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OPTILAS
HUGHES

Manual No. 7188C

NEC

P5.3-5-8-7-14-[redacted]-21

GLG5260/5360/5270 LASER HEAD
GLS5360/5361/5362 POWER SUPPLY
GLS5290/5292/5270/5271 POWER SUPPLY
GLT2150/2140/2350 LASER TUBE

INSTRUCTION MANUAL

NEC Corporation
Tokyo, Japan

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1. LASER SAFETY

Please read this section of the manual carefully before installing or operating your laser.

The protective housing of this laser product should always be placed during normal laser operation. Removal of the protective housing may expose the user to unnecessary radiation, and should be done only in accordance with specific instructions given in this manual.

Follow the instructions described in this manual for proper installation and operation of your laser. Use of protective eyewear or other precautionary measures depending on the conditions of use, visual function required, and type of laser product, is recommended. Consult user standards such as ANSI, ACGIH, or OSHA for guidance.

WARNING---HIGH VOLTAGE

The laser head and power supply of this laser product contain electrical circuits operating at HIGH VOLTAGES.

Whenever access to the interior of the laser or power supply is necessary, EXERCISE EXTREME CAUTION TO AVOID CONTACTS WITH HIGH VOLTAGES. THESE HIGH VOLTAGES ARE LETHAL.

Users of this laser product without due regard to these precautions, or in a manner that is not in compliance with procedures recommended here, may cause an unsafe condition.

WARNING

At all times during installation, operation, maintenance or service of your laser, avoid all unnecessary exposure to laser or collateral radiation* in excess of the accessible emission limits listed in Performance Standards for Laser Products, 21 CFR 1040.10 (d).

* Collateral radiation is defined as "any electronic product radiation, except laser radiation, emitted by a laser product as a result of or necessary for the operation of a laser incorporated into that product" (21 CFR 1040.10 (b) (9)).

CAUTION

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. There are many different types of lasers. Their maximum radiant powers vary from a few microwatts to thousands of watts. Higher output power produced by lasers normally has a potentially greater safety hazard. Laser users should take particular care with lasers that produces pulsed or invisible output. The following general laser safety precautions are especially important for users of medium - and high - power laser products. ("medium power" implies a class III laser, with total power output greater than 1 mW and less than 500 mW. Similarly, "high power" implies a class IV laser, with total power output greater than 500 mW).

SAFETY RECOMMENDATIONS FOR USE OF LASER HAVING OUTPUT POWER OF 1 mW AND GREATER.

(1) Never look directly into the laser beam.

(2) Set up a controlled-access area strictly for laser operation. Restrict access to this area only to those persons who have been instructed in the safe operation of lasers.

(3) Post warning signs in prominent locations near the laser area.

(4) Provide enclosed paths for laser beams when possible.

(5) Set up experiments so the laser is NOT at eye level.

(6) Set up a target for the beam. A folded metal sheet painted black works well. Also, set up shields to prevent strong reflections going beyond the area needed for the experiment.

(7) Use the remote connector feature with Class III or IV laser products to provide a safer work area.

MAINTENANCE STEPS NECESSARY TO KEEP THIS LASER PRODUCT IN COMPLIANCE WITH 21 CFR 1040.10 AND 1040.11

This laser product complies with Title 21 of the United States Code of Federal Regulations, Chapter I, Subchapter J, Parts 1040.10 and 1040.11, as applicable. To maintain compliance with these performance standards, once a year, or whenever the product has been subjected to adverse environmental conditions, such as fire, flood, mechanical abrasion, solvent spillage, etc., check that all features of the product listed on the radiation control drawing in the section (remote control connectors, emission indicators, beam attenuators, control key switches, etc.) are functioning properly, and that all required label are firmly in place and completely legible.

(1) If the laser product is equipped with a remote control connector, verify that electrical disconnection of the remote control connector prevents laser operation.

