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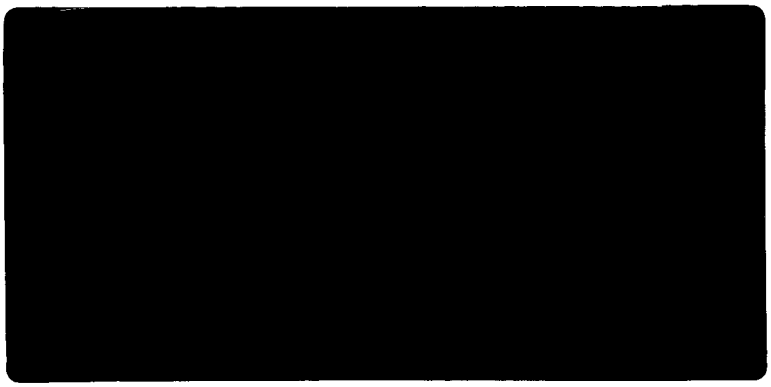

EON CORPORATION

175 PEARL STREET • BROOKLYN 1, N.Y. • ULSTER 8-0250

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

STERILIZABLE GEIGER-MUELLER TUBES

FOR SPACE APPLICATIONS

March 22, 1965

This work was performed for the Jet Propulsion Laboratory, California Institute of Technology, pursuant to a subcontract issued under Prime Contract NAS 7-100 between the California Institute of Technology and the United States of America represented by the National Aeronautics and Space Administration.

CONTRACT NO. JPL-CPFF-950681

March 16, 1964

EON CORPORATION
175 Pearl Street
Brooklyn, N.Y. 11201

FINAL REPORT

STERILIZABLE GEIGER-MUELLER TUBES

FOR SPACE APPLICATIONS

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ABSTRACT:

26400

The details of design, fabrication and evaluation of two gas and heat sterilizable Geiger-Mueller tubes (Types 5112R and 6226) developed for space applications, are covered in this report.

The Type 5112R has a stainless steel thin wall cathode (30 mg/cm^2) and the 6226 a grid supported thin end mica window (1.4-1.5mg/cm^2).

Samples of both tube types were subjected to all electrical, sterilization and environmental tests as required by the Jet Propulsion Laboratory specifications for this study. In addition, the tubes were subjected to extensive shelf life tests and active [illegible] tests at high counting rates. All JPL requirements were met successfully by the EON detectors.

Drawings and specifications for both tube types; sketches of test fixtures, including those required for shock and vibration and evaluation test data are included in the report and its appendices.

Author

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

I.

INTRODUCTION & TARGET REQUIREMENTS:

The objectives of this program as summarized from the Scope and Program of the JPL Contract No. 950681 are as follows:

A. To study and empirically prove the feasibility of providing Geiger-Mueller tubes which can be sterilized for applications in space.

B. The contractor shall perform a testing and/or development program to provide heat and gas sterilizable Geiger-Mueller tubes. Two tube types are required - one with a thin wall construction and the other with a thin mica end window.

C. The tubes shall meet all applicable requirements and shall retain their original characteristics after sterilization.

D. Physical Requirements

(The following are re-stated from the Requirements Section of the JPL Statement of Work)

(1) Thin wall counter tube:

Diameter	1" max.
Length	5" max.
Effective cathode wall thickness --	30 mg/cm^2

(2) Mica end window tube:

Diameter	0.344" nom.
Length	2" max.
Window thickness	1.0-1.5 mg/cm^2

E. Electrical characteristic requirements:

(1) Thin wall counter tube

Operating voltage	975v max.
Plateau length	100v min.
Plateau slope	5%/100v max.
Dead time	150 μsec max.
Background due to cosmic rays at sea level	35 c/m max.

(2) Mica end window counter tube

Operating voltage	800v max.
Plateau length	75v min.
Plateau slope	5%/100v max.
Dead time	50 μsec max.
Background due to cosmic rays at sea level	5c/min. max.

F. Sterilization requirements:

(1) Dry Heat: Three cycles - 36 hours each at $145^{\circ} \pm 2^{\circ}C$ in a dry nitrogen atmosphere. After each high temperature run, the tube shall be allowed to stabilize at room temperature.

(2) Gas: 32 hours at $110^{\circ} \pm 10^{\circ}F$ in a gas mixture consisting of 12% ethylene oxide and 88% Freon 12 by weight. Relative humidity shall be between 35 - 90%

G. Environmental requirements:

(1) Static Acceleration

$\pm$ 190g for 20 minutes in each of 3 orthogonal directions.

(2) Vibration

Sinusoidal vibration swept at 1/2 octave/min. as follows:

a)	± 0.5" constant displacement	5-17cps
b)	5g rms	17-50cps
c)	15g rms	50-100cps
d)	35g rms	100-2000cps
e)	wide band noise - 25g rms for 9 min.	15-2000cps

(3) Shock

(5 blows in each direction along each of three axes)

a) ± 200g terminal peak sawtooth - 0.5ms rise time
b) ± 150g terminal peak sawtooth - 5.0ms rise time
c) ± 1000g terminal peak sawtooth - 3.0ms rise time

(4) Thermal

a) 12 days in vacuum at +75°C
b) 4 days in vacuum at -10°C

II.

METHOD OF APPROACH

As a starting point for the development work, it was decided to evaluate the standard EON detectors which most nearly meet the required physical and electrical characteristics. The first of these is a stainless steel, thin wall, halogen self-quenching counter tube known as the Type 5112. The second is a stainless steel, thin mica end window miniature tube, halogen self-quenched and known as the Type 6213.

Data sheets for each of these detectors are shown on Pages 11 and 13.

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

It was proposed to fabricate a number of tubes of each of these tube types utilizing existing methods of chemical processing and exhaust. Each step would be evaluated to determine the normal failure rate. Should the failure rate in any step preclude a reasonable yield, a study of the reason for the failures in this particular step would be made. After modifications were made to eliminate the reasons for the particular failures, a new lot of detectors would then be studied and the cycle begun again until a lot of tubes which satisfies the required specifications would be successfully made.

The reliability analysis would include

1. A review of specifications for all the produced materials
2. A 100% check of all incoming material to make sure that it is in accordance with all EON specifications and drawings.
3. A review of all chemical processing such as cleaning and plating procedures
4. A leak test on the helium Mass spectrometer of all cathodes after machining to ascertain that the thin wall section is vacuum tight and free of any microscopic flaws in the metal.
5. A similar leak detector test of all sub-assemblies and the fully assembled tubes.
6. Another leak test after the tubes were sealed to the exhaust manifold before and after baking.

The finished tubes would, after exhaust and processing, be tested for their electrical characteristics and then be placed on shelf-life for a few weeks. After the shelf life, the tubes would be retested and then subjected to dry heat and gas sterilization, static acceleration and vibration tests according to the test flow diagram as specified by JPL. After each step, the tubes will be visually inspected and electrically tested.

In order to assure that the mechanical re-positioning of the tubes under test with reference to the radiological source remains constant, regardless of how often the tubes are removed from the test fixture, special test jigs for each tube type were designed and fabricated. Each test jig has its radiological source permanently built into it. The distance between the tube under test and the source has been chosen so as to give a counting rate of approximately 100 counts per second.

Originally, it was decided to check three tube parameters after each of the various environmental tests. The parameters chosen were relative plateau slope, background and gamma response.

Tube data is usually taken at a counting rate of approximately 100 counts per second using one minute readings at each test point. As we are dealing with random phenomena, it was

necessary to determine whether changes in counting rate should be attributed to the randomness of the radiation emission or to a permanent change in the tube itself. A statistical analysis showed that by using counting times of 1 minute at counting rates of 100 counts per second, a very substantial error in relative plateau slope could be possible & that longer counting times should be used. It was therefore decided that all counting rate data would be taken at a counting time of 3 minutes.

III.

INITIAL PHASES OF TUBE DESIGN

Among the standard Geiger-Mueller counter tubes manufactured by EON Corporation are two tube types whose electrical and physical characteristics were very similar to those required by JPL. The EON Type 5112 is a stainless steel, thin wall Geiger tube which it was believed would come very close to meeting the JPL requirements for the thin wall counter tube. The EON Type 6213 is an end mica window counter tube which also was believed to almost meet the JPL requirements for the mica end window tube.

For comparison purposes, the characteristics of the EON tubes and the JPL requirements are tabulated in Table 1.

TABLE 1

Comparison of Electrical and Physical Characteristics of the EON 5112 and 6213 Detectors and the Requirements of the JPL Specification

	EON 5112	JPL
Diameter	5/8" max.	1" max.
Length	4-1/4" max.	5" max.
Cathode and thickness	30 mg/cm^2	30 mg/cm^2
Operating voltage	900v	975v
Operating plateau length	100v min.	100v min.
Relative plateau slope	10%/100v max.	5%/100v max.
Dead time	100 μs max.	150 μs max.
Background	35c/min. max.	35c/min. max.

	EON 6213	JPL
Diameter	0.344"	0.344"
Length	1-7/16" max.	2" max.
Window thickness	1.4-2.0 mg/cm^2	1.0-1.5 mg/cm^2
Operating voltage	550v	800v max.
Operating plateau length	75v min	75v min.
Relative plateau slope	20%/100v	5%/100v
Dead time	25 μsec	50 μsec max.
Background	5c/min max	5c/min max.

It is apparent that the major electrical differences between the EON types and the types required by JPL lie in the value of relative plateau slope. JPL specifications require a much lower value of relative plateau slope than is normally available for commercial tubes. Although it was known that

it would not be possible to do better than 10% per 100v for the 5112 and 20% per 100v for the 6213 without major changes in design and gas fill of the two tubes, the initial electrical and sterilization tests were made with these tube types.

Tube Type 5112 - Fig. 1

This radiation detector tube is fabricated entirely of Sealmet HC-1 stainless steel and utilizes Fosterite ceramic for the insulators. The insulators are fused to the stainless steel by using a powdered glass technique. A specially formulated glass frit is suspended in distilled water and the suspension is then applied to the boundaries of the insulator and the stainless steel and fused at high temperatures. The result is a thermally matched fused seal which operates over a very wide temperature range and can safely be operated at temperatures up to 300°C without devitrification. We therefore did not expect any difficulties with the tube envelope or the metal to ceramic glass seals from a temperature point of view. This was not the case with the halogen quench. In this tube type, Chlorine is used as the quenching gas. Chlorine reacts violently with steel at elevated temperatures. To reduce the chemical reaction between the gas and the steel envelope at the required operating temperature, the cathode and other exposed metal parts are plated with a noble metal which is not attacked by the halogen gas.

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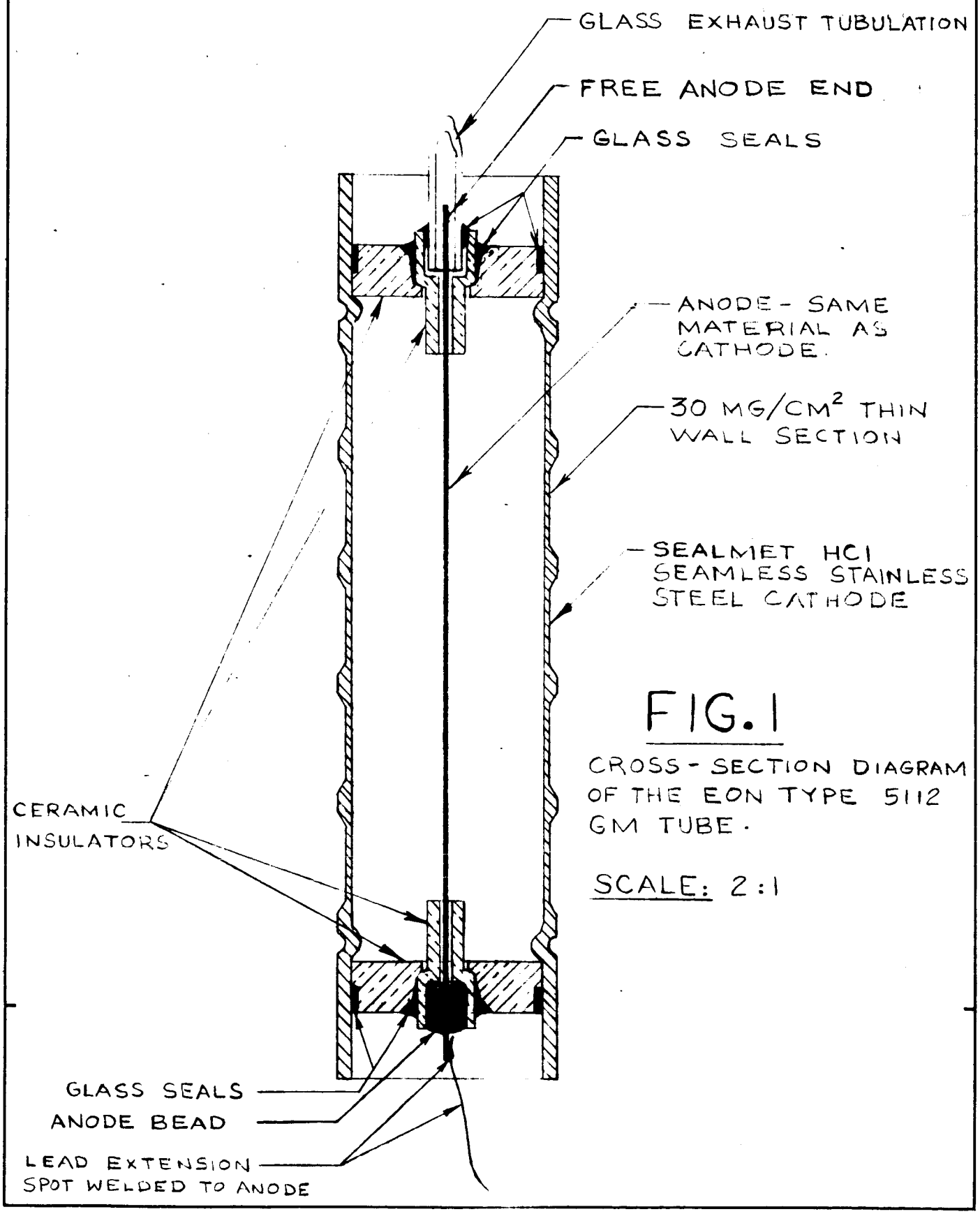


FIG. 1

CROSS-SECTION DIAGRAM OF THE EON TYPE 5112 GM TUBE.

SCALE: 2:1

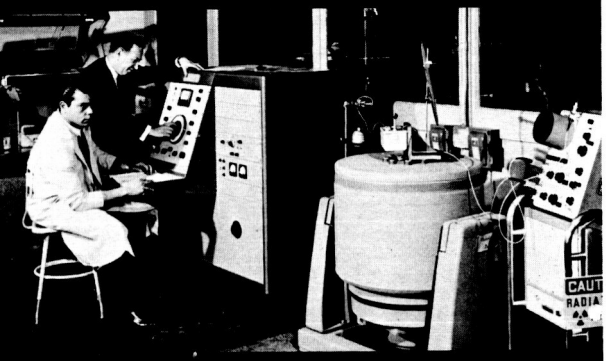
EON
CORPORATION

175 PEARL STREET □ BROOKLYN 1, N.Y.

ULSTER 8-0250

ACTUAL SIZE X 1½

250 KV CONSTANT POTENTIAL X-ray machine



Vibration: 5-10,000 cps

Partial Groupings of **ENVIRONMENTAL FACILITIES** which enable EON to meet all your environmental test requirements.

Shock: 0-2000 g's

Temperature: —100 F to +350 F
Humidity: 95% RH
Altitude: 0-200,000 ft.

COUNTER TUBE
BETA • GAMMA

5112

METAL THIN WALL, SINGLE PRONG BASE

DESCRIPTION

The EON 5112 is a sturdy, stainless steel, thin wall halogen self-quenching counter tube which has been utilized in great quantities in low cost uranium prospecting and portable radiological survey and monitoring equipments. It was designed to replace conventional thin wall glass and aluminum organic self-quenched tubes which were too perishable and fragile for these applications. The 5112 is stable, exhibits no photosensitivity or hysteresis; and will not be damaged by over voltage or exposure to very high intensity radiation.

Beta, gamma energy response characteristics are given on the reverse side. These characteristics are unaffected by temperature changes within the range —55°C to +75°C.

See Appendix for application notes, performance nomographs and tables.

OPERATING CHARACTERISTICS

Recommended Operating Voltage:	900	Volts
Operating Plateau Length*, at 100 counts/sec.:	100	V. Min.
Relative Plateau Slope*, averaged for 100 volt interval at approx. 100 counts/sec.:	.10	%/V. Max.
Starting Voltage**:	830	V. Max.
Pulse Amplitude† (circuitry same as for Starting Voltage) when operating at approx. 900 volts Note: The pulse amplitude is substantially constant for values of series resistance from 1-20 megohms. The pulse amplitude increases linearly (approx.) with increase in overvoltage within the voltage interval over which the relative plateau slope is averaged.	5	V. Min.
Conventional Dead Time at Recommended Operating Voltage (series resistor=1 megohm)	approx. 100	microsec.
Maximum Counting Rate (assuming 100 microsecond dead time)	approx. 10,000	counts/sec.
Efficiency of Detection of Very Fast β-Particles and Cosmic Rays:	approx. 85	%
Photosensitivity and Hysteresis:	None	
Background at Recommended Operating Voltage (shielded by 1/4" Alum. inside 2" Lead):	35	counts/min. Max.
Operating Temperature Range:	—55°C to +75°C	
Capacity:	3.0	micromicrofarads
Life: unaffected by operation	Covered by Warranty A	See Appendix
Cathode Material:	stainless steel: 28% chromium—72% iron	
Effective Cathode Dimensions:	.726" inside diameter x 2 15/16"	
Effective Cathode Thickness:		
portion of surface.....30 mg./sq. cm.	80	%
portion of surface.....230 mg./sq. cm.	20	%

* Measured with scaler having a resolving time of 5 microseconds; series resistor = 1 megohm; coupling capacitor = 50 micromicrofarads.

** Starting Voltage for this tube is that voltage at which uniform pulses of 1 volt amplitude appear across a 1 megohm series resistor (50 micromicrofarads coupling capacitor).

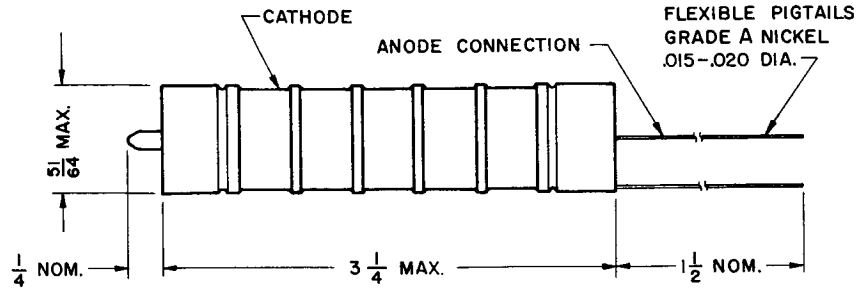
† Peak Voltage which appears across 1 megohm series resistor.

TECHNICAL INFORMATION

The EON 5112 detector has been adapted to many unusual applications, both industrially and in the laboratory where the larger sensitive cathode surface proves valuable.

Many have been utilized in satellite experiments. Since the environmental conditions of many of these applications preclude the use of the plastic base and cap, EON will, upon request, supply this detector as shown in the adjacent outline drawing.

Other special adaptions and sensitive lengths can also be supplied upon request.



NOTE: OTHER DETAILS SAME AS STANDARD 5112 TUBE

GAMMA RESPONSE:

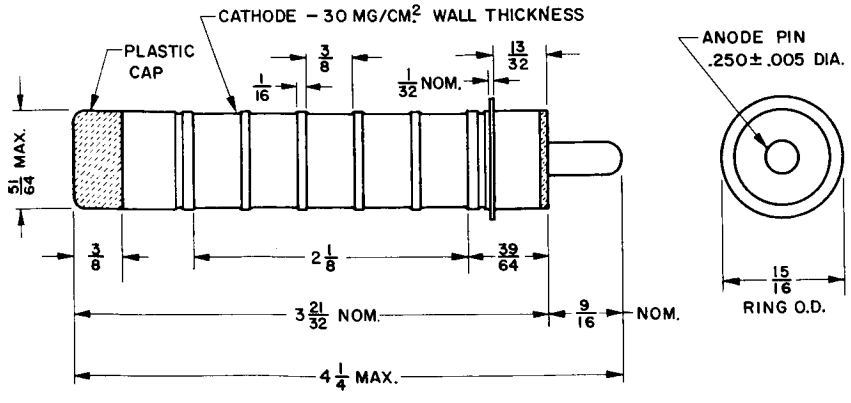
Tabulated (right) as a function of gamma (and X-ray) photon energy is the number of secondary electrons (computed) which will emerge into the sensitive volume of the EON Type 5112 counter tube per square centimeter of counter tube wall for a normally incident gamma photon flux of 1000 photons per square centimeter.

The 5112 gamma response may be computed by integrating these tabulated values over the effective cathode area (see Operating Characteristics). The response for other photon energies may be computed using the formulae given in the Appendix.

Energy of γ Photon	No. of Sec. Electrons Sect. of wall 30 mg./cm² thick	No. of Sec. Electrons Sect. of wall .012" (230 mg./cm²) thick
.08 mev	1.94	1.73
.10 mev	1.63	1.50
.20 mev	1.35	1.39
.30 mev	1.39	1.64
.40 mev	1.41	1.87
.50 mev	1.41	2.12
.60 mev	1.38	2.34
.70 mev	1.35	2.54
.80 mev	1.32	2.78
.90 mev	1.27	2.93
1.0 mev	1.27	3.13
1.1 mev	1.24	3.28
1.3 mev	1.19	3.55
1.5 mev	1.18	3.91

With essentially flat geometry and close proximity of the source to the window, computed beta particle transmission for the 5112 will be:

Energy of Particle	Source	30 mg./ sq. cm.	230 mg./ sq. cm.
.050 mev	E_{av} of Carbon^{14}	—	—
.155 mev	E_{max} of Carbon^{14}	1.4%	—
.167 mev	E_{max} of Sulphur^{35}	2.1%	—
.254 mev	E_{max} of Calcium^{45}	9.1%	—
.29 mev	E_{max} of Technetium^{99}	12.2%	—
.335 mev (9.3%)	E of Iodine^{131}	17.0%	—
.608 mev (87.2%)		41.7%	.1%
.815 mev (0.7%)		53.3%	.8%
.61 mev	E_{max} of Strontium^{90}	41.7%	.1%
.695 mev	E_{max} of Krypton^{85}	45.8%	.2%
.714 mev	E_{max} of Chlorine^{36}	47.2%	.32%
1.701 mev	E_{max} of Phosphorus^{32}	75.2%	11.2%



EON SPEC
NO. 214-6-62

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

The anode in this tube is fused directly to the ceramic insulator which terminates one end of the tube. The opposite end of the anode is centered in a boss which is part of the ceramic insulator which terminates the opposite end of the tube. This type of construction does not permit maintenance of the accurate centering of the anode under severe environmental conditions nor does it permit placing the anode under tension to avoid possible sag.

Altogether 52 tubes of this construction were fabricated of which four tubes were broken accidentally - two on exhaust and two when clamping in the vibration jig. Thirty tubes were subjected to all tests as specified by JPL except for the high rise time shock and wide band noise test. Twenty tubes were subjected to dry heat and sterilization tests, acceleration and vibration tests only.

The electrical test data consists of three minute readings of three points on the plateau and measurement of the background count. The plateau points chosen for this tube type were 900, 950 and 1000 volts. The 950 volt point is also the gamma sensitivity test point. The relative plateau slope was calculated from these three points.

The test data for these tubes which was attached to the monthly progress reports showed, however, great variations in the value of plateau slope and relatively high background counting rates. The average relative plateau slope was 9%/100 volts and the average background 39 counts per minute.

An important factor which contributes appreciably to the slope of a Geiger-Mueller tube is the concentricity of the anode relative to the cathode. Other factors for improvement of slope and length of operating plateau are the nature of the gas fill and the gas fill pressures. These tubes utilize mixtures of noble gases such as Neon and Argon with an admixture of a halogen such as Chlorine. Substantial improvements can be achieved by suitably varying the proportions of these components.

It was therefore decided to modify the present tube design and change gas mixtures in order to obtain more uniform distribution of background counting rates and flatter plateaus (5%/100v). A description of the modifications and the resulting test results is given in Section 2.

Tube Type 6213 - Fig. 2

This tube type also uses a Sealmet HC-1 stainless steel cathode and a Fosterite ceramic insulator. The anode is mechanically crimped to an anode support which is sealed to

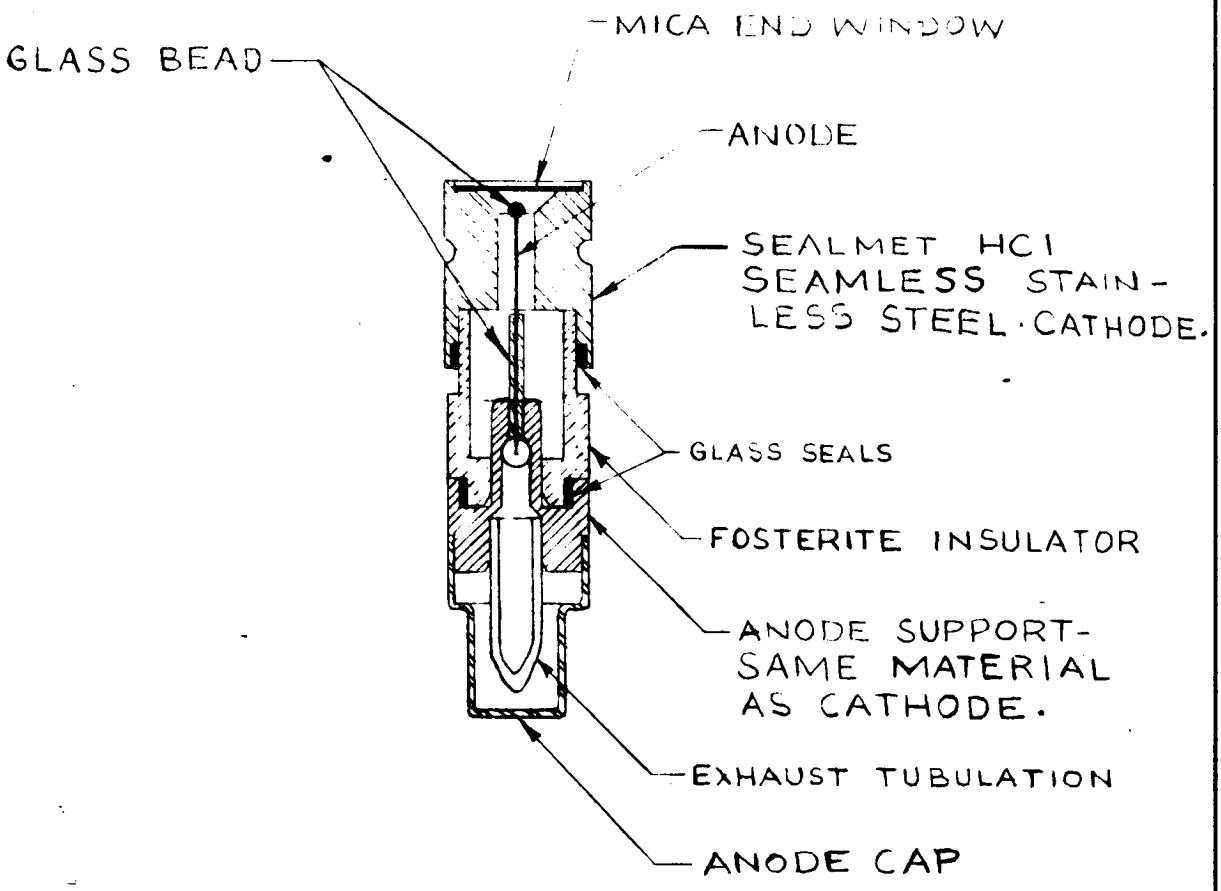


FIG. 2

CROSS-SECTION DIAGRAM OF EON TYPE 6213 GM TUBE.

SCALE: 2:1

EON CORPORATION

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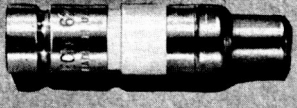
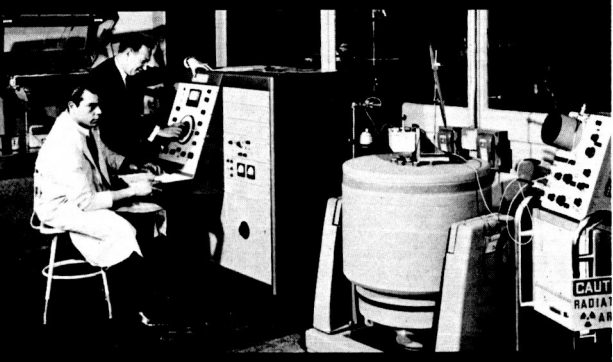
ULSTER 8-0250

ACTUAL SIZE X 4



ACTUAL SIZE

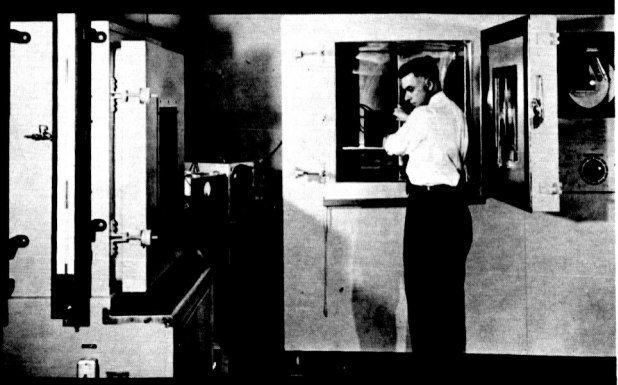
250 KV CONSTANT POTENTIAL X-ray machine



Vibration: 5-10,000 cps

Partial Groupings of ENVIRONMENTAL FACILITIES which enable EON to meet all your environmental test requirements.

Shock: 0-2000 g's



Temperature: −100 F to +350 F
Humidity: 95% RH
Altitude: 0-200,000 ft.

COUNTER TUBE

ALPHA • BETA • GAMMA

6213

THIN END MICA WINDOW, MINIATURE, SELF-QUENCHING (HALOGEN)

DESCRIPTION

The EON 6213 is a satellitized alpha, beta, gamma detector designed to provide precise quantitative measurements of radioactivity over wide ranges of counting rate. The 6213 is an improved version of the high level detector utilized in the original satellite surveys of the Van Allen belts.

It is filled with a spectroscopically pure noble gas plus halogen admixture; operates in the Geiger region, and cannot be damaged by over voltage.

Computed alpha, beta and gamma energy response characteristics are given on the reverse side. These characteristics are not affected by temperature changes within the range of −55°C to +75°C.

See Appendix for application notes, performance nomographs and tables.

OPERATING CHARACTERISTICS

Recommended Operating Voltage:	550	Volts
Note: Upon request this tube can be supplied to operate within the range 500-700 volts. Unless a special operating voltage is requested when ordering, a standard tube will be supplied.		
Operating Plateau Length*, at 100 counts/sec.:	75	V. Min.
Relative Plateau Slope*, averaged for 75 volt interval at approx. 100 counts/sec.:	.20	%/V. Max.
Starting Voltage**:	525	V. Max.
Pulse Amplitude† (circuitry same as for Starting Voltage) when operating at 550 volts	50	V. Min.
Note: The pulse amplitude is substantially constant for values of series resistance from 1-20 megohms. The pulse amplitude increases linearly (approx.) with increase in overvoltage within the voltage interval over which the relative plateau slope is averaged.		
Conventional Dead Time at Recommended Operating Voltage (series resistor=1 megohm)	approx. 25	microsec.
Maximum Counting Rate (assuming 25 microsecond dead time)	approx. 40,000	counts/sec.
Efficiency of Detection of Very Fast β-Particles and Cosmic Rays:.....	approx. 85	%
Photosensitivity and Hysteresis:	None	
Background at Recommended Operating Voltage (shielded by 1/4" Alum. inside 2" Lead):	5	counts/min. Max.
Operating Temperature Range:	−55°C to +75°C	
Capacity:	1.5	micromicrofarads

Life: unaffected by operation ..... Covered by Warranty A See Appendix

Cathode Material: .....stainless steel: 28% chromium—72% iron

Effective Cathode Dimensions: .....093" inside diameter x .300" long

Effective Cathode Thickness:..... .125"

Connector: Anode Terminal is standard JEDEC miniature terminal for which commercial connectors are available.

*Measured with scaler having a resolving time of 5 microseconds; series resistor = 1 megohm; coupling condenser = 50 micromicrofarads.

**Starting Voltage for this tube is that voltage at which uniform pulses of 1 volt amplitude appear across a 1 megohm series resistor (50 micromicrofarads coupling condenser).

†Peak Voltage which appears across 1 megohm series resistor.

