 10% V              |
| Current at 6.30 V | AC or DC<br>0.3 A. $\pm$ 10% |

#### MECHANICAL, See Figure 1

|                                        |                    |
|----------------------------------------|--------------------|
| Overall length (Including Cap)         | 3.155 +.335, -.000 |
| Seated height (Including Cap)          | 3.074 $\pm$ .159"  |
| Diameter                               | 2.250 +.010, -.000 |
| Shield length, with protective cap     | 2.672 max.         |
| Shield length, without protective caps | 2.562 $\pm$ .010   |
| Envelope connections                   | see figure 2       |
| Socket, 26 pin (SK-100)                | see figure 3       |
| Weight, total                          | 16 oz. max.        |
| Mounting Position                      | Any (see note 7)   |

#### INTERELECTRODE CAPACITANCES (typical)

|                                                            |        |
|------------------------------------------------------------|--------|
| Any spade to all other elements<br>(including heater)      | 4 uuf  |
| Any target to all other elements<br>(including heater)     | 4 uuf  |
| Odd grids (5) to all other elements<br>(including heater)  | 10 uuf |
| Even grids (5) to all other elements<br>(including heater) | 10 uuf |
| Cathode to all other elements<br>(including heater)        | 6 uuf  |

#### MAXIMUM RATINGS

|                               |                                         |
|-------------------------------|-----------------------------------------|
| Target voltage                | 300 V                                   |
| Spade voltage                 | 200 V                                   |
| Grid voltage                  | 200 V                                   |
| Heater-cathode voltage        | $\pm$ 90 V                              |
| Individual target dissipation | 1 watt                                  |
| Switching Speed               | From static to<br>above 2 Mc.<br>Note 6 |

#### TEST CONDITIONS AND SPECIFICATIONS See Note 1, 2

|                                             |                                  |
|---------------------------------------------|----------------------------------|
| Target voltage ( $E_{TT}$ )                 | Spade voltage                    |
| Target, individual output current ( $I_T$ ) | 6.5 $\pm$ 1.0 ma.<br>see note 5  |
| Target, Load Resistor ( $R_T$ )             | 3.3K ohms                        |
| Cathode current ( $I_K$ )                   | 7.5 nom.                         |
| Spade voltage ( $E_{SS}$ )                  | 100 $\pm$ 15V<br>d.c. see note 2 |
| Spade current ( $I_S$ )                     | 1.0 ma. Nom.                     |
| Spade load resistor ( $R_S$ )               | 100 K ohms                       |
| Grid voltage ( $E_{CC}$ )                   | +25 V d.c.<br>see Note 3         |
| Grid input pulse amplitude ( $E_i$ )        | -50 V see Note 3, 6              |
| Cut-off voltage (all spades common)         | +200 V see Note 4                |

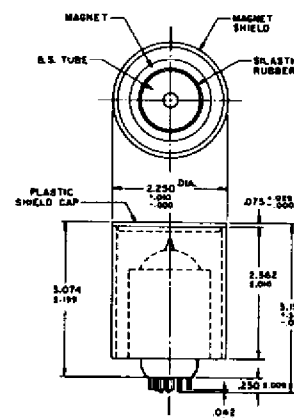


Figure 1  
Outline Drawing

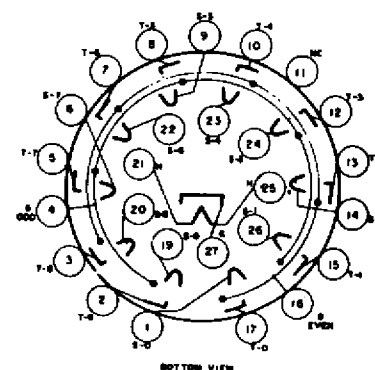


Figure 2  
Envelope Connection Diagram

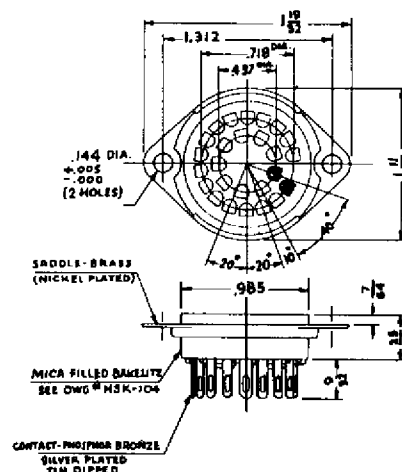


Figure 3  
Contact Socket Assembly  
(Burroughs Part SK-100)

BEAM SWITCHING TUBE  
TYPE 6703 (BD 301)

## NOTES

1. The tube is tested at 10 KC but will operate in excess of two megacycles under optimum operating conditions.
2. Under the specified test conditions in the test circuit, Figure 6, the tube will be clear and no output current will be produced, when all of the spades are at the spade source potential. As long as the spade source potential does not exceed the Firing voltage (Note 4), a beam will not form spontaneously. Output current may be produced by forming a beam in the tube by lowering the potential of one spade to cathode potential. Once formed, the beam will not clear as long as the spade source voltage exceeds the specified minimum. With the potential of the switching grids at the specified minimum, the beam will not switch if the spade source voltage does not exceed the specified maximum.
3. Under the specified conditions, the beam will not switch if the potential of the switching grid at the position where the beam is formed exceeds the specified grid bias voltage.
4. Firing Voltage (DC Cut-Off Voltage): That voltage between cathode and spade bus above which spontaneous electron beam formation can occur. See Bulletin BX-535, page 5, for detailed explanation.
5. The tube is a constant current device having pentode type output characteristics. For a fixed value of spade voltage, output current at a given output is constant over a wide range of target voltage; however, because of normal manufacturing tolerances, the amount of target current can vary from target to target. With the tube operating in the test circuit, Figure 6, and with the spade and target supply voltages fixed at 100 volts, the target and cathode current measured with the beam at each of the ten targets must be within the specified limits.
6. (a) The beam is switched to the next position by applying a negative change in potential to the switching grid at the position where the beam is formed. Once the beam has switched from this position, the potential on the switching grid at this position no longer affects the beam. When the tube is operated in the test circuit as specified, the grid switching voltage specified in the minimum change in potential from the specified grid bias voltage which will always switch the beam. At switching rates above 10 KC, the drive pulses to the switching grids must increase in amplitude as the frequency increases in order to overcome capacitive effects. With switching grid pulses of appropriate amplitude, the tube will operate at switching rates exceeding 2.0 MC.
- (b) The switching grids are electrically connected inside the tube into even and odd sets. The switching voltages are alternately applied to the even grid and odd grid terminals.
7. The tubes are magnetically shielded and can be mounted side by side without significant interactions; however, magnetic shielding is not complete at the ends of the tube. The tubes should not be mounted with magnetic materials within one inch of either end. To avoid stress between the glass envelope and shield, the tube should be mounted by clamping the magnetic shield to the chassis. The tube base and socket should not be clamped firmly, but should be allowed to float freely.

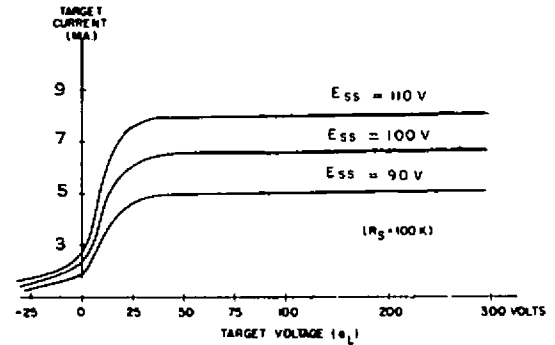


Figure 4  
Typical Outline Characteristic

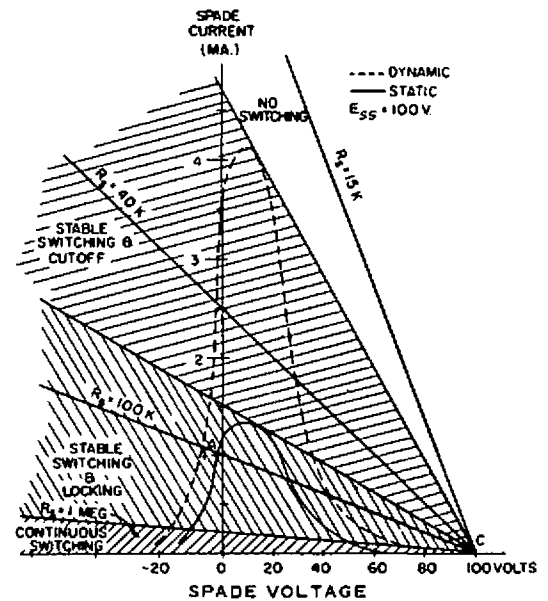


Figure 5  
Typical Beam Forming and  
Locking Spade Characteristic

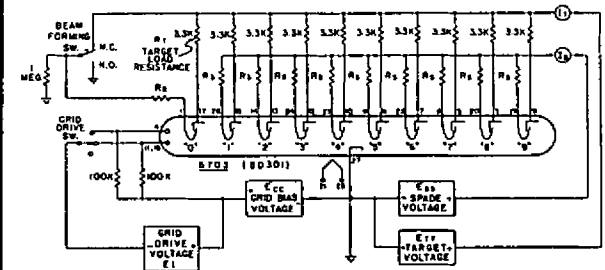


Figure 6  
Basic Circuit for 6703

# BEAM SWITCHING TUBE



## engineering data report

# 6704

### Magnetron Beam Switching Tube (MO-10R)

#### HIGH SPEED, HIGH VACUUM, TEN OUTPUT

Type 6704 differs from Type 6700 in that it has 10 internally mounted spade load vacuum resistors to permit operation at higher frequencies and with reduced number of external stem leads.

#### ELECTRICAL

|                 |                  |
|-----------------|------------------|
| Heater, Voltage | 6.3 $\pm$ 10% V  |
|                 | AC or DC         |
| Current at 6.3V | 0.3 A. $\pm$ 10% |

#### MECHANICAL, See Figure 1

|                                         |              |
|-----------------------------------------|--------------|
| Overall length (Including Dome Cap)     | 3.500" max.  |
| Seated height (Including Dome Cap)      | 3.240" max.  |
| Diameter, without protective caps       | 1.630" max.  |
| Magnet, length, without protective caps | 1.765" max.  |
| Envelope connections                    | see figure 2 |
| Socket, 20 pin (No. SK-105)             | see figure 3 |
| Weight, total                           | 7.5 ozs.     |
| Mounting Position                       | Any (Note 7) |

#### INTERELECTRODE CAPACITANCES (typical)

|                                                            |        |
|------------------------------------------------------------|--------|
| Any spade to all other elements<br>(including heater)      | 2 uuf  |
| Any target to all other elements<br>(including heater)     | 5 uuf  |
| Odd grids (5) to all other elements<br>(including heater)  | 10 uuf |
| Even grids (5) to all other elements<br>(including heater) | 10 uuf |
| Cathode to all other elements<br>(including heater)        | 6 uuf  |

#### MAXIMUM RATINGS

|                               |                                |
|-------------------------------|--------------------------------|
| Target voltage                | 300 V DC                       |
| Spade voltage                 | 200 V DC                       |
| Grid voltage                  | 200 V DC                       |
| Heater-cathode voltage        | $\pm$ 90 V DC                  |
| Individual target dissipation | 1 watt                         |
| Switching Speed               | From static to<br>above 10 Mc. |

#### TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

See Notes 1 and 2

|                                             |                                  |
|---------------------------------------------|----------------------------------|
| Target voltage ( $E_{TT}$ )                 | Spade Voltage                    |
| Target, individual output current ( $I_T$ ) | 4.7 - 6.3 MA                     |
|                                             | see note 5                       |
| Target Load Resistor ( $R_T$ )              | 3.3 K ohms                       |
| Cathode current ( $I_K$ )                   | 6.5 ma nom.                      |
| Spade voltage ( $E_{SS}$ )                  | 100 $\pm$ 10% V d.c.             |
|                                             | see note 2                       |
| Spade current ( $I_S$ )                     | 1.0 ma nom.                      |
| Spade load resistor ( $R_S$ )               | 100 K ohms mounted<br>internally |
| Grid voltage ( $E_{CC}$ )                   | +25 V DC                         |
|                                             | see note 3                       |
| Grid input pulse amplitude ( $E_i$ )        | -50 V see Note 6.                |
| Cut-off voltage (all spades common)         | +200 V see note 4                |

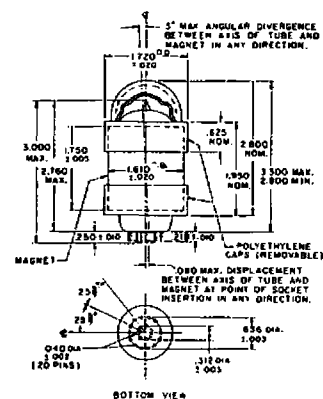


Figure 1  
Outline Drawing

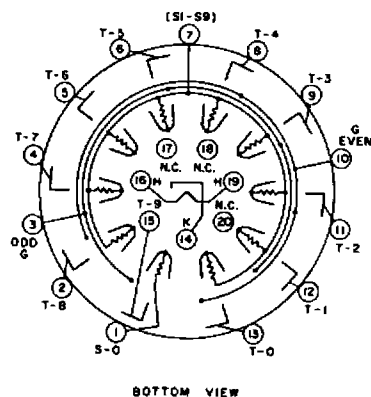


Figure 2  
Envelope Connection Diagram

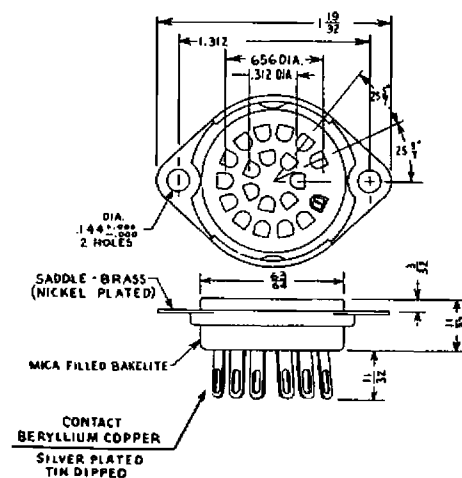


Figure 3  
Contact Socket Assembly

BEAM SWITCHING TUBE  
TYPE 6704 (MO-10R)

## NOTES

1. The tube is tested at 10 KC but will operate in excess of ten megacycles under optimum operating conditions.
2. Under the specified test conditions in the test circuit, Figure 6, the tube will be clear and no output current will be produced, when all of the spades are at the spade source potential. As long as the spade source potential does not exceed the Firing Voltage (Note 4), a beam will not form spontaneously. Output current may be produced by forming a beam in the tube by lowering the potential of one spade to cathode potential. Once formed, the beam will not clear as long as the spade source voltage exceeds the specified minimum. With the potential of the switching grids at the specified grid bias voltage, the beam will not switch if the spade source voltage does not exceed the specified maximum.
3. Under the specified conditions, the beam will not switch if the potential of the switching grid at the position where the beam is formed exceeds the specified grid voltage.
4. Firing Voltage (DC Cut-Off Voltage): That voltage between cathode and spade bus above which spontaneous electron beam formation can occur. See Bulletin BX-535, page 5, for detailed explanation.
5. The tube is a constant current device having pentode type output characteristics. For a fixed value of spade voltage, output current at a given target is constant over a wide range of target voltage; however, because of normal manufacturing tolerances, the amount of target current can vary from target to target. With the tube operating in the test circuit, Figure 6, and with the spade and target supply voltages fixed at 100 volts, the target and cathode current measured with the beam at each of the ten targets must be within the specified limits.
6. (a) The beam is switched to the next position by applying a negative change in potential to the switching grid at the position where the beam is formed. Once the beam has switched from this position, the potential on the switching grid at this position no longer affects the beam. When the tube is operated in the test circuit as specified, the grid input pulse amplitude specified is the minimum change in potential from the specified grid voltage which will always switch the beam. The drive pulses to the switching grids must increase in amplitude as the frequency increases in order to overcome capacitive effects. With switching grid pulses of appropriate amplitude, the tube will operate at switching rates exceeding 10.0 MC.
- (b) The switching grids are electrically connected inside the tube into even and odd sets. The switching voltages are alternately applied to the even grid and odd grid terminals.
7. In order to prevent changes in the electrical characteristics of this tube, do not strike the magnet and do not place the tube in close proximity (less than 2.0 inches) to ferro-magnetic materials or within strong magnetic fields. Do not operate tubes with spacing between tubes of less than 4.0 inches center to center. To secure tubes in equipment, mount them by clamping magnet to chassis. Allow socket to float so that magnetic alignment between the tube envelope and the magnet is not disturbed.

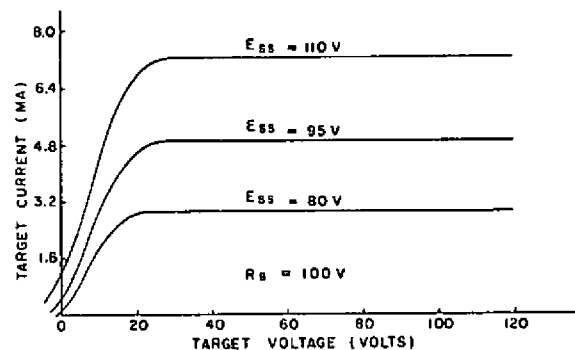


Figure 4  
Output characteristic

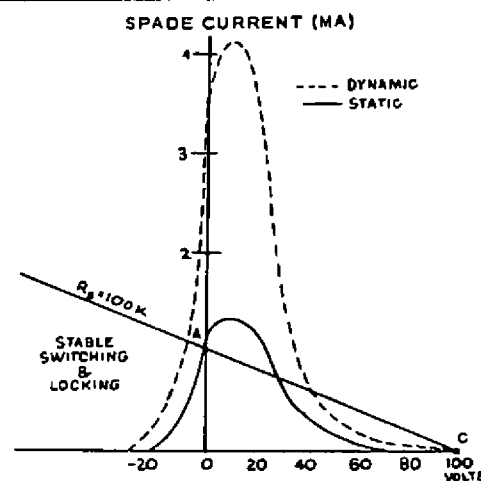


Figure 5  
Beam Forming & Locking Spade Characteristic

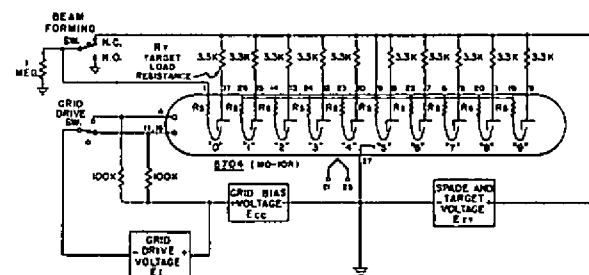


Figure 6  
Basic Circuit for 6704

### NOTES:

1. Constants as shown will accept a 3 V. RMS, 5.0 Mc input signal which will drive an MO-10R at 10 Mc.
2. The tuned circuit should utilize a high L/C ratio for maximum output voltage. This output voltage should be 100 V or more peak to peak. The coil shown uses 36 turns of #22 Birmal center tapped on a 3/4" dia. form.
3. The dotted connection makes the circuit a Hartley Oscillator.

ANOTHER ELECTRONIC CONTRIBUTION BY  
**Burroughs Corporation**  
 ELECTRONIC COMPONENTS DIVISION  
 PLAINFIELD, NEW JERSEY  
 Formerly Electronic Tube Division

AN APPLICATIONS ENGINEERING DEPARTMENT,  
 OFFERING ENGINEERING SERVICE AND  
 CONSULTATION, IS AVAILABLE TO ASSIST YOU IN  
 TAKING FULL ADVANTAGE OF THIS DEVICE.  
 WRITE FOR FURTHER INFORMATION.  
 Phone: PLainfield 7-5000.

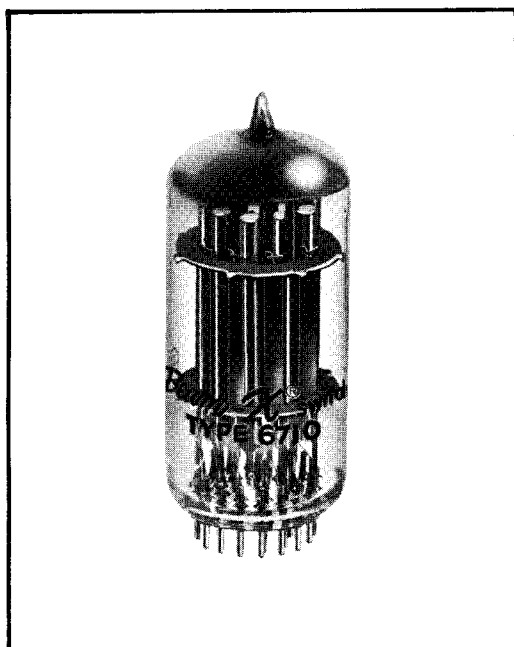


# BEAM-X<sup>®</sup> SWITCH

## GENERAL PURPOSE

### Type 6710 (BX-1000)

The BEAM-X Switch, type 6710, is a 10 position, high vacuum electronic switching device. It is intended for use wherever multiposition electronic counting, distributing or switching is required.



## ELECTRICAL CHARACTERISTICS:

| RATINGS                                   | ABSOLUTE MAX. | VALUE            | NOTES       |
|-------------------------------------------|---------------|------------------|-------------|
| Target Voltage ( $E_t$ )                  | .....         | 300 Vdc          | .....       |
| Spade Voltage ( $E_s$ )                   | .....         | 100 Vdc          | .....       |
| Grid Voltage ( $E_{cc}$ )                 | .....         | 200 Vdc          | .....       |
| Shield Grid Voltage ( $E_{sg}$ )          | .....         | 200 Vdc          | .....       |
| Heater — Cathode Voltage ( $E_{hk}$ )     | .....         | $\pm 100$ Vdc    | .....       |
| Individual Target Dissipation ( $P/t_a$ ) | .....         | 1 W              | .....       |
| Heater Voltage ( $E_f$ )                  | .....         | $6.3 \pm 10\%$ V | .....       |
| Switching Speed (F)                       | .....         | 2 MC             | Notes 1 & 4 |

## TEST CONDITIONS AND TEST LIMITS

The BEAM-X Switch, Type 6710 is tested in a circuit similar to Figure 7. These tests are designed to demonstrate current uniformity from position to position within specified limits and operating stability throughout the frequency range at high and low voltage limits.

| TEST CONDITIONS                  | VALUE | NOTES                |
|----------------------------------|-------|----------------------|
| Spade Resistance ( $R_s$ )       | ..... | 150 K ohms           |
| Target Load Resistance ( $R_t$ ) | ..... | 3.3 K ohms           |
| Target Voltage ( $E_t$ )         | ..... | Equals $E_s$         |
| Shield Grid Voltage ( $E_{sg}$ ) | ..... | Equals $E_s$         |
| Grid Bias Voltage ( $E_{cc}$ )   | ..... | 40 V                 |
| Grid Switching Voltage ( $E_i$ ) | ..... | $-55$ V              |
| Heater Voltage ( $E_f$ )         | ..... | 6.3                  |
| Test Frequency (f)               | ..... | Pushbutton and 10 KC |

| TEST LIMITS                         | VALUE | NOTES             |
|-------------------------------------|-------|-------------------|
| Spade Voltage ( $E_s$ )             | ..... | $55 \pm 10\%$ V   |
| Individual Target Current ( $I_t$ ) | ..... | $2.7 \pm 30\%$ ma |
| Heater Current ( $I_h$ )            | ..... | $150 \pm 10\%$ ma |
| Firing Voltage ( $E_{co}$ )         | ..... | 100V              |

## MECHANICAL CHARACTERISTICS:

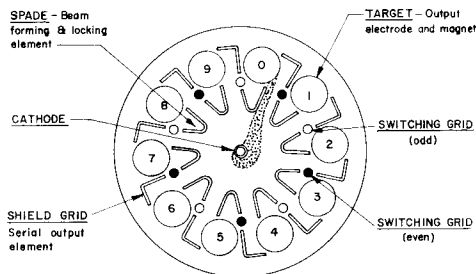
|                     | VALUE | NOTES          |
|---------------------|-------|----------------|
| Overall Length      | ..... | 3.125 in. max. |
| Seated Height       | ..... | 2.875 in. max. |
| Diameter            | ..... | 1.160 in. max. |
| Weight Total        | ..... | 1.75 oz.       |
| Mounting Position   | ..... | Any            |
| Outline             | ..... | See Figure 6   |
| Envelope Connection | ..... | See Figure 3   |

## NOTES

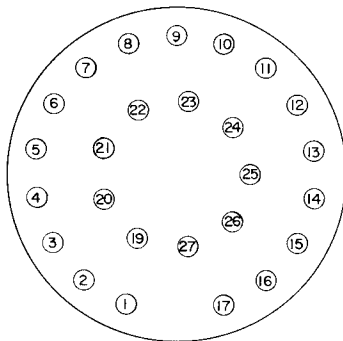
1. Tube is tested at 10 KC but will operate in excess of 2 MC under suitable operating conditions.
2. When tube is operated in test circuit.
3. When tube is operated in test circuit at Spade Voltage = 55 V.
4. For higher frequency operation, a greater pulse amplitude is required.
5. When filament is operated at 6.3 V.
6. Tubes should be mounted at least 1.5 inch from magnetic material and should be spaced at least 2.5 inches center to center.
7. Firing Voltage (DC Cutoff Voltage): That voltage between cathode and spade buss above which erratic electron beam formation will occur. See Bulletin BX-535B, page 5, for detailed explanation.

Detailed theory, circuit design and application data contained in Brochure BX535B.





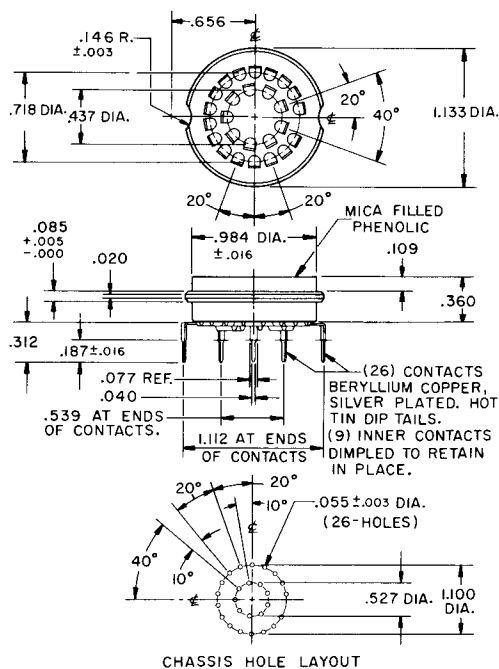
1. CROSS SECTION



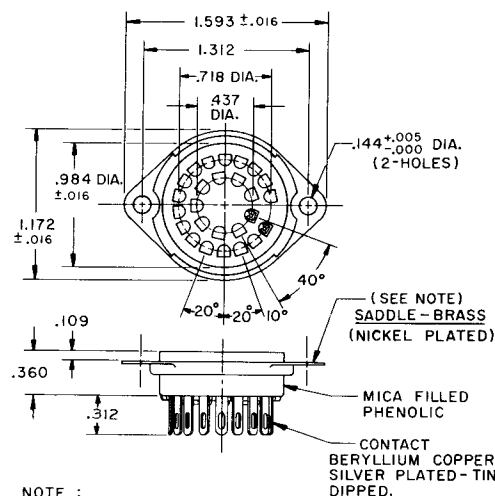
2. PIN NUMBERING DIAGRAM

| PIN NO. | CONNECTION  | PIN NO. | CONNECTION |
|---------|-------------|---------|------------|
| 1       | Spade-0     | 14      | Spade-2    |
| 2       | Target-9    | 15      | Target-1   |
| 3       | Target-8    | 16      | Grid Even  |
| 4       | Grid Odd    | 17      | Target-0   |
| 5       | Target-7    | 19      | Spade-9    |
| 6       | Spade-7     | 20      | Spade-8    |
| 7       | Target-6    | 21      | Heater     |
| 8       | Target-5    | 22      | Spade-6    |
| 9       | Spade-5     | 23      | Spade-4    |
| 10      | Target-4    | 24      | Spade-3    |
| 11      | Shield Grid | 25      | Heater     |
| 12      | Target-3    | 26      | Spade-1    |
| 13      | Target-2    | 27      | Cathode    |

3. TUBE CONNECTION TABLE

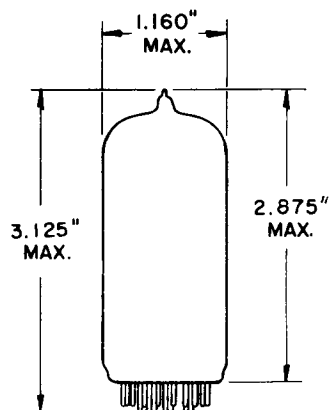


4. PRINTED CIRCUIT SOCKET, SK-131

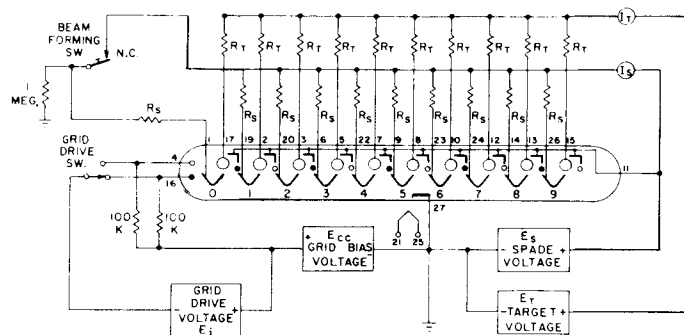


NOTE :  
THE SADDLE  
IS PERMANENTLY  
FASTENED TO SOCKET.