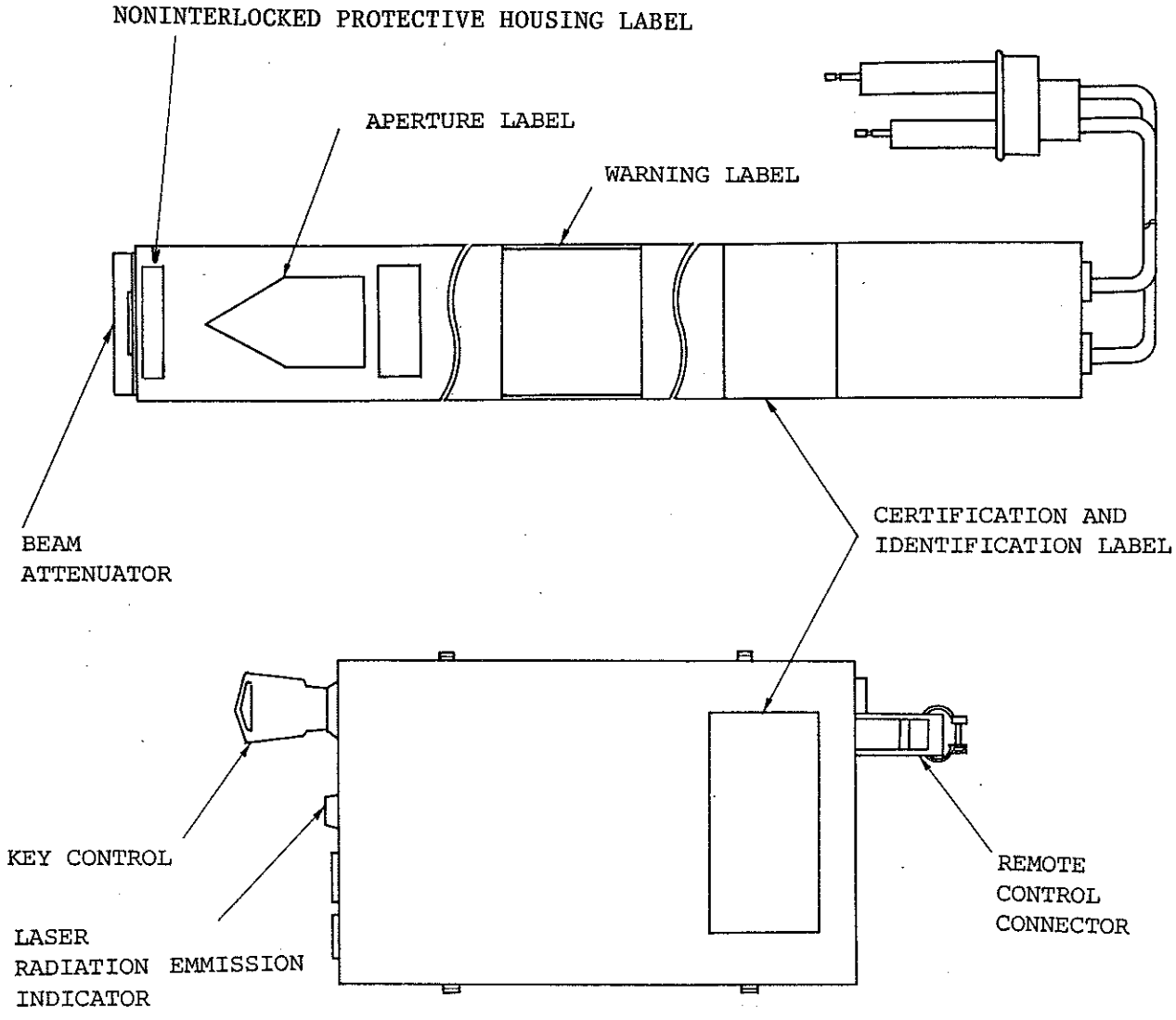
(2) If the laser product is equipped with a key control, verify that the laser is not operable when the key is removed.

(3) If the laser product has an emission indicator light, verify that this indicator is functioning properly. This indicator light should turn on automatically during laser emission. For all Class III or Class IV laser products, the emission indicator light should turn on automatically a sufficient time before emission starts, so that the user can avoid radiation exposure.

(4) If the laser product has a beam attenuator, verify that the attenuator can actually block access to laser emission.

(5) If the laser product has safety interlocks, verify that each interlock stops emission of laser or collateral radiation upon removal or displacement of the interlocked part of the protective housing.

(6) If the laser product has safety interlocks designed so as to allow defeat of the interlock feature, then verify that, when defeated, the defeat mechanism (plug or knob) is clearly visible and prevents the replacement of the cover without first disengaging the defeat mechanism.



Note: On GLS5362, a manufacturer label is affixed instead of certification and identification label.

Fig.1 GLG5260/5360/5270 laser head with GLS5360/5361/5362 power supply laser radiation control drawing.

2. TECHNICAL FEATURES

HeNe lasers are now the most reliable lasers among visible light lasers, and are utilized in various industrial fields. For example, low power HeNe lasers, with 1 to 2 mW output power, have been used in POS system and facsimile. Medium power lasers, with around 5 mW output power, have been used in medium speed laser printers and various kinds of alignment systems. High power, 15 to 50 mW, lasers are mainly for high speed laser printers and holography.