TECHNICAL INFORMATION

The EON 6213 counter tube is the outgrowth of development work to produce a detector for high level gamma measurements. The mica window, combined with the design of the cathode, makes it possible for beta radiation to enter the small sensitive volume. Very high counting rates can therefore be obtained with relatively weak beta sources to simulate high gamma fields for operational and calibration check of the detector and its complete system by means of weak beta sources. This simulation technique has become a standard design requirement in high level gamma monitoring systems.

These tubes can be used in vacuum or at moderately high pressures where changes are not abrupt. For applications where pressures are in hundreds of pounds or where pressure changes are sudden, the 6213 can be supplied with ceramic end windows. The two versions are electrically and mechanically interchangeable.

The 6213, because of its thin mica window, is very useful in the measurement of high intensity soft alpha and beta fields. Its miniature size and minimal weight make it ideally suitable for applications where space and weight are at a premium.

The 6213 meets the applicable military requirements of shock and vibration and is impervious to corrosion from sale spray. The use of precision molded ceramic insulation yields tubes which have uniform dimensions, are mechanically strong, and uniform from tube to tube. The thin mica window is sealed to the cathode by means of a permanent vacuum-tight, fused glass seal which, with other design and processing features, insures unchanged characteristics throughout the life of the tube.

GAMMA RESPONSE:

Tabulated (right) as a function of gamma (and X-ray) photon energy is the number of secondary electrons (computed) which will emerge into the sensitive volume of the EON Type 6213 counter tube per square centimeter of counter tube wall for a normally incident gamma photon flux of 1000 photons per square centimeter.

The 6213 gamma response may be computed by integrating these tabulated values over the effective cathode area (see Operating Characteristics). The response for other photon energies may be computed using the formulae given in the Appendix.

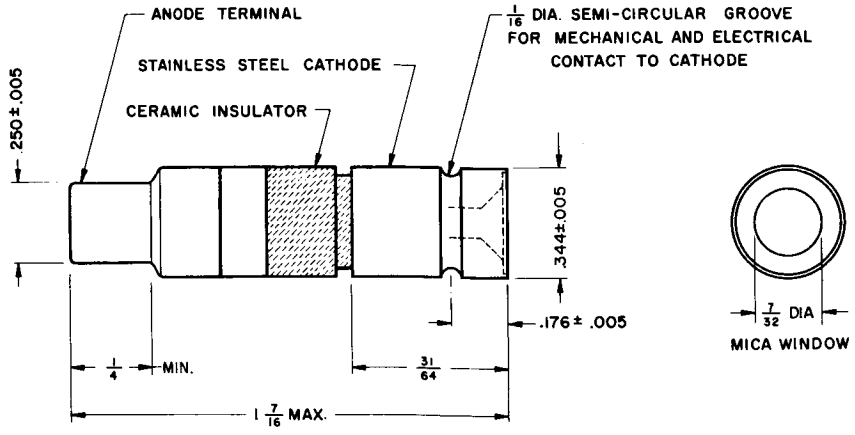
Energy of γ Photon	No. of Sec. Electrons
.08 mev	.480
.10 mev	.640
.20 mev	1.000
.30 mev	1.270
.40 mev	1.520
.50 mev	1.790
.60 mev	1.980
.70 mev	2.220
.80 mev	2.420
.90 mev	2.630
1.0 mev	2.850
1.1 mev	3.040
1.3 mev	3.420
1.5 mev	3.870

The mica windows of the 6213 will pass alpha particles as follows (computed):

Window Thickness	α Initial Kinetic Energy	α Mean Range in Air
1.4 mg./sq. cm.	greater than 1.9 mev	greater than 1.0 cm.
2.0 mg./sq. cm.	$>$ 2.6 mev	$>$ 1.5 cm.

With essentially flat geometry and close proximity of the source to the window, computed beta particle transmission will be:

Energy of Particle	Source	1.4 mg./ sq. cm.	2.0 mg./ sq. cm.
.050 mev	E_{av} of $Carbon^{14}$	48.0%	36.0%
.155 mev	E_{max} of $Carbon^{14}$	82.0%	75.0%
.167 mev	E_{max} of $Sulphur^{35}$	83.6%	77.4%
.254 mev	E_{max} of $Calcium^{45}$	89.4%	85.2%
.29 mev	E_{max} of $Technetium^{99}$	90.7%	87.0%
.335 mev (9.3%)	E of $Iodine^{131}$	92.1%	88.9%
.608 mev (87.2%)	E of $Iodine^{131}$	95.9%	94.2%
.815 mev (0.7%)	E of $Iodine^{131}$	97.1%	95.9%
.61 mev	E_{max} of $Strontium^{90}$	95.9%	94.2%
.695 mev	E_{max} of $Krypton^{85}$	96.4%	94.9%
.714 mev	E_{max} of $Chlorine^{36}$	96.6%	95.1%
1.701 mev	E_{max} of $Phosphorus^{32}$	98.7%	98.1%



one end of the ceramic insulator. This sub-assembly is then sealed to the cathode. The final assembly step consists in sealing the mica window to the cathode. All seals are made utilizing the powder glass technique discussed previously.

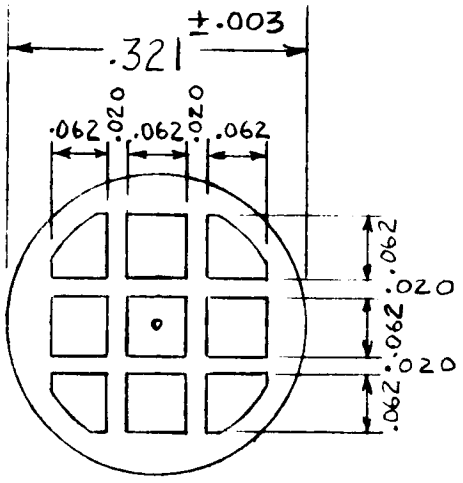
Some difficulties were anticipated with this tube design as far as meeting the JPL specifications are concerned.(1)The steepness of the plateau slope results in great part from the internal design of the tube. The ratio of length of cathode to diameter is very poor for a low value of plateau slope - optimum is of the order of 4-5. In the 6213 this ratio is 2.7.

(2) The small diameter anode (.012) is supported at one end utilizing a cantilever suspension. Therefore the anode cannot be maintained in tension because the end mica window is at the opposite end making it impossible to provide an additional point of support at the window end. It is therefore possible to have the anode off center and not concentric with the cathode over its entire length. This eccentricity also contributes importantly to high plateau slope.

(3) The problem of the end mica window itself meeting the requirements of operation in a vacuum environment. Unless steps are taken to prevent reversal of the curvatures of the window as the external atmosphere pressure is removed (as would be the case when the tube is caused to operate in a vacuum) the mica may fracture. Repeated flexing also may bring about a failure as a result of fatigue which is further aggravated by separation of adjacent crystals of mica.

Altogether 34 tubes of this tube type were fabricated. The plateau test points chosen were 550, 600 and 650 volts. The 600 volt point was also the gamma sensitivity test point. The plateau slope was calculated from these three points. The tubes were subjected to three dry heat and one gas sterilization cycle. Out of this lot nine tubes were lost during the gas sterilization cycle. An investigation of the failures indicated that many mica windows had been damaged. The windows were broken on some tubes; on others, the windows were cracked. It was established that most of the windows had been damaged when the gas sterilizer was evacuated. It was, therefore, decided to modify the tube design and provide a strong back for the window made out of 1/2mil stainless steel. This material was chosen so as to be thermally compatible with the mica, the cathode and the glass seals of the detector. A chemical milling technique is used to etch these sub-miniature strongbacks. This technique not only produces a reinforcement member without burrs and sharp edges but also enables us to control the dimensions of the strongback.

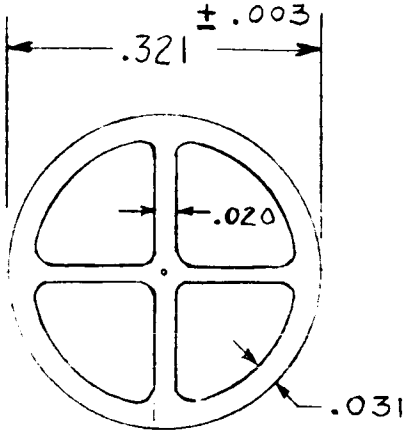
Two different designs of strongback are available. They differ only by the percentage transmission - see Figs. 3 & 4. One design (Fig. 3) consists of two crossbars having a width of 0.020". The crossbars form part of a ring the dimensions of



OPEN AREA = 62%

"STRONGBACK" MATERIAL - SAME AS FIG. 3

FIG. 4



OPEN AREA = 80%

"STRONGBACK" MATERIAL: HC-1 SEALMET STAINLESS STEEL .0005 THICK

FIG. 3

SCALE - 5:1

which match the outside and inside dimensions of the mica window seat. The other design (Fig. 4) consists of a mesh design.

The average value of the plateau slope was greater than 20% per100v and therefore, far in excess of the JPL specification. As mentioned previously the steep slope was due to the poor geometry, i.e. small rate of length to diameter of the sensitive length. It was, therefore, suggested to JPL that the Type 6213 be replaced by a tube which was slightly larger than the 6213, was ruggedized and had geometry more nearly equal to the optimum. This new tube type was similar to the 6222R - see Fig. 5.

Tube Type 6222R - Fig. 5

This tube type also utilizes a stainless steel cathode, a Fosterite ceramic insulator and an anode support. The anode is crimped in the anode support. For additional support and centralization, it was proposed that a ceramic yoke be located within the cathode, as shown in Fig. 5.

Fifteen tubes of this design were fabricated. Eight tubes had the crossbar strongbacks and seven tubes had the mesh design strongbacks.

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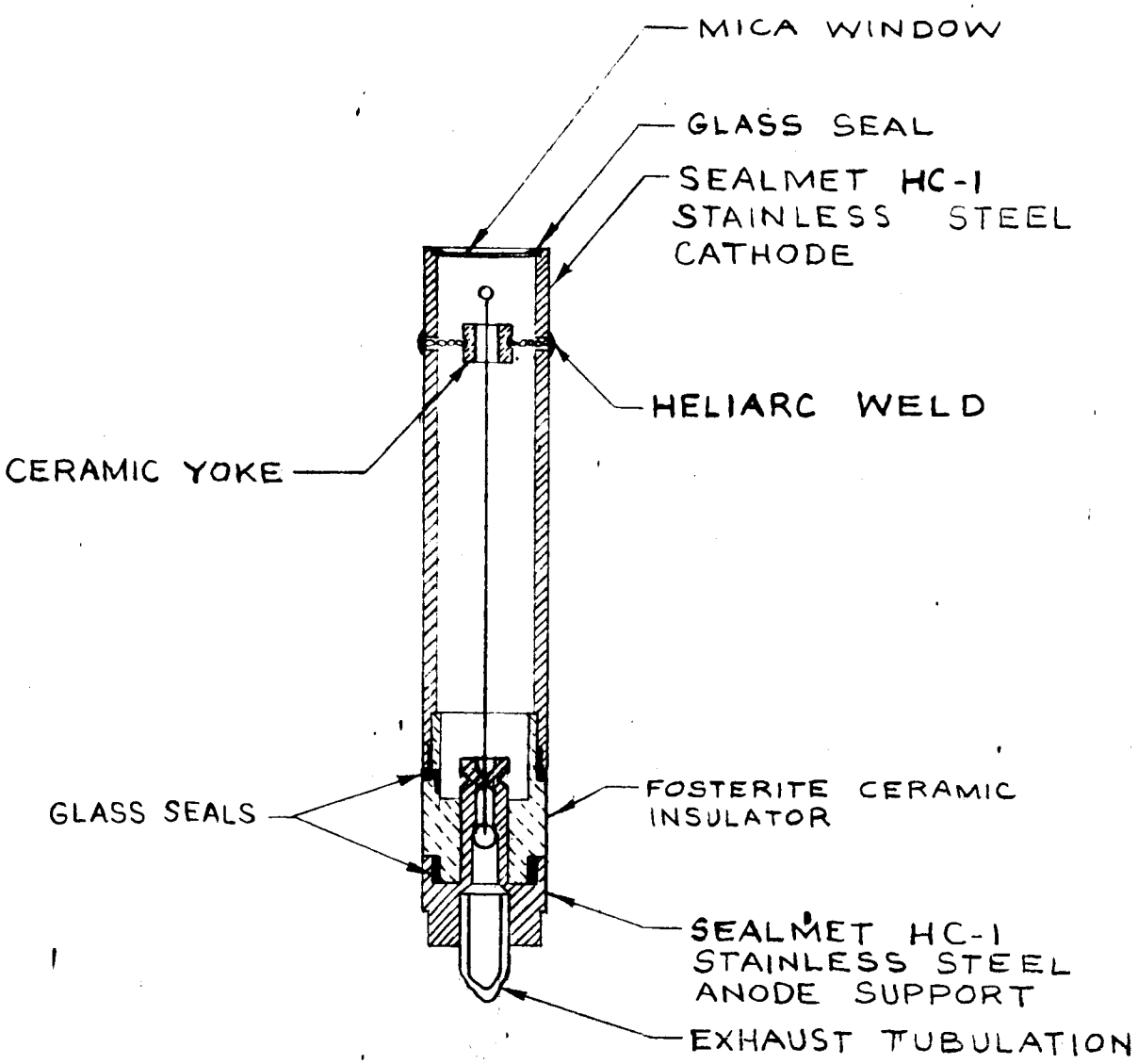

FIG. 5 SCALE 2:1

RUGGEDIZED END MICA WINDOW GM TUBE

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

After performing the necessary electrical tests, all tubes were placed in the gas sterilization chamber and remained there for 36 hours. After sterilization no appreciable differences in counting rates, plateau slopes and backgrounds were found when the test results were compared with the initial results. Four of these tubes were then subjected to vibration tests. Two passed these tests; two tubes showed changes in their electrical characteristics after the 35g, 100-2000cps test. Visual inspection of these two tubes showed a marked distortion of that section of the anode wire which protrudes beyond the supporting ceramic yoke - see Fig. 6. Due to this distortion, and the resulting eccentricity of the anode, the plateau slope increased considerably. It was also found that the plateaus were initially not as flat as had been anticipated. The average plateau slope of these tubes was 15.9%. We believe that the reasons for the steep plateau were twofold. First the end of the anodes and the metal strongbacks were too close together, thus increasing very rapidly the end effect as a function of increased anode voltage; and secondly, because of the ruggedizing ceramic yoke, the sensitive length of the anode was reduced.

It was therefore decided to revise the Type 6222R by increasing the distance between window and anode, reducing the length of the supporting ceramic and reducing the size of the glass bead at the end of the anode to a minimum.

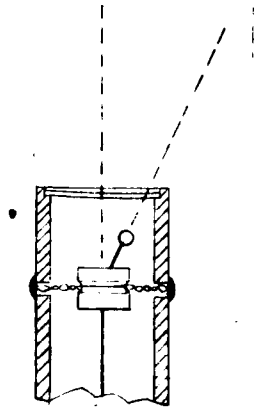

FIG. 6

DIAGRAM SHOWING HOW RUGGEDIZED TUBE OF FIG. 5 FAILED IN VIBRATION.

An experimental batch consisting of 9 tubes of the revised version of this tube type was made. The tubes were tested for their electrical characteristics and five of the tubes were subjected to vibrations of 100-2000 cps and 35g.

The analysis of the test results of the revised version showed a better mechanical performance but no marked improvement of the plateau slope was obtained. In order to meet the JPL specifications, a completely new tube type had to be developed. Description of this new type and the test results will be discussed in the next section.

IV.

FINAL TUBE DESIGN AND CONSTRUCTION

5112R - Fig. 7

As a result of tests described in the previous section, it was decided that it would be necessary to effect major modifications in the design of this tube in order to arrive at a suitably ruggedized tube.

The modification consisted of a re-design of both ceramic insulators, adding an anode support and putting the anode in tension. The cathode and the exterior dimensions remained the same.

The re-design of the tube permitted a most perfect concentricity of the anode with respect to the cathode. The ceramic insulator which accepts the exhaust tubulation has a centralizing hole for the anode and two additional holes which permit exhaust of tube and also serve as entrance ports for the gas fill. The anode wire is provided at one end with a small ball for anchoring in the centralizing hole in the ceramic insulator. After both insulators are sealed to the cathode, the anode is inserted into the centralizing hole and the anode support;while maintaining the anode wire in tension, the anode support is crimped and sealed off by heliarc welding. The tubes are then leak tested and sealed to the exhaust manifold. Proper tension is given by a 5 lb. weight.

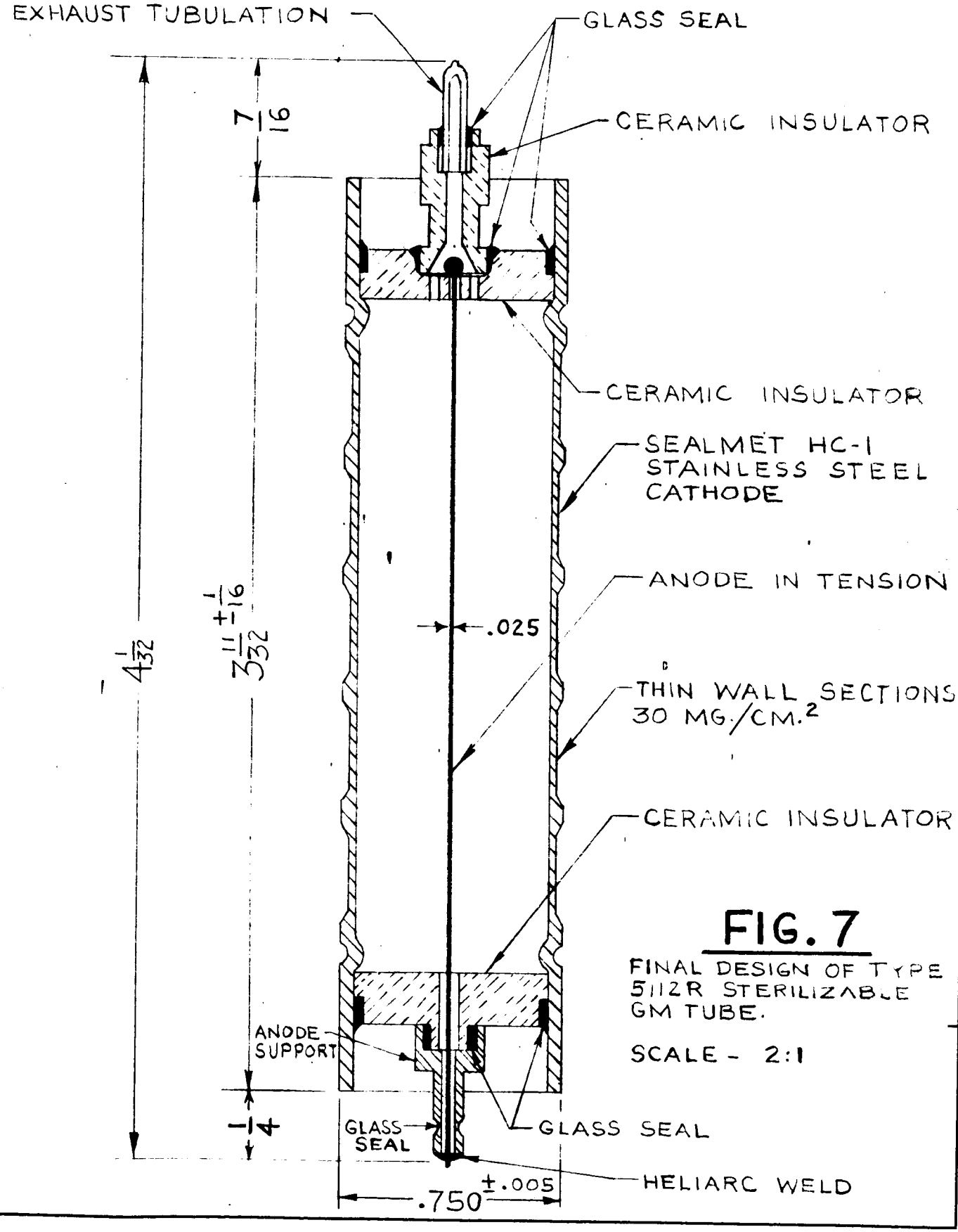

FIG. 7

FINAL DESIGN OF TYPE 5112R STERILIZABLE GM TUBE.

SCALE - 2:1

Altogether 35 tubes of this tube type were made. Some were tested for electrical characteristics only; others were subjected to all specified tests except for the high rise time shock tests and wide band vibration. Ten tubes were selected at random and subjected to all specified tests. All tubes passed their respective tests.

Out of the lot of 35 tubes, five were lost; three tubes were accidentally damaged in handling and two tubes went into discharge as a result of a shift in the plateau. The average plateau slope of the tubes of this construction improved considerably as compared to the slopes of the previous construction. The attached test data indicates a minimum variation in counting rates and general lowering of the background count.

6226 - Fig. 8

To fulfill the requirements of this contract with reference to a 5% plateau slope, a new tube design was developed. The outside dimensions of the new type were kept identical to the dimensions of Type 6222R. The anode dimensions and the filling mixture were changed. Extensive investigation was made to determine the optimum gas mixture for the new anode-cathode construction. The ruggedization of this type was achieved by using a heavy anode which is crimped into the

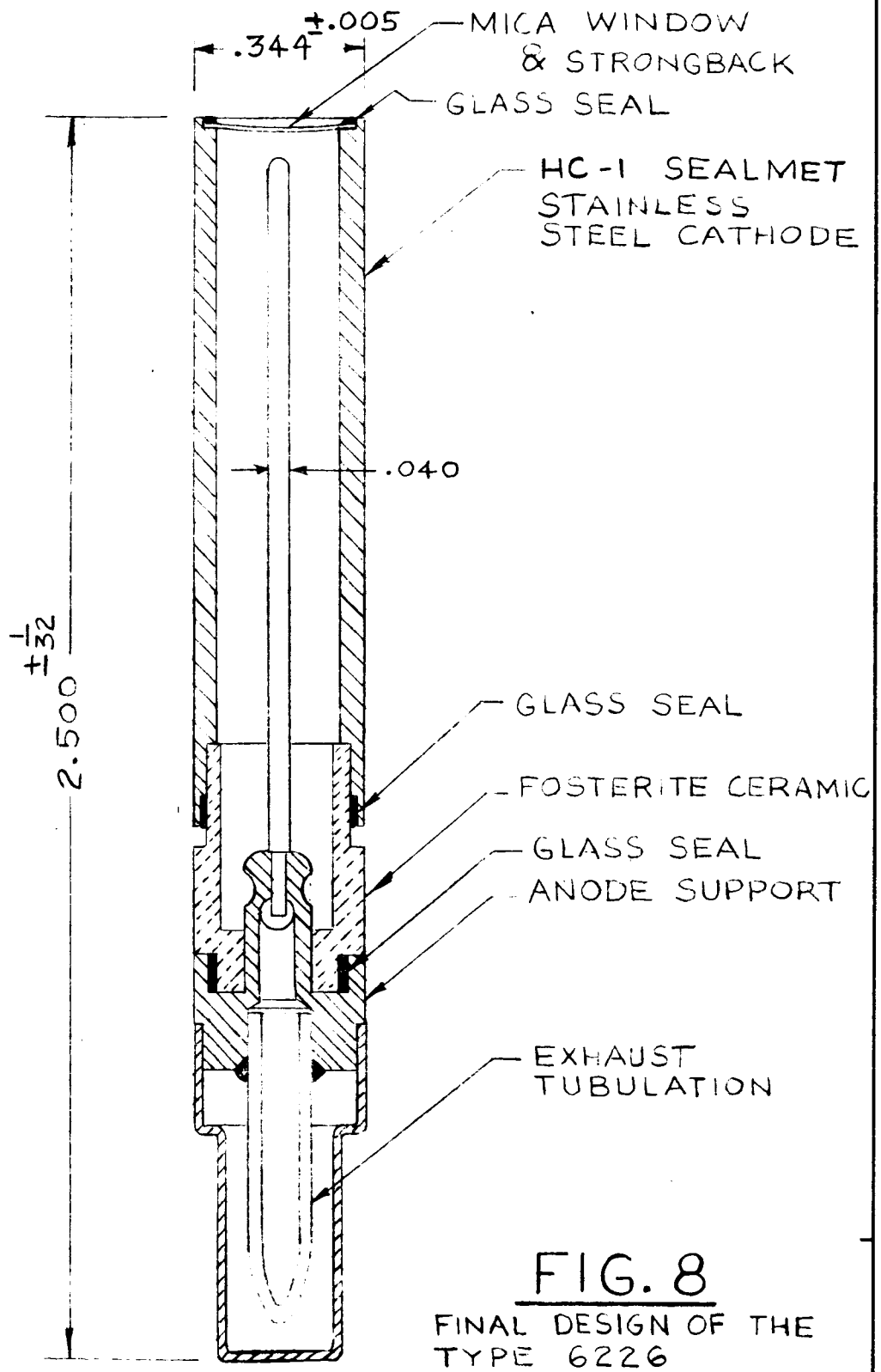

FIG. 8

FINAL DESIGN OF THE TYPE 6226 STERILIZABLE GM DETECTOR.

anode support. In spite of the cantilever suspension of the anode, no problems on vibration and shock were encountered because of the use of the large diameter anode. Preliminary tests performed with tubes having this new structure showed excellent mechanical and electrical results. The plateaus were flat and within JPL specifications. The background also was very low.

Altogether 20 tubes of this tube type were made. Three tubes were lost initially because of a shift in the plateau during the three dry heat sterilization cycles. Twelve tubes were successfully subjected to all tests as specified by the JPL specifications. The test results are discussed in a subsequent section.

V.

Specifications

The final specifications developed for the Types 5112R and the 6226 detectors are supplied in this section.

The specifications have been prepared in the MIL format so as to take advantage of the established test methods and procedures which have already been developed and standardized by the Services for similar detectors. The specifications, as written, are suitable for procurement purposes.

The testing of the prototype tubes whose method of fabrication was described previously in this report, has been performed in accordance with these specifications. Test results are given in following sections.

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

INDIVIDUAL MILITARY SPECIFICATION SHEET

(Note 1)

ELECTRON TUBE, RADIATION COUNTER, GEIGER-MUELLER, HIGH SENSITIVITY, BETA-GAMMA, HALOGEN, SELF-QUENCHING, METAL THIN WALL, RUGGEDIZED, STERILIZABLE

EON 5112R

Ratings:	Operating Voltage Vo	Rp Meg
absolute Maximum:	1000	---
Minimum:	900	1.0
Test Cond.: (Note 2)	950	1.0

Dimensions: Per Outline

**Cathode: Sealmet PRC-1 stainless steel material

Ref.	Test	Conditions	Min.	Max.
3.1	Qualification Approval:	Required for JAN marking		
3.7.4	Marking:			
3.7.6	Additional Marking:8	Note 3		
4.5	Holding	Note 11 t=60 days	Note 12	
4.19.1.1.1	Background & Contamination:	t=2 minutes Note 5	N/t:--	35 Npm
4.19.1.1.2	Photosensitivity	t=2 minutes	N/t:--	20 Npm
4.19.1.2	**Leakage Current	Vo=500 Vdc	L1b:--	0.5 µAdc

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

Ref.	Test	Conditions	Min.	Max.
4.19.2.2.1.1	Relative Plateau Slope:	Voltage range= 900-1000 Vdc Note 5	Ps:---	0.075%/V
4.19.2.2.1.3	Plateau length		Pl:100	---Vdc
4.19.2.3.1	Gamma Response	t=2 minutes Note 7	N/t:7000±15%	cpm
4.19.2.4	Pulse Amplitude	Vo=950 Vdc Nps/eg:= 200 max Rp=1.0 megohm	e_o:5	---Vdc
	**Conventional Dead Time	Rp=1.0 megohm Coupling Capacitor = 50 uuf Vo=950 Vdc Note 8	t_d:--	150 μsec
	*Dry Heat Sterilization	Note 15	Note 4	
	*Gas Sterilization	Note 16	Note 4	
	*Thermal, Vacuum(1)	T=75°C t=288 hours Test Chamber Pressure - 0.3" Hg	Note 4	
	*Thermal-Vacuum(2)	T= -10°C t= 96 hours Test Chamber Pressure - 0.3" Hg	Note 4	
	*Static Acceleration	a= 190g t= 20 min. Notes 9,13	Note 4	
	*Vibration(1)	Notes 9,10,14	Note 4	
	**Vibration(2)	Notes 9,10,17	Note 4	

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

Ref.	Test	Conditions	Min.	Max.
	*Shock (1)	Notes 9,10,18 ± 200g terminal peak sawtooth; 0.5 millisecond rise time	Note 4	
	**Shock (2)	Notes 9,10,18 ± 150g terminal peak sawtooth; 5.0 millisecond rise time	Note 4	
	**Shock (3)	Notes 9,10,18 ± 1000g terminal peak sawtooth; 3.0 millisecond rise time	Note 4	

Note 1: The requirements and tests of Specification MIL-E-1D shall apply except as otherwise required herein..

Note 2: Tests may be made in any sequence.

Note 3: Each tube is to have an individual serial number which shall be legibly punched or engraved into the cathode.

Note 4: Criterion for passing this test shall be compliance after test of at least 80% of the tubes with the following requirements:

(1) Gamma response - initial limits

(2) Relative plateau slope - initial limits - $\pm$ 0.02%/V

(3) Background and contamination - initial limits

Note 5: In determining tube response (count rate) Vo=950 Vdc and Rp=1 meg. Tube count rates shall be determined using a scaler having a resolving time of 5 mirco-seconds and a discrimination level of one volt.

Note 6: The tube shall be exposed to radiation from a General Electric 15-watt germicidal lamp and a General Electric 15-watt fluorescent lamp, or equivalent.

Note 7: The gamma response excitation test fixture in accordance with EON drawing SK146-1004.

Note 8: Use power supply and scope of Pulse Amplitude Test.

Note 9: Acceleration and/or vibration and/or shock shall be applied as follows:

(1) parallel to long axis of tube

(2) perpendicular to long axis of tube

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Note 10: Test shall be performed utilizing fixture in accordance with EON Drawing No. SK 146-1030.

Note 11: Tests in Note 12 are to be performed sixty (60) days after initial performance of all production tests.

Note 12: Tube shall meet the initial acceptance requirements for background and contamination; gamma response and relative plateau slope.

Note 13: Test shall be performed utilizing fixture in accordance with EON Drawing No. SK 146-1043

Note 14: A sinusoidal vibration swept at 1/2 octave per minute

(i) $\pm$ 0.5 inch constant displacement, 5-17 cps.

(ii) 5 g rms, 17-50 cps

(iii) 15 g rms, 50-100 cps

(iv) 35 g rms, 100-2000 cps

Note 15: (A) The tubes shall be placed in a chamber provided with a dry nitrogen atmosphere and the temperature raised to and maintained at 145°C $\pm$ 2°C for 36 hours.

(B) Upon completion of the process described above, the tubes shall be removed from the chamber and allowed to stabilize at room conditions.

(C) This procedure shall be performed a minimum of three (3) times on each unit.

(D) After stabilization at room conditions, the units shall be energized and tested. The tubes shall be examined for deleterious effects such as cracking, softening and discoloration.

Note 16: A) The tubes shall be placed in a chamber and allowed to stabilize at $110^{o} \pm 10^{o}$F. The gas mixture (12% ethylene oxide and 88% Freon 12, by weight) shall then be introduced into the chamber. Sufficient water vapor must be added to the gas mixture to raise the relative humidity in the chamber to between 35% and 90%. The gas concentrations, temperature, and relative humidity shall be maintained within the specified limits for the test period of 32 hours.

B) At the end of the test period, the ethylene oxide mixture shall be purged from the chamber with dry air or N_2.

C) The tubes shall be removed from the chamber and after stabilization at room conditions, be energized and tested.

Note 17: Wide-band noise, 25 g rms, 9 minutes duration, 15-2000 cps

Note 18: Test is performed 5 times in each of the directions of Note 9.

