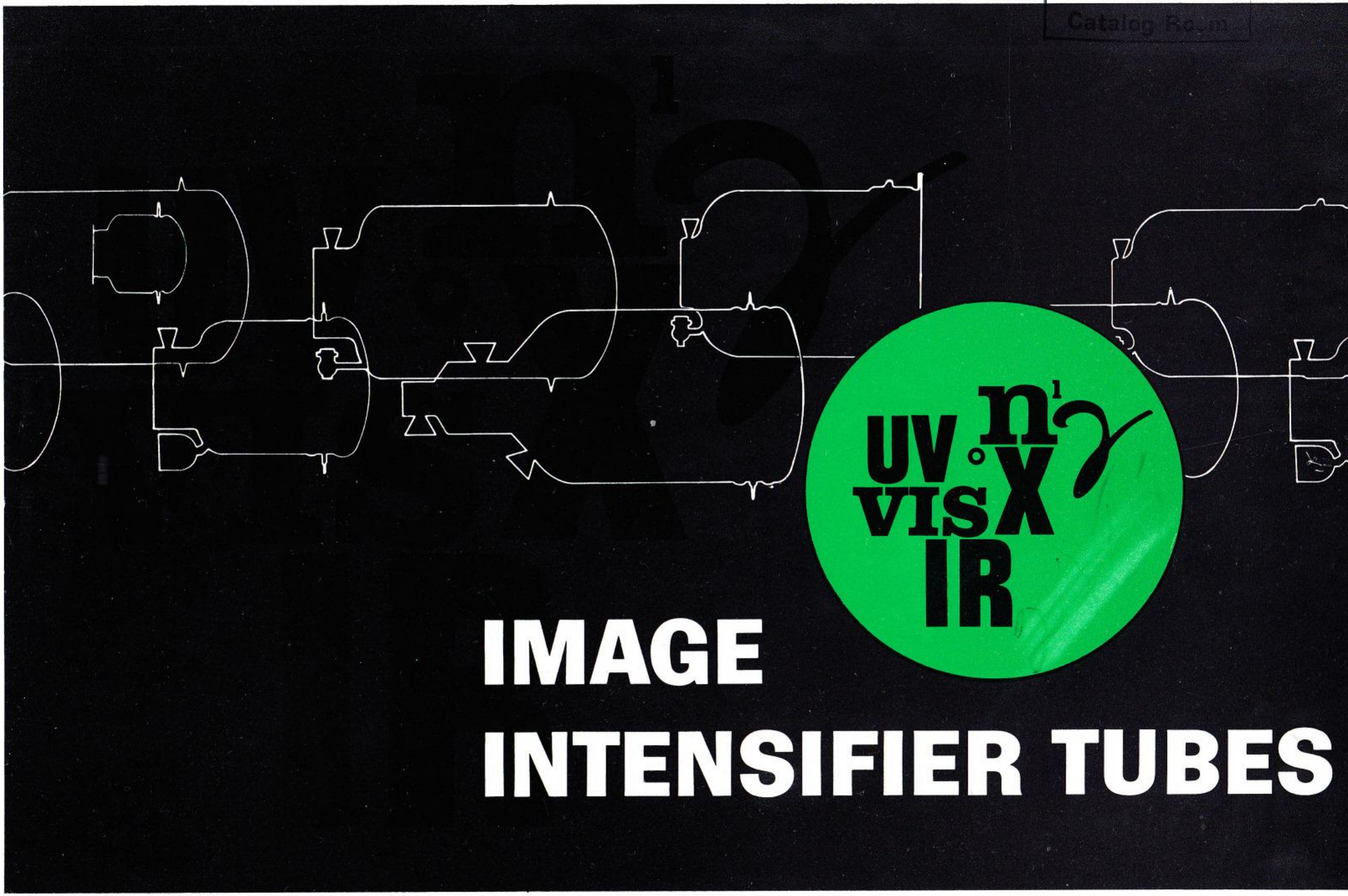


IMAGE INTENSIFIER TUBES

THE RAULAND CORPORATION

The Rauland Corporation is engaged in the design, development and production of image intensifier tubes for use in various regions of the spectrum. The tubes presently available include visible, x-ray, gamma-ray and neutron radiation sensitive types.

