

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

**No.18/1/2006-EI/**

**Specification for** : **Valve Type- CQK- 350-1/ BEL- 550,000 CX**  
Ceramic metal tetrode with coaxial structure

**Specification No.** : Specs./18/1/2006/TM/1008

**No. of pages** : 7

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**Date of approval** : **20.08.2007**

**Date of issue** : **21.08.2007**

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

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**Specifications No.:** Specs./18/1/2006/TM/1008

**Specifications of Ceramic Tetrode Valve Type: CQK- 350-1/ BEL 550,000 CX**

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

**1. Scope:**

This Ceramic Tetrode Valve is being used in class-B modulator stage of 500 KW MW and 500 KW SW Transmitters, Class- D and Class- C in RF power amplifier stages of 300KW MW BBC make and 250 KW SW BBC make 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:               | Condensed water vapour cooled.                  |
| d. Operating frequency: | up to 30 MHz.                                   |
| e. Operating position:  | Vertical, Anode up.                             |
| f. Weight:              | Approx.70kg.                                    |

**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 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:                             | 24      | V(AC) ±5% |
| Filament current:                                   | 620     | A         |
| Max starting current:                               | 1800    | A         |
| Cold Resistance:                                    | ≈ 0.006 | Ω         |
| Mutual Conductance: (Va= 10KV, Vg2=900 V, Ia = 30A) | ≈ 290   | mA/V      |

#### 4.1.2 Interelectrode Capacitance:

	<u>Min.</u>	<u>Max.</u>	<u>Typical</u>	<u>Unit</u>
K – G <sub>1</sub>	400	460	430	pf.
K – G <sub>2</sub>	230	290	260	pf.
K – A	3	5	4	pf.
G <sub>1</sub> – G <sub>2</sub>	320	390	390	pf.
G <sub>1</sub> – A	8	12	10	pf.
G <sub>2</sub> – A	120	140	130	pf.

#### 4.1.3 Amplification Factor: $\mu_{g_2 g_1}$

When-  $I_a=27A(DC)$ ,  $V_a=15KV(DC)$ ,  $V_{G_2} = 800V(DC)$       **4.0    5.4    5.0**

#### 4.1.4 Control grid voltage at transit point:

When-  $V_{G_2} = 800V(DC)$ ,  $I_a=27A(DC)$ ,  $V_a=15 KV(DC)$       **-235    -155 V**

#### 4.1.5 Control grid reverse current at transit point

When-  $V_{G_2}= 800V(DC)$ ,  $I_a=27A(DC)$ ,  $V_a = 15 KV(DC)$       **3000  $\mu A$**

#### 5. Mechanical Specifications:

Max. Length-                      **715 mm**  
Max diameter-                      **325 mm**  
Weight less packing-              **70 Kg**

**(Please also see the attached diagram of the valve)**

#### 6. Operating Data:

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

##### Maximum Rating:

DC Anode voltage	22	KV
DC Screen grid voltage	2.2	KV
Signal DC Anode current	55	A
Power input	1200	KW
Screen Grid dissipation	7	KW
Anode dissipation	550	kW
Control Grid Dissipation	4	KW
Dc Control Grid Voltage	- 1.8	KV
Peak Cathode Current	600	A

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

DC Anode voltage	22	18	14	KV
DC Screen grid voltage	2000	2000	2000	V
DC control grid voltage	-765	-715	-660	V
Peak AC control grid voltage G-G	1490	1390	1280	V
Signal DC anode current Max	108	108	108	A
Zero Signal DC anode current	6	6	6	A
DC screen grid current	3	3	3	A
DC control grid current	0	0	0	A
Driving Power	0	0	0	W
Output power	1656	1314	976	KW
Load resistance Anode-to-anode	460	365	270	$\Omega$

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

**Maximum Rating:**

DC Anode voltage up to 30MHz	15	KV
DC Screen grid voltage	1200	V
AC Screen grid voltage	1000	V (Modulation factor 1)
DC Control grid voltage	-1500	V
DC Control grid current	10	A
DC Anode current	65	A
Screen Grid dissipation	5.3	KW
Anode dissipation	370	KW
Power input	975	KW
Control grid dissipation	3.2	KW
Grid resistor (Tube not conductive)	10	K $\Omega$

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

DC Anode voltage	15	12.5	KV
DC Screen grid voltage	1200	1190	V
Peak AC screen grid voltage	960	960	V
DC control grid voltage	-950	-930	V
Peak AC control grid voltage	1200	1200	V
DC anode current	50	51	A
DC screen grid current	3	3.6	A
DC control grid current	2.7	3.2	A
Driving Power	3.2	3.6	KW
Output power	590	490	KW
Power output at $f \leq 3\text{MHz}$	600	500	KW
Frequency maximum	30	30	MHz

### 6.3 Class- C, HF Power Amplifier without modulation:

#### Maximum Rating:

DC Anode voltage up to 30MHz	22	KV
DC Screen grid voltage	1600	V
DC Control grid voltage	-1200	V
DC Control grid current	10	A
DC Anode current	80	A
Screen Grid dissipation up to 30MHz	7	KW
Power input	1700	KW
Anode dissipation	550	KW
Control grid dissipation	4	KW
Grid resistor (Tube not conductive)	10	K $\Omega$

#### Typical Operation Ratings:

DC Anode voltage	22	18	14	KV
DC Screen grid voltage	1500	1500	1500	V
DC control grid voltage	-1160	-1170	-1140	V
Peak AC control grid voltage	1490	1515	1460	V
DC Anode current	76	77	72	A
DC screen grid current	3.6	3.9	4.3	A
DC control grid current	4.1	4.2	3.7	A
Driving Power	5.9	5.2	5.2	KW
Output power	1335	1090	790	KW
Power output at $f \leq 3\text{MHz}$	1350	1100	800	KW
Frequency Maximum	30	30	30	MHz

### 6.4 Class D, Anode - Screen and control Modulator, RF Power Amplifier:

#### Maximum Rating:

DC Anode voltage up to 10MHz	15	KV
DC Screen grid voltage	1400	V
AC Screen grid voltage	2500	V
DC Control grid voltage	-1200	V
DC Control grid current	10	A
AC control grid voltage	3500	V
DC Anode current	65	A
Screen Grid dissipation	5	KW
Anode dissipation	305	KW
Power input	975	KW
Control grid dissipation	3.2	KW
Grid resistor (Tube not conductive)	10	K $\Omega$

### Typical Operation Ratings:

DC Anode voltage	15	12.5	KV
DC Screen grid voltage	1200	1200	V
Screen grid with modulation factor	80	80	%
DC control grid voltage	-810	-770	V
AC control grid voltage	1110	1070	V
Control grid with modulation factor	70	70	%
DC anode current	59	59	A
DC screen grid current	1.8	1.8	A
DC control grid current	2.0	2.1	A
Driving Power	2.0	2.1	KW
Power output	750	610	KW

### 6.7 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	3	bars
Maximum temperature at water jacket outlet	90	°C
Maximum temperature at water jacket inlet	60	°C
Maximum temperature between outlet and inlet	30	°C
Minimum water flow rate	150	l/min.
Maximum temperature at any point on the Tube envelope	220	°C
Minimum air flow at the base of the tube	3	m <sup>3</sup> /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 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.