(1)

out of date

INDUSTRIAL TUBES

NATIONAL ELECTRONICS, INC.
GENEVA, ILL.

NATIONAL® Power Tubes are produced by Industrial Tube specialists, exclusively.

Out-of-date

NATIONAL®
IGNITRONS AND
GASEOUS RECTIFIER
AND THYRATRON TUBES

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NATIONAL® Industrial Tubes are designed and built for great dependability.

National Electronics specializes in the design and manufacture of industrial electronic tubes particularly suited to the requirements of industry. Dependability and long life are paramount among these requirements.

WARRANTIES

NATIONAL tubes carry the longest warranties in the industry.

Preferred Thyratrons and Rectifiers are guaranteed for 2 years. These tubes are outstandingly reliable and very conservatively designed. Sockets are available for these types that are highly reliable at the currents involved.

All NATIONAL electronic tubes are designed and built to give the longest life possible under the conditions imposed by the application.

N-24 WARRANTY — 2 YEARS

Preferred NATIONAL Thyratrons and Rectifiers are warranted for 2 YEARS against defects in design, material, and workmanship when used within published ratings. If such defects appear within 2 YEARS after the tube is placed in service, a pro-rata adjustment will be made, based upon the difference between the elapsed life in months at failure and 2 years. A fraction of a month, consisting of sixteen days or more, will be considered a full month of life. A period of fifteen days or less will be deducted from the tube life.

If defects appear within one year after the tube is placed in service, free replacement will be made.

Once a tube has been installed in regular service its life will be considered continuous.

No adjustment will be made if the tube life exceeds 2 years. This warranty expires 2½ years after date of sale to ultimate user and 3 years after date of shipment by manufacturer.

N-12 WARRANTY — 1 YEAR

Other NATIONAL Industrial Tubes are warranted for 1 YEAR against defects in design, material, and workmanship when used within published ratings. If such defects appear within 1 YEAR after the tube is placed in service, a pro-rata adjustment will be made, based upon the difference between the elapsed life in months at failure and one year. A fraction of a month, consisting of sixteen days or more, will be considered a full month of life. A period of fifteen days or less will be deducted from the tube life.

Once a tube has been installed in regular service its life will be considered continuous.

No adjustment will be made if the tube life exceeds 1 year. This warranty expires 1½ years after date of sale to ultimate user and 2 years after date of shipment by manufacturer.

N-3000 WARRANTY — 3000 HOURS

Certain specified NATIONAL Industrial Tubes are warranted to be free from defects in design, material, and workmanship for a useful life in excess of 3000 HOURS when used within published ratings. If such defects appear before 3000 hours of use, a pro-rata adjustment will be made, based upon the difference between the tube life in hours at failure and 3000 hours.

The tube life in hours is the actual total time the tube has been used.

No adjustment will be made if the tube life exceeds 3000 hours. This warranty expires 1½ years after date of sale to ultimate user and 2 years after date of shipment by manufacturer.

Printed in USA 5-58/GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NATIONAL ELECTRONICS

INDUSTRIAL TUBE INTERCHANGEABILITY

Other Type No.	Tube Class	DC Amps Output	Replace With National Type*
(EL-C1J)	Thy.	1.0	NL-716
(EL-C1J/A)	Thy.	1.0	NL-716
(C1K/6014) (EL-C1K)	Thy.	1.0	NL-716
C1K/6014 EL-C1K	Thy.	1.0	NL-6014/C1K
M-1K-5	H.W.R.	5.0	NL-617
2AC-15&A	H.W.R.	15.0	NL-623
2D21	Thy.	0.1	
2-RA-6	H.W.R.	6.0	NL-619
M-2K-2.5	H.W.R.	2.5	NL-615
E-M-2.5	H.W.R.	2.5	Electro-Matic
BR-3	H.W.R.	3.0	NL-653/5835
(C3J/5632) (C3J) (EL-C3J)	Thy.	2.5	NL-710/6011
(C3J/A/5684) (C3J/A) (EL-C3J/A)	Thy.	2.5	NL-710/6011
(3C), (EL-3C)	F.W.R.	2.5	NL-604
(EL-3C/L)	F.W.R.	2.5	NL-604L
3C23	Thy.	1.5	NL-3C23
(EL-C4J)	Thy.	4.0	NL-740
(EL-C4J/F)	Thy.	4.0	NL-740P
(EL-C4J/L)	Thy.	4.0	NL-740L
(4B24)	F.W.R.	2.5	NL-604
(4B24/3C)	F.W.R.	2.5	NL-604
CR-5	Thy.	5.0	Electro-Matic
E-M-5	H.W.R.	5.0	Electro-Matic
EMB-5	H.W.R.	5.0	Electro-Matic
EMB-5GN	Thy.	4.0	Electro-Matic
M-5-15	H.W.R.	15.0	NL-623
(5C21)	Thy.	6.4	NL-760
BR-6	H.W.R.	6.0	NL-619
HW-6	H.W.R.	6.0	NL-619
(C6J/5C21) (C6J) (EL-C6J)	Thy.	6.4	NL-760
(EL-C6J/F)	Thy.	6.4	NL-760P
(C6J-A/5685) (C6J/A) (EL-C6J/A)	Thy.	6.4	NL-760
(EL-C6J/K)	Thy.	6.4	NL-760
(EL-C6J/KF)	Thy.	6.4	NL-760P
(EL-C6J/KL)	Thy.	6.4	NL-760L
(EL-C6J/L)	Thy.	6.4	NL-760L
(6B), (EL-6B)	H.W.R.	6.4	NL-635
(EL-6B/L)	H.W.R.	6.4	NL-635L
(6C), (EL-6C)	F.W.R.	6.4	NL-606
(EL-6C/L)	F.W.R.	6.4	NL-606L
(6F), (EL-6F)	H.W.R.	6.4	NL-635P
P-14	Thy.	1.0	NL-714
M-7-15	H.W.R.	15.0	NL-643
M-9-15	H.W.R.	15.0	NL-625
E-M-15	H.W.R.	15.0	Electro-Matic
M-15	H.W.R.	15.0	NL-623
HW-15	H.W.R.	15.0	Mellaphone
FG-17, TT-17 WL-17, DR-17	Thy.	0.5	NL-715/5557/FG17
18X	H.W.R.	5.0	NL-617
EMB-20	H.W.R.	15.0	Electro-Matic
20X	H.W.R.	15.0	NL-643

Other Type No.	Tube Class	DC Amps Output	Replace With National Type*
FG-27A	Thy.	2.5	
FG-32	H.W.R.	2.5	NL-5558/FG-32
FG-33	Thy.	2.5	NL-5720/FG-33
FG-57	Thy.	2.5	NL-5559/FG-57
FG-81A	Thy.	2.5	
FG-95	Thy.	2.5	NL-5560/FG95
FG-105	Thy.	6.4	
WT-T106	Thy.	2.5	Weltronic
WT-T108	Thy.	1.5	Weltronic
WT-T117	Thy.	0.5	Weltronic
RX-120&A	H.W.R.	15.0	NL-625
WT-T133	Thy.	1.5	Weltronic
FG-172	Thy.	6.4	
CE-202&B	H.W.R.	15.0	NL-625
CE-203	H.W.R.	15.0	NL-623
HW-203	H.W.R.	15.0	NL-623
CE-205	H.W.R.	5.0	NL-617
CE-206	H.W.R.	6.0	NL-619
HD-206	H.W.R.	6.0	NL-619
CE-207	H.W.R.	15.0	NL-627
210-0015	Thy.	0.5	Weltronic
210-0017	Thy.	4.0	Weltronic
210-0055	B, Ign.	56.0	Weltronic
210-0070	A, Ign.	22.4	Weltronic
210-0071	B, Ign.	56.0	Weltronic
210-0072	C, Ign.	140.0	Weltronic
210-0106	Thy.	2.5	Weltronic
210-0147	C, Ign.	140.0	Weltronic
210-0149	B, Ign.	56.0	Weltronic
210-0152	D, Ign.	355.0	Weltronic
210-0158	B, Ign.	56.0	Weltronic
210-0159	C, Ign.	140.0	Weltronic
210-0165	D, Ign.	355.0	Weltronic
210-0170	Ign.	70.0	Weltronic
RX-212	H.W.R.	20.0	NL-627
CE-213&A	H.W.R.	2.5	NL-615
CE-215	H.W.R.	15.0	NL-623
(CE-224)	F.W.R.	2.5	NL-604
249R	H.W.R.	1.0	NL-649/5834
249S	H.W.R.	1.0	NL-649/5834
WT-272	Thy.	0.5	Weltronic
CE-309	Thy.	0.5	NL-715/5557/FG17
WT-310	H.W.R.	15.0	Weltronic
CE-311	Thy.	1.5	NL-3C23
CE-320&A	Thy.	2.5	NL-710-6011
323A CE-323A	Thy.	1.5	NL-323B
323B UE-323B CE-323B	Thy.	1.5	NL-323B
WT-373	H.W.R.	2.5	Weltronic
393A GL-393A CE-393A	Thy.	1.5	NL-393A
404	H.W.R.	15.0	Accurate Eng.
406	H.W.R.	15.0	Accurate Eng.
410	H.W.R.	5.0	Accurate Eng.
412	H.W.R.	6.0	Accurate Eng.
414	Thy.	12.5	
424	H.W.R.	20.0	Accurate Eng.
426	H.W.R.	2.5	Accurate Eng.

Other Type No.	Tube Class	DC Amps Output	Replace With National Type*
440	H.W.R.	2.5	Accurate Eng.
495	H.W.R.	6.4	Accurate Eng.
502-A	Thy.	0.1	
WT-568	H.W.R.	2.5	Weltronic
617	H.W.R.	5.0	Syntron
(NL-618)	H.W.R.	6.4	NL-635
(NL-618L)	H.W.R.	6.4	NL-635L
(NL-618P)	H.W.R.	6.4	NL-635P
623	H.W.R.	15.0	Syntron
WL-624	Thy.	6.4	
625	H.W.R.	15.0	Syntron
627	H.W.R.	20.0	Syntron
KU-627	Thy.	0.64	
KU-628	Thy.	2.0	
WL-629	Thy.	0.04	
WL-632A&B	Thy.	2.5	NL-632B
KU-636	Thy.	1.0	
WL-672A	Thy.	3.2	
KU-676	Thy.	6.4	
WL-677	Thy.	6.4	
NU-976	Thy.	0.5	NL-715/5557/FG17
W1053/210-0152	D, Ign.	355.0	Weltronic
1701	Thy.	0.5	NL-715/5557/FG17
2050	Thy.	0.1	
2051	Thy.	0.1	
(5545) (GL-5545)	Thy.	6.4	NL-760
5550 GL-5550/GL-415 WL-5550/681	A, Ign.	22.4	NL-5550
5550/210-0070	A, Ign.	22.4	Weltronic
5551 GL-5551/FG-271 WL-5551/652	B, Ign.	56.0	NL-1051
5551/210-0071	B, Ign.	56.0	Weltronic
5551A	B, Ign.	56.0	NL-1051
5552 GL-5552/FG-235A WL-5552/651	C, Ign.	140.0	NL-1052
5552/210-0072	C, Ign.	140.0	Weltronic
5552A	C, Ign.	140.0	NL-1052
5553 GL-5553/FG258A WL-5553/655	D, Ign.	355.0	NL-1053#
5553B	D, Ign.	355.0	NL-1053#
5557 GL-5557/FG17 5557/TT17 WL-5557/17	Thy.	0.5	NL-715/5557/FG17
5558 GL-5558/FG32 WL-5558/32	H.W.R.	2.5	NL-5558/FG-32
5559 GL-5559/FG57 WL-5559/57	Thy.	2.5	NL-5559/FG-57
5560 GL-5560/FG95	Thy.	2.5	NL-5560/FG-95
(GL-5632) (5632/C3J)	Thy.	2.5	NL-710/6011
(WL-5683) (5683/C1J/A)	Thy.	1.0	NL-716
(WL-5684) (5684/C3J/A)	Thy.	2.5	NL-710/6011
(WL-5685) (5685/C6J)	Thy.	6.4	NL-760
GL-5720/FG33	Thy.	2.5	NL-5720/FG-33
5822 GL-5822 WL-5822 NL-5822	Ign.	70.0	NL-1022
GL-5822A WL-5822A	Ign.	70.0	NL-1022
5834	H.W.R.	1.0	NL-649/5834
5835	H.W.R.	3.0	NL-653/5835
5855	Thy.	18.0	
(5892)	H.W.R.	6.4	NL-635
GL-6011	Thy.	2.5	NL-710/6011
6012	Thy.	0.5	
6014	Thy.	1.0	NL-6014/C1K
6015	H.W.R.	6.4	NL-618P
6044	Thy.	6.4	
6346	B, Ign.	56.0	NL-1051
6347	C, Ign.	140.0	NL-1052
6348	D, Ign.	355.0	NL-1053#
6511	Ign.	70.0	NL-1022
(GL-6807)	Thy.	6.4	NL-760
(GL-6808)	Thy.	6.4	NL-760P
(GL-6809)	Thy.	6.4	NL-760L
GL-6855/716	Thy.	1.0	NL-716
GL-6856/740	Thy.	4.0	NL-740
GL-6857/740P	Thy.	4.0	NL-740P
GL-6858/760	Thy.	6.4	NL-760
GL-6859/760P	Thy.	6.4	NL-760P
(GL-6860/C6JF)	Thy.	6.4	NL-760P
GL-6930/635P	H.W.R.	6.4	NL-635P
7014	F.W.R.	2.5	NL-604
7015	F.W.R.	2.5	NL-604L
7016	F.W.R.	6.4	NL-606
7017	F.W.R.	6.4	NL-606L
7018	H.W.R.	2.5	NL-615
7019	H.W.R.	6.4	NL-635
7020	H.W.R.	6.4	NL-635L
7021	Thy.	1.0	NL-714
7022	Thy.	4.0	NL-740L
7023	Thy.	6.4	NL-760L

NOTE 1. All replacing NATIONAL TYPES shown can be directly substituted except where #, ( ) symbols apply.

\# Denotes NATIONAL type 1.5" larger diameter.

( ) Tubes type numbers shown in parentheses are replaceable by NATIONAL types as indicated, except in abnormal temperature applications where air temperature inside cabinet is above 140° F.

NOTE 2. NATIONAL ignitrons NL-1022, NL-1051, NL-1052, and NL-1053 are equipped with thermal plate for mounting Protection or Water Saver Thermostat.

* Where no replacing NATIONAL type is shown, order brand listed.

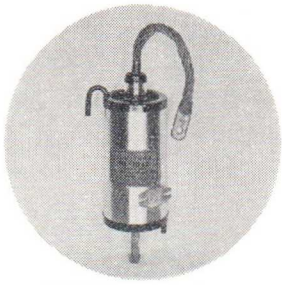
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS

Printed in USA 11/57

NATIONAL ELECTRONICS, INC. GENEVA • ILLINOIS • U.S.A.

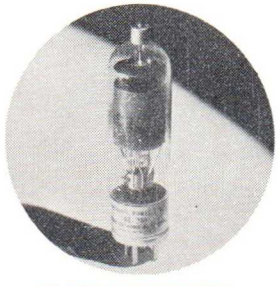
ELECTRONIC TUBES FOR INDUSTRY

NL-1051 IGNITRON

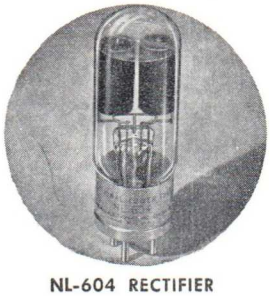


NL-1052 IGNITION

NL-3C23 THYRATRON



NL-740 THYRATRON



NL-604 RECTIFIER

WRITE FOR INDIVIDUAL TUBE DATA SHEETS FOR FULL DETAILS.

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-1022	1500 peak	1200 peak	16	56	336 peak	Water
NL-1051	250 - 600	600 Kva	30.2	56	200 Kva	Water
NL-1052	250 - 600	1200 Kva	75.6	140	400 Kva	Water
NL-1053	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	Arg & Merc.	1.5	6	1250	2.5	7	Convection
NL-323B	Arg & Merc.	1.5	6	1250	2.5	7	Convection
NL-393A	Arg & Merc.	1.5	6	1250	2.5	7	Convection
NL-632B	Mercury	2.5	30	1500	5.0	5	Convection
NL-710/6011	Arg & Merc.	2.5	30	1500	2.5	9	Convection
NL-714	Arg & Merc.	1	3	1250	2.5	5	Convection
NL-715/5557	Mercury	1	3	5000	2.5	5	Convection
NL-716	Arg & Merc.	1	8	1250	2.5	6.3	Convection
NL-732	Arg & Merc.	30	225	1500	2.5	55	Convection
NL-740,L,P	Arg & Merc.	4	50	1500	2.5	16	Convection
NL-741	Mercury	4	50	5000	2.5	16	Convection
NL-760,L,P	Arg & Merc.	6.4	77	1500	2.5	21	Convection
NL-761	Mercury	6.4	77	5000	2.5	21	Convection
NL-5559/FG57	Mercury	2.5	15	1000	5.0	4.6	Convection
NL-5560/FG95	Mercury	2.5	15	1000	5.0	4.6	Convection
NL-5720/FG33	Mercury	2.5	15	1000	5.0	4.6	Convection
NL-6014/C1K	Xenon	1	8	1250	2.5	6.3	Convection

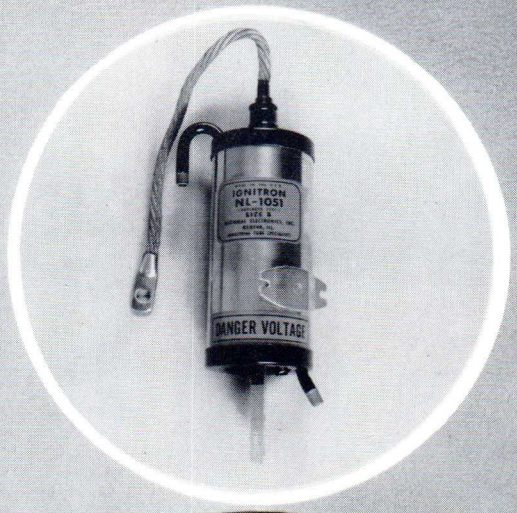
HALF WAVE RECTIFIERS

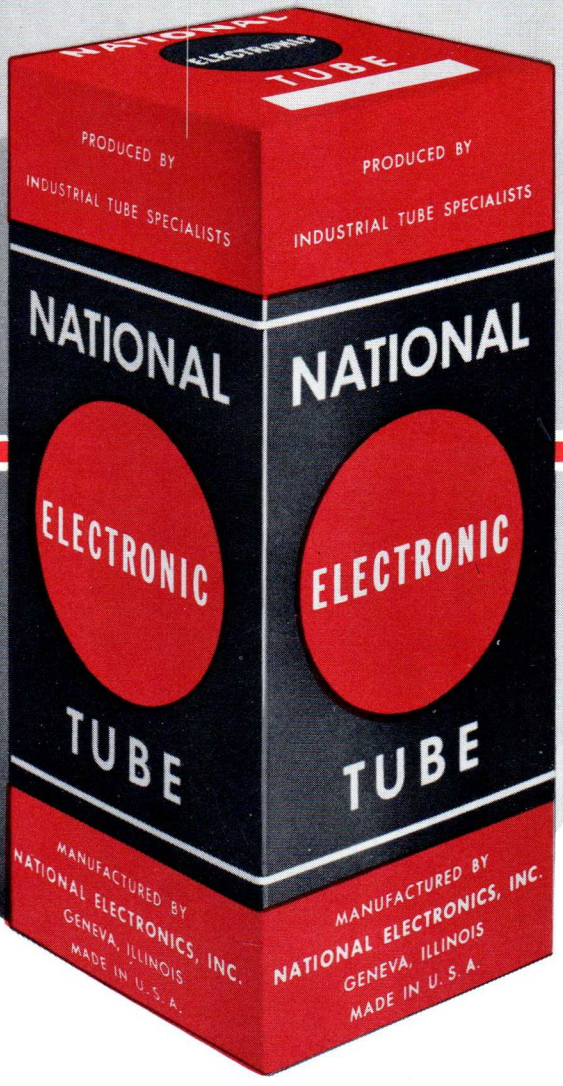
NL-614	Xenon	2.5	15	900	2.5	8.5	Convection
NL-615	Mercury	2.5	10	2000	2.5	7	Convection
NL-617	Mercury	5	20	1000	2	12	Convection
NL-618,L,P	Xenon	6.4	40	900	2.5	18	Convection
NL-619	Mercury	6	20	300	2	12	Convection
NL-623	Mercury	15	45	500	2.5	20	Convection
NL-635,L,P	Arg & Merc.	6.4	77	1000	2.5	18	Convection
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-5558/FG32	Mercury	2.5	15	5000	5	4.5	Convection

FULL WAVE RECTIFIERS

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

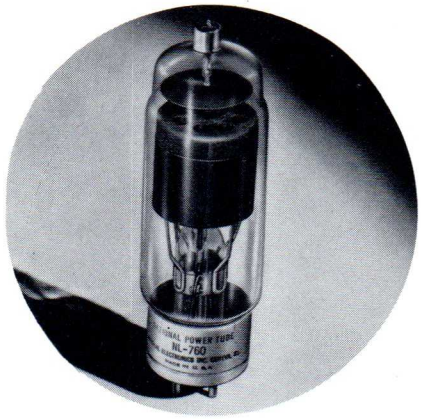
Industrial Tube Specialists





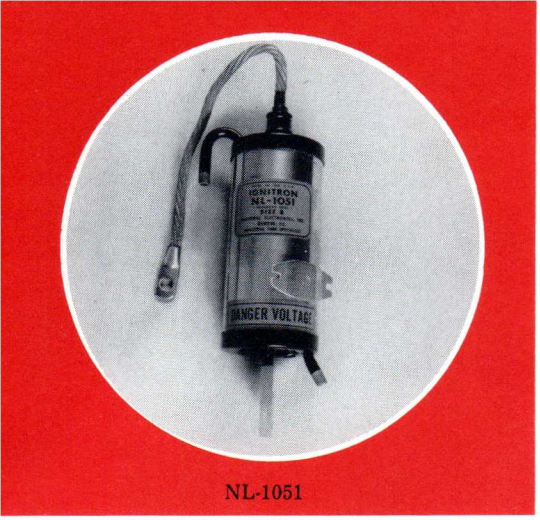
NATIONAL® POWER TUBES

QUICK REFERENCE DATA



ignitrons....
thyratrons....
rectifiers....

NATIONAL ELECTRONICS INC. GENEVA, ILL. U. S. A.



NL-1051

IGNITRONS Are ignitor fired mercury pool rectifiers with the high peak current capacity required in resistance welding applications. They provide a satisfactory means of switching high currents at very high speeds, making it possible to control both the amplitude and duration of current as required for consistent and accurate resistance welding. Their rugged metal construction is especially designed for the industrial field.

Resistance Welder Service

TYPE	REPLACES*	DESCRIPTION	MAXIMUM DIMENSIONS INCHES		SIZE
			Rigid Length	Dia.	
NL-1001	———	Sturdy glass construction. Useful for demonstrating principles of ignitors and ignitrons.	9-3/16	2-5/8	•
NL-1005	———	Steel construction. Thermostat mounting plate. Equivalent to 300 ampere contactor.	15-1/2	5-5/8	B
NL-1051 NL-1051A	(6346), 5551A, FG-271 WL-652, WL-657, 5551	Thermostat mounting plate. Coil construction. Equivalent to 300 ampere contactor. 1051A, quick change type.	13	3-1/4★	B
NL-1052 NL-1052A	(6347), FG-235A, 5552 WL-651, WL-656, 5552A	Thermostat mounting plate. Coil construction. Equivalent to 600 ampere contactor. 1052A, quick change type.	15	4-5/8★	C
NL-1053 NL-1053A	5553, (6348), 5553B, 5553A	Thermostat mounting plate. Coil construction. Equivalent to 1200 ampere contactor. 1053A, quick change type.	20	7-1/8★	D
NL-1054	———	Coil construction. Equivalent to 2400 ampere contactor.	22	10-1/8★	E
NL-5550	WL-681, GL-415, 5550	Clamp mounting. Equivalent to 150 ampere contactor.	9-7/8	2.140	A
NL-5551	———	Obsolete type. Replace with NL-1051	—	—	—
NL-5552	———	Obsolete type. Replace with NL-1052.	—	—	—

Frequency-Changer Welder Service

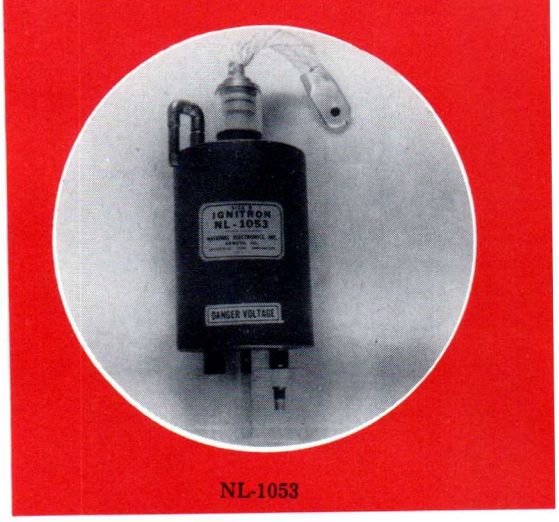
TYPE	REPLACES*	DESCRIPTION	MAXIMUM DIMENSIONS INCHES		SIZE
			Rigid Length	Dia.	
NL-1022	(6511), 5822	Coil construction. Thermostat mounting plate.	15	4-5/8★	C
NL-1051	(6346), 5551A, 5551, FG-271, WL-652, WL-657	Coil construction. Thermostat mounting plate.	13	3-1/4★	B
NL-1053	(6348), 5553, 5553B, 5553A	Coil construction. Thermostat mounting plate.	20	7-1/8★	D
NL-1054	——	Coil construction.	22	10-1/8★	E
NL-5551	——	Obsolete type. Replace with NL-1051.	—	—	—
NL-5822	——	Obsolete type. Replace with NL-1022.	—	—	—

*These types, offered by other suppliers, can be directly replaced with the listed NATIONAL® POWER TUBE — Complete interchangeability. Tubes listed in parenthesis are types sold with thermostat as an integral part of tube, whereas the NATIONAL® type can be purchased separately and thermostat purchased only when needed.

Thermostats

These Spencer-Klixon thermostats are recommended for use with NATIONAL® thermal

TYPE	USE	DESCRIPTION	Maximum Potential Shell to Contacts Volts DC
C4391N7-51	Water Saver	Metal shell thermostat, single pole, one pair of contacts. Rubber covered flexible leads with spade terminals. Supplied with terminal block and mounting clamp with spring loaded fasteners.	600
C4391N7-52	Protection		600
C4391N7-58	Water Saver	Metal shell thermostat, single pole, one pair of contacts. Rubber covered flexible leads with spade terminals. Supplied with mounting clamp with spring loaded fasteners.	600
C4391N7-59	Protection		600



NL-1053

NATIONAL'S Pioneering development of the thermostatically protected ignitron eliminated a great many maintenance problems and loss of production time. This development combined with the NATIONAL® cooling coil construction permits the use of warmer cooling water than formerly possible and maximum possible water saving. NATIONAL'S coil construction gives increased cooling efficiency, increased averaging time, and direct connection of thermostat to inner can temperature.

Resistance Welder Service

MAXIMUM RATINGS					MAXIMUM AVERAGING TIME SECONDS		TYPE COOLING	WARRANTY	TYPE
Supply Volts RMS	Maximum Demand kva	Corresp. Current DC Amps	Maximum Current DC Amps	Corresp. Demand kva	At 250V	At 500V			
250-600	150	4.9	9.	50	28	14	Air	N-12	NL-1001
250-600	600	30.2	56	200	18	9	Air	N-12	NL-1005
250-600	600	30.2	56	200	27	13.5	Water	N-12	NL-1051 NL-1051A
250-600	1200	75.6	140	400	21	10.5	Water	N-12	NL-1052 NL-1052A
250-600	2400	192.	355	800	22	11	Water	N-12	NL-1053 NL-1053A
250-600	4800	486	900	1600	17.8	8.9	Water	N-12	NL-1054
250-600	300	12.1	22.4	100	22	9.2	Water	N-12	NL-5550
—	—	—	—	—	—	—	—	—	NL-5551
—	—	—	—	—	—	—	—	—	NL-5552

Frequency-Changer Welder Service

INVERSE VOLTAGE	CORRESPONDING RATED MAX. AVE. AND PEAK CURRENT				TYPE COOLING	WARRANTY	TYPE
	Peak Amps	Ave. Amps	Ave. Amps	Peak Amps			
1200 1500	1500 1200	20 16	70 56	420 336	Water	N-12	NL-1022
1200 1500	600 480	5 4	22.5 18	135 108	Water	N-12	NL-1051
1200 1500	3000 2400	40 32	140 112	840 672	Water	N-12	NL-1053
1200 1500	6000 4800	120 96	340 272	2040 1632	Water	N-12	NL-1054
— —	— —	— —	— —	— —	—	—	NL-5551
— —	— —	— —	— —	— —	—	—	NL-5822

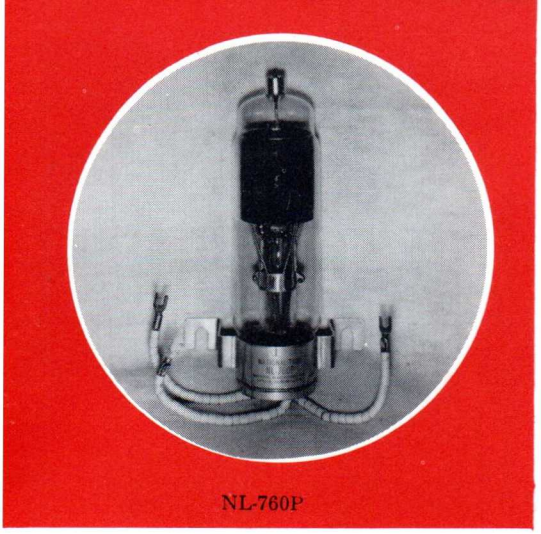
•Approx. equivalent to ½ of Size A.

★Not including water connection which may extend 1-¼" from outer can on one side only on sizes B, C, and D and 1-¾" on size E.

ignitrons and are available from NATIONAL ELECTRONICS, INC.

Thermostats

CONTACT RATINGS								TEMPERATURE °F		LEAD LENGTH INCHES	TYPE
AC Volts	AC Amps	AC Volts	AC Amps	AC Volts	AC Amps	AC Volts	AC Amps	Open	Close		
125	3	250	1.5	440	.75	600	.50	86	96	3-1/2	C4391N7-51
125	3	250	1.5	440	.75	600	.50	125	105	3-1/2	C4391N7-52
125	3	250	1.5	440	.75	600	.50	86	96	36	C4391N7-58
125	3	250	1.5	440	.75	600	.50	125	105	36	C4391N7-59



NL-760P

THYRATRONS

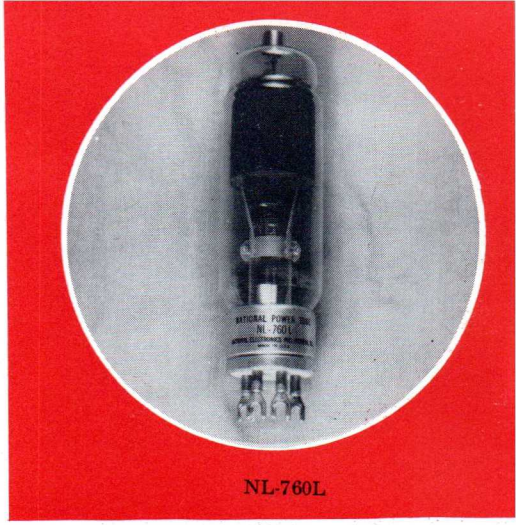
Are grid controlled rectifiers that make possible countless start and stop operations with no maintenance. They function as current and voltage switches that operate silently with no moving parts. The application of a small amount of power to the grid controls many times more anode power accurately and instantaneously.

TYPE	REPLACES*	DESCRIPTION	MAXIMUM DIMEN INCHES	
			Rigid Lgth.	Dia.
NL-3C23	GE-3C23, WL-3C23, CE-311	Filament type. Medium 4-pin bayonet base, A4-10. Medium cap, C1-5.	6-1/8	2-1/16
NL-323B	323A, 323B	Filament type. Medium 5-pin base, A5-11. Small cap, C1-1.	6-5/8	2-1/16
NL-393A	393A	Filament type. Intermediate 7-pin octal base, B7-12. Small cap, C1-1.	6-5/8	2-1/16
NL-632B	WL-632B	Four electrode, heater-cathode type. Medium 4-pin base, A4-71. Medium cap, C1-5. Medium grid cap, C1-5, on side of base.	8-5/16	2-5/16•
NL-710/6011	(C3J), (C3J/A), (5632), (5684)	Filament type. Medium 4-pin base, A4-10. Medium cap, C1-5.	6-1/4	1-5/8
NL-710L	EL-C3J/L	Filament type. Lug base. Medium cap, C1-5.	7-1/4	2-3/16
NL-714	(C1A), (C1B), (C1B/A)	Filament type. Medium 4-pin base, A4-10. Medium cap, C1-5.	6-1/8	1/16
NL-715/5557/FG17	FG-17, WL-17, CE-309, TT-17	Filament type. Medium 4-pin base, A4-10. Medium cap, C1-5.	6-1/8	2-1/16
NL-716	(C1J), (C1K), (C1J/K)	Single end, filament type. Medium 4-pin base, A4-10.	4-5/16	1-9/16
NL-730	——	Filament type. Industrial 412 base, A4-16. Medium cap, C1-5.	8-3/4	2-1/16
NL-732	——	Filament type. Bracket type mounting.	19-1/8	3-5/8
NL-740	(C4J/A)	Filament type. Industrial 4-pin base, A4-81. Medium cap, C1-5.	9-1/2	2-1/16
NL-740P	(C4J/F)	Filament type. Panel mounting base. Medium cap, C1-5.	8-5/8	2-1/16
NL-740L	——	Filament type. Lug base, A4-90. Medium Cap, C1-5.	9-1/2	2-3/16
NL-741	——	Filament type. Industrial 4-pin base, A4-81. Medium cap, C1-5.	9-1/2	2-1/16
NL-741P	——	Filament type. Panel mounting base. Medium cap, C1-5.	8-5/8	2-1/16
NL-741L	——	Filament type. Lug base, A4-90. Medium Cap, C1-5.	9-1/2	2-3/16
NL-760	(C6J), (5685), (C6J/A), (5545)	Filament type. Super jumbo industrial 4-pin base, A4-18. Medium cap, C1-5.	9-1/2	2-9/16
NL-760P	(C6J/F), (C6J/AF)	Filament type. Panel mounting base. Medium cap, C1-5.	8-3/4	2-9/16
NL-760L	(C6J/L), (C6J/KL)	Filament type. Lug base, A4-90. Medium Cap, C1-5.	10	2-9/16
NL-761	——	Filament type. Super jumbo industrial 4-pin base, A4-18. Medium cap, C1-5.	9-1/2	2-9/16
NL-761P	——	Filament type. Panel mounting base. Medium cap, C1-5.	8-3/4	2-9/16
NL-761L	——	Filament type. Lug base, A4-90. Medium Cap, C1-5.	10	2-9/16
NL-5559/FG-57	FG-57, 5559	Heater-cathode type. Medium 4-pin base, A4-10. Medium cap, C1-5.	7-1/4	2-1/16
NL-5560/FG-95	FG-95, 5560	Four electrode, heater-cathode type. Medium 4-pin base, A4-71. Medium anode cap, C1-5. Medium grid cap, C1-5, on side of base.	7-15/16	2-5/16
NL-5632/C3J	5632, C3J	Filament type. Medium 4-pin base, A4-10. Medium cap, C1-5.	6	1-5/8
NL-5665/C16J	EL-C16J, 5665	Filament type. Panel mounting base. Flexible leads.	10-1/2*	2-3/4
NL-5684/C3J/A	5684, C3J/A	Filament type. Medium 4-pin base, A4-10. Medium cap, C1-5.	6	1-5/8
NL-5720/FG-33	FG-33, 5720	Heater-cathode type. Medium 4-pin base, A4-10. Medium cap, C1-5.	7-1/2	1/16
NL-6014/C1K	C1J, C1J/K, C1K, 6014	Single end, filament type. Medium 4-pin base, A4-10.	4-5/16	1-9/16

*These types, offered by other suppliers, can be directly replaced with the listed NATIONAL® POWER TUBE — complete interchangeability. Tubes listed in parenthesis can be replaced with NATIONAL® type except in abnormal applications, especially those involving air temperatures above 140°F, where it is desirable to check ratings.

•Does not include grid cap.

NATIONAL® Thyratrons are available in a variety of sizes and ratings for every application. NATIONAL® combination argon and mercury vapor thyratrons combine the quick starting of gas tubes with the long life of mercury tubes to give the best possible thyratrons for industrial applications. For higher voltage application, mercury vapor tubes with the same current ratings are available. Suffix letters P and L denote panel mounting and lug base types, respectively.



NL-760L

S.	FILAMENT		GAS FILLING	MAXIMUM RATINGS					Surge Amps	WARRANTY	TYPE
	Volts	Amps		Number of Electrodes	Peak Inverse Volts	Peak Forward Volts	Peak Anode Amps	Average Anode Amps			
	2.5	7	Arg. & Merc.	3	1250	1250	6	1.5	120	N-24	NL-3C23
	2.5	7	Arg. & Merc.	3	1250	1250	6	1.5	120	N-12	NL-323B
	2.5	7	Arg. & Merc.	3	1250	1250	6	1.5	120	N-12	NL-393A
	5.0	4.6	Merc.	4	1500	1500	30	2.5	150	N-12	NL-632B
	2.5	9	Arg. & Merc.	3	1500	1500	30	2.5	250	N-12 N-24	NL-710/6011 NL-710L
	2.5	5	Arg. & Merc.	3	1250	1250	3	1	50	N-24	NL-714
	2.5	5	Merc.	3	5000	2500	2	.5	50	N-12	NL-715/5557/FG-17
	2.5	6.3	Arg. & Merc.	3	1250	1250	8	1	80	N-24	NL-716
	2.5	12	Arg. & Merc.	3	1500	1500	40	3.2	560	N-12	NL-730
	2.5	55	Arg. & Merc.	3	1500	1500	160	30	1500	N-12	NL-732
	2.5	16	Arg. & Merc.	3	1500	1500	30	4	400	N-24	NL-740 NL-740P NL-740L
	2.5	16	Merc.	3	5000	2500	15	2.5	400	N-12	NL-741 NL-741P NL-741L
	2.5	21	Arg. & Merc.	3	1500	1500	77	6.4	770	N-12 N-24 N-24	NL-760 NL-760P NL-760L
	2.5	21	Merc.	3	5000	2500	30	4	770	N-12	NL-761 NL-761P NL-761L
	5.0	4.5	Merc.	3	1000	1000	15	2.5	200	N-12	NL-5559/FG-57
	5.0	4.5	Merc.	4	1000	1000	15	2.5	200	N-12	NL-5560/FG-95
	2.5	9	Xenon	3	1250	900	30	2.5	300	N-3000	NL-5632/C3J
	2.5	31	Xenon	3	1250	1000	{100 160	{18 16	1000	N-3000	NL-5665/C16J
	2.5	9	Xenon	3	1250	1000	30	2.5	300	N-3000	NL-5684/C3J/A
	5.0	4.5	Merc.	3	1000	1000	15	2.5	200	N-12	NL-5720/FG-33
	2.5	6.3	Xenon	3	1250	1000	8	1	77	N-3000	NL-6014/C1K

NL-732

RECTIFIERS Are electronic valves and are the principal means used today for the conversion of alternating current to direct current. Recent refinements and developments have made rectifier tubes available that are especially suited for every need in the rapidly expanding industrial electronic control field.

NATIONAL® Rectifiers are especially designed for industrial applications. They are available in a variety of voltage and current ratings to supply all types of requirements. The sturdy construction, increased efficiency, low maintenance, and reliability of NATIONAL® rectifier tubes have made them one of the leaders in the industrial electronics field. Suffix letters P and L denote bracket mounting and lug base types, respectively. All types are 2.5 volts filament unless noted otherwise.

NL-618P

TYPE	REPLACES*	MAX. DIM. INCHES		BASE	CAP	FIL. AMPS	GAS FILLING	MAXIMUM RATINGS			Warranty
		Rigid Lgth.	Dia.					Peak Inverse Volts	Peak Anode Amps	Average Anode Amps	
NL-604 NL-604L	(EL-3C) (EL-3CL)	7-1/2 7-1/2	2-1/16 2-1/16	A4-81 A4-90	—	11.5	Arg.&Merc.	900	10	2.5	N-24
NL-606 NL-606L	(EL-6C) (EL-6CL)	8 8-5/8	2-9/16 2-9/16	A4-18 A4-90	—	17	Arg.&Merc.	900	25.6	6.4	N-12 N-24
NL-614	—	5-5/8	1-9/16	A4-10	C1-5	9	Xenon	900	15	2.5	N-3000
NL-615	CE-213	6-3/8	2-1/16	A4-10	C1-5	7	Merc.	2000	10	2.5	N-24
NL-616	—	6-1/4	1-5/8	A4-10	C1-5	9	Arg.&Merc.	1250	30	2.5	N-24
NL-617	CE-205	8-1/4	2-1/16	Mogul Screw	C1-5	11.5‡	Merc.	1000	20	5.0	N-12
NL-618 NL-618P NL-618L	EL-6B EL-6F EL-6BL	8 7-1/8 8-1/4	2-1/16 2-1/16 2-3/16	A4-81 Special A4-90	C1-5	18	Xenon	900	40	6.4	N-3000
NL-619	CE-206	7	2-1/16	G2-3	C1-5	11.5‡	Merc.	300	20	6.0	N-12
NL-623	CE-203 CE-215	8-3/4	3-13/16	Mogul Screw	Flex Lead	20	Merc.	500	45	15	N-12
NL-625	CE-202 & B	11-3/4	3-13/16	Mogul Screw	Flex Lead	20	Merc.	900	45	15	N-12
NL-627	CE-207 RX-212	12	3-13/16	Mogul Screw	C1-5	26	Merc.	1000	120	20	N-3000
NL-635 NL-635L NL-635P	(EL-6B) (EL-6B/L) (EL-6F)	9-1/2 9-1/2 8-5/8	2-1/16 2-3/16 2-1/16	A4-81 A4-90 Special	C1-5	18	Merc.	1000	77	6.4	N-12 N-24 N-24
NL-643	—	10	2-9/16	Mogul Screw	Flex Lead	23	Merc.	700	90	15	N-12
NL-649/5834	249R&S, 5834	5-7/16	1-9/16	A4-10	—	7	Merc.	900	10	2.0	N-12
NL-653/5835	BR-3, 5835	5-3/4	2-1/16	A4-10	—	9.5	Merc.	900	12	3.0	N-12
NL-5558/ FG-32	5558, FG-32	7	1-9/16	A4-10	—	4.5†	Merc.	2000	15	2.5	N-12

*These types, offered by other suppliers, can be directly replaced with the listed NATIONAL® POWER TUBE — complete interchangeability. Tubes listed in parenthesis can be replaced with NATIONAL® type except in abnormal applications, especially those involving air temperatures above 140°F, where it is desirable to check ratings.