5. GENERAL PURPOSE SOCKET, SK-100



6. OUTLINE DRAWING



7. TYPICAL TEST CIRCUIT

ANOTHER ELECTRONIC CONTRIBUTION BY  
**Burroughs Corporation**  
 ELECTRONIC COMPONENTS DIVISION  
 PLAINFIELD, NEW JERSEY

# Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY

Bulletin No. 1030

January 1, 1963

6711

(BX-2000) General Purpose, Shielded BEAM-X<sup>R</sup> Switch

The 6711 (BX-2000) is a shielded general purpose 10 position, high vacuum electronic switching tube. It is intended for use wherever multi-position electronic counting, distributing or switching is required. It has frequency capabilities from DC to above 2 MC and features magnetically shielded construction for applications where space conservation is important.

## ELECTRICAL CHARACTERISTICS

| <u>Ratings</u>                            | <u>Absolute Maximum</u> | <u>Value</u>    | <u>Notes</u> |
|-------------------------------------------|-------------------------|-----------------|--------------|
| Target Voltage ( $E_t$ )                  |                         | 300 Vdc         |              |
| Spade Voltage ( $E_s$ )                   |                         | 100 Vdc         |              |
| Grid Voltage ( $E_{cc}$ )                 |                         | 200 Vdc         |              |
| Shield Grid Voltage ( $E_{sg}$ )          |                         | 200 Vdc         |              |
| Heater - Cathode Voltage ( $E_{hk}$ )     |                         | +100 Vdc        |              |
| Individual Target Dissipation ( $P/t_a$ ) |                         | 1 W             |              |
| Heater Voltage ( $E_f$ )                  |                         | 6.3 $\pm$ 10% V |              |
| Switching Speed ( $\bar{F}$ )             |                         | 2 MC            | Notes 1,4    |

## MECHANICAL CHARACTERISTICS

|                     | <u>Value</u>   | <u>Notes</u> |
|---------------------|----------------|--------------|
| Overall Length      | 3.125 in. max. |              |
| Seated Height       | 2.875 in. max. |              |
| Diameter            | 1.270 in. max. |              |
| Weight Total        | 2.75 oz. nom.  |              |
| Mounting Position   | Any            | Note 6       |
| Outline             | See figure 6   |              |
| Envelope Connection | See figure 3   |              |

## ENVIRONMENTAL DATA

|             |                    |
|-------------|--------------------|
| Temperature | -65° C. to +85° C. |
| Altitude    | 60,000 ft.         |

## TEST CONDITIONS AND TEST LIMITS

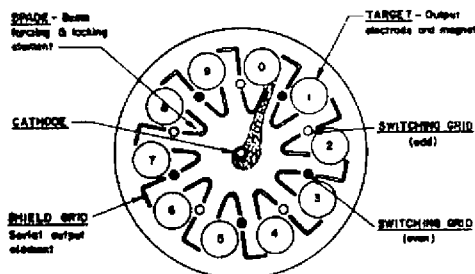
The BEAM-X Switch, Type BX-2000, is tested in a circuit similar to Figure 7. These tests are designed to demonstrate current uniformity from position to position within specified limits and operating stability throughout the frequency range at high and low voltage limits.

| <u>Test Conditions</u>                     | <u>Value</u>         | <u>Notes</u>            |
|--------------------------------------------|----------------------|-------------------------|
| Spade Resistance ( $R_s$ ) . . . . .       | 150 K ohms           |                         |
| Target Load Resistance ( $R_L$ ) . . . . . | 3.3 K ohms           |                         |
| Target Voltage ( $E_L$ ) . . . . .         | Equals $E_s$         |                         |
| Shield Grid Voltage ( $E_{sg}$ ) . . . . . | Equals $E_s$         |                         |
| Grid Bias Voltage ( $E_{cc}$ ) . . . . .   | 50 V                 |                         |
| Grid Switching Voltage ( $E_i$ ) . . . . . | -55 V . . . . .      | Note 4                  |
| Heater Voltage ( $E_f$ ) . . . . .         | 6.3                  |                         |
| Test Frequency (f) . . . . .               | Pushbutton . . . . . | Notes 1, 4<br>and 10 KC |

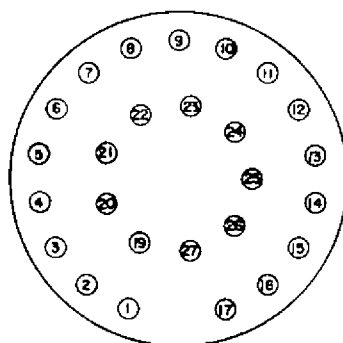
| <u>Test Limits</u>                            | <u>Value</u>                | <u>Notes</u> |
|-----------------------------------------------|-----------------------------|--------------|
| Spade Voltage ( $E_s$ ) . . . . .             | $55 \pm 10\%$ V . . . . .   | Note 2       |
| Individual Target Current ( $I_L$ ) . . . . . | $2.9 \pm 25\%$ ma . . . . . | Note 3       |
| Heater Current ( $I_h$ ) . . . . .            | $150 \pm 10\%$ ma . . . . . | Note 5       |
| Firing Voltage ( $E_{co}$ ) . . . . .         | 100 V . . . . .             | Note 7       |

### NOTES

1. Tube is tested at 10 KC but will operate in excess of 2 MC under suitable operating conditions.
2. When tube is operated in test circuit.
3. When tube is operated in test circuit at Spade Voltage = 55 V.
4. For higher frequency operation, a greater pulse amplitude is required.
5. When filament is operated at 6.3 V.
6. Tubes may be mounted side by side (no minimum spacing). Tubes should not be mounted on a ferrous chassis.
7. Firing Voltage (DC Cutoff Voltage): That voltage between cathode and spade buss above which erratic electron beam formation will occur.  
for detailed explanation.



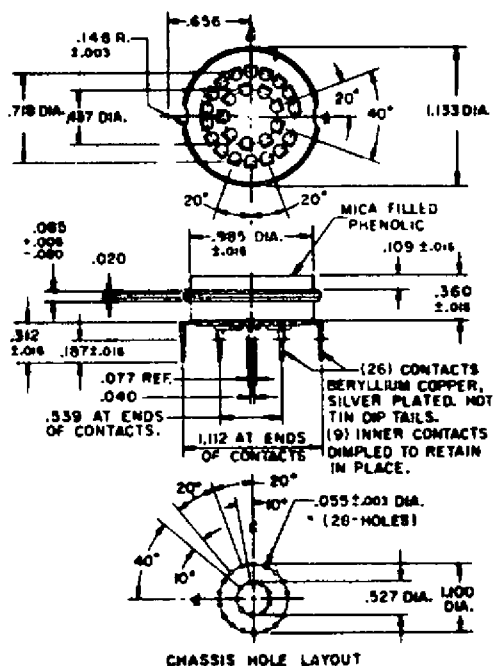
1. CROSS SECTION



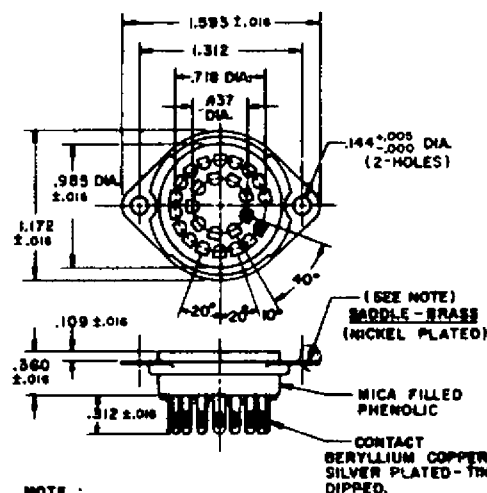
2. PIN NUMBERING DIAGRAM

| PIN NO. | CONNECTION  | PIN NO. | CONNECTION |
|---------|-------------|---------|------------|
| 1       | Spade-0     | 14      | Spade-2    |
| 2       | Target-9    | 15      | Target-1   |
| 3       | Target-8    | 16      | Grid Even  |
| 4       | Grid Odd    | 17      | Target-0   |
| 5       | Target-7    | 19      | Spade-9    |
| 6       | Spade-7     | 20      | Spade-8    |
| 7       | Target-6    | 21      | Heater     |
| 8       | Target-5    | 22      | Spade-6    |
| 9       | Spade-5     | 23      | Spade-4    |
| 10      | Target-4    | 24      | Spade-3    |
| 11      | Shield Grid | 25      | Heater     |
| 12      | Target-3    | 26      | Spade-1    |
| 13      | Target-2    | 27      | Cathode    |

3. TUBE CONNECTION TABLE

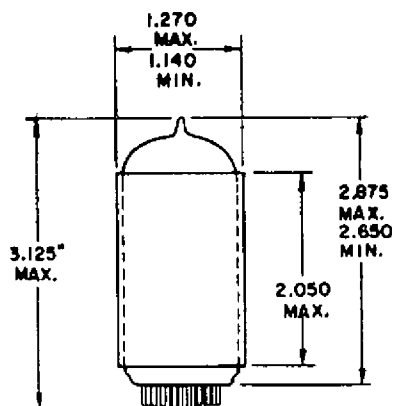


4. PRINTED CIRCUIT SOCKET, SK-131

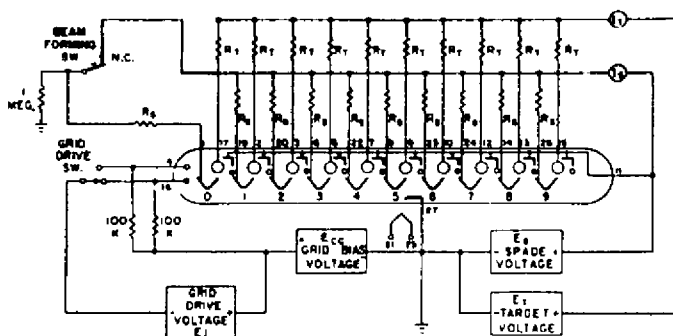


NOTE :  
THE SADDLE SHALL  
BE PERMANENTLY  
FASTENED TO SOCKET.

5. GENERAL PURPOSE SOCKET, SK-100



6. OUTLINE DRAWING



7. TYPICAL TEST CIRCUIT

ANOTHER ELECTRONIC CONTRIBUTION BY  
**Burroughs Corporation**  
 ELECTRONIC COMPONENTS DIVISION  
 PLAINFIELD, NEW JERSEY

# Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY

Bulletin No. 1031

January 1, 1963

## 6712

(BX-3000) High Current, BEAM-X<sup>R</sup> Switch

The 6712 (BX-3000) is a high current 10 position, high vacuum electronic switching tube. It is intended for use wherever multiposition electronic counting, distributing or switching is required. It has frequency capabilities from DC to above 2 MC.

### ELECTRICAL CHARACTERISTICS

| <u>Ratings Absolute Maximum</u>                     | <u>Value</u>     | <u>Notes</u> |
|-----------------------------------------------------|------------------|--------------|
| Target Voltage ( $E_t$ ) . . . . .                  | 300 Vdc          |              |
| Spade Voltage ( $E_s$ ) . . . . .                   | 150 Vdc          |              |
| Grid Voltage ( $E_{cc}$ ) . . . . .                 | 200 Vdc          |              |
| Shield Grid Voltage ( $E_{sg}$ ) . . . . .          | 200 Vdc          |              |
| Heater - Cathode Voltage ( $E_{hk}$ ) . . . . .     | $\pm 100$ Vdc    |              |
| Individual Target Dissipation ( $P/t_a$ ) . . . . . | 1 W              |              |
| Heater Voltage ( $E_f$ ) . . . . .                  | $6.3 \pm 10\%$ V |              |
| Switching Speed (F) . . . . .                       | 2 MC . . . . .   | Notes 1, 4   |

### MECHANICAL CHARACTERISTICS

|                               | <u>Value</u>   | <u>Notes</u> |
|-------------------------------|----------------|--------------|
| Overall Length . . . . .      | 3.125 in. max. |              |
| Seated Height . . . . .       | 2.875 in. max. |              |
| Diameter . . . . .            | 1.160 in. max. |              |
| Weight Total . . . . .        | 1.75 oz. nom.  |              |
| Mounting Position . . . . .   | Any . . . . .  | Note 6       |
| Outline . . . . .             | See Figure 6   |              |
| Envelope Connection . . . . . | See Figure 3   |              |

### ENVIRONMENTAL DATA

|                       |                    |
|-----------------------|--------------------|
| Temperature . . . . . | -65° C. to +85° C. |
| Altitude . . . . .    | 60,000 ft.         |

## TEST CONDITIONS AND TEST LIMITS

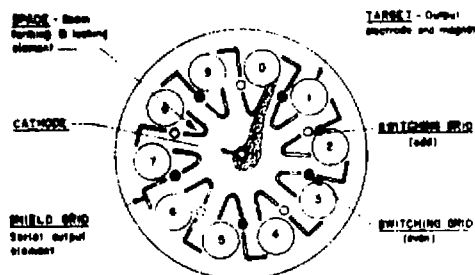
The BEAM-X Switch, Type BX-3000, is tested in a circuit similar to Figure 7. These tests are designed to demonstrate current uniformity from position to position within specified limits and operating stability throughout the frequency range at high and low voltage limits.

| <u>Test Conditions</u>                     | <u>Value</u>         | <u>Notes</u>            |
|--------------------------------------------|----------------------|-------------------------|
| Spade Resistance ( $R_s$ ) . . . . .       | 150 K ohms           |                         |
| Target Load Resistance ( $R_t$ ) . . . . . | 3.3 K ohms           |                         |
| Target Voltage ( $E_t$ ) . . . . .         | Equals $E_s$         |                         |
| Shield Grid Voltage ( $E_{sg}$ ) . . . . . | Equals $E_s$         |                         |
| Grid Bias Voltage ( $E_{cc}$ ) . . . . .   | 50 V                 |                         |
| Grid Switching Voltage ( $E_i$ ) . . . . . | -55 V . . . . .      | Note 4                  |
| Heater Voltage ( $E_f$ ) . . . . .         | 6.3                  |                         |
| Test Frequency ( $f$ ) . . . . .           | Pushbutton . . . . . | Notes 1, 4<br>and 10 KC |

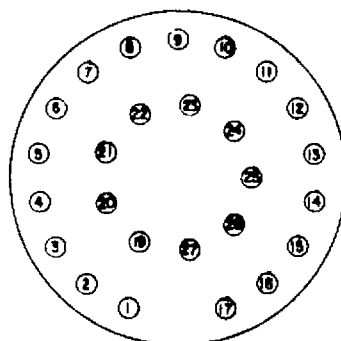
| <u>Test Limits</u>                            | <u>Value</u>               | <u>Notes</u> |
|-----------------------------------------------|----------------------------|--------------|
| Spade Voltage ( $E_s$ ) . . . . .             | 80 $\pm$ 10% V . . . . .   | Note 2       |
| Individual Target Current ( $I_t$ ) . . . . . | 5.0 $\pm$ 20% ma . . . . . | Note 3       |
| Heater Current ( $I_h$ ) . . . . .            | 150 $\pm$ 10% ma . . . . . | Note 5       |
| Firing Voltage ( $E_{co}$ ) . . . . .         | 150 V . . . . .            | Note 7       |

### NOTES

1. Tube is tested at 10 KC but will operate in excess of 2 MC under suitable operating conditions.
2. When tube is operated in test circuit.
3. When tube is operated in test circuit at Spade Voltage = 80 V.
4. For higher frequency operation, a greater pulse amplitude is required.
5. When filament is operated at 6.3 V.
6. Tubes should be mounted at least 1.5 inch from magnetic material and should be spaced at least 3.5 inches center to center.
7. Firing Voltage (DC Cutoff Voltage): That voltage between cathode and spade buss above which erratic electron beam formation will occur.



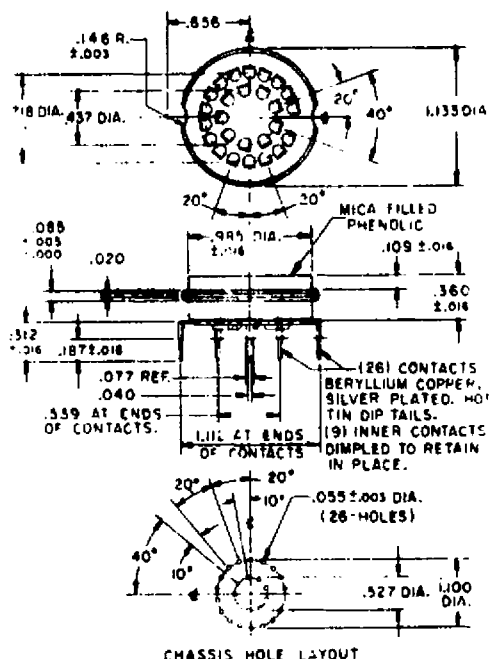
1. CROSS SECTION



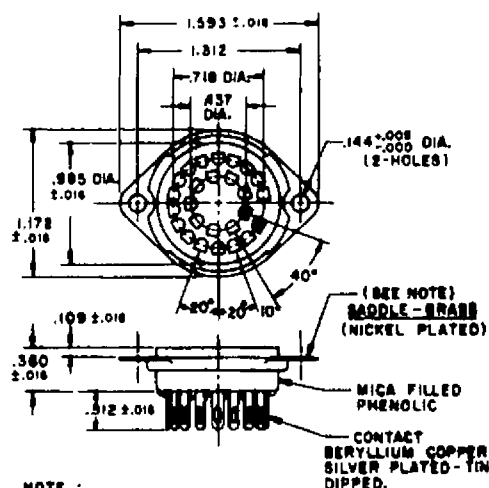
2. PIN NUMBERING DIAGRAM

| PIN NO. | CONNECTION  | PIN NO. | CONNECTION |
|---------|-------------|---------|------------|
| 1       | Spade-0     | 14      | Spade-2    |
| 2       | Target-9    | 15      | Target-1   |
| 3       | Target-8    | 16      | Grid Even  |
| 4       | Grid Odd    | 17      | Target-0   |
| 5       | Target-7    | 19      | Spade-9    |
| 6       | Spade-7     | 20      | Spade-8    |
| 7       | Target-6    | 21      | Heater     |
| 8       | Target-5    | 22      | Spade-6    |
| 9       | Spade-5     | 23      | Spade-4    |
| 10      | Target-4    | 24      | Spade-3    |
| 11      | Shield Grid | 25      | Heater     |
| 12      | Target-3    | 26      | Spade-1    |
| 13      | Target-2    | 27      | Cathode    |

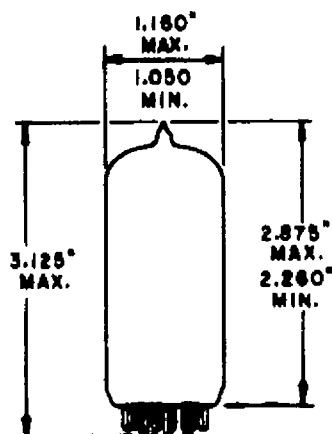
3. TUBE CONNECTION TABLE



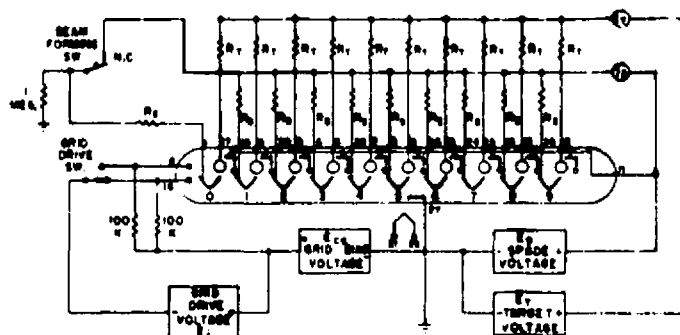
4. PRINTED CIRCUIT SOCKET, SK-131



5. GENERAL PURPOSE, SK-100



6. OUTLINE DRAWING



7. TYPICAL TEST CIRCUIT

ANOTHER ELECTRONIC CONTRIBUTION BY  
**Burroughs Corporation**  
 ELECTRONIC COMPONENTS DIVISION  
 PLAINFIELD, NEW JERSEY

Bulletin No. 1050

**6714**  
**(BX-4001) Low Voltage Shielded**  
**BEAM-X® Switch**

October 15, 1963

The 6714 (BX-4001) BEAM-X® Switch is a 10-position, high vacuum electronic switching device. It is specifically designed and tested for use in low voltage, multi-position electronic switching circuits. It has frequency capabilities in excess of 1 mc and its low voltage characteristics are compatible with standard transistor driving circuitry. In addition, it features magnetically shielded construction for applications where space conservation is important.

**ELECTRICAL CHARACTERISTICS**

| RATINGS ABSOLUTE MAX.                          | VALUE                | NOTES |
|------------------------------------------------|----------------------|-------|
| Target Voltage (Et) . . . . .                  | 300 Vdc . . . . .    |       |
| Spade Voltage (Es) . . . . .                   | 100 Vdc . . . . .    |       |
| Grid Voltage (Ec) . . . . .                    | 200 Vdc . . . . .    |       |
| Shield Grid Voltage (Esg) . . . . .            | 200 Vdc . . . . .    |       |
| Heater - Cathode Voltage (Ehk) . . . . .       | ±100 Vdc . . . . .   |       |
| Cathode Current (Ik) . . . . .                 | 10 ma. . . . .       |       |
| Individual Target Dissipation (P/ta) . . . . . | 1 W . . . . .        |       |
| Heater Voltage (Ef) . . . . .                  | 6.3 ±10% V . . . . . |       |
| Switching Speed (F) . . . . .                  | 2 MC . . . . .       | 1     |

**MECHANICAL CHARACTERISTICS**

|                               |                           |   |
|-------------------------------|---------------------------|---|
| Overall Length . . . . .      | 3.125 in. max. . . . .    |   |
| Seated Height . . . . .       | 2.875 in. max. . . . .    |   |
| Diameter . . . . .            | 1.270 in. max. . . . .    |   |
| Weight Total . . . . .        | 2.75 oz. . . . .          |   |
| Mounting Position . . . . .   | Any . . . . .             | 5 |
| Outline . . . . .             | See Figure 4 . . . . .    |   |
| Envelope Connection . . . . . | See Figures 2, 3. . . . . |   |

**TEST CONDITIONS AND TEST LIMITS**

The BEAM-X® Switch, Type 6714 is tested in a circuit similar to Figure 5. These tests are designed to demonstrate current uniformity from position to position within specified limits and operating stability throughout the frequency range at high and low voltage limits.

| TEST CONDITIONS                         | VALUE                           | NOTES |
|-----------------------------------------|---------------------------------|-------|
| Spade Resistance (Rs) . . . . .         | 270 <sup>1</sup> K ohm. . . . . |       |
| Target Load Resistance (Rt) . . . . .   | 10 K ohm . . . . .              |       |
| Target Voltage (Et) . . . . .           | Equals Es. . . . .              |       |
| Shield Grid Voltage (Esg) . . . . .     | Equals Es. . . . .              |       |
| Grid Bias Voltage (Ec) . . . . .        | 26 V. . . . .                   |       |
| Grid Switching Voltage (Esig) . . . . . | -24V. . . . .                   | 3     |
| Heater Voltage (Ef) . . . . .           | 6.3 V. . . . .                  |       |
| Test Frequency (f) . . . . .            | Push Button and 10 Kc . . . . . | 1, 3  |

| TEST LIMITS                              | VALUE                   | NOTES |
|------------------------------------------|-------------------------|-------|
| Spade Voltage (Es) . . . . .             | 30 ±10% V. . . . .      |       |
| Individual Target Current (It) . . . . . | 1.000 ±30% ma . . . . . | 2     |
| Heater Current (If) . . . . .            | 150 ±10% ma . . . . .   | 4     |
| Firing Voltage (Eco) . . . . .           | 40 V. . . . .           | 6     |

**NOTES:**

1. The tube is tested at pushbutton and 10 KC rates but may operate at rates up to 2 MC under suitable operating conditions.
2. When tube is operated in test circuit at Spade Voltage = 30 V.
3. For higher frequency operation, a greater pulse amplitude is required.
4. When filament is operated at 6.3 V.
5. Tubes may be mounted side by side (no minimum spacing). To avoid possible operational changes in tube characteristics, tubes should not be mounted on a ferrous chassis.
6. Firing Voltage (DC Cutoff Voltage) is that voltage between cathode and spade buss above which erratic electron beam formation will occur.

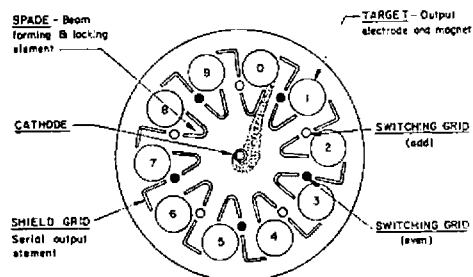


Fig. 1. CROSS SECTION

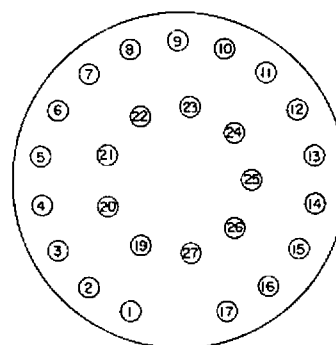


FIG. 2. PIN NUMBERING DIAGRAM

| Pin No. | Connection  | Pin No. | Connection |
|---------|-------------|---------|------------|
| 1       | Spade-0     | 14      | Spade-2    |
| 2       | Target-9    | 15      | Target-1   |
| 3       | Target-8    | 16      | Grid Even  |
| 4       | Grid Odd    | 17      | Target-0   |
| 5       | Target-7    | 19      | Spade-9    |
| 6       | Spade-7     | 20      | Spade-8    |
| 7       | Target-6    | 21      | Heater     |
| 8       | Target-5    | 22      | Spade-6    |
| 9       | Spade-5     | 23      | Spade-4    |
| 10      | Target-4    | 24      | Spade-3    |
| 11      | Shield Grid | 25      | Heater     |
| 12      | Target-3    | 26      | Spade-1    |
| 13      | Target-2    | 27      | Cathode    |

FIG. 3. PIN CONNECTION CHART

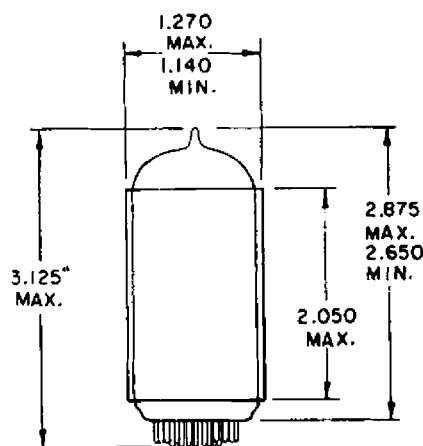


FIG. 4. OUTLINE DRAWING

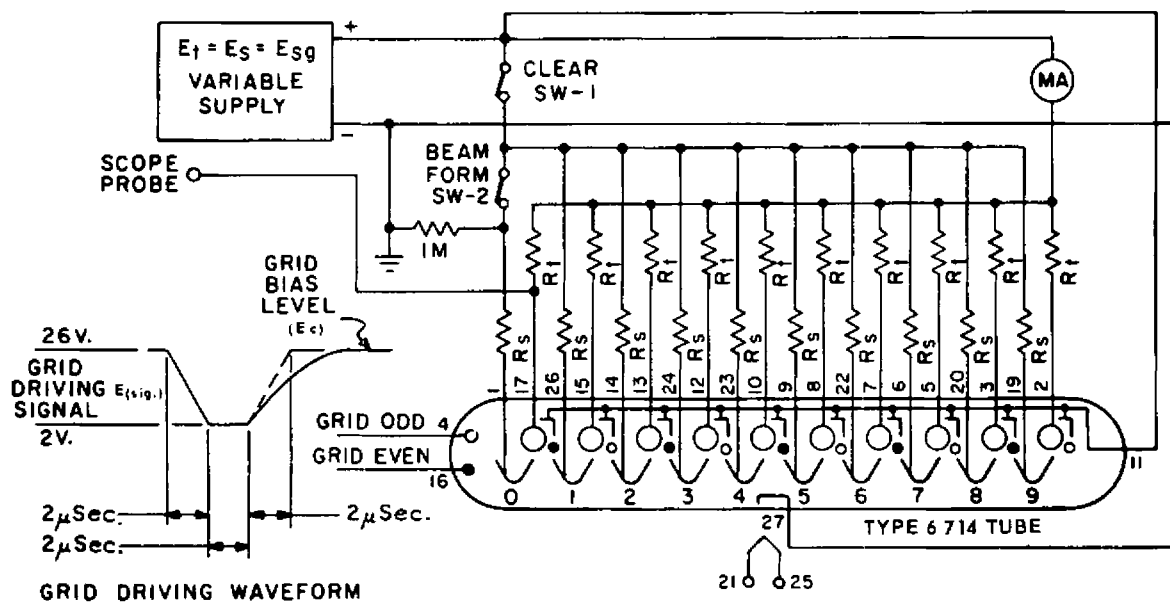


FIG. 5 TEST CIRCUIT

**NUMERICAL INDICATOR****engineering data report****6844****(NIXIE\*)(HB-106)**

The 6844 is a gas-filled, cold cathode, 10-digit ("0" through "9"), numerical indicator tube, having a common anode. It features a suppressor screen to minimize darkening of the viewing dome. It is intended for use as a direct, in-line, read-out device.