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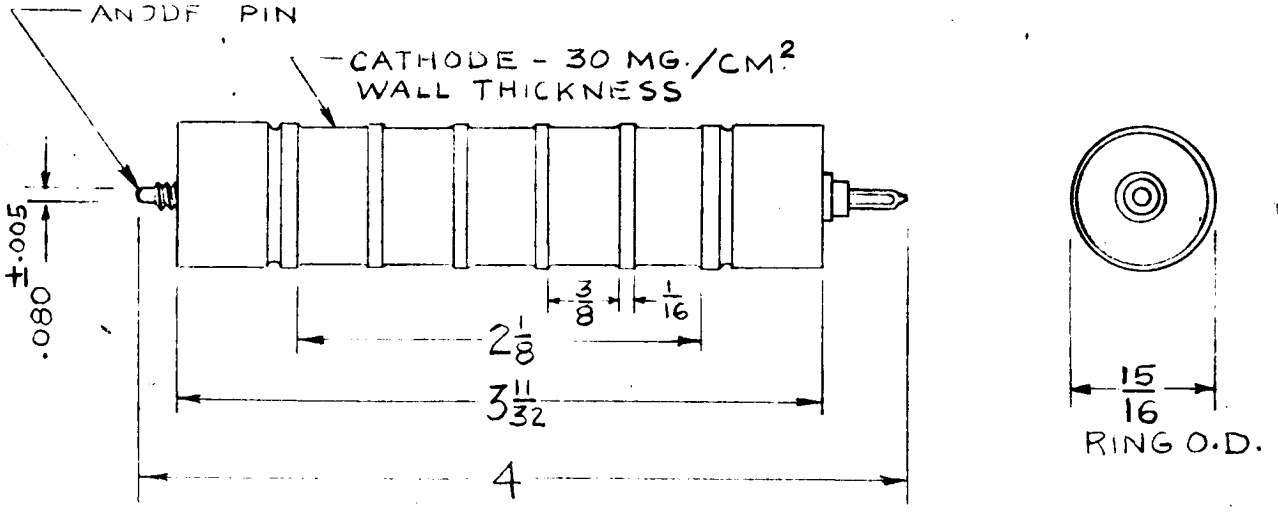

REVISION A	DATE	REVISION B	DATE	REVISION C	DATE

INDIVIDUAL MILITARY SPECIFICATION SHEET

(Note 1)

ELECTRON TUBE, RADIATION COUNTER, GEIGER-MUELLER, HIGH SENSITIVITY, BETA-GAMMA, HALOGEN, SELF-QUENCHING, END MICA WINDOW, RUGGEDIZED, STERILIZABLE

EON 6226

Ratings:		Operating Voltage Vo	Rp Neg
absolute Maximum:		800	---
Minimum:		700	1.0
Test Cond.:	(Note 2)	750	1.0
Dimensions:	Per Outline		**Cathode: Sealmet PRC-1 stainless steel material

Ref.	Test	Conditions	Min.	Max.
3.1	Qualification Approval:	Required for JAN marking	---	---
3.7.4	Marking:		---	---
3.7.6	Additional Marking:	Note 3	---	---
4.5	Holding	Note 11 t=60 days	Note 12	
4.19.1.1.1	Background & Contamination:	t=2minutes Note 5	N/t:--	5 Npm
4.19.1.1.2	Photosensitivity:	t=2minutes Notes 5,6	N/t	5 Npm
4.19.1.2	**Leakage Current:	Vo=500 Vdc	Llb:--	0.5 μAdc
4.19.2.3.1	Beta Response	t=2 minutes Notes 5,19	N/t:6	Nps

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE

Ref.	Test	Conditions	Min.	Max.
4.19.2.2.1.1	Relative Plateau Slope:	Voltage range= 700-800 Vdc Note 5	Ps:--	0.05%/V
4.19.2.2.1.3	Plateau Length:		Pl:100	--Vdc
4.19.2.3.1	Gamma Response	t=2 minutes Notes 5,7	N/t:7000	±15% cpm
4.19.2.4	Pulse Amplitude	Vo=750 Vdc Nps/eg:= 200 max Rp=1.0 megohm	e_o:15	Vdc
	**Conventional Dead Time	Rp=1.0 megohm Coupling Capacitor = 50 uuf Vo=750 Vdc Note 8	t_d:--	50 μsec
	*Dry Heat Sterilization	Note 15	Note 4	
	*Gas Sterilization	Note 16	Note 4	
	*Thermal-Vacuum(1)	T=75°C t=288 hours Test Chamber Pressure 0.3"Hg	Note 4	
	*Thermal-Vacuum(2)	T= -10°C t= 96 hours Test Chamber Pressure 0.3"Hg	Note 4	
	*Static Acceleration	a= 190g t= 20 min. Notes 9,13	Note 4	
	*Vibration(1)	Notes 9,10,14	Note 4	
	**Vibration(2)	Notes 9,10,17	Note 4	

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

Ref.	Test	Conditions	Min.	Max.
	*Shock(1)	Notes 9,10,18 ±200g terminal peak sawtooth; 0.5 millisecond rise time	Note 4	
	**Shock(2)	Notes 9,10,18 ±150g terminal peak sawtooth; 5.0 millisecond rise time	Note 4	
	**Shock(3)	Notes 9,10,18 ±1000g terminal peak sawtooth; 3.0 millisecond rise time	Note 4	

Note 1: The requirements and tests of Specification MIL-E-1D shall apply except as otherwise required herein.

Note 2: Tests may be made in any sequence.

Note 3: Each tube is to have an individual serial number which shall be legibly punched or engraved into the cathode.

Note 4: Criterion for passing this test shall be compliance after test of at least 80% of the tubes with the following requirements:

(1) Gamma response - initial limits

(2) Relative plateau slope - initial limits - $\pm$ 0.02%/V

(3) Background and contamination - initial limits

Note 5: In determining tube response (count rate) Vo=750 Vdc and Rp=1 meg. Tube count rates shall be determined using a scaler having a resolving time of 5 micro-seconds and a discrimination level of one volt.

Note 6: The tube shall be exposed to radiation from a General Electric 15-watt germicidal lamp and a General Electric 15-watt fluorescent lamp, or equivalent.

Note 7: The gamma response excitation test fixture in accordance with EON drawing SK146-1027.

Note 8: Use power supply and scope of Pulse Amplitude Test.

Note 9: Acceleration and/or vibration and/or shock shall be applied as follows:

(1) parallel to long axis of tube

(2) perpendicular to long axis of tube

Note 10: Test shall be performed utilizing fixture in accordance with EON Drawing No. SK 146-1028.

Note 11: Tests in Note 12 are to be performed sixty (60) days after initial performance of all production tests.

Note 12: Tube shall meet the initial acceptance requirements for background and contamination; gamma response and relative plateau slope.

Note 13: Test shall be performed utilizing fixture in accordance with EON Drawing No. SK 146-1044.

Note 14: A sinusoidal vibration swept at 1/2 octave per minute

(i) $\pm$ 0.5 inch constant displacement, 5-17 cps.

(ii) 5 g rms, 17-50 cps

(iii) 15 g rms, 50-100 cps

(iv) 35 g rms, 100-2000 cps

Note 15: (A) The tubes shall be placed in a chamber provided with a dry nitrogen atmosphere and the temperature raised to and maintained at 145°C $\pm$ 2°C for 36 hours.

(B) Upon completion of the process described above, the tubes shall be removed from the chamber and allowed to stabilize at room conditions.

(C) This procedure shall be performed a minimum of three (3) times on each unit.

(D) After stabilization at room conditions, the units shall be energized and tested. The tubes shall be examined for deleterious effects such as cracking, softening and discoloration.

Note 16: (A) The tubes shall be placed in a chamber and allowed to stabilize at 110° $\pm$ 10°F. The gas mixture (12% ethylene oxide and 88% Freon 12, by weight) shall then be introduced into the chamber. Sufficient water vapor must be added to the gas mixture to raise the relative humidity in the chamber to between 35% and 90%. The gas concentration, temperature, and relative humidity shall be maintained within the specified limits for the test period of 32 hours.

(B) At the end of the test period, the ethylene oxide mixture shall be purged from the chamber with dry air or N_2.

(C) The tubes shall be removed from the chamber and after stabilization at room conditions, be energized and tested.

REVISION A	DATE	REVISION B	DATE	REVISION C	DATE

Note 17: Wide band noise, 25 g rms, 9 minutes duration, 15-2000 cps.

Note 18: Test is performed 5 times in each of the directions of Note 9.

Note 19: Test shall be performed utilizing fixture in accordance with EON Drawing No. SK146-1046.

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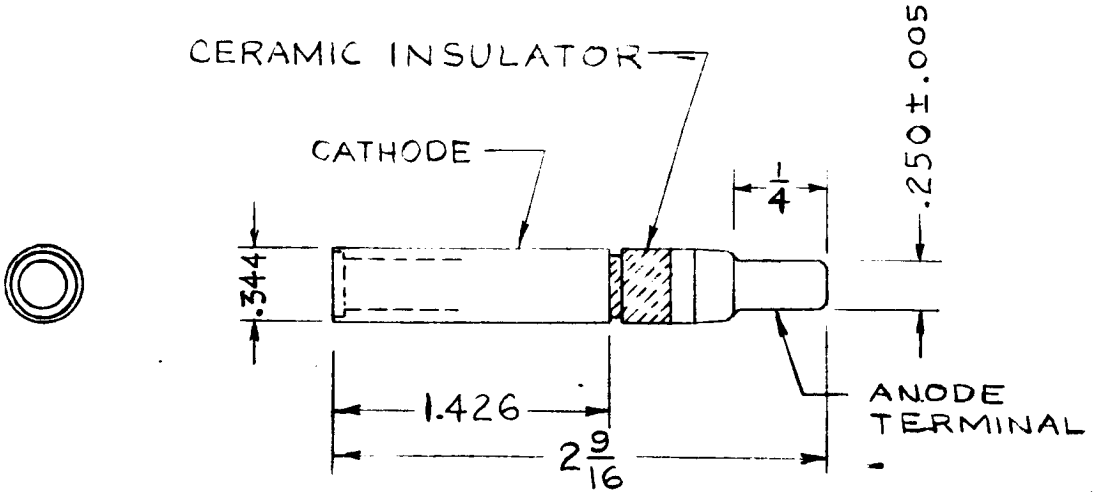

VI

Test Results and Evaluation Summaries:

The test results for both final tube designs are tabulated and enclosed in Appendix A.

No difficulties or problems were encountered in the testing of the final prototypes. The tubes passed all required tests as specified by JPL. All tests except for the high rise time shock and wide band noise tests were performed using the facilities of EON Corporation. The high rise time shock tests were performed at Environmental Dynamics Division of Turbo Machine, Inc., Monrovia, California. The random vibration tests were performed at Associated Testing Laboratories, Inc., Wayne, New Jersey.

Fig. 9 shows a typical oscilloscope trace of a 150g sawtooth shock with a 5 milliseconds rise time.

Fig. 10 shows a typical oscilloscope trace of a 1000g sawtooth shock with a 3 milliseconds rise time.

Ten tubes of each type were selected at random and subjected to these tests. All tubes passed these tests successfully.

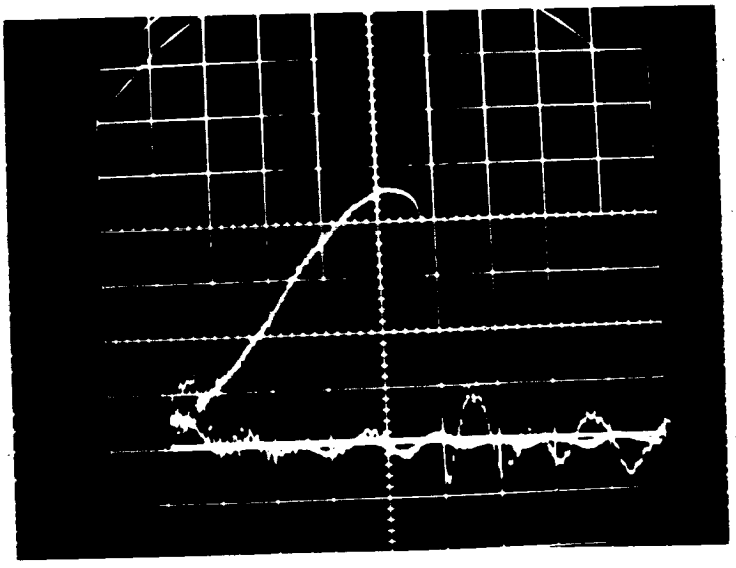

Fig. 9 -- Typical trace of 150g sawtooth shock with 5 milliseconds rise time

Vertical scale -- 0.1 v/cm; 4.2 cm = 150g
Horizontal scale -- 1.0 ms/cm

Accelerometer sensitivity - 28 pk mv/pk g.

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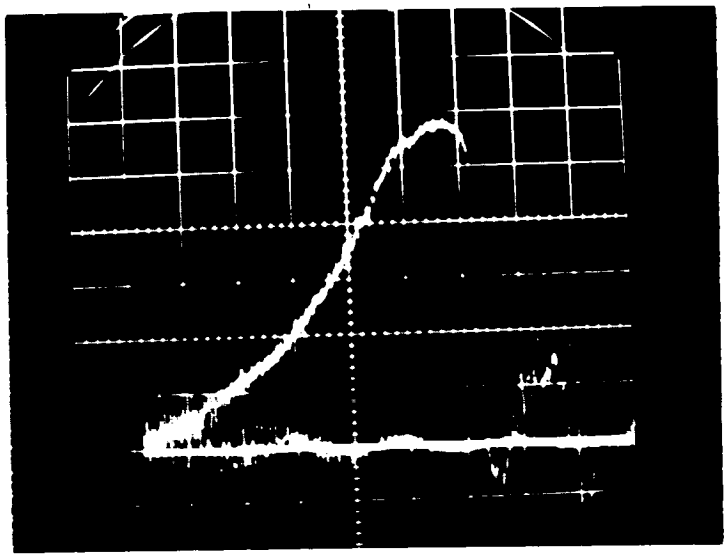

Fig. 10 -- Typical Trace of 1000g sawtooth shock with 3 millisecond rise time.

Vertical scale: 0.5 v/cm; 5.6 cm = 1000g
Horizontal scale: 0.5 ms/cm

Accelerometer sensitivity - 2.8 pk mv/pk g

It was noticed that a small number of the 6226 detectors exhibited a downward drift of starting voltage. This occurred most often during the third dry heat sterilization cycle. Although the tubes do eventually stabilize, they are not suitable for operation at the required operating voltage as specified in the specification of Section V. The holding period following the dry heat sterilization test is sufficiently long to permit these tubes to be detected and removed from the production lots. Figure 11 demonstrates graphically what happens to the operating points on a plateau when the starting voltage of the tube drops too much.

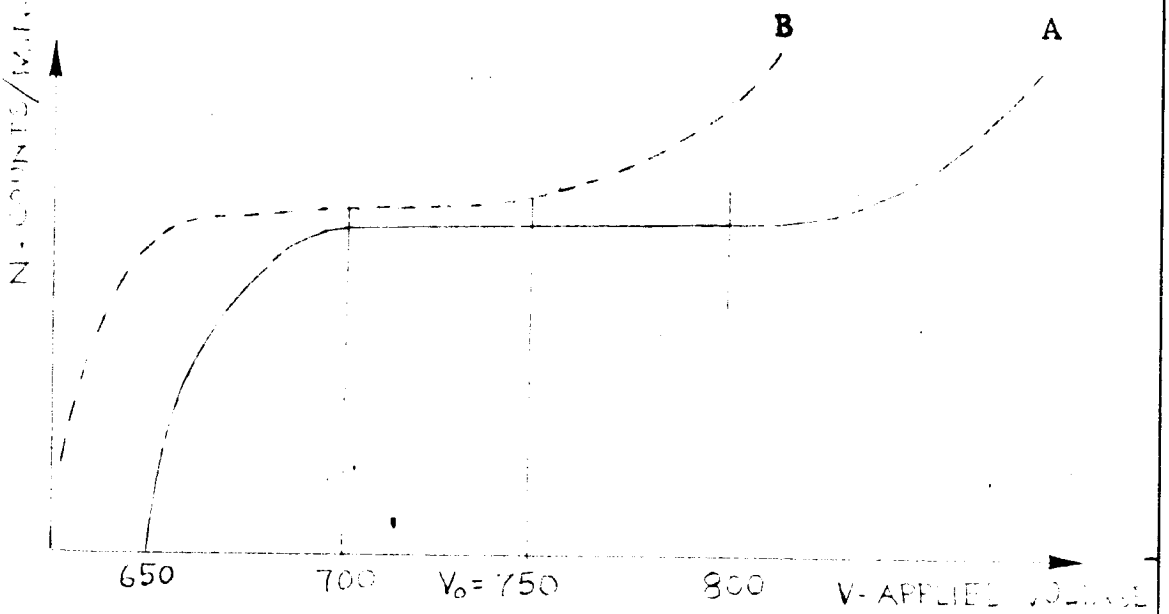

Fig. 11.

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Curve A represents a normal plateau curve of a detector tube with a starting voltage of 650 volts. When the starting voltage drops, the plateau usually tends to shift in the direction of lowered operating voltage as shown by curve B. If the drop in starting voltage is great enough, the plateau curve will shift to such a degreee (B) that the 800v plateau point will be in the upward sloping portion of the plateau curve, thus resulting in a considerable increase in the counting rate or even in discharge.

The drop in voltage is most likely attributable to a chemical reaction between the chlorine content of the filling gas mixture and the cathode base material. This reaction is accelerated at higher temperatures. To prevent this reaction the cathodes are plated on the inside with one, and sometimes, two metals which are not attacked by chlorine. The plating sometimes being porous permits the chlorine to penetrate the pores and combine with the base metal. This results in a lowering of gas pressue inside the tube and a consequent drop in starting voltage.

To eliminate this condition it would be advisable to investigate different plating and processing techniques and plating materials. This is discussed further in Section VII.

Of the ten 6226 tube samples which were subjected to the high rise time shock tests, eight tubes passed these tests electrically and mechanically without exhibiting any degradation in performance. Two samples passed the tests mechanically but exhibited slight change in their electrical characteristics. Because of this, two additional tubes, chosen at random, were also shock tested at 1000g and 3 millisecond rise time and passed without any problem.

Electrical test of the two tubes which had exhibited change indicated that one (#1989) had suffered a slight shift of the plateau in the direction of decreasing applied voltage and had a somewhat erratic behaviour of counting rates at 800 volts. The second tube (#2642) exhibited a very steep plateau throughout the operating range and went into discharge at 800 volts. When the operating voltages were reduced to 600, 650 and 700 volts, tube #2642 was again operating normally although the relative plateau slope still remained steep.

The change in the electrical characteristics of these two tubes was finally discovered to have resulted from a slight deformation of the anode resulting from too great a value of impact shock.

Fig. 12 shows a photo of the oscilloscope traces taken during the shock tests. The shock test was monitored by two accelerometers. One was attached to the shock table, the other to the tube fixture. An analysis of the oscilloscope traces shows distinctly that while the table and the fixture were subjected to a 1000g shock of a 3 millisecond rise time (upper trace) the fixture and therefore the tubes received an additional shock of approximately 1250g and 0.5 millisecond rise time (lower trace). This additional shock was due to the rebound of the thin mounting plate of the tube fixture. All of the tube samples tested experienced this additional shock component without failure.

VII

Conclusions and Recommendations

All of the requirements of the scope of this program have been satisfied by the final EON design of the 5112R and the 6226 detectors. We believe that there are two areas in which further development of these two detectors should be undertaken. We feel that it is necessary to work further to develop the techniques for creating optimum internal surface conditions for both the anode and the cathode.

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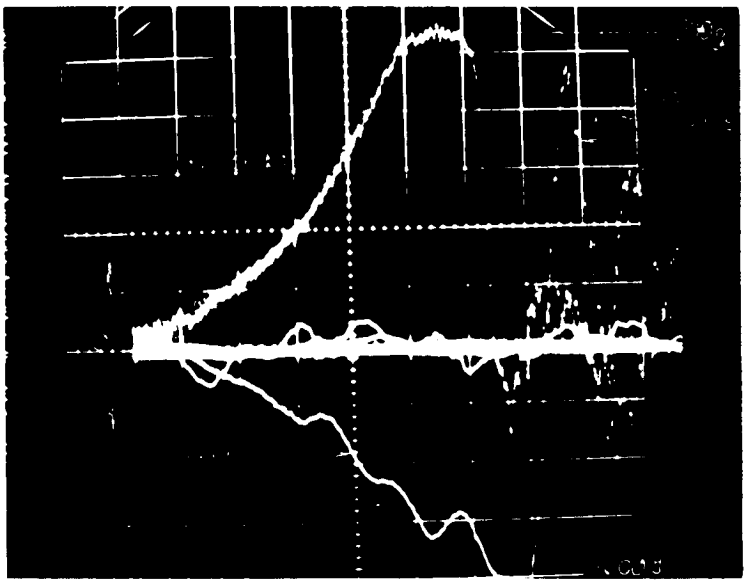

Fig. 12 - Traces showing response of shock table and 6226 tubes plus test fixture to 1000g sawtooth shock of Fig. 10.

Top Trace - shock table
Vertical scale -- 0.5 v/cm; 5.6 cm = 1000g
Horizontal scale - 0.5 ms/cm
Accelerometer sensitivity - 2.8 pk mv/pk g

Bottom Trace - (inverted) - test fixture
Vertical scale = 2.0 v/cm; 4 cm = 1000g
Accelerometer sensitivity - 8 pk mv/pk g

Further work is also required to study the composition of the mixture of gases which make up the gas fill. The gas mixture is intimately related to the nature of the tube surfaces. As previously described, the stainless steel anodes and cathodes are first plated with rhodium and over the top of this material, we deposit a coating of platinum. The theory underlying this procedure is to provide a protective cladding surface on all of the electrodes which are exposed to the chlorine quench admixture. It should be remembered that chlorine is an extremely chemically active material which goes into spontaneous combustion with iron at approximately 450°C. At room temperatures, the rate at which this reaction takes place, is, of course, infinitesimally small. As temperature is increased, the reaction becomes more active. In general, the present processing appears to work. However, an appreciable number of tubes exhibit a drift of their characteristics (especially the starting voltage) and this results in a change in optimum operatig conditions. We have established criteria which enable us to test our detectors and to predict successfully which tubes will stabilize.

One present explanation as to why certain of these tubes are perfectly stable and others continue to change runs along the following lines. We believe that the claddings are sometimes porous to the extent that appreciable sections of the steel

remain unclad and present areas of steel which can react with the chlorine. There is also some reason to believe that the coatings themselves are chemically active surfaces onto which the gases are adsorbed. Recent tests indicate that two new avenues of investigation should be undertaken. The first is to treat the stainless steel surfaces so as to create impervious surfaces which would not require external cladding. For example, we are considering the creation of inert chromic oxide surfaces which are known to be resistant to the actions of either chlorine or bromine. Such surfaces, if properly created, would not suffer from flaking as is possible with plated surfaces. The second approach would be to search for new cladding materials which are not as difficult to apply uniformly as rhodium and platinum.

It had originally been contemplated that a complete reliability program would be conducted with respect to the type 5112R and 6226 detectors. However, because of the difficulties encountered in meeting certain of the characteristics, the reliability program could not be undertaken in adequate depth. Instead the main effort was applied to the many problems of geometry which finally resulted in detectors which meet the limits as specified.

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We therefore feel that the reliability program which includes a complete failure analysis for both detectors of the final design should be undertaken.

VIII

Electrical and Mechanical Test Equipment

The principal pieces of test equipment utilized in this program are as follows:

1. Scaler — Baird Atomic Type S-135
resolving time 5 microseconds
built-in timer
adjustable discriminator 0-10 volts

Baird Atomic Model 123 The Abacus 11
fixed discriminator

2. Timer — Motor driven X-ray Timer Switch
Model 42

3. Oscilloscope — RCA Model WO-91A
Tectronix Type 503

4. Voltmeter — Hewlett Packard
Digital Voltmeter Model 405 BR

Electrostatic Voltmeter
Sensitive Research Instrument Corp.

5. Temperature Box — Associated Testing Laboratories
Model ELH-2-LC-1

6. Oven — GECO - Gruenberg Electric Company
Model BG 208

7. Gas Sterilizer — Cryotherm - Model 1016
American Sterilizer Company.

This sterilizer was designed for use with "canned" gas. The composition of the canned gas was 11% ethylene oxide; 54.0% Freon 11; 35.0% Freon 12. In order to use the gas mixture as specified by JPL (12% ethylene oxide; 88% Freon 12) the sterilizer was modified.

8. Centrifuge — For the static acceleration tests an International Clinical centrifuge was modified. The predetermined speed of the centrifuge is continuously monitored by a General Radio Company Strobatac Type 1531-A.

9. Shock Machine — For the specified 200g, 0.5 millisecond rise time shock, EON's Navy Flyweight machine is used.

The only machine capable of performing the specified 150g 5.0 millisecond rise time and 1000g 3.0 millisecond rise time shocks was located at the Environmental Dynamics Division of Turbo Machine, Inc., Monrovia, California.

The tests were performed on the Model ED-100 single table machine. This machine is a free fall guillotine type machine. In order to obtain the required acceleration, the drop table is preaccelerated by two heavy rubber bands. To obtain the required rise time, the shock table is dropped on a lead snubber. The desired rise time is obtained by deformation of the snubber. Fig. 15.

The shock tests are monitored using Endevco Model 2225M2 accelerometers and an Endevco Amplifier Model 2614.

10. Vibration — Vibration system consisting of:
Unholtz-Dickie Model VLG-82.
1200 pound force Electro-Dynamic vibration machine.
Complete system including BK Model 1038 automatic shaker control
Model A103A - Amplifier
Model 206 - Air cooled shaker
Model 607 - Dial A Gain
Model F-90-50 Adjustable type field supply
Accelerometer Enevco type 2216
Brual & Kjaer Automatic Vibration Exciter Control Type 1018.

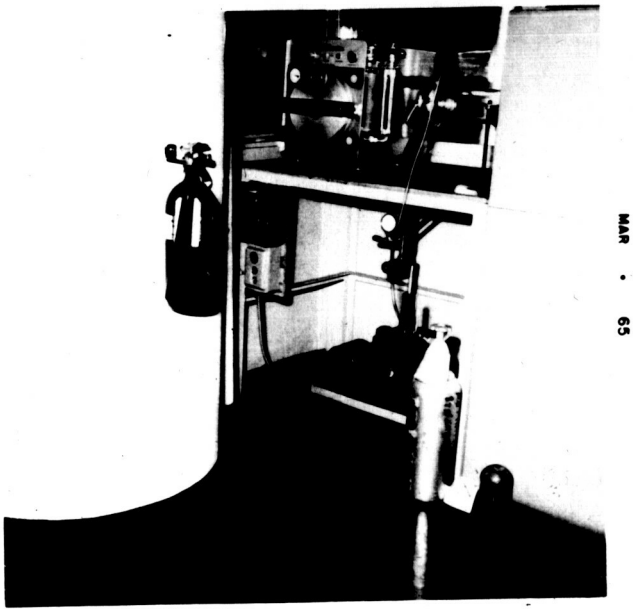

Fig. 13 -- Gas Sterilizer - Model 1016
American Sterilizer Company

Fig. 14 -- Centrifuge and Strobotac
Used for static acceleration test

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Fig. 15 - Deformation of lead snubber after 1000g 3.0 millisecond rise time shock.

Left specimen is snubber before shock. It is 2.550 dia. x 1.650" high.

Right specimen is snubber after shock. It has been flattened to .575" thick.

Fig. 16 - Type 5112R tubes mounted on shock table of Navy Flyweight machine - used for the 200g 0.5 millisecond rise time shock test.

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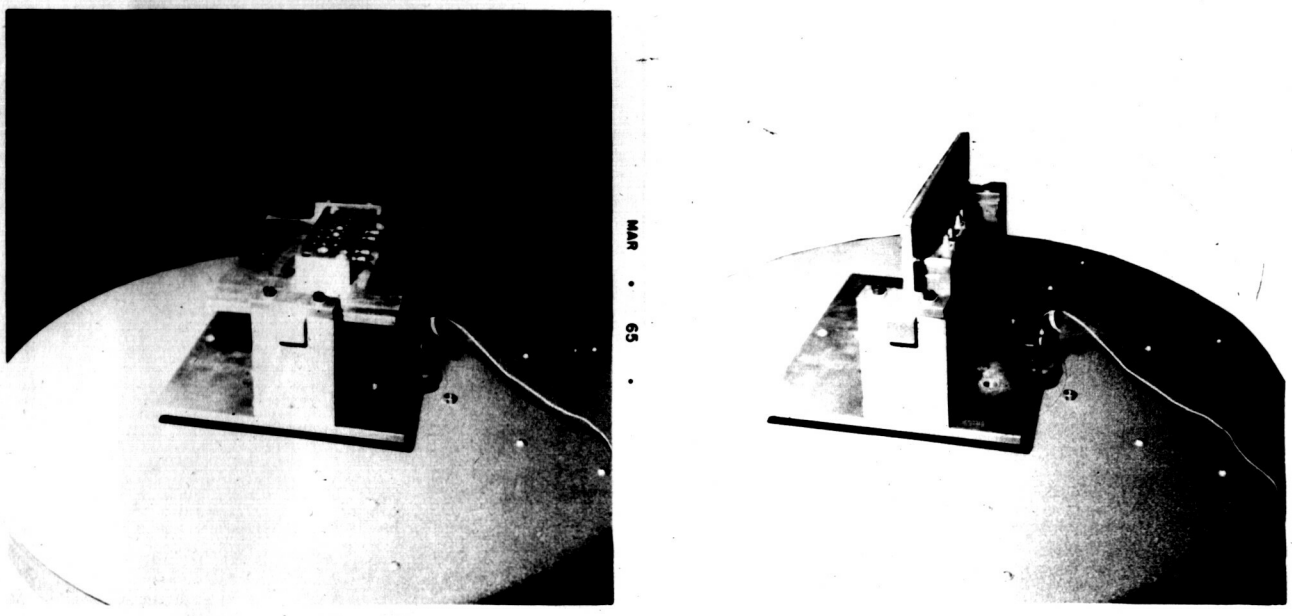

Fig. 17 - Tubes mounted on the Unholtz-Dickie Vibration Table.
A - tubes in horizontal position
B - tubes in vertical position

11. Wide Band Noise

This test was performed at the Associated Testing Laboratories, Inc. The vibration system consisted of
Ling Electronics Corp. Vibration Exciter Model A246
Power Cubicle PP-20/24
Remote Control Console R-1001
Accelerometer Endevco Model 2215C
Ling Random Noise Control Console 1390B
Kroher-Hite Variable Frequency Band Pass Filter 3307
Bruel & Kjaer Al Vacuum Tube Voltmeter 2416
Dimco-Gray Timer 168

The tubes were subjected to random frequency vibrations over the frequency range of 20-2000 cps at an applied vibration level of 0.3 g^2/cps (24 g rms overall). The applied vibration level is maintained for a period of nine minutes in each of the two specified axis.

A crystal accelerometer which is mounted to the test fixture, is used to control the applied vibration level. The vibration level is determined and monitored on a system which contains 44 parallel band pass filters with individual attenuators for spectrum shaping. Each filter has a maximum band width of 50 cps. The system also contains 44 monitoring circuits with acceleration spectral density monitors which read directly in g^2/cps.

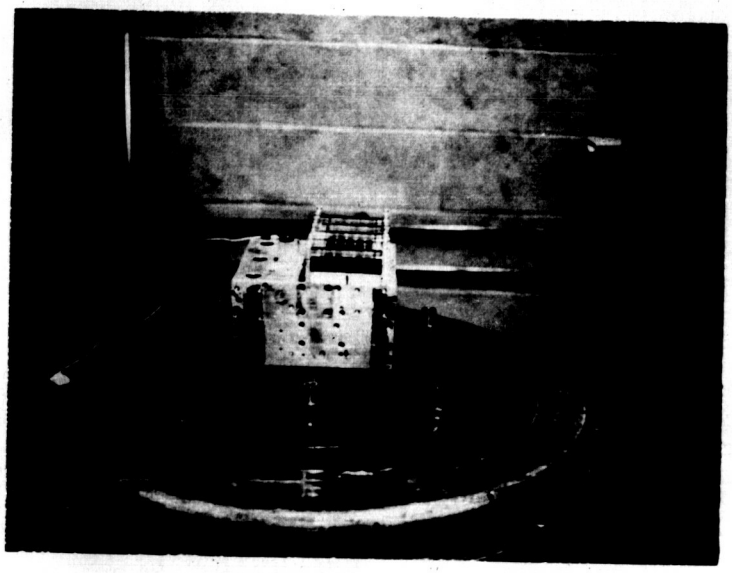

Fig. 18a -- Photo showing 5112R tubes mounted for Wide Band Noise Test.

Fig. 18b -- Same as Fig. 18a for 6226 detectors.

