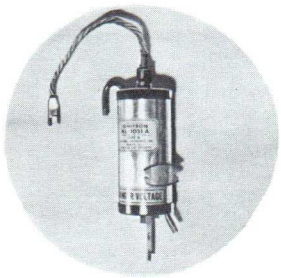
Omni Ray AG Zürich 8 Dufourstrasse 56 Tel. (051) 34 44 30

Omni Ray
INFORMATION

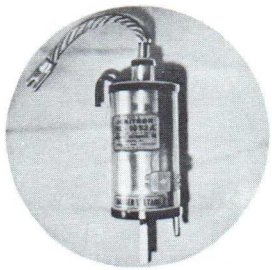
Industrie Elektronenröhren

NATIONAL ELECTRONICS, INC.

62.5010/1

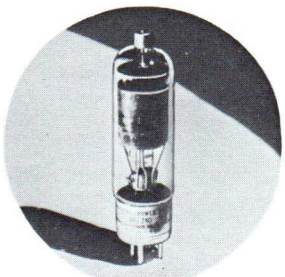


NL-1051A IGNITRON

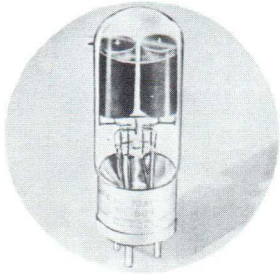


NL-1052A IGNITRON

NL-3C23 THYRATRON



NL-740 THYRATRON



NL-604 RECTIFIER

IGNITRONS

TYPE NUMBER	VOLTS	MAXIMUM RATINGS				TYPE OF COOLING
		Maximum Demand	Corresponding Current DC-Amps	Maximum Current DC-Amps	Corresponding Demand	
NL-1001	250 - 600	150 Kva	4.9	9.0	50 Kva	Convection
NL-1005	250 - 600	600 Kva	30.2	56	200 Kva	Forced air
NL-1009	250 - 600	1700 Kva	120	220	570 Kva	Water
NL-1011A	250 - 600	600 Kva	30.2	56	200 Kva	Water
NL-1012A	250 - 600	1200 Kva	75.6	140	400 Kva	Water
NL-1013A	250 - 600	2400 Kva	192.	355	800 Kva	Water
NL-1014	250 - 600	4800 Kva	486.	900	1600 Kva	Water
NL-1022A	1500 peak	1200 peak	16	56	336 peak	Water
NL-1051A	250 - 600	600 Kva	30.2	56	200 Kva	Water
NL-1052A	250 - 600	1200 Kva	75.6	140	400 Kva	Water
NL-1053A	250 - 600	2400 Kva	192	355	800 Kva	Water
NL-1054	250 - 600	4800 Kva	486	900	1600 Kva	Water
NL-5550	250 - 600	300 Kva	12.1	22.4	100 Kva	Water clamp

THYRATRONS

TYPE NUMBER	GAS FILLING	DC OUTPUT AMPS.	PEAK RATING AMPS	PEAK INVERSE VOLTS	FILAMENT VOLTS	FILAMENT AMPS	TYPE OF COOLING
NL-3C23	Gas & Merc.	1.5	6	1250	2.5	7	Convection
NL-632B	Mercury	2.5	30	1500	5.0	5	Convection
NL-710L	Gas & Merc.	2.5	30	1500	2.5	9	Convection
NL-710/6011	Gas & Merc.	2.5	30	1500	2.5	9	Convection
NL-714	Gas & Merc.	1	3	1250	2.5	5	Convection
NL-715/5557	Mercury	1	3	5000	2.5	5	Convection
NL-716	Gas & Merc.	1	8	1250	2.5	6.3	Convection
NL-720,L	Gas & Merc.	2.5	30	1500	2.5	9	Convection
NL-732	Gas & Merc.	30	225	1500	2.5	55	Convection
NL-740,L,P	Gas & Merc.	4	50	1500	2.5	16	Convection
NL-760,L,P	Gas & Merc.	6.4	77	1500	2.5	21	Convection
NL-778,L,P	Gas & Merc.	6.4	110	1500	2.5	21	Convection
NL-5560/FG95	Mercury	2.5	15	1000	5.0	4.5	Convection
NL-5632/C3J,L	Inert Gas	2.5	30	1250	2.5	9	Convection
NL-5665/C16J	Inert Gas	18.0	160	1250	2.5	31	Convection
NL-5684/C3J/A,L	Inert Gas	2.5	30	1250	2.5	9	Convection
NL-6014/C1K	Inert Gas	1	8	1250	2.5	6.3	Convection

