



KLYSTRON TV 2011

The TV 2011 is intended for use as a source of rf power for linear accelerator service. It is a five-cavity high power sealed-off klystron amplifier able to deliver a 20 kW average power min. and a 20 MW peak power min. in S-band. It is pretuned in factory at a given center frequency in the range 2700 - 3100 Mc (1).

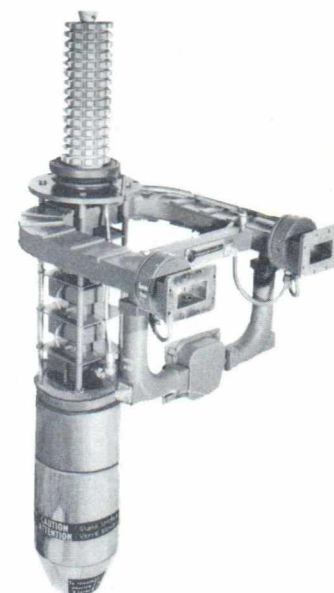
The rf input is made on a 50 Ω -N type coaxial plug and the output through two ceramic windows. The total rf output power may be recombined in a single waveguide by use of a TV 19101 recombiner.

The beam focusing is obtained by a TV 19008 focus coil external to the tube. The windows, body and collector of the tube are cooled by a single water flow, the collector being cooled by water vaporization according to the Vapotron technique * which insures a high safety of operation.

The structure of the tube includes an active getter which insures a permanent high vacuum.

In short, the TV 2011 klystron offers the following main advantages :

- high efficiency
- high reliability
- high power
- high gain



CHARACTERISTICS

Mechanical

Dimensions	see drawing page 6
Mounting position	vertical, cathode down
Weight	65 kg (145 lbs) approximately
Envelope	metal, ceramics and glass
RF input	UG 22 D/U plug
RF output	two RG 48/U waveguides with reduced rectangular flanges (see drawing page 4)
Active getter input	UG 496/U plug
Cooling water inlet	STAUBLI plug, small size

(1) The TV 2011 B2 model operates at 2856 Mc

* C.F.T.H. reg. trade mark

**Electrical**

Cathode	unipotential, indirectly heated
Heater voltage (a.c or d.c)	25 V $\pm$ 5% (1)
Hot heater resistance	1 Ω $\pm$ 10 %
Cold heater resistance	0.14 Ω $\pm$ 10 %
Frequency	S band (2)
Bandwidth at - 1 db	min 15 Mc
Tuning	no tuning (3)
Perveance	1.8 $\pm$ 0.1 μ A.V - 3/2
Peak applied power	} see diagramm page 5
Average applied power	
Efficient d.c pulse length	
Repetition rate	
Efficiency (for an output peak power 10 MW).....	min 30 %
Drive, peak	nom 200 W

Accessories

RF input connector.....	UG 21 D/U (coaxial line RG 143/U)
Waveguide flanges	RH 1404 158 or equivalent, must fit the flanges of the klystron (drawing page 4)
Active getter connector.....	UG 60 D/U
Water inlet connector.....	STAUBLI connector (provided with each tube), fits a 8 or 13mm inner diameter tube. When disconnected from the plug, the connector locks the water circuit.
Focus coil	TV 19008
Recombiner	TV 19101
Heater-cathode connector	TV 19201
Vapodyne * system	see data NZ 1253

(1) The exact heating voltage is indicated on the testing sheet of each tube.
This voltage is to be observed within $\pm$ 5 %.

(2) The TV 2011 B2 model is tuned for operation at 2856 Mc.

(3) The tube is tuned in factory. Do not touch the locking devices of the cavities.

