

**PRASAR BHARATI
BROADCASTING CORPORATION OF INDIA
DIRECTORATE GENERAL: ALL INDIA RADIO
(PLANNING & DEVELOPMENT UNIT)**

No.18/1/2006-EI/

Specification for : **Valve Type- CQK- 650-1**
Ceramic metal tetrode with coaxial structure

Specification No. : Specs./18/1/2009/TM/1014

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Para wise compliance report for all the clauses of the specifications must be done without these tender will be rejected.

(KAILASH CHAND)
CO. (TM)

Specifications No.: Specs./18/1/2009/TM/1014

Specifications of Ceramic Tetrode Valve Type: CQK- 650-1

Para wise compliance report for all the clauses of the specification must be done by the Tenderer without it tender will be rejected.

1. Scope:

This Ceramic Tetrode Valve is being used in RF power amplifier stage of 500 KW MW and 500 KW SW Transmitters in AIR Network.

2. General characteristic of the valve:

The valves offered should be **New and of first quality.**

- | | |
|-------------------------|---|
| a. Valve: | Ceramic metal Tetrode with co-axial structure. |
| b. Filament: | Thoriated tungsten cathode with direct heating. |
| c. Anode: | Cooled with condensed water vapour. |
| d. Operating frequency: | Up to 30 MHz. |
| e. Operating position: | Vertical, Anode up. |
| f. Anode Dissipation | 1250 KW |
| g. Designed | For RF broadcasting application amplifier |
| h. Output Power | Up to 950 KW in MW |
| i. Output Power | Up to 550 KW in SW |
| j. Weight: | Approx.130kg. |

3. Eligibility of the supplier:

- a. The supplier must possess valid ISO 9001/ 2000 Certificate in production.
- b. Original Equipment Manufacturer or their Authorised agent shall only be eligible to quote.
- c. Authorisation letter must be ink signed by the OEM and submitted along with the tender. Name and address of the OEM and location of its manufacturing facilities is to be given.
- d. The supplier must possess an experience of at least 5 years in manufacturing.
- e. The supplier must provide past record of timely and good quality supply of tendered items to Broadcast Organisations in the preceding two years supported with copies of orders placed by the Broadcast Organisation with the Manufacturing firm, and Broadcaster's satisfaction letters regarding the tendered item.

Any offer which fails to meet the above eligible condition will be summarily rejected.

4. Electrical Specifications:

	<u>Min.</u>	<u>Max.</u>	<u>Unit</u>
4.1 Filament current for Vf= 12V	1520	1860	A

4.2 Interelectrode Capacitance:

K – G ₁	980	1140	pf.
K – G ₂	225	285	pf.
K – A	4.0	6.0	pf.
G ₁ – G ₂	585	685	pf.
G ₁ – A	12.0	18.0	pf.
G ₂ – A	175	205	pf.

4.3 Amplification Factor: $\mu_{g_2 g_1}$

When- $V_{G_2} = 1500V(DC)$, $I_a=38A(DC)$, $V_a=16KV(DC)$, 3.1 4.5 V/V

4.4 Control grid voltage at transit point:

When- $V_{G_2} = 1500V(DC)$, $I_a=38A(DC)$, $V_a=16 KV(DC)$ -580 -430 V

4.5 Control grid reverse current at transit point

When- $V_{G_2} = 1500V(DC)$, $I_a=38A(DC)$, $V_a = 16 KV(DC)$ 5000 μA

5. Mechanical Specifications:

Max. Length-	778 mm
Max diameter-	405 mm
Weight less packing-	130 Kg

(Please also see the attached diagram of the valve)

6. Operating Data:

6.1 Maximum Rating:

Maximum heating surge current	5000	A
Anode dissipation	1250	KW
Screen Grid dissipation	15	KW
Control Grid Dissipation	10	KW
DC Anode voltage	15	KV
DC Screen grid voltage	1.5	KV
Peak Voltage between control grid and screen grid	4	KV
Peak Cathode Current	800	A
Filament voltage	12	V