‡Filament voltage. is 2.0 volts.

†Filament voltage is 5.0 volts.

WARRANTIES

National Electronics specializes in the design and manufacture of industrial electronic tubes particularly suited to the requirements of industry. Dependability and long life are paramount among these requirements.

WARRANTIES

NATIONAL® tubes carry the longest warranties in the industry.

Preferred Thyratrons and Rectifiers are guaranteed for 2 years. These tubes are outstandingly reliable and very conservatively designed. Sockets are available for these types that are highly reliable at the currents involved.

All NATIONAL® electronic tubes are designed and built to give the longest life possible under the conditions imposed by the application.

N-24 WARRANTY — 2 YEARS

Preferred NATIONAL® Thyratrons and Rectifiers are warranted for 2 YEARS against defects in design, material, and workmanship when used within published ratings. If such defects appear within 2 YEARS after the tube is placed in service, a pro-rata adjustment will be made, based upon the difference between the elapsed life in months at failure and 2 years. A fraction of a month, consisting of sixteen days or more, will be considered a full month of life. A period of fifteen days or less will be deducted from the tube life.

If defects appear within one year after the tube is placed in service, free replacement will be made.

Once a tube has been installed in regular service its life will be considered continuous.

No adjustment will be made if the tube life exceeds 2 years. This warranty expires 2½ years after date of sale to ultimate user and 3 years after date of shipment by manufacturer.

N-12 WARRANTY — 1 YEAR

Other NATIONAL® Industrial Tubes are warranted for 1 YEAR against defects in design, material, and workmanship when used within published ratings. If such defects appear within 1 YEAR after the tube is placed in service, a pro-rata adjustment will be made, based upon the difference between the elapsed life in months at failure and one year. A fraction of a month, consisting of sixteen days or more, will be considered a full month of life. A period of fifteen days or less will be deducted from the tube life.

Once a tube has been installed in regular service its life will be considered continuous.

No adjustment will be made if the tube life exceeds 1 year. This warranty expires 1½ years after date of sale to ultimate user and 2 years after date of shipment by manufacturer.

N-3000 WARRANTY — 3000 HOURS

Certain specified NATIONAL® Industrial Tubes are warranted to be free from defects in design, material, and workmanship for a useful life in excess of 3000 HOURS when used within published ratings. If such defects appear before 3000 hours of use, a pro-rata adjustment will be made, based upon the difference between the tube life in hours at failure and 3000 hours.

The tube life in hours is the actual total time the tube has been used.

No adjustment will be made if the tube life exceeds 3000 hours. This warranty expires 1½ years after date of sale to ultimate user and 2 years after date of shipment by manufacturer.

INDEX

PREFERRED TYPES LISTED IN BOLD FACE

Distributed by

NATIONAL ELECTRONICS, INC.

GENEVA, ILLINOIS, U.S.A.

Form SB-1B

Printed in USA 6-58/GR

RECTIFIER TUBE

NL-604
FULL-WAVE RECTIFIER TUBE
2.5 Amperes dc

NATIONAL POWER TUBE NL-604 is a sturdy full-wave rectifier tube designed especially for industrial power rectifier application up to 250 volts dc. It is gas and mercury filled for quick starting, long life, and constancy of characteristics within wide temperature limits. It is available with a lug base under the type number NL-604L

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-604 RECTIFIER TUBE
TECHNICAL INFORMATION

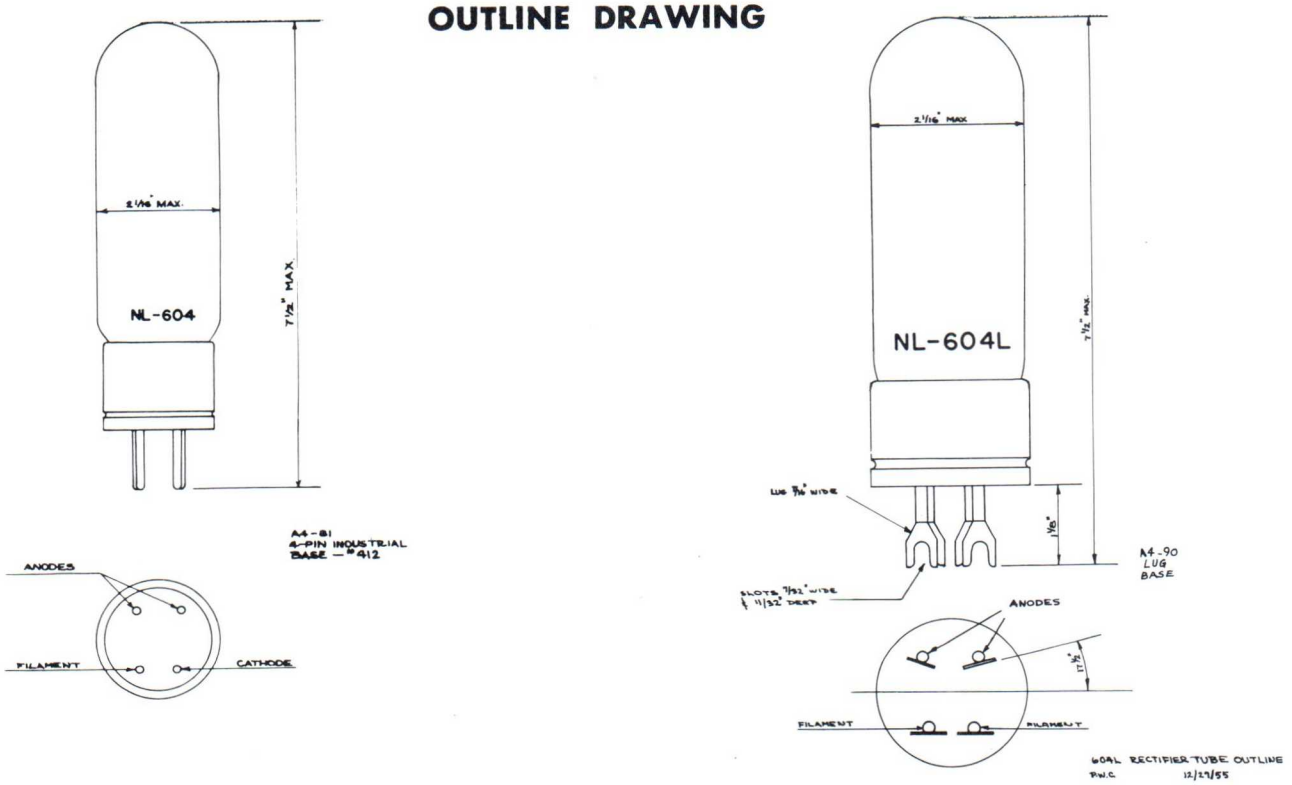
dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	10
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	900
Filament volts	2.5
Filament amperes	11.5 ± 1
Filament heating time (seconds)	15
Typical arc drop at 5 amperes peak (volts)	10
Typical Anode starting voltage (volts)	10
Maximum ac short circuit current (amperes)	150
Condensed mercury temperature limits (°C)*	0 to + 90
Approx. temp. rise, cond. merc. above ambient, no load (°C)	18
Approx. temp. rise, cond. merc. above ambient, full load (°C)	28
Mounting position	vertical, base down
Net weight (ounces)	5
Approx. shipping weight (lbs.)	3

*The tube may be started and satisfactory operation will result between 0 and 90°C. For maximum life the condensed mercury temperatures after warm-up should run between +40 and +90°C which corresponds to approximately +15 to +65°C ambient.

ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



Printed in USA 10/57

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-606
FULL-WAVE RECTIFIER TUBE
6.4 Amperes dc

NATIONAL POWER TUBE NL-606 is a sturdy full-wave rectifier tube designed especially for industrial power rectifier applications up to 250 volts dc. It is gas and mercury filled for quick starting and long life. It is available with a lug base under the type number NL-606L.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-606 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	6.4
Instantaneous Amperes output (maximum)	25.6
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	900
Filament volts	2.5
Filament amperes	17 ± 2
Filament heating time (seconds)	40
Typical arc drop at 9 amperes peak (volts)	10
Typical Anode starting voltage (volts)	10
Maximum ac short circuit current (amperes)	360
Condensed mercury temperature limits (°C) *	0 to +90
Approx. temp. rise, cond. merc. above ambient, no load (°C)	30
Approx. temp. rise, cond. merc. above ambient, full load (°C)	40
Mounting position	vertical, base down
Net weight (ounces)	8
Approx. shipping weight (lbs.)	3

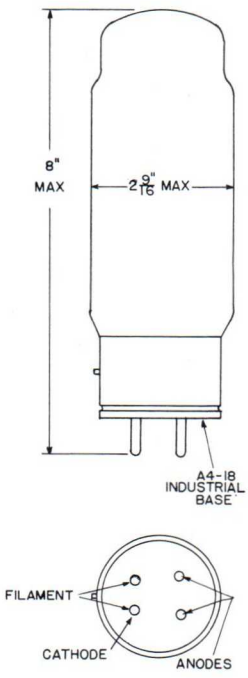
*Satisfactory operation will be obtained between 0 and +90°C. For long life the tube should be operated between +40 and +90°C condensed mercury, or approximately 0 to +50°C ambient.

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

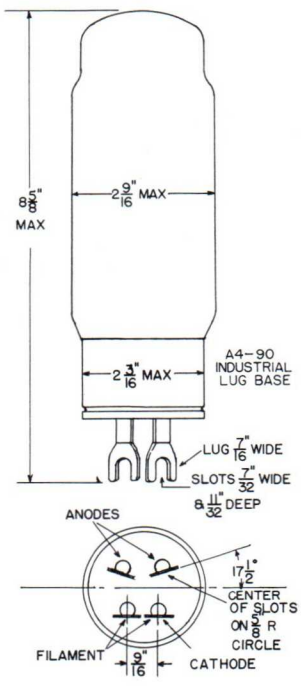
LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWINGS

NL-606



NL-606L



Printed in USA 11/57

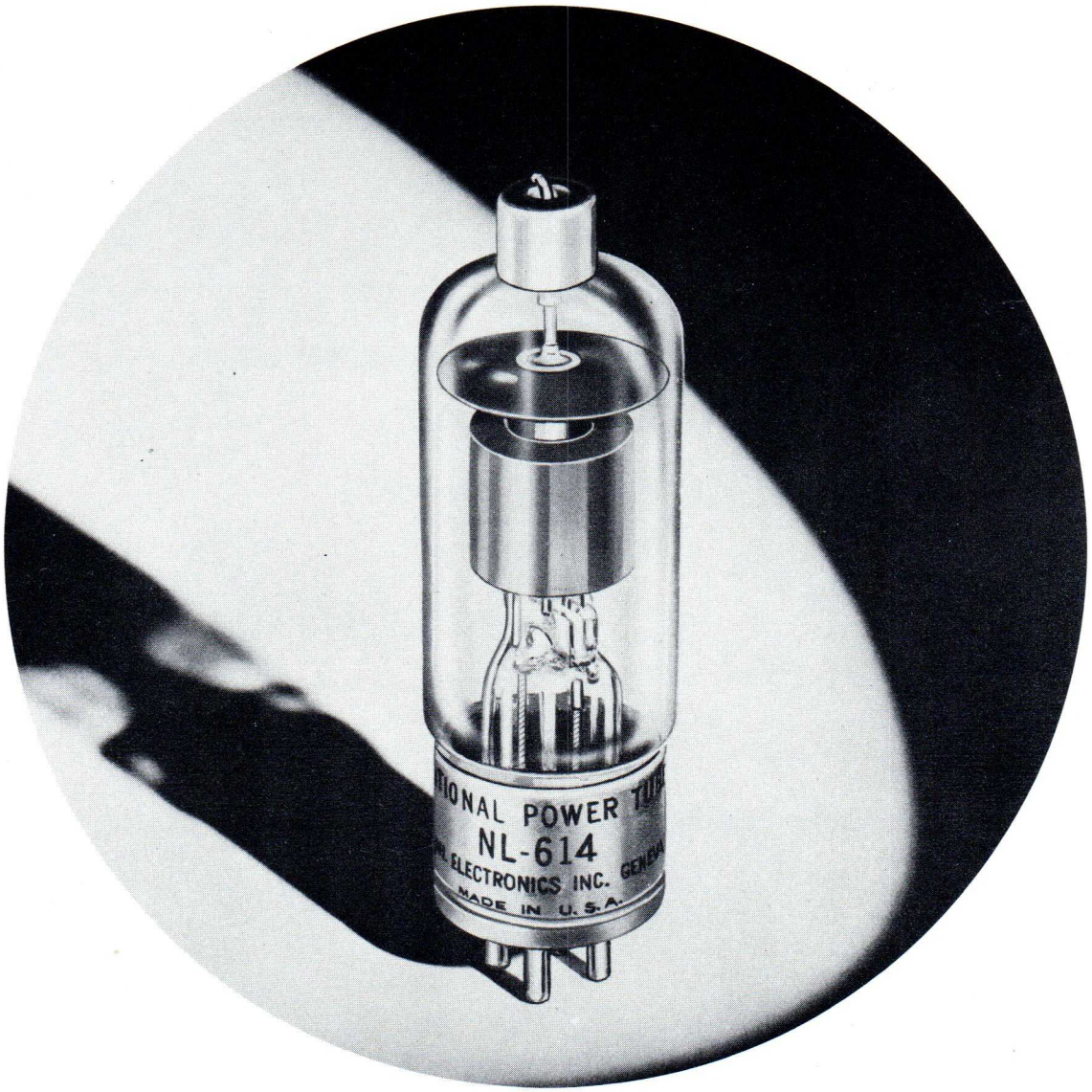
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-614

INERT-GAS-FILLED RECTIFIER TUBE

2.5 Amperes dc



NATIONAL POWER TUBE NL-614 is a sturdy rectifier tube designed especially for industrial power rectifier applications up to 250 volts dc. It is xenon-filled for efficiency, compactness, and the ability to operate within very wide temperature limits.

NATIONAL ELECTRONICS, INC.

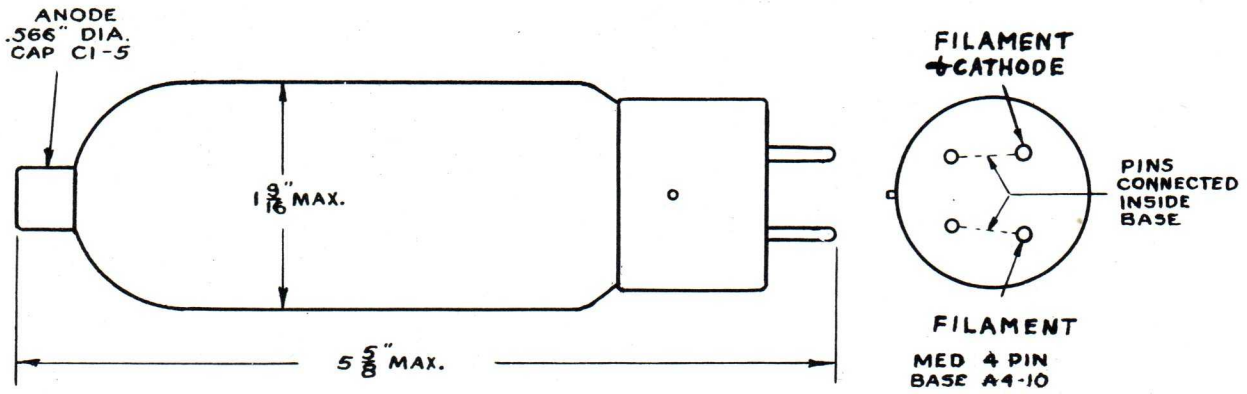
GENEVA, ILLINOIS, U. S. A.

dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	15
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	900
Filament volts	2.5
Filament amperes	7 to 11
Filament heating time (seconds)	20
Typical arc drop at 8 amperes peak (volts)	10
Typical Anode starting voltage (volts)	13
Maximum ac short circuit current (amperes)	250
Maximum Commutation Factor (A/usec x V/usec)	10
Ambient temperature limits (°C)	— 55 to + 70
Mounting position	any
Net weight (ounces)	3
Approx. shipping weight (lbs.)	3

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

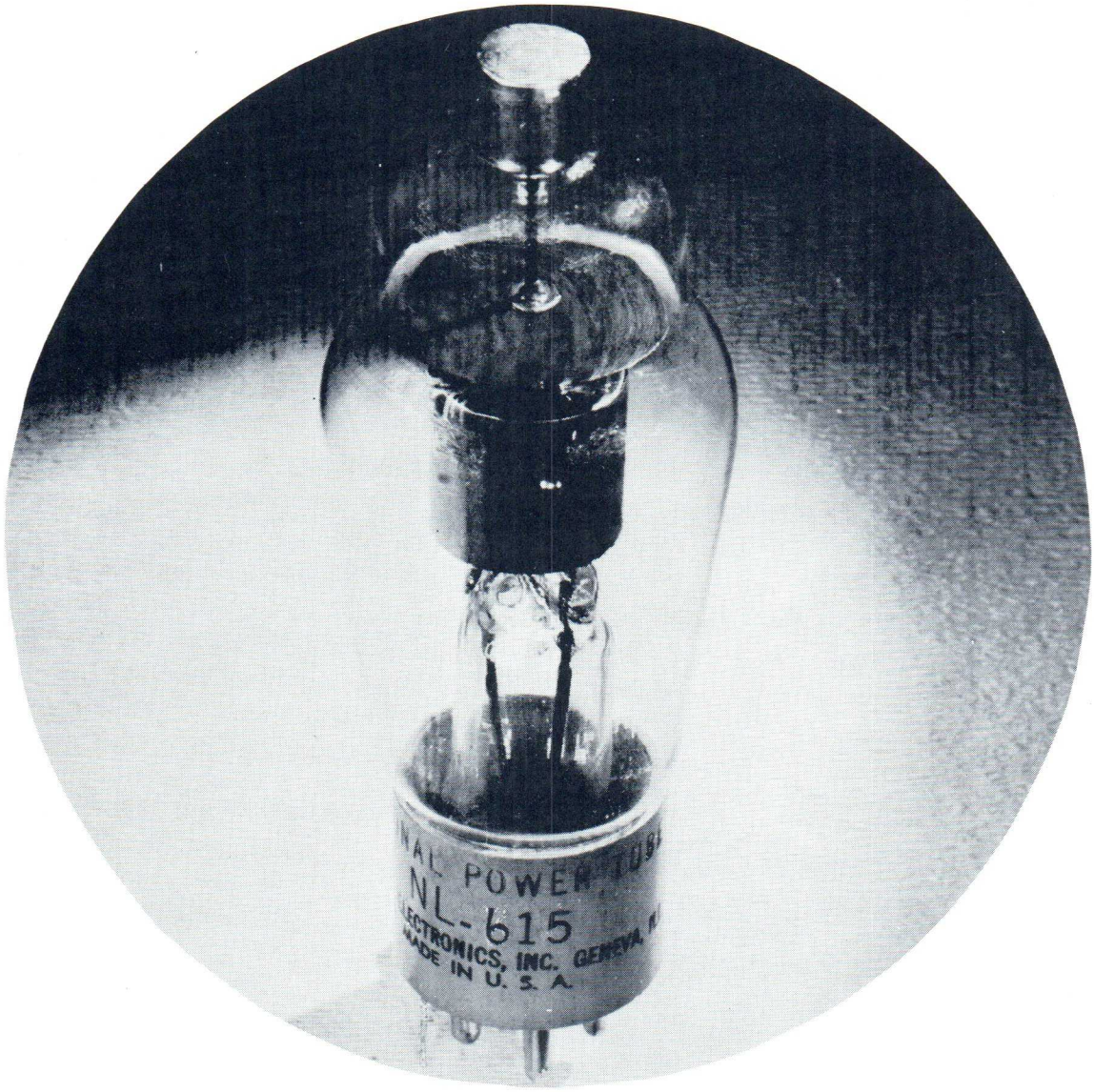
OUTLINE DRAWING



Printed in USA 11-54

RECTIFIER TUBE

NL-615
RECTIFIER TUBE
2.5 Amperes dc



NATIONAL POWER TUBE NL-615 is a sturdy rectifier tube designed especially for industrial power rectifier applications up to 600 volts dc. It is mercury filled for efficiency, long life, and the ability to stand high inverse voltage.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

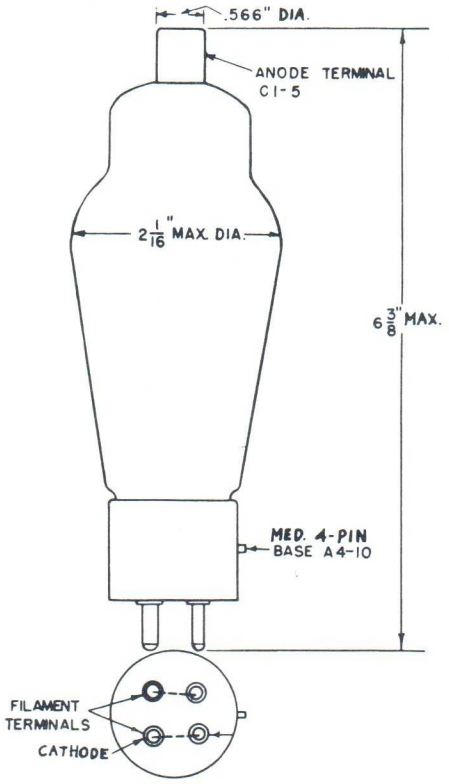
NL-615 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	10
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	2000
Filament volts	2.5
Filament amperes	7 ± 1
Filament heating time (seconds)	20
Typical arc drop at 8 amperes peak (volts)	12
Typical Anode starting voltage (volts)	13
Maximum ac short circuit current (amperes)	250
Condensed mercury temperature limits (°C)	+ 35 to + 80
Approximate temperature rise, cond. mercury above ambient (°C)	30
Mounting position	vertical, base down
Net weight (ounces)	4
Approx. shipping weight (lbs.)	3

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING

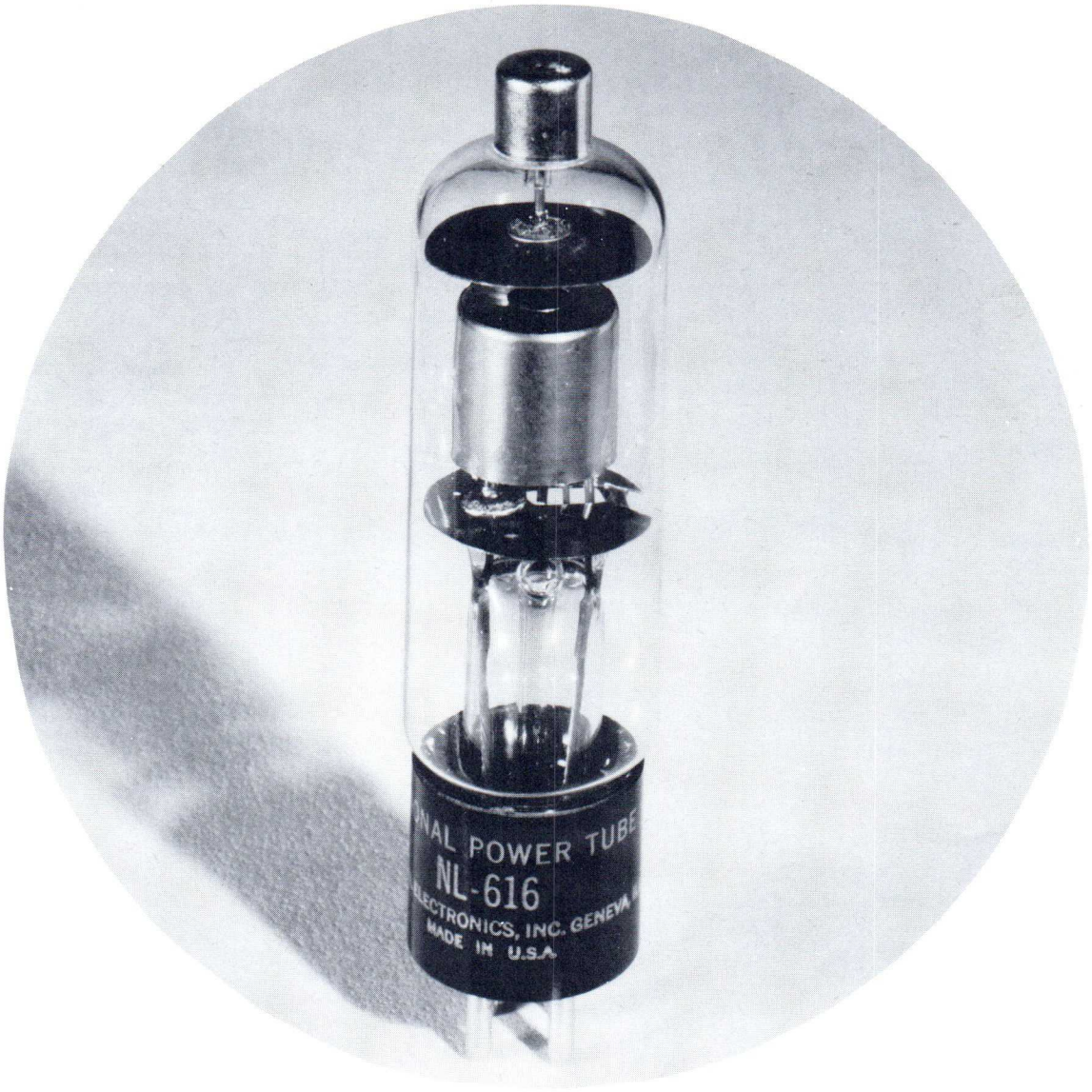


Printed in USA 12-55

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-616
RECTIFIER TUBE
2.5 Amperes dc — 30 Amperes Peak



NATIONAL POWER TUBE NL-616 is a sturdy rectifier tube designed especially for industrial power rectifier applications up to 600 volts dc. It is mercury and argon filled for efficiency, long life, and quick starting.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-616 RECTIFIER TUBE
TECHNICAL INFORMATION

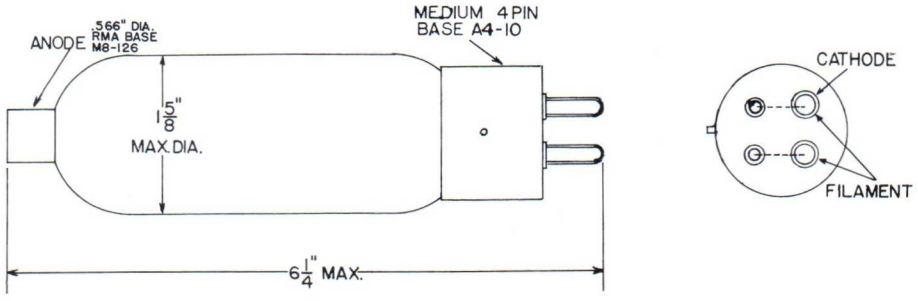
dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	30
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	1250
Filament volts	2.5
Filament amperes	9 ± 2
Filament heating time (seconds)	20
Typical arc drop at 8 amperes peak (volts)	9
Typical Anode starting voltage (volts)	13
Maximum ac short circuit current (amperes)	300
Condensed mercury temperature limits (°C)*	+40 to +100
Approximate temperature rise, cond. mercury above ambient, full load, (°C)	30
Mounting position	vertical, base down
Net weight (ounces)	4
Approx. shipping weight (lbs.)	3

*The tube may be started and satisfactory operation will result between —40 and +100°C. For maximum life the condensed mercury temperature after warm-up should run between +40 and +100°C which corresponds to approximately +10 to +70°C ambient.

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING

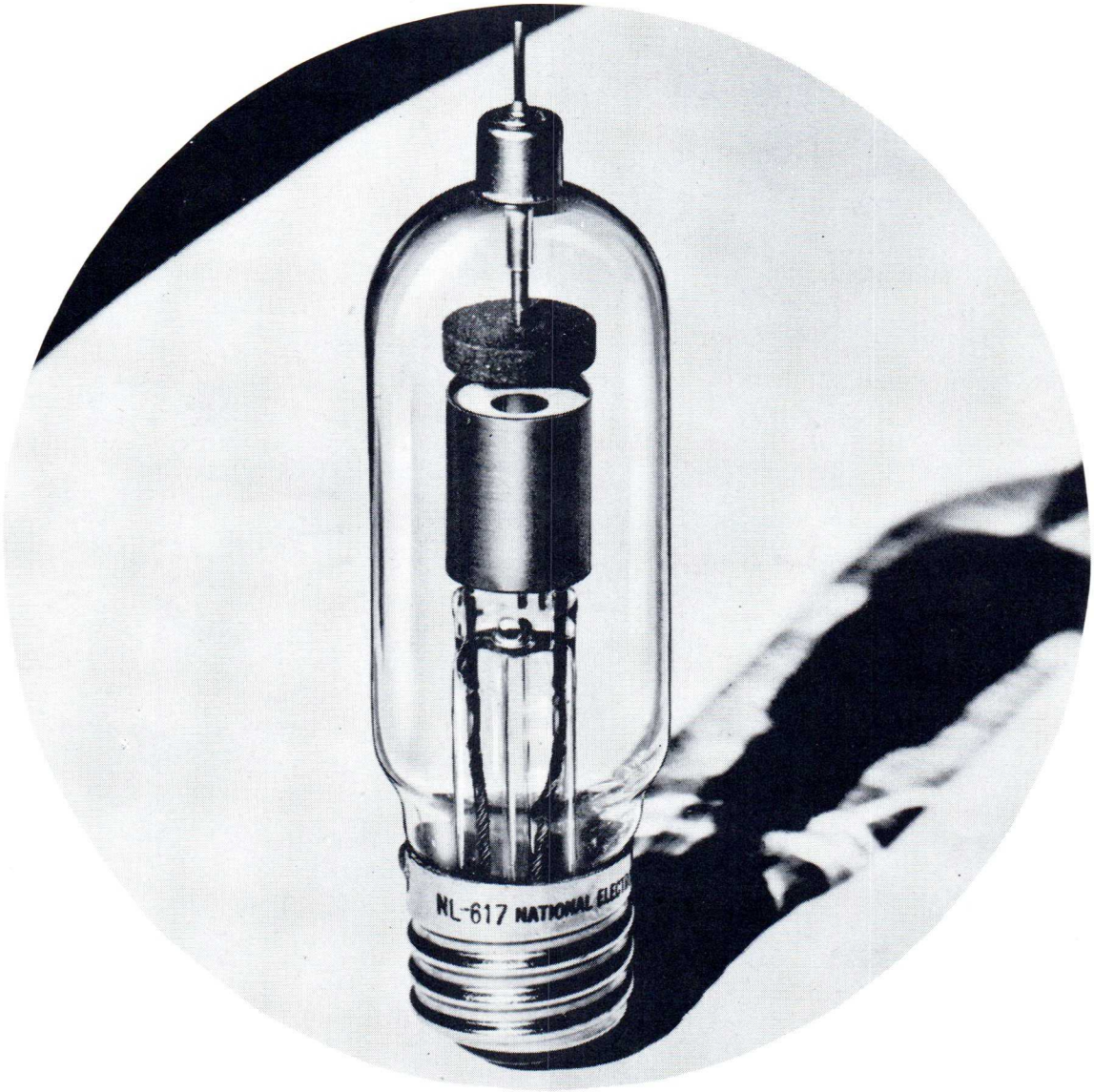


Printed in USA 5-56 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-617
RECTIFIER TUBE
5 Amperes dc



NATIONAL POWER TUBE NL-617 is a sturdy mercury vapor rectifier tube with Mogul screw base. It is designed especially for industrial rectifier applications at 250 and 600 volts dc and is mercury vapor filled for high efficiency, long life, and the ability to withstand high peak inverse voltages.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

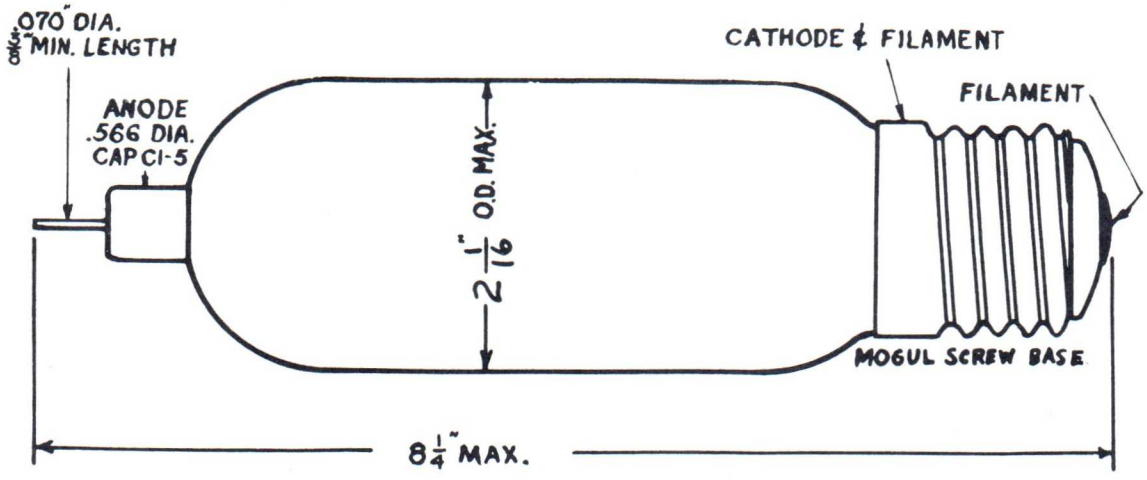
NL-617 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	5
Instantaneous Amperes output (maximum)	20
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	1000
Filament volts	2.0
Filament amperes	10 to 13
Filament heating time (seconds)	60
Typical arc drop at 15 amperes peak, 70 °C (volts)	10
Typical Anode starting voltage (volts)	12
Maximum ac short circuit current (amperes)	250
Condensed mercury temperature limits (°C)	+ 35 to + 90
Approx. temp. rise, cond. merc. above ambient, no load (°C)	25
Approx. temp. rise, cond. merc. above ambient, full load (°C)	40
Mounting position	vertical, base down
Net weight (ounces)	6
Approx. shipping weight (lbs.)	4

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



Printed in USA 5-56 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-618

INERT-GAS-FILLED RECTIFIER TUBE

6.4 Amperes dc

NATIONAL POWER TUBE NL-618 is a sturdy rectifier tube designed especially for Industrial power rectifier and control applications. It is xenon-filled for efficiency, compactness, and the ability to operate within very wide temperature limits. NL-618 utilizes a No. 412 Industrial 4-pin base. It is available with a bracket base for panel mounting under the type Number NL-618P, also with the new NATIONAL-designed lug type base under type number NL-618L.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-618 RECTIFIER TUBE
TECHNICAL INFORMATION

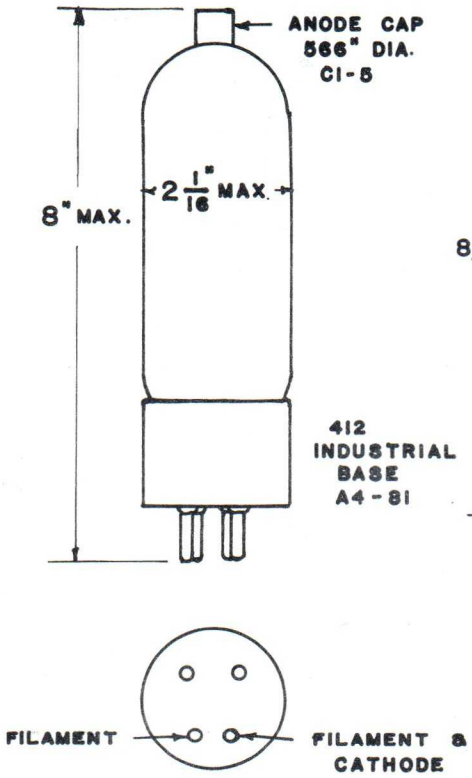
dc Amperes output (maximum)	6.4
Instantaneous Amperes output (maximum)	40
Maximum time of averaging anode current (seconds)	20
Maximum peak inverse volts	900
Max. commutation factor (V/u sec. x A/u sec.)	0.66
Filament volts	2.5
Filament amperes	18 ± 2
Filament heating time (seconds)	60
Typical arc drop at 20 amperes peak (volts)	9
Typical Anode starting voltage (volts)	20
Maximum ac short circuit current (amperes)	770
Ambient temperature limits (°C)	— 55 to + 75
Mounting position	Any
Net Weight (ounces)	6
Approx. shipping weight (lbs.)	4

Note: Max. base shell to lead voltage, 1500 Vrms.

