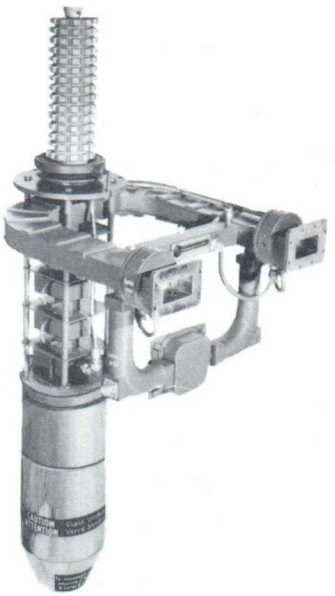
KLYSTRON TV 2011



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 50Ω -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

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Electrical

Cathode	unipotential, indirectly heated
Heater voltage (a.c or d.c)	25 V ± 5 % (1)
Hot heater resistance	1 Ω ± 10 %
Cold heater resistance	0.14 Ω ± 10 %
Frequency	S band (2)
Bandwidth at - 1 db	min 15 Mc
Tuning	no tuning (3)
Perveance	1.8 ± 0.1 μA.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 ± 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.

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

TYPICAL OPERATION

(Load : V S W R ⩽ 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 µs
Duty cycle	.001
Water flow	3 l/mn
Water inlet pressure	1 kg/cm2

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 µs
Duty cycle	max .002
Load V S W R	max 1.5
Absolute pressure on the output windows	max 4 kg/cm2
Cooling water inlet temperature	max 50°C
Cooling water flow	min 3 l/mn
Cooling water inlet pressure	max 8 kg/cm2 gen.

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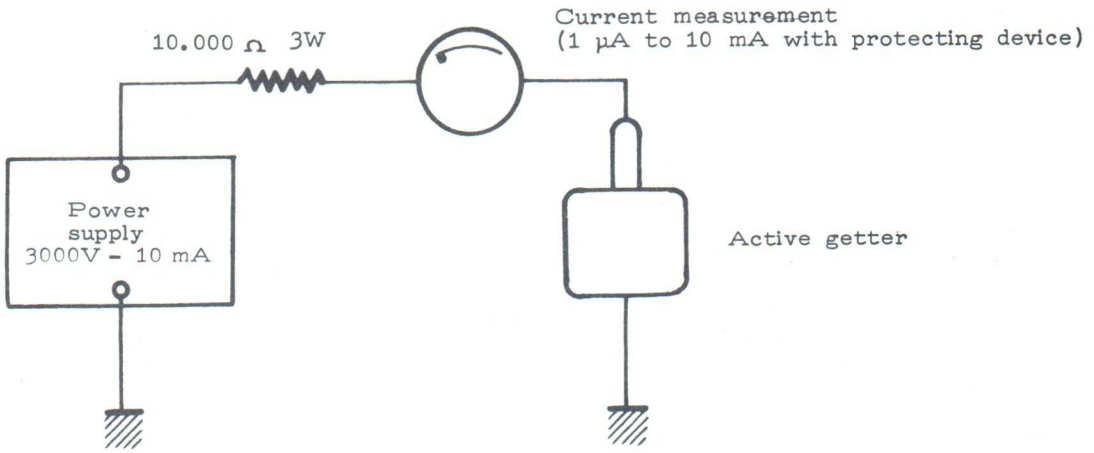
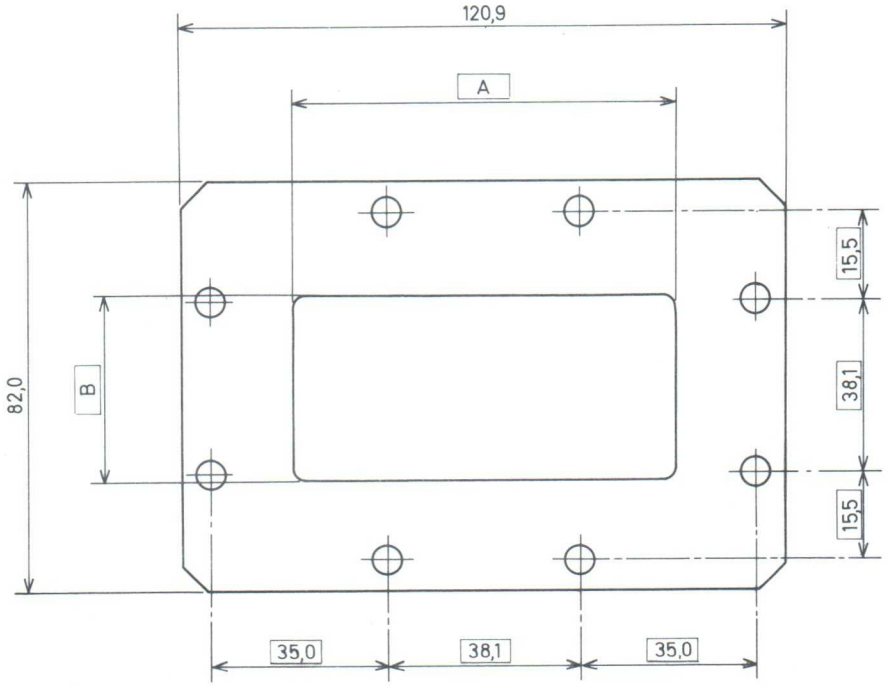
ACTIVE GETTER FEEDING CIRCUIT



