GENERAL CATALOG

STORAGE TUBES
ELECTROMAGNETIC CATHODE RAY TUBES
ELECTROSTATIC CATHODE RAY TUBES
PHOSPHOR CHARACTERISTICS
GAS RECTIFIERS AND XENON THYRATRONS
MERCURY RECTIFIERS AND THYRATRONS
HIGH VACUUM DIODES
MISCELLANEOUS TYPES
VACUUM GAUGES AND CONTROLS
ELECTRONIC TIMERS
WELDING EQUIPMENT

Design -- Development -- Production

Vacuum Tube Products Co. Inc.

2020 SHORT STREET - OCEANSIDE, CALIFORNIA

Phone: SAratoga 2-7648 - Post Office Box 810

Phone: SAratoga 2-6567

LPS. DEC. 1957—1M

FOREWORD

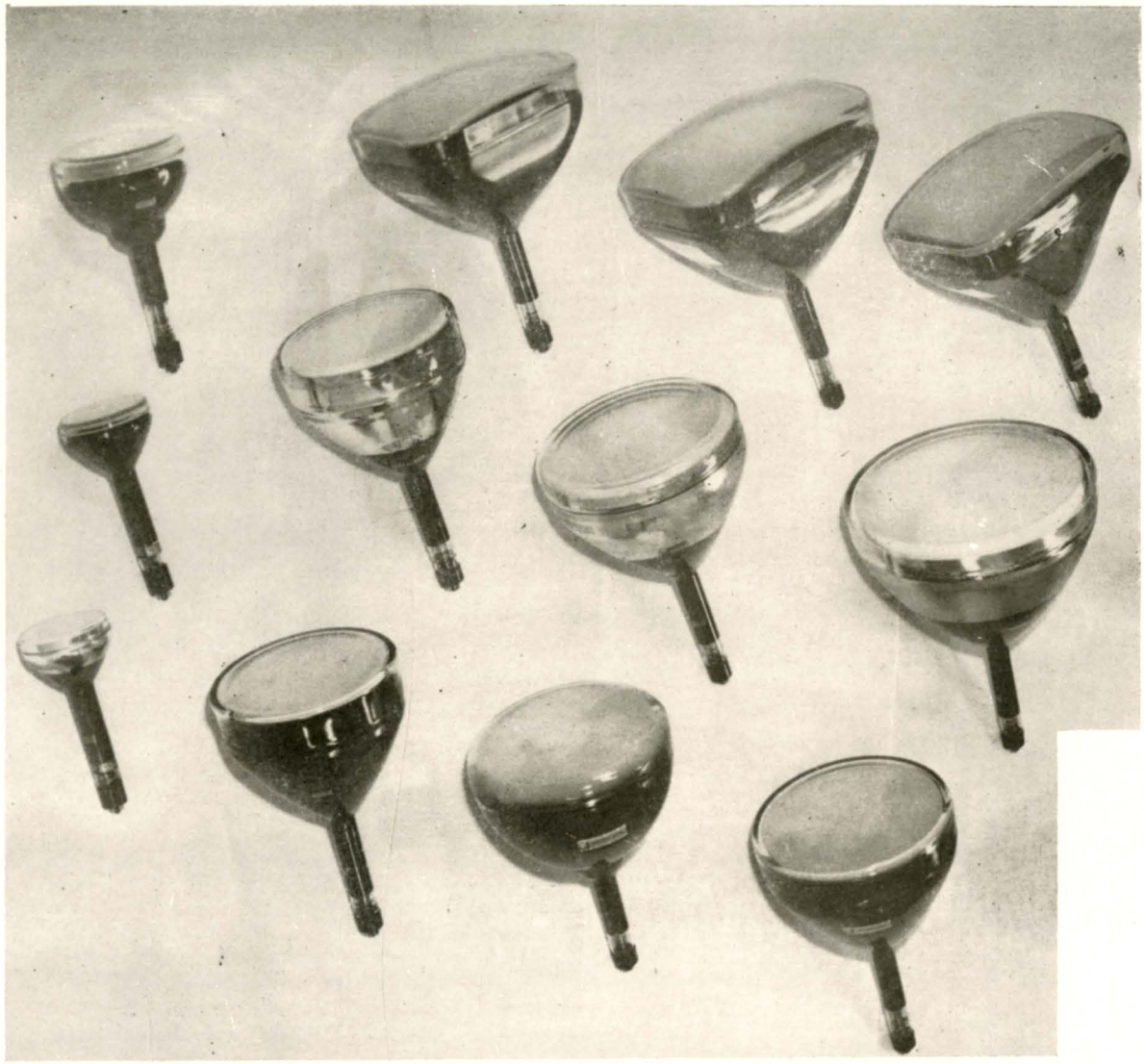
This catalog displays cathode ray tubes produced by VACUUM TUBE PRODUCTS CO. INC. for radar, fire control, read-out, oscillograph and other applications. The present high state of development possessed by these tubes has been accomplished only after long painstaking research into phosphors, screen settling processes, cathode ray gun structures, and the evolution of new and intensive exhaust procedures. Designed by specialists for either special or conventional purposes, cathode ray tubes manufactured by VACUUM TUBE PRODUCTS CO. INC. will meet every demand for maximum performance and extreme reliability.

Also included in the catalog is complete information on all available phosphors (P-1 through P-28 inclusive) used in cathode ray tubes.

Your attention is also called to the other sections of this catalog listing the general types of electron tubes and electronic equipment manufactured by VACUUM TUBE PRODUCTS CO. INC. Your inquiries are invited if requirements exist for items not listed.

LPS. DEC. 1957 1M

PRODUCT DATA SHEET



Electromagnetic Deflection

Cathode Ray Tubes

VACUUM TUBE PRODUCTS CO. INC.
506 SOUTH CLEVELAND STREET, OCEANSIDE, CALIFORNIA
Phone: SAratoga 2-6567

LPS. 1-1-57 1M

PRODUCT DATA SHEET

VTP 5ACP4

The VTP 5ACP4 cathode ray tube is an electromagnetic deflection and electrostatic focus tube of the zero focus voltage type providing high definition and intensity. A metal backed screen is used to provide the ultimate conditions when viewing is required at high ambient light levels. The metallic coating also provides freedom from ion burns. A high quality optical glass face plate is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust.

The VTP 5ACP4 tube is interchangable with the old style 5F tube by merely removing the focus coil and connecting a jumper between pins 6 and 7 in equipment designed for the 5F. An improvement in equipment operation will be noticed in any units operating above 3000 anode volts.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (conductive inner wall coating and G#3)	18,000 Max. Volts D.C.
Grid #2 Voltage (Accelerating Electrode)	410 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Valus	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Focus	Electrostatic
Focus Voltage range (Max.)	plus or minus 500 Volts
Deflection	Magnetic
Deflection Angle (Approximate)	53 Degrees
Basing (RETMA) 8EQ	Medium Shell Octal 8 Pin

Anode terminal aligns with Pin #5 within 10 degrees.
Anode contact is small recessed ball cap in bulb wall.

TYPICAL OPERATION

Pin No.	1	2	3	4	5	6	7	8
Element	NC	H	G#2	NC	G#1	F	K	H

Heater Voltage	6.3 Volts
Anode Voltage	12,000 Volts
Grid #2 Voltage	250 Volts
Grid #1 Voltage	—27 to —63 Volts
Focus Voltage	Zero
Grid #1 Circuit resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	15,000 Min. Ohms

Note: Type VTP 5ACP4 tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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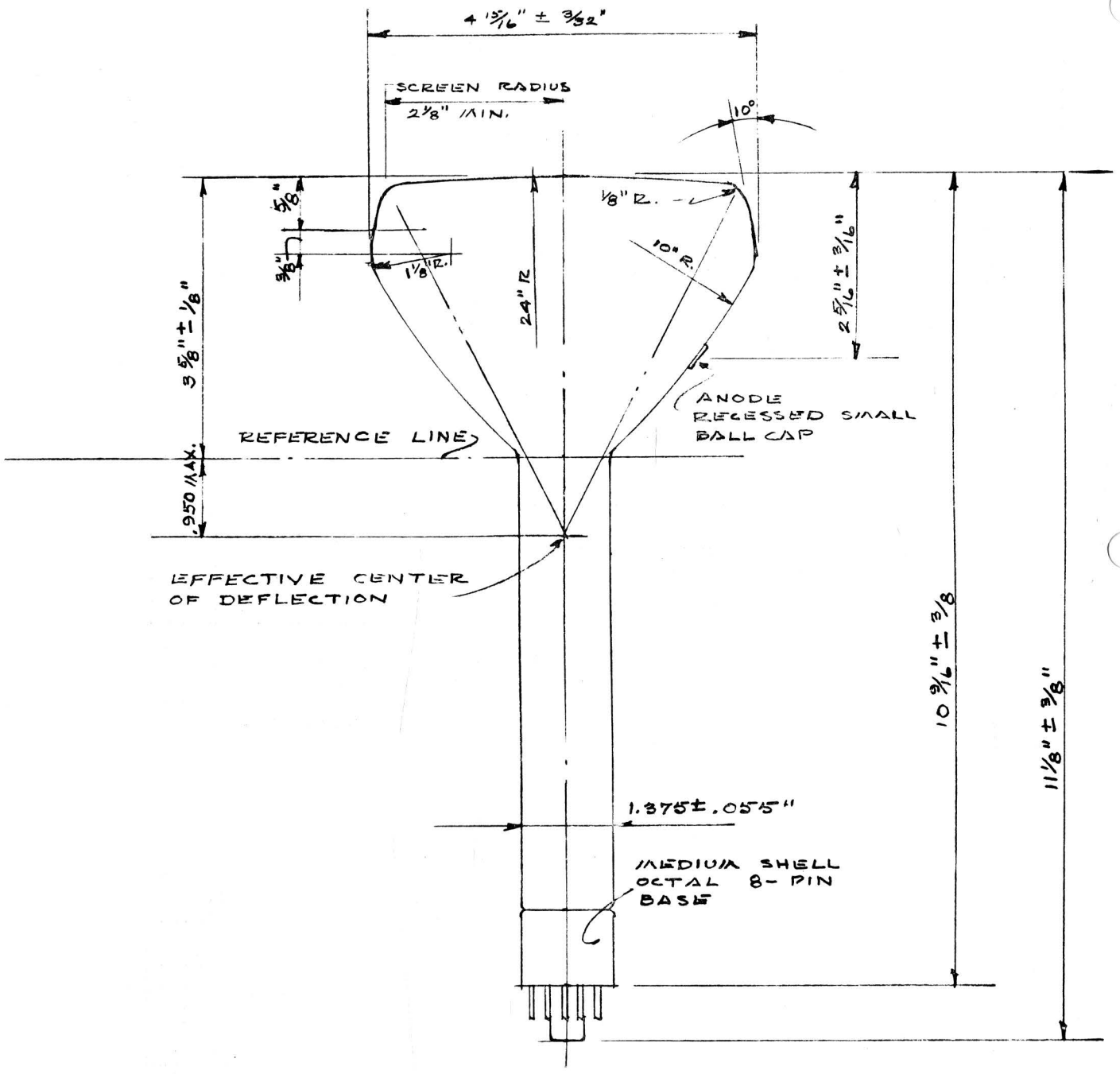
Phone: SAratoga 2-7648 — Post Office Box 810
Phone: SAratoga 2-6567



LPS. SEPT. 1957 1000

PRODUCT DATA SHEET

VTP 5F

The VTP 5F cathode ray tube is an electromagnetic deflection and focus type tube providing high definition and intensity. A high quality optical glass face plate is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 5F cathode ray tube is available with the following phosphors: P1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 19, 20, 23, 25.

In addition, any type is available with metal backing.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (Conductive inner wall coating and G#3)	10,000 Max. Volts D.C.
Grid #2 Voltage (Accelerating Electrode)	410 Max Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with Respect to Cathode	125 Max. Volts D.C.
Focus	Magnetic
Deflection	Magnetic
Deflection Angle (Approximate)	53 Degrees

Basing (RETMA) 5 AN — Medium Shell Octal 8 Pin

Anode terminal aligns approximately with Pin #5

Pin No.	1	2	3	4	5	6	7	8
Element	NC	H	G#2	NC	G#1	NC	K	H

Anode contact is small recessed ball cap in bulb wall.

TYPICAL OPERATION

Heater Voltage	6.3 Volts
Anode Voltage	6,000 Volts
Grid #2 Voltage	250 Volts
Grid #1 Voltage	—27 to —63 Volts
Grid #1 Circuit resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	10,000 Min. Ohms

Note: Type VTP 5F tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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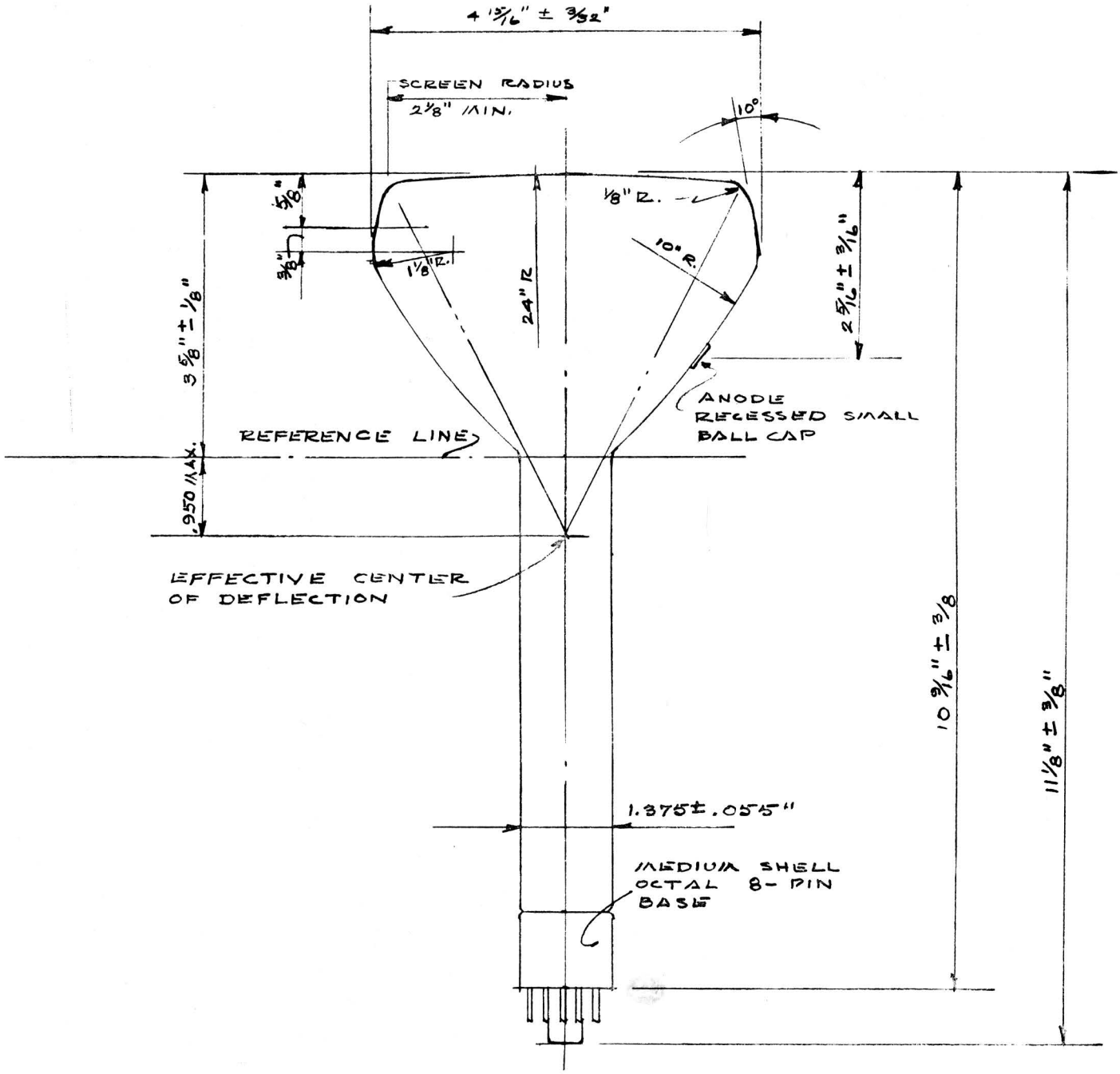

VACUUM TUBE PRODUCTS CO INC. 2020 Short Street, Oceanside, California

LPS. NOV. 1957—2M

PRODUCT DATA SHEET

VTP 7B

The VTP 7B cathode ray tube is an electromagnetic type tube providing high definition and intensity. A high quality optical glass face plate is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 7B cathode ray tube is available with the following phosphors:

P 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

In addition any type is available with metal backing.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (Conductive inner wall coating and G#3)	10,000 Max. Volts D.C.
Grid #2 Voltage (Accelerating Electrode)	410 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Focus	Magnetic
Deflection	Magnetic
Deflection Angle (Approximate)	53 Degrees
Basing (RETMA) 5AN	Medium Shell 8 Pin

Pin No.	1	2	3	4	5	6	7	8
Element	NC	H	G#2	NC	G#1	NC	K	H

Anode contact is small recessed ball cap in bulb wall.

TYPICAL OPERATION

Heater Voltage	6.3 Volts
Anode Voltage	7,000 Volts
Grid #2 Voltage	250 Volts
Grid #1 Voltage	−27 to −63 Volts
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	10,000 Min. Ohms.

Note: Type VTP 7B tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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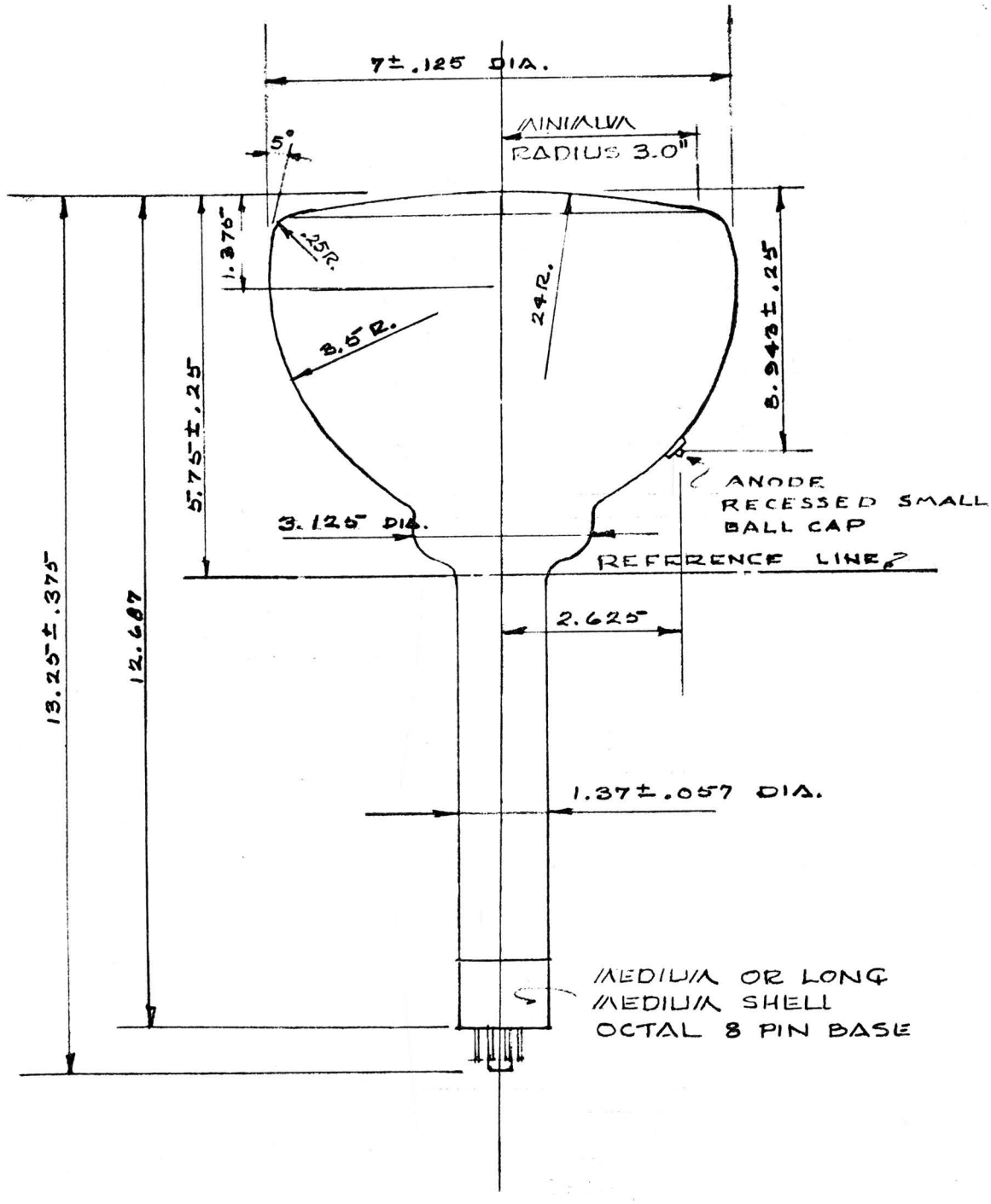
Phone: SAratoga 2-6567



LPS. SEPT. 1957 1000

PRODUCT DATA SHEET

VTP 7L

The VTP 7L cathode ray tube is an electromagnetic deflection and electrostatic focus tube of the zero focus voltage type providing high definition and intensity. A metal backed screen is used to provide the ultimate conditions when viewing is required at high ambient light levels. The metallic coating also provides freedom from ion burns. A high quality optical glass face plate is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust.

The VTP 7L cathode ray tube is available with the following phosphors:

P 1, 2, 3, 4, 5, 7, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (conductive inner wall coating and G#3)	18,000 Max. Volts D.C.
Grid #2 Voltage (accelerating electrode)	410 Max. Volts D.C.
Grid # 1 Voltage (control electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Focus	Electrostatic
Focus Voltage Range (Max.)	plus or minus 500 Volts
Deflection	Magnetic
Deflection Angle (approximate)	53 Degrees
Basing (RETMA 8EQ)	Medium Shell Octal 8 Pin

Anode terminal aligns approximately with base pin #5

Anode contact is small recessed ball cap in bulb wall.

TYPICAL OPERATION

Pin No.	1	2	3	4	5	6	7	8
Element	NC	H	G#2	NC	G#1	Focus	K	H

Heater Voltage	6.3 Volts
Anode Voltage	12,000 Volts D.C.
Grid #2 Voltage	250 Volts D.C.
Grid #1 Voltage	-27 to -63 Volts
Focus Voltage	Zero
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	15,000 Min. Ohms

Note: Type VTP 7L tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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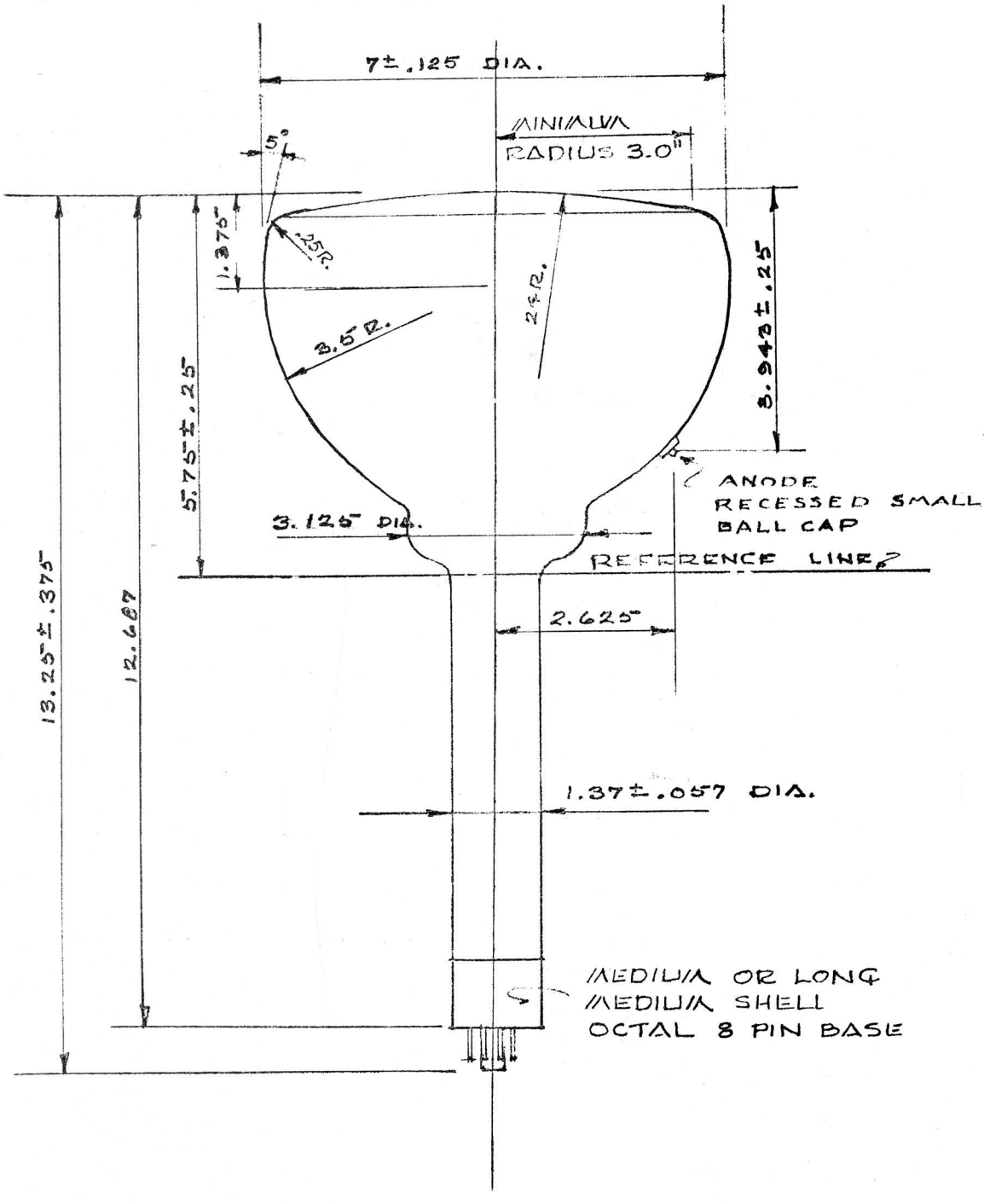
SAratoga 2-6567



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PRODUCT DATA SHEET

VTP 10B, 10F, 10K

The VTP 10B, 10F, and 10K cathode ray tubes are electromagnetic deflection and focus tubes providing high definition and intensity. A high quality optical glass face plate is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 10B, 10F and 10K cathode ray tubes are available with the following phosphors:

P1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25.

In addition, any type is available with either a clear or neutral grey face plate, and with either the ion trap type electron gun or a straight gun. Metal backing of the phosphor is also supplied if required.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (Conductive inner wall coating and G#3)	12,000 Max. Volts D.C.
Grid #2 Voltage (Accelerating Electrode)	410 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Focus	Magnetic
Deflection	Magnetic
Deflection Angle (Approximate)	50 Degrees
Ion Trap Operation	External Magnet
Basing	Small Shell Duodecal 7 Pin

Anode terminal aligns approximately with base pin #3.

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12
Element	H	G#1				NC	NC			G#2	K	H

Anode contact is small recessed cavity in bulb wall.

TYPICAL OPERATION

Heater Voltage	6.3 Volts
Anode Voltage	11,000 Volts
Grid #2 Voltage	250 Volts
Grid #1 Voltage	—27 to —63 Volts
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	11,000 Min. Ohms

Note: Type VTP 10B, 10F, and 10K tubes operate from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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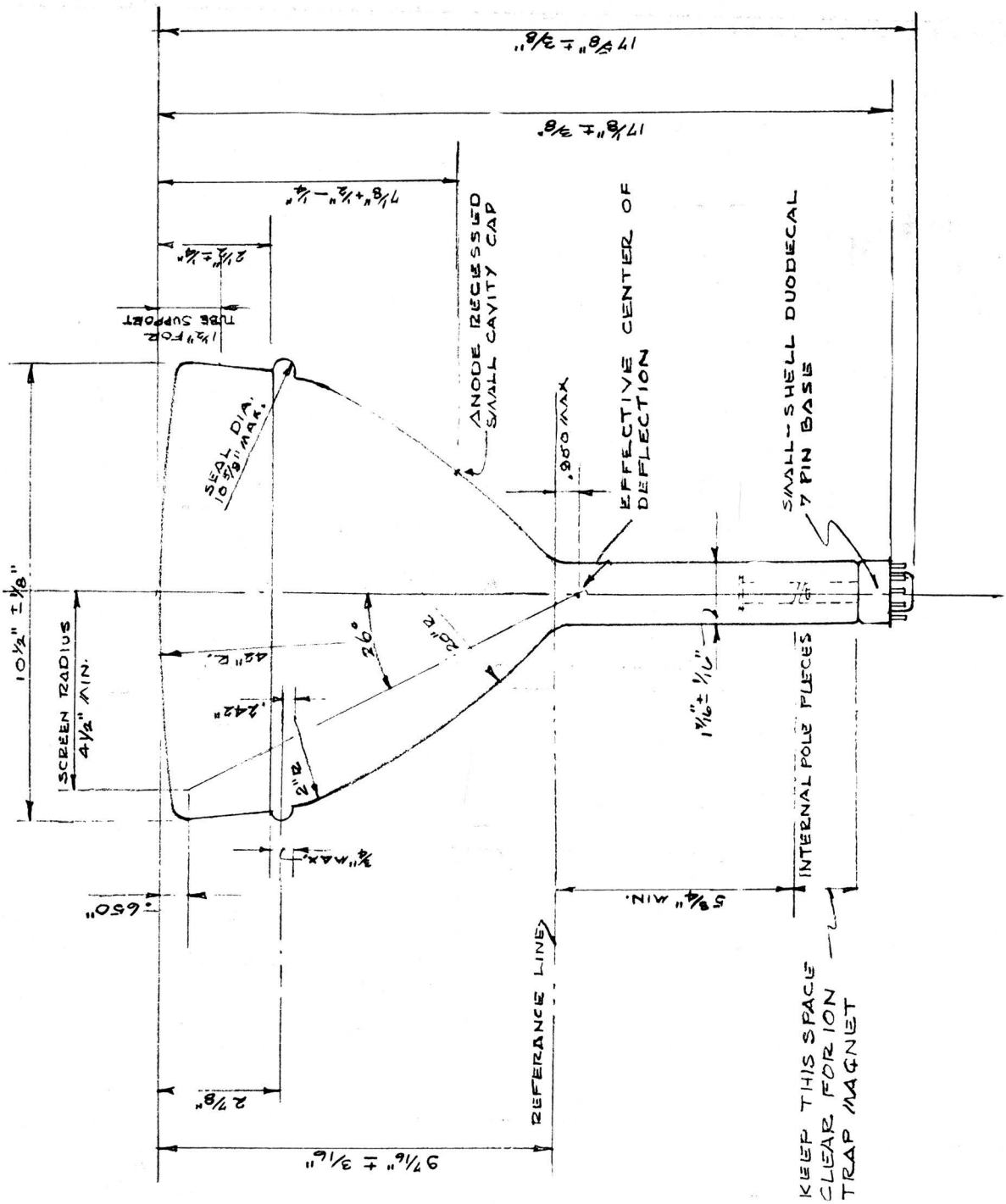
SAratoga 2-6567



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PRODUCT DATA SHEET

VTP 12D

The VTP 12D cathode ray tube is an electromagnetic deflection and focus tube providing high definition and intensity due to the use of a high resolution electron gun. A high quality optical glass face plate is used to allow full benefit of the excellent signal presentations. The "A" version of this tube is supplied with a clear panel while the "B" version incorporates a neutral gray panel, thereby minimizing light reflection from the tube face.

Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 12D cathode ray tube is available with the following phosphors: 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

In addition, any type is available with metal backing.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (Conductive inner wall coating and G#3)	12,000 Max. Volts D.C.
Grid # Voltage (Accelerating Electrode)	410 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	180 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Focus	Magnetic
Deflection	Magnetic
Deflection Angle (Approximate)	50 Degrees

Basing (RETMA) 5 AN ..... Long Medium or Medium Shell 8 pin.

Note. Anode terminal aligns approximately with base pin #5.

Pin No.	1	2	3	4	5	6	7	8
Element	NC	H	G#2	NC	G#1	NC	K	H

Anode contact is small recessed ball cap in bulb wall.

Where required, a snap-on medium cap with connector is supplied.

TYPICAL OPERATION

Heater Voltage	6.3 Volts
Anode Voltage	7,000 Volts
Grid #2 Voltage	250 Volts
Grid #1 Voltage	−25 to −70 Volts
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	11,000 Min. Ohms

Note: Type VTP 12D tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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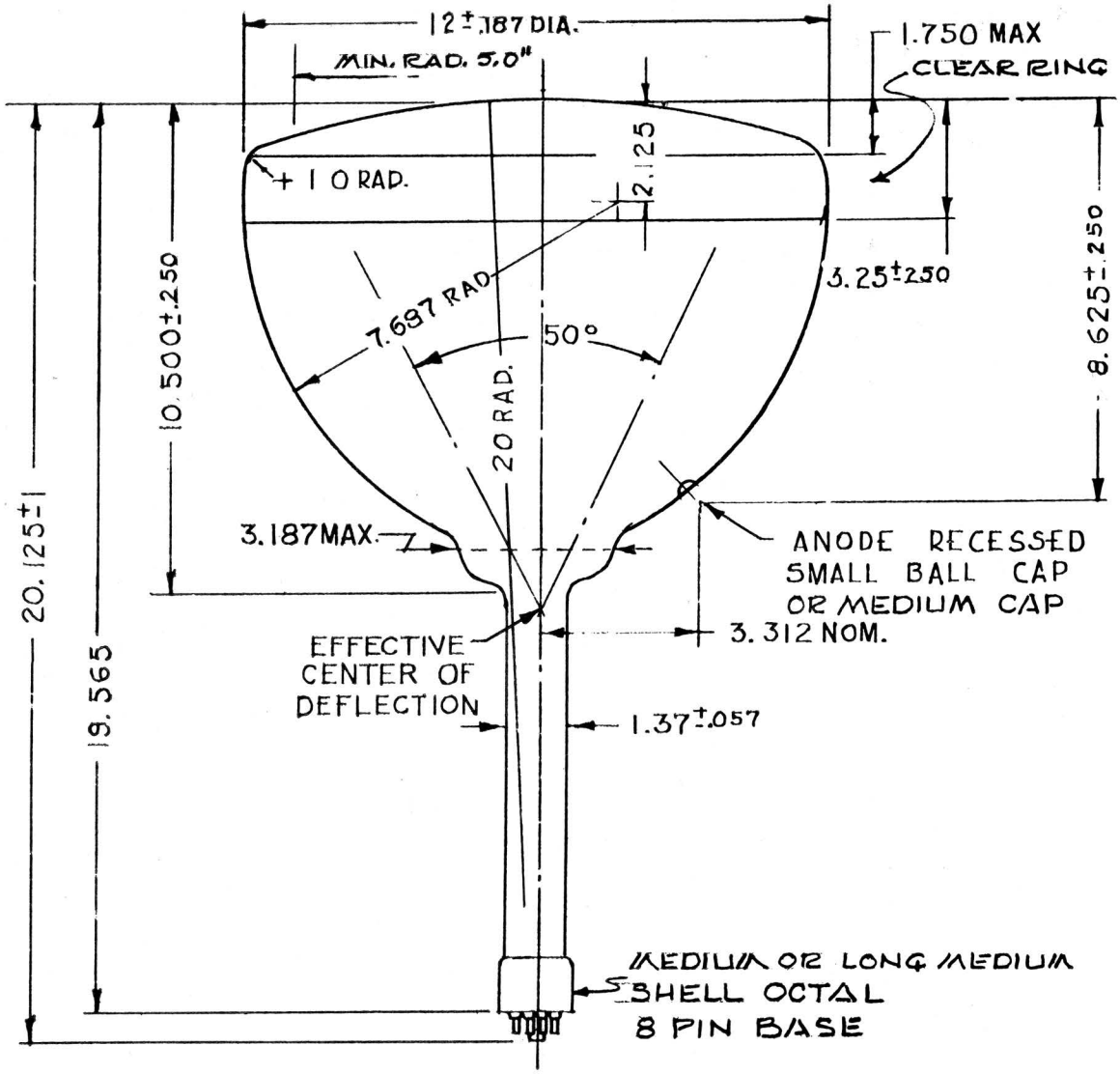

VACUUM TUBE PRODUCTS CO INC. 2020 Short Street, Oceanside, California

PRODUCT DATA SHEET

VTP 12L and 12S

The VTP 12L and 12S cathode ray tubes are electromagnetic focus and deflection tubes providing high definition and intensity. A high quality optical glass face plate is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long, careful exhaust. The VTP 12L and 12S cathode ray tubes are available with the following phosphors:

P 1, 2, 3, 4, 5, 7, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25.

In addition, any type is available with metal backing. Both types are also available with either a clear or neutral grey face plate, and are available with or without the ion trap type electron gun.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (Conductive inner wall coating and G#3)	12,000 Max. Volts D.C.
Grid #2 Voltage (Accelerating Electrode)	410 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Focus	Magnetic
Deflection	Magnetic
Deflection Angle Horizontal (Approximate)	50 Degrees
Ion Trap Operation	External Magnet
Basing	Small Shell Duodecal 7 Pin

Anode terminal aligns approximately with base pin #3.

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12
Element	H	G#1				NC	NC			G#2	K	H

Anode contact is small recessed cavity in bulb wall.

TYPICAL OPERATION

Heater Voltage	6.3 Volts
Anode Voltage	12,000 Volts
Grid #2 Voltage	250 Volts
Grid #1 Voltage	—27 to —63 Volts
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	11,000 Min. Ohms

Note: Type VTP 12L and 12S Tubes operate from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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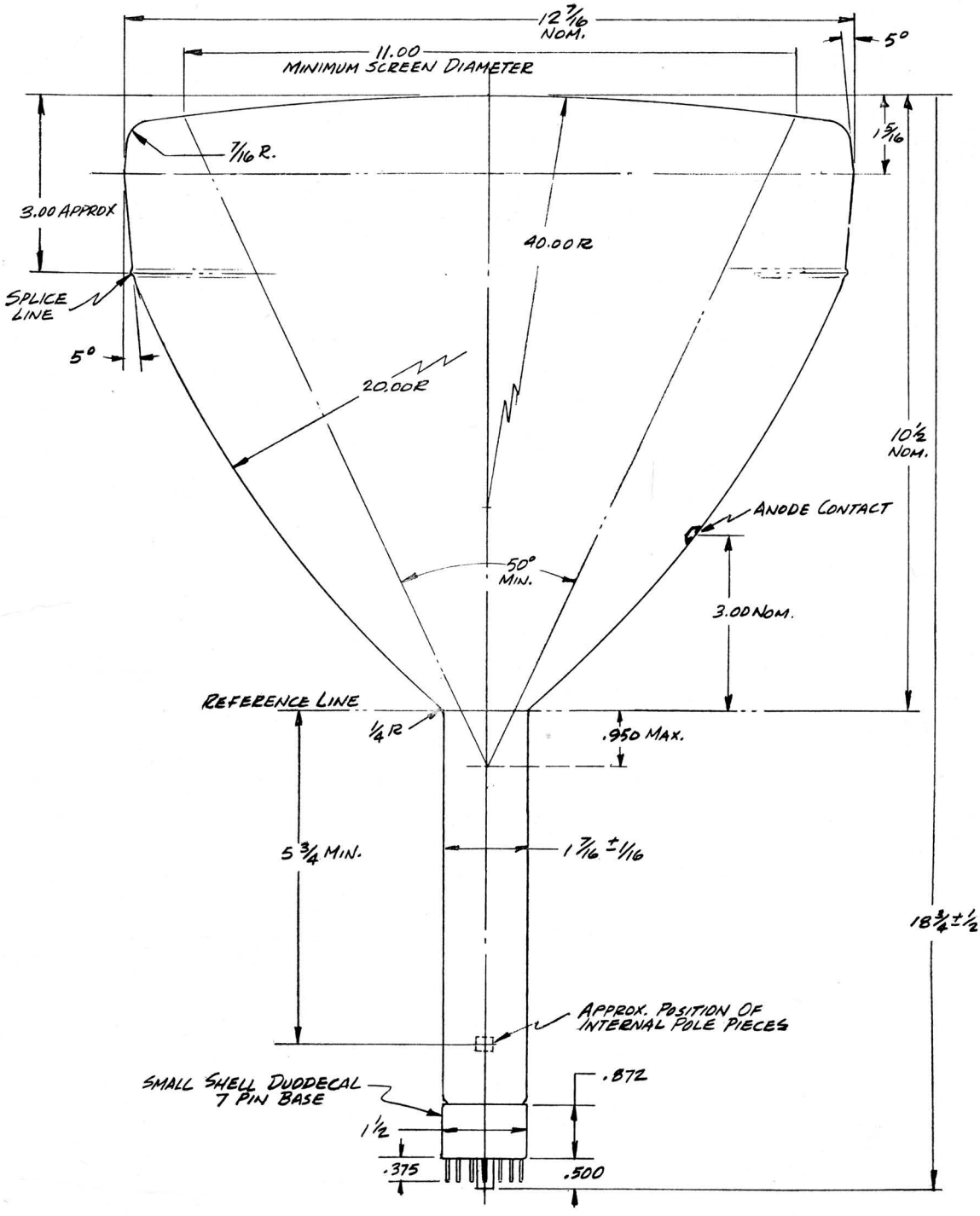

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PRODUCT DATA SHEET

VTP 14D

The VTP 14D cathode ray tube is an electromagnetic deflection and focus tube providing high definition and intensity. A high quality neutral grey face plate of optical glass is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust.

The VTP 14D cathode ray tube is available with the following phosphors: P 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

In addition, any type is available with metal backing. The VTP 14D is normally supplied with an ion trap type electron gun, but a straight gun is available if required.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (Conductive inner wall coating and G#3)	14,000 Max. Volts D.C.
Grid #2 Voltage (Accelerating Electrode)	410 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Focus	Magnetic
Deflection	Magnetic
Deflection Angle (Approximate)	65 Degrees
Ion Trap Operation	External Magnet
Basing	Small Shell Duodecal 7 Pin

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12
Element	H	G#1				NC	NC			G#2	K	H

Anode Contact is small recessed cavity in bulb wall.

TYPICAL OPERATION

Heater Voltage	6.3 Volts
Anode Voltage	11,000 Volts
Grid #2 Voltage	250 Volts
Grid #1 Voltage	—27 to —63 Volts
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	11,000 Min. Ohms

Note: Type VTP 14D tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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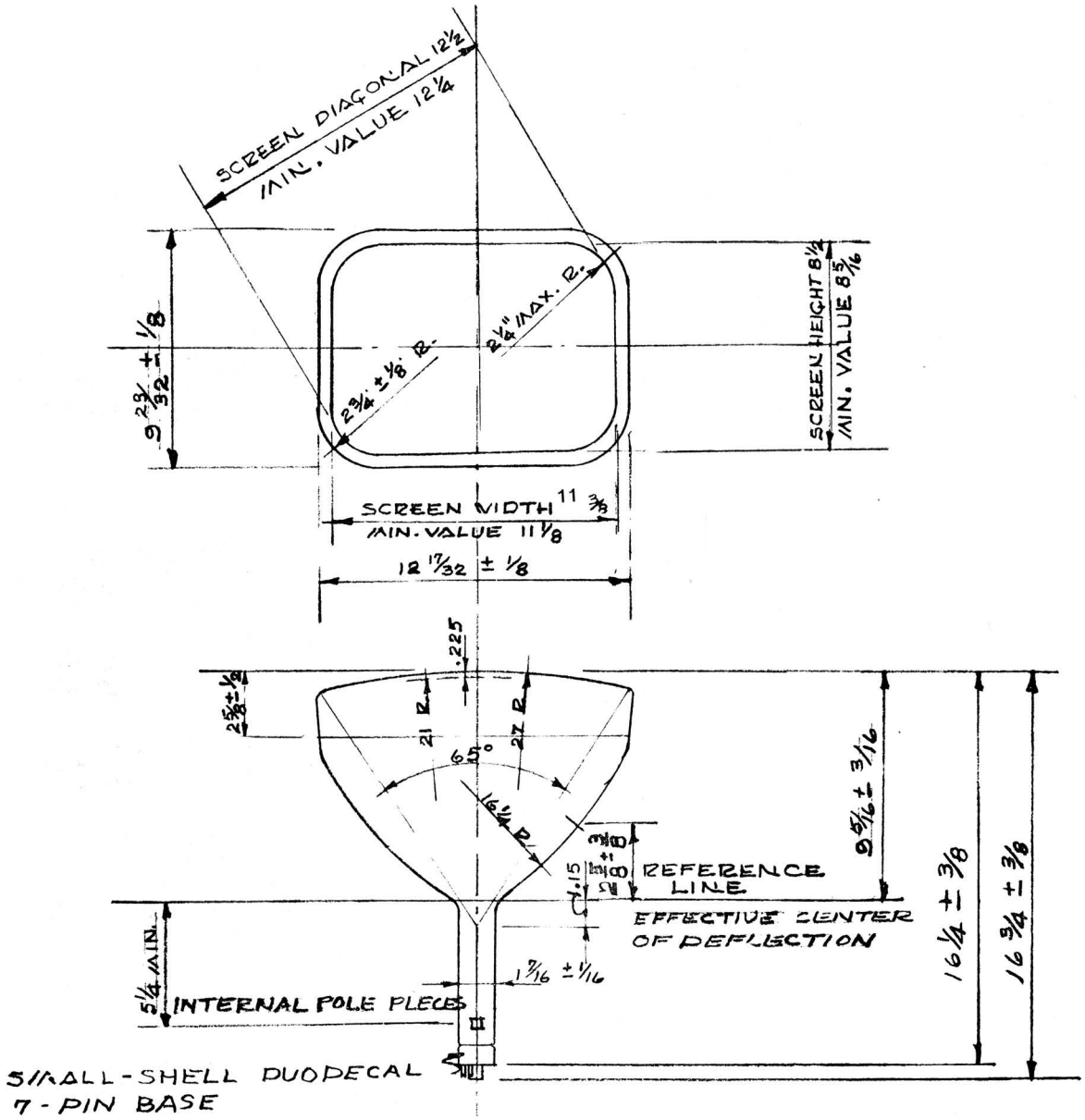


SMALL-SHELL DUODECAL
7-PIN BASE

PRODUCT DATA SHEET

VTP 16AF

The VTP 16AF cathode ray tube is an electromagnetic deflection and electrostatic focus type tube, providing high definition and intensity. The 16AF is designed with a zero focus type electron gun affording substantially automatic focus, independent of accelerator voltage variations. A metal backed screen is used to provide the ultimate when viewing is required at high ambient light levels. The metallic coating also provides freedom from ion burns. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 16AF cathode ray tube is available with the following phosphors: P 1, 2, 3, 4, 5, 11, 12, 15,16,18, 19, 20, 23,24.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Anode Voltage (conductive inner wall coating and G#3)	16,000 Max. Volts D.C.
Heater Current	0.6 Amperes
Grid #2 Voltage (accelerating electrode)	410 Max. Volts D.C.
Grid #1 Voltage (control electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Focus	Electrostatic
Focus Voltage Range (Max.)	plus or minus 500 Volts
Deflection	Magnetic
Deflection Angle (approximate)	65 Degrees
Basing (RETMA 12L)	Small Shell Duodecal 7 Pin

Pin No.	1	2	6	7	10	11	12
Element	H	G#1	Focus	NC	G#2	K	H

Anode contact in small recessed cavity in bulb wall.

TYPICAL OPERATION

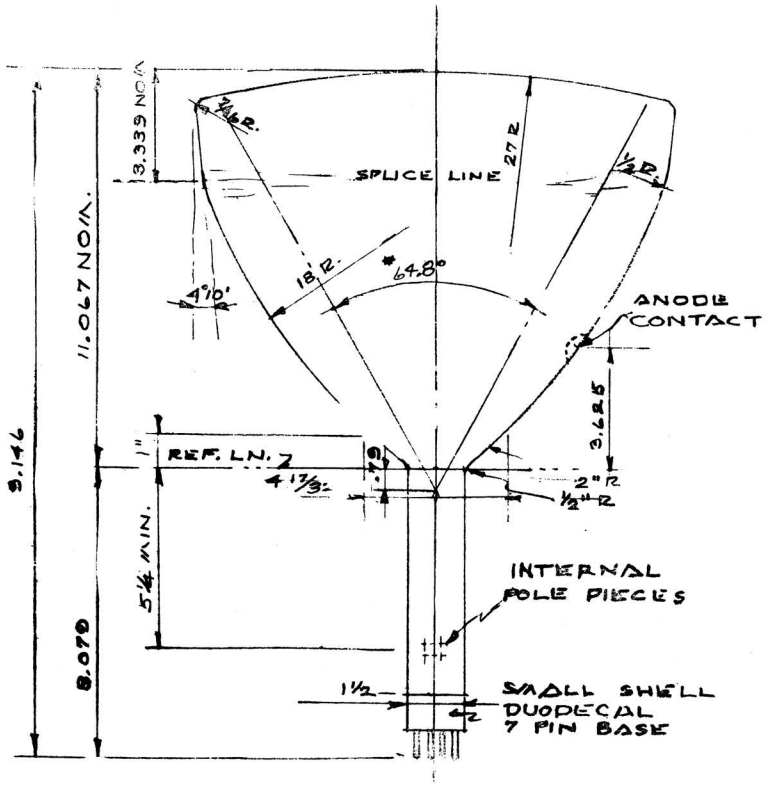
Heater Voltage	6.3 Volts
Anode Voltage	12,000 Volts D.C.
Grid #2 Voltage	250 Volts D.C.
Grid #1 Voltage	-27 to -63 Volts
Focus Voltage	Zero
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	15,000 Min. Ohms

Note: Type VTP 16AF tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

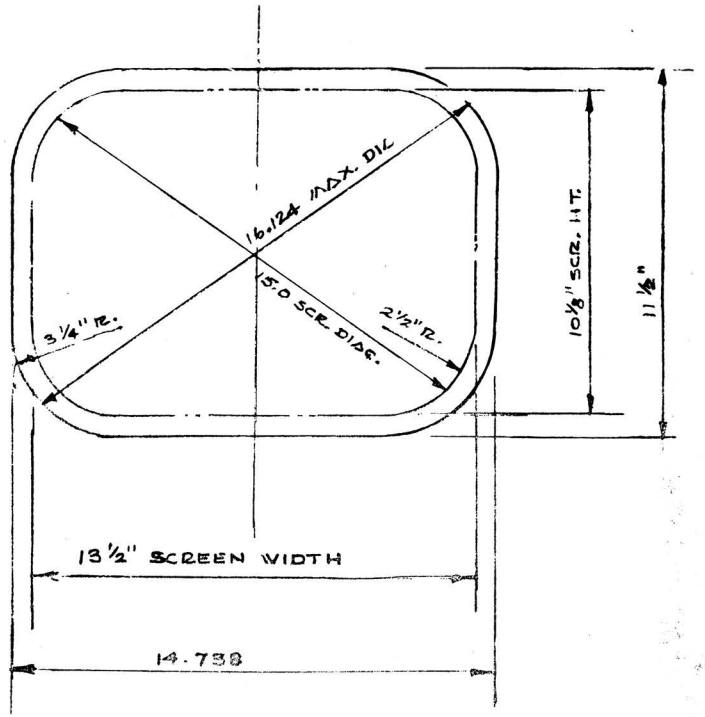
VACUUM TUBE PRODUCTS CO. INC.

506 SOUTH CLEVELAND STREET, OCEANSIDE, CALIFORNIA

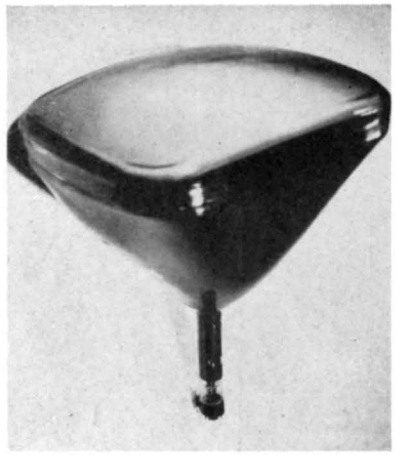
SAratoga 2-6567



* 70° DIAGONAL
50.8° HEIGHT



PRODUCT DATA SHEET



VTP 17B

The VTP 17B cathode ray tube is an electromagnetic deflection and focus tube providing high definition and intensity. A high quality neutral grey face plate of optical quality glass is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust.

The VTP 17B cathode ray tube is available with the following phosphors:
P 1, 2, 3, 4, 5, 7, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25.

In addition, any type is available with metal backing. The VTP 17B is normally supplied with an ion trap type electron gun, but a straight gun is available if required.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (Conductive inner wall coating and G#3)	16,000 Max. Volts D.C.
Grid #2 Voltage (Accelerating Electrode)	410 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	150 Max. Volts D.C.
Heater Positive with respect to Cathode	150 Max. Volts D.C.
Focus	Magnetic
Deflection	Magnetic
Deflection Angle Horizontal (Approximate)	65 Degrees
Ion Trap Operation	External Magnet
Basing	Small Shell Duodecal 7 Pin

Anode terminal aligns approximately with base pin #3.

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12
Element	H	G#1				NC	NC			G#2	K	H

Anode contact is small recessed cavity in bulb wall.