**MECHANICAL (SEE FIG. 1)**

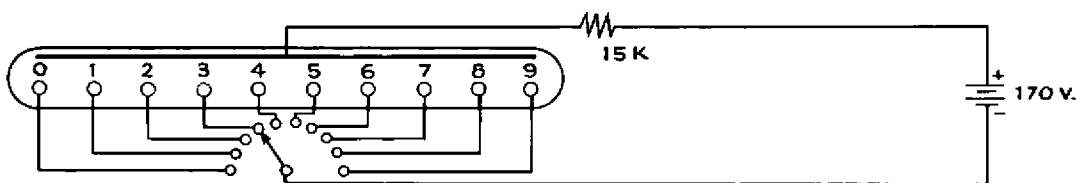
|                                            |                             |
|--------------------------------------------|-----------------------------|
| Overall length.....                        | 1.380" Max.                 |
| Seated Height.....                         | 1.125" Max.                 |
| Bulb Diameter.....                         | 1.080" Max.                 |
| Envelope Connections.....                  | See Fig. 2                  |
| Height of Numerals.....                    | 0.610" Nom.                 |
| Numeral Design (Human Engineering).....    | See Fig. 3                  |
| Socket, 13-Pin (# HSK-106 or HSK-112)..... | See Fig. 4, Note 4          |
| Weight.....                                | 1 oz. Max.                  |
| Mounting Position.....                     | See Note 1                  |
| Cathode(s).....                            | Glow Discharge              |
| Shock.....                                 | 350 G's (30° Hammer)        |
| Vibration.....                             | 10 G's, 60 Cps.             |
| Temperature.....                           | -65°C Through +70°C, Note 2 |
| Altitude.....                              | 70,000 Ft.                  |

**ELECTRICAL****1. ABSOLUTE RATINGS**

|                                  |                 |
|----------------------------------|-----------------|
| Ionization Voltage.....          | 170 Vdc Minimum |
| Anode Current                    |                 |
| Peak.....                        | 4.0 MA, Note 3  |
| Average.....                     | 2.2 MA Max.     |
| Individual Cathode Warrtage..... | 0.38 Watts Max. |

**2. TEST CONDITIONS ( See Typical Circuit)**

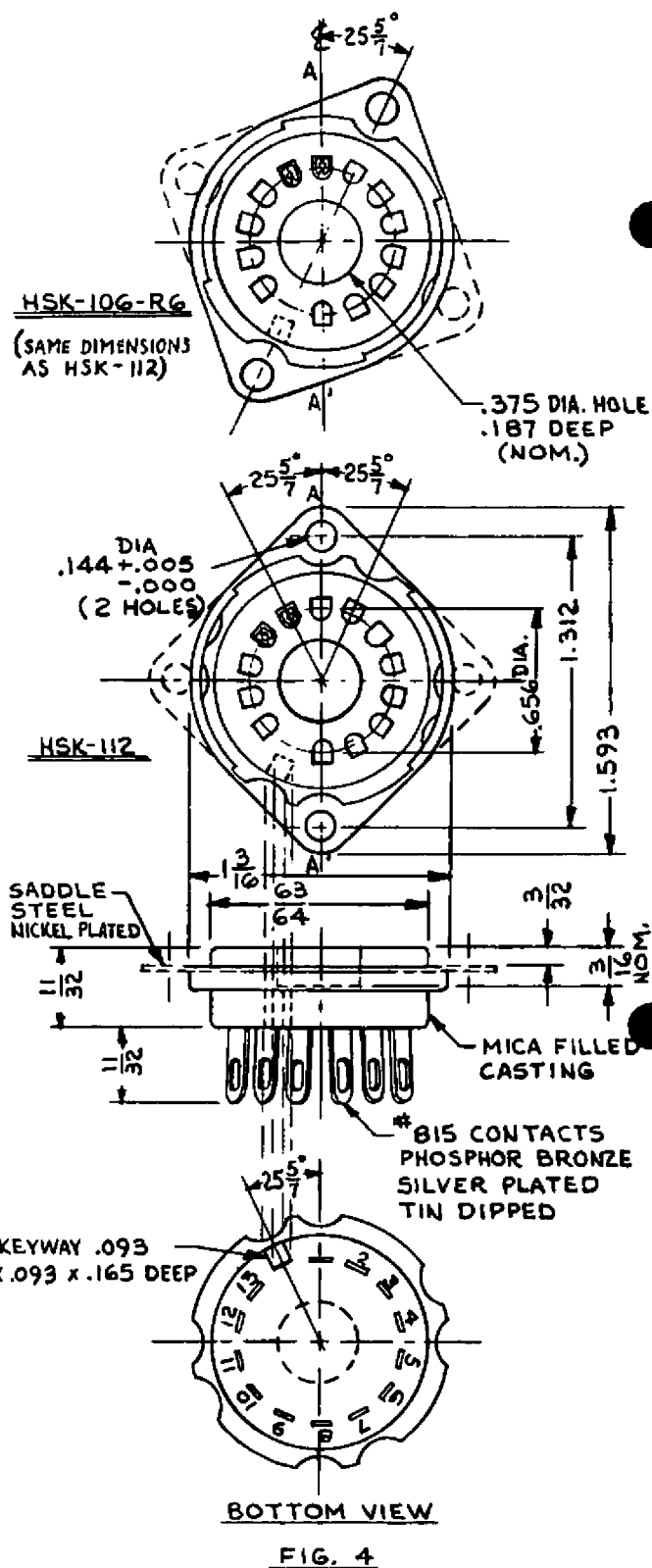
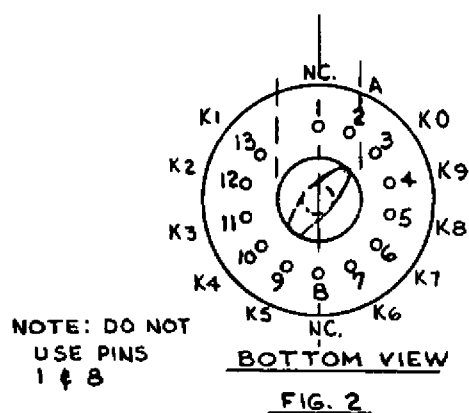
|                            |                           |
|----------------------------|---------------------------|
| Anode Supply Voltage.....  | 170 Vdc                   |
| Anode Series Resistor..... | 15K ohms                  |
| Anode Current.....         | 1.0 MA Min. — 2.2 MA Max. |

**TYPICAL CIRCUIT****NOTES**

1. The tube socket is oriented with respect to the viewing position so that A—A<sup>1</sup>, intersecting the center of Pins 1 and 8 is vertical with Pin 8 on top. This orients the numerals in the correct vertical position. The numbers are viewed through the top of the tube.
2. From +30°C to +70°C, no significant change in cath-

ode current occurs. From +30°C to -65°C an increase in cathode current (Up to 50%) may be expected.

3. It is recommended that the cathode current be kept at its lowest possible value for complete numeral glow in order to obtain maximum life.
4. HSK-112 available early 1957.



1234567890

**Electronic Tube Division**  
 BURROUGHS CORPORATION  
 Plainfield, New Jersey

**AN APPLICATIONS ENGINEERING DEPARTMENT,  
OFFERING ENGINEERING SERVICE AND CONSULTATION,  
HAS BEEN SET UP TO ASSIST YOU IN TAKING FULL ADVANTAGE  
OF THIS DEVICE. WRITE FOR FURTHER INFORMATION.**

## NUMERICAL INDICATOR



# engineering data report

**6844A**

(BD-302) NIXIE\*

The 6844A (BD-302) is an improved version of the type 6844. This tube is a gas-filled, cold cathode, 10-digit ("0" through "9"), numerical indicator tube, having a common anode with a suppressor screen to minimize darkening of the viewing dome. This tube features a cup design providing a non-glare background. It is intended for use as a direct in-line read-out device.

MECHANICAL DATA  
(SEE FIGURE 1)

|                                               |                                    |
|-----------------------------------------------|------------------------------------|
| Overall Length .....                          | 1.380" Max.                        |
| Seated Height .....                           | 1.125" Max.                        |
| Bulb Diameter .....                           | 1.080" Max.                        |
| Envelope Connections .....                    | See Figure 2                       |
| Height of Numerals .....                      | 0.610" Nom.                        |
| Numerical Design<br>(Human Engineering) ..... | See Figure 3                       |
| Socket, 13-Pin<br>(#HSK-106 or HSK-112) ..... | See Figure 4                       |
| Weight .....                                  | 1 oz. Max.                         |
| Mounting Position .....                       | See Note 1                         |
| Cathode(s) .....                              | Glow Discharge                     |
| Shock .....                                   | 350 G's (30° Hammer)               |
| Vibration .....                               | 10 G's, 60 Cps.                    |
| Temperature .....                             | -65° C. through<br>+70° C., Note 2 |
| Altitude .....                                | 70,000 Feet                        |

### ELECTRICAL DATA

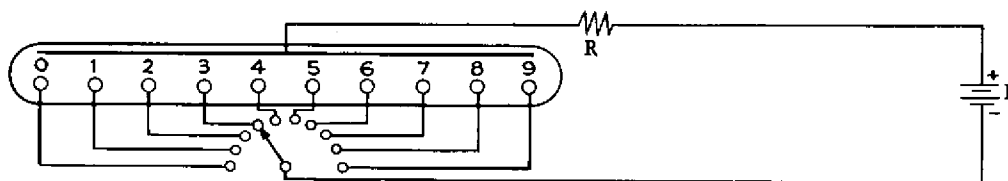
1. ABSOLUTE RATINGS:

|                                  |                 |
|----------------------------------|-----------------|
| Ionization Voltage .....         | 170 Vdc Minimum |
| Anode Current .....              |                 |
| Peak .....                       | 4.0 MA          |
| Average .....                    | 2.5 MA Max.     |
| Individual Cathode Wattage ..... | 0.4 Watts Max.  |

2. TEST CONDITIONS: (See Typical Circuit)

Anode Supply Voltage .....170 Vdc  
Anode Series Resistor .....15 K Ohms  
Anode Current .....1.5 MA Min.  
                                                2.5 MA Max.

### TYPICAL CIRCUIT



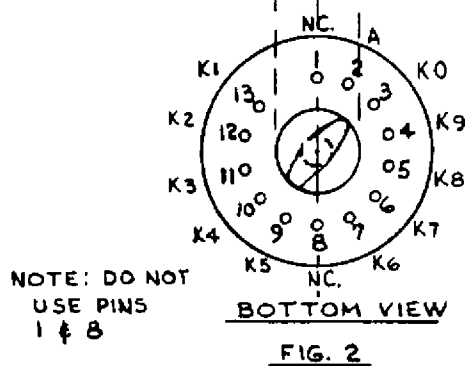
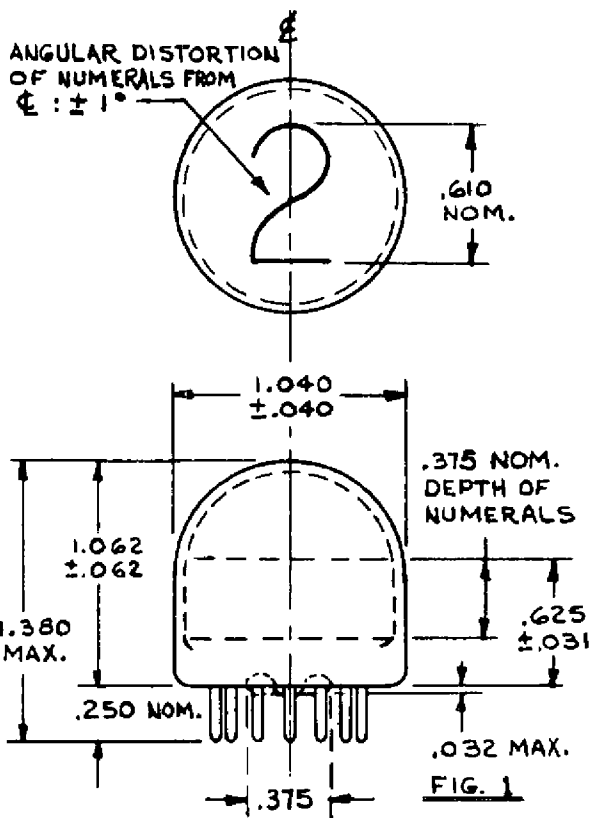
(SEE NOTE 3)

## RECOMMENDED OPERATING CONDITIONS

|          |          |
|----------|----------|
| <u>E</u> | <u>R</u> |
| 170V     | 15K      |
| 250V     | 47K      |
| 300V     | 75K      |

## NOTES

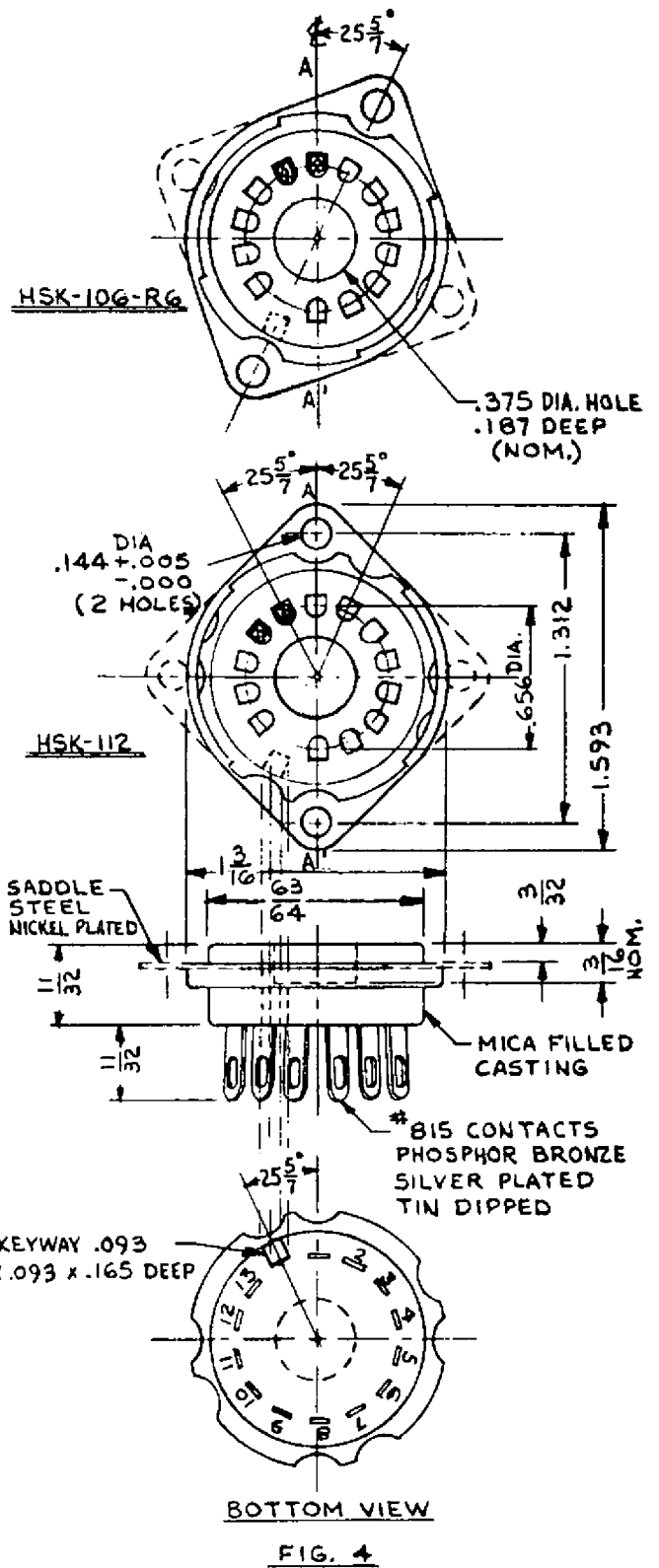
- (1) The tube socket is oriented with respect to the viewing position so that A — A', intersecting the center of Pins 1 and 8 is vertical with Pin 8 on top. This orients the numerals in the correct vertical position. The numbers are viewed through the top of the tube.
- (2) From +30° C. to +70° C., no significant change in cathode current occurs. From +30° C. to -65° C. an increase in cathode ( $I_p$  to 50%) may be expected.
- (3) Recommend highest voltage available be selected with corresponding series resistor.



1234567890

(REF. WADC TR 54-160 APPENDIX PAGE 102)

FIG. 3



**Electronic Tube Division**

BURROUGHS CORPORATION

Plainfield, New Jersey

AN APPLICATIONS ENGINEERING DEPARTMENT,  
OFFERING ENGINEERING SERVICE AND CONSULTATION,  
HAS BEEN SET UP TO ASSIST YOU IN TAKING FULL ADVANTAGE  
OF THIS DEVICE. WRITE FOR FURTHER INFORMATION.

**NUMERICAL INDICATOR****engineering data report****7009****MINIATURE NIXIE\* (BD-200S)**

The 7009 (BD-200S) is a gas-filled, cold cathode, 10 digit ("0" through "9"), miniature indicating tube, having a common anode with a suppressor screen to minimize darkening of the viewing dome. This tube features a cup design providing a non-glare background. It is intended for use as a direct in-line read-out device.

**MECHANICAL DATA**  
(SEE FIGURE 1)

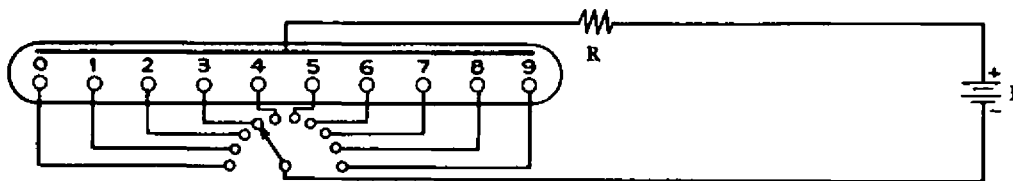
|                            |                          |
|----------------------------|--------------------------|
| Overall Length.....        | 1.175" Max. (cut leads)  |
|                            | 2.325" Max. (long leads) |
| Seated Height.....         | 0.925" Max.              |
| Bulb Diameter.....         | 0.650" Max.              |
| Envelope Connections.....  | See Figure 2             |
| Height of Numerals.....    | 0.305" Nominal           |
|                            | See Figure 1             |
| Numeral Design             |                          |
| (Human Engineered).....    | See Figure 3             |
| Socket (SK116) 11 Pin..... | See Figure 4             |
| Weight.....                | 0.5 Oz. Max.             |
| Mounting Position.....     | See Note 1               |
| Cathode(s).....            | Glow Discharge           |

**ELECTRICAL DATA****1. ABSOLUTE RATINGS:**

|                         |                          |
|-------------------------|--------------------------|
| Ionization Voltage..... | 170 V. Max. (See Note 2) |
| Supply Voltage.....     | 170 V. Min. (See Note 2) |
| Cathode Current         |                          |
| Peak.....               | 2.0 Ma. Max.             |
| Average.....            | 1.0 Ma.                  |

**2. TEST CONDITIONS: (See Typical Circuit)**

|                      |               |
|----------------------|---------------|
| Supply Voltage.....  | 170 Vdc       |
| Series Resistor..... | 68 K Ohms     |
| Cathode Current..... | 0.70 Ma. Min. |
|                      | 1.20 Ma. Max. |

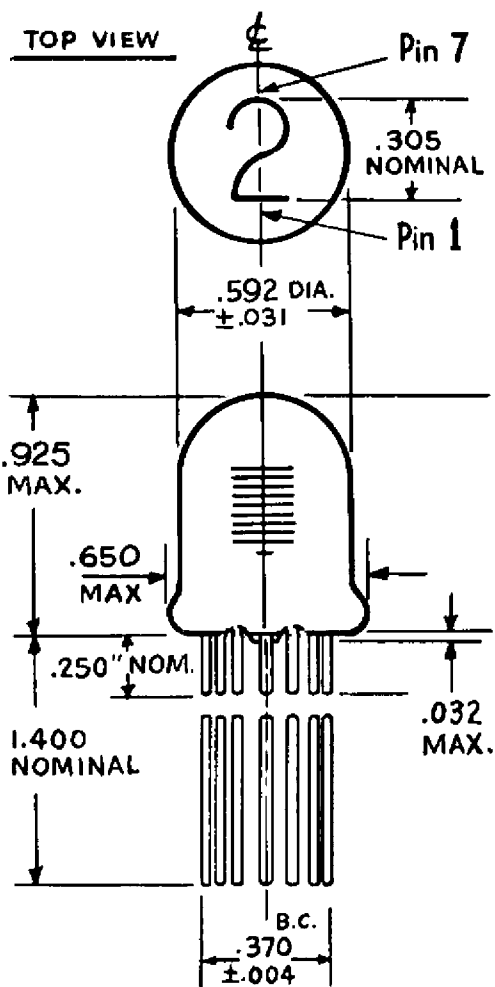
**TYPICAL CIRCUIT****RECOMMENDED OPERATING CONDITIONS**  
(SEE NOTE 2)

| E    | R    |
|------|------|
| 170V | 68K  |
| 250V | 150K |
| 300V | 200K |

**NOTES**

(1) The tube socket is mounted with respect to the viewing position so that a line intersecting pins 1 & 7 is vertical with pin 7 on top. This orients the numerals in the correct viewing position. They are viewed through the top of the tube.

(2) All 7009 tubes will ionize at 170 V. or less. The minimum supply voltage should be 170 V.; however, the use of the highest voltage available with the appropriate series resistor is recommended to maintain cathode current within the specified limits.

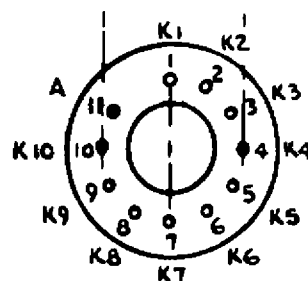


OUTLINE DRAWING  
FIG. 1

1234567890

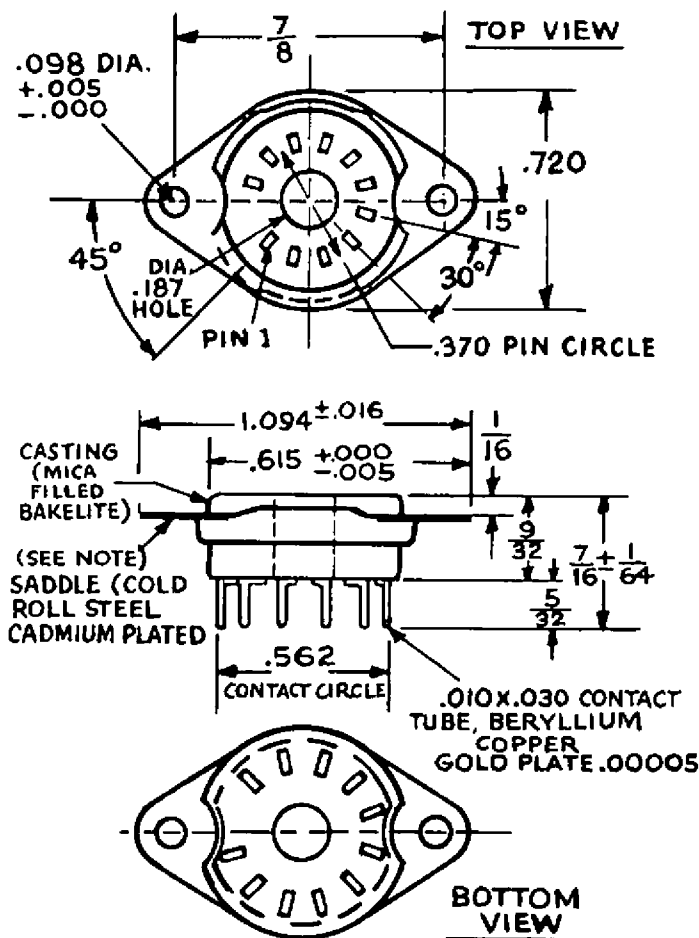
HUMAN ENGINEERED NUMBER SHAPES  
USED ON ALL TUBE TYPES

FIG. 3



BOTTOM VIEW

ENVELOPE CONNECTION DIAGRAM  
FIG. 2



CONTACT SOCKET ASSEMBLY SK 116  
FIG. 4

**Burroughs Corporation**

ELECTRONIC TUBE DIVISION

Plainfield, New Jersey

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# NUMERICAL INDICATOR



## engineering data report

### 7153

### (BD-206) SUPER NIXIE\*

The 7153 (BD-206) is a gas-filled, cold cathode, 10-digit ("0" through "9"), numerical indicator tube, having a common anode with a suppressor screen to minimize darkening of the viewing dome. This tube features a cup design providing a non-glare background. It is intended for use as a direct, in-line, readout device.