HALF WAVE RECTIFIERS

NL-615	Mercury	2.5	10	2000	2.5	7	Convection
NL-617	Mercury	5	20	1000	2	12	Convection
NL-618,L,P	Inert Gas	6.4	40	900	2.5	18	Convection
NL-619	Mercury	6	20	300	2	12	Convection
NL-623	Mercury	15	45	500	2.5	20	Convection
NL-635,L,P	Gas & Merc.	6.4	77	1000	2.5	18	Convection
NL-643	Mercury	15	90	700	2.5	23	Convection
NL-649/5834	Mercury	2	10	900	2.5	7	Convection
NL-653/5835	Mercury	3	12	900	2.5	10	Convection
NL-664L	Gas & Merc.	10	120	1000	2.5	25	Convection

FULL WAVE RECTIFIERS

NL-604,L	Gas & Merc.	2.5	10	900	2.5	11.5	Convection
NL-606,L	Gas & Merc.	6.4	25.6	900	2.5	17	Convection

HIGH VOLTAGE SWITCHING IGNITRONS

National Electronics, Inc. High Voltage Switching Ignitrons are used in a variety of applications including capacitor discharge, clamping, and crowbar. Each application has its own particular switching requirement depending upon voltage, current, pulse repetition rate, pulse shape and load characteristics.

Each ignitron type has been designed to meet specific needs. The NL-1037, NL-7703, and NL-7703H serve as examples. Ratings of these types are identical in most respects. The NL-7703 was developed with a molybdenum anode for highest reliability in 20 KV operation. Some applications have conditions that do not give desired life with a molybdenum anode so the NL-1037 was developed. Characteristics of both are identical except the NL-1037 has a graphite anode. The NL-7703H was added for applications with special ignitor firing requirements.

RATINGS AND CHARACTERISTICS

	NL-1036 Improved 7171	NL-1037	NL-1038	NL-1039 NL-1039H	NL-1059A	NL-7703 NL-7703H
Approx. OD, Inches	2	2	4	2	5	2
Height, Inches	8	8	7	8	21	8
[1]Maximum Peak Current, Kiloamperes	35	100	100	100	100	100
[1]Maximum Average Current, Amperes	.75	.75	1.7	.75	2.0	.75
[1]Maximum Averaging Time, Minutes	1	1	1	1	1	1
Maximum Peak Anode Voltage, Kilovolts	15	20	15	20	20	20
[1]Maximum Energy Switching Capability, Ringing Applications, Kilojoules per Minute (J)	20	30	50	30	50	30
Ionization Time	← Less Than 1 Microsecond →					
[2]Number of Ignitors	1	1	2	1	3	1
[3]Anode Material	G	G	G	SS	G	Mo
[4]Anode Insulator	P	DP	P	DP	P	DP
Anode Seal and Stud Potting	On Order	Yes	No	Yes	No	Yes
[5]Maximum Cathode Temperature, °C	35	35	35	35	35	35
[5]Cooling Method	Clamp	Clamp	Clamp	Clamp	Liquid	Clamp
Net Weight, Lbs.	1.9	2.0	7.5	2.7	22	2.8
Approximate Shipping Weight, Lbs.	6	6	10	6	26	6