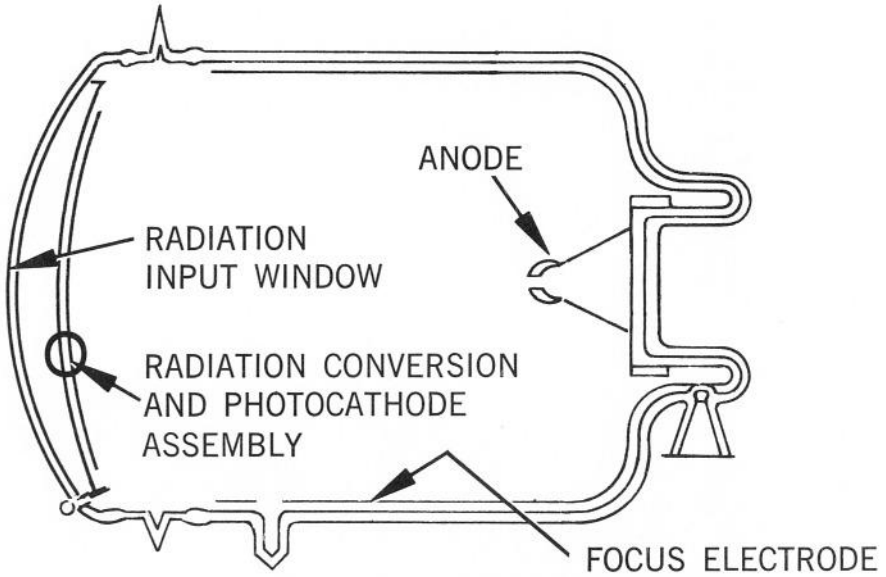
The tubes embody a variety of design features. These variations include spectral sensitivity range, input and output diameters, and applications. The visible and x-ray sensitive tube types are available in both single and dual stage designs. The dual stage types are fiber optic coupled. A listing of these parameters according to spectral sensitivity range follows:

VISIBLE — Responses from 3000 to 11000 A
Input window diameters from 1 to 9 inches
Output image diameters from ½ to 1 inch

X-RAYS — Responses from 5 KeV to 400 KeV
Input window diameters from 6 to 9 inches
Output image diameters from ¾ to 3 inches

GAMMA-RAYS — Responses from 0.25 MeV to 30+ MeV
Input window diameters of 9 inches
Output image diameters of 1 inch

NEUTRONS — Response sensitivity limited to thermal neutrons
Input window diameters 6 to 9 inches
Output image diameters of 1 inch



REPRESENTATIVE IMAGE INTENSIFIER TUBE OF THE LARGE INPUT DIAMETER TYPE

As noted in the illustration above, an image intensifier is comprised of a radiation conversion layer, photocathode, focus electrode(s), accelerating anode and phosphor viewing screen[1,2]. While the tube shown is a strongly minifying single stage design, other variations are available which embody different geometries.

1. Visible Radiation Intensifier tubes do not have a radiation conversion and photocathode assembly — the photocathode is deposited directly on the inside surface of the input window in the visible tubes.
2. The only tube not utilizing a phosphor screen for readout purposes is the R-6198 Electronography tube—which utilizes direct impingement of the electron beam on a fine grain photographic emulsion.

The applications of the different tube types are varied . . .