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APPENDIX A

TEST RESULTS - 5112R

and 6226

EON CORPORATION

electronic-Optical-Nuclear products

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TUBE # 41140 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7212	7576	7879	8.8	31			11/20
7303	7584	7820	6.9	39	Dry Heat	1	11/23
7354	7444	7853	6.7	48		2	11/25
7313	7676	7825	6.7	36		3	11/30
7217	7400	7737	7.0	38	Gas St. Accel.		12/28
7260	7492	7800	7.2	40		+x	12/29
7300	7481	7825	7.0	42		-x	12/29
7272	7410	7789	7.0	39		+y	12/30
7320	7504	7842	7.0	35		-y	12/30
7357	7481	7862	6.7	38		+z	12/30
7308	7414	7851	7.3	38		-z	12/31
7158	7539	7625	6.2	32	Vibration	5-17 x	1/6
7256	7314	7699	6.1	29		5-17 y	1/7
7028	7421	7626	8.1	25		17-50 x	1/8
7087	7489	7604	6.9	27		17-50 y	1/11
7123	7593	7725	8.0	37		50-100 x	1/12
7149	7654	7747	7.8	30		50-100 y	1/13
7290	7575	7721	5.7	32		100-2000x	1/14
7358	7554	7690	4.4	28		100-2000y	1/18
6316	6361	6745	6.8	30	Shock	200g x	1/25
6224	6403	6749	8.2	29		200g y	1/26
6270	6382	6747	7.5	31		200g z	1/27
7467	7632	8017	7.2			150g x	2.1
7270	7678	7863	7.7			150g y	2.1
7093	7462	7831	9.9			1000g x	2.2
7298	7404	7946	8.7	31		1000g y	2.2
7280	7811	7917	8.1		Wide Band	15-2000 x	2/12
7309	7865	7961	8.3	31		15-2000 y	2/12
7509	7782	7981	6.1	30	Thermal	+ 75°C	3/1
7565	7771	7973	5.3	32		- 10°C	3/10

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TUBE # 4131 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7178	7357	7745	7.7	24			11/20
7284	7600	7858	7.6	20	Dry Heat	1	11/23
7194	7332	7709	7.0	18		2	11/25
7011	7451	7716	9.5	26		3	11/30
7092	7246	7592	6.9	18	Gas St.		12/28
7000	7210	7615	8.5	22	Accel.	+x	12/29
7045	7215	7665	8.6	21		-x	12/29
7100	7191	7704	8.4	17		+y	12/30
7120	7153	7742	8.7	16		-y	12/30
7081	7185	7712	8.8	19		+z	12/30
7132	7156	7681	7.7	18		-z	12/31
7031	7390	7715	9.3	17	Vibration	5-17 x	1/6
7131	7422	7724	8.0	15		5-17 y	1/7
7133	7399	7600	6.3	16		17-50 x	1/8
7147	7368	7450	4.1	14		17-50 y	1/9
7043	7392	7622	7.8	23		50-100 x	1/12
7103	7468	7707	8.1	20		50-100 y	1/13
7011	7256	7664	9.0	21		100-2000x	1/14
7174	7467	7783	8.2	20		100-2000y	1/18
7234	7444	7582	4.7	22	Shock	200g x	1/25
7159	7327	7626	6.4	19		200g y	1/26
7196	7385	7604	5.5	12		200g z	1/27
7476	7643	7762	3.7			150g x	2/1
7164	7158	7892	9.4			150g y	2/1
7354	7435	7824	6.3			1000g x	2/2
7277	7545	7646	4.9	12		1000g y	2/2
7350	7605	7770	5.5		Wide Band	15-2000 x	2/12
7141	7612	7801	8.7	11		15-2000 y	2/12
7557	7657	7934	4.9	10	Thermal	+ 75°C	3/1
7572	7672	8037	6.1	10		- 10°C	3/10

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TUBE # 4137 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7295	7703	7901	7.9	20			11/20
7309	7617	7994	9.0	20	Dry Heat	1	11/23
7136	7472	7907	10.3	22		2	11/25
7561	7641	7979	5.5	26		3	11/30
7158	7509	7907	10.0	29	Gas St.		12/28
7227	7521	7968	9.9	25	Accel.	+x	12/29
7232	7545	7948	9.5	24		-x	12/29
7180	7532	7971	10.5	27		+y	12/30
7241	7498	7921	9.1	22		-y	12/30
7199	7427	7961	10.3	21		+z	12/30
7241	7400	7916	9.1	23		-z	12/31
7233	7504	7785	7.4	23	Vibration	5-17 x	1/6
7222	7494	7626	5.4	21		5-17 y	1/7
7049	7408	7675	8.5	20		17-50 x	1/8
7040	7448	7771	9.8	20		17-50 y	1/11
7185	7545	7789	8.0	23		50-100 x	1/12
7140	7369	7769	8.6	21		50-100 y	1/13
7141	7277	7603	6.4	21		100-2000x	1/14
7229	7389	7680	6.1	20		100-2000y	1/18
7115	7489	7680	7.6	19	Shock	200g x	1/25
7277	7631	7732	6.0	20		200g y	1/26
7196	7560	7706	6.7	21		200g z	1/27
7312	7508	8034	9.6			150g x	2/1
7284	7603	7898	8.1			150g y	2/1
7358	7523	7769	5.5			1000g x	2/2
7025	7520	7717	9.2	18		1000g y	2/2
7471	7747	8017	7.1		Wide Band	15-2000 x	2/12
7389	7703	8033	8.4	15		15-2000 y	2/12
7321	7836	8035	9.1	16	Thermal	+ 75°C	3/1
7332	7671	7938	7.8	16		- 10°C	3/10

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TUBE # 4128 TUBE TYPE 5112R

Plateau Points Volts			R.P.S. %	Background c/m	TEST		Date
900	950	1000					
7188	7291	7669	6.6	16			11/20
7254	7439	7642	5.2	17	Dry Heat	1	11/23
7232	7447	7855	8.4	20		2	11/25
7240	7320	7571	4.5	21		3	11/30
7039	7290	7483	6.1	20	Cas St.		12/28
7100	7301	7504	5.5	19	Accel.	+x	12/29
7164	7323	7494	4.5	15		-x	12/29
7210	7300	7554	4.7	18		+y	12/30
7180	7262	7500	4.4	22		-y	12/30
7174	7222	7497	4.5	21		+z	12/30
7137	7248	7438	4.2	20		-z	12/31
6960	7079	7458	7.0	14	Vibration	5-17 x	1/6
7022	7185	7582	7.8	12		5-17 y	1/7
6971	7282	7431	6.3	11		17-50 x	1/8
6910	7112	7479	5.1	12		17-50 y	1/11
6770	7329	7319	8.3	12		50-100 x	1/12
6969	7319	7443	6.5	11		50-100 y	1/13
7210	7386	7570	4.9	12		100-2000x	1/14
7083	7293	7528	6.1	12		100-2000y	1/18
7019	7279	7589	7.8	10	Shock	200g x	1/25
6926	7338	7518	8.1	11		200g y	1/26
6972	7308	7553	8.0	11		200g z	1/27
7365	7551	7780	5.5			150g x	2/1
7160	7454	7715	7.5			150g y	2/1
7047	7411	7630	7.9			1000g x	2/2
7217	7288	7614	5.5	15		1000g y	2/2
7406	7625	7795	5.1		Wide Band	15-2000 x	2/12
7420	7635	7707	3.8	14		15-2000 y	2/12
7284	7653	7893	8.0	17	Thermal	+ 75°C	3/1
7248	7608	7933	9.0	17		- 10°C	3/10

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TUBE # 4115 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7617	7747	8114	6.4	6			11/20
7762	7993	8302	7.0	12	Dry Heat	1	11/23
8026	8264	8399	4.5	16		2	11/25
8329	8372	8513	2.2	15		3	11/30
8086	8380	8527	5.3	9	Gas St.		12/28
8120	8410	8545	5.1	12	Accel.	+x	12/29
8010	8365	8500	5.9	12		-x	12/29
8071	8323	8481	5.0	11		+y	12/30
8100	8393	8575	5.7	10		-y	12/30
8045	8368	8512	5.6	9		+z	12/30
8099	8371	8564	5.6	13		-z	12/31
8021	8321	8496	5.7	12	Vibration	5-17 x	1/6
8072	8349	8659	7.0	11		5-17 y	1/7
8074	8318	8478	4.9	11		17-50 x	1/8
7915	8293	8454	6.5	12		17-50 y	1/11
7867	7994	8619	9.4	11		50-100 x	1/12
7078	7227	8494	5.8	10		50-100 y	1/13
8042	8503	8651	7.2	10		100-2000x	1/14
8142	8346	8802	7.9	11		100-2000y	1/18
8163	8443	8502	4.0	10	Shock	200g x	1/25
8277	8514	8584	3.6	10		200g y	1/26
8220	8478	8543	3.8	9		200g z	1/27
8417	8592	8939	6.1			150g x	2/1
8475	8380	8728	3.0			150g y	2/1
8135	8543	8583	5.3			1000g x	2/2
8372	8331	8767	4.8	11		1000g y	2/2
8435	8661	8918	5.6		Wide Band	15-2000 x	2/12
8326	8830	8944	7.0	9		15-2000 y	2/12
8404	8710	9129	8.3	10	Thermal	+ 75°C	3/1
8350	8757	8895	6.2	10		- 10°C	3/10

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TUBE # 4063 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7743	8075	8368	7.7	14			11/20
8189	8304	8645	5.5	12	Dry Heat	1	11/23
8434	8723	8877	5.1	12		2	11/25
8813	9025	9207	4.4	15		3	11/30
8695	8969	9156	5.8	17	Gas St.		12/28
8710	8990	9123	4.6	15	Accel.	+x	12/29
8740	9003	9204	8.2	16		-x	12/29
8700	8923	9078	4.2	12		+y	12/30
8680	8942	9020	3.8	11		-y	12/30
8702	8910	9079	4.2	16		+z	12/30
8710	9004	9146	4.8	17		-z	12/31
8735	8990	9230	5.5	9	Vibration	5-17 x	1.6
8631	8983	9207	6.4	11		5-17 y	1.7
8658	8821	9128	5.3	10		17-50 x	1.8
8598	8615	9038	5.1	11		17-50 y	1.11
8650	8797	9083	4.9	18		50-100 x	1/12
8887	8961	9189	3.4	16		50-100 y	1/13
8757	9142	9287	5.8	15		100-2000x	1/14
8617	9057	9257	7.1	16		100-2000y	1/18
8618	8908	9077	6.2	14	Shock	200g x	1/25
8574	8976	9202	7.3	15		200g y	1/26
8596	8942	9139	6.1	12		200g z	1/27
8988	9380	9552	6.0			150g x	2/1
8925	9124	9320	4.4			150g y	2/1
8759	8857	9531	8.7			1000g x	2/2
8759	9033	9097	3.9	13		1000g y	2/2
8961	9361	9526	6.0		Wide Band	15-2000 x	2/12
8970	9313	9443	5.1	12		15-2000 y	2/12
8373	8721	9029	7.5	12	Thermal	+ 75°C	3/1
8988	9355	9769	8.3	11		- 10°C	3/10

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TUBE # 4126 TUBE TYPE. 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/s	TEST		Date
7421	7715	7809	5.1	14			11/20
7389	7756	7925	8.2	15	Dry Heat	1	11/23
7238	7606	7911	8.9	18		2	11/25
7218	7523	7750	7.1	13		3	11/30
7144	7378	7814	9.1	14	Gas St.		12/28
7224	7358	7887	9.0	12	Accel.	+x	12/29
7261	7383	7910	8.8	12		-x	12/29
7200	7351	7871	9.1	10		+y	12/30
7235	7348	7895	9.0	13		-y	12/30
7187	7300	7812	7.7	14		+z	12/30
7150	7323	7781	8.6	14		-z	12/31
7175	7536	7682	9.4	12	Vibration	5-17 x	1/6
7020	7395	7824	10.9	13		5-17 y	1/7
6833	7449	7745	12.2	14		17-50 x	1/8
7015	7191	7734	10.0	12		17-50 y	1/11
7055	7557	7636	7.7	10		50-100 x	1/12
7006	7466	7748	9.9	9		50-100 y	1/13
7200	7464	7798	8.0	10		100-2000x	1/14
7151	7492	7737	7.8	10		100-2000y	1/18
7287	7530	7680	5.2	9	Shock	200g x	1/25
7152	7429	7819	9.0	10		200g y	1/26
7220	7479	7749	7.1	12		200g z	1/27
7352	7649	7854	6.6			150g x	2/1
7172	7565	7857	9.1			150g y	2/1
7136	7561	7910	10.3			1000g x	2/2
7112	7546	7716	7.8	12		1000g y	2/2
7034	7665	7882	11.1		Wide Band	15-2000 x	2/12
7163	7622	7985	10.9	10		15-2000 y	2/12
7102	7347	7633	7.3	9	Thermal	+ 75°C	3/1
7070	7411	7450	5.1	9		- 10°C	3/10

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TUBE # 4134 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7053	7347	7596	7.4	16			11/20
7045	7351	7808	10.4	15	Dry Heat	1	11/23
7069	7394	7542	6.4	15		2	11/25
6990	7314	7599	8.3	23		3	11/30
7090	7300	7511	5.7	16	Gas Sc.		12/28
7025	7240	7580	7.7	18	Accel.	+x	12/29
7068	7282	7510	6.1	15		-x	12/29
7010	7331	7548	7.3	12		+y	12/30
7066	7361	7595	7.2	14		-y	12/30
7098	7311	7565	6.4	16		+z	12/30
7050	7326	7509	6.3	17		-z	12/31
7004	7281	7377	5.1	17	Vibration	5-17 x	1/6
6991	7346	7521	7.2	16		5-17 y	1/7
6917	7240	7309	5.4	15		17-50 x	1/8
6987	7100	7494	7.2	16		17-50 y	1/11
6993	7189	7439	6.2	18		50-100 x	1/12
7052	7360	7490	6.0	15		50-100 y	1/13
7080	7482	7643	7.5	14		100-2000x	1/14
6972	7419	7518	7.4	15		100-2000y	1/18
5927	6416	6614	8.2	12	Shock	200g x	1/25
6103	6401	6494	6.1	14		200g y	1/26
6015	6408	6554	7.1	15		200g z	1/27
6946	7448	7586	8.6			150g x	2/1
6935	7444	7697	10.3			150g y	2/1
7050	7363	7452	5.5			1000g x	2/2
7100	7301	7612	7.0	22		1000g y	2/2
7457	7620	7841	5.0		Wide Band	15-2000 x	2/12
7492	7594	7830	4.5	16		15-2000 y	2/12
7187	7516	7767	7.7	14	Thermal	+ 75°C	3/1
7283	7637	7799	6.8	14		- 10°C	3/10

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TUBE # 4136 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Back-ground c/m	TEST		Date
7107	7440	7680	7.7	14			11/20
7205	7529	7721	6.9	14	Dry Heat	1	11/23
7010	7455	7672	8.9	14		2	11/25
7360	7570	7843	6.4	11		3	11/30
7019	7398	7551	7.2	12	Gas St.		12/28
7100	7402	7650	7.4	10	Accel.	+x	12/29
7122	7448	7698	7.7	14		-x	12/29
7073	7412	7672	8.1	11		+y	12/30
7148	7472	7642	6.6	11		-y	12/30
7099	7379	7699	8.1	12		+z	12/30
7118	7389	7646	7.2	12		-z	12/31
6938	7267	7504	7.9	17	Vibration	5-17 x	1/6
7119	7325	7602	6.6	18		5-17 y	1/7
6922	7194	7494	8.0	16		17-50 x	1/8
6891	7257	7520	8.7	15		17-50 y	1/11
7198	7284	7465	3.7	17		50-100 x	1/12
7059	7519	7560	6.7	18		50-100 y	1/13
7116	7430	7556	5.9	16		100-2000x	1/14
7151	7363	7644	6.7	17		100-2000y	1/18
7084	7433	7682	8.1	18	Shock	200g x	1/25
7113	7427	7699	7.9	16		200g y	1/26
7098	7430	7690	8.0	12		200g z	1/27
7263	7650	7734	6.2			150g x	2/1
7111	7429	7731	8.4			150g y	2/1
7037	7306	7489	6.2			1000g x	2/2
7012	7463	7584	8.0	10		1000g y	2/2
7167	7787	7785	8.0		Wide Band	15-2000 x	2/12
7387	7499	7843	6.1	10		15-2000 y	2/12
7337	7701	7790	5.9	8	Thermal	+ 75°C	3/1
7467	7651	7917	5.9	6		- 10°C	3/10

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TUBE # 4085 TUBE TYPE 5112R

Plateau Points Volts 900	950	1000	R.P.S. %	Back-ground c/m	TEST		Date
7522	7736	7751	3.0	16			
7714	8209	8317	7.4	15	Dry Heat	1	
8236	8423	8737	5.9	13		2	
8756	9039	9301	6.0	21		3	
8601	8831	8826	2.5	10	Gas St.		
8550	8745	8797	2.8	11	Accel.	+x	
8504	8720	8768	3.0	11		-x	
8594	8745	8802	2.4	13		+y	
8662	8718	8859	2.3	12		-y	
8696	8727	8905	2.4	13		+z	
8600	8745	8973	4.3	10		-z	
8627	8983	8904	3.1	16	Vibration	5-17 x	
8638	8669	9075	5.1	14		5-17 y	
8654	8817	9052	4.5	12		17-50 x	
8491	8849	8990	5.9	14		17-50 y	
8506	9034	9035	5.9	9		50-100 x	
8607	8972	9095	5.4	10		50-100 y	
8737	8947	9067	3.7	8		100-2000x	
8591	8980	9137	6.1	10		100-2000y	
8630	8958	8953	3.6	11	Shock	200g x	
8431	8885	9053	7.0	9		200g y	
8530	8921	9003	5.3	10		200g z	
8883	8989	9243	4.0			150g x	
9017	8956	9244	2.5			150g y	
8751	9054	9165	4.6			1000g x	
8741	8901	9274	6.0	12		1000g y	
8963	9044	9168	2.3		Wide Band	15-2000 x	
8823	9120	9388	6.2	12		15-2000 y	
9027	9228	9303	3.0	14	Thermal	+ 75°C	
9042	9352	9571	5.7	14		- 10°C	

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TUBE # 4123 TUBE TYPE 5112R.

Plateau Points		Volts	R.P.S. %	Background c/m	TEST		Date
7205	7501	7731	7.0	15			11/20
7179	7667	7936	9.9	12	Dry Heat	1	11/23
7196	7541	7760	7.5	10		2	11/25
7359	7699	7819	5.8	18		3	11/30
7164	7473	7685	7.0	12	Gas St.		12/28
7220	7424	7781	7.6	12	Accel.	+x	12/29
7242	7400	7810	7.7	13		-x	12/29
7150	7449	7698	7.4	11		+y	12/30
7182	7421	7718	7.2	10		-y	12/30
7144	7407	7698	7.5	11		+z	12/30
7100	7464	7749	8.7	12		-z	12/31
7056	7366	7845	10.7	11	Vibration	5-17 x	1/6
7110	7352	7730	8.4	10		5-17 y	1/7
7113	7561	7633	6.9	8		17-50 x	1/8
6971	7353	7528	7.6	10		17-50 y	1/11
7307	7445	7765	6.2	13		50-100 x	1/12
7101	7438	7782	9.2	14		50-100 y	1/13
7273	7663	7752	6.3	11		100-2000x	1/14
7320	7525	7610	3.9	11		100-2000y	1/18
7366	7661	7777	5.4	10	Shock	200g x	1/25
7325	7560	7739	5.5	10		200g y	1/26
7345	7610	7758	5.4	12		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
7511	7891	7967	5.8	17	Thermal	+ 75°C	3/1
7548	7937	8030	6.1	17		- 10°C	3/10

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TUBE # 4125 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Back-ground c/m	TEST		Date
7658	7942	8082	5.6	19			11/20
7614	7913	8057	5.6	19	Dry Heat	1	11/23
7736	7852	8211	6.1	19		2	11/25
7666	7860	8196	6.7	20		3	11/30
7606	7781	8182	7.3	20	Gas St.		12/28
7622	7852	8098	6.1	18	Accel.	+x	12/29
7648	7820	8200	7.1	17		-x	12/29
7680	7811	8141	5.9	21		+y	12/30
7605	7800	8173	7.3	22		-y	12/30
7658	7812	8157	6.4	20		+z	12/30
7616	7837	8191	7.4	20		-z	12/31
7385	7874	8042	8.3	21	Vibration	5-17 x	1/6
7486	7825	8154	8.5	22		5-17 y	1/7
7228	7788	8059	10.7	25		17-50 x	1/8
7411	7748	8003	7.7	24		17-50 y	1/11
6894	7542	8113	16.1	21		50-100 x	1/12
6677	7471	8069	18.6	20		50-100 y	1/13
7719	7973	8234	6.5	18		100-2000x	1/14
7667	8053	8255	7.3	19		100-2000y	1/18
7544	7933	8348	10.1	20	Shock	200g x	1/25
7556	7899	8228	8.6	21		200g y	1/26
7550	7916	8288	8.0	19		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4122 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7183	7380	7750	7.7	11			11/20
7377	7629	7847	6.2	15	Dry Heat	1	11/23
7069	7440	7823	10.1	23		2	11/25
7203	7366	7829	8.5	26		3	11/30
7022	7287	7692	9.2	12	Gas St.		12/28
7057	7409	7781	9.8	12	Accel.	+x	12/29
7100	7422	7811	9.6	16		-x	12/29
7125	7474	7823	9.3	18		+y	12/30
7097	7408	7799	9.5	14		-y	12/30
7111	7400	7765	8.8	14		+z	12/30
7180	7425	7800	8.4	15		-z	12/31
7073	7257	7510	6.0	10	Vibration	5-17 x	1/6
7114	7228	7651	7.5	8		5-17 y	1/7
6969	7244	7569	8.3	10		17-50 x	1/8
6923	7254	7799	12.1	10		17-50 y	1/11
6991	7380	7478	6.6	19		50-100 x	1/12
7400	7370	7632	3.2	15		50-100 y	1/13
7003	7524	7859	11.4	16		100-2000x	1/14
7311	7573	7693	5.1	15		100-2000y	1/18
7170	7427	7667	6.7	14	Shock	200g x	1/25
7161	7561	7711	7.3	12		200g y	1/26
7165	7494	7689	7.0	12		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4114 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7440	7574	7847	5.4	5			11/20
7278	7684	7805	8.2	8	Dry Heat	1	11/23
7263	7628	7770	6.7	13		2	11/25
7410	7600	7851	5.8	19		3	11/30
7146	7329	7715	9.1	12	Gas St.		12/28
7100	7289	7740	8.8	10	Accel.	+x	12/29
7202	7301	7699	6.8	10		-x	12/29
7262	7353	7789	7.2	13		+y	12/30
7248	7313	7710	6.3	12		-y	12/30
7281	7326	7747	6.4	12		+z	12/30
7211	7298	7700	6.7	15		-z	12/31
7084	7479	7595	6.9	13	Vibration	5-17 x	1/6
7060	7390	7738	9.2	12		5-17 y	1/7
7149	7284	7660	7.0	12		17-50 x	1/8
7078	7231	7637	7.5	11		17-50 y	1/11
6962	7378	7717	8.4	8		50-100 x	1/12
8709	8871	8950	2.7	10		50-100 y	1/13
7090	7412	7779	9.3	8		100-2000x	1/14
7183	7516	7665	6.4	10		100-2000y	1/18
5976	6279	6459	7.7	10	Shock	200g x	1/25
6086	6346	6658	9.0	9		200g y	1/26
6031	6312	6558	8.3	8		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4030 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/s	TEST		Date
7217	7541	7795	7.7	7			11/20
7433	7673	7930	6.5	7	Dry Heat	1	11/23
7480	7660	7861	6.0	7		2	11/25
7353	7622	7770	5.5	15		3	11/30
7087	7346	7764	9.2	7	Gas St.		12/28
7160	7400	7820	8.9	6	Accel.	+x	12/29
7112	7381	7794	9.3	4		-x	12/29
7145	7426	7781	8.6	9		+y	12/30
7192	7434	7811	8.3	7		-y	12/30
7221	7489	7881	8.8	6		+z	12/30
7200	7456	7867	8.9	7		-z	12/31
7199	7403	7744	7.4	12	Vibration	5-17 x	1/6
7235	7491	7668	5.8	14		5-17 y	1/7
7102	7314	7618	7.1	12		17-50 x	1/8
7172	7458	7804	8.5	12		17-50 y	1/11
7257	7546	7829	7.7	16		50-100 x	1/12
7257	7643	7857	8.0	14		50-100 y	1/13
7298	7487	7737	8.5	15		100-2000x	1/14
7424	7521	7865	5.9	16		100-2000y	1/18
7206	7519	7780	7.6	18	Shock	200g x	1/25
7252	7566	7829	7.6	19		200g y	1/26
7229	7542	7804	7.6	19		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4149 TUBE TYPE 5112 R

Plateau Points - Volts 900	950	1000	R.P.S. %	Background c/m	TEST		Date
7370	7774	7787	5.4	19			11/20
7375	7746	8007	8.2	21	Dry Heat	1	11/23
7302	7746	7914	7.9	24		2	11/25
7369	7537	7864	6.6	24		3	11/30
7296	7439	7778	6.5	21	Gas St.		12/28
7250	7410	7721	6.4	22	Accel.	+x	12/29
7312	7425	7795	6.5	21		-x	12/29
7350	7400	7804	6.1	23		+y	12/30
7300	7424	7768	6.3	20		-y	12/30
7290	7481	7799	6.8	21		+z	12/30
7301	7467	7728	5.7	20		-z	12/31
7330	7649	7797	6.2	22	Vibration	5-17 x	1/6
7163	7542	7834	8.9	20		5-17 y	1/7
7193	7471	7758	8.3	18		17-50 x	1/8
7109	7420	7813	9.5	20		17-50 y	1/11
7245	7608	7916	8.8	19		50-100 x	1/12
7151	7460	7772	8.2	20		50-100 y	1/13
7361	7557	7832	6.2	18		100-2000x	1/14
7370	7478	7809	5.9	20		100-2000y	1/18
7308	7697	7871	7.3	18	Shock	200g x	1/25
7305	7706	7940	7.1	19		200g y	1/26
7306	7701	7905	7.8	18		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

SHEET OF

EON CORPORATION
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175 PEARL ST., BROOKLYN 1, N.Y.

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TUBE # 4127 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Back-ground c/m	TEST		Date
7252	7542	7672	5.6	31			11/20
7040	7552	7848	10.6	25	Dry Heat	1	11/23
6959	7545	7649	10.5	19		2	11/25
7310	7505	7762	7.4	27		3	11/30
6929	7454	7508	7.9	18	Gas St.		12/28
7150	7462	7712	8.9	14	Accel.	+x	12/29
7181	7504	7758	7.7	15		-x	12/29
7086	7410	7500	5.6	12		+y	12/30
7100	7398	7512	5.6	14		-y	12/30
7111	7400	7545	6.0	13		+z	12/30
7125	7404	7689	7.5	11		-z	12/31
7048	7490	7602	7.4	10	Vibration	5-17 x	1/6
7039	7353	7714	9.2	11		5-17 y	1/7
6981	7324	7507	7.2	11		17-50 x	1/8
6905	7237	7637	10.1	11		17-50 y	1/11
7093	7443	7612	7.0	20		50-100 x	1/12
7187	7257	7756	7.8	19		50-100 y	1/13
7171	7376	7697	7.1	20		100-2000x	1/14
7070	7350	7812	10.1	19		100-2000y	1/18
7111	7548	7730	8.2	20	Shock	200g x	1/25
7196	7465	7862	8.9	19		200g y	1/26
7153	7506	7796	8.6	20		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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175 PEARL ST., BROOKLYN 1, N.Y.

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TUBE # 4111 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/s	TEST		Date
6849	7191	7423	8.0	9			11/20
6848	7199	7439	7.2	7	Dry Heat	1	11/23
6965	7126	7408	6.2	7		2	11/25
7036	7276	7517	6.6	17		3	11/30
6683	6947	7175	7.1	10	Gas St.		12/28
6712	7116	7255	6.9	8	Accel.	+x	12/29
6760	7101	7298	7.6	8		-x	12/30
6748	7076	7242	7.0	10		+y	12/30
6700	7125	7282	8.2	12		-y	12/30
6695	6912	7100	5.9	10		+z	12/30
6703	6900	7192	7.1	9		-z	12/31
6804	6971	7201	5.5	8	Vibration	5-17 x	1/6
6679	6998	7123	6.4	6		5-17 y	1/7
6857	6807	7176	4.7	10		17-50 x	1/8
6739	6998	7224	7.1	11		17-50 y	1/11
6944	7147	7388	6.2	14		50-100 x	1/12
6891	7207	7375	6.7	14		50-100 y	1/13
6936	7058	7349	6.0	12		100-2000 x	1/14
6837	7159	7286	6.3	11		100-2000 y	1/18
6740	7258	7388	9.0	12	Shock	200g x	1/25
6876	6930	7317	6.4	11		200g y	1/26
6808	7094	7352	7.5	10		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4147 **TUBE TYPE** 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7474	7589	7866	5.1	16			11/20
7325	7599	7990	8.8	18	Dry Heat	1	11/23
7417	7583	7930	6.8	20		2	11/25
7235	7599	7787	7.3	24		3	11/30
7394	7540	7722	4.4	17	Gas St.		12/28
7320	7600	7878	7.4	16	Accel.	+x	12/29
7395	7575	7900	6.7	17		-x	12/29
7400	7523	7898	6.6	19		+y	12/30
7382	7507	7887	6.7	15		-y	12/30
7412	7547	7903	6.5	16		+z	12/30
7373	7500	7863	6.5	17		-z	12/31
7241	7585	7572	4.4	14	Vibration	5-17 x	1/6
7065	7524	7674	8.1	15		5-17 y	1/7
7084	7453	7628	7.3	14		17-50 x	1/8
7181	7394	7562	5.2	12		17-50 y	1/11
7232	7469	7737	6.8	24		50-100 x	1/12
7049	7486	7576	7.0	24		50-100 y	1/13
7465	7614	7781	4.3	25		100-2000x	1/14
7165	7627	7695	7.0	21		100-2000y	1/18
6119	6392	6593	7.5	20	Shock	200g x	1/25
6097	6328	6639	8.6	21		200g y	1/26
6108	6360	6616	8.0	22		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4138 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7301	7777	7982	8.8	24			11/20
7580	7884	8181	7.6	20	Dry Heat	1	11/23
7541	7749	8052	6.4	19		2	11/25
7496	7619	8103	8.0	30		3	11/30
7255	7571	7787	7.1	31	Gas St.		12/28
7320	7540	7812	7.9	31	Accel.	+x	12/29
7457	7582	7844	5.1	30		-x	12/29
7426	7513	7881	6.1	29		+y	12/30
7396	7474	7819	5.7	30		-y	12/30
7422	7456	7919	6.7	31		+z	12/30
7400	7498	7876	6.4	31		-z	12/31
7269	7556	7948	9.0	30	Vibration	5-17 x	1/6
7075	7514	7940	11.5	28		5-17 y	1/7
7143	7491	7914	10.3	29		17-50 x	1/8
7149	7565	7722	7.6	30		17-50 y	1/11
7100	7463	7900	10.7	29		50-100 x	1/12
7058	7429	7895	11.3	29		50-100 y	1/13
7110	7495	7912	10.7	30		100-2000x	1/14
7212"	7515	7967	10.0	28		100-2000y	1/18
					Shock	200g x	
						200g y	
						200g z	
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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175 PEARL ST., BROOKLYN 1, N.Y.