TYPICAL OPERATION

Heater Voltage	6.3 Volts
Anode Voltage	12,000 Volts
Grid #2 Voltage	300 Volts
Grid #1 Voltage	—33 to —77 Volts
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	11,000 Min. Ohms

Note: Type VTP 17B tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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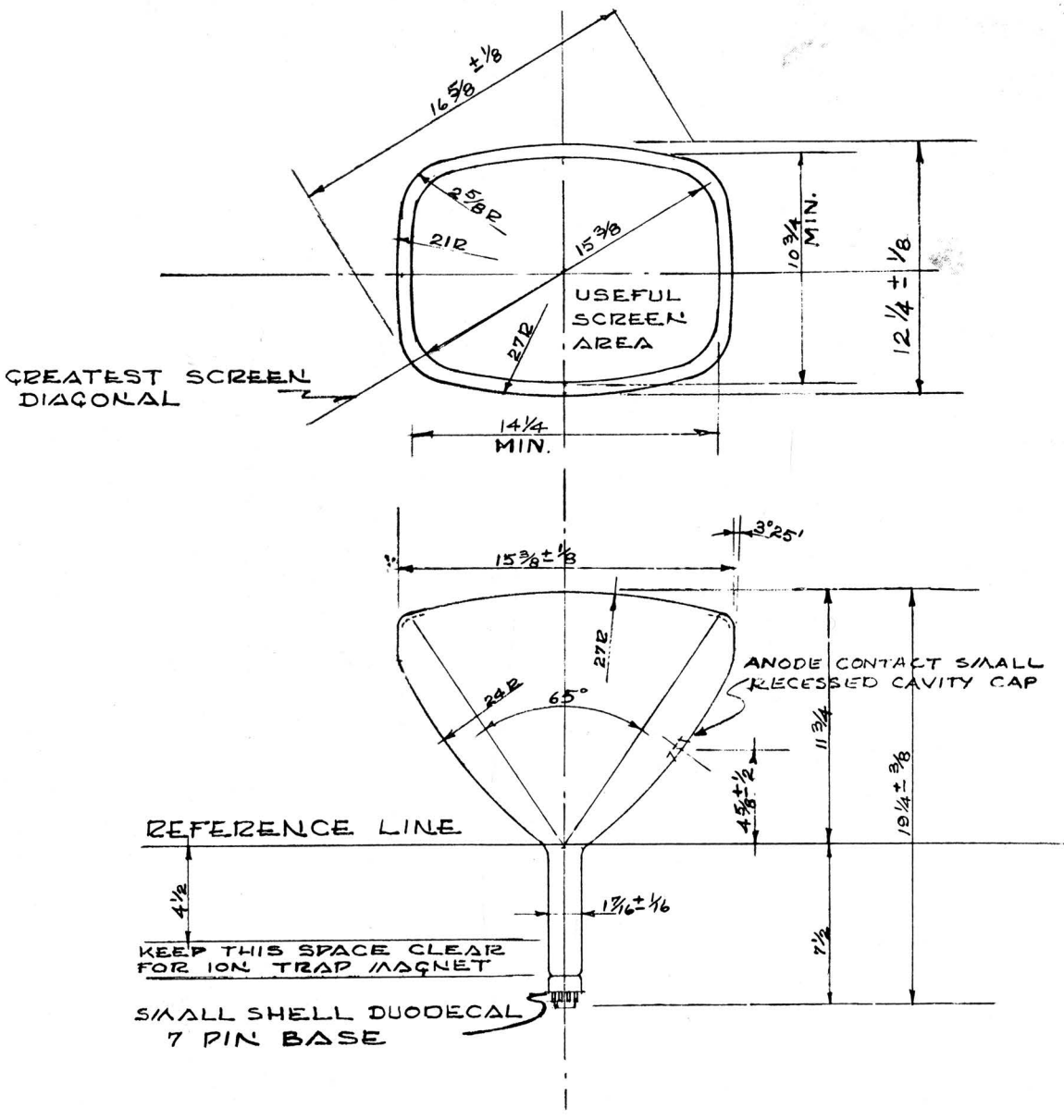

VACUUM TUBE PRODUCTS CO., INC. 220 Short Street, Oceanside, California

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PRODUCT DATA SHEET

VTP 20C

The VTP 20C cathode ray tube is an electromagnetic deflection and focus tube providing high definition and intensity. A high quality neutral grey face plate of optical quality glass is used to allow full benefit of the excellent signal presentation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 20C cathode ray tube is available with the following phosphors: P 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

In addition, any type is available with metal backing. The VTP 20C is normally supplied with an ion trap type electron gun, but a straight gun is available if required.

GENERAL CHARACTERISTICS

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode Voltage (Conductive inner wall coating and G#3)	18,000 Max. Volts D.C.
Grid #2 Voltage (Accelerating Electrode)	410 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	150 Max. Volts D.C.
Heater Positive with respect to Cathode	150 Max. Volts D.C.
Focus	Magnetic
Deflection	Magnetic
Deflection Angle Horizontal (Approximate)	66 Degrees
Ion Trap Operation	External Magnet
Basing	Small Shell Duodecal 7 Pin

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12
Element	H	G#1				NC	NC			G#2	K	H

Anode contact is small recessed cavity in bulb wall.

TYPICAL OPERATION

Heater Voltage	6.3 Volts
Anode Voltage	12,000 Volts
Grid #2 Voltage	300 Volts
Grid #1 Voltage	—33 to —77 Volts
Grid #1 Circuit Resistance	
Maximum	1.5 Megohms
Minimum	150 Ohms
Grid #2 Circuit Resistance	470 Min. Ohms
Anode Circuit Resistance	15,000 Min. Ohms

Note: Type VTP 20C tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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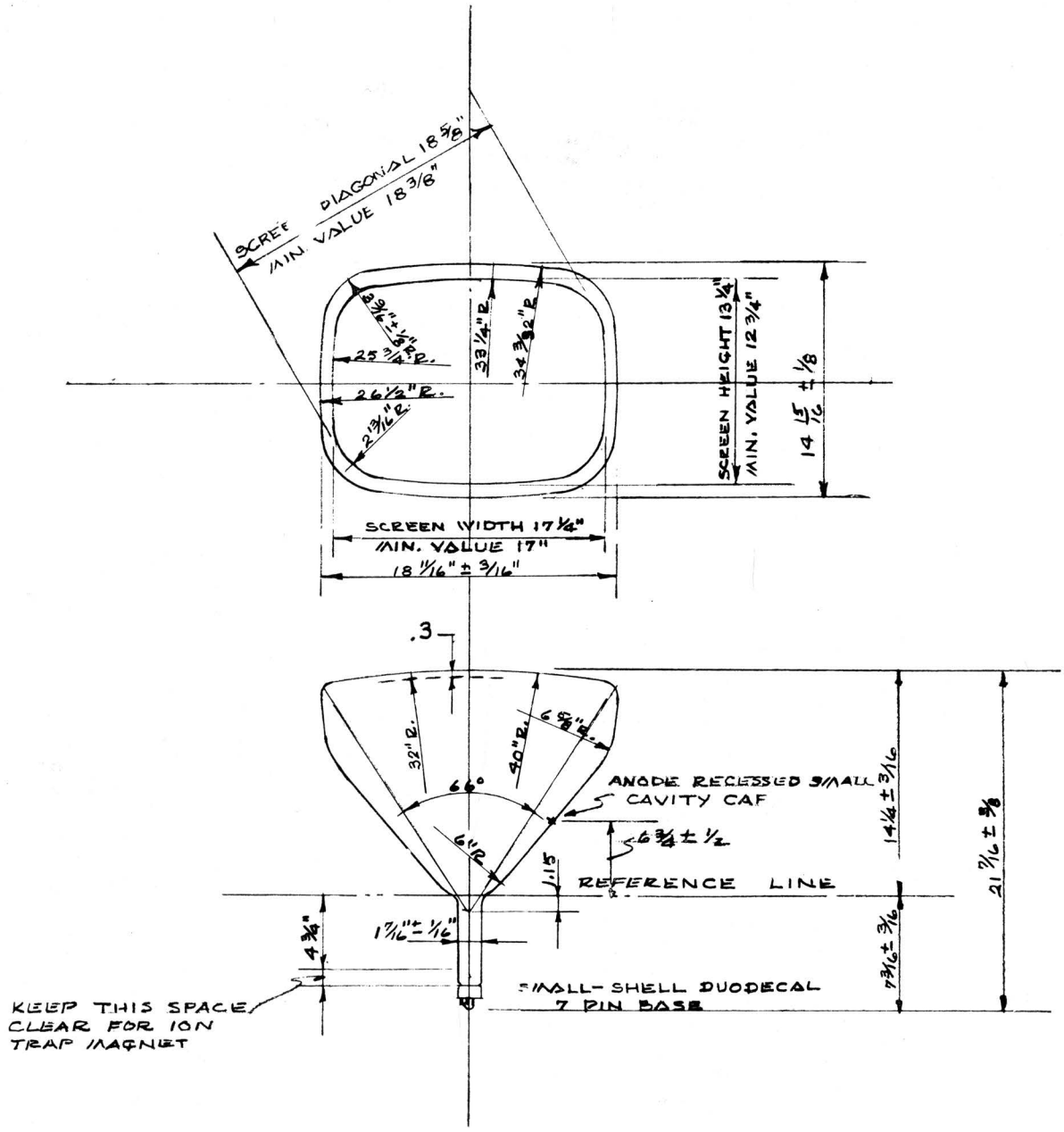
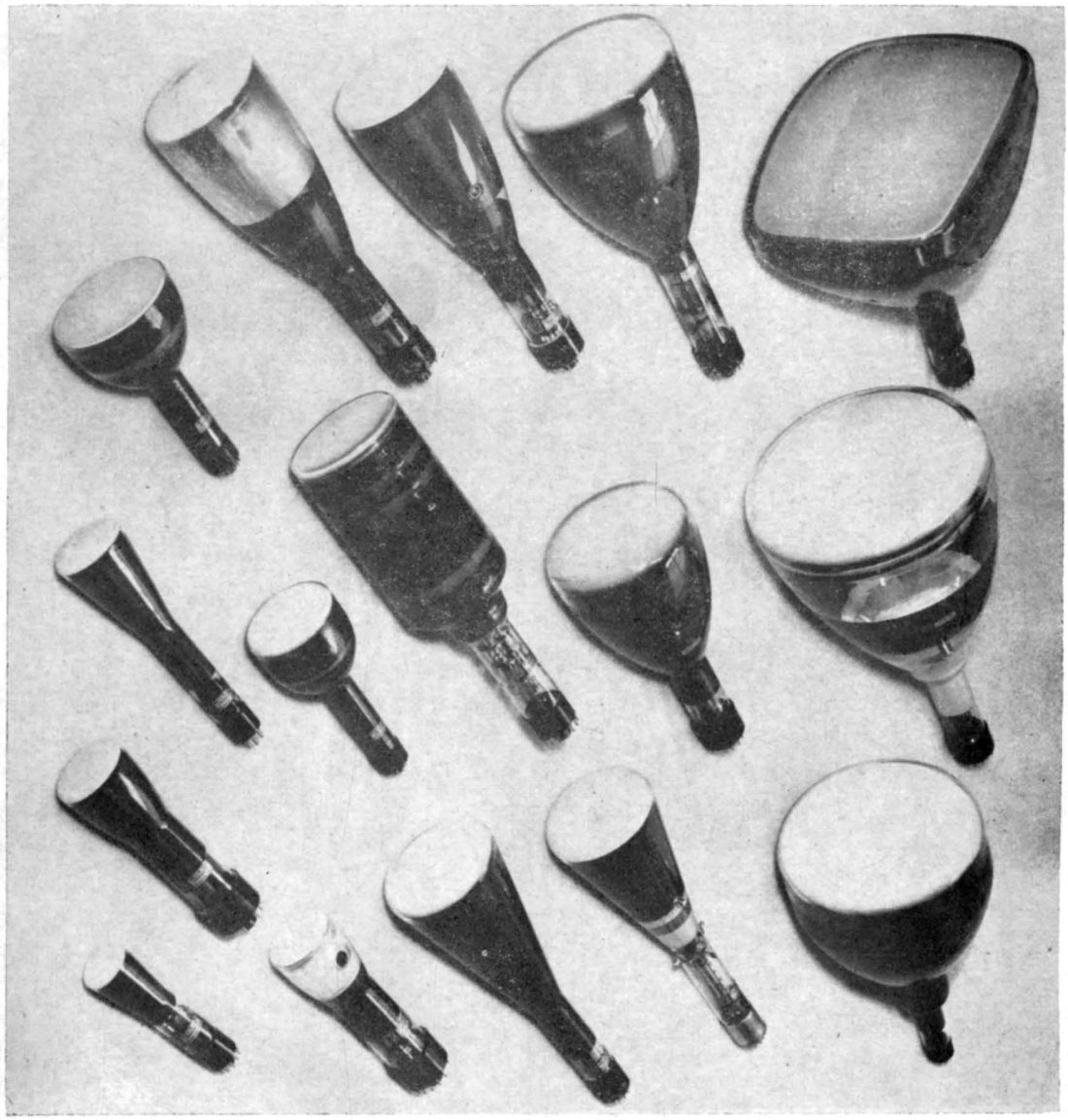

SCREEN DIAGONAL 18 5/8"
MIN. VALUE 18 3/8"
33 1/4" R.
34 3/32" R.
25 7/16" R.
26 1/2" R.
SCREEN HEIGHT 13 1/4"
MIN. VALUE 12 3/4"
14 15/16 ± 1/8
SCREEN WIDTH 17 1/4"
MIN. VALUE 17"
18 11/16" ± 3/16"
.3
32" R.
40" R.
66°
6" R.
ANODE RECESSED SMALL CAVITY CAF
6 3/4 ± 1/2
1.15
REFERENCE LINE
14 1/4 ± 3/16
21 7/16 ± 5/8
7 3/16 ± 3/16
1 7/16" ± 1/16"
4 3/4"
KEEP THIS SPACE CLEAR FOR ION TRAP MAGNET
SMALL-SHELL DUODECAL 7 PIN BASE

PRODUCT DATA SHEET



Electrostatic Deflection
CATHODE RAY TUBES

VACUUM TUBE PRODUCTS CO. INC.

506 SOUTH CLEVELAND STREET, OCEANSIDE, CALIFORNIA

Phone: SAratoga 2-6567

LPS. 1-1-57 1M

ELECTROSTATIC DEFLECTION TYPES

In the panel above are shown some of the electrostatic deflection type cathode ray tubes manufactured by VACUUM TUBE PRODUCTS CO. INC. These and similar types of cathode ray tubes are described in detail in the pages which follow. It will be noted that VTP tubes employ only a general designation to indicate screen size and type, and that all types are available in most phosphors. Metal backing of screens also is available in all types where greater brilliance is required.

LPS. DEC. 1957—1M

PRODUCT DATA SHEET

VTP 3ABP — 3ABP-A

P - 1, 2, 4, 7, 11, 15, 19

The VTP 3ABP and VTP 3ABP-A are electrostatic deflection and focus cathode ray tubes of the two gun type providing high definition and intensity. The VTP 3ABP type is supplied with plain phosphor, while the VTP 3ABP-A is the metal backed version utilizing the exclusive Vacuum Tube Products method of closely controlled highly reflective screen backing. Precise control of all manufacturing methods makes possible the high quality inherent in the VTP 3ABP types. Features of the VTP 3ABP - 3ABP-A are high deflection sensitivity, excellent overall focus, and a zero first anode (focus) current type electron gun. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. In addition to the above registered phosphor types, the VTP 3ABP - 3ABP-A are available in the following phosphor types: P-3, 5, 12, 13, 14, 16, 17, 18, 20, 23, 24, 25, or blended phosphors if desired.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage		6.3 Volts
Heater Current		1.2 Amperes
Anode No. 3 Voltage (Accelerator Electrode)		8000 Max. Volts D. C.
Anode No. 2 Voltage (High Voltage Electrode)		3000 Max. Volts D. C.
Anode No. 1 Voltage (Focusing Electrode)		1500 Max. Volts D. C.
Ratio Anode No. 3 Voltage to Anode No. 2 Voltage		4 Max.
(NOTE: Optimum conditions are obtained when ratio is less than 2)		
Grid No. 1 Voltage (Control Electrode)	Negative Bias Value	200 Max. Volts D. C.
	Positive Bias Value	0 Max. Volts D. C.
	Positive Peak Value	2 Max. Volts D. C.
Peak Voltage between Anode No. 2 and any Deflection Electrode		600 Max. Volts
Useful Screen Diameter		2.68 Inches Min.

Basing (RETMA) 14T ..... B14-38 Medium Shell Diheptal 14Pin

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Element	H	G1	F	D1	D2	D3	D4	D4	D3	D2	D1	F	G1	H-K
Gun	A-B	A	A	A	A	A	A	B	B	B	B	B	B	A-B

NOTE: Pin No. 1 (Heater) and Pin No. 14 (Heater-Cathode) are common to both guns.
Anode No. 2 and Anode No. 3 are also common to both guns.

Base - Gun Alignement. D3D4 trace aligns with Anode Terminals and Pin No. 5.
Positive voltage on D3 deflects beam toward Pin No.12.
Positive voltage on D1 reflects beam between Pins No. 1 and No. 2.

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3 Volts
Anode No. 3Voltage	4000 Volts D. C.
Anode No.2 Voltage	2000 Volts D. C.
Anode No. 1 Voltage	350 - 550 Volts D. C.
Grid No. 1 Voltage	-45 to -75 Volts D. C.
Modulation Factors (Grid Drive)	45 Max. Volts D. C.
Deflection Factors:	
D1 and D2	165 to 200 Volts D. C. /inch
D3 and D4	165 to 200 Volts D. C. /inch
NOTE: Both deflection systems are designed for center value of	185 Volts D. C. /inch
Undeflected Focus Spot Position	Within a ¼ inch Radius Circle

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode	5.0 Max. Megohms

NOTE: The VTP 3ABP - 3ABP-A tube operates from power supplies that are dangerous. Caution should be used in all installations.

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Phone: SAratoga 2-7648
Phone: SAratoga 2-6567
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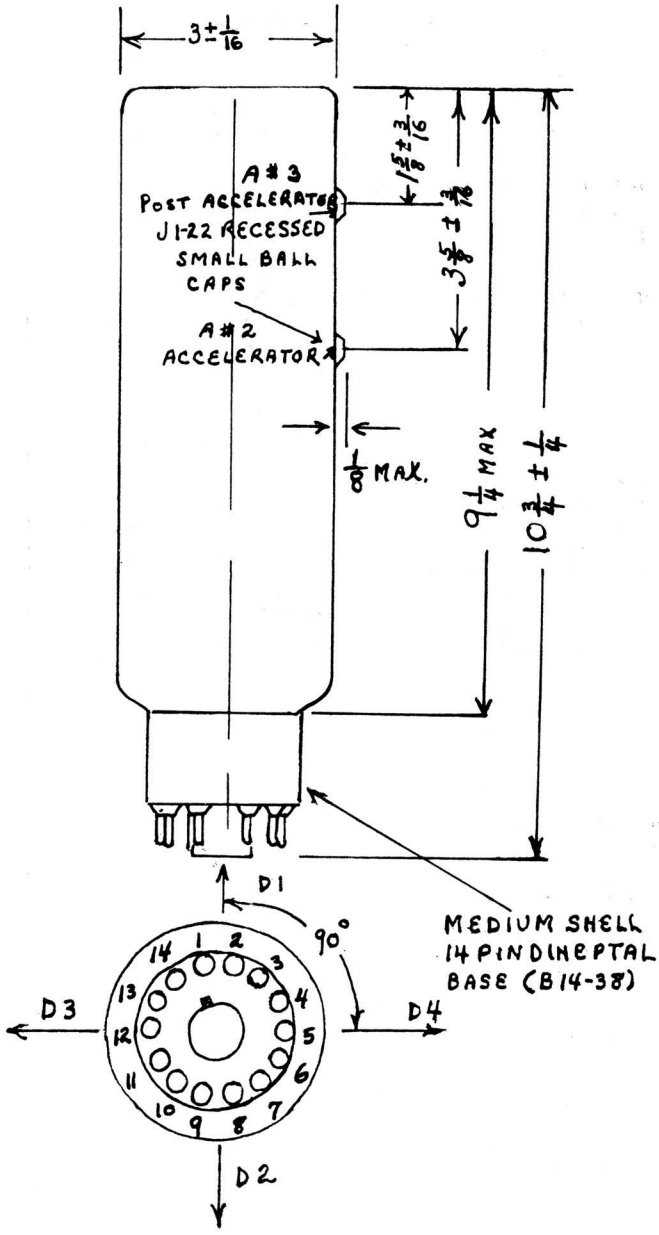
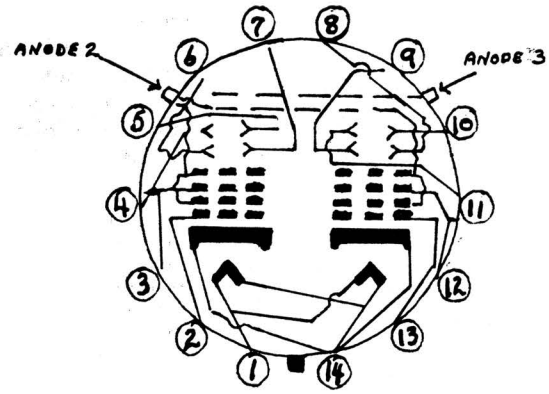
VTP 3ABP - 3ABP-A

P-1, 2, 4, 7, 11, 15, 19



CATHODE RAY TUBE

TYPE 3ABP



BASING CONNECTIONS

GUN A		GUN B	
Pin No.	Element	Pin No.	Element
1	Heater	8	Deflector 4
2	Grid 1	9	Deflector 3
3	Focus Electrode	10	Deflector 2
4	Deflector 1	11	Deflector 1
5	Deflector 2	12	Focus Electrode
6	Deflector 3	13	Grid 1
7	Deflector 4	14	Heater & Cathode

Pins Nos. 1 and 14 Heater and Cathode are common to both.

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PRODUCT DATA SHEET

VTP 5AB

The VTP 5AB cathode ray tube is an electrostatic deflection and focus type tube providing high definition and intensity. The VTP 5AB is designed with a high voltage post deflection accelerator making possible a high intensity spot with a minimum loss of deflection sensitivity. Features of this type are high deflection sensitivity, excellent overall focus and a zero first anode (focus) current type electron gun. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 5AB type cathode ray tube is available with the following phosphors: P 1, 2, 3, 4, 5, 7, 11, 12, 13, 14,15, 16, 17, 18, 19, 20, 21, 23, 25.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #3 Voltage (Accelerating Electrode)	6000 Max. Volts D.C.
Anode #2 Voltage (High Voltage Electrode)	3000 Max. Volts D.C.
Anode #1 Voltage (Focus Electrode)	1200 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	200 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Voltage between Anode #2 and any deflecting electrode	750 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Heater Negative with respect to Cathode (During a warm-up period not to exceed 15 seconds).	410 Max. Volts D.C.

Basing (RETMA) 15G ..... Medium Shell Diheptal 12 pin.
Anode terminal aligns approximately with base pin #5

Pin No.	1	2	3	4	5	7	8	9	10	11	12	14
Element	H	K	G#1	NC	A#1	D3	D4	A#2	D2	D1	NC	H

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3 Volts
Anode #3 Voltage	4000 Volts D.C.
Anode #2 Voltage	2000 Volts D.C.
Anode #1 Voltage	250 to 355 Volts D.C.
Anode #1 Current (For Operating Conditions)	—15 to +10 Microamperes
Grid #1 voltage	—37 to —56 Volts
(For visual extinction of undeflected focused spot)	
Deflection Factors — Volts D.C./Inch	
Electrodes D1, D2	56 to 80
Electrodes D3, D4	22 to 38

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode	5.0 Max. Megohms

Note: The VTP 5AB tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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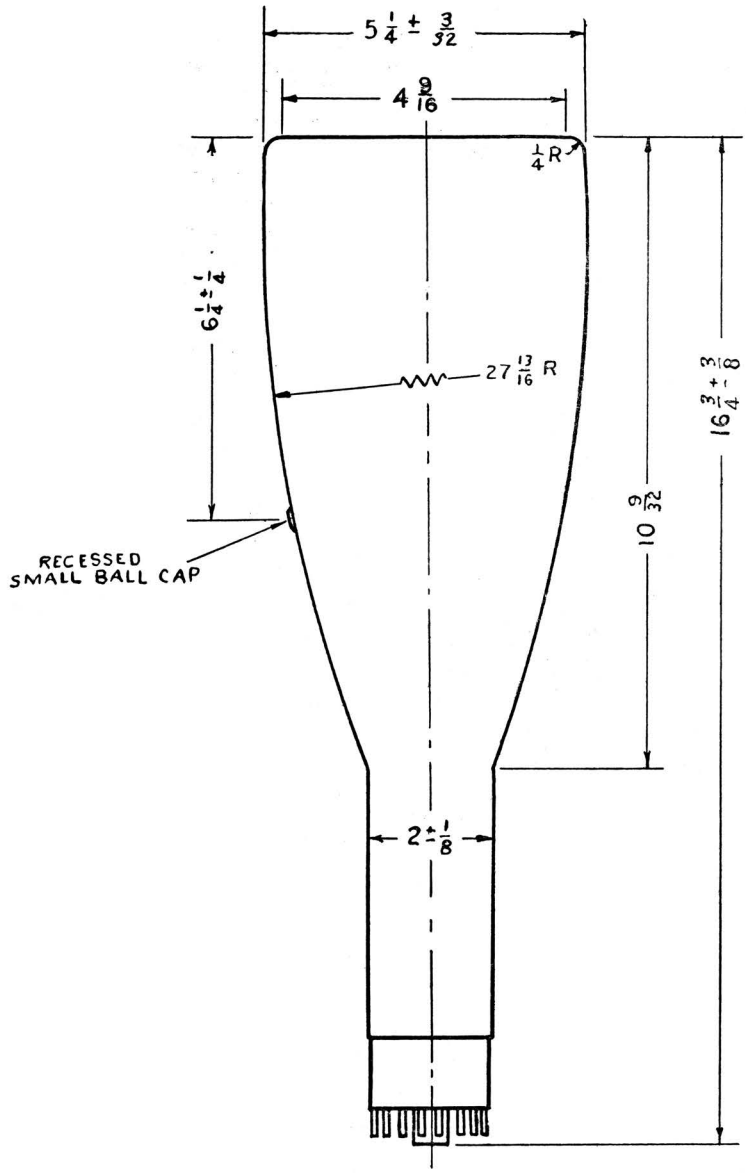

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VACUUM TUBE PRODUCTS

VTP 5AJ

The VTP 5AJ cathode ray tube is an electro-static deflection and focus type tube for general oscillographic and other applications requiring relatively large screen size with a minimum overall length. The tube is designed with a high voltage post-deflection accelerator electrode making possible a high intensity spot with a minimum loss of deflection sensitivity. A special feature of the tube lies in the design of the intensifier together with the electrically conductive screen to provide an anode for the electron beam. This type of operation allows the use of a soft main beam to provide high deflection sensitivity while allowing the use of intensifier voltages up to ten times the beam voltage. The above operation provides excellent signal presentation with high deflection sensitivity and intensity with an excellent spot characteristic in a minimum overall length. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 5AJ cathode ray tube is available with the following phosphors:
P 1, 2, 3, 4, 5, 7, 11, 12, 14, 15, 16; 17; 18; 19; 20.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #3 Voltage (Accelerator Electrode)	10,000 Max. Volts D.C.
Anode #2 Voltage (High Voltage Electrode)	2500 Max. Volts D.C.
Anode #1 Voltage (Focusing Electrode)	1500 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	200 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Voltage between Anode #2 and any deflecting Electrode	500 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Basing	Small shell duodecal 12 pin

Pin No.	1	2	3	4	5	6	7	8	9	10	11	12
Element	H	K	NC	D1	F	D4	A#2	D2	D3	NC	G#1	H

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3 Volts
Anode #3 Voltage	6000 Volts D.C.
Anode #2 Voltage	750 Volts D.C.
Anode #1 Voltage Range	400 to 900 Volts D.C.
Grid #1 Voltage Range	-30 to -60 Volts
Deflection Sensitivity	230 Volts D.C./Inch

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode Circuit	3.0 Max. Megohms

Note: Type VTP 5AJ tube operates from power supplies that are dangerous.
The above circuit values are recommended as a safety measure.

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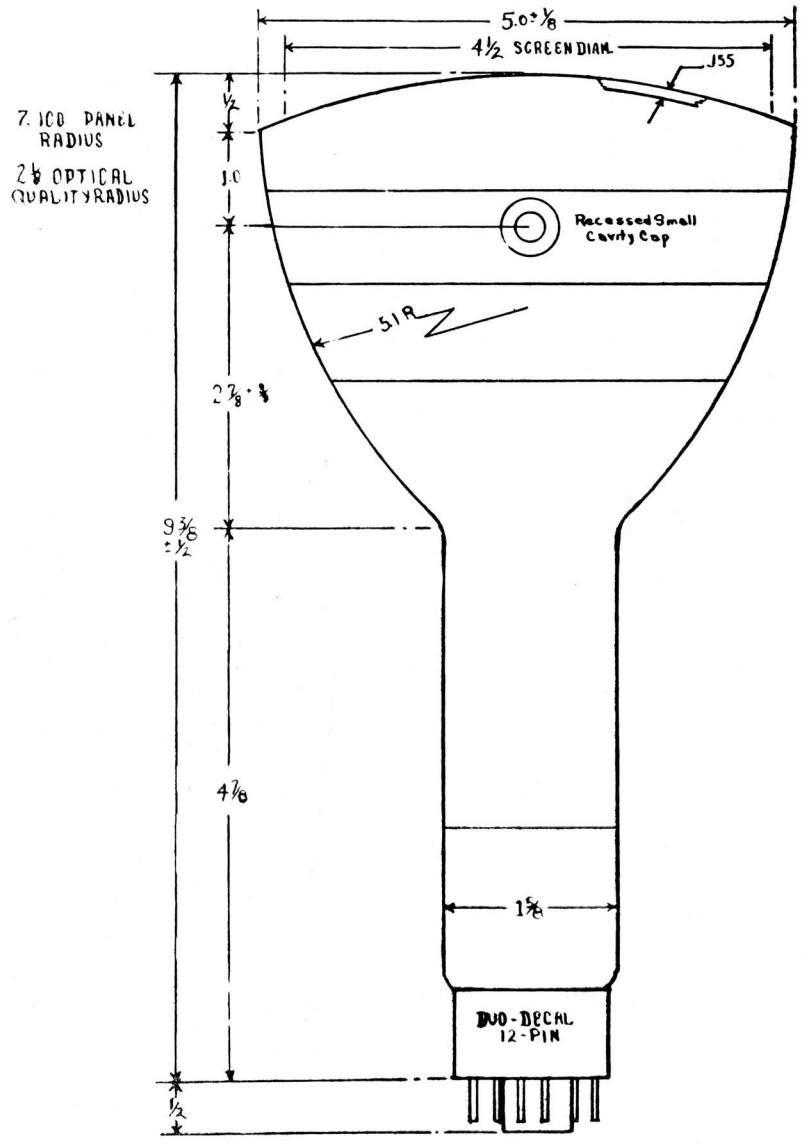
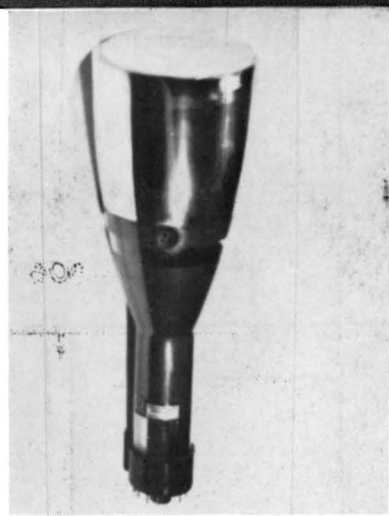
FEB. 55


5.0±⅛
4½ SCREEN DIAM.
J55
½
7.100 PANEL RADIUS
2⅛ OPTICAL QUALITY RADIUS
1.0
Recessed Small Cavity Cap
51R
2⅞±⅛
9⅜ ±½
4⅛
1⅝
DUO-DECAL 12-PIN
½

PRODUCT DATA SHEET



VTP 5C

The VTP 5C cathode ray tube is an electrostatic deflection and focus type tube for general oscillographic and other applications requiring a high intensity. The VTP 5C type is designed with a high voltage post deflection accelerator electrode making possible a high intensity spot with minimum loss in deflection sensitivity, and with slight increase in spot size. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 5C type cathode ray tube is available with the following phosphors: P 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

In addition, any type is available with metal backing.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #3 Voltage (Accelerator Electrode)	4,000 Max. Volts D.C.
Anode #2 Voltage (High Voltage Electrode)	2,000 Max Volts D.C.
Anode #1 Voltage (Focusing Electrode)	1,000 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	200 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Voltage between Anode #2 and any Deflecting Electrode	500 Max Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Basing (RETMA) 14-J	Medium Shell Diheptal 12 Pin

Anode #3 Contact aligns with 1D2 trace and Pin #5 within 10 degrees.

Pin No.	1	2	3	4	5	7	8	9	10	11	12	14
Element	H	K	G#1	NC	A#1	D3	D4	A#2	D2	D1	IC	H

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3	6.3	6.3 Volts
Anode #3 Voltage	2,000	3.000	4,000 Volts
Anode #2 Voltage	2,000	1,500	2,000 Volts
Anode #1 Voltage	575	430	575 Volts
Anode #1 Current (For any operating condition)	—15 to +10 Microamperes		
Grid #1 Voltage	—30 to —95	—22.5 to —67.5	—30 to —95 Volts

(For visual extinction of undeflected focused spot)

Deflection Factors — Volts DC/in.

Electrodes D1 D2	62 to 84	59 to 80	78 to 106
Electrodes D3 D4	54 to 74	50 to 68	66 to 90

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Meghoms
Resistance in any Deflecting Electrode	5.0 Max. Meghoms

Note: The VTP 5C tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure

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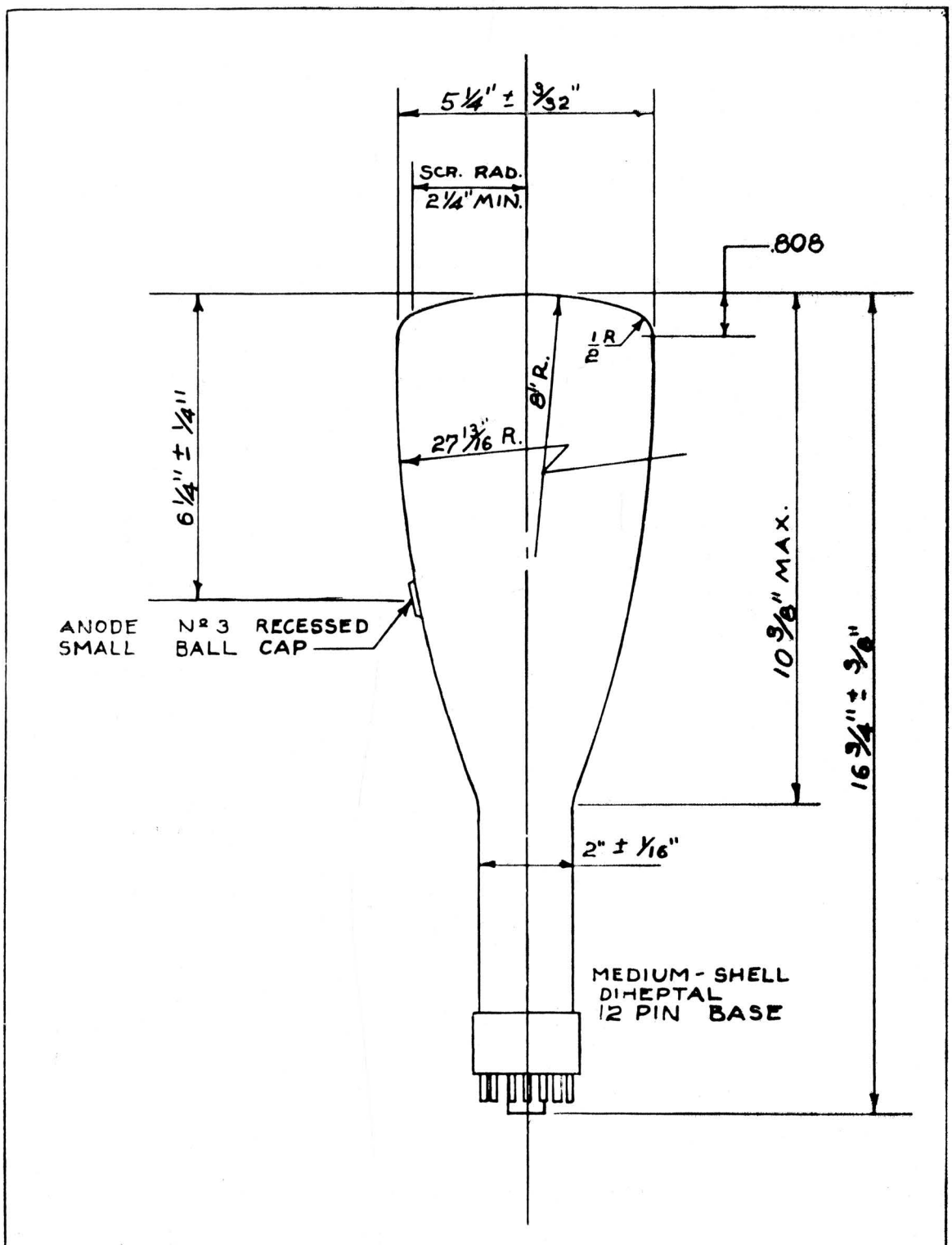
5¼" ± 9/32"
SCR. RAD.
2¼" MIN.
.808
1/2 R
8" R.
27 13/16 R.
6¼" ± ¼"
10 9/16" MAX.
16 3/4" ± 3/16"
2" ± 1/16"
ANODE SMALL
Nº 3 RECESSED BALL CAP
MEDIUM-SHELL DIHEPTAL 12 PIN BASE

PRODUCT DATA SHEET

VTP 5R

The VTP 5R cathode ray tube is an electrostatic deflection and focus type tube incorporating an intensifier subdivided into several steps. This feature permits the use of high accelerating potentials while maintaining the optimum in deflection sensitivity. The deflection plate and anode connections are made through the neck of the tube instead of through the base. Low capacity deflection plate leads facilitate high frequency operation. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 5R type cathode ray tube is available with the following phosphors: P1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

For increased intensity all VTP 5R type tubes are supplied with metal backing.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #3 Voltage (accelerator High-Voltage Electrode)	25,000 Max. Volts D.C.
Anode #2 Voltage	3500 Max. Volts D.C.
Ratio Anode #3 Voltage to Anode #2 Voltage	10 Max.
Anode #1 Voltage	1500 Max. Volts D.C.
Grid #1 Voltage	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Basing (RETMA) 14F	Medium Shell 12 diheptal

Anode terminal aligns approximately with Pin #5

Pin. No.	1	2	3	4	5	7	8	9	10	11	12	14
Element	H	K	G1	NC	A#1	NC	NC	NC	NC	NC	NC	H

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3 Volts
Anode #3	10,000 Volts dc
Anode #2	2,000 Volts
Anode #1 Voltage for focus	258 to 596 Volts
Grid #1 Voltage	-30 to -90 Volts
Deflection Factors	
D1 and D2	97 to 150 Volts dc/in.
D3 and D4	93 to 142 Volts dc/in.
Useful Scan	
D1 and D2	4.25 inches
D3 and D4	4.25 inches

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode Circuit	5 Max. Megohms

Note: Type VTP 5R tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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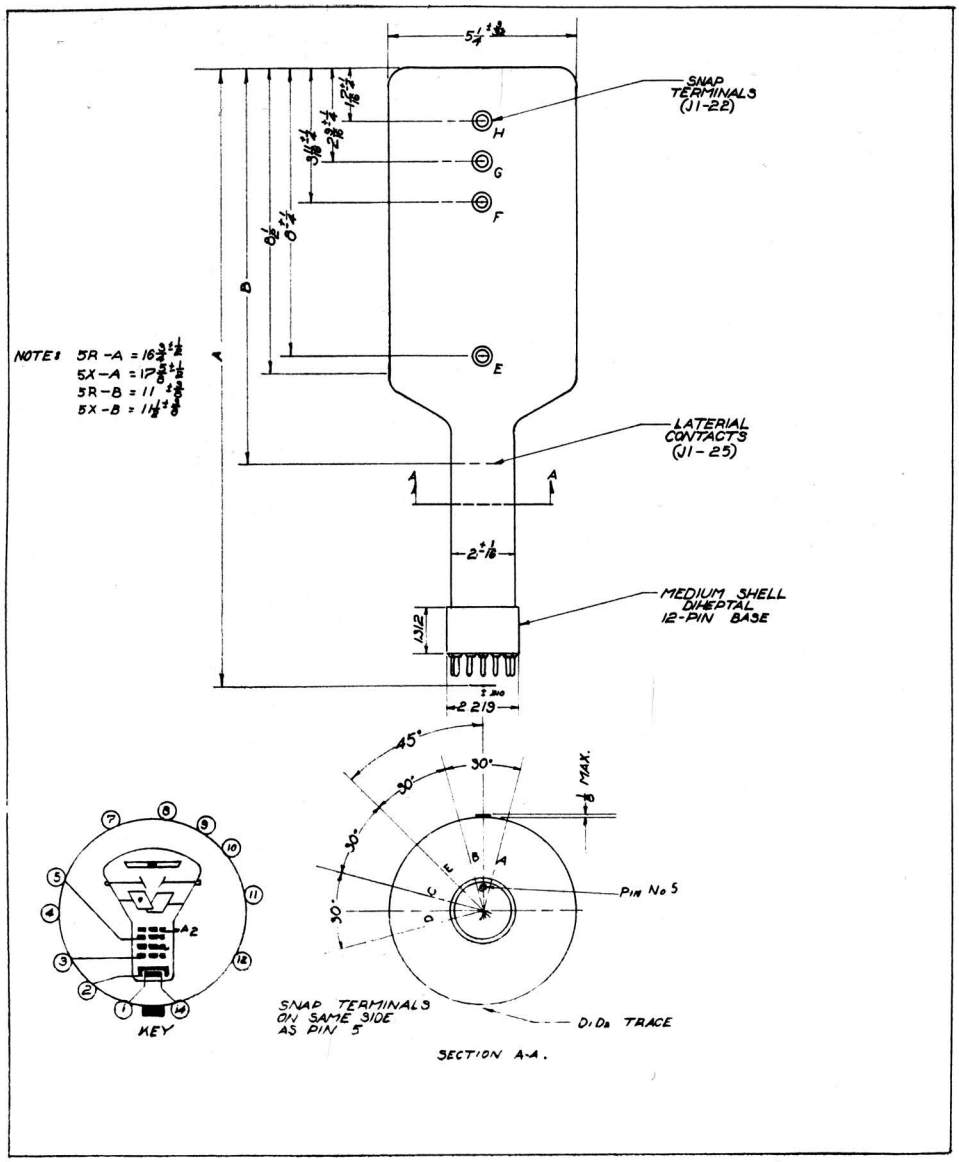

VACUUM TUBE PRODUCTS CO INC. 2020 Short Street, Oceanside, California

PRODUCT DATA SHEET

VTP 5X

The VTP 5X cathode ray tube is an electrostatic deflection and focus type tube designed with very high sensitivity D3D4 deflection plates and the intensifier sub-divided into several steps for operation at high voltages and a high ratio of intensifier to second anode voltage. The VTP 5X finds particular use in wide-band oscillographs and for other applications requiring high D3D4 deflection plate sensitivity. Assurance of long life is had through the exclusive Vacuum Tube Products methods of long and careful exhaust. The VTP 5X type cathode ray tube is available with the following phosphors: P1, 2, 3, 4, 5, 7, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25.

All VTP 5X type tubes are supplied with metal backing to give increased intensity.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #3 Voltage (Accelerator High-Voltage Electrode)	25,000 Max. Volts D.C.
Anode #2 Voltage	3,500 Max. Volts D.C.
Ratio Anode #3 Voltage to Anode #2 Voltage	10 Max.
Anode #1 Voltage	1,500 Max. Volts D.C.
Grid #1 Voltage	
Negative Bias Value	125 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Basing (RETMA) 14 F	Medium Shell 12 pin diheptal

Pin. No.	1	2	3	4	5	7	8	9	10	11	12	14
Element	H	K	G1	NC	A#1	NC	NC	NC	NC	NC	NC	H

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3 Volts
Anode #3	10,000 Volts D.C.
Anode #2	2,000 Volts D.C.
Anode #1 Voltage for focus	258 to 596 Volts D.C.
Grid #1 Voltage	-30 to -90 Volts
Deflection Factors	
D1 and D2	97 to 150 Volts D.C./in.
D3 and D4	35 to 54 Volts D.C./in.
Useful Scan	
D1 and D2	4.25 inches
D3 and D4	4.25 inches

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode Circuit	5 Max. Megohms

Note: Type VTP 5X tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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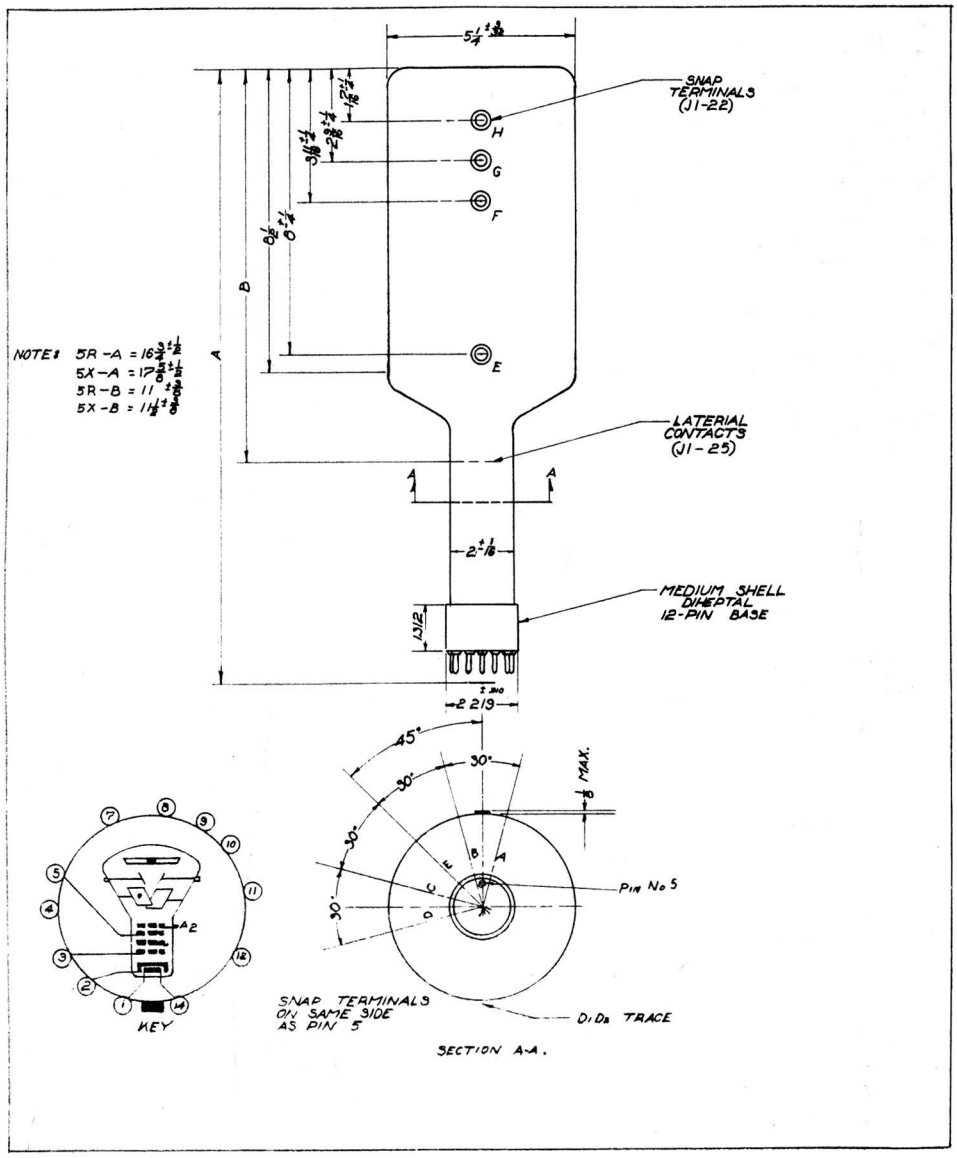
SNAP TERMINALS (J1-22)
H
G
F
E
LATERIAL CONTACTS (J1-25)
MEDIUM SHELL DIHEPTAL 12-PIN BASE
NOTE: 5R-A = 16 3/4 ±1/2
5X-A = 17 5/8 ±1/2
5R-B = 11 ±1/2
5X-B = 11 1/2 ±3/8
2.219
45°
30°
90°
30°
30°
1/8 MAX.
Pin No 5
SNAP TERMINALS ON SAME SIDE AS PIN 5
DiDa TRACE
KEY
SECTION A-A.

PRODUCT DATA SHEET

VTP 7J

The VTP 7J cathode ray tube is an electrostatic deflection and focus type tube providing high definition and intensity. Features of this type are high deflection sensitivity, excellent overall focus and zero first anode (focus) current type electron gun. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 7J cathode ray tube is available with the following phosphors: P 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

In addition, any type is available with metal backing.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #2 Voltage (High Voltage Electrode)	6,000 Max. Volts D.C.
Anode #1 Voltage (Focusing Electrode)	2,800 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	200 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Voltage between Anode #2 and any Deflecting Electrode	750 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Heater Negative with respect to Cathode (During warm period not to exceed 15 seconds)	410 Max. Volts D.C.

Basing (RETMA) 14-G ..... Medium Shell Diheptal 12 Pin

Pin No.	1	2	3	4	5	7	8	9	10	11	12	14
Element	H	K	G#1	NC	A#1	D3	D4	A#2	D2	D1	IC	H

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3	6.3 Volts
Anode #2 Voltage	4,000	6,000 Volts
Anode #1 Voltage	1,080 to 1,600	1,020 to 2,400 Volts
Anode #1 Current	(For any operating condition)	—15 to +10 Microamperes
Grid #1 Voltage	—48 to —112	—72 to —168 Volts
	(For visual extinction of undeflected focused spot)	
Deflection Factors — Volts DC/in.		
Electrodes D1, D2	124 to 164	186 to 246
Electrodes D3, D4	100 to 136	150 to 204

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode	5.0 Max. Megohms

Note: The VTP 7J operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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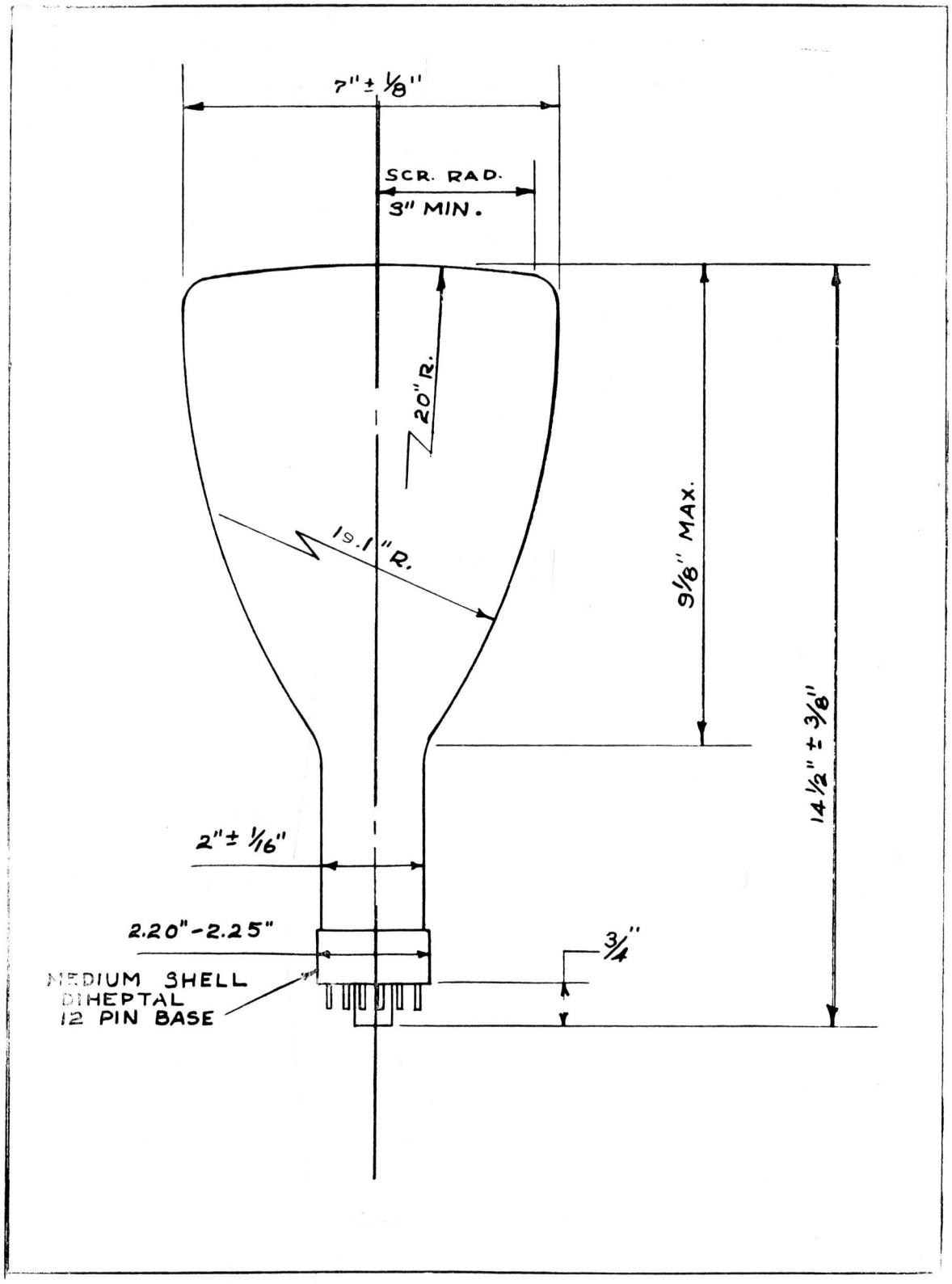
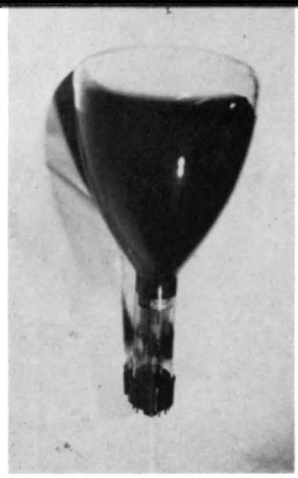

7" ± 1/8"
SCR. RAD.
3" MIN.
20" R.
19.1" R.
9 1/8" MAX.
14 1/2" ± 3/8"
2" ± 1/16"
2.20"-2.25"
3/4"
MEDIUM SHELL
DIHEPTAL
12 PIN BASE

PRODUCT DATA SHEET



VTP 8B

The VTP 8B cathode ray tube is an electrostatic deflection and focus type tube providing high deflection and intensity. The VTP 8B type has high deflection sensitivity and excellent overall focus. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 8B is available with the following phosphors: P1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

In addition, any type is available with metal backing.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #2 Voltage (High Voltage Electrode)	6,600 Max. Volts D.C.
Anode #1 Voltage (Focusing Electrode)	3,100 Max. Volts D. C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	200 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D. C.
Positive Peak Value	2 Max. Volts D. C.
Peak Voltage between Anode #2 and any Deflecting Electrode	750 Max, Volts D. C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D. C.

Basing (RETMA) 14-G ..... Medium Shell Diheptal 12 Pin

Pin No.	1	2	3	4	5	7	8	9	10	11	12	14
Element	H	K	G#1	NC	A#1	D3	D4	A#2	D2	D1	IC	H

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3 Volts
Anode #2 Voltage	6,000 Volts
Anode #1 Voltage	1,620 to 2,400 Volts
Grid # 1 Voltage	—72 to —168 Volts

(For visual extinction of undeflected focused spot)

Deflection Factors - Volts DC/in.

