

**GOVERNMENT OF INDIA**

**MINISTRY OF RAILWAYS**



**Functional Specification of Abrasive Stone**  
**to be used on Rail Grinding Machines of**  
**Indian Railways**

**SPECIFICATION No TM-206**

RESEARCH DESIGNS & STANDARD ORGANISATION,  
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## **Draft Functional Specification of Abrasive Stone to be used on Rail Grinding Machines of Indian Railways**

### **1. General:**

- 1.1. These specifications provide the technical and functional requirements for the manufacture, testing and supply of Abrasive Stones (here after referred stones) for use on Rail Grinding Machines (here after referred as RGM) of Indian Railways. The stones to be supplied are meant for grinding the rails to improve the worn profile of rail head, rail wheel contact point band, its location, and to remove fatigued material having micro cracks and other surface defects on the rail table surface and remove short wave and long wave corrugations. The supplier shall furnish, deliver and warrant the stones as per these specifications and tender conditions.
- 1.2. The Technical Specifications have been drafted to cover the performance and quality requirement of the stone in a neutral manner without bias to any specific manufacturer. Tenderers are requested to carefully study the specifications and assure that their stone fully comply with these specifications. Thereafter, if a tenderer feels that his stone can substantially meet the performance and quality requirement of the specification in general but does not fully satisfy a particular specification, he should immediately seek clarification from the purchaser prior to submission of bids as to whether such deviation is substantive or not. Whenever there are any such deviation(s), tenderer should mention the same in the statement of deviation from the specification to be submitted along with bid and should clarify how his **stone** will meet the functional requirement of such clause.
- 1.3. The Technical Specifications have been drafted to cover the performance and quality requirement of the stone in a neutral manner without bias to any specific manufacturer. Tenderers are requested to carefully study the specifications and assure that their stone fully comply with these specifications. Thereafter, if a tenderer feels that his stone can substantially meet the performance and quality requirement of the specification in general but does not fully satisfy a particular specification, he should immediately seek clarification from the purchaser prior to submission of bids as to whether such deviation is substantive or not. Whenever there are any such deviation(s), tenderer should mention the same in the statement of deviation from the specification to be submitted along with bid and should clarify how his equipment will meet the functional requirement of such clause.
- 1.4. The tenderer shall specify the model offered and furnish a detailed clause by clause Technical Description of the same as per clause-3 of this specification in particular and all the items of the specifications in general in detail in the "Technical

Description”, along with the sketches to show the manner in which the requirement of the specification are accomplished by stones (models) offered.

- 1.5. Photographs/video (in compact disc/Pen drive) of the type of stones offered in static mode (showing close-ups of all facets of stone) should be enclosed with the offer.

## **2. Dimensional requirements:**

- 2.1. The design and dimensions of the stone components shall be to SI (International) System of Units standards. Quality assurance during manufacturing of the stone shall be according to ISO-9001 & ISO 14001:2004.
- 2.2. The stones supplied will be used on RGM being owned by Indian Railways. It should be compatible in all aspects to be used on RGMs owned by Indian Railways. Tenderers are advised to study the Stones presently being used on RGM.
- 2.3. Size of the stone- 250 mm (10 in.) outside diameter, 160 mm (6 in.) inside diameter, and 75 mm (3 in.) thickness cup wheel with a tolerance level of  $\pm 2\%$ .
- 2.4. Stone shall be moulded on a back plate having three equidistant 3/8” tapped holes at approximately 207mm PCD (Pitch Circle Diameter) to securely mount it to the stone holder of RGM with three bolts.
- 2.5. The working of the stone shall not be affected in any manner due to overhead electricity and also due to track circuit voltage (12 V & 1 AMP).
- 2.6. Once the stone is fitted on RGM, any of its parts shall not infringe the adjoining track as per ‘Indian Railways Schedule of dimensions 1676mm Gauge (BG) – revised 2004 with latest corrigendum and up to date correction slips issued “While opening and closing of work”.

## **3. Working Mechanism:**

- 3.1. The stone shall be able to effectively grind track on Indian Railways. The stone should be capable of producing good longitudinal profile of the railhead continuously.
- 3.2. The stone should be capable of grinding operations on plain track and curves, track in tunnels, track on bridges having guard rails without removing the guard rails, and track on platform lines. It should also be capable of grinding operations on track on level crossings having check rails and curves with check rails after removing check rails. Maximum grind speed of RGM is 18kmph on plain track.
- 3.3. The minimum speed, at which the stone can grind effectively without any damage to the rail, shall be as per supplier's design but it shall be mentioned in the offer.