#### MECHANICAL DATA (SEE FIGURE 1)

|                                               |                                    |
|-----------------------------------------------|------------------------------------|
| Overall Length .....                          | 1.625" Max.                        |
| Seated Height .....                           | 1.325" Max.                        |
| Bulb Diameter .....                           | 1.350" Max.                        |
| Envelope Connections .....                    | See Figure 2                       |
| Height of Numerals .....                      | .808" Nom.                         |
| Numerical Design<br>(Human Engineering) ..... | See Figure 3                       |
| Socket, 13-Pin<br>(#HSK-106 or HSK-112) ..... | See Figure 4                       |
| Weight .....                                  | 1.0 oz. Max.                       |
| Mounting Position .....                       | See Note 1                         |
| Cathode(s) .....                              | Glow Discharge                     |
| Shock .....                                   | 350 G's (30° Hammer)               |
| Vibration .....                               | 10 G's, 60 Cps.                    |
| Temperature .....                             | -65° C. through<br>+70° C., Note 2 |
| Altitude .....                                | 70,000 Feet                        |

#### ELECTRICAL DATA

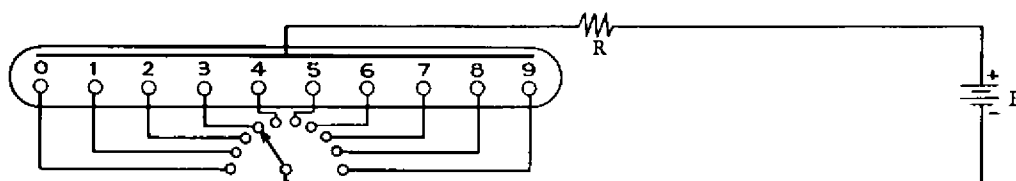
##### 1. ABSOLUTE RATINGS:

|                                  |                 |
|----------------------------------|-----------------|
| Ionization Voltage .....         | 250 Vdc Minimum |
| Anode Current                    |                 |
| Peak .....                       | 5.0 MA          |
| Average .....                    | 3.0 MA Max.     |
| Individual Cathode Wattage ..... | 0.8 Watts Max.  |

##### 2. TEST CONDITIONS: (See Typical Circuit)

|                             |                               |
|-----------------------------|-------------------------------|
| Anode Supply Voltage .....  | 250 Vdc                       |
| Anode Series Resistor ..... | 43 K Ohms                     |
| Anode Current .....         | 2.0 MA Min. to<br>3.0 MA Max. |

#### TYPICAL CIRCUIT



(SEE NOTE 3)

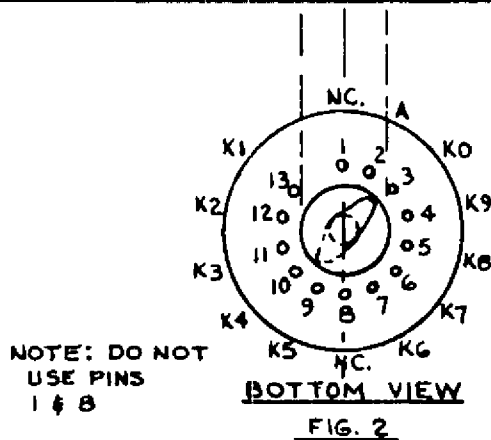
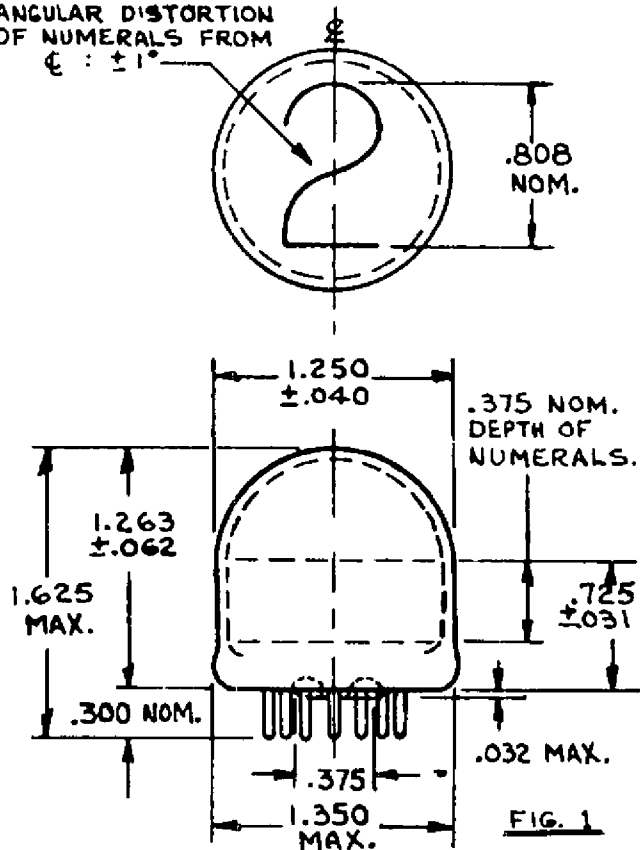
#### RECOMMENDED OPERATING CONDITIONS

| E    | R   |
|------|-----|
| 250V | 43K |
| 300V | 62K |

#### NOTES

- (1) The tube socket is oriented with respect to the viewing position so that A — A', intersecting the center of Pins 1 and 8 is vertical with Pin 8 on top. This orients the numerals in the correct vertical position. The numbers are viewed through the top of the tube.
- (2) From +30° C. to +70° C., no significant change in cathode current occurs. From +30° C. to -65° C. an increase in cathode (Up to 50%) may be expected.
- (3) Recommend highest voltage available be selected with corresponding series resistor.

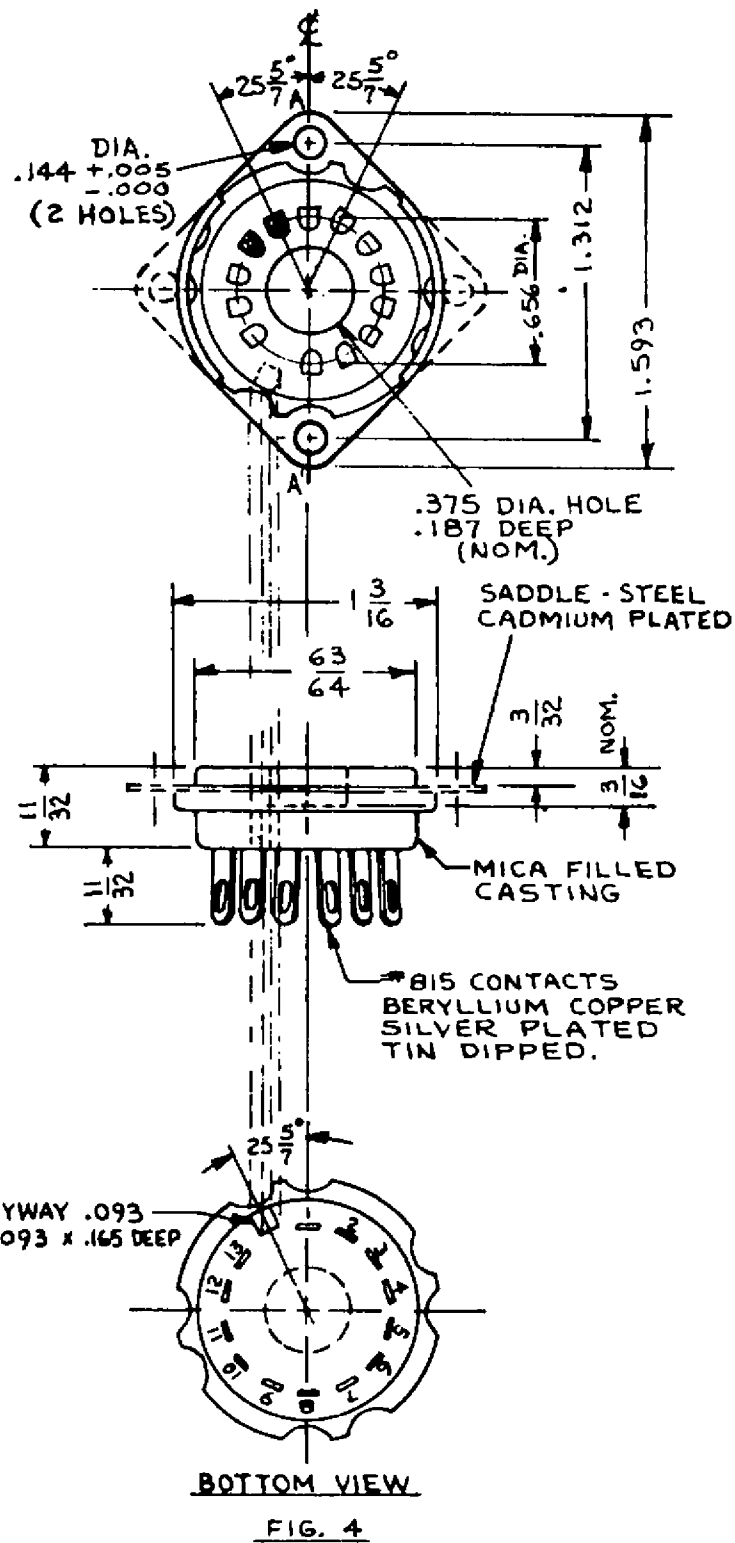
ANGULAR DISTORTION  
OF NUMERALS FROM  
 $\epsilon : \pm 1^\circ$



1234567890

(REF. WADC TR 54-160 APPENDIX PAGE 102)

FIG. 3



**Electronic Tube Division**  
BURROUGHS CORPORATION  
Plainfield, New Jersey

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# NUMERICAL INDICATOR



## engineering data report

# 7977

(B 4032) ULTRA LONG LIFE MINIATURE NIXIE<sup>®</sup> TUBE

The 7977 (B4032) is a gas-filled, cold cathode, 10 digit ("0" through "9"), miniature indicating tube, having a common anode. This tube is intended for use as a direct in-line readout device. The extremely long life of this indicator is an outstanding characteristic.

NUMERICAL INDICATOR  
TYPE 7977 (B 4032)

### MECHANICAL DATA

|                        |                                |
|------------------------|--------------------------------|
| Overall Length         | 1.175" Max.                    |
| Seated Height          | .940" Max.                     |
| Bulb Diameter          | .592" $\pm$ .031"              |
| Overall Diameter       | .680" Max.                     |
| Envelope Connections   | See Figure 2                   |
| Height Numerals        | 0.305" Nominal<br>See Figure 1 |
| Numeral Design         | See Figure 3                   |
| Socket (SK 116) 11 Pin | See Figure 4                   |
| Weight                 | 0.2 Oz. Max.                   |
| Mounting Position      | See Note 1                     |
| Cathode (s)            | Glow Discharge                 |

### ENVIRONMENTAL DATA

|                                      |                                             |
|--------------------------------------|---------------------------------------------|
| Temperature                          | -65°C to +65°C                              |
| Altitude                             | 70000 ft.                                   |
| Vibration                            | 10 to 500 cps.<br>0.06 in D.A.<br>or 10 G   |
| Applicable Government Specifications | MIL-STD 202A<br>Method 204<br>condition (A) |
| Shock                                | 55 G, 11 $\pm$ 1 m<br>sec.                  |

### ELECTRICAL DATA

#### 1. ABSOLUTE RATINGS:

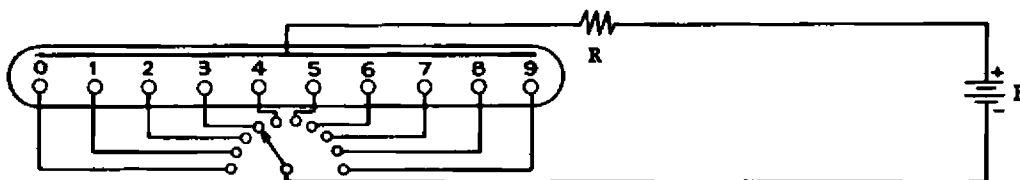
|                    |                             |
|--------------------|-----------------------------|
| Ionization Voltage | 170 V. Max.<br>(See Note 2) |
| Supply Voltage     | 170 V. Min.<br>(See Note 2) |
| Cathode Current    | 1.5 ma Max.<br>(See Note 3) |

#### 2. TEST CONDITIONS:

(See Typical Circuit) Note 5

|                           |                                  |
|---------------------------|----------------------------------|
| Supply Voltage (E)        | 170 Vdc                          |
| Series Resistor (R)       | 15 K $\pm$ 1%                    |
| Cathode Current ( $I_k$ ) | 1.05 ma $\pm$ 33%<br>(Note 4, 6) |

### TYPICAL CIRCUIT

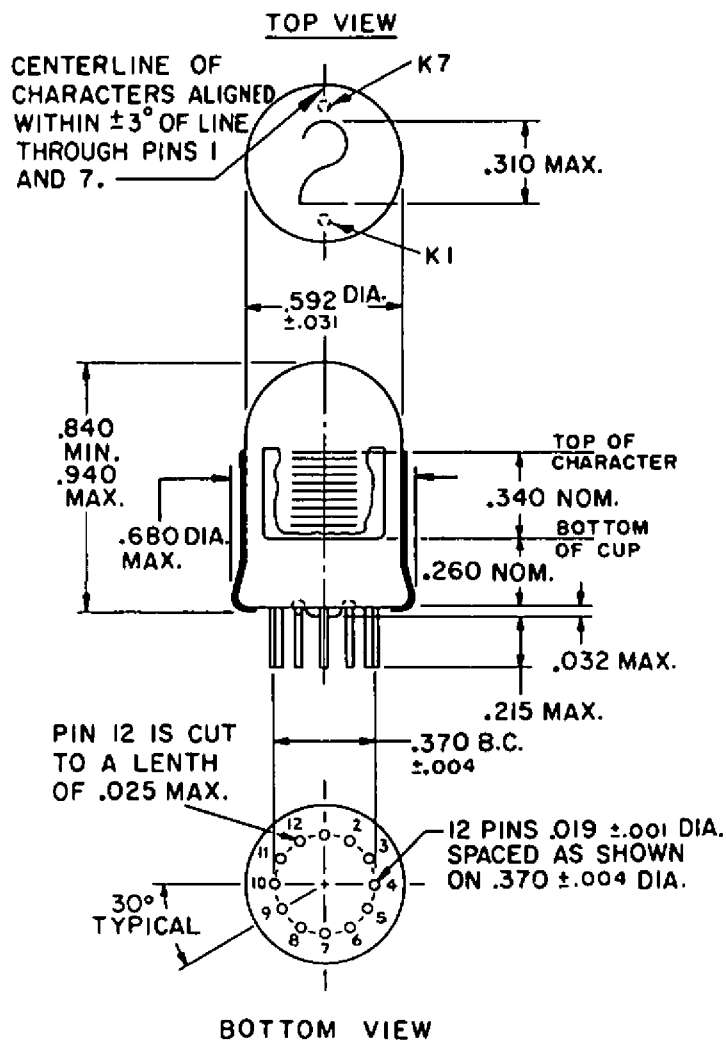


### RECOMMENDED OPERATING CONDITIONS

| E     | R     |
|-------|-------|
| 170 V | 15 K  |
| 250 V | 91 K  |
| 300 V | 150 K |

### NOTES

- (1) The tube socket is mounted with respect to the viewing position so that a line intersecting pins 1 & 7 is vertical with pin 7 on top. This orients the numbers in the correct viewing position. They are viewed through the top of the tube.
- (2) All 7977 tubes will ionize at 170 V. or less. The minimum supply voltage should be 170 V.; however, the use of the highest voltage available with the appropriate series resistor is recommended to maintain cathode current within the specified limits.
- (3) The section of the pins that protrudes above the base into the tube may glow when the corresponding cathode is energized. This glow is not harmful, however, and is hidden from view by the anode cup and the plastic sleeve around the tube.
- (4) When operated in test circuit current measured for each cathode in turn will be within specified limits.
- (5) Tubes may be driven by electronic switches. Consult representative or factory for recommended circuitry.
- (6) The selected character should glow over its entire surface when the test voltage is applied.



NOTE: TUBE NORMALLY SUPPLIED WITH .250 PINS. TUBES WITH LEADS, 1.140" LONG MAY BE OBTAINED BY ORDERING TUBES WITH SUFFIX L ADDED TO DESIGNATION, AS 7977 L

OUTLINE DRAWING  
FIG. 1

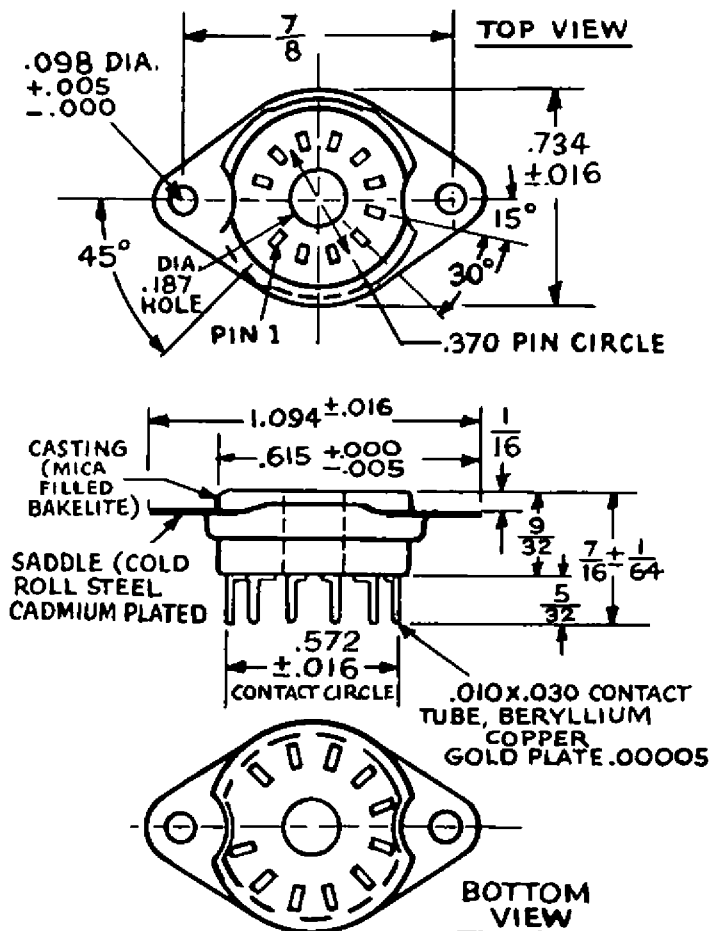
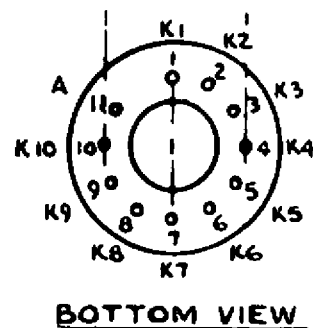
1234567890

NUMBER SHAPES USED ON ALL TUBE TYPES

LETTERS AND SPECIAL CHARACTERS  
ARE ALSO AVAILABLE ON REQUEST.

FIG. 3

ANOTHER ELECTRONIC CONTRIBUTION BY  
**Burroughs Corporation**  
ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY  
*Formerly Electronic Tube Division*



CONTACT SOCKET ASSEMBLY SK 116  
FIG. 4

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## 7977A

Bulletin No. 1047

October 15, 1963

### (B-4032A) Ultra Long Life NIXIE® Tube

The 7977A (B-4032A) is a gas filled, cold cathode, miniature size numerical indicating tube containing a common anode and ten metallic cathodes. The cathodes are formed in the shape of numerals (0-through 9). The tube is intended for use as a direct in-line readout device in areas of low or even dark ambient light.

#### ELECTRICAL DATA

##### ABSOLUTE RATINGS

Ionization Voltage . . . . . 170 Vdc max.  
Supply Voltage . . . . . 170 Vdc min.  
(Note 1)  
Cathode Current . . . . . 2.0 ma max.

##### TEST CONDITIONS (SEE FIGURE 1)

Supply Voltage (Ebb) . . . 170 Vdc (Note 3)  
Series Resistor (Rp) . . . . 15 K

##### TEST LIMITS (NOTE 2)

Cathode Current (Ik)  
(minimum) . . . . . 0.7 ma  
(maximum) . . . . . 1.4 ma

#### MECHANICAL DATA

Outline . . . . . See Figure 2  
Pin Connection . . . . . See Figure 3  
Mounting Position . . . . . See Figure 3  
Weight . . . . . 0.2 oz.

#### ENVIRONMENTAL DATA

Temperature . . . . . - 20°C to + 55°C  
(Note 2)  
Altitude . . . . . 70,000 ft. max.  
Vibration . . . . . (1) 10-50-10 cps  
.08" excursion  
(2) 50-500-50 cps  
10 G's acceleration  
T = 15 minutes (Note 4)  
Shock . . . . . (1) 250 G's 1 ± .5 millisec.  
duration  
(2) 50 G's 11 ± 1 milli-  
sec. duration (Notes 5  
and 6)

#### NOTES:

1. The minimum supply voltage should be 170 volts. However, the use of the highest available voltage with appropriate series resistor is recommended to maintain cathode current within specified limits. A supply voltage of 200 volts or more is recommended to assure proper operation at the temperature extremes.
2. At temperatures above and below 25°C changes in cathode current can be expected.
3. Under the specified test conditions, the tube will ionize in total darkness.
4. For this test, tubes are mounted in each of three planes, X-1, X-2, and Y-1, for one-third of the total excitation time. On each plane, the ten cathodes are energized sequentially at the test conditions.
5. Shock test may be performed on any shock machine capable of producing a half sine wave shock form of the specified duration and amplitude.
6. Each tube is subjected to a total of 20 shocks, 5 shocks in each of positions X-1, X-2, Y-1, and Y-2, in any sequence.

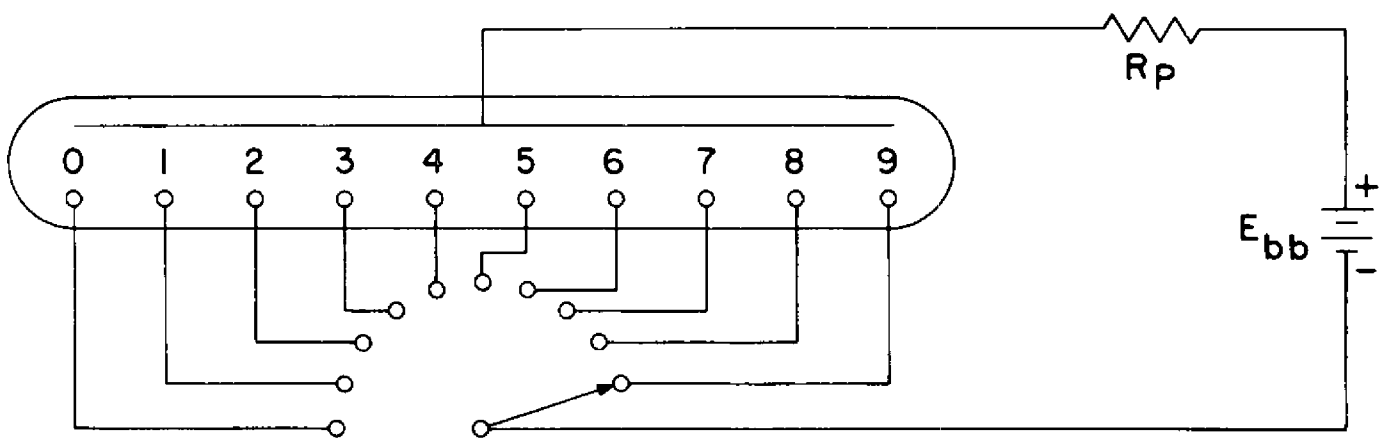


Fig. 1. TEST CIRCUIT

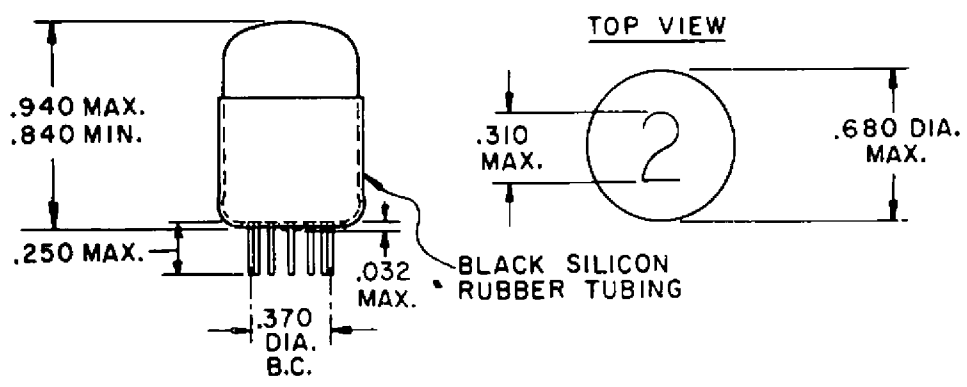
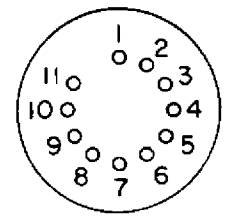


FIG. 2 OUTLINE DRAWING

| PIN NO. | CHARACTER |
|---------|-----------|
| 1       | NUMERAL 1 |
| 2       | NUMERAL 2 |
| 3       | NUMERAL 3 |
| 4       | NUMERAL 4 |
| 5       | NUMERAL 5 |
| 6       | NUMERAL 6 |
| 7       | NUMERAL 7 |
| 8       | NUMERAL 8 |
| 9       | NUMERAL 9 |
| 10      | NUMERAL 0 |
| 11      | ANODE     |



BOTTOM VIEW

FOR PROPER VIEWING, TUBE SHOULD BE MOUNTED WITH PINS 1 AND 7 VERTICALLY ALIGNED WITH PIN 7 AT THE TOP.

FIG. 3. PIN CONNECTIONS

# NUMERICAL INDICATOR

## engineering data report



# 8037

(B 5031) ULTRA LONG LIFE NIXIE<sup>®</sup> TUBE

The 8037 (B 5031) is a gas-filled, cold cathode, 10-digit ("0" through "9"), numerical indicator tube, having a common anode with a suppressor screen to minimize darkening of the viewing dome. This tube features a cup design providing a non-glare background. It is intended for use as a direct, in-line, readout device.

### MECHANICAL DATA (See Figure 1)

Overall Length . . . . . 1.380" max.  
Seated Height . . . . . 1.124" max.  
Bulb Diameter . . . . . 1.080" max.  
Envelope Connection . . . . . See Figure 2  
Height of Numerals . . . . . .61" nom.  
Numerical Design . . . . . See Figure 3  
Socket, 13-Pin  
(HSK-112) . . . . . See Figure 4  
Weight . . . . . 0.4 oz. max.  
Mounting Position . . . . . See Note 4  
Cathode (s) . . . . . Glow Discharge

### ENVIRONMENTAL DATA

Temperature . . . . . -65° to +85° C  
Note 5  
Altitude . . . . . 70,000 ft.  
Vibration . . . . . 10 - 50 cps  
0.08 in.  
excursion  
Shock . . . . . 55 g 11 ± 1 msec

### ELECTRICAL DATA

#### 1. ABSOLUTE RATINGS:

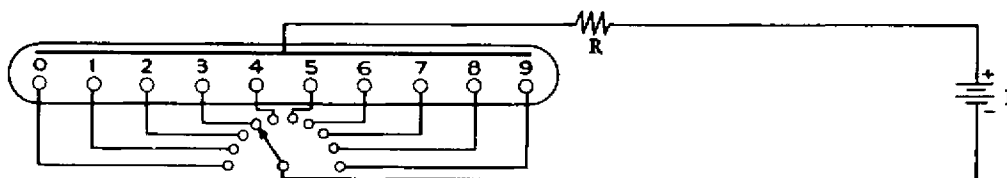
Ionization Voltage . . . . . 170 Vdc Maximum  
Supply Voltage . . . . . 170 Vdc Minimum  
Note 1  
Cathode Current . . . . . 3.0 ma Maximum  
Note 2

#### 2. TEST CONDITIONS:

(See Typical Circuit) Note 3

Anode Supply Voltage (E) . . . 170 Vdc  
Anode Series Resistor (R) . . . 10 K ohms ± 1%  
Cathode Current ( $I_k$ ) . . . . . 2.25 ma ± 33%

### TYPICAL CIRCUIT



(SEE NOTE 3)

### TYPICAL OPERATING CONDITIONS

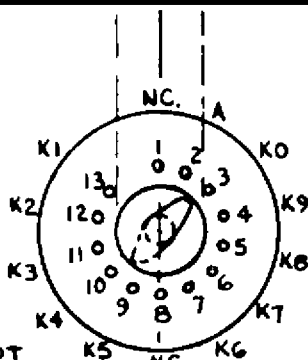
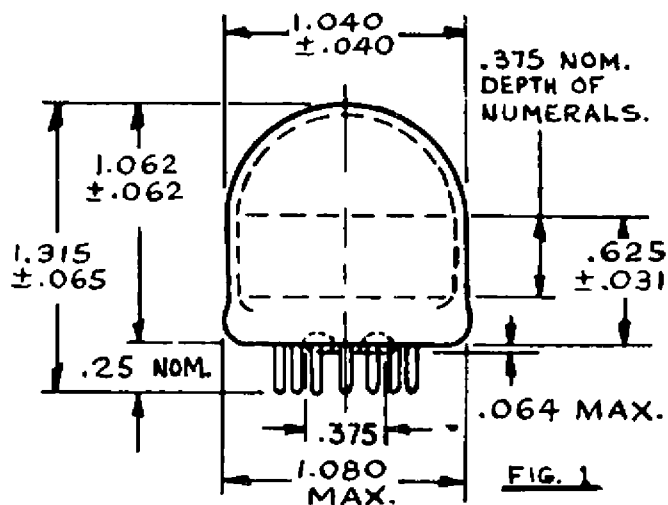
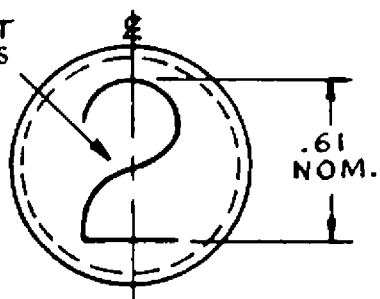
| E     | R         |
|-------|-----------|
| 170 V | 10 K ohm  |
| 250 V | 47 K ohm  |
| 300 V | 110 K ohm |

### NOTES

1. All 8037 tubes will ionize at 170 volts or less. The minimum supply voltage should be 170 Vdc; however, the use of the highest voltage available with the appropriate series resistor is recommended.
2. For pulsed or time sharing operation of the tube, the maximum cathode current rating corresponds to the peak pulse current. At currents exceeding this limit, the tube pins or cathode leads can glow.
3. With the tube operated in the test circuit and with the specified anode supply voltage and series resistance, the cathode current will be within the specified test limits. If an anode supply voltage greater than the minimum specified is available, it can be used with a correspondingly larger series resistance so that cathode current remains between the specified limits.
4. The centerline of the numbers to be displayed passes through pins 1 and 8 of the tube. The tube and socket should be oriented so that pins 1 and 8 are in a vertical line with pin 8 at the top. The numbers are viewed through the end of the tube opposite from the base.
5. At -65° C cathode current may increase by 60% or decrease by 50%.  
At +85° C cathode current may decrease by 50%.
6. The selected character should glow over its entire surface when the test voltage is applied.