Elements D1 D2	146 to 198
Elements D3 D4	124 to 168

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode	5.0 Max. Megohms

Note: The VTP 8B tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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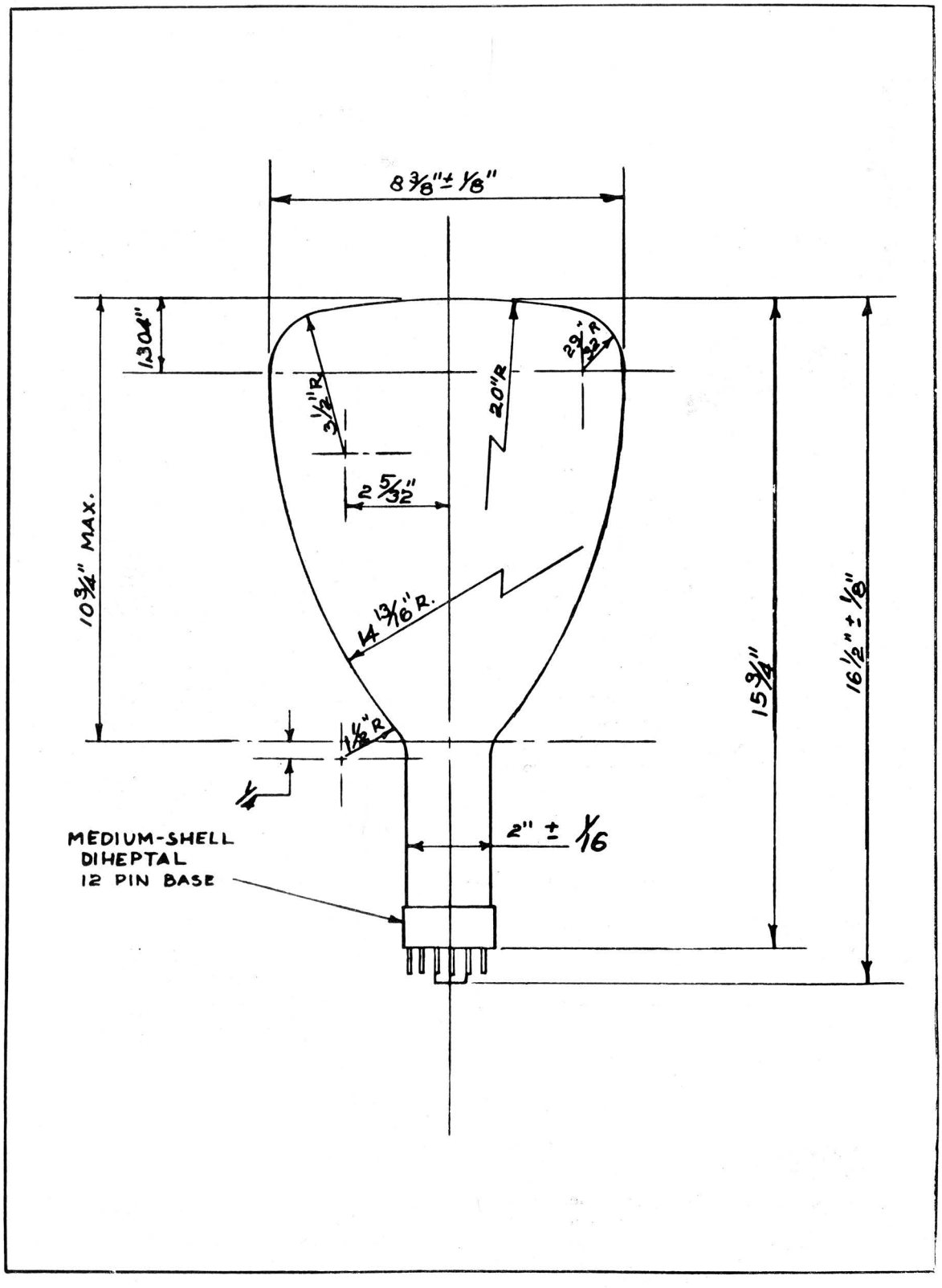
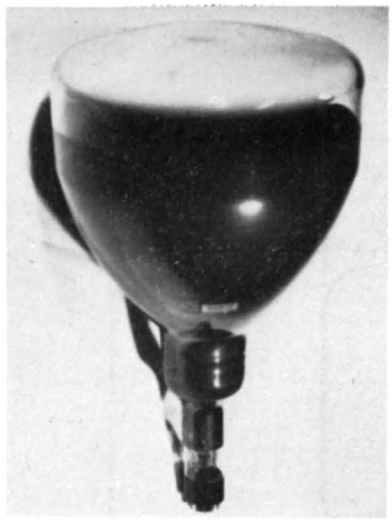

8 3/8" ± 1/8"
1 3/4"
10 3/4" MAX.
3 1/2" R.
2 5/32"
20" R
2 9/32" R
14 13/16" R.
1 1/8" R.
15 3/4"
16 1/2" ± 1/8"
2" ± 1/16
MEDIUM-SHELL
DIHEPTAL
12 PIN BASE

PRODUCT DATA SHEET



VTP 10H

The VTP 10H cathode ray tube is an electrostatic deflection and focus type tube providing high definition and intensity. The VTP 10H type tube is designed for oscillographic and other applications requiring large screen areas and high deflection sensitivity. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust.

The VTP 10H cathode ray tube is available with the following phosphors: P 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 19, 20, 23 25.

In addition, any type is available with metal backing.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #2 Voltage (High Voltage Electrode)	5,000 Max. Volts D. C.
Anode #1 Voltage (Focusing Electrode)	2,000 Max. Volts D. C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	200 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Voltage between Anode #2 and any Deflecting Electrode	750 Max. Volts D. C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D. C.
Heater Positive with respect to Cathode	125 Max. Volts D. C.
Basing (RETMA) 14-G	Medium Shell Diheptal 12 Pin

Pin No.	1	2	3	4	5	7	8	9	10	11	12	14
Element	H	K	G#1	NC	A#1	D3	D4	A#2	D2	D1	IC	H

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3 Volts
Anode #2 Voltage	5,000 Volts
Anode #1 Voltage	1,500 Volts
Anode #1 Current (For any operating condition)	—15 to+10 Microamperes
Grid #1 Voltage	—60 to —140 Volts
(For visual extinction of undeflected focused spot)	
Deflection Factors — Volts DC/in.	
Electrodes D1 D2	(Approximate) 130
Electrodes D3 D4	(Approximate) 100

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode	5.0 Max. Megohms

Note: The VTP 10H tube operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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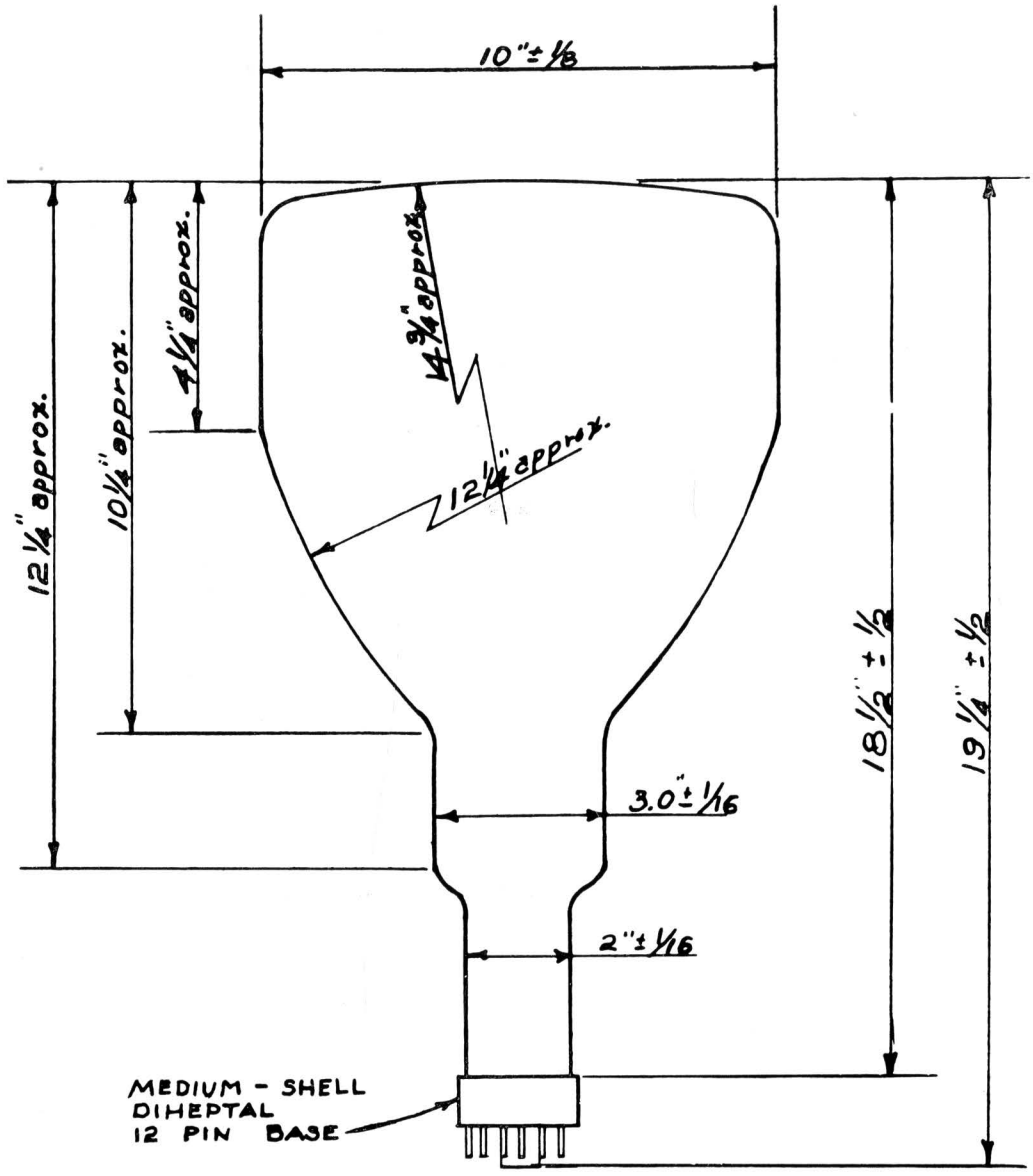

LPS. SEPT. 1957 1000

PRODUCT DATA SHEET

VTP 12G-A

The VTP 12G-A cathode ray tube is an electrostatic deflected and focused type tube for general oscillographic and other applications requiring large screen areas. The VTP 12G-A is designed with a post deflection accelerator electrode for high intensity and deflection sensitivity. Assurance of long life is had through the exclusive Vacuum Tube Products method of long and careful exhaust. The VTP 12G-A cathode ray tube is available with the following phosphors: P 1, 2, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 25.

In addition, any type is available with metal backing.

MAXIMUM RATINGS — DESIGN CENTER VALUES

Heater Voltage	6.3 Volts
Heater Current	0.6 Amperes
Anode #3 Voltage (Accelerator Electrode)	6,600 Max. Volts D.C.
Anode #2 Voltage (High Voltage Electrode)	4,400 Max. Volts D.C.
Anode #1 Voltage (Focusing Electrode)	2,200 Max. Volts D.C.
Grid #1 Voltage (Control Electrode)	
Negative Bias Value	250 Max. Volts D.C.
Positive Bias Value	0 Max. Volts D.C.
Positive Peak Value	2 Max. Volts D.C.
Peak Voltage between Anode #2 and any Deflecting Electrode	750 Max. Volts D.C.
Peak Heater to Cathode Voltage	
Heater Negative with respect to Cathode	125 Max. Volts D.C.
Heater Positive with respect to Cathode	125 Max. Volts D.C.
Basing (RETMA) 14-J	Medium Shell Diheptal 12 Pin

TYPICAL OPERATING CONDITIONS

Heater Voltage	6.3 Volts
Anode #3 Voltage	5,500 Volts
Anode #2 Voltage	2,000 Volts
Anode #1 Voltage (Approx.)	1,200 Volts
Anode #1 Current (For any operating condition)	—15 to +10 Microamperes
Grid #1 Voltage	—35 to —80 Volts
(For visual extinction of undeflected focused spot)	
Deflector Factors — Volts DC/in	
Electrodes D1 D2	47 ± 15%
Electrodes D3 D4	36 ± 15%

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance	1.5 Max. Megohms
Resistance in any Deflecting Electrode	1.0 Max. Megohms

Note: The VTP 12G-A operates from power supplies that are dangerous. The above circuit values are recommended as a safety measure.

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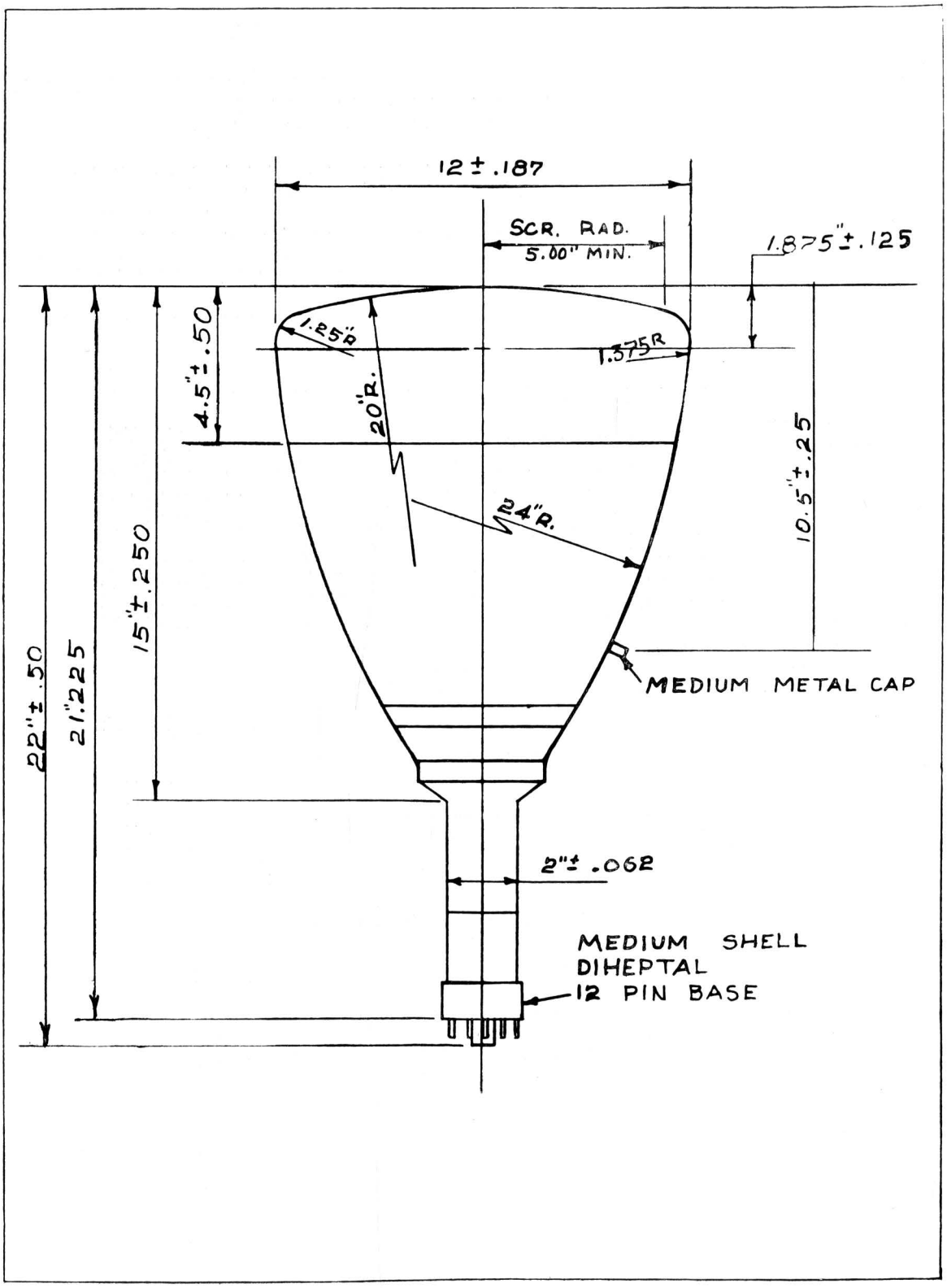

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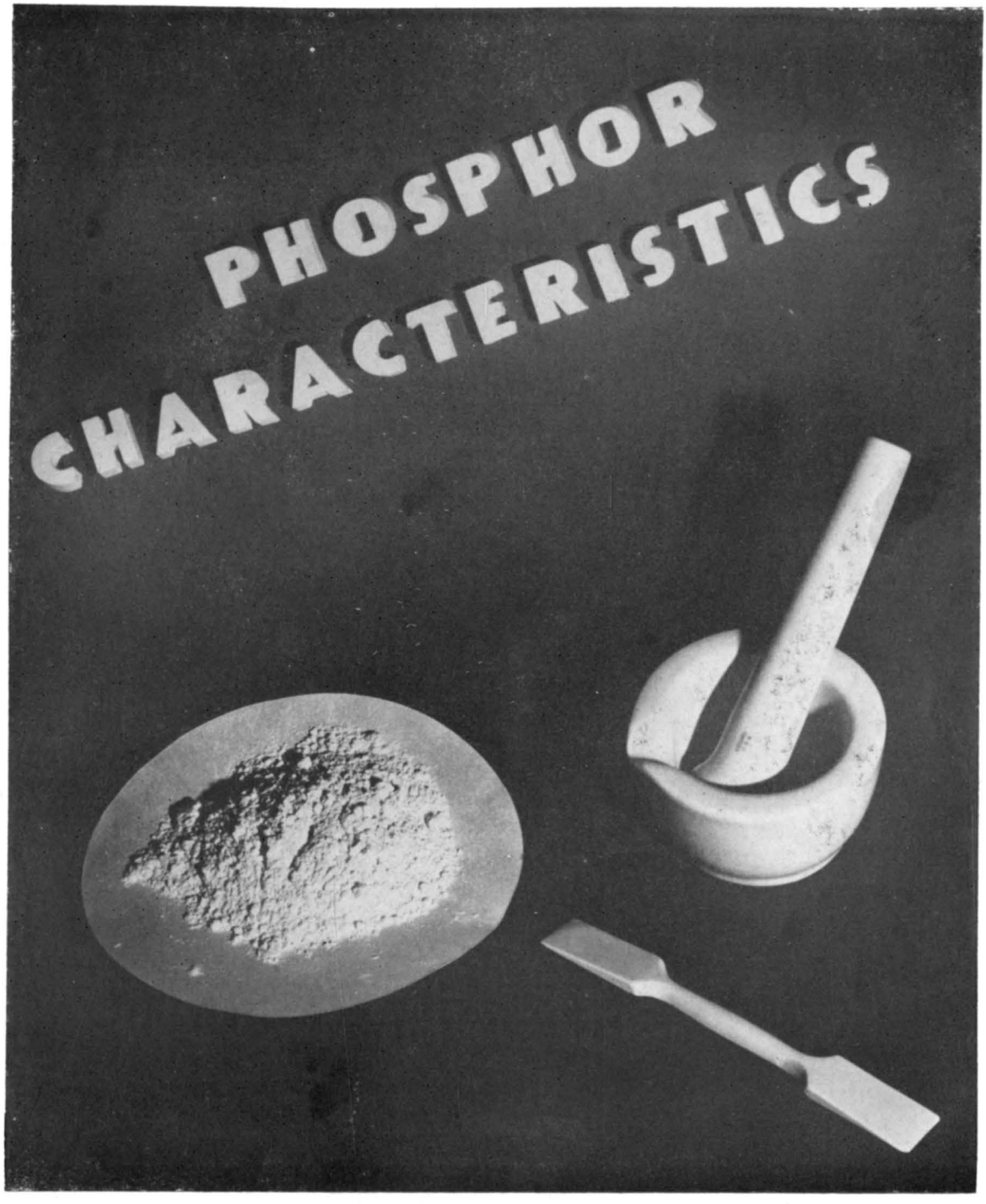

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LPS. DEC. 1957—1M

PHOSPHORS

Phosphors or luminescent materials are solids which possess the property of emitting light upon receiving radiation of one or more different types. In considering phosphors for use in cathode ray tubes, two materials having entirely different properties are of importance. The first of these are known as fluorescent materials which "fluoresce" under direct radiation, emitting a form of light termed fluorescence. This conversion of invisible radiation into visible light occurs almost instantaneously and with little or no change in the temperature of the fluorescent materials. The second are phosphorescent materials which posses the property of storing energy for a period of time, the phosphorescence radiating visible light for some time after receiving initial excitation. The length of time during which this condition exists depends upon the decay characteristics of the particular phosphor used.

By combining fluorescent materials with phosphorescent materials, phosphors are created which may be suitable for various purposes. The variation in nature and quantity of these combined materials provide phosphors which possess the property of converting various types of radiation into visible light, and of maintaining the radiation of visible light for various periods of time. Materials may be prepared which respond to light, either visible or ultra violet or to cathode ray electrons, alpha, beta or gamma radiation, X-rays, radium, or to a hydrogen flame.

In the preparation of phosphors or luminescent solids, a non-luminescent compound known as the diluent is combined with small traces of a second material termed an "activator". In the process of preparation, the two materials must be well intermixed and then heated to redness, the time and temperature of heating serving as controlling factors in determining the intensity, and sometimes the color, of the luminescence. Brightness also will vary depending upon the relative quantities of the two materials used. By proper combination, a phosphor suitable for cathode ray tube use can be prepared which will possess the two specific characteristics which fundamentally describe the phosphor-spectral radiation or color, and phosphorescence, which is more commonly called persistence or afterglow.

Although many thousands of types of phosphors are known, only a comparative few of the inorganic types are suitable for use in cathode ray tubes. In general, these are the silicate phosphors, and the sulphide phosphors. Of metals employed in the two groups of materials, zinc is predominant.

VACUUM TUBE PRODUCTS CO. INC. is, of course, aware that the internal structure of tubes is not of general interest to most consumers. However, the foregoing information has been offered in the belief that—together with the succeeding tables and graphs—the discerning engineer will be provided with sufficiently detailed information to enable him to make an effective choice of a cathode ray tube for any specific application.

Cathode ray tubes manufactured by VACUUM TUBE PRODUCTS CO. INC. are available with fluorescent screens of P-1 through P-28 with few exceptions. These phosphors are detailed in the following paragraphs.

Phosphor..P-1 produces a brilliant fluorescent spot of green color and medium persistence. Cathode ray tubes employing this phosphor are particularly useful for general oscillograph applications such as those in which recurrent wave phenomena must be observed visually.

Phosphor P-2 is a zinc sulphide phosphor with a blue-green fluorescence and a green phosphorescent color with long persistence. The blue-green fluorescence is of short persistence, however, making this type of screen suitable for use where readability of high writing rates is necessary. This type of screen is generally used in oscillographs and in some radar or sonar indicator applications.

Phosphor P-3 is a zinc beryllium silicate phosphor having a yellow fluorescence and a yellow phosphorescence with a medium short persistence. Although this type of phosphor is nearing obsolesence, it continues to find uses in oscillograph and indicator applications.

Phosphor P-4 provides a highly effective screen of white fluorescence with medium persistence. Tubes employing this phosphor are generally useful for television picture applications.

Phosphor P-5 presents a highly actinic spot of bluish fluorescence with very short persistence. This type of phosphor is of particular value in cathode ray tubes employed in high speed photographic applications.

Phosphor P-6 is a white phosphor developed primarily for use with color television applications. However, it is not in general use.

Phosphor P-7 is a two-layer (cascade) screen of long persistence. When receiving radiation from an electronic beam, this type of phosphor will produce a bluish fluorescence of short persistence. Following excitation, the screen will exhibit a greenish-yellow phosphorescence lasting for several minutes. Cathode ray tubes employing this phosphor are found most often in radar or sonar applications, where extremely low-speed recurrent phenomena or medium-speed non-recurrent phenomena are to be observed.

Phosphor P-8 Obsolete.

Phosphor P-9 Obsolete.

Phosphor P-10 is a very long persistence screen of the potassium chloride type, and finds application in memory devices. It is not in general use.

Phosphor P-11 presents a highly actinic spot of brilliant bluish fluorescence having sufficiently short persistence to make its use practicable in most moving film photographic applications without blurring. Exceptions are those instances where the film is driven at high rate of speed. The characteristic brilliance of this phosphor makes it also valuable in those applications requiring the visual observation of various phenomena. The persistence of P-11 phosphor is approximately 100 times as long as the P-5 phosphor.

Phosphor P-12 is a zinc magnesium fluoride phosphor having an orange fluorescence and a phosphorescence of similar color and medium-long persistence. This phosphor was developed primarily for radar applications and enjoys the advantage of possessing an afterglow of the same color possessed by the fluorescence.

Phosphor P-13 Obsolete.

Phosphor P-14 is a two-layer (cascade) phosphor consisting of a zinc sulphide and a zinc cadmium sulphide, and having a purple fluorescence with an orange phosphorescence. Although the persistence of this phosphor is slightly less than that of the P-7 phosphor, its orange phosphorescence is better suited to a dark-adapted eye and may be observed with less fatigue.

Phosphor P-15 is an extremely short persistence type of phosphor that produces a fluorescent spot of both blue-green and near-ultraviolet color. The latter color has a persistence that is even shorter than that of the bluegreen fluorescence, a feature that establishes this phosphor as being particularly well-suited to the high speed scanning requirements of a flying spot signal generator.

Phosphor P-16 is an extremely short persistence type of phosphor having small grain size, and providing a color peaking at the near ultra-violet at 3700 angstroms. It is of particular value in flying spot generator applications where a minimum of blurring or trailing of the signal is a requirement.

Phosphor P-17 is a two-layer (cascade) screen having a fluorescence of greenish-yellow color and a phosphorescence of a yellow color. The initial fluorescence is of extremely short persistence, but the phosphorescence is of long duration. This type of phosphor is most often used in simultaneous dual applications. Its short persistence component consists essentially of the P-15 phosphor and its long persistence component is the same as the P-7 phosphor.

Phosphor P-18 is a silicate phosphor having a medium persistence very similar to the P-4 phosphor. It is of particular use in high voltage applications.

Phosphor P-19 is a zinc magnesium fluoride phosphor having a rich orange fluorescence and an orange phosphorescence of extremely long persistence. It is suitable for radar and sonar applications, and in oscillographic uses where very long memory is required. This phosphor produces a screen having several advantages over the P-7 and P-12 screens since it lacks the harsh blue flash of a P-7 screen and provides a much longer persistence in the orange color. The extremely long persistence may be most usefully employed at low ambient light levels.

Phosphor P-20 is a zinc cadmium sulphide phosphor having a short persistence identical to that of the P-11 phosphor, and a fluorescence peaking at a wavelength of 5505 angstroms. It is of particular use in high voltage image tube applications.

Phosphor P-21 is a long persistence type phosphor quite similar to the P-19, but having a fluorescence more in the red portion of the spectrum. P-21 Phosphor find particular use where long memory is required.

Phosphor P-22 is a medium persistence phosphor of use primarily in Color Television. The three separate colors, red, blue and green are usually applied separately and so blended that the combined output, when fully excited, is comparable to the P-4.

Phosphor P-23 is a medium persistence phosphor in which the color has been shaded to approach a sepia tint similar to that used in photography. It was primarily designed for use in black and white television.

Phosphor P-24 is an extremely short persistence phosphor having small grain size and peaking in the blue-green region at slightly over 5,000 angstroms. It is of particular value in flying spot generator application having a persistence such that the light value drops to 65% of original value after 2 microseconds.

Phosphor P-25 is a long persistence phosphor having an orange fluorescence and orange phosphorescence. It is well suited for radar, and sonar applications, and in oscillographic uses where long persistence is required.

Phosphor P-26 is an extremely long persistence phosphor producing a fluorescent spot of orange color peaking at 5900 angstroms. The phosphorescence is also orange. It is used in radar, sonar and oscillographic applications requiring long memory.

Phosphor P-27 is a medium persistence phosphor that produces a red colored fluorescence peaking at 6700 angstroms with a presistence very similar to the P-1 type phosphor. It is used in oscillographic applications and under low ambient light levels.

Phosphor P-28 is a medium persistence phosphor producing a light yellow color peaking at 5500 angstroms. It is used in oscillographic applications that do not require the initial blue flash of the P-7 type phosphors.

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DESCRIPTIONS OF PHOSPHORS BY COLOR AND PERSISTENCE

Phosphors, as used for the screens of cathode-ray tubes, have two important characteristics: COLOR and PERSISTENCE. These characteristics can be used to define the phosphor. Descriptions of phosphors which have been used in the manufacture of cathode-ray tubes are listed in the index table below, and are each described in the following pages. These phosphors are identified by the designations P1, P2, P3, etc., as assigned by the RETMA Data Bureau.
Color may be specified by a Spectral-Energy Emission Characteristic Curve, or by the coordinates x and y on the ICI Color Chart.
Persistence may be specified by a Persistence Characteristic Curve, or by numerical limit values.
The table on the next page describes the test conditions for measuring color and persistence of phosphors.

In the following table, Bo equals Initial Brightness, and B equals Brightness at Time T

Phosphor Designation	COLOR			PERSISTENCE	
	Fluorescent	Phosphorescent	Specified by	Duration	Specified by
P1	Green	Green	Curve—phosphor P1	Medium	Curve—Phosphor P1
P2	Blue-Green	Green	Curve—phosphor P2	Long	Curve—Phosphor P2 $B = B_o/T^n$, n = 1.0 to 1.2
P3	Yellow	Yellow	Curve—phosphor P3	Medium	Curve—Phosphor P3
P4 Sulfide	White	White	ICI color coordinates x=0.313, y=0.324 Curve—phosphor P6	Short	Brightness not over 7% of peak value in 33 milliseconds after cessation of excitation
P4 Silicate	White	Blue	ICI color coordinates x=0.313, y=0.324 Curve—phosphor P7	Medium	Brightness not over 7% of peak value in 33 milliseconds after cessation of excitation
P4 Silicate Sulfide	White	Yellow	ICI color coordinates x=0.313, y=0.324 Curve—phosphor P7	Medium	Brightness not over 7% of peak value in 33 milliseconds after cessation of excitation
P5	Blue	Blue	Curve—phosphor P5	Very Short	Curve—Phosphor P5 Time Constant = 6 to 10 μsec
P6	White	White	Curve—phosphor P6	Short	Curve—Phosphor P6 $B = B_o/T^n$, n = 1.6 to 2.0
P7	Blue-White	Yellow	Curve—phosphor P7	Long	Curve—Phosphor P7 $B = B_o/T^n$, n = 0.7 to 1.2
P10	Dark Trace: Color depends on absorption characteristics and type of illumination			Very Long	Long variable persistence dependent on temperature, amount of illumination, and electron-energy density of bombardment
P11	Blue	Blue	Curve—phosphor P11	Short	Curve—Phosphor P11
P12	Orange	Orange	Curve—phosphor P12	Medium Long	Curve—Phosphor P12 Time Constant=100 to 130 millisec
P14	Purple	Orange	Curve—phosphor P14	Medium Long	Curve—Phosphor P14 $B = B_o/T^n$, n = 0.9 to 1.4
P15	Blue-Green	Blue-Green	Curve—phosphor P15	Extremely Short	Visible Decay: Hyperbolic to 30% in 1.5 μsec Ultraviolet Decay: Exponential, Time Constant = 0.1 μsec
P16	Violet and Near-Ultraviolet	Violet and Near-Ultraviolet	Curve—phosphor P16	Extremely Short	Curve—Phosphor P16
P17	Greenish-Yellow	Yellow	Curve—phosphor P17	One C'mp't Extremely Short Other C'mp't Long	Short Component: Hyperbolic to 30% in 1.5 μsec Long Component: Curve—Phos. P17 $B = B_o/T^n$, n = 0.7 to 1.2
P18	Blue	Yellow-Orange	Curve—phosphor P18	Medium	Curve—Phosphor P18
P19	Orange	Orange	Curve—phosphor P19	Very Long	Exponential to 1/e in 80 milliseconds Hyperbolic from 200 milliseconds on
P20	Blue	Blue	Curve—phosphor P20	Short	Curve—Phosphor P20

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DESCRIPTION OF PHOSPHORS BY COLOR AND PERSISTENCE

P-21	Orange	Orange	Curve—Phosphor P21	Very Long	Exponential to 1/e in 80 milliseconds Hyperbolic from 200 milliseconds on.
P-22	White	White	Curve—Phosphor P22	Medium	Curve—Phosphor P22
P-23	Off-white	Off-white	Curve—Phosphor P23	Medium	Curve—Phosphor P23
P-24	Blue Green	Blue Green	Curve—Phosphor P24	Ext. Short	Curve—Phosphor P24
P-25	Orange	Orange	Curve—Phosphor P25	Very long	Curve—Phosphor P25
P-26	Orange	Orange	Curve—Phosphor P26	Very long	Curve—Phosphor P26
P-27	Red	Red	Curve—Phosphor P27	Medium	Curve—Phosphor P27
P-28	Blue Green	Green	Curve—Phosphor P28	Long	Curve—Phosphor P28

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TEST CONDITIONS

FOR MEASURING COLOR AND PERSISTENCE OF PHOSPHORS

Characteristic	PHOSPHOR	Excitation Conditions	PLOT	COORDINATES	RANGE
COLOR	P1, P2, P3, P5, P6, P7, P11, P12, P14, P15, P16, P18, P19, P21	Stationary spot, 1/60 sec pulse, 1 sec repetition rate or steady excitation, 2 to 8 kv, 1 to 2 μa/cm2	Linear	Relative Radiant Energy vs. Wavelength in angstroms	3000 to 7000 angstroms
	P4, P23	Scanning: Standard television, 525 lines, 60 fields, focused pattern*	——	ICI x and y	——
	P17, P20	Steady excitation, 7 to 10 kv, 1 to 2 μa/cm2	Linear	Relative Radiant Energy vs. Wavelength in angstroms	4000 to 7000 angstroms
PERSISTENCE	P1, P3, P5, P12, P27	Stationary spot, 1/60 sec pulse, 1 sec repetition rate or line scan, 4 kv, 2 to 50 μa/cm2	Semi-log	Relative Brightness vs. Time	0.01 to 400 millisec
	P2, P7, P14, P28	Stationary spot, 1/60 sec pulse or 1/60 sec scanned raster, 1 sec repetition rate or line scan, 4 kv, 2 to 50 μa/cm2	Log-log	Brightness in millifoot-lamberts vs. Time	0.0001 to 1000 seconds
	P6, P11	Stationary spot, 1/60 sec pulse, 1 sec repetition rate or line scan, 4 kv, 2 to 50 μa/cm2	Log-log	Brightness in millifoot-lamberts vs. Time	0.01 to 4 millisec
	P4, P18	Stationary spot, 1/60 sec pulse, 1 sec repetition rate or line scan, 4 kv, 2 to 50 μa/cm2	Semi-log	Relative Brightness vs. Time	0 to 60 millisec
	P15	Scanning: Standard television, 525 lines, 60 fields, focused pattern* 20 kv, 1 to 2 μa/cm2	——	——	——
	P16, P24	Scanning: Standard television, 525 lines, 60 fields, focused pattern* 20 kv, 1 to 2 μa/cm2	Semi-log	Relative Brightness vs. Time	0.0001 to 0.01 millisec
	P17: Short Comp't.	Scanning: Standard television, 525 lines, 60 fields, focused pattern* 7 to 10 kv, 1 to 2 μa/cm2	——	——	——
	Long Comp't.	Stationary spot, 1/60 sec pulse or 1/60 sec scanned raster, 1 sec repetition rate or line scan, 7 to 10 kv, 2 to 50 μa/cm2	Log-log	Brightness in millifoot-lamberts vs. Time	0.0001 to 1000 seconds
	P19, P21, P25, P26	Scanning: Standard television, 525 line, 60 fields, focused pattern* 20 kv, 1 to 2 μa/cm2	Log-log	Relative Brightness vs. Time	0 to 60 seconds
	P20	Scanning: Standard television, 525 lines, 60 fields, focused pattern* 4 kv, 2 to 50 μa/cm2	Log-log	Relative Brightness vs. Time	.04 to 4 milliseconds

*Raster size, raster highlight brightness, and electrode voltages should be set at typical values recommended for tube type.

This material has been prepared by Subcommittee on Phosphor and Screen Characteristics of the JETEC Cathode-Ray Tube Committee JTC-6.

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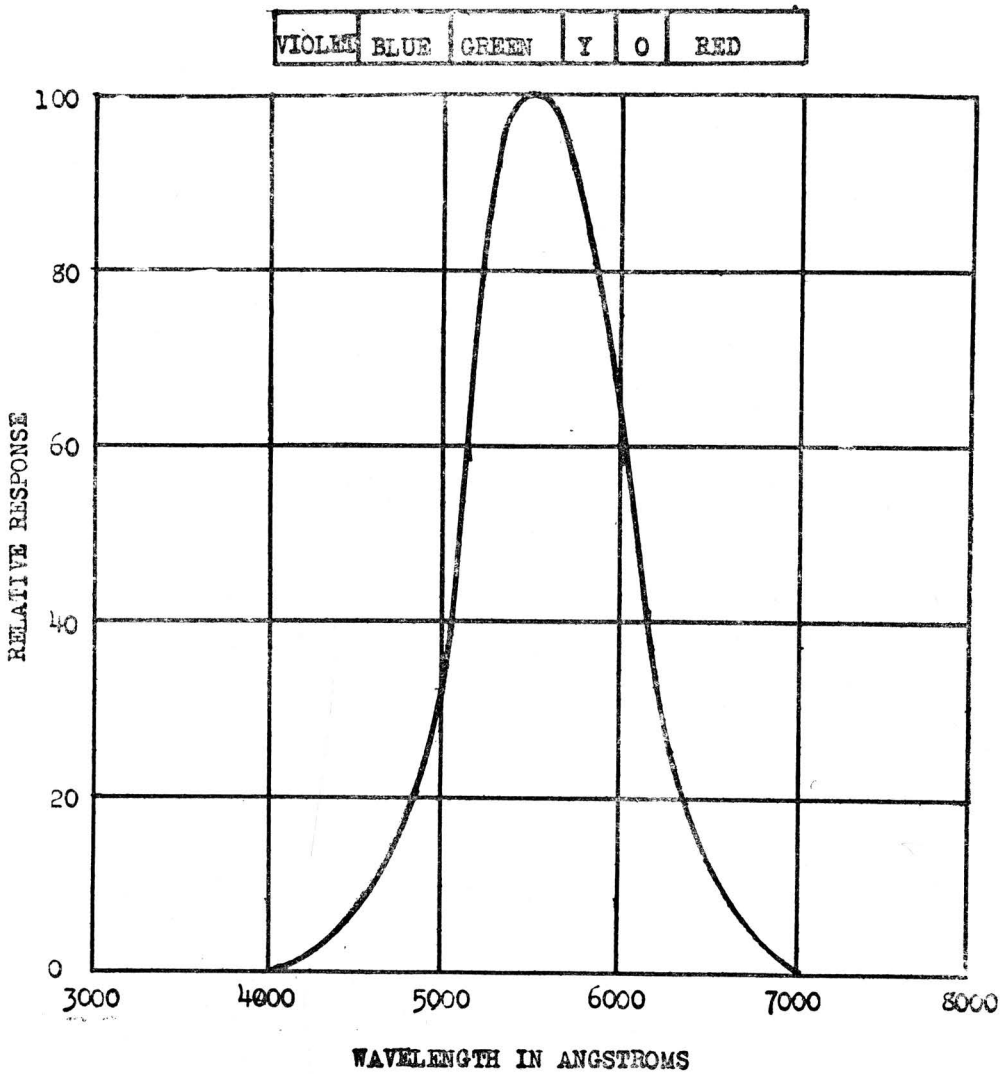
SPECTRAL SENSITIVITY OF THE HUMAN EYE



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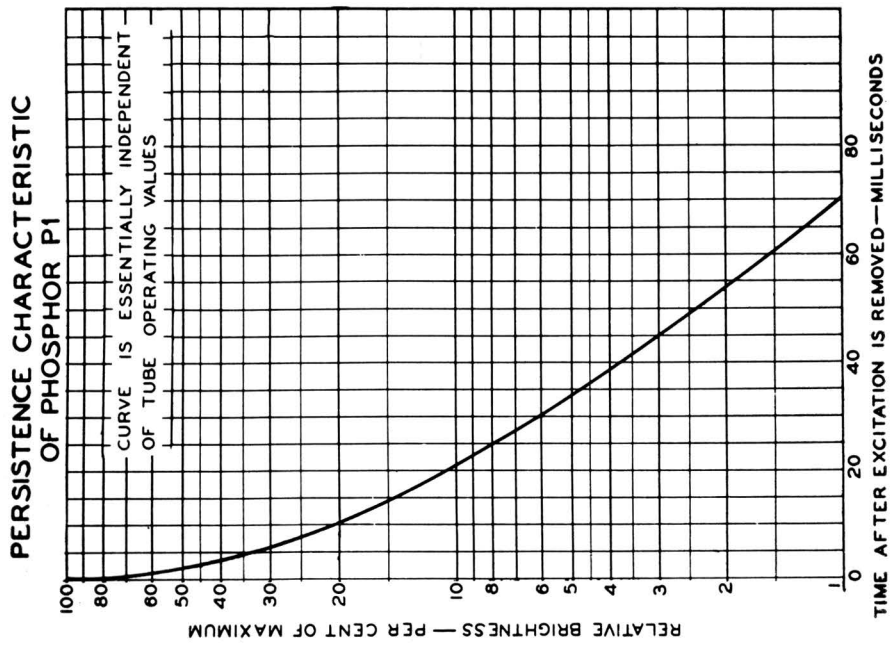
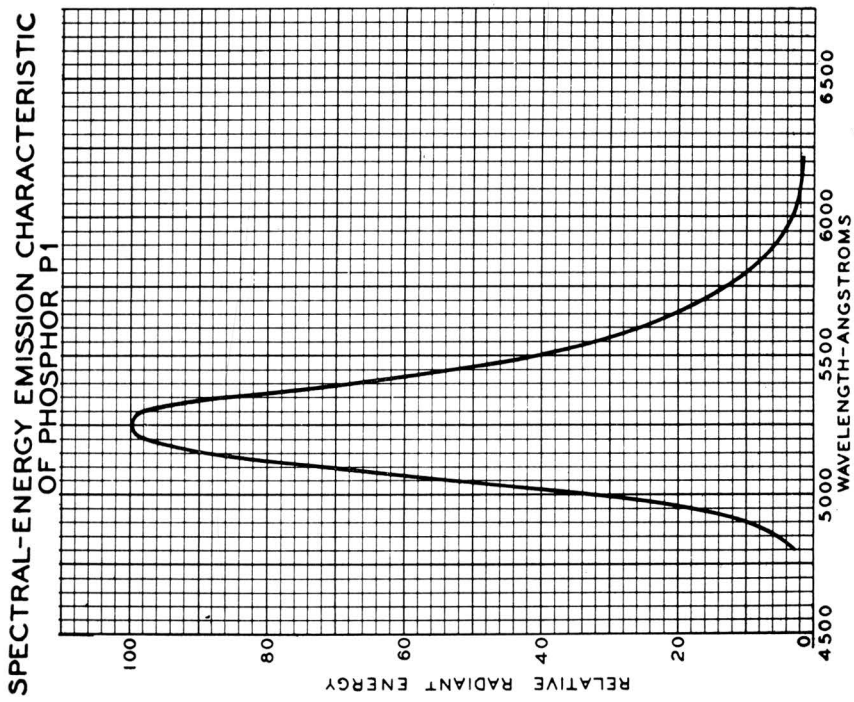
PHOSPHOR P-1





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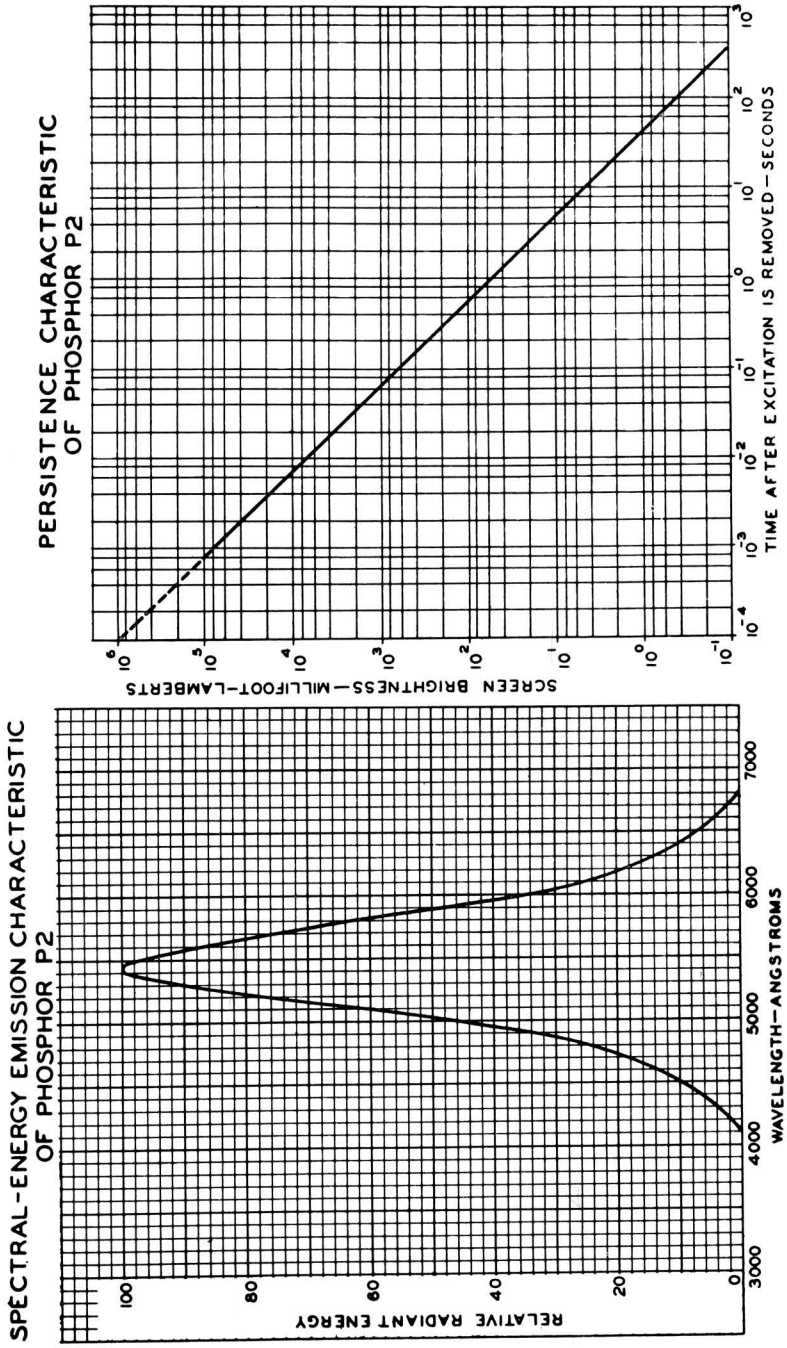
PHOSPHOR P-2



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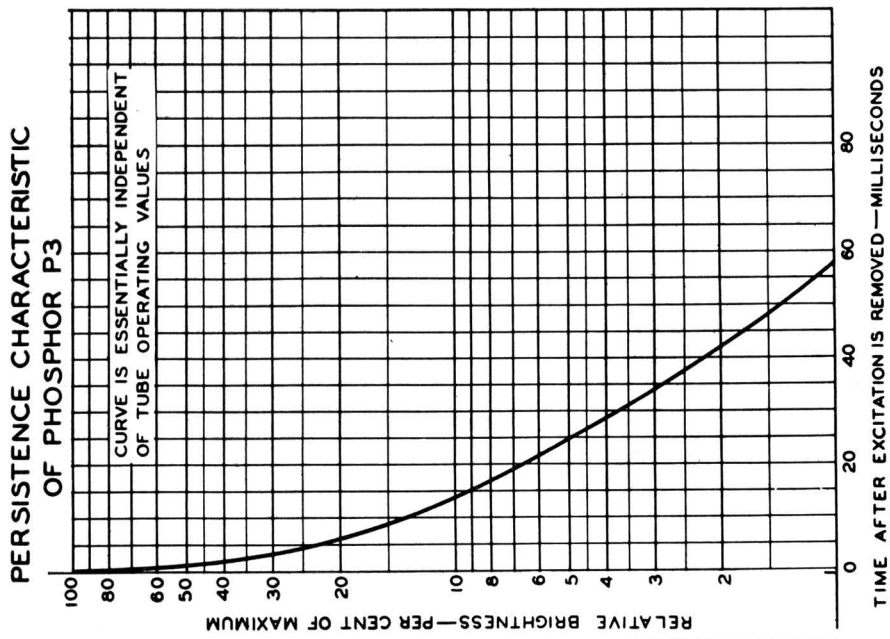
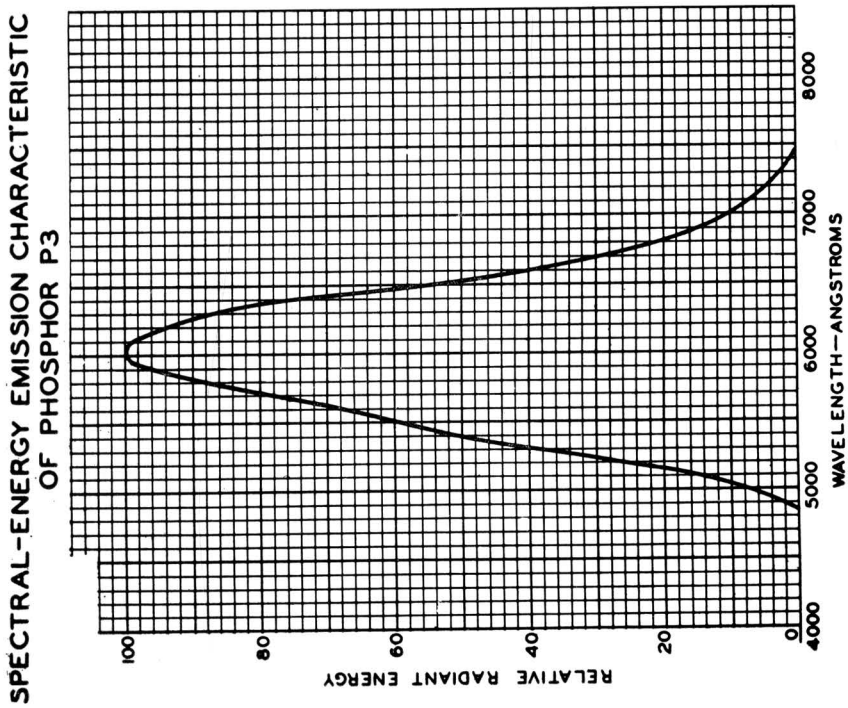
PHOSPHOR P-3





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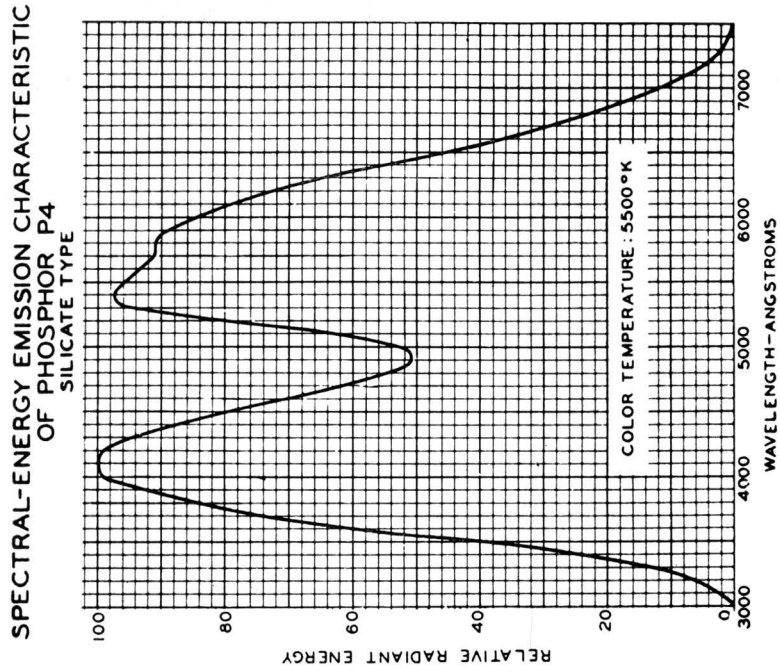

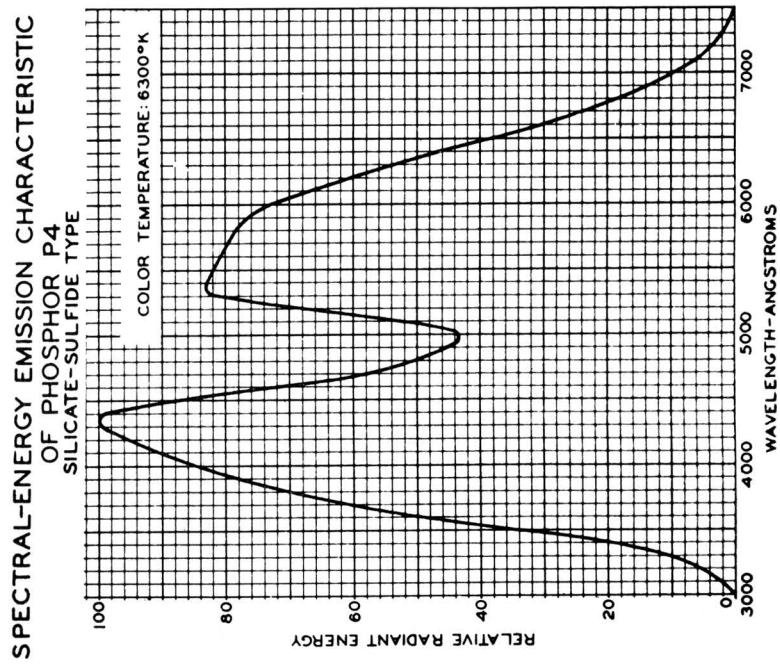

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PHOSPHOR P-4

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P4
SULFIDE TYPE

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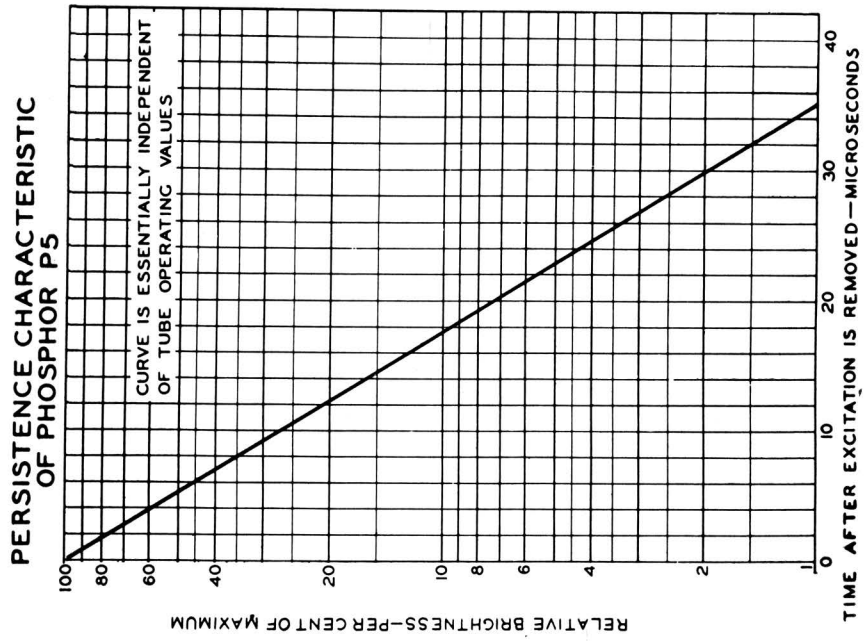
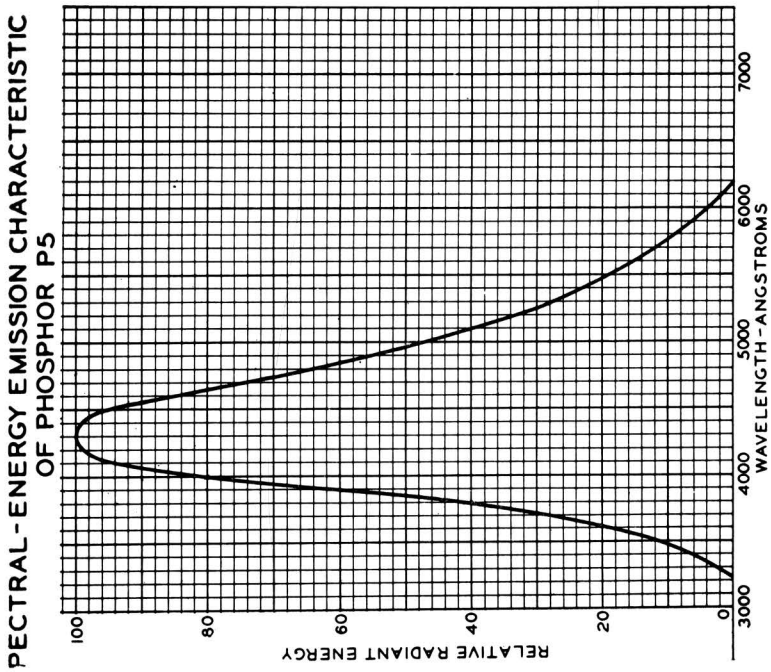
PHOSPHOR P-5