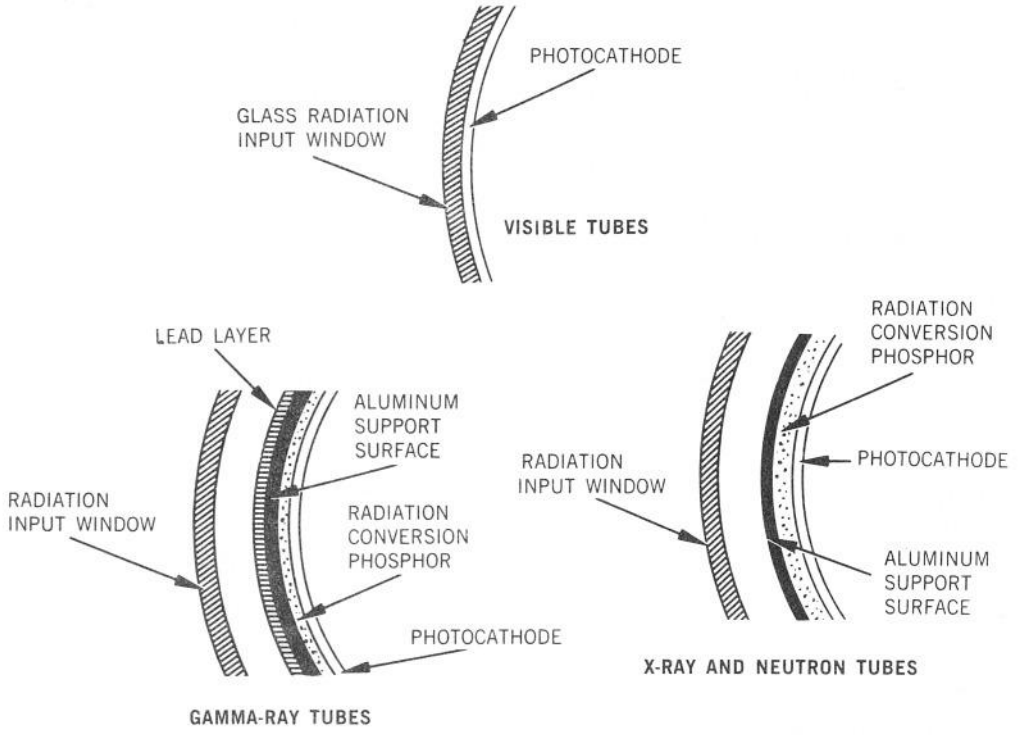
Visible tubes — Stellar photography, spectroscopy, physics research, low light level photography, night surveillance.

X-Ray tubes — Crystallography, diagnostic medicine, nuclear research, nuclear medicine, industrial nondestructive testing.

Gamma-Ray tubes — High energy nuclear physics and heavy industrial non-destructive testing.

Neutron tubes—Physics research and neutron radiography.

In the illustration (to the right) is a representation of the different forms of radiation conversion systems which are utilized in the unique Rauland family of image intensifier tubes. With the exception of the visible type, all tubes convert the incoming radiation to visible light by means of a "phosphor" . . . with the produced light then causing the production of photoelectrons. The photoelectrons are then accelerated and focused onto the image plane . . . in most cases a phosphor screen.



REPRESENTATIVE ILLUSTRATIONS OF VARIOUS RADIATION CONVERSION SYSTEMS

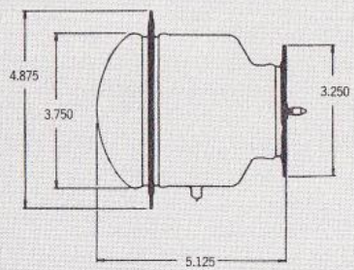
On the following pages are described the present line of image intensifier tubes available from the Rauland Corporation . . .

VIS
IR
UV

LIGHT LIGHT LIGHT LIGHT L

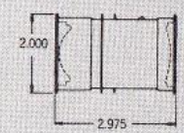
ELECTROSTATIC TRIODE
(ELECTRONOGRAPHY)
TYPE R-6198

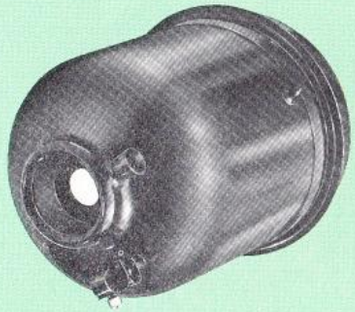
Input Diameter — 1 inch
Spectral Response —
S-9, S-11 or S-20
Output Image Diameter — ½ in.
Resolution — 100 lp/mm
(fine grain Emulsion)
Applications — Stellar
photography and spectroscopy



ELECTROSTATIC TRIODE
TYPE R-6286

Input Diameter — 1 inch
Spectral Response —
S-1, S-11 or S-20
Output Image Diameter — 1 inch
Resolution — 40 lp/mm
Applications — General purpose
scientific & industrial

