



# All India Radio



**Specifications No. :** Spec/18/1/2005/TM/1001

Specifications of ceramic Tetrode (CQK50-2/ BEL 100000 CX)

## **1.Scope:**

The ceramic Tetrode is being used in AIR's network of transmitters MW & SW. The valve will be used in modulator stage of 300KW MW BBC make transmitters and in RF power amplifier stage of 100 KW SW BBC make and 100 KW MW HMB-140 BEL make transmitters.

## **2. General characteristic of the valve:**

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

- a. Ceramic/ metal Tetrode with co-axial structure.
- b. Thoriated tungsten cathode with direct heating.
- c. Anode: Condensed water vapor cooled .
- d. Operating frequency up to 30 MHz.
- e. Anode dissipation: 110KW.
- f. Designed for RF Broadcasting applications amplifiers.
- g. Output power up to 100KW in SW broadcasting.
- h. Operating position : Vertical anode up.
- i. Weight: Approx.45kg.
- j. Constant current characteristics:

## **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. Name and address of the OEM and location of its manufacturing facilities is to be given.
- c. Authorisation letter must be ink signed by the OEM and submitted alongwith the tender.
- d. The supplier must possess an experience of at least 2years 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 :

4.1.1 Filament voltage	: 12.6 Volt		
	<u>Min.</u>	<u>Max.</u>	<u>Unit</u>
Filament current for Vf 12.6V	300	365	A

#### 4.1.2 Interelectrode Capacitance

K – G <sub>1</sub>	235	270	pf.
K – G <sub>2</sub>	27	34	pf.
K – A	0.35	0.65	pf.
G <sub>1</sub> – G <sub>2</sub>	285	330	pf.
G <sub>1</sub> – A	2.55	3.85	pf.
G <sub>2</sub> – A	60	70	pf.

#### 4.1.3 Amplification Factor $\mu_{g_2g_1}$

VG <sub>1</sub> = 50V    Ia=4A    Va=15KV VG <sub>2</sub> = 800V	5.8	6.9	V/V
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#### 4.1.4 Control grid voltage at transit point

VG <sub>2</sub> = 800V    Ia=4A    Va=15 KV	- 150	-100	V
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#### 4.1.5 Control grid reverse current at transit point

VG <sub>2</sub> =800V    Ia=4A    Va = 15 KV	500	$\mu$ A
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5. Mechanical Specifications: Please see the attached diagram of the valve.

#### 6. Operating Data

##### 6.1 Class B, AF Power Amplifier and Modulator:

##### Maximum Rating:

DC Anode voltage	18	KV
DC Screen grid voltage	2.0	KV
Signal DC Anode current	15	A
Power input	250	KW

Screen Grid dissipation	3	KW
Anode dissipation	100	kW

### Typical Operation Ratings for Two Tubes in Push- Pull:

DC Anode voltage	18	15	12	KV
DC Screen grid voltage	1600	1600	1600	V
DC control grid voltage	-280	-280	-280	V
Peak AC control grid voltage G-G	530	530	530	V
Signal DC anode current Max	25.4	25.4	25.4	A
Zero Signal DC anode current	2	2	2	A
DC screen grid current	0.5	0.5	0.5	A
DC control grid current	0	0	0	A
Driving Power	0	0	0	W
Output power	320	260	191	KW
Load resistance Anode-to-anode	16000	1300	1000	$\Omega$

### 6.2 Class C, Anode - Screen Modulated, RF Power Amplifier:

#### Maximum Rating: ( Carrier Conditions )

DC Anode voltage up to 30MHz	15	KV
DC Anode voltage from 31-60MHz	12.5	KV
DC Screen grid voltage	800	V
AC Screen grid voltage	700	V (Modulation factor 1)
DC Control grid voltage	-800	V
DC Control grid current	2	A
DC Anode current	16.5	A
Screen Grid dissipation up to 30MHz	2.2	KW
Screen Grid dissipation from 31-60MHz	1.8	KW
Anode dissipation	65	KW
Power input	975	KW
Control grid dissipation	2	KW
Grid resistor (Tube not conductive)	10	K $\Omega$

#### Typical Operation Ratings: (Modulation factor 1)

DC Anode voltage	15	12.5	10	KV
DC Screen grid voltage	800	800	800	V
Peak AC screen grid voltage	700	700	700	V
DC control grid voltage	-390	-375	-365	V
Peak AC control grid voltage	600	585	575	V
DC anode current	16	16	16	A
DC screen grid current	0.4	0.4	0.4	A

DC control grid current	0.9	0.9	0.9	A
Driving Power	490	485	480	W
Output power	189	151	117	KW
Power output at $f \leq 3\text{MHz}$	192	157	123	KW
Frequency maximum	30	60	60	MHz

### 6.3 Class- C, RF Power Amplifier without modulation or frequency modulated:

#### Maximum Rating:

DC Anode voltage up to 30MHz	18	KV
DC Anode voltage from 31-60MHz	15	KV
DC Screen grid voltage	1200	V
DC Control grid voltage	-1000	V
DC Control grid current	10	A
DC Anode current	20	A
Screen Grid dissipation up to 30MHz	3	KW
Screen Grid dissipation from 31-60MHz	2.5	KW
Power input	300	KW
Anode dissipation	100	KW
Control grid dissipation	4	KW
Grid resistor (Tube not conductive)	10	K $\Omega$

#### Typical Operation Ratings:

DC Anode voltage	18	15	12	KV
DC Screen grid voltage	1200	1200	1200	V
DC control grid voltage	-750	-735	-720	V
Peak AC control grid voltage	1000	985	970	V
DC Anode current	20	20	20	A
DC screen grid current	0.8	0.8	0.8A	
DC control grid current	0.7	0.7	0.7	A
Driving Power	650	640	630	W
Output power	293	235	182	KW
Power output at $f \leq 3\text{MHz}$	298	244	190	KW
Frequency Maximum	30	60	60	MHz

### 6.4 Tube Cooling:

Anode of the valve should be condensed water vapor cooled.

Maximum pressure at water jacket Inlet	3 bar
Maximum pressure Inside cooling pipes	3 bar
Maximum temperature at water jacket outlet	90°C
Maximum temperature at water jacket inlet	60°C
Maximum temperature between outlet and inlet water jacket	30°C

Minimum water flow in anode operation	35 l/min.
Maximum temperature at any point on the } Tube envelope should not be more than }	220°C
Minimum air flow at the base of the tube	3m <sup>3</sup> /min.
Temperature gradient must be less than	10 °C/cm

## 7. Certificate of Origin:

- a). 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.

## 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 which 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.

[Diagram](#)