The National NL5553B is a stainless-steel jacketed, water cooled, mercury pool ignitron designed especially for welder control and similar AC control applications. Its rating is approximately equivalent to a 1200 ampere magnetic contactor.

The NL5553B has a copper thermostat mounting plate attached to the outside cylinder in such a manner that it makes thermal contact with the inner cylinder. The temperature of this copper plate is essentially the same as that of the inner cylinder and it is slotted so that it can accommodate the standard ignitron thermostat mounting. This plate can be used either for protection or water-saver thermostat. One each of these thermostats mounted on a pair of these ignitrons can provide both protection against overheating and water savings.

**TECHNICAL INFORMATION**

**AC Control Applications** - Ratings are based on full-cycle conduction (no phase delay) regardless of whether or not phase control is used, on frequencies from 25 to 60Hz, and any voltage between 250 and 600 volts rms. Higher voltage ratings are available. Ratings are for two ignitrons in inverse parallel, see curve S-40M.

<table>
<thead>
<tr>
<th>Maximum demand 1</th>
<th>2400 kVA</th>
<th>Maximum surge current - peak amps = 280% of max. rms demand current allowed at system voltage.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corresponding maximum average anode current per tube 1</td>
<td>192 ADC</td>
<td>Max ratio of peak fault to peak anode current</td>
</tr>
<tr>
<td>Maximum average anode current per tube 1</td>
<td>355 ADC</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**Rectifier Applications** - Ratings are based on intermittent duty, on no phase delay, and on frequencies from 50 to 60Hz. When phase control is used, current ratings are reduced as per phase control current rating curve. Values are for one tube, see curves S-70 & S-102.

<table>
<thead>
<tr>
<th>Maximum peak anode voltage</th>
<th>600</th>
<th>1200</th>
<th>1500</th>
<th>Maximum average current</th>
<th>54</th>
<th>40</th>
<th>32 ADC</th>
<th>Maximum duration time of fault current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum peak anode current</td>
<td>4000</td>
<td>3000</td>
<td>2400</td>
<td>Max ratio of avg. to peak current, max.</td>
<td>190</td>
<td>140</td>
<td>112 ADC</td>
<td>0.15</td>
</tr>
<tr>
<td>Corresponding average current</td>
<td>54</td>
<td>40</td>
<td>32 ADC</td>
<td>Max ratio of peak fault to peak anode current</td>
<td>190</td>
<td>140</td>
<td>112 ADC</td>
<td>Max ratio of peak fault to peak anode current</td>
</tr>
<tr>
<td>Maximum Average current</td>
<td>190</td>
<td>140</td>
<td>112 ADC</td>
<td>Maximum duration time of fault current</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15 sec.</td>
<td>Max ratio of peak fault to peak anode current</td>
</tr>
</tbody>
</table>
Ignitor Requirements (Same for both applications.)

Ignitor Voltage
Maximum instantaneous allowed ignitor positive ----- Anode Voltage
Maximum instantaneous required, ignitor positive 3 ---- 200 V
Maximum instantaneous allowed ignitor negative ----- 5 V

Ignitor Current
Maximum instantaneous allowed ------------------------ 100 A
Maximum instantaneous required 3 --------------------------- 30 A
Maximum rms allowed ------------------------------------- 10 A
Maximum average allowed -------------------------------- 1 A
Ignitor ignition time maximum 3 -------------------------------- 100 µs
Ignitor current maximum averaging time --------------- 5 sec.

Cooling Requirements (Same for both applications.)

Type of cooling ---------------------------------------------- Water
Minimum inlet water temperature ---------------------- 0 °C
Maximum cooling system temperature
(Measured at thermostat mount)
Rectifier Applications --------------------------------------- 40 °C
AC Control Applications:
    At 600 V rms ------------------ 40 °C
    At 500 V rms ------------------ 45 °C
    At 250 V rms ------------------ 50 °C

Approximate water flow required at continuous full
load (water flow may be reduced if cooling system
temperature is maintained within limits). ------------ 1.5 to 3 GPM
Pressure drop per tube at 3 GPM ------------------------- 5 lb/in²
Water temperature rise at 3 GPM, full load ------------ 9 °C
Approx. temperature rise, water at inlet to
thermostat mount (at full load and 3 GPM). ------------ 3 °C

General Characteristics
Number of Anodes ------------------------------------------ 1
Number of Ignitors ------------------------------------------ 1
Mounting Position ------------------------------------------ Vertical - Anode up
Net Weight ----------------------------------------------- 17 lb
Approx. shipping weight ----------------------------------- 26 lb

Peak arc drop at 13,600 peak amps (approx.) -------------- 36 V
Peak arc drop at 1115 peak amps (approx.) --------------- 17 V
TECHNICAL CURVES

DEMAND CURRENT VS PERCENT DUTY

2 TUBES CONNECTED IN INVERSE PARALLEL

POWER RECTIFIER RATING INTERMITTENT SERVICE

50% TUBE DUTY

PHASE CONTROL CURRENT RATINGS

Page 3
Notes:

1) Using log-log paper, straight line interpolation of RMS Demand Current vs. Average Anode Current and Maximum Averaging Time vs. Anode Voltage may be used to determine intermediate ratings.

2) Using log-log paper, straight line interpolation of Peak Anode Current vs. Average Anode Current may be used to determine intermediate ratings. See curves for details.