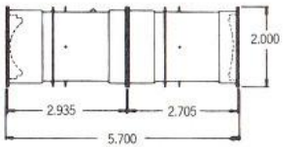




IGHT LIGHT LIGHT LIGHT LIGH

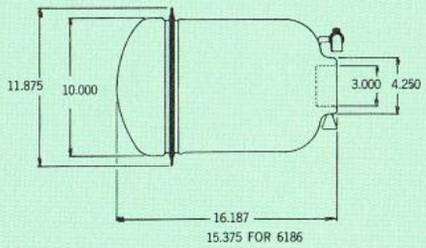
ELECTROSTATIC TWO-STAGE (FIBER OPTIC INTERSTAGE) TYPE R-6251

Input Diameter — 1 inch
Spectral Response — S-9, S-11 or S-20
Output Image Diameter — 1 inch
Resolution — 15 lp/mm
Applications — Special purpose scientific



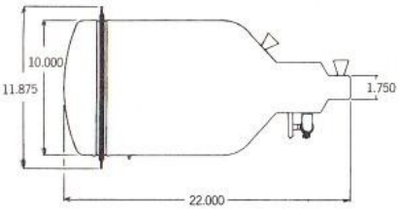
ELECTROSTATIC TRIODE TYPE R-6186-P

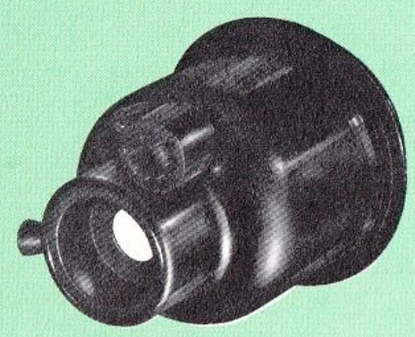
Input Diameter — 9 inches
Spectral Response — S-9, S-11 or S-20
Output Image Diameter — 1 inch
Resolution — 100 lp/inch
Applications — Multi-purpose scientific research

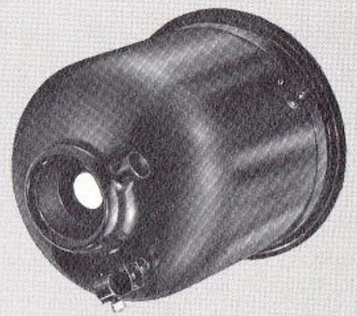


ELECTROSTATIC TWO-STAGE (FIBER OPTIC INTERSTAGE) TYPE R-6204-P

Input Diameter — 9 inches
Spectral Response — S-9, S-11 or S-20
Output Image Diameter — ¾ in.
Resolution — 50 lp/inch
Applications — Atomic Research and Nuclear Medicine



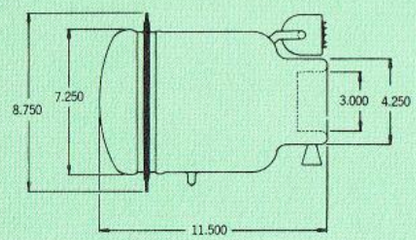




RAY X-RAY X-RAY X-RAY X-RAY

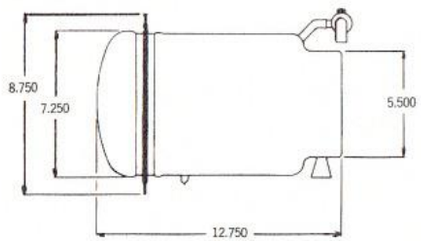
ELECTROSTATIC TETRODE TYPE R-6176-RPF

Input Diameter — 6 inches
Spectral Response — X-Ray, 30 to 200 KVP
Output Image Diameter — 5/8 in.
Resolution — 40 lp/inch
Brightness Intensification*— 4,500 (typical)
Applications — Medical and industrial radiography



