Mechanical Drawing Office
10.05.24

RWF/SPECN-1/012/1987

Dy.CMM/P

Sub: Specification for Pouring Tube Ceramic.

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The Specification for Pouring Tube Ceramic has been amended (details in the below table).

S.N	Old Specification No	Latest Specification No	Description
01	RWF/SPECN-1/012/1987 Alt 'o'	RWF/SPECN-1/012/1987 Alt 'p'	Specification for Pouring Tube Ceramic

A copy of the latest specification is attached for your information please.

Dy.CME/D

Encl: As above

Copy to:

Dy.CME/W-I : For information

8819

RWF/M/SPECN-1/012/1987 Alt 'p'

GOVERNMENT OF INDIA
(Ministry of Railways)

SPECIFICATION FOR POURING TUBE CERAMIC (PL No.84908300)

Issued by

MECHANICAL DRAWING OFFICE
RAIL WHEEL FACTORY
YELAHANKA, BANGALORE-560 064
INDIA

PCME	CWE/W	Dy.CCMT	Dy.CME/W-I	Dy.CME/D	SSE/D
APPROVED	REVIEWED	VERIFIED		PREPARED	

AMENDMENT SHEET

Alt 'o' Cl. No.	Alt 'p' Cl. No	Description	Job No	Sign
--	--	**PL No. Changed on Front page** Previous PL No. 84980916 Changed PL No. 84908300	7924	
--	3.7	**Added Clause No. 3.7**: Pouring Tube ceramic shall not sink during usage. To achieve the above, firm is also permitted to supply pre-grooved/knurled pouring tube ceramic (depth of groove/knurling to be approximately 3mm to 4mm) for the length inside the holding casting (approx. 12") on either end. The ultimate objective of the above pre-grooved/knurled portion is to provide adequate holding with the casting and prevent tube sinkage.		
6.7	6.7	**Addition of word "Sink" in Clause No. 6.7:** The tube should not bend/crack/**sink** or get attacked by slag/metal and puncture during the use.		
---	9.0	**Added Clause No. 9.0: Penalty Clause** Minimum expected life of the pouring tube ceramic is two (2) heats/tube under RWF's standard working conditions. If the pouring tube ceramic fails to complete two (2) heats/tube, deductions shall be made from the firm's pending bills/PG/BG in the following manner. i) If the pouring tube ceramic fails due to **puncture/sink/tube cut** before completion of two heats/tube, 20% of full cost of new pouring tube ceramic (all inclusive) shall be recovered from the firm's pending bills/PG/BG. ii) No extra payment shall be made for pouring tube ceramic which undergoes/completes more than two (2) heats/tube. iii) No deduction shall be made for pouring tube ceramic condemned before minimum expected life due to handling, transportation, process constraints and other operational issues attributable to RWF. RWF's decision in this regard shall be final and binding.		

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SPECIFICATION FOR POURING TUBE CERAMIC

INTRODUCTION

The pouring tube ceramic is a very vital consumable in the manufacturing of cast steel wheels at Rail Wheel Factory, Yelahanka, Bangalore - 560 064, Karnataka, India. The process employed is the patented Griffin's controlled pressure pouring technique. The ladle containing about 20 tons of molten steel at about 1620 - 1640 °C is placed in a pit, which is sealed by a cover, which also carries the pouring tube at the centre. The relevant process detailed is given elsewhere in the specification. Considering the critical nature of the item, it is necessary that the tenderer possesses adequate knowledge of the pouring process and has proven experience of having supplied such pouring tubes to any plant manufacturing Cast Steel Railway Wheels.

The tenderers are therefore required to furnish details of supplies made by them to any such plants in the world and also to enclose performance reports in support of satisfactory and consistent supplies having been made.

Tenderers are advised in their own interest to study the wheel manufacturing process at Rail Wheel Factory, Yelahanka, Bangalore - 64 in order that they may appreciate the critical functional requirements of the Pouring tube.

1.0 SCOPE

1.1 The specification covers the design and supply of Pouring Tube Ceramic which will be supplied at Rail Wheel Factory, Yelahanka, Bangalore - 560 064, Karnataka State, India, as per instructions and conditions of contract and tender papers enclosed.

2.0 GENERAL DESCRIPTION

2.1 Pouring tube as per enclosed Drawing No.C/MO-12/9, Alt.`k'.

3.0 JOB REQUIREMENTS

3.1 The pouring tube is assembled with pressure Pouring Tank cover. The molten metal rises through the pouring Tube into the mould by means of controlled pressure (Max. of 35 PSI) pouring technique.

3.2 The Pouring tube will be required for the manufacture of cast steel wheels to the following composition.

Carbon	:	0.47% to 0.77%
Manganese	:	0.60% to 0.80%
Phosphorus	:	0.03% Max.
Sulphur	:	0.03% Max.