NEC's new 5 to 7 mW HeNe lasers GLG5260/5360/5270 and their power supplies are ideal for these applications with extremely high reliability and performances. GLG5260 and GLG5360 are 5 mW single mode lasers, and GLG5270 is a 7 mW multimode laser.

This instruction manual describes the new 5 to 7 mW cylindrical HeNe laser series and laser tubes.

1) Laser tube

The GLG5260/5370/5270 laser heads contain an internal mirror tube, GLT2150/2140/2350, respectively, in which the optical cavity function is provided by fixing a pair of mirrors at either end of the tube. Accordingly, only the bare tube handles the laser function by being energized. This will be attractive for OEMs who demand easy to handle low cost lasers for their equipments. Followings are several features.

a) Output power stability is greatly improved by utilizing a hemispherical cavity configuration (GLT2150 and GLT2140) and by keeping the capillary position strictly fixed against the tube envelope. Therefore, even in the bare tube operation, the output power is kept constant versus tube temperature change, attitude change, especially tube rotation around the tube axis.

b) Although the cavity configuration is hemispherical, the mode volume is not decreased because of increased capillary length. Therefore, the output power level is not decreased.

c) The tube length is one of the shortest class in the world.

d) Tube voltage is very low, because of the simplified discharge path. It will be convenient for users in respect to discharge stability and the power supply cost.

e) Long operational life and semi-eternal storage life can be expected, due to the glass-sealed mirrors that were first developed by NEC.

2) Laser head

The GLG5260/5360/5270 series laser heads are constructed by installing a laser tube into an aluminum cylindrical case, along with the ballast resistor. The ballast resistor is contained to

cancel negative resistance in the discharge tube.

a) The case axis can be made to coincide with the beam axis by fine adjustment.

b) An optical shutter is mounted at the beam exit in order to meet NCDRH regulations (laser safety regulations).

c) The high voltage connector for the power supply is ALDEN 8102, which is often used by recent power supply manufacturers.

3) Laser power supply

Utilizing a high frequency energy conversion circuit, the GLS5270/5271, GLS5290 /5292 and GLS5360 series laser power supplies feature high efficiency and small size.

The GLS5290/5292 and GLS5360 series operate directly from the AC power lines. GLS5270/5271 are from DC 12 V. The input and output circuits are completely isolated. The high voltage section of GLS5270/5271 and GLS5290/5292 are completely molded and free from electrical hazards. The GLS5360 series is packaged in order to comply with NCDRH regulations.

a) The high power conversion efficiency allows reliable circuit operation without heat sinking.

b) These power supplies contain a fault protection circuit against output short circuits and output open circuits.

c) Laser operating current is regulated by a feedback electronic circuit.

d) To meet NCDRH regulations, electronic delay inhibits laser ignition for 3.5 seconds after input power is applied.