ELECTROSTATIC TRIODE TYPE R-6228-PF

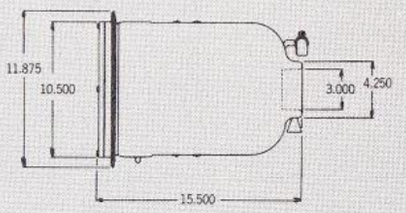
Input Diameter — 6 inches
Spectral Response — X-Rays, 30 to 200 KVP
Output Image Dia. — 2.75 in.
Resolution — 80 lp/inch
Brightness Intensification*— 400 (typical)
Application — Industrial nondestructive testing

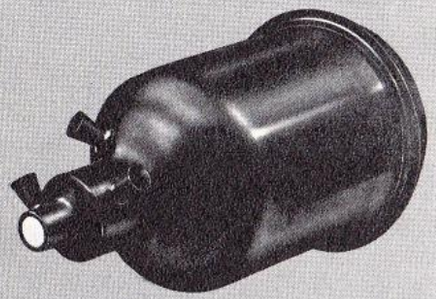


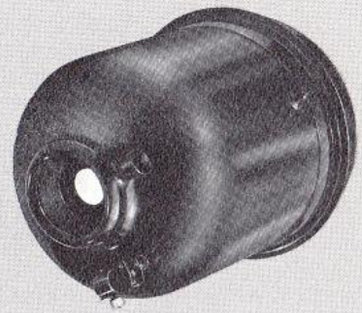
ELECTROSTATIC TRIODE (BERYLLIUM INPUT WINDOW) TYPE R-6189-P

Input Diameter — 9 inches
Spectral Response — X-Rays, 10 to 100 KeV
Output Image Diameter — 1 in.
Resolution — 40 lp/inch
Brightness Intensification*— 2,000 (typical)
Applications—X-Ray Deffraction and low energy radiology

TYPE R-6189-RP This tube, while being almost identical to the R-6189-P, is suitable for even lower energy levels due to internal design modifications.



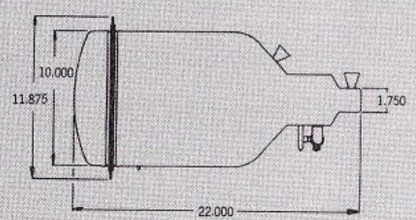




X-RAY X-RAY X-RAY X-RAY X-R

ELECTROSTATIC TWO-STAGE (FIBER OPTIC INTERSTAGE) TYPE R-6276-P

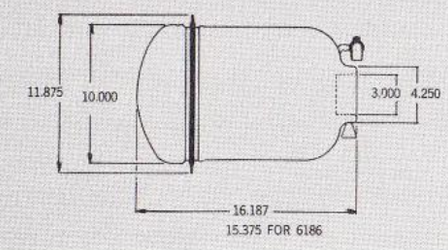
Input Diameter — 9 inches
Spectral Response — 20 to 150 KVP
Output Image Diameter — ¾ in.
Resolution — 25 lp/inch
Brightness Intensification*— 50,000 (typical)
Applications—Nuclear medicine



ELECTROSTATIC TRIODE TYPE R-6175-RP

Input Diameter — 9 inches
Spectral Response — X-Rays, 40 to 300 KVP
Output Image Diameter — 1 in.
Resolution — 40 lp/inch
Brightness Intensification*— 4,000 (typical)
Applications — Medical and Industrial Radiography

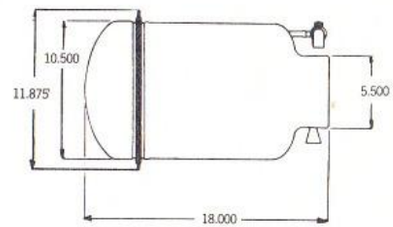
TYPE R-6284-P This tube is practically identical to the R-6175-RP with the chief exception being that the input window is of a larger radius of curvature. The modified geometry yields higher system resolution in Nuclear medical applications.



ELECTROSTATIC TRIODE TYPE R-6199-P

Input Diameter — 9 inches
Spectral Response — X-Rays, 40 to 300 KVP
Output Image Diameter—2.90 in.
Resolution — 70 lp/inch
Brightness Intensification*— 600 (typical)
Application — Principally industrial nondestructive testing

TYPE R-6281-P This tube is quite similar to the R-6199-P with the principal exception that the brightness gain is substantially higher. The gain is typically 1500* and allows application to Cine and Kineflouorography.