- 3.4. The stone shall be capable of grinding profile of UIC 60 Kg rail section, 52 Kg rails having 72/90/110 UTS strength and Head Hardened rails inclusive of fish plated joint, insulated joints and welded joints in long welded rails and short welded rails laid on pre stressed concrete sleepers, steel sleepers, composite sleepers and wooden sleepers. It shall also function effectively on rails having surface defects such as wheel burns, shelling etc. The stones shall be able to carry out controlled \* grinding of all rail corrugation defects and also defects of long wave length to produce a smooth cross sectional profile without creating any sharp edge between the rail table and gauge face.
- \*Controlled grinding refers to controlling and maintaining target rail head profile through grinding the rails in corrective mode and preventive mode, to improve the worn profile of rail head, rail wheel contact band, its location, while removing fatigued material having micro cracks, other surface defects on the rail head and corrugations.
- 3.5. The rail grinding mechanism of RGM on which stone will be mounted is electric driven grinding motor, drawing power from an on-board diesel generating set. The power of one grinding motor is 30HP. The grinding motor is controlled through suitable starter control for starting/stopping of motor.
- 3.6. All the components of the stone must be robust and capable of continuous operation upto 5 hrs in one spell under the field working conditions. Their performance should not deteriorate due to heavy heat accumulation in the work area and metallic dust generated at the work site.
- 3.7. To ensure Gauge Face correction without flattening the root curve, all of the grinding modules of RGM on which stone will be mounted have the ability of attaining spindle axis orientation with respect to the rail axis, up to 70° on the gauge corner and 45° on the field corner. At all angles the grinding effort is 100%.
- 3.8. With existing stones in place, the RGM is capable of removing, a minimum of 20sq. mm material from each rail(40 sq. mm for both the rails) per pass, from the rail top of a 60 kg. UIC (90 UTS) rail section, with top surface work hardened to BHN 315 to 380, while operating at a speed of 10 kmph. While assessing the performance of the stone supplied, the performance of material removal of test rail shall meet/exceed the above and profile (after grinding) shall be close to the target profile and the metal removal shall be fairly uniform over the entire rail surface.
- 3.9. With existing stones in place, the capacity of RGM regarding depth of grinding per pass, from 60 kg 90 UTS work hardened rail top while grinding uniformly over full width and gauge faces at various working speeds, is as mentioned below :

15kmph : 0.13mm

10kmph : 0.20mm

While assessing the performance of the stone supplied, the performance of depth of cut of test rail shall meet/exceed the above.

- 3.10. There should not be any chattering, frictional ploughing or occurrence of uneven removal of the material at Maximum speed of grinding nor there any metallurgical changes or bluing of the rail top at the minimum operating speed.
- 3.11. The stone must be capable of bi-directional grinding i.e. in both the directions on the same track without loss of metal removal capacity or productivity.
- 3.12. While the RGM is operating at full grinding load at the maximum working speed, the minimum life of each stone shall not be less than 5 hrs grinding time.
- 3.13. The stone must be capable of grinding under the following track conditions:
  - (i) Maximum continuous gradient(more than 1 Km)3%
  - (ii) Minimum radius curve 175m
- 3.14. The surface finishes after the grinding shall be that corresponding to RMS value of 12 microns roughness or less.
- 3.15. Stone shall be moulded to a back plate of suitable material, the hardness of which should be less than 100 BHN.
- 3.16. The stone shall be wrapped with impregnated high strength resin reinforced with glass fibre on periphery.
- 3.17. The maximum rotational speed of grinding motor is 3630 RPM. The stone shall be dynamically balanced and tested at a minimum 5445 RPM. Test certificate for each Batch of stones should be submitted at the time of supply.
- 3.18. Visually there should not be any crack on the face of stone.
- 3.19. On visual examination, there should not be any slumping on stone. Maximum slump of 1/16" will be allowed.
- 3.20. Excess bond resin build up should not be visible on all the faces of stone.
- 3.21. During grinding operation, stone should not show any sign of cracking/spalling. There shall not be any split/stick of bond resin during grinding operation

- 3.22. The RGM is equipped with Rail Grinding templates for Broad Gauge (1676 mm), with four different profiles (a) Tangent track (b) The high rail in mild curves (c) The high rail in sharp curves (d) Low rail in both mild and sharp curves. The tenderer should study the existing templates and assure that their stone can perform grinding to achieve these templates.
- 3.23. Truing and dressing of each stone shall be carried out by the supplier before finally dispatching the stone so as to produce good macro and micro geometry (respectively) of cutting face of stone.
- 3.24. Residual Shelf Life of stone shall be minimum 2 years at the time of supply.
- 3.25. Each stone shall be packed with water proof sheets so as to prevent damage due to moisture.
- 3.26. Supplier has to furnish the compositional detail of Stone to be supplied for following parameters:
- i. Type of grit material
  - ii. Grit size
  - iii. Bond strength or wheel hardness/grade
  - iv. Bonding material
  - v. Structural porosity
  - vi. Concentration ratio per cubic centimeter of grinding stone volume
  - vii. any other technical parameter as deemed relevant

#### **4. SAFETY:**

- 4.1. The stone should be designed, manufactured and tested in accordance with European Safety Standard EN12413:2007 (Safety requirement for Bonded Abrasive Product) or any other equivalent standard being followed.