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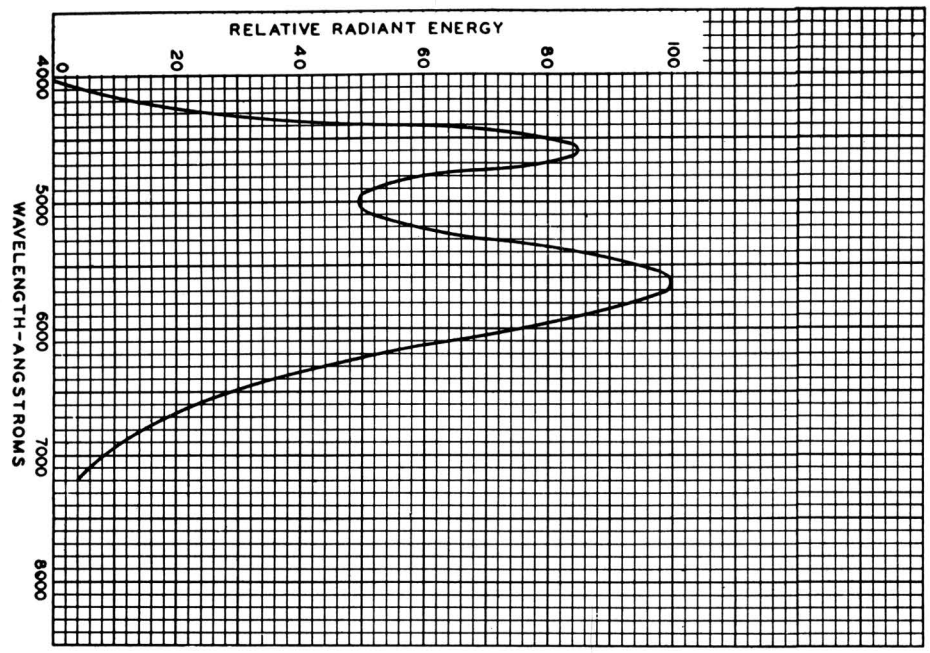
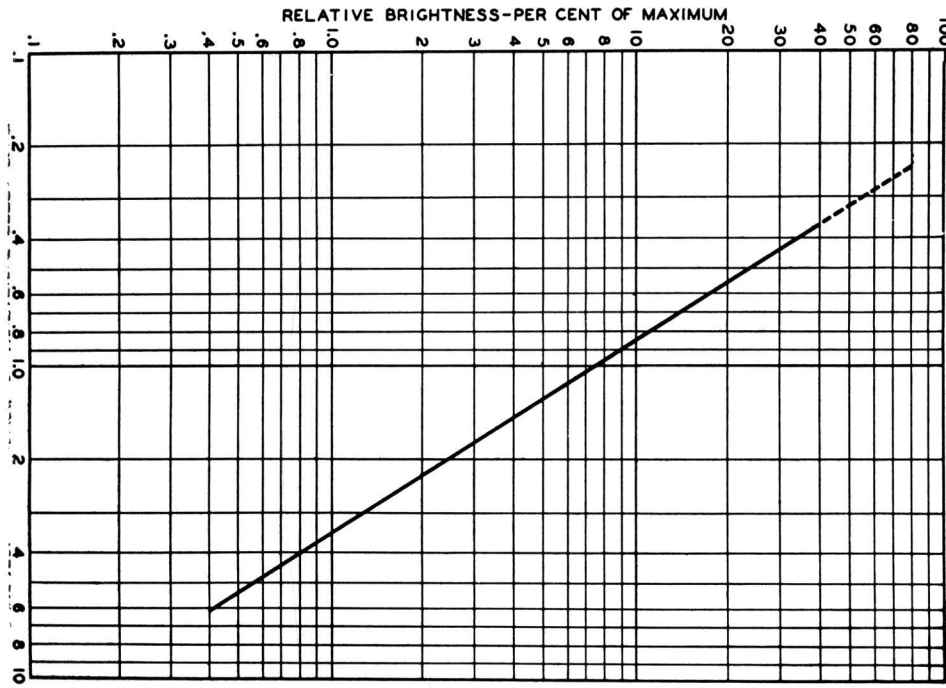
PHOSPHOR P-6



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P6



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P6

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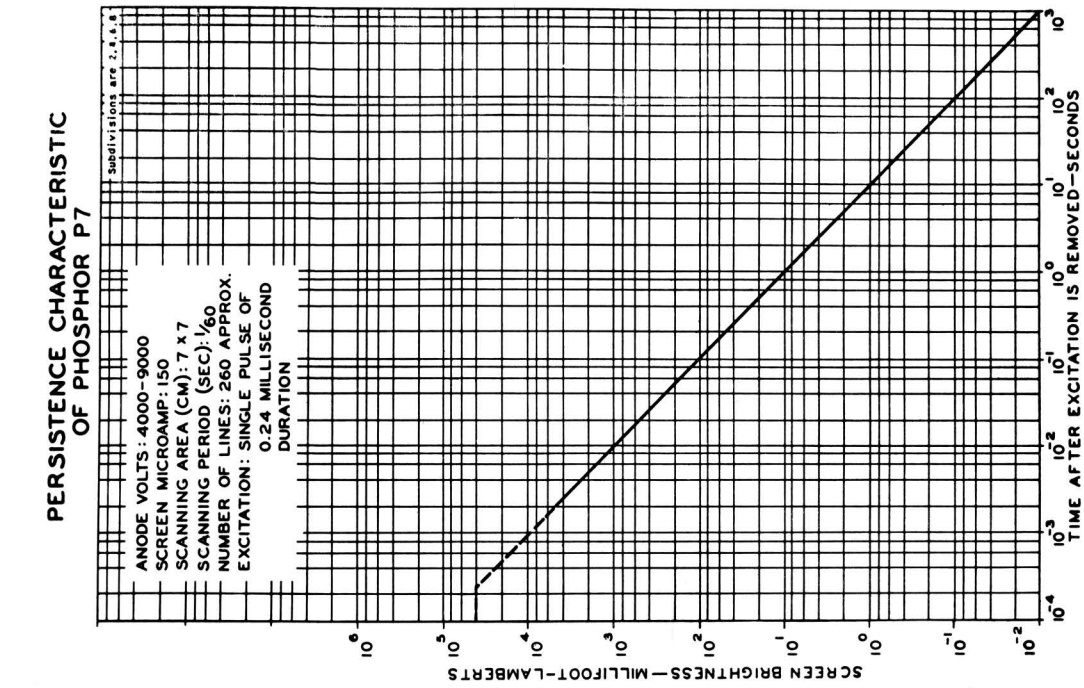
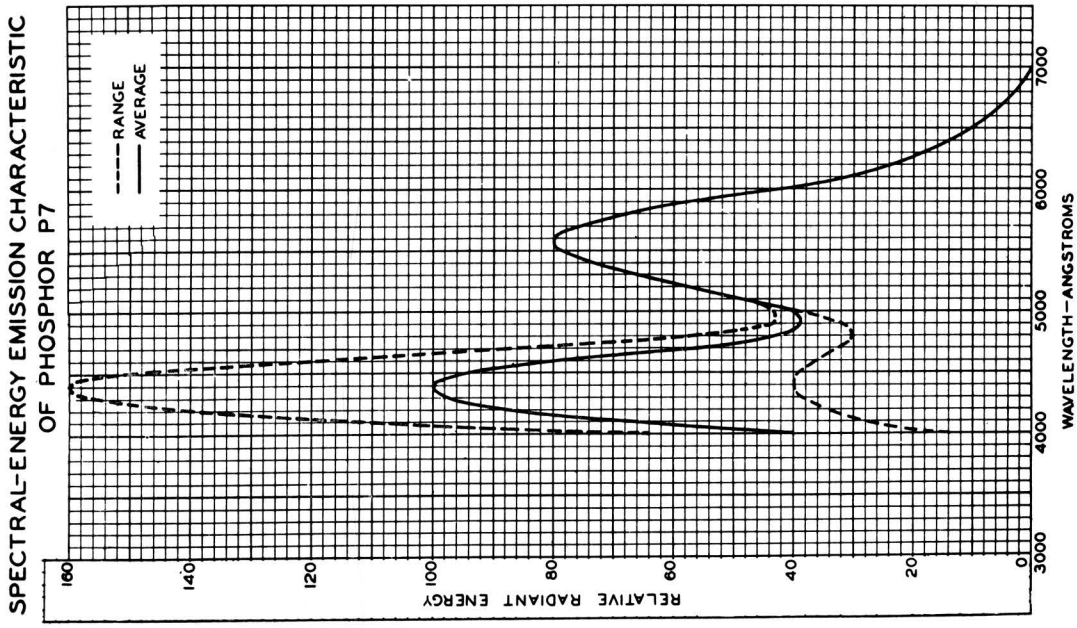
PHOSPHOR P-7





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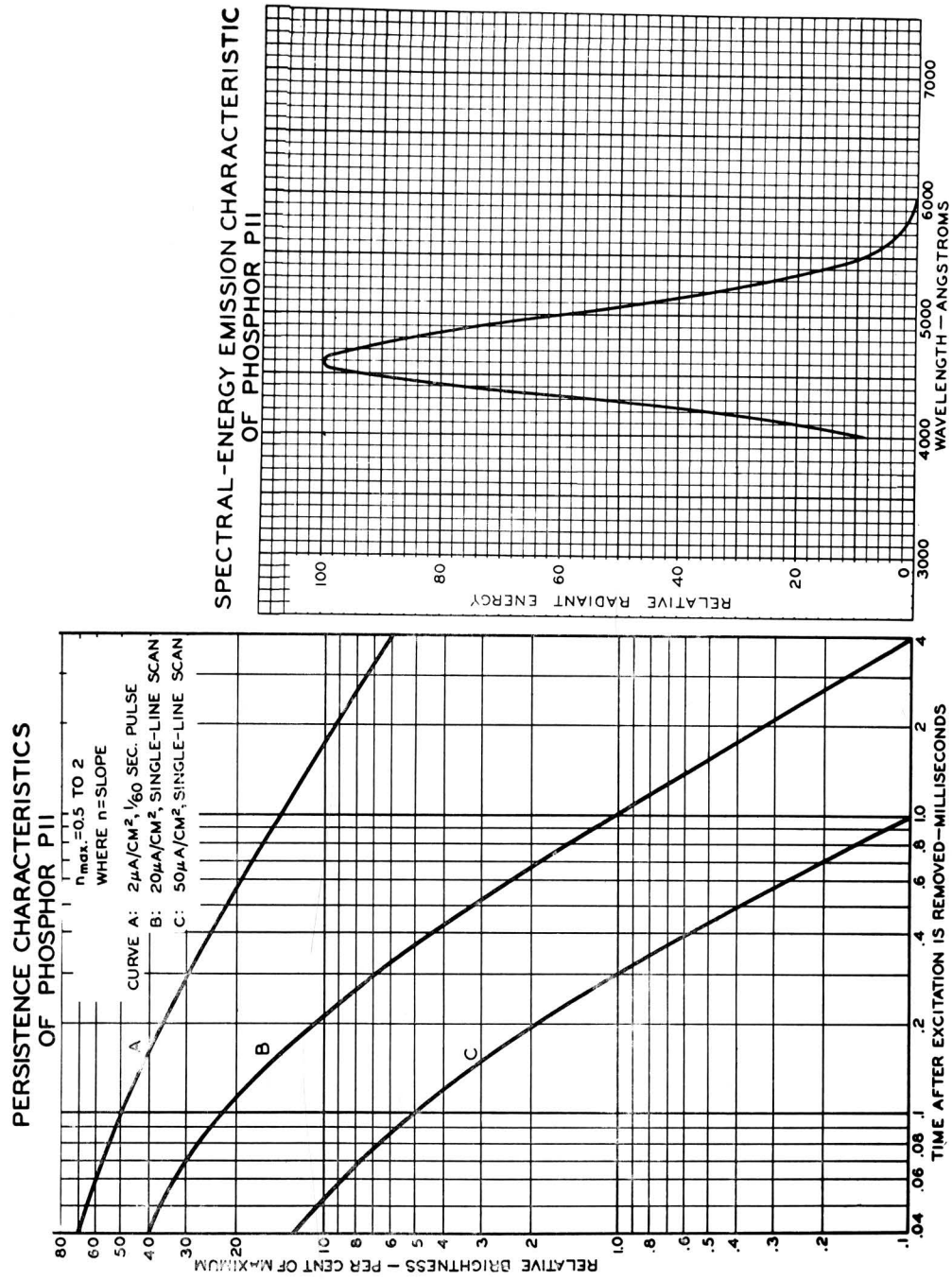
PHOSPHOR P-11



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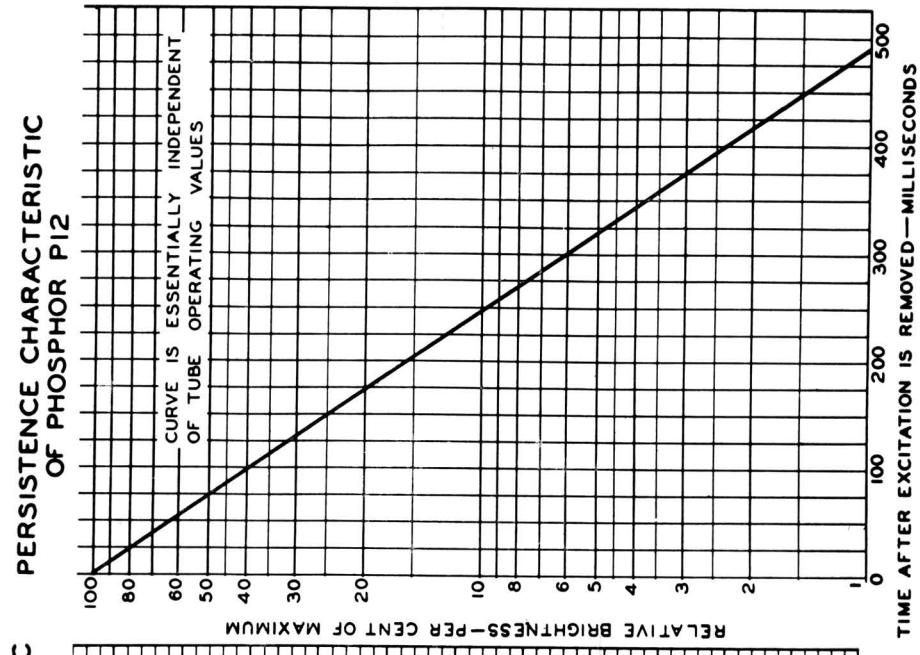
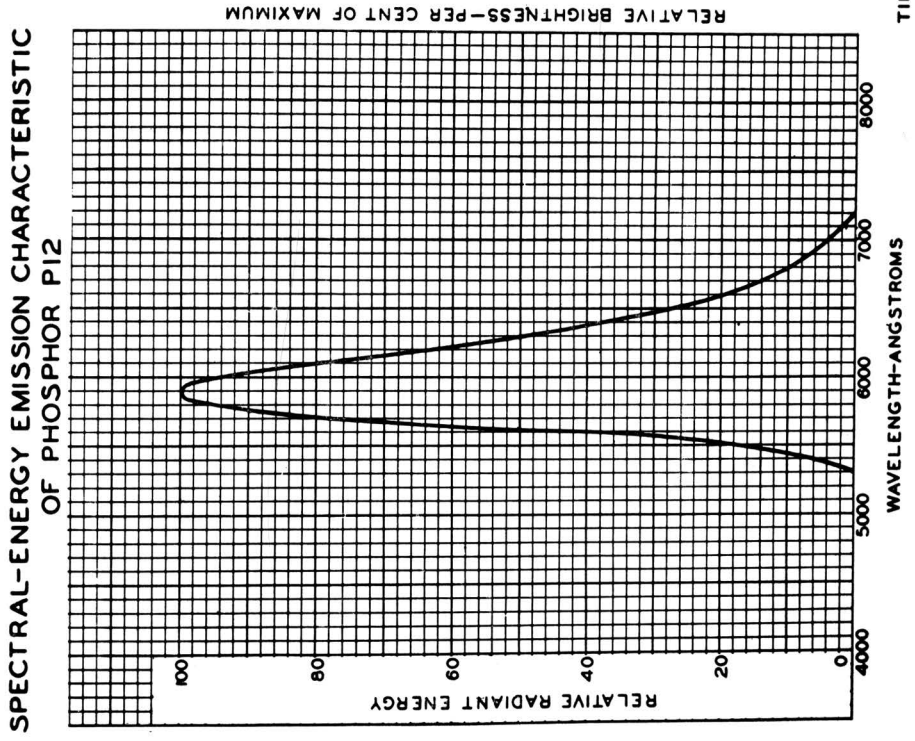
PHOSPHOR P-12





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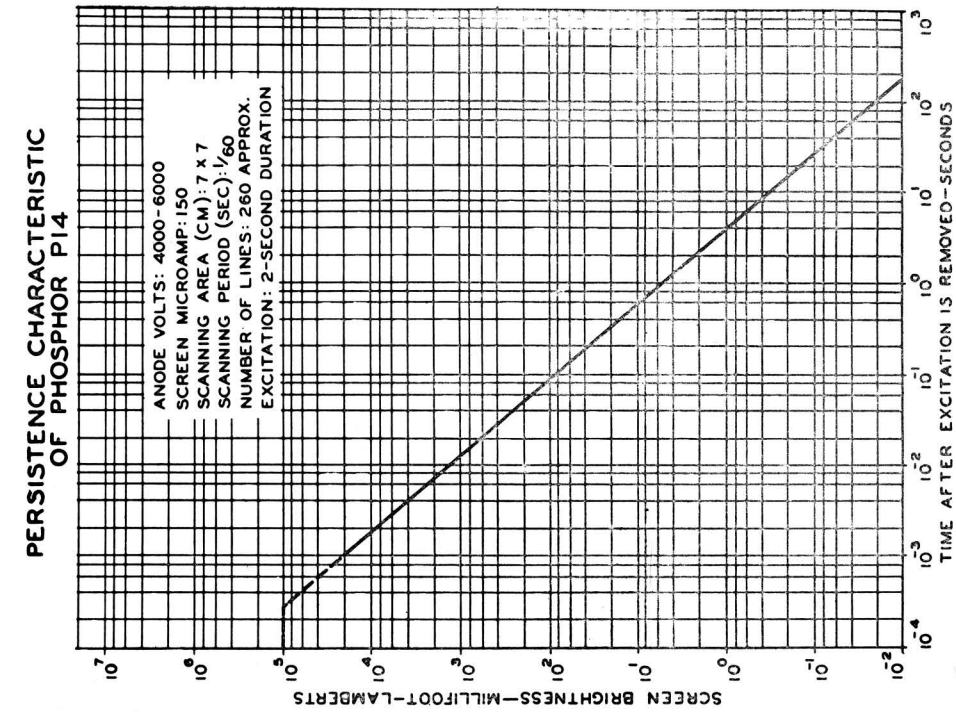
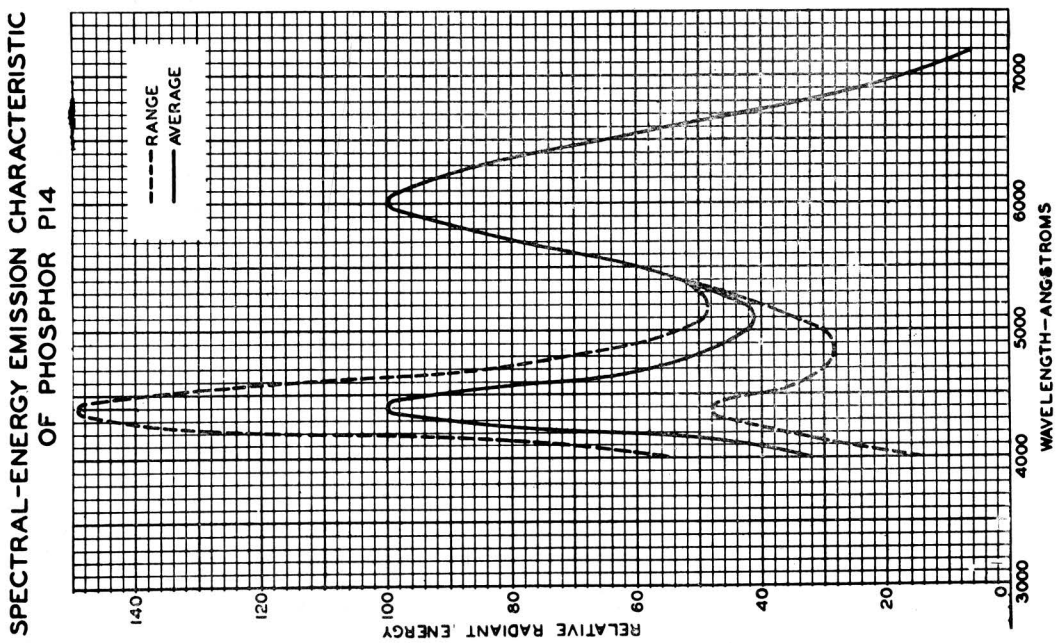
PHOSPHOR P-14





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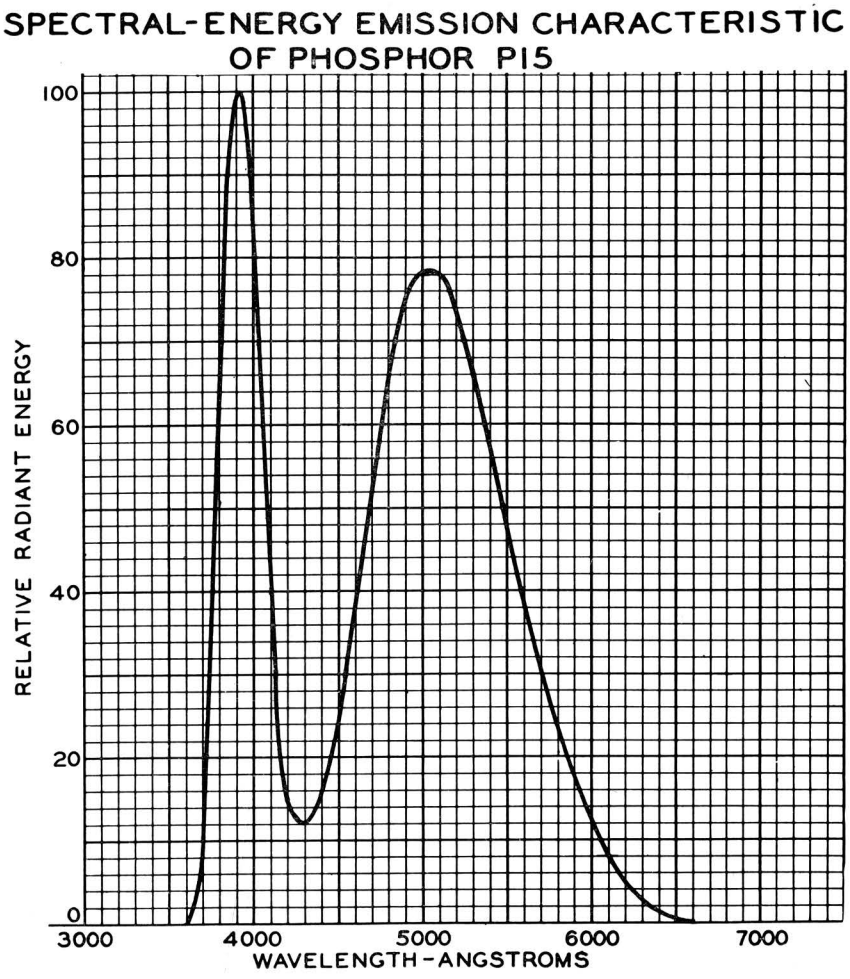
PHOSPHOR P-15



The P15 screen has the shortest persistence of any present phosphor available. The P15 has a decay time of less than 1.5 microseconds under normal operating conditions.

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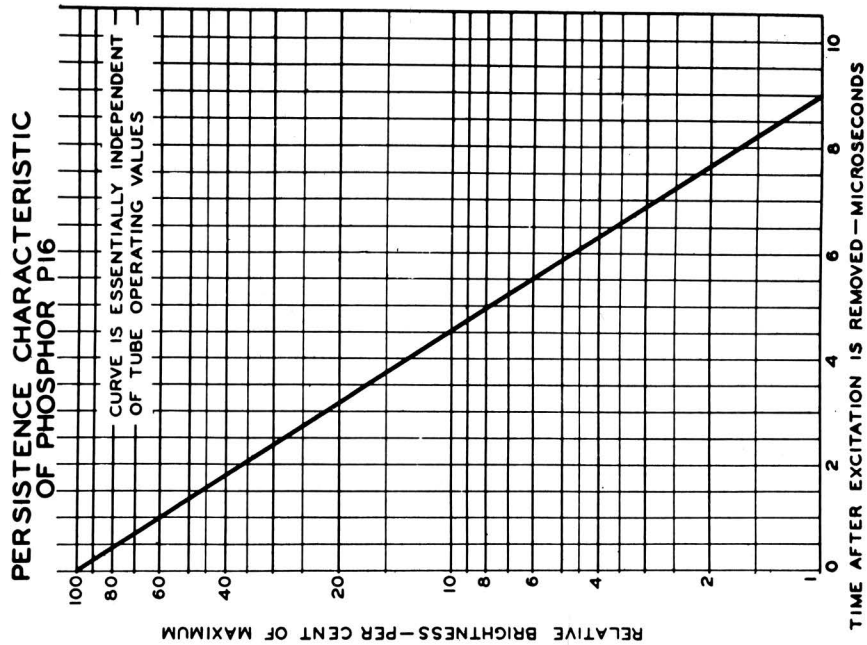

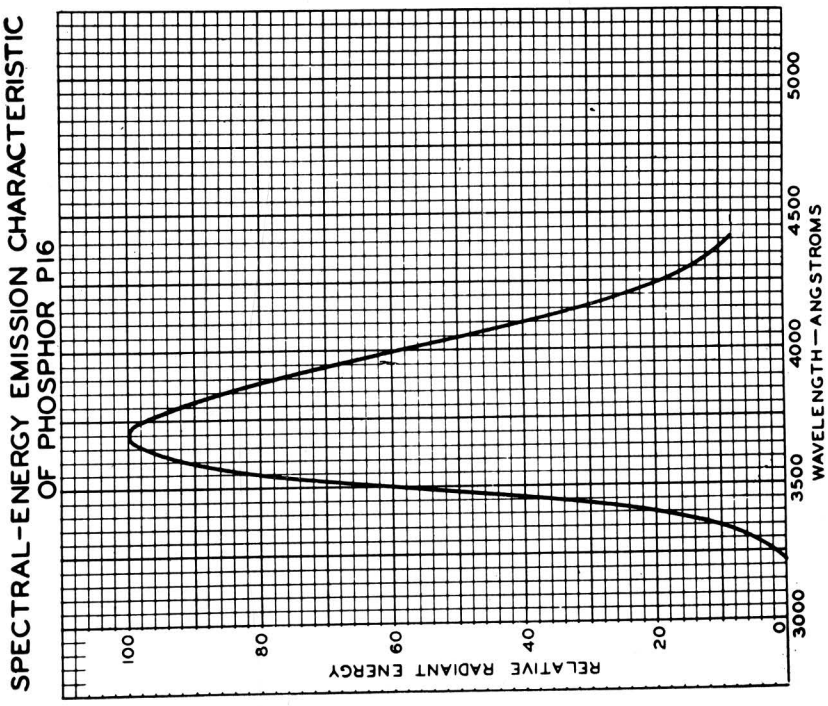

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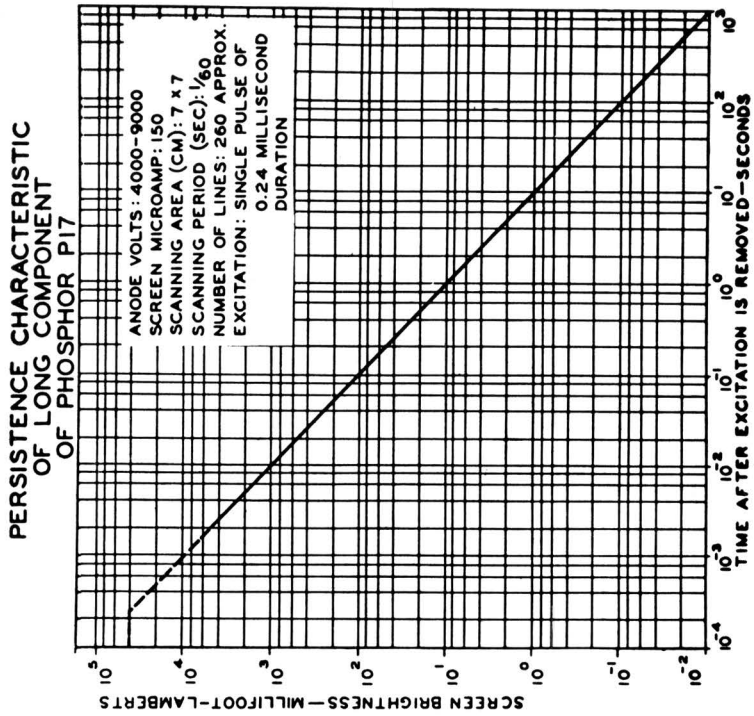
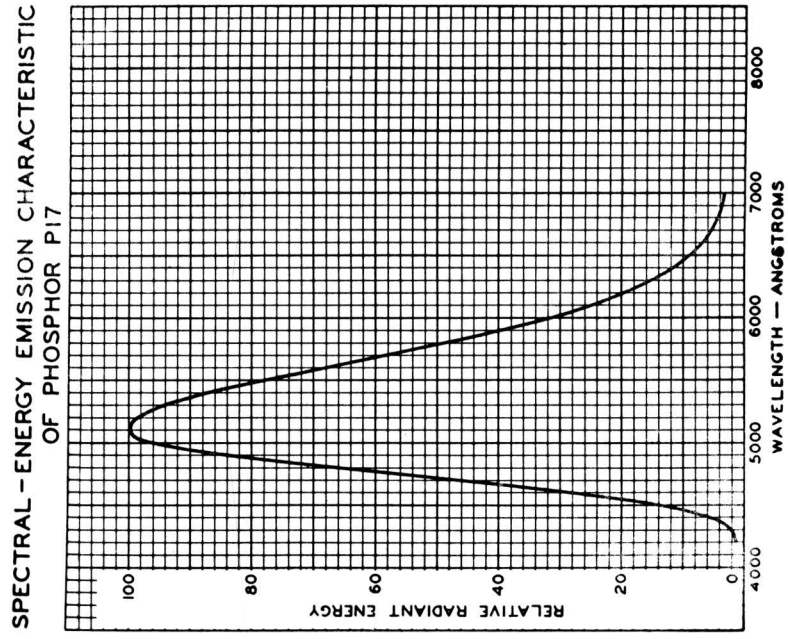
PHOSPHOR P-17





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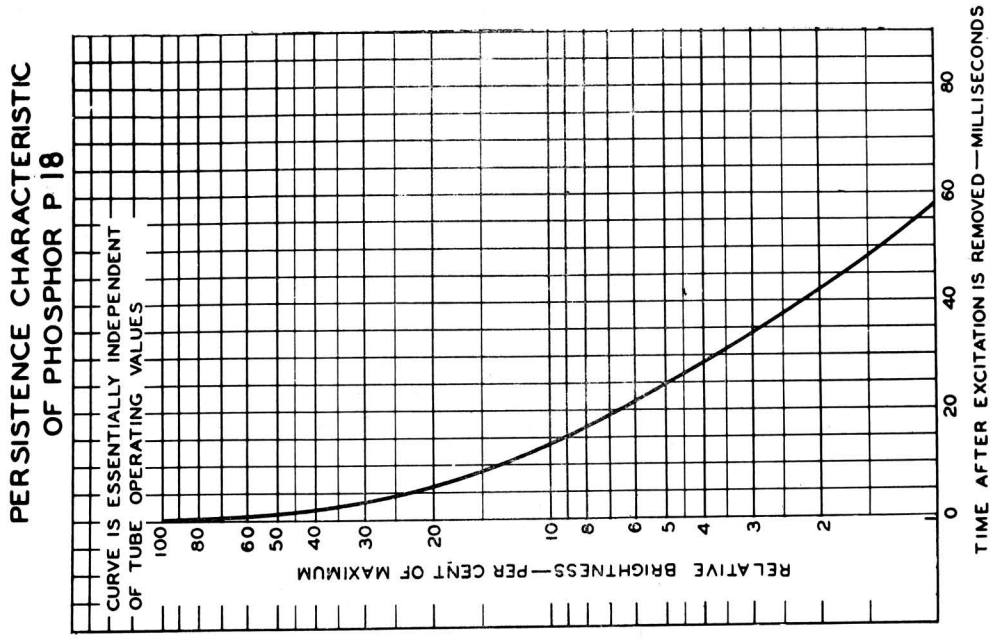

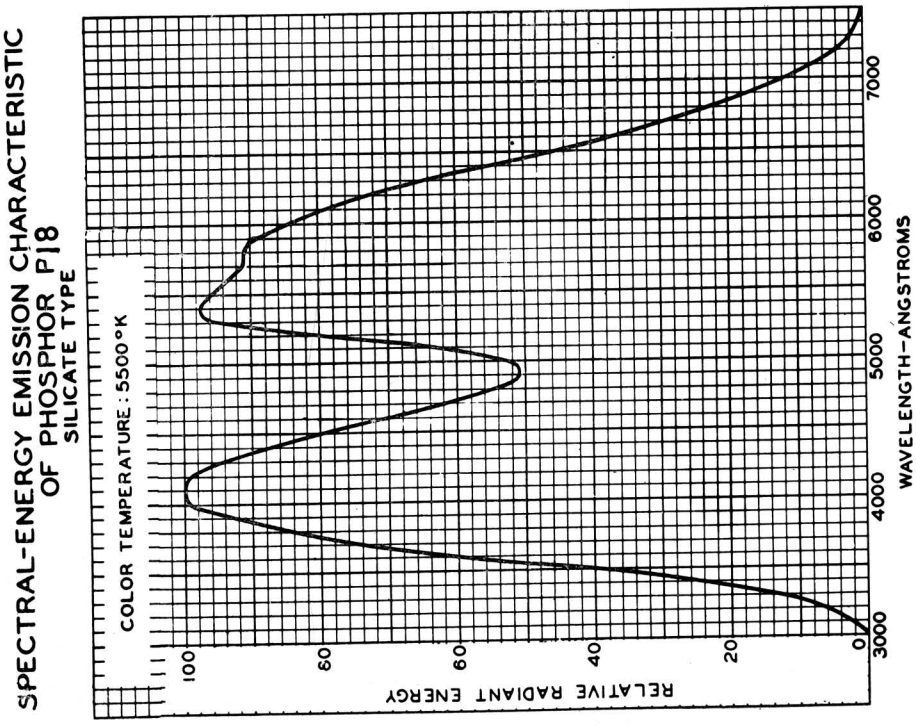

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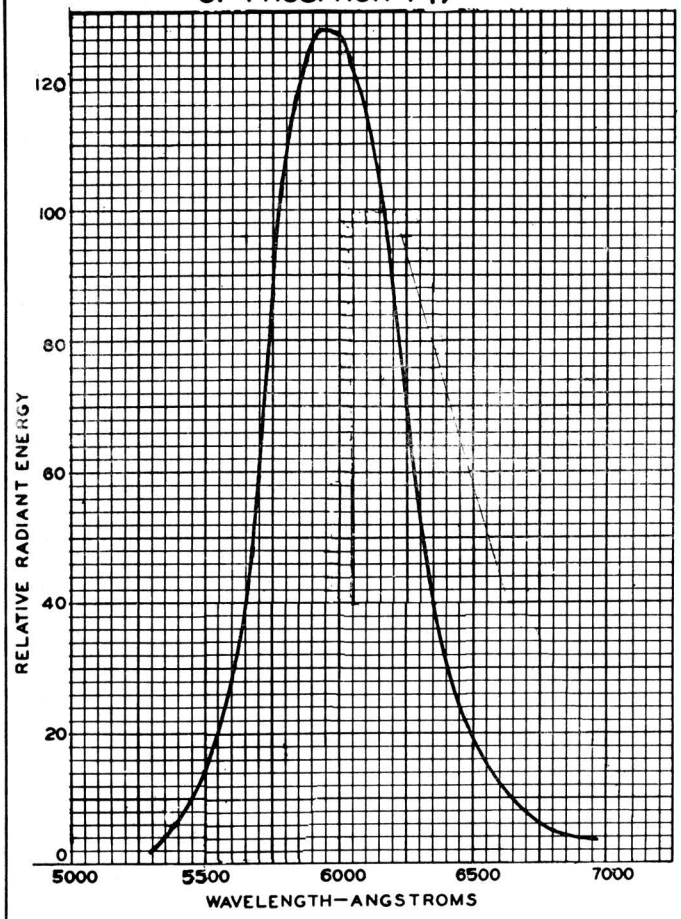
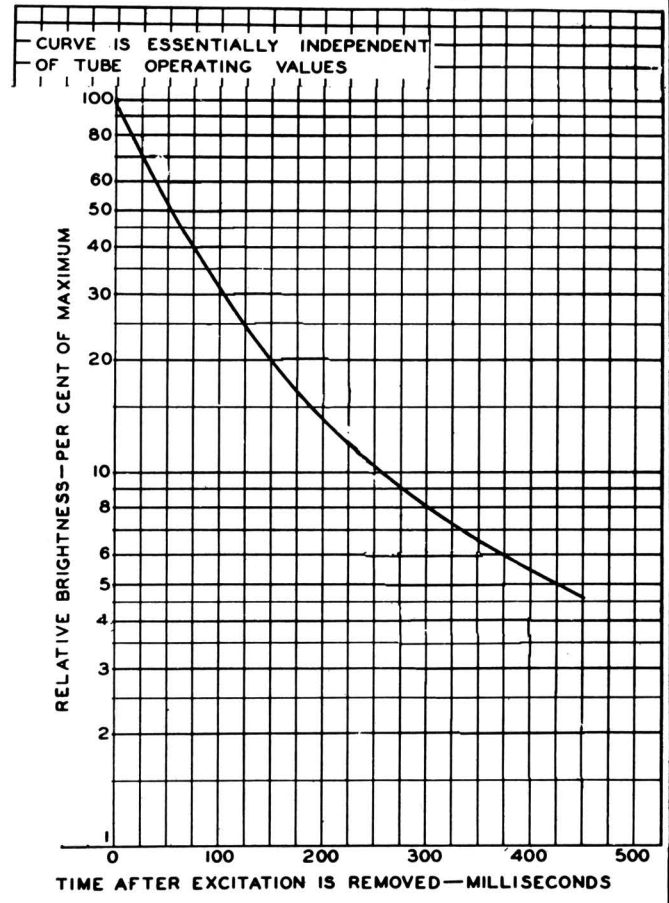
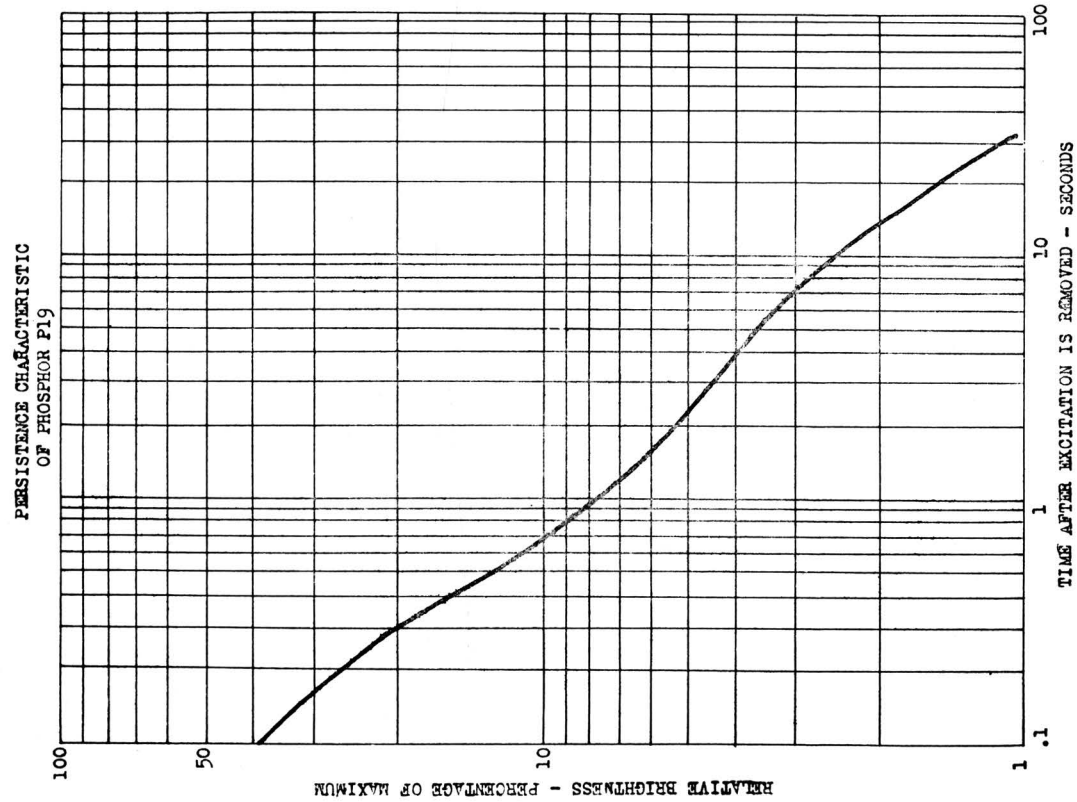
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P19



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P19





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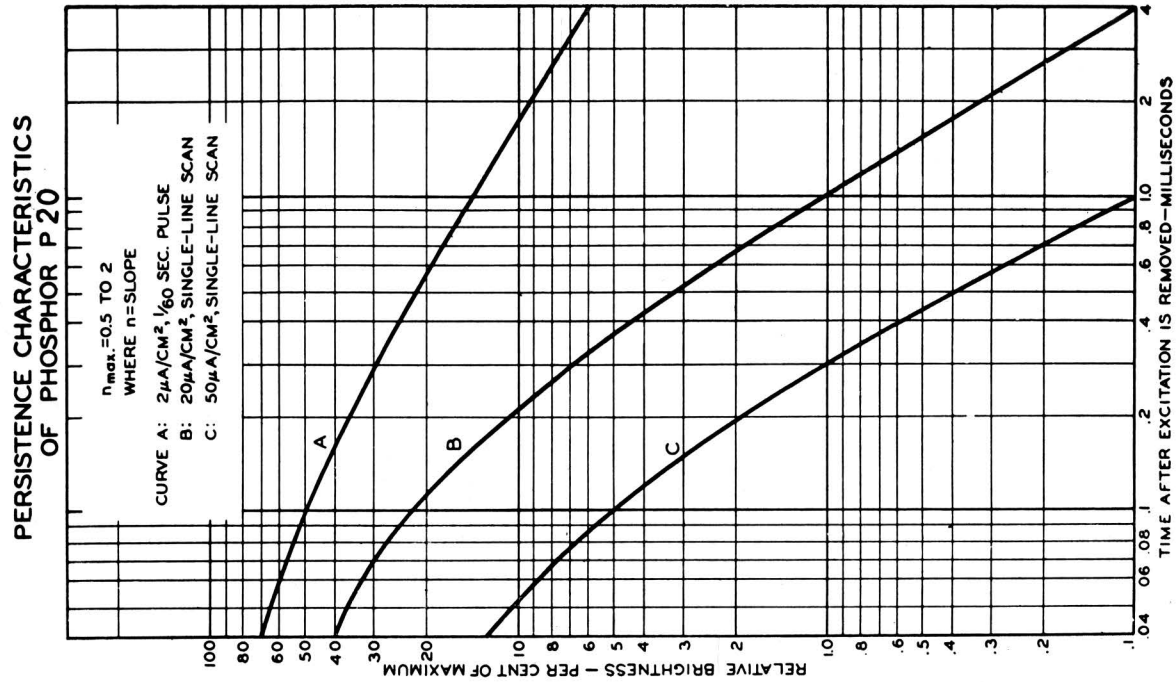

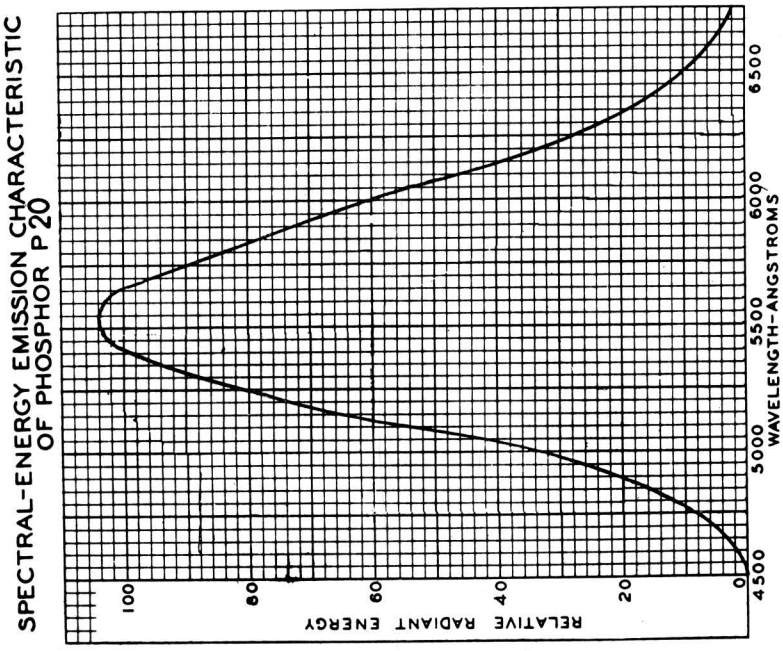

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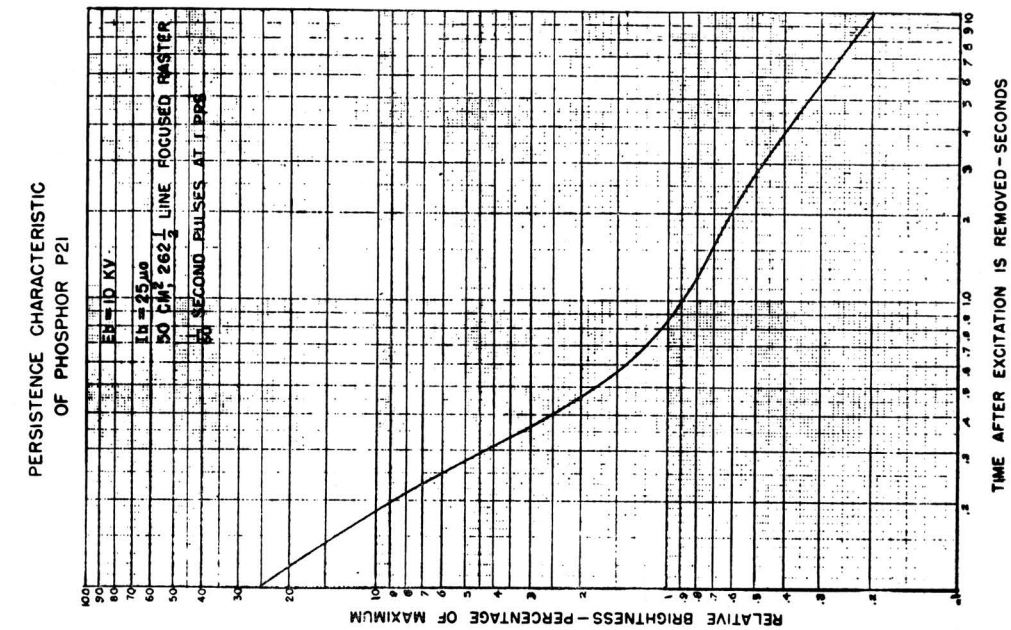
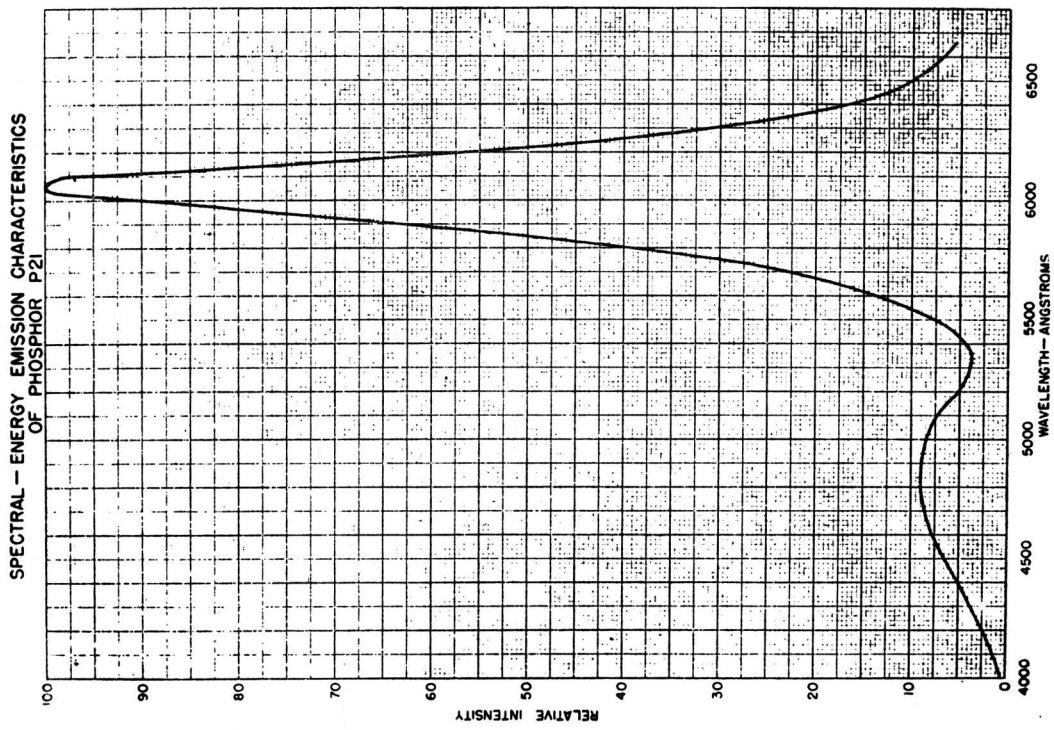
PHOSPHOR P-21





VACUUM TUBE PRODUCTS CO. INC.