[1]In the peak voltage range from 5000 volts to maximum rating, the maximum coulomb-per-second transfer capability of the ignitron is basically a constant. In unidirectional current applications this capability is defined by specifying the maximum peak anode current, maximum average anode current, and the maximum averaging time. In applications with current reversal (ringing), it is more convenient to specify the maximum energy that can be switched per minute as a function of peak anode voltage and percentage of reversal; maximum peak anode current also applies. While the exact relationship has not been determined, the following expression gives conservative values of energy switching capability for anode voltages down to 5000 volts and for 30% to 85% reversal.

$$\text{Maximum energy switched per minute} = J \times \frac{Va}{Vr} \times \left(\frac{85}{R}\right)^2$$

J= Rated maximum energy switching capability per minute. Va = Actual peak anode voltage.
Vr = Rated peak anode voltage. R = Actual percent reversal.

The maximum energy ratings listed are for rated peak anode voltage and 85% reversal.

[2]NL-1036, NL-1037, NL-1039, and NL-7703 have standard welder ignitors.

NL-1039H, NL-1059, and NL-7703H have high resistance ignitors.

[3]G — Graphite. Mo — Molybdenum. SS — Stainless Steel.

[4]P — Straight insulator, no pant leg. DP — Double pant leg.

[5]Cathode temperature should be lower than anode stud temperature during operation. Cooling by means of a cooling clamp permits coaxial type mounting to minimize inductance. Cooling clamp may also be used for mounting.

Printed in U.S.A. 6/64 R.W.W.Co.

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A SUBSIDIARY OF EITEL-McCULLOUGH, INC.
GENEVA, ILLINOIS, U. S. A.

TUBE LIFE CONSIDERATIONS

Tube life (number of shots) is a function of the operating peak anode voltage, peak current, and average current, and is increased by operation at values below the maximum ratings. While the specific relationship has not been determined, we suggest the following exponential expression as a conservative approximation:

$$\text{Number of expected operations multiplier} = e^{a+b+c-3}$$

$$a = \frac{\text{Rated maximum peak anode voltage}}{\text{Actual peak anode voltage}}$$

$$b = \frac{\text{Rated maximum peak anode current}}{\text{Actual peak anode current}}$$

$$c = \frac{\text{Rated maximum average current}}{\text{Actual average current}}$$

or

$$c = \frac{\text{Rated maximum energy switched at actual operating conditions}}{\text{Actual energy switched}}$$

IGNITOR

Standard Welder Ignitrons fire in less than 100 microseconds with an applied voltage of 200 volts. Shorter firing times can be obtained by using high voltages. Three thousand to five thousand volts will give less than one microsecond firing time.

High Resistance Ignitors are heavy-duty-shaped, have long life and minimize ignitor wetting in applications of severe service. They will fire in less than 100 microseconds with an applied voltage of 800 volts. Ignitor voltages from 2 to 5 kilovolts are required for reliable fast firing.

Anode firing (using anode voltage supply) or separate excitation can be used with either type ignitor. In both cases, sufficient energy must be available to the ignitor for reliable firing. A firing circuit supplying minimum energy needed by a new tube is not the best practice since ignitor energy requirements increase with tube life. While each application dictates its own energy requirements, four to eight Joules per ignitor is reasonable for the most severe applications at maximum ratings and for maximum life consistant with this type operation to insure firing in parallel ignitron applications.

Reverse ignitor current is undesirable, but is not destructive if tube is simultaneously conducting anode current.

ANODE MATERIAL

Anode materials, graphite and molybdenum, affect life and reliability. Life is equated to the number of times a tube will operate before prefires or misfires become too frequent for the application. Reliability is dependent upon the number of acceptable prefires or misfires during life. What may be considered end of life for one application may be acceptable reliability for another. This is especially so in parallel operation when a few microseconds prefire may be objectionable. In single tube operation, this would never be noticed. Applications requiring extremely high reliability have had more success with molybdenum anodes. Graphite, on the other hand, does not display as high reliability in critical applications but gives longer life in many applications because of less tendency towards ignitor wetting.

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 minimum voltage (Table 1) across ignitron (anode positive and ignitor not connected) with a series combination of a 1 to 4 ufd 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 ignitron will stabilize above Hi-Pot Stabilization Voltage (Table 1).