*Brightness Intensification being defined as the ratio of tube output screen brightness to that of a Patterson CB-2 fluoroscopic screen under identical irradiation conditions.

RAY GAMMA-RAY GAMMA-RAY

ELECTROSTATIC TRIODE
TYPE R-6206-P

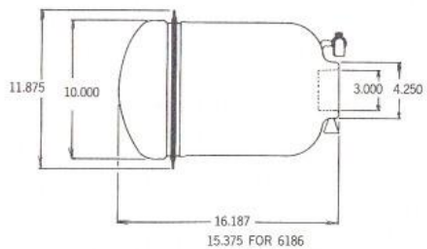
Input Diameter — 9 inches

Spectral Sensitivity — 1 to 30+ MeV

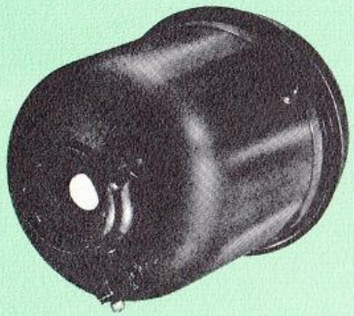
Output Image Diameter — 1 inch

Resolution — 25 lp/inch

Application — High energy industrial radiography and scientific research



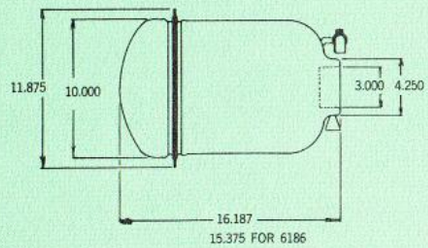
NEUTRON

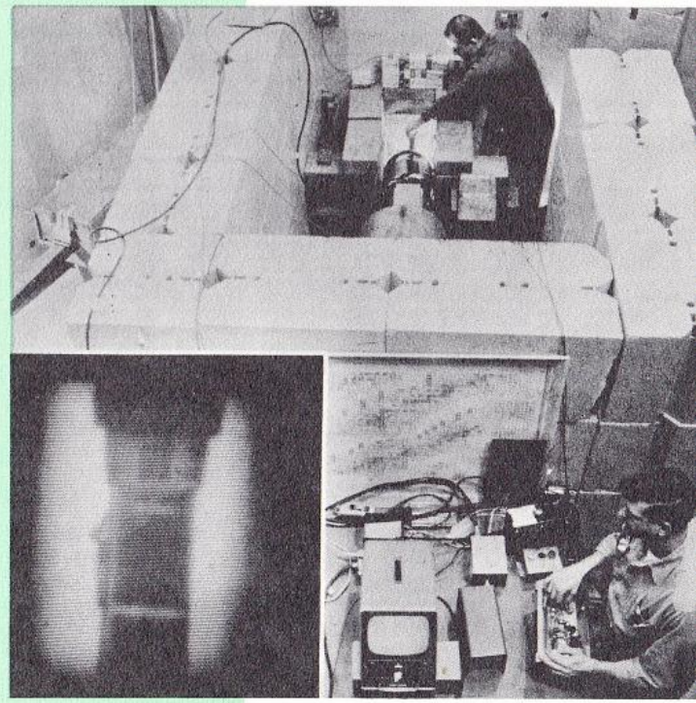


NEUTRON NEUTRON

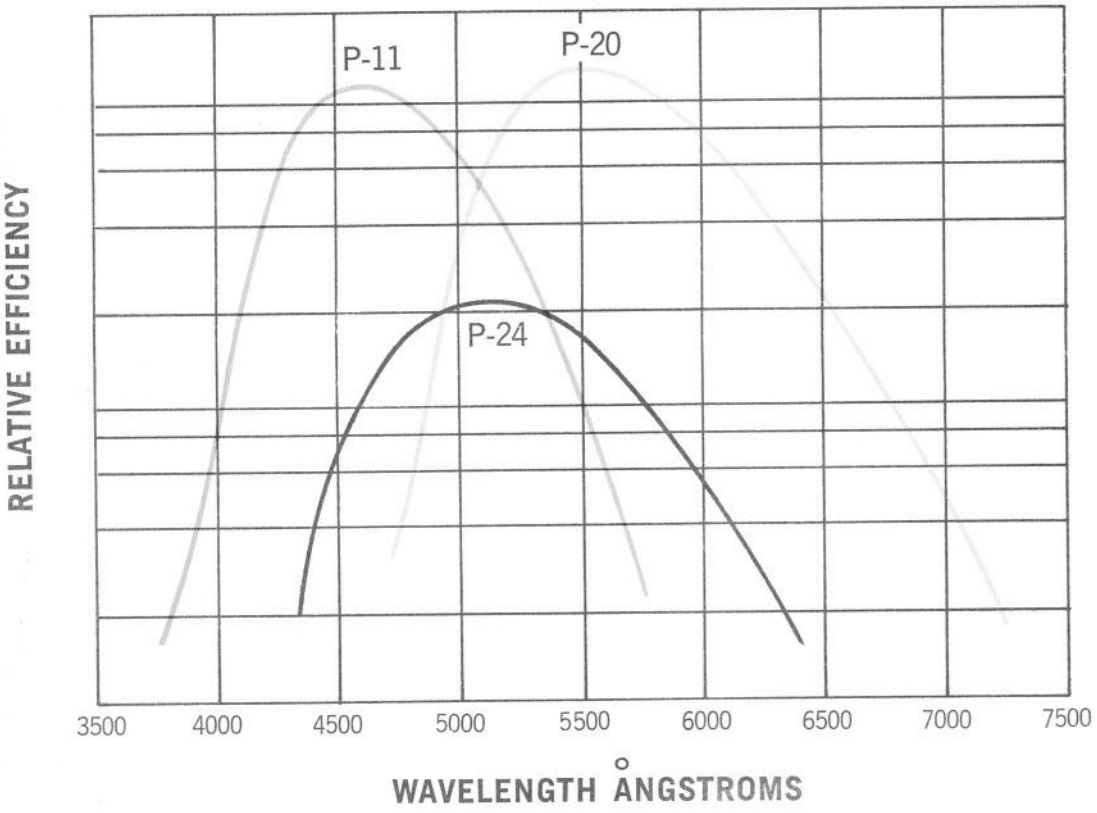
ELECTROSTATIC TRIODE
TYPE R-6277-P

Input Diameter — 9 inches
Spectral Sensitivity — Thermal neutrons
Flux Sensitivity Threshold — — 1 x 10^3 n/cm^2/sec
Output Image Diameter — 1 inch
Resolution — 30 lp/inch
Applications — Physics research and neutron radiography

