GOVERNMENT OF INDIA
(Ministry of Railways)

SPECIFICATION FOR HIGH ALUMINA ROOF SETS FOR DELTA ZONE OF GEC ARC FURNACE

MECHANICAL DRAWING OFFICE
RAIL WHEEL FACTORY
YELAHANKA, BANGALORE-560 064
I N D I A

	10/4/17		01/04/2017
CWE/W	AED/M&C	Dy. CME/Mfg	SSE/D
APPROVED	REVIEWED	VERIFIED	PREPARED

SPECIFICATION FOR HIGH ALUMINA DELTA ZONE ROOF SETS FOR HIGH POWER ELECTRIC ARC FURNACE

1.0 SCOPE

The specification covers the design and supply of 70% High Alumina Delta Zone Roof set for GEC Model "13" High power electric Arc Furnace, 20 tons capacity available at Rail Wheel Factory, Yelahanka, Bangalore - 560 064, Karnataka State, India.

2.0 GENERAL DESCRIPTION

High Alumina 70% Refractory roof set for Delta Zone along with High Alumina 80% Mortar in the gaps around Electrode rings. The size of the brick should be 300 mm long for Delta Zone roof set and 400 mm long for electrode holes as shown in the drawing WAP/SK/MW-351 Alt. `a'.

3.0 JOB REQUIREMENT

High Alumina Roof Set is required for relining of the Delta Zone roof of Direct Electric Arc Furnaces (GEC Model No.13). The refractory material of the roof set should maximise service life. Expected life of the Delta roof set is around 80 heats.

4.0 TECHNICAL DATA

4.1 HIGH ALUMINA REFRACTORY

4.1.1 CHEMICAL COMPOSITION

i) Al_2O_3	: 70% Min.
ii) Fe_2O_3	: 3.5% Max.
iii) Alkalis	: 1.5% Max.

4.1.2 PHYSICAL PROPERTIES

i) Pyrometric Cone Equivalent (PCE)	: +36 (as per ASTM Std. Pyrometric cone.)
ii) Cold Crushing Strength (CCS)	: 350 Kg/cm^2 min.
iii) Apparent porosity (AP)	: 22% max.
iv) Permanent Linear Change (PLC) (at 1450°C for 4 hrs.)	: +3.5% max.
v) Size tolerance	:±1.0% or ±1mm, whichever is greater.
vi) Refractoriness under Load (RUL)	: 1400°C min.
vii) Bulk Density (BD)	: 2.6 gm/cc min.

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4.1.3 REFRACTORY PARTICLE SIZE

Bricks should be compact having close grains. When bricks are cut either for sampling or for lining purpose, they should not show any signs of lamination or refractory particle loosening due to larger grains or inadequate bonding. The raw material should not have more than 3 mm size refractory particles. The bricks shall be free from corner/edge damages.

4.1.4 INSPECTION SAMPLING NORM

As per IS 1528: 1974 Pt. VII (Physical & Chemical).

4.1.5 ACCEPTANCE CRITERIA

As per IS 1528: 1974 Pt. VII (Physical & Chemical). The manufacturer should ensure that while assembling delta zone on the roof former, there should not be gap and the bricks fit snugly.

4.2 HIGH ALUMINA MORTAR

4.2.1 CHEMICAL & PHYSICAL PROPERTIES

Al_2O_3	: 80% Min.
Fe_2O_3	: 2% Max.
Pyrometric Cone Equivalent (PCE)	: +39 (as per ASTM Std. Pyrometric cone.)
Water Content for optimum workability	: 25 to 30%

4.3 TEST FACILITIES

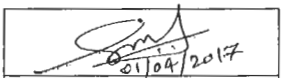
The firm should have complete testing facilities to check the material as per the specification given above.

5.0 DESIGN GUIDELINE

New supplier should study the roof former available at RWF for the above-mentioned Arc Furnace to incorporate this aspect in the design of the bricks.

6.0 STORAGE

The supplier should have arrangement to store the subject item under covered accommodation to protect them from water. Utmost care should be taken during the transportation of these bricks by adequately covering them with tarpaulin etc., to avoid getting exposed to rain.