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Silicon	:	0.15% to 0.40% Min.
Molybdenum	:	0.07% to 0.15%
Vanadium	:	0.10% to 0.16%

3.3 EASE OF GRINDING

The tube, after assembly is required to be ground off flush with the surrounding parting ring using a hand held grinder. It should be easy to grind with hand grinder. Grinding wheel specification to IS 551 (37C 16R-4B- L5) to its latest revision.

3.4 In its service the Pouring tube is required to withstand slag attack (slag basicity is around 1.75 to 3.2 generally) and action of ladle insulation compound of the following composition:

Carbon	:	40 to 60%
SiO_2	;	40 to 50%
Al_2O_3	:	10% Max.
Fe_2O_3	:	5% Max.
CaO	:	5% Max.

3.5 The Pouring tube should also withstand repeated up and down movements in the molten metal which are done as a part of the process for preventing localised solidification of the metal inside the tube.

3.6 Occasionally the tube is also required to be fitted with steel cone at the bottom to facilitate piercing of the slag layer.

3.7 Pouring Tube ceramic shall not sink during usage. To achieve the above, firm is also permitted to supply pre-grooved/knurled pouring tube ceramic (depth of groove/knurling to be approximately 3mm to 4mm) for the length inside the holding casting (approx. 12") on either end. The ultimate objective of the above pre-grooved/knurled portion is to provide adequate holding with the casting and prevent tube sinkage.

4.0 MANUFACTURE

4.1 CHARECTERISTICS OF RAW MATERIALS USED:

Supplier will provide details of the grade, source, specification and acceptance criteria of important raw materials used for manufacturing of pouring tube to satisfy the job requirement mentioned above.

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4.2 MANUFACTURING FACILITIES REQUIRED:

The manufacturer shall document details about in-process production parameter (sieve analysis of materials, green BD, green strength, temperature & duration of baking) during manufacturing, which shall be offered for verification of RWF's representative on demand during capacity/capability assessment or inspection.

4.3 TESTING FACILITIES

The manufacturer shall have all the facilities to test the properties of pouring tube ceramic specified in this specification.

4.4 QUALITY ASSURANCE PLAN (QAP)

The manufacturer shall submit their Quality Assurance Plan (QAP) along with their bid for approval by RWF, which will be followed in the manufacturing of pouring tube ceramic to satisfy the technical requirement as required under this specification. Manufacturer shall get their QAP approved from RWF in advance, unless a waiver is given to this effect.

5.0 TECHNICAL DATA

5.1 MATERIAL & MANUFACTURING PROCESS

Fired Ceramic Tube manufactured through extrusion process only.

5.2 SIZE FOR CERAMIC POURING TUBE

Outer dia. : 6 3/8" ± 1/8" (162mm ± 3mm)
Inner dia. : 3 1/2" $^{+0"}/_{-1/8"}$ (89mm $^{+0mm}/_{-3mm}$)
Length : 84" $^{+1/2"}/_{-0"}$ (2133.6mm $^{+12.7mm}/_{-0mm}$)
(NOTE: Equivalent metric dimensions are acceptable.)

5.3 DISTORTION

5.3.1 Warpage should not exceed 1/2" (12.7mm) in its entire length. Concentricity should be within 3/32" (2.4mm) i.e. the difference between the max. wall thickness and the min. wall thickness should not exceed 3/16" (4.8mm).

5.4 PROPERTIES

5.4.1 Permeability (measured perpendicular to axis). Typical values expected are 0.0050 cm. gm. sec. The tenderers should furnish supporting certificates. The surface and structure of the tube should be such that when the glaze is applied (as described in paragraph Nos. 6.2 & 6.3), the tube should be airtight and should present a glazy uniform surface.

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5.5 STRUCTURE

5.5.1 There should be no loose particles or surface imperfections visible to the naked eye which may get washed off from the tube and get included in the metal during pouring. Broken pieces of used tubes can be collected by the tenderers for their guidance.

5.6 THERMAL SHOCK RESISTANCE TEST

5.6.1 A 6" (152.4mm) long section of pouring tube is pre-heated to 1800°F (982°C), removed from the heating furnace and placed on a sand bed. Steel at about 2900°F (1553°C) as poured into the tube and it is air-cooled. There should be no thermal cracks or spalling on pouring of the metal.

5.7 The nominal chemical composition and other properties of pouring tube are given below.

5.7.1 COMPOSITION FOR POURING TUBE

(When tested as per IS 12107:1987 Part 2, 3 & 6 or equivalent ASTM Standard)

Al_2O_3 %	: 66
SiO_2 %	: 30
Fe_2O_3 %	: 1

5.7.2. PHYSICAL PROPERTIES FOR POURING TUBE

(When tested as per IS 1528:2012 Part 15 or equivalent ASTM Standard)

App. Porosity %	: 25
B.D. (gram/cc)	: 2.2
Specific gravity	: 2.9

5.7.3 X-RAY FINDINGS

	MULLITE
Major	1. Cristobalite
Minor	2. L-Quartz
	3. L-Alumina

6.0 OPERATIONAL PARAMETERS & REQUIREMENT OF CERAMIC TUBE

6.1 Ceramic tube is cut to the exact size by using diamond circular saw.

6.2 Tube is fixed on the Holding casting using Air setting cement and allowed to dry in air. Subsequently Flame drying is done for not less than 2 hours with 30 lbs (13.62 kg) weight on top to prevent swelling.

