

## TH 491H TETRODE HYPERVAPOTRON

The TH 491H is a ceramic-metal, high power transmitting vapor cooled tetrode with integral boiler-condenser. It can be used as a C.W. oscillator or a grounded grid RF amplifier at frequencies up to 1000 MHz.

The TH 491H is especially intended for use in modulated RF power amplifier in broadband television transmitter.

The anode cooler of special design (THOMSON patents) can dissipate 30 kW. The corresponding energy can be transferred by vaporization and immediate condensation to a distilled water circuit which can reach 100 °C. It can be used at a high temperature in a secondary circuit.



### GENERAL CHARACTERISTICS

#### Electrical

|                                                        |                    |
|--------------------------------------------------------|--------------------|
| Type of cathode                                        | thoriated tungsten |
| Heating                                                | direct             |
| Filament voltage (1) - (2)                             | 5.2 ± 2 % V        |
| Filament current, approx.                              | 180 A              |
| Peak cathode current                                   | 40 A               |
| Interelectrode capacitance (grounded grid operation) : |                    |
| - input (g2 tied to g1)                                | 110 pF             |
| - output (g2 tied to g1)                               | 23 pF              |
| - cathode - anode                                      | < 0.1 pF           |
| Amplification factor g1 - g2 avg.                      | 4.5                |
| Transconductance (for $I_a = 5$ A)                     | 100 mA/V           |

#### Mechanical

|                                                                  |                                |
|------------------------------------------------------------------|--------------------------------|
| Operating position                                               | vertical, anode up             |
| Anode cooling                                                    | high temperature anode cooling |
| Maximum anode dissipation in CW operation                        | 30 kW                          |
| Minimum waterflow                                                | 18 l/mn                        |
| Maximum temperature of inlet water                               | 75 °C                          |
| Maximum temperature of outlet water                              | 100 °C                         |
| Total pressure drop (boiler-condenser + 2 locking connectors)    | 1.2 bar                        |
| Maximum allowable pressure at the entrance of the cooling system | 4 bar                          |
| Electrode terminal cooling                                       | forced air                     |
| Minimum airflow for envelope and electrode terminal cooling (3)  | 4 m³/mn                        |
| Maximum temperature at any point of ceramic insulators (4)       | 250 °C                         |
| Net weight, approx.                                              | 16 kg                          |
| Dimensions                                                       | see drawing                    |

- (1) For heater voltage application, see note page 3.
- (2) In high frequency operation, the cathode is subjected to considerable back bombardment, which raises its temperature. After the circuit has been adjusted for proper tube operation, the heater voltage must be reduced to prevent over-heating of the cathode with resulting short life.
- (3) For 30 °C incoming air temperature.
- (4) It is necessary to provide air cooling for tube terminals and insulators. This air flow must be established before application of any electrode voltage and maintained during 3 minutes at least after heater voltage has been removed.

## CLASS B TELEVISION - MODULATED R.F. POWER AMPLIFIER

### GROUNDING GRID - BANDS IV and V

#### I - Maximum ratings (reference potential : cathode potential)

|                      |     |    |                     |     |     |
|----------------------|-----|----|---------------------|-----|-----|
| DC anode voltage     | 6   | kV | Anode dissipation   | 30  | kW  |
| DC grid g2 voltage   | 600 | V  | Grid g2 dissipation | 200 | W   |
| DC grid g1 voltage   | 250 | V  | Grid g1 dissipation | 100 | W   |
| Peak cathode current | 40  | A  | Frequency           | 870 | MHz |
| DC anode current     | 10  | A  |                     |     |     |

#### II - Typical operation (reference potential : cathode potential)

##### POSITIVE GRID MODULATION AND NEGATIVE SYNCHRONIZATION

- all data given at white level

|                    |     |     |                         |      |    |
|--------------------|-----|-----|-------------------------|------|----|
| Frequency          | 700 | MHz | Average anode current   | 7.3  | A  |
| Bandwidth          | 10  | MHz | Average grid g2 current | 80   | mA |
| DC anode voltage   | 5.5 | kV  | Average grid g1 current | 450  | mA |
| DC grid g2 voltage | 400 | V   | Driving power           | 1500 | W  |
| DC grid g1 voltage | 150 | V   | Peak driving power      | 1900 | W  |
|                    |     |     | Load output power       | 20   | kW |
|                    |     |     | Load peak output power  | 25   | kW |