TYPICAL OPERATION

(Load : V S W R $\leq$ 1.1)

Beam voltage	250 kV
Beam current	230 A
Output, peak	22 MW
Output, average	22 kW
Gain	50 db
Bandwidth (- 1 db)	25 Mc
Efficiency	38 %
Pulse duration	3 μ s
Duty cycle	.001
Water flow	3 l/mn
Water inlet pressure	1 kg/cm ²

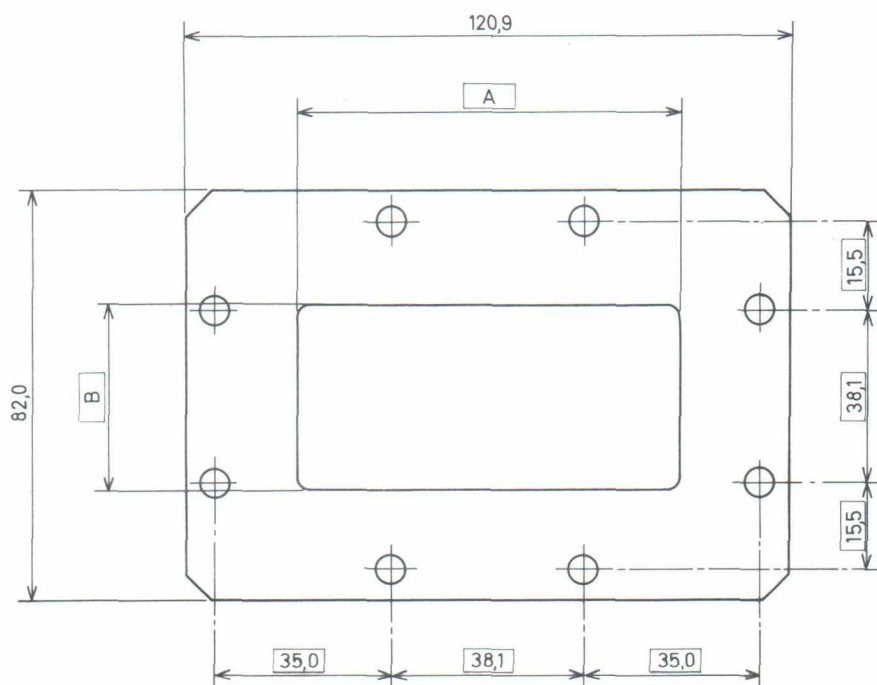
MAXIMUM RATINGS

(non simultaneous)