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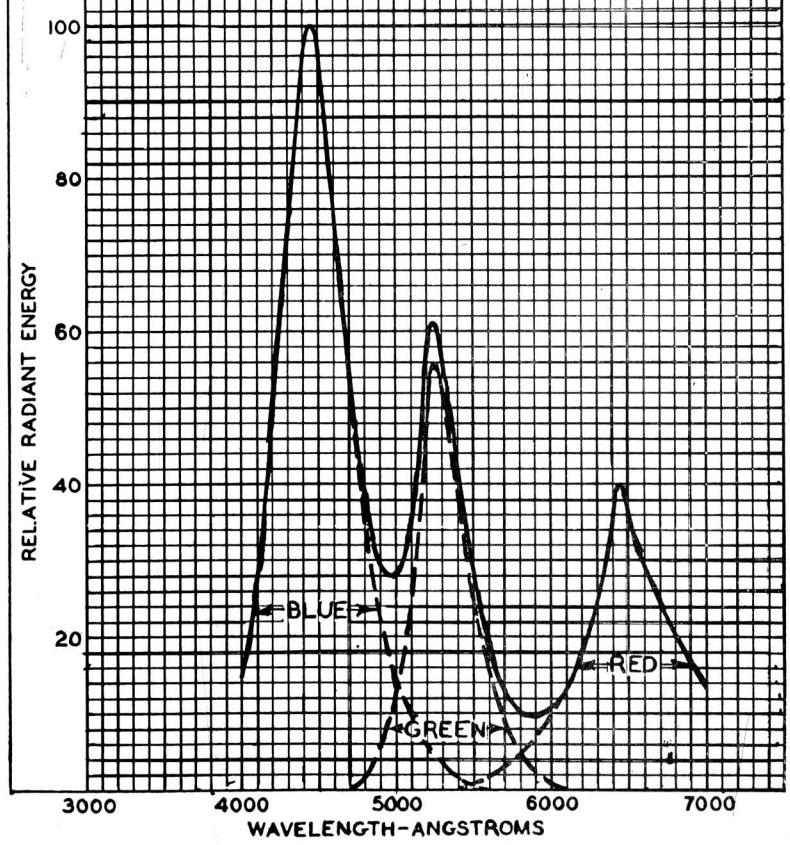
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF GROUP PHOSPHOR P22

EQUAL EXCITATION OF EACH PHOSPHOR

PHOSPHOR	RANGE OF MAX. VALUE ANGSTROMS
BLUE EMITTING	4420 TO 4520
GREEN EMITTING	5230 TO 5270
RED EMITTING	6360 TO 6580

PERSISTENCE OF GROUP

IDENTICAL TO PHOSPHOR P4



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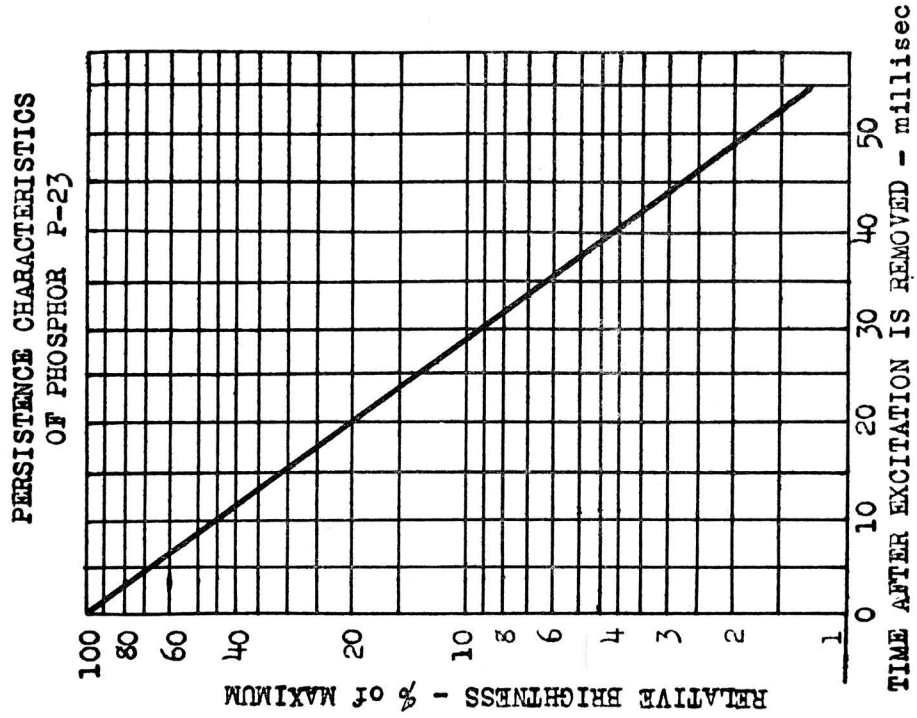

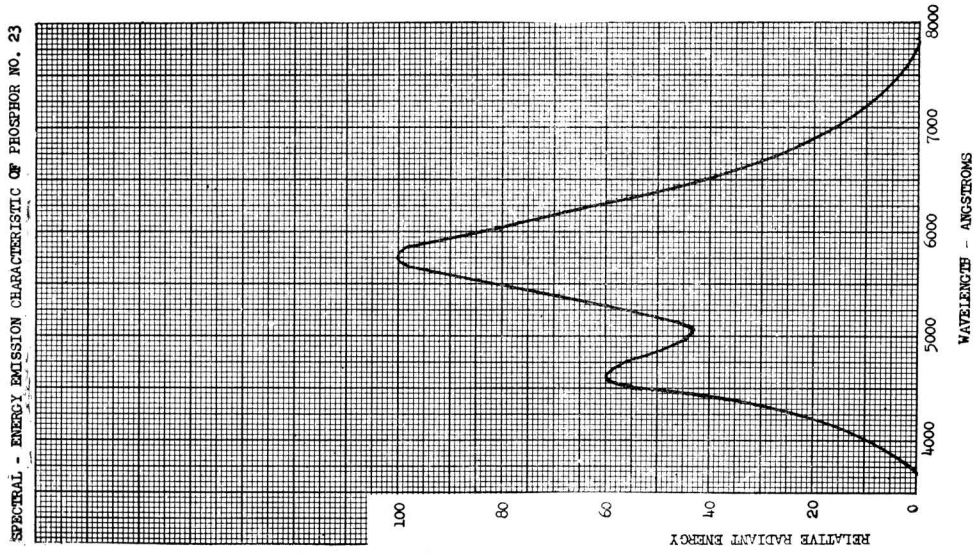

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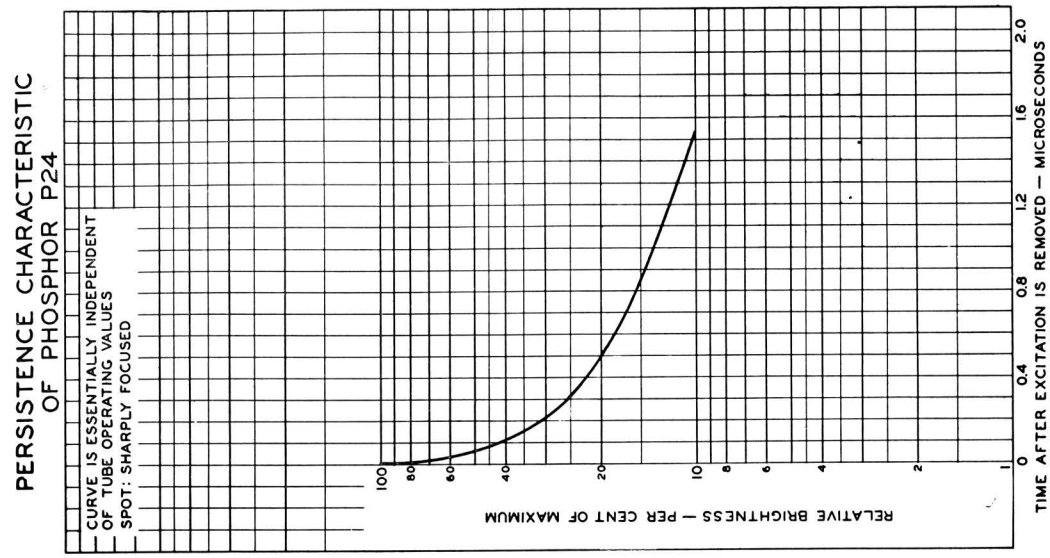
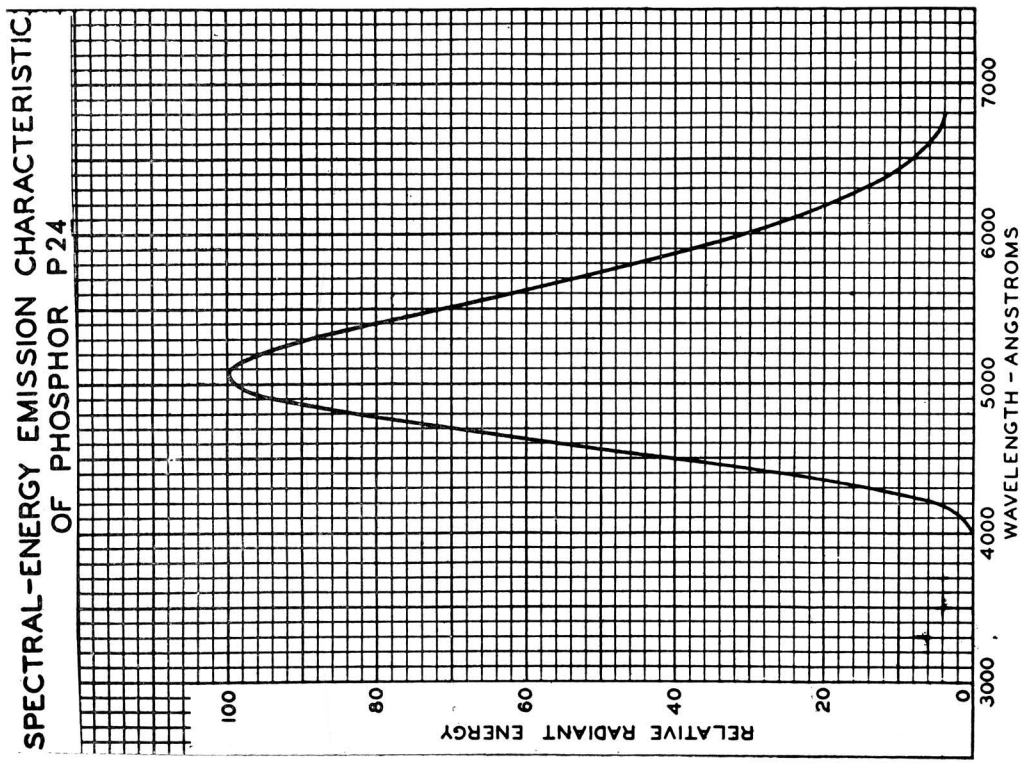
PHOSPHOR P-24





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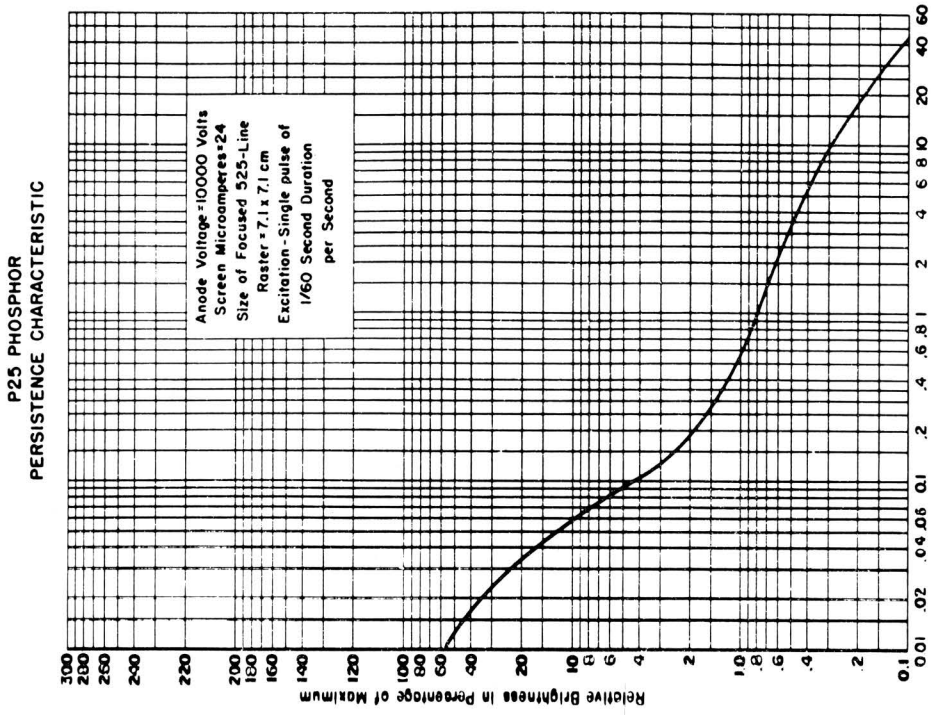
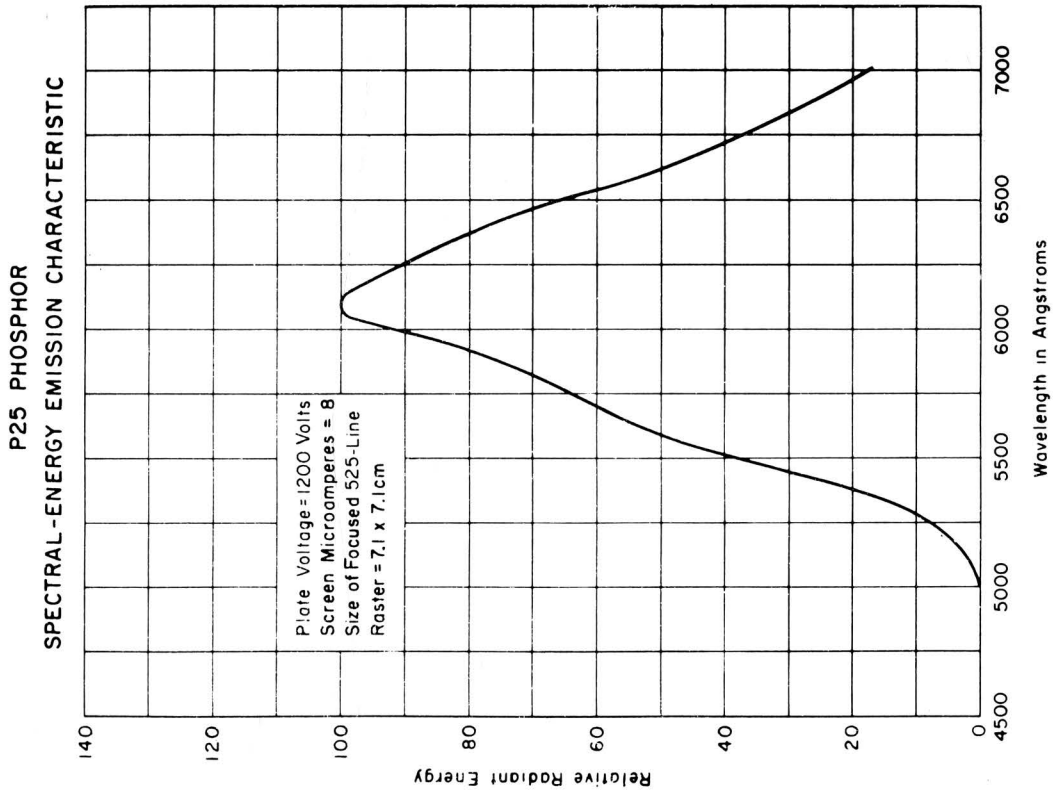
PHOSPHOR P-25





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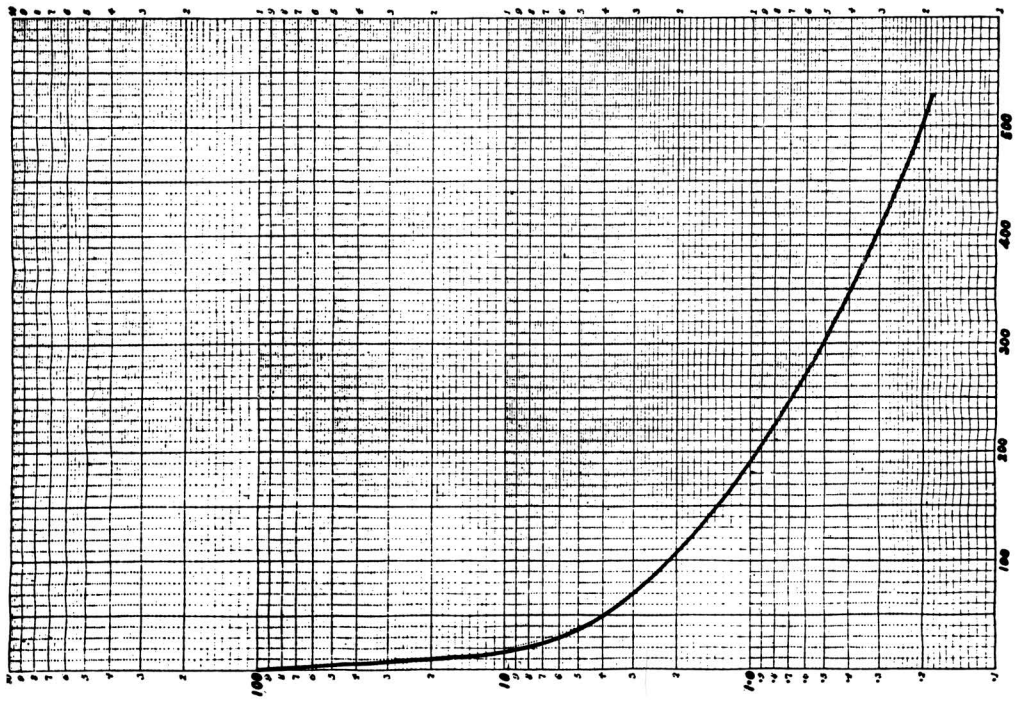
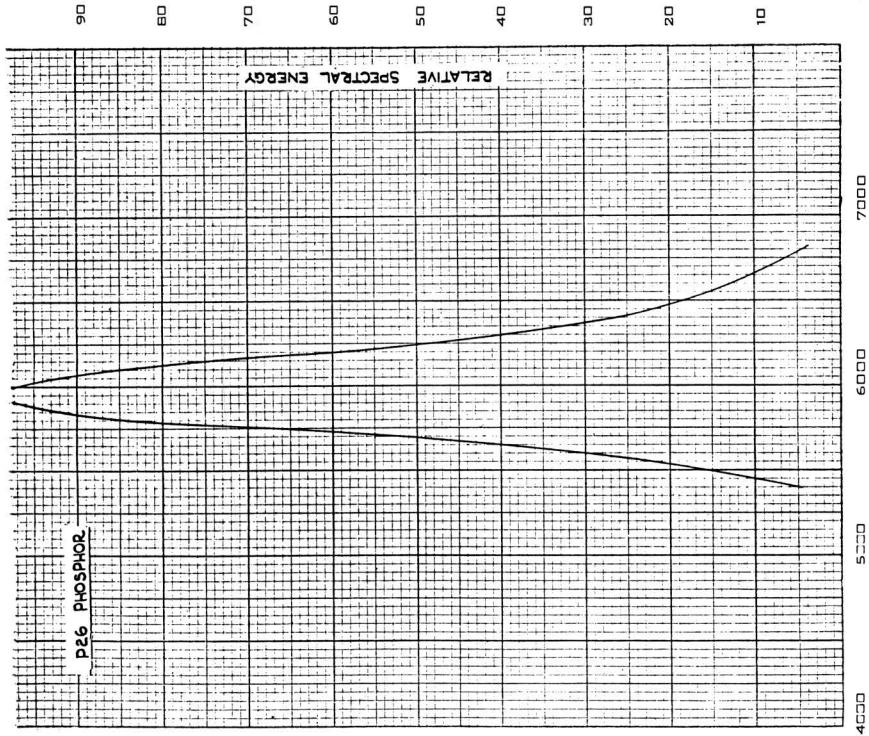
PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P 26



SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P26



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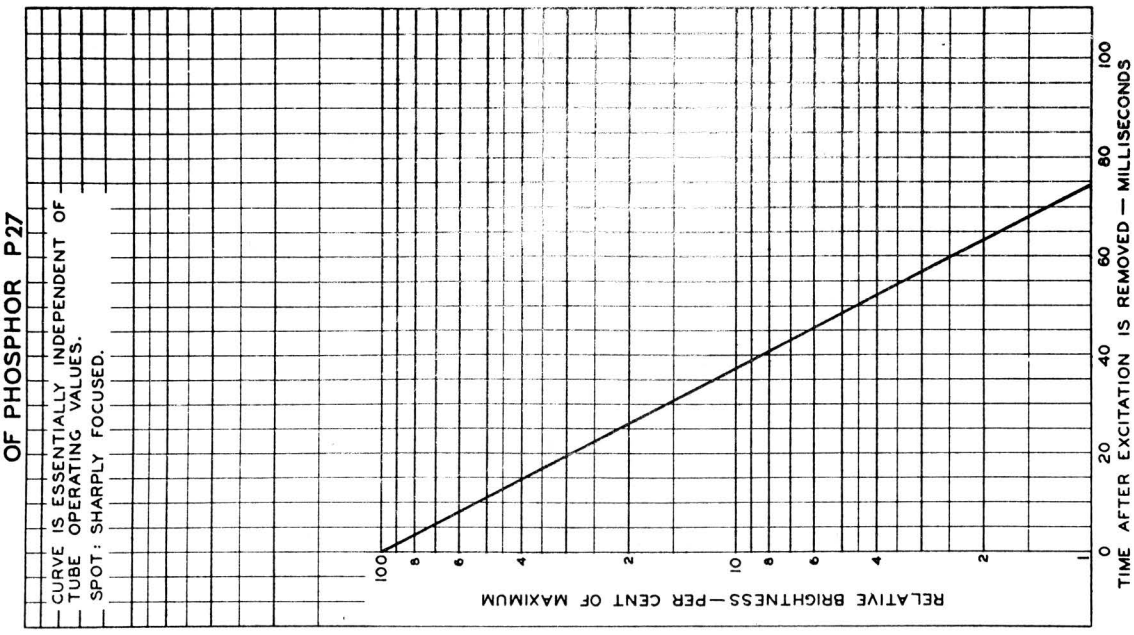
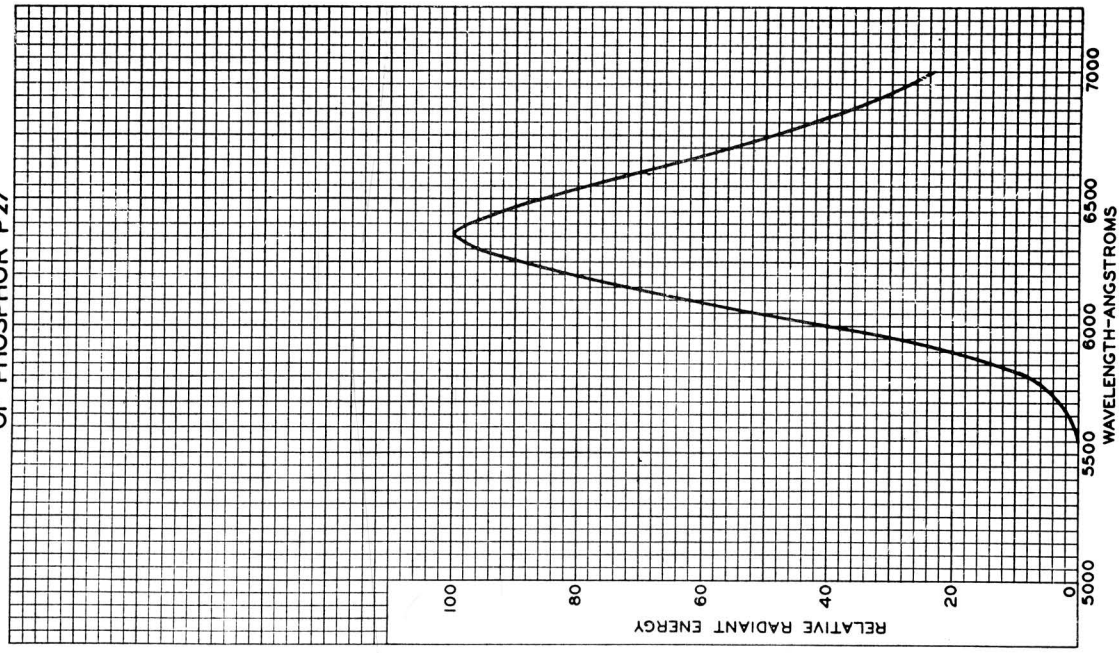
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P27



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P27



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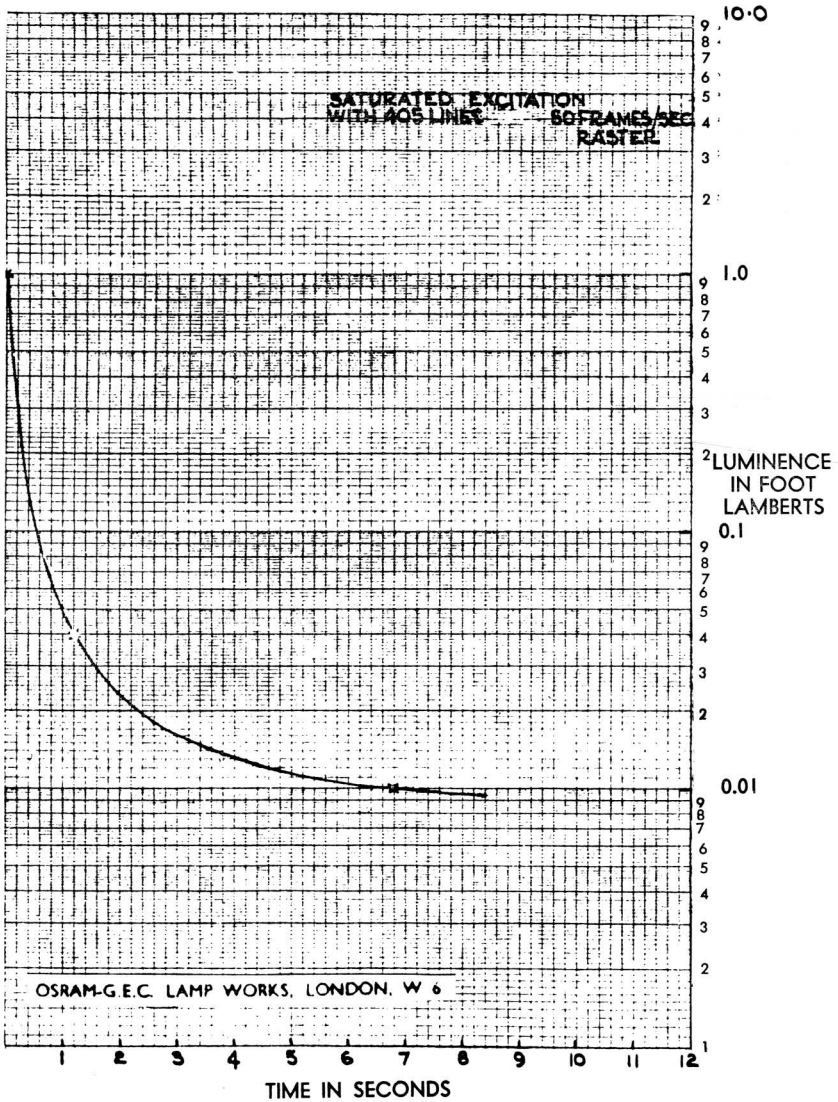
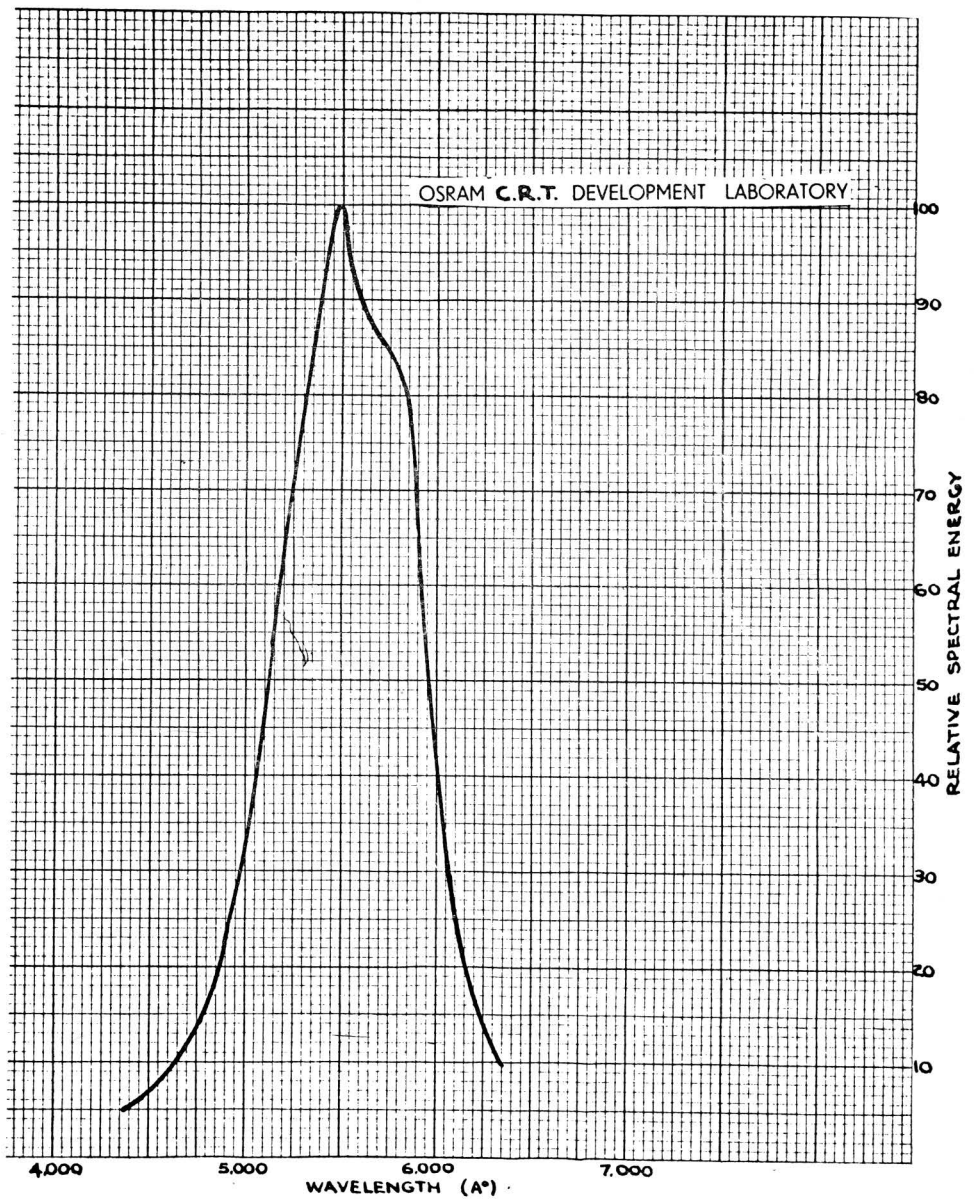
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P-28



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P-28



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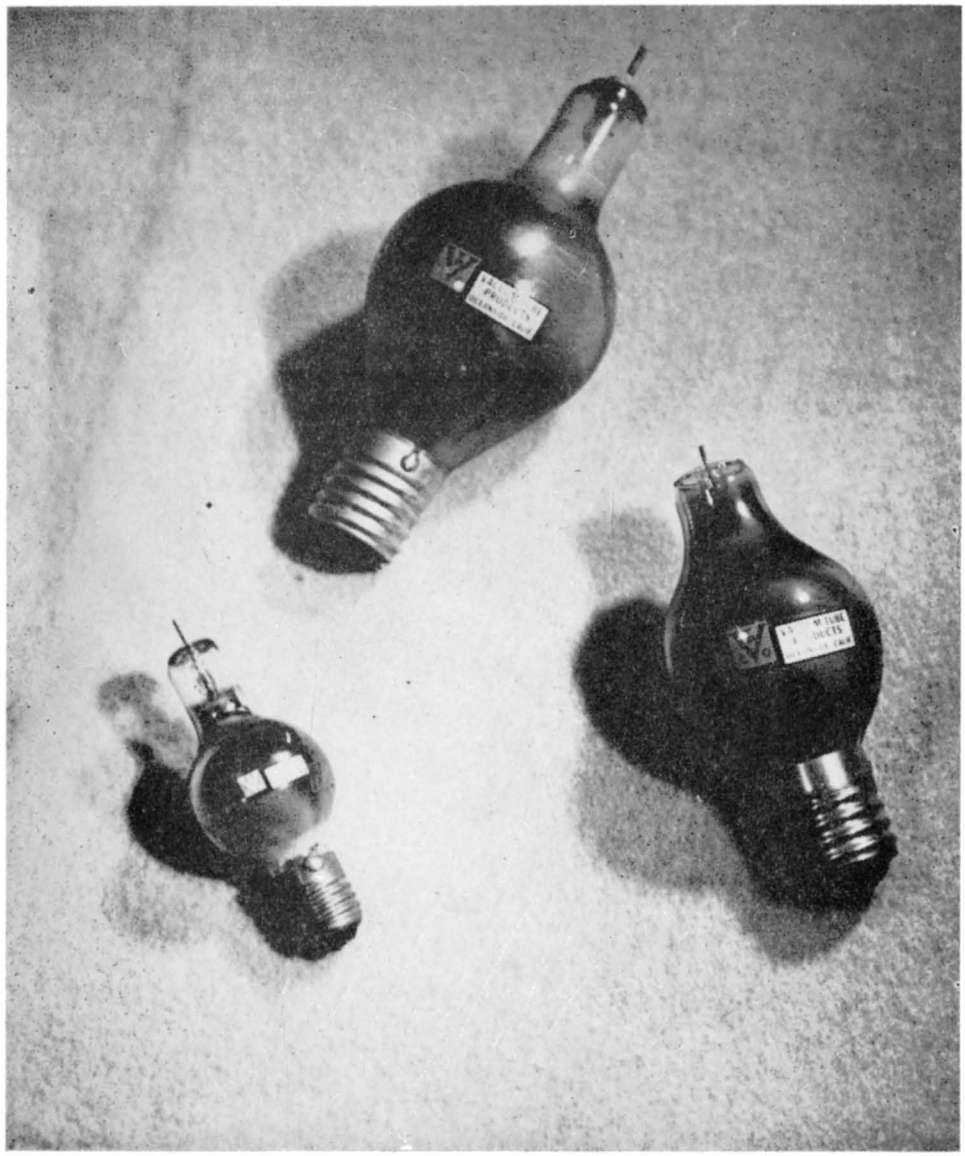
PRODUCT DATA SHEET



Gas Rectifiers

VACUUM TUBE PRODUCTS CO. INC.

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PRODUCT DATA SHEET

Mercury Vapor Rectifiers

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PRODUCT DATA SHEET

Miscellaneous Type Tubes

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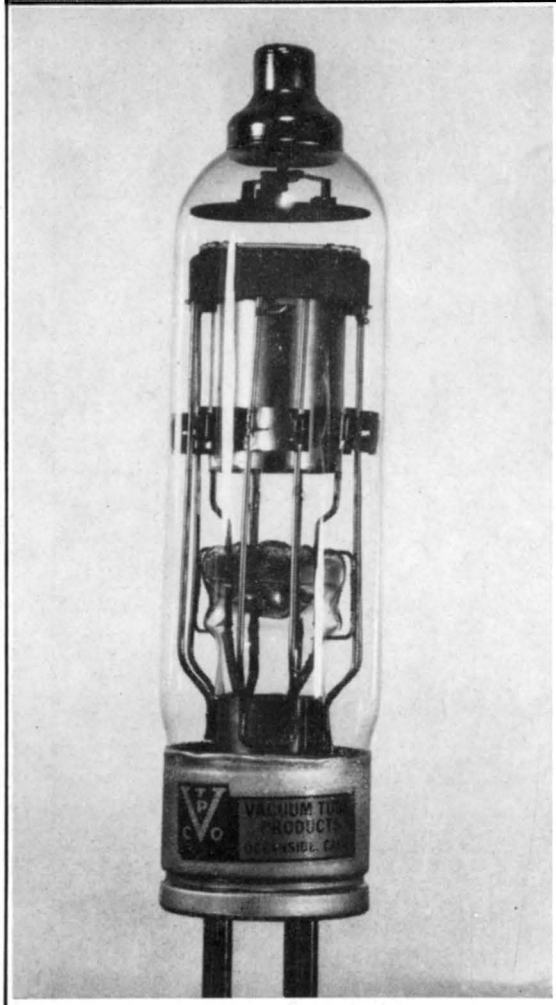
PRODUCT DATA SHEET



VTP 5685/C6JA/5C21

The VTP 5685/C6JA/5C21 is a rugged and reliable xenon thyratron designed for grid controlled rectifier service where high efficiency is of primary concern. A typical application is for use in controlling current pulses to welding transformers for spot and seam welding machines. Another wide usage is the control of power to D.C. motors supplied from A.C. lines allowing wide ranges of motor speed control. Xenon thyratrons of this type are also used for converting A.C. power sources to adjustable current or voltage D. C. supplies, not only for general industrial uses, but also where the tubes are subjected to wide extremes of ambient temperature conditions.

The VTP 5685/C6JA/5C21 has been thoroughly engineered and incorporates such features as hard glass construction, zirconium coated graphite anode, precious metal non-emitting grid construction, close and uniform grid control, low grid current, low deionization time, high frequency operation, low arc drop, high peak currents, black body heat dissipation, and automatic gettering action. It is also electrically identical to the C6JF and is interchangeable except for the base.

The VTP-5685/C6JA/5C21, manufactured under tight controls at Vacuum Tube Products Co. Inc., is so designed as to replace any tubes designated as 5685, C6J, C6JA, or 5C21.

SPECIFICATIONS

Cathode:	Directly heated filament type
Heater Voltage:	2.5 volts (A.C.)
Heater Current:	17.0 to 23.0 amperes (A.C.)
Heating Time:	60 seconds

Rated Anode Current: (Continuous)	6.4 amps (D.C. meter reading)
Rated Anode Current: (Average Max.)	6.4 amps (D.C. meter reading)
Rated Anode Current: (15 seconds Max. ON and 15 seconds Min. OFF)	12.8 amps (DC meter reading)
Rated Anode Current:—Peak (Continuously oscillographically recorded)	100 amps
Peak Forward Voltage:	1000 volts
Peak Inverse Voltage:	1250 volts
Operating Temperature range — Degrees Centigrade	—55 to +75
Operating Altitude:	0 to 60,000 ft.

Tube Voltage Drop:	With 6.4 amp. D.C. flowing through the tube, the maximum voltage drop across the tube will be 14 volts.
Peak Emission:	With 77 amp. D.C. flowing through the tube, the maximum voltage drop across the tube will be 45 volts.
Critical Grid Voltage:*	When the anode has 1000 volts D. C. applied, the tube will start to pass current when the grid bias is made less negative and falls between —3.0 and —6.2 volts D.C.
Critical Anode Voltage:*	When the grid has plus 3.0 volts applied, the tube will start to pass current when the anode voltage is raised and conduction will start at less than +75 volts D. C. anode voltage.
A.C. Anode Voltage for conduction:*	With zero grid volts bias, the tube will pass current at less than 80 volts A.C. applied.

Operating frequency — Maximum Recommended: 400 cycles +10%

*NOTE: The filament pin adjacent to the grid pin shall be negative with respect to the other filament pin on the half cycle that the plate is positive.

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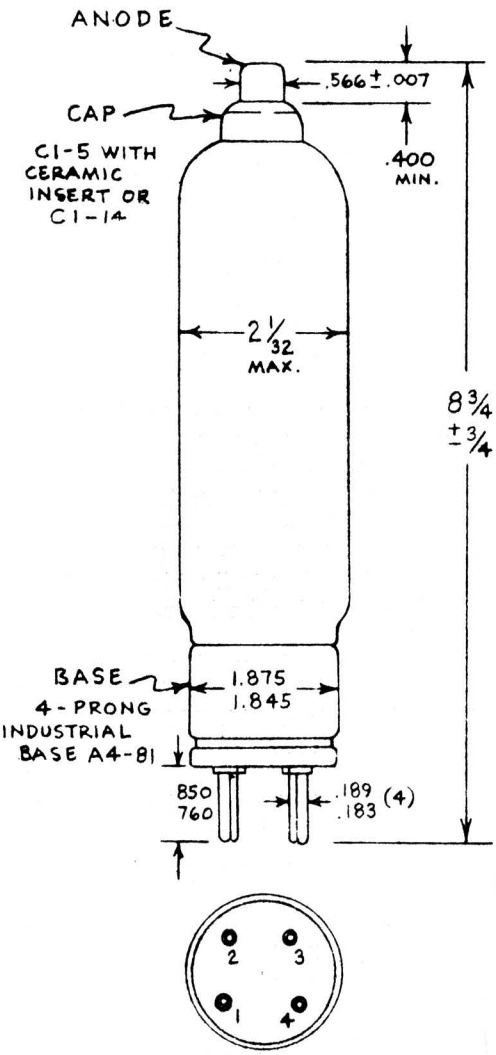
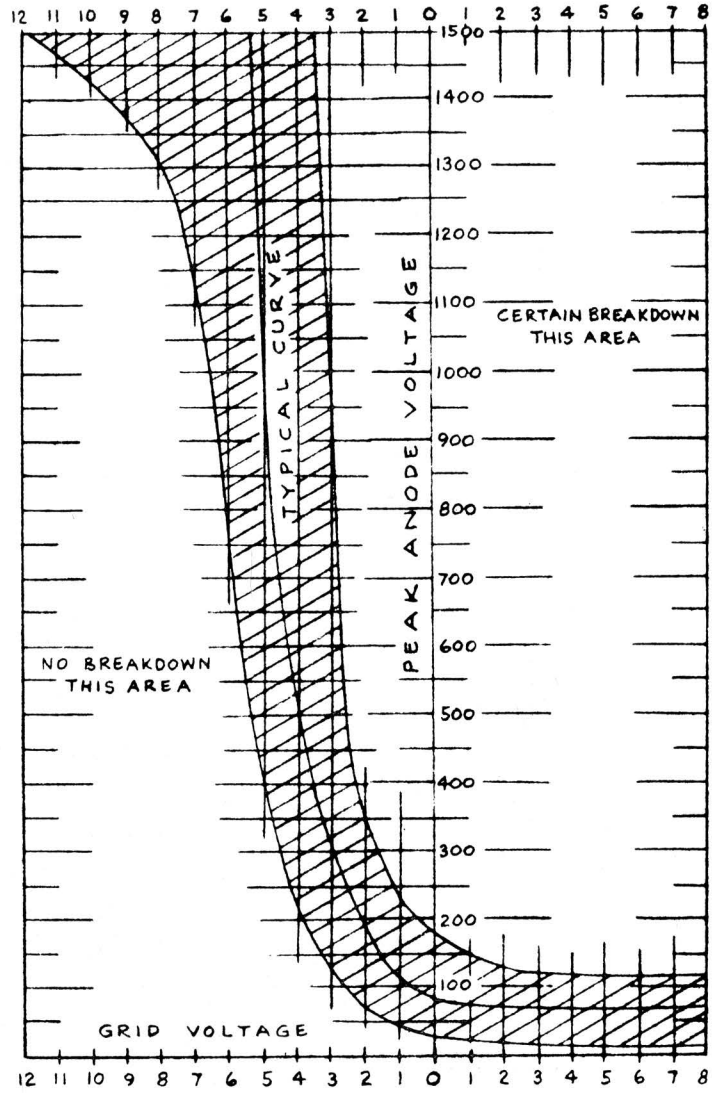
VTP 5685/C6JA/5C21



BOTTOM VIEW OF BASE



TYPICAL CHARACTERISTIC CURVE

PIN # 1 GRID
PIN # 2 FILAMENT
PIN # 3 FILAMENT
PIN # 4 NO CONNECTION

NOTE: FOR CIRCUIT APPLICATION MAKE CATHODE CONNECTION TO PIN # 2

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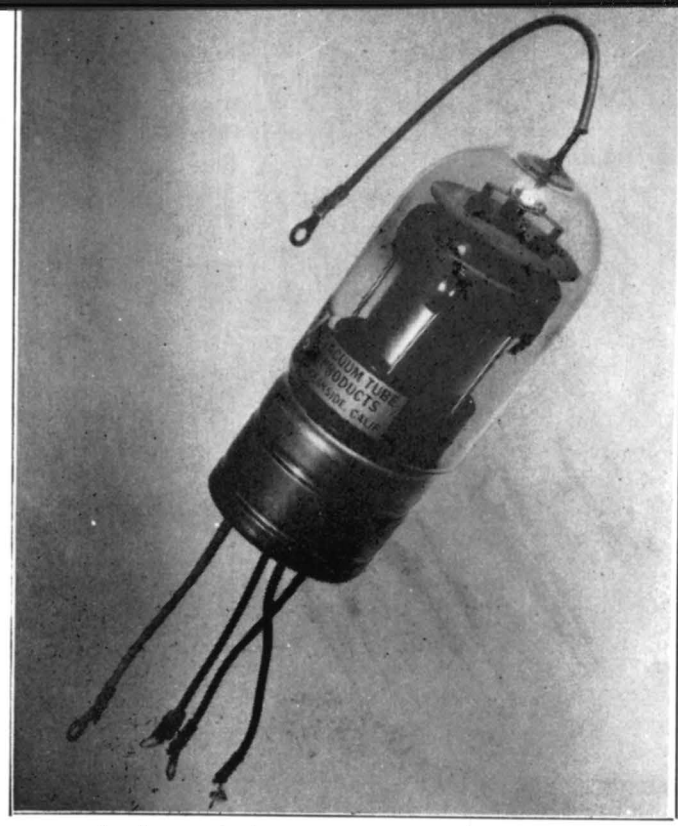
PRODUCT DATA SHEET



VTP 6278/C5F14
XENON THYRATRON

The VTP 6278/C5F14 is a rugged and reliable xenon thyratron designed for grid controlled rectifier service where high efficiency is of primary concern. A typical application is in inverter use for the generation of medium or high frequency alternating currents from a low voltage direct current source. Wide use is found for the VTP 6278/C5F14 for use in electronic inverters with temperature controlled tuning fork stabilizers to supply 400 cycle power sources suitable for running aircraft gyrocompasses and providing reference frequencies for accurate range measurements on radar equipments. Other applications are power rectifiers, variable speed motor controls, frequency controls, welder controls, electronic timers.

The tube has been thoroughly engineered and provides such features as internal insulation of the heater source from the other electronic components, so that no electrical interaction is possible. Other features are hard glass construction, metallized graphite anode, precious metal non-emitting grid construction, arc shielding, high shock interlocking construction, close and uniform grid control, low grid current, low deionization time, high frequency operation, low arc drop, high peak currents, black body heat dissipation, and automatic gettering action.

SPECIFICATIONS

Cathode:	Indirectly heated
Heater Voltage:	14 volts (AC, DC)
Heater Current:	2.5 ± .2 amperes (AC, DC)
Heating Time:	14 volts — 120 sec. min.
	28 volts — 25 sec. min. 60 sec. max.
Rated Anode Current: (Continuous)	5 amperes DC
Rated Anode Current: (Intermittent 5 min.)	7.5 amperes DC
Oscilloscope Peak Anode Current (Constantly Occurring):	60 amperes
Fault Current:	.1 microsec. 720 amperes
Peak Forward or Inverse Voltage:	500 volts
Anode Starting Voltage (DC) at grid +20:	12 volts
Arc Drop: (Wattmeter Method)	8-10.5 volts DC
Arc Drop: (DC Method)	7—9.5 volts DC
Grid voltage:	+2—12 volts DC
Grid Current (60 cps.)	5 microamperes max.
Max. Negative Grid Voltage:	100 volts AC

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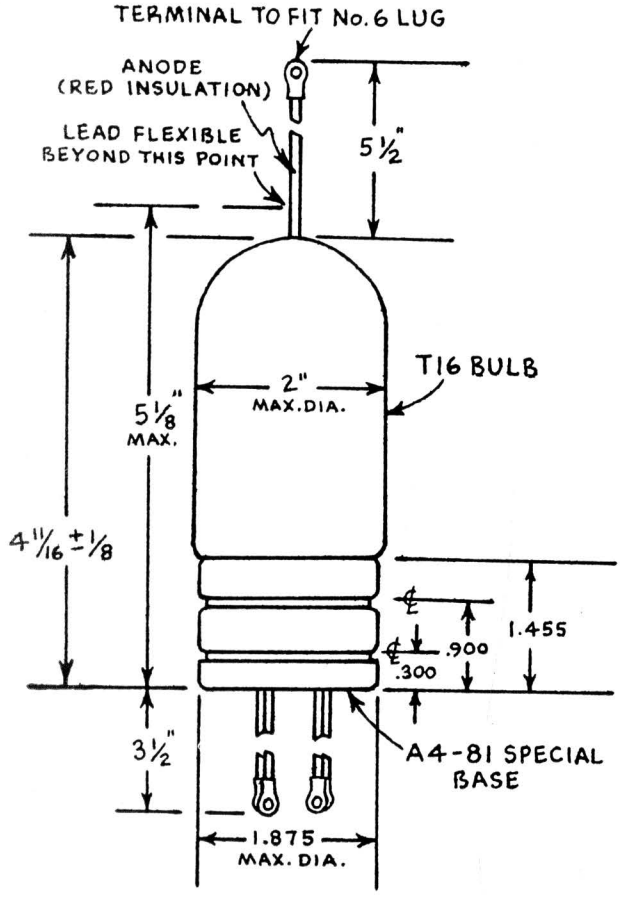
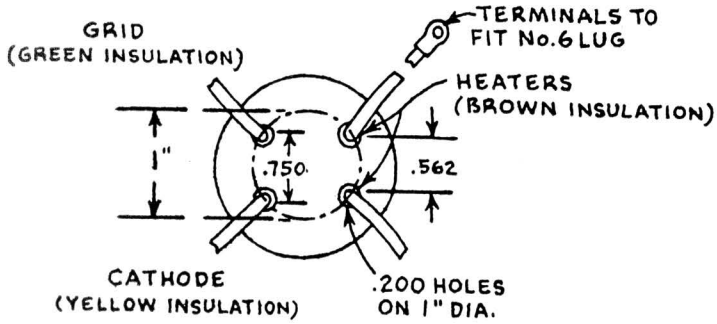
Deionization Time:	200 microsec. max.
Max. Heater Cathode Voltage:	100 volts
Grid Anode Capacitance:	Approx. 6 mmf
Grid Cathode Capacitance:	Approx. 16 mmf
Ambient Temperature Limits:	−55° to +75° C.
*Max. Frequency: (At Reduced Ratings)	1250 cps.
Vibration: (Continuously varied)	.04 amplitude 10—15 cps.
Max. Shock:	200 g.

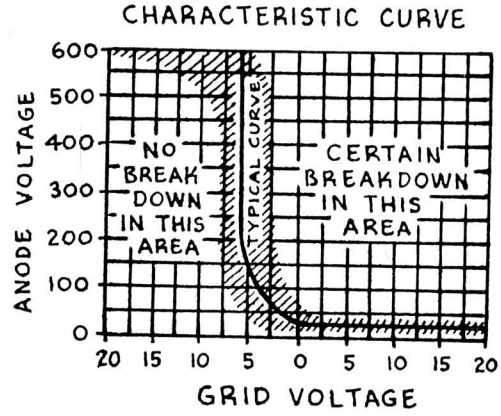
* At higher frequencies, or high voltage inductive load applications where initial inverse voltage is suddenly applied, a cushion circuit (condenser and resistor across tubes) should be included in circuit for long life expectancy.



WEIGHT 5½ OUNCES



BOTTOM VIEW OF BASE



CONNECTIONS

HEATERS: Brown Insulation, 3½" flexible leads, Closed lugs for No. 6 studs

GRID: Green Insulation, 3½" flexible lead, Closed lug for No. 6 stud

CATHODE. Yellow Insulation, 3½" flexible lead, Closed lug for No. 6 stud

ANODE: Red Insulation, 5½" flexible lead, Closed lug for No. 6 stud.

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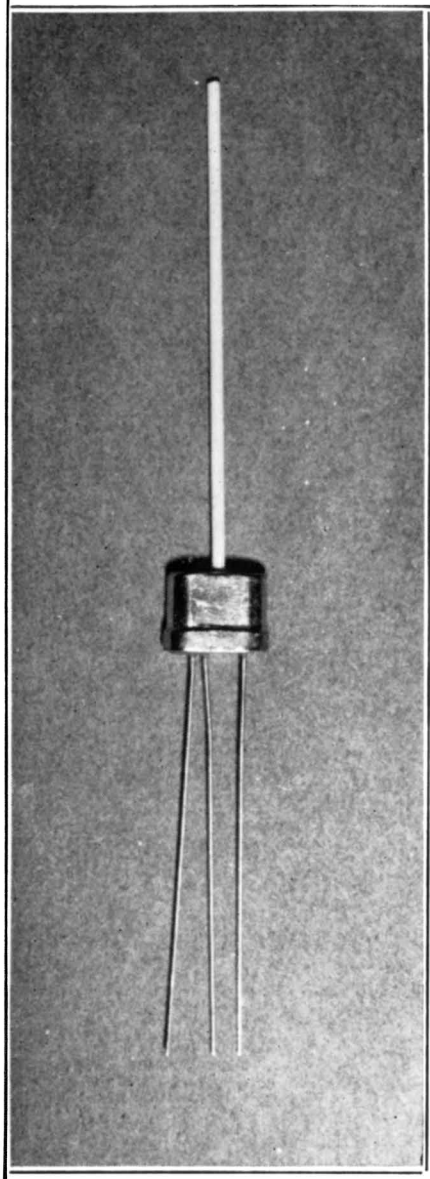

VTP MINIATURE THERMOCOUPLE

VTP 1-CH-CO-2

The VTP 1-CH-CO-2 Miniature Thermocouple is now made available to supply the long felt need for measuring very fast temperature changes. Its extremely fast reaction time and accurate indication of temperature changes makes it now possible to pinpoint primary sources of heat in packaged electronic components. The unit is made in a size suitable for mounting adjacent to such electronic components as tubes, transformers and resistors, or other heat generating components of radar or missile guidance systems.

Response time	Less than 1/4 second
Usable indicated temperature range	−100°C to +800°C
Ceramic support tube	1/16" Diameter, 1 7/8" Long
Thermocouple wires	.001" Diameter

Transistor type base is used to provide ease of mounting and polarity indication.

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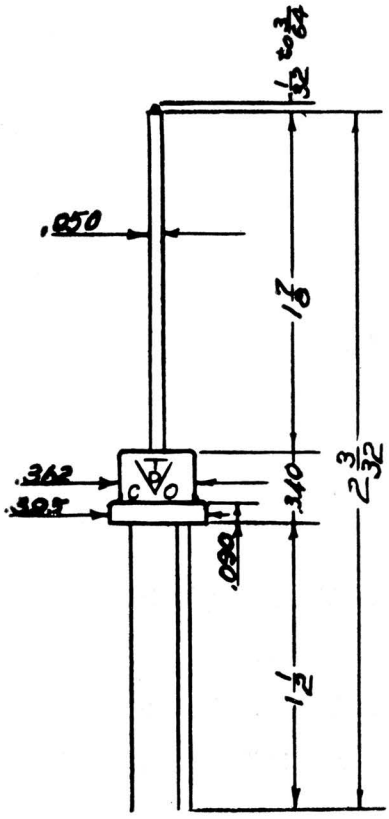
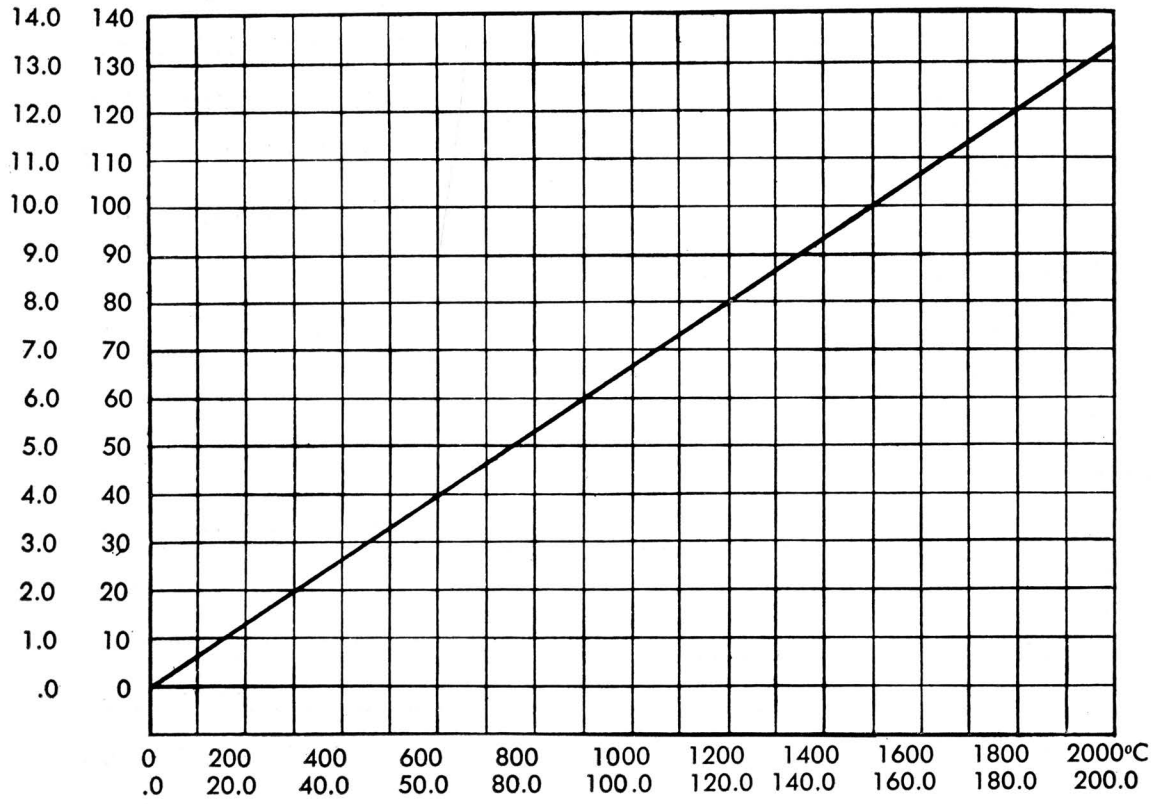
VTP MINIATURE THERMOCOUPLE
VTP 1-CH-CO-2



	Chromel P	Cupron Constantan
Composition percent	90 Ni 10Cr	55 Cu 45Ni
Range of application, °C.	0 to 1100	
Resistivity, micro—ohm—C.M.	70	49
Temperature coefficient of resistivity, °C.	.00035	.0002
Melting temperature, °C.	1400	1190
EMF in MV reference junction at 0 °C.	100°C	6.3MV
	200	13.3
	400	28.5
	600	44.3
Influence of temperature and gas atmosphere	Chromel attacked by sulphurous atmosphere. Resistance to oxidation good. Resistance to reducing atmosphere poor.	



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2020 SHORT STREET
OCEANSIDE, CALIFORNIA
P. O. Box 810 Telephones: SAratoga 2-7648, 2-6567

VACUUM CATALOG COMPONENTS

VACUUM GAUGE CONTROLS

TC-43—THERMOCOUPLE GAUGE CONTROL

The TC-43 two-meter thermocouple vacuum gauge is a vacuum gauge control provided with both an indicating meter for the heater current, and one for the system pressure. This gauge is the ultimate in design for vacuum gauge controls operating in this range and can be used to measure pressures accurately to better than 2% when equipped with mirror scale indicating meters. (Available non-standard at extra cost. Also available in rack- mounted version.)