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TUBE # 4081 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
6730	7057	7392	9.4	24			12/17
6783	7236	7408	7.8	11	Dry Heat	1	12/30
6773	7137	7157	5.4	10		2	1/5
6830	6911	7366	7.8	10		3	1/7
6704	6999	7264	8.0	8	Gas St.		1/11
6852	7033	7409	7.9	10	Accel.	+x	1/19
6863	7174	7422	7.8	10		-x	1/19
6857	7103	7415	7.9	10		+y	1/20
6780	7051	7344	8.0	9		-y	1/20
6818	7077	7379	8.0	11		+z	1/20
6835	7055	7391	7.9	10		-z	1/20
6804	7096	7274	6.6	11	Vibration	5-17 x	1/21
6819	7075	7332	7.3	10		5-17 y	1/21
6841	7124	7377	7.5	11		17-50 x	1/21
6785	7090	7384	8.5	12		17-50 y	1/21
6775	6962	7418	9.2	10		50-100 x	1/22
6782	7069	7426	9.1	10		50-100 y	1/22
6778	7015	7422	9.6	8		100-2000x	1/22
6791	7055	7348	7.9	9		100-2000y	1/22
6824	7079	7386	7.9	11	Shock	200g x	1/25
6801	7047	7404	8.6	12		200g y	1/26
6802	7071	7339	7.5	10		200g z	1/27
						150g x	
"						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4141 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7118	7334	7560	6.0	25			12/17
6804	7405	7486	9.7	29	Dry Heat	1	12/30
6979	7544	7488	6.8	32		2	1/5
7007	7231	7588	8.0	30		3	1/7
7042	7348	7752	9.7	28	Gas St.		1/11
7051	7449	7570	7.0	30	Accel.	+x	1/19
6923	7456	7489	7.6	29		-x	1/19
6987	7452	7529	7.3	28		+y	1/20
6955	7454	7509	7.4	31		-y	1/20
6939	7405	7499	7.6	30		+z	1/20
6947	7429	7504	7.5	31		-z	1/20
6902	7401	7496	8.0	30	Vibration	5-17 x	1/21
6912	7381	7427	7.0	29		5-17 y	1/21
6981	7415	7498	7.0	30		17-50 x	1/21
6994	7323	7543	7.5	31		17-50 y	1/21
6958	7389	7516	7.6	33		50-100 x	1/22
6940	7422	7502	7.6	29		50-100 y	1/22
7109	7244	7510	5.5	28		100-2000x	1/22
6972	7319	7567	8.1	30		100-2000y	1/22
7040	7281	7538	6.9	29	Shock	200g x	1/25
7006	7300	7552	7.5	30		200g y	1/26
6993	7358	7527	7.3	30		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4150 TUBE TYPE 5112R

Plateau Points		Volts	R.P.S. %	Background c/m	TEST		Date
6818	7149	7158	4.8	20			12/28
6920	7037	7378	6.5	20	Dry Heat	1	12/30
6796	7029	7350	7.5	25		2	1/5
6798	7108	7336	7.6	24		3	1/7
6818	7134	7369	7.7	25	Gas St.		1/11
6898	7077	7311	5.8	22	Accel.	+x	1/19
6725	7219	7473	10.3	24		-x	1/19
6811	7148	7392	8.1	24		+y	1/20
6768	7183	7432	9.2	21		-y	1/20
6746	7201	7422	9.4	20		+z	1/20
6757	7192	7427	9.3	22		-z	1/20
6830	7242	7410	8.0	22	Vibration	5-17 x	1/21
6793	7217	7418	8.7	20		5-17 y	1/21
6845	7147	7364	7.3	19		17-50 x	1/21
6801	7169	7395	8.3	23		17-50 y	1/21
6784	7276	7413	10.0	22		50-100 x	1/22
6841	7176	7362	7.3	18		50-100 y	1/22
6812	7226	7387	8.0	21		100-2000x	1/22
6768	7222	7430	9.2	20		100-2000y	1/22
6792	7115	7202	5.8	19	Shock	200g x	1/25
6931	7153	7355	6.1	19		200g y	1/26
6861	7134	7278	5.8	20		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4146 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7339	7563	7723	5.1	45			12/17
7161	7565	7752	7.8	42	Dry Heat	1	12/30
7148	7290	7514	4.3	51		2	1/5
7093	7385	7714	8.4	50		3	1/7
7071	7329	7756	9.4	48	Gas St.		1/11
7199	7598	7680	6.3	.52	Accel.	+x	1/19
7201	7390	7713	6.9	50		-x	1/19
7200	7494	7696	6.6	54		+y	1/20
7200	7442	7704	6.8	50		-y	1/20
7146	7413	7730	7.9	48		+z	1/20
7199	7420	7783	7.9	48		-z	1/20
7178	7416	7756	7.8	49	Vibration	5-17 x	1/21
7189	7455	7726	7.5	50		5-17 y	1/21
7183	7435	7741	7.4	49		17-50 x	1/21
7191	7438	7718	7.2	49		17-50 y	1/21
7305	7426	7753	6.1	45		50-100 x	1/22
7207	7411	7681	6.4	48		50-100 y	1/22
7256	7418	7717	6.2	47		100-2000x	1/22
7228	7456	7706	6.4	50		100-2000y	1/22
7266	7441	7729	6.2	52	Shock	200g x	1/25
7233	7468	7712	6.4	50		200g y	1/26
7168	7481	7672	6.8	50		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
	"					- 10°C	

EON CORPORATION

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175 PEARL ST., BROOKLYN 1, N.Y.

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TUBE # 4130 TUBE TYPE · 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Back-ground c/m	TEST		Date
7082	7558	7677	7.9	20			12/17
7100	7696	7624	6.8	17	Dry Heat	1	12/30
7031	7368	7560	7.2	14		2	1/5
7023	7398	7546	7.1	14		3	1/7
7131	7229	7713	7.9	15	Gas St.		1/11
7009	7198	7649	8.9	16	Accel.	+x	1/19
7018	7306	7644	8.6	15		-x	1/19
7013	7252	7646	8.7	12		+y	1/20
7015	7279	7640	8.0	11		-y	1/20
7073	7254	7626	7.6	14		+z	1/20
7050	7222	7656	8.4	15		-z	1/20
7040	7345	7608	9.1	15	Vibration	5-17 x	1/21
7045	7283	7632	8.1	14		5-17 y	1/21
7100	7304	7596	6.8	12		17-50 x	1/21
7115	7266	7654	7.4	14		17-50 y	1/21
7054	7357	7739	9.3	14		50-100 x	1/22
7082	7582	7620	7.1	12		50-100 y	1/22
7068	7469	7679	8.2	11		100-2000x	1/22
7061	7413	7709	8.7	12		100-2000y	1/22
7050	7379	7658	8.3	13	Shock	200g x	1/25
7052	7368	7698	8.8	14		200g y	1/26
7076	7336	7647	7.8	14		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

EON CORPORATION

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TUBE # 4135 **TUBE TYPE** 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
7123	7475	7773	8.7	33			12/17
7078	7597	7803	9.7	49	Dry Heat	1	12/30
7168	7496	7796	8.4	50		2	1/5
7253	7507	7552	4.0	50		3	1/7
7181	7468	7797	8.3	52	Gas St.		1/11
7264	7617	7764	6.6	47	Accel.	+x	1/19
7328	7543	7836	6.8	51		-x	1/19
7296	7580	7800	6.7	46		+y	1/20
7312	7561	7818	6.7	43		-y	1/20
7282	7534	7685	5.3	49		+z	1/20
7300	7540	7718	5.6	52		-z	1/20
7291	7537	7701	5.4	50	Vibration	5-17 x	1/21
7301	7549	7759	6.1	50		5-17 y	1/21
7277	7528	7655	5.0	49		17-50 x	1/21
7294	7544	7736	5.9	51		17-50 y	1/21
7281	7547	7622	4.5	45		50-100 x	1/22
7323	7535	7787	6.2	49		50-100 y	1/22
7302	7541	7704	5.3	48		100-2000x	1/22
7299	7560	7752	6.0	49		100-2000y	1/22
7290	7553	7687	5.3	51	Shock	200g x	1/25
7306	7544	7737	5.7	50		200g y	1/26
7302	7552	7712	5.4	49		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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TUBE # 4151 TUBE TYPE 5112R

Plateau Points Volts			R.P.S. %	Back-ground c/m	TEST		Date
900	950	1000					
6851	7290	7560	9.7	17			12/17
6933	7072	7467	7.6	18	Dry Heat	1	12/30
6885	7127	7387	7.1	17		2	1/5
6976	7332	7384	5.6	17		3	1/7
6839	7306	7426	8.0	15	Gas St.		1/11
6984	7165	7582	8.4	12	Accel.	+x	1/19
7110	7330	7480	5.1	14		-x	1/19
7047	7247	7531	6.7	11		+y	1/20
7078	7288	7565	6.7	13		-y	1/20
6981	7207	7474	6.8	10		+z	1/20
7029	7247	7519	6.8	15		-z	1/20
7005	7227	7496	6.8	12	Vibration	5-17 x	1/21
7017	7237	7507	6.8	14		5-17 y	1/21
6996	7284	7445	6.2	14		17-50 x	1/21
7006	7260	7476	6.5	12		17-50 y	1/21
7031	7130	7595	7.9	12		50-100 x	1/22
7018	7139	7530	7.2	10		50-100 y	1/22
7024	7134	7562	7.6	9		100-2000x	1/22
6974	7110	7494	7.3	11		100-2000y	1/22
6979	7122	7528	7.4	11	Shock	200g x	1/25
6986	7116	7511	7.4	12		200g y	1/26
7048	7223	7495	6.2	13		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

SHEET

EON CORPORATION
Electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

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TUBE # 4143 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Background c/m	TEST		Date
6538	6986	7380	12.1	10			12/17
6587	7107	7321	10.3	15	Dry Heat	1	12/30
6596	6887	7171	8.4	7		2	1/5
6468	6897	7250	11.3	6		3	1/7
6719	7107	7093	5.3	8	Gas St.		1/11
6705	7136	7271	7.9	10	Accel.	+x	1/19
6602	7101	7218	8.7	9		-x	1/19
6653	7118	7244	8.3	6		+y	1/20
6627	7109	7231	8.5	5		-y	1/20
6547	7003	7162	8.8	7		+z	1/20
6600	7103	7221	8.7	9		-z	1/20
6573	7053	7191	8.8	8	Vibration	5-17 x	1/21
6591	7068	7211	8.8	10		5-17 y	1/21
6655	7087	7252	8.4	10		17-50 x	1/21
6628	7095	7186	7.9	11		17-50 y	1/21
6821	6981	7336	7.4	8		50-100 x	1/22
6707	7048	7279	9.2	7		50-100 y	1/22
6764	7014	7308	7.8	8		100-2000x	1/22
6696	7054	7247	7.8	9		100-2000y	1/22
6758	7018	7291	7.6	10	Shock	200g x	1/25
6727	7036	7269	7.7	9		200g y	1/26
6774	7008	7302	7.6	9		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

SHEET OF

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175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

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TUBE # 4124 TUBE TYPE 5112R

Plateau Points 900	950	Volts 1000	R.P.S. %	Back-ground c/m	T'E S T		Date
7231	7417	7791	7.6	32			12/17
7201	7507	7643	5.9	28	Dry Heat	1	12/30
7043	7366	7596	7.5	17		2	1/5
7148	7325	7616	6.4	18		3	1/7
7096	7486	7635	7.2	19	Gas St.		1/11
7168	7549	7411	3.2	20	Accel.	+x	1/19
7111	7368	7640	7.2	15		-x	1/19
7139	7458	7525	5.2	15		+y	1/20
7125	7413	7582	6.2	17		-y	1/20
7146	7481	7511	4.9	16		+z	1/20
7135	7447	7546	5.5	19		-z	1/20
7140	7464	7528	5.2	18	Vibration	5-17 x	1/21
7125	7416	7584	6.2	20		5-17 y	1/21
7135	7428	7547	5.5	21		17-50 x	1/21
7123	7398	7593	6.4	20		17-50 y	1/21
7049	7252	7537	6.7	18		50-100 x	1/22
6996	7353	7807	11.0	18		50-100 y	1/22
7022	7302	7672	8.9	19		100-2000x	1/22
7009	7327	7739	10.0	17		100-2000y	1/22
7072	7377	7643	7.8	21	Shock	200g x	1/25
7060	7314	7590	7.3	20		200g y	1/26
7066	7345	7616	7.5	20		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

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175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

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TUBE # 2434 **TUBE TYPE 6226**

Plateau Points 700	750	Volts 800	R.P.S. %	Back-ground c/m	TEST		Date
6895	6923	7051	2·2	5			11/27
6981	7179	7290	4·3	4	Dry Heat	1	11/30
7348	7416	7443	1·3	5		2	12/3
7106	7238	7530	5·9	6		3	12/7
6935	7043	7002	1·0	6	Gas St.		12/28
7010	7089	7112	1·4	5	Accel.	+x	12/29
7100	7150	7199	1·4	5		-x	12/29
7040	7100	7148	1·5	7		+y	12/30
6987	7112	7183	2·8	4		-y	12/30
7071	7189	7224	2·1	5		+z	12/30
7104	7168	7259	2·2	6		-z	12/31
7026	7192	7306	3·9	4	Vibration	5-17 x	1/4
7068	7200	7345	3·9	5		5-17 y	1/4
7188	7277	7369	2·5	5		17-50 x	1/4
7226	7268	7369	2·0	4		17-50 y	1/4
7095	7229	7279	2·6	6		50-100 x	1/4
7192	7355	7316	1·7	5		50-100 y	1/4
7142	7323	7339	2·7	7		100-2000x	1/5
7003	7158	7318	4·3	8		100-2000y	1/5
7262	7297	7493	3·2	6	Shock	200g x	1/25
7054	7088	7295	3·4	4		200g y	1/26
7158	7192	7394	3·3	5		200g z	1/27
7222	7471	7399	2·4			150g x	2.1
7243	7455	7590	4·7			150g y	2.1
7314	7385	7691	5·1			1000g x	2.2
7378	7351	7569	2·6	6		1000g y	2.2
7468	7677	7874	5·3		Wide Band	15-2000 x	2.12
7489	7797	7979	6·3	4		15-2000 y	2.12
7379	7436	7469	1·2	4	Thermal	+ 75°C	3.1
7279	7327	7526	3·4	5		- 10°C	3.10

EON CORPORATION

Electronic-Optical-Nuclear products

175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

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TUBE # 1431 TUBE TYPE 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Background c/m	TEST		Date
4965	5768	5846	15.3	9			
5144	5789	5858	12.3	8	Dry Heat	1	
5468	5733	5951	8.4	10		2	
5343	5596	5812	8.4	11		3	
5257	5516	5748	8.9	11	Gas St.		
5301	5577	5789	8.8	11	Accel.	+x	
5388	5610	6018	11.2	8		-x	
5355	5592	6000	11.6	10		+y	
5411	5686	6116	12.4	10		-y	
5393	5489	5849	8.3	12		+z	
5200	5494	5698	9.0	11		-z	
5500	5823	5959	8.9	13	Vibration	5-17 x	
5520	5817	5937	7.2	11		5-17 y	
5552	5805	6077	9.1	12		17-50 x	
5493	5770	5859	6.4	12		17-50 y	
5431	5699	5958	8.8	10		50-100 x	
5522	5579	5848	5.9	11		50-100 y	
5468	5708	5863	6.9	12		100-2000x	
5689	5830	5797	1.8	11		100-2000y	
5496	5841	5909	7.1	12	Shock	200g x	
5555	5884	5991	7.4	10		200g y	
5522	5862	5950	7.3	10		200g z	
5917	6021	6047	2.2			150g x	
5863	5995	6070	3.4			150g y	
5790	6016	6005	3.6			1000g x	
5577	5920	5987	6.9	11		1000g y	
5909	6002	6365	7.6		Wide Band	15-2000 x	
5874	5927	6466	1.0	10		15-2000 y	
5543	6005	6009	7.8	11	Thermal	+ 75°C	
5576	5969	5990	6.9	10		- 10°C	

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TUBE # 1701 TUBE TYPE 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Back-ground c/m	TEST		Date
6758	6859	6897	2.0	46			12/28
6835	6851	7023	2.7	47	Dry Heat	1	12/30
7195	7231	7297	1.4	37		2	1/5
7133	7153	7318	2.6	40		3	1/7
7226	7213	7282	0.8	40	Gas St.		1/11
7108	7229	7348	3.3	42	Accel.	+x	1/19
6941	7158	7367	6.0	41		-x	1/19
7024	7193	7358	4.7	35		+y	1/20
6982	7175	7362	5.3	32		-y	1/20
7058	7164	7340	3.9	30		+z	1/20
6908	7011	7118	3.0	32		-z	1/20
7387	7348	7801	5.6	31	Vibration	5-17 x	1/21
7349	7448	7580	3.1	38		5-17 y	1/21
7128	7179	7459	4.6	38		17-50 x	1/21
7238	7313	7519	3.9	37		17-50 y	1/21
7183	7246	7489	4.2	40		50-100 x	1/23
7210	7279	7504	4.0	42		50-100 y	1/23
7382	7468	7531	2.0	45		100-2000x	1/23
7296	7373	7517	3.0	43		100-2000y	1/23
7064	7090	7230	2.3	46	Shock	200g x	1/25
7180	7231	7373	2.7	40		200g y	1/26
7281	7349	7452	2.3	42		200g z	1/27
7661	7890	7860	2.6			150g x	2/1
7685	7906	8040	4.5			150g y	2/1
7766	7832	7849	1.0			1000g x	2/2
7420	7468	7527	1.4	46		1000g y	2/2
7865	7996	7991	1.6		Wide Band	15-2000 x	2/12
7708	7925	7944	3.0	40		15-2000 y	2/12
7683	7510	7982	4.0	41	Thermal	+ 75°C	3/1
7451	7529	7669	2.9	38		- 10°C	3/10

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175 PEARL ST., BROOKLYN 1, N.Y.

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TUBE # 1915 TUBE TYPE 6226

Plateau Points Volts			R.P.S.	Background	TEST		Date
700	750	800	%	c/m			
6077	6387	6512	6.8	3			12/28
6522	6590	6611	1.3	2	Dry Heat	1	12/30
6426	6845	6783	5.2	4		2	1/5
6635	6533	6683	0.8	3	"	3	1/7
6341	6483	6634	4.5	4	Gas St.		1/11
6505	6543	6663	2.4	3	Accel.	+x	1/19
6371	6577	6608	3.7	4		-x	1/19
6438	6510	6635	3.0	6		+y	1/20
6404	6543	6621	3.3	6		-y	1/20
6415	6694	6702	4.3	7		+z	1/20
6409	6618	6661	3.8	4		-z	1/20
6581	6807	6804	3.3	3	Vibration	5-17 x	1/21
6621	6702	6985	5.4	3		5-17 y	1/21
6601	6754	6894	4.4	2		17-50 x	1/21
6611	6728	6944	5.0	4		17-50 y	1/21
6680	6864	6995	4.6	5		50-100 x	1/23
6645	6796	6969	4.8	1		50-100 y	1/23
6613	6801	6886	4.0	4		100-2000x	1/23
6514	6747	6794	4.2	4		100-2000y	1/23
6579	6771	6881	4.5	3	Shock	200g x	1/25
6546	6759	6837	4.3	2		200g y	1/26
6530	6753	6815	4.2	2		200g z	1/27
7079	7241	7164	1.2			150g x	2/1
6975	7048	7183	3.0			150g y	2/1
6665	6981	7234	8.2			1000g x	2/2
6648	6963	6996	5.0	3		1000g y	2/2
7060	7210	7460	5.6		Wide Band	15-2000 x	2/12
7118	7263	7438	4.4	2		15-2000 y	2/12
6826	6994	7003	2.5	2	Thermal	+ 75°C	3/1
6898	7061	7146	3.5	3		- 10°C	3/10

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175 PEARL ST., BROOKLYN 1, N.Y.

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TUBE # 2086 · TUBE TYPE 6226

Plateau Points		Volts	R.P.S. %	Background c/m	TEST		Date
700	750	800					
6082	6194	6435	5·7	6			12/28
6186	6398	6373	2·9	8	Dry Heat	1	12/30
6475	6611	6729	3·8	7		2	1/5
6430	6644	6624	2·9	7		3	1/7
6475	6513	6485	1·5	8	Gas St.		1/11
6395	6499	6512	3·3	7	Accel.	+x	1/19
6442	6502	6724	4·3	7		-x	1/19
6418	6500	6618	3·1	8		+y	1/20
6430	6501	6671	3·7	6		-y	1/20
6452	6556	6700	3·8	4		+z	1/20
6435	6529	6659	3·4	4		-z	1/20
6443	6542	6679	3·6	7	Vibration	5-17 x	1/21
6387	6500	6669	4·3	6		5-17 y	1/21
6510	6628	6828	4·8	6		17-50 x	1/21
6456	6673	6769	4·7	7		17-50 y	1/21
6483	6650	6798	4·7	8		50-100 x	1/23
6641	6747	6714	1·1	7		50-100 y	1/23
6562	6648	6786	3·4	7		100-2000 x	1/23
6775	6724	6886	1·7	4		100-2000 y	1/23
6668	6686	6836	2·5	3	Shock	200g x	1/25
6562	6679	6802	3·6	4		200g y	1/26
6615	6682	6819	3·1	4		200g z	1/27
6797	6806	6897	1·5	5		150g x	2/1
6933	7134	7192	3·6	5		150g y	2/1
7030	6982	7243	3·1			1000g x	2/2
6811	7046	7083	3·9	5		1000g y	2/2
7228	7247	7402	2·4		Wide Band	15-2000 x	2/12
7191	7159	7299	1·5	6		15-2000 y	2/12
6886	7008	7195	4·4	5	Thermal	+ 75°C	3/1
6805	6836	7106	4·4	5		- 10°C	3/10

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175 PEARL ST., BROOKLYN 1, N.Y.

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TUBE # 1983 TUBE TYPE 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Background c/s	TEST		Date
6421	6418	6671	3.9	7			11/27
6329	6539	6876	8.4	9	Dry Heat	1	11/30
6545	6681	6739	2.9	10		2	12/3
6385	6492	6701	4.8	11		3	12/7
6191	6587	6553	5.5	6	Gas St.		12/28
6270	6550	6600	5.0	4	Accel.	+x	12/29
6310	6595	6627	4.8	8		-x	12/29
6250	6500	6598	5.4	10		+y	12/30
6282	6512	6636	5.5	7		-y	12/30
6340	6509	6610	4.2	6		+z	12/30
6378	6573	6682	4.6	6		-z	12/31
6602	6694	6812	3.2	4	Vibration	5-17 x	1/4
6612	6684	6798	2.8	3		5-17 y	1/4
6531	6684	6641	1.7	4		17-50 x	1/4
6676	6531	6810	2.1	2		17-50 y	1/4
6470	6602	6703	3.5	4		50-100 x	1/4
6366	6658	6731	5.5	6		50-100 y	1/4
6429	6536	6520	1.4	12		100-2000x	1/5
6486	6468	6575	1.3	11		100-2000y	1/5
6513	6450	6676	2.5	8	Shock	200g x	1/25
6453	6524	6699	3.8	8		200g y	1/26
6483	6487	6687	3.2	4		200g z	1/27
6583	6767	6790	3.1			150g x	2/1
6751	6884	7027	4.0			150g y	2/1
6834	6865	7054	3.2			1000g x	2/2
6562	6737	6724	2.4	3		1000g y	2/2
7087	7001	7318	3.3		Wide Band	15-2000 x	2/12
7120	7071	7123	0.5	4		15-2000 y	2/12
6681	6767	6846	2.4	4	Thermal	+ 75°C	3/1
6743	6837	7004	3.2	3		- 10°C	3/10

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175 PEARL ST., BROOKLYN 1, N.Y.

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TUBE # 2229 **TUBE TYPE** 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Back-ground c/m	TEST		Date
6879	6861	7166	4.2	17			11/27
7145	7224	7308	2.3	14	Dry Heat	1	11/30
7189	7346	7303	1.5	14		2	12/3
7080	7355	8362	17.4	13		3	12/7
7002	7064	7178	24	13	Gas St.		12/28
7100	7180	7230	1.8	10	Accel.	+x	12/29
7185	7210	7290	1.5	10		-x	12/29
7112	7200	7245	1.8	9		+y	12/30
7079	7191	7200	1.7	8		-y	12/30
7104	7147	7268	2.3	11		+z	12/30
7168	7237	7341	2.4	10		-z	12/31
7396	7441	7526	1.8	11	Vibration	5-17 x	1/4
7410	7474	7500	1.2	12		5-17 y	1/4
7405	7450	7552	1.9	9		17-50 x	1/4
7421	7401	7639	3.0	11		17-50 y	1/4
7401	7423	7595	2.6	10		50-100 x	1/4
7307	7470	7383	1.0	11		50-100 y	1/4
7176	7272	7444	3.7	14		100-2000x	1/5
7236	7241	7372	1.9	14		100-2000y	1/5
7296	7397	7575	3.8	10	Shock	200g x	1/25
7204	7485	7435	3.1	9		200g y	1/26
7250	7441	7505	3.4	11		200g z	1/27
7613	7603	7647	0.5			150g x	2/1
7676	7683	7771	1.2			150g y	2/1
7698	7727	7809	1.4			1000g x	2/2
7502	7576	7636	1.8	12		1000g y	2/2
8047	8125	8139	1.1		Wide Band	15-2000 x	2/12
7983	8037	7999	2.0	10		15-2000 y	2/12
7457	7727	7986	6.9	11	Thermal	+ 75°C	3/1
7452	7532	7943	6.5	11		- 10°C	3/10

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175 PEARL ST., BROOKLYN 1, N.Y.

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REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

TUBE # 1925 TUBE TYPE 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Background c/m	TEST		Date
6149	6205	6366	3.5	7			11/27
6221	6287	6409	3.0	8	Dry Heat	1	11/30
6425	6435	6569	2.2	6		2	12/3
6147	6414	6451	5.1	4		3	12/7
6143	6238	6275	2.1	2	Gas St.		12/28
6228	6304	6412	2.9	3	Accel.	+x	12/29
6198	6312	6578	6.0	3		-x	12/29
6110	6277	6392	4.5	5		+y	12/30
6217	6308	6508	4.6	4		-y	12/30
6171	6258	6424	4.0	2		+z	12/30
6132	6240	6398	4.3	2		-z	12/31
6357	6470	6493	2.1	4	Vibration	5-17 x	1/4
6322	6419	6472	2.3	3		5-17 y	1/4
6427	6486	6632	3.2	4		17-50 x	1/4
6302	6472	6478	2.7	5		17-50 y	1/4
6379	6473	6697	4.9	7		50-100 x	1/4
6290	6382	6442	2.4	6		50-100 y	1/4
6281	6480	6392	1.7	2		100-2000x	1/5
6370	6298	6430	1.0	3		100-2000y	1/5
6354	6421	6559	3.2	4	Shock	200g x	1/25
6388	6539	6642	3.9	2		200g y	1/26
6371	6480	6600	3.5	1		200g z	1/27
6615	6473	6727	1.7			150g x	2.1
6630	6757	6792	2.4			150g y	2.1
6459	6644	6470	1.6			1000g x	2.2
6483	6689	6724	3.6	3		1000g y	2.2
6707	6834	6894	2.7		Wide Band	15-2000 x	2.12
6738	6848	6937	2.9	3		15-2000 y	2.12
6615	6697	6746	2.0	4	Thermal	+ 75°C	3.1
6539	6575	6824	4.3	4		- 10°C	3.10

EON CORPORATION
Electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

TUBE # 2642 TUBE TYPE 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Back-ground c/m	TEST		Date
6695	6704	6939	3.7	5			11/27
6848	6885	7117	3.9	6.	Dry Heat	1	11/30
7110	7058	7365	3.6	6		2	12/3
6818	6933	7659	12.1	7		3	12/7
6659	6707	6718	0.8	6	Gas Sf.		12/28
6700	6792	6812	1.6	4	Accel.	+x	12/29
6668	6745	6859	2.8	4		-x	12/29
6726	6712	6800	1.1	5		+y	12/30
6681	6654	6752	1.0	3		-y	12/30
6800	6873	6951	2.2	6		+z	12/30
6710	6810	6945	3.5	6		-z	12/31
6958	7060	6996	0.5	5	Vibration	5-17 x	1/4
6942	7001	6981	0.5	4		5-17 y	1/4
6850	6932	7162	4.5	3		17-50 x	1/4
6900	6954	7137	3.4	4		17-50 y	1/4
6902	6944	7042	2.0	5		50-100 x	1/4
6788	6829	7002	3.1	5		50-100 y	1/4
6840	6881	6953	1.6	2		100-2000x	1/5
6800	6850	6923	1.8	3		100-2000y	1/5
6713	6914	6981	3.9	2	Shock	200g x	1/25
6672	6799	7083	6.1	1		200g y	1/26
6692	6856	7032	5.0	2		200g z	1/27
7017	7041	7156	2.0	3		150g x	2/1
7092	7137	7207	1.6	3		150g y	2/1
7076	7945					1000g x	2/2
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

SHEET OF

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

TUBE # 1989 TUBE TYPE 6226

Plateau Points Volts			R.P.S.	Back-ground	TEST		Date
700	750	800	%	c/m			
6395	6593	6628	3.5	4			12/28
6497	6646	6823	4.9	5	Dry Heat	1	12/30
6754	6880	6869	1.7	5		2	1/5
6501	6752	6727	3.3	4		3	1/7
6524	6560	6680	2.1	4	Gas St.		1/11
6711	6744	6796	1.3	3	Accel.	+x	1/19
6581	6596	6765	2.8	4		-x	1/19
6646	6670	6780	2.0	2		+y	1/20
6613	6633	6772	2.4	2		-y	1/20
6568	6596	6726	2.4	4		+z	1/20
6534	6674	6798	3.4	3		-z	1/20
6551	6635	6762	3.2	2	Vibration	5-17 x	1/21
6537	6597	6721	2.8	5		5-17 y	1/21
6517	6621	6772	3.9	4		17-50 x	1/21
6520	6590	6726	3.1	4		17-50 y	1/21
6769	6962	6934	2.4	6		50-100 x	1/23
6686	6929	7016	4.8	7		50-100 y	1/23
6727	6945	6975	3.6	5		100-2000x	1/23
6623	6767	6850	3.4	8		100-2000y	1/23
6713	6859	7181	6.9	10	Shock	200g x	1/25
6668	6813	7015	5.1	9		200g y	1/26
6640	6836	7098	6.7	12		200g z	1/27
7113	7097	7254	2.0	10		150g x	2/1
7129	7247	7344	3.0	10		150g y	2/1
7048	7364	7304	3.5	9		1000g x	2/2
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
6792	6978	7137	5.0	9	Thermal	+ 75°C	3/1
6846	7130	7167	4.5	10		- 10°C	3/10

SHEET OF

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

TUBE # 2766 TUBE TYPE 6226

Plateau Points Volts			R.P.S. %	Background c/m	TEST		Date
700	750	800					
6251	6373	6374	1.9	10			11/27
6346	6435	6515	2.6	12	Dry Heat	1	11/30
6240	6318	6449	3.3	12		2	12/3
6230	6547	6953	11.0	14		3	12/7
6029	6078	6164	2.3	7	Gas St.		12/28
6103	6128	6213	1.8	10	Accel.	+x	12/29
6145	6189	6221	0.9	11		-x	12/29
6112	6130	6200	1.4	8		+y	12/30
6089	6100	6240	2.5	8		-y	12/30
6179	6203	6359	2.9	9		+z	12/31
6137	6198	6280	2.3	11		-z	1/4
6260	6431	6541	4.4	6	Vibration	5-17 x	1/4
6200	6398	6491	4.6	5		5-17 y	1/4
6391	6308	6590	3.2	4		17-50 x	1/4
6311	6375	6531	3.5	4		17-50 y	1/4
6239	6302	6372	2.1	5		50-100 x	1/4
6234	6255	6374	1.6	7		50-100 y	1/5
6268	6445	6415	2.3	12		100-2000x	1/5
6207	6274	6463	4.1	10		100-2000y	1/25
6775	6818	7208	6.4	8	Shock	200g x	1/26
6597	6757	7109	7.6	7		200g y	1/27
6686	6787	7158	7.0	9		200g z	1/27
						150g x	
						150g y	
						1000g x	
6495	6648	6534	2.1	10		1000g y	2/2
6592	6821	7036	6.5		Wide Band	15-2000 x	2/12
6821	6888	6925	1.5	10		15-2000 y	2/12
6521	6562	6549	0.4	8	Thermal	+ 75°C	3/1
6475	6414	6545	1.1	10		- 10°C	3/10

SHEET OF

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

TUBE # 1985 TUBE TYPE 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Background c/m	TEST		Date
6369	6510	6674	4.7	4			11/27
6628	6528	6737	1.7	3	Dry Heat	1	11/30
6697	6822	6855	2.3	2		2	12/3
6703	6810	8069	20.0	3		3	12/7
6383	6515	6676	4.5	3	Gas St.		12/28
6292	6478	6600	4.8	2	Accel.	+x	12/29
6320	6490	6658	5.2	5		-x	12/29
6300	6454	6681	5.9	4		+y	12/30
6357	6502	6693	5.2	3		-y	12/30
6372	6517	6611	3.6	2		+z	12/30
6401	6532	6681	4.3	3		-z	12/31
6669	6753	6791	1.8	4	Vibration	5-17 x	1/4
6620	6693	6753	2.0	5		5-17 y	1/4
6760	6789	6902	2.1	7		17-50 x	1/4
6731	6774	6846	1.7	6		17-50 y	1/4
6461	6537	6861	6.2	7		50-100 x	1/4
6479	6658	6996	7.8	7		50-100 y	1/4
6616	6723	6987	5.5	5		100-2000x	1/5
6568	6660	7016	6.7	4		100-2000y	1/5
6585	6890	7097	7.4	3	Shock	200g x	1/25
6620	6773	7068	6.6	4		200g y	1/26
6602	6831	7082	7.0	6		200g z	1/27
						150g x	
						150g y	
						1000g x	
6930	7058	7347	5.9	8		1000g y	2/2
7130	7206	7462	4.6		Wide Band	15-2000 x	2/12
7107	7159	7586	6.7	7		15-2000 y	2/12
6889	6840	7204	4.6	9	Thermal	+ 75°C	3/1
6909	6869	7287	5.5	8		- 10°C	3/10

SHEET OF

EON CORPORATION

Electronic-Optical-Nuclear products

175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

TUBE # 2176 **TUBE TYPE** 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Background c/m	TEST		Date
6436	6557	6787	5.4	9			11/27
6534	6663	6815	4.2	7	Dry Heat	1	11/30
6817	6828	7115	4.4	7		2	12/3
6495	6701	7279	11.7	6		3	12/7
6411	6579	6848	6.7	3	Gas St.		12/28
6555	6627	6921	5.9	1	Accel.	+x	12/29
6512	6600	6789	4.2	2		-x	12/29
6576	6610	6804	3.5	5		+y	12/30
6600	6693	6812	2.5	4		-y	12/30
6632	6656	6800	2.5	4		+z	12/30
6599	6673	6770	2.6	3		-z	12/31
6849	6849	6980	1.9	2	Vibration	5-17 x	1/4
6900	6920	7378	6.9	3		5-17 y	1/4
6687	6725	7122	6.5	5		17-50 x	1/4
6596	6734	6978	5.7	4		17-50 y	1/4
6605	6669	6910	4.6	4		50-100 x	1/4
6453	6692	6897	6.6	3		50-100 y	1/4
6571	6724	7034	6.9	9		100-2000 x	1/5
6609	6756	7067	6.8	6		100-2000 y	1/5
6775	6818	7208	6.4	5	Shock	200g x	1/25
6597	6757	7109	7.6	6		200g y	1/26
6686	6787	7158	7.0	5		200g z	1/27
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