NUMERICAL INDICATOR  
TYPE 8037 (B5031)

ANGULAR  
DISPLACEMENT  
OF NUMERALS  
FROM  
E: 3° MAX.



NOTE: DO NOT  
USE PINS  
1 & 8

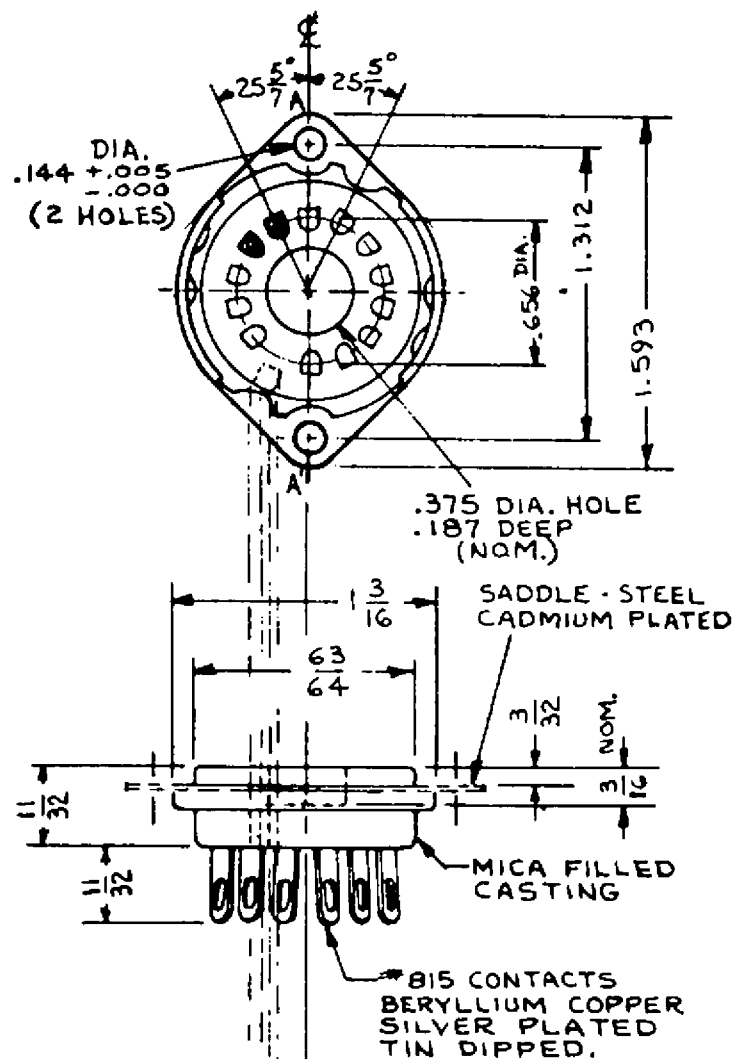
BOTTOM VIEW

FIG. 2

1234567890

(REF. WADC TR 54-160 APPENDIX PAGE 102)

FIG. 3



BOTTOM VIEW

BURROUGHS PART No. SK-112

FIG. 4

ANOTHER ELECTRONIC CONTRIBUTION BY  
**Burroughs Corporation**  
ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY  
Formerly Electronic Tube Division

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Phone: PLainfield 7-5000.

# Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION

PLAINFIELD, NEW JERSEY

## NUMERICAL INDICATOR Engineering Data Report

Bulletin No. 1028

January 1, 1963

8421

(B5092) Ultra Long Life NIXIE<sup>R</sup> Tube

The 8421 (B5092) is a gas-filled, cold cathode, standard size numerical indicating tube containing a common anode and ten metallic cathodes. The cathodes are formed in the shape of numerals ("0" through "9"). The tube is intended for use as a direct in-line readout device.

### MECHANICAL DATA

Overall Length . . . . . 1.380 Max.  
Seated Height . . . . . 1.124 Max.  
Bulb Diameter . . . . . 1.080 Max.  
Numeral Height . . . . . .610 Nominal  
Pin Connection . . . . . See figure 3  
Mounting Position . . . . . See note 2  
Weight . . . . . .4 oz. nom.

### ELECTRICAL DATA

#### Absolute Ratings

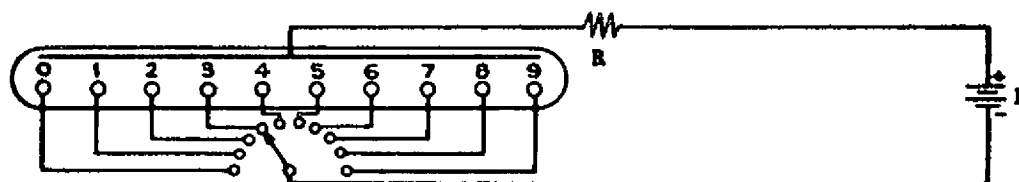
Ionization Voltage . . 170 Vdc Max.  
Supply Voltage . . . . 170 Vdc Min.  
(Note 1)  
Cathode Current . . . . 3.5 ma Max.

#### Test Conditions

Supply Voltage (E) . . 170 Vdc  
Series Resistor (R) . . 10 K  
Cathode Current ( $I_k$ )  
(minimum) . . . . . 1.5 ma  
(maximum) . . . . . 3.0 ma

### ENVIRONMENTAL DATA

Temperature . . . . . -65° C. to +85° C.  
Altitude . . . . . 70,000 ft.



| E     | R    |
|-------|------|
| 170 V | 10 K |
| 200 V | 24 K |
| 250 V | 56 K |
| 300 V | 82 K |

Figure 1. Basic Circuit

### NOTES

1. The minimum supply voltage should be 170 volts. However, the use of the highest available voltage with the appropriate series resistor is recommended to maintain cathode current within the specified limits. A supply voltage of 200 volts or more is recommended to assure proper operation at the temperature extremes.
2. The tube should be oriented with pins 1 and 8 in a vertical line with pin 8 at the top.



# Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY

Bulletin No. 1027

NUMERICAL INDICATOR  
Engineering Data Report

January 1, 1963

## 8422

(B5991) Ultra Long Life Rectangular NIXIE<sup>R</sup> Tube

The 8422 (B5991) is a gas-filled, cold-cathode, rectangular numerical indicating tube containing a common anode and ten metallic cathodes. The cathodes are formed in the shape of numerals ("0" through "9"). The tube is intended for use as a direct in-line readout device. The width and depth of this tube are approximately 75% of standard size cylindrical types permitting side by side stacking in a minimum of panel space with no sacrifice in readability.

### MECHANICAL DATA

|                             |              |
|-----------------------------|--------------|
| Overall Length . . . . .    | 1.120 Max.   |
| Seated Height . . . . .     | .862 Max.    |
| Bulb Width . . . . .        | .790 Max.    |
| Bulb Length . . . . .       | 1.020 Max.   |
| Numeral Height . . . . .    | .610 Nominal |
| Pin Connection . . . . .    | See figure 3 |
| Mounting Position . . . . . | See note 2   |
| Weight . . . . .            | .3 oz. nom.  |

### ELECTRICAL DATA

#### Absolute Ratings

|                              |                          |
|------------------------------|--------------------------|
| Ionization Voltage . . . . . | 170 Vdc Max.             |
| Supply Voltage . . . . .     | 170 Vdc Min.<br>(Note 1) |
| Cathode Current . . . . .    | 3.5 ma max.              |

#### Test Conditions (See Figure 1)

|                                        |         |
|----------------------------------------|---------|
| Supply Voltage (E) . . . . .           | 170 Vdc |
| Series Resistor (R) . . . . .          | 8.2 K   |
| Cathode Current<br>(Minimum) . . . . . | 1.5 ma  |
| (Maximum) . . . . .                    | 3.0 ma  |

### ENVIRONMENTAL DATA

|                       |                             |
|-----------------------|-----------------------------|
| Temperature . . . . . | -65° C. to +70° C. (Note 1) |
| Altitude . . . . .    | 70,000 feet                 |

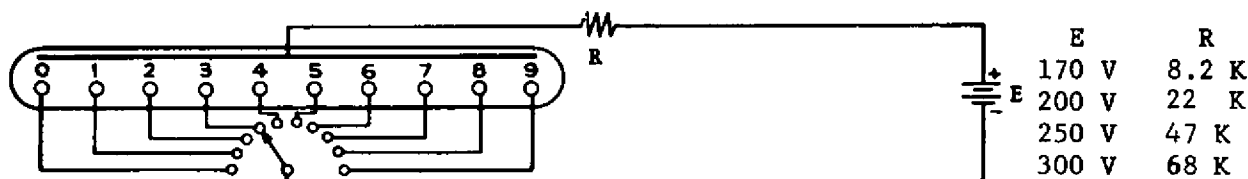


FIGURE 1. Basic Circuit

### NOTES

1. The minimum supply voltage should be 170 volts. However, the use of highest available voltage with the appropriate series resistor is recommended to maintain cathode current within the specified limits. A supply voltage of 200 volts or more is recommended to assure proper operation at the temperature extremes.
2. The center line of the numbers to be displayed passes through pins 6 and 12 of the tube. The tube socket should be oriented so that pins 6 and 12 are in a vertical line with pin 12 at the top.

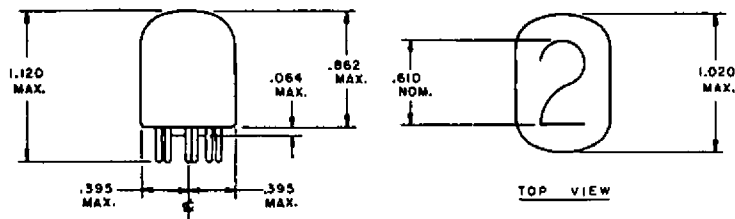


Figure 2. OUTLINE DRAWING

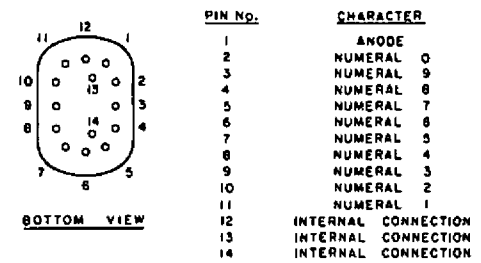


Figure 3. PIN CONNECTIONS

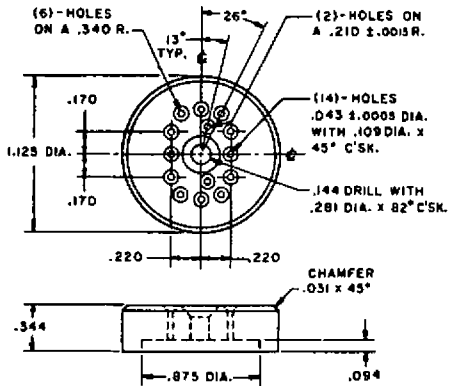


Figure 4. PIN STRAIGHTENER, LS-210

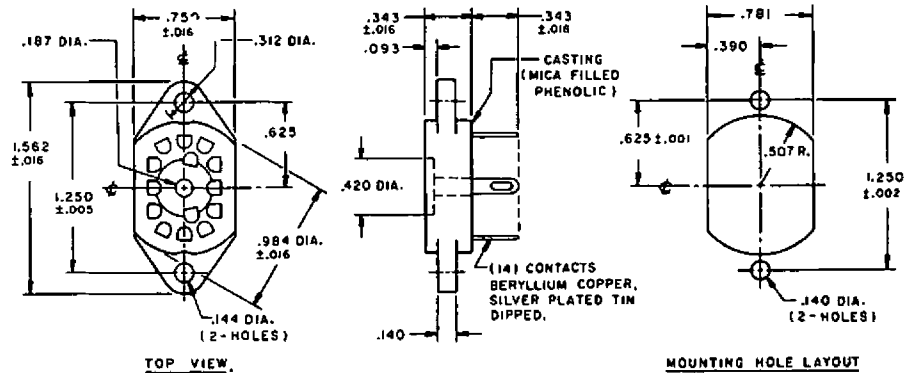


Figure 5. GENERAL PURPOSE SOCKET, SK-136

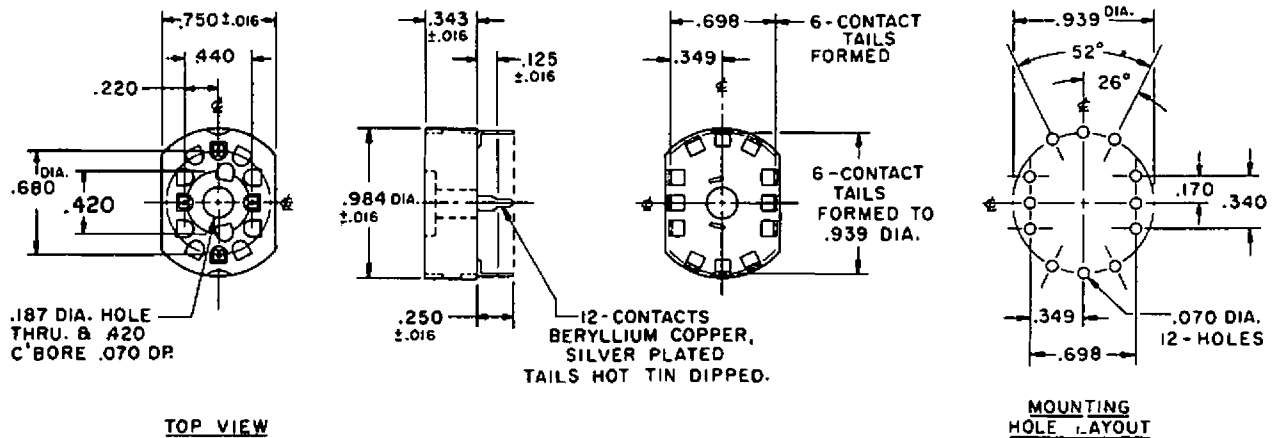


Figure 6. PRINTED CIRCUIT SOCKET, SK-144

ANOTHER ELECTRONIC CONTRIBUTION BY  
**Burroughs Corporation**  
 ELECTRONIC COMPONENTS DIVISION  
 PLAINFIELD, NEW JERSEY

# Burroughs Corporation

ELECTRONIC COMPONENTS DIVISION  
PLAINFIELD, NEW JERSEY

Bulletin No. 1029

January 1, 1963

## NUMERICAL INDICATOR Engineering Data Report

# 8423

(B6091) Ultra Long Life NIXIE<sup>R</sup> Tube

The 8423 (B6091) is a gas-filled, cold-cathode, super size numerical indicating tube containing a common anode and ten individual metallic cathodes. The cathodes are formed in the shape of numerals ("0" through "9"). This tube is intended for use as a direct, in-line, readout device.

### MECHANICAL DATA

Overall Length . . . . . 1.522 Max.  
Seated Height . . . . . 1.212 Max.  
Bulb Diameter . . . . . 1.350 Max.  
Numeral Height . . . . . .805 Nominal  
Pin Connection . . . . . See figure 3  
Mounting Position. . . . . See Note 2  
Weight . . . . . .8 oz. nom.

### ENVIRONMENTAL DATA

Temperature . . . . . -65° C. to +85° C.  
Altitude . . . . . 70,000 ft.

### ELECTRICAL DATA

#### Absolute Ratings

Ionization Voltage . . . 170 Vdc Max.  
Supply Voltage . . . . 170 Vdc Min.  
(Note 1)  
Cathode Current . . . . 4.5 ma Max.

#### Test Conditions

Supply Voltage (E) . . . 170 Vdc  
Series Resistor (R) . . . 6.8 K  
Cathode Current (Ik)  
(Minimum) . . . . . 1.5  
(Maximum) . . . . . 4.0

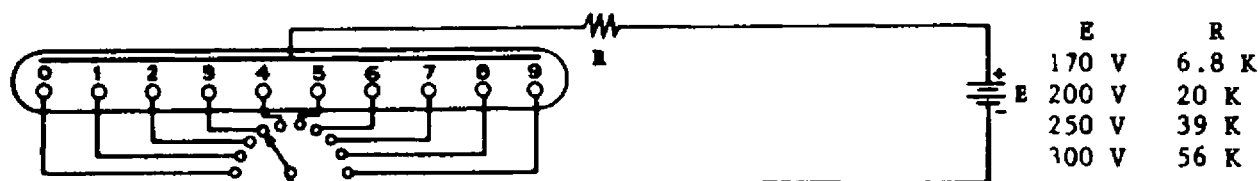


FIGURE 1. BASIC CIRCUIT

### NOTES

1. The minimum supply voltage should be 170 volts. However, the use of the highest available voltage with the appropriate series resistor is recommended to maintain cathode current within the specified limits. A supply voltage of 200 volts or more is recommended to assure proper operation at the temperature extremes.
2. Tubes should be mounted with pins 1 and 8 in a vertical line with pin 8 at the top.

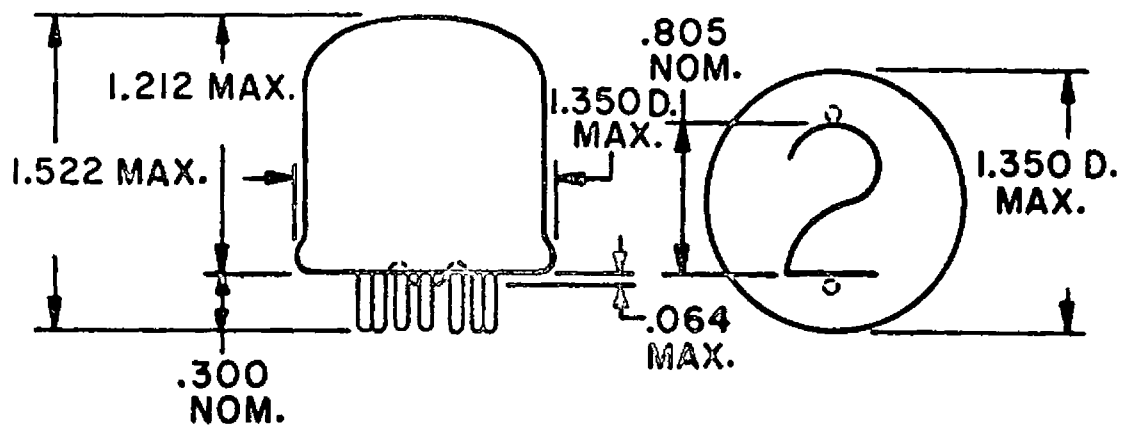
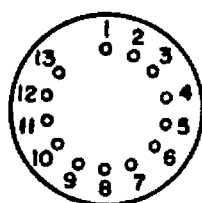


FIGURE 2. OUTLINE DRAWING



BOTTOM VIEW

| PIN NO. | CHARACTERS          |
|---------|---------------------|
| 1       | INTERNAL CONNECTION |
| 2       | ANODE               |
| 3       | 0                   |
| 4       | 9                   |
| 5       | 8                   |
| 6       | 7                   |
| 7       | 6                   |
| 8       | INTERNAL CONNECTION |
| 9       | 5                   |
| 10      | 4                   |
| 11      | 3                   |
| 12      | 2                   |
| 13      | 1                   |

FIGURE 3. PIN CONNECTIONS

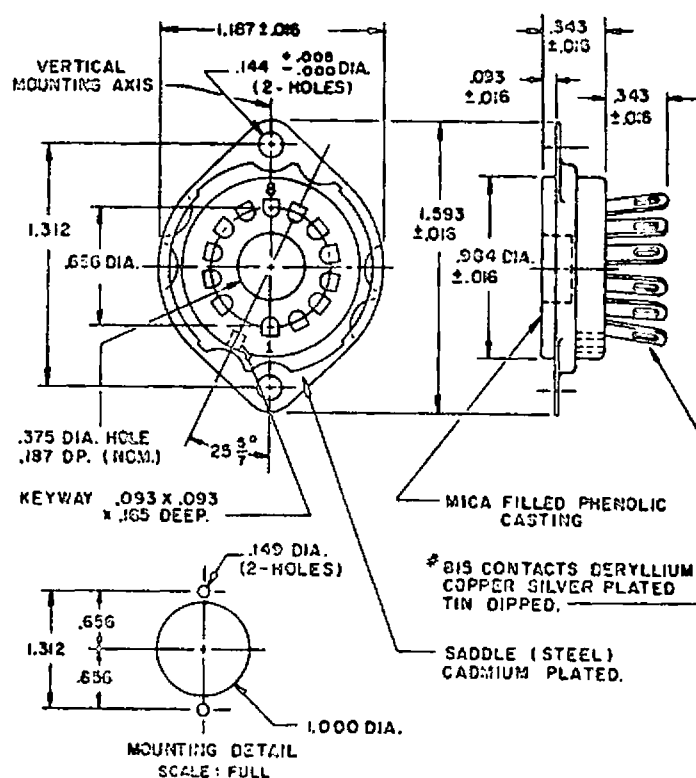
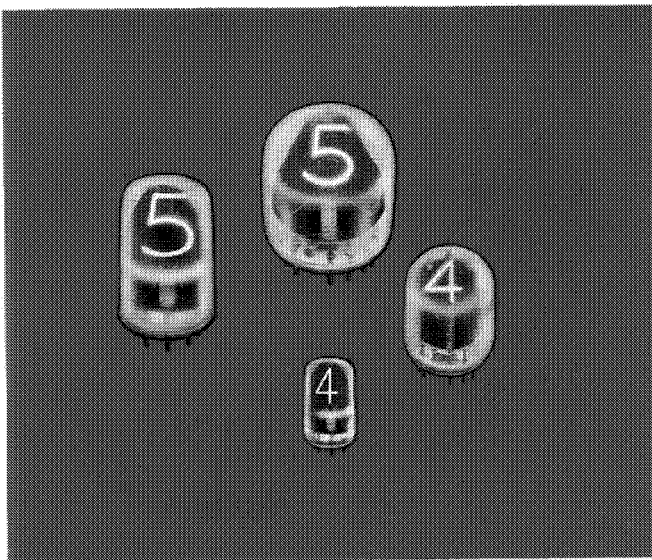


FIGURE 4. GENERAL PURPOSE SOCKET, SK-112



## MINIATURE NIXIE® INDICATOR TUBES

Available in rectangular and round configurations. Use for airborne and mobile equipment readouts and small lightweight instruments.

Character Size . . . . . 0.3"

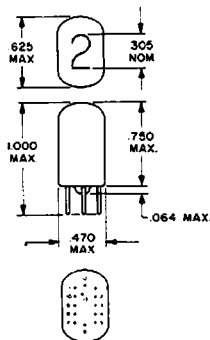
Viewing Distance . . . . . 14.0"

## STANDARD NIXIE INDICATOR TUBES

Available in round and rectangular configurations. Use for desk top displays and bench test equipment.

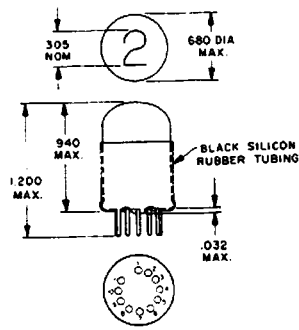
Character Size . . . . . 0.6"

Viewing Distance . . . . . 30.0"



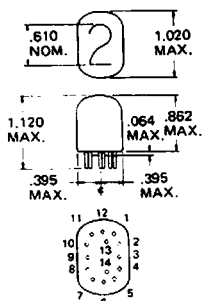
Type B4998 (Rectangular)  
**PIN CONNECTIONS**  
Pin No. Numeral

|     |       |
|-----|-------|
| 1-  | 2     |
| 2-  | 3     |
| 3-  | 4     |
| 4-  | 5     |
| 5-  | 6     |
| 6-  | 1C    |
| 7-  | 7     |
| 8-  | 8     |
| 9-  | 9     |
| 10- | 0     |
| 11- | anode |
| 12- | 1     |
| 13- | 1C    |



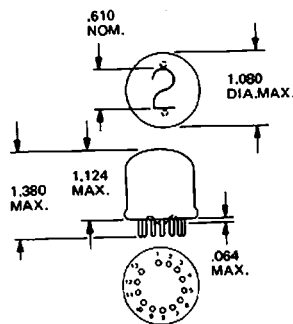
Type B4032 (7977) (round)  
**PIN CONNECTIONS**  
Pin No. Numeral

|     |   |
|-----|---|
| 1-  | 1 |
| 2-  | 2 |
| 3-  | 3 |
| 4-  | 4 |
| 5-  | 5 |
| 6-  | 6 |
| 7-  | 7 |
| 8-  | 8 |
| 9-  | 9 |
| 10- | 0 |



Type B5991 (8422) (rectangular)  
**PIN CONNECTIONS**  
Pin No. Numeral

|     |       |
|-----|-------|
| 1-  | anode |
| 2-  | 0     |
| 3-  | 9     |
| 4-  | 8     |
| 5-  | 7     |
| 6-  | 6     |
| 7-  | 5     |
| 8-  | 4     |
| 9-  | 3     |
| 10- | 2     |
| 11- | 1     |
| 12- | 1C    |
| 13- | 1C    |
| 14- | 1C    |



Type B5092 (8421) (round)  
**PIN CONNECTIONS**  
Pin No. Numeral

|     |       |
|-----|-------|
| 1-  | 1C    |
| 2-  | anode |
| 3-  | 0     |
| 4-  | 9     |
| 5-  | 8     |
| 6-  | 7     |
| 7-  | 6     |
| 8-  | 1C    |
| 9-  | 5     |
| 10- | 4     |
| 11- | 3     |
| 12- | 2     |
| 13- | 1     |

### ELECTRICAL DATA/MINIATURE TUBES (See Note 1)

|                          | B4998<br>Rectangular | B4032<br>(7977)<br>Round |
|--------------------------|----------------------|--------------------------|
| <b>Absolute Ratings</b>  |                      |                          |
| Ionization Voltage (Max) | 170 Vdc              | 170 Vdc                  |
| Supply Voltage (Min)     | 170 Vdc              | 170 Vdc                  |
| Cathode Current (Peak)   | 2.5 ma               | 2.0 ma                   |
| <b>Test Conditions</b>   |                      |                          |
| Supply Voltage           | 170 Vdc              | 170 Vdc                  |
| Series Resistor          | 15 K                 | 15 K                     |
| Cathode Current (Min)    | 1.0 ma               | 0.7 ma                   |
| (Max)                    | 2.0 ma               | 1.4 ma                   |
| <b>Sockets</b>           |                      |                          |
| Standard Wiring          | SK176                | SK116A                   |
| Printed Circuit          | SK178                | SK118A                   |

### ELECTRICAL DATA/STANDARD TUBES (See Note 1)

|                          | B5991<br>(8422)<br>Rectangular | B5092<br>(8421)<br>Round |
|--------------------------|--------------------------------|--------------------------|
| <b>Absolute Ratings</b>  |                                |                          |
| Ionization Voltage (Max) | 170 Vdc                        | 170 Vdc                  |
| Supply Voltage (Min)     | 170 Vdc                        | 170 Vdc                  |
| Cathode Current (Peak)   | 3.5 ma                         | 3.5 ma                   |
| <b>Test Conditions</b>   |                                |                          |
| Supply Voltage           | 170 Vdc                        | 170 Vdc                  |
| Series Resistor          | 8.2K                           | 10K                      |
| Cathode Current (Min)    | 1.5 ma                         | 1.5 ma                   |
| (Max)                    | 3.0 ma                         | 3.0 ma                   |
| <b>Sockets</b>           |                                |                          |
| Standard Wiring          | SK169                          | SK112                    |
| Printed Circuit          | SK144                          | SK130                    |

### NOTES

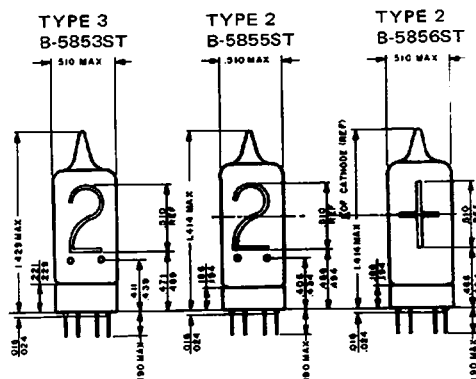
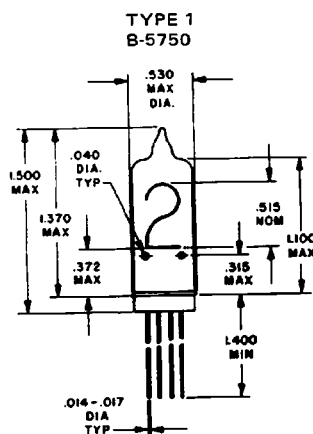
1. The minimum supply voltage should be +170 Vdc, however, the use of the highest voltage available with an appropriate series resistor is recommended to provide: 1) greater tolerance of B+ & Rp; 2) more uniform brightness; 3) more constant current operation; 4) improved operation with temperature and 5) improved life.
2. Special NIXIE tubes such as regular life wide angle types and weldable or tin dipped flying lead types are also available.
3. Special character NIXIE tubes such as + and - tubes, tubes with alphabet characters, and symbols ( $\mu$ , mV) are also available.