Table 1

Tube Type	1036	1037	1038	1059	7703	7703H
Minimum Voltage (Kilovolts, DC)	17	22	22	22	22	22
Hi-Pot Stabilization Voltage (Kilovolts, DC)	30	35	35	35	35	35

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, permitting a maximum of 30 milliamperes to flow.

RECOMMENDED PRACTICE AFTER INITIAL USE — Mercury condensed in the anode and anode seal area greatly decreases the tube's voltage hold-off ability. Heat conditioning before initial use corrects improper mercury distribution before the tube is first placed in operation. Once the tube is in operation, the anode and anode seal area temperature must be equal to or greater than that of the cathode. This is also true during any cooling period. The anode and anode area must not cool faster than the cathode.

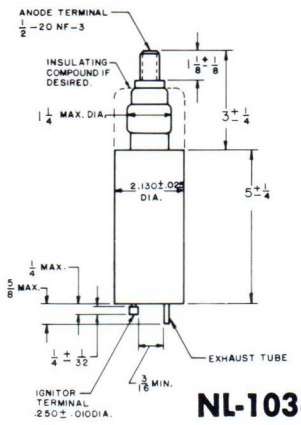
The ignitor becomes susceptible to damage by movement of mercury after use in a capacitor discharge or crowbar application. For maximum life, we recommend that an ignitron not be moved until end-of-life once it has been placed in service.

LIFE AND WARRANTY

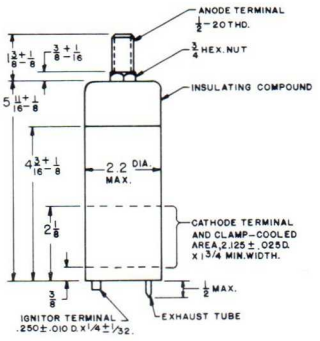
National Electronics, Inc. warrants the tube types listed above to be free from defects of design, material, and workmanship when received and, after receiving Recommended Conditioning Before Initial Use, to operate satisfactorily when first installed and, if used within ratings, to give a minimum of 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 18 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.