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7.0 PACKING

The material shall be packed in a disposable wooden base pallet of ≤1.5t capacity, capable of being handled by 3t forklift. The edges of the brick shall be protected with cardboard paper and strapped on to the base pallet. Special care has to be taken to avoid corner damages.

8.0 TRANSPORTATION & HANDLING

The bricks should be transported to RWF stores by road directly from the firm's premises to avoid any damages to the bricks. Special care should be taken by the supplier to ensure that the edges do not get chipped off during manufacturing and subsequent handling. The bricks which are chipped off are liable to be rejected and will have to be replaced by the firm at the firm's expense.

9.0 QUALITY ASSURANCE PLAN (QAP)

The supplier shall submit their Quality Assurance Plan (QAP) along with their bid for approval by RWF, which will be followed in the processing of High Alumina roof sets for Delta Zone of GEC Arc Furnace to satisfy the technical requirement as required under this specification. Supplier shall get their QAP approved from RWF in advance, unless a waiver is given to this effect.

10.0 TRIAL OF THE SUPPLY

The material for trial shall necessarily meet all the requirements mentioned elsewhere in this specification prior to shop floor trial. Only after this, the material will be taken up for shop floor trial by RWF as per trial scheme at Annexure-1 and the corresponding trial report shall be prepared as per Annexure-2.

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Annexure –1

TRIAL SCHEME OF HA 70% BRICKS FOR ROOF DELTA REGION

1	Trial scheme No.	RWF/M/SPECN-1/061/1995 alt --- / Trial Scheme PL NO……
2	Objective of Trial	To establish the suitability of HA 70% bricks for roof delta region as per above specification.
	Description of Material PO Number & PO date PO Qty. Supplier	HA 70% bricks for roof delta region …… …… ……
4	IDN Number & Date IDN Qty.	…… ……
5	Authority for conducting Trial	Dy.CME/ Mfg
6	Earlier trial details	First Time Supply/ Second time/ Third time ……/……/……
7	Trial Parameters	As mentioned in Trial Scheme.
8	Specification	RWF/M/SPECN-1/061/1995 alt ---
9	Pre-trial Testing details	Met. Lab Report & MTC
10	Trial qty	Full IDN Qty/ 5% of the tendered quantity.
11	Equipment / Station process	Ladle lining.

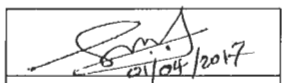
(…… to be filled by Team Members)

Trial Parameters:

1. Total quantity of HA 70% bricks for roof delta region to be drawn and trial conducted on the entire quantity under the purchase order/5% of the tendered quantity, whichever is less.
2. Inspection & testing by shop and whenever required by laboratory completely in line (not in part) with the specification. Sampling for inspection as per specification.
3. Examination of MTC (Manufacturer's Test Certificate) and comments on its suitability.

Specific Requirements:

The overall performance w.r.t shrinkage, erosion, spalling, life should be at par with established brands already in use, when tried in matching number by ensuring same process parameter during use and in the same period (or just preceding/succeeding period).



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Annexure –2

TRIAL REPORT OF HA 70% BRICKS FOR ROOF DELTA REGION

1	Trial No.	RWF/M/SPECN-1/061/1995 alt --- / Trial Scheme PL NO……
2	Objective of Trial	To establish the suitability of HA 70% bricks for roof delta region as per above specification.
3	Description of Material PO Number & PO date PO Qty. Supplier	HA 70% bricks for roof delta region …… …… ……
4	IDN Number & Date IDN Qty.	…… ……
5	Authority for conducting Trial	Dy. CME/ Mfg
6	Earlier trial details	First Time Supply/ Second time/ Third time ……/……/……
7	Trial Parameters	As mentioned in Trial Scheme.
8	Specification	RWF/M/SPECN-1/061/1995 alt ---
9	Pre-trial Testing details	Met. Lab Report & MTC
10	Trial qty	Full IDN Qty/ 5% of the tendered quantity
11	Equipment / Station process	Ladle lining
12	Nominated Officers	ACMT/W & AWM/SMS

(…… to be filled by Team Members)

Application Test: Shop Floor test conducted from date ___to date ___ & H. No. __

Trial Parameters:

1 Total quantity of HA 70% bricks for roof delta region to be drawn and trial conducted on the entire quantity under the purchase order/5% of the tendered quantity, whichever is less.