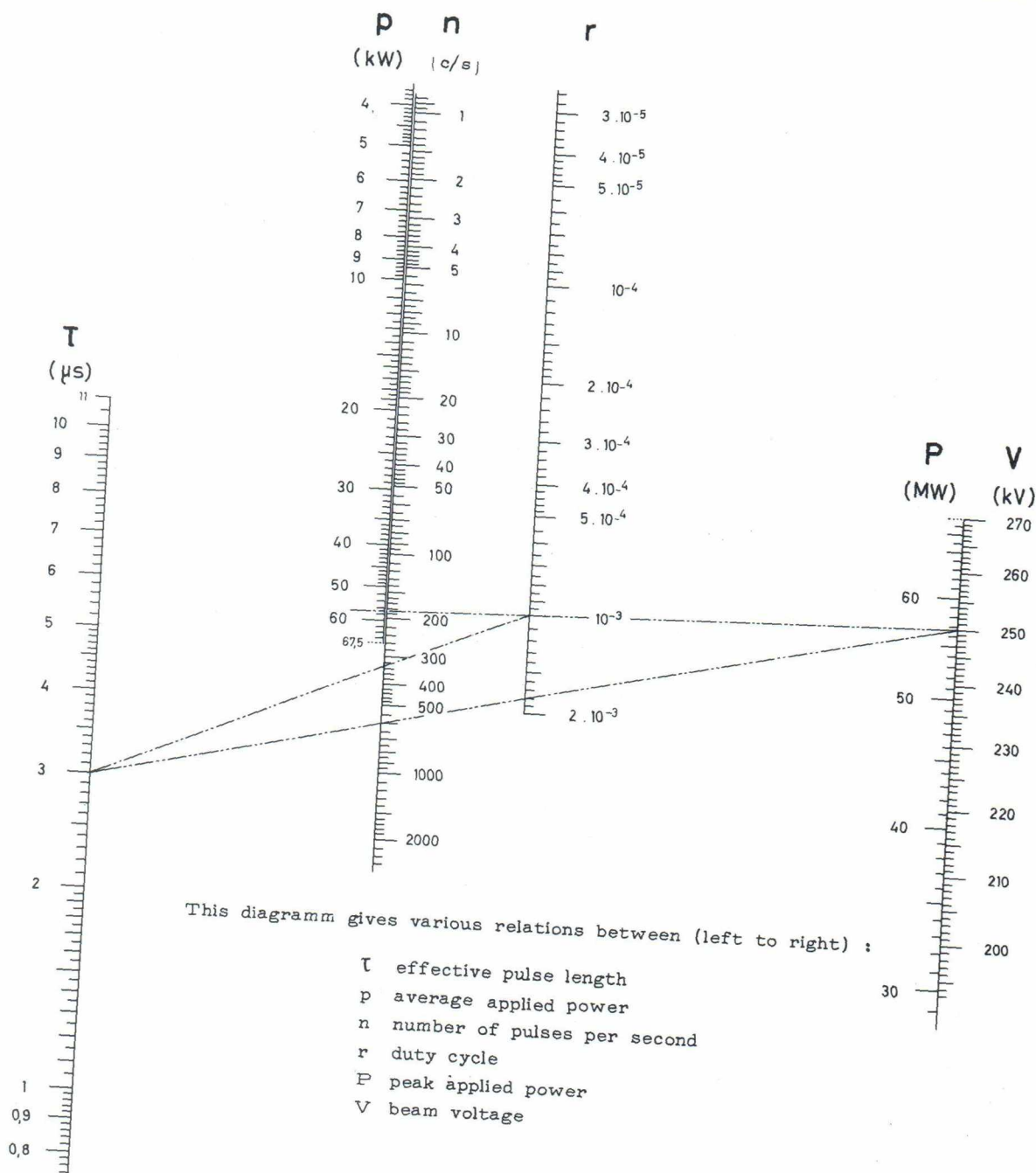
Heater warm-up time	min 15 mn
Heater surge current	max 50 A
Beam voltage	max 270 kV
Average applied power	max 67.5 kW
Efficient d.c pulse duration	max 11 μ s
Duty cycle	max .002
Load V S W R	max 1.5
Absolute pressure on the output windows	max 4 kg/cm ²
Cooling water inlet temperature	max 50°C
Cooling water flow	min 3 l/mn
Cooling water inlet pressure	max 8 kg/cm ² gen.

The diagram shows a series circuit. On the left is a rectangular box labeled "Power supply" with "3000V - 10 mA" below it. Two terminals on the top of this box are connected to a resistor and a meter. The resistor is represented by a zigzag line and labeled "10.000 Ω 3W". To the right of the resistor is a circular meter with a needle, labeled "Current measurement (1 μ A to 10 mA with protecting device)". To the right of the meter is a component labeled "Active getter", represented by a rectangle with a small vertical tube on top. The bottom terminals of the power supply, the getter, and the meter are all connected to a common ground, indicated by a hatched area.