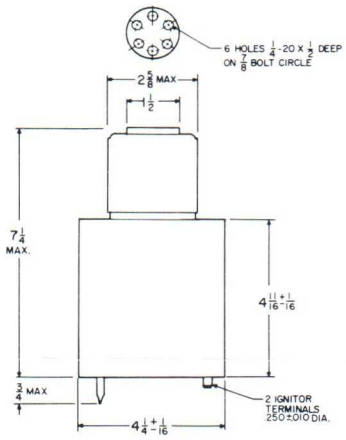
OUTLINE DRAWINGS



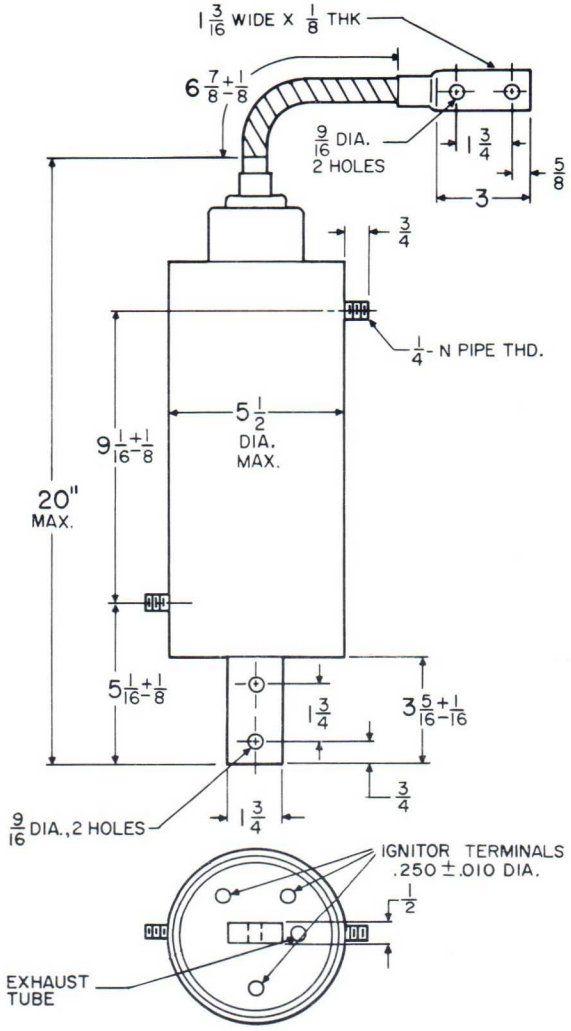
NL-1036



NL-1037
NL-1039
NL-1039H
NL-7703
NL-7703H



NL-1038



NL-1059

HIGH VOLTAGE IGNITRONS TO CONTROL CAPACITOR DISCHARGE

by

Howard E. Zuvers

There is a rapidly growing market for ignitron-switched capacitor discharge systems. There are 5,000 - 10,000 ignitrons in this relatively new, comparatively unpublished usage in the United States (March, 1964). The potential market may be greater than the present welding equipment Market. These new uses for ignitron-switched capacitor banks were the out-growth of a research program of the United States Atomic Energy Commission into the peaceful use of thermal nuclear energy.

There are five groups of applications. The first two are those which are considered to have the greatest potential growth.

1. Explosive forming:
   The energy stored in capacitors is released in a confined space to shape the confining member to conform to an outer die. For example, a wire explodes in a cylinder containing water, the arc converts enough of the water to steam to explode the cylinder into a final form. This can be expanded to include the new exploding wire technology.[1] Another application is sismographic work.

2. Magnetic forming:
   The magnetic field set up by the current discharge paths, for example, a coil, may collapse a cylinder around an inner conductor. This may soon be of common use in the automobile industry to join members, for example, automotive tie rods.

3. Magnetic lenses for particle accelerators to either shape the particle stream for focusing or for shifting the stream to various experiments.

4. Arc discharge type wind tunnels:
   Each of the aircraft companies has its ignitron controlled capacitor bank in which a gas is quickly heated to impinge on the part to simulate passing through the sound barrier.

5. Fusion research experiments:
   Ignitrons are used either to control the current which supplies the magnetic field or to switch the current for the main arc discharge.

These new uses for energy discharge systems, most of which use ignitrons as a switching device, are the by-products of an intensive capacitor-ignitron development sponsored by the United States Atomic Energy Commission's fusion research laboratories. The systems took considerable engineering to give longest tube and capacitor life with lowest inductance, hence, maximum energy transfer into the load.

The following is a brief history of how this came to be. The ignitrons which evolved from this development are quite special.[2] They are made with different techniques because they must hold off 20,000-30,000 volts with the same size tubes now operating at a maximum of 1,000 volts. There will soon be available a 50,000 volt ignitron to match an already developed 50,000 volt capacitor.

A typical discharge system consists of:

1. Controlled DC rectifier. The primary may be controlled by a variable volt transformer, induction voltage regulator, or ignitron contactor. The larger systems have some provisions for disconnecting the DC supply from the capacitor bank. In general, it is preferable that the capacitor bank be charged quickly because the life of a capacitor is some inverse function of the voltage.

2. The capacitors are quite special since life of a capacitor is supposedly in the inverse of the seventh power of the total voltage excursion. These pulse capacitors are subject to considerable mechanical forces due to the high peak currents; so, the older capacitor design and construction techniques don't work.

3. The ignitrons used are also special as are the ignitron-to-capacitor mounting brackets which have to be designed for low total inductance. The usual technique is to mount the ignitron directly on the capacitor with several coax cables in parallel connecting the ignitron capacitor combination to the load. The United States Atomic Energy Commission Laboratories at Princeton, Los Alamos, and Livermore have evolved many ingenious mechanical and electrical configurations.[3] The industrial users have copied these. Engineering problems are not easy--while only 30,000 - 40,000 amperes are needed to fasten a connector to a small coaxial cable, several million are needed in the magnetic focusing equipment. Up to 1600 ignitrons, each operating at 35,000 amperes, have been used.