## LOW PRICED SIDE-VIEWING NIXIE INDICATOR TUBES

The low priced series NIXIE tubes are ultra-long life, high quality, cold-cathode indicator tubes having a common anode. They can display the numerals 0-9 and have two decimal points inside the tube (right and left of the numerals) which are independently operable. The numeral aspect ratio (height to width) has been designed to provide the optimum in readability and viewing distance. The small diameter of these tubes (0.530" max) permits 0.540" center-to-center mounting and their short seated height allows for minimal instrument panel dimensions. The B-5750 NIXIE tube is a low pressure device designed for d-c operation. It is not electrically interchangeable with the high pressure B-5755, B-5855, and B-5859 NIXIE tubes.

Character Size ..... 0.5"

Viewing Distance ..... 24.0'



Tube Outline Dimension Chart

## LOW COST SERIES NIXIE TUBES SPECIFICATIONS

| CONDITION                                    | B-5750                         | B-5853                       | B-5855                  |
|----------------------------------------------|--------------------------------|------------------------------|-------------------------|
| <b>Absolute Ratings</b>                      |                                |                              |                         |
| Ionization Voltage .....                     | 170Vdc max .....               | 170Vdc max .....             | 170Vdc max              |
| Supply Voltage .....                         | 170Vdc min .....               | 170Vdc min .....             | 180Vdc min              |
| Peak Anode Current .....                     | 15ma max .....                 | 17ma max .....               | 17ma max                |
| Anode Current (D.C.) .....                   | 4.5ma max .....                | — .....                      | —                       |
| Decimal Point Current .....                  | 0.3ma .....                    | 3ma peak .....               | 3ma peak                |
| Cathode Prebias .....                        | 60Vdc to 120Vdc .....          | — .....                      | —                       |
| Average Total Power Dissipation .....        | 0.5 watts .....                | 0.5 watts .....              | 0.5 watts               |
| <b>Typical Operating Conditions (Note 1)</b> |                                |                              |                         |
| Supply Voltage .....                         | 170Vdc (7.5 K $\Omega$ ) ..... | 170Vdc .....                 | 200Vdc nom              |
| Peak Anode Current .....                     | 2.6ma typ .....                | 14ma typ .....               | 14ma typ                |
| Pulse Durations .....                        | — .....                        | 100 $\mu$ s .....            | 100 $\mu$ s             |
| Duty Cycle .....                             | — .....                        | 5% .....                     | 5%                      |
| CONDITION                                    | B-5856                         | B-5859                       | B-5870                  |
| <b>Absolute Ratings</b>                      |                                |                              |                         |
| Ionization Voltage .....                     | 170Vdc max .....               | 170Vdc max .....             | 170Vdc max              |
| Supply Voltage .....                         | 170Vdc min .....               | 170Vdc min .....             | 170Vdc min              |
| Peak Anode Current .....                     | — .....                        | — .....                      | —                       |
| Anode Current (D.C.) .....                   | 2.8ma max .....                | 5.0ma max .....              | 4.5ma max               |
| Decimal Point Current .....                  | — .....                        | 0.1ma to 0.5ma .....         | —                       |
| Cathode Prebias .....                        | 60Vdc to 110Vdc .....          | 60Vdc to 110Vdc .....        | 60Vdc to 110 Vdc        |
| Average Total Power Dissipation .....        | 0.5 watts .....                | 0.5 watts .....              | 0.5 watts               |
| <b>Typical Operating Conditions (Note 1)</b> |                                |                              |                         |
| Supply Voltage .....                         | 170Vdc (15K $\Omega$ ) .....   | 170Vdc (10K $\Omega$ ) ..... | 170Vdc (7.5K $\Omega$ ) |
| Anode Current (D.C.) .....                   | 2.0ma typ .....                | 3.4ma typ .....              | 3.2ma typ               |
| Pulse Durations .....                        | — .....                        | — .....                      | —                       |
| Duty Cycle .....                             | — .....                        | — .....                      | —                       |

### NOTE

1. The minimum supply voltage should be 170Vdc, however, the use of the highest voltage available with an appropriate series resistor is recommended. Typical load lines are 170Vdc-10K $\Omega$ , 200Vdc-22K $\Omega$ , 250Vdc-43K $\Omega$ , and 300Vdc-62K $\Omega$ . When choosing a load line other than the ones indicated, it should be chosen such that  $I_A$  is equal to or greater than the nominal operating current.

(continued from page 6)

### PIN CONNECTIONS — B5750

|                 | PIN NO. | CONNECTION |
|-----------------|---------|------------|
| 7 ● ●6          | 1—      | Numeral 1  |
| 8 ● ●5          | 2—      | Numeral 2  |
| 14 ● 9 ● ●4 ●13 | 3—      | Numeral 3  |
| 10 ● ●3         | 4—      | Numeral 4  |
| 11 ● ●2         | 5—      | Numeral 5  |
| 12 ● ●1         | 6—      | Numeral 6  |
|                 | 7—      | Anode      |
|                 | 8—      | Numeral 7  |
|                 | 9—      | Numeral 8  |
|                 | 10—     | Anode*     |
|                 | 11—     | Numeral 9  |
|                 | 12—     | Numeral 0  |
|                 | 13—     | Rt Dec Pt  |
|                 | 14—     | Lft Dec Pt |

BASING DIAGRAM  
BOTTOM VIEW

\*Pin 10 removed from B-5850 Series.

### TUBE DESCRIPTIONS

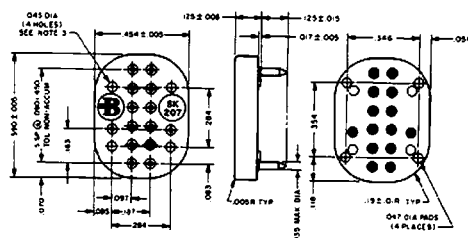
| TYPE              | PRES-SURE | OPER-ATION                    | FORMAT                   | INTER-CHANGE WITH |
|-------------------|-----------|-------------------------------|--------------------------|-------------------|
| B-5750... I ....  | Low..     | D.C. ....                     | 0-9 with d.p. on each .. | None              |
| B-5755... I ....  | High..    | Pulsed .....                  | side of numeral.         | None              |
| B-5853... III ..  | High..    | Pulsed .....                  | "                        | B-5855            |
| B-5855... II .... | High..    | Pulsed .....                  | "                        | None              |
| B-5859... II .... | High..    | D.C. ....                     | "                        | None              |
| B-5870... III ... | High..    | D.C. ....                     | "                        | B-5859/<br>B-5870 |
| B-5856 .. II ...  | Low ..    | D.C. ....                     | (±) plus/minus .....     | None              |
| B-5866 .. III ... | Low ..    | Pulsed/DC(±) plus/minus ..... | "                        | B-5856            |

The above tube type numbers are for long lead versions. For short lead versions, the following suffixes should be used.

S—tube with minimum thickness spacer (0.130" max) and leads cut to 0.190" max.

ST—tube with thick spacer that makes them mechanically interchangeable with B-5755S.

SK-207



The SK-207 Sockets are intended for use with Burroughs B-5750S and B-5850S series NIXIE® tubes.



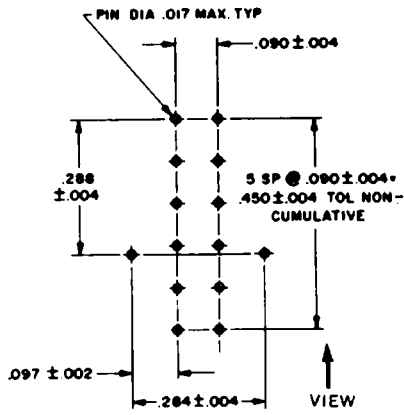


Figure 2. PIN LAYOUT (TOP VIEW)

| PIN | CONNECTIONS |
|-----|-------------|
| 1   | NUMERAL 1   |
| 2   | NUMERAL 2   |
| 3   | NUMERAL 3   |
| 4   | NUMERAL 4   |
| 5   | NUMERAL 5   |
| 6   | NUMERAL 6   |
| 7   | ANODE *     |
| 8   | NUMERAL 7   |
| 9   | NUMERAL 8   |
| 10  | ANODE *     |
| 11  | NUMERAL 9   |
| 12  | NUMERAL 0   |
| 13  | RT DEC PT   |
| 14  | LFT DEC PT  |

\*Anode pins are connected internally

Table 1. PIN CONNECTIONS

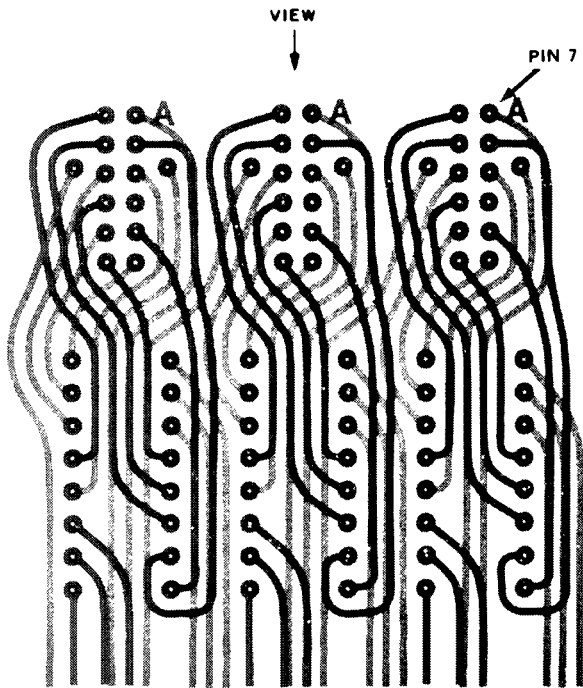


Figure 3a. P.C. LAYOUT WITH FAIRCHILD 9960 (TOP VIEW)  
(9960 notch away from viewer)

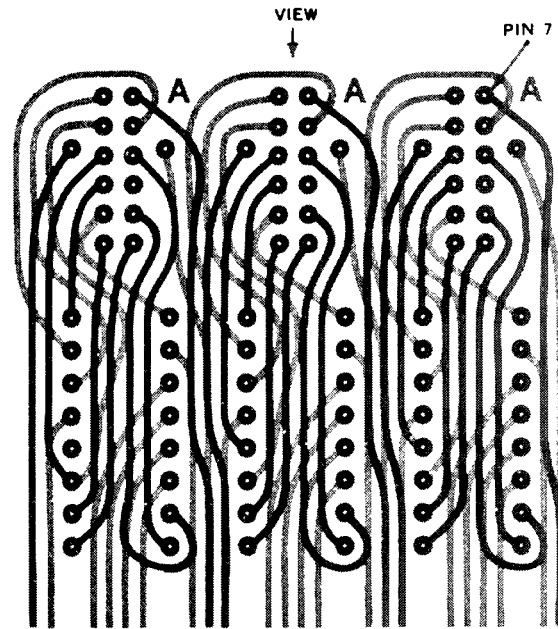


Figure 3b. P.C. LAYOUT WITH TEXAS INSTRUMENTS SN-7441N (TOP VIEW)

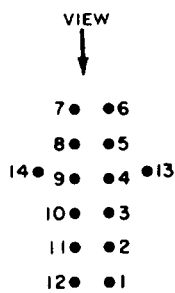
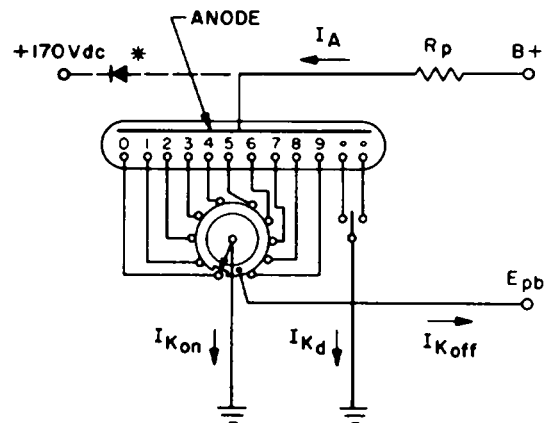


Figure 4. BASING DIAGRAM (BOTTOM VIEW)



\* To test for Ionization at +170 Vdc

Figure 5. TEST CIRCUIT

## ENVIRONMENTAL SPECIFICATIONS

|                              |                                                                    |                     |                                                                                          |
|------------------------------|--------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------|
| Shock                        | 250 g's, 1.0 msec., 20 total shocks<br>X1, X2, Y1 and Y2 planes    | Ambient temperature | -20 to +55°C<br>-40 to 70°C (reduced life)                                               |
| Thermal Shock                | 15 sec., 90°C water - immediate transfer to 30°C water, 15 seconds | Altitude            | 70,000 ft.                                                                               |
| Life Expectancy<br>(dynamic) | (200,000 hours) (Note 10)                                          | Vibration           | 10-50-10 cps., 08" total excursion<br>50-2000 cps 10 g's 15 minutes<br>X1, X2, Y1 planes |

## NOTES

- The minimum supply voltage should be +170 Vdc, however, the use of the highest voltage available with an appropriate series resistor is recommended to provide: 1) greater tolerance of B+ & Rp; 2) more uniform brightness; 3) more constant current operation; 4) improved operation with temperature and 5) improved life. (See Table 2 and Note 7)
- This NIXIE tube can be used in 4 modes of operation (Figure 5)
  - When a numeral is always "on" and a decimal point will never be "on."
  - When a numeral is always "on" and a decimal point may or may not be "on."
  - When a numeral is always "on" and a decimal point is always "on."
  - When a numeral or a decimal point will be "on" but not at the same time (numeral or decimal point are lighted alone) — use the anode resistor plus a decimal point resistor.

In cases a, b and c, only the limiting anode resistor is necessary. (See Table 2)

NOTE: In cases a, b and c, a numeral **must** be "on" when the decimal point is "on" to prevent the decimal point from receiving excessive current.

|                                   |     |     |     |     |
|-----------------------------------|-----|-----|-----|-----|
| Supply Voltage (Vdc)              | 170 | 200 | 250 | 300 |
| Anode Resistor (Rp) (kΩ)          | 9.1 | 20  | 43  | 62  |
| Decimal point resistor (Rkd) (kΩ) | 120 | 270 | 560 | 750 |

Table 2

- For proper viewing the tube should be oriented so that pins 7 and 6 are closest to the viewer (Figure 4.)
- As noted on the tube outline drawing (Figure 1) an external portion of the tube is at the anode potential. CAUTION should be exercised.
- Value when decimal point is "off."
- Value when only the decimal point is "on."
- For proper NIXIE tube operation, a load line must pass through the operating region (shaded area) above point "A" and below point "B" in Figure 6. Operation at an anode current below point "A" can result in partial or incomplete numeral glow. Operation at an anode current above point "B" can result in not only spurious numeral glow but also shorter life. Typical load lines for 170 Vdc-10 kΩ, 200 Vdc-22 kΩ, 250 Vdc-43 kΩ, and 300 Vdc-62 kΩ are shown. The limits of the operating region were determined at the 330 V-100 kΩ, 330 V-51.4 kΩ. At these limits the tubes will exhibit an anode current within the limits of 1.8 ma min. and 3.5 ma max. These limits can be used to determine if a tube meets the specification.
- In a typical strobed/time sharing application, (Figure 7) "same-numeral" cathodes (i.e., all 1's, all 2's, etc.) of all tubes are connected in parallel and the anodes are strobed sequentially. The rapid strobing is above the flicker rate and visual indication is normal. However, since the "on" duty cycle is not 100%, a higher than normal current is used to compensate for loss of brightness. The B-5750 NIXIE tubes are constructed and specified for these peak current conditions and no extraneous glow is exhibited during this operation.
- The maximum pulse duration is 5.0 milliseconds with a 10% max duty cycle.
- Under normal DC operating conditions.
- Lead length on B-5750S is 0.175" ± .015 (for use with SK-207 socket).

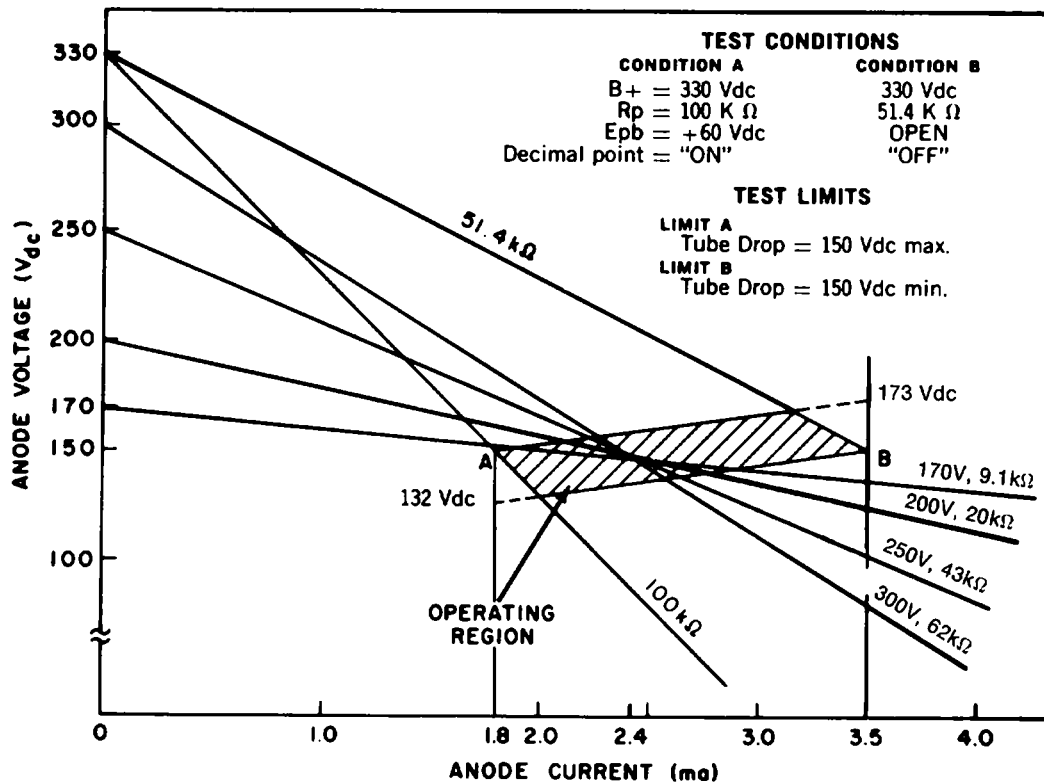


Figure 6. TUBE CHARACTERISTICS (NOTE 7)

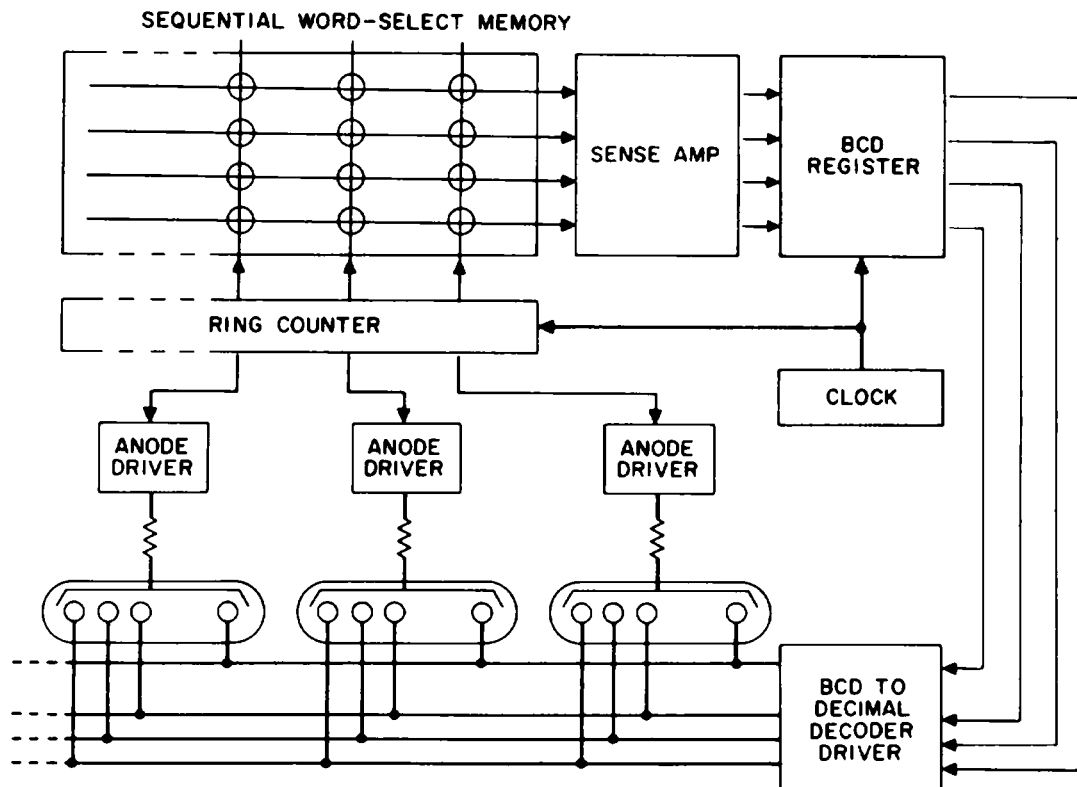


Figure 7. BLOCK DIAGRAM  
TYPICAL TIME SHARING APPLICATION (NOTE 8)



# NIXIE® NUMERICAL INDICATOR TUBE (FOR TIME SHARING APPLICATIONS)

**TYPES**  
**B-5855**  
**B-5855S**

The B-5855 NIXIE tube is an ultra-long life, high quality, cold cathode, numeric indicator tube. The tube can display the numerals 0-9 and has two independently operable decimal points inside the tube (right and left of the numerals). Substantial driver-circuitry cost savings can be obtained because the tube has been designed for high peak current-low duty cycle pulsed operation with time shared driver circuitry. Bright clear characters together with an optimum aspect ratio (height to width) provides excellent readability and viewing distance. The small diameter of the tube (0.510" max.) permits 0.520" center-to-center mounting and its short seated height (1.350" max. including standoff) allows for minimal instrument panel dimensions.

A moveable pin straightener-standoff\*, which is used to align the tube pins for ease of PC layout and insertion, is part of the tube assembly. Also, the standoff is provided with "bumps" to give clearance so flux gas can escape during soldering.

The B-5855S is identical to the B-5855 except the B-5855S leads are cut to 0.175"  $\pm$  .015 for use with the SK207 socket, Bulletin 1138.

\*Standoff will not be supplied with the tube until after October 1, 1968.

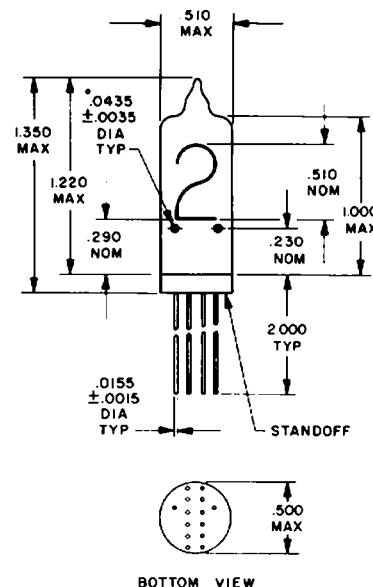
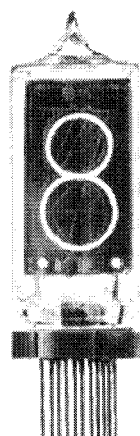


Figure 1. OUTLINE DRAWING  
SEE NOTE 4

## ELECTRICAL SPECIFICATIONS

### Absolute Ratings

|                                          |               |
|------------------------------------------|---------------|
| Ionization Voltage                       | +170 Vdc max  |
| Supply Voltage                           | +180 Vdc min. |
| Peak Anode Current (Note 3)              | 17 ma max     |
| Decimal Point Cathode Current            | Note 6        |
| Average Total Power Dissipation (Note 5) | 0.25 watts    |

### Typical Operating Conditions (Note 1, Figures 2 & 6)

|                               |               |
|-------------------------------|---------------|
| Supply Voltage                | +200 Vdc nom. |
| Peak Anode Current (Figure 2) | 14 ma typ     |
| Pulse Durations               | 100 $\mu$ sec |
| Duty Cycle                    | 2 msec        |

### Test Conditions (Figures 2 & 6)

|                    |                   |
|--------------------|-------------------|
| Peak Anode Current | 11 ma peak        |
| Pulse Duration     | 100 $\mu$ sec     |
| Repetition Rate    | 500 cps           |
| Test Circuit       | Figure 6 (Note 7) |

### Test Limits

|                   |                        |
|-------------------|------------------------|
| Tube Voltage Drop | 180 V peak<br>(Note 8) |
|-------------------|------------------------|

## MECHANICAL CHARACTERISTICS

|                       |                                                |
|-----------------------|------------------------------------------------|
| Outline Drawing       | Figure 1                                       |
| Pin Connection        | Table 1                                        |
| Pin Layout            | Figure 4                                       |
| Basing Diagram        | Figure 5                                       |
| Weight                | 0.4 oz. max                                    |
| Lead Finish- B-5855   | Hot tin dip from 1.000 in. from tube base      |
| Max. Viewing Distance | 24 feet                                        |
| Mounting              | Note 2                                         |
| Color                 | Neon red<br>3650, 4358, 5654, & 5852 Angstroms |

## ENVIRONMENTAL SPECIFICATIONS

|                     |                                                                                          |
|---------------------|------------------------------------------------------------------------------------------|
| Shock               | 250 g's, 1.0 msec., 20 total shocks<br>X1, X2, Y1 and Y2 planes                          |
| Thermal Shock       | 15 sec., 90°C water – immediate transfer<br>to 30°C water, 15 seconds                    |
| Ambient temperature | –20 to +55°C<br>–40 to 70°C (reduced life)                                               |
| Altitude            | 70,000 ft.                                                                               |
| Vibration           | 10–50–10 cps., 08" total excursion<br>50-2000 cps 10 g's 15 minutes<br>X1, X2, Y1 planes |

## NOTES

1. The tube is normally operated from a constant current source. If a constant voltage source is used, the appropriate current limiting resistor should be used to maintain anode current within specified limits.
2. For proper viewing the tube should be oriented so that pins 7 and 6 are closest to the viewer.
3. In a typical strobed/time sharing application, (Figure 6), "same-numeral" cathodes (i.e., all 1's, all 2's, etc.) of all tubes are connected in parallel and the anodes are strobed sequentially. The rapid strobing is above the flicker rate and visual indication is normal. However, since the "on" duty cycle is not 100%, a higher than normal current is used to compensate for loss of brightness. The (B-5855) NIXIE tubes are constructed and specified for these peak current conditions and no extraneous glow is exhibited during this operation.
4. Lead length on B-5855S is  $0.175'' \pm .015$  (for use with SK-207 Socket).
5. Maximum on time for calculating average power dissipation is 20 msec.
6. The decimal point must never be operated at a potential more negative than the on numeric cathode.
7. Decimal points are disconnected for this test.
8. This measurement is made after the tube has ionized and near the termination of the 100  $\mu$ sec anode pulse.