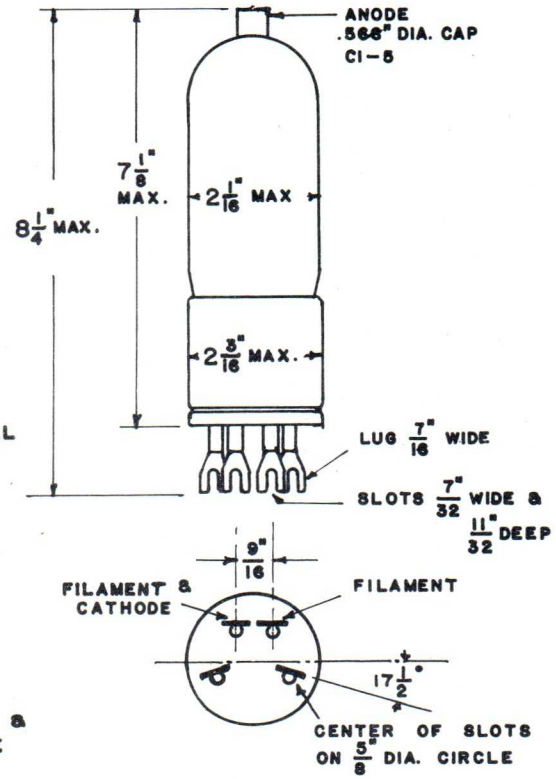
ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAN

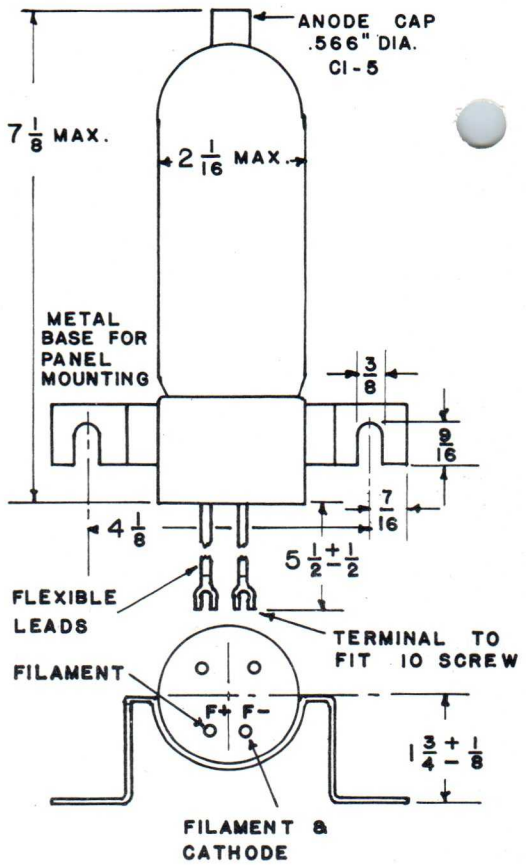
OUTLINE DRAWING
NL-618



OUTLINE DRAWING
NL-618L



OUTLINE DRAWING
NL-618P

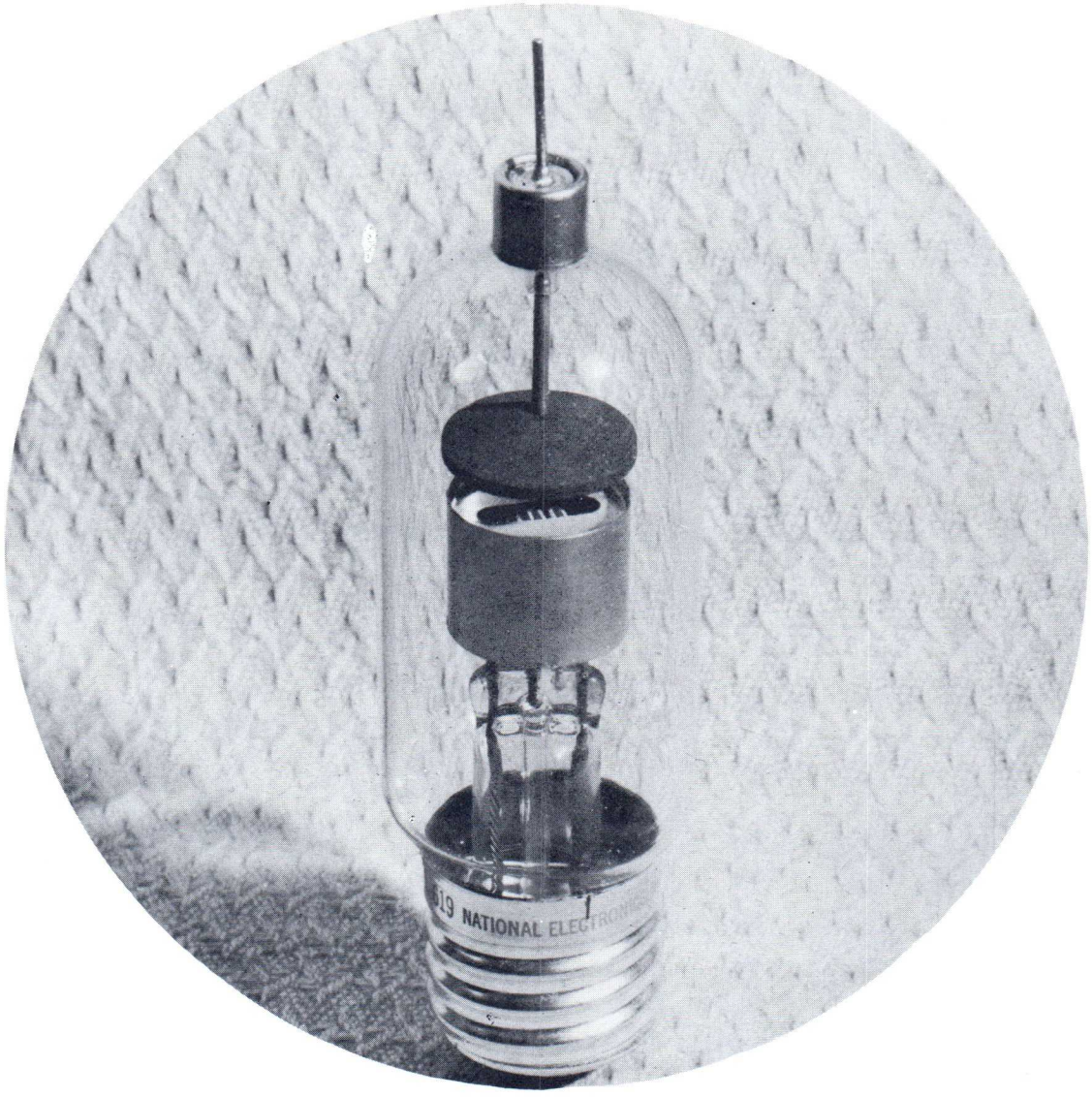


Printed in USA—3-55

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-619
RECTIFIER TUBE
6 Amperes dc



NATIONAL POWER TUBE NL-619 is a sturdy mercury vapor rectifier tube with Mogul screw base. It is designed especially for industrial rectifier applications at 90 volts dc. The tube is mercury vapor filled to obtain long life and high efficiency in operation.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

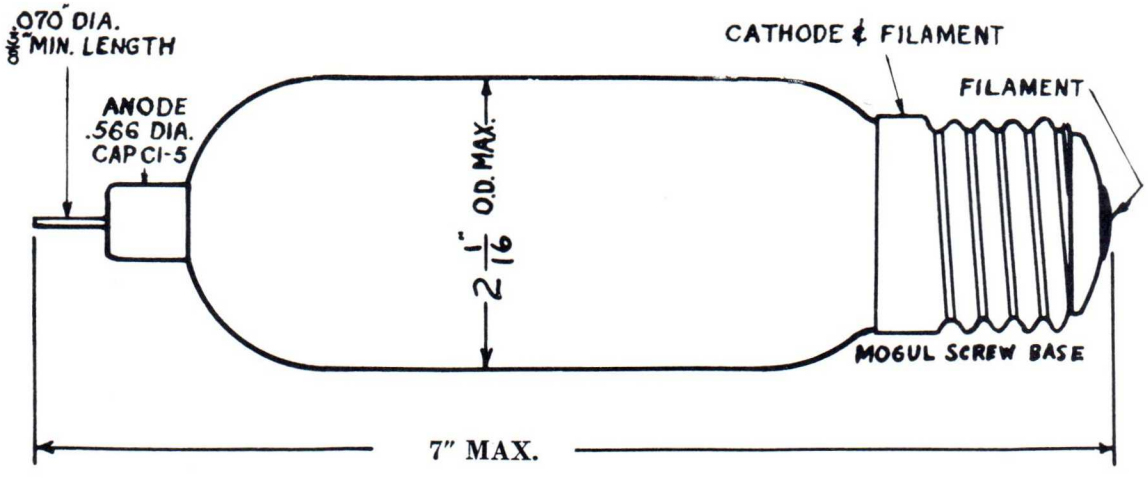
NL-619 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	6
Instantaneous Amperes output (maximum)	20
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	300
Filament volts	2.0
Filament amperes	10 to 13
Filament heating time (seconds)	60
Typical arc drop at 15 amperes peak, 70°C (volts)	10
Typical Anode starting voltage (volts)	9
Maximum ac short circuit current (amperes)	250
Condensed mercury temperature limits (°C)	+35 to +115
Approx. temp. rise, cond. merc. above ambient, no load (°C)	25
Approx. temp. rise, cond. merc. above ambient, full load (°C)	60
Mounting position	vertical, base down
Net weight (ounces)	6
Approx. shipping weight (lbs.)	4

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING

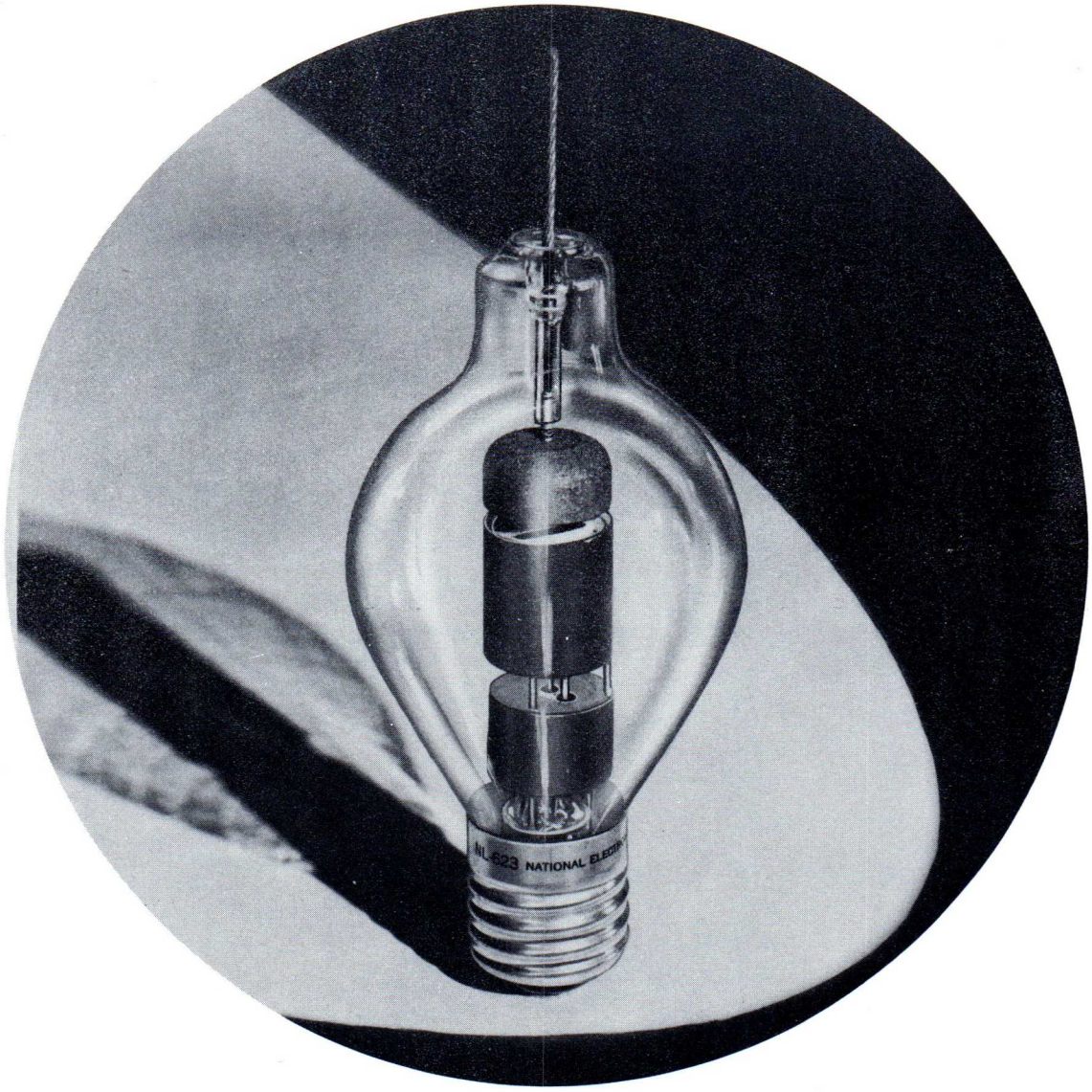


Printed in USA 5-56 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-623
RECTIFIER TUBE
15 Amperes dc



NATIONAL POWER TUBE NL-623 is a sturdy rectifier tube designed especially for Industrial power rectifier applications up to 150 volts dc. It is mercury filled for efficiency, long life, and the ability to withstand high inverse voltage.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

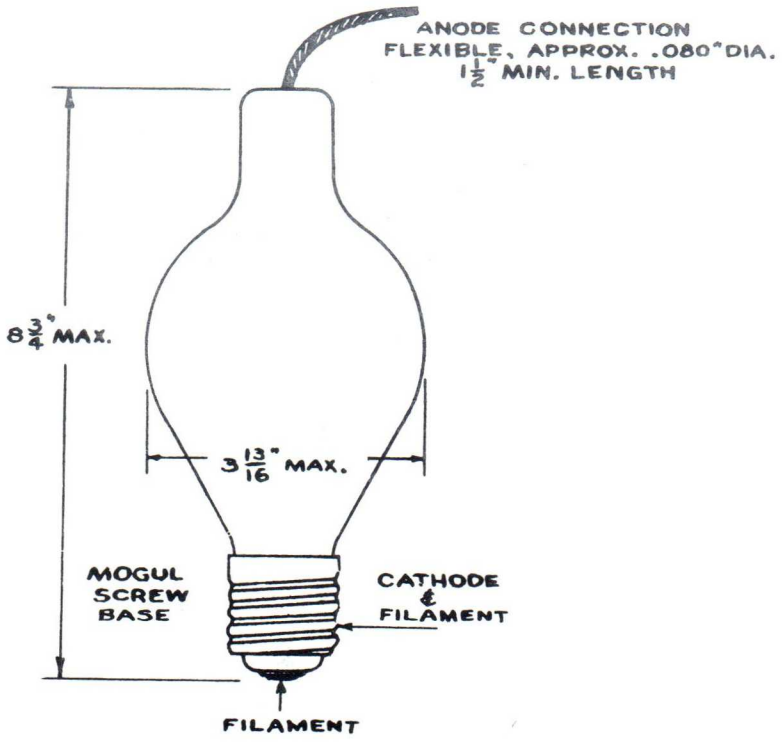
NL-623 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	15
Instantaneous Amperes output (maximum)	45
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	500
Filament volts	2.5
Filament amperes	20 ± 2
Filament heating time (seconds)	120
Typical arc drop at 45 amperes peak (volts)	10
Typical Anode starting voltage (volts)	13
Maximum ac short circuit current (amperes)	750
Condensed mercury temperature limits (°C)	+ 35 to + 100
Approximate temperature rise, cond. mercury above ambient, no load (°C)	40
Approximate temperature rise, cond. mercury above ambient, full load (°C)	60
Mounting position	vertical, base down
Net weight (ounces)	6
Approx. shipping weight (lbs.)	5

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING

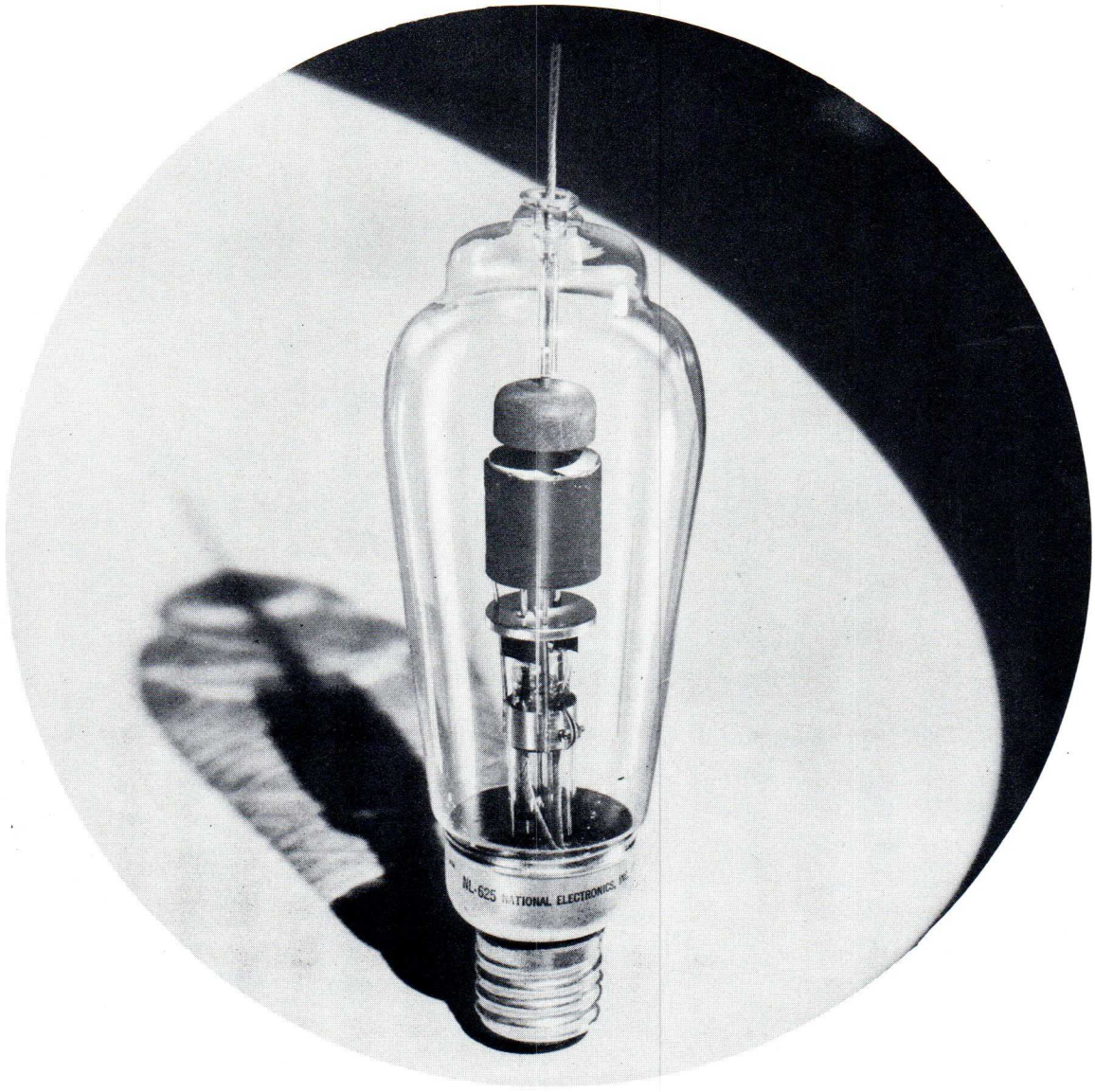


Printed in USA/7-57/C

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-625
RECTIFIER TUBE
15 Amperes dc



NATIONAL POWER TUBE NL-625 is a sturdy rectifier tube designed especially for industrial power rectifier applications up to 250 volts dc. It is mercury filled for efficiency, long life, and the ability to stand high inverse voltage.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

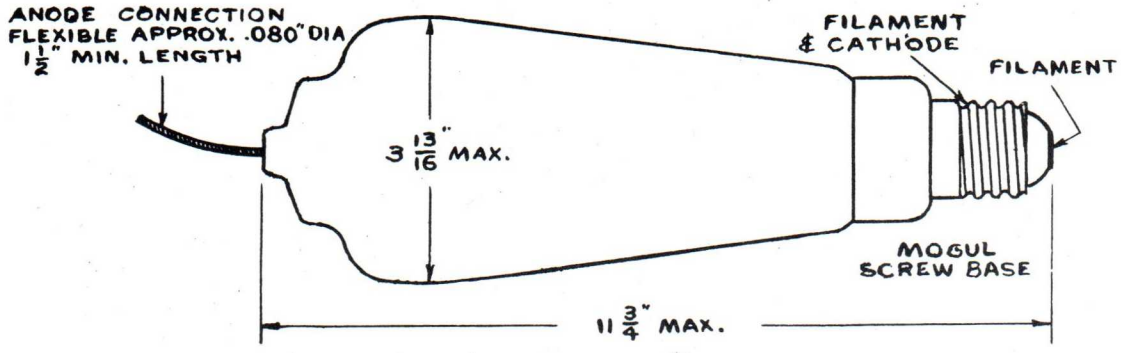
NL-625 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	15
Instantaneous Amperes output (maximum)	45
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	900
Filament volts	2.5
Filament amperes	20 ± 2
Filament heating time (seconds)	120
Typical arc drop at 45 amperes peak (volts)	10
Typical Anode starting voltage (volts)	13
Maximum ac short circuit current (amperes)	750
Condensed mercury temperature limits (°C)	+ 35 to + 80
Approx. temp. rise, cond. merc. above ambient, no load (°C)	25
Approx. temp. rise, cond. merc. above ambient, full load (°C)	40
Mounting position	vertical, base down
Net weight (ounces)	12
Approx. shipping weight (lbs.)	7

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING

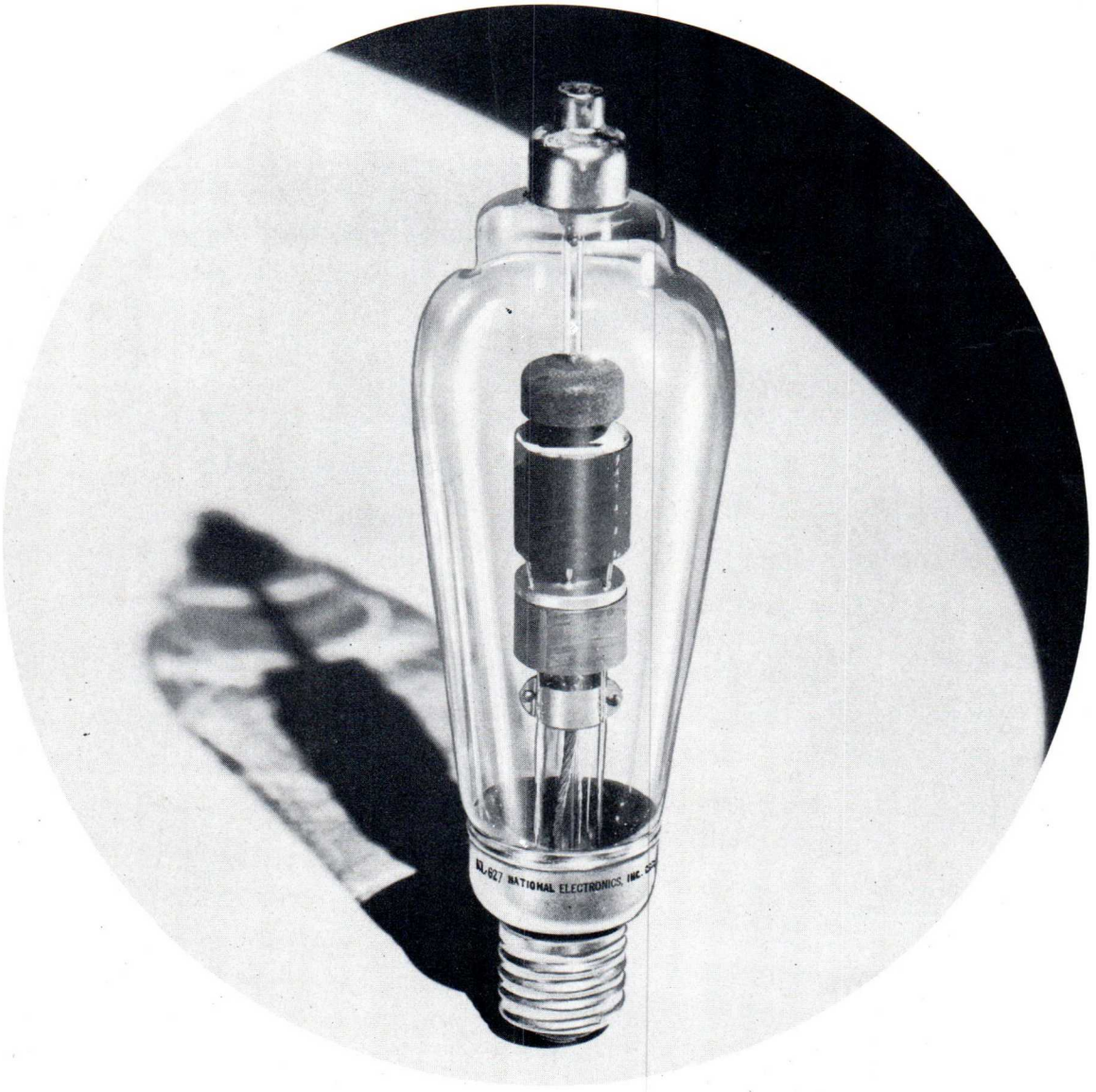


Printed in U. S. A.--11-54

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-627
RECTIFIER TUBE
20 Amperes dc



NATIONAL POWER TUBE NL-627 is a sturdy rectifier tube designed especially for industrial power rectifier applications up to 250 volts dc. It is mercury filled for efficiency, long life, and the ability to stand high inverse voltage.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

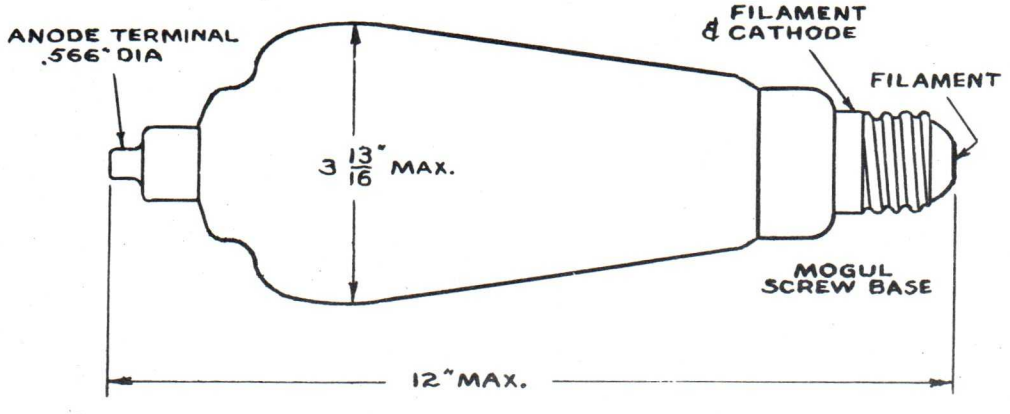
NL-627 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	20
Instantaneous Amperes output (maximum)	120
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	1000
Filament volts	2.5
Filament amperes	26 ± 2
Filament heating time (seconds)	120
Typical arc drop at 60 amperes peak (volts)	10
Typical Anode starting voltage (volts)	13
Maximum ac short circuit current (amperes)	1000
Condensed mercury temperature limits (°C)	+ 35 to + 80
Approximate temperature rise, cond. mercury above ambient no load (°C)	25
Approximate temperature rise, cond. mercury above ambient full load (°C)	45
Mounting position	vertical, base down
Net weight (ounces)	13
Approx. shipping weight (lbs.)	7

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



Printed in U. S. A.--11-54

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-635
RECTIFIER TUBE
6.4 Amperes dc

NATIONAL POWER TUBE NL-635 is a sturdy rectifier tube designed especially for industrial power rectifier applications up to 250 volts dc. It is mercury and gas filled for efficiency, long life, and the ability to withstand high inverse voltages. NL-635 utilizes a No. 412 industrial 4-pin base. It is available with a bracket base for panel mounting under the type number NL-635P and the new National lug type base under the number NL-635L.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-635 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	6.4
Instantaneous Amperes output (maximum)	77
Maximum time of averaging anode current (seconds)	20
Maximum peak inverse volts	1000
Filament volts	2.5
Filament amperes	18 ± 2
Filament heating time (seconds)	60
Typical arc drop at 20 amperes peak (volts)	9
Typical Anode starting voltage (volts)	20
Maximum ac short circuit current (amperes)	770
Condensed mercury temperature limits (°C)*	−40 to +100
Approximate temperature rise, cond. mercury above ambient (°C)	30
Mounting position	vertical, base down
Net weight (ounces)	6
Approx. shipping weight (lbs.)	4

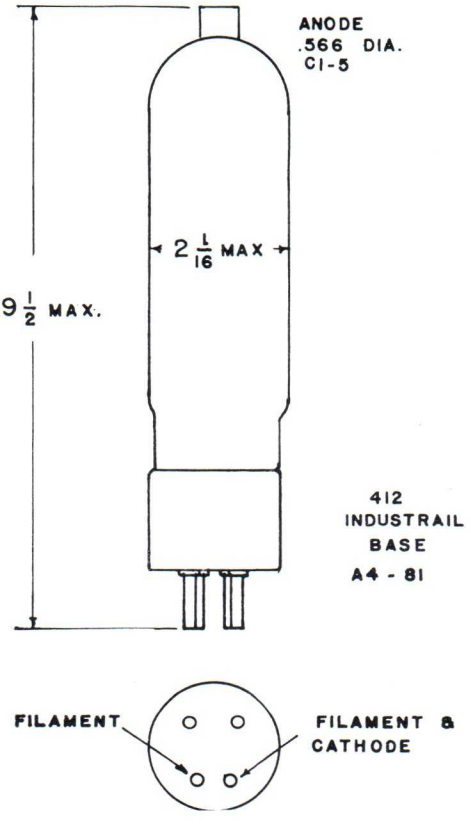
*Satisfactory operation will be obtained between —40 to +100°C. For long life the tube should be operated between +40 to +100°C condensed mercury, or approximately +10 to +70°C ambient.

LIGHT FILAMENT BEFORE APPLYING LOAD

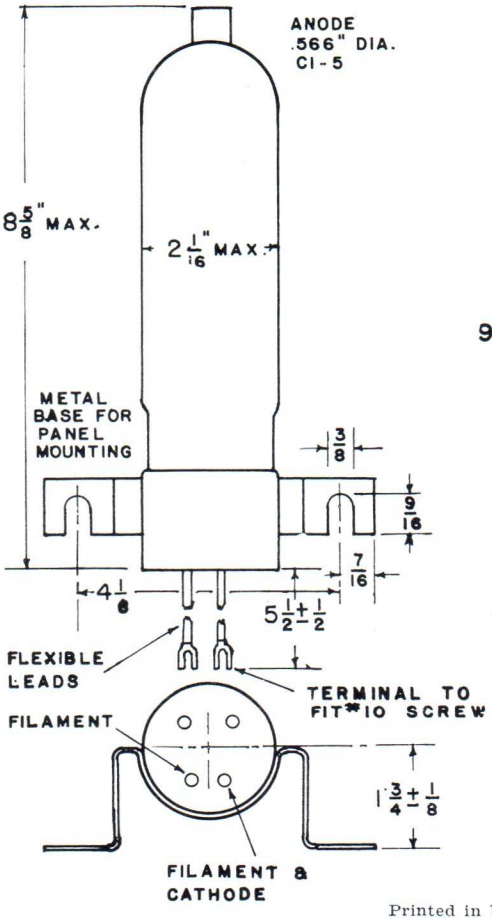
ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

OUTLINE DRAWINGS

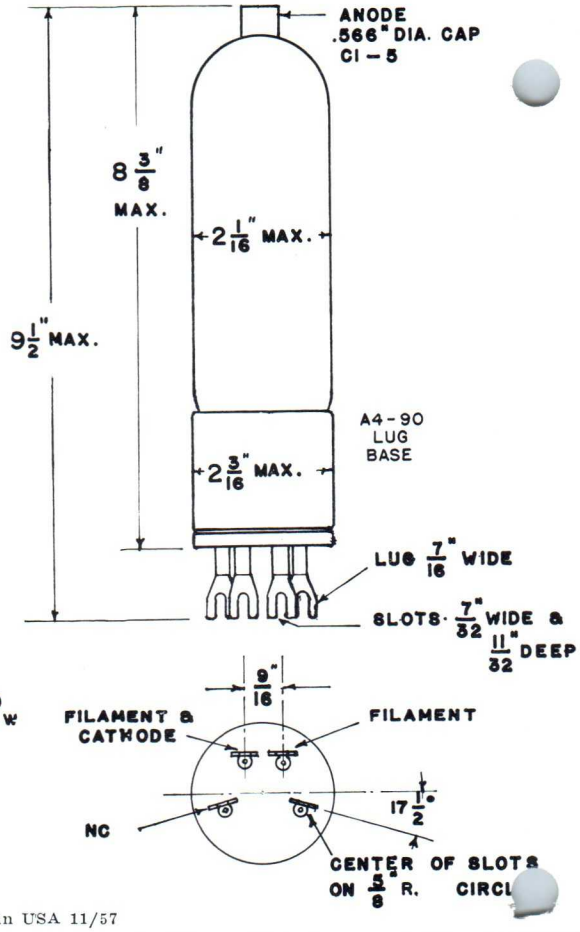
NL-635



NL-635P



NL-635L

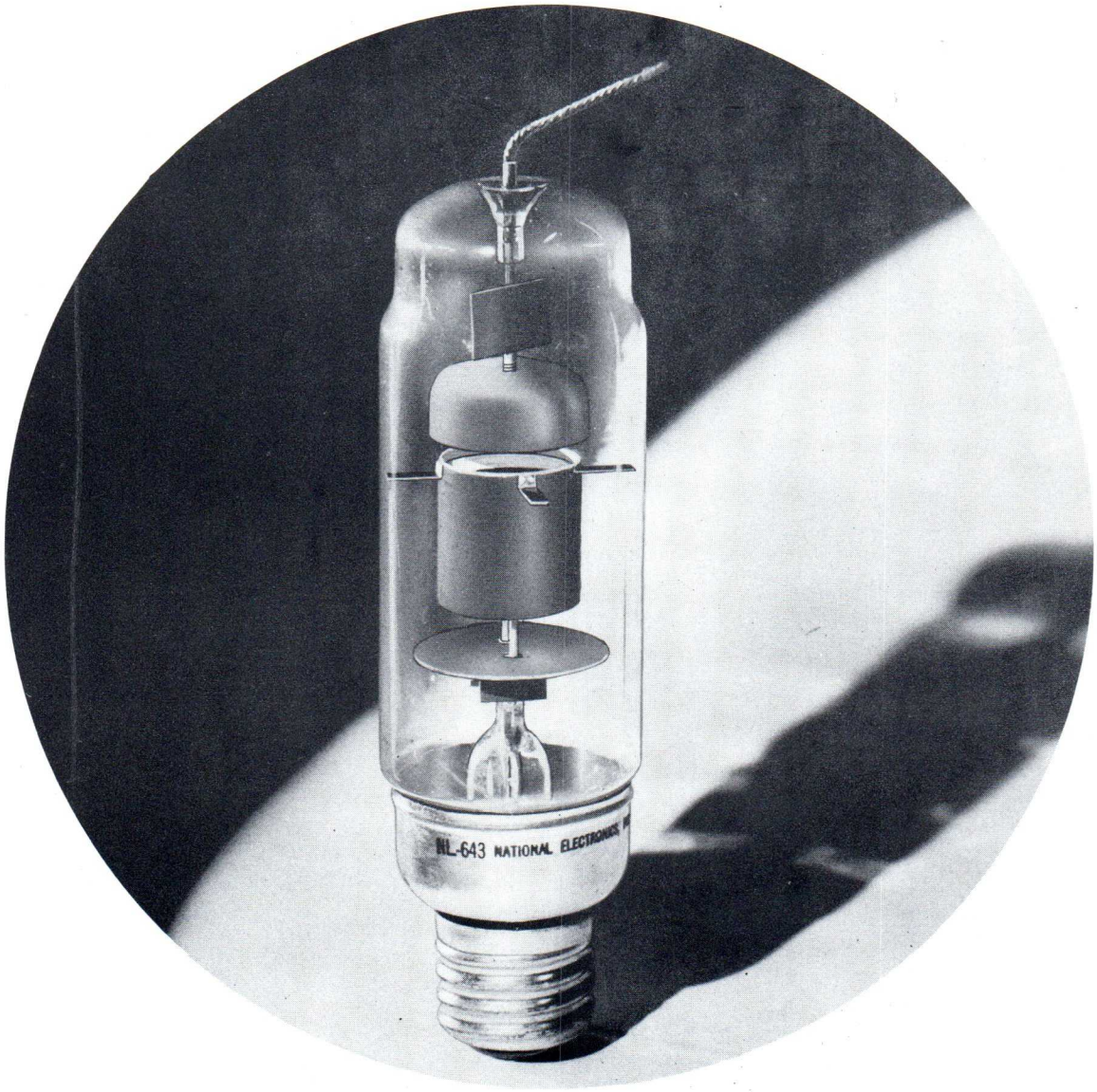


Printed in USA 11/57

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-643
RECTIFIER TUBE
15 Amperes dc



NATIONAL POWER TUBE NL-643 is a sturdy rectifier tube designed especially for industrial power rectifier applications up to 200 volts dc. It is mercury filled for efficiency and the ability to withstand high inverse voltage. NL-643 is designed to give exceptionally long life when used within its ratings.

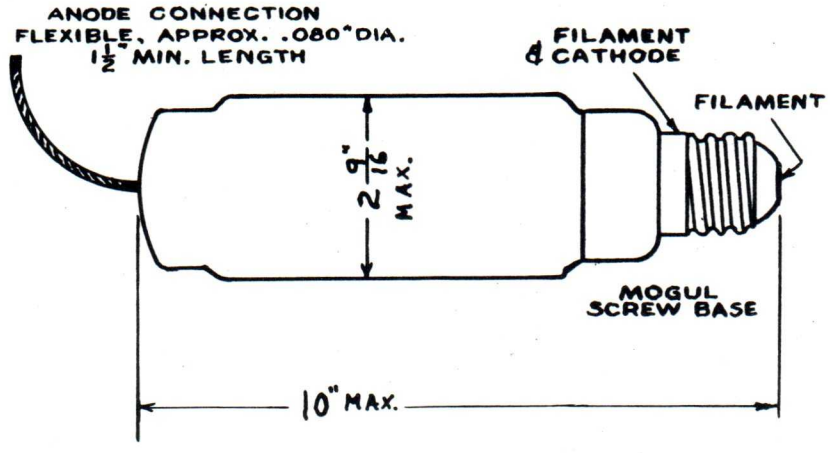
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

dc Amperes output (maximum)	15
Instantaneous Amperes output (maximum)	90
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	700
Filament volts	2.5
Filament amperes	23 ± 2
Filament heating time (seconds)	120
Typical arc drop at 45 amperes peak (volts)	10
Typical Anode starting voltage (volts)	13
Maximum ac short circuit current (amperes)	750
Condensed mercury temperature limits (°C) (700 volts peak inverse)	+ 35 to + 90
Condensed mercury temperature limits (°C) (500 volts peak inverse)	+ 35 to + 100
Approximate temperature rise, cond. mercury above ambient, no load (°C)	35
Approximate temperature rise, cond. mercury above ambient, full load (°C)	50
Mounting position	vertical, base down
Net weight (ounces)	9
Approx. shipping weight (lbs.)	5

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



Printed in U. S. A.--11-54

RECTIFIER TUBE

NL-649

RECTIFIER TUBE

2 Amperes dc

NATIONAL POWER TUBE NL-649 is a sturdy, single-ended, rectifier tube designed especially for industrial power rectifier applications and for "back-rectifier" applications in conjunction with a thyratron tube. It is mercury filled for efficiency, long life, and the ability to stand high inverse voltage.

NATIONAL ELECTRONICS, INC.

GENEVA, ILLINOIS, U. S. A.

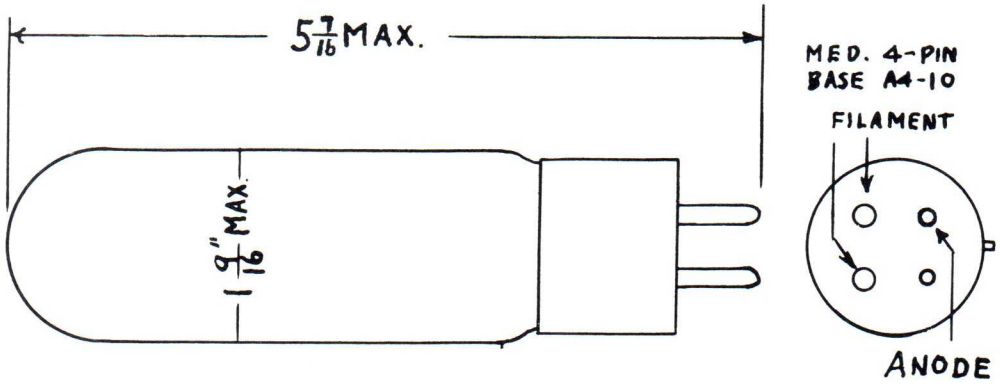
NL-649 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	2
Instantaneous Amperes output (maximum)	10
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	900
Filament volts	2.5
Filament amperes	7 ± 1
Filament heating time (seconds)	20
Typical arc drop at 6 amperes peak (volts)	9
Typical Anode starting voltage (volts)	16
Maximum ac short circuit current (amperes)	125
Condensed mercury temperature limits (°C)	$+35$ to $+85$
Approximate temperature rise, cond. mercury above ambient (°C)	25
Mounting position	vertical, base down
Net weight (ounces)	3
Approx. shipping weight (lbs.)	3

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING

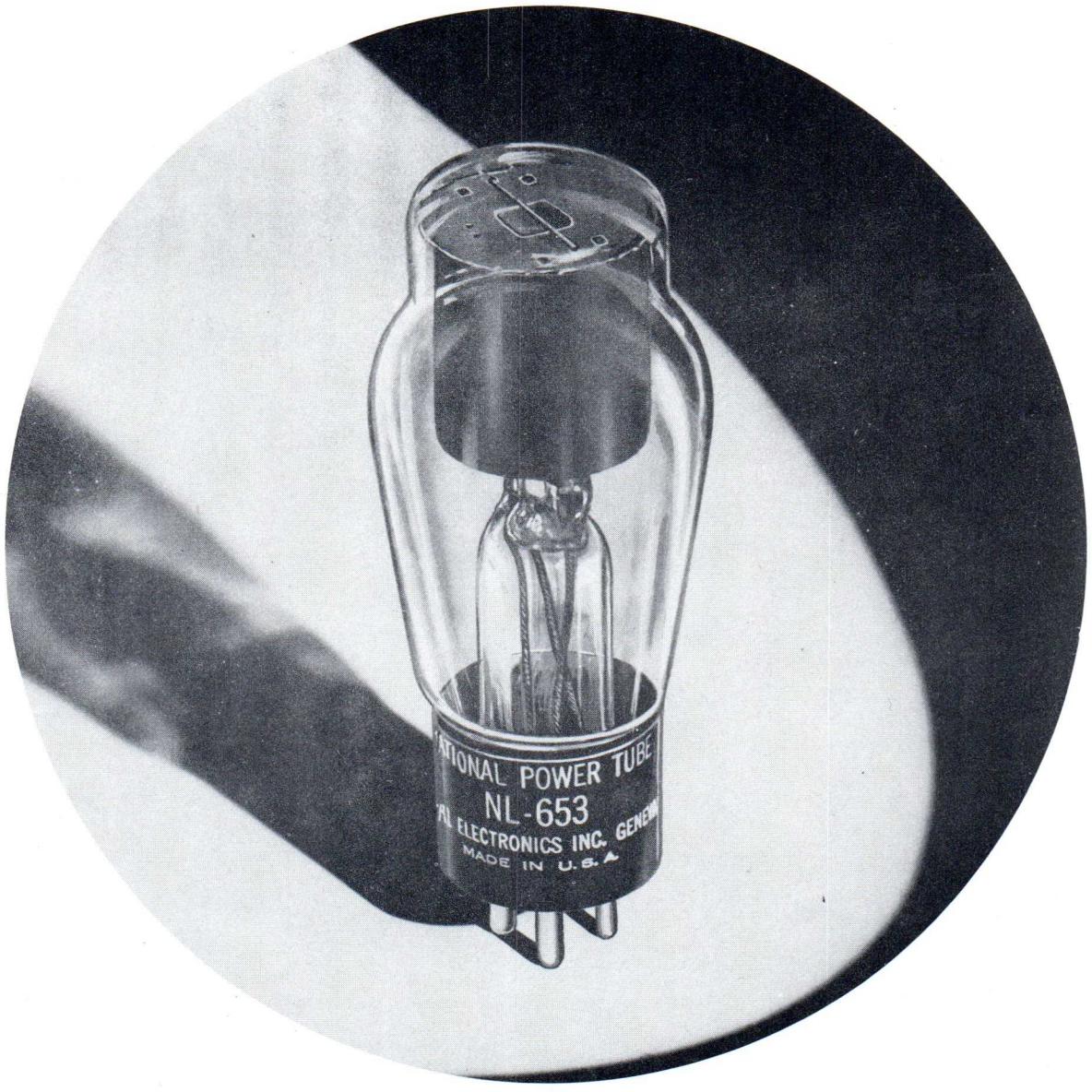


Printed in USA 5-56 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-653
RECTIFIER TUBE
3 Amperes dc



NATIONAL POWER TUBE NL-653 is a sturdy, single-ended, rectifier tube designed especially for industrial power rectifier applications and for "back-rectifier" applications in conjunction with a thyratron tube. It is mercury filled for efficiency, long life, and the ability to stand high inverse voltage.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

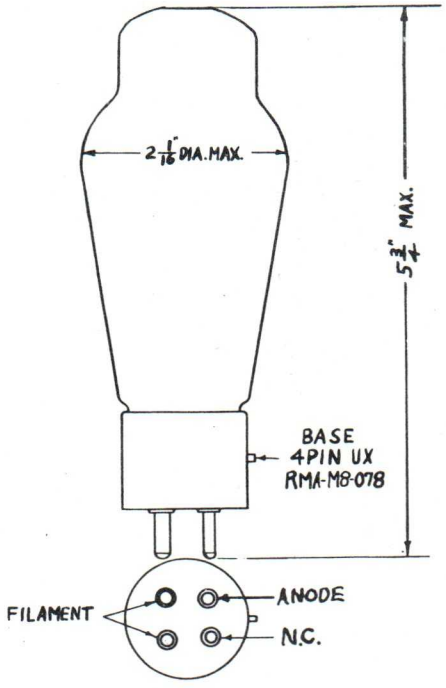
NL-653 RECTIFIER TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	3
Instantaneous Amperes output (maximum)	12
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	900
Filament volts	2.5
Filament amperes	9½ ± 1½
Filament heating time (seconds)	40
Typical arc drop at 12 amperes peak (volts)	11
Typical Anode starting voltage (volts)	16
Maximum ac short circuit current (amperes)	200
Condensed mercury temperature limits (°C)	+ 35 to + 85
Approximate temperature rise, cond. mercury above ambient (°C)	30
Mounting position	vertical, base down
Net weight (ounces)	4
Approx. shipping weight (lbs.)	3

ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



Printed in USA 11-54

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

RECTIFIER TUBE

NL-5558/FG-32

RECTIFIER TUBE

2.5 Amperes dc

NATIONAL POWER TUBE NL-5558/FG-32 is a sturdy rectifier tube designed especially for Industrial power rectifier applications up to 1500 volts dc. It is mercury filled for efficiency, long life, and the ability to stand high inverse voltage.

NATIONAL ELECTRONICS, INC.

GENEVA, ILLINOIS, U. S. A.