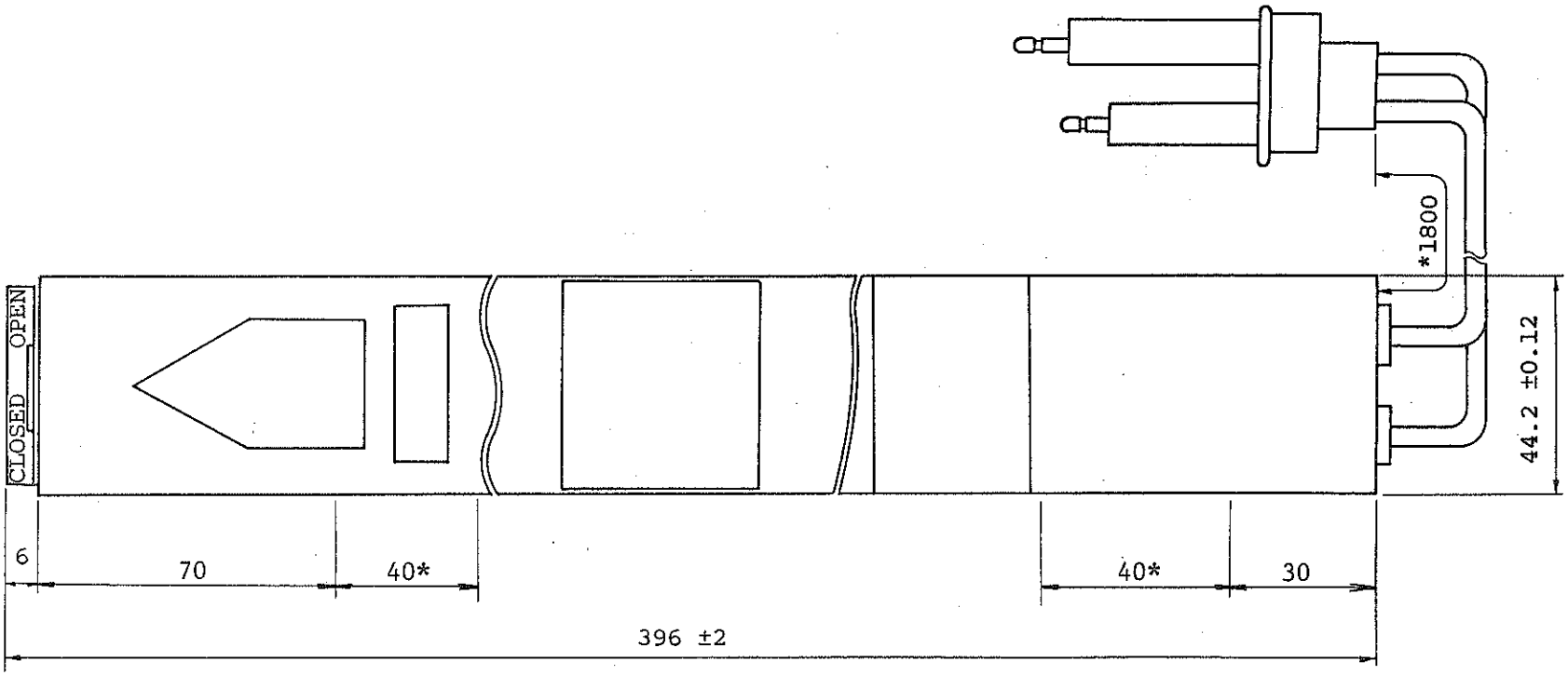
e) The GLS5360 series contains a key switch, a remote control connector and an emission indicator to meet NCDRH regulations.

3. SPECIFICATIONS

3.1 Laser head

TYPE		GLG5260	GLG5360	GLG5270
Minimum Output Power		5.0 mW	5.0 mW	7.0 mW
Polarization		Random	>500:1	Random
Wavelength		632.8 nm		
Transverse Mode		TEM 00		Multi mode
Longitudinal Mode Spacing		435 MHz		-
Beam Diameter at $1/e^2$		0.83 mm		0.9 mm(*1)
Beam Divergence		0.96 mrad		4 mrad(*1)
Output Power Stability		<±5 %/24 H		
Warm-up Time		<15 minutes		
Beam Noise and Ripple (10 Hz to 10 MHz)		<1 % rms		-
Static Beam Alignment	Location	<0.1 mm TIR (±0.05 mm)		-
	Angle	<1 mrad		-
Starting Voltage		<10 kV		
Operating Voltage		2350 ± 100 V dc		
Operating Current		6.5 mA		
Operating Temperature		0°C to 50°C		
Storage Temperature		-40°C to 80°C		
Relative Humidity		≦90 %		
Dimensions		44.2 dia. X 396 mm		
Weight		approx. 700 g		
Outline Drawing		Fig.2		

(*1) Typical value at the 1/2 of power maximum point.



E-vector direction of polarization of GLG5360 is perpendicular to this sheet.

Unit:mm

*) Recommended mounting area

Fig. 2 GLG5260/5360/5270 Series Drawing

3.2 Laboratory power supply

Type	GLS5360	GLS5361	GLS5362
Line Input Voltage	100 Vac±10%	117 Vac±10%	220/240 Vac±1
Power consumption	approx. 40 VA		
Input Frequency	50 / 60 Hz		
Output Voltage	2250 to 3000 Vdc		
Output current	6.5 mA		
Current Regulation	$<$ ±0.1 mA		
Starting Voltage	$>$ 10 kV		
Operating Temperature	-10°C to 50°C		
Storage Temperature	-20°C to 80°C		
Relative Humidity	$\leqq$ 90 %		
CDRH Time Delay	approx. 3.5 sec		
Output connector	ALDEN 8102F		
Dimensions (H)X(W)X(L)	63 X 92.2 X 145 mm		
Weight	approx. 1.3 kg		
Outline Drawing	Fig.3		