SHEET OF

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

TUBE # 2487 TUBE TYPE 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Background c/m	TEST		Date
6509	6707	6935	6.4	6			11/27
6739	6781	6951	3.1	8	Dry Heat	1	11/30
6745	6985	7685	13.8	7		2	12/3
6687	6840	—				3	12/7
					Gas St. Accel.		
						+x	
						-x	
						+y	
						-y	
						+z	
						-z	
					Vibration	5-17 x	
						5-17 y	
						17-50 x	
						17-50 y	
						50-100 x	
						50-100 y	
						100-2000x	
						100-2000y	
					Shock	200g x	
						200g y	
						200g z	
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

SHEET OF

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

TUBE # 2478 TUBE TYPE 6226

Plateau Points 700	750	Volts 800	R.P.S. %	Background c/m	TEST		Date
6674	6859	7022	5.1	8			12/28
6582	6960	6904	4.6	5	Dry Heat	1	12/30
7233	7107	7458	3.2	10		2	1/5
7357	7418	—				3	1/7
					Gas St. Accel.		
						+x	
						-x	
						+y	
						-y	
						+z	
						-z	
					Vibration	5-17 x	
						5-17 y	
						17-50 x	
						17-50 y	
						50-100 x	
						50-100 y	
						100-2000x	
						100-2000y	
					Shock	200g x	
						200g y	
						200g z	
						150g x	
						150g y	
						1000g x	
						1000g y	
					Wide Band	15-2000 x	
						15-2000 y	
					Thermal	+ 75°C	
						- 10°C	

APPENDIX B

Shelf Life Test

EON CORPORATION — electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE 8.12.64

Shelf Life Test — Start

TUBE TYPE 5112 [redacted]

#	900V	950V	1000V	Slope	Bkgd		
4062	7187	7505	7828	8.6	24		
4076	7200	7573	7888	9.1	22		
4056	7202	7625	8005	10.5	14		
4089	7084	7555	7800	10.5	14		
4099	7329	7609	7964	8.2	18		
4066	7070	7545	7783	9.5	24		
4053	7100	7432	7754	8.7	21		
4112	6965	7500	7906	12.5	28		
4092	7044	7504	7826	10.4	10		
4032	7329	7703	8000	8.7	17		

SHEET OF

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE: 10.7 64

Shelf Life Test — 1344 hours

TUBE TYPE 5112 [redacted]

#	900V	950V	1000V	Slope	Bkgd		
4062	6803	7207	7388	8.1	22		
4076	6757	7538	7631	11.6	11		
4056	7080	7341	7594	7.0	19		
4089	6758	7274	7525	10.5	20		
4099	7020	7504	7775	10.0	9		
4066	6756	7187	7388	8.8	18		
4053	7340	7725	7919	7.5	21		
4112	6600	7148	7380	10.9	22		
4092	6919	7238	7615	9.7	21		
4032	7159	7638	7881	9.4	19		

SHEET OF

EON CORPORATION

electronic-Optical-Nuclear products

175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE 12.16.64

Shelf Life Test — 3024 hours

TUBE TYPE 5112 [redacted]

#	900V	950V	1000V	Slope	Akgol		
4062	7178	7670	8078	11·7	18		
4076	7246	7871	8373	14·2	14		
4056	7267	7942	8070	10·1	20		
4089	7266	7636	8167	11·8	19		
4099	7374	7886	8500	14·2	10		
4066	7052	7567	8014	12·7	16		
4053	7740	8146	8587	10·4	17		
4112	7174	7375	7807	8·6	17		
4092	7206	7853	8024	10·4	16		
4032	7442	8047	8311	10·8	11		

SHEET OF

EON CORPORATION
Electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE: 8.12.64

Shelf Life Test -start

TUBE TYPE 5112 [redacted]

#	900V	950V	1000V	Slope	Bkgd		
4072	7130	7505	7902	10.6	11		
4105	7487	7814	8049	7.7	15		
4054	7186	7480	7779	7.9	11		
4055	7079	7402	771C	8.5	11		
4077	7044	7352	7739	9.4	20		
4044	7210	7645	7854	8.4	11		
4104	7344	7604	8019	8.9	17		
4069	7323	7614	7976	8.6	18		
4034	7129	7405	7754	8.4	17		
4117	7180	7684	7997	10.6	19		

SHEET OF

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE	REVISION C	DATE: 10.7.64

Shelf Life Test — 1344 hours

TUBE TYPE 5112 [redacted]

#	900V	950V	1000V	Slope	Bkgd		
4C72	6860	7328	7410	7.5	18		
4105	7081	7343	7721	8.7	19		
4C54	6800	7221	7347	7.6	12		
4C55	6945	7150	7641	9.7	22		
4C77	6948	7518	7733	10.4	21		
4C44	7072	7289	7707	8.7	13		
4104	6900	7454	7597	9.4	20		
4C69	6950	7492	7808	11.4	30		
4C34	6900	7388	7599	9.5	21		
4117	6973	7400	7728	10.2	15		

SHEET OF

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE 12.16.64

Shelf Life Test — 3024 hours

TUBE TYPE 5112 [redacted] NO.

#	900V	950V	1000V	Slope	Bkgd		
4072	7251	7722	7952	9.1	12		
4105	7369	7884	8213	10.7	21		
4054	7224	7560	8058	11.0	25		
4055	7329	7761	8030	9.1	15		
4077	7436	7864	8130	8.8	15		
4044	7246	7804	8182	12.0	15		
4104	7162	7968	8207	13.1	25		
4069	7348	7907	8182	10.5	26		
4034	7123	7820	8055	11.9	20		
4117	7229	7708	8186	12.4	19		

SHEET OF

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

APPENDIX C

High Counting Rate

EON CORPORATION

electronic-Optical-Nuclear products

175 PEARL ST., BROOKLYN 1, N.Y.

ENGINEERING DATA

DATE ISSUED:

REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE: 12.17.64

TUBE TYPE 5112 R [redacted] High counting rate

#		900 V	950 V	1000 V	Plateau	Bezel	
4150		107974	108907	109717	1.6	14	
4141		93863	95068	94759	1.0	25	
4081		91175	91644	92721	1.7	24	
4130		94649	95646	96596	2.0	20	
4146		93672	94825	94848	1.2	45	
4143		90054	90968	91858	1.9	10	
4151		92317	92850	93738	1.5	17	
4135		94870	95090	95166	.4	33	
4124		95150	96023	96535	1.6	32	

SHEET OF

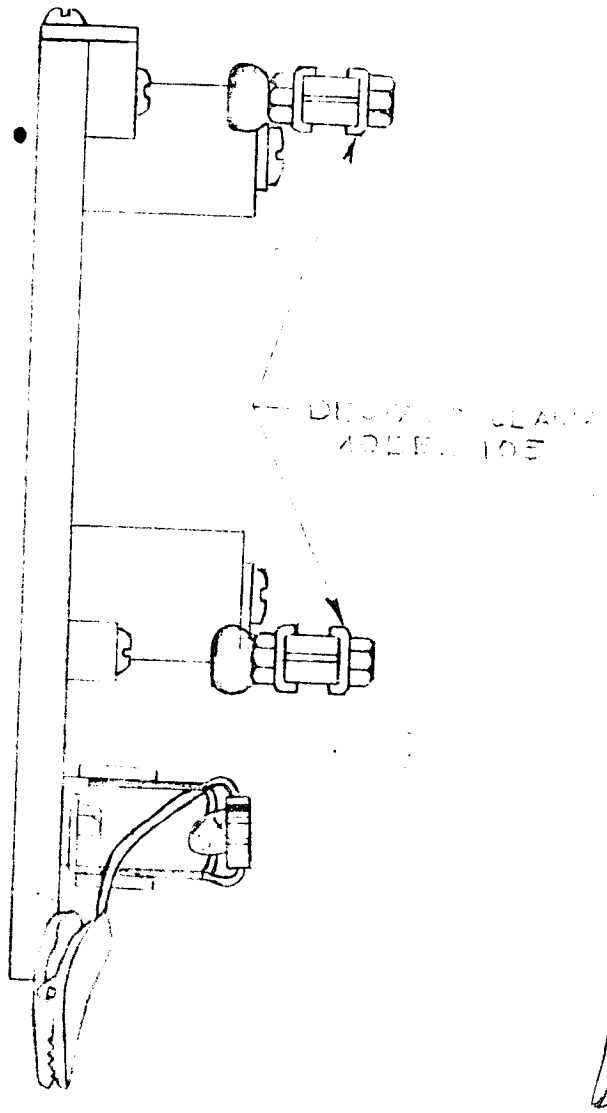
REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

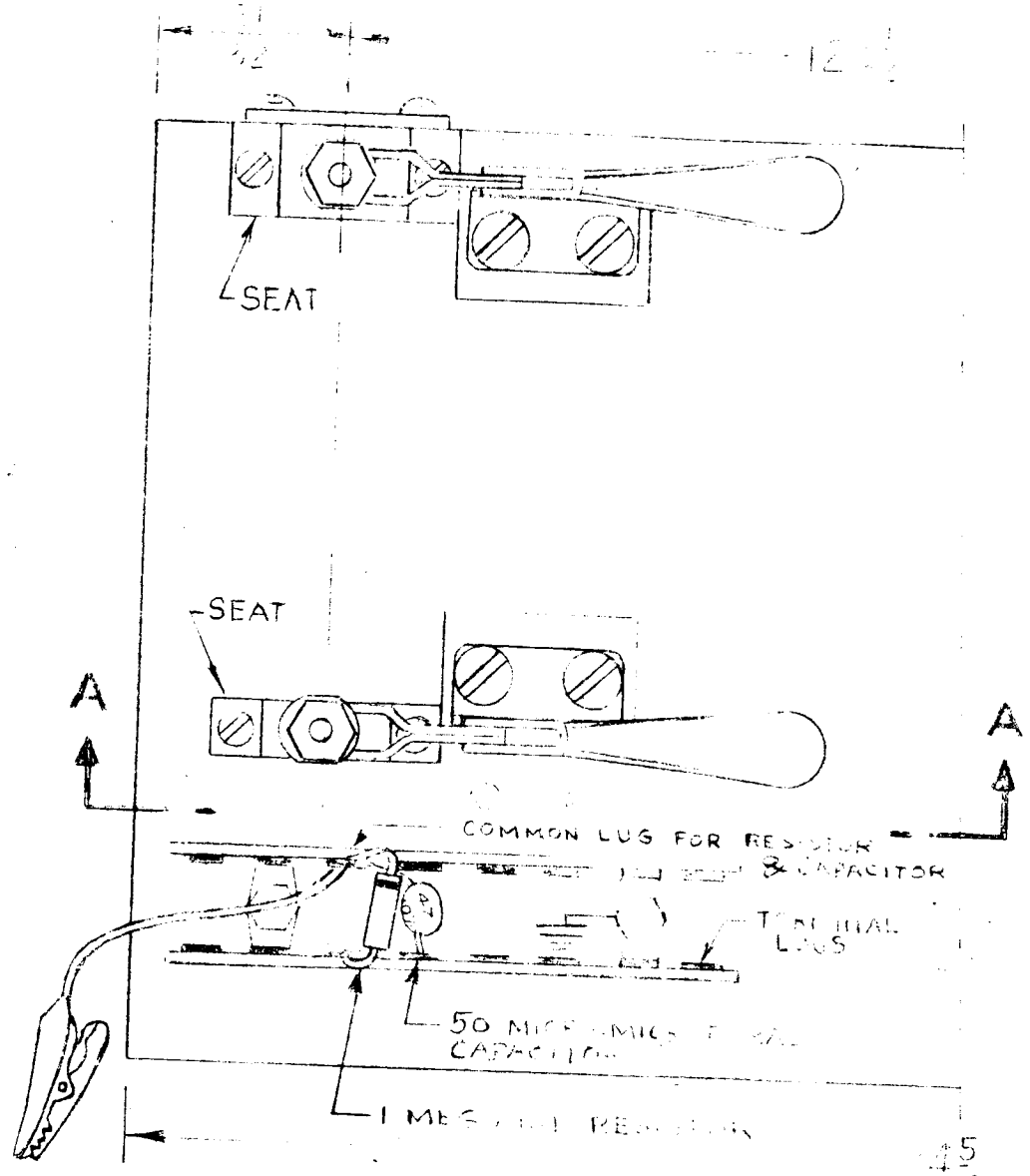
APPENDIX D

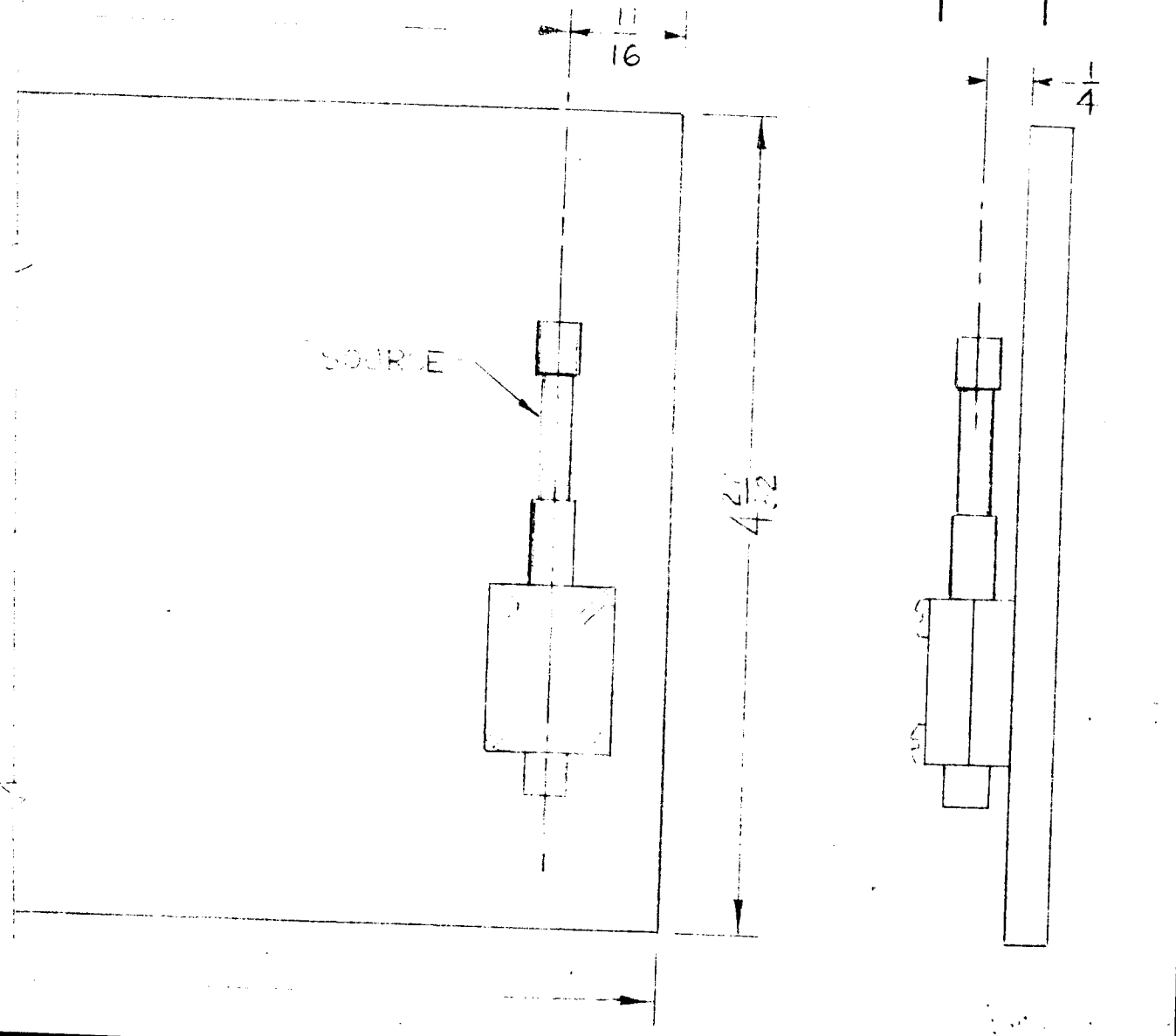
Test Fixtures for

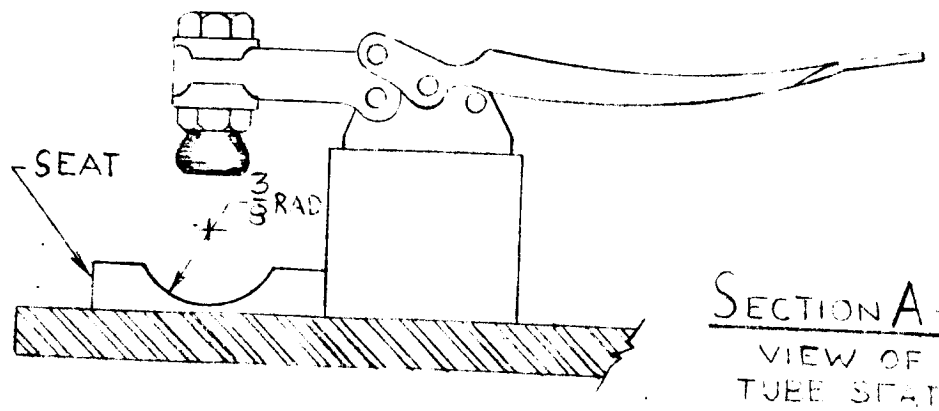
Tube Types 5112R & 6226

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED









SECTION A-A
VIEW OF TUBE SEAT

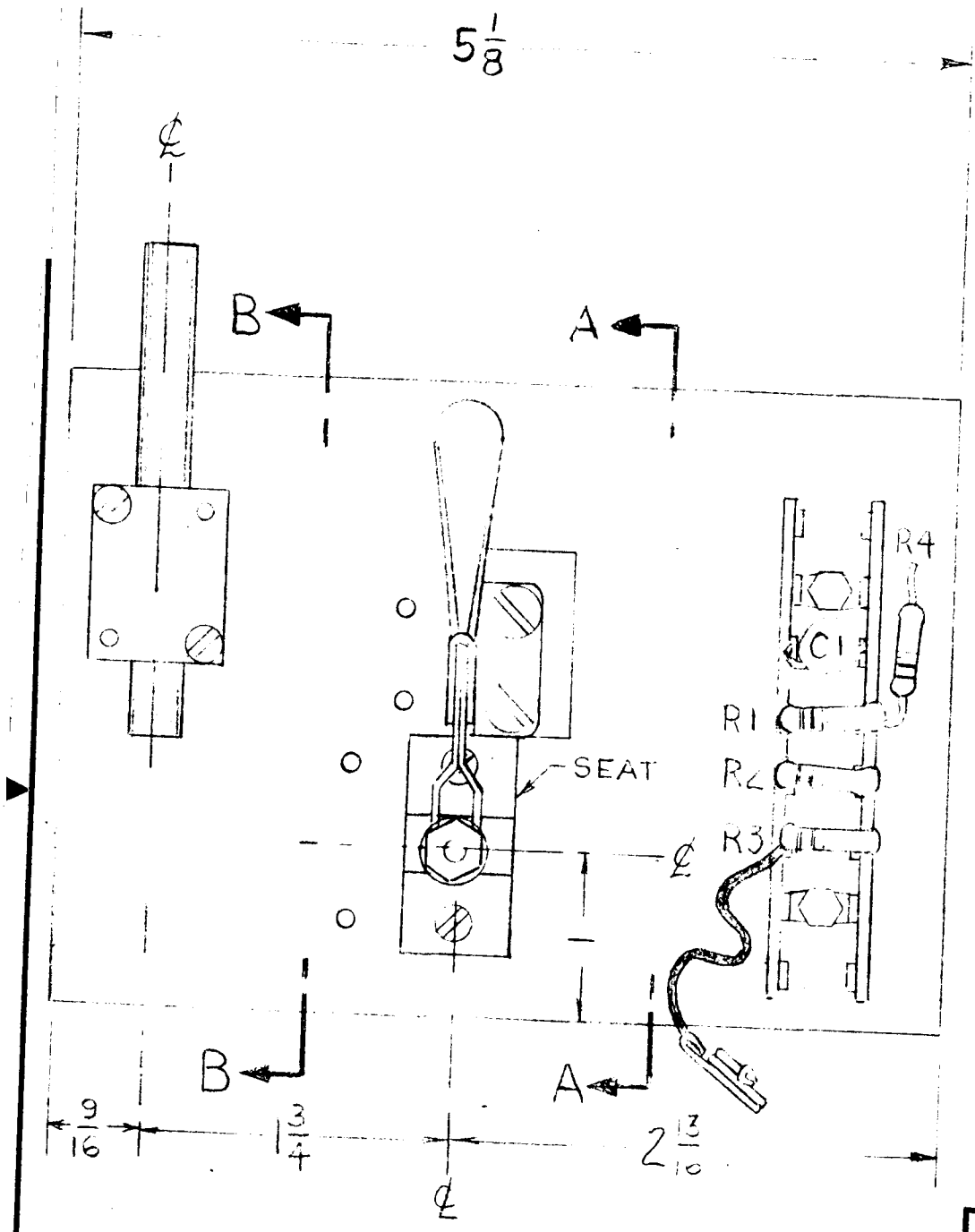
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 30′ BREAK ALL SHARP EDGES	DR	EON CORPORATION — electronic-optical-nuclear products — 175 PEARL ST., BROOKLYN 1, N.Y.	
MATERIAL ALUM.	CHK	GAMMA TEST FIXTURE 5112R	
FINISH	APPD	CODE IDENT NO.	SIZE B — SK146-1004
	APPD	SCALE FULL	WT. — SHEET

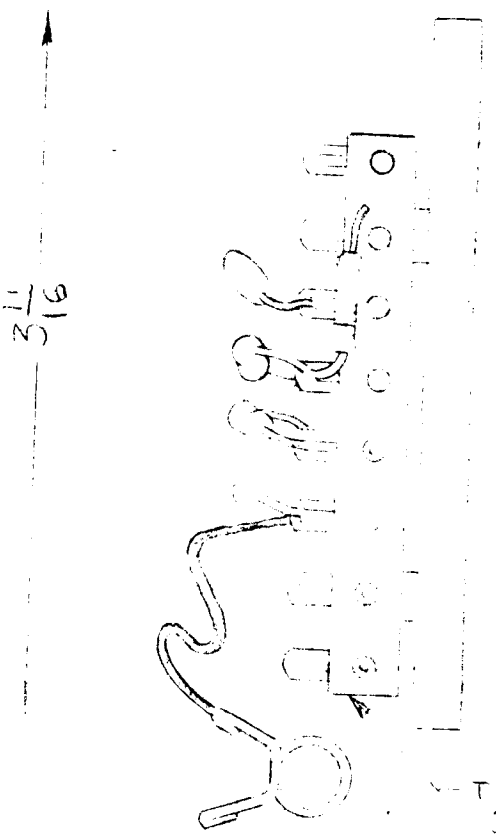
OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

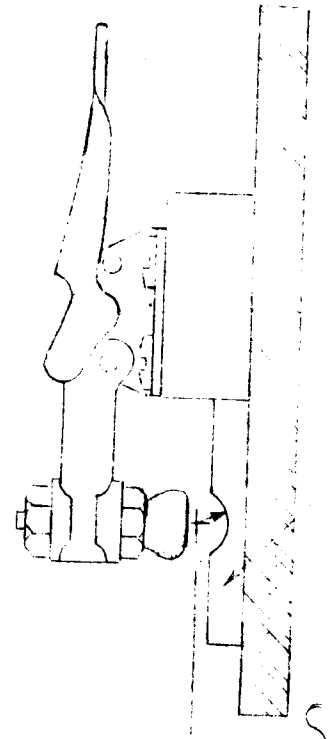
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED

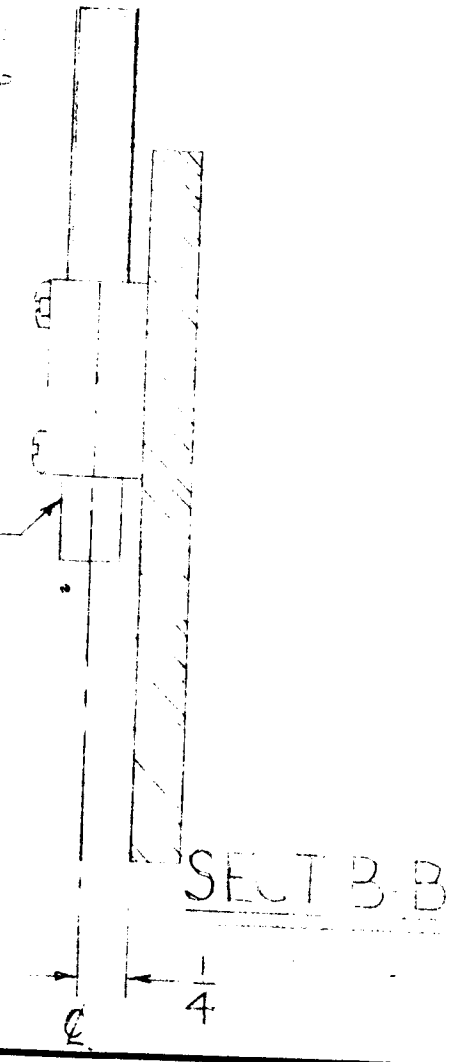
COMPONENTS

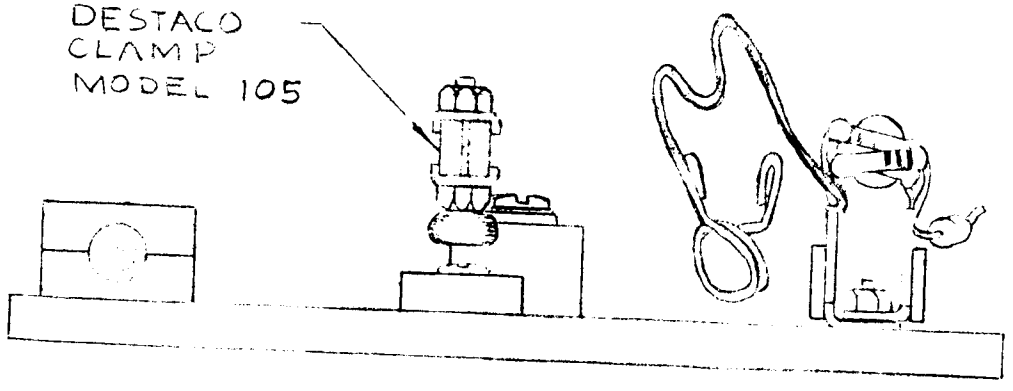
RESISTOR	R1	1 MEGOHM	± 10% TOLERANCE
"	R2	4.7 "	± 5%
"	R3	10 "	± 10%
"	R4	10 "	± 10%
CAPACITOR	C1	68 μμf	











UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 30'
BREAK ALL SHARP EDGES

MATERIAL

FINISH

DR KD

CHK

APPD

APPD

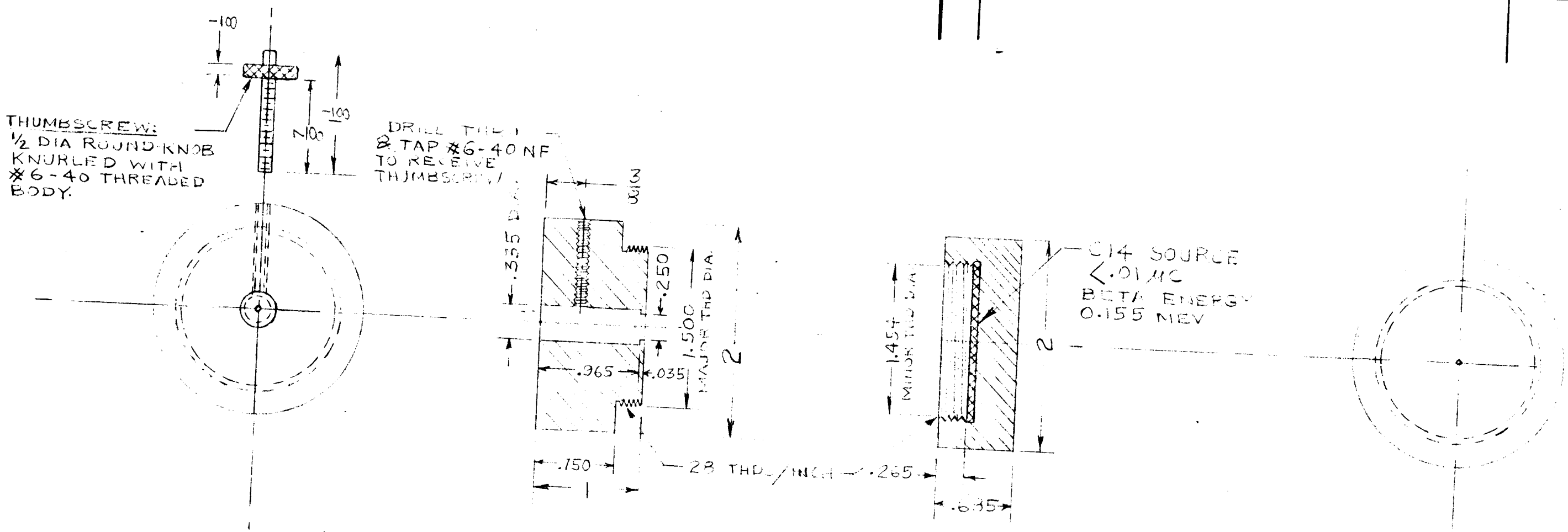
EON CORPORATION
Electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

GAMMA TEST FIXTURE 6226

CODE IDENT NO.	SIZE	
	B	SK146-1027
SCALE FULL	WT.	SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



MALE SECTION

FEMALE SECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 30′ BREAK ALL SHARP EDGES	DR KD 4-8-65	EON CORPORATION electronic-Optical-Nuclear products 175 PEARL ST., BROOKLYN 1, N.Y.
MATERIAL	CHK	BETA RESPONSE TEST FIXTURE
FINISH	APPD	CODE IDENT NO. · SIZE B · SK146-1046
	APPD	SCALE FULL · WT. · SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

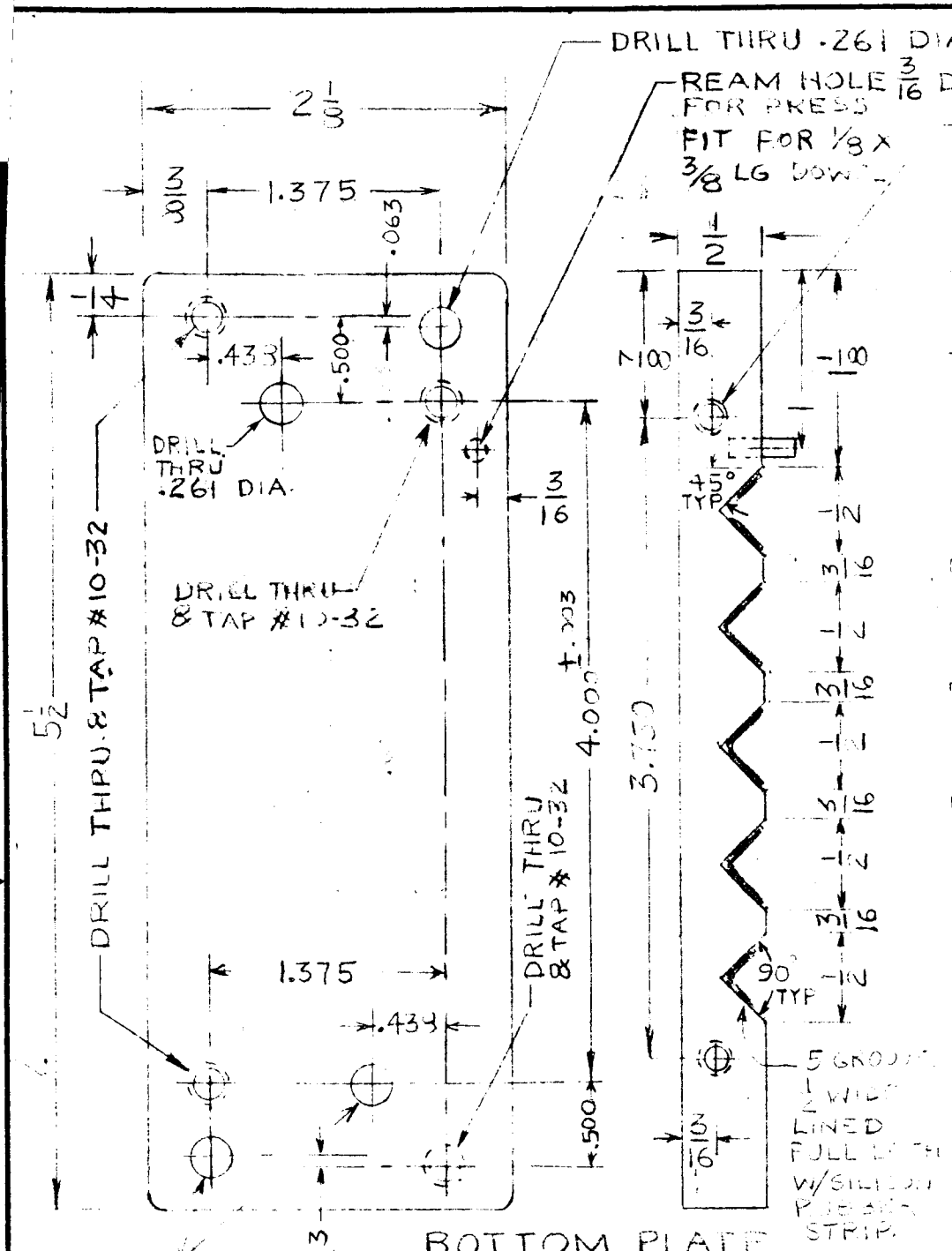
REVISION A	DATE:	REVISION B	DATE:	REVISION C	DATE:

APPENDIX E

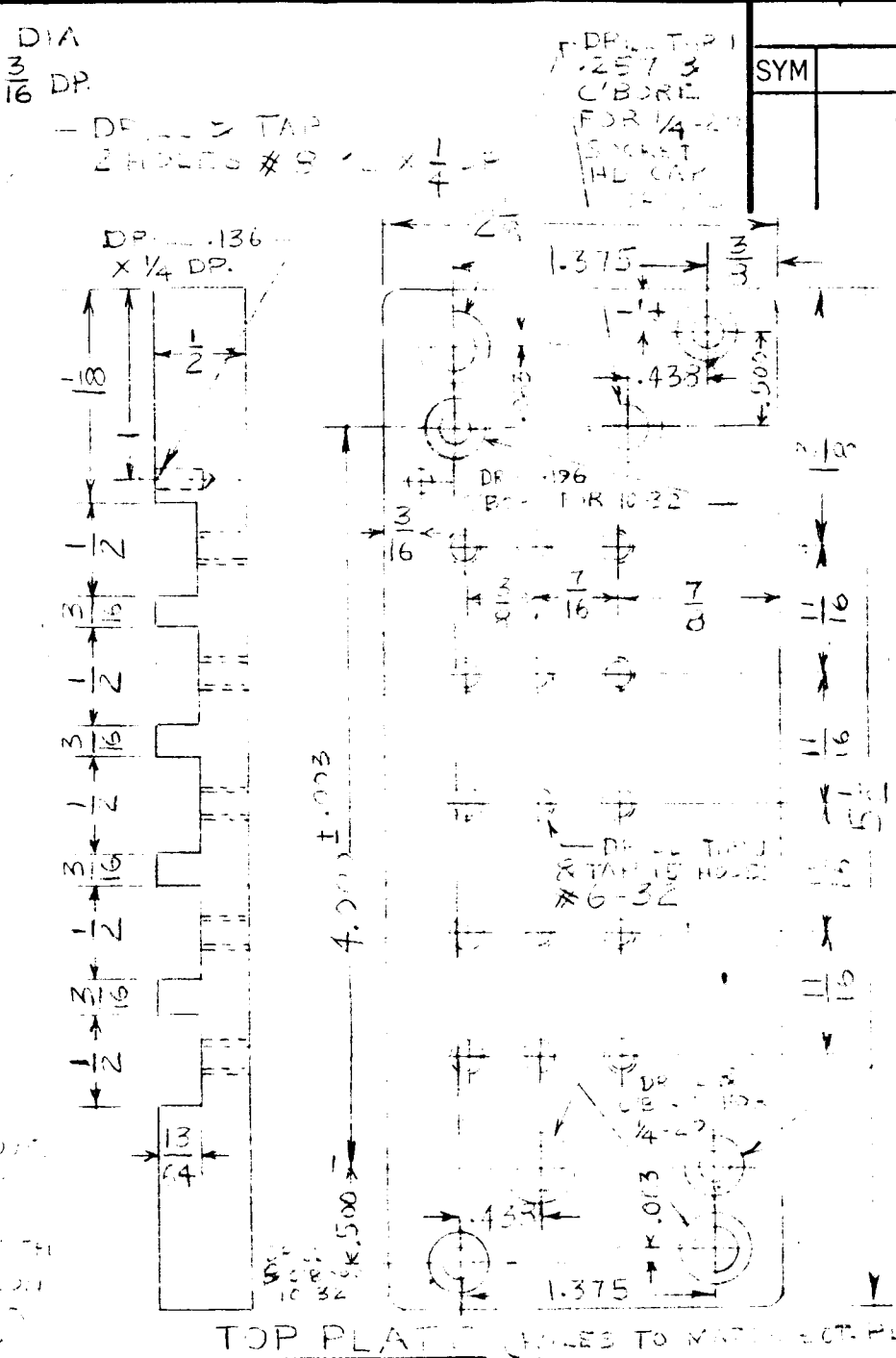
VIBRATION AND SHOCK FIXTURES

FOR TYPES 5112R and 6226.

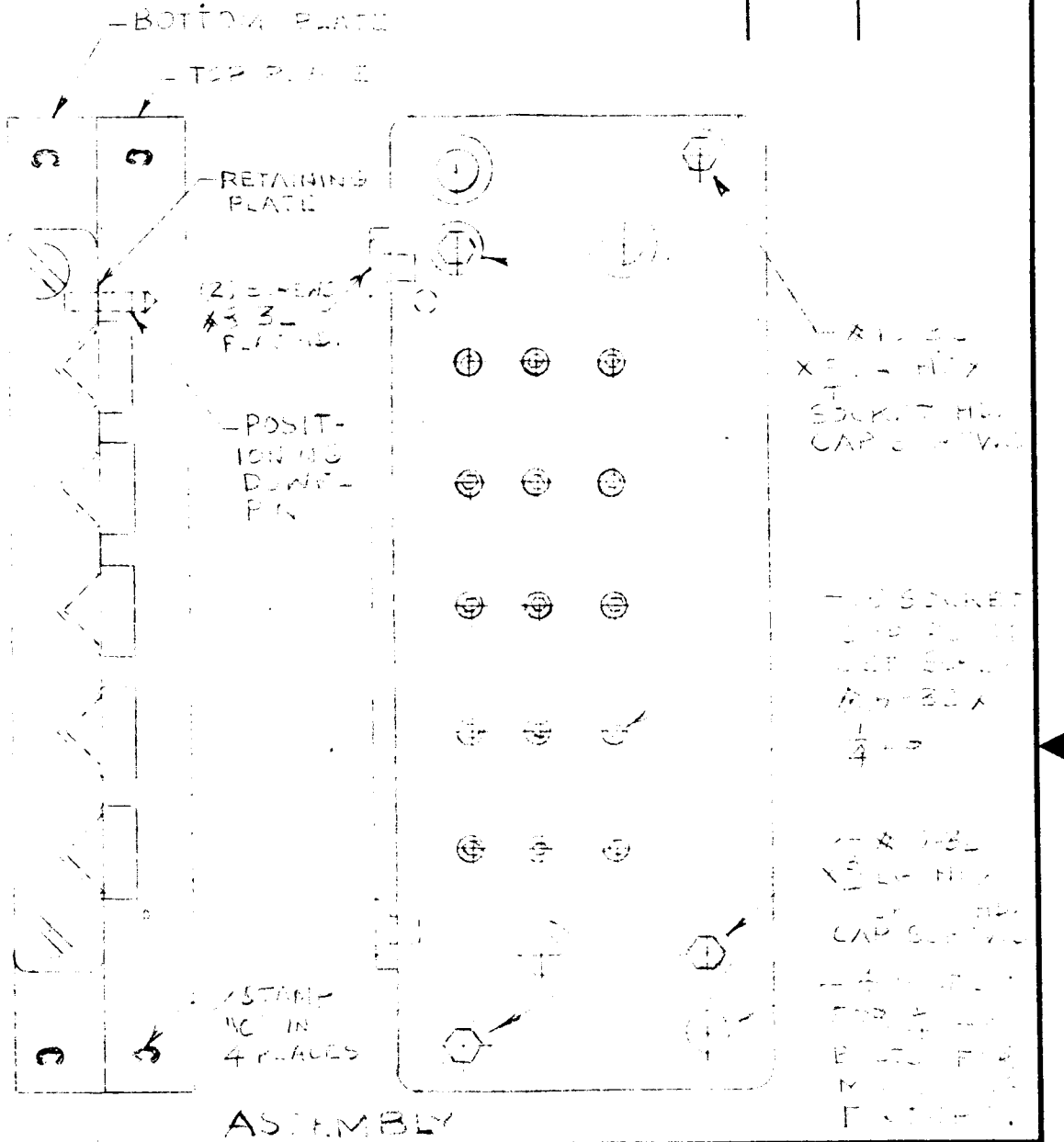
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



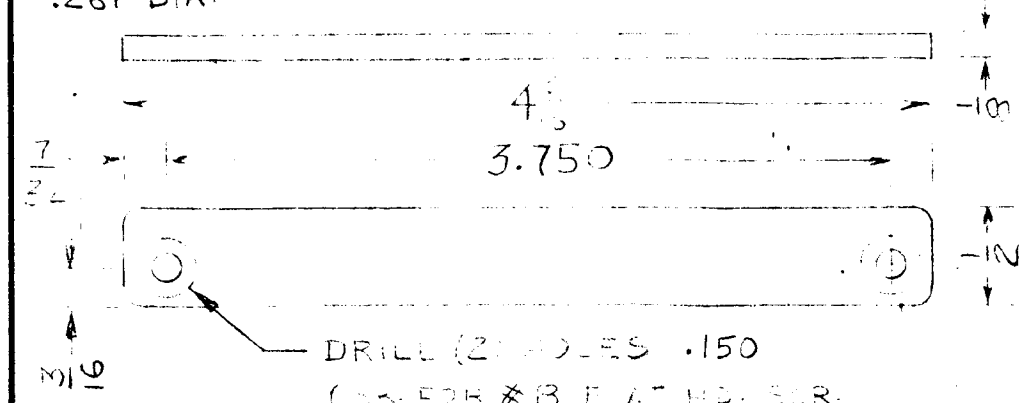
BOTTOM PLATE



TOP PLATE



ASSEMBLY



RETAINING PLATE

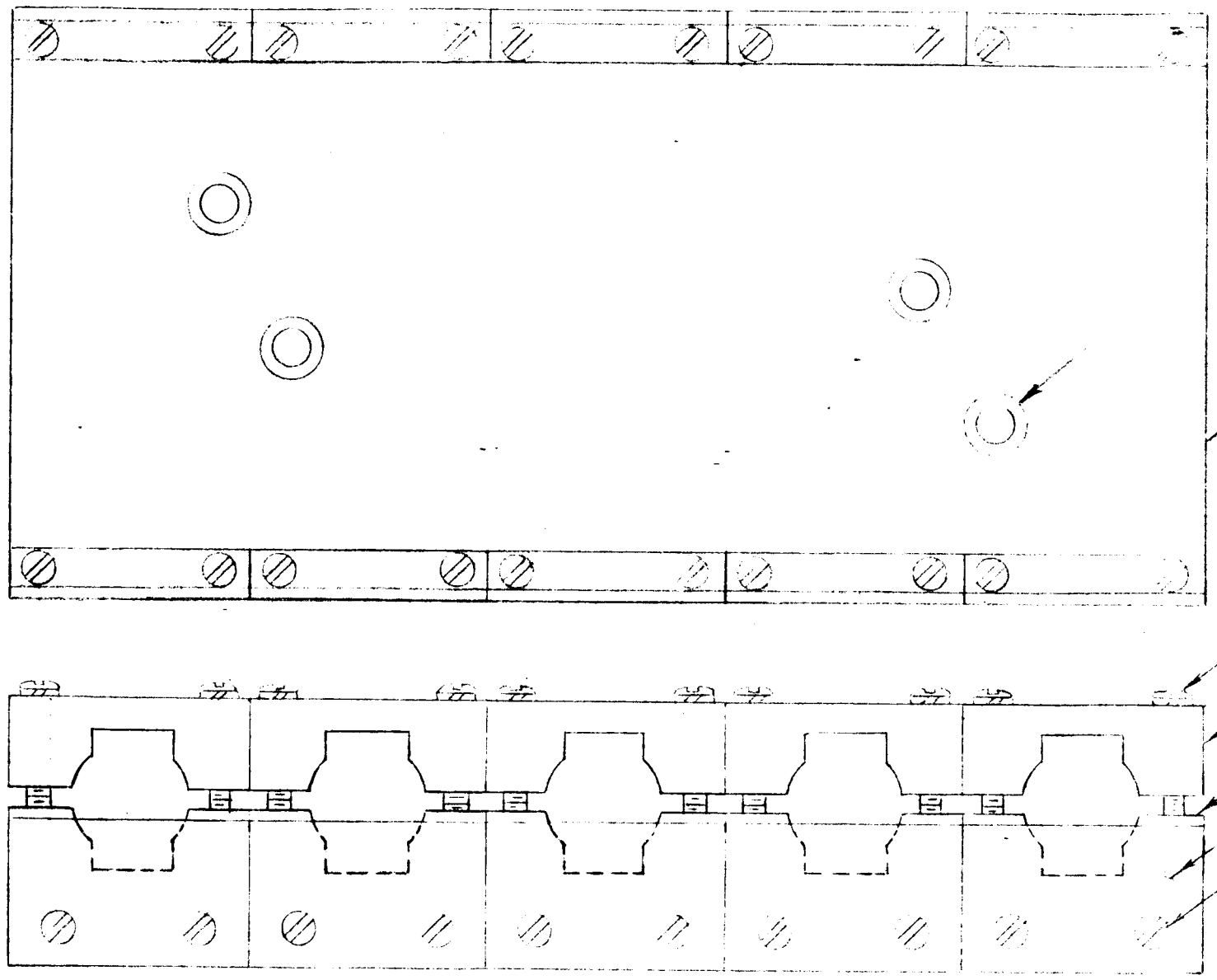
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 30' BREAK ALL SHARP EDGES	DR KD 3-25-65
MATERIAL 6061-T6 ALUM.	CHK
FINISH NONE	APPD
	APPD

EON CORPORATION — electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

VIBRATION & SHOCK TESTING FIXTURE TYPE 6226

CODE IDENT NO.	SIZE	
	B	SK 146-1023
SCALE FULL	WT.	SHEET

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



—HOLES FOR MOUNTING FIXTURE

—A-SK146-1031

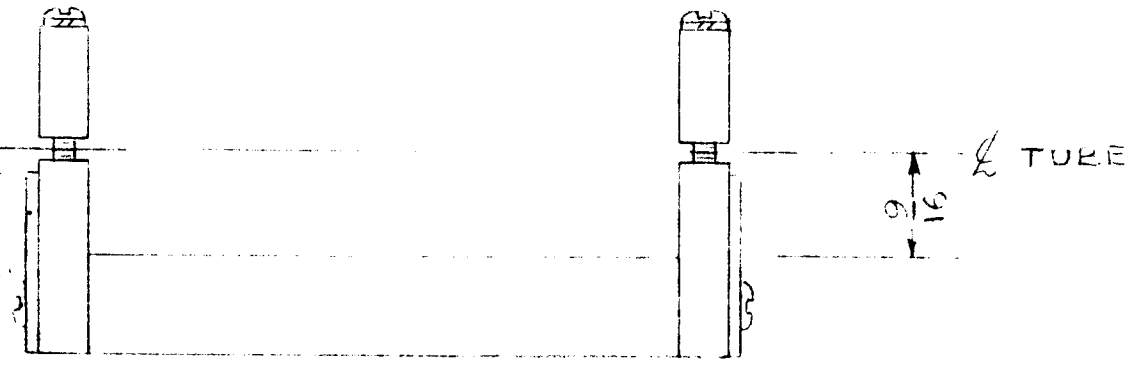
—#4-40 x 1 PAN HD. MACH. SCR. W/LOCKWSHR

—A-SK146-1034

—A SK146-1033

—A-SK146-1035

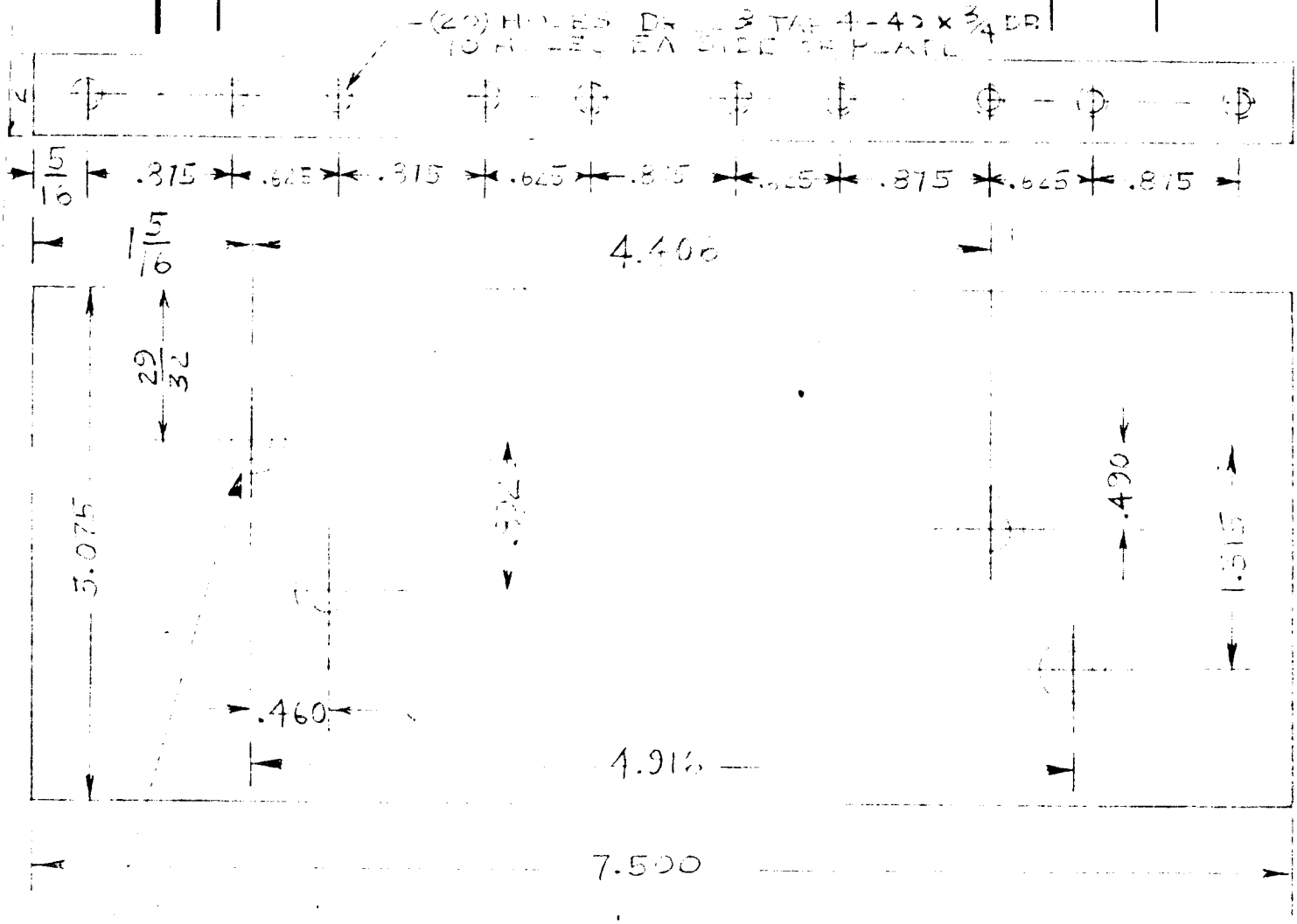
—#4-40 x 3/4 PAN HD. MACH. SCR.



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 30′ BREAK ALL SHARP EDGES	DR K.E. 4-1-65	EON CORPORATION — Electronic-Optical-Nuclear products — 175 PEARL ST., BROOKLYN 1, N.Y.	
MATERIAL	CHK	SHOCK & VIBRATION FIXTURE ASSY TYPE B FIXTURE	
FINISH	APPD	CODE IDENT NO.	SIZE B — SK146-1020
	APPD	SCALE FULL	WT. — SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KD

CHK

APPD

APPD

EON CORPORATION — electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

EON PLATE

TYPE SIZE FINISH

NEXT ASSY: B-SK146-1030

MATL - 1/2" THK ALUM ALLOY

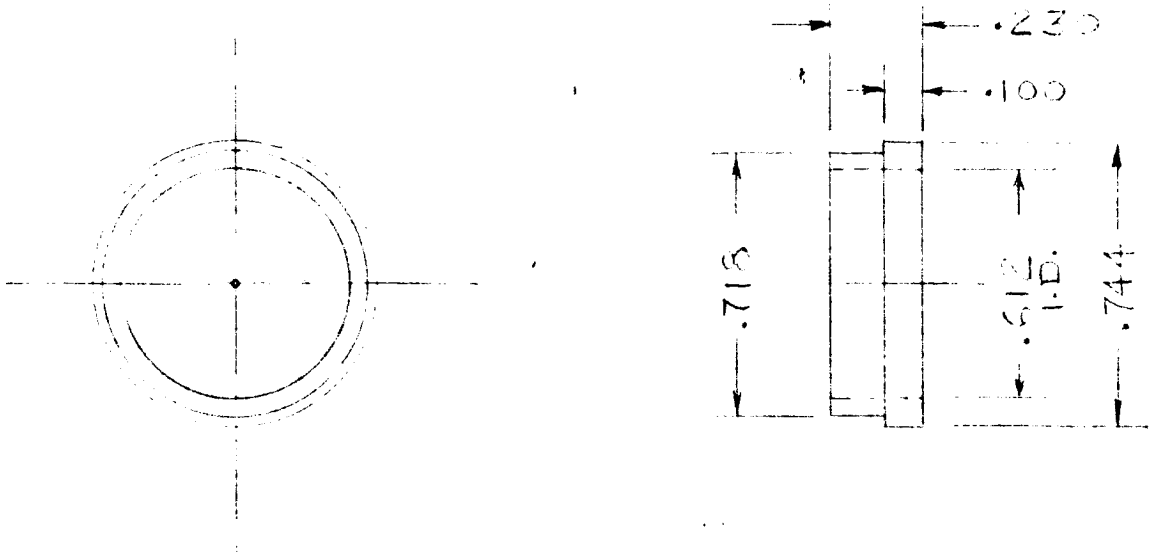
FINISH - NONE

CODE IDENT NO.	SIZE	
	A	SK146-1031

SCALE FULL | WT. | SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KD 3-29-62

CHK

APPD

APPD

MAT'L -

FINISH -

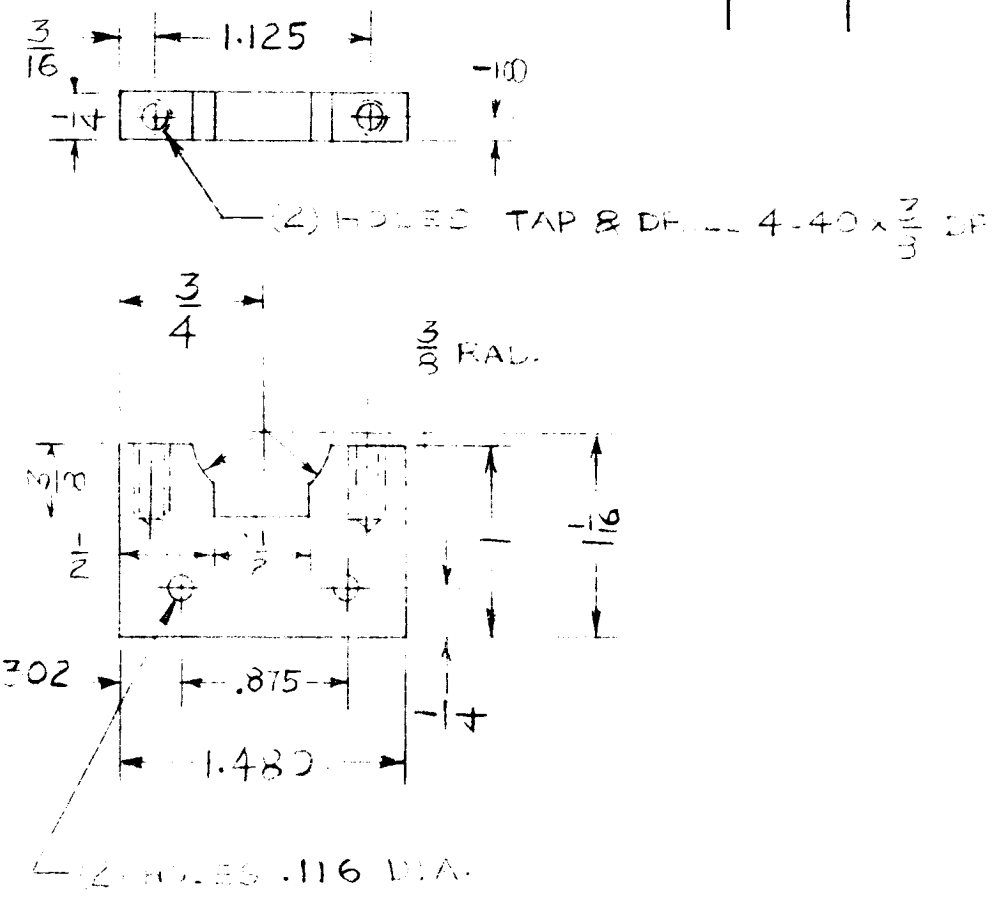
eon EON CORPORATION *electronic-Optical-Nuclear products*
175 PEARL ST., BROOKLYN 1, N.Y.

PLASTIC BUSHING
TYPE 5112 P FIXTURE

CODE IDENT NO.	SIZE	
	A	SK146-1032
SCALE 2:1	WT.	SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



NOTE: REMOVE BURRS

NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KD

CHK

APPD

APPD

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

LOWER SEAT

TYPE SIZE FINISH

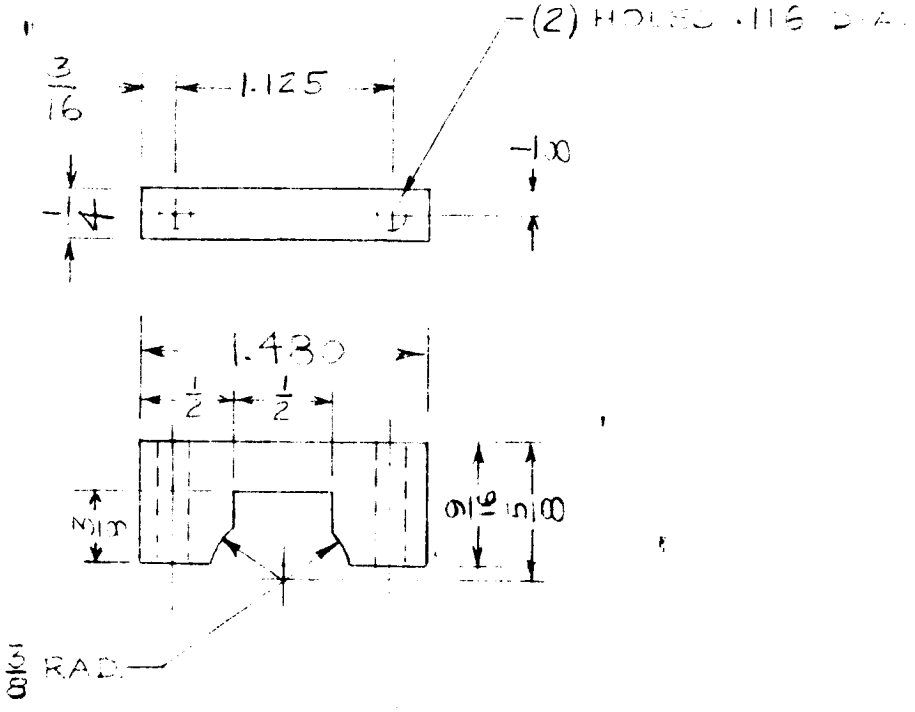
MATL B-1033

CODE IDENT NO.	SIZE	
	A	SK146-1033

SCALE FULL | WT. | SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



NOTE: REMOVE BURRS

NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KC 3-23-65

CHK

APPD

APPD

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

UPPER SEAT

TYPE 5112 R FIXTURE

NEXT ASSY: B-SK146-1030
B-SK146-1043

MATL: [illegible] ALUM
ALLOY 6061-T6

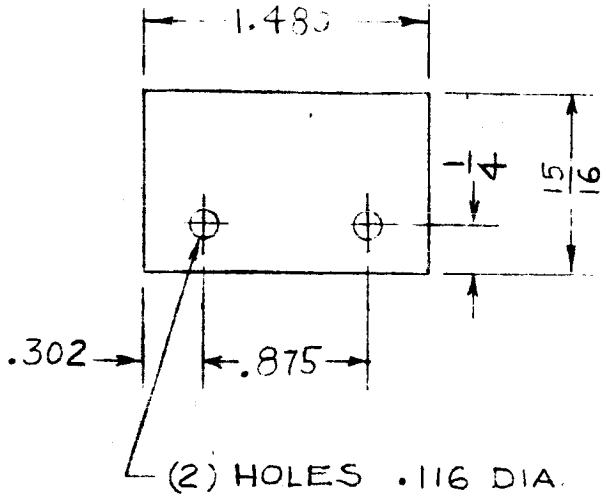
FIN: NONE

CODE IDENT NO.	SIZE	
	A	SK146-1034

SCALE [illegible] WT. SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KD 3-29-65