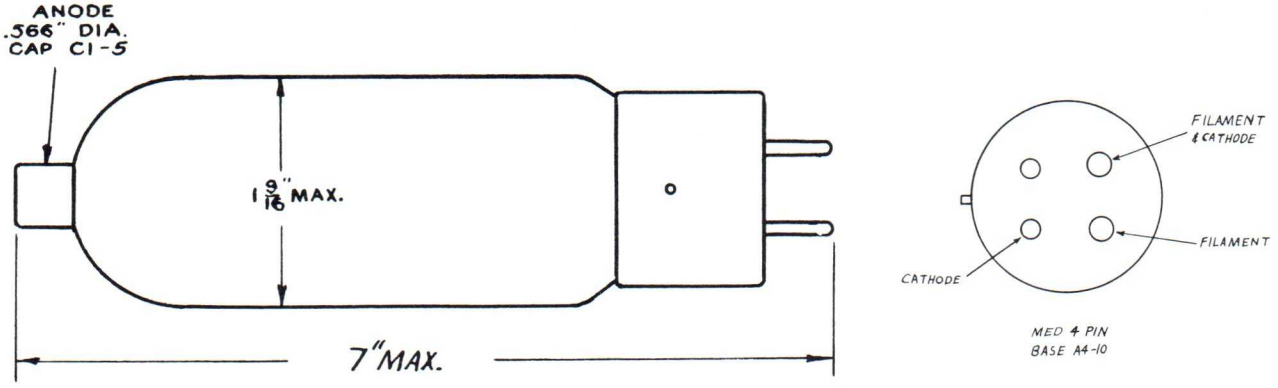
NL-5558/FG-32 RECTIFIER TUBE
TECHNICAL INFORMATION

Indirectly heated Cathode		
dc Amperes output (maximum)	2.5	2.5
Instantaneous Amperes output (maximum)	15	15
Maximum time of averaging anode current (seconds)	15	15
Maximum peak inverse volts	2000	5000
Heater volts	5	5
Heater amperes	4.5 ± .4	4.5 ± .4
Cathode heating time (minutes)	5	5
Typical arc drop at 10 amperes peak (volts)	12	12
Typical Anode starting voltage (volts)	50	50
Maximum ac short circuit current (amperes)	200	200
Condensed mercury temperature limits (°C)	+ 35 to + 80	+ 35 to + 60
Approximate temperature rise, cond. mercury above ambient (°C)	28	28
Mounting position	vertical, base down	
Net weight (ounces)	4	4
Approx. shipping weight (lbs.)	3	3

ALL DATA ARE BASED ON RETURNS TO CATHODE

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



THYRATRON TUBES

NL-3C23, NL-323B and NL-393A
THYRATRON TUBES
1.5 Amperes dc — 6 Amperes Peak

NATIONAL POWER TUBE NL-3C23 is a quick heating thyratron designed especially for industrial grid controlled rectifier applications. It is gas and mercury filled for quick starting and constancy of characteristics within wide temperature limits.

NL-323B and NL-393A are similar thyratron tubes, but use different bases and caps.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-3C23, NL-323B and NL-393A THYRATRON TUBES
TECHNICAL INFORMATION

dc Amperes output (maximum)	1.5
Instantaneous Amperes output (maximum)	6
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	1250
Maximum peak forward volts	1250
Filament volts	2.5
Filament amperes	7
Filament heating time (seconds)	15
Typical arc drop at 5 amperes peak (volts)	15
Grid control characteristic	see curve
Maximum negative grid voltage before conduction (volts)	500
Maximum negative grid voltage during conduction (volts)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to grid capacitance (uuf)	2
Maximum ac short circuit current (amperes)	120
Condensed mercury temperature limits (°C)*	—40 to +80
Approximate temperature rise, cond. mercury above ambient (°C)	20
Mounting position	vertical, base down
Net weight (ounces)	3
Approx. shipping weight (lbs.)	3

*The tube may be started and satisfactory operation will result between —40 and +80°C. For maximum life the condensed mercury temperature after warm-up should run between +40 and +80°C which corresponds to approximately +20 to +60°C ambient.

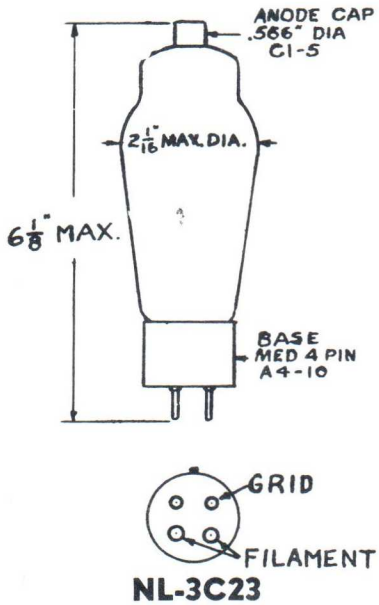
All data are for frequencies between 25 and 210 cycles per second.

Special ratings apply to other frequencies.

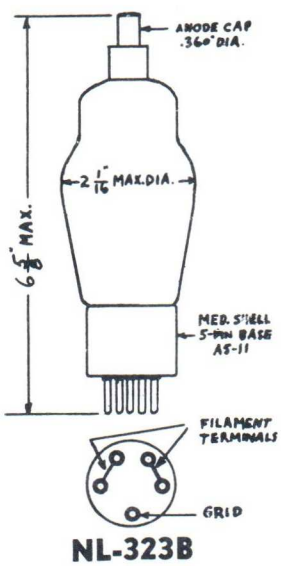
ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

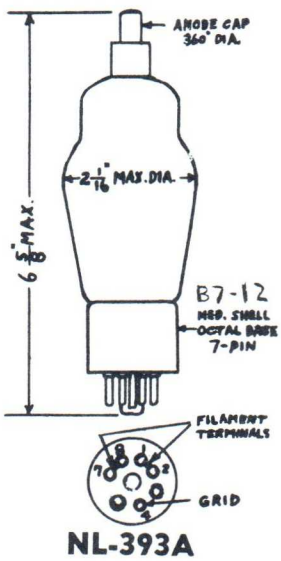
OUTLINE DRAWINGS



NL-3C23

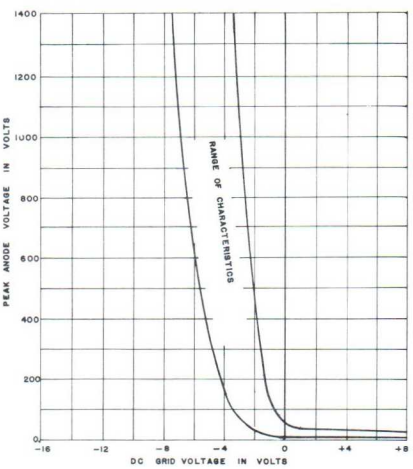


NL-323B



NL-393A

GRID CHARACTERISTIC



Printed in USA 12-55

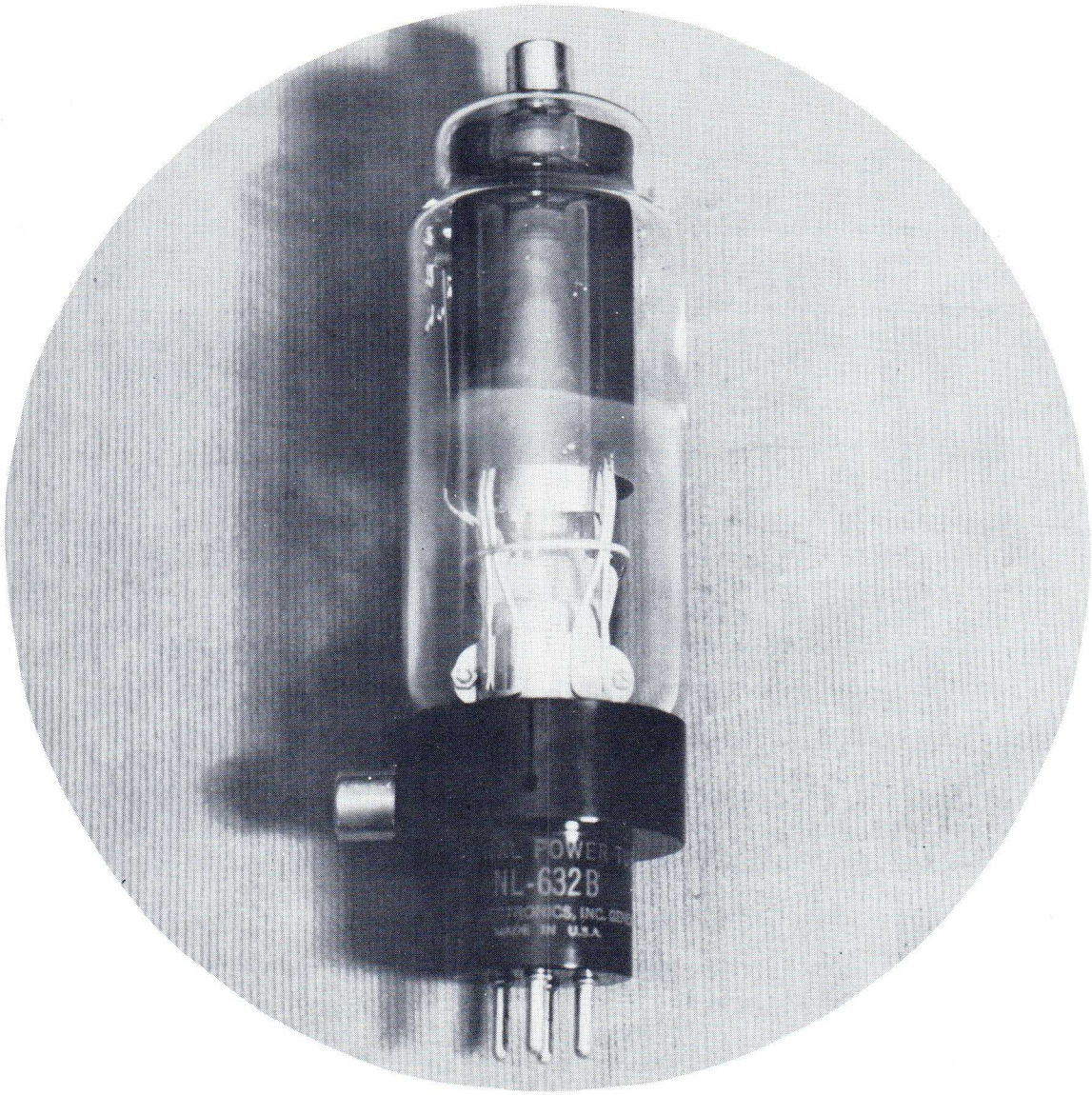
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-632B

THYRATRON TUBE

2.5 Amperes dc -- 30 Amperes Peak



NATIONAL POWER TUBE NL-632B is an indirectly heated cathode thyratron designed especially for control, timing, and ignitor firing applicatons. The shield grid construction and mercury vapor filling give stable operation even with high impedance grid supplies.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

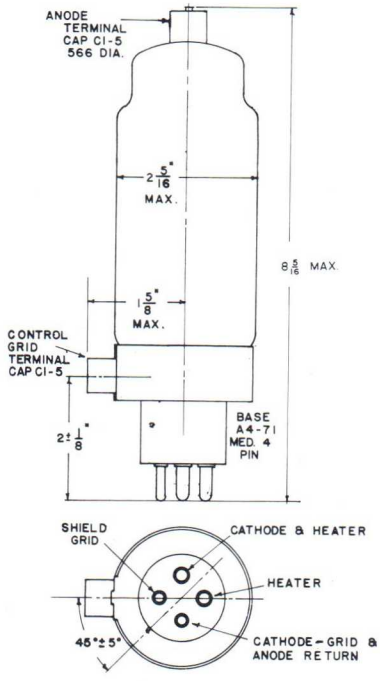
NL-632B THYRATRON TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	30
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	1500
Maximum peak forward volts	1500
Filament volts	5.0 ± .25
Filament amperes	4.6 ± .3
Heating time (seconds)	300
Typical arc drop at 10 amperes peak (volts)	12
Grid control characteristic	see curve
Maximum negative control grid voltage before conduction (volts)	1000
Maximum negative control grid voltage during conduction (volts)	10
Maximum negative shield grid voltage before conduction (volts)	300
Maximum negative shield grid voltage during conduction (volts)	5
Maximum control grid current (average amperes)	.25
Maximum control grid current (peak amperes)	1.0
Maximum shield grid current (average amperes)	.25
Maximum shield grid current (peak amperes)	1.0
Maximum critical control grid current (microamperes)	1.0
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to control grid capacitance (uuf)	0.04
Cathode to control grid capacitance (uuf)	4.4
Maximum ac short circuit current (amperes)	150
Condensed mercury temperature limits (°C)	+40 to +80
Approximate temperature rise, cond. mercury above ambient (°C)	30
Mounting position	vertical, base down
Net weight (ounces)	8
Approx. shipping weight (lbs.)	4

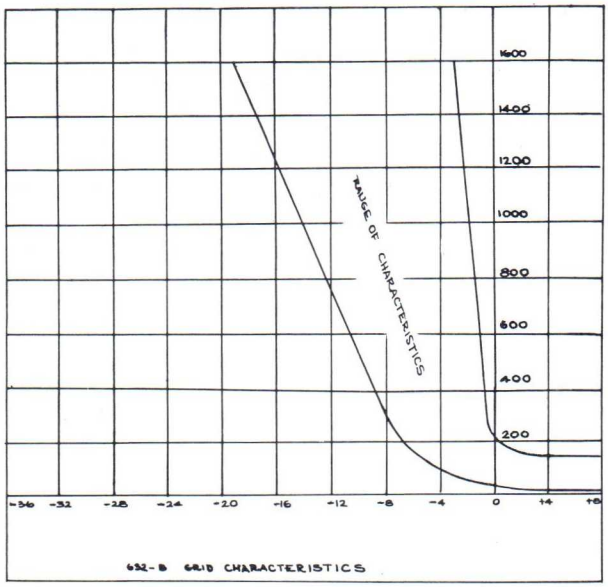
ALL DATA ARE BASED ON RETURNS TO CATHODE

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



GRID CHARACTERISTIC



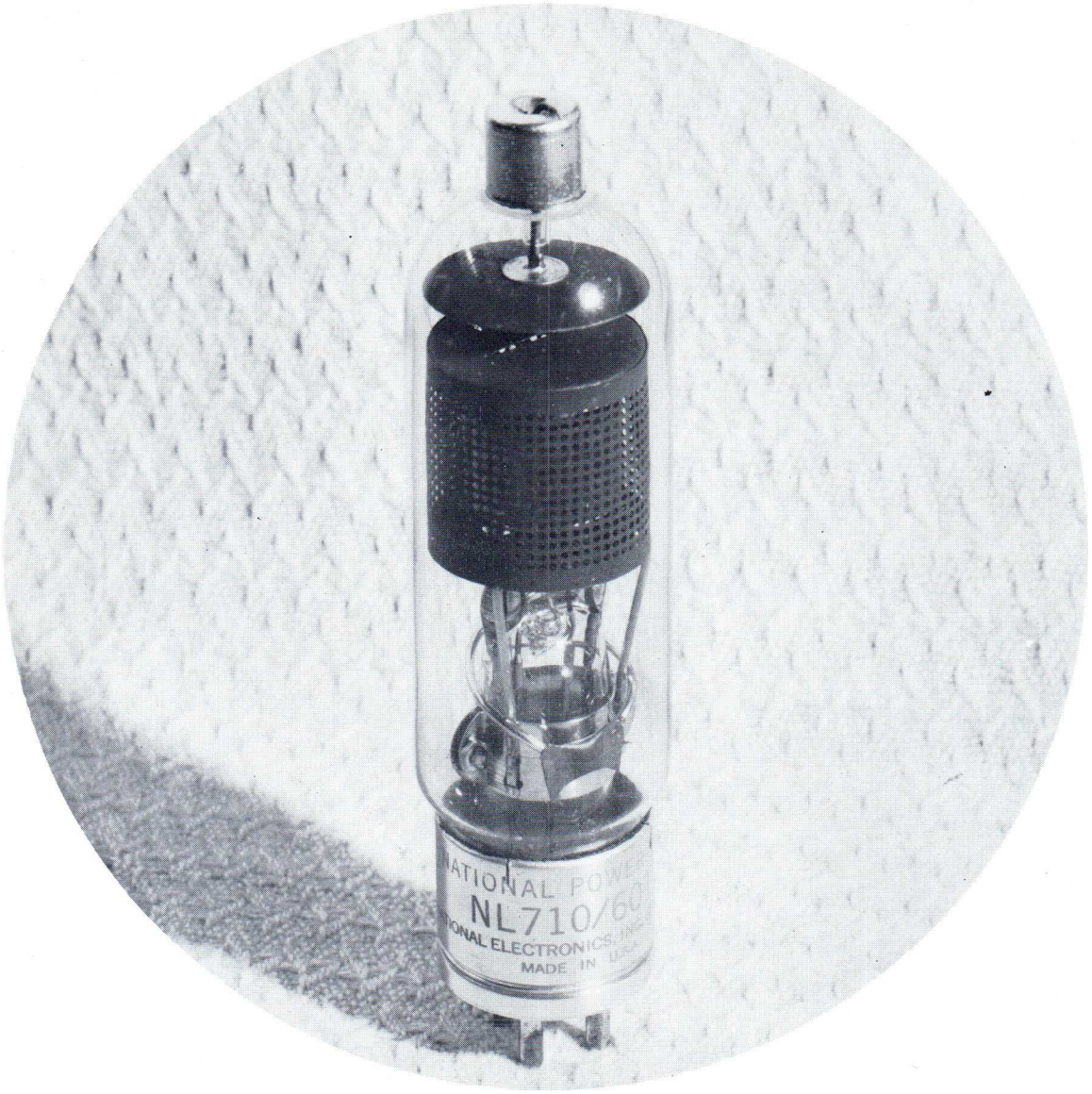
Printed in USA 3/5

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-710/6011 & NL-710L

2.5 Amperes dc -- 30 Amperes Peak



NATIONAL POWER TUBE NL-710/6011 is a quick heating thyratron designed especially for ignitor firing and regulated rectifier applications. It is gas and mercury filled for quick starting and constancy of characteristics within wide temperature limits. The NL-710/6011 with the lug type base is designated as the NL-710L.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-710/6011 & NL-710L
THYRATRON TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	30
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	1500
Maximum peak forward volts	1500
Filament volts	2.5
Filament amperes	9 ± 2
Filament heating time (seconds)	20
Typical arc drop at 8 amperes peak (volts)	10
Grid control characteristic	see curve
Maximum negative grid voltage before conduction (volts)	500
Maximum negative grid voltage during conduction (volts)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to grid capacitance (uuf)	2
Grid to filament capacitance (uuf)	12
Maximum ac short circuit current (amperes)	250
Condensed mercury temperature limits (°C)*	— 40 to + 80
Approximate temperature rise, cond. mercury above ambient (°C)	30
Mounting position	vertical, base down
Net weight (ounces)	4
Approx. shipping weight (lbs.)	3

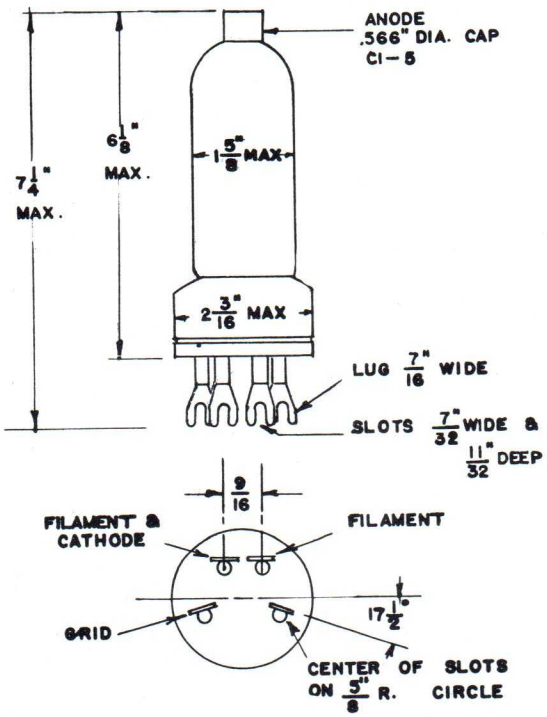
*The tube may be started and satisfactory operation will result between —40 and +80°C. For maximum life the condensed mercury temperature after warm-up should run between +40 and +80°C which corresponds to approximately +10 to +50°C ambient.

ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

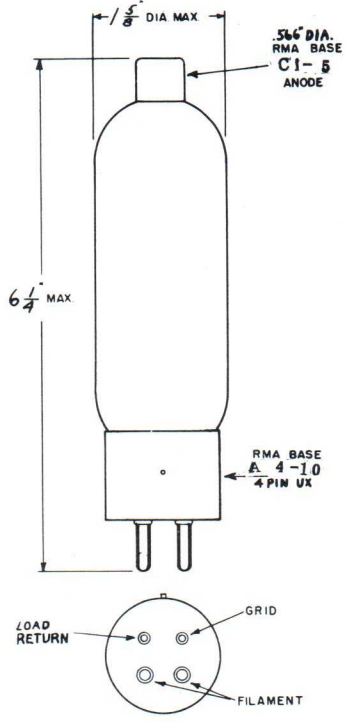
LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWINGS

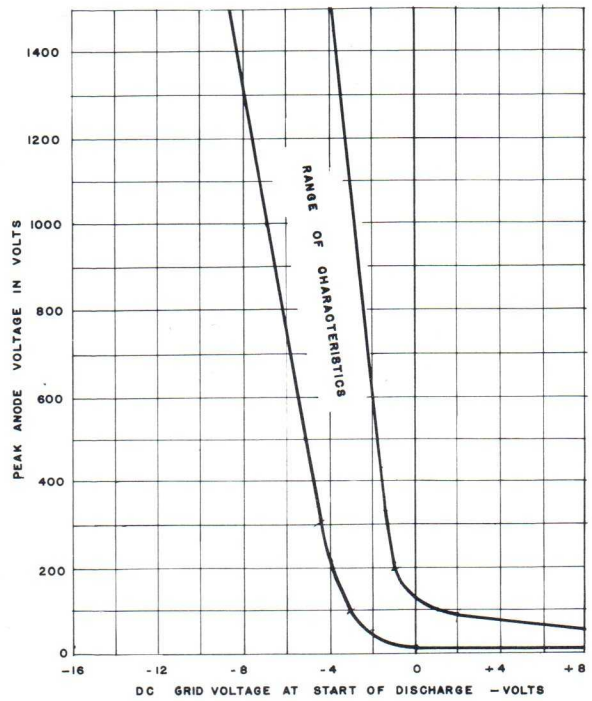
NL-710L



NL-710/6011



GRID CHARACTERISTIC



Printed in USA 6/58

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-714 & NL-715/5557
THYRATRON TUBES
1 Ampere dc — 3 Amperes Peak

NATIONAL POWER TUBE NL-714 is a quick heating industrial thyratron designed especially for timing control and regulated rectifier applications. It is gas and mercury filled for quick starting and constancy of characteristics within wide temperature limits.

NL-715-5557 has the same general characteristics, within its narrower temperature limits, but is filled with mercury only to permit use of the tube at higher voltages such as are found in the amateur radio transmitter application.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

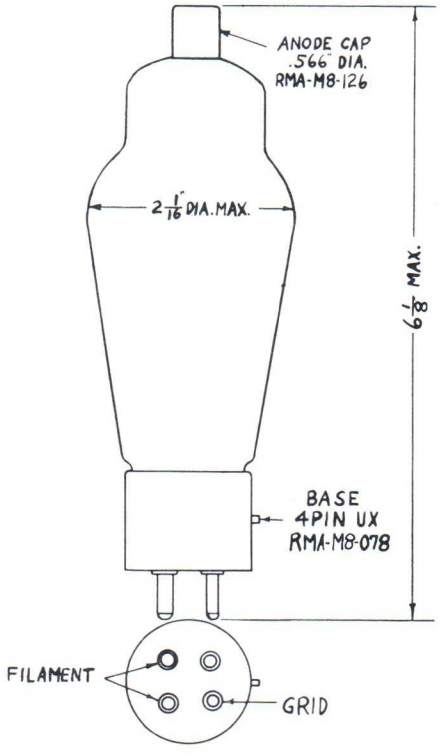
NL-714 & NL-715/5557 THYRATRON TUBES
TECHNICAL INFORMATION

	NL-714	← NL-715/5557 →		
dc Amperes output (maximum)	1.0	.25	.5	1.0
Instantaneous Amperes output (maximum)	3	1	2	3
Maximum time of averaging anode current (seconds)	5	5	5	5
Maximum peak inverse volts	1250	10,000	5,000	1250
Maximum peak forward volts	1250	5,000	2,500	1250
Condensed mercury temperature limits (°C)	−40-+80	+40-+60	+40-+80	+40-+90
Filament volts	2.5			2.5
Filament amperes	5 ± .5			5 ± .5
Heating time (seconds)	5			5
Typical arc drop at 3 amperes peak (volts)	15			15
Grid control characteristic	See Curve			
Maximum negative grid voltage before conduction (volts)	500			500
Maximum negative grid voltage during conduction (volts)	10			10
Maximum critical grid current (microamps)	5			5
Ionization time (approx., microseconds)	10			10
Deionization time (approx., microseconds)	1000			1000
Anode to grid capacitance (uuf)	2			2
Maximum ac short circuit current (amperes)	50			50
Approx. temp. rise, cond. mercury above ambient (°C)	15			15
Mounting position	Vertical, base down			
Net weight (ounces)	3			3
Approx. shipping weight (lbs.)	3			3

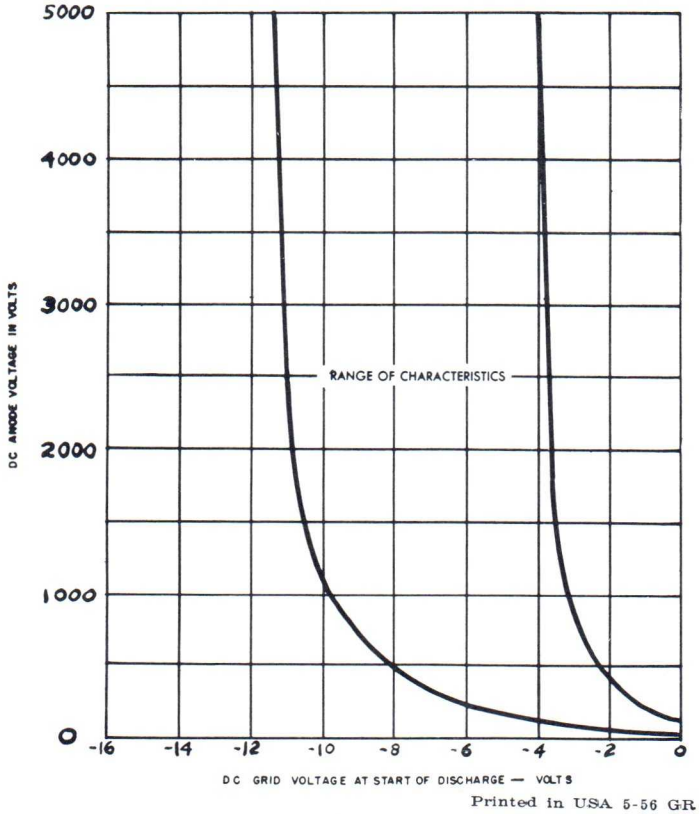
ALL DATA ARE BASED ON RETURNS TO FILAMENT CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



GRID CHARACTERISTIC

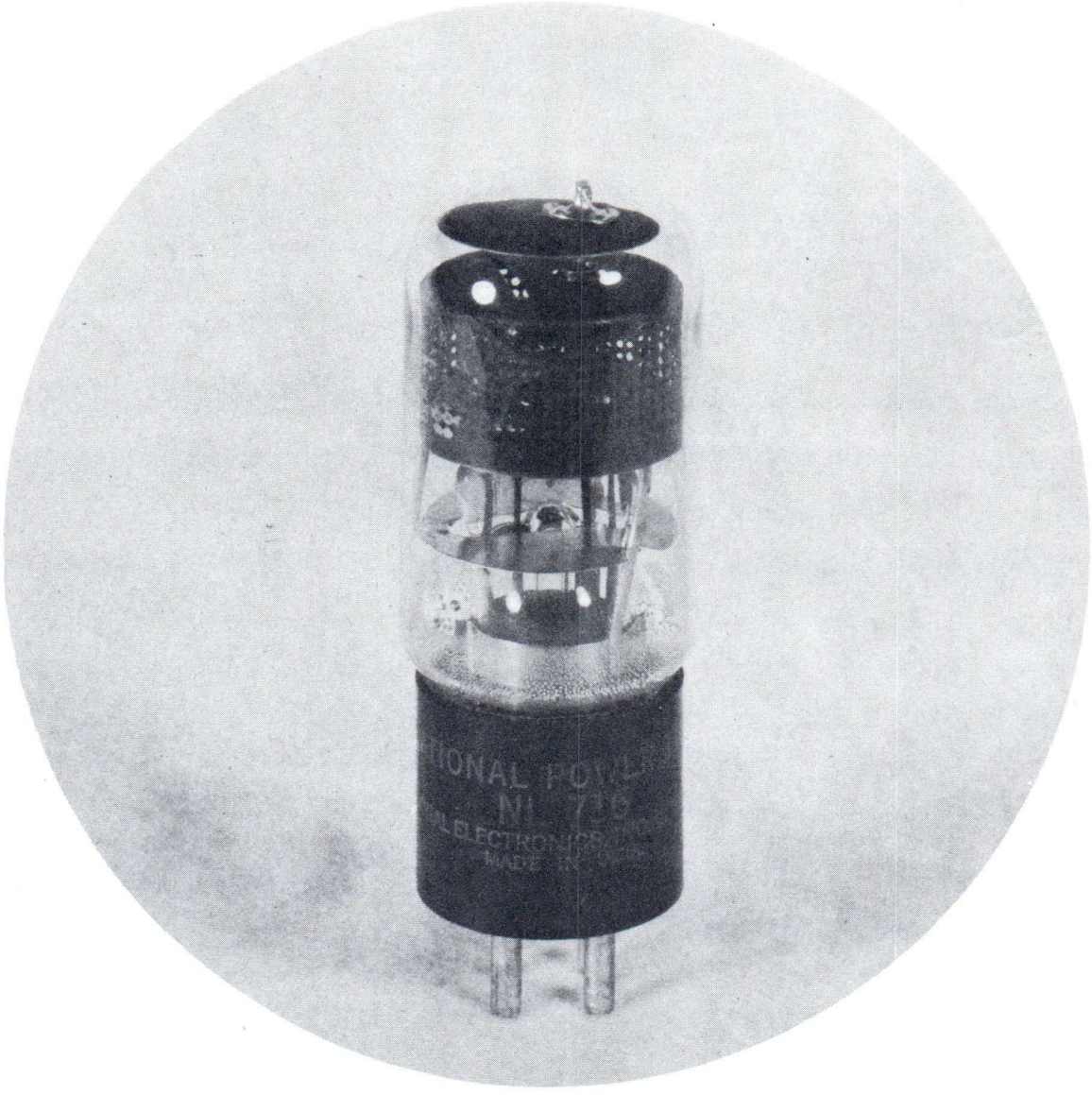


Printed in USA 5-56 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-716
THYRATRON TUBE
1.0 Ampere dc -- 8.0 Amperes Peak



NATIONAL POWER TUBE NL-716 is a compact, quick heating thyratron designed for timing and control applications. It is gas and mercury filled for quick starting and wide temperature limits. NL-716 gives long life without circuit cushioning.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-716 THYRATRON TUBE
TECHNICAL INFORMATION

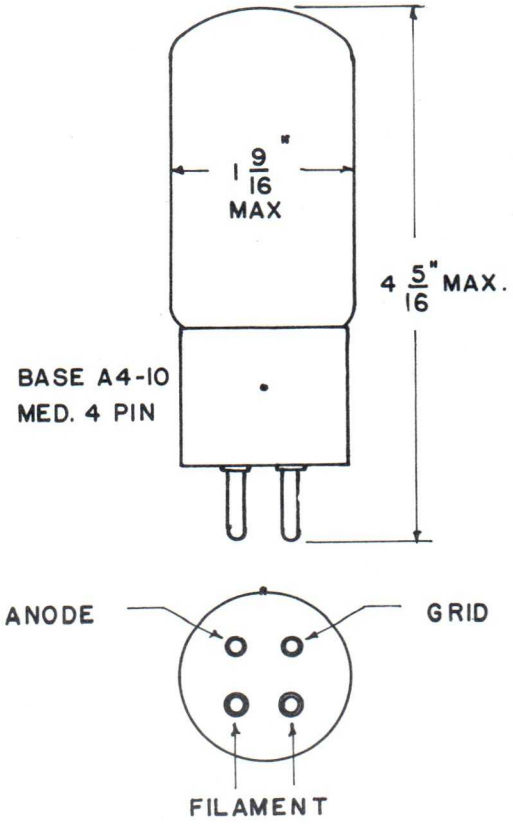
dc Amperes output (maximum)	1.0
Instantaneous Amperes output (maximum)	8.0
Maximum time of averaging anode current (seconds)	5
Maximum peak inverse volts	1250
Maximum peak forward volts	1250
Filament volts	2.5
Filament amperes	6.3 ± 0.8
Filament heating time (seconds)	15
Typical arc drop at 5 amperes peak (volts)	8
Grid control characteristic	see curve
Maximum negative grid voltage before conduction (volts)	500
Maximum negative grid voltage during conduction (volts)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to grid capacitance (uuf)	3
Maximum critical grid current (microamperes)	10
Maximum ac short circuit current (amperes)	80
Condensed mercury temperature limits (°C)*	—40 to +80
Approximate temperature rise, cond. mercury above ambient (°C)	30
Mounting position	vertical, base down
Net weight (ounces)	3
Approx. shipping weight (lbs.)	3

*The tube may be started and satisfactory operation will result between —40 and +80°C. For maximum life the condensed mercury temperature after warm-up should run between +40 and +80°C which corresponds to approximately +10 and +50°C ambient.

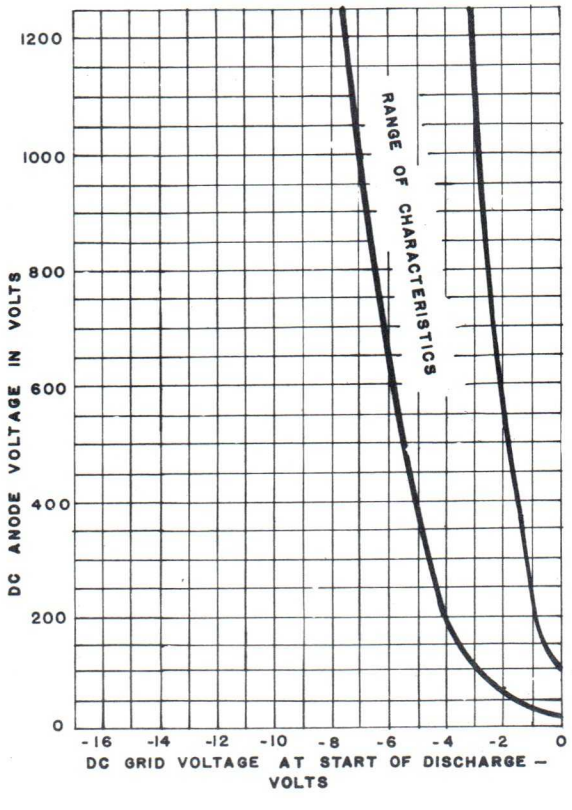
ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



GRID CHARACTERISTIC

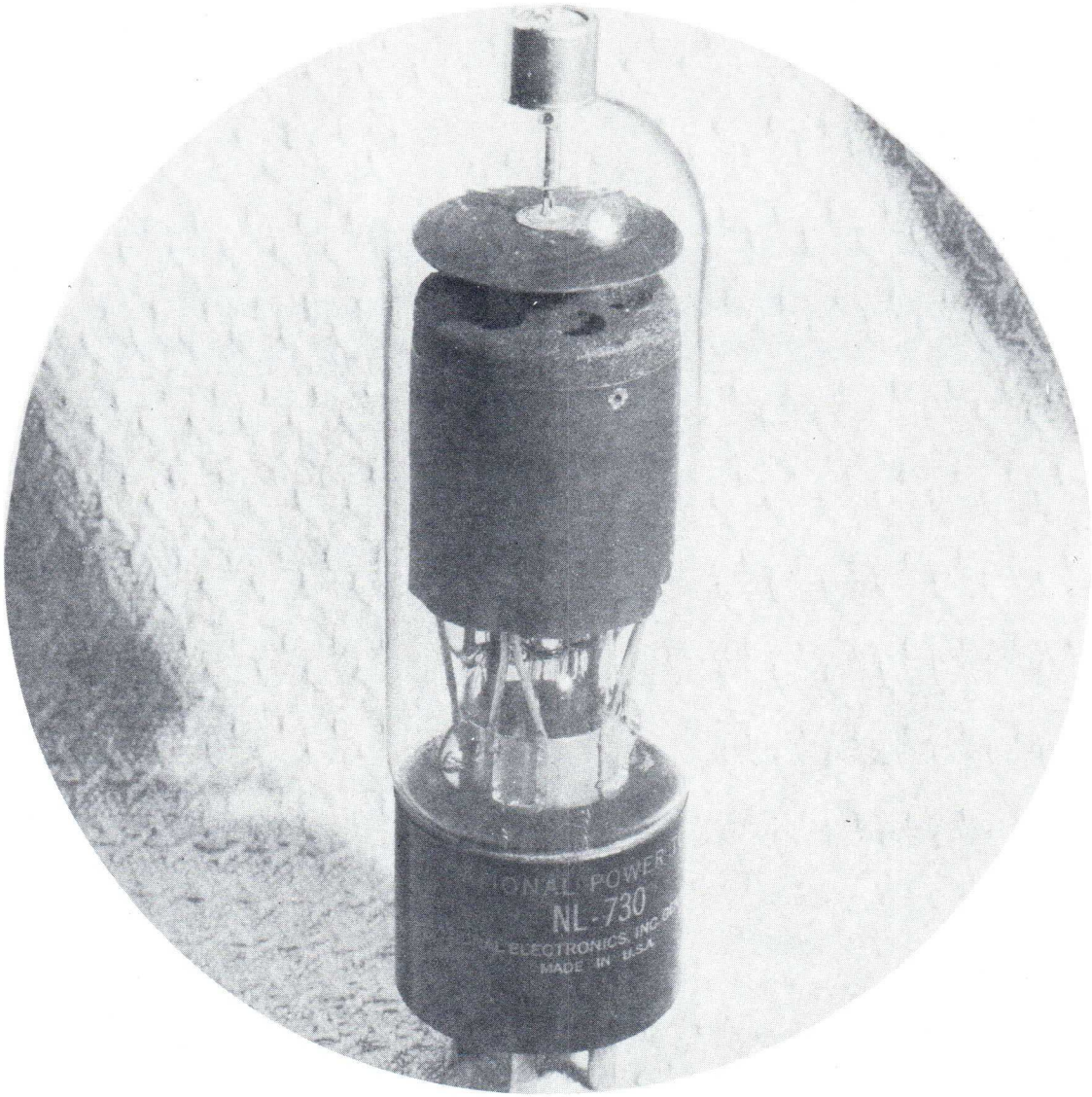


Printed In USA—10-55—G. R.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBES

NL-730
3.2 Amperes dc — 40 Amperes Peak



NATIONAL POWER TUBE NL-730 is a quick heating thyratron especially designed for motor speed control and regulated rectifier applications. It is gas and mercury filled to give quick starting, long life, and wide temperature limits.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-730 THYRATRON TUBE
TECHNICAL INFORMATION

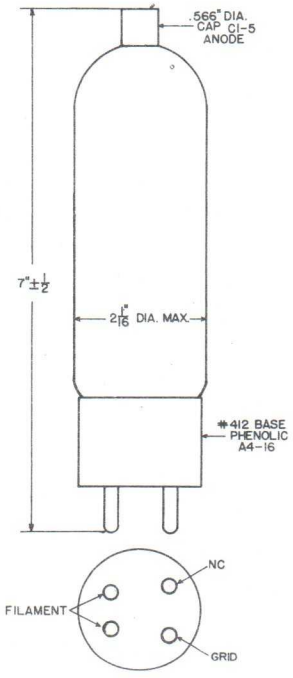
dc Amperes output (maximum)	3.2
Instantaneous Amperes output (maximum)	40
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	1500
Maximum peak forward volts	1500
Condensed mercury temperature limits (°C)*	—40 to +80
Filament volts	2.5
Filament amperes	12 ± 1.5
Filament heating time (seconds)	30
Typical arc drop at 12 amperes peak (volts)	12
Grid control characteristic	See Curve

Maximum negative grid voltage before conduction (volts)	500
Maximum negative grid voltage during conduction (volts)	10
Maximum critical grid current (microamps)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to grid capacitance (uuf)	4
Maximum ac short circuit current (amperes)	560
Approx. temp. rise, cond. mercury above ambient (°C)	30
Mounting position	Vertical, base down
Net weight (ounces)	7
Approx. shipping weight (lbs.)	4

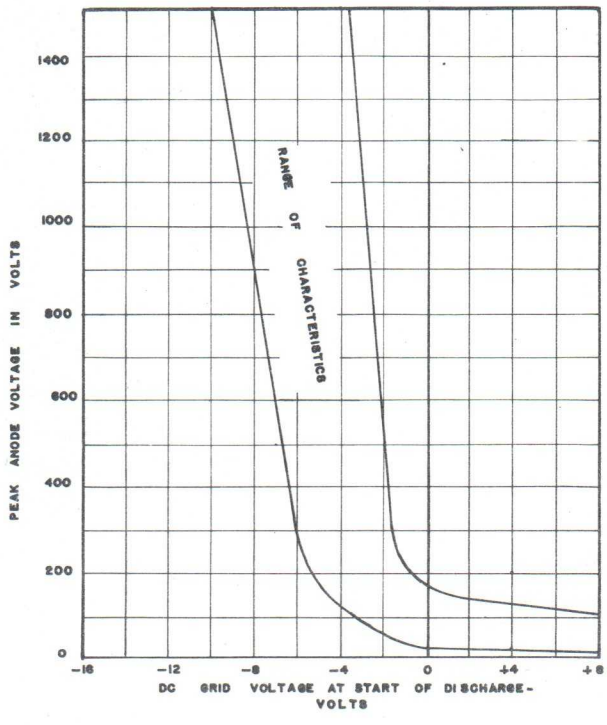
*The tube may be started and satisfactory operation will result between —40 and +80°C. For maximum life the condensed mercury temperature after warm-up should run between +40 and +80°C which corresponds to approximately +10 to +50°C ambient.

ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

OUTLINE DRAWING



GRID CHARACTERISTIC



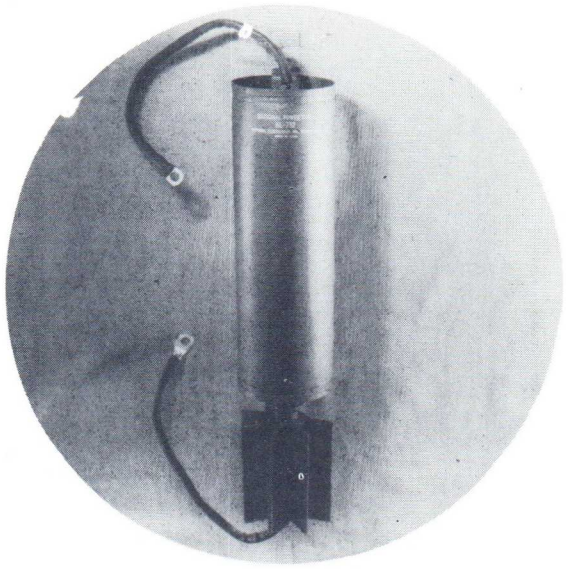
Printed In USA—10-55—G. R.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-732 THYRATRON TUBE

30 Amperes dc -- 225 Ampere peak
1500 Volts peak

NATIONAL POWER TUBE NL-732 is a metal envelope thyratron designed especially for resistance welding and AC control applications. It is gas and mercury filled for quick starting and long life without circuit cushioning.