The stories of these new applications began when simultaneously (1954 on) at the Atomic Energy Commission Laboratories at Livermore and Los Alamos, ignitrons were used to discharge capacitors charged to 10,000 and 20,000 volts. Shortly afterwards, the Stellerator project at Princeton University began, also using ignitrons. Doctors James L. Tuck and James Phillips headed the project at Los Alamos, Dr. Lyman Spitzer headed the Princeton project and Doctors Richard Post and Sterling Colgate, the Livermore project. The three projects evolved separately. Each felt that they independently discovered that, by selecting tubes, standard ignitrons sizes A and D would hold off 15,000 - 20,000 volts and discharge 50,000 and more amperes. Since parallel tubes were needed (up to 1600 at 35,000 A), extreme reliability is needed. The need for all tubes to operate at these voltages without selection was the initiating emphasis for the development.

Because of these independent, initial development efforts, there have been many kinds of ignitrons used. Special ignitrons have been developed to meet specific customer needs or preferences. National Electronics makes a complete line of capacitor switching ignitrons (see attached data sheets). The standard size A, 5550, and the rectifier ignitron, 5555, were the first two tubes used and from which the presently available tube types have evolved. There are available a series of 2" diameter tubes with different anode materials; graphite, stainless steel, and molybdenum. Different glass seals are used; the more complicated and expensive glass seal gives a better voltage distribution across the glass and more distance for voltage flash-over, hence, longer life. The success of the 2" diameter tube lead to the 4" 1038 which is a short, graphite anode tube designed to offer the greater mass possible with the same lower inductance.

It should be remembered that these are all limited life devices. Life is in the thousands to millions of shots but not the year-in year-out life of the standard welding ignitrons. The reason for the comparatively short life is

that these tubes are being used at hundreds of times their normal current carrying capacities. Metal evaporates from the side walls in the presence of the very high temperature arc. This coats the insulator and wets the ignitor. The anodes erode and under some conditions, the tubes get gassy.

****

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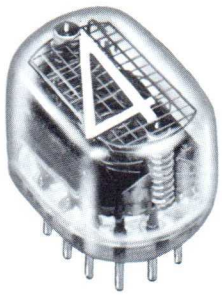
BIG READOUT TUBE*
NEWS from NATIONAL ELECTRONICS

NL-7037



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ONAL®

NDICATING TUBES

CHANGES COLOR TO INDICATE APPROACH OF END OF TUBE LIFE.....

Photos show typical operating colors for Life Indicating Tubes. Tube on left shows the color of the discharge, pale lilac, during normal operation.

Tube on the right shows the neon red color of the discharge of a tube approaching end of life.

NATIONAL ELECTRONICS, INC.

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GENEVA, ILLINOIS

NATIONAL® Life Indicating Tubes solve many Industrial power tube maintenance problems and eliminate most down-time due to tube failure. A few of the advantages of Self-Testing Tubes are listed below.

GIVES WARNING GLOW

The pale lilac (bluish purple) glow of a normally operating tube changes to a warning neon red approximately 300 hours before the end of tube life.

CHECK TUBE LIFE AT A GLANCE

Maintenance is reduced to a routine observation of the color of the glow while equipment stays in operation. Tubes need not be removed from socket to check for end of life.

ELIMINATE COSTLY DOWN-TIME

Tube replacement can be made at the next convenient shut down — no down time. Color of tube glow starts changing approximately 300 hours before tube replacement is required.

INCREASED TUBE LIFE

The special gas mixture and improved nickelate cathode greatly increase tube life. Tube life is increased by 50 to 100 percent which greatly reduces tube replacement.

AVAILABLE TYPES

The Life Indicating Tubes which are currently available are listed in the table.