CHK

APPD

APPD

EON CORPORATION — electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

RETAINING PLATE
TYPE 5 [illegible] FIXTURE
NEXT ASS'Y: B-SK146-1030

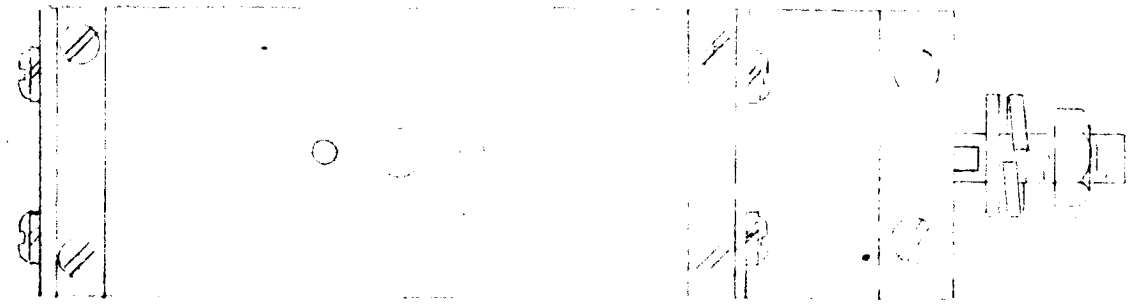
MAT'L: 1/8 ALUM

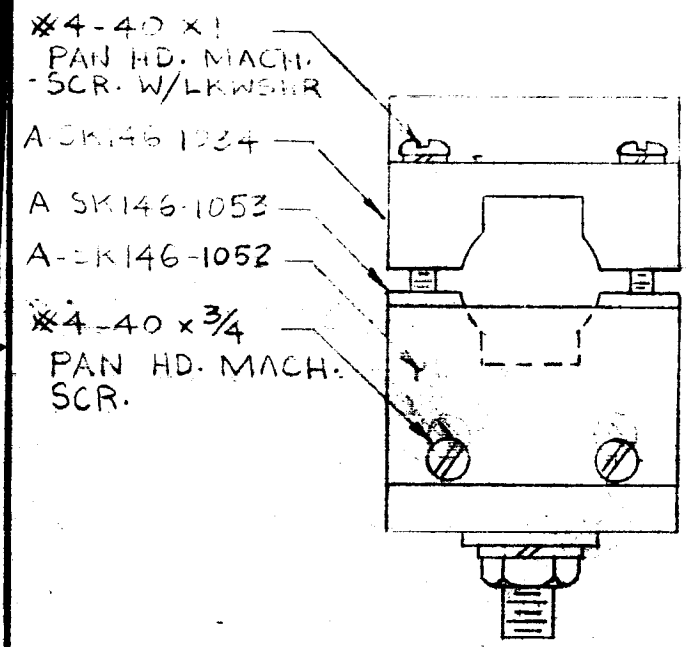
FINISH: NONE

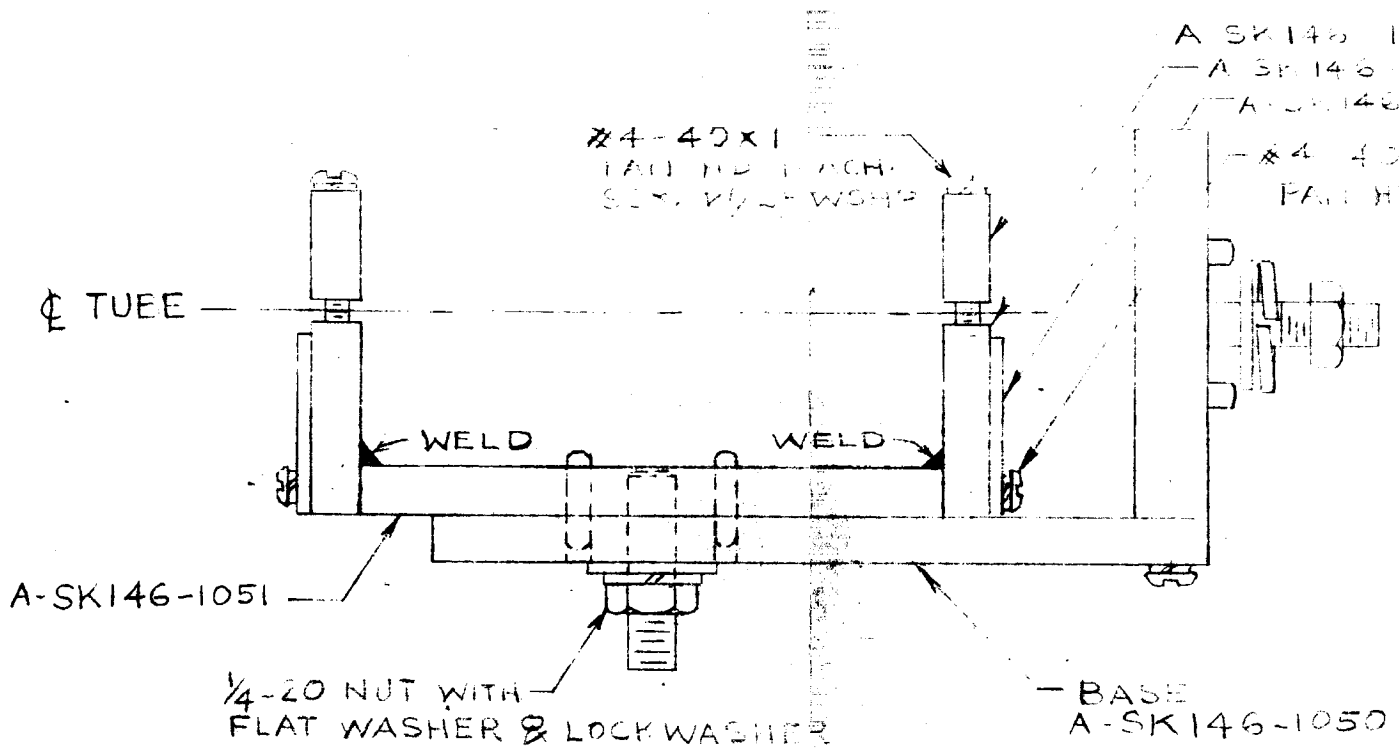
CODE IDENT NO.	SIZE	
	A	SK146-1035
SCALE [illegible]	WT.	SHEET

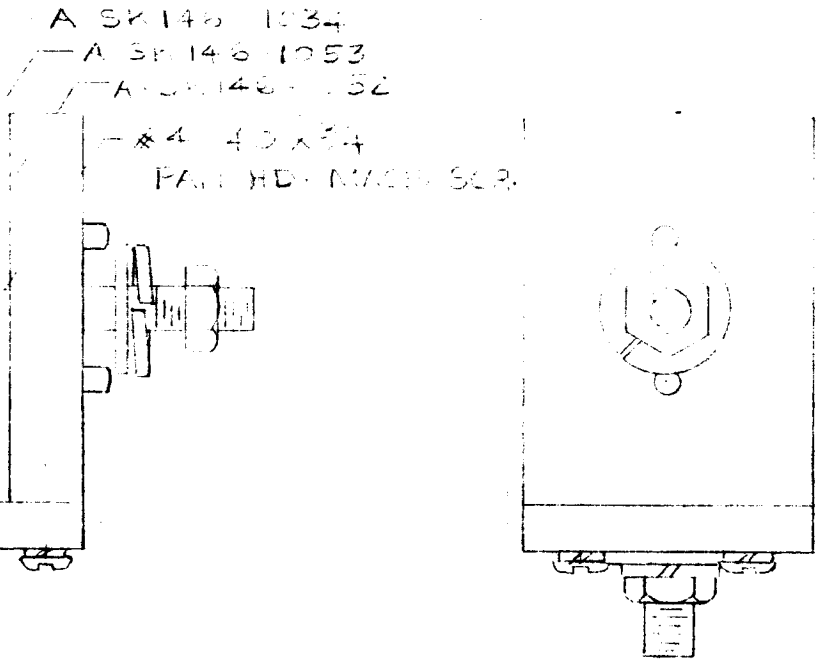
OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED









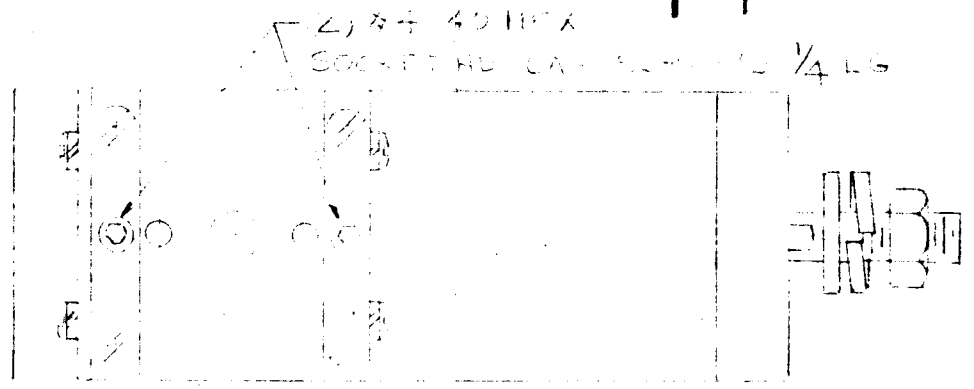
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 30′ BREAK ALL SHARP EDGES	DR KD 4-7-65
MATERIAL	CHK
FINISH	APPD
	APPD
	MATL. APPR.
	FINISH NOTE

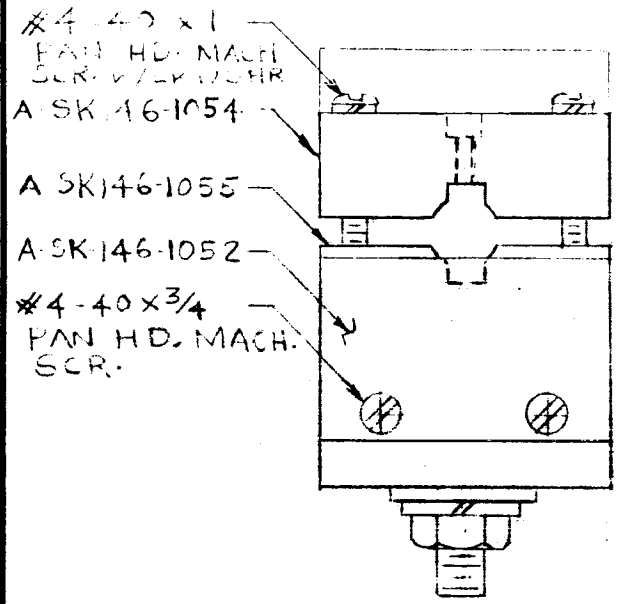
EON CORPORATION — Electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

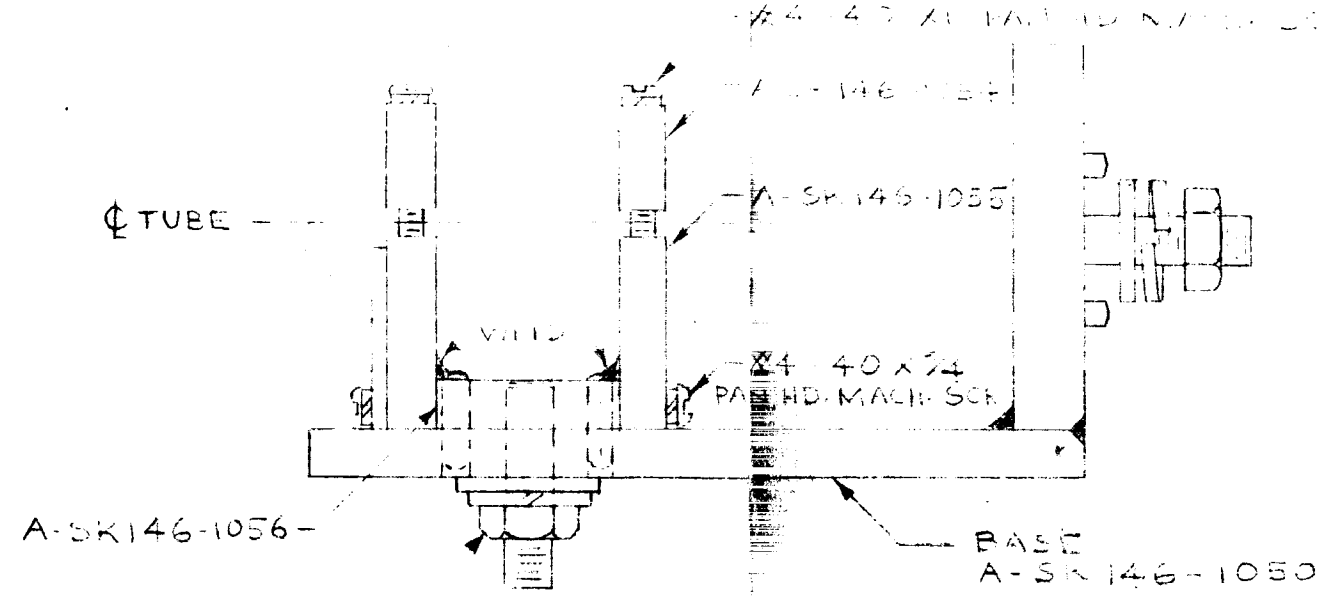
CODE IDENT NO.	SIZE	
	B	SK146-1053
SCALE	WT.	SHEET

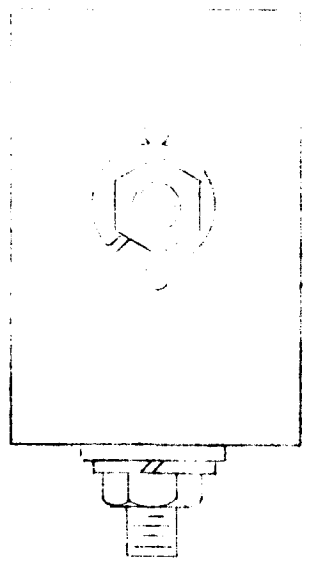
OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED





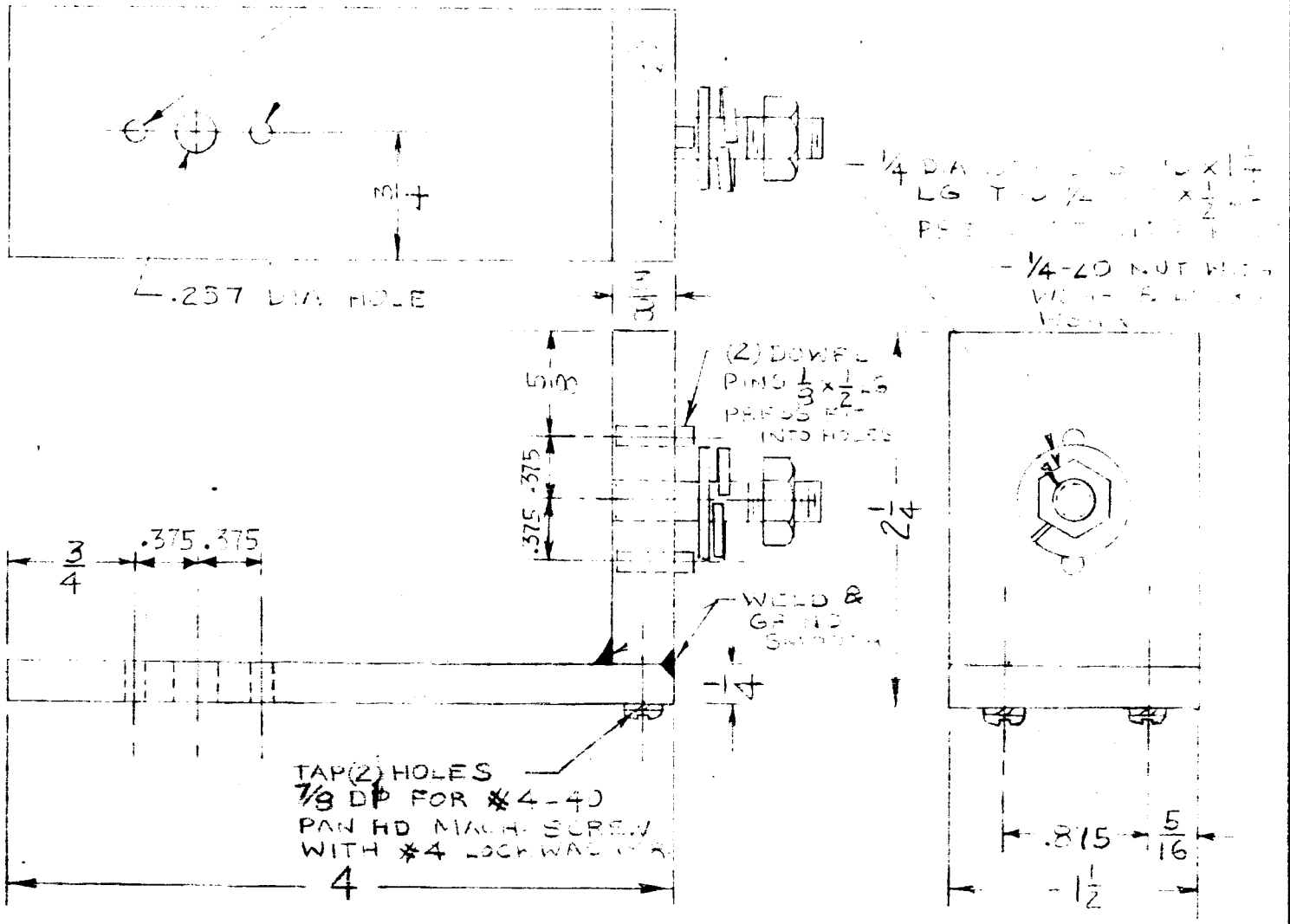




UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 30′ BREAK ALL SHARP EDGES	DR KL 4-7-62	EON CORPORATION — electronic-Optical-Nuclear products — 175 PEARL ST., BROOKLYN 1, N.Y.
MATERIAL	CHK	
FINISH	APPD	
	APPD	
		CODE IDENT NO. / SIZE B / SK146-1044
		SCALE FULL / WT. / SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
	-(2) HOLES .136 DIA.		



NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64. DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KD 4-7-65

CHK

APPD

APPD

EON CORPORATION
Electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

CENTERING GAGE

NEXT ASSY

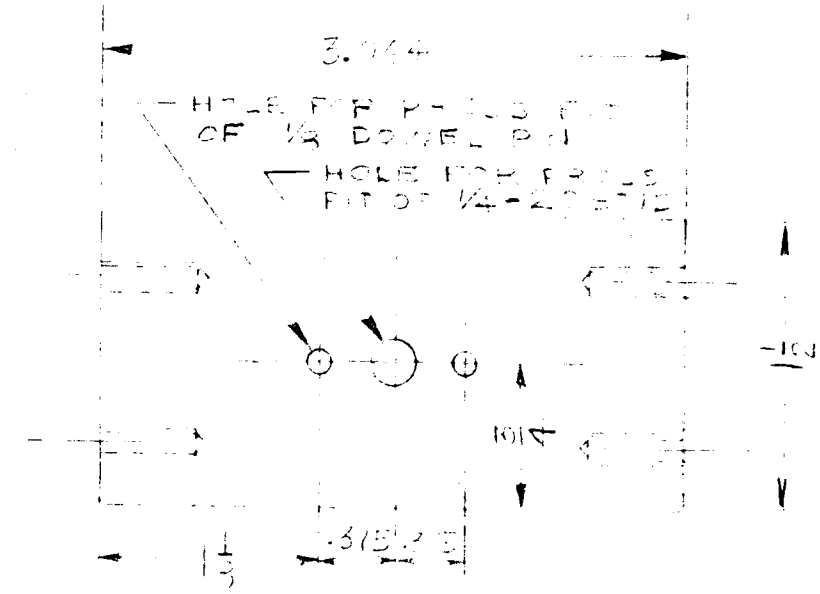
MATL

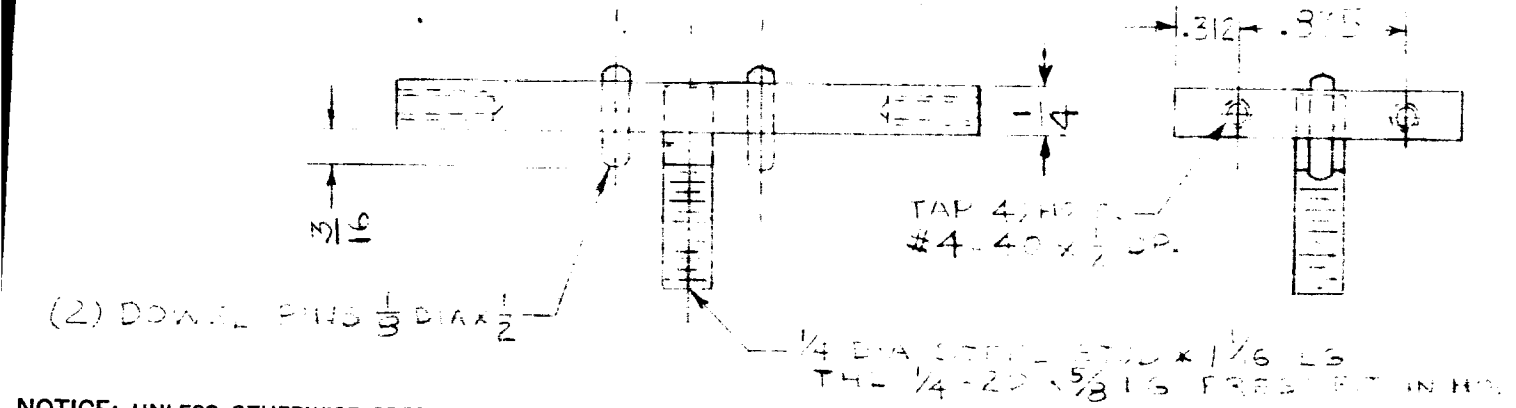
FINISH NO.

CODE IDENT NO.	SIZE	
	A	SK146-1050
SCALE	WT.	SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED





NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64 DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR [illegible] 4 7 65

CHK

APPD

APPD

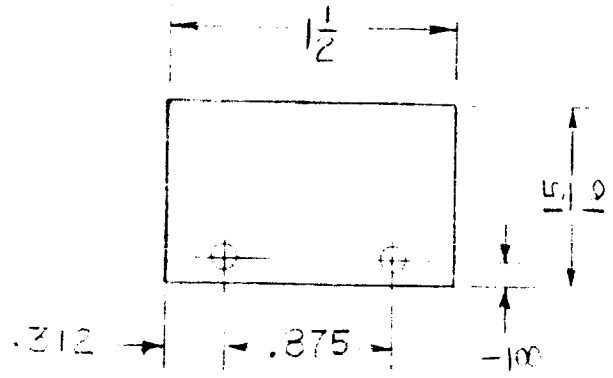
eon EON CORPORATION — electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

BUTTON [illegible] - 5112 R
[illegible] FIXTURE
NEXT ASSY [illegible]

CODE IDENT NO.	SIZE	
	A	SKI[illegible]
SCALE [illegible]	WT.	SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KD 4-7-65

CHK

APPD

APPD

MAT'L - 1/16 AL.

FINISH - NONE

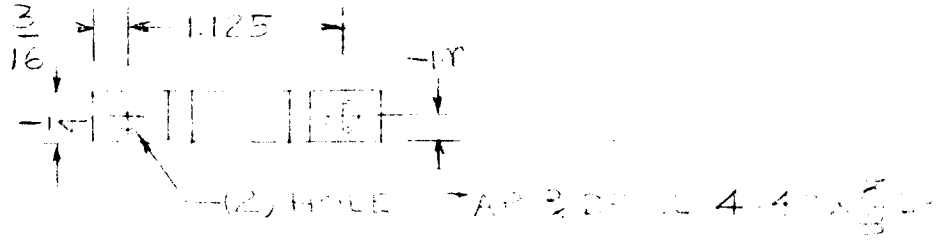
EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

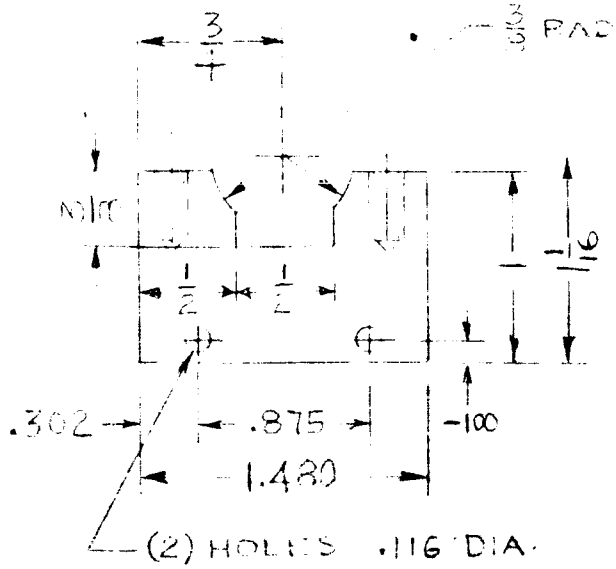
P[illegible] - SIZE - T[illegible]
C[illegible]
U[illegible]
NEXT A[illegible] B SK146-1013
B SK 43-1024

CODE IDENT NO.	SIZE	
	A	SK146-1052
SCALE	WT.	SHEET

GILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED





NOTE: REMOVE BURRS

NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KD 4-1-65

CHK

APPD

APPD

EON CORPORATION
electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

LOWER SEAT - 5112 R. CL[illegible] FIXTURE

NEXT ASS'Y: B-SK146 1043

MAT'L - ALUM 6061-T6

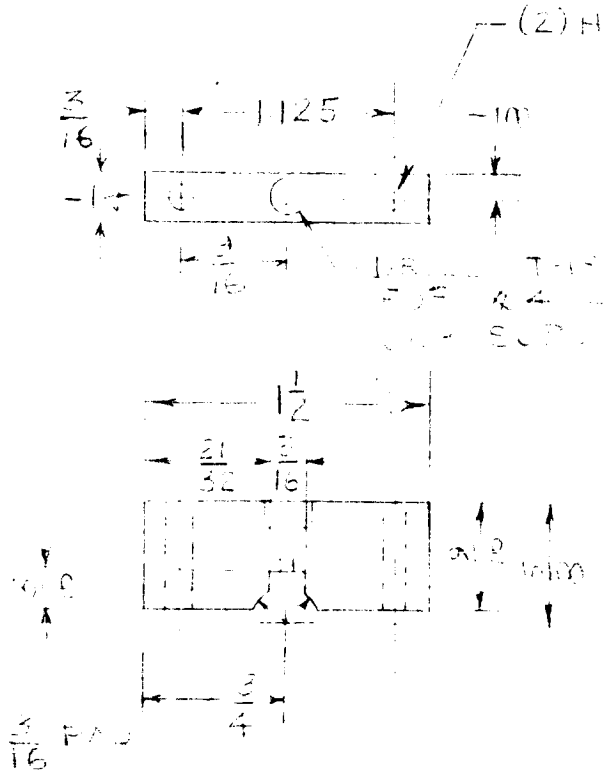
FINISH - NONE

CODE IDENT NO.	SIZE	SK146-103[illegible]
	A	

SCALE FULL | WT. | SHEET

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. ULTRAVEL NO. 490M

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



NOTE: REMOVE BURRS

NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

DR KD 4-3-65

CHK

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175 PEARL ST., BROOKLYN 1, N.Y.

UPPER SEAT - 6226 CENTRIFUGE PART

NEXT ASS'Y: B-SK14-1044

CODE IDENT NO.	SIZE	
	A	SK146-102
SCALE FULL	WT.	SHEET

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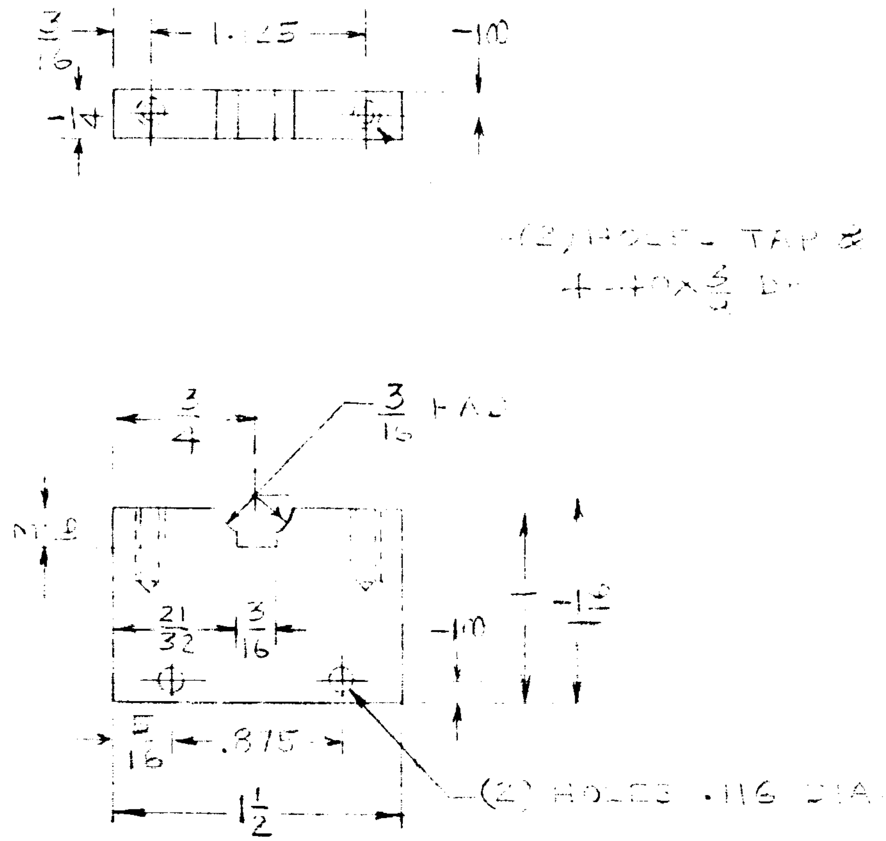
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED

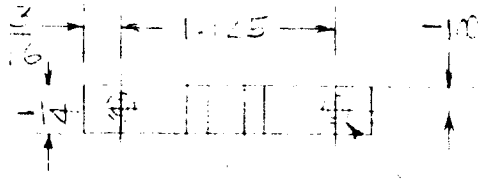


NOTE: REMOVE BURRS

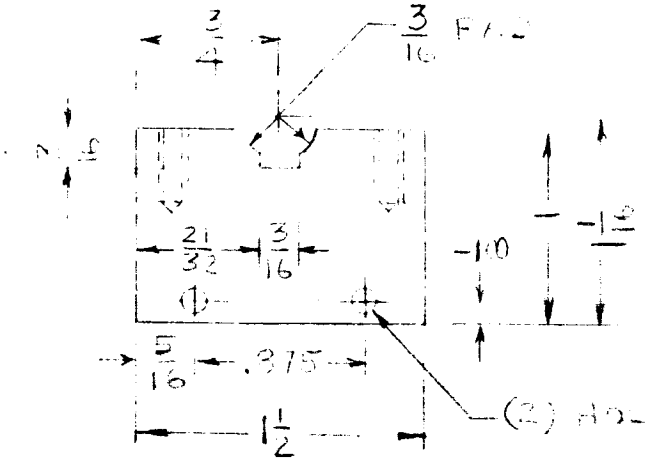
NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30′. BREAK ALL SHARP EDGES.

DR KD 4-8-65	**EON CORPORATION** — electronic-Optical-Nuclear products, 175 PEARL ST., BROOKLYN 1, N.Y.	
CHK		
APPD	LOWER SEAT - 6426 [illegible] NEXT ASSY B-SK-46 1044	
APPD		
MAT'L - AL. ALY 6061 T6	CODE IDENT NO.	SIZE A — SK146-1055
[illegible]	SCALE FULL	WT. — SHEET

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



(2) HOLES TAP 5-40 THD x 3/8 DP



NOTE: REMOVE BURRS

NOTICE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. TOLERANCES ON: FRACTIONS ±1/64, DECIMALS ±.005, ANGLES ±30'. BREAK ALL SHARP EDGES.

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CHK

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175 PEARL ST., BROOKLYN 1, N.Y.

LOWER SEAT - 6226
CRITICAL
NEXT ASSY B-SK146-1054

MATL - ALUM 6061-T6

FINISH - BLACK

CODE IDENT NO.	SIZE	
	A	SK146-1055
SCALE FULL	WT.	SHEET

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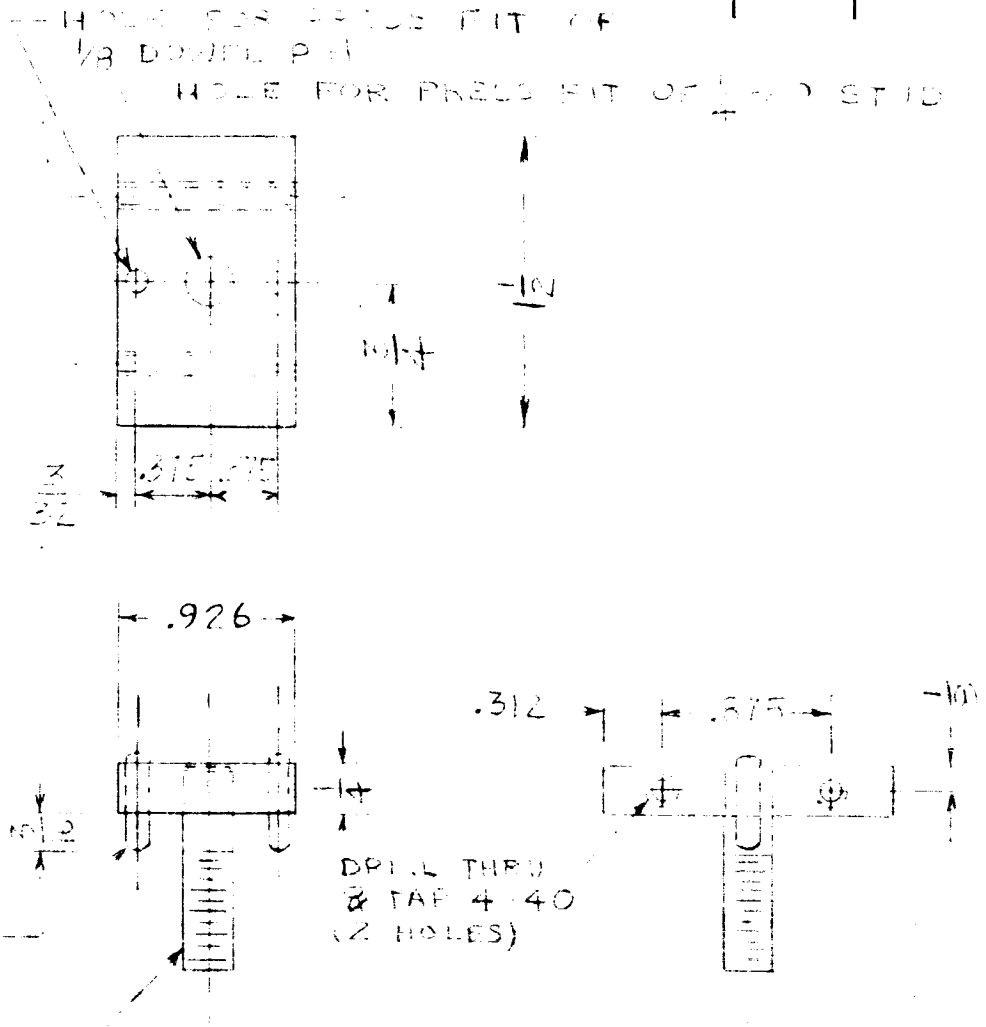
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED



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DR KD 4-3-65

CHK

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EON CORPORATION
Electronic-Optical-Nuclear products
175 PEARL ST., BROOKLYN 1, N.Y.

CODE IDENT NO. | SIZE A | SCALE | WT. | SHEET

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