TECHNICAL INFORMATION

dc Amperes output (Maximum)	30	25
Instantaneous amperes output (Maximum)	160	225
Maximum time of averaging anode current (seconds)	30	
Maximum peak inverse volts	1500	
Maximum peak forward volts	1500	
★Condensed mercury temperature limits (°C)	—40 to +80	
Filament volts	2.5	
Filament amperes	55 ± 5	
Filament heating time (seconds)	180	
Typical arc drop at 100 amperes peak (volts)	12	
Grid control characteristics	See Curve	
Maximum negative grid voltage before conduction (volts)	500	
Maximum negative grid voltage during conduction (volts)	10	
Maximum critical grid current (microamps)	10	
Max. dc grid current (amperes)	1	
Ionization time (approx., microseconds)	10	
Deionization time (approx. microseconds)	1000	
Anode to grid capacitance (uuf) (approx.)	4	
Maximum ac short circuit current (amperes)	2500	
Approx .temp. rise, cond. mercury above ambient (°C)	30	
Mounting position	Vertical Fin down	
Net weight (pounds)	7	
Approx. shipping weight (lbs.)	15	

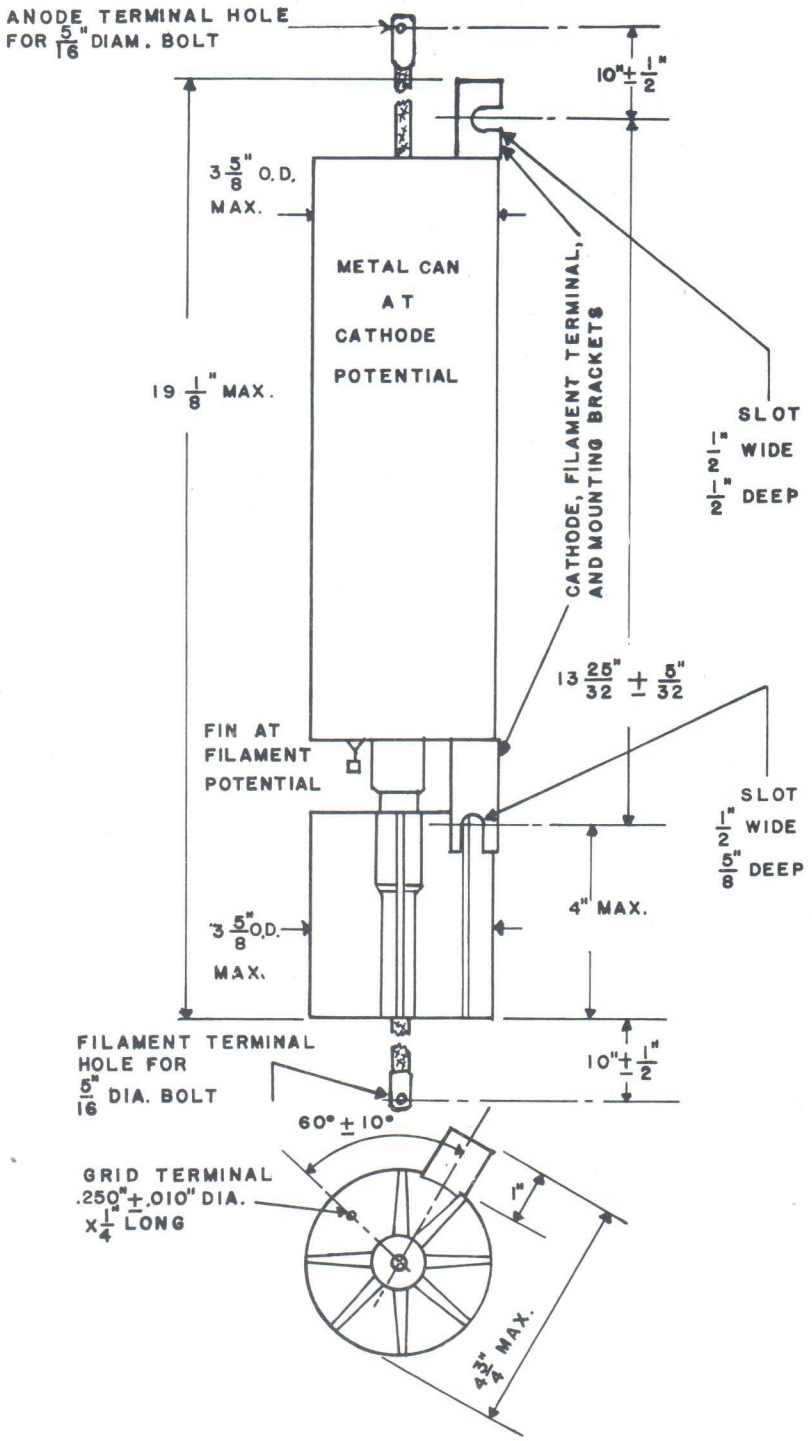
★The tube may be started and satisfactory operation will result between —40 and +80°C. For maximum life the condensed mercury temperature after warm-up should run between +40 and +80°C which corresponds to approximately + 10and +50°C ambient.

All data are based on returns to filament center tap or to tube bracket and with filament voltage phasing such that the lower filament terminal (lead) is positive when the anode is positive.

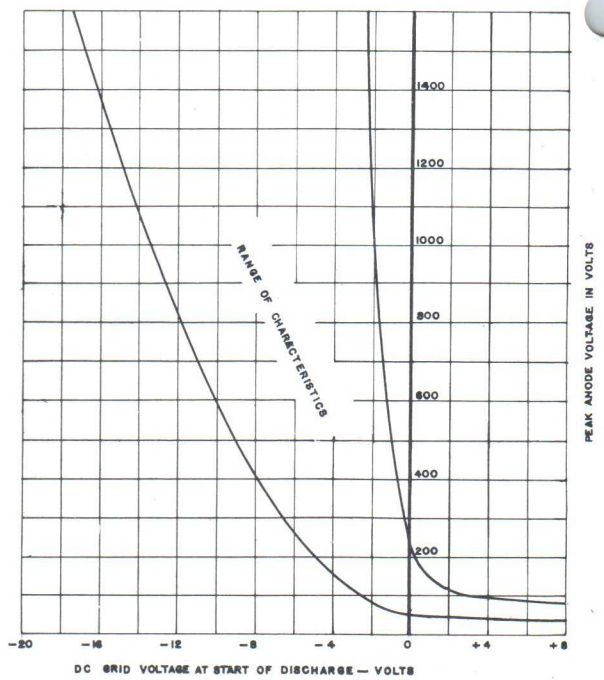
Printed in USA 9-56

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-732 THYRATRON TUBE

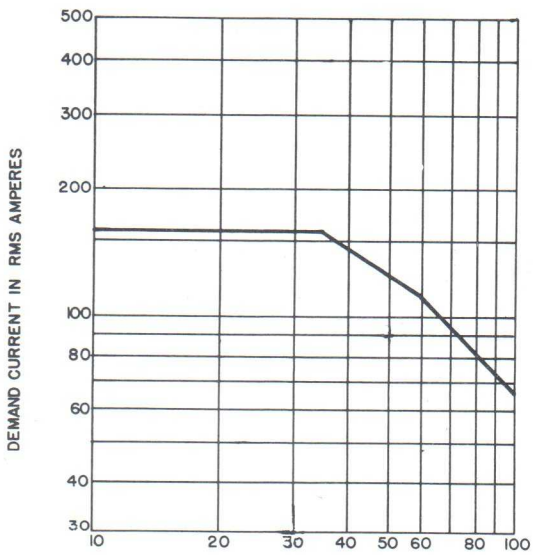


NL-732 OUTLINE



NL 733 GRID CHARACTERISTIC CAN RETURN FILAMENT PHASING AS NOTED IN DATA

WELDER RATING

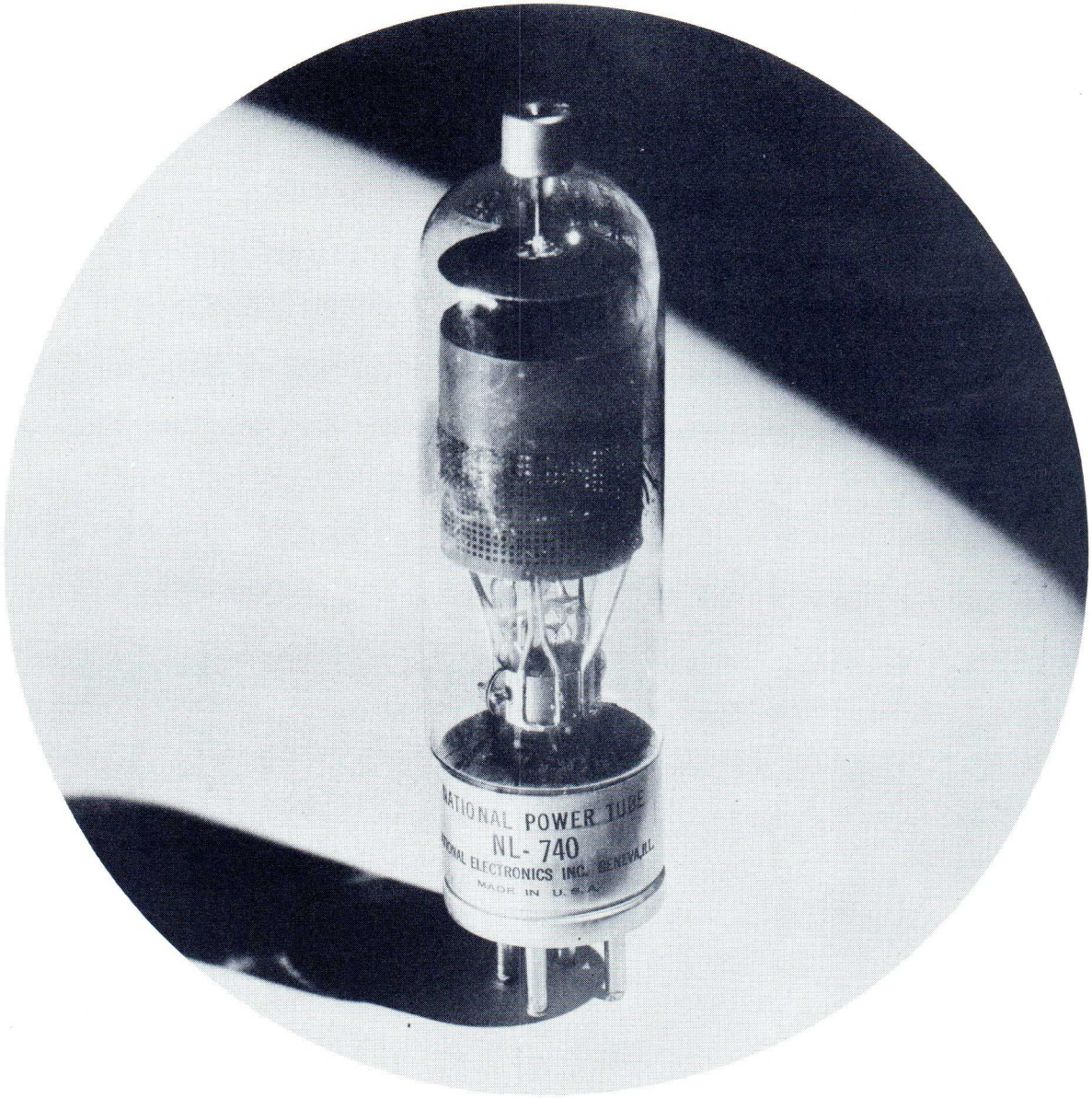


PECENT DUTY — 2 TUBES CONNECTED IN INVERSE PARALLEL

THYRATRON TUBES

NL-740 & NL-741

4 Amperes dc — 50 Amperes Peak



NATIONAL POWER TUBE NL-740 is a quick heating Industrial thyratron designed especially for heavy duty ignitor firing applications and for use in motor speed control and regulated rectifier equipments. It is gas and mercury filled for quick starting and constancy of characteristics within wide temperature limits.

NL-741 has the same general characteristics, within its narrower temperature limits, but is filled with mercury only to permit use of the tube at higher voltages.

Both types are available with bracket type bases for panel mounting under type numbers NL-740P and NL-741P.

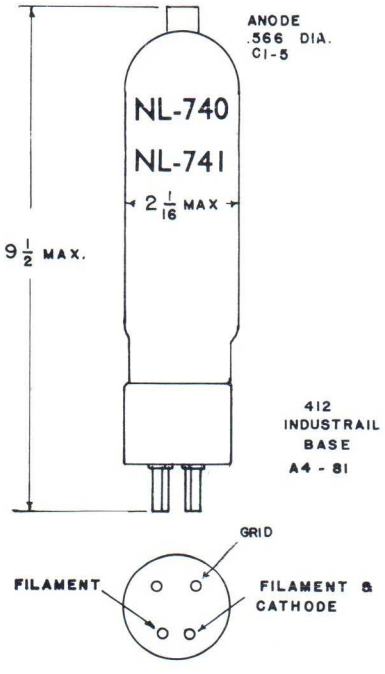
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-740 & NL-741
THYRATRON TUBES

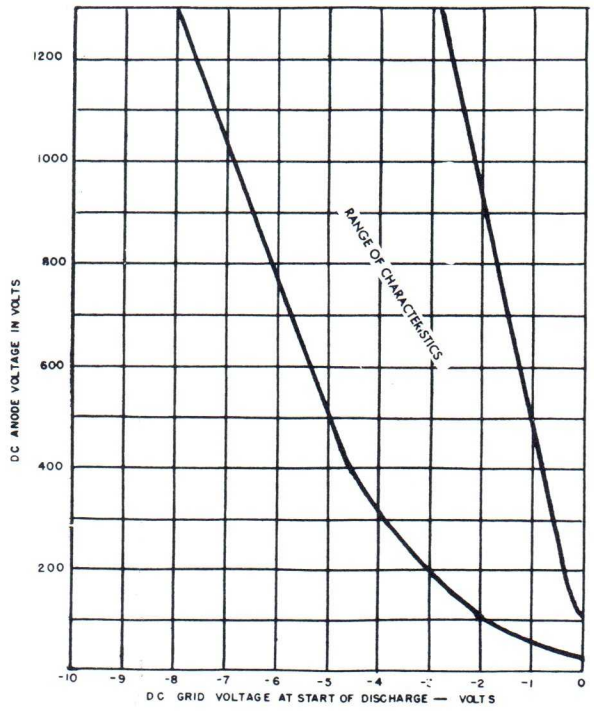
TECHNICAL INFORMATION

	NL-740		NL-741		
dc Amperes output (maximum)	4.0	2.5	4.0	2.5	2.5
Instantaneous Amperes output (maximum)	30	50	30	50	15
Maximum time of averaging anode current (seconds)	5	5	5	5	5
Maximum peak inverse volts	1500	1500	1500	1500	5000
Maximum peak forward volts	1500	1500	1500	1500	2500
Condensed mercury temperature limits (°C)	−40 to +80	−40 to +80	+40 to +90	+40 to +90	+40 to +65
Filament volts	2.5				
Filament amperes	16±2				
Heating time (seconds)	30				
Typical arc drop at 12 amperes peak (volts)	12				
Grid control characteristic	See Curve				
Maximum negative grid voltage before conduction (volts)	500				
Maximum negative grid voltage during conduction (volts)	10				
Maximum critical grid current (microamps)	10				
Ionization time (approx., microseconds)	10				
Deionization time (approx., microseconds)	1000				
Anode to grid capacitance (uuf)	3				
Maximum ac short circuit current (amperes)	400				
Approx. temp. rise, cond. mercury above ambient (°C)	25				
Mounting position	Vertical, base down				
Net weight (ounces)	7				
Approx. shipping weight (lbs.)	4				

OUTLINE DRAWING

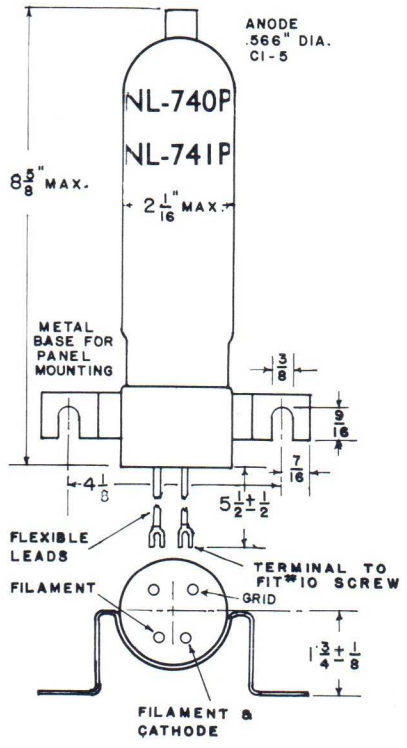


GRID CHARACTERISTIC



RETURNS TO FILAMENT CENTER TAP

OUTLINE DRAWING



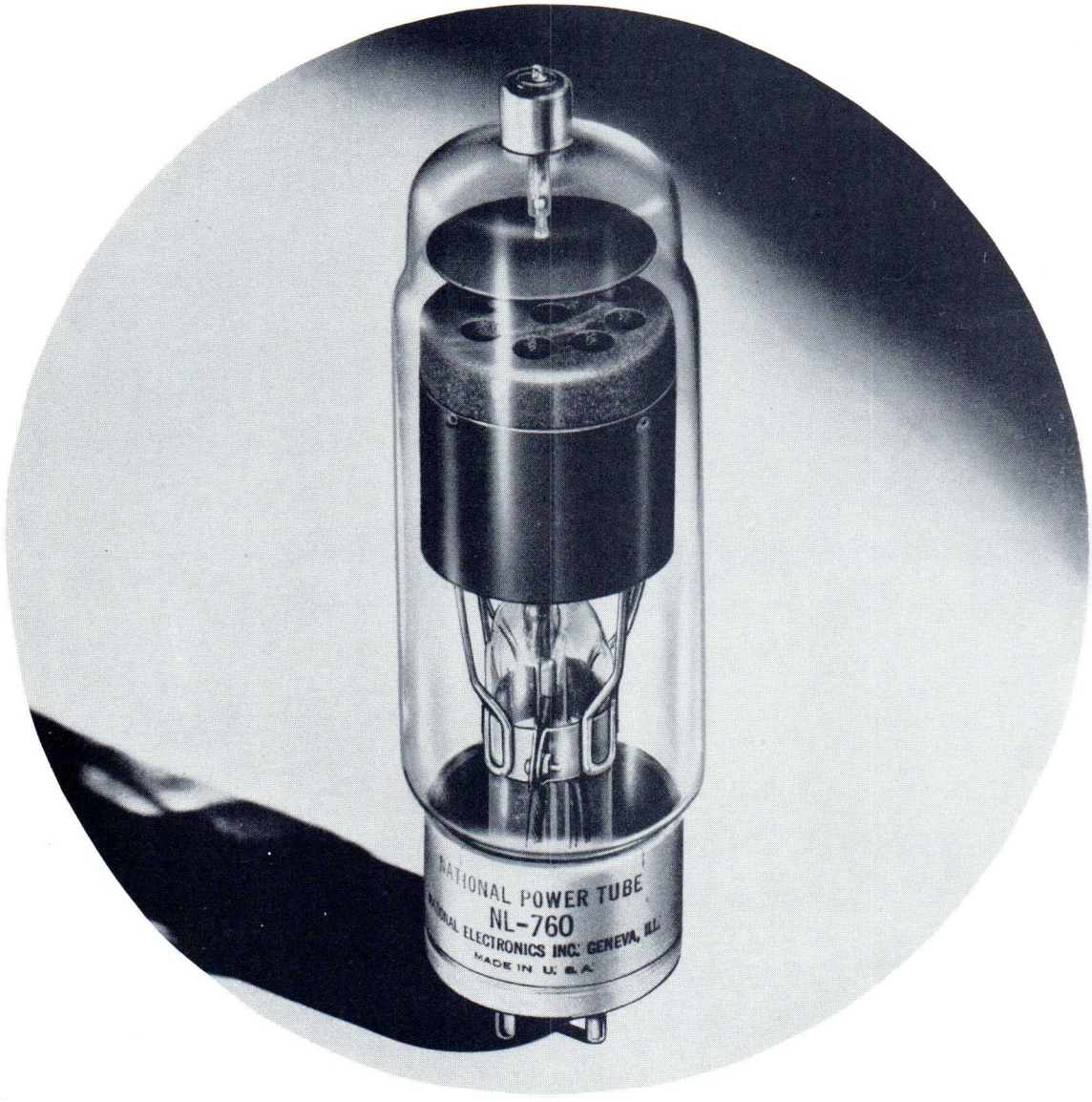
Litho in U.S.A.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-760 & NL-761

6.4 Amperes dc -- 77 Amperes Peak



NATIONAL POWER TUBE NL-760 is a quick heating industrial thyratron designed especially for welding control, motor speed control, and regulated rectifier applications. It is gas and mercury filled for quick starting, constancy of characteristics within wide temperature limits, and long life.

NL-761 has the same general characteristics, within its narrower temperature limits, but is filled with mercury only to permit use of the tube at higher voltages.

Both types are available with bracket type bases for panel mounting under type numbers NL-760P and NL-761P, and with the new National-designed lug type bases under type numbers NL-760L and NL-761L.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-760 & NL-761 THYRATRON TUBES
TECHNICAL INFORMATION

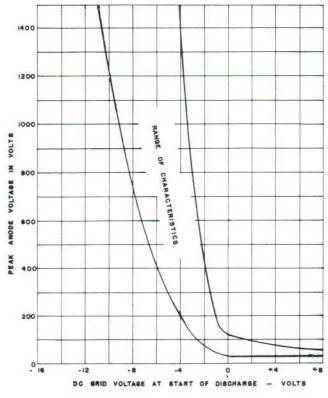
	NL-760	NL-761	
dc Amperes output (Maximum)	6.4	6.4	4.0
Instantaneous Amperes Output (Maximum)	77	77	30
Maximum time of averaging anode current (seconds)	15	15	15
Maximum peak inverse volts	1500	1500	5000
Maximum peak forward volts	1500	1500	2500
Condensed mercury temperature limits (°C)	—40 to +80*	+40 to +90	+40 to +65

(All data from Filament volts on down are the same and in single column.)

Filament volts	2.5
Filament amperes	21 ± 2
Filament heating time (seconds)	60
Typical arc drop at 20 amperes peak (volts)	12
Grid control characteristic	See Curve
Maximum negative grid voltage before conduction (volts)	500
Maximum negative grid voltage during conduction (volts)	10
Maximum critical grid current (microamps)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to grid capacitance (uuf)	4
Maximum ac short circuit current (amperes)	770
Approx. temp. rise, cond. mercury above ambient (°C)	30
Mounting position	Vertical, base down
Net weight (ounces)	9
Approx. shipping weight (lbs.)	5

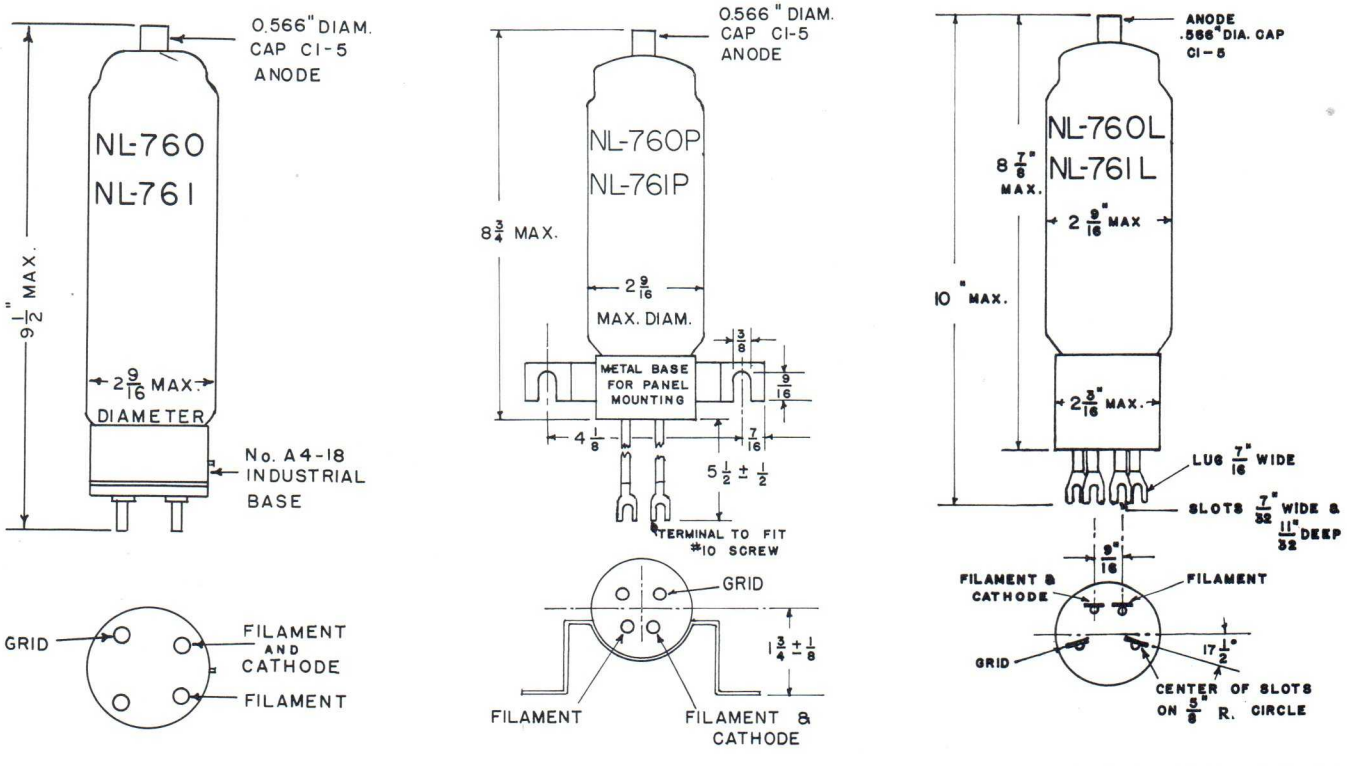
*The tube may be started and satisfactory operation will result between —40 and +80°C. For maximum life the condensed mercury temperature after warm-up should run between +40 and +80°C which corresponds to approximately +10 to +50°C ambient

GRID CHARACTERISTIC



ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

OUTLINE DRAWINGS

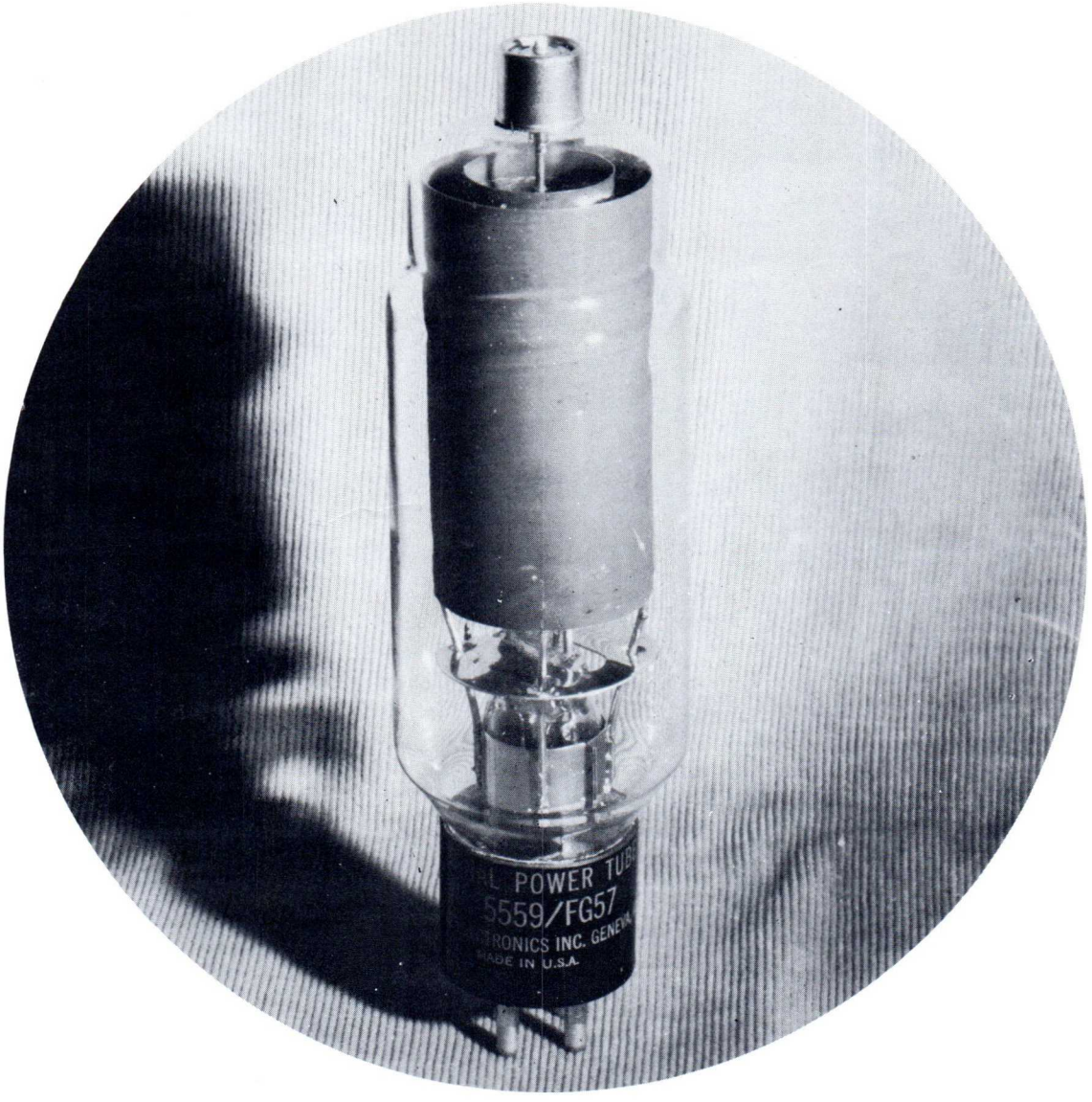


Printed in U.S.A. 12/56 G.R.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-5559/FG-57
THYRATRON TUBE
2.5 Amperes dc -- 15 Amperes Peak



NATIONAL POWER TUBE NL-5559/FG57 is an indirectly heated cathode thyratron designed especially for those applications where little grid power is available. The mercury filling and efficient cathode give long and dependable life.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

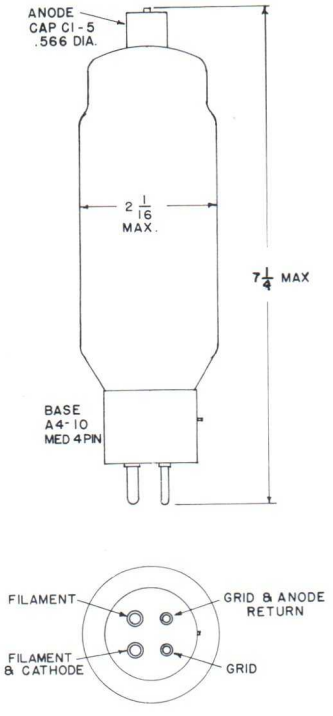
NL-5559/FG-57 THYRATRON TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	15
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	1000
Maximum peak forward volts	1000
Filament volts	5.0 ± .25
Filament amperes	4.5 ± .4
Cathode heating time (seconds)	300
Typical arc drop at 10 amperes peak (volts)	12
Grid control characteristic	see curve
Maximum negative grid voltage before conduction (volts)	500
Maximum negative grid voltage during conduction (volts)	10
Maximum grid current (amperes)	.25
Maximum critical grid current (microamperes)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to grid capacitance (uuf)	2.5
Cathode to grid capacitance (uuf)	10
Maximum ac short circuit current (amperes)	200
Condensed mercury temperature limits (°C)	+ 40 to + 80
Approximate temperature rise, cond. mercury above ambient (°C)	30
Mounting position	vertical, base down
Net weight (ounces)	5
Approx. shipping weight (lbs.)	4

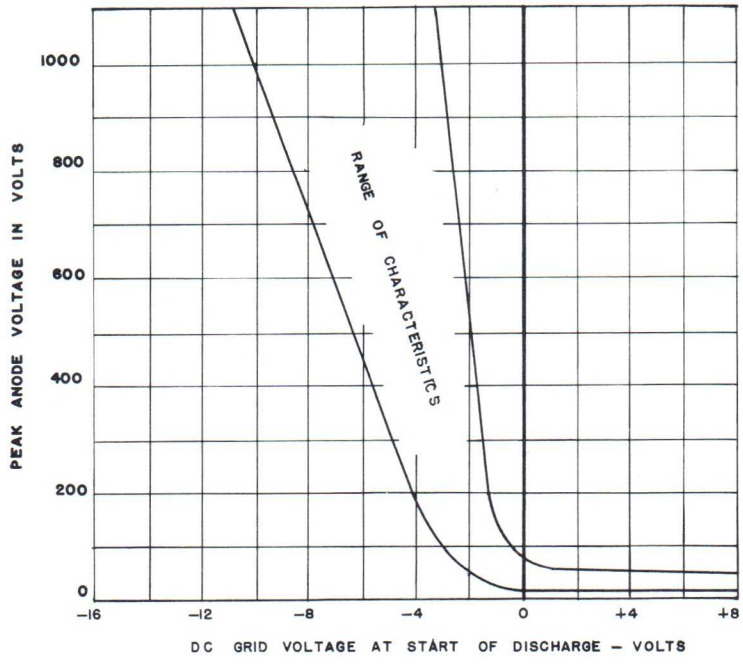
ALL DATA ARE BASED ON RETURNS TO CATHODE

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



GRID CHARACTERISTIC

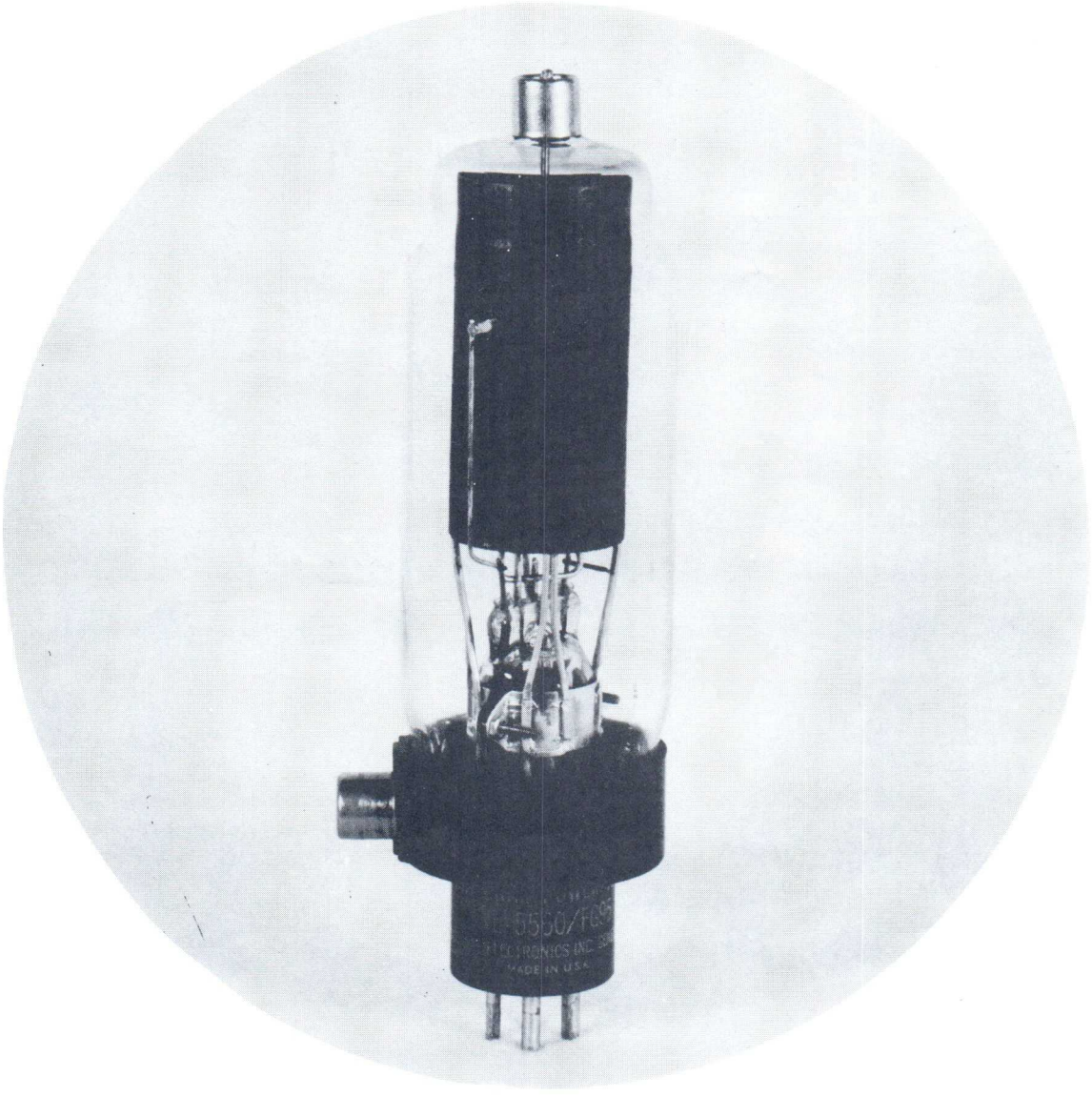


Printed in USA 5-56 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-5560/FG95
THYRATRON TUBE
2.5 Amperes dc -- 15 Amperes Peak



NATIONAL POWER TUBE NL-5560/FG95 is an indirectly heated cathode thyratron designed especially for control, timing, and ignitor firing applications. The shield grid construction and mercury vapor filling give stable operation even with high impedance grid supplies.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-5560/FG95 THYRATRON TUBE
TECHNICAL INFORMATION

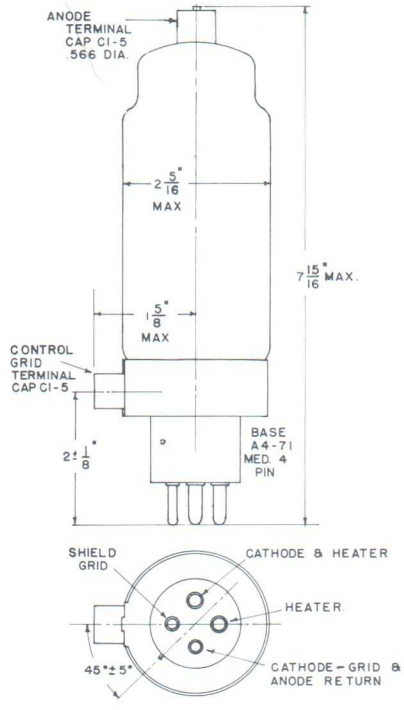
dc Amperes output (maximum)	.5*	2.5
Instantaneous Amperes output (maximum)	30*	15
Maximum time of averaging anode current (seconds)		15
Maximum peak inverse volts		1000
Maximum peak forward volts		1000
Filament volts		5.0 ± .25
Filament amperes		4.5 ± .4
Heating time (seconds)		300
Typical arc drop at 10 amperes peak (volts)		12
Grid control characteristic		see curve
Maximum negative control grid voltage before conduction (volts)		1000
Maximum negative control grid voltage during conduction (volts)		10
Maximum negative shield grid voltage before conduction (volts)		300
Maximum negative shield grid voltage during conduction (volts)		5
Maximum control grid current (amperes)		.25
Maximum shield grid current (amperes)		1.0
Maximum critical control grid current (microamperes)		1.0
Ionization time (approx., microseconds)		10
Deionization time (approx., microseconds)		1000
Anode to control grid capacitance (uuf)		0.2
Cathode to control grid capacitance (uuf)		4.4
Maximum ac short circuit current (amperes)		200
Condensed mercury temperature limits (°C)		+40 to +80
Approximate temperature rise, cond. mercury above ambient (°C)		30
Mounting position		vertical, base down
Net weight (ounces)		8
Approx. shipping weight (lbs.)		4

*These ratings apply with heater voltage 5.5 ± 5% Volts.