LIFE INDICATING TUBES

LIFE INDICATING TUBE NO.	NOMENCLATURE	TUBE AMPERE RATING	REPLACES TUBE NUMBER
NL-7723-Ne	Pin Base Diode	2.5	NL-610 EL-3B
NL-5684-Ne	Pin Base Thyratron	2.5	EL-C3J EL-C3J/A NL-710 5684
NL-5684A-Ne	Pin Base High Commutation Thyratron	2.5	EL-C3J EL-C3J/A NL-710 5684
NL-C3J/AL-Ne	Lug Base Thyratron	2.5	EL-C3J/L NL-710L EL-C3J/AL 7556
NL-7556A-Ne	Lug Base High Commutation Thyratron	2.5	EL-C3J/L NL-710L EL-C3J/AL 7556
NL-7786-Ne	Lug Base Diode	6.4	NL-660L EL-6B/L NL-618L NL-635L
NL-C6J/K-Ne	Pin Base High Commutation Thyratron	6.4	EL-C6J/K NL-760 NL-C6J/K 5685 EL-C6J EL-C6J/A GL-6807
NL-6989-Ne	Lug Base High Commutation Thyratron	6.4	EL-C6J/KL NL-760L NL-6989/C6J/KL 7298 EL-C6J/L EL-C6J/AL GL-6809 6989

Life indicating tubes may be substituted directly for the equivalent types shown in the table above. Other life indicating tube types are in development and will be available in the near future. You will be advised as soon as they are available.

PRINTED IN USA 8/61

INDUSTRIAL TUBE SPECIALISTS

NATIONAL ELECTRONICS, INC.
A SUBSIDIARY OF EITEL-McCULLOUGH, INC.
GENEVA, ILLINOIS · CE 2-4300

November 19, 1962

NEW DATA SHEET

Gentlemen:

We are enclosing a technical data sheet for two new NATIONAL high voltage, mercury-vapor rectifiers, NL-6894 and NL-6895.

NL-6894 and NL-6895 are sturdy rectifier tubes especially designed for high voltage power rectifier applications. They are mercury filled for high efficiency, long life and the ability to operate at high peak inverse voltage.

Each individual tube is tested under the most exacting conditions to assume a uniform high quality product.

NL-6894 and NL-6895 have multiple ratings depending upon application and operating temperature. These ratings are: maximum dc amperes output, up to 2.5; maximum instantaneous amperes output, up to 11.5; maximum peak inverse volts, up to 20,000; condensed mercury temperature limits, 20°C up to 60°C.

Other ratings applying to all applications are: filament volts, 5; filament amperes, 9 to 11; filament heating time (seconds), 30; maximum averaging time (seconds), 20; maximum ac short circuit current (amperes), 100; and condensed mercury temperature rise above ambient, approximately 18°C.

Very truly yours,

NATIONAL ELECTRONICS, INC.

Joe S. Kirk

Joe S. Kirk

JSK:lh

Enclosure

P.S. Please insert this sheet in your NATIONAL tube catalog.

file

INDUSTRIAL TUBE SPECIALISTS

NATIONAL ELECTRONICS, INC.

A SUBSIDIARY OF EITEL-McCULLOUGH, INC.

GENEVA, ILLINOIS · CE 2-4300

February 28, 1962

✓ NEW DATA SHEETS

Gentlemen:

NATIONAL ELECTRONICS, INC. has added two more high voltage tubes to their Industrial Tube line. They are the NL-575A and the NL-673.

NL-575A and NL-673 are sturdy rectifiers, especially designed for high voltage power rectifier applications. They are mercury filled for high efficiency, long life, and the ability to operate at high peak inverse voltages.

NL-575A and NL-673 ratings are: peak inverse volts - 15000; D.C. amperes maximum - 2.5; maximum instantaneous amperes - 10; filament volts - 5; and filament amperes - 10.

NL-673 is supplied with the A4-18 industrial base and the NL-575A with the A4-29 50 watt base.

Yours truly,

NATIONAL ELECTRONICS, INC.