TC-43-CM—THERMOCOUPLE GAUGE CONTROL

The TC-43-CM is a thermocouple vacuum gauge control identical to the TC-43 except that a contact type meter is provided for the pressure indication. The contacts on this meter may be set at any desired point within the instrument's range and an external circuit may be actuated when the pressure arrives at the set position. Connections are available at the rear of the chassis for connection to the external controls.

TC-43-1—THERMOCOUPLE GAUGE CONTROL

The TC-43-1 is a two-meter selectable circuit thermocouple vacuum gauge control similar to the TC-43 except that gauge tubes are connected to the control through an 11-pin socket. A selector switch is provided, connecting any one of four gauge tubes to the indicating meter, thereby allowing the operator to measure pressure selectively at any one of four measuring points.

TC-43-1-CM—THERMOCOUPLE GAUGE CONTROL

The TC-43-1-CM is a two-meter selectable circuit thermocouple vacuum gauge control using a contact meter for the indicating instrument. It is identical to the TC-43-1 except for the indicating meter and has the feature of allowing the operation of external controls from the contact actuation on this meter. Terminals are provided at the rear of the chassis for the control of external circuits. No provision is made for allowing the meter to control any system except the one gauge tube selected at any one time.

TC-43-2—THERMOCOUPLE GAUGE CONTROL

The TC-43-2 two-meter dual gauge thermocouple gauge control is a vacuum gauge control similar to the TC-43 except that a switch is provided to use either one of two gauge tubes, thereby allowing measurements of either fore-vacuum or fine-vacuum, by means of a single control.

TC-43-2-CM—THERMOCOUPLE GAUGE CONTROL

The TC-43-2-CM two-meter dual gauge thermocouple control is identical to the TC-43-2 except for the installation of a contact meter and its associated wiring. This gauge control finds use in the protection of diffusion pump systems when the gauge control is set to provide for lock-out of heater circuits above certain pressures, yet contains the feature of being able to monitor both fore-vacuum and fine-vacuum.

VACUUM CATALOG COMPONENTS

VACUUM GAUGE CONTROLS (Continued)

TC-43-3—THERMOCOUPLE GAUGE CONTROL

The TC-43-3 is a miniature single meter thermocouple vacuum gauge utilizing the same meter for checking heater current and pressure readings. The unit has been designed as a miniature version allowing for its use in numerous positions on either stationary or rotating vacuum equipment. These gauges find application on automatic systems where they may be used to measure backing pump pressures, thereby indicating diffusion pump through-put and either leaking or out-gassing in the high vacuum system, eliminating the undependability of ion type gauges for measurement of fine vacuum on high speed vacuum systems.

TC-43-3-CM—THERMOCOUPLE GAUGE CONTROL

The TC-43-3-CM is a miniature vacuum gauge control identical to the TC-43-3 except that a contact type meter has been provided to allow for the interlocking of vacuum systems and the protection of delicate items against sudden pressure increases.

VTP-3-147—COMBINATION IONIZATION AND THERMOCOUPLE GAUGE CONTROL

The VTP-3-147 is a laboratory model ionization gauge with dual thermocouple gauge control. It is provided with many features to make it the ultimate in a fine laboratory instrument. It is the only gauge control manufactured to date incorporating such features as self-calibration, change in gauge sensitivity to match any type available ionization gauge, calibration of ionization gauge sensitivity, and isolation amplifiers with highly insulated input circuits insuring against freedom of drifts throughout extended periods of operation.

VTP-3-147-CM—COMBINATION IONIZATION AND THERMOCOUPLE GAUGE CONTROL

The VTP-3-147-CM is a laboratory model ionization gauge control with a dual thermocouple control and a contact meter provided on the thermocouple gauge section. The contact meter is wired such as to allow the use of the contact points for the control of an external circuit and is frequently used to allow for safety start-ups, allowing equipment to be turned on whenever the fore vacuum has arrived at a low enough pressure to activate the contacts of the meter. The contact meter may be set at any desired value within its range.

PGC-25-01—DUAL RANGE PHILIPS GAUGE CONTROL

The PGC-25-01 is a Philips gauge control covering two ranges from 25 microns to .1 micron, and .11 microns to .01 microns. This gauge control is simple, reliable, and rugged, and is used with the PG-25 (Philips) gauge, cold discharge tube, to measure pressure in systems where the accuracy is of secondary importance and the danger of filament burn-out of hot filament gauge tubes is of concern. The accuracy of this gauge is dependent upon the accuracy of line voltage, and if this is of importance, line voltage stabilizers should be used in conjunction with the PGC-25-01.

P-40-41—PIRANI GAUGE CONTROL

The P-40-41 is a Pirani gauge control to allow the operation of either the Type VTP-6440 or VTP-6441 Pirani vacuum gauges. The combination of the P-40-41 and the Pirani vacuum gauge tubes is a rugged, reliable, vacuum measuring system having fast response and one that is completely inert to radioactive material that may contaminate some vacuum systems. The gauge design is such as to provide for reproducible readings to an accuracy of better than 5%.

VTP-43-01—COMBINATION THERMOCOUPLE AND PHILIPS GAUGE CONTROL

The VTP-43-01 is a single thermocouple gauge control and a PGC-25-01 Philips gauge control in combination in one cabinet. This combination allows for the measurement of both fore-vacuum and fine-vacuum at the same time, and is the simplest and least expensive combination type gauge control suitable for this purpose.

VACUUM CATALOG COMPONENTS

VACUUM GAUGE CONTROLS (Continued)

VTP-43-01-CM—COMBINATION THERMOCOUPLE AND PHILIPS GAUGE CONTROL

The VTP-43-01-CM is a thermocouple and PGC-25-01 Philips gauge control with a contact meter on the thermocouple gauge. The contact meter may be used as a vacuum interlock or protector for safety turn-off of heating elements or similar devices due to unexpected pressure increases.

PGC-350-03—PHILIPS GAUGE CONTROL

The PGC-350-03 Philips gauge control is a unit operating over a continuous range from 350 to .03 microns. This unit is designed so that switching is unnecessary to cover this wide range. The meter will proceed from atmosphere through 350 microns to approximately 20 microns, at the top of the scale, then an indicating light will change, and the meter will start to decrease and proceed in the direction of the .03 micron point as the pressure is lowered. While the gauge is sufficiently accurate for most general vacuum use, its accuracy is inferior to the PGC-25-01. This gauge control cannot be supplied with a contact meter since its design is such that the meter indicates in both directions, and it does not directly distinguish, except by means of indicating lights, whether its progress is to the right or to the left.

500-7—FOUR RANGE PHILIPS GAUGE CONTROL

The 500-7 is a Philips gauge control faving four ranges covering the pressure range from 500 microns to 10^{-7} millimeters. This gauge is the most accurate of any cold cathode type discharge gauge control available and approaches the accuracy of the hot filament type gauges due to the incorporation of regulator and amplifier circuits. A particular feature of this gauge control is the broad spread of the meter readings, allowing an operator to accurately measure in a specified segment of the vacuum spectrum.

500-7-CM—FOUR RANGE PHILIPS GAUGE CONTROL

The 500-7-CM is a Philips gauge control with four ranges covering 500 microns to 10^{-7} millimeters and containing a contact type meter. This gauge control is identical to the 500-7 with the exception of the contact meter.

243-5007—COMBINATION THERMOCOUPLE AND PHILIPS GAUGE CONTROL

The 243-5007 is a dual thermocouple and Philips gauge control having a range covering 1000 microns to 10^{-7} millimeters. This gauge control is a unit allowing for the use of a thermocouple gauge tube in both the rough and fine vacuum systems and having the PG-25 gauge tube in the fine vacuum system. This is a most desirable vacuum gauge control combination wherein none of the components will be damaged by continuous or repetitive exposure to either vacuum or atmosphere. This unit finds application on production type vacuum systems used in the manufacture of vacuum or gas-filled electron tubes.

243-5007-CM—COMBINATION THERMOCOUPLE AND PHILIPS GAUGE CONTROL

The 243-5007-CM is a dual thermocouple and Philips gauge control with the contact meter on the thermocouple gauge section. This instrument is identical to the 243-5007 except for the incorporation of the contact meter. The meter contacts may be used for the protection of heater elements or diffusion pump oil should an abnormal increase in pressure occur in the vacuum system.

P-2-4—DUAL RANGE PIRANI GAUGE CONTROL

The P-2-4 is a dual range Pirani gauge control operating from either the VTP-6440 or VTP-6441 Pirani gauge tube. A switch is provided to broaden the range so that increased accuracy of readings may be obtained in the pressure range from 20 down to .1 micron. (This gauge is under development and not yet commerially available.)

TC-2-43—DUAL RANGE THERMOCOUPLE GAUGE CONTROL

The TC-2-43 dual range thermocouple gauge control is a gauge using the VTP-6343 thermocouple gauge tube and is designed to increase the accuracy of reading in the low micron range. (This gauge is under development and not yet available.)

VACUUM GAUGE CONTROLS (Continued)

TC-2-CCH-1—DUAL ELEMENT THERMOCOUPLE GAUGE CONTROL

The TC-2-CCH-1 is a thermocouple gauge control using a single meter and operates with the 2-CCH dual element thermocouple gauge tube. This gauge control is similar to the Type TC-43-3 except that it is designed for use only with the directly heated thermocouple gauge tubes of the dual element type.

TC-2-CCH-1-CM—DUAL ELEMENT THERMOCOUPLE GAUGE CONTROL

The TC-2-CCH-1-CM is a thermocouple gauge control identical to the TC-2-CCH-1 except for the incorporation of a contact meter. The contact meter is provided with external connections allowing for the controling of external circuits whenever the pressure arrives at the pre-selected point. External circuits may be turned either ON or OFF by means of the contact selection.

TC-3-CCH-1—TRIPLE ELEMENT THERMOCOUPLE GAUGE CONTROL

The TC-3-CCH-1 thermocouple gauge control is a single meter gauge control suitable for use of triple element, directly heated thermocouple gauge tubes. Triple element thermocouple gauge tubes are designed to minimize variations in pressure indication due to variations in ambient temperature, and this gauge control is recommended for use where extremely wide variations in atmospheric temperature are encountered. (This tube gauge control is under development and not yet available.)

TC-3-CCH-1-CM—TRIPLE ELEMENT THERMOCOUPLE GAUGE CONTROL

The TC-3-CCH-1-CM is a thermocouple gauge control with a single meter designed for use with triple element thermocouple gauge tubes and incorporates a contact meter for use in actuating external circuits due to changes in pressure. (This tube gauge control is under development and not yet available.)

TC-2-CCH-2—THERMOCOUPLE GAUGE CONTROL

The TC-2-CCH-2 thermocouple gauge control incorporates two meters and is suitable for use with a directly heated dual thermocouple gauge tube. (This gauge control is under development and not yet available.)

TC-2-CCH-2-CM—THERMOCOUPLE GAUGE CONTROL

The TC-2-CCH-2-CM is a thermocouple gauge control with two meters, one included with electrical contacts. This gauge control is designed for use with directly heated dual element thermocouples. (This gauge control is under development and not yet available.)

TC-3-CCH-2—THERMOCOUPLE GAUGE CONTROL

The TC-3-CCH-2 is a thermocouple gauge control incorporating two meters designed for use with triple element thermocouple gauge tube. (This gauge control is under development and not yet available.)

TC-3-CCH-CM—THERMOCOUPLE GAUGE CONTROL

The TC-3-CCH-CM is a thermocouple gauge control incorporating two meters with contact meter and triple thermocouples. (This gauge control is under development and not yet available.)

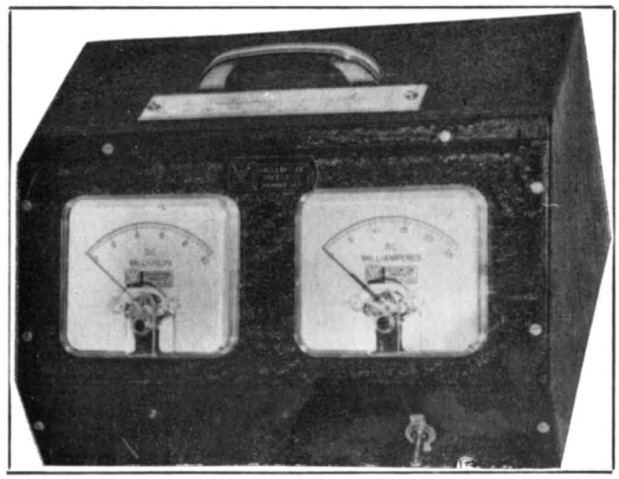
I-150-30—IONIZATION GAUGE CONTROL

The I-150-30 is an ionization gauge control for hot filament type ionization gauge tubes having a manual filament adjustment and utilizing a sensitive indicating microammeter without amplifier. This is the most inexpensive ionization gauge control available, and while it requires manual adjustment, it may be used for readings of the highest accuracy due the elimination of components capable of causing either amplifier or indicator drift.

I-150-30-CM—IONIZATION GAUGE CONTROL

The I-150-30-CM is an ionization gauge control identical to the I-150-30 except for the inclusion of the contact meter in the pressure indicating circuit. The contact meter is connected to the rear of the chassis so that either controls may be actuated when a specified pressure is reached, or alarms may be connected and sounded as the pressure increases.

PRODUCT DATA SHEET



THERMOCOUPLE

VACUUM GAUGE

The Model TC-43 Thermocouple Vacuum Gauge is designed for use with Type VTP 6343 Thermocouple Vacuum Gauge tube. The unit is housed within a sloping panel cabinet attractively finished with black wrinkle enamel. The cabinet is also provided with a hinged top for accessibility of components mounted on top of the chassis.

The TC-43 series of Vacuum Gauge controls provide the ultimate in reliability and accuracy due to the Voltage Stabilization system incorporated in the circuit. When the heater current is properly set for the individual gauge tube in use, continued accurate pressure readings may be made regardless of power line voltage fluctuations.

Front panel controls include an on-off switch, a vernier heater current adjustment, an octal socket for cable connection to the thermocouple gauge tube, an 0-10 milli-voltmeter, and an 0-25 milliammeter. These meters are specially designed with long 50-division scales for ease of reading. At the rear of the cabinet are located the power receptacle and a rough current adjustment.

A calibration chart is incorporated on each thermocouple control unit, enabling the operator to make a quick converson from millivolt output to pressure in microns. This chart is easily replaceable where special applications require the pressure measurement of gases other than air. Each control unit also contains an isolation transformer, isolating all gauges from the line voltage, thus eliminating shock or ionization hazards.

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Phone: SAratoga 2-6567

Model TC-43-1 Thermocouple Vacuum Gauge is identical to Model TC-43 as described above, with the exception that it has an 11-pin socket for cable connection to the thermocouple gauge tube, and a rotary selector switch mounted on the front panel. Model TC-43-1 is designed for use with several gauge tubes in one system, enabling the operator to monitor pressure at different locations in the system without having to make individual connections for each reading.

Model TC-43-2 Thermocouple Vacuum Gauge is identical to Model TC-43 but is provided with two octal sockets and cables for the operation of either one of two type VTP 6343 thermocouple vacuum gauge tubes.

SPECIFICATIONS

ELECTRICAL

Voltage	110 Volts
Operating Current	150 ma.
Frequency	50-60 cycles

MECHANICAL

Height	6 1/2 in.
Width	11-1/16 in.
Depth	7 1/4 in.
Weight	10 lbs.

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LPS. DEC. 57-2M

PRODUCT DATA SHEET

MODEL TC-43-3
THERMOCOUPLE VACUUM GAUGE

The Model TC-43-3 is a miniaturized version of the Model TC-43 Thermocouple Vacuum Gauge and is designed for use with the VTP-6343 Thermocouple Gauge Tube. The light weight and compact size makes it a versatile and portable instrument. It is attractively housed in a sloping panel cabinet finished in grey wrinkle enamel.

The unit has been designed for accuracy, simplicity and reliability. Although its accuracy is such that it may be used as an instrument for advanced engineering, its rugged construction and long life reliability, when used in conjunction with the VTP-6343 Thermocouple Vacuum Gauge Tube, make it especially useful for production line conditions, automatic machine installations, or in environments not particularly favorable. When the heater is properly set for the individual gauge tube in use, continued accurate pressure readings may be obtained regardless of power line voltage fluctuations.

The TC-43-3 Vacuum Gauge is a complete vacuum measuring unit when supplied with A. C. power and the gauge cord is attached to a VTP-6343 Vacuum Gauge Tube. Front panel controls include an indicating meter calibrated both in D. C. Millivolts and Microns pressure of dry air. A pilot light is installed in the lower left hand section of the panel indicating when the unit is operable. To set the calibration of the unit it is necessary only to depress the push switch on the top of the cabinet to change the scale of the meter to measure gauge tube heater current in milliamperes. Under this condition the meter has a scale of 0-20 ma. The potentiometer installed in the lower right hand corner may now be adjusted to set the heater current to the value marked on the individual gauge tube. For example: if the gauge tube has a calibrated heater current of 16 ma., the meter should read 8 on the 0-10 D. C. millivolt scale. A further check on the accuracy of this setting may be made when taking vacuum readings. Under this condition the potentiometer may be set to the zero micron point, without the switch depressed, when the pressure in the vacuum system is less than .1 microns. The use of either method of calibration will provide very accurate pressure readings over the entire scale range.

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MODEL TC-43-3

THERMOCOUPLE VACUUM GAUGE

SPECIFICATIONS

ELECTRICAL

Voltage	110 volts
Operating Current	150 ma.
Frequency	50 - 60 cycles

MECHANICAL

Height	5 1/4 inches
Width	4 1/4 inches
Depth	5 1/4 inches
Weight	3 pounds

CHARACTERISTICS

Operation	Air to high vacuum
Calibration	1-1000 micron dry air

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LPS. DEC. 1957—1M

PRODUCT DATA SHEET

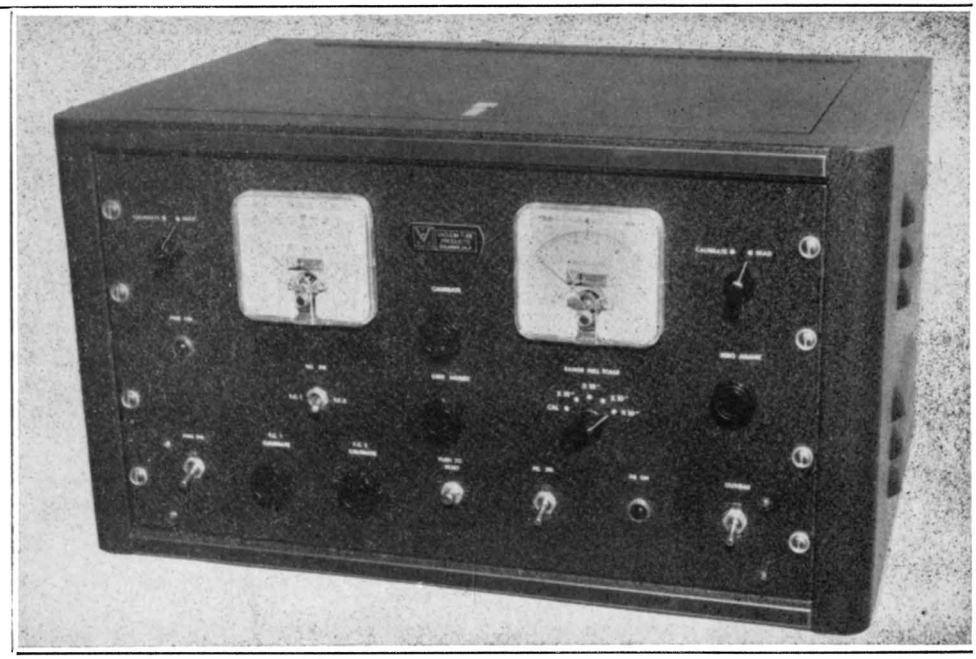
MODEL VTP 3-147

VACUUM

CONTROL

GAUGE

LABORATORY TYPE
PRECISION GAUGE



The VTP Model 3-147 Vacuum Gauge Control has been made available to fulfill the need of accurately measuring pressures in the range from 1 millimeter of Hg into the 10^{-9} range. This gauge control has been provided with all of the features capable of permitting the most exact laboratory measurements, yet it is neither so costly or complex as to make its use for production vacuum measurement difficult. The model 3-147 Vacuum Gauge Control is the result of many years of experience in manufacturing the largest line of vacuum gauge tubes in the U.S.A. and incorporates many features not found in any other units. The model 3-147 is the only gauge control available that provides for both fore vacuum and high vacuum measurement at the same time, as well as vacuum alarm protection and ionization gauge tube reference calibration.

SPECIFICATIONS

Range — Ionization Gauge:
- Maximum Pressure ..... 5 microns
- Minimum Pressure (Direct Reading) ..... 2 x 10^{-8}mm Hg
- Minimum Pressure (Extended Reading) ..... 4 x 10^{-9}mm Hg
- (Additional ranges available on special order)

Range—Thermocouple Gauge: (Two positions available)
- Maximum Pressure ..... 1000 microns
- Minimum Pressure ..... .1 micron

Physical Size ..... 12" high x 15" deep x 22" wide.
Weight ..... 40 lbs.
Power Input ..... 115 V A.C. 60 cycles, 175 watts
Cables Provided:
- Removable 115 V A.C. line cord.
- 2 Thermocouple tube connecting cables.
- (Ionization gauge tube cables are provided on order only, if required, to match the gauge tube used.)

Gauge Tubes Required:
- 2 Thermocouple tubes — type VTP 6343 (Metal) or VTP 6535 (glass)
- 1 Ionization gauge tube
  - Recommended types: VG1-A, VG-3, VG-4, NRC 507, VTP 6578
  - Useable types: RCA 1949, 1950; Westinghouse 5966; Eimac 100 IG.

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Phone: SAratoga 2-6567

MODEL VTP 3-147 VACUUM GAUGE CONTROL

SPECIAL FEATURES

All ion current circuits are insulated with polyethylene, ceramic or glass.

Ion current preamplifier isolates low current high impedance circuits prior to measurement providing freedom from erratic electrical drift and an impedance change is made before the ion current reaches any circuits wired to tube bases.

Complete voltage regulation is provided both in the thermocouple gauge section and the ionization gauge section of the instrument.

Dual meters are provided to allow continuous monitoring of both the fore vacuum and high vacuum systems.

Precision resistors and high quality components are used throughout to provide freedom from change in calibration for the life of the gauge.

Provision is made so that external Laboratory Standard meters may be used to calibrate the ion current amplifier to make the Model VTP 3-147 a secondary standard.

Provision is made to accurately check the sensitivity of the ionization gauge used thereby eliminating the possible error of the gauge tube manufacturers rating.

Provision is made to adjust instrument sensitivity to any ion gauge tube sensitivity yet maintain a direct correct range reading from the standard meter installed.

Provision is made to control external circuits such as alarms or controls from the ion gauge tube protection lock out circuit. Connections are made to the rear of the chassis providing both a normally open and a normally closed circuit as well as 115 volts A.C. at up to 3 amperes from the lock out circuit.

Vacuum protection can also be supplied in the range of 1 to 1000 microns as an extra feature if required.

Tubes Used: Total 14 tubes.

2	5Y3	Rectifiers
2	VR150	Voltage Regulators
1	VR105	Voltage Regulator
2	VR90	Voltage Regulators
1	VR75	Voltage Regulator
2	2D21	Gauge Tube Filament Regulators
1	6K5GT	Ion Current Pre-Amplifier
2	6V6GT	Indicating Meter Amplifiers
1	6J6	Lockout Relay Amplifier

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VACUUM TUBE PRODUCTS CO. INC
2020 SHORT STREET
OCEANSIDE, CALIFORNIA
P. O. Box 810 Telephones: SAratoga 2-7648, 2-6567

VACUUM CATALOG COMPONENTS

VACUUM GAUGE TUBES

VTP-6343—THERMOCOUPLE GAUGE TUBE

The VTP-6343 vacuum gauge tube is a small, rugged vacuum gauge tube operating on the principle of change in the thermal conductivity of a gas by variation in density. The tube is of all metal construction and is designed for reliable operation under continual commercial service. A particular feature of the VTP-6343 is the incorporation of very small heaters and thermocouples so that a response time is maintained below .1 of a second.

VTP-6416—THERMOCOUPLE GAUGE TUBE

The VTP-6416 is a metal thermocouple vacuum gauge tube of a medium size wherein a larger sized heater and thermocouple wire are employed allowing its use on systems not requiring extremely fast response. This tube finds application in systems having contaminating vapors. This tube may be removed from the system and cleaned internally by vigorous shaking with solvents enclosed. The tube will then respond to its original calibration curve if the elements are undamaged by the contamination.

VTP-6440, VTP-6441—PIRANI GAUGE TUBES

The VTP-6440 and VTP-6441 are metal enclosed Pirani vacuum gauge tubes working on the principle of change in thermal conductivity of the residual gas due to changes in gas density. These two tube types are identical in internal construction and operation and vary only in their means of connection to a vacuum system. The VTP-6440 is provided with a $\frac{1}{8}$" pipe thread connection whereas the VTP-6441 uses a non-threaded ½" tubulation suitable for connection to the vacuum system by means of a port couple. The metal shell of these Pirani tubes satisfactorily shields the internal element from external radiations and the sensitivity, or accuracy, is relatively unaffected by changes in ambient temperature.

VTP-6535—GLASS THERMOCOUPLE GAUGE TUBE

The VTP-6535 vacuum gauge tube is an all glass tube with an internal structure similar to that used in the VTP-6343 tube. The construction of the VTP-6535 allows its use either by direct sealing of the pyrex connecting tube to an all glass vacuum system or coupling either to a glass or metal system by means of a port couple.

VTP-6536—GLASS THERMOCOUPLE GAUGE TUBE

The VTP-6536 vacuum gauge tube is an all glass tube with an internal structure identical to that used in the VTP-6416 tube. The construction of the VTP-6536 allows its use either by direct sealing of the pyrex connecting tube to an all glass vacuum system or coupling to either a glass or metal system by means of a port couple.

VTP-6578—IONIZATION GAUGE TUBE

The VTP-6578 is a flange type three-filament ionization gauge tube. This tube is provided with a flange and gasket groove allowing its use on vacuum systems requiring long periods of operation . Three filaments are provided to maintain operation of the system whether or not any single filament burns out due to excess life, or due to the release of some corrosive gas within the vacuum system while the tube is in operation. Connections are provided to out-gas the grid structure by passing current through the grid element. The collector element is a single rod having a minimum cross-sectional area allowing most accurate readings of the gauge and a minimum release of absorbed gas due to the ion bombardment.

VTP-6579—THERMISTOR GAUGE TUBE

The VTP-6579 is a thermistor vacuum gauge operating on the principle of the thermal conductivity of the gaseous atmosphere. A rugged heater is provided to operate as the heating element whose temperature is measured by the thermistor. The output of the thermistor will be noted as a change in resistance and is of such a value as to operate directly into a vacuum tube amplifier circuit. This type of gauge provides a resistance change from apporximately 82,000 ohms to 22,000 ohms. It must be noted that due to the nature of this type gauge tube, its accuracy is notas good as the thermocouple or Pirani type gauge tubes, but its primary advantage is in its ability to operate directly into vacuum tube circuits.

VACUUM GAUGE TUBES (Continued)

VTP-6770—THERMISTOR GAUGE TUBE

The VTP-6770 is a thermistor vacuum gauge operating on the principle of the thermal conductivity of the gaseous atmosphere. A rugged heater is provided to operate as the heating element whose temperature is measured by the thermistor. The output of the thermistor will be noted as a change in resistance and is of such a value as to operate directly into a vacuum tube amplifier circuit. This type of gauge provides a resistance change from approximately 750 ohms to 450 ohms. It must be noted that due to the nature of this type gauge tube, its accuracy is not as good as the thermocouple or Pirani type gauge tubes, but its primary advantage is in its ability to operate directly into vacuum tube circuits.

VG-3—IONIZATION GAUGE TUBE

The VG-3 glass triode ion gauge is a hot filament type of gauge tube suitable for use with ionization gauge controls where all glass tubes are required. It is provided with a kovar sealing glass envelope and may be sealed directly to all glass systems utilizing either 7052 glass, or 7040 glass, or may be coupled to either metal or glass systems by means of a port couple. The VG-3 glass tube is made with elements of pure metal and maintains its accuracy throughout life.

VG-4—IONIZATION GAUGE TUBE

The VG-4 single filament metal flange ionization tube is a triode type ionization gauge with elements of the conventional design, but with mechanical construction such that it may be placed on a flanged fitting and measure true pressures within large vessels. A teflon gasket is provided so that the gauge will measure true pressure to the highest vacuum ranges.

PG-25—PHILIPS GAUGE TUBE

The PG-25 (Philips) gauge tube is a cold discharge type provided with an internal, specially designed, loop element inserted in a flat-sided metal container. This gauge tube is of a demountable design so that it may be dismounted for cleaning should it be operated for extended periods of time in contaminating atmospheres. It is provided with removable magnets and pole pieces so that cleaning is simplified and magnetic metals may be removed should they accidentally enter the tubulation. A special feature of this gauge tube is its internal gap which insures against false readings of the gauge tube and, at all times, passing highest currents at highest pressures.

VTP-2-CCH—THERMOCOUPLE GAUGE TUBE

The VTP-2-CCH is a dual element, directly heated thermocouple vacuum gauge tube. This tube is of all metal construction and is made in the minimum size, providing for rugged usage in commercial service and relatively fast response. While the calibration curve is different from that of the Type VTP-6343, it finds application where less expensive gauge tubes are required. It will not operate interchangeably with the VTP-6343, but requires a specially designed gauge control.

VG-1A—IONIZATION GAUGE TUBE

The VG-1A is a triode type ion gauge tube of the hot filament type made entirely of pyrex glass and incorporating a platinized collector fused directly to the outer glass envelope. While the accuracy of this gauge tube is not as good as the other types, it does have the advantage of being able to be fused directly to an all glass vacuum system and baked out during a system evacuation. It may be sealed directly to pyrex glass systems or connected to either glass or metal vacuum systems by means of a port couple.

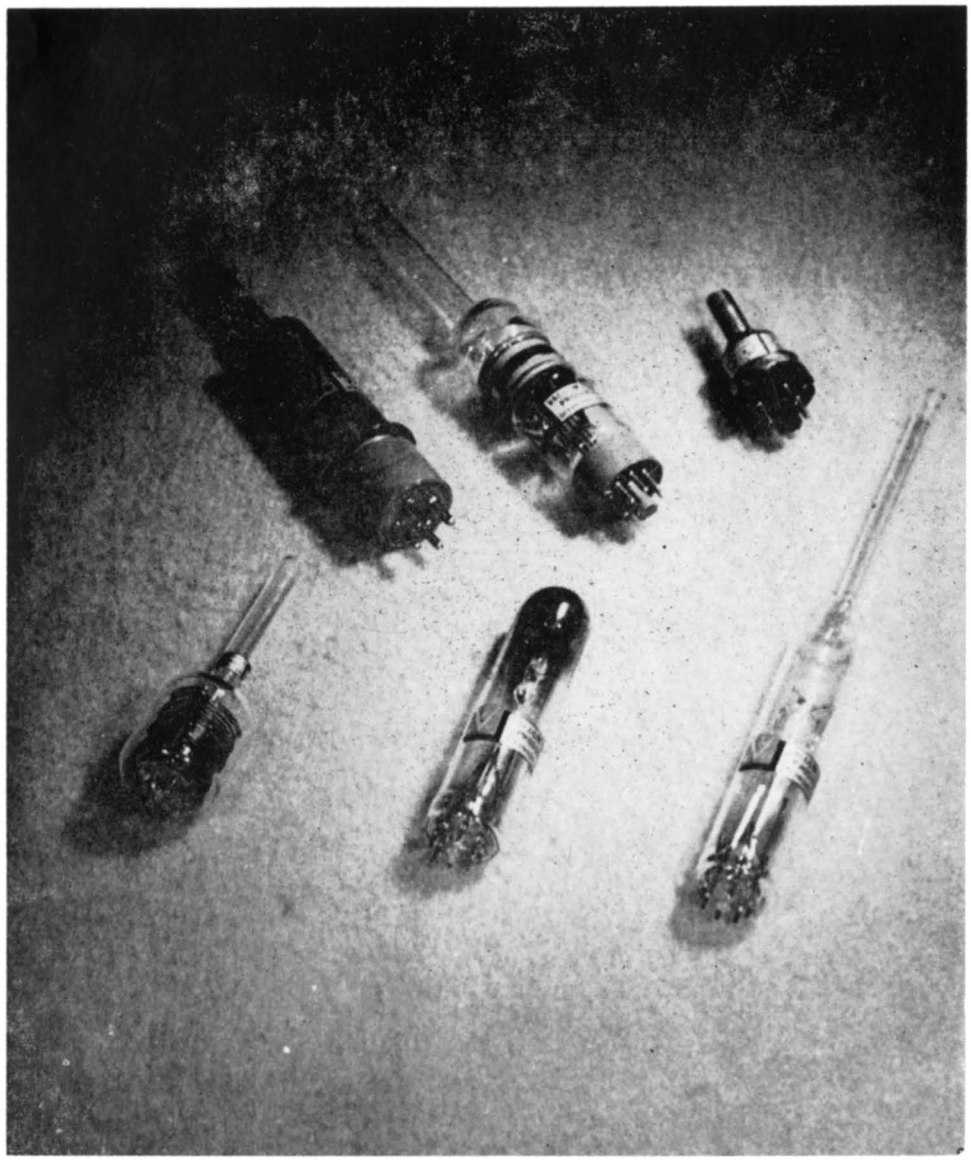
VTP-7169 IONIZATION GAUGE TUBE

The VTP-7169 is an ionization gauge tube of the hot filament type suitable for measuring pressure from the 10^{-3} to the 10^{-9} region. It is provided with three filaments capable of being used either separately or collectively, allowing for either extra long life or higher gauge sensitivity when using higher electron currents to the grid. The VTP-7169 has a sensitivity of 60 microamperes per micron when using 5 milliamperes grid current. This tube has a heavy grid mounted like a filament and the gauge tube may be outgassed by passing current directly through the grid wire either as a separate outgassing operation, or while the tube is reading vacuum system pressure.

VTP-7170 IONIZATION GAUGE TUBE

The VTP-7170 is an ionization gauge tube of the hot filament type suitable for measuring pressure from the 10^{-3} to the 10^{-9} region. It is provided with three filaments capable of being used either separately or collectively, allowing for either extra long life or higher gauge sensitivity when using higher electron currents to the grid. The VTP-7170 has a sensitivity of 50 microamperes per micron when using 5 milliamperes grid current. This tube has a fine wire molybdenum grid heavily gold plated to minimize contamination due to chemical action. Outgassing is accomplished by D.C. bombardment of the grid by passing electron current to it from a 200 to 400 Volt source.

PRODUCT DATA SHEET



Vacuum Gauges

VACUUM TUBE PRODUCTS CO. INC.

2020 SHORT STREET - OCEANSIDE, CALIFORNIA

Phone: SAratoga 2-7648 - Post Office Box 810
Phone: SAratoga 2-6567

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PRODUCT DATA SHEET

THERMOCOUPLE VACUUM GAUGE TUBE

Type VTP 6343

The VTP 6343 is a vacuum gauge tube of the thermocouple type used for measuring pressures in the range of .1 to 1000 microns. The VTP 6343 is a thermal conductivity gauge that provides an output E.M.F. determined by the operating current and the heat conductivity of the residual gas. A reliable pressure reading is obtained when the heater is supplied from a stabilized source.

The VTP 6343 is of all metal construction and is assembled by projection welding methods. The internal structure is ruggedized by design and is assembled by special fusing techniques, providing excellent sensitivity and very fast response.

Due to the speed of detecting changes in pressures, the VTP 6343 finds use in leak detecting as well as absolute pressure measuring. Vacuum systems may be probed with materials such as acetone to detect leaks due to the variation of thermal conductivity between acetone and air. When leaks are encountered the VTP 6343 will detect the vapor, and a decrease in output E.M.F. can be measured due to the acetone entering the system.

OPERATING CHARACTERISTICS

Heater Current Normal (Note 1)	Approx. 17.0 ma.
Heater Current Maximum (Note 3)	100 ma.
Heater Resistance (Cold) Nominal	8½ ohms
Heater Resistance (Hot) Nominal	18 ohms
Heater to Thermocouple Resistance (Note 2)	Less than 100 ohms
Thermocouple Output — with 55 ohm Load (Meter Internal Resistance)	
Hard Vacuum	10 Millivolts
Air	.1 Millivolts
Thermocouple Resistance (Cold)	8½ ohms
Speed of Response	Faster than .1 second
Basing	RETMA 8FR

Pin No.	1	3	5	7
Element	Heater	Neg. Thermocouple	Pos. Thermocouple	Heater

Note 1: While either A.C. or D.C. may be used, D.C. is recommended due to availability of less expensive and more accurate meters in this range. All gauge tubes are individually calibrated and marked with the heater current required to provide 10 millivolts output across 55 ohms when the gauge is under hard vacuum.

Note 2: While the heater and the thermocouple are in direct contact to provide maximum speed of response, use of this electrical circuit is not recommended unless the current is maintained below 50 μa.

Note 3: The heater may be operated at such a current and absolute pressure that the thermocouple output does not exceed 10 millivolts across a 55 ohm load. The internal elements will then remain below 200° C.

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2020 SHORT STREET - OCEANSIDE, CALIFORNIA

Phone: SAratoga 2-7648
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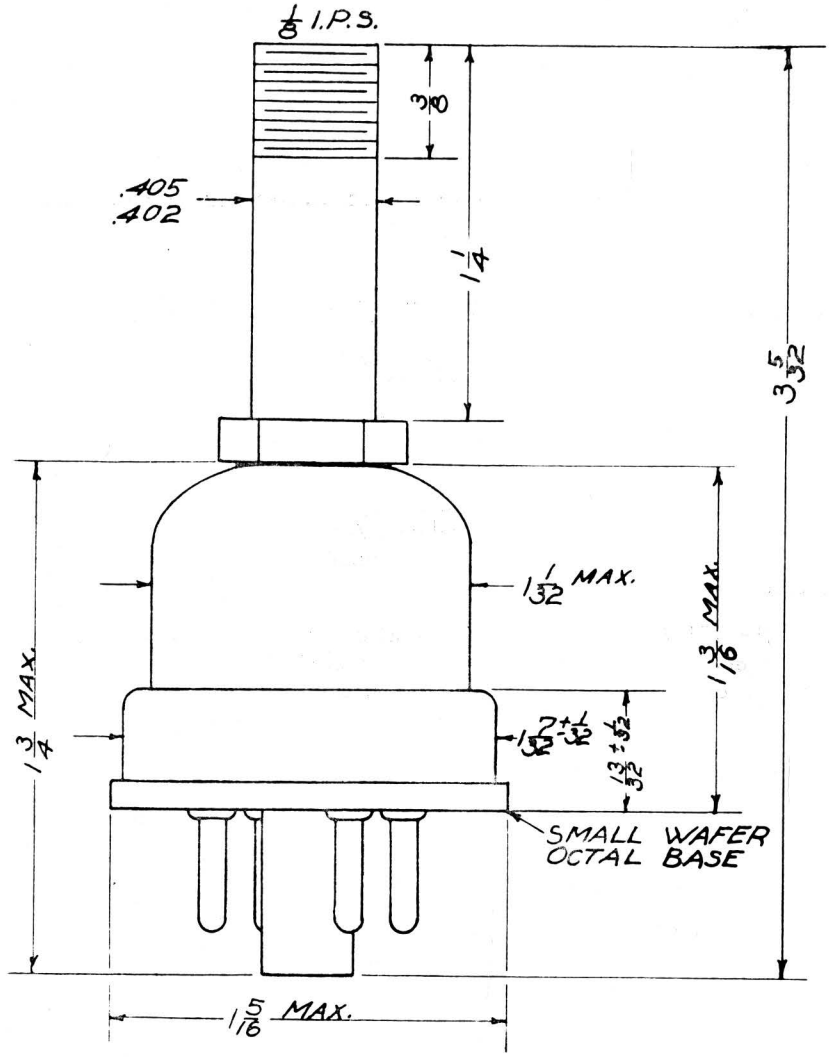
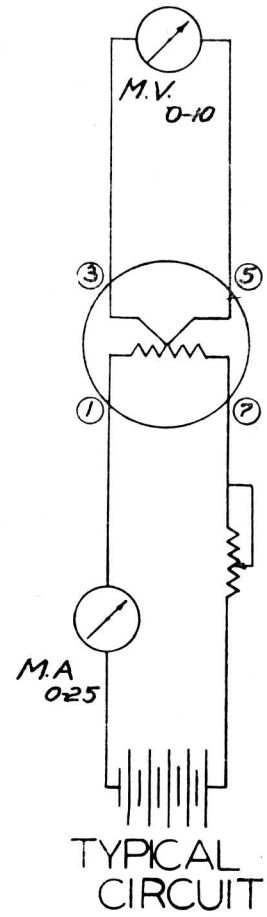
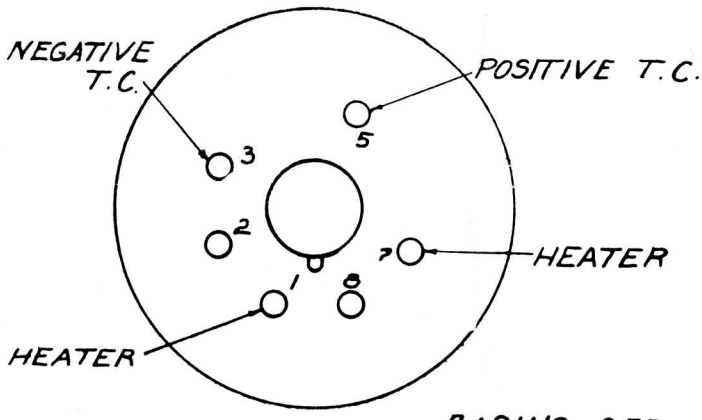
Post Office Box 810



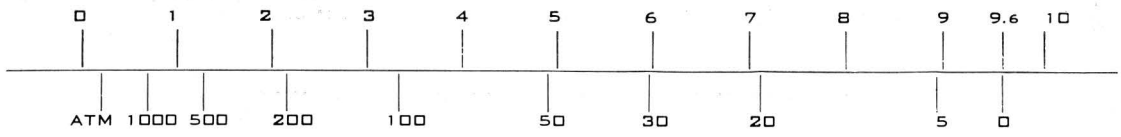


TYPICAL CIRCUIT



BASING 8FR

Typical Calibration Curve
Meter Millivolts



Pressure (Microns)

VACUUM TUBE PRODUCTS CO INC. 2020 Short Street, Oceanside, California

PRODUCT DATA SHEET

THERMOCOUPLE VACUUM GAUGE TUBE
Type VTP 6416

The VTP 6416 is a vacuum gauge tube of the thermocouple type, used for measuring pressures in the range of .1 to 1000 microns. The VTP 6416 is a thermal conductivity gauge that provides an output E.M.F. determined by the operating current and the heat conductivity of the residual gas. A reliable pressure reading is obtained when the heater is supplied from a stabilized source.

The VTP 6416 is of all metal construction and is assembled by projection welding methods. The internal structure is designed for maximum ruggedness, and all connections are electrically welded. This tube may be operated indefinitely at air pressure without damage to either the heater or thermocouple.

The VTP 6416 finds use in fore vacuum monitoring on large systems such as cyclotrons and accelerators, where a long pumping cycle is common and long life rather than response speed is the prime requirement.

OPERATING CHARACTERISTICS

Heater Current Normal (Note 1)	Approx. 600 ma.
Heater Current Maximum	1000 ma.
Heater Resistance (Cold) Nominal	.2 ohms
Heater Resistance (Hot) Nominal	.25 ohms
Heater to Thermocouple Resistance (Note 2)	0
Thermocouple Output — with 55 ohm Load (Meter Internal Resistance)	
Hard Vacuum	10 Millivolts
Air	1.0 Millivolts
Thermocouple Resistance (Cold)	3½ ohms
Speed of Response	Approx. 15 seconds
Basing	RETMA 8FS

Pin No.	1	3	5	7
Element	Heater	Neg. Thermocouple	Heater	Pos. Thermocouple

Note 1: Whiie either A.C. or D.C. may be used, A.C. is recommended due to ease of supply adjustment from a variable transformer. All gauge tubes are individually calibrated and marked with the heater current required to provide 10 millivolts output across 55 ohms when the gauge is under hard vacuum.

Note 2: Heater and thermocouple are electrically welded together at the thermocouple junction.

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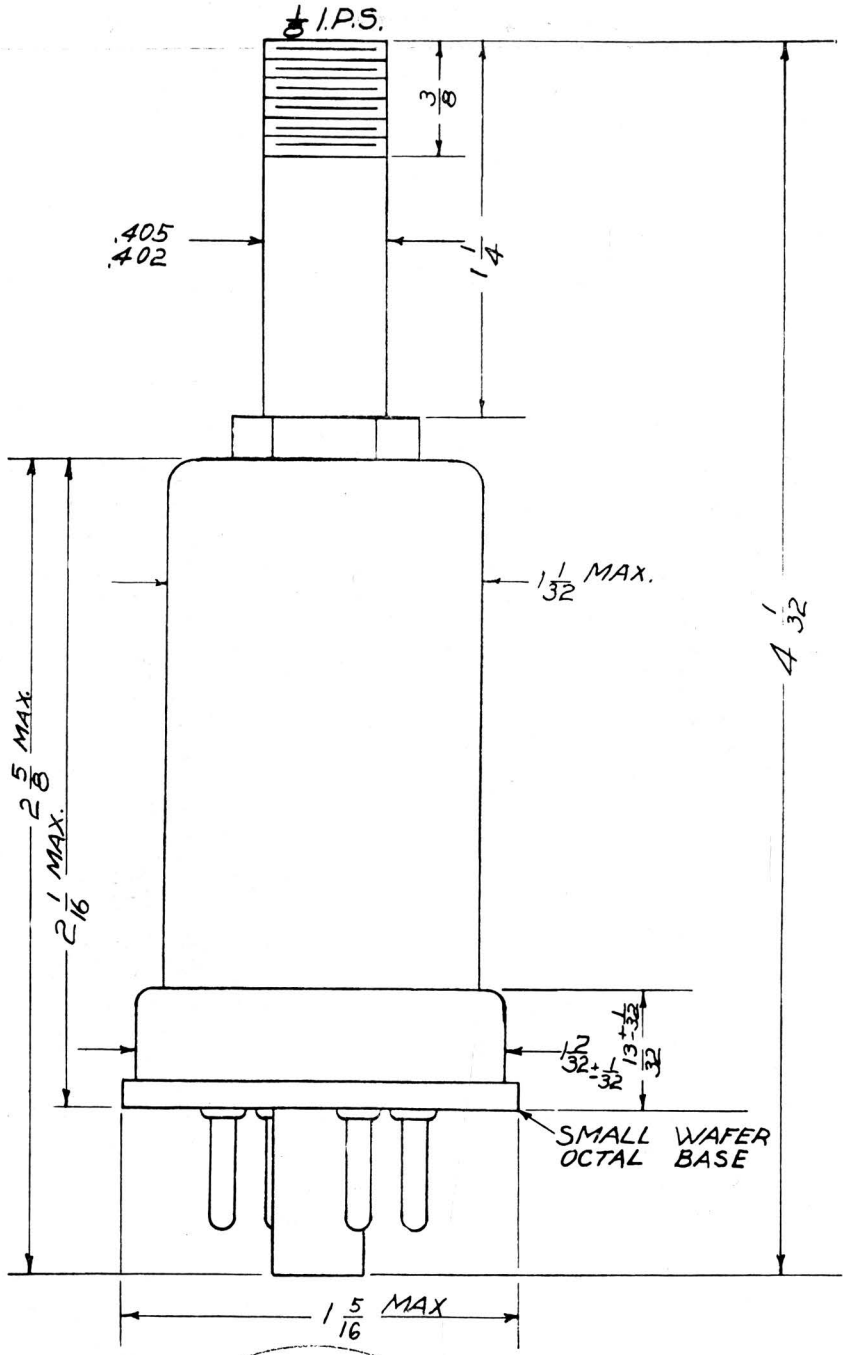
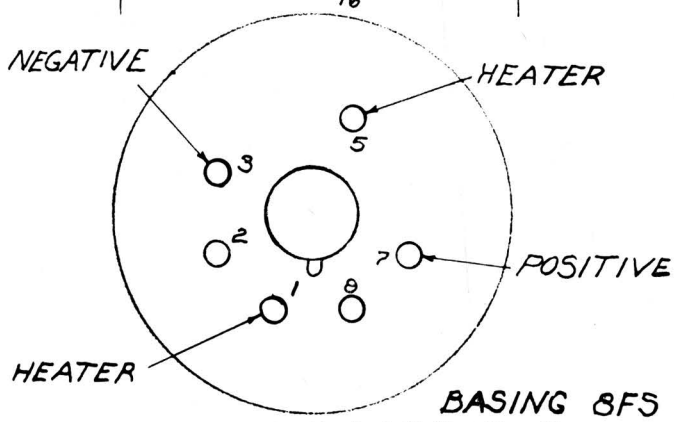
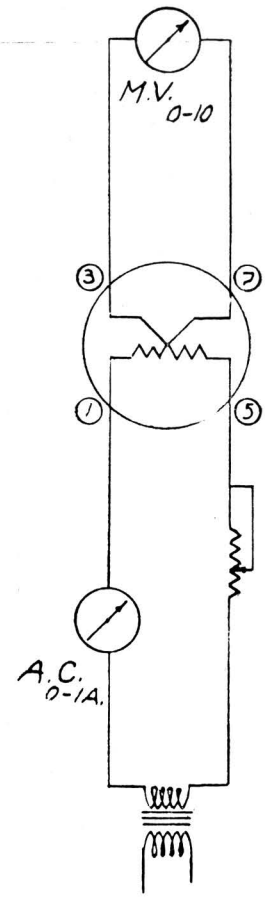
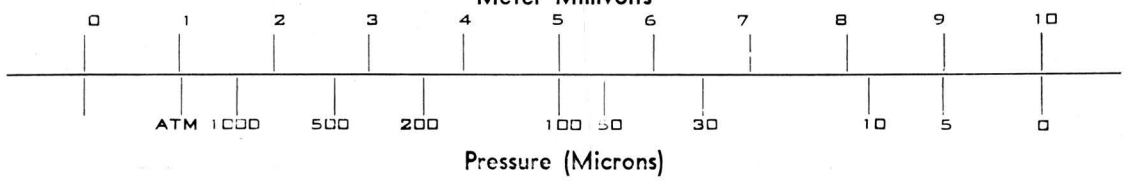




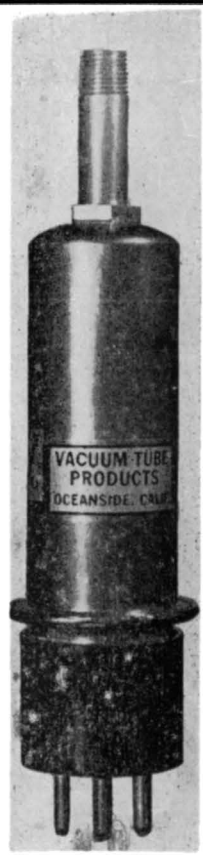
BASING 8FS



Typical Calibration Curve



PRODUCT DATA SHEET



PIRANI VACUUM GAUGE TUBES

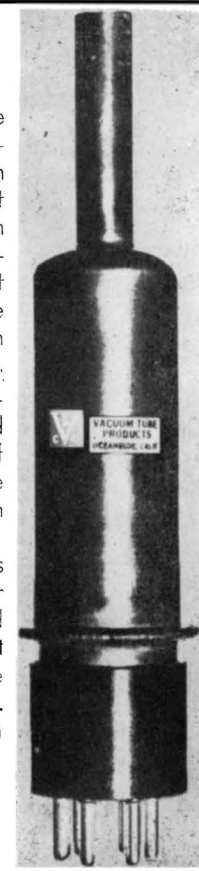
VTP 6440 **VTP 6441**

Pirani Vacuum Gauge Tubes, Type 6440 and 6441, are tubes of the thermal conductivity type and are used for measurement of pressures in the range of .1 to 5000 microns. Both tube types are electrically identical and vary only in the exhaust tube structure. Type VTP 6440 uses an exhaust tube connection of approximately .4" diameter, with ⅛" pipe threads, for attachment to the vacuum system. Type VTP 6441 uses an exhaust tube connection of .5" O.D., suitable for connection with the system by means of either a rubber hose or a compression fitting.

These VTP Pirani tubes are designed for extreme ruggedness and versatility, having the features of an all-metal welded construction and platinum filament with a high coefficient of thermal resistivity. Dual filaments are incorporated to provide double output and increased sensitivity when operating each filament in opposite legs of a Wheatstone bridge circuit.

Due to the all-metal construction, these VTP Pirani tubes are relatively non-sensitive to radiant heat from open flames or glow coils and compensating tubes are not normally used such as required when using glass type pirani tubes. Ambient temperature variations normally do not unduly affect the gauge calibration due to the low sensitivity in this temperature range.

The platinum ribbon structure used in the VTP 6440 and VTP 6441 provides extremely fast response to pressure changes and operation at air pressure for indefinite periods will not damage the tube or change its calibration.



OPERATING CHARACTERISTICS

Heater Resistance Cold, Zero Current:
- Heater #1 (Pins #1 and #3) ..... 37½ ohms
- Heater # 2 (Pins #4 and #6) ..... 37½ ohms

Heater Resistance Hot, with 100 ma. Current in air (Note 1):
- Heater # 1 (Pins #1 and #3) ..... 42 ohms
- Heater #2 (Pins #4 and #6) ..... 42 ohms

Heater Resistance Hot, with 100 ma. Current in Hard Vacuum (Note 1):
- Heater #1 (Pins #1 and #3) ..... 60 ohms
- Heater #2 (Pins #4 and #6) ..... 60 ohms

Heater Resistance Characteristics:

Heater Current	Resistance in Air	Resistance in Hard Vacuum
0 ma.	37.5 ohms	37.5 ohms
50 ma.	38 ohms	39 ohms
100 ma.	42 ohms	60 ohms
150 ma.	43 ohms	78 ohms
200 ma.	54 ohms	81 ohms
250 ma.	57 ohms	83 ohms
300 ma.	60 ohms	84 ohms

Heater Current Normal ..... 100 ma.
Heater Current Maximum ..... 300 ma.
Heater Voltage (Note 2) ..... 10 volts
Speed of Response ..... 600 Milliseconds
Basing ..... RETMA 6CQ

Pin No.	1	2	3	4	5	6
Element	Htr. #1	Gnd.	Htr. #1	Htr. #2	Gnd.	Htr. #2

Note 1: Heater resistance is dependent upon circuit use and absolute pressure. Data is supplied for 100 ma. current inasmuch as these values are obtained when using the recommended circuit.

Note 2: Heater voltage is dependent upon circuit use and value specified is that used in recommended circuit.