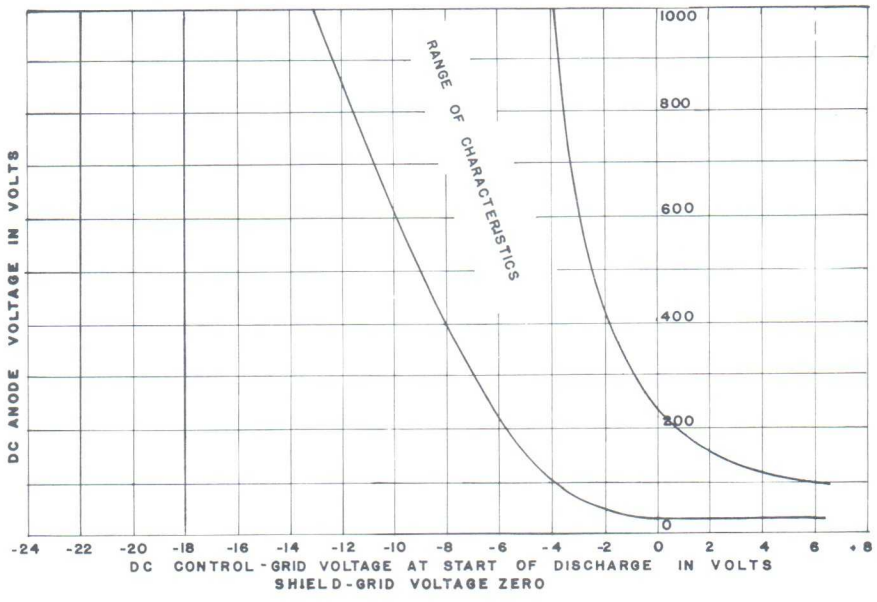
ALL DATA ARE BASED ON RETURNS TO CATHODE

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



GRID CHARACTERISTIC

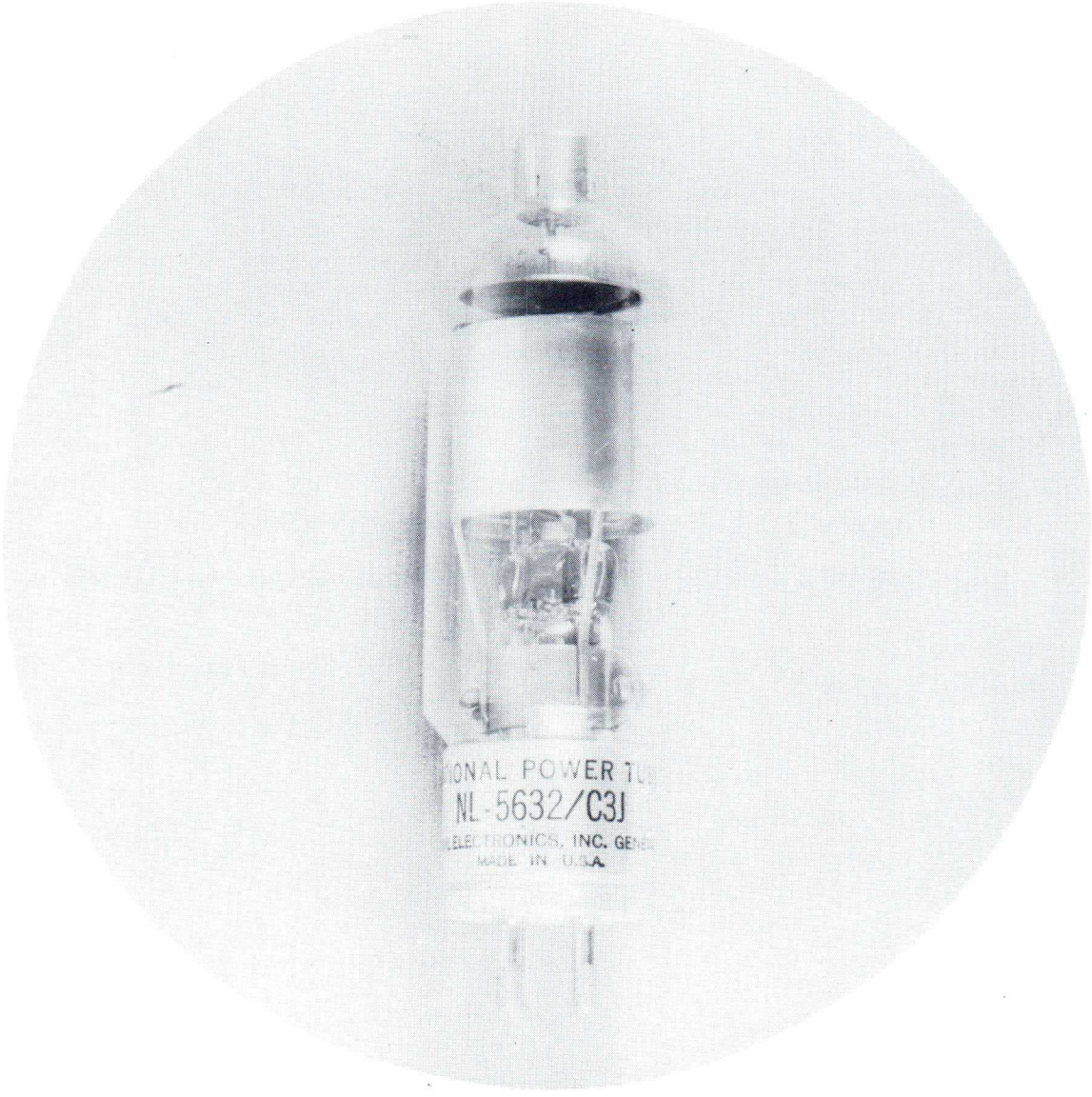


Printed in USA 12-55

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-5632/C3J
THYRATRON TUBE
2.5 Amperes dc -- 30 Amperes Peak



NATIONAL POWER TUBE NL-5632/C3J is a quick heating thyratron designed for timing and control applications. It is xenon filled for quick starting and the ability to operate within wide ambient temperature limits. It is ruggedly constructed for industrial applications.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

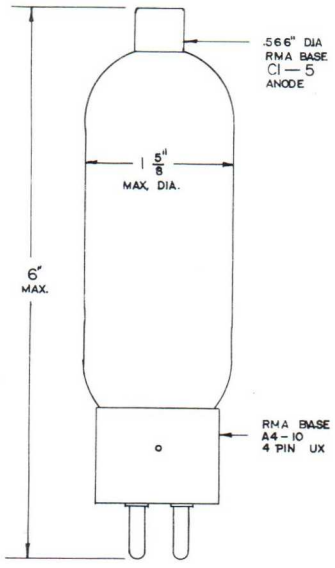
NL-5632/C3J THYRATRON TUBE
TECHNICAL INFORMATION

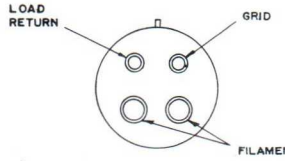
dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	30
Maximum time of averaging anode current (seconds)	4.5
Maximum peak inverse volts	1250
Maximum peak forward volts	900
Max. Commutation Factor (V/usec x V/usec) at a max. initial inverse voltage of 350 volts	0.66
Filament volts	2.5
Filament amperes	9 ± 2
Heating time (seconds)	30
Typical arc drop at 10 amperes peak (volts)	10
Grid control characteristic	see curve
Maximum negative grid voltage before conduction (volts)	100
Maximum negative grid voltage during conduction (volts)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to grid capacitance (uuf)	2
Maximum critical grid current (microamperes)	10
Maximum ac short circuit current (amperes)	300
Ambient temperature limits (°C)	—55 to +75
Mounting position	any
Net weight (ounces)	3
Approx. shipping weight (lbs.)	3

ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

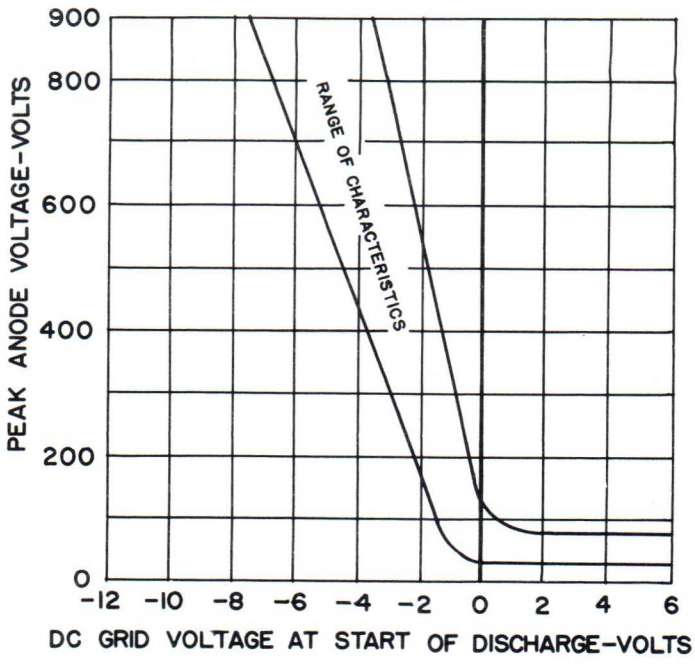
LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING





GRID CHARACTERISTIC



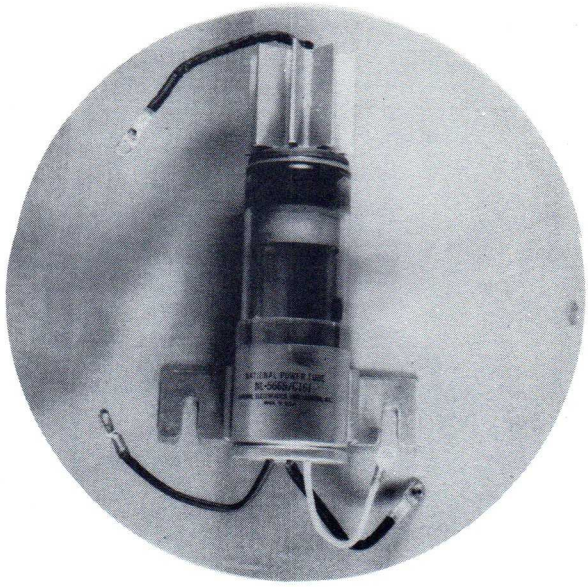
Printed in USA 8-57 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-5665/C16J THYRATRON TUBE

18 Amperes dc -- 160 Ampere peak
1250 Volts peak

National Power Tube NL-5665/C16J is a compact, quick heating thyratron designed for motor speed control and welding control applications. It is xenon filled for quick starting and the ability to operate within very wide temperature limits.



TECHNICAL INFORMATION

dc Amperes output (Maximum)	18	16
Instantaneous amperes output (Maximum)	100	160
Maximum time of averaging anode current (seconds)	4.5	
Maximum peak inverse volts	1250	
Maximum peak forward volts	1000	
Max. commutation factor (V/usec. x A/usec.) at max. initial inverse voltage of 330 volts	0.66	
Filament volts	2.5	
Filament amperes	31 ± 3	
Filament heating time (seconds)	60	
Typical arc drop at 50 amperes peak (volts)	12	
Grid control characteristic	See Curve	
Maximum negative grid voltage before conduction (volts)	100	
Maximum negative grid voltage during conduction (volts)	10	
Maximum critical grid current (microamps)	10	
Ionization time (approx., microseconds)	10	
Deionization time (approx. microseconds)	1000	
Anode to grid capacitance (uuf) (approx.)	8	
Maximum ac short circuit current (amperes)	1000	
Ambient temperature limits (°C)	—55 to +75	
Mounting position	Vertical	
Net weight (ounces)	32	
Approx. shipping weight (lbs.)	3½	

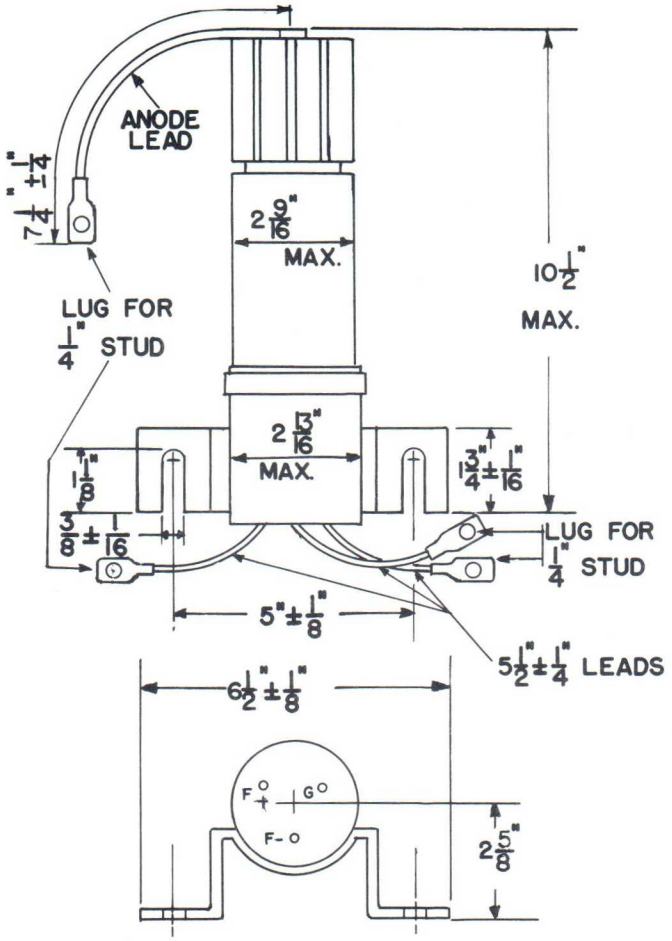
ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP. Filament lead F— should be negative with respect to F+ during conduction period.

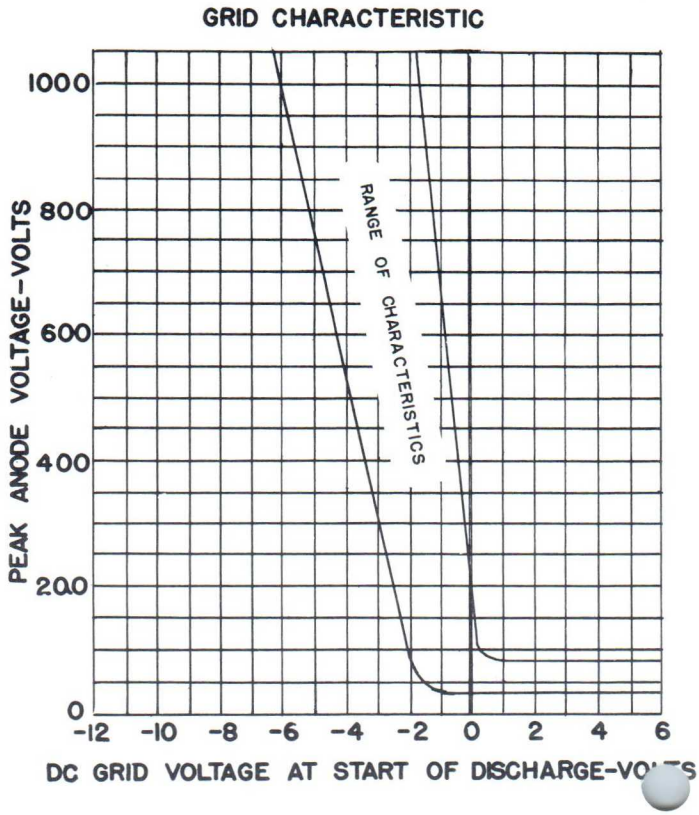
LIGHT FILAMENT BEFORE APPLYING LOAD.

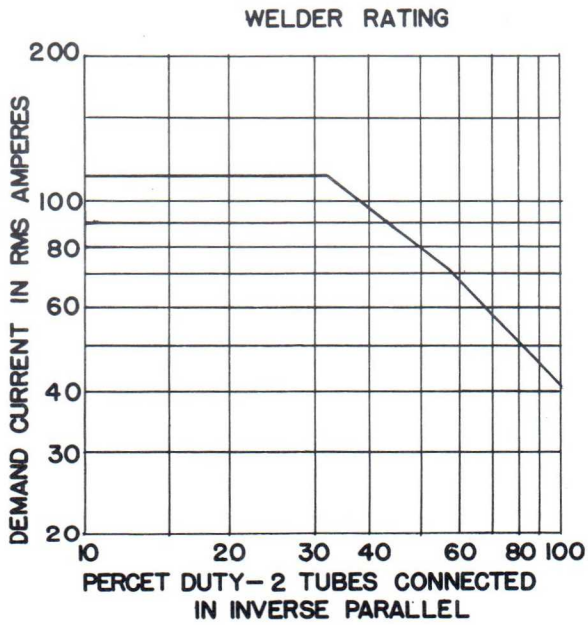
Printed in USA 8-57 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-5665/C16J THYRATRON TUBE



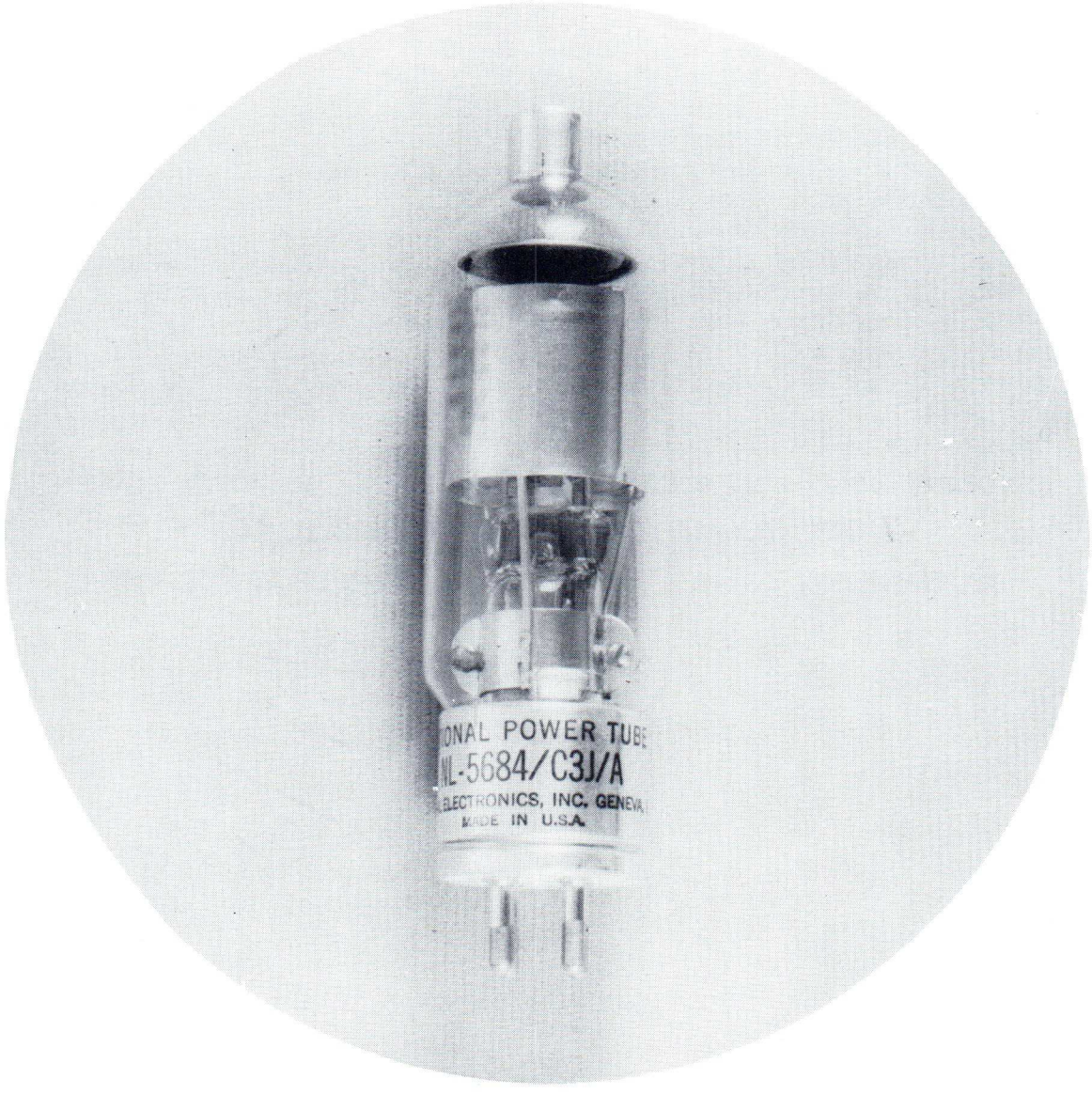




NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-5684/C3J/A
THYRATRON TUBE
2.5 Amperes dc -- 30 Amperes Peak



NATIONAL POWER TUBE NL-5684/C3J/A is a quick-heating, ruggedly constructed thyratron designed for timing, control and other industrial applications. It is xenon filled for quick starting characteristics and operation within wide temperature limits.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

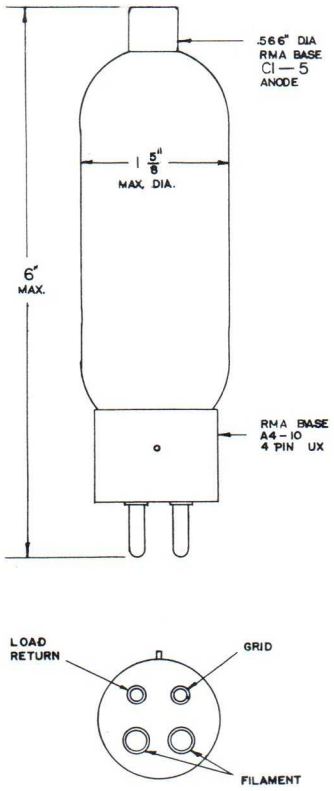
NL-5684/C3J/A THYRATRON TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	2.5
Instantaneous Amperes output (maximum)	30
Maximum time of averaging anode current (seconds)	4.5
Maximum peak inverse volts	1250
Maximum peak forward volts	1000
Max. Commutation Factor (V/usec x V/usec) at a max. initial inverse voltage of 350 volts	0.66
Filament volts	2.5
Filament amperes	9 ± 2
Heating time (seconds)	30
Typical arc drop at 10 amperes peak (volts)	10
Grid control characteristic	see curve
Maximum negative grid voltage before conduction (volts)	100
Maximum negative grid voltage during conduction (volts)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	1000
Anode to grid capacitance (uuf)	2
Maximum critical grid current (microamperes)	10
Maximum ac short circuit current (amperes)	300
Ambient temperature limits (°C)	—55 to +75
Mounting position	any
Net weight (ounces)	3
Approx. shipping weight (lbs.)	3

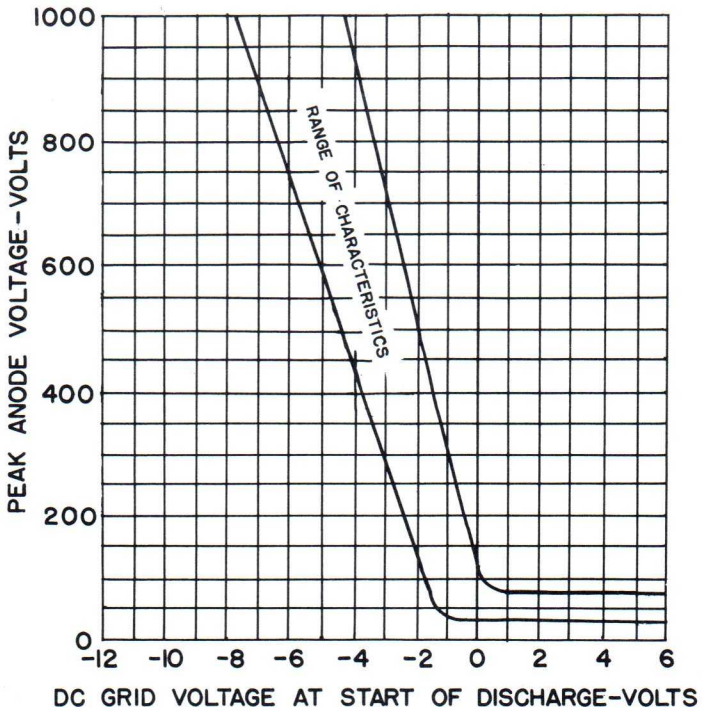
ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



GRID CHARACTERISTIC

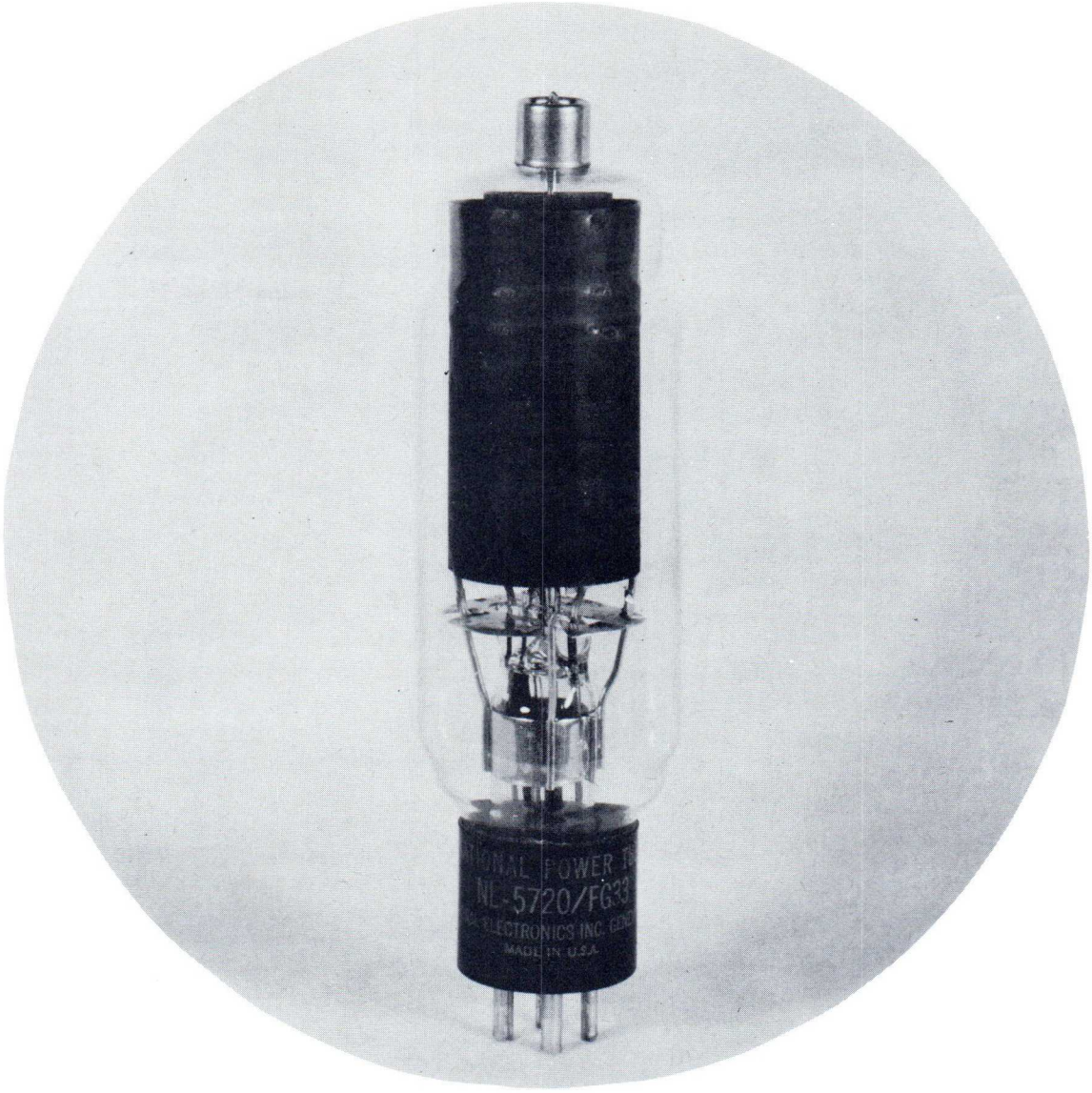


Printed in USA 8-57 G

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-5720/FG33
THYRATRON TUBE
2.5 Amperes dc -- 15 Amperes Peak



NATIONAL POWER TUBE NL-5720/FG33 is a mercury vapor thyratron with a positive grid characteristic. It is especially useful in applications that require no current flow when there is no grid excitation.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

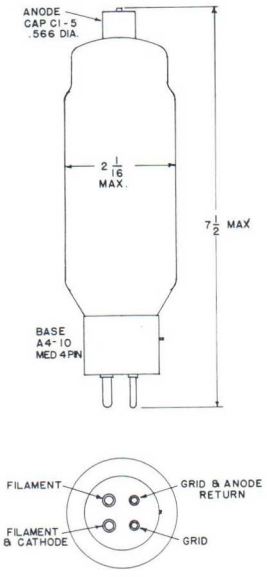
NL-5720/FG33 THYRATRON TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	2.5
Instantaneous amperes output (maximum)	15
Maximum time of averaging anode current (seconds)	15
Maximum peak inverse volts	1000
Maximum peak forward volts	1000
Maximum positive control-grid current average (one cycle averaging time) (amperes)	.25
Maximum negative control grid voltage Before conduction (volts)	500
During conduction (volts)	10
Maximum short circuit current (amperes)	200
Filament Volts	5.0 ± .25
Filament currents (amps)	4.5 ± .4
Cathode heating time (seconds)	300
Anode to control grid capacitance (uuf)	2.7
Control Grid to Cathode Capacitance (uuf)	8.0
Critical grid current at Ep=220 V a-c (Maximum Microamperes)	1000
Ionization time (Approx. Microseconds)	10
Deionization time (Approx. Microseconds)	1000
Anode drop at 8 amperes peak (volts)	15
Condensed mercury temperature limits (°C)	+35 to +80
Approximate temperature rise, cond. mercury above ambient	
No load (°C)	26
Full load (°C)	37
Mounting position	vertical, base down
Net weight (ounces)	5
Approx. shipping weight (lbs.)	4

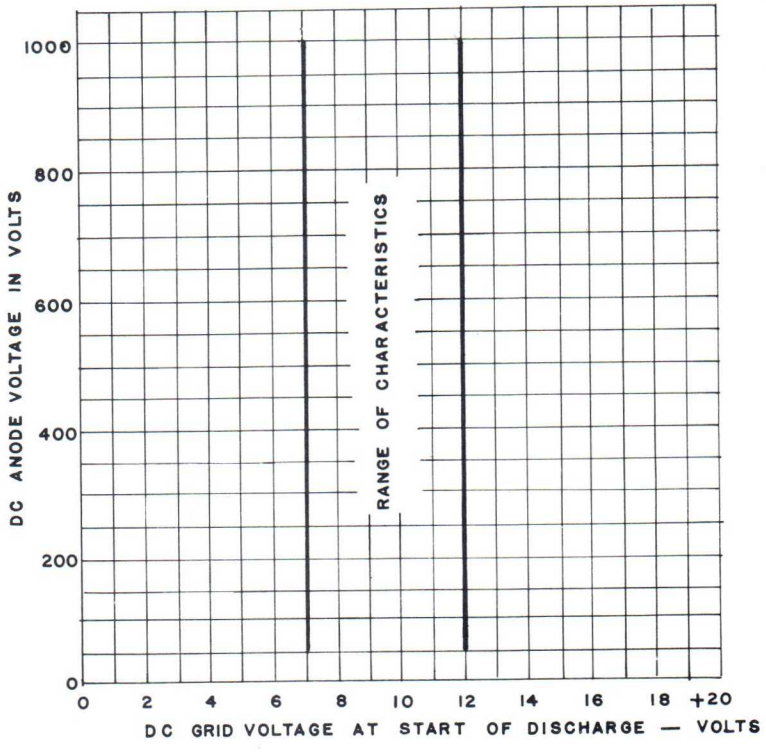
ALL DATA ARE BASED ON RETURNS TO CATHODE

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



GRID CHARACTERISTIC



Printed in USA 5-56 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

THYRATRON TUBE

NL-6014/CIK
THYRATRON TUBE
1.0 Ampere dc -- 8.0 Amperes Peak

NATIONAL POWER TUBE NL-6014/CIK is a compact, quick heating thyratron designed for timing and control applications. It is xenon filled for quick starting and the ability to operate within very wide temperature limits.

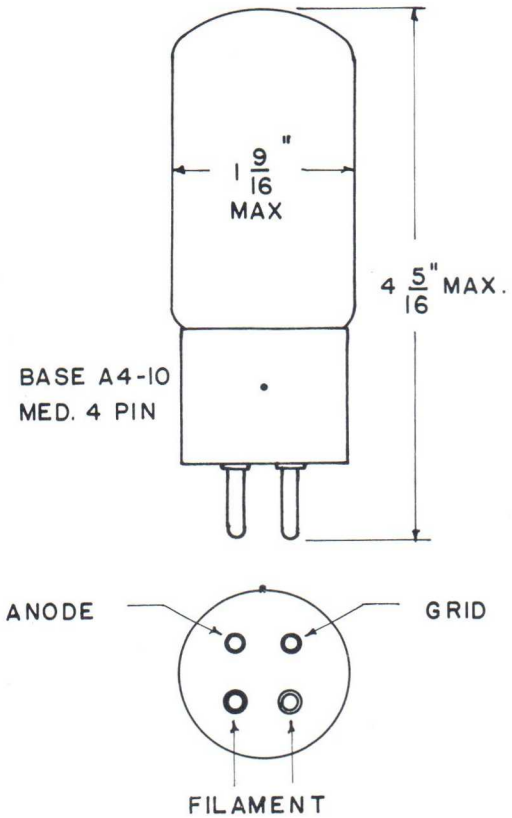
NL-6014/CIK THYRATRON TUBE
TECHNICAL INFORMATION

dc Amperes output (maximum)	1.0
Instantaneous Amperes output (maximum)	8.0
Maximum time of averaging anode current (seconds)	4.5
Maximum peak inverse volts	1250
Maximum peak forward volts	1000
Filament volts	2.5
Filament amperes	6.3 ± 0.8
Heating time (seconds)	25
Typical arc drop at 5 amperes peak (volts)	8
Grid control characteristic	see curve
Maximum negative grid voltage before conduction (volts)	100
Maximum negative grid voltage during anode conduction (volts)	10
Ionization time (approx., microseconds)	10
Deionization time (approx., microseconds)	500
Anode to grid capacitance (uuf)	1
Maximum critical grid current (microamperes)	5
Maximum ac short circuit current (amperes)	77
Ambient temperature limits (°C)	—55 to +70
Mounting position	any
Net weight (ounces)	3
Approx. shipping weight (lbs.)	3

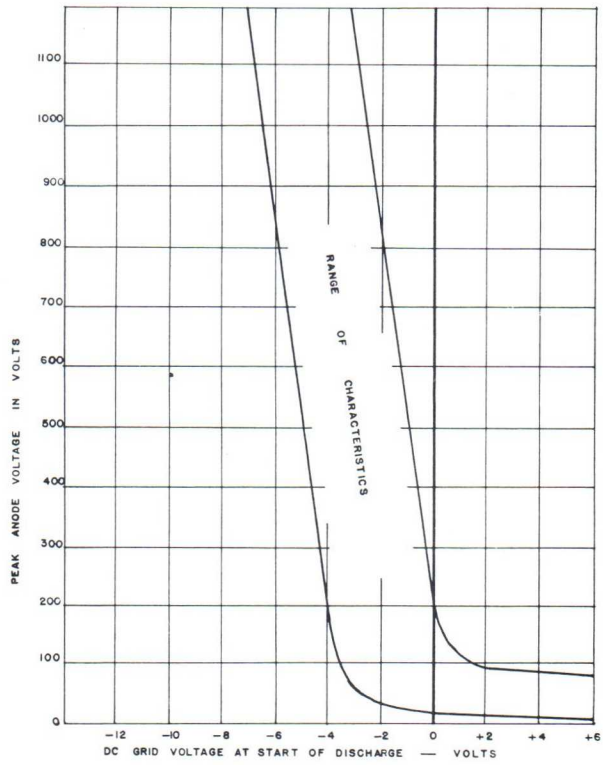
ALL DATA ARE BASED ON RETURNS TO FILAMENT TRANSFORMER CENTER TAP

LIGHT FILAMENT BEFORE APPLYING LOAD

OUTLINE DRAWING



GRID CHARACTERISTIC

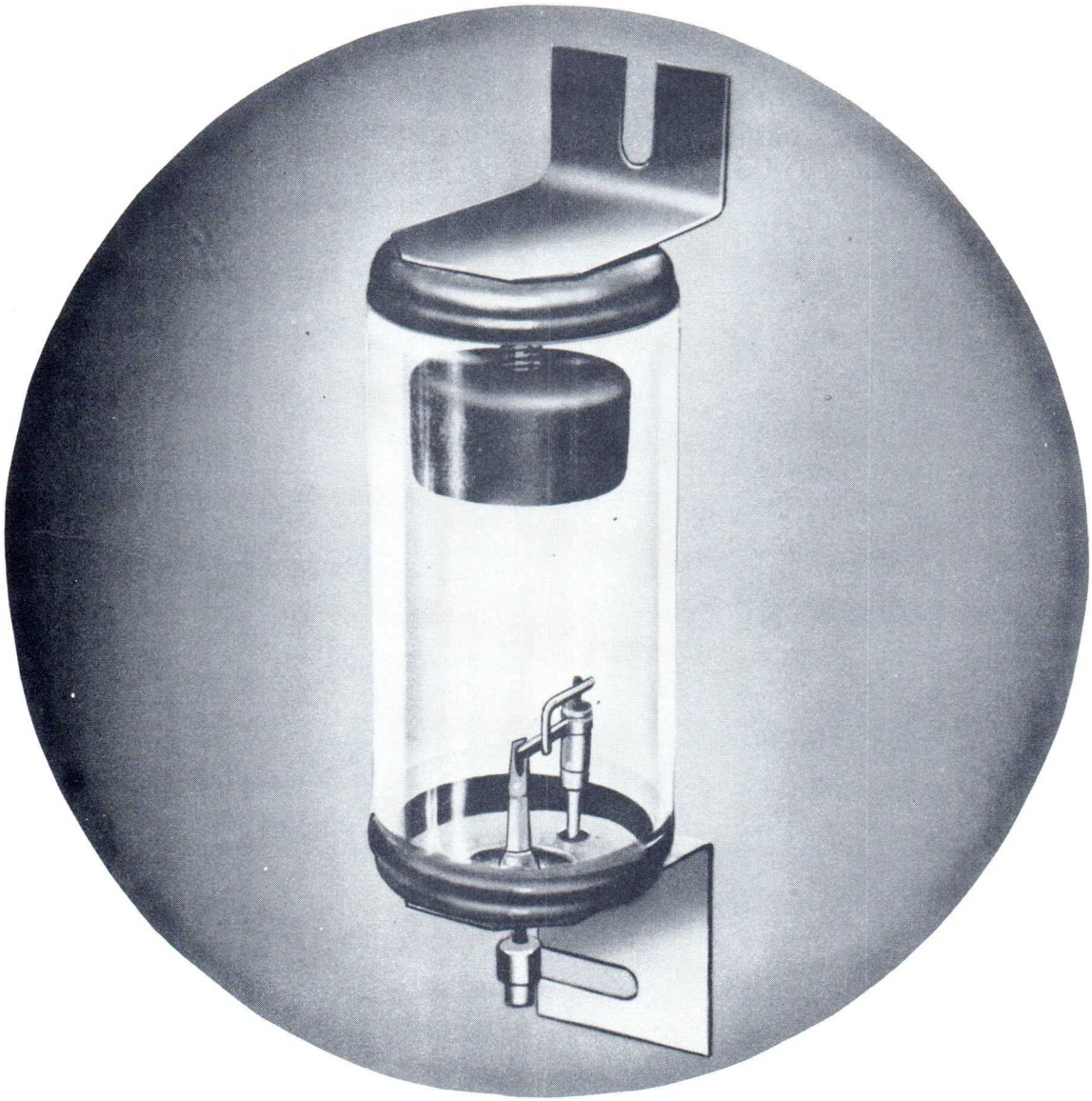


Printed in USA 12-57

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

IGNITRON TUBE

NL-1001
IGNITRON TUBE
9 Amperes dc



NATIONAL IGNITRON NL-1001 is a sturdy, glass, air-cooled mercury pool tube designed especially for welder control and similar AC control applications. It is also useful for demonstrating the operating principles of ignitors and ignitrons. NL-1001 is designed for forced air cooling but may be used with free air cooling at reduced ratings.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-1001 IGNITRON TUBE
TECHNICAL INFORMATION

AC CONTROL APPLICATIONS — Ratings are based on full-cycle conduction (no phase delay) regardless of whether or not phase control is used, and on frequencies from 25 to 60 cycles.

Maximum voltage — rms volts	250	500	600
[1]Maximum condensed mercury temp. —°C	90	80	70
Minimum condensed mercury temp.-°C		10	
[2]Maximum demand current—rms amps	600	300	250
[2]Corresponding maximum average anode current per tube-amps DC		4.9	
[2]Maximum average anode current per tube — amps DC		9.0	
[2]Corresponding maximum demand current — rms amps	200	100	83
Maximum averaging time — seconds	28	14	12
Maximum surge current—peak amps	1680	840	700
[1]With free air cooling — (no forced ventilation) Approximate average anode current per tube which will give rated "Maximum Condensed Mercury Temperature" in 40°C ambient — amps DC	3.5	2.8	2.1

CAPACITOR DISCHARGE APPLICATIONS

Maximum discharges per second			60
Maximum peak forward volts			3000
Maximum peak inverse volts			3000
Maximum peak current — amps			500
Maximum condensed mercury temperature--°C	70		55
[1]Maximum average current — amps dc	3		9
Maximum averaging time — seconds	3.3		1.1

[4]RECTIFIER APPLICATIONS — Frequencies from 25 to 60 cycles.

Maximum peak anode voltage—volts Forward	500		900
Inverse	500		900
Maximum Condensed mercury temperature — °C	80		60
Maximum peak anode current—amps		77	
[1]Maximum average anode current — amps DC		6.4	
Maximum averaging time—seconds		10	
Maximum surge current (.03 second) — peak amperes		300	
[1]With free air cooling—(no forced ventilation) approximate average anode current per tube which will give rated "Maximum Condensed Mercury Temperature" in 40°C ambient — amps DC	2.8		1.4

IGNITION REQUIREMENTS (Same for both applications.)

Ignitor Voltage

Maximum instantaneous allowed, ignitor positive — volts	900
[3]Maximum instantaneous required, ignitor positive — volts	200
Maximum instantaneous allowed, ignitor negative — volts	5

Ignitor Current

Maximum instantaneous allowed — amperes	100
[3]Maximum instantaneous required — amperes	30
Maximum average allowed — ampere	1
[3]Ignitor ignition time, maximum — microseconds	100
Ignitor current averaging time — seconds	5

GENERAL CHARACTERISTICS

Number of anodes	1
Number of Ignitors	1
Mounting Position	Vertical
Arc drop at 100 amps peak, approx. — volts	12
Net weight — lbs.	1½
Approx. shipping weight — lbs.	5

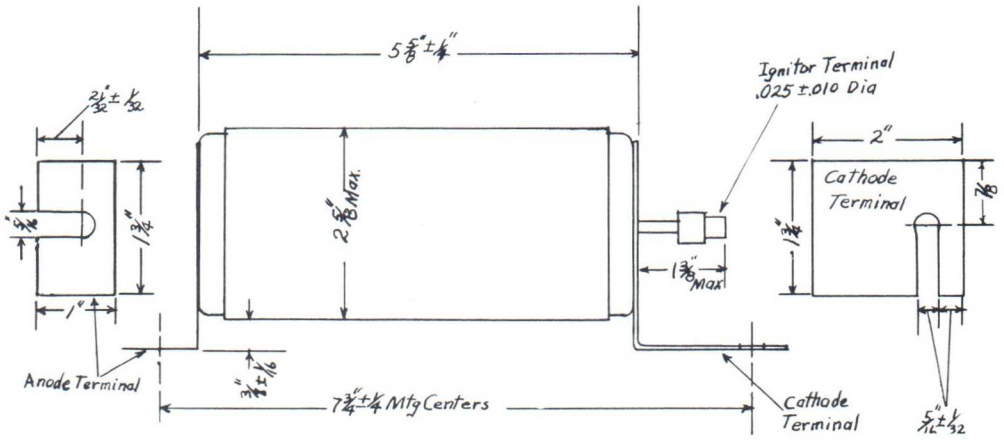
[1]The required condensed mercury temperatures are easily obtained with a small fan or blower. Free air cooling may be used but average anode current must be reduced to bring condensed mercury temperature below the maximum rated values.

[2]Using log-log paper, straight line interpolation of Demand Current vs. Average Anode current may be used to determine intermediate ratings.

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

[4]Curves must not be used for rectifier applications.