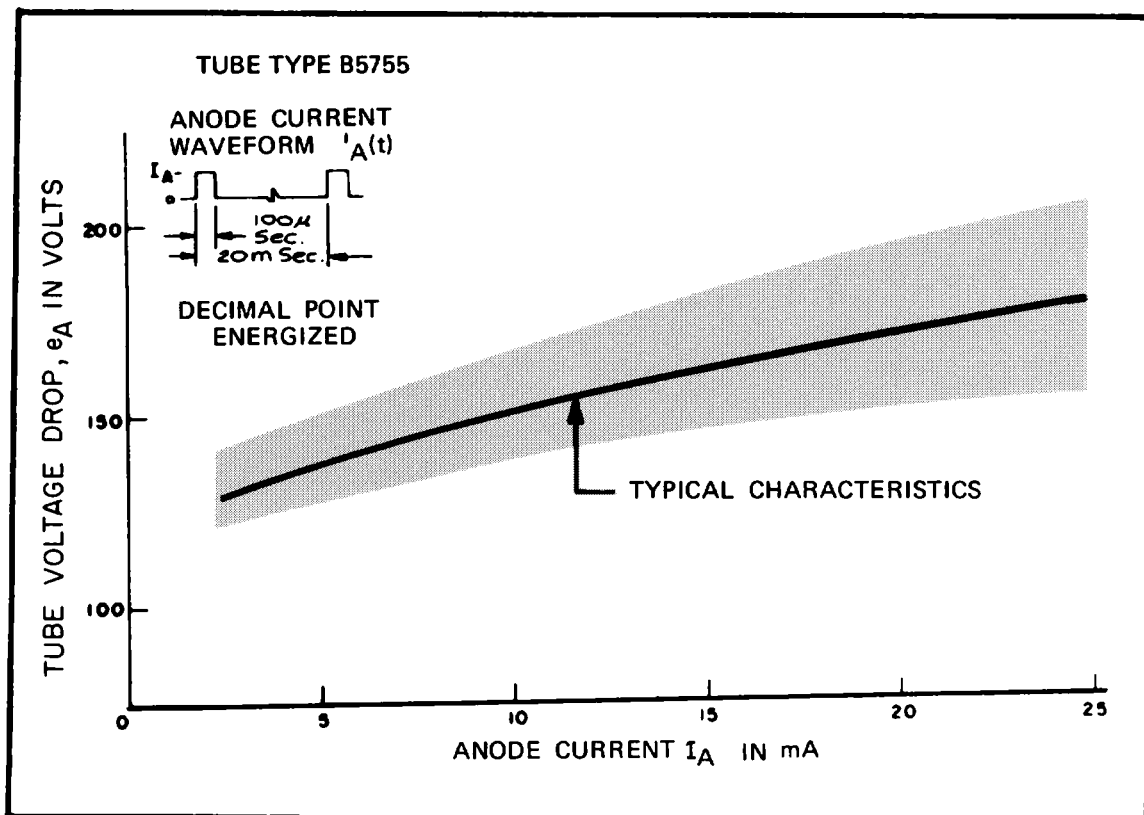


Figure 2 NIXIE TUBE, V-I CHARACTERISTICS

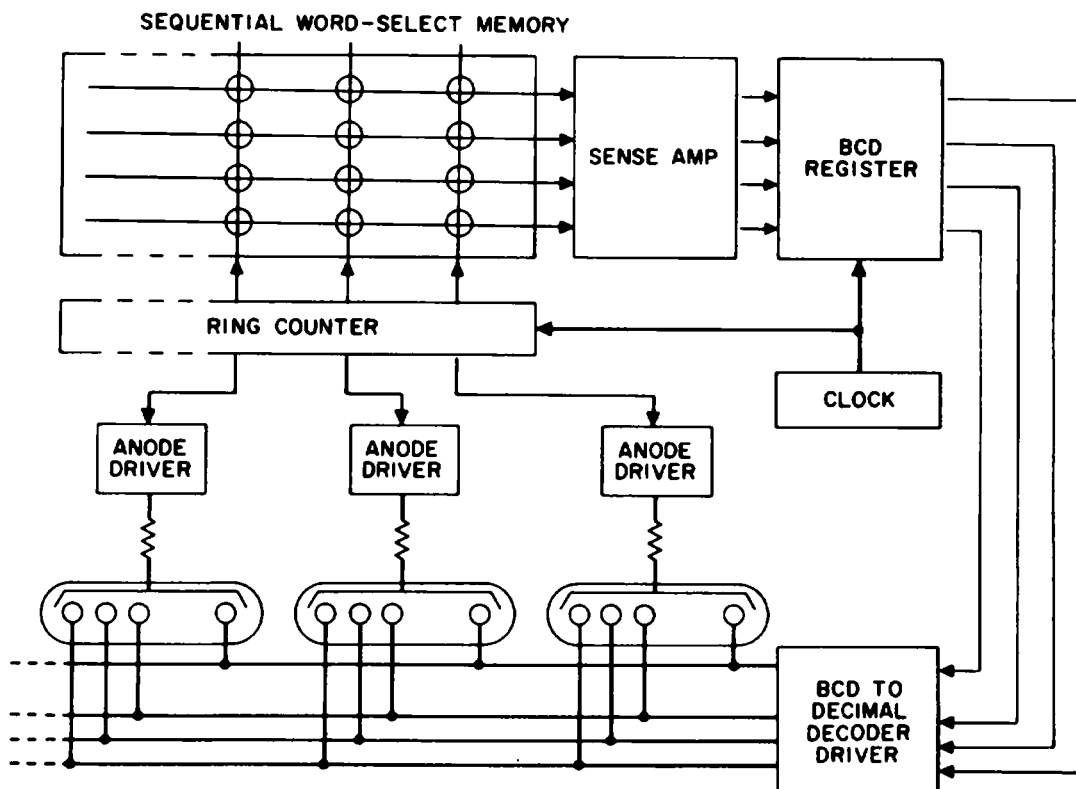


Figure 3 BLOCK DIAGRAM TYPICAL TIME SHARING APPLICATION (Note 3)

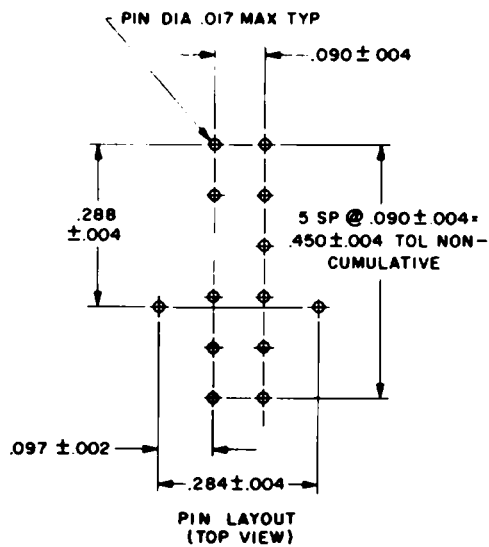


Figure 4. PIN LAYOUT (Top View)

| PIN | CONNECTIONS  |
|-----|--------------|
| 1   | NUMERAL 1    |
| 2   | NUMERAL 2    |
| 3   | NUMERAL 3    |
| 4   | NUMERAL 4    |
| 5   | NUMERAL 5    |
| 6   | NUMERAL 6    |
| 7   | ANODE        |
| 8   | NUMERAL 7    |
| 9   | NUMERAL 8    |
| 10  | NO STEM LEAD |
| 11  | NUMERAL 9    |
| 12  | NUMERAL 0    |
| 13  | RT DEC PT    |
| 14  | LFT DEC PT   |

Table 1. PIN CONNECTIONS

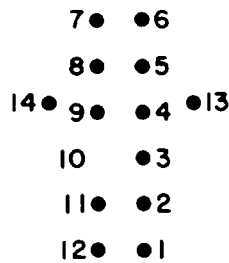


Figure 5. BASING DIAGRAM  
(Bottom View)

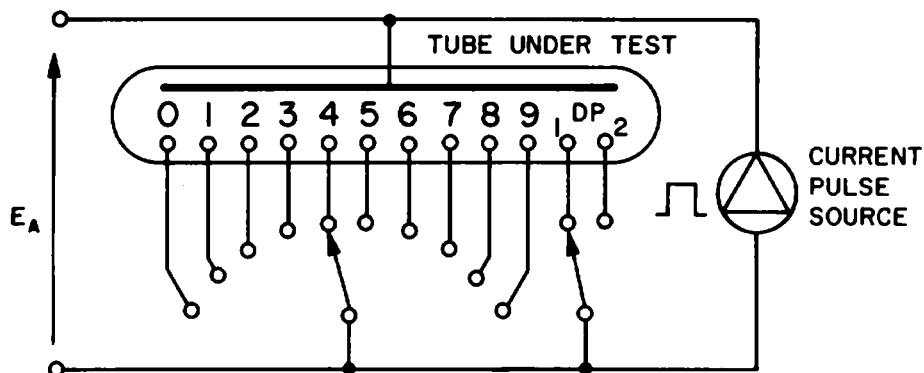


Figure 6. TEST CIRCUIT

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# NIXIE® PLUS-MINUS INDICATOR TUBE (FOR DC APPLICATIONS)

TYPES

**B-5856**  
**B-5856S**

## PRELIMINARY INFORMATION

The B-5856 NIXIE tube is an ultra-long life, high quality, cold-cathode indicator tube having a common anode with +, - display. The numeral aspect ratio (height to width) has been designed to provide the optimum in readability and viewing distance. The small diameter of the tube (0.510" max) permits 0.520" center-to-center mounting and its short seated height (1.350" max including standoff) allows for minimal instrument panel dimensions.

A moveable pin-straightener-standoff, which is used to align the tube pins for ease of PC layout and insertion, is part of the tube assembly: The standoff also allows solder gas to escape during soldering.

These tubes have been specifically designed to operate only in DC applications.

The B-5856S is identical to the B-5856 except its leads are cut to 0.175"  $\pm$  .015 for use with the SK-207 socket, Bulletin 1138.

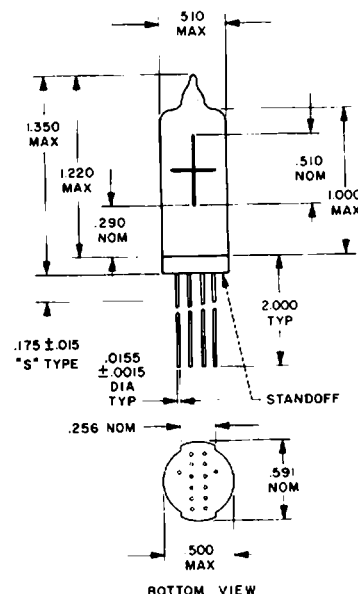
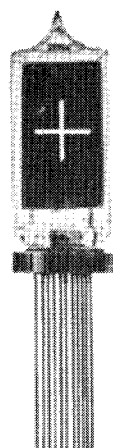


Figure 1. OUTLINE DRAWING

## ELECTRICAL SPECIFICATIONS

### Absolute Ratings

|                                     |                     |
|-------------------------------------|---------------------|
| Ionization Voltage (Note 1, Fig. 4) | +170 Vdc max        |
| Supply Voltage                      | +170 Vdc min        |
| Anode Current                       | 2.8 ma max          |
| Cathode Pre-bias                    | +60 Vdc to +110 Vdc |

### Typical Operating Conditions (Note 1, Figure 4)

|                           |               |
|---------------------------|---------------|
| Supply Voltage            | +170 Vdc      |
| Series Resistor (Table 2) | 15 k $\Omega$ |
| Anode Current (Figure 4)  | 2.0 ma typ    |
| Cathode Pre-bias Voltage  | +60 Vdc       |

Test Conditions (Figure 4)

Test Limits (Figure 4)

## MECHANICAL SPECIFICATIONS

|                       |                                           |
|-----------------------|-------------------------------------------|
| Outline Drawing       | Figure 1                                  |
| Pin Connection        | Table 1                                   |
| Pin Layout            | Figure 2                                  |
| Basing Diagram        | Figure 3                                  |
| Weight                | 0.4 oz. max                               |
| Lead Finish B-5856    | Hot tin dip from 0.600 in. from tube base |
| Max. Viewing Distance | 24 feet                                   |

|                       |                                   |
|-----------------------|-----------------------------------|
| Mounting              | Note 2                            |
| Color                 | Neon red                          |
|                       | 3650, 4358, 5654 & 5852 angstroms |
| Brightness            | 200 ft. lamberts                  |
| Soldering Heat B-5856 | 260 $\pm$ 5°C for 10 $\pm$ 1 sec. |
|                       | 0.250" from tube base             |

## ENVIRONMENTAL DATA

|                 |                                                                    |
|-----------------|--------------------------------------------------------------------|
| Shock           | 250 g's, 1.0 msec., 20 total shocks<br>X1, X2, Y1 and Y2 planes    |
| Thermal Shock   | 15 sec., 90°C water - immediate transfer to 30°C water, 15 seconds |
| Life Expectancy | (dynamic) (200,000 hours) (Note 10)                                |

|                     |                                                                                           |
|---------------------|-------------------------------------------------------------------------------------------|
| Ambient temperature | -20 to +55°C<br>-40 to 70°C (reduced life)                                                |
| Altitude            | 70,000 ft.                                                                                |
| Vibration           | 10-50-10 cps., .08" total excursion<br>50-2000 cps 10 g's 15 minutes<br>X1, X2, Y1 planes |

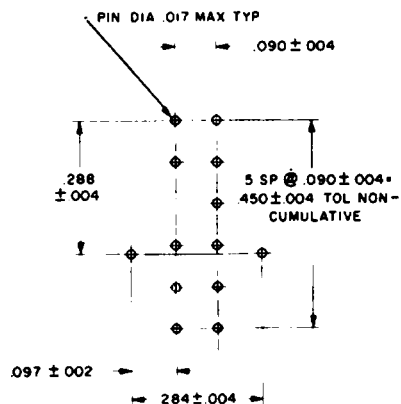
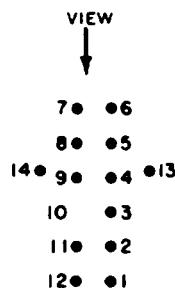


Figure 2. PIN LAYOUT (TOP VIEW)



(BOTTOM VIEW)

Figure 3. BASING DIAGRAM

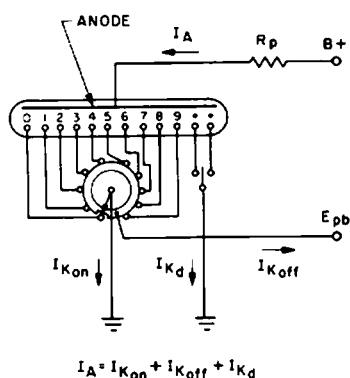


Figure 4. TEST CIRCUIT

| PIN | CONNECTIONS |
|-----|-------------|
| 1   | —, MINUS    |
| 2   |             |
| 3   |             |
| 4   |             |
| 5   |             |
| 6   | +, PLUS     |
| 7   | ANODE       |
| 8   |             |
| 9   |             |
| 10  | NO PIN      |
| 11  |             |
| 12  |             |
| 13  |             |
| 14  |             |

BLANK SPACES REPRESENT  
INTERNAL CONNECTIONS

Table 1. PIN CONNECTIONS

## NOTES

1. The minimum supply voltage should be +170 Vdc, however, the use of the highest voltage available with an appropriate series resistor is recommended to provide: 1) greater tolerance of B+ & Rp; 2) more uniform brightness; 3) more constant current operation; 4) improved operation with temperature and 5) improved life. (See Table 2)

|                          |     |     |     |     |
|--------------------------|-----|-----|-----|-----|
| Supply Voltage (Vdc)     | 170 | 200 | 250 | 300 |
| Anode Resistor (Rp) (kΩ) | 15  | 30  | 56  | 82  |

Table 2. Anode Resistor Values

2. For proper viewing the tube should be oriented so that pins 7 and 6 are closest to the viewer (Figure 3.)
3. Lead length on B-5856S is 0.175" ± .015 (for use with SK-207 socket).
4. Under normal DC operating conditions.



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# NIXIE® NUMERICAL INDICATOR TUBE

( FOR DC AND TIME SHARING APPLICATIONS )

TYPES  
**B-5859**  
**B-5859S**

## PRELIMINARY INFORMATION

The B-5859 NIXIE tube is an ultra-long life, high quality, cold-cathode indicator tube having a common anode. It can display the numerals 0-9 and has two decimal points inside the tube (right and left of the numerals) which are independently operable. The numeral aspect ratio (height to width) has been designed to provide the optimum in readability and viewing distance. The small diameter of the tube (0.510" max) permits 0.520" center-to-center mounting and its short seated height (1.350" max including standoff) allows for minimal instrument panel dimensions.

A moveable pin-straightener-standoff, which is used to align the tube pins for ease of PC layout and insertion, is part of the tube assembly. The standoff also allows solder gas to escape during soldering. These tubes have been specifically designed to operate both in normal DC applications and strobed/time sharing applications (See Note 8).

The B-5859S is identical to the B-5859 except its leads are cut to 0.175"  $\pm$  .015 for use with the SK-207 socket, Bulletin 1138.

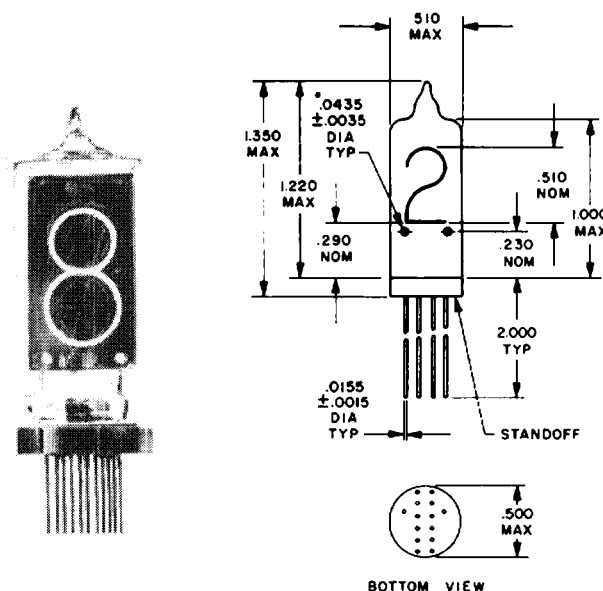


Figure 1. OUTLINE DRAWING

## ELECTRICAL SPECIFICATIONS

### Absolute Ratings

|                                           |                     |
|-------------------------------------------|---------------------|
| Ionization Voltage (Note 1, Fig. 4)       | +170 Vdc max        |
| Supply Voltage                            | +170 Vdc min        |
| Anode Current (Note 5)                    | 5.0 ma max          |
| Peak Anode Current<br>(Notes 8 & 9)       | 20 ma max           |
| Decimal Point Cathode Current<br>(Note 6) | 0.1 ma to 0.5 ma    |
| Cathode Pre-bias                          | +60 Vdc to +110 Vdc |

### Typical Operating Conditions (Notes 1, 2 & 7, Figures 4, 5 & 6)

|                                 |               |
|---------------------------------|---------------|
| Supply Voltage                  | +170 Vdc      |
| Series Resistor (Table 2)       | 10 k $\Omega$ |
| Anode Current (Figure 4)        | 3.4 ma typ    |
| Decimal Point Current (Table 2) | 0.35 ma typ   |
| Cathode Pre-bias Voltage        | +60 Vdc       |

### Test Conditions (Figures 4, 5 and 6)

### Test Limits (Figures 4, 5 and 6)

## MECHANICAL SPECIFICATIONS

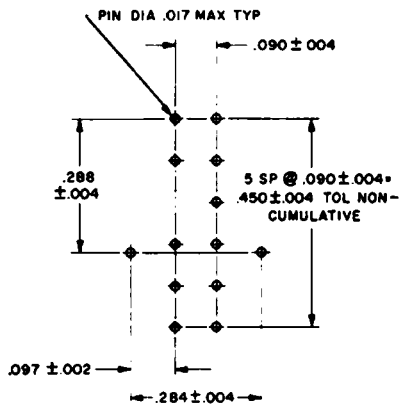
|                       |                                           |
|-----------------------|-------------------------------------------|
| Outline Drawing       | Figure 1                                  |
| Pin Connection        | Table 1                                   |
| Pin Layout            | Figure 2                                  |
| Basing Diagram        | Figure 3                                  |
| Weight                | 0.4 oz. max                               |
| Lead Finish B-5859    | Hot tin dip from 0.600 in. from tube base |
| Max. Viewing Distance | 24 feet                                   |

|                       |                                   |
|-----------------------|-----------------------------------|
| Mounting              | Note 3                            |
| Color                 | Neon red                          |
|                       | 3650, 4358, 5654 & 5852 angstroms |
| Brightness            | 200 ft. lamberts                  |
| Soldering Heat B-5859 | 260 $\pm$ 5°C for 10 $\pm$ 1 sec. |
|                       | 0.250" from tube base             |

## ENVIRONMENTAL DATA

|                              |                                                                    |
|------------------------------|--------------------------------------------------------------------|
| Shock                        | 250 g's, 1.0 msec., 20 total shocks<br>X1, X2, Y1 and Y2 planes    |
| Thermal Shock                | 15 sec., 90°C water - immediate transfer to 30°C water, 15 seconds |
| Life Expectancy<br>(dynamic) | (200,000 hours) (Note 10)                                          |

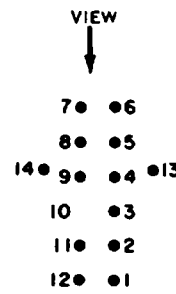
|                     |                                                                                          |
|---------------------|------------------------------------------------------------------------------------------|
| Ambient temperature | -20 to +55°C<br>-40 to 70°C (reduced life)                                               |
| Altitude            | 70,000 ft.                                                                               |
| Vibration           | 10-50-10 cps., 08" total excursion<br>50-2000 cps 10 g's 15 minutes<br>X1, X2, Y1 planes |



| PIN | CONNECTIONS |
|-----|-------------|
| 1   | NUMERAL 1   |
| 2   | NUMERAL 2   |
| 3   | NUMERAL 3   |
| 4   | NUMERAL 4   |
| 5   | NUMERAL 5   |
| 6   | NUMERAL 6   |
| 7   | ANODE       |
| 8   | NUMERAL 7   |
| 9   | NUMERAL 8   |
| 10  | NO PIN      |
| 11  | NUMERAL 9   |
| 12  | NUMERAL 0   |
| 13  | RT DEC PT   |
| 14  | LFT DEC PT  |

Figure 2. PIN LAYOUT (TOP VIEW)

Table 1. PIN CONNECTIONS



(BOTTOM VIEW)

Figure 3. BASING DIAGRAM

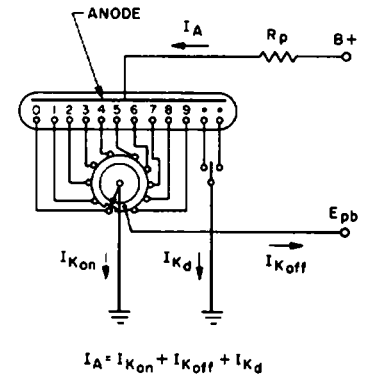


Figure 4. TEST CIRCUIT

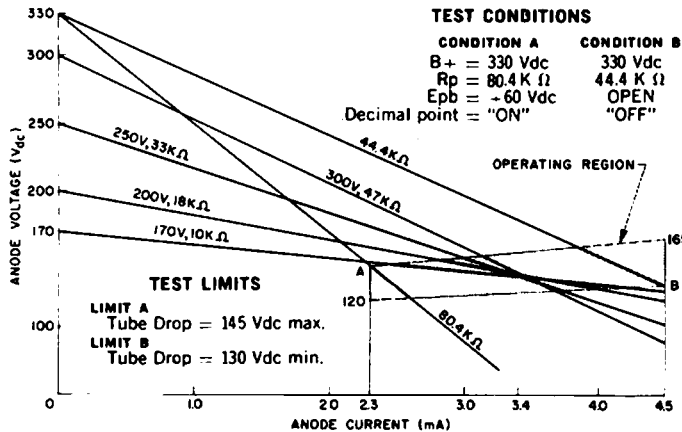


Figure 5. TUBE CHARACTERISTICS DC (NOTE 7)

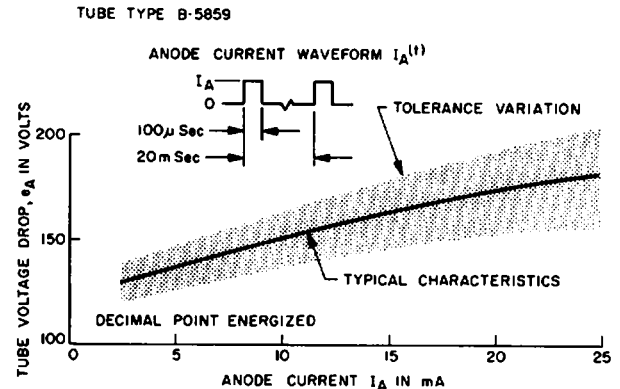


Figure 6. TUBE CHARACTERISTICS (TIME SHARING) (NOTES 7 AND 8)

## NOTES

- The minimum supply voltage should be +170 Vdc, however, the use of the highest voltage available with an appropriate series resistor is recommended to provide: 1) greater tolerance of B+ & Rp; 2) more uniform brightness; 3) more constant current operation; 4) improved operation with temperature and 5) improved life. (See Table 2 and Note 7)
- This NIXIE tube can be used in 4 modes of operation (Figure 4)
  - When a numeral is always "on" and a decimal point will never be "on."
  - When a numeral is always "on" and a decimal point may or may not be "on."
  - When a numeral is always "on" and a decimal point is always "on."
  - When a numeral or a decimal point will be "on" but not at the same time (numeral or decimal point are lighted alone) — use the anode resistor plus a decimal point resistor.

In cases a, b and c, only the limiting anode resistor is necessary. (See Table 2)

NOTE: In cases a, b and c, a numeral must be "on" when the decimal point is "on" to prevent the decimal point from receiving excessive current.

|                                   |     |     |     |     |
|-----------------------------------|-----|-----|-----|-----|
| Supply Voltage (Vdc)              | 170 | 200 | 250 | 300 |
| Anode Resistor (Rp) (kΩ)          | 10  | 18  | 33  | 47  |
| Decimal point resistor (Rkd) (kΩ) | 100 | 180 | 330 | 470 |

Table 2

- For proper viewing the tube should be oriented so that pins 7 and 6 are closest to the viewer (Figure 3.)
- Lead length on B-5859S is 0.175" ± .015 (for use with SK-207 socket).
- Value when decimal point is "off."
- Value when only the decimal point is "on."
- For proper NIXIE tube operation, a load line must pass through the operating region (shaded area) above point "A" and below point "B" in Figure 5. Operation at an anode current below point "A" can result in partial or incomplete numeral glow. Operation at an anode current above point "B" can result in shorter life. Typical load lines for 170 Vdc-10 kΩ, 200 Vdc-18 kΩ, 250 Vdc-33 kΩ, and 300 Vdc-47 kΩ are shown. The limits of the operating region were determined at the 330 V-80.4kΩ, 330 V-44.4 kΩ. At these limits the tubes will exhibit an anode current within the limits of 2.3 ma min. and 4.5 ma max. These limits can be used to determine if a tube meets the specification.
- In a typical strobed/time sharing application, (Figure 6) "same-numeral" cathodes (i.e., all 1's, all 2's, etc.) of all tubes are connected in parallel and the anodes are strobed sequentially. The rapid strobing is above the flicker rate and visual indication is normal. However, since the "on" duty cycle is not 100%, a higher than normal current is used to compensate for loss of brightness. The B-5859 NIXIE tubes are constructed and specified for these peak current conditions and no extraneous glow is exhibited during this operation.
- The maximum pulse duration is 5.0 milliseconds with a 10% max duty cycle.
- Under normal DC operating conditions.