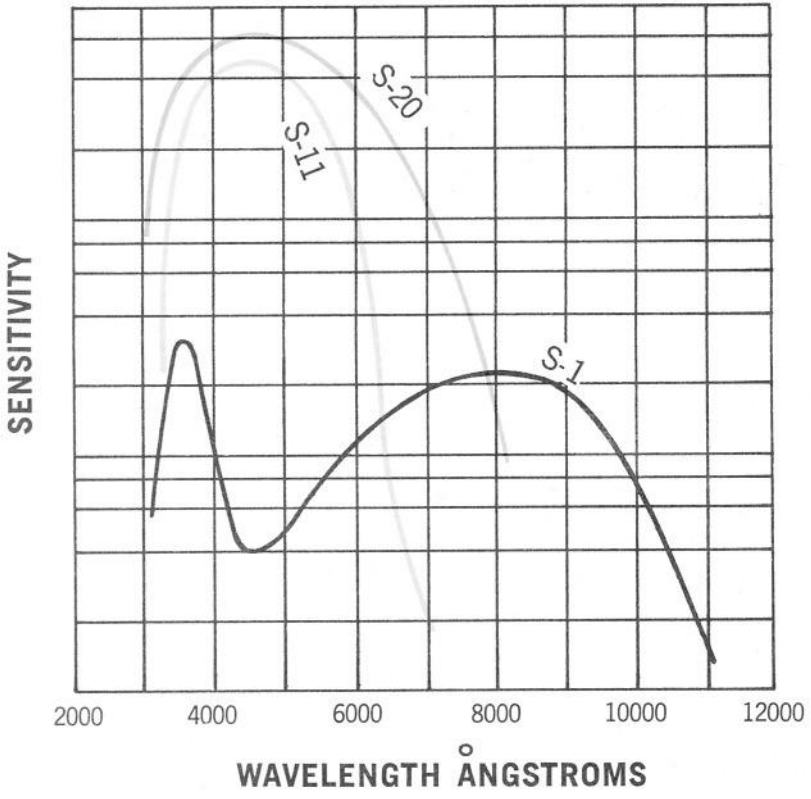




TYPICAL SPECTRAL RESPONSE CHARACTERISTICS OF ALUMINIZED PHOSPHOR SCREENS

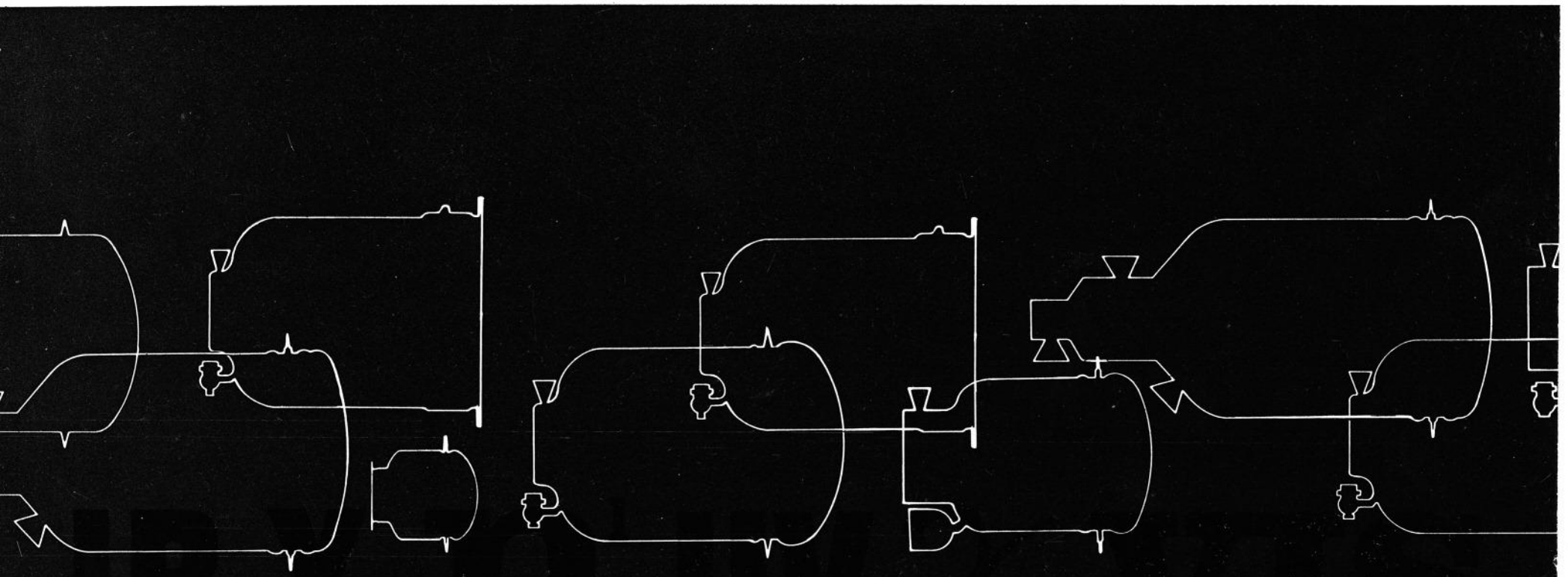


SPECTRAL RESPONSE CHARACTERISTICS



GRAPHS OF PHOTOCATHODE AND PHOSPHOR CHARACTERISTICS

The information detailed in this brochure is intended to be indicative of the image tube products presently available from The Rauland Corporation . . . the information is intentionally generalized and meant to present a cross section of the Organization's present capabilities.



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SPECIAL PRODUCTS DIVISION