6.2 Operating Example in SW (Carrier conditions)

	Ex.1	Ex.2	
Operating frequency	26	26	MHz
Anode DC voltage	14	12.5	KV
Screen grid DC voltage	1450	1500	V
Control grid DC voltage	-1000	-960	V
Anode DC current	41	51	a
Screen grid DC current	3	0.5	A
Control grid DC current	0.2	0	A
Anode dissipation	74	137	KW
Screen grid dissipation	4.5	0.75	KW
Output power	500	500	KW
Anode efficiency	87	78.5	%

6.3 Operating Example in MW (Carrier conditions)

	Ex.1	Ex.2	
Operating frequency	1.6	1.6	MHz
Anode DC voltage	15	14	KV
Screen grid DC voltage	1500	1400	V
Control grid DC voltage	-1100	-1000	V
Anode DC current	71	61	a
Screen grid DC current	4	3	A
Control grid DC current	0.7	0.5	A
Anode dissipation	115	104	KW
Screen grid dissipation	6	4.2	KW
Output power	950	750	KW
Anode efficiency	89	88	%

6.4 Tube Cooling:

Anode of the valve should be condensed water vapor cooled.

Maximum pressure at water jacket Inlet	3 bars
Maximum pressure inside cooling pipes	4.7 bars
Maximum temperature at water jacket outlet	90 ⁰ C
Maximum temperature at water jacket inlet	60 ⁰ C
Maximum temperature difference between outlet and inlet	30 ⁰ C
Minimum water flow in anode operation	175 l/min.
Maximum temperature at any point on the Tube envelope	220 ⁰ C
Minimum air flow cooling at the base of the tube	5 m ³ /min

In addition the ceramic insulators and electrode terminals shall be forced air cooled

7. Certificate of Origin:

- i. In order to verify that each tube supplied by OEM comes from an ISO-9001/2000 certified factory, the vendor should provide country of origin and type of the tube, and Sr. No., if any, must be engraved or inked on the body of each tube and it must be visible easily even while in operation.
- b) In the absence of such a certificate of origin on the tubes, the tubes shall be considered as rebuilt or not manufactured by vendor.
- c) Rebuilt/ Refurbished/Reconditioned tube will not be accepted

8. Package and Marking

Please refer to the relevant clause in the booklet “ **Instructions to Bidders**”

9. INSURANCE AGAINST WAR AND MARINE RISK:

Please refer to Commercial terms for transportation by air, sea and land up to ultimate consignee.

10. Tube Appearance

The tube (Valve) brazing area, ceramic cleanliness, electrical connections, coolant connection, plating, shining silver plated surface around anode, cathode grid rings should be of high quality.

The shining of silver plated on cathode, grid and anode ring should be as good as new after the run of 500 hours operation of the tube.

11. Delivery

Delivery should complete in nine months after the issue of the AT. The lot of tubes should be duly insured (Insurance as per commercial terms) and be delivered at the destination of ultimate consignee (AIR Stations in India) mentioned in the AT.

12. Guarantee Conditions

The electron tubes shall be free from defects in design, material and workmanship. The tube will be operated within pre designed fixed parameters and dynamic broadcast parameters, by taking all cooling conditions into account.

The tube shall be guaranteed for 5000Hrs. of heater/filament operation or 2 years from the date of receipt whichever ever occur first. In case of failure of the tube within the first 500 Hrs. full free replacement with a **New and of first quality tube** is to be provided by the OEM/ supplier. Prorata credit will be for failure of tube between 500hrs. and 5000hrs. The claim shall be settled by the **Supplier/OEM without any option** as given below :

If the tube fails after 500 hours and within guaranteed 5000 hours, then prorata

$$C = \frac{P(G-H)}{G}$$

C - Credit

G - Guaranteed no. of hours

H - Useful filament hours served by the defective tube.

P - Purchased price of defective tube.

13. Performance Guarantee

As per DGS and D rule

14. Literature

Necessary literature, catalogues concerning to the article in supply and the company profile including the manufacturing procedure etc. must be supplied by the Bidder.