##### NEGATIVE GRID MODULATION AND POSITIVE SYNCHRONIZATION

|                         |     |     |                              |      |    |
|-------------------------|-----|-----|------------------------------|------|----|
| Frequency               | 620 | MHz | DC grid g2 current, approx.: |      |    |
| Bandwidth               | 10  | MHz | - synchronization level      | 130  | mA |
| DC anode voltage        | 5.5 | kV  | - pedestal level*            | 60   | mA |
| DC grid g2 voltage      | 400 | V   | DC grid g1 current, approx.: |      |    |
| DC grid g1 voltage      | 150 | V   | - synchronization level      | 480  | mA |
| DC anode current :      |     |     | - pedestal level*            | 240  | mA |
| - synchronization level | 8.2 | A   | Driving power, approx. :     |      |    |
| - pedestal level*       | 6.2 | A   | - synchronization level      | 1800 | W  |
|                         |     |     | - pedestal level*            | 1100 | W  |
|                         |     |     | Load output power (5) :      |      |    |
|                         |     |     | - synchronization level      | 25   | kW |
|                         |     |     | - pedestal level*            | 15   | kW |

(5) The load is directly connected to amplifier output.

\* Without signal.

## TUBE PROTECTION AND FEEDING INSTRUCTIONS

In order to achieve long tube life, maximum operating efficiency and circuit stability consistent with the full tube capability, the following instructions should be strictly observed.

### I - ELECTRODES FEEDING ORDER -

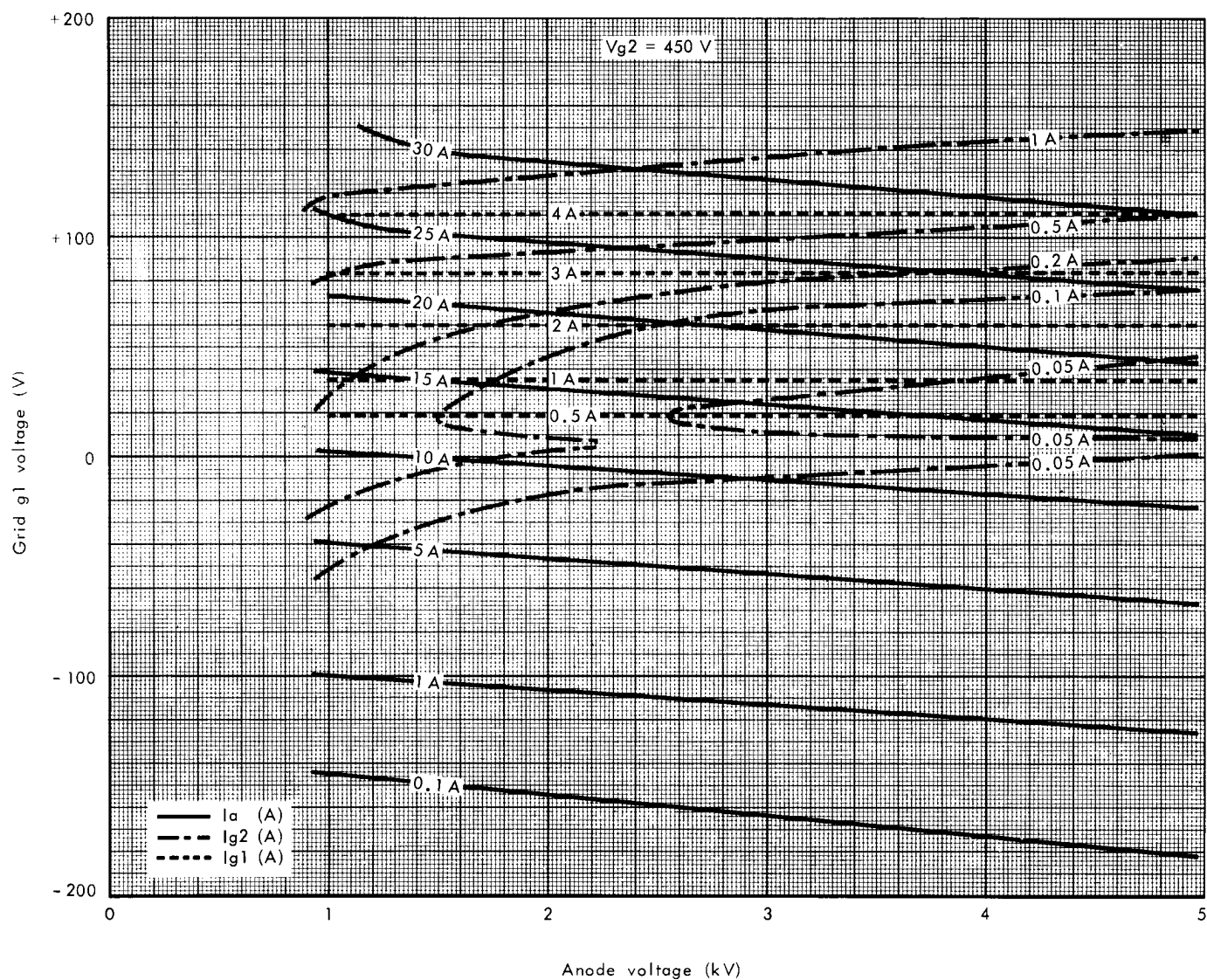
Apply successively :