KLYSTRON OUTPUT FLANGE

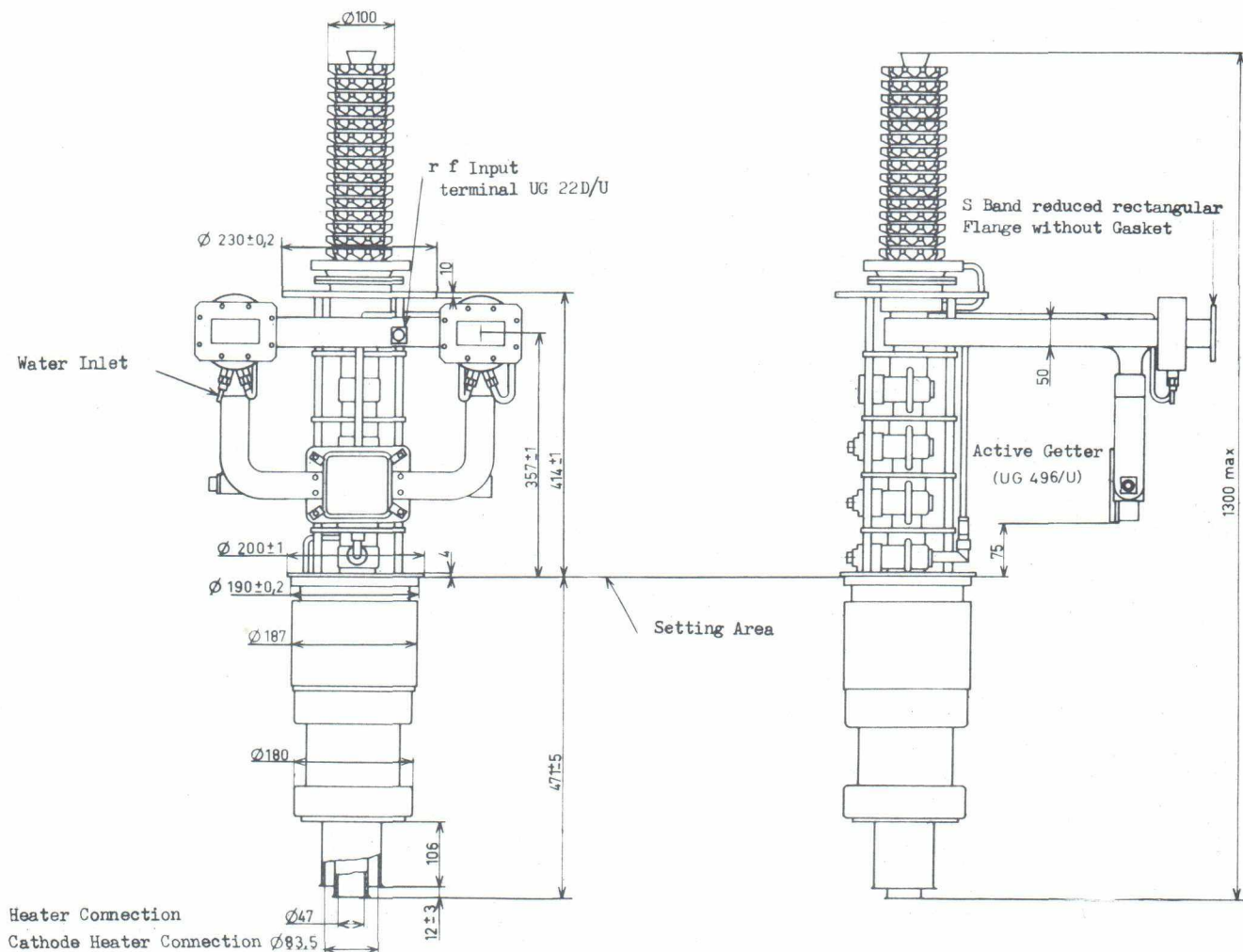


8 holes $\varnothing 6,2^{+0,2}$ $\begin{array}{|c|} \hline \blacklozenge 0,2 \\ \hline \end{array}$
group $\begin{array}{|c|} \hline \equiv 0,5 \\ \hline \end{array}$ AB



Example :

One needs 3 μs , 57 MW applied power (that is 22 MW output peak with 38% efficiency). The right-hand scales indicate the beam voltage : 250 kV. A straight line between both points indicates the maximum duty cycle (1.8×10^{-3}), the maximum repetition rate (600 c/s) and the maximum average applied power (here the limit = 67.5 kW is exceeded). Then r must decrease. If $r = 10^{-3}$, two new straight lines give $p = 57$ kW and $n = 330$ c/s.



All dimensions in mm

