THYRATRON
ARGON AND MERCURY - VAPOR

FILAMENT
AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)

GLASS BULB

THE 3C23 IS A THREE ELECTRODE, ARGON AND MERCURY-VAPOR FILLED THYRATRON WITH NEGATIVE CONTROL CHARACTERISTIC DESIGNED FOR GRID CONTROLLED RECTIFIER, MOTOR CONTROL, OR RELAY SERVICE. THE ADDITION OF ARGON GAS TO THE MERCURY-VAPOR ATMOSPHERE PERMITS THE TUBE TO START CONDUCTION AT LOW TEMPERATURES.

THE 3C23 EMPLOYS A MEDIUM, 4-PIN BAYONET BASE.

ELECTRICAL DATA

FILAMENT VOLTAGE 2.5 ± 0.125 VOLTS
FILAMENT CURRENT @ EF = 2.5 VOLTS
CATHODE HEATING TIME — MINIMUM 7 AMPS
ANODE TO CONTROL GRID CAPACITANCE 15 SECONDS
DE-IONIZATION TIME — APPROXIMATE 1.8 μF
ANODE VOLTS = 120, ANODE CURRENT = 1.5 AMPS
GRID VOLTS = - 20, GRID RESISTOR = 10,000 OHMS
360 μF
ANODE VOLTS = 120, ANODE CURRENT = 1.5 AMPS,
GRID VOLTS > 500, GRID RESISTOR = 100,000 OHMS
60 μF
ANODE VOLTAGE DROP — APPROXIMATE
INITIAL 10 VOLTS
END OF LIFE 20 VOLTS

MECHANICAL DATA

MOUNTING POSITION VERTICAL BASE DOWN
TYPE OF COOLING CONVECTION
BULB ST16
BASE A4-10 MEDIUM
CAP C1-5 MEDIUM
NET WEIGHT 3 OUNCES MAXIMUM
SOCKET MEDIUM 4 PIN BAYONET

CONTINUED ON FOLLOWING PAGE
CONTINUED FROM PRECEDING PAGE

RATINGS

<table>
<thead>
<tr>
<th>ABSOLUTE VALUES</th>
<th>MIN.</th>
<th>MAX.</th>
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<tbody>
<tr>
<td>PEAK ANODE VOLTAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FORWARD</td>
<td>---</td>
<td>1250 VOLTS</td>
</tr>
<tr>
<td>REVERSE</td>
<td>---</td>
<td>1250 VOLTS</td>
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<tr>
<td>GRID VOLTAGE</td>
<td></td>
<td></td>
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<tr>
<td>PEAK OR DC BEFORE TUBE CONDUCTION</td>
<td>---</td>
<td>-500 VOLTS</td>
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<tr>
<td>AVERAGE DURING TUBE CONDUCTION - NOTE 1</td>
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<td>-10 VOLTS</td>
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<tr>
<td>ANODE CURRENT</td>
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<tr>
<td>PEAK</td>
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<td>6 AMPS.</td>
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<tr>
<td>AVERAGE - NOTE 2</td>
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<td>1.5 AMPS.</td>
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<tr>
<td>FAULT - FOR DURATION OF 0.1 SEC. MAX. - NOTE 3</td>
<td>---</td>
<td>120 AMPS.</td>
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<tr>
<td>GRID CURRENT</td>
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<tr>
<td>AVERAGE - NOTE 4 (PER SECOND)</td>
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<td>40.01 AMP.</td>
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<tr>
<td>OPERATING FREQUENCY</td>
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<td>420 CYCLES</td>
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<tr>
<td>ALTITUDE</td>
<td>---</td>
<td>10,000 FEET</td>
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<td>TEMPERATURE RANGE - NOTE 5</td>
<td>40</td>
<td>80 °C</td>
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<tr>
<td>FILAMENT VOLTAGE</td>
<td>2.37</td>
<td>2.63 VOLTS</td>
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</tbody>
</table>

1. AVERAGED OVER ONE CONDUCTING PERIOD.

2. AVERAGED OVER ANY INTERVAL OF FIVE SECONDS MAXIMUM.

3. THE EQUIPMENT DESIGNER SHOULD LIMIT THE SHORT CIRCUIT CURRENT TO 120 AMPERES CIRCUITWISE. IT SHOULD BE UNDERSTOOD THAT WHILE THE TUBE MAY STAND SEVERAL FAULTS AT THIS MAGNITUDE OF CURRENT, EACH FAULT WILL ADVERSELY AFFECT TUBE LIFE.

4. AVERAGED OVER THE PERIOD OF GRID CONDUCTION.

5. THE RECOMMENDED OPERATING RANGE FOR THIS TUBE IS FROM 40° TO 80° CENTIGRADE. OPERATION BETWEEN -35° AND +40° CENTIGRADE AT REDUCED RATINGS, OR "STARTS" IN THIS TEMPERATURE RANGE ARE PERMISSIBLE, BUT WILL RESULT IN CONSIDERABLY SHORTENED LIFE.
THYRATRON TUBES, IF CORRECTLY USED, WILL GIVE MANY THOUSANDS OF HOURS OF RELIABLE SERVICE. THE CORRECT USE OF A TUBE INVOLVES AMONG OTHER THINGS ADHERENCE TO THE FOLLOWING RULES:

1. AVOID COLD STARTS. THE HEAT SHIELDED, OXIDE COATED FILAMENT SHOULD BE ENERGIZED BEFORE THE ANODE VOLTAGE IS APPLIED IN ORDER TO OBTAIN MAXIMUM LIFE.