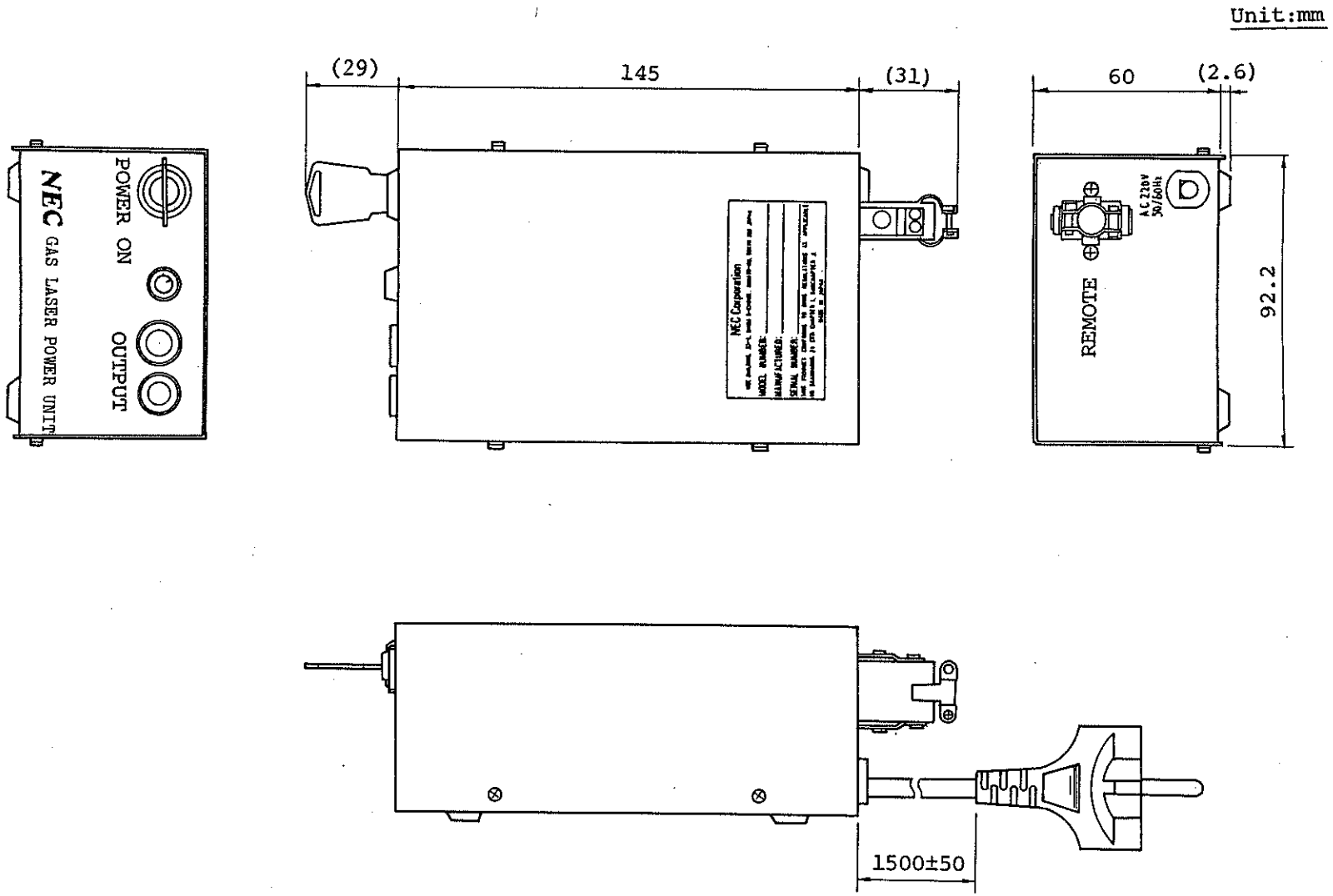


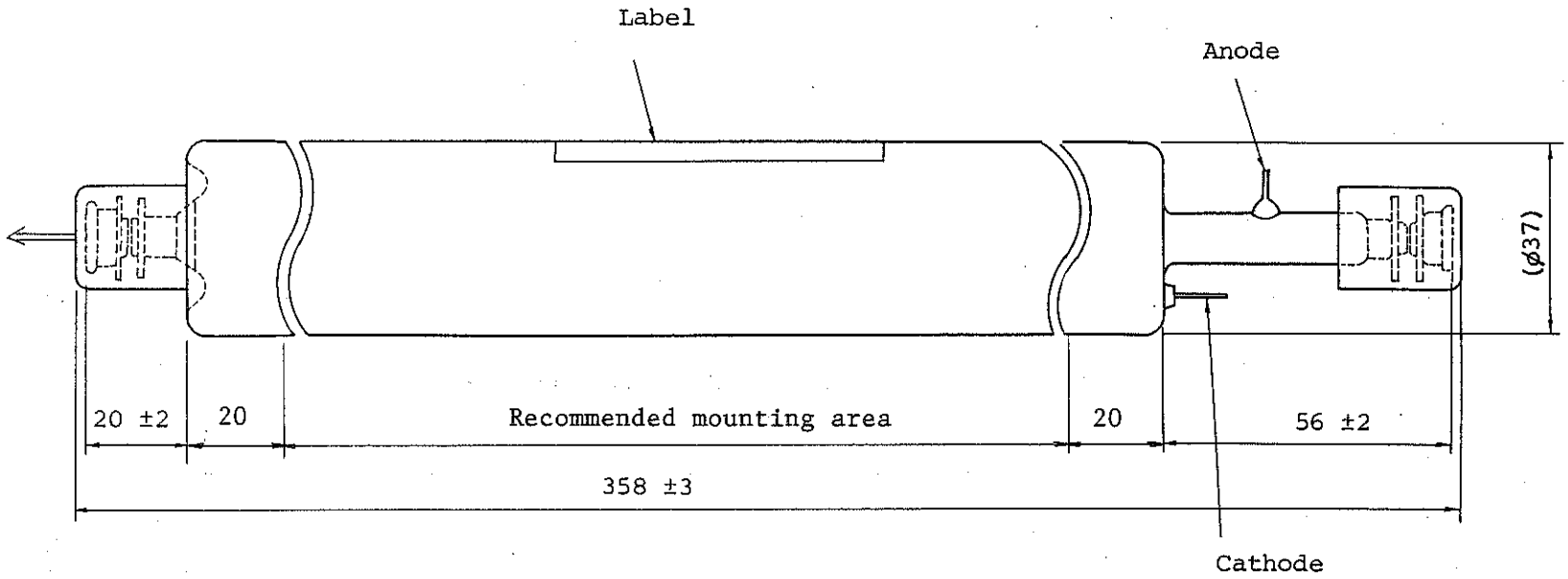
Fig. 3 GLS5360 Series Drawing

Unit: mm
This figure shows GLS5361.

3.3 Laser tube

Type		GLT2150	GLT2140	GLT2350
Minimum Output Power (mW) at 632.8 nm		5	5	7
Polarization		Random	>500:1	Random
Transverse Mode		TEM_{00}		Multi mode
Beam Diameter at $1/e^2$		0.83 mm		0.9 mm (*1)
Beam Divergence		0.96 mrad		4 mrad (*1)
Longitudinal Mode Spacing		435 MHz		-
Amplitude Noise (30 Hz to 10 MHz)		<1.0 % rms		-
Long Term Drift		<±5 %		
Starting Voltage		< 9 kV		
Operating Voltage		1900 ± 100 Vdc		
Operating Current		6.5 mA		
Recommended Minimum Ballast Resistor		70 kohm		
Dimensions		37 dia. X 355 mm		
Weight		200 g		