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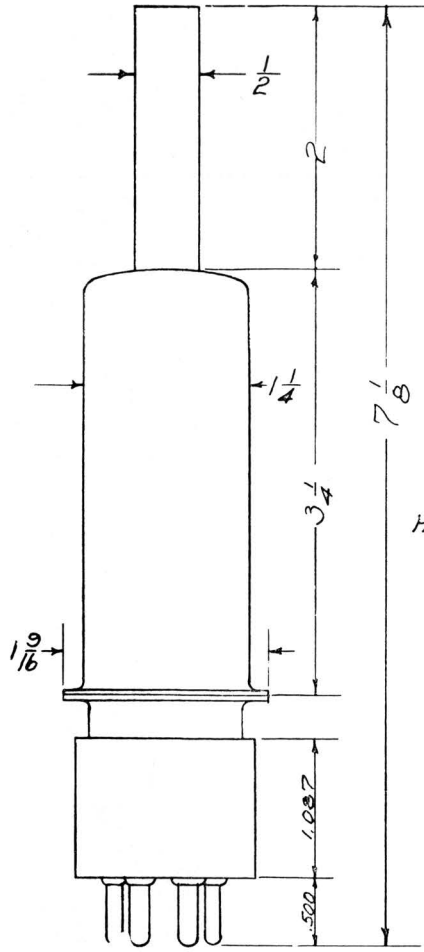
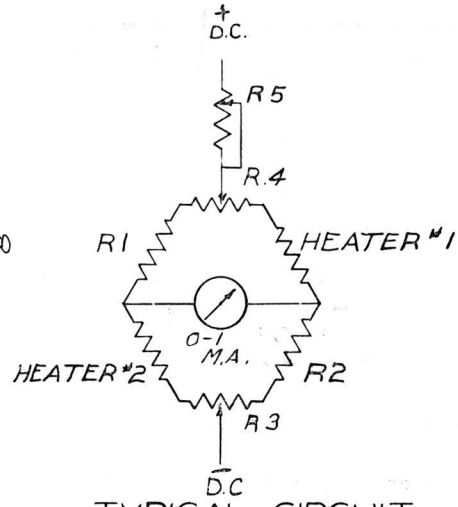
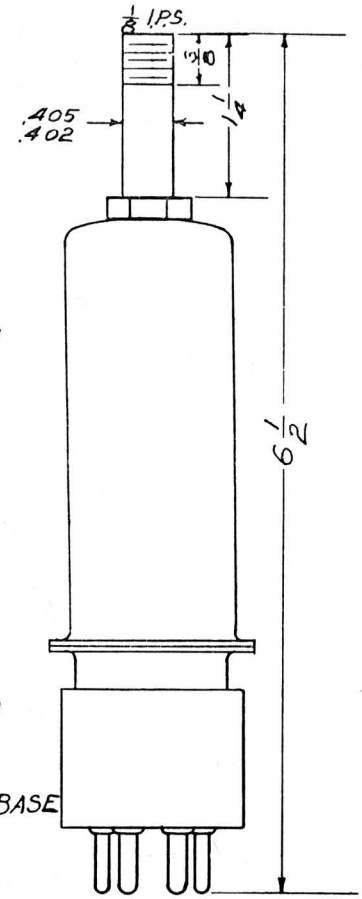


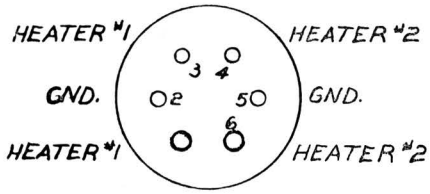


TYPICAL CIRCUIT

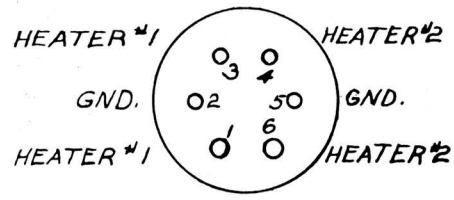
R1-R2	50 OHMS
R3-R4	.5 OHMS
R5	AS REQUIRED
D.C	10 VOLTS

MEDIUM SHELL REGULAR BASE



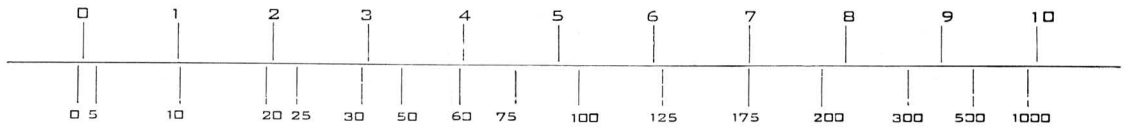


BASING 6CQ



BASING 6CQ

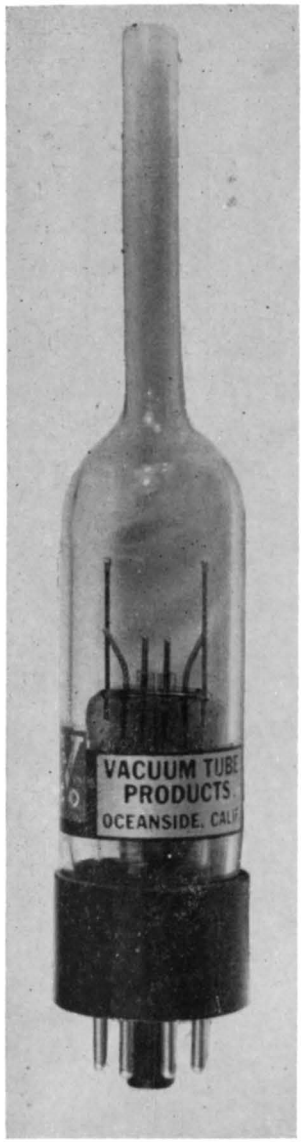
Typical Calibration Curve
Meter Scale 0 - 1 Ma.



PRESSURE MICRONS

LPS. MAR. 58 2M COPIES

PRODUCT DATA SHEET



THERMOCOUPLE VACUUM GAUGE TUBE
Type VTP 6535

VTP 6535 is a thermal conductivity gauge that provides an output used for measuring pressures in the range of .1 to 1000 microns. The VTP 6535 is a thermal conductivity gauge that provides an output E.M.F. determined by the operating current and the heat conductivity of the residual gas. A reliable pressure reading is obtained when the heater is supplied from a stabilized source.

The VTP 6535 is made of Pyrex #774 glass and finds use on vacuum systems of all-glass construction where the excellent features of this gauge are required. Attachment can be made to soft glass systems by means of a glass graded seal. The VTP 6535 is identical electrically with the VTP 6343 and has excellent sensitivity with very fast response.

Due to the speed of detecting changes in pressures, the VTP 6535 finds use in leak detecting as well as absolute pressure measuring. Vacuum systems may be probed with materials such as acetone to detect leaks due to the variation of thermal conductivity between the acetone and air. When leaks are encountered the VTP 6535 will detect the vapor, and a decrease in output E.M.F. can be measured due to the acetone entering the system.

OPERATING CHARACTERISTICS

Heater Current Normal (Note 1)	Approx. 17.0 ma
Heater Current Maximum (Note 3)	100 ma
Heater Resistance (Cold) Nominal	8½ ohms
Heater Resistance (Hot) Nominal	18 ohms
Heater to Thermocouple Resistance (Note 2)	Less than 100 ohms
Thermocouple Output—with 55ohm Load (Meter Internal Resistance)	
Hard Vacuum	10 Millivolts
Air	.1 Millivolts
Thermocouple Resistance (Cold)	8½ ohms
Speed of Response	Faster than .1 second
Basing	RETMA 8FR

Pin No.	1	3	5	7
Element	Heater	Neg. Thermocouple	Pos. Thermocouple	Heater

Note 1: While either A.C. or D.C. may be used, D. C. is recommended due to availability of less expensive and more accurate meters in this range. All gauge tubes are individually calibrated and marked with the heater current required to provide 10 millivolts output across 55 ohms when the guage is under hard vacuum.

Note 2: While the heater and the thermocouple are in direct contact to provide maximum speed of response, use of this electrical circuit is not recommended unless the current is maintained below 50μa.

Note 3. The heater may be operated at such a current and absolute pressure that the thermocouple output does not exceed 10 millivolts across a 55 ohm load. The internal elements will then remain below 200° C.

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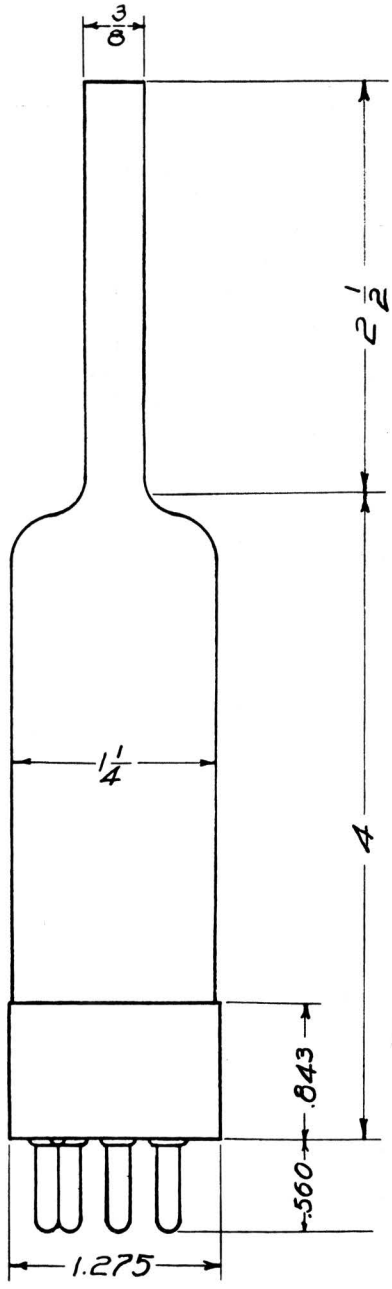
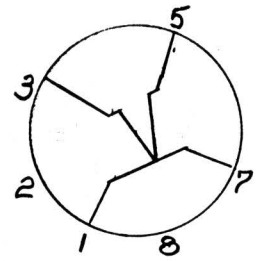
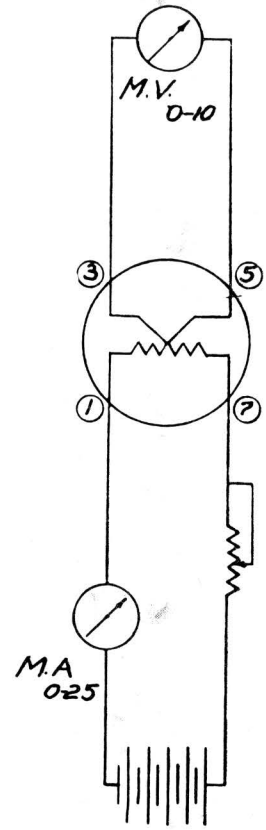
THERMOCOUPLE VACUUM GAUGE TUBE
TYPE VTP 6535





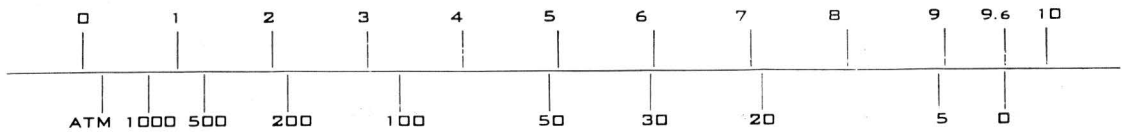
BASING 8FR

PIN 1 - - - - HEATER
PIN 3 - NEGATIVE T. C.
PIN 5 - POSITIVE T. C.
PIN 7 - - - HEATER



TYPICAL CIRCUIT

Typical Calibration Curve
Meter Millivolts

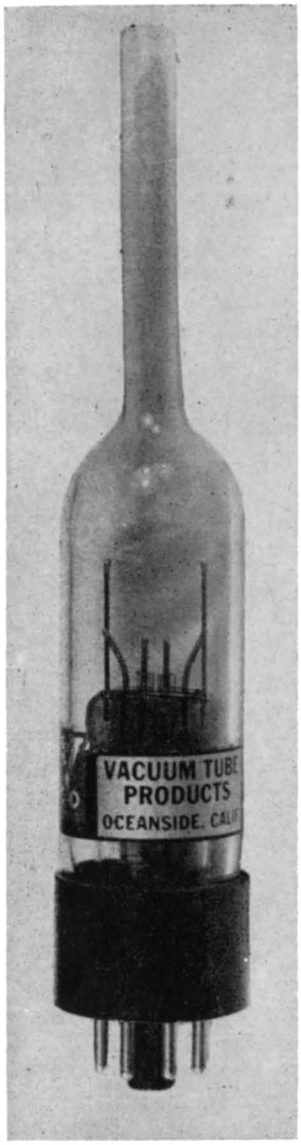


Pressure (Microns)

VACUUM TUBE PRODUCTS CO INC. 2020 Short Street, Oceanside, California

LPS. JAN. 58-2M

PRODUCT DATA SHEET



THERMOCOUPLE VACUUM GAUGE TUBE
Type VTP 6536

TheVTP 6536 is a vacuum gauge tube of the thermocouple type, used for measuring pressures in the range of .1 to 1000 microns. The VTP 6536 is a thermal conductivity gauge that provides an output E.M.F. determined by the operating current and the heat conductivity of the residual gas. A reliable pressure reading is obtained when the heater is supplied from a stabilized source.

The VTP 6536 is made of Pyrex #774 glass and finds use on vacuum systems of all glass construction where the excellent features of this gauge are required. Attachment can be made to soft glass systems by means of a glass graded seal. The VTP 6536 is identical electrically with the VTP 6416 and incorporates a structure designed for maximum ruggedness. This tube may be operated indefinitely at air pressure without damage to either the heater or thermocouple.

The VTP 6536 finds use in fore vacuum monitoring on large systems such as cyclotrons and accelerators, where a long pumping cycle is common and long life rather than response speed is the prime requirement. Application is also found where it is desirable to use glass sealed gauge tubes to replace compression coupled metal gauge tubes on all-glass systems.

OPERATING CHARACTERISTICS

Heater Current Normal (Note 1)	Approx. 600 ma.
Heater Current Maximum	1000 ma.
Heater Resistance (Cold) Nominal	.2 ohms
Heater Resistance (Hot) Nominal	.25 ohms
Heater to Thermocouple Resistance (Note 2)	0
Thermocouple Output—with 55 ohm Load (Meter Internal Resistance)	
Hard Vacuum	10 Millivolts
Air	1.0 Millivolts
Thermocouple Resistance (Cold)	3½ ohms
Speed of Response	Approx. 15 seconds
Basing	RETMA 8FS

Element	Heater	Neg. Thermocouple	Heater	Pos. Thermocouple
Pin No.	1	3	5	7

Note 1: **While either A.C. or D.C. may be used, A.C. is recommended due to ease of supply adjustment from a variable transformer. All gauge tubes are individually calibrated and marked with the heater current required to provide 10 millivolts output across 55 ohms when the gauge is under hard vacuum.**

Note 2: **Heater and thermocouple are electrically welded together at the thermocouple junction.**

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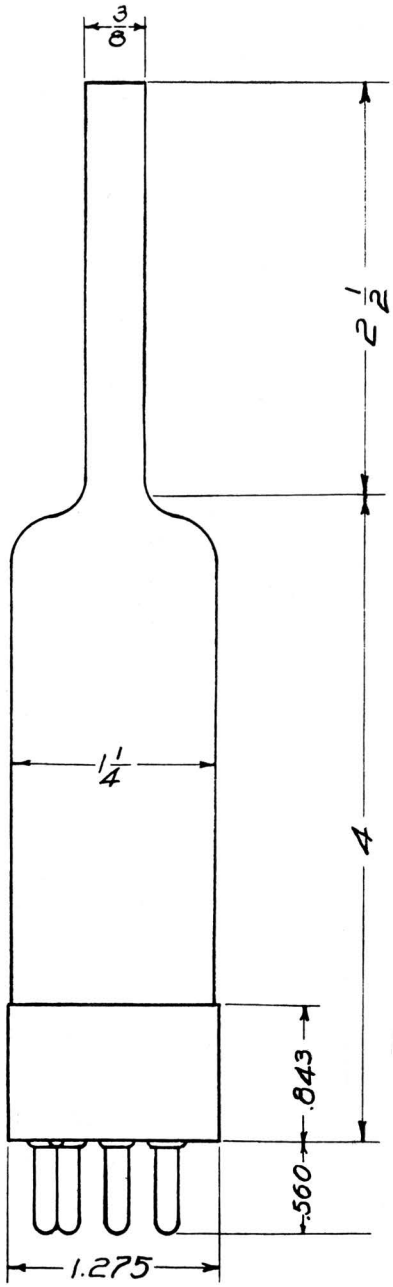
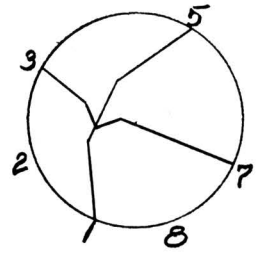
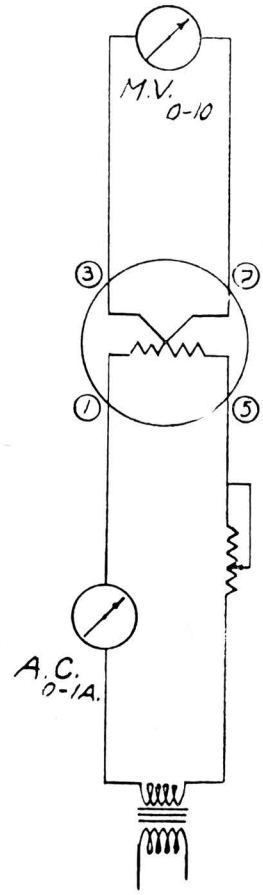
THERMOCOUPLE VACUUM GAUGE TUBE
TYPE VTP 6536





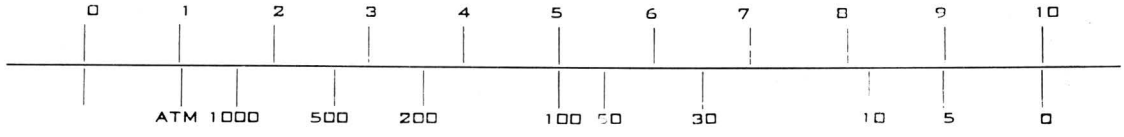
BASING 8FS

PIN 1 - - - - HEATER
PIN 3 - - NEGATIVE T.C.
PIN 5 - - - HEATER
PIN 7 - - - POSITIVE T.C.



TYPICAL CIRCUIT

Typical Calibration Curve
Meter Millivolts



Pressure (Microns)

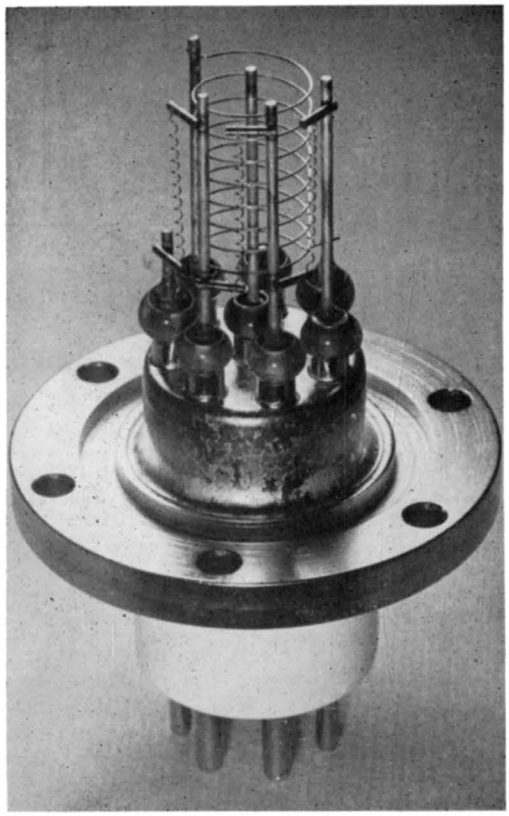
VACUUM TUBE PRODUCTS CO INC. 2020 Short Street, Oceanside, California

LPS. DEC. 57-2M

PRODUCT DATA SHEET

VTP IONIZATION GAUGE TUBE TYPE VTP 6578

The VTP 6578 Ionization Gauge Tube is the ultimate in reliability and accuracy for measuring vacuum in large metal systems. The inherent design incorporating the use of pure metals, accurate electrode positioning and freedom from connecting tube restrictions allow a precise measurement of low pressures. By utilizing a design with the grid surrounding the collector, the absolute minimum of errors in gas pressure are obtained, inasmuch as the collector is physically small and few gas molecules are released by collector ion bombardment. The VTP 6578 is constructed with three separately connected filaments providing the maximum in gauge reliability when used on large systems and where a shutdown for gauge tube replacement is costly. Provision is also made for outgassing the grid by direct heating by applying a voltage to the two end connections brought out to separate base pins. Grid **outgassing** may be done while the tube is in operation, if desired.



SCALE FULL SIZE

GENERAL CHARACTERISTICS

Filaments	Three.
Note: Use filaments individually for maximum life.	
Filament Voltage (Single Filament)	5.0 Max. Volts
Filament Current	6.0 Max. Amps
Grid Voltage (Referenced to Filament)	500 Max. Volts
Grid Voltage (Referenced to Flange)	500 Max. Volts
Grid Current (Emission Current)	15 Max. Ma
Grid Voltage (Pin 3 to Pin 5)	5 Max. Volts
Grid Current (Pin 3 through Pin 5 circuit)	4¼ Max. Amps
Collector Voltage (Referenced to Filament)	500 Max. Volts
Collector Voltage (Referenced to Flange)	500 Max. Volts
Collector Current	Varies directly with gas pressure and directly with grid current

When filament is hot do not exceed following pressures

Pressure Maximum (Corrosive gases or Nitrogen)	5 Microns
Pressure Maximum (Noble gases or Hydrogen)	2 Atmospheres

NOTE: It is not necessary to remove the VTP 6578 when pressure testing metal systems for leaks.

Base	Ceramic RETMA A7-14
Basing	RETMA 7EH

Pin No.	1	2	3	4	5	6	7
Element	F1F2	F1	G	C	G	F3	F2F3

Mounting (Mechanical)	6 equally spaced 13/64" holes on 2¼" hole circle
Mounting Position	Any
Maximum Flange Temperature	180°C

TYPICAL OPERATION

Filament Voltage — Single Filament. (Adjust to provide 5 ma Emission to Grid)	Approx. 3.0 Volts
Filament Current (when obtaining emission from 1 filament)	Approx. 4.0 Amps
Grid Voltage (Use voltage regulated supply)	+ 150 Volts
Grid Current (Adjust filament voltage to obtain this value)	5 Ma
Collector Voltage	—30 Volts
Collector Current (Depends on gas and on gas pressure)	60 Microamps/micron for Dry Air
Grid Outgassing Operation	Apply 5 volts at approx 4 amps between pins 3 and 5 until gas pressure measured is stable.

NOTE: The collector of the VTP 6578 does not require outgassing due to its small size and the radiation heating from the grid outgas operation.

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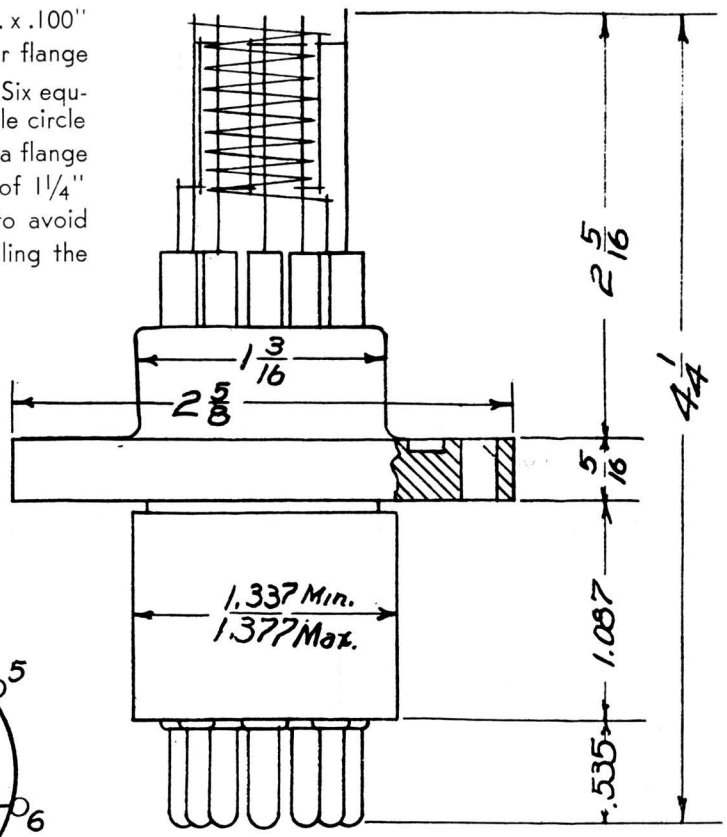
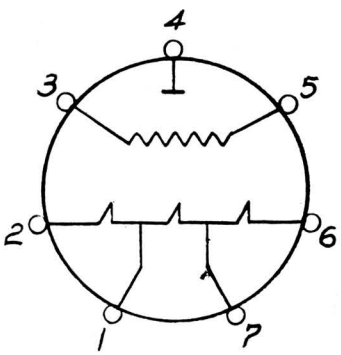
Phone: SAratoga 2-6567

IONIZATION GAUGE TUBE
TYPE 6578

A gasket groove 1½" I.D. x 1⅞" O.D. x .100" deep is provided in the 2⅝" diameter flange to accomodate AN6227B-28 O-Rings. Six equally spaced 13/64" holes on a 2¼" hole circle are provided to facilitate clamping to a flange on the vacuum system. A clearance of 1¼" diameter by 2⅝" deep is required to avoid damage to tube elements when installing the VTP 6578.

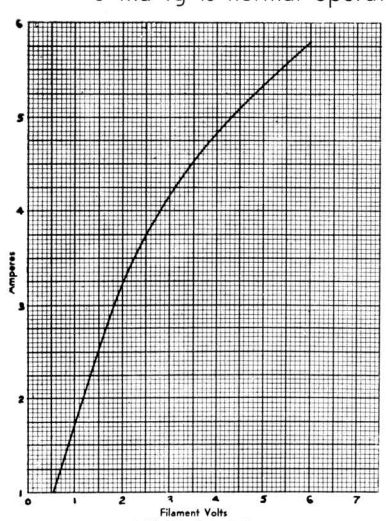




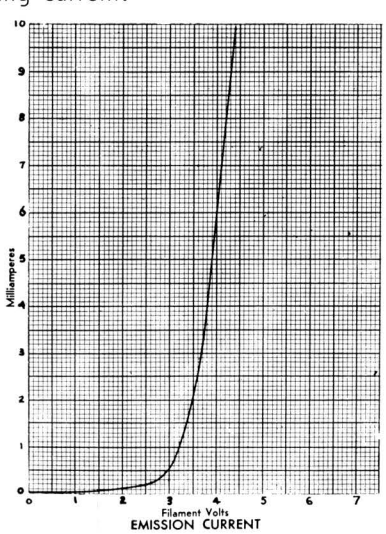
Base—Ceramic RETMA A7-14 BASING PEH

Typical curves with Eg = +150 Ep = —30

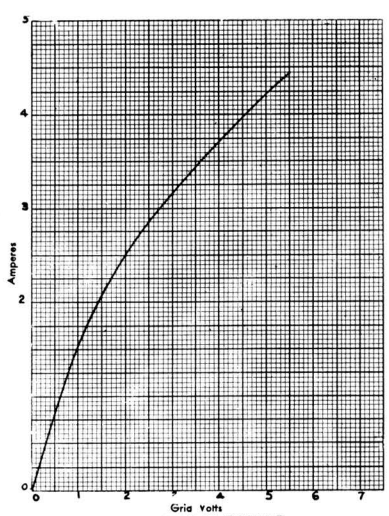
Note: Do not exceed 10 ma grid current to o btain maximum filament life.
5 ma Ig is normal operating current.



HEATER CURRENT



EMISSION CURRENT



GRID OUTGAS CURRENT

VACUUM TUBE PRODUCTS CO. INC.
2020 SHORT STREET, OCEANSIDE, CALIFORNIA

LPS. JAN. 58-2M

PRODUCT DATA SHEET

THERMISTOR VACUUM GAUGE
VTP 6579

The VTP 6579 is a vacuum gauge of the thermal conductivity type incorporating a small thermistor as the sensing element. The VTP 6579 is designed to operate in the range of .1 to 1000 microns. The pressure reading is determined by the change in cooling on the platinum heater. A reliable pressure reading is obtained when the heater is supplied from a stabilized source and excessive changes in ambient temperature are not encountered.

The VTP 6579 is of all metal construction and is assembled by projection welding methods. The internal structure is ruggedized by design and is assembled by special fusing techniques, providing excellent sensitivity and fast response.

The VTP 6579 has been designed specifically for use with vacuum controls. The change in resistance of the thermistor unit, due to changes in pressure, provides an excellent means of changing the bias voltage of a vacuum or gas filled amplifier tube. The amplification obtained may then operate relays, alarms or process controls.

OPERATING CHARACTERISTICS

Heater Current Normal (Note 1)	Approx. 350 Ma
Heater Current Maximum	500 Ma
Heater Resistance (cold) Nominal	.32 Ohms
Heater Resistance (hot) Nominal	.40 Ohms
Heater to Thermistor Resistance	10 Min. Megohms
Heater to Thermistor Voltage	75 Max. Volts
Maximum Voltage permissible across Thermistor	75 Volts
Maximum Wattage permissible in Thermistor	35 Milliwatts
Thermistor Resistance with 0.5 ma flowing in circuit:	
Hard Vacuum	6.6 K ohms
1000 Microns	22.0 K ohms
Air	31.0 K ohms
Thermistor Resistance with 1.5 ma flowing in circuit	
Hard Vacuum	3.2 K ohms
1000 Microns	8.0 K ohms
Air	10.3 K ohms
Thermistor Circuit Current	20.0 Max. Ma.
Base	Octal
Basing	RETMA 8GP

Pin No.	1	3	5	7
Element	Heater	Thermistor # 1	Heater	Thermistor # 2

NOTE 1. All gauge tubes are individually calibrated to provide a resistance in the thermistor circuit of 6.6 K ohms with 0.5 ma flowing in the measuring circuit. The heater current required is marked on each tube.

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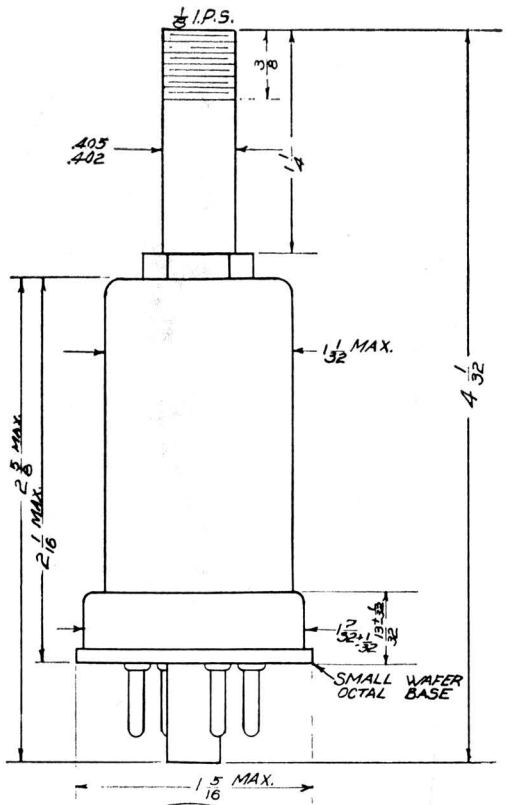
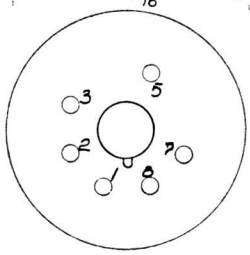
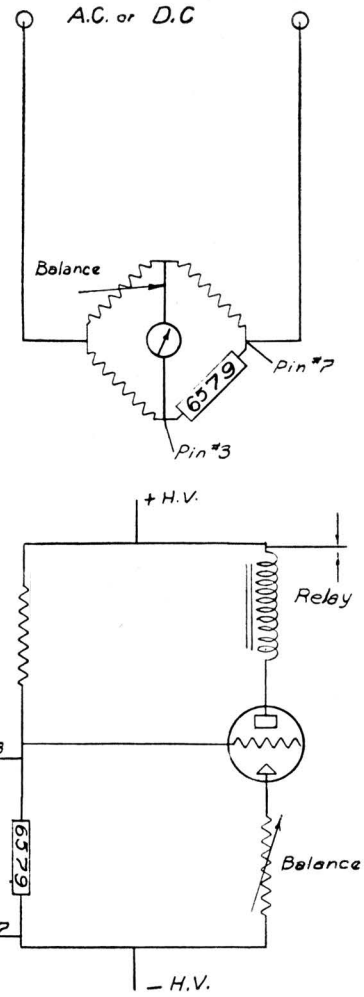


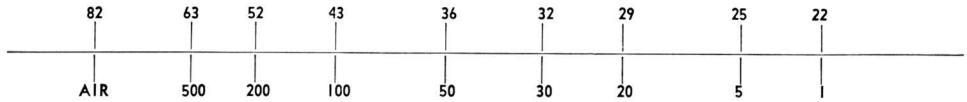


Pin #1 HEATER
Pin #3 THERMISTOR #1
Pin #5 HEATER
Pin #7 THERMISTOR #2



Typical Circuits

THERMISTOR RESISTANCE (K Ohms)



PRESSURE (Microns)

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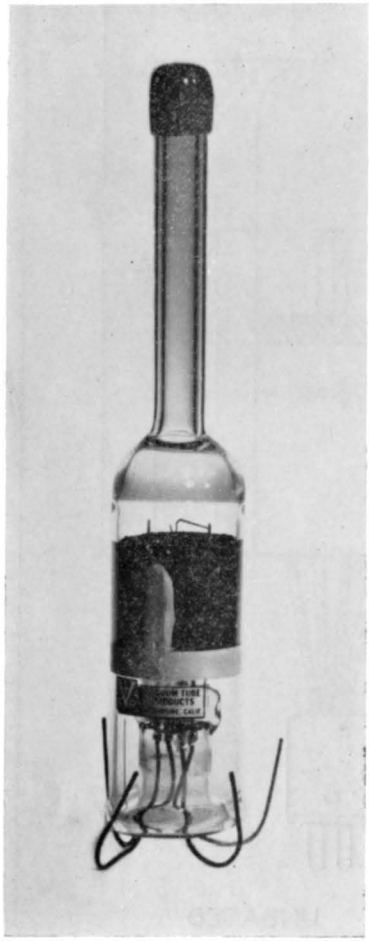

VG-1A/VG-1B - VG-1AA/VG-1BA

The VG-1 types of hot filament ionization gauge have long been the standard reference vacuum gauge tube due to the construction allowing for quick outgassing. The particular feature of this tube is the design of the collector wherein this element consists of a thin platinum film fused directly to the gauge tube outer wall. A special seal is used to provide electrical connections to the collector element by attaching a clip to the silver band provided around the tube envelope. Extremely long separation of electrical leads are achieved by this method of assembly thereby allowing for the reading of very low pressures.

Another feature of the VG-1 type tube is the incorporation of double grid lead connections. By application of power between these terminals, the grid may be raised to a sufficient temperature to outgas the gauge tube and its elements.

Electrically the four tube types are identical. Different suffix letters have been assigned to have the following meanings: The VG-1A is the standard tube with 1/2" O.D. tubulation and flexible grid and filament leads. The VG-1B is the same tube with 3/4 O.D. tubulation. The VG-1-AA is the VG-1A with the flexible grid and filament leads terminated in a Jones Plug while the VG-1BA is the VG-1B with the leads similarly terminated in a Jones Plug.

GENERAL CHARACTERISTICS

Filament Voltage	7.0 Max. Volts
Filament Current	5.0 Max. Amps
Grid Voltage (referenced to filament)	500 Max. Volts
Grid Current (Emission Current)	15 Max. Ma.
Grid Voltage (Lead 1 to Lead 4)	7.0 Max. Volts
Grid Current (Lead 1 through Lead 4)	7.0 Max. Amps.
Collector Voltage (referenced to filament)	200 Max. Volts

Collector Current—Varies directly with gas pressure and directly with grid current.

When filament is hot do not exceed following pressures:
- Pressure Maximum (Corrosive gases or Nitrogen) 5 Microns
- Pressure Maximum (Noble gases) 1.2 Atmospheres
- Pressure Maximum (Hydrogen) 1000 Microns

Basing ..... Flexible Leads

LEAD NO.	1	2	3	4	BAND
ELEMENT	G	F	F	G	COLLECTOR

VG—1AA and VG—1BA Basing:

—4 ..... Jones Plug #P-304-FHT

PIN NO.	1	2	3	4	BAND
ELEMENT	F	F	G	G	COLLECTOR

—6 ..... Jones Plug #P-306-CCT

PIN NO	1	2	3	4	5	6	BAND
ELEMENT	N.C.	N.C.	F	F	G	G	COLLECTOR

NOTE: When the Suffix Letter "A" is added to either (VG-1AA and VG-1BA) The Tubes are supplied with: -4, a 4-pin Jones Plug or; -6, a 6-pin Jones Plug.

Mounting (Mechanical) ..... Portcouple or glass seal
Mounting Position ..... Any
Bulb and tubulation glass ..... Pyrex—Corning #7740

TYPICAL OPERATION

Filament Voltage (Adjust to provide 5 Ma Emission to grid) ..... Approx. 4 Volts
Filament Current ..... Approx. 4 Amps
Grid Voltage (use regulated supply) ..... +150 Volts
Collector Voltage ..... —30 Volts
Collector Current (Depends on gas and gas pressure) ....100 Microamperes/micron
(See Chart for sensitivity ratio for other gases) for dry air.

GRID OUTGASSING OPERATION—Apply approx. 6 volts at approx. 6.4 Amps between leads 1 and 4 Outgassing is complete when gas pressure measured is stable.

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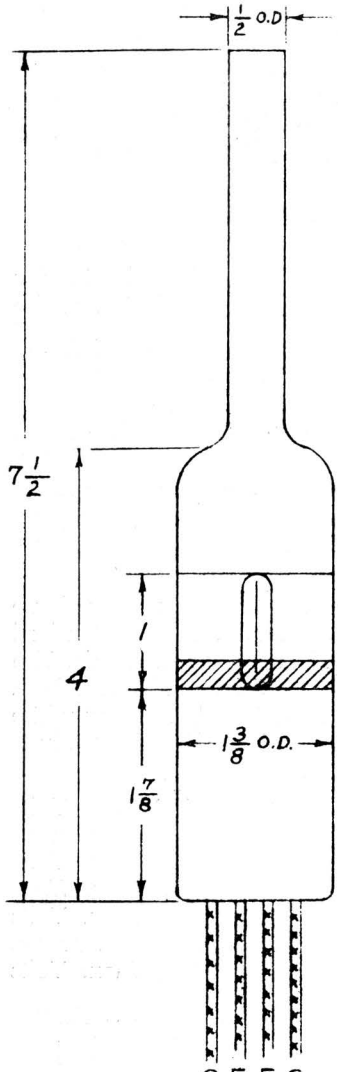
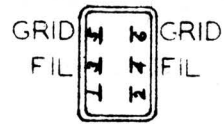


VG-1A UNBASED
VG-1AA BASED

CINCH-JONES PLUG
TYPE P-306-CCT

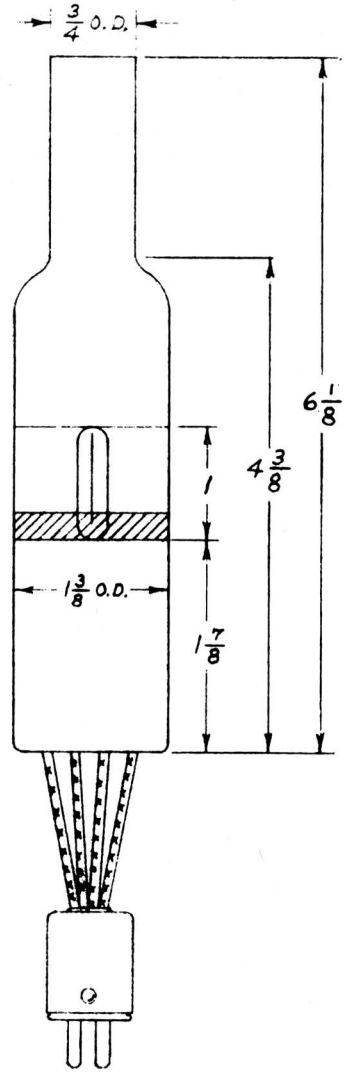


PLUG
TERMINAL
CONNECTIONS

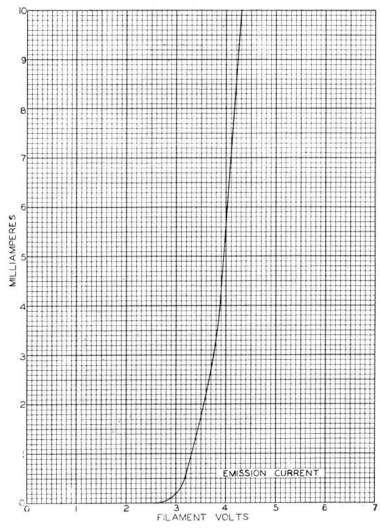
CINCH-JONES PLUG
TYPE P-304-FHT

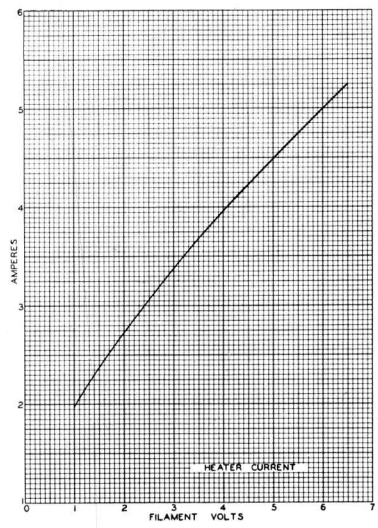
NOTE:
4 CONTACT PLUG -4
6 CONTACT PLUG -6

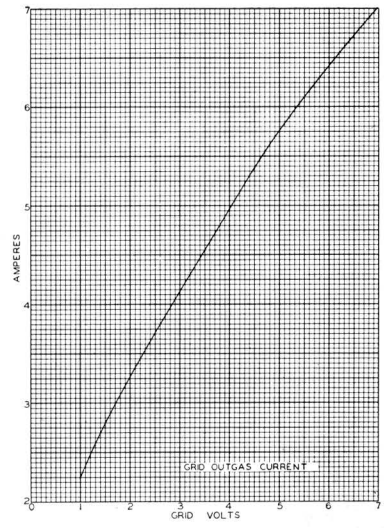
GAS	SENSITIVITY IN Micro Amps/Micron
Helium	14
Hydrogen	46
Oxygen	85
Nitrogen	110
Air (Dry)	100
Carbon Monoxide	112
Carbon Dioxide	120
Argon	162



VG-1B UNBASED
VG-1BA BASED







VACUUM TUBE PRODUCTS CO. INC. — 2020 Short Street, Oceanside, California

LPS. 4-58 2M

PRODUCT DATA SHEET

VTP-7169 — VTP Ionization Gauge Tube

The VTP-7169 Ionization Gauge Tube is an all glass gauge tube designed for the maximum of reliability and reproduction of accurate readings. This tube type utilizes the recognized superior design of the metal version—VTP Type 6578—but is now available in this type suitable for attachment to all glass vacuum systems. Attachment may also be made to tubular connectors on metal systems by means of VTP portcouples.

The VTP-7169 employs a grid surrounding the collector with dual grid connections allowing for easy outgassing of the grid and other elements of the gauge by merely passing heater current directly through the grid structure. The VTP-7169 is provided with three separately connected filaments providing the maximum in gauge reliability when used on large systems and where a shutdown for gauge tube replacement is costly.

GENERAL CHARACTERISTICS

Filaments (use filaments individually for maximum life) .....Three.
Filament Voltage ..... 5.0 Max. Volts
Filament Current ..... 6.0 Max. Amps
Grid Voltage (Referenced to Filament) .....500 Max. Volts
Grid Current (Emission Current) ..... 15 Max Ma
Grid Voltage (Pin #3 to Pin #5).....5 Max. Volts
Grid Current (Pin #3 through pin #5 circuit).....4¼ Max.Amps
Collector Voltage (Referenced to Filament)..... 500 Max. Volts
Collector Current—Varies directly with gas pressure and directly with grid current.

When Filament is hot do not exceed following pressures:

Pressure Maximum (Corrosive gases or Nitrogen) ..... 5 Microns
Pressure Maximum (Noble gases or Hydrogen).....1.2 Atmospheres

Base .....Medium Moulded flare Septar 7 pin—RETMA E7-2

Basing: Pin No.	1	2	3	4	5	6	7
Element	F1F2	F1	G	C	G	F3	F2F3

Mounting (Mechanical) ..... Portcouple or glass seal
Mounting Position ..... Any
Bulb Glass (Type) ..... Nonex 7720

TYPICAL OPERATION

Filament Voltage—Single Filament.
(Adjust to provide 5 ma Emission to grid).....Approx. 3.0 Volts
Filament Current (When obtaining Emission from one Filament) Approx. 4.0 Amps
Grid Voltage (use regulated supply) .....+ 150 Volts
Grid Current (adjust filament voltage to obtain this value) .....5 Ma
Collector Voltage .....—30 Volts
Collector Current (Depends on gas and gas pressure).....60 Microamps/micron for dry air.
Grid Outgassing Operation—Apply 5 volts at approx. 4 amps between pins #3 and #5 until gas pressure measured is stable.

Note: Neither the bulb or the collector of the VTP-7169 require separate outgassing due to the efficient radiation heating from the grid outgas operation.

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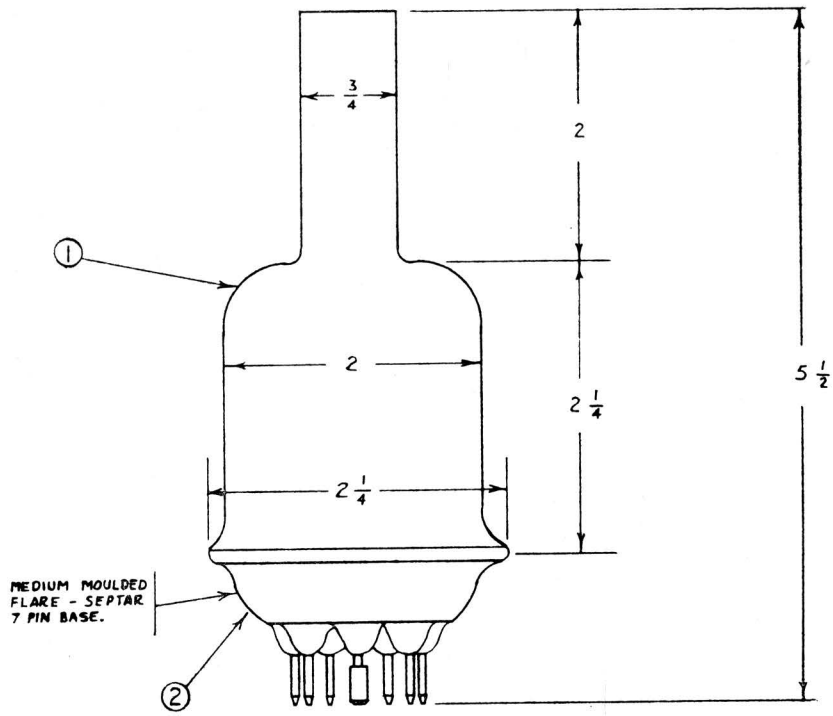
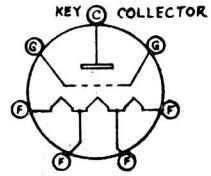
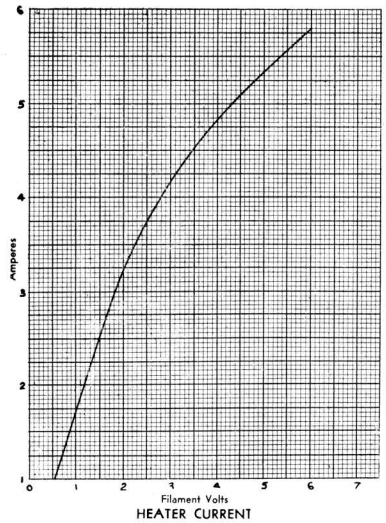
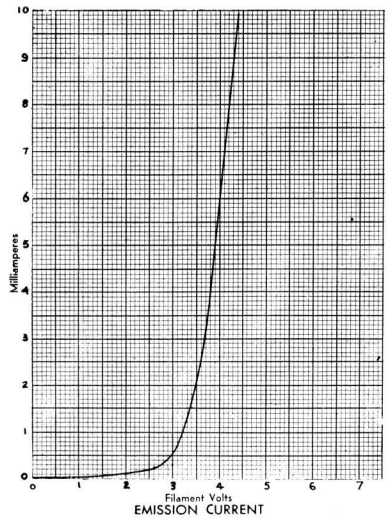




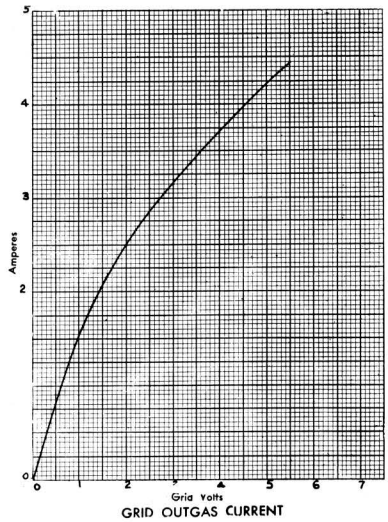
BASING VIEW
BOTTOM



HEATER CURRENT



EMISSION CURRENT

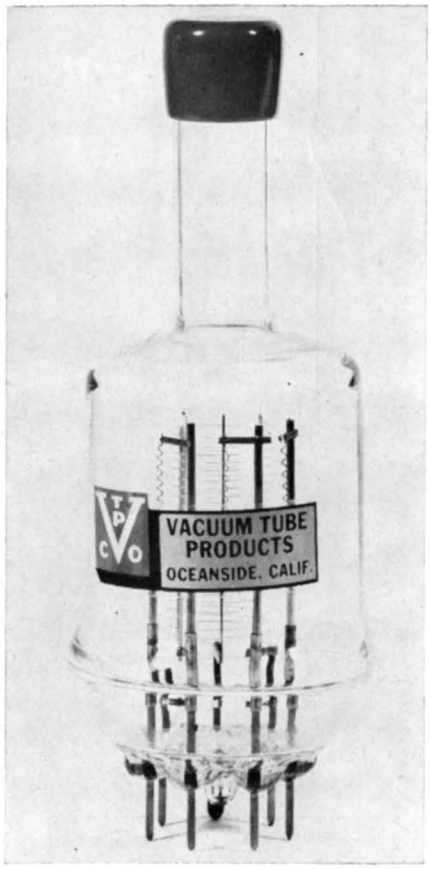


GRID OUTGAS CURRENT

VACUUM TUBE PRODUCTS CO. INC. — 2020 Short Street, Oceanside, California

LPS. 4-50 3M

PRODUCT DATA SHEET



VTP-7170 — VTP Ionization Gauge Tube

The VTP-7170 Ionization Gauge Tube is an all glass gauge tube designed for the maximum of reliability and reproduction of accurate readings. This tube type is externally similar to the VTP Type 7169 and differs only in the grid structure installed. The VTP-7170 is of all glass construction and may be attached to all glass vacuum systems by direct glass sealing or to either glass or metal vacuum systems by means of a port couple.

The VTP-7170 employs a grid surrounding the collector. The design of this grid structure is such that it can be easily outgassed by means of D.C. bombardment when connected to gauge controls designed for this method of element outgassing. The VTP-7170 is provided with three separately connected filaments providing the maximum in gauge reliability when used on large systems and where a shutdown for gauge tube replacement is costly.

GENERAL CHARACTERISTICS

Filaments (use filaments individually for maximum life) .....Three.
Filament Voltage (single filament) 5.0 Max. Volts
Filament Current .....5.0 Max. Amps
Grid Voltage (Referenced to Filament) .....500 Max. Volts
Grid Current (Emission Current) .....40 Max. Ma.
Grid Power (Dissipation for outgassing) .....20 Max.Watts
Collector Voltage (referenced to filament).....500 Max. Volts
Collector Current .....Varies with gas pressure and directly with grid current.

When Filament is hot do not exceed following pressures.

Pressure Maximum (Corrosive gases or Nitrogen).....5 microns
Pressure Maximum (Noble gases or Hydrogen) .....1.2 Atmospheres

Base .....Medium Moulded flare Septar 7 pin—RETMA E7-2

Basing: Pin No.	1	2	3	4	5	6	7
Element	F1F2	F1	G	C	G	F3	F2F3

Mounting (Mechanical) ..... Portcouple or glass seal
Mounting Position ..... Any
Bulb and Tubulation Glass .....Nonex—Corning #7720

TYPICAL OPERATION

Filament Voltage — Single Filament.
(Adjust to provide 5 Ma Emission to Grid).....Approx. 3.0 Volts
Filament Current (When obtaining Emission from one Filament) Approx. 4.0 Amps
Grid Voltage (Use Voltage Regulated supply) .....+150 Volts
Grid Current (Adjust filament voltage to obtain this value).....5 Ma
Collector Voltage .....—30 Volts
Collector Current* (Depends on gas and gas pressure) ....50 Microamps/micron for Dry Air @ 5 Ma Grid Current.

GRID OUTGASSING OPERATION: Apply positive 400 Volts to Grid, with negative to filament. Adjust Filament Voltage to approx. 4.25 Volts or to allow 35 Ma of Grid Current to flow. Continue bombarding until the pressure reading measured is stable.

*NOTE: The sensitivity of the VTP-7170 may be increased to 100 μa/micron of dry air by using a grid current of 10 milliamp. This may be done in either of two ways___(1) Use two filaments at one time to obtain 5 ma emission from either one___or (2) Increase the filament temperature of one filament to provide 10 ma emission.