Joe S. Kirk

Joe S. Kirk

P.S. Please insert these data sheets in your NATIONAL industrial catalog.

File

NATIONAL ELECTRONICS, INC.

A SUBSIDIARY OF EITEL-McCULLOUGH, INC.

GENEVA, ILLINOIS · CE 2-4300

August 21, 1961

N E W T U B E T Y P E S

Gentlemen:

Two new high voltage rectifier tubes have been added to the NATIONAL line. They are the NL-KY21A and NL-RX21A. A new data sheet is enclosed for each of these types.

The NL-KY21A is a grid controlled mercury-vapor rectifier recommended for use in power supplies or control circuits where a variable voltage is desired.

The NL-RX21A is a half-wave, mercury-vapor rectifier incorporating features which enable it to withstand high inverse voltages.

A pair of either of these tube types in a conventional single phase full wave circuit will supply a DC output of 5 kilowatts (3500 volts at 1.5 amperes) with a choke input filter.

Both types are now available from NATIONAL'S stock.

Please check data sheets for rating details and insert these new sheets in your NATIONAL Industrial Tubes Data Book.

Yours very truly,

NATIONAL ELECTRONICS, INC.

Joe S. Kirk

Joe S. Kirk

JSK/mmc
Enclosure

A. Normal Loose Leaf Sheets.

1. Enter in L notebook (part)
2. Add Description
3. New Types
   A. Enter in Notebooks
   B. Add to complete list
   C. Add to prefixes
   D. Add to contents in front of LL.
4. Circulate new sheets
5. Sheets other than circulated
6. Amend content in front of LL
7. Types removed for filing
   A. Sheets
   B. Notebooks
   C. Complete lists
8. File sheets removed
   A. Types
   B. Contents, etc.
9. When sheets circulated have been returned
10. L notebook (balance)
11. File instructions.

Returned
8-11-61

National Electronics, Incorporated

GENEVA, ILLINOIS

May 1, 1961

N E W D A T A S H E E T

Gentlemen:

A new inert gas filled thyratron tube has been added to the NATIONAL line and is known as the NL-734/5544. A data sheet is enclosed covering this new tube.

The NL-734/5544 was designed especially for welding control, motor control and other industrial applications. It is inert gas filled for quick starting and it operates reliably within wide temperature limits.

This tube is also available with the lug base under the type number NL-734/L.

Please check data sheet for rating details and insert this new sheet in your NATIONAL Industrial Tubes Data Book.

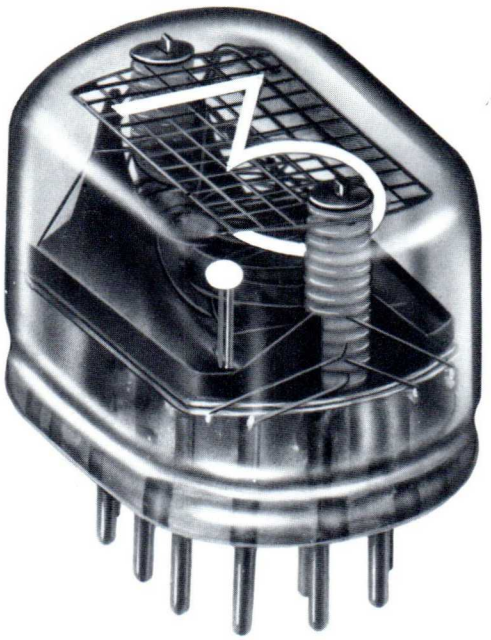
Very truly yours,

NATIONAL ELECTRONICS, INC.

H. W. A. Chalberg

H. W. A. Chalberg
Sales Manager

HWAC:ks
Enclosure



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*NL-809

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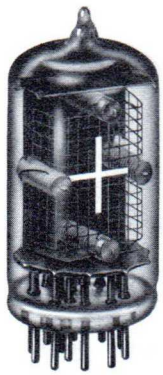
NL-812 WITH DECIMAL POINT

NL-811 PLUS AND MINUS



NL-811

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