- 1 -  $\frac{1}{2} V_f$  (filament voltage) during 60 seconds ;
- 2 - Nominal  $V_f$  during 60 seconds ;
- 3 - Grid bias ;
- 4 - Anode voltage ;
- 5 - Screen voltage ;
- 6 - Driving voltage.

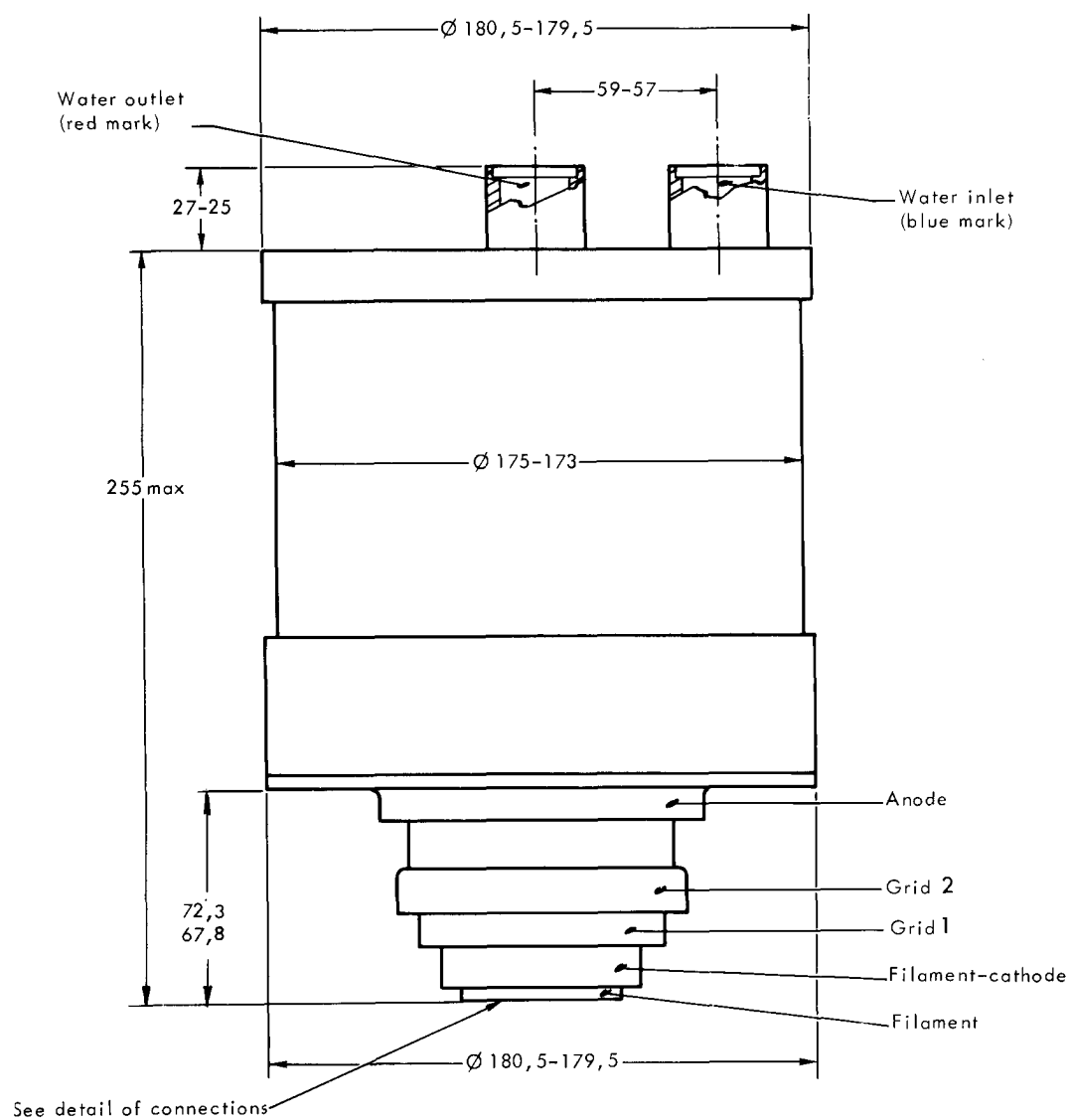
### II - SECURITY DEVICES AGAINST ANODE, SCREEN, GRID OVERCURRENTS -

- 1 - Overcurrents due to improper utilisation conditions : the protection can be achieved by 3 relays inserted in series, respectively in grid, screen and anode circuits. These relays are adjusted so as to operate when currents equal to 1.5  $I_{max.}$  are attained,  $I_{max.}$  being the normal current in the considered operating conditions. When one of these relays operate, the driving voltage and the screen and anode voltages must be simultaneously cut-off.
- 2 - Overcurrents due to stray oscillations or electrode arcings : the protection can be achieved by 3 short-response security devices (grid, screen, anode) acting for currents equal to 5  $I_{max.}$ ,  $I_{max.}$  being the normal current in the considered operating conditions. Each of these 3 systems acting on the 2 others must cause the short-circuit of the driving, screen and anode voltages and eventually the grid bias voltage with a total delay lower than 30 microseconds.

