GAS NOISE SOURCES, 1.12-1.70 KMC

These tubes are designed for use as noise sources in microwave measurements. They are constructed for use with 90° H-plane mounts in RG-69U waveguide, or equivalent, to provide noise in the 1.12 to 1.70 kMc frequency range. When used in properly matched mounts they function essentially as untuned noise generators over most of the recommended transmission bandwidth of the mount. When used in a 90° H-plane mount which is terminated by a piston adjusted to match the susceptance of the tube and mount, the excess noise coupled into the guide is approximately 15.2 db for the Argon types, 6881, 7147 and 8401, and approximately 18 db for the Neon types, 7992, 7101 and 8402. The excess noise ratio in db is defined as 10 log \( \frac{|E|}{|E_0|} \).

All of these types may be operated in a DC circuit which provides a starting voltage spike, although the 8401 and 8402 are recommended primarily for pulse operation at duty cycles of less than 50%. The 7147 and 7101 further may be operated in a high voltage AC circuit without provision of an initial starting spike. In all cases the operating circuits must have sufficient series resistance to limit the tube currents to the rated values.

In the cases of the 7147 and 7101 when operated in an AC circuit there is a small correction to the available excess noise depending upon circuit components and the AC frequency. When operated in a DC circuit, only one cathode is active, the other serving as the anode.

The use of pure inert gases eliminates any dependence of noise output on operating temperature. The noise sources are available for measurement at practically zero warm up time.

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### GAS NOISE SOURCES, 1.12-1.70 KMC

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Unit</th>
<th>6881/TD21</th>
<th>7992/TD62</th>
<th>7147/TD33</th>
<th>7101/TD29</th>
<th>8401/TD49</th>
<th>8402/TD75</th>
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</thead>
<tbody>
<tr>
<td>Recommended Mode of Operation</td>
<td></td>
<td>DC</td>
<td>DC</td>
<td>DC or AC</td>
<td>DC or AC</td>
<td>Pulse</td>
<td>Pulse</td>
</tr>
<tr>
<td>Anode Current (Peak)</td>
<td>ma</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Anode Current (Average)</td>
<td>mA</td>
<td>250 max</td>
<td>250 max</td>
<td>250 max</td>
<td>250 max</td>
<td>200 max</td>
<td>200 max</td>
</tr>
<tr>
<td>Tube Voltage drop (Average)</td>
<td>Vdc</td>
<td>65</td>
<td>145</td>
<td>75</td>
<td>130</td>
<td>125</td>
<td>235</td>
</tr>
<tr>
<td>Tube Dissipation (Average)</td>
<td>Watts</td>
<td>16</td>
<td>36</td>
<td>19</td>
<td>33</td>
<td>25</td>
<td>47</td>
</tr>
<tr>
<td>Starting Voltage (Note 1.3)</td>
<td>KV</td>
<td>2.0-4.0</td>
<td>2.5-4.5</td>
<td>2.0-4.0 (Fig 1)</td>
<td>2.5-4.5 (Fig 1)</td>
<td>2.0-4.0</td>
<td>2.5-4.5</td>
</tr>
<tr>
<td>Starting Current (Note 2.3)</td>
<td>mA</td>
<td>300</td>
<td>350</td>
<td>300</td>
<td>350</td>
<td>300</td>
<td>350</td>
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<tr>
<td>Ambient Temp. Range</td>
<td>°C</td>
<td>-55° to +85°</td>
<td>-55° to +85°</td>
<td>-55° to +85°</td>
<td>-55° to +85°</td>
<td>-55° to +85°</td>
<td></td>
</tr>
<tr>
<td>Nr-1 Tube in Mount @ Rated Current (Notes 4.5)</td>
<td>db</td>
<td>15.20x.50</td>
<td>18.0x.50</td>
<td>15.20x.50 (Note 6)</td>
<td>18.0x.50 (Note 6)</td>
<td>15.2x.50</td>
<td>18.0x.50</td>
</tr>
</tbody>
</table>

**Note 1:** With the noise source in a case grounded mount, starting voltages were measured in Figures 1, 2, or 3 where appropriate.

**Note 2:** With the noise source in a case grounded mount and the starting current (start) through the choke of Figure I adjusted to the value stated, the noise source will start within three attempts of closing and opening switch SW.

**Note 3:** In general the starting voltage for DC or pulse operation will decrease with a starting pulse of either a faster rise time or longer pulse width.

**Note 4:** The excess noise ratio (Nr-1) is defined in db as \( (NR-1) = 10 \log \left( \frac{T_e}{290} - 1 \right) \) where \( Te \) is the effective electron temperature.

**Note 5:** The values of (Nr-1) are given for the tubes mounted in a 90° H plane mount which is terminated by a piston adjusted to match susceptance of the tube and mount.

**Note 6:** When operated in an AC circuit there is a small correction to the available excess noise depending upon circuit components and the AC frequency.
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**FIGURE 1:** Typical Starting and Operating Circuit for D.C. Operation

The run start switch shown in the typical circuit provides the high voltage surge or spike necessary to initiate the discharge. In the start position, current passes through the choke. As the switch is released to the run position, a high surge voltage appears momentarily across the tube, caused by the collapse of the magnetic field in choke "L1". This high voltage initiates the discharge in the noise source which is then sustained by the power supply voltage and stabilized by the resistance R1.

![Diagram](image)

**FIGURE 2:** Typical Starting and Operating Circuits for AC Operation

![Diagram](image)

**FIGURE 3:** Typical Starting and Operating Circuit for Pulse Operation

The pentode or beam tube, V1, acts as a switch interrupting the current flow in L1 when the bias switch, SW1 is in position 1. The resultant voltage spike developed is impressed across the noise source. The current limited by R3 to rated value. The noise source is turned off when the bias switch, SW1, is in position 2, causing the current through the passing tube, V2, to be interrupted. The circuit can be modified to drive the grids of the switch tube and passing tube with pulses, thus pulsing the noise output.

E = 2500 Vac
R = 9500 Ω 600 W

**NOTE:**
R MAY BE INCLUDED IN SUPPLY AS REACTANCE

L1 - 2 Hy
R1 - 5 K
R2 - 10 K - adjusted for required pulse amplitude
R3 - 1.5 K - adjusted for rated Ib
R4 - Start-run or on-off switch
C1 - surge capacitor
V1 - turn-on tube
V2 - turn-off tube

Passing Type
OUTLINE DRAWINGS

BI-PIN BASE
.093 PIN DIA.

1.550 DIA. MAX.
1.475 DIA. MIN.

13½ NOM.
15.0 MAX.
14½ MIN.

.295 MAX.
.255 MIN.

DC AND PULSE TYPES
6881/TD21, 7992/TD62, 8401/TD49, 8402/TD75

BI-PIN BASE (BOTH ENDS)
.093 PIN DIA.

1.550 DIA. MAX.
1.475 DIA. MIN.

13½ NOM.
15.0 MAX.
14½ MIN.

.295 MAX.
.255 MIN.

AC-DC TYPES
7147/TD33, 7101/TD29

NOTE: SILVER PLATE
MASK TOP OF FLANGE AND
BOTH ENDS BEFORE PAINTING
SMOOTH GRAY.

MOUNT

TUBE IN MOUNT

3/32 BRASS PINS
4 REQD.

SOLDER

UG 417/U
FLANGE
1 REQD.

14.820