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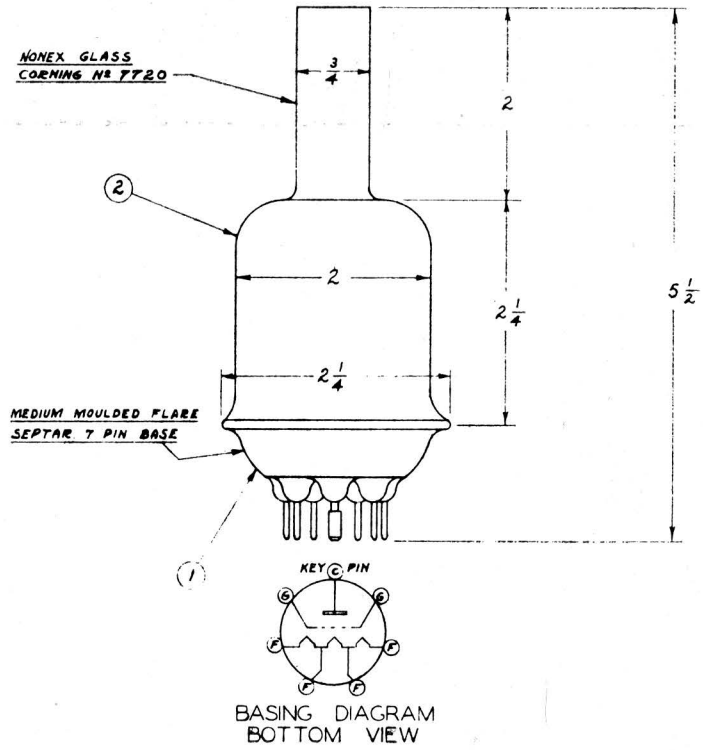

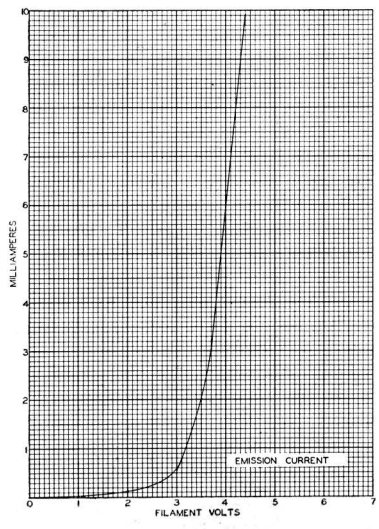

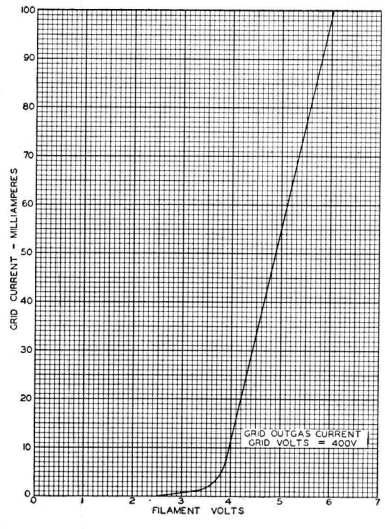

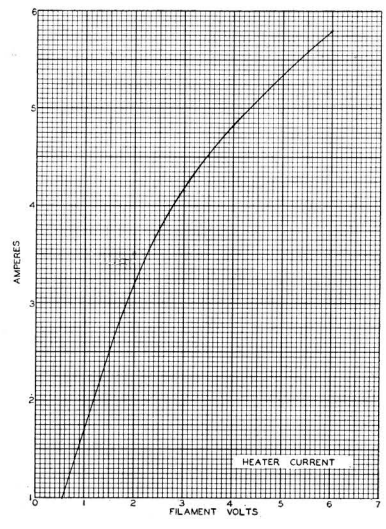

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OCEANSIDE, CALIFORNIA
P. O. Box 810 Telephones: SAratoga 2-7648, 2-6567

VACUUM CATALOG COMPONENTS

LEAK DETECTORS

LD-15—LEAK DETECTOR TUBE

The LD-15 is a metal shell detector tube suitable for use in conjunction with detector controls such as the LD-F-100 or the Consolidated Electrodynamics Corporation Type LD-01. The tube is useful in detecting the presence of halogen gas and is normally used attached to a vacuum system operating in the range of 100 to 300 microns. Operation is such that a collector current of approximately 10 microamperes at 165 volts is applied to the elements of the tube. The presence of halogen gas will cause an increase in the ionization current between the cold and hot element, and by means of a sensitive amplifier, minute amounts of halogen gas may be detected. Normal usage is to probe a vacuum system with Freon 12 and observe any increase in ion current.

LD-15-4—DEMOUNTABLE LEAK DETECTOR TUBE

The LD-15-4 is a metal shell demountable detector tube. This tube is identical in internal construction to the LD-15 and differs only in that the external shell may be removed, thereby exposing the internal structure. This allows for the use only of the internal element by mounting it in a vacuum system similar to that employed with the VG-4 or to dismantle the tube for repair and reassembly by bolts and gaskets instead of welding such as is done on the LD-15. Since the halogen gas drift throughout a system is sometimes slow, increased sensitivity of leak detection is possible by inserting the leak detector element into a flange fitting on a vacuum system. The outer shell assembly then may be used for protection purposes only when the element structure is removed from the vacuum system.

LD-F-100—LEAK DETECTOR CONTROL

The LD-F-100 is a leak detector control system suitable for operation with the LD-15 or the LD-15-4 detector tubes. The LD-F-100 provides proper operating voltages, including stabilized supplies and amplifiers, so that changes in detector tube currents will indicate on the indicating meters. The use of LD-F-100 in conjunction with the detector tube, a flask of Freon 12, and a vacuum system, is sufficient to provide for a complete leak detection system.

AA-1—AUDIO ALARM

The AA-1 audio alarm is a unit designed to provide for an audible indication due to a change in direct current flow. This unit finds application when connected to any of the ionization gauge controls or to the leak detectors and is used to call an operator's attention to either variation in current or the presence of the probe gas when leak detecting. Greatly increased accuracy in leak-hunting can be accomplished by attaching the audio alarm to the leak detection system since the operator can pay complete attention to the search area while probing with the search gas.

FCR-1—FILAMENT CURRENT REGULATOR

The FCR-1 is a filament current regulator suitable for regulation of ionization gauge tube filaments. Provision is made to add to or subtract from manually adjusted filament circuits to regulate the ionization gauge tube filament emission by means of the grid current flow to the gauge tube. The unit acts as a feed-back system and will tend to adjust the filament temperature so that sufficient emission wiill be provided to pass a selected amount of current through the sensing circuit and allow the regulaion of grid current to the selected value.

LDS-1—LEAK DETECTOR SYSTEM

The LDS-1 is a leak detector system with back fill incorporating a vacuum system, the LD-F-100 detector control, the LD-15-4 metal shell demountable detector tube, pressure indicators and tanks of fill gas, together with the valve system.

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VACUUM CATALOG COMPONENTS

VACUUM EQUIPMENT

TR-3—TROLLEY EXHAUST STATION

The TR-3 is a trolley exhaust station provided with a 3-cubic-foot mechanical backing pump, a diffusion pump, and a glass manifold suitable for the evacuation of electron tubes. An electric oven is provided with counter-balance and guide rails to cover the manifold. All controls are provided, such as ON - OFF switches for all epuipment, regulator for oven temperature, and a TC-43-3 vacuum gauge for measurement of fore pump pressure.

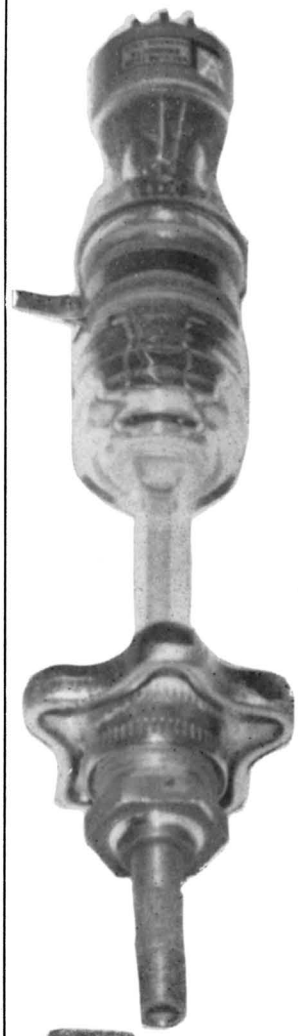
AL4-4—CATHODE RAY TUBE ALUMINIZER

The AL4-4 is a four-position aluminizer for cathode ray tubes. A 3-cubic-foot mechanical pump is provided, together with a 4-inch diffusion pump, a high vacuum valve, an air release valve, a four-position manifold, a TC-43-3 vacuum gauge, and a PGC-25-01 vacuum gauge, as well as all operating controls, fuses, gaskets and individual port covers. The unit is completely self-contained with the exception of the requirement for input power, water cooling and water draining. The finish is a gray hammertone. The unit is provided with an aluminum table top, black bakelite panel, removable side panels and is ruggedly constructed from 2" square cold rolled steel tubing.

ES-1—ELECTRONIC SWITCH

The ES-1 is an electronic switch suitable for actuating power circuits from contact type meters. This unit operates from delicate input circuits which change the bias level of a triode tube having a power relay in its plate circuit. Heavy duty contacts on the power relay allow for the control of heavy electrical circuits.

PRODUCT DATA SHEET



VACUUM PORT COUPLE

Types VC and VCA Vacuum Port Couples were specifically designed to afford a simple and positive connection for metal gauge tubes to glass vacuum systems and, conversely, glass gauge tubes to metal systems. A tapered rubber bushing within the connector assures a leakproof union, eliminating graded seals or difficult glass to metal seals. The rubber bushing also affords a certain flexibility to the connection, decreasing stresses due to shock and vibration.

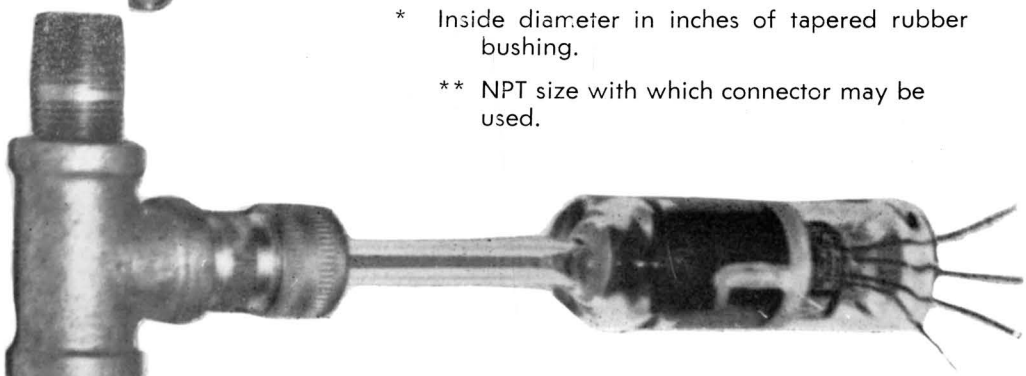
Type VC Vacuum Port Couple is particularly adapted to semi-permanent applications requiring compactness and lightness of weight. Type VCA is identical to Type VC with the addition of a $2\frac{1}{2}$ inch diameter metal handle for making the connection. Type VCA lends itself particularly to such applications as test manifolds, where frequent changes of connections are required. Both types are supplied with an attractive, corrosion-resistant cadmium finish.

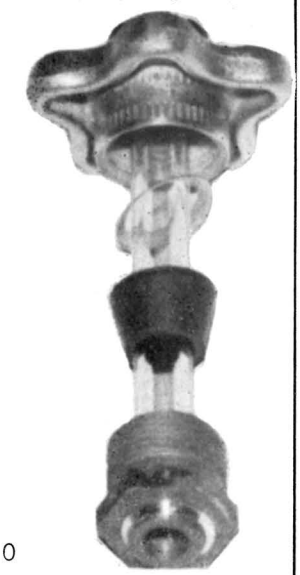
Types VC and VCA Vacuum Port Couples are available in the following sizes.

Model No.	A*	B**
411	.250 to .375	$\frac{1}{8}$
412	.250 to .375	$\frac{3}{8}$
413	.250 to .375	$\frac{1}{2}$
414	.250 to .375	$\frac{3}{4}$
415	.375 to .500	$\frac{1}{8}$
416	.375 to .500	$\frac{1}{2}$
417	.375 to .500	$\frac{3}{4}$
418	.500 to .625	$\frac{1}{8}$
419	.500 to .625	$\frac{3}{4}$
420	.500 to .625	1

* Inside diameter in inches of tapered rubber bushing.

** NPT size with which connector may be used.





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Manufacturer of Quality Products for the Electronic Industry.

ELECTROMAGNETIC CATHODE RAY TUBES

MULTIGUN CATHODE RAY TUBES

ELECTROSTATIC CATHODE RAY TUBES

STORAGE TUBES

ELECTRON BEAM TUBES

GAS RECTIFIERS

HIGH VACUUM DIODES

MOVABLE ELEMENT TUBES

SWITCH TUBES

THYRATRON TUBES

VACUUM GAUGE TUBES

VACUUM GAUGE CONTROLS

PRECISION SEAM WELDERS

PRECISION SPOT WELDERS

ELECTRONIC TIMERS

VACUUM SYSTEMS AND COMPONENTS

GLASS TO METAL COUPLINGS

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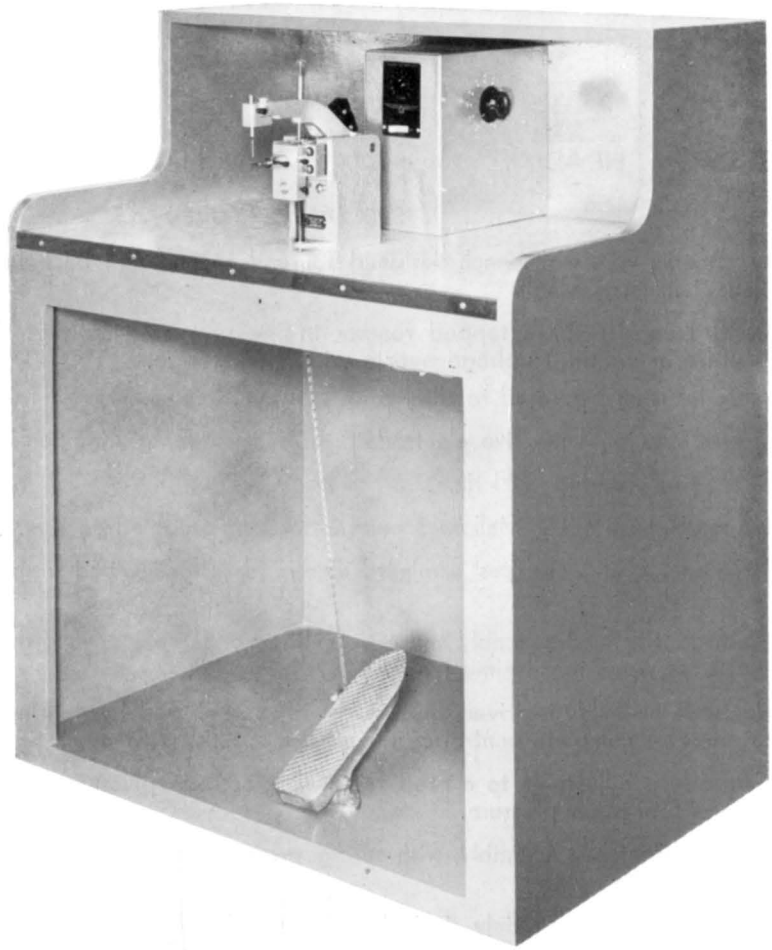
PRODUCT DATA SHEET

PRECISION SPOT WELDER



AVAILABLE IN SINGLE - HEAD OR DUAL - HEAD MODELS

MAXIMUM RATINGS

	LOW RANGE	HIGH RANGE
Input: (Electrodes Shorted)	1.25 KVA	5 KVA
Weld Current:	Up to 1750 AMPS	Up to 3000 Amps
Secondary Voltage (Open Circuit)	1/3 Volt/Turn	2/3 Volt/Turn
Welds/Minute	120	90
Duty Cycle	75%	50%

At normal line voltage, common practice is to use six secondary turns on welding transformer.

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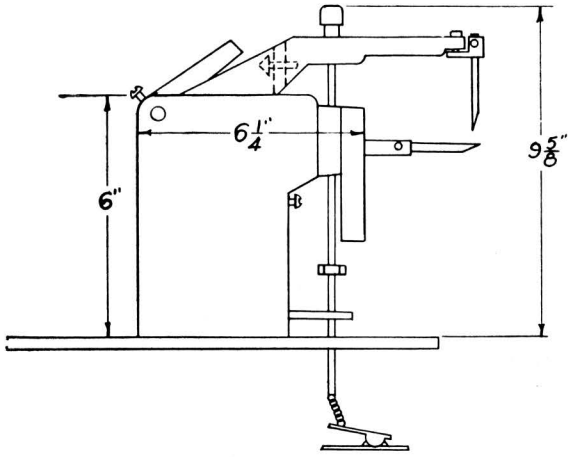
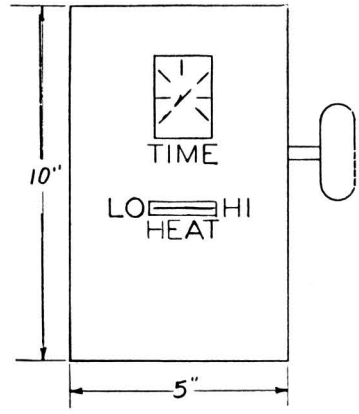


WELDER HEAD



TIMER CONTROL BOX

SPECIAL FEATURES

A completely versatile unit, with bench designed for end to end and back to back operations, simplifying floor layout in large plants.

The Heat Control consists of a tapped reactor in the primary circuit of the welder transformer, allowing uniform welding voltage over a wide heat range.

An Electronic Timer is incorporated to allow positive weld times adjustable from 2 to 20 cycles.

The welder never fires until positive electrode pressure is made, assuring non-spattering of welds.

Power is consumed only during weld time.

Electrodes are made from 5/16" Mallory 3 copper for long trouble-free service.

Precision machined bearing surfaces eliminate electrode side play and insure positive contact for each weld.

The lower electrode is a fixed assembly and remains rigid under pressure of the upper electrode. Variable positioning is provided for maximum versatility.

The upper electrode assembly is driven downward with a foot pedal actuating the weld control circuit, giving the operator complete control of the electrode movement at all times.

The upper electrode is adjustable to a predetermined electrode pressure, and remains constant regardless of additional foot pedal pressure.

Light weight upper electrode assembly, with spring pressure follow up, provides forging action for strongest and most ductile welds.

Electrodes are located approximately six inches above table surface. Spacing of welder head has been designed to provide ample surrounding space allowing for welding of large pieces.

Adjustable foot pedal pressure reduces operator fatigue to a minimum.

Standard model welder may be used on 110 volt house type circuits when light weight welding is required.

SPECIFICATIONS

ELECTRICAL		MECHANICAL	
Power Rating:	2.5 KVA	Height:	42"
Voltage:	220V (3 wire 110—0—110)	Width	34"
	110V (Low Range only)	Depth	24"
Frequency:	50 - 60 cycles	Table Height:	30"
Phase:	Single	Weight:	130 lbs.
Max. Current:	24 Amperes		

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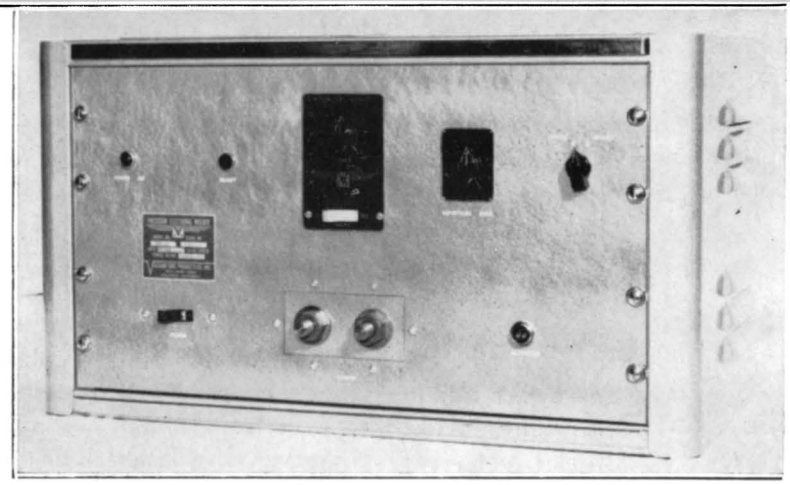
PRODUCT DATA SHEET

VTW—1
SEAM WELDING
UNIT



The VTW-1, Seam Welding Unit, has been designed to meet the needs of the industrial user for a welding unit capable of reliable operation on multiple shift production lines. This unit was primarily designed for the assembly of stainless steel foils for use as insulation blankets surrounding jet engines in jet aircraft as well as assembly of the stainless steel honeycomb structures now being incorporated as structural support members in the latest high-speed aircraft.

The VTW-1 unit, while initially developed for seam welding use, may also be used as a welding power unit for general spot welding applications when used in conjunction with the VTA-9 bench model welding head. This combination finds application in welding where difficult materials such as molybdenum, tungsten, beryllium copper, or stainless steel must be joined, as well as other materials where material thickness in less than .001" and oxide-free welds are required.

Many VTW-1 units have now been in operation for several years with double shift usage, without component failures. All Vacuum Tube Products Co. Inc. welding equipment is designed for continuous industrial service.

The VTW-1 is a completely self-contained unit consisting of the VTA-4 Welding Transformer together with the VTF-218 Fractional Cycle Timer and the VTA-3 Adjustable Speed Repeat Timer, all housed in an attractive silver gray hammertone cabinet. In addition, a VTA-13 Ground Cable and VTA-11 Seam Welding Hand Piece are provided so that no further components are necessary to perform either spot or seam welding operations. The standard unit is provided for operation from either a 220-volt single phase or a 208-volt leg of a three phase 50 or 60 cycle either grounded or ungrounded power line. The metal cabinet and the welder hand pieces are completely isolated from the power circuit, eliminating all possibility of shock hazards.

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VTW - 1 SEAM WELDING UNIT

OPERATION

All controls are readily accessible from the front panel except for the weld actuation switch, which is in the VTA-11 Seam Welding Hand Piece. A main power switch is provided in the lower left hand section of the panel, which controls all power to the unit. When the switch is in the on position, a pilot light will indicate applied power, and after a delay of one minute provided by the cathode protection circuit, the second pilot light will indicate that welds can be made. A switch in the upper right section of the panel is provided for the selection of either single spot or seam weld operation. To the left of this switch a potentiometer is installed allowing the operator to select welding speeds approximately in the range of 1 to 20 welds per second. The controls in the center of the panel provide adjustment of weld power. The potentiometer allows adjustment of the timing cycle from approximately zero time to $\frac{1}{2}$ cycle, or zero to 180 electrical degrees. A high-low heat switch is provided to allow the use or non-use of the damper tube. When the switch is in the low heat position, the damper tube is in use and the weld time is maintained less than $\frac{1}{2}$ cycle. With the switch in the high position, the damper tube is not used, and the inductive kickback of the weld transformer can be utilized to obtain a greater weld heat. On units supplied for operation on 220 volts or less, an internal high-low heat switch is installed to provide for series or parallel connection of the welding transformer primary windings. The switch is appropriately marked and permits normal operation in the low heat position. In the high heat position the transformer windings are paralleled, and while the volts-per-turn ratio on the transformer is doubled, this operation is permissible with Fractional Cycle Timer installed. The hand piece cables are attached to the two $\frac{1}{2}$" USS bronze bolts in the middle lower section of the panel. The weld actuation switch cable is attached to the receptacle in the lower right hand section of the panel.

MECHANICAL SPECIFICATIONS

Size:	$12\frac{1}{4}$" x 15" x 22"
Finish:	Silver Gray Hammertone
Weight:	87 pounds

ELECTRICAL SPECIFICATIONS

Input Voltage: 205 to 240 volts, 50 or 60 cycles

Power Input — Standby: 135 watts

Power Load — Peak (at crest of weld cycle): 100 maximum amperes (Welder Transformer primary current)

Power Output — Peak (at crest of weld cycle): 20 KVA

Weld Speed — Maximum: 20 welds per second.

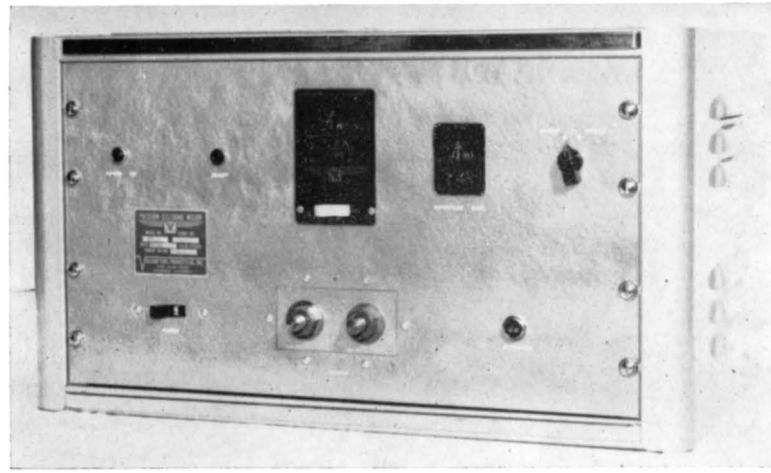
NOTE: Weld speed and maximum weld current must be such that average weld transformer primary current does not exceed 6.4 amperes continuous average or 12.8 amperes for 15 seconds average.

PRODUCT DATA SHEET

VTW-2

COMBINATION

WELDING UNIT



The VTW-2 Combination Welding Unit is designed to supply the requirements for all types of light duty resistance welding. The unit provides power output for a welding head such as the VTA-9, the tweezer weld points such as the VTA-12, or the welding hand pieces such as the VTA-11 and VTA-13. A complete range of weld time adjustment is available, 0 to $\frac{1}{2}$-cycle from the Fractional Cycle Timer Model VTF-218 installed, and 2 to 20 cycles from the VTA-1 installed. There is provision, as well, for either single weld or seam welding over a speed range of 1 to 20 welds per second from the VTA-3 Adjustable Speed Repeat Timer, installed. A VTA-4 Welding Transformer is utilized, providing for an adjustable output voltage. The VTA-11 and the VTA-13 are the only accessories supplied as standard with the VTW-2 unit.

The unit is housed in an attractive silver gray hammertone rack type cabinet with a 10½" high panel containing all operating controls. The lower left hand corner of the panel contains the main line on-off switch. From left to right across the panel are installed first, the 2 to 20 half-cycle operation selector switch, the 2 to 20 time adjust potentiometer, the fractional cycle time adjust potentiometer, the repetition weld rate adjust potentiometer and the single-repeat weld operation selection switch. Directly below the 2 to 20 cycle adjust potentiometer is the main line pilot light. Directly below the fractional cycle timer potentiometer is installed the high-low heat switch for the fractional cycle timer operation. Directly below the repetition rate potentiometer is installed a pilot light to indicate that the cathode time protection delay circuit is operative. The right hand lower section of the panel contains a weld actuator switch receptacle and the weld power is available from the two receptacles in the lower section of the panel.

OPERATION

The main line switch located in the lower left section of the panel may be turned to the on position, which will be indicated by the lighting of the pilot light located below the 2 to 20 cycle adjust potentiometer. At the end of the cathode protection period the pilot light will light below the repetition weld rate adjust potentiometer, indicating that welding may proceed. Assuming that connections have been made to the welding hand pieces and the actuation switch, selection should now be made on the single or repeat weld switch for the type of operation desired, and selection should be made on the 2 to 20 half-cycle timer selector switch for the appropriate timer. Time adjustment may now be set on the particular timer selected, with minimum time being at

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the counter-clockwise position of the adjustment knob and maximum time being at the clockwise position of the adjustment knob. The weld actuator switch may now be actuated and the time adjustment readjusted to a time suitable for the material being welded. On units supplied for operation on 220 volts or less, an internal high-low heat switch is installed to provide for series or parallel connection of the welding transformer primary windings. The switch is appropriately marked and permits normal operation in the low heat position. In the high heat position the transformer windings are paralleled.

MECHANICAL SPECIFICATIONS

Size: 12¼" x 15" x 22"
Finish: Silver Gray Hammertone
Weight: 95 pounds

ELECTRICAL SPECIFICATIONS

Power Input: 208 or 220 volt two wire service
Input Voltage: 205 to 240 volts, 50 or 60 cycle
Frequency: 50 to 60 cycle
Phase: Single

SECTION I: When Fractional Cycle Timer is in use

Power Input — Standby: 145 Watts
Power Load — Peak (at crest of weld cycle): 100 Amperes Maximum
(Welder Transformer primary current)
Power Output — Peak (at crest of weld cycle): 20 KVA
Weld Speed — Maximum: 20 welds per second

NOTE: Weld speed and maximum weld current must be such that average weld transformer primary current does not exceed 6.4 amperes continuous average or 12.8 amperes for 15 second average.

Output Voltage: Internal — Switch — High 17 volts peak
Internal — Switch — Low 8½ volts peak

SECTION II: When 2 to 20 Cycle Timer is in use

Power Rating: 2½ KVA (5KVA at 50% duty cycle)
Power Input — Standby: 145 Watts
Maximum Current: 24 Amperes
Weld Speed — Maximum. 3 welds per second

NOTE: The 2 to 20 cycle timer section is not normally recommended for use on automatic repeat timing.

Transformer Ratio: ⅔ turn per volt
Secondary Voltage: Adjustable
Output Voltage: Standard 4 volts maximum

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PRODUCT DATA SHEET

VTW-4, SPOT WELDER POWER SUPPLY

The VTW-4, Spot Welder Power Supply, is designed to meet the general requirements of a reliable welding supply where weld timing in the range of 2 to 20 cycles provides an optimum weld. This unit finds application in the light assembly fields such as in the assembly of vacuum tubes, transistors, jewelry, and other light metal assemblies. The unit provides an ideal power supply for the welding of steel, nickel, stainless steel, nickel alloys, resistance alloys, magnetic alloys, and other comparable low-conductivity materials, when used in conjunction with a suitable welding head such as the VTA-9 (supplied separately).

The VTW-4 Spot Welder Power Supply is mounted in a Gray Hammertone rack type cabinet and consists of a VTA-1 2 to 20 Cycle Timer in conjunction with the VTA-4 Welding Transformer and a heat control adjustment similar to the VTA-8. The VTW-4 provides reproducible welds over time settings of 2 to 20 cycles and will deliver power through the contactor and VTA-4 Welding Transformer with VTA-8 heat control, up to $2\frac{1}{2}$ KW or up to 5 KW with a duty cycle of 50% or less.

OPERATION

A special feature of the VTW-4 Spot Welder Power Supply is the electrical design of the unit, wherein no power is consumed from the line except while the actuation switch is closed, and therefore no warm-up time is required. The unit utilizes a cold cathode type thyratron with a resistance capacitance circuit providing timing control over the range of 2 to 20 cycles. The adjustment resistor is located at the upper right hand of the front panel. A high-low heat switch is installed directly below this time adjustment, providing extended range of weld power control. The weld heat rheostat is installed in the left section of the panel and is provided with a large knob, allowing for increased heat when the rheostat is turned in a clockwise direction. The weld actuation connection is installed in the right hand lower section of the panel, and the weld power is available through the two $\frac{1}{2}$" USS bronze bolts installed in the lower center section of the panel.

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SPECIAL FEATURES

No standby power required
Immediate weld upon closure of actuation switch
High power output in small package
Reliable repetition of weld heat settings
Durable, rugged, long life.

MECHANICAL SPECIFICATIONS

Size:	12¼ x 15" x 22"
Finish:	Gray Hammertone
Weight:	70 pounds

ELECTRICAL SPECIFICATIONS

Power Rating:	2½ KVA (5 KVA at 50% duty cycle)
Input Voltage:	208 or 220 volt 2-wire service
	220 volt 3-wire service
	110 volt (usable on low heat range only)
Power Input - Standby:	O Watts
Frequencies:	50 - 60 cycle
Phase:	Single
Maximum Current:	24 Amperes power line demand
Transformer Ratio:	⅔ turn per volt
Secondary Voltage:	Adjustable
Output Voltage:	Standard 4 volts maximum

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PRODUCT DATA SHEET

VTW-9,STORED ENERGY POWER SOURCE

The VTW-9, Stored Energy Power Source, has been designed for industrial use where the features of a capacity discharge type welder are required or where a light duty power line is the only source available. The Vacuum Tube Products Co. Inc. Stored Energy Welder incorporates only such components that will allow continuous industrial use of the machine with freedom from maintenance problems. A selectable bank of oil-filled paper capacitors are charged by means of an adjustable voltage from a heavy duty power transformer and with electron tube rectification. This stored energy is discharged into the welding transformer through a heavy duty mercury contact relay. The components of the VTW-9 have been selected so that they will be completely within their operating ratings should an operator actuate the weld firing circuit by the fastest possible manual means.

The VTW-9 is housed in an attractive (Gray Hammertone) cabinet with a heavy duty carrying handle and is a complete stored energy power unit requiring only a light duty input cord. The design of this unit is such as to allow its use for portable applications, temporary bench top weld repair work, or for factory installation where numerous units may be in continuous use. All controls are easily accessible from the front panel, which includes a main power line smitch, capacitor selector switch, heat range selector switch, weld actuator switch receptacle, and two heavy duty output terminals for attachment of welding equipment.

OPERATION

To place the VTW-9 in operation, it is merely necessary to connect the line cord to an appropriate source of power, connect the two $1/2$" USS bronze bolts at the lower center of the panel to the spot welding head or welding hand piece, connect the actuating switch circuit to the actuating switch connector socket at the lower right hand section of the panel, turn the power line switch at the lower left hand section of the panel to the on position, then weld. The weld heat may be selected by either of two methods: one, by adjustment of the voltage applied to the storage capacitors, or two, by, by selection of the stored capacity. It should be remembered that the actual weld time is dependent upon the amount of capacity used, and the amount of weld power available is dependent upon charged voltage. Appropriate selection of a proper combination will be dependent upon the material and the thickness of the items being welded. The capacitor selection switch is located in the upper left hand section of the panel, and the voltage selection switch is located in the upper right hand section of the panel.

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SPECIAL FEATURES

A welder source suitable for operation from light duty power lines.

A welder source completely portable and usable for such items as attachment of strain gauges to aircraft wings, patching jet aircraft insulation blankets, jewelry manufacture, vacuum tube assembly.

Very short weld times, providing welds free from oxidation.

Reliable components used throughout, allowing continuous industrial use.

Extremely fast recharging time provides exact duplication of every weld.

Combination of capacitor selection and charging voltage allows effectively infinite adjustment over entire range.

MECHANICAL SPECIFICATIONS

Size:	9½" wide x 10½ high x 10½ deep.
Finish:	Gray Hammertone
Weight:	42 pounds

ELECTRICAL SPECIFICATIONS

Input:	105 to 120 volt line
Phase:	Single
Input Power - Peak:	2 KW

Note: This power required for less than 1/60 of a second immediately following weld actuation.

Input Power - Standby:	75 Watts
Out - Peak Volts:	1 - 30 Volts
Storage Capacity:	84 Microfarads
Storage Voltage:	600 Volts maximum
Discharge Time:	.002 seconds maximum.

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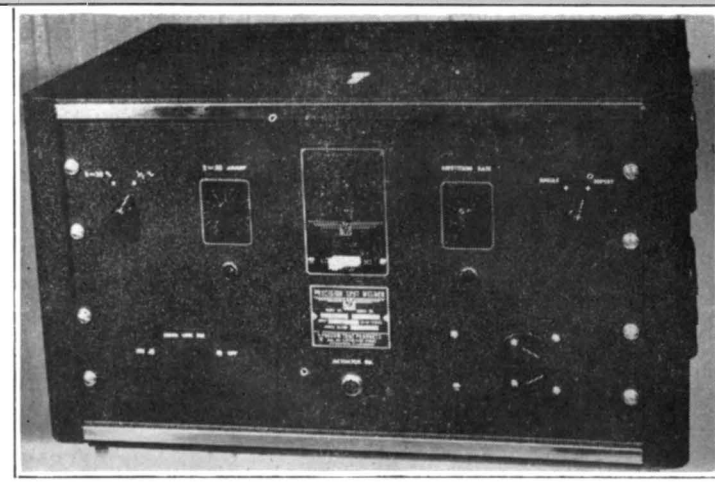
PRODUCT DATA SHEET

VTW-10 COMBINATION WELDING UNIT



The VTW-10, Combination Welding Unit, is designed to fulfill requirements for all types of light and medium duty resistance welding. The unit provides power output to supply a welding head such as the VTA-9, the tweezer weld points such as the VTA-12, or the welding hand pieces such as the VTA-10 and VTA-11, either of which are used with the VTA-13 Ground Piece.

A complete range of weld time adjustment can be obtained over the range of zero to $\frac{1}{2}$ cycle available from a modified Fractional Cycle Timer Model VFT-217 installed, and 2 to 20 cycles available from the VTA-1 installed, as well as the provision for either single weld or seam welding over a weld-speed range of 1 to 20 welds per second, provided by the VTA-3 Adjustable Speed Repeat Timer installed. A VTA-7 Size 2 Welding Transformer is utilized and connects with the timer control cabinet by means of the heavy duty 3-wire rubber covered cable and range plug mating with the socket on the timer panel. The VTA-11 and the VTA-13 are the only accessories supplied as standard with the VTW-10 unit.

The timer control unit is housed in an attractive gray hammertone rack type cabinet with a $10\frac{1}{2}$" high panel containing all operating controls. The VTW-10 timer cabinet and the VTA-7 welding transformer cabinet are identical in size. A main line on-off switch is provided in the lower left hand corner of the timer control cabinet. Other controls on this panel, from left to right, are the 2 to 20 half-cycle operation selector switch, the 2 to 20 time adjust potentiometer, the fractional cycle time adjust potentiometer, the repetition weld rate adjust potentiometer, and the single-repeat weld operation selection switch. Directly below the 2 to 20 cycle adjust potentiometer is the main line pilot light. Directly below the fractional cycle timer potentiometer is installed the high-low heat switch for the fractional cycle timer operation. Directly below the repetition rate potentiometer is installed the pilot light to indicate that a cathode time protection delay circuit is operative. The right hand lower section of the panel contains the 3-pole range socket for connection to the weld transformer primary by means of the range cable and plug attached to the VTA-7. Provision is made for connection to the weld actuation circuit by means of the weld actuation switch receptacle centrally located on the lower section of the panel.

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VTW-10 COMBINATION WELDING UNIT

OPERATION

The main line switch located in the lower left section of the panel may be turned to the on position, and indication will be obtained by the lighting of the pilot light located below the 2 to 20 cycle adjust potentiometer. At the end of the cathode protection period, the pilot light will light below the repetition weld rate adjust potentiometer, indicating that welding may proceed. Assuming that the VTA-7 primary plug is connected to the 3-wire range socket and the secondary of the VTA-7 is connected to a weld load and that the actuation switch circuit on the welder has been properly made, selection should now be made on the single or repeat weld switch for the type of operation desired, and selection should be made on the 2 to 20 half-cycle timer selector switch for the appropriate timer. Time adjustment may now be set on the particular timer selected, with minimum time being at the counter-clockwise position of the adjustment knob and maximum time being at the clockwise position of the adjustment knob. The weld actuator switch may now be actuated and the time adjustment re-adjusted to a time suitable for the material being welded.

MECHANICAL SPECIFICATIONS

Timer Control Cabinet:

Size: 12¼" x 15" x 22"
Finish: Gray Hammertone
Weight: 80 pounds

Weld Transformer, Type VTA-7:

Size: 12¼" x 15" x 22"
Finish: Gray Hammertone
Weight: 112 pounds

ELECTRICAL SPECIFICATIONS

Power Input: 440 or 480 volt 2-wire service.
Frequency: 50 to 60 cycle
Phase: Single

SECTION I: When Fractional Cycle Timer is in use:

Power Input — Standby: 160 watts
Power Load — Peak (at crest of weld cycle): 100 maximum amperes (Welder Transformer primary current)
Power Output — Peak (at crest of weld cycle): 40 KVA
Weld Speed — Maximum: 20 welds per second

NOTE: Weld speed and maximum weld current must be such that average weld transformer primary current does not exceed 6.4 amperes continuous average or 12.8 amperes for 15 seconds average.

Output Voltage: 8½ volts maximum.

SECTION II: When 2 to 20 Cycle Timer is in use:

Power Rating: 5 KVA (10 KVA at 50% duty cycle)
Power Input: — Standby: 160 watts
Maximum Current: 26 amperes
Weld Speed — Maximum: 3 welds per second

NOTE: The 2 to 20 cycle time section is not normally recommended for use on automatic repeat timing.

NOTE: Internal series resistors are installed to limit weld power when 2 to 20 Cycle Timer is in use.

Transformer Ratio: 1¼ volts per turn
Secondary Voltage: Adjustable
Output Voltage: Standard 8½ volts maximum.

PRODUCT DATA SHEET

Welder Accessories

Vacuum Tube Products Co. Inc makes available a complete line of accessories and components designed for the effective welding of light weight and difficult materials. While complete assemblies are available as standard equipment, additional weld pieces, timers, transformers, heat rheostats, and welding heads are also available. Upon order, Vacuum Tube Products Co. Inc, will also fabricate welding equipment especially designed to meet a customer's specific requirements.

VTA—1:

2 to 20 CYCLE NON-SYNCHRONOUS TIMING CONTROL. The VTA-1 is the standard timing control used in many of the Vacuum Tube Products Co. Inc. welding units. This control utilizes the resistance capacitance charging characteristic to measure a unit of time and then allow the firing of a cold cathode thyratron tube. The start of time takes place immediately upon closing the firing switch, and the end of time is denoted by the actuation of a relay within the timer which breaks a controlled circuit. Relay contacts rated at 5 amps. A.C. provide a circuit suitable for controlling any sized contactor or thyratron or ignition firing circuit. The VTA-1 operates from a 110-volt 50 to 60 cycle circuit and is housed in a 5" x7" x 2" chassis with 6-prong recessed Jones plug connections as well as a pair of flexible leads with time adjustment potentiometer attached. The unit is supplied without case and without chassis bottom but comes complete with mating unwired Jones 6-prong socket.

VTA-2:

2 TO 20 CYCLE TIMER AND WELD HEAT CONTROL. The VTA-2 is a complete weld control unit as used on the VTB-1 Bench Welder Assembly. The unit consists of a VTA-1 weld timer together with the VTA-8 heat control rheostat, wired and installed in a black wrinkle metal cabinet 5" wide, 10" high, and 10½" deep. The front panel contains the weld time adjustment potentiometer as well as a high-low heat switch. The VT-8 rheostat is mounted on the right side panel where the adjustment knob is readily accessible.

VTA—3:

ADJUSTABLE SPEED TIMER. The VTA-3 Adjustable Speed Repeat Timer is a non-synchronous automatic switch continuously adjustable over a speed range of one switch action per second to twenty switch actions per second. This versatile timer finds application in many fields other than its primary use for seam welding inasmuch as it provides a completely isolated switched electrical circuit capable of handling up to 3 amperes at 115 volts A.C. The VTA-3 operates from either 110 or 220 volt 50-60 cycle A.C. power and is assembled on a 4" x 6" x 2" chassis provided with 6-prong recessed Jones plug connections and flexible leads through a grommet in the chassis connected to the speed adjustment potentiometer. The unit is supplied uncased and without bottom on the chassis but comes complete with an unwired mating Jones 6-prong socket.

VTA—4:

WELDING TRANSFORMER, SIZE #1. The VTA-4 is the Vacuum Tube Products Co. Inc. standard welding transformer as used in such units as the VTB-1 Bench Welder and the VTW-1 Seam Welder. The VTA-4 is supplied with open frame construction allowing ready adjustment of welding voltage desired by merely looping in the desired number of secondary turns. The VTA-4 is supplied with a ten-foot length

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Phone: SAratoga 2-6567
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of #0 cable with lugs attached, sufficient to provide for six secondary turns that will deliver 4 volts. The VTA-4 is supplied complete with angle iron brackets and mounting holes, allowing sturdy installation when fastened through the 4 mounting holes provided. The VTA-4 has been designed especially for welder use and will deliver the maximum power consistent with size when used for this type of service. The VTA-4 also finds some use in regular power service and delivers power efficiently when loaded; however, standby excitation power is slightly higher than for transformers designed for continuous duty. The VTA-4 is rated at 2½ KVA or 5 KVA with 50% duty cycle, and is available with 110, 220, 440, or 550 volt primary windings.

VTA—5:

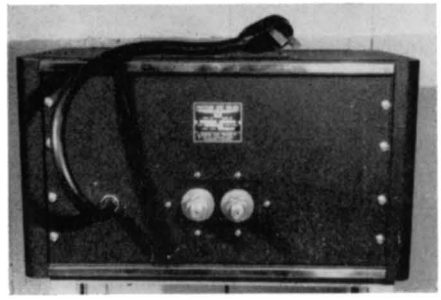
ENCASED WELDING TRANSFORMER. The VTA-5 is the Welding Transformer Type VTA-4 enclosed in a black wrinkle metal case provided with means for installing power input leads through a cable clamp in the rear of the cabinet and with the power output leads connected to two ½" USS bronze bolts mounted in an insulating block on the front panel. Case size is 9½" wide, 10½" high, and 10½" deep, with louvered sides and top. Four rubber feet are installed on the bottom of the case so that the unit may be placed wherever desired without marring its support.

VTA—6:

WELDING TRANSFORMER, SIZE #2. The VTA-6 is the Vacuum Tube Products Co. Inc. welding transformer with a rating comparable to two Size #1 units. The VTA-6 is supplied with open frame construction allowing ready adjustment of welding voltage desired by merely looping in the desired number of secondary turns. The VTA-6 is supplied with a twelve-foot length of #4/0 cable with lugs attached, sufficient to provide for 6 secondary turns that will deliver 7½ volts. The VTA-6 is supplied complete with angle iron brackets and mounting holes, allowing sturdy installation when fastened through the 4 mounting holes provided. The VTA-6 has been designed especially for welder use and will deliver the maximum power consistent with size when used for this type of service. TheVTA-6 also finds some use in regular power service and delivers power efficiently when loaded; however, standby excitation power is slightly higher than for transformers designed for continuous duty. The VTA-6 is rated at 5KVA or 10 KVA with 50% duty cycle, and is available with 110, 220, 440 or 550 volt primary windings.

VTA—7:

ENCASED WELDING TRANSFORMER



VTA—7

The VTA-7 is the Welding Transformer Type VTA-6 enclosed in a black wrinkle rack type cabinet provided with power input leads and attached 3 terminal range plug entering through a grommet in the front of the panel, and with the power output leads connected to two ¾" USS bronze bolts mounted in an insulating block on the front panel. Cabinet size is 12¼" x 15" x 22", with the front panel measuring 10½" x 19".

VTA—8:

HEAT CONTROL RHEOSTAT. The VTA-8 Heat control Rheostat is a weld heat control unit identical to the units used in the VTB-1 and VTW-4, but available as a separate unit completely enclosed in a black wrinkle metal box 10" x 10" x 4½" deep. The VTA-8 rheostat is 6¾" in diameter, rating at 600 volts, 12½ ohms, and 10 amperes to 3 amperes continuous service. When used for welder duty, peak powers of up to 3 times the continuous rating may be applied.

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VTA—9:

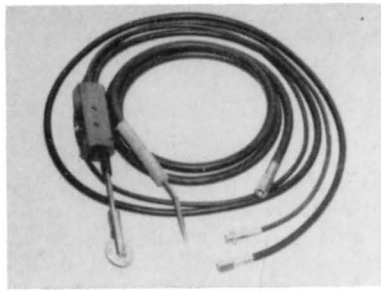
PRECISION WELDING HEAD AND FOOT PEDAL. The VTA-9 is the high precision welding head as supplied on the VTB-1 Bench Welder. The unit is supplied complete with foot pedal, actuating chain, and flexible welding connections for the movable electrode. Major features of the VTA-9 are the provisions for extremely accurate welding due to precision machining, precise welding electrode pressure adjustment, and extremely fast weld follow-up or forging action due to the aluminum top electrode construction, together with the very short lever arm on the high current flexible electrical connection. Complete adjustment may be made of the welding electrode position both horizontally and vertically by means of standard electrode holders. Adjustments also can be made for released top electrode stop position, firing switch overtravel, welding point pressure, and foot pedal return.

VTA—10:

SPOT WELDING HAND PIECE. The VTA-10 Spot Welding Hand Piece is a 5/16" diameter Mallory No. 3 pointed electrode mounted in a mahogany hand piece housing a button microswitch, allowing weld actuation. A six-foot length of #6 welding cable (rubber covered) is attached, together with a polished brass hex terminal to fit 1/2" USS bolts, standard on all Vacuum Tube Products Co. Inc. welding machines. A 2-wire flexible rubber covered cord terminates in an Amphenol connector to mate with the panel mounted actuation switch cocket, standard on all Vacuum Tube Products Co. Inc. welding equipment.

VTA—11

SEAM WELDING HAND PIECE:

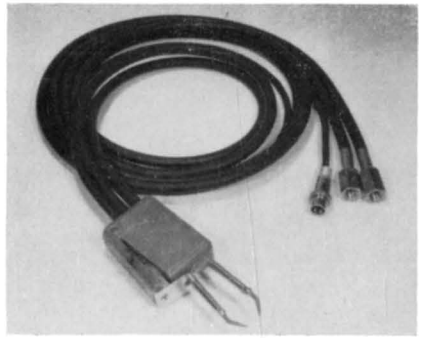


VTA-11 and VTA 13

The VTA-11 Seam Welding Hand Piece is identical to the VTA-10 except that the seam weld roller is substituted for the pointed electrode. A 1 3/4" diameter sharp-edged roller welding wheel is mounted in a 5/8" diameter yoke by means of a 1/4" diameter removable pin. This roller weld assembly is soft-soldered to the 5/16" Mallory No. 3 rod as used on the VTA-10, and may be removed or changed to allow the use of other electrodes for special purposes if desired. The mahogany hand piece, actuation switch, cables, and connections are identical with the VTA-10.

VTA—12:

TWEEZER WELDING HAND PIECE.



VTA—12

The VTA-12 Tweezer Welding Hand Piece is a portable pair of welding electrodes attached to a pair of 4 1/2 foot weld current carrying leads, allowing an operator to weld assemblies otherwise inacessible to welding machines. The well-designed hand piece provides for complete adjustment of welder point pressure by means of internal springs and screw adjustments, as well as firing after contact and overtravel, by means of the stop positions of the internally mounted miniature microswitch. The heavy duty welding cables terminate in polished brass hex terminals to fit 1/2" USS bolts, standard on the Vacuum Tube Products Co. Inc. welding units, and the 2-wire flexible rubber covered cord terminates in an Amphenol connector to mate with the panel mounted actuation switch socket, also standard on all Vacuum Tube Products Co. Inc. welding equipment.

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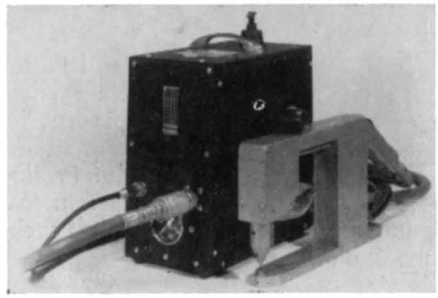
VTA—13:

HAND PIECE GROUND CABLE. The VTA-13 is a bakelite-encased 5/16" Mallory No. 3 pointed rod suitable for hand holding and pressure against a material being welded either with the VTA-10 Spot Weld Hand Piece or with the VTA-11 Seam Welding Hand Piece. The VTA-13 is supplied complete with a six-foot length of #4 rubber covered welding cable terminating in a polished brass hex terminal to fit a 1/2" USS bolt, standard on all Vacuum Tube Products Co. Inc. welding equipment.

VTA—14:

AIR CONTROLLED PORTABLE WELDER HEAD.



VTA— 14 and VTA—15

The VTA-14 is a light weight, 7 pound, aluminum portable welder head of the Tweezer type which can be operated from any standard light or medium powered welding supply unit such as the VTW-1, VTW-2 or VTW-13.

The Tweezer type head is provided with an air cylinder for actuation of the movable electrode and is capable of applying weld point pressures up to 75 pounds. The unit can be held and operated easily by one operator. The weld circuit is actuated by means of a thumb switch located in the handle. It is normally provided with two 6 foot long #4 cables for power supply, one 6 foot cord for the actuation switch and one 6 foot airline for connection to the VTA-15 Pneumatic Control.

VTA—15:

PNEUMATIC CONTROL. The VTA-15 is a Pneumatic Actuator Control for use in conjunction with the VTA-14 Welder Head. It is packaged in a black wrinkle metal case with a visible air gauge. Welds may be made at specifically selected pressures and the unit will make exact duplicate welds, capable of certification. It has an electric solenoid valve, providing proper air flow to the welder head, and allows for the relief and return of the head, or tweezers. It also has an adjustable air pressure regulator allowing the welding supply to provide power at precise and pre-selected electrode pressures.

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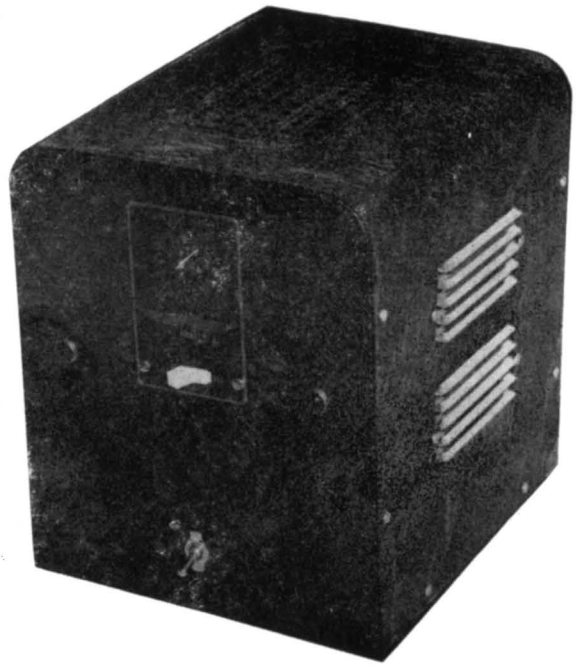
PRODUCT DATA SHEET



FRACTIONAL CYCLE TIMER

The VTP Fractional Cycle Timer is designed to meet the more specialized requirements of resistance welding when used for timing spot or seam welders, or other timing operations in industrial service where extreme reliability is required. The extremely fast time setting insures spatter-proof, oxide-free welds, and allows positive welding of such materials as molybdenum and tungsten. Positive adjustment in the fractional cycle range also allows welding of materials of less than .001" thickness with reliability and uniformity.

All controls are readily accessible from the front panel and consist of an On-Off switch with pilot indicator, a cathode protection pilot, a high-low range switch, and a variable time control. A cathode protection circuit is incorporated to allow proper warm-up time before welds can be made. When the correct operating temperatures have been reached, an indicator lights on the front panel. The weld time is adjustable from 1/6 to nearly 1/2 cycle, with the option of also utilizing the reverse part of the cycle.

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Phone: SAratoga 2-6567

The standard VTF Fractional Cycle Timer is offered in eight different models to meet the particular demands of industry.

Model VTF-216: Designed for 220-volt, 3-wire, 50-60 cycle operation.

Model VTF-217: Designed for 110-volt, 50-60 cycle operation.

Model VTF-218: Designed for operation from 220 volt, ungrounded 3 phase 50-60 cycle supply.

Model VTF-219: Designed for 440 volt, 2-wire 50-60 cycle ungrounded operation.

Model VTF-220: Heavy duty control. Power rating 180 amperes peak.

Model VTF-221: Synchronous Seam Welding control. Operates from 110-0-110 volt 50-60 cycle 3-wire line, 110 volt 2-wire line or 220 volt or 208 volt 2-wire line.

Model VTF-222: Synchronous Seam Welding Control, High Power.

Model VTF-223: Non-Synchronous Seam Welding Control, High Power.

The Fractional Cycle Timers are designed for use with the VTP Precision Spot and Seam Welders, and are available installed ready for operation, or available as individual components where the excellent timing features of the units are desired for equipment already in use.

MECHANICAL SPECIFICATIONS

	Models VTF 216, 217, 218, 219,	**Models VTF 220, 221, 222, 223**
Size	$10\frac{1}{2}$x9x$10\frac{1}{2}$ inches	$12\frac{1}{2}$x$14\frac{1}{3}$x22 inches*
Finish	Gray Hammertone	Gray Hammertone
Weight	20 lbs. approx.	55 lbs. approx.

*Models VTF 220, 222, and 223 are in two cabinets each of this size.

OPERATIONAL SPECIFICATIONS

	Models VTF 216, 217, 218, 219	**Models VTF 220, 221, 222, 223**
Current Output	40 Max. Peak Amperes	100 Max. Peak Amperes
Repetition Rate	300 Welds/Min.	1200 Welds/Min.
Power Imput, Standby	110 Watts	160 Watts*
Power Output	Adjustable over the range 2 Watt Seconds to 100 Watt Seconds	Adjustable over the range 2 Watt Seconds to 467 Watt Seconds

*Model VTF 221 = 150 Watts

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