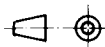
# CONSTANT CURRENT CHARACTERISTICS



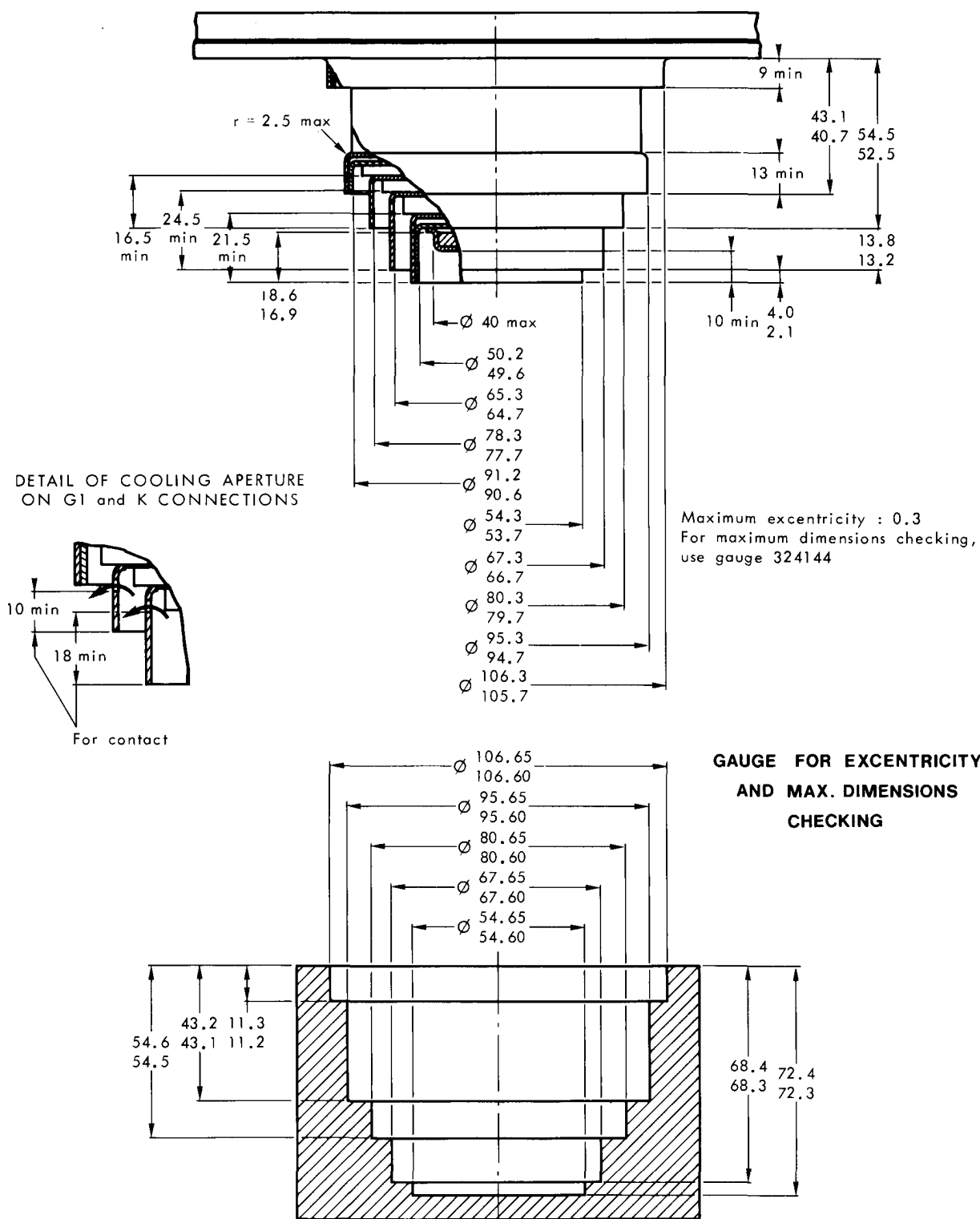
## OUTLINE DRAWING



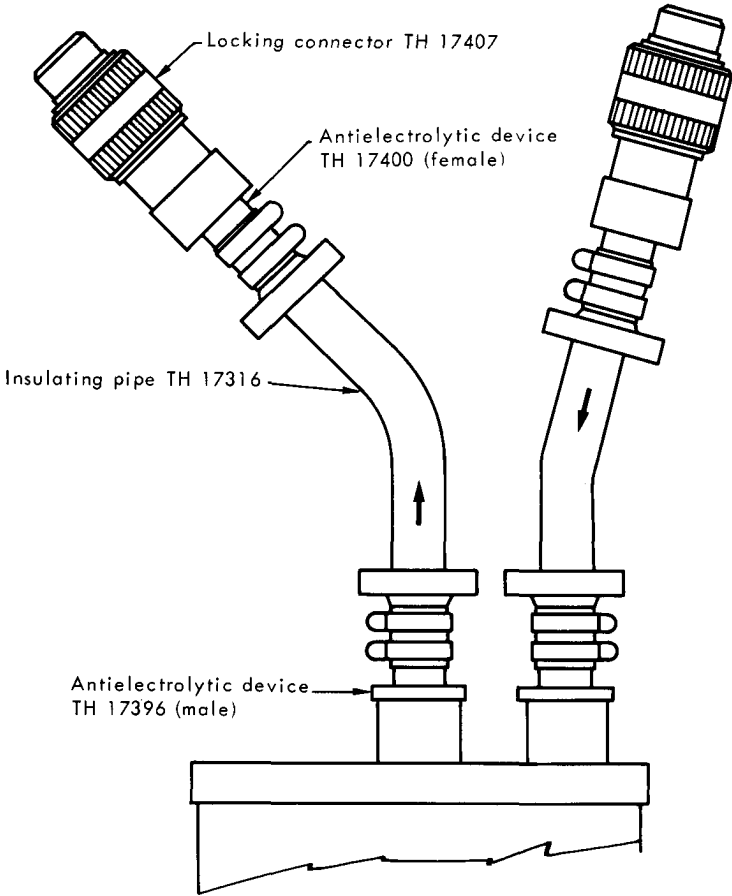
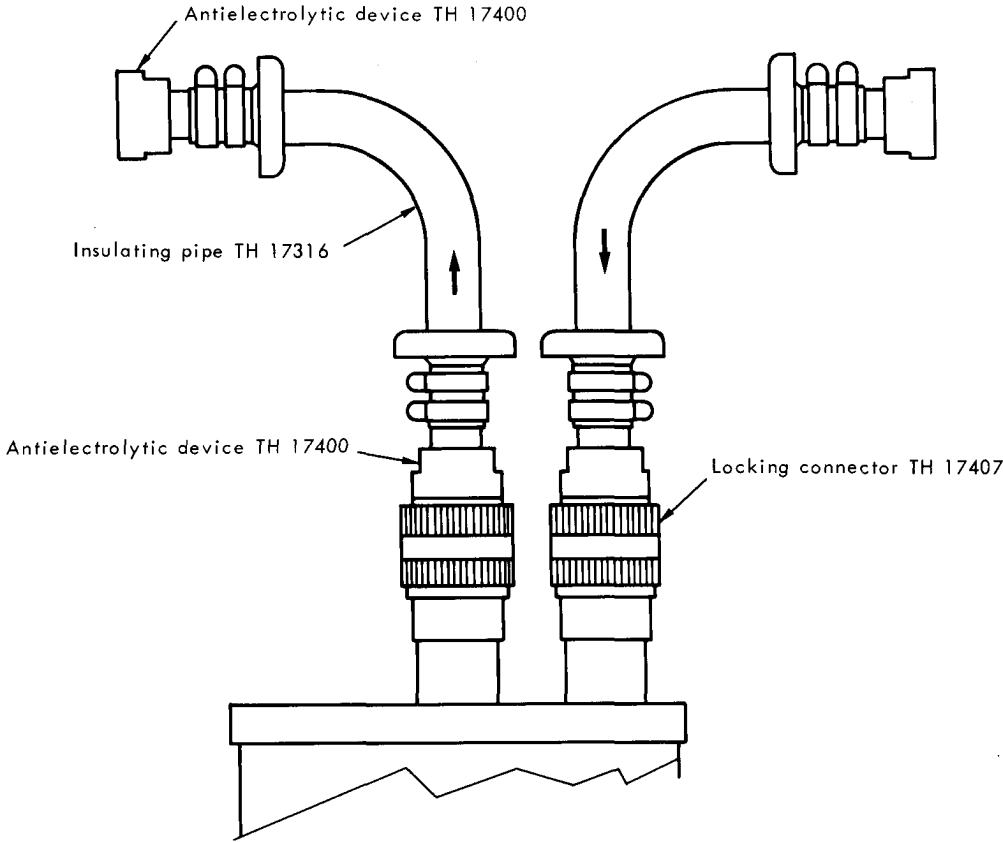
Dimensions in mm.



# DETAILS OF ELECTRODE TERMINALS



COOLING SYSTEM CONNECTION



TH 491H



**THOMSON-CSF**  
GROUPEMENT TUBES ELECTRONIQUES



**THOMSON-CSF**

GROUPEMENT TUBES ELECTRONIQUES