3) Ignition will occur if either maximum required instantaneous potential is applied or maximum required instantaneous current flows for the rated maximum ignitor ignition time.

4) When separate excitation is used, the recommended Electronic Industries Association Standards for capacitor firing apply.

Available Accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1K958-Series</td>
<td>Ignitor Tulip Clip/Cable Assembly (Various options available, check with your local Richardson representative for details.)</td>
</tr>
<tr>
<td>IG5F2-10</td>
<td>Ignitor Trigger Module (For capacitive discharge applications only.)</td>
</tr>
</tbody>
</table>

Tube Life Considerations

The method used to determine the life expectancy of an ignitron varies according to the application and it is necessary to consider the various types separately. It must be understood that the ratings specified are absolute limits. It is the responsibility of the equipment designer to ensure that the specified limits cannot be exceeded under the worse possible conditions of component tolerance, voltage fluctuation, and load variation.

A general rule of thumb: To obtain longer life, the ignitron must be operated at lower levels. Typically, life may be increased 10X if either the voltage or current is halved.

Ignitrons are robust high current switching devices. The current ratings may be exceeded to some extent without destroying the ignitron but with the consequence of reduced life.

IGNITOR

The ignitor is a small rod of semi-conducting material with a pointed end that is partially immersed into the cathode pool. When a suitable current pulse is passed through the ignitor-mercury junction (with the ignitor being positive with respect to the cathode pool) forms a cathode spot on the surface of the mercury and free electrons are emitted. If the anode is sufficiently positive with the cathode at this time, an arc will form between the cathode and anode. Once the arc is initiated, the ignitor has no further control and the ignitron continues to conduct until the voltage across the ignitron falls below the ionization potential of the mercury vapor.

In capacitor discharge circuits the ignitron has to pass a very high current and the conditions are naturally harmful to the ignitron. The mercury pool and the ignitor itself will become contaminated and the best life will be obtained if a high energy pulse is applied to the ignitor. Under these conditions a pulse from a separate excitation circuit containing a 1uf capacitor charged from 1500V to 3000V will provide 1 to 4.5 Joules of energy to the ignitor. Richardson Electronics endorses National Electronics Ignitrons using these parameters. Considering the wide range of ignitors available across the range of ignitrons produced, Richardson Electronics recommends that an ignitor pulse providing 4 to 7 Joules is optimal.
MOUNTING

The performance and life of the ignitron is greatly improved if it is operated in a field free space. Magnetic fields tend to force the arc toward the tube sidewall and aggravate sidewall arcing. Metal vapor produced by sidewall arcing is one of the major contributors to ignitor wetting. We recommend a coaxial type mounting to minimize field effects.

INSTALLATION INFORMATION

RECOMMENDED CONDITIONING BEFORE INITIAL USE - The ignitron is in high voltage operating condition before leaving the factory. Shipping tends to redistribute mercury throughout the ignitron making certain conditioning steps desirable before installation.

Heat Conditioning - Before applying voltage, heat anode stud to 100-125°C (keeping cathode near room temperature) for two hours minimum. This drives mercury away from anode and anode seal area.

Voltage Conditioning (after Heat Conditioning) - Apply 110% of operating voltage (preferably DCV) or up to 110% of rated maximum voltage across ignitron (anode positive and ignitor not connected) with a series combination of a 1 to 4 uf capacitor and a 1 ohm resistor in parallel with the ignitron. NATIONAL will replace any ignitron that will not hold off minimum voltage at initial test when caused by a manufacturing defect. Additional conditioning at higher voltages is recommended to stabilize the ignitron after shipping. Slowly increase voltage above minimum. Breakdown may occur but the ignitron will attain a Hi-Pot Stabilization Voltage of approximately 125% of operating voltage, or up to 125% of rated maximum voltage.

NOTE: The time required for conditioning to Hi-Pot Stabilization Voltage can be reduced by using a variable ac voltage source connected directly across the ignitron (ignitor not connected). Slowly increase the voltage; limit the current to 30 milliamperes maximum.

RECOMMENDED PRACTICE AFTER INITIAL USE - Mercury condensed in the anode and anode seal area greatly decreases the ignitron's voltage hold-off ability. Heat conditioning before initial use complements proper mercury distribution before the ignitron is first placed in operation. Once in operation, maintain a thermal gradient so that the anode area is at least 10°C greater than the cathode. This is also true during any cooling period. The anode and anode area must not cool faster than the cathode.

The ignitor becomes susceptible to damage by movement of mercury after use in a capacitor discharge or crowbar application. For maximum life, we recommend that an ignitron not be moved until end-of-life once it has been placed in service.

LIFE AND WARRANTY

Richardson Electronics, Ltd. warrants the tube types listed above to be free from defects of design, material, and workmanship when received and, after receiving Recommended Conditioning Before Initial Use, to operate satisfactorily when first installed and, if used within ratings, to give a minimum of 1000 operations. No adjustment will be made if the tube is not placed in service within six months after date of shipment by manufacturer. This warranty expires 12 months after date of shipment by manufacturer.

National High Voltage Switching Ignitrons have an expected life of many times the warranted number of operations in most applications. Operating within the recommended ratings and following the Recommended Practices After Initial Use will greatly increase the life or operations obtained.