CDRH Conformation	Classification	IIIb		
	Max. Output Power	10 mW		20 mW
Outline Drawing		Fig.4	Fig.5	Fig.4

(*1) Typical value at the 1/2 of power maximum point.



Unit:mm

Fig. 4 GLT2150/2350 Drawing

APPENDIX

CONNECTING AND MOUNTING METHODS OF HE-NE GAS LASER TUBES

This application note is describing how to connect the power supply with NEC laser tube and how to mount NEC laser tube.

I. CONNECTION

CAUTION

Mis-connection of electrodes will result in irreparable damage to the laser tube and will void the warranty.

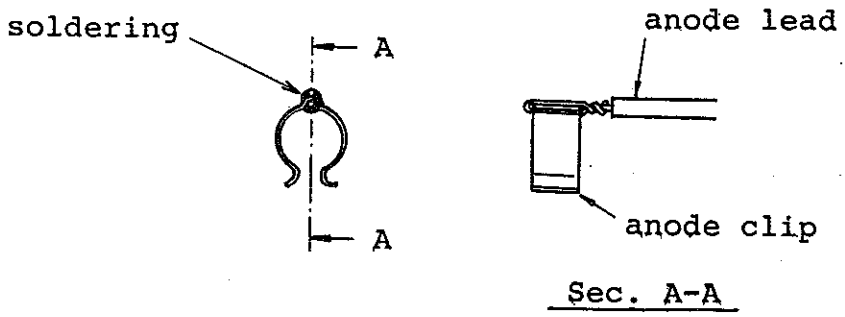
1. Anode

1.1 Anode clip type

In case of anode clip type of laser tube, anode clip is attached in the mirror support area.