OUTLINE DRAWING

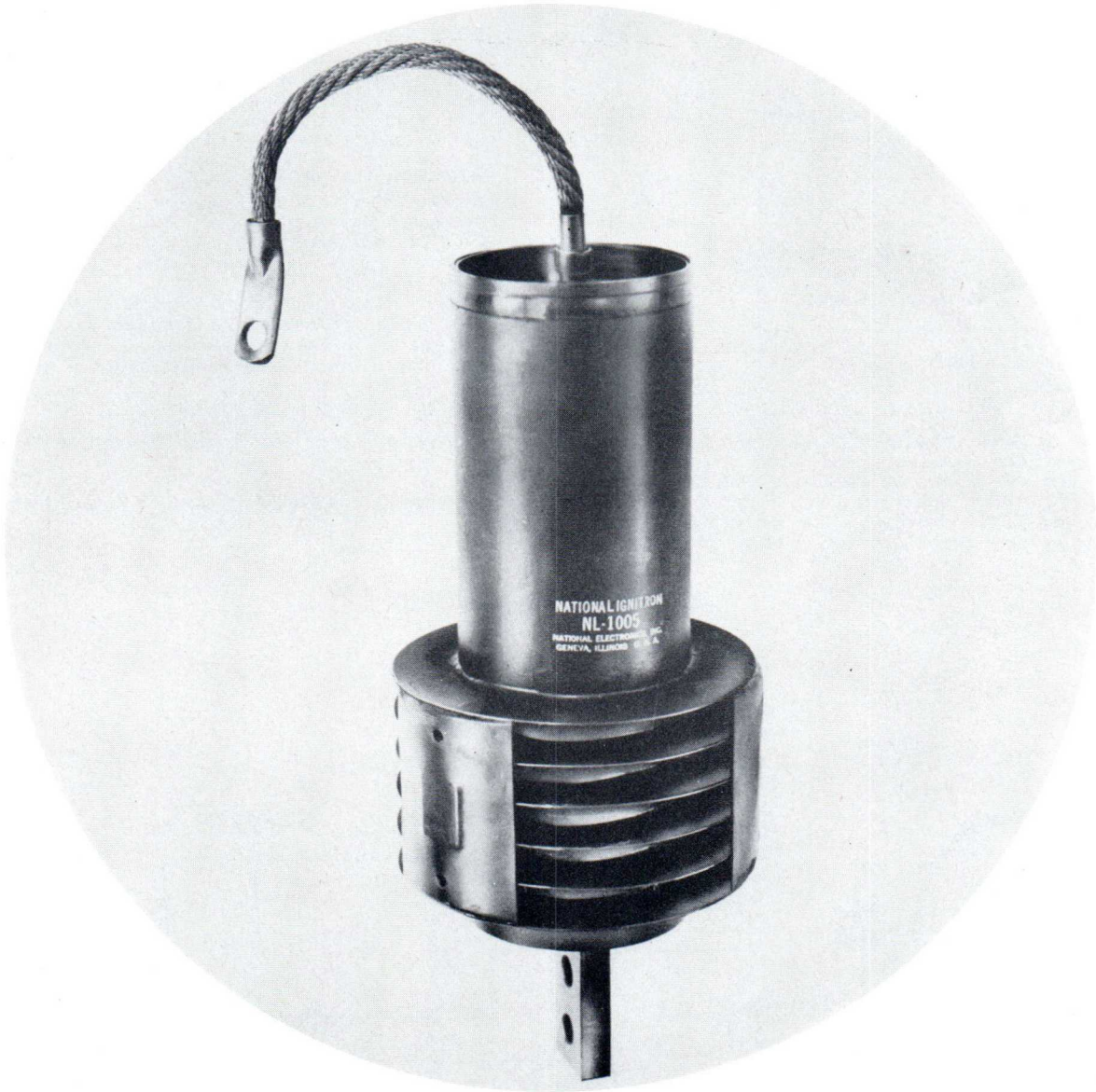


Printed in U.S.A. 12/56 G.R

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

IGNITRON TUBE

NL-1005
IGNITRON TUBE
56 Amperes dc



NATIONAL IGNITRON NL-1005 is a sturdy, metal, air-cooled mercury pool tube designed especially for welder control and similar AC control applications. It is also useful in some rectifier applications. NL-1005 is designed for forced air cooling but may be used with free air cooling at reduced ratings.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-1005 IGNITRON TUBE
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 60 cycles, and any voltage between 250 and 600 volts rms.

[1]Maximum demand — kva	600
[1]Corresponding maximum average anode current per tube — amps dc	30.2
[1]Maximum average anode current per tube—amps dc	56
[1]Corresponding maximum demand — kva	200
[1]Maximum averaging time — seconds	
At 500 volts rms	9
At 250 volts rms.	18
Maximum surge current — peak amps — per cent of max. rms. demand current	250
[4]Maximum cylinder temperature	
At 600 volts rms	80°C
At 500 volts rms	85°C
At 250 volts rms	90°C

[2]INTERMITTENT RECTIFIER APPLICATIONS — Frequencies from 25 to 60 cycles.

Maximum peak anode voltage — volts	
Inverse	500
Forward	500
Maximum anode current, amps	
Instantaneous	700
Average, per tube	40
Averaging time — seconds	3
Surge, peak amps, averaging time — 0.15 seconds	6000
Maximum cylinder temperature at 500 volts peak	75°C

IGNITION REQUIREMENTS (same for both applications)

Ignitor Voltage

Maximum instantaneous allowed, ignitor positive, volts	900
[3]Maximum instantaneous required, ignitor positive, volts	200
Maximum instantaneous allowed, ignitor negative, volts	5

Ignitor Current

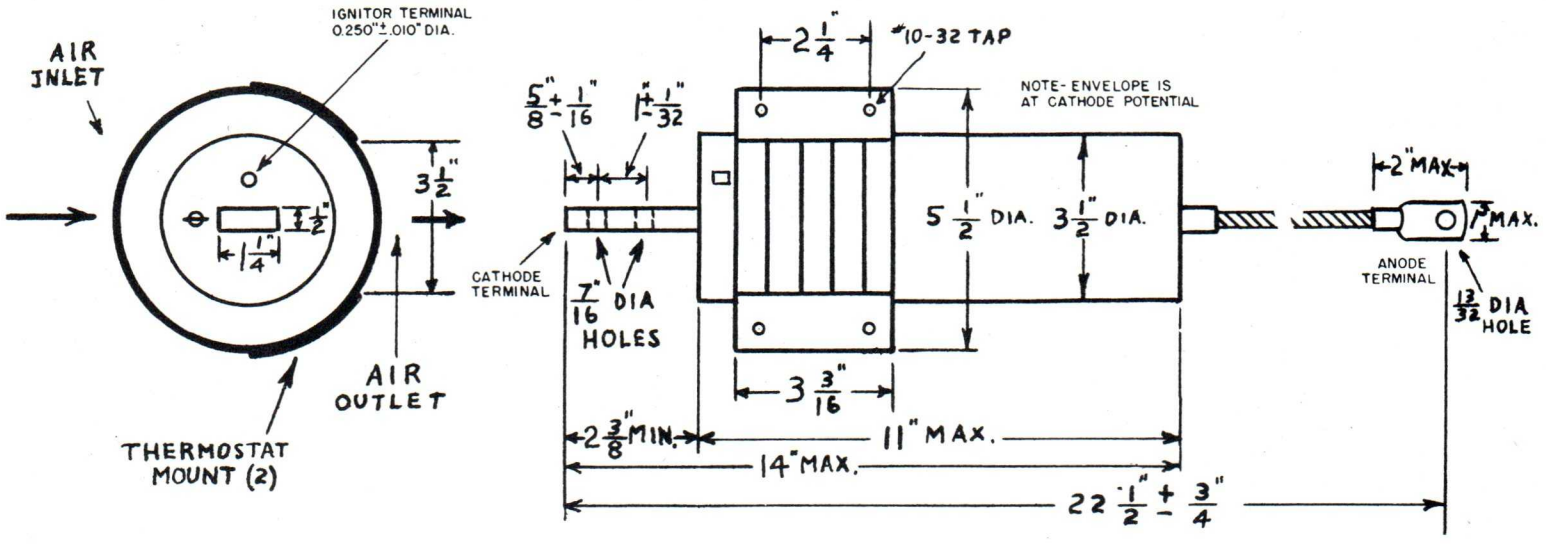
Maximum instantaneous allowed — amperes	100
[3]Maximum instantaneous required — amperes	30
Maximum average allowed — amperes	1
[3]Ignitor ignition time, maximum — microseconds	100
Ignitor current averaging time — seconds	5

GENERAL CHARACTERISTICS

Number of Anodes	1
Number of Ignitors	1
Mounting position	Vertical
Peak arc drop — approximate volts	12
Type of cooling	forced air
Approximate air flow required at 50 amperes dc for 45°C rise over ambient — cubic feet per minute	140
Reduced air flow may be used at lighter load as long as Maximum Cylinder Temperature limits are not exceeded.	
Net weight — lbs.	7
Approx. Shipping Weight — lbs.	15

[1]Using log-log paper, straight line interpolation of Demand Current vs. Average Anode Current may be used to determine intermediate ratings.
[2]Curves must not be used for rectifier applications.
[3]Ignition will occur if either maximum required instantaneous positive potential is applied or maximum required instantaneous current flows for the rated maximum ignitor ignition time.
[4]Measured between center fins and opposite blower.

OUTLINE DRAWING

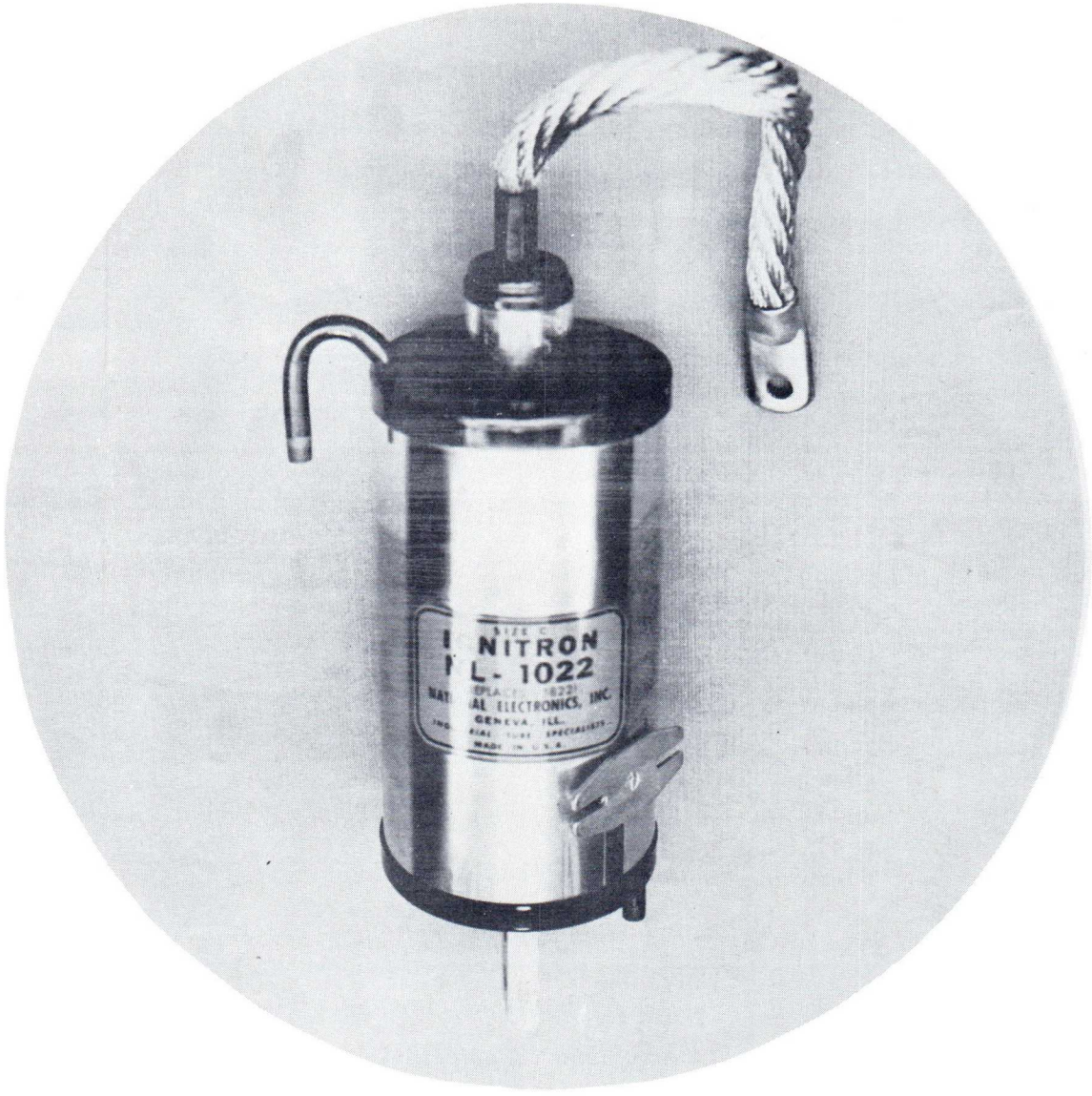


Printed in USA 11-54

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

IGNITRON TUBE

NL-1022
IGNITRON TUBE
70 Amperes dc



NATIONAL IGNITRON NL-1022 is a metal, water cooled, mercury pool tube designed especially for frequency-changer resistance welders. NL-1022 baffles reduce the deionization time so that it will operate satisfactorily in applications involving severe condtions of commutation.

NL-1022 utilizes an all-copper cooling coil construction with thermostat mount that provides exceptional cooling efficiency. The cooling coil is self flushing and prevents sediment deposits. The mercury-pool cathode permits the tube to handle extremely high currents on an intermittent basis.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

TECHNICAL INFORMATION
NL-1022 IGNITRON TUBE

MAXIMUM RATINGS — Ratings are based on full cycle conduction (no phase delay) regardless of whether phase control is used and frequencies from 50 to 60 cycles.

MAXIMUM PEAK ANODE VOLTAGE —VOLTS

Inverse	1200	1500
Forward	1200	1500

•ANODE CURRENT, AMPS.

Maximum peak	1500	1200
Corresponding maximum average per tube	20	16
Maximum average per tube	70	56
Corresponding maximum peak	420	336
Maximum averaging time, seconds	6.25	6.25
Max. Ratio of average to peak current, maximum averaging time 0.2 sec.	0.166	0.166
Max. Ratio of surge to peak current	12.5	12.5
Maximum duration of surge current, sec.	0.15	0.15

COOLING REQUIREMENTS

Type of cooling	water
Minimum inlet water temperature, °C	0
Approximate water flow required at continuous full load, GPM	1/2 to 1
Water flow may be reduced if cooling system is maintained within limits of protection thermostat.	
Pressure drop per tube at 1 GPM, lbs. per sq. in.	4
Water temperature rise (at 1 GPM at full load) °C	5
Approx. temperature rise, water at inlet to thermostat mount (at 1 GPM and full load) °C	4

GENERAL CHARACTERISTICS

Number of anodes	1
Number of ignitors	1
Mounting position	Vertical
Peak arc drop — approximate volts	25
Net weight — lbs.	11
Approx. shipping weight — lbs.	16

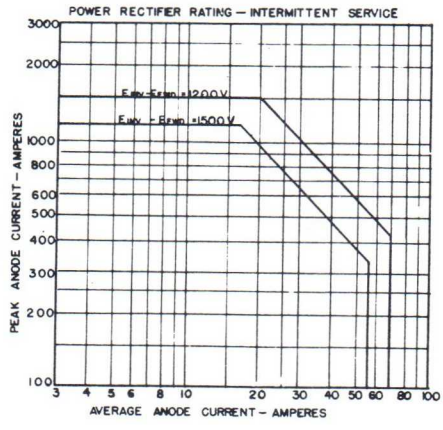
IGNITION REQUIREMENTS

Ignitor Voltage —

Maximum instantaneous allowed, ignitor positive — volts	Anode
■Maximum instantaneous required, ignitor positive — volts	200
Maximum instantaneous allowed, ignitor negative — volts	5

Ignitor Current —

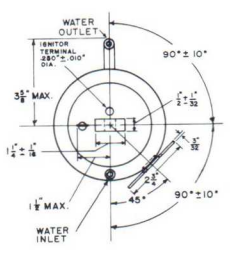
Maximum instantaneous allowed, amperes	100
■Maximum instantaneous required, amperes	30
Maximum average allowed, ampere	1
■Ignitor ignition time, maximum microseconds	100
Ignitor averaging time, seconds	5

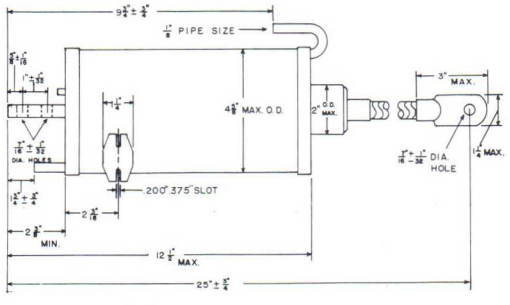


•Using log-log paper, straight line interpolation may be used to determine intermediate ratings.

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

OUTLINE DRAWING





Printed in USA 3/56

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-1051 IGNITRON

Size B
56 Amperes dc

National Ignitron NL-1051 is a metal, water-cooled, mercury pool tube designed especially for welder control and similar AC control applications. Its rating is approximately equivalent to a 300 ampere magnetic contactor. **NL-1051** utilizes a thermostat mount brazed to an all-copper cooling system that provides exceptional cooling efficiency. The inner can, copper cooling coil, and thermostat mount being brazed together in a single unit assures a rugged, dependable, and adjustment free temperature control system that operates directly on inner can temperature.

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 60 cycles, and any voltage between 250 and 600 volts rms. Ratings are for two tubes in inverse parallel.

[1]Maximum demand — kva	600
[1]Corresponding maximum average anode current per tube — amps DC	30.2
[1]Maximum average anode current per tube — amps DC	56
[1]Corresponding maximum demand — kva	200

[1]Maximum averaging time — seconds	
at 600 volts rms	11.25
at 250 volts rms	27
Maximum surge current — peak amps	280% of max. rms. demand current

[2]**Rectifier Applications**— Ratings are based on intermittent duty, on no phase delay, and on frequencies from 50 to 60 cycles. When phase control is used, current ratings are reduced as per phase control current rating curve. Values are for one tube.

Maximum peak anode voltage — volts	500	1200	1500
Maximum peak anode current — amps	700	600	480
Corresponding average current—amps DC	—	5	4
Maximum average anode current — amps DC	40	22.5	18
Corresponding peak current — amps	—	135	108
Maximum averaging time, sec.	6	10	10
Max. ratio of average to peak current, maximum averaging time 0.2 seconds	—	.166	.166
Ratio of fault to max. peak current	12.5	12.5	12.5
Maximum duration time of surge current — sec.	.15	.15	.15

Ignition Requirements — (Same for both applications.)

Ignitor Voltage

Maximum instantaneous allowed, ignitor positive	anode voltage
[3]Maximum instantaneous required, ignitor positive — volts	200
Maximum instantaneous allowed, ignitor negative — volts	5

Ignitor Current

Maximum instantaneous allowed — amperes	100
[3]Maximum instantaneous required — amperes	30
Maximum rms allowed — amperes	10
Maximum average allowed — ampere	1
[3]Ignitor ignition time maximum — microseconds	100
Ignitor current max. averaging time — seconds	5

Cooling Requirements — (Same for both applications.)

Type of cooling	Water
Minimum inlet water temperature, °C	0
Maximum cooling system temperature (measured at thermostat mount). °C	
Rectifier applications	45
AC control applications	
At 600 volts rms	45
At 500 volts rms	50
At 250 volts rms	55

Water flow may be reduced at light loads if cooling system temperature (measured at thermostat mount) is maintained within limits.

Typical cooling requirements at 500 volts rms operation for AC control applications.

Inlet Water Temp. °C	100% Load Water flow required G.P.M.	100% Load Pressure drop per tube lbs. per sq. in.	50% Load Water flow required G.P.M.	50% Load Pressure drop per tube lbs. per sq. in.
15	1/4	.4	1/16	.1
30	1/2	.75	1/8	.2
40	1-1/2	3.0	1/4	.4

More water is required at 600 volts to maintain cooling system temperature within limits and less at 250 volts.

Water temperature rise at 1 G.P.M., full load, °C	2
Approximate temperature rise inlet water to thermostat, °C	4

GENERAL CHARACTERISTICS

Number of Anodes	1
Number of Ignitors	1
Mounting Position	Vertical
Peak arc drop at 3400 peak amps — approx. volts	26
Peak arc drop at 176 peak amps. — approx. volts	13
Net weight — lbs.	4½
Approx. shipping weight — lbs.	7

[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.

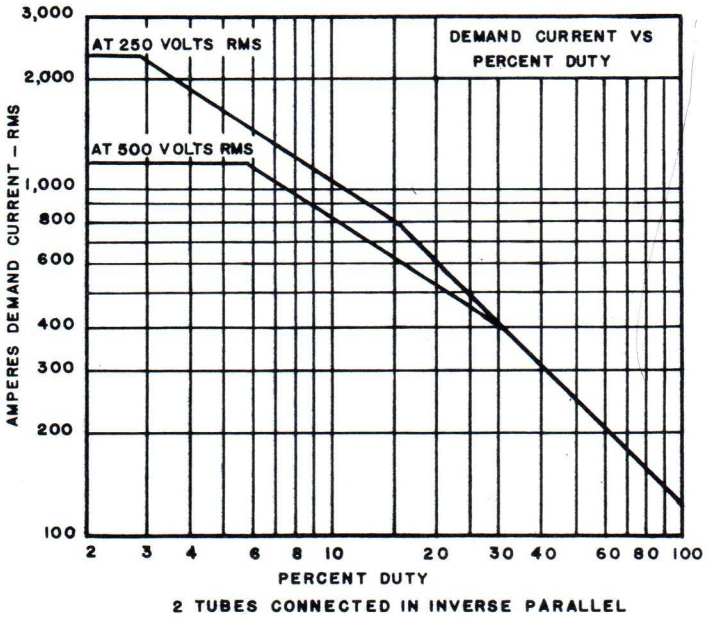
[2]Using log-log paper, straight line interpolation of Peak Anode Current vs. Average Anode Current may be used to determine intermediate ratings. See curves for details.

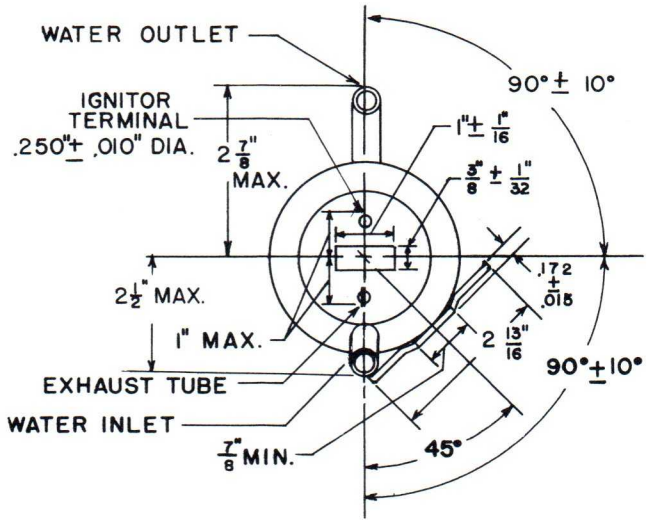
[3]Ignition will occur if either maximum required instantaneous potential is applied or maximum required instantaneous current flows for the rated maximum ignitor ignition time.

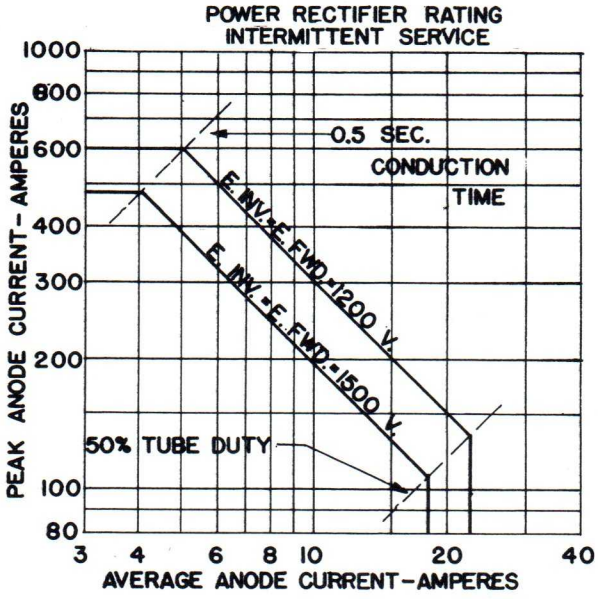
Printed in USA 8-57 GR

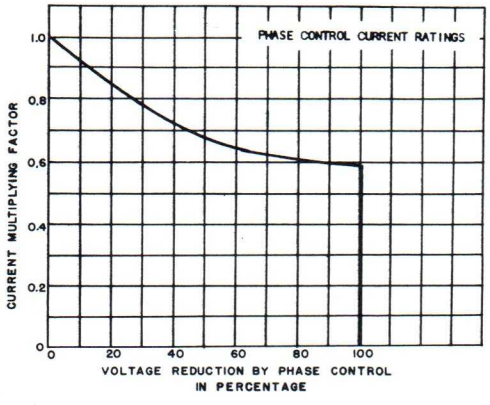
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

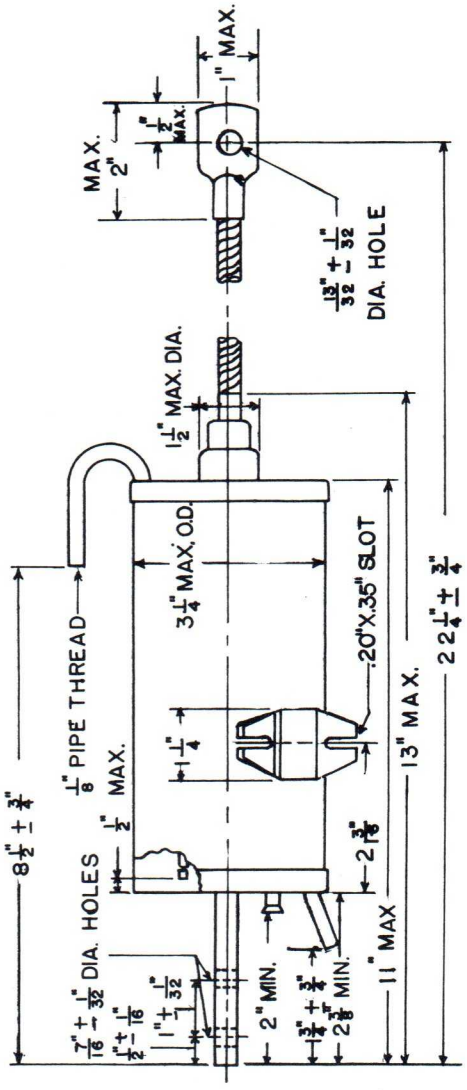
NL-1051 IGNITRON











NATIONAL ELECTRONICS, INC.

GENEVA, ILLINOIS, U. S. A.

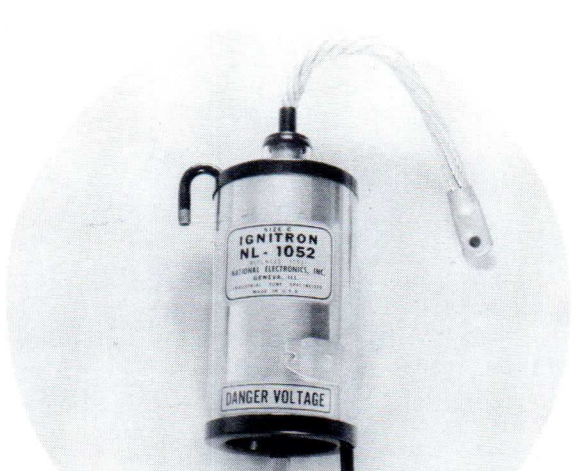
NL-1052 IGNITRON

Size C

140 Amperes dc

National Ignitron NL-1052 is a metal, water-cooled, mercury pool tube designed especially for welder control and similar AC control applications. Its rating is approximately equivalent to a 600 ampere magnetic contactor.

NL-1052 utilizes a thermostat mount brazed to an all-copper cooling system that provides exceptional cooling efficiency. The inner can, copper cooling coil, and thermostat mount being brazed together in a single unit assures a rugged, dependable, and adjustment free temperature control system that operates directly on inner can temperature.



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 60 cycles, and any voltage between 250 and 600 volts rms. Ratings are for two tubes in inverse parallel.

[1]Maximum demand — kva	1200
[1]Corresponding maximum average anode current per tube — amps DC	75.6
[1]Maximum average anode current per tube — amps DC	140
[1]Corresponding maximum demand — kva	400
[1]Maximum averaging time — seconds at 600 volts rms	8.75
at 250 volts rms	21.
Maximum surge current — peak amps	280% of max. rms demand current

[2]**Rectifier Applications** — Ratings are based on intermittent duty, on no phase delay, and on frequencies from 25 to 60 cycles. Values are for one tube.

Maximum peak anode voltage — volts	500
Maximum peak anode current — amps	1600
Maximum average anode current — amps DC	100
Maximum averaging time, sec.	6
Maximum peak fault current — amps	6000
Maximum duration time of fault current — sec.	.15

Ignition Requirements — (Same for both applications.)

Ignitor Voltage	
Maximum instantaneous allowed, ignitor positive	anode voltage
[3]Maximum instantaneous required, ignitor positive — volts	200
Maximum instantaneous allowed, ignitor negative — volts	5

Ignitor Current	
Maximum instantaneous allowed — amperes	100
[3]Maximum instantaneous required — amperes	30
Maximum rms allowed — amperes	10
Maximum average allowed — ampere	1
[3]Ignitor ignition time maximum — microseconds	100
Ignitor current max. averaging time — seconds	5

Cooling Requirements — (Same for both applications.)

Type of cooling	Water
Minimum inlet water temperature, °C	0
Maximum cooling system temperature (measured at thermostat mount), °C	
Rectifier applications	45
AC control applications	
At 600 volts rms	45
At 500 volts rms	50
At 250 volts rms	55

Water flow may be reduced at light loads if cooling system temperature (measured at thermostat mount) is maintained within limits.

Typical cooling requirements at 500 volts rms operation for AC control applications.

Inlet Water Temp. °C	100% Load Water flow required G.P.M.	100% Load Pressure drop per tube lbs. per sq. in.	50% Load Water flow required G.P.M.	50% Load Pressure drop per tube lbs. per sq. in.
15	⅜	.6	⅛	.2
30	½	.9	¼	.4
40	1¼	4.0	½	.9

More water is required at 600 volts to maintain cooling system temperature within limits and less at 250 volts.

Water temperature rise at 1 G.P.M., full load, °C	5
Approximate temperature rise inlet water to thermostat, °C	4

GENERAL CHARACTERISTICS

Number of Anodes	1
Number of Ignitors	1
Mounting Position	Vertical
Peak arc drop at 6800 peak amps — approx. volts	28
Peak arc drop at 440 peak amps. — approx. volts	14
Net weight — lbs.	10
Approx. shipping weight — lbs.	12

[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.

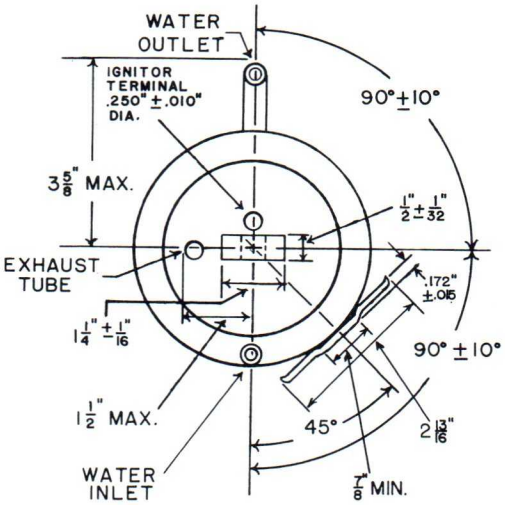
[2]Curves must not be used for rectifier applications.

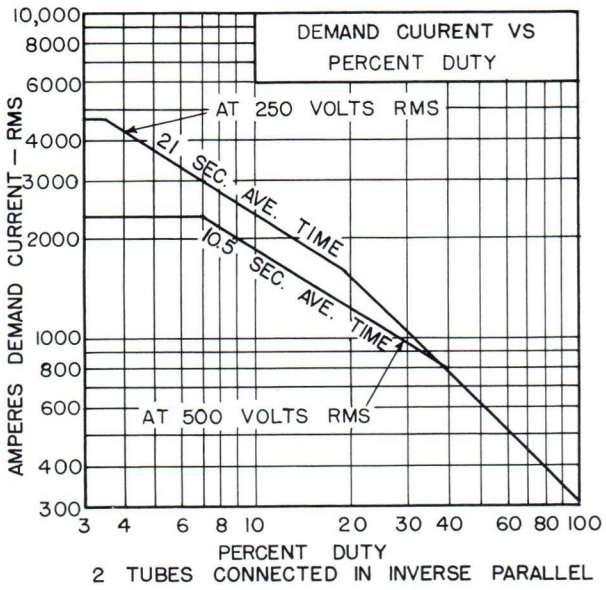
[3]Ignition will occur if either maximum required instantaneous potential is applied or maximum required instantaneous current flows for the rated maximum ignitor ignition time.

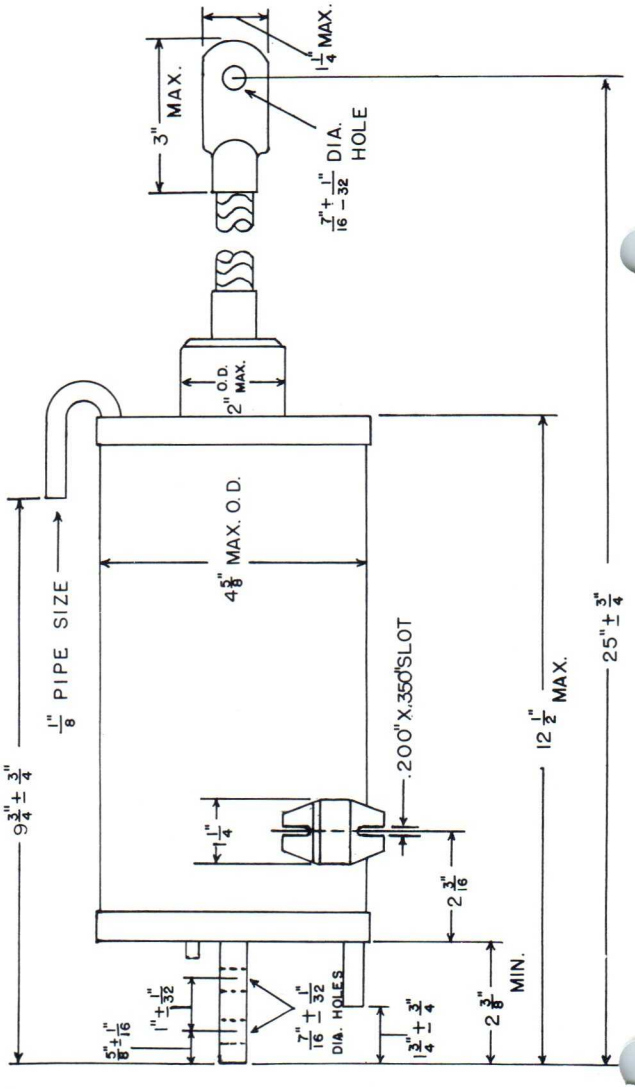
Printed in USA 11-57 GR

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-1052 IGNITRON







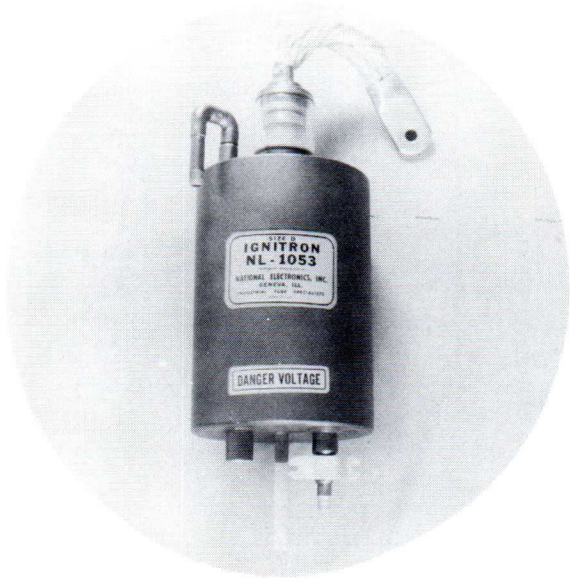
NL-1053 IGNITRON

Size D

355 Amperes dc

National Ignitron NL-1053 is a metal, water-cooled, mercury pool tube designed especially for welder control and similar AC control application. Its rating is approximately equivalent to a 1200 ampere magnetic contactor.

NL-1053 utilizes a thermostat mount brazed solidly to the cathode header and cooling coil to give accurate temperature indication and tube protection. The large stainless steel envelope with internal cooling coil greatly increases the cooling surface for long life and arc-back-free operation.



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 60 cycles, and any voltage between 250 and 600 volts rms. Ratings are for two tubes in inverse parallel.

[1]Maximum demand — kva	2400
[1]Corresponding maximum average anode current per tube — amps DC	192
[1]Maximum average anode current per tube — amps DC	355
[1]Corresponding maximum demand — kva	800
[1]Maximum averaging time — seconds at 600 volts rms	9.2
at 250 volts rms	22.
Maximum surge current — peak amps	280% of max. rms demand current

[2]**Rectifier Applications** — Ratings are based on intermittent duty, on no phase delay, and on frequencies from 50 to 60 cycles. When phase control is used, current ratings are reduced as per phase control current rating curve. Values are for one tube.

Maximum peak anode voltage — volts	600	1200	1500
Maximum peak anode current — amps	4000	3000	2400
Corresponding average current — amps DC	54	40	32
Maximum average anode current—amps DC	190	140	112
Corresponding peak current — amps	1140	840	672
Maximum averaging time, sec.	6.5	6.5	6.5
Max. ratio of average to peak current, maximum averaging time 0.2 seconds	.166	.166	.166
Max. ratio of peak fault to peak anode current	12.5	12.5	12.5
Maximum duration time of fault current — sec.	.15	.15	.15

Ignition Requirements — (Same for both applications.)

Ignitor Voltage

Maximum instantaneous allowed, ignitor positive	anode voltage
[3]Maximum instantaneous required, ignitor positive — volts	200
Maximum instantaneous allowed, ignitor negative — volts	5

Ignitor Current

Maximum instantaneous allowed — amperes	100
[3]Maximum instantaneous required — amperes	30
Maximum rms allowed — amperes	10
Maximum average allowed — ampere	1
[3]Ignitor ignition time maximum — microseconds	100
Ignitor current max. averaging time — seconds	5

Cooling Requirements — (Same for both applications.)

Type of cooling	Water
Minimum inlet water temperature °C	0
Maximum cooling system temperature (measured at thermostat mount) — °C	
Rectifier Applications	50
AC Control Applications	
At 600 volts rms	50
At 500 volts rms	55
At 250 volts rms	60
Approximate water flow required at continuous full load GPM	1½ to 3
Water flow may be reduced if cooling system temperature is maintained within limits.	
Pressure drop per tube at 3 GPM — lbs. per sq. in.	3.2
Water temperature rise at 3 GPM, full load — °C	8
Approx. temperature rise, water at inlet to thermostat mount (at full load and at 3 GPM) — °C	10

GENERAL CHARACTERISTICS

Number of Anodes	1
Number of Ignitors	1
Mounting Position	Vertical
Peak arc drop at 13,600 peak amps — approx. volts	36
Peak arc drop at 1115 peak amps — approx. volts	17
Net weight — lbs.	35½
Approx. shipping weight — lbs.	40

[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.

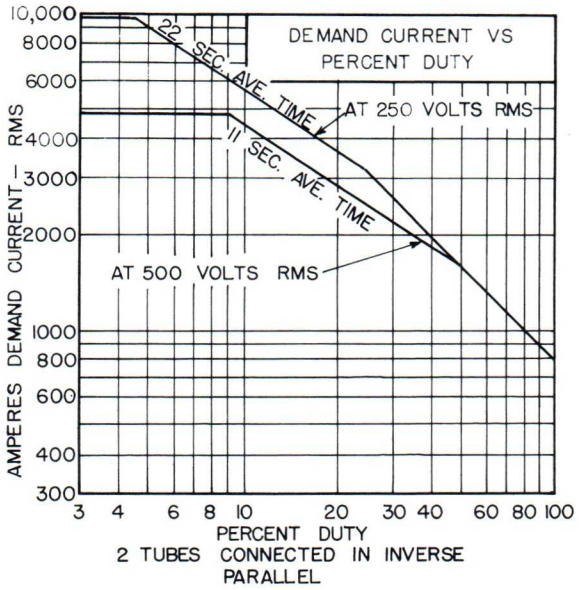
[2]Using log-log paper, straight line interpolation of Peak Anode Current vs. Average Anode Current may be used to determine intermediate ratings. See curves for details.

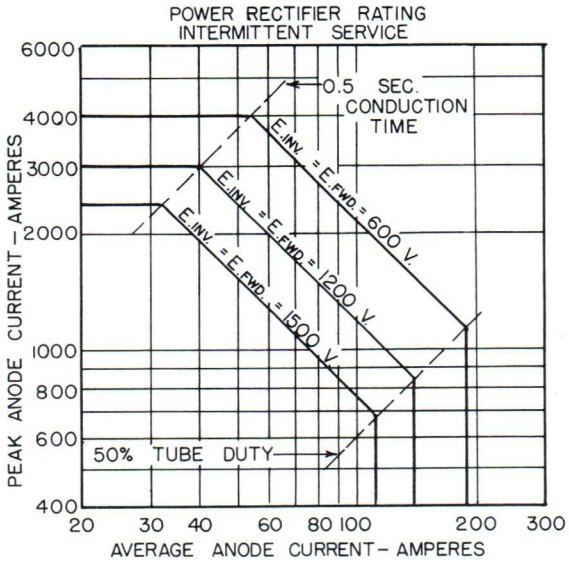
[3]Ignition will occur if either maximum required instantaneous potential is applied or maximum required instantaneous current flows for the rated maximum ignitor ignition time.