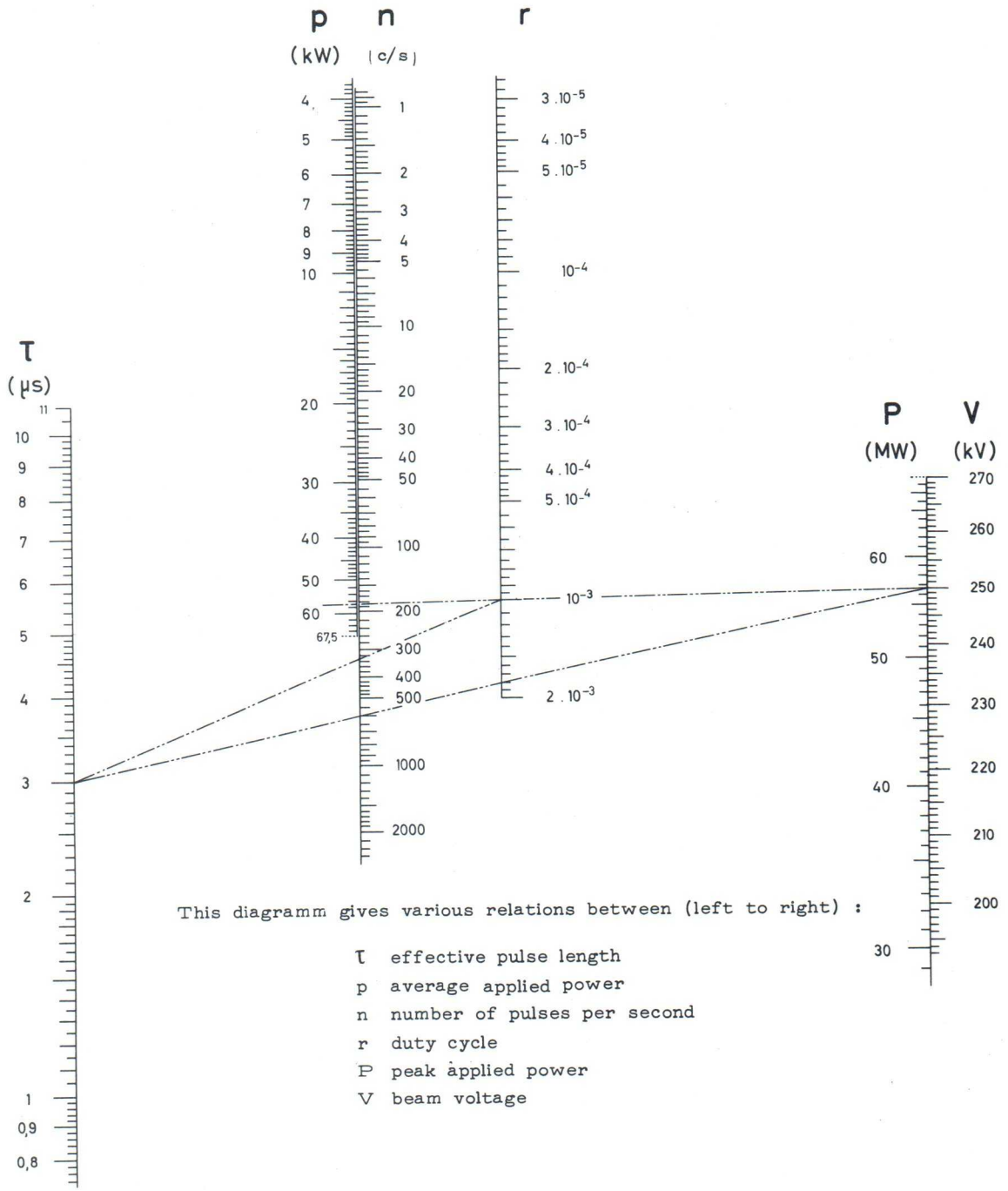
The active getter operation requires the use of a TV 19500 permanent magnet supplied with TV 19008 Focus Coil.