6.3 Complete tube is dipped in glaze material to have a coating on the outer surface of the tube (Glazing is facilitated by application of vacuum).

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6.4 The ceramic tube is subjected to extreme thermal shock in operation. To minimise this, tube is preheated in an electric oven gradually about 200°F(93°C) per hour upto 1800°F(982°C) to 2000°F(1093°C) and held at this temp, till it is taken for assembly to pouring cover and pouring operation.

6.5 Pre-heated tube is assembled to the pouring tank cover (See Fig.1) and is immersed in the liquid metal at about 2950°F(1621°C) during casting of wheels. Duration of casting is approximately 45 minutes to 1 hour.

6.6 Tube is used second time after an interval of upto 2 1/2 hours during which tube is kept in holding furnace at about 1800°F(982°C) along with the cover.

6.7 The tube should not bend/crack/sink or get attacked by slag/metal and puncture during the use.

6.8 The above information is given for manufacture/production purpose.

7.0 The manufacturers shall issue a test certificate for all parameters under clause No. 5.0.

8.0 SAMPLING NORM AND ACCEPTANCE CRITERIA

Each time a consignment is received a sample shall be drawn as per table and used. If the material fails with respect to any of the clauses mentioned in 5.0 & 6.0, the entire lot shall be rejected.

Sl. No.	Quantity	Sample Size
01	Upto 200 Nos	2 Nos
02	200 & above and batches of 500 Nos.	5 Nos

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9.0 Penalty Clause

Minimum expected life of the pouring tube ceramic is two (2) heats/tube under RWF's standard working conditions. If the pouring tube ceramic fails to complete two (2) heats/tube, deductions shall be made from the firm's pending bills/PG/BG in the following manner.

i) If the pouring tube ceramic fails due to **puncture/sink/tube cut** before completion of two heats/tube, 20% of full cost of new pouring tube ceramic (all inclusive) shall be recovered from the firm's pending bills/PG/BG.

ii) No extra payment shall be made for pouring tube ceramic which undergoes/completes more than two (2) heats/tube.

iii) No deduction shall be made for pouring tube ceramic condemned before minimum expected life due to handling, transportation, process constraints and other operational issues attributable to RWF. RWF's decision in this regard shall be final and binding.

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ALT	DESCRIPTION	JOB No.	INITIALS
(K) 21.06.16	UPDATED AS PER SPECIFICATION RWF/M/SPECN-1/012/1987 ALT. 'o'. CHANGED LENGTH FROM 82"(2082.8mm) TO 84"(2133.6mm).	6773	APPROVED

NOTE :

1. MATL: AS PER SPECN "POURING TUBE CERAMIC-RWF/M/SPECN-1/012-ALT.'O'
2. WARPAGE SHOULD NOT EXCEED 1/2" (12.7 mm) IN THE ENTIRE LENGTH.
3. CONCENTRICITY SHOULD BE WITHIN 3/32" (2.4 mm)THAT IS THE MAX. AND MINIMUM WALL THICKNESS SHOULD NOT DIFFER BY MORE THAN 3/16" (4.8mm).
4. PHYSICAL PROPERTIES:
   - i. PERMEABILITY (MEASURED PERPENDICULAR TO AXIS): TYPICAL .005 gm. cm. sec. THE SURFACE AND STRUCTURE OF THE TUBE SHOULD BE SUCH THAT WHEN THE GLAZE IS APPLIED, THE TUBE WILL BE AIR TIGHT.
   - ii. STRUCTURE : THERE SHOULD BE NO LOOSE PARTICLES WHICH CAN BE WASHED OFF THE TUBE IN TO THE METAL.
   - iii. THERMAL SHOCK RESISTANCE TEST : A 6" (152 mm) LONG SECTION OF POURING TUBE IS PREHEATED TO 1800°F (982°C) REMOVED FROM THE HEATING FURNACE AND PLACED ON A SAND BED. STEEL AT 2900°F(1593°C) IS POURED IN TO THE CENTER OF TUBE AND IT IS AIR COOLED, THERE SHOULD BE NO THERMAL CRACKS OR SPALLING.
5. SUPPLY IN EQUIVALENT METRIC DIMENSIONS IS ACCEPTABLE.

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INDIAN RAILWAYS

EXTRUDED POURING TUBE
(ORDERING SIZE)

RAIL WHEEL FACTORY
BANGALORE

REF DRG.

SCALE	AME/D	22.6.16
--	SSE/D	21.6.16
PROJECTION	CHD	
	DRN	CB 07.07.08
ALT (K)		

DRG.No. C/MO-12/9

JOB No. 3970 SHEET OF

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