2. AVOID OPERATING THE TUBE OUTSIDE OF THE SPECIFIED FILAMENT VOLTAGE RANGE.

3. AVOID EXCEEDING THE RATED PEAK INVERSE VOLTAGE. EXCESS INVERSE VOLTAGE CAN CAUSE EITHER AN IMMEDIATE FAILURE OR A RAPID DECLINE IN USEFUL LIFE.

NO CLEAR CUT METHOD OF FORETELLING TUBE FAILURE HAS BEEN DEvised. PERIODIC REPLACEMENT OF A TUBE AS A ROUTINE PREVENTIVE MAINTENANCE DEVICE IS NOT RECOMMENDED AS A TUBE THAT HAS OPERATED FOR SEVERAL THOUSAND HOURS MAY BE GOOD FOR SEVERAL MORE THOUSAND HOURS OF USEFUL OPERATION. QUITE OFTEN MAINTENANCE PERSONNEL CAN, AFTER SOME EXPERIENCE WITH A PIECE OF EQUIPMENT, ANTICIPATE TUBE FAILURE BY OBSERVATION. VISUAL CHECKS OF TUBE (ARC) DROP WILL INDICATE TUBES APPROACHING END OF LIFE. TUBE DROP VOLTAGES CONSIDERABLY HIGHER THAN THAT OF THE LAST READINGS, OR READINGS ABOVE 20 VOLTS INDICATE TUBES THAT MAY SOON FAIL. WHILE SUCH A READING CAN BE TAKEN DIRECTLY AT THE TUBE IN THE OPERATING EQUIPMENT, IT IS A DANGEROUS PRACTICE. THE VOLTAGES AT WHICH THIS TUBE NORMALLY OPERATES ARE LETHAL.

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A MORE PRACTICAL AND EXACT MEASUREMENT IS OBSERVING THE TUBE VOLTAGE DROP IN A TEST JIG WHILE IT PASSES ONE OR TWO HIGH CURRENT PULSES. SUCH A JIG IS ILLUSTRATED IN FIGURE 1. THE OSCILLOSCOPE IS CALIBRATED BY FIRST SETTING SWITCH S2 TO CURRENT CHECK. MOMENTARY CONTACT SWITCH S1 IS THEN TAPPED WHILE CURRENT SET RESISTOR R2 IS ADJUSTED UNTIL A PATTERN 8 VOLTS HIGH APPEARS ON THE OSCILLOSCOPE SCREEN. THIS INDICATES THAT A PEAK CURRENT OF EIGHT AMPERES IS FLOWING THROUGH THE TUBE UNDER TEST AND THROUGH CALIBRATING RESISTOR R3. THE TUBE VOLTAGE DROP CAN THEN BE READ DIRECTLY IN VOLTS ON THE OSCILLOSCOPE SCALE BY SETTING SWITCH S2 TO THE TEST POSITION AND TAPPING SWITCH S1. A NEW TUBE WILL HAVE A VOLTAGE DROP OF APPROXIMATELY 10 VOLTS. A TUBE APPROACHING THE END OF LIFE MAY HAVE A VOLTAGE DROP OF 20 VOLTS.

GRID-CONTROLLED THYRATRONS CAN BE INCORPORATED INTO CIRCUITS TO PROVIDE NUMEROUS SERVICES INCLUDING THE SPEED CONTROL OF DC MOTORS, DC TO AC INVERSION, AC TO DC RECTIFICATION, AND SUPPLYING VARIABLE AC POWER FROM AN AC SOURCE.

FIGURE 2 ILLUSTRATES ONE METHOD OF CONVERTING AC TO DC. THE MAGNITUDE OF THE DC OUTPUT VOLTAGE IS CONTROLLED BY THE VARIABLE RESISTOR WHICH CONTROLS THE FIRING ANGLE, OR GRID VOLTAGE PHASE, OF THE THYRATRONS. THE USE OF THYRATRONS TO SUPPLY A VARIABLE AC OUTPUT FROM A FIXED AC SOURCE IS SHOWN IN FIGURE 3. AGAIN, THE VARIABLE RESISTOR SERVES TO CONTROL THE PHASE ANGLE OF THE APPLIED GRID VOLTAGE AND THUS THE OUTPUT VOLTAGE.
**FIG. 2** THYRATRON POWER SUPPLY PROVIDING VARIABLE D-C OUTPUT FROM A-C INPUT

**FIG. 3** THYRATRON POWER SUPPLY PROVIDING VARIABLE A-C OUTPUT FROM A-C INPUT