Comments:

2 Inspection & testing by shop and whenever required by laboratory completely in line (not in part) with the specification. Sampling for inspection as per specification.

Enclosure Details:

3 Examination of M Lab report & MTC (Manufacturer's Test Certificate) and comments on its suitability

Comments :

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Specific Requirements:

The overall performance w.r.t shrinkage, erosion, spalling, life should be at par with established brands already in use, when tried in matching number by ensuring same process parameter during use and in the same period (or just preceding/succeeding period).

Observations:

AWM/WM ACMT/W SSE/SMS

WM/W

Remarks of Dy CME/Mfg.

Remarks of AED/M&C

CWE/W

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AMENDMENT SHEET

Alt. 'f' Clause No.	Alt. 'g' Clause No.	Description	Job No.	Sign
--	9	Clause added: 9.0 QUALITY ASSURANCE PLAN (QAP) The supplier shall submit their Quality Assurance Plan (QAP) along with their bid for approval by RWF, which will be followed in the processing of high alumina roof sets for delta zone of GEC arc furnace to satisfy the technical requirement as required under this specification. Supplier shall get their QAP approved from RWF in advance, unless a waiver is given to this effect.	6952	
--	10	Clause added: 10.0 TRIAL OF THE SUPPLY The material for trial shall necessarily meet all the requirements mentioned elsewhere in this specification prior to shop floor trial. Only after this, the material will be taken up for shop floor trial by RWF as per trial scheme at Annexure-1 and the corresponding trial report shall be prepared as per Annexure-2.		
--	Annexure-1	Added Annexure-1 TRIAL SCHEME OF HIGH ALUMINA ROOF SETS FOR DELTA ZONE OF GEC ARC FURNACE		
--	Annexure-2	Added Annexure-2 TRIAL REPORT OF HIGH ALUMINA ROOF SETS FOR DELTA ZONE OF GEC ARC FURNACE		

