Westinghouse Rectifier Tube

TECHNICAL INFORMATION

Main Use: Half Wave Rectifier
Number of Electrodes: 2
Maximum Crest Inverse Voltage: 5000
Maximum Crest Anode Current (Amperes): 0.3
Filament:
Volts: 2.5
Amperes: 2.0
Type: Oxide Coated
Approximate Tube Voltage Drop: 15
Maximum Overall Dimensions:
Length: 5"'
Diameter: 1/16"
Base Type Numbers:
Industrial Base #410
Type of Cooling: 3907 cap
Air

GENERAL DESCRIPTION

The KI-605 is a half-wave, hot cathode, mercury vapor rectifier tube for use in suitable rectifying devices designed to supply d-c. power from a-c. supply lines. Full-wave rectification is accomplished by using two of these tubes. The cathode is in the form of a ribbon filament of the coated type.

FIG. 1—TYPE KI-605 TUBE AND BASE DIMENSIONS
INSTALLATION

Mechanical—The KI-605 is designed for use with the standard industrial socket* and a cap connector.** These should be mounted so as to hold the tube in a vertical position with the filament (large base) end down. The tube must not be subjected to excessive vibration, and it may, therefore, be necessary in some installations to provide a spring mounting. The bulb becomes hot during continuous operation and for this reason should not be touched by an inflammable material and should not come in contact with any metallic body nor be subjected to the drops or spray of any liquid.

Cooling—This tube is designed to operate with an ambient temperature of not less than 0°C. (32°F.) and not more than 50°C. (122°F.). The ambient temperature is the temperature of the air which, coming into contact with the heated parts of the tube, carries off its heat.

Electrical—Hot cathode, mercury vapor type of rectifier tubes should be installed and mounted so that they are not subject to extraneous high voltage or any high frequency fields, both of which tend to produce breakdown effects in mercury vapor. Coupling of the rectifier circuits with high frequency fields should also be avoided for the same reason. If necessary, shields should be provided so that high voltage fields cannot affect the tube, and filters should be used so that radio frequency currents cannot be fed back into the rectifier tubes.

The filament should be operated on alternating current. The return lead of the filter and load circuit should be connected to the center tap of the filament winding. It should be remembered that the filament circuit may be at a high potential and due caution should be exercised in measuring the filament voltage.

The filament voltage should always be adjusted to the rated value on each individual tube under normal load conditions. It must not fluctuate more than 5% from the rated value. This shall include the effects of regulation caused by the load and also the normal power supply regulation.

It is recommended that the anode supply of the circuit be provided with a time delay relay having an obtainable delay period of 20 seconds in order that the filament will be allowed to come up to temperature before anode voltage is applied. Since, in general, different installations will have filament supply transformers of widely different characteristics, it is recommended that the time delay relays for each installation be adjusted to give the maximum permissible delay. In any case, the filament must be allowed to come up to operating temperature before anode voltage is applied. For average conditions, the delay should be approximately 5 seconds.

OPERATION

Ordinary care in the handling and use of the KI-605 and provision for the necessary operating conditions peculiar to this rectifier will minimize accidental damage of the tube.

The mercury within the bulb may have become sputtered onto the filament and anode during shipment. Therefore, when the KI-605 is first placed in operation, the filament must be lighted at normal temperature for 15 minutes without any applied anode voltage in order to start proper distribution of the mercury.

The filament of rectifier KI-605 should always be operated at rated voltage. Less than this voltage may result in high tube drop with consequent bombardment of the cathode and eventual loss of emission. Greater than rated voltage will shorten the life of the filament.

There are two fundamental limitations in the operation of the KI-605. These are the maximum crest inverse voltage which should never exceed 5000 volts, and the maximum crest plate current of .3 amperes.

Maximum crest inverse voltage is the highest instantaneous voltage that a rectifier tube can safely stand in the direction opposite to that in which it is designed to pass current. In other words, it is the safe arc-back limit with the tube operating within the specified temperature range. The relations between the crest inverse voltage, the d-c. voltage and the r.m.s. value of a-c. voltage depend largely upon the individual characteristics of the rectifier circuit and the power supply. The presence of line surges, or any transient or wave form distortion may raise the actual crest voltage to a value which is higher than that calculated from the sine wave voltages in the transformer. It should, therefore, be emphasized that the maximum rating of the tube refers to the actual inverse voltage and not to the calculated values. A cathode ray oscillograph or a spark gap connected across the tube is useful in determining the actual crest inverse voltage.

Maximum crest anode current is the highest instantaneous current that a rectifier tube can safely stand in the direction in which it is designed to pass current. If a large condenser is used in the filter circuit next to the rectifier
Westinghouse Rectifier Tube

A summary of the approximate conditions and typical results which will usually be obtained from the use of these circuits is described briefly by the following table:

<table>
<thead>
<tr>
<th>No. of Tubes</th>
<th>Input Voltage R.M.S.</th>
<th>Approx. Output D.C. Current (amps.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 phase Full Wave</td>
<td>2 tubes</td>
<td>1750 per tube</td>
</tr>
<tr>
<td>1 phase Full Wave</td>
<td>4 total</td>
<td>3500</td>
</tr>
<tr>
<td>3 phase Half Wave</td>
<td>3 per leg</td>
<td>2050</td>
</tr>
<tr>
<td>3 phase Double Y</td>
<td>6 per leg</td>
<td>2050</td>
</tr>
<tr>
<td>Parallel</td>
<td>3 phase Full Wave</td>
<td>6 per leg</td>
</tr>
</tbody>
</table>

The above table is based upon ideal sine wave conditions.

In practice, as already stated, the output shown cannot always be obtained because the applied voltage must be lower due to transformer regulation, and the possible presence of abnormal line surges. Normal operation conditions must be determined for each individual installation.

Each tabulated value of d-c. voltage is the effective d-c. output voltage from the rectifier tube, and any drop in the filter, therefore, must be subtracted from the value given, in order to obtain the available output. Owing to the low tube voltage drop of approximately 15 volts, the only reduction in rectified voltage when the load is increased, is due to the drop in the transformer and filter windings.

In the case of the three-phase full wave and single phase four tube full wave circuits, two Kl-605 tubes are used in series. This arrangement is made possible by the low and constant voltage drop within the Kl-605. These circuits are desirable where higher d-c. voltages are required.

In the design of rectifiers using these circuits, special precautions should be taken not to exceed the tube ratings.

The Kl-605 has a characteristic blue glow when it is operating. In service the bulb will eventually darken. This is not an indication of the end of life and tubes should not be retired on this account.

Information on complete apparatus or special circuits may be obtained through the nearest Westinghouse District Office.

tube, the crest current is often as much as four times the load current. In order to determine accurately the crest current in any circuit, the best procedure usually is to measure it with a peak form of meter or to use an oscillograph.

The foregoing ratings and information are based upon use at commercial frequencies if not in excess of 150 cycles per second. Use at high frequencies will affect its operation and life and special information should be obtained from the manufacturer.

**FIG. 2—CIRCUITS FOR HOT CATHODE MERCURY VAPOR TUBES**

Several circuits particularly suited for use with the Kl-605 are schematically given above.