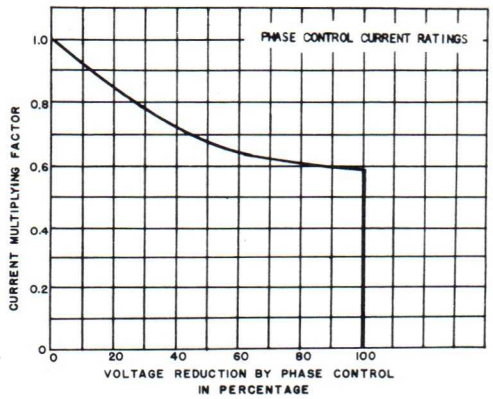
Printed in USA 11-57 GR

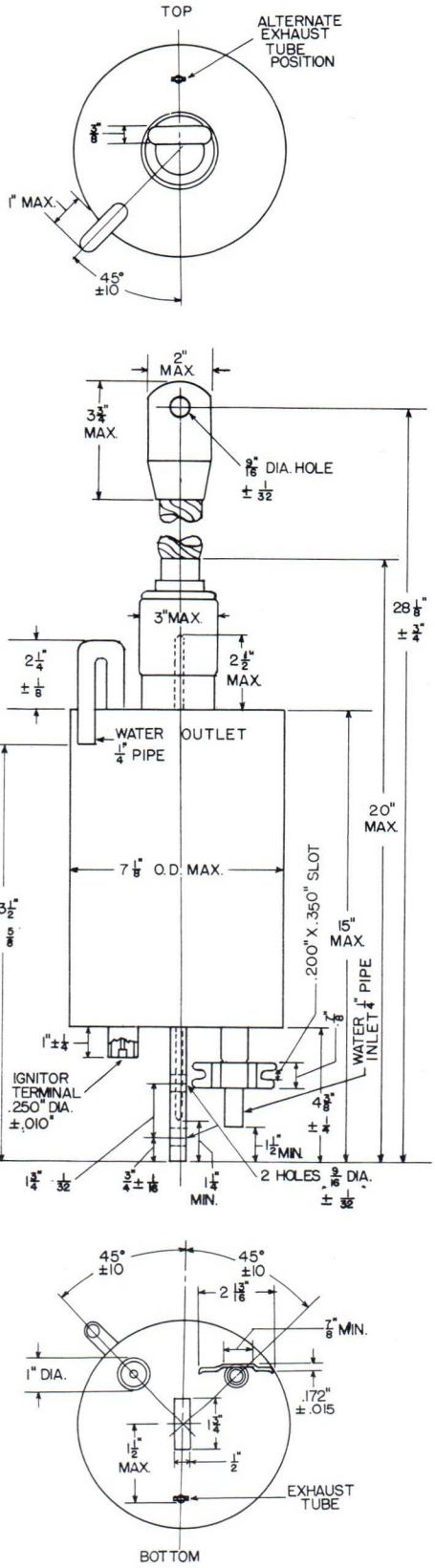
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-1053 IGNITRON







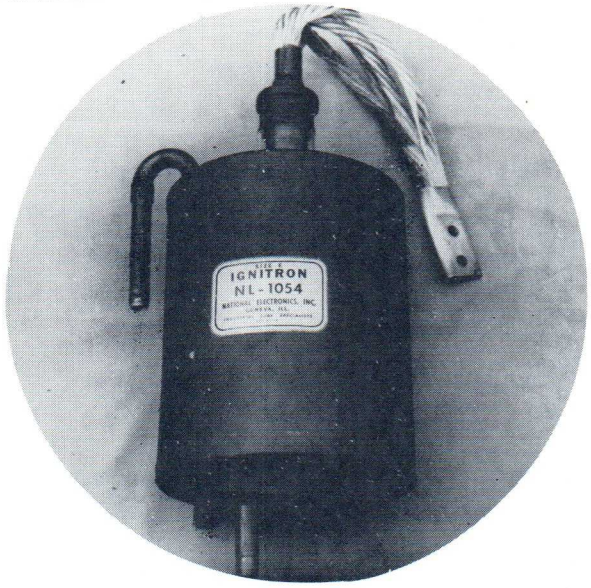


NL-1054 IGNITRON

SIZE E

900 Amperes dc

NATIONAL IGNITRON NL-1054 is a metal, water-cooled, mercury pool tube designed especially for welder and similar AC control applications. Its rating is approximately equivalent to a 2400 ampere magnetic contactor. NL-1054 internal cooling coil greatly increases the cooling surface giving long life and arc-back-free operation.



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 60 cycles, and any voltage between 250 and 600 volts rms. Ratings are for two tubes in inverse parallel.

[1]Maximum demand — kva	4800*
[1]Corresponding maximum average anode current per tube, amps DC	486
[1]Maximum average anode current per tube — amps DC	900
[1]Corresponding maximum demand — kva	1600
[1]Maximum averaging time — seconds at 500 volts rms.	8.9
at 250 volts rms	17.8
Maximum surge current — peak amps	280% of max. rms demand current

RECTIFIER APPLICATIONS — Ratings are based on intermittent duty, on no phase delay, and on frequencies from 50 to 60 cycles. Values for one tube.

Maximum peak anode volts	1200
[2]Maximum peak anode current, amps	6000
[2]Corresponding maximum average anode current, amps DC	120
[2]Maximum average anode current, amps dc	340
[2]Corresponding maximum peak anode current, amps	2040
Maximum averaging time, seconds	12.5
Maximum ratio of average to peak current, maximum averaging time, 0.6 sec.	0.166
Maximum ratio of peak surge current to peak anode current	12.5
Maximum duration of surge current, seconds	0.15

IGNITION REQUIREMENTS — (Same for both applications.)

Ignitor Voltage

Maximum instantaneous allowed, ignitor positive — anode voltage	
[3]Maximum instantaneous required, ignitor positive — volts	200
Maximum instantaneous allowed, ignitor negative — volts	5

Ignitor Current

Maximum instantaneous allowed — amperes	100
[3]Maximum instantaneous required — amperes	30
Maximum average allowed — ampere	1
[3]Ignitor ignition time maximum — microseconds	100
Ignitor current averaging time — seconds	5

COOLING REQUIREMENTS — (Same for both applications)

Type of cooling	Water
Minimum inlet water temperature, °C	0
Maximum outlet water temperature °C	40
Approximate water flow required at continuous full load, GPM	6
At duty less than maximum % duty for any given demand current, water flow can be reduced in proportion to reduction in duty.	
Minimum water flow, at any load, GPM	1.5
Pressure drop per tube at 6 GPM — lbs. per sq. in.	16
Water temperature rise at 6 GPM — full load — °C	9

GENERAL CHARACTERISTICS

Number of anodes	1
Number of ignitors	1
Mounting position	Vertical
Peak arc drop at 6000 amperes peak — approximate volts	25
Net weight — lbs.	85
Approx. shipping weight — lbs.	105

[1]Using log-log paper, straight line interpolation of RMS Demand Current vs. Average Anode Current 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.

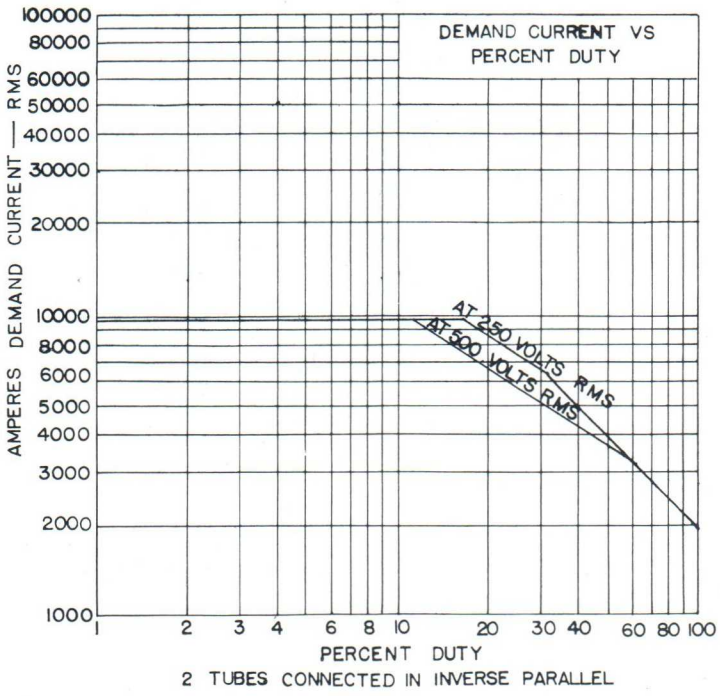
[3]Ignition will occur if either maximum required instantaneous potential is applied or maximum required instantaneous current flows for the rated maximum ignitor ignition time.

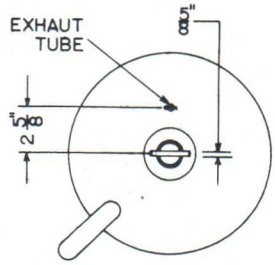
*Maximum demand current at voltages below 500 is 9600 Amps. rms.

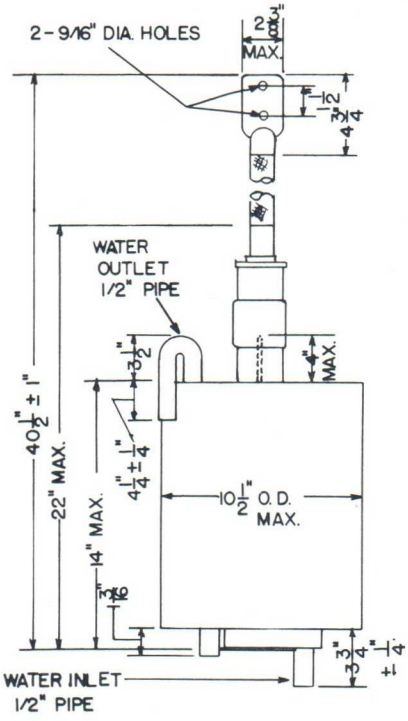
Printed in U.S.A. 10/56 G.R.

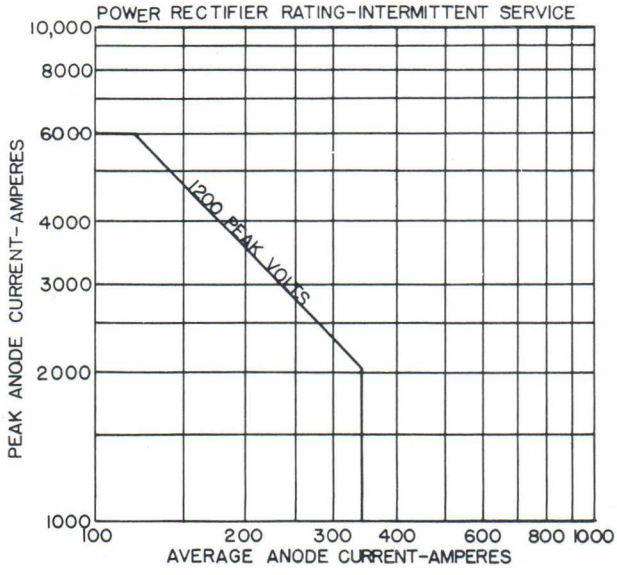
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

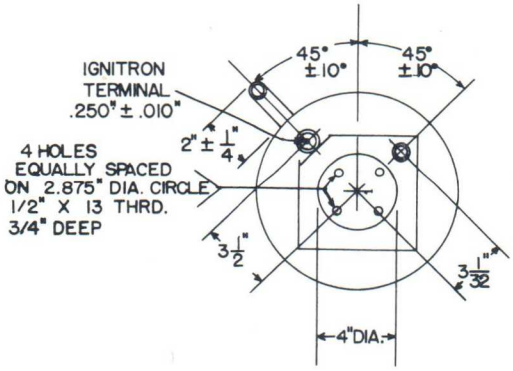
NL-1054 IGNITRON







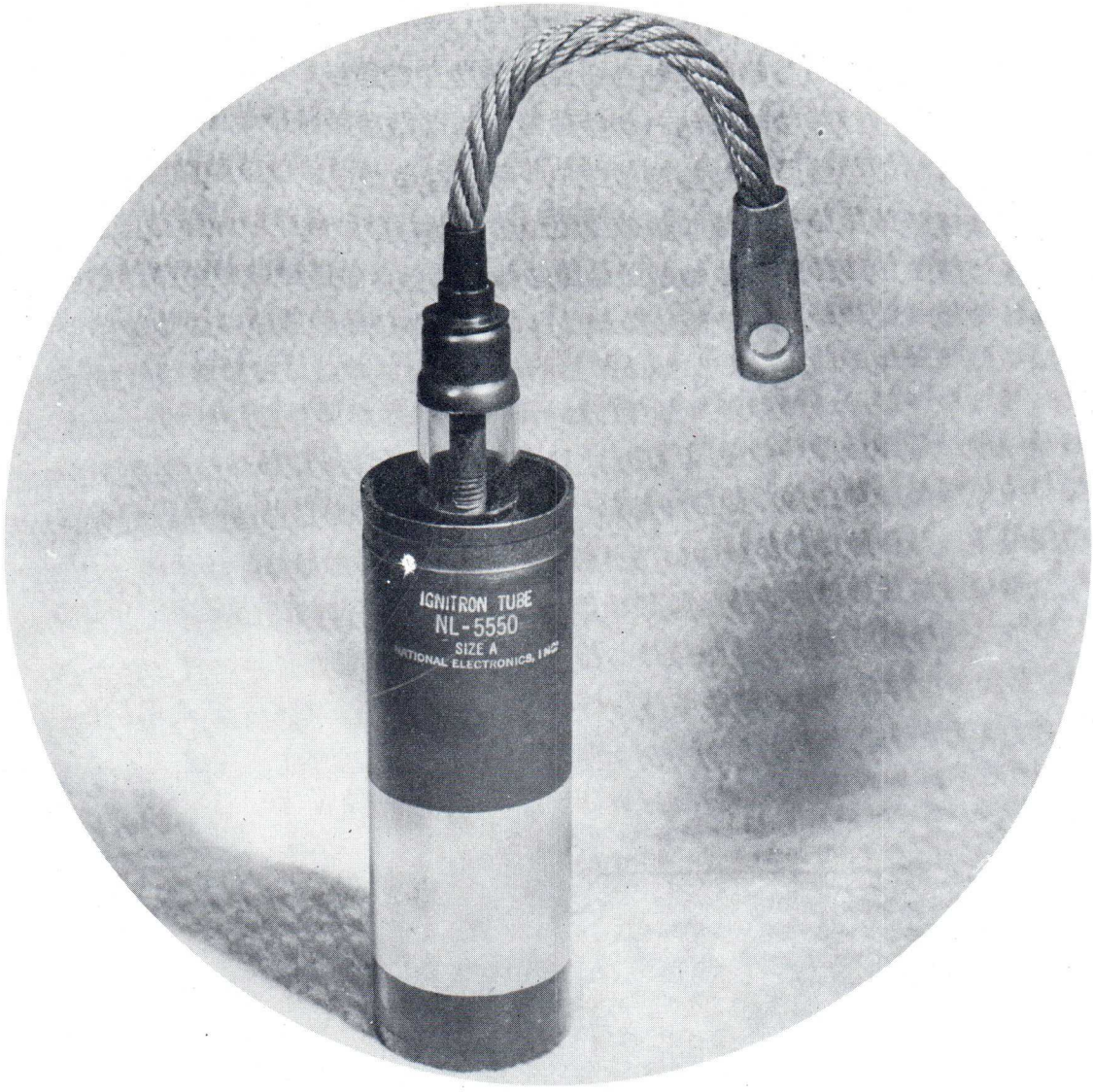




NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

IGNITRON TUBE

NL-5550
IGNITRON TUBE
22.4 Amperes dc



NL-5550 is a mercury pool tube designed especially for resistance welding control. Its rating is approximately equivalent to a 150-ampere magnetic contactor.

NL-5550 can be used to control 25-60 cycle AC at voltages of 250 to 600 volts. It can also be used to control stored electrostatic energy for resistance welding.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NL-5550 IGNITRON TUBE
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 60 cycles, and any voltage between 250 to 600 volts rms.

Maximum clamp temperature, °C	75	50
[1]Maximum demand — kva	150	300
[1]Corresponding maximum average anode current per tube — amps DC	4.9	12.1
[1]Maximum average anode current per tube — amps DC	9.0	22.4
[1]Corresponding maximum demand — kva	50	100

[1]Maximum averaging time — seconds		
At 600 volts rms.	11.6	9.2
At 250 volts rms.	27.8	22
Maximum surge current — Peak amps	280	280
	percent of max. rms demand current	

[2]CAPACITOR DISCHARGE RATINGS

Maximum discharges per sec.	60	60		
Peak forward voltage, max.	3000	6000		
Peak inverse volts, max.	3000	3000		
Peak anode current, max. amps.	500	500		
Maximum temp. of cooling clamp, °C	70	40	60	40
Corresponding maximum average current, amps DC	3	15	2.5	8
Maximum averaging time, sec.	3.3	0.66	4.0	1.25

IGNITION REQUIREMENTS (same for both applications)

Ignitor Voltage

Maximum instantaneous allowed, ignitor positive— anode voltage

[3]Maximum instantaneous required, ignitor positive — volts 200

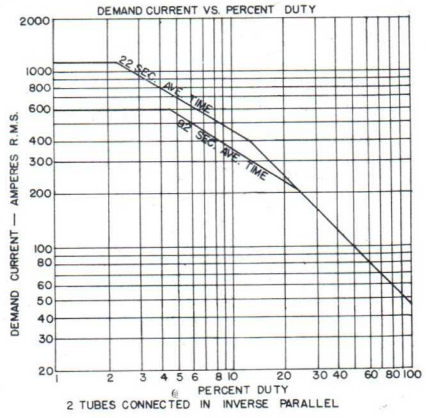
Maximum instantaneous allowed, ignitor negative—volts 5

Ignitor Current

Maximum instantaneous allowed — amperes	100
[3]Maximum instantaneous required — amperes	30
Maximum average allowed — ampere	1
[3]Ignitor ignition time maximum — microseconds	100
Ignitor current averaging time — seconds	5

GENERAL CHARACTERISTICS

Number of anodes	1
Number of ignitors	1
Mounting position	Vertical
Peak arc drop — approximate volts	12
Type of cooling	Water cooled clamp
Minimum inlet water temperature — °C	0
Net weight — lbs.	1.5
Approx. shipping weight — lbs.	8

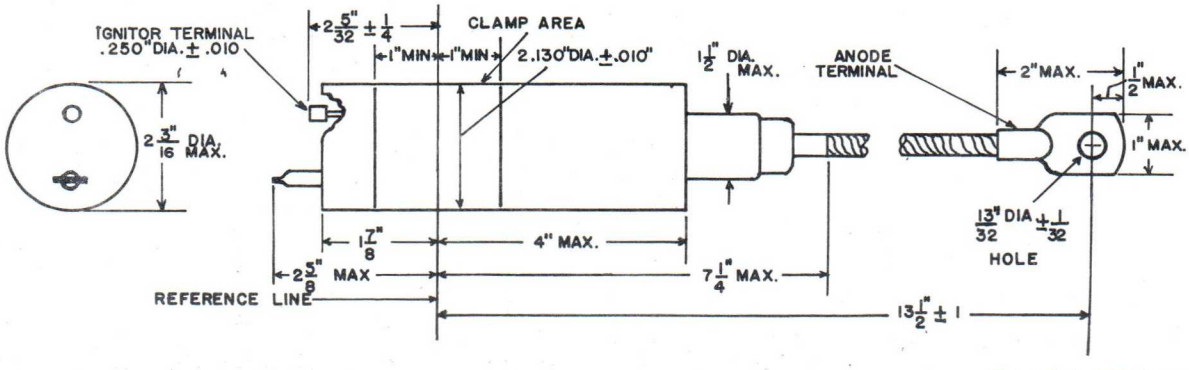


[1]Using log-log paper, straight line interpolation of Demand Current vs. Average Anode Current may be used to determine intermediate ratings.

[2]Using log-log paper, straight line interpolation between listed points may be used to determine intermediate ratings of average anode current and maximum averaging time vs. temperature.

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

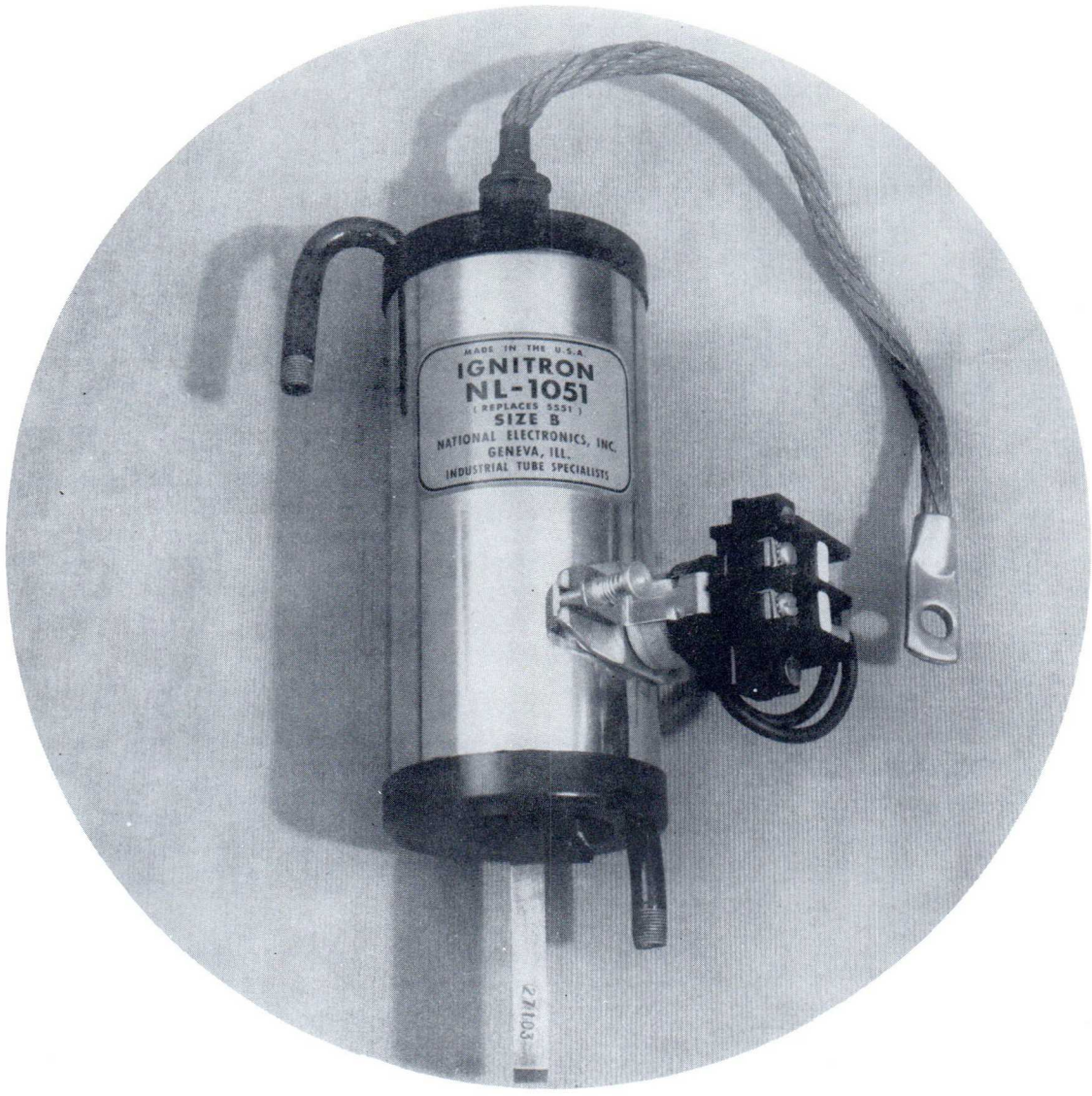
OUTLINE DRAWING



Printed in U.S.A. -- 3-55

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NATIONAL THERMALLY PROTECTED IGNITRONS



Eliminates condensation.

Allows use of 40 to 50°C cooling water.

- No sediment deposits.
- Permits maximum water-saving.

NATIONAL ELECTRONICS, INC.

GENEVA, ILLINOIS, U. S. A.

NATIONAL THERMALLY PROTECTED IGNITRONS

FEATURES AND ADVANTAGES

The National Electronics, Inc. construction of ignitrons, Fig. 2, incorporates many additional and exclusive features. The thermostatically protected ignitrons, pioneered by NATIONAL, give ignitrons the same type of protection that has been employed with electric motors for many years, where the thermostat senses the internal temperature directly. The NATIONAL coil construction offers many cooling and maintenance advantages.

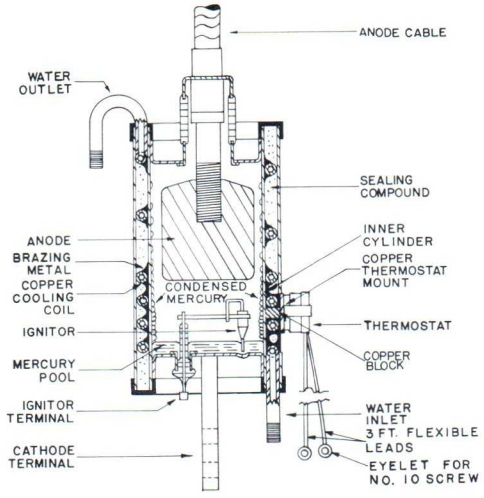


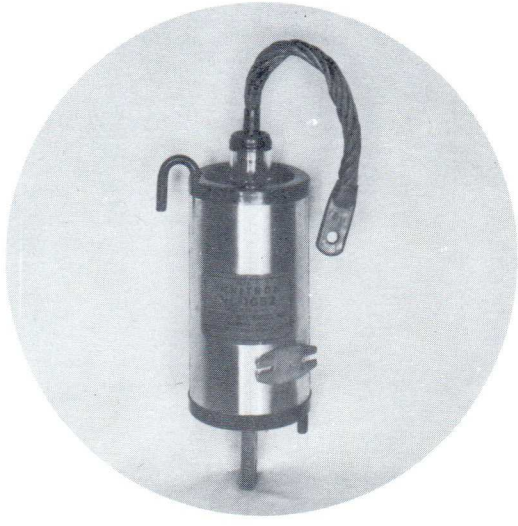
FIG. 2 NL-1052 SIZE C IGNITRON

The National construction incorporates many valuable features:

- ★ Turbulent flow through coil for efficient cooling.
- ★ Direct connection of thermostat to inner can.
- ★ Thermostats easily demountable.
- ★ Ignitor terminal easily accessible.
- ★ Outer jacket not in direct contact with cooling water.
- ★ Only one style tube for all applications.

These features have resulted in many important savings of time and expense. Some of these advantages are:

- ★ More efficient cooling.
- ★ Allows the use of 40 to 50°C cooling water.
- ★ Elimination of all troublesome flow switches.
- ★ Assurance of equipment shut-down if ignitron overheats.
- ★ Elimination of unnecessary shut-downs.
- ★ Elimination of condensation on ignitrons.
- ★ Increased maximum averaging time.
- ★ Reduction of spare tube types.
- ★ Same thermostat for all types.
- ★ Great water saving possible.
- ★ No sediment deposits.
- ★ Easy conversion of existing equipments.



The National cooling coil construction provides turbulent water flow even at low pressures and concentrates the flow where most needed to give increased cooling efficiency. The National thermal ignitron used with a protection thermostat is the only tube available allowing the use of 50°C cooling water. This is particularly important in recirculating systems where water temperatures often rise quite high in summer. No longer do these high water temperatures make it necessary to short out the flow switches during the hot months as they can now be eliminated. The protection thermostat assures equipment shut-down if the ignitron overheats. The thermostat, being directly connected to the inner can through a short copper block, operates directly on inner can temperature. Likewise, extremely cool water does not affect the thermostat nor reduce protection. True tube protection is obtained in both cases.

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

NATIONAL THERMALLY PROTECTED IGNITRONS

Such occurrences as fluctuating water pressure, irregular flow, and temperature rise of cooling water no longer cause unnecessary shut-downs and unnecessary loss of production time. The thermostat will shut down the equipment only when the tube temperature rises high enough to endanger the ignitrons. As the cooling water does not come in contact with the outer can there will be no condensation and consequent damaging drip from the ignitron. Nor is it necessary to shut off the water during down time to prevent condensation on the ignitron.

The greater thermal capacity of the National construction permits greater maximum averaging time, for increased welding capacity. On the B and C sizes, it has been increased by 50% and on the D, by 100%.

Spare tube stocks can be reduced to a minimum. Since the thermostats are demountable, tubes are purchased without thermostats and can be used to replace old style tubes or, with the addition of a thermostat can be used for thermal protection. It is necessary to stock only one style tube for each size used.

All sizes use the same thermostats. A small thermostat stock is adequate for proper maintenance of all welders. All thermostats are supplied with the necessary mounting clamps. No delicate adjustment is necessary on the thermostats before mounting.

The high efficiency of the cooling system makes possible maximum water saving. A substantial water saving, in excess of 90%, for many applications, can be obtained by reducing the water flow by means of a manually operated water valve. This is possible because the coil construction maintains turbulent flow at low rates of flow. The protection thermostat protects the ignitrons and shuts down equipment if reduction has been excessive. Additional savings are possible during down time with a water-saver thermostat and solenoid valve.

There are no stagnant spots in the cooling system to build up sediment deposits. The coils are self flushing and all sediment is flushed down the drain. This eliminates loss in cooling efficiency due to such deposits and decreases maintenance costs.

INSTALLATION INSTRUCTIONS

Existing equipments can easily be converted to take advantage of these features.

For tube protection, one protection thermostat, C4391-7-52 or C4391-7-59, is mounted on ignitron in outgoing water position. This arrangement eliminates the flow switch and its unnecessary shutdowns. Flow switch may be removed from water line if desired. The protection thermostat may be connected into the circuit in either of the following ways:

1. For most positive protection, series contacts of thermostat with line breaker trip holding coil so that line breaker opens when thermostat contacts open. Remove all electrical connections from flow switch and tape to prevent shorting.

2. Contacts may be connected to leads provided on old flow switch for circuit interruption. The thermostats are capable of interrupting ignitor current. Remove all other connections to flow switch and tape to prevent shorting.

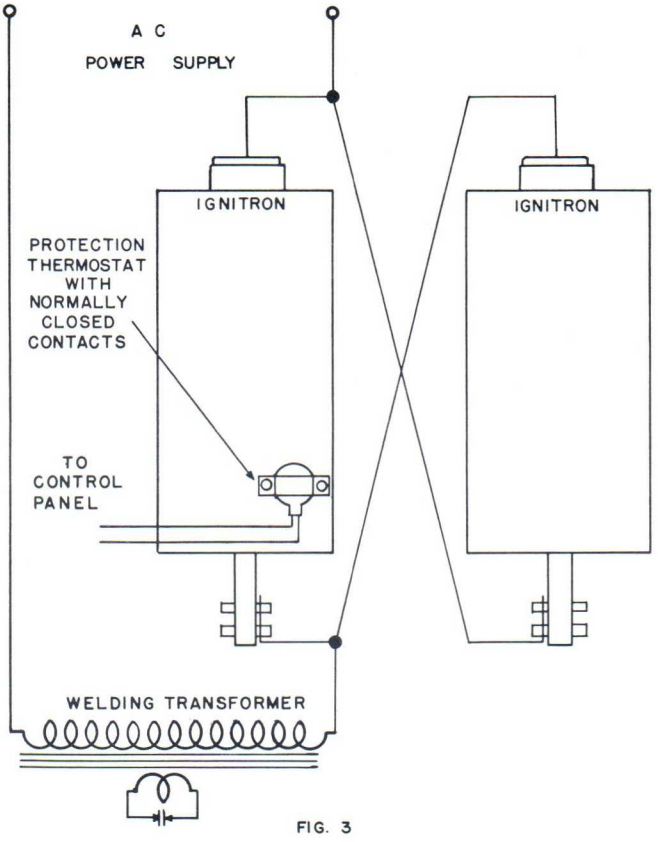


FIG. 3

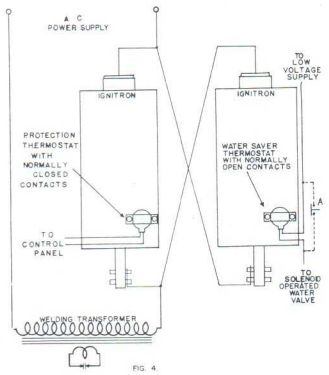


FIG. 4

Water saving on NATIONAL ignitrons can be accomplished by one of three methods:

1. By use of water-saver thermostat paralleled by relay contacts as shown at A in Fig. 4. The contacts of the thermostat should be shorted by a pair of auxiliary contacts closing when the weld initiating switch closes, and held closed during the weld cycle. This mode of operation starts the water flow immediately when the weld initiating switch is closed and provides maximum cooling. The thermostat then functions to provide water flow during part of the non-conducting period to remove the heat stored in the ignitron and cuts off the water when ignitron is cool. With this type of operation the full rated load of the ignitron is available since the water starts flowing prior to the beginning of the conduction period. It also permits saving of tip and transformer cooling water by controlling this water with the same solenoid water valve.

2. By using only the protection thermostat, C4391-7-52 or C4391-7-59, Fig. 3, and partially closing a hand valve in the cooling water line to give only the flow needed for adequate cooling on the particular job. The hand valve should control water flow to only one pair of ignitrons. Tip and transformer water flow should not be reduced. If water flow is reduced too far the protection thermostat will open to prevent damage to ignitrons.

3. By use of water-saver thermostat without paralleling relay contacts, Fig. 4. When this method is used it is necessary to decrease the percent duty to prevent the ignitrons from overheating before the water starts to flow. This is not a derating of the ignitrons but is necessary for protection due to the thermal time lag of the thermostats. Using the C4391-7-51 or C4391-7-58 requires a reduction in maximum rated percent duty at any given current of 30% on the Size B, NL-1051, and 40% on the Size C, NL-1052. This method of operation is not recommended for use with the Size D, NL-1053. The use of thermostats with a different time response would require a modification of these reduction factors.

PRECAUTIONS IN WATER-SAVER APPLICATIONS

1. Water-saver applications cannot be made when flow switch is used for protection.
2. Failure to have cooling coils full of water before ignitrons start to conduct may result in arc backs and tube failure as temperature of ignitrons will rise at a higher rate than normal.

THERMOSTATS

Each thermostat is available in two styles. Existing equipment can easily be converted. Types C4391-7-51, water saver, and C4391-7-52, protection, are provided with terminal block for making connections at thermostat, Fig. 5. Types C4391-7-58, water saver, and C4391-7-59, protection, are provided with leads three feet long for making connections to existing terminal blocks, Fig. 6. They are mounted 45° from front of tube so that no additional space is required in cabinet.

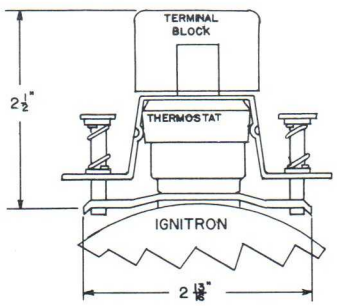


FIG. 5

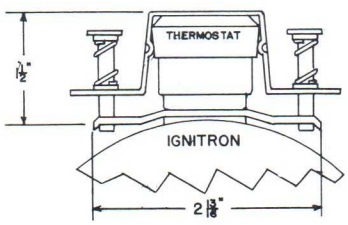


FIG. 6

Printed in USA/6-57/G

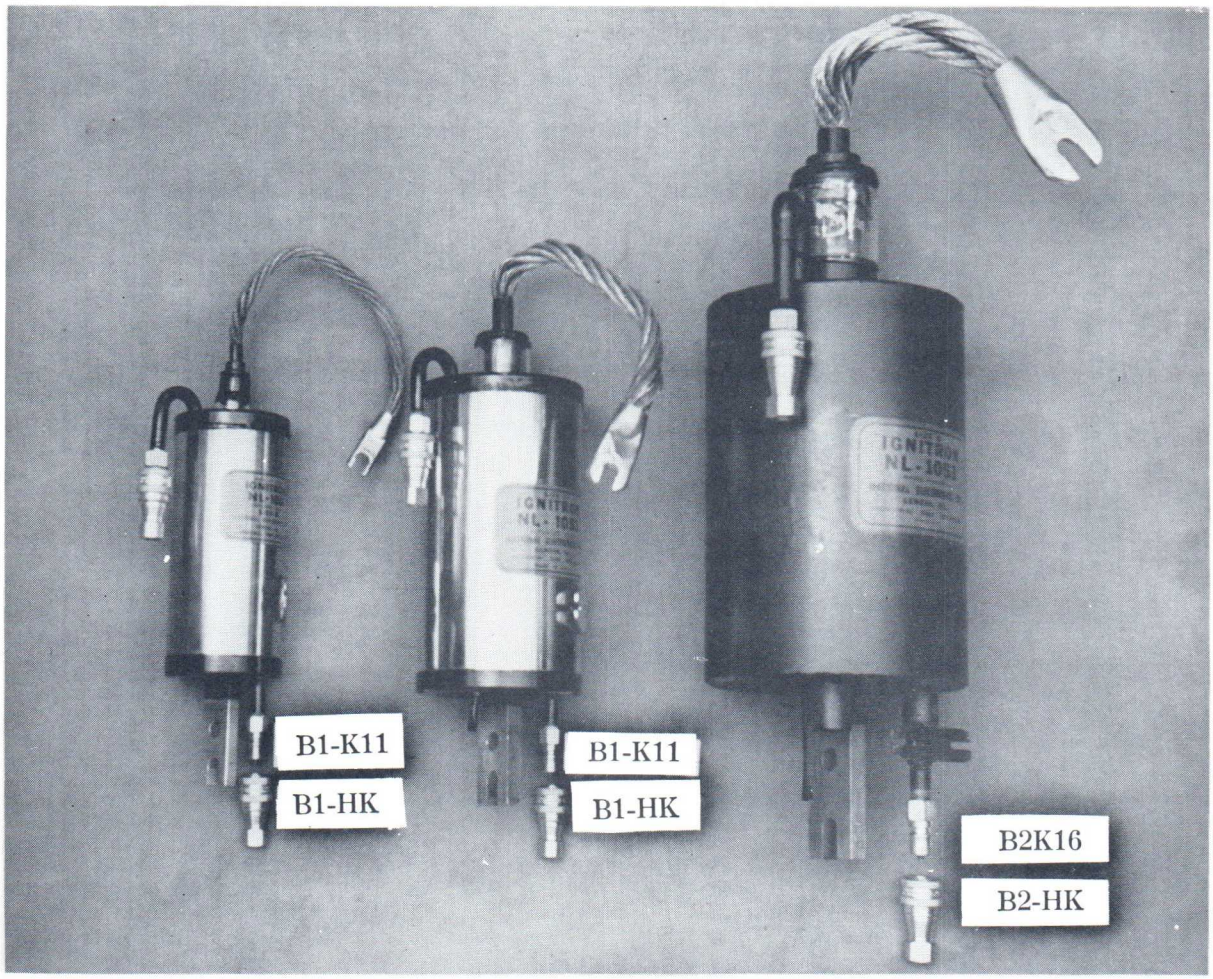
NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

QUICK-CHANGE IGNITRONS
NL-1051A NL-1052A NL-1053A
NATIONAL ELECTRONICS COMPATIBLE QUICK CHANGE IGNITRONS

The NATIONAL NL-1051A, NL-1052A, and NL-1053A Ignitrons have been designed to speed and simplify installation in and removal from welding controls. The slot which replaces the lower hole in the cathode bus bar eliminates the necessity of completely removing the lower cathode bolt when changing a tube. The slot in the anode lead provides the same speed and convenience. These tubes are completely interchangeable with the NL-1051, NL-1052, and NL-1053.

In addition, quick change water connectors are available at a slight extra cost. These connectors are of a snap together type and are very easily installed on both tube and water hoses.

The tube water nipples are threaded to accommodate these quick change connectors. Once the connectors have been installed on tubes and hoses the water can be connected or disconnected in a few seconds, and with no loss of water or time out to close the water valve since the water connectors stop water flow when the two halves of the connectors are separated.



REDUCE DOWN TIME WITH NATIONAL'S COMPATIBLE QUICK CHANGE IGNITRONS.

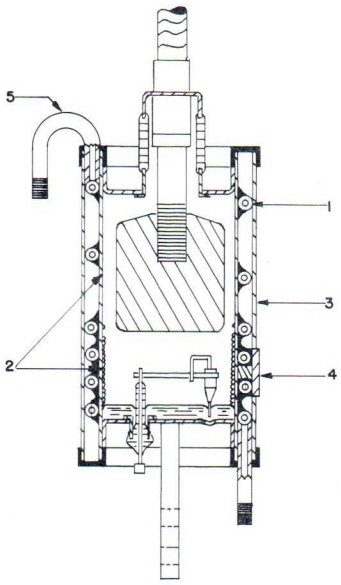
Printed in USA 12-55

NATIONAL ELECTRONICS, INC.
GENEVA, ILLINOIS, U. S. A.

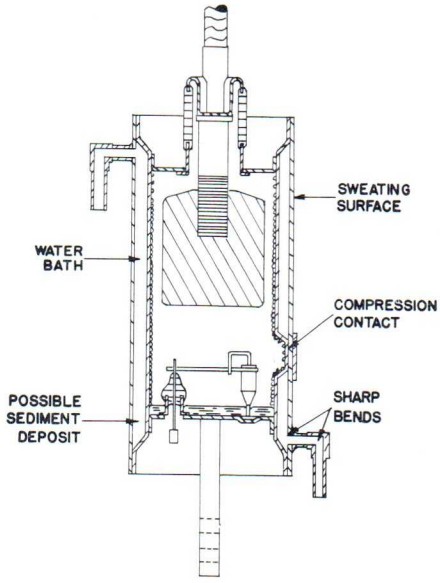
Dependability . . . . . Economy

IGNITRONS ARE NOT ALL ALIKE

NATIONAL (NL BRAND) IMPROVED DESIGN IGNITRONS



BATH COOLING CONSTRUCTION IGNITRONS



1. COPPER COOLING COIL. The high conductivity of copper, greater thermal mass of the assembly, and turbulent flow of the cooling water through the tubing are utilized to give maximum cooling efficiency.

2. INNER WALL TEMPERATURE CONTROLLED FOR PARTICULAR AREAS. Close spacing of coil is maintained on lower section for cooler wall where mercury condensation is desired. Wide spacing on upper section eliminates danger of arc-backs by preventing mercury condensation near anode.

3. NO SWEATING — NO DRIPPING WATER TO INJURE OTHER COMPONENTS. Cooling coils and outside of inner can are covered with an insulating coating. This coating plus the outer can prevent outside air contact with water cooled parts and eliminate water condensation on tube.

4. POSITIVE TEMPERATURE SENSING. Copper thermal block and thermostat mount are brazed and soldered to inner can. No variations in temperature sensing will result from aging or impurities in cooling water. Even muddy water does not impair the accuracy.

5. NO SEDIMENT DEPOSITS OR FLOW RESTRICTIONS. The sweeping bends of the cooling coil produce free highly turbulent flow, are self-flushing, and maintain high cooling efficiency.

These advantages found only in NATIONAL ELECTRONICS' coil construction ignitrons give longer trouble-free service, less down time, and consequently, lower maintenance costs.

For DEPENDABILITY and ECONOMY

Specify* NATIONAL ELECTRONICS' *Ignitrons

Geneva, Illinois, U.S.A.