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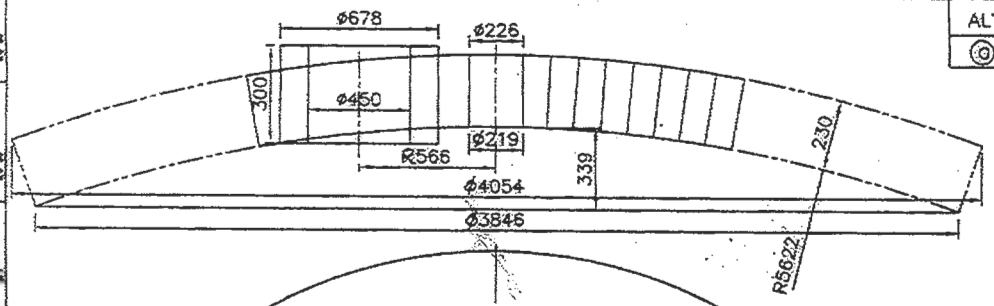
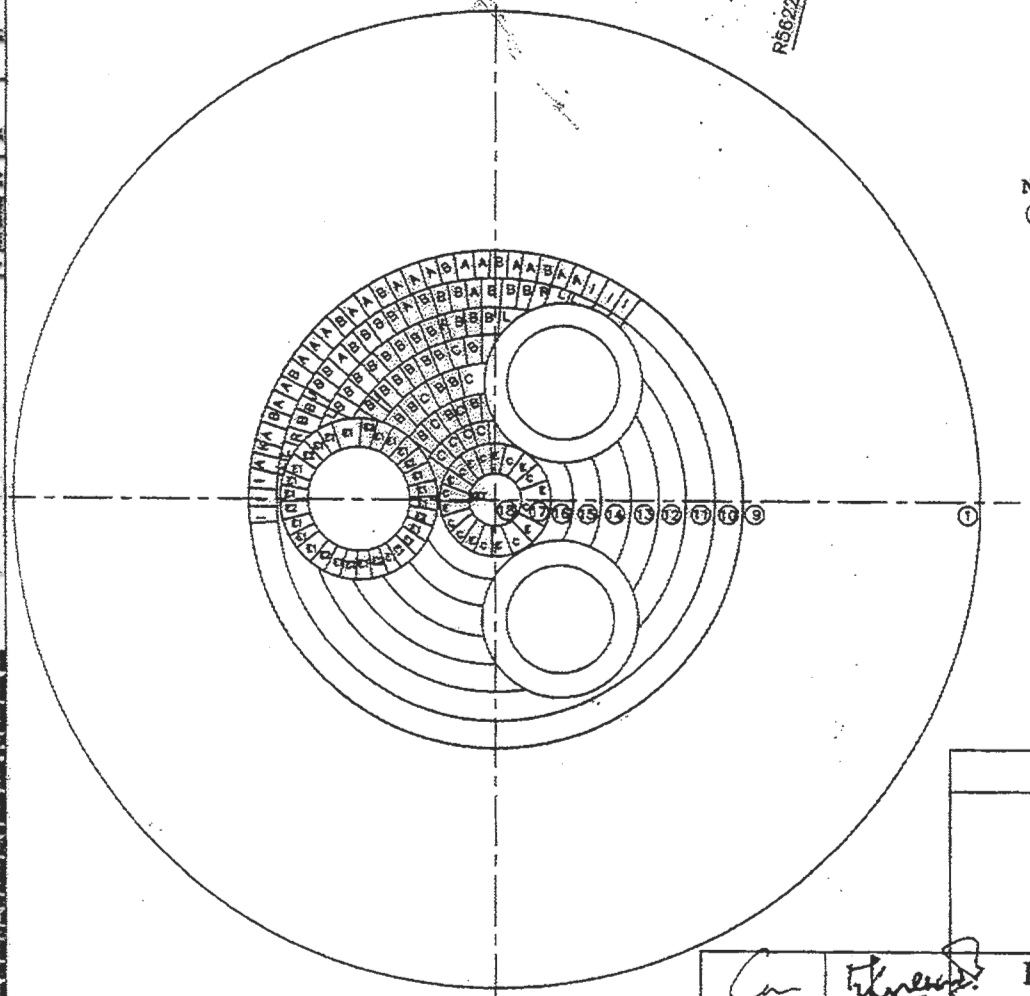
ALT	DESCRIPTION	JOB No.	APPROVED
ⓒ	DRAWING REDRAWN & NOTE No.1 WAS 'BILL OF MATL.FOR GUIDANCE ONLY'	4787	





NOTE:-

ⓒ 1. THIS DRAWING IS FOR GUIDANCE OF ROOF DIAMETER AND CENTRE RAISE. MANUFACTURER IS FREE TO SELECT HIS OWN BILL OF MATERIAL TO SUIT THE DELTA ZONE FURNACE ROOF DIMENSIONS.

RING.NO	A	B	C	D	D1	E	F	J	K	L	R	E1	E2		KEY	REMARKS
	BRICKS MARK															
TOTAL	44	138	37	1	—	9	9	7	4	18	6	66	21		1	
ELECTRODE BRICKS												66	21			
18															1	
17			10			9										
16			12													
15		9	6												1	
14		12	6													
13		21	3					3								
12		33							3	6						
11	9	42						3		12	6					
10	35	21		1			9	1	1							

BILL OF MATERIALS

INDIAN RAILWAYS		REF DRG.	
ARC FURNACE ROOF DELTA ZONE LINING	SCALE —	AME/D	17/3/07
		SSE/D	17/3/07
	PROJECTION	CHD	12.3.07
		DRN SHAM	22.11.05
		ALT ⓒ	
RAIL WHEEL FACTORY BANGALORE		DRG.No. RWF/SK/MW-351	
		JOB No. 4787	SHEET 1 OF 1

APPROVED	REVIEWED
DY.CME/MFG	CME/M

ALL DIMENSIONS ARE IN 'MILLIMETRES'.
PERMISSIBLE DEVIATION FOR UNTOLERANCED DIMENSIONS AS PER IS:2102 CLASS 'm'

Gr. NUMBER	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
Ra, um	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50