KLYSTRON OUTPUT FLANGE



all dimensions in mm.

8 holes ⌀ $6{,}2^{+0{,}2}$ ⌖ 0,2 group ⫽ 0,5 AB



This diagramm gives various relations between (left to right) :

- τ effective pulse length
- p average applied power
- n number of pulses per second
- r duty cycle
- P peak applied power
- V beam voltage

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.

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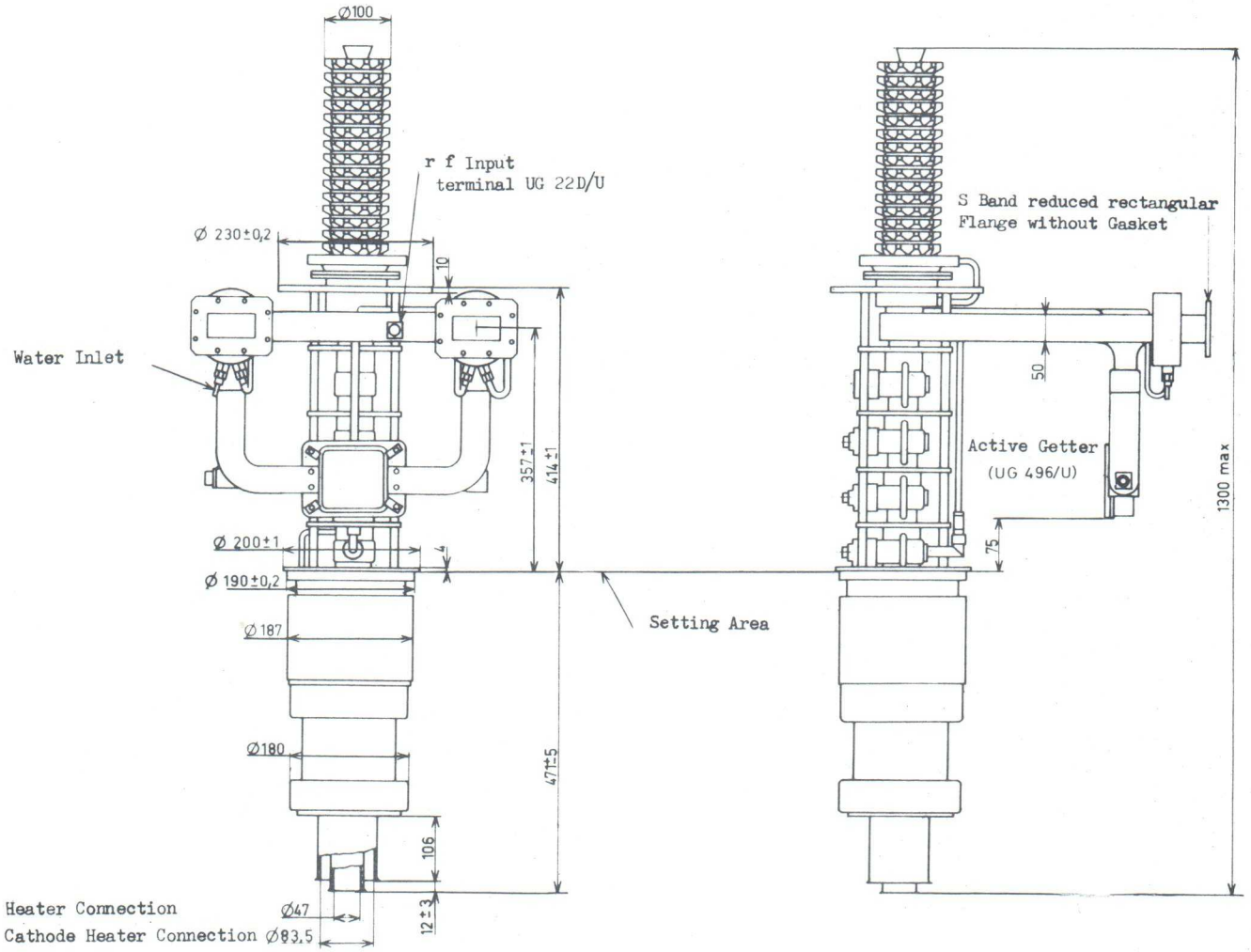

All dimensions in mm