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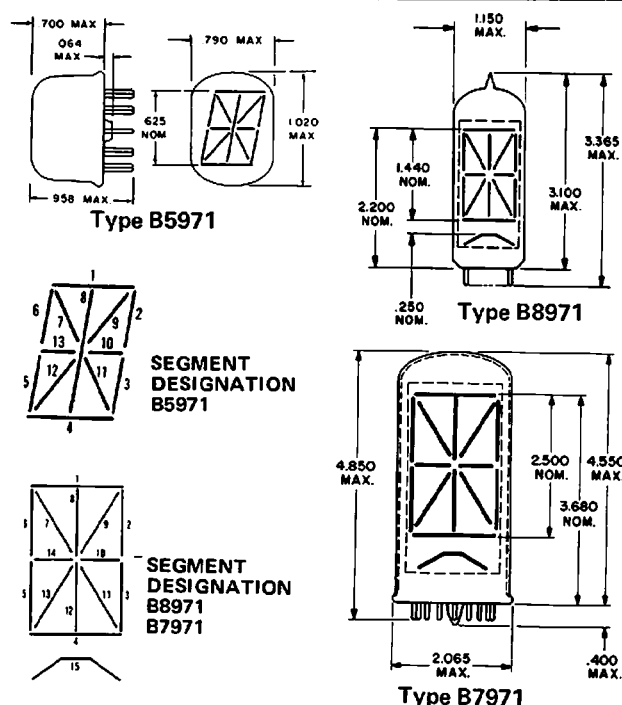
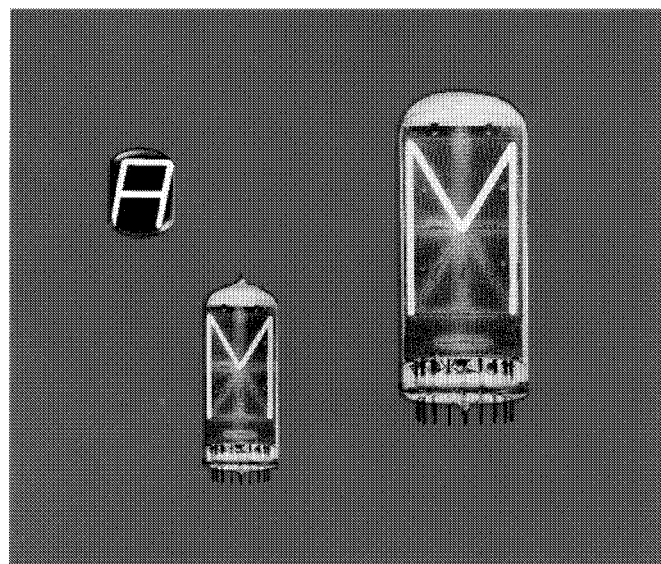
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## ALPHANUMERIC NIXIE INDICATOR TUBES

Available in three sizes, standard, medium and large, alphanumeric NIXIE tubes have the capability to display all letters of the alphabet, numerals 0-9 and special characters in a single tube.

|                        | Standard | Medium | Large  |
|------------------------|----------|--------|--------|
| Character Size .....   | 0.6"     | 1.4"   | 2.5"   |
| Viewing Distance ..... | 30.0'    | 65.0'  | 100.0' |

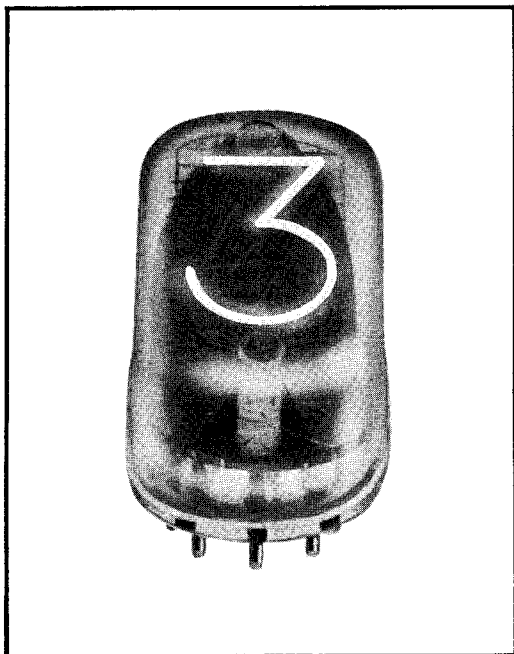


### ELECTRICAL CHARACTERISTICS

|                                                                 |            | B5971        |
|-----------------------------------------------------------------|------------|--------------|
| <b>Absolute Ratings</b>                                         |            |              |
| Supply Voltage (Ebb) .....                                      |            | 170 Vdc Min. |
| <b>Cathode Current</b>                                          |            |              |
| Ik (Total all cathodes) .....                                   |            | 12 ma max.   |
| Ik (Individual cathodes, K1 through K12 — except K8, K10) ..... |            | 1.7 ma max.  |
| Ik (Individual cathodes, K10, K13) .....                        |            | 1.5 ma max.  |
| Ik (Individual cathode, K8) .....                               |            | 3.0 ma max.  |
| <b>Test Conditions</b>                                          |            |              |
| Supply Voltage (Ebb) .....                                      |            | 170 Vdc      |
| Series Anode Resistor (R <sub>D</sub> ) .....                   |            | 6.8 K ± 1%   |
| <b>Absolute Ratings</b>                                         |            |              |
|                                                                 | B8971      | B7971        |
| Supply Voltage (Ebb, Vdc min) .....                             | 170        | 170          |
| <b>Individual Cathode Current (Ik, ma max)</b>                  |            |              |
| K1, K4, K15 .....                                               | 6.0        | 6.0          |
| K7, K9, K11, K13 .....                                          | 5.0        | 5.5          |
| K10, K14 .....                                                  | 3.5        | 4.0          |
| K2, K3, K5, K6, K8, K12 .....                                   | 4.5        | 5.0          |
| Total All Cathodes .....                                        | 14.0       | 21.0         |
| <b>Test Conditions</b>                                          |            |              |
| Supply Voltage, Ebb (Vdc) .....                                 | 170        | 170          |
| Series Anode Resistor, R <sub>D</sub> (Ohms) .....              | 4.3 K ± 1% | 1.8 K ± 1%   |



# READOUT DEVICES



## NUMERICAL INDICATOR

### Type B-5991

#### Ultra Long Life Rectangular NIXIE® Tube

The B-5991 NIXIE Indicator Tube is a gas-filled, cold cathode, 10 digit ("0" through "9") rectangular tube, having a common anode. It is the first in a series of rectangular tubes which permit the miniaturization of digital equipment using in-line readout. Both the width and depth of this new tube have been reduced to approximately 75% of standard size cylindrical types while retaining numeral size. Individual tubes can now be stacked side by side using minimum panel space with no sacrifice in readability. In addition, the smaller width and depth of the rectangular tubes permit much greater design flexibility including the use of smaller drive circuits.

The rectangular tube retains all the characteristics which have made NIXIE Indicator Tubes the most widely accepted readout device in the electronics industry.

## MECHANICAL DATA

|                         |              |
|-------------------------|--------------|
| Overall Length .....    | 1.120 Max.   |
| Seated Height .....     | .862 Max.    |
| Bulb Width .....        | .790 Max.    |
| Bulb Length .....       | 1.020 Max.   |
| Numeral Height .....    | .603 Nominal |
| Pin Connection .....    | See Figure 3 |
| Mounting Position ..... | See Note 2   |

## ELECTRICAL DATA

### ABSOLUTE RATINGS

|                          |                          |
|--------------------------|--------------------------|
| Ionization Voltage ..... | 170 Vdc Max.             |
| Supply Voltage .....     | 170 Vdc Min.<br>(Note 1) |
| Cathode Current .....    | 3.0 ma Max.              |

### TEST CONDITIONS (See Basic Circuit)

|                            |         |
|----------------------------|---------|
| Supply Voltage (Ebb) ..... | 170 Vdc |
| Series Resistor (R) .....  | 8.2 K   |
| Cathode Current (Ik)       |         |
| (Minimum) .....            | 1.5 ma  |
| (Maximum) .....            | 3.0 ma  |

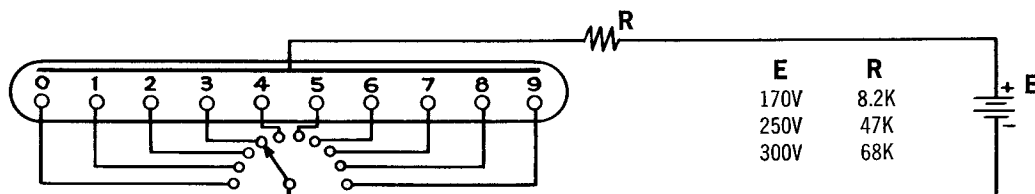


Figure 1.

## NOTES

1. The minimum supply voltage should be 170 volts. However, the use of the highest available voltage with the appropriate series resistor is recommended to maintain cathode current within the specified limits.
2. The center line of the numbers to be displayed passes through pins 6 and 12 of the tube. The tube socket should be oriented so that pins 6 and 12 are in a vertical line with pin 12 at the top.

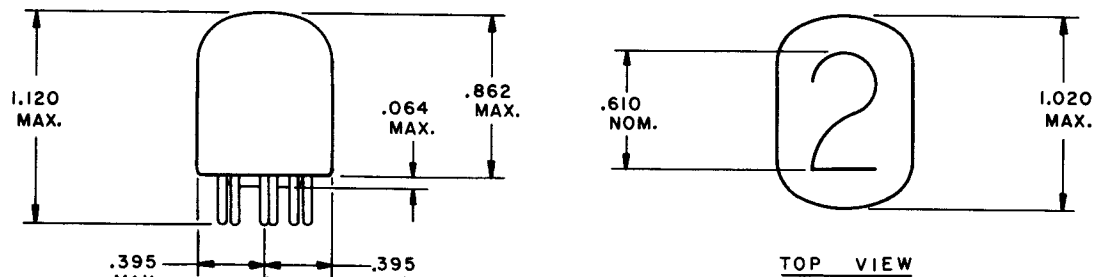


Figure 2.

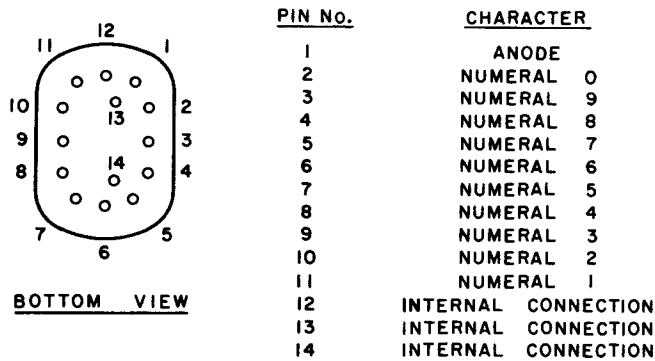
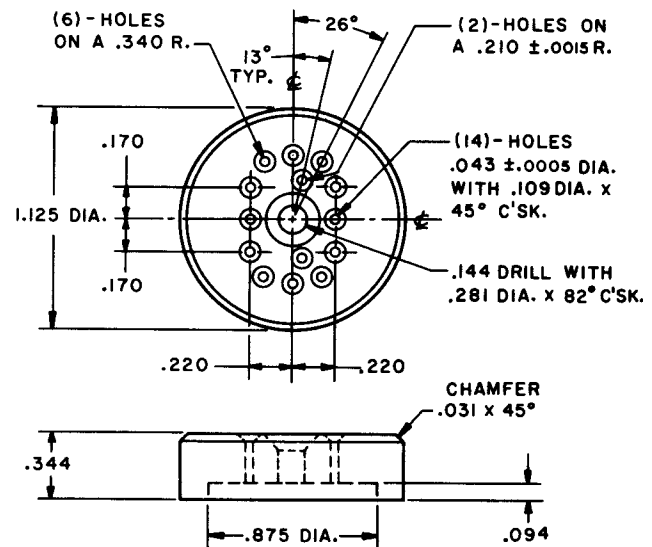


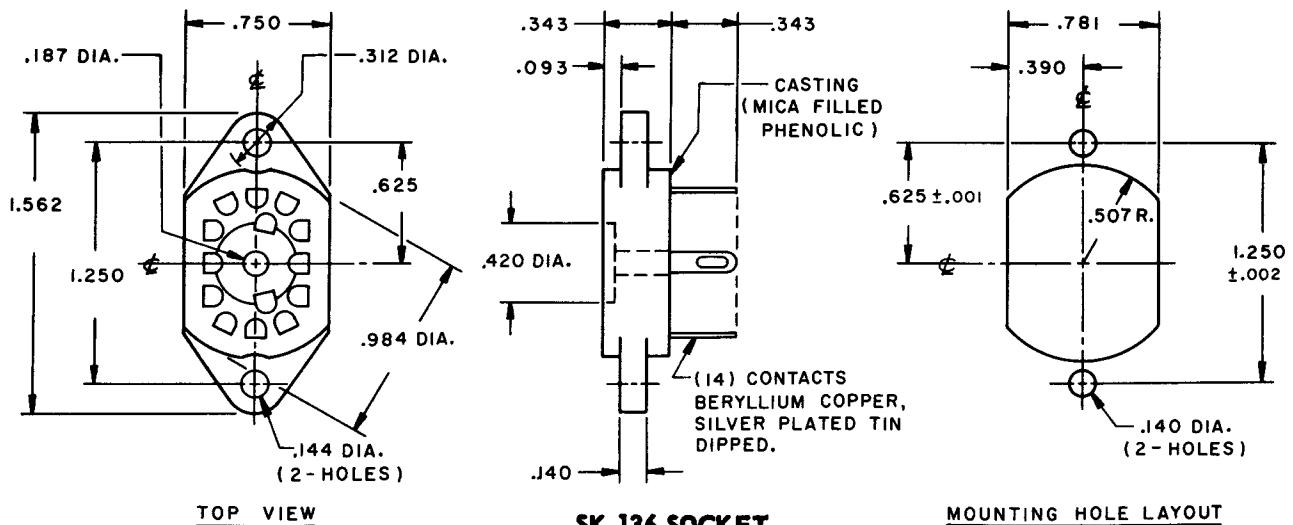
Figure 3.



PIN STRAIGHTENER

LS-210

Figure 4.



SK-136 SOCKET

Figure 5.

ANOTHER ELECTRONIC CONTRIBUTION BY  
**Burroughs Corporation**  
 ELECTRONIC COMPONENTS DIVISION  
 PLAINFIELD, NEW JERSEY

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## SUPER NIXIE INDICATOR TUBES (B-6091)

Designed for wide angle viewing. Use for desk top displays and bench test equipment.

Character Size . . . . . 0.8"

Viewing Distance . . . . . 38.0'

## LARGE NIXIE INDICATOR TUBES (B-8091)

Designed for wide angle top viewing. Use for large audience displays and status boards.

Character Size . . . . . 1.4"

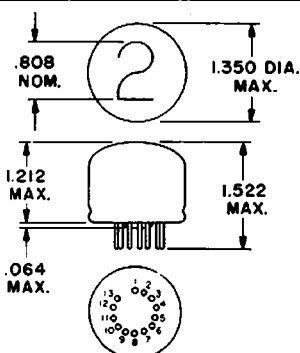
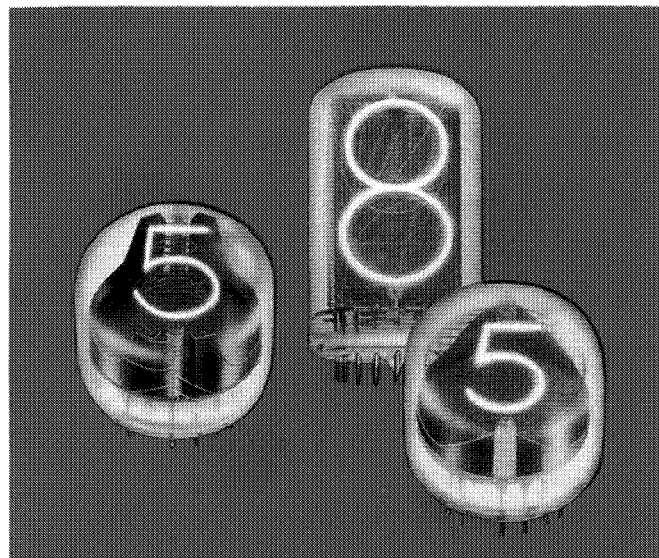
Viewing Distance . . . . . 65.0'

## JUMBO NIXIE INDICATOR TUBES (B-7037)

Designed for wide angle side viewing. Use for large audience displays and status boards.

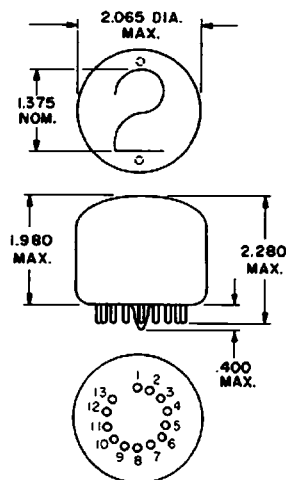
Character Size . . . . . 2.0"

Viewing Distance . . . . . 100.0'



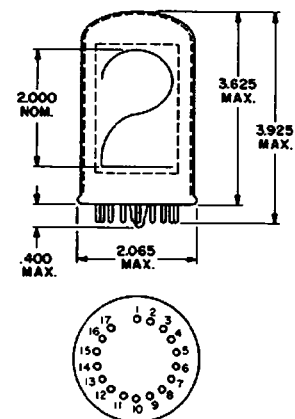
Type B-6091 (8423)  
PIN CONNECTIONS

| Pin No. | Numerical |
|---------|-----------|
| 1—      | IC        |
| 2—      | anode     |
| 3—      | 0         |
| 4—      | 9         |
| 5—      | 8         |
| 6—      | 7         |
| 7—      | 6         |
| 8—      | IC        |
| 9—      | 5         |
| 10—     | 4         |
| 11—     | 3         |
| 12—     | 2         |
| 13—     | 1         |



Large Type B-8091  
PIN CONNECTIONS

| Pin No. | Numerical |
|---------|-----------|
| 1—      | IC        |
| 2—      | anode     |
| 3—      | 0         |
| 4—      | 9         |
| 5—      | IC        |
| 6—      | IC        |
| 7—      | 8         |
| 8—      | 7         |
| 9—      | 6         |
| 10—     | 1C        |
| 11—     | 1C        |
| 12—     | 5         |
| 13—     | 4         |
| 14—     | 3         |
| 15—     | 1C        |
| 16—     | 2         |
| 17—     | 1         |



Jumbo Type B-7037  
PIN CONNECTIONS

| Pin No. | Numerical |
|---------|-----------|
| 1—      | IC        |
| 2—      | Anode     |
| 3—      | 6         |
| 4—      | 0         |
| 5—      | IC        |
| 6—      | IC        |
| 7—      | 2         |
| 8—      | 4         |
| 9—      | 1         |
| 10—     | IC        |
| 11—     | IC        |
| 12—     | 8         |
| 13—     | 9         |
| 14—     | 5         |
| 15—     | IC        |
| 16—     | 7         |
| 17—     | 3         |

### ELECTRICAL DATA/SUPER (See Note 1) (See Note 3)

|                          | B-6091 (8423)<br>Wide Angle |
|--------------------------|-----------------------------|
| <b>Absolute Ratings</b>  |                             |
| Ionization Voltage (Max) | 170 Vdc                     |
| Supply Voltage (Min)     | 170 Vdc                     |
| Cathode Current (Peak)   | 4.5 ma                      |
| <b>Test Conditions</b>   |                             |
| Supply Voltage           | 170 Vdc                     |
| Series Resistor          | 6.8K $\Omega$               |
| Cathode Current (Min)    | 1.5 ma                      |
| (Max)                    | 4.0 ma                      |
| Cathode Prebias Voltage  | 65 Vdc                      |
| <b>Sockets</b>           |                             |
| Standard Wiring          | SK112                       |
| Printed Circuit          | SK130                       |

### ELECTRICAL DATA/LARGE (See Note 1) (See Note 3)

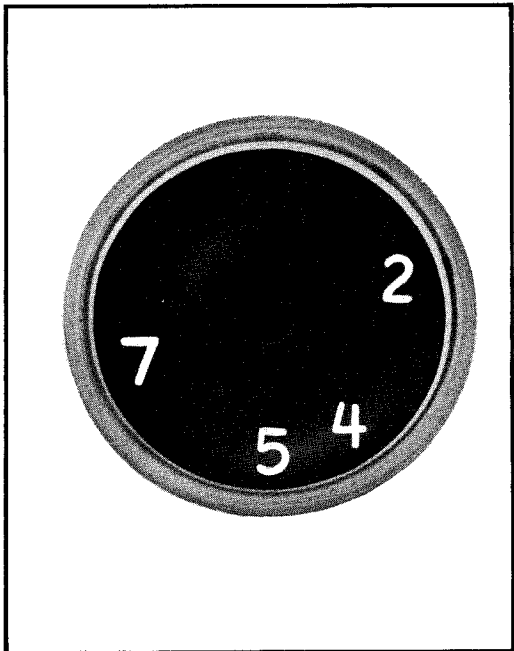
|                          | B-8091<br>Wide Angle |
|--------------------------|----------------------|
| <b>Absolute Ratings</b>  |                      |
| Ionization Voltage (Max) | 170 Vdc              |
| Supply Voltage (Min)     | 170 Vdc              |
| Cathode Current (Peak)   | 6.5 ma               |
| <b>Test Conditions</b>   |                      |
| Supply Voltage           | 170 Vdc              |
| Series Resistor          | 5.6K $\Omega$        |
| Cathode Current (Min)    | 3.0 ma               |
| (Max)                    | 6.0 ma               |
| Cathode Prebias Voltage  | 65 Vdc               |
| <b>Sockets</b>           |                      |
| Wiring                   | SK137                |

### ELECTRICAL DATA/JUMBO (See Note 1) (See Note 3)

|                          | B-7037<br>Wide Angle/Side View |
|--------------------------|--------------------------------|
| <b>Absolute Ratings</b>  |                                |
| Ionization Voltage (Max) | 200 Vdc                        |
| Supply Voltage (Min)     | 200 Vdc                        |
| Cathode Current (Peak)   | 7.5 ma                         |
| <b>Test Conditions</b>   |                                |
| Supply Voltage           | 200 Vdc                        |
| Series Resistor          | 9.1K $\Omega$                  |
| Cathode Current (Min)    | 4.0 ma                         |
| (Max)                    | 7.0 ma                         |
| Cathode Prebias Voltage  | 65 Vdc                         |
| <b>Socket</b>            |                                |
| Wiring                   | SK137                          |



# READOUT DEVICES



## NUMERICAL INDICATOR Type B-9012 PIXIE® Position Indicator Tube

The B-9012 is a gas-filled, cold cathode, indicator tube. It contains ten glow positions or cathodes located 36° apart which are visible through numerical perforations in a plate located above the cathodes. The plate serves as a common anode and functions in the manner of an internal bezel with the indicated number determined by the position of the glow discharge. A twelfth electrode functions as a "keep alive" to obtain rapid ionization for those applications in which this property is desirable.

The PIXIE Indicator Tube is an extremely low cost device which has the ability to display up to ten independent bits of information simultaneously. It is ideal for counting or status displays and requires very low power. It has the same long life characteristics as Burroughs NIXIE Indicator Tubes.

### MECHANICAL DATA

|                         |                    |
|-------------------------|--------------------|
| Overall Length .....    | 1.040 max.         |
| Seated Height .....     | .720 ±.060         |
| Bulb Diameter .....     | 1.080 max.         |
| Socket .....            | SK-111 H, SK-111 V |
| Mounting Position ..... | Any                |
| Weight .....            | 1.0 oz. max.       |

### ELECTRICAL DATA

#### ABSOLUTE RATINGS

|                                             |               |
|---------------------------------------------|---------------|
| Individual Cathode Ionization Voltage ..... | 150 Vdc max.  |
| Individual Cathode Current .....            | 600μ Adc max. |
| Keep Alive Ionization Voltage .....         | 180 Vdc max.  |

#### TEST CONDITIONS

|                                          |                            |
|------------------------------------------|----------------------------|
| Anode to Cathode Supply Voltage .....    | 150 Vdc                    |
| Anode Series Resistor .....              | 82 K                       |
| Anode to Keep Alive Supply Voltage ..... | 180 Vdc                    |
| Cathode Current .....                    | 400 ua max.<br>250 ua min. |

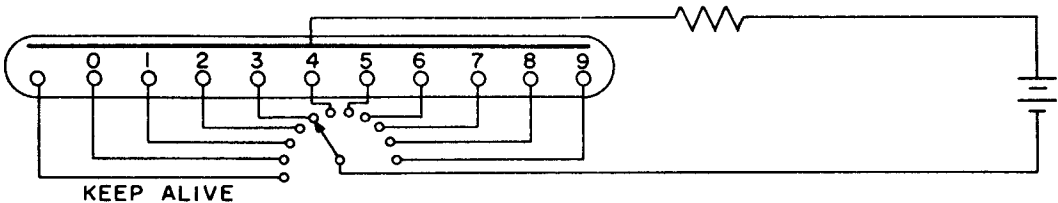
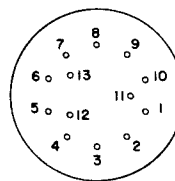
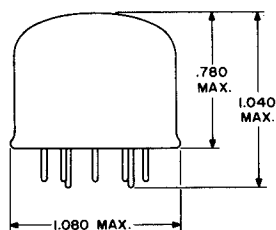
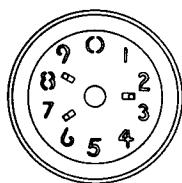


Figure 1. BASIC CIRCUIT

### NOTES

1. The basic circuit shown in Figure 1 is used for test purposes only. Individual cathodes are checked for proper ionization with a 150 Vdc supply voltage; the keep alive electrode is checked with a supply voltage of 180 Vdc. For simultaneous ionization of several digits, the test circuit must be modified to contain individual 82K resistors in each cathode rather than a single 82K anode resistor. Use of the keep alive electrode is not required unless ionization times on the order of several microseconds are desired. When using the keep alive electrode, it must be connected through a 4.7 megohm resistor to a separate supply.



BOTTOM VIEW

| PIN NO. | CHARACTER  |
|---------|------------|
| 1       | 2          |
| 2       | 1          |
| 3       | 0          |
| 4       | 9          |
| 5       | 8          |
| 6       | 7          |
| 7       | 6          |
| 8       | 5          |
| 9       | 4          |
| 10      | 3          |
| 11      | ANODE      |
| 12      | KEEP ALIVE |
| 13      | ANODE      |

Figure 2. OUTLINE DRAWING

Figure 3. PIN CONNECTIONS

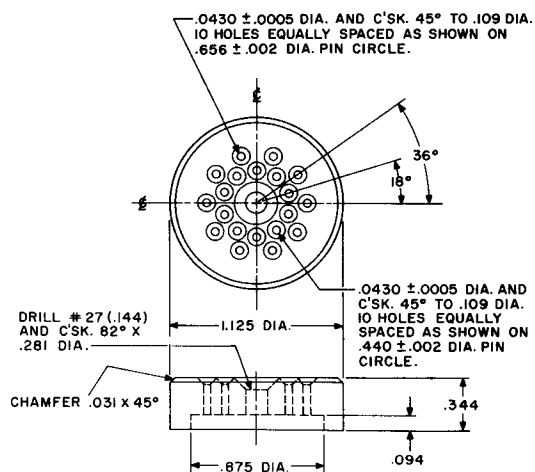
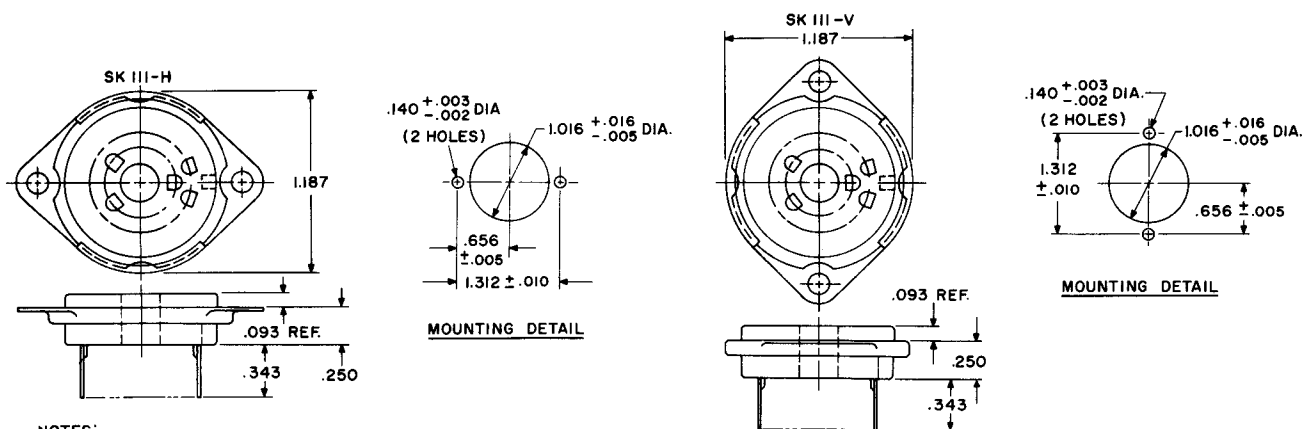


Figure 4. PIN STRAIGHTENER, LS-203



NOTES:

1. THE SADDLE IS PERMANENTLY FASTENED TO SOCKET.
2. SK III-H IS FOR HORIZONTAL MOUNTING.
3. SK III-V IS FOR VERTICAL MOUNTING.

Figure 5. GENERAL PURPOSE SOCKETS, SK-111-H AND SK-111-V

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 PLAINFIELD, NEW JERSEY

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