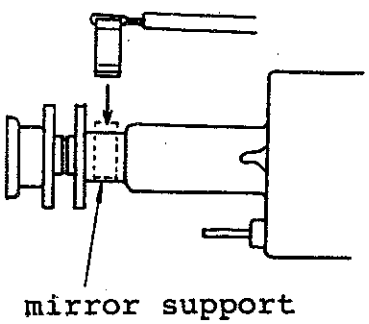
a) Remove the anode clip installed in the mirror support area.

b) Wind an anode lead around the top of the clip as follows, and then, solder them.



Sec. A-A

c) Insert the clip into the mirror support are from the opposite side of cathode pin.



1.2 Anode pin type

In case of anode pin type of laser tube, two methods are recommended.

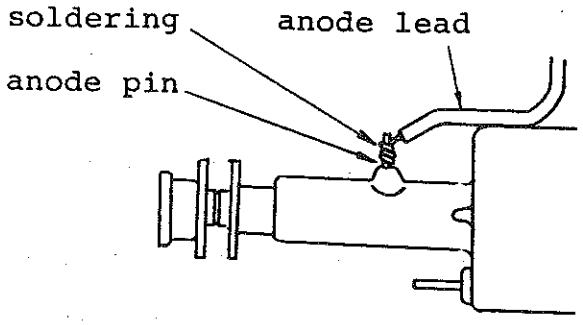
Note: Never apply anode clips to anode pin type tubes. This may cause abnormal output power reduction.

(1) Direct connection procedure

a) Polish the pin by files or sandpapers to remove the black oxidized layer.

b) Wind an anode lead a few turns around the pin.

c) Fix by soldering.



(2) Receptacle connection procedure

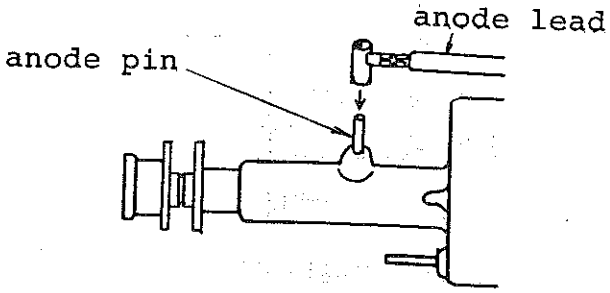
a) Polish the pin by files of sandpapers to remove the black oxidized layer.

b) By means of pin receptacles, which are available on the market, connect an anode lead and a pin as follows:

straight type

T-shape type

pin receptacle



c) Fix by soldering to avoid that the receptacle comes out.

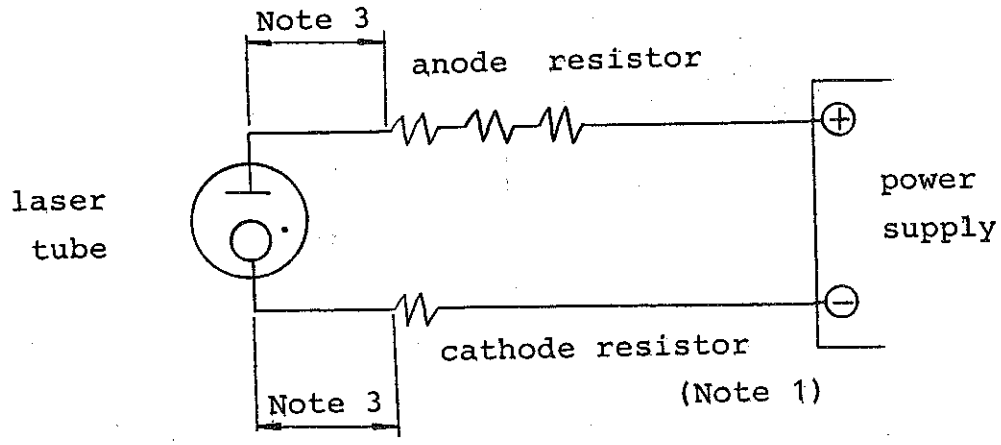
2. Cathode pin

A cathode pin should be connected to a cathode lead by the same method as the anode pin connection. (refer to 1.2.)

3. Ballast resistance (Note 1)

A series resistor (Note 2) is necessary to obtain a stable electrical discharge.

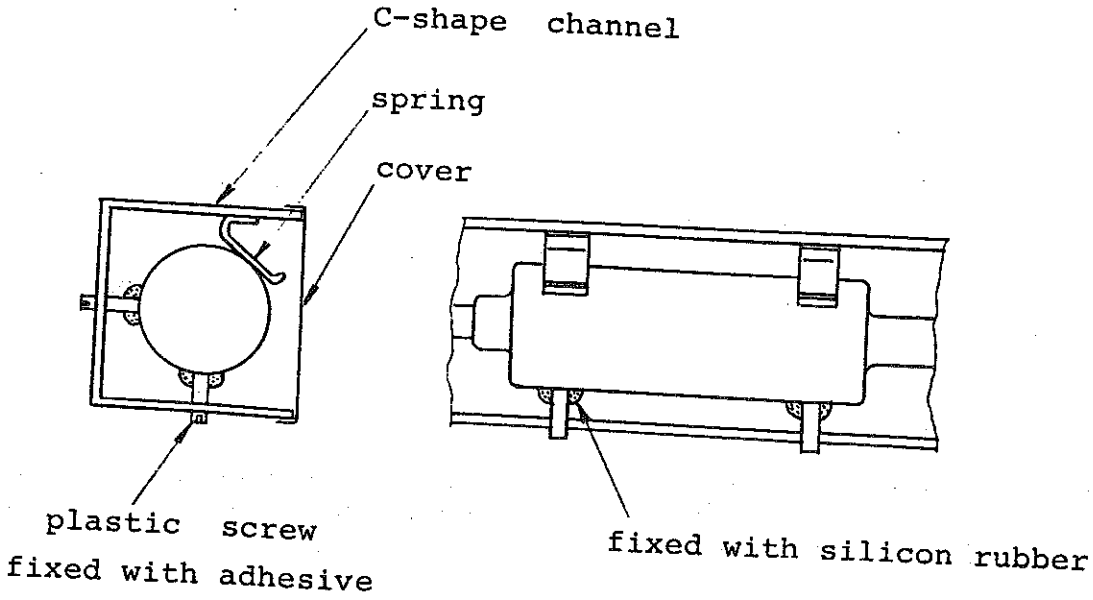
As it is recommended in the catalogue, set resistors between anode and positive terminal of power supply.



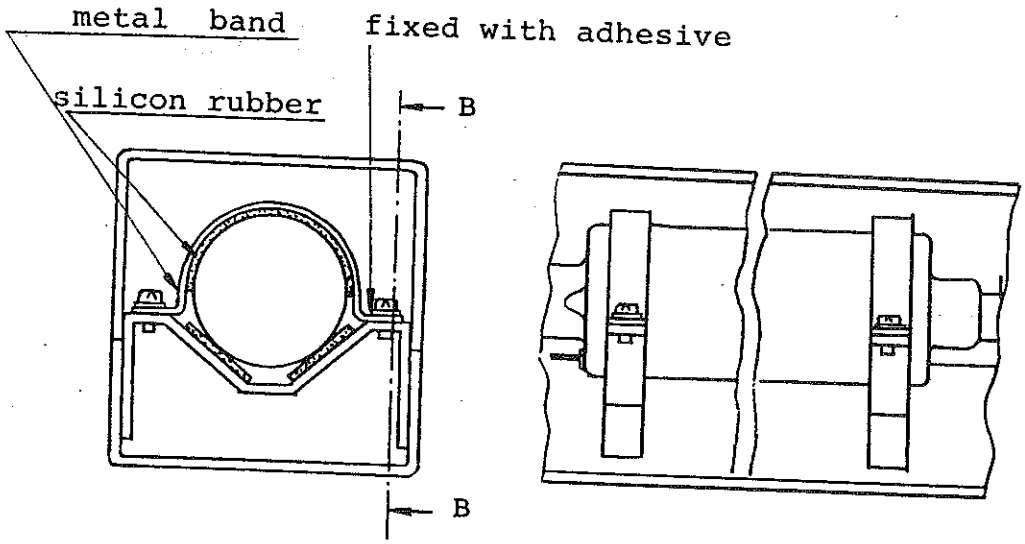
Note 1 : In some cases a small portion of ballast resistor is required in the cathode side. (Please refer to the individual catalogue.)

Note 2 : The ballast resistors should be divided into several small resistors in order to reduce the load of individual resistors.

Note 3 : Anode and anode-resistor, cathode and cathode-resistor should be close to each other. (within approx. 60 mm)



b) No need of positioning



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