#### **5. MAKER'S TEST CERTIFICATE:**

- 5.1. Copies of maker's certificate guaranteeing the performance of the stone shall be supplied in duplicate along with the delivery of each batch of stones.

## **6. INSPECTION:**

- 6.1. While inspecting the stone before dispatch from the supplier's premises, the inspecting officer of the supplier shall verify the conformity of the stone with respect to individual clause of technical requirements laid down in this specification. The stone's conformity/non-conformity with respect to each item shall be recorded, before the issue of the "Inspection certificate and approval for dispatch of the machine" as per Annexure-I enclosed.
- 6.2. List of documents to be submitted at the time of supply should include:
- i. Technical details of stone as per clause no. 3.26 and any other technical parameter as deemed relevant
  - ii. Test certificate from renowned/reputed/approved lab or in house lab for clause no. 3.26
  - iii. Maker's Test Certificate.
  - iv. Manufacturer's Internal Quality Inspection Report
  - v. Dynamic testing certificate for each stone as per clause no. 3.17
  - vi. List of necessary tools,if any, to be dispatched along with the stone
  - vii. List of. Manuals, Drawings, to be dispatched along with the stone,
  - viii. Report of clause 5.1
  - ix. Details of the firm, its manufacturing plant
  - x. Relevant documents for supplying the offered stone to other rail grinding machines worldwide issued by user railway/Rail Grinding Machine Manufacturer.

## **7. MARKING:**

- 7.1. Following should be written/marked on the Stone at appropriate location with temper proof sticker-
- i. Part number
  - ii. Complete Alphanumeric code describing specification of stone
  - iii. All relevant dimensions
  - iv. Name of Manufacturer
  - v. Stamping internal inspection and acceptance.
  - vi. Manufacturing Date and the Expiry Date of the Stone.
  - vii. Any other detail as deemed relevant.

**8. Acceptance test-**The acceptance test as below shall be carried out at the time of supply by the consignee Railway.

8.1. For acceptance test, random stones will be drawn from the stones supplied. The sample size shall consist of 36 stones per 1000 stones or part thereof supplied.

8.2. All the tests shall be carried out in presence of supplier's representative.

8.3. The acceptance test of stone shall consist of:

- A. Dimensional test as per clause no. 2.0 for all stones supplied
- B. Visual construction and engineering test as per clause no. 3.0 for all the stones supplied
- C. Slump Test- All stones of sample size will be checked for slumping. A square will be placed on stone face to ensure that grinding face is perpendicular to the hole and convex or concave slumping will be measured. Maximum slump of 1/16" will be allowed.
- D. Output performance quality tests with the following conditions and methodology:
  - a) Stone will be tested on High carbon 90 UTS/110 UTS H.H. rails with 60-kg/52 kg UIC section.
  - b) Sample stones (36 stones) shall be fixed one side of RGM while on other side existing Stones supplied by OEM of RGM or any other approved stone, which has been found suitable in RGM by the Indian Railway, will be fixed.
- E. For the purpose of metal removal capability of the stone (clause 3.8), 5 sites of minimum 500m each (tangent track) shall be selected. At each site measurement of both left and right rail profile shall be taken.
  - i. At each site, the machine shall grind a length of at least 500 meters to ensure that the stones are not heated up.
  - ii. Profile of the rail section shall not be deformed.
  - iii. The profile of the rail shall be close to the desired profile.
  - iv. The rail hardness shall be measured and recorded.
  - v. To assess the material removal capability of the stone (clause 3.8), At each site, on the test rails, 5 X-sections shall be selected on both rails. These X-sections shall be at least 2 meters away from any weld/fish plated joint and not in heavily corrugated rail.
  - vi. The X-sectional area shall be recorded, at each X-section, before the grinding, and after 1 grinding passes. The working speed, while grinding shall be maintained as specified. The material removal per pass at each X-section shall be worked out by averaging the loss of X-section over 5 passes by five.

- vii. The average material removal per pass for the site shall be the average of material removal per pass at 5 X-sections.
  - viii. The average material removal per pass at the specified speed at each of the 5 sites for both left and right rail separately shall be more than that specified in clause 3.8.
- F. For the purpose of depth of metal removal capability of the stone (clause 3.9), 5 sites of minimum 500m each (tangent track) shall be selected for carrying out tests at the speeds mentioned in clause 3.9. At each site measurement of both left and right rail shall be taken:
- i. At each site, the machine shall grind a length of at least 500 meters to ensure that the stones are not heated up.
  - ii. Profile of the rail section shall not be deformed.
  - iii. The profile of the rail shall be close to the desired profile.
  - iv. The rail hardness shall be measured and recorded.
  - v. 5 points shall be chosen at 5 locations across the X-section, one towards gauge face side, three in the middle of rail top and one towards non-gauge face side such as to cover full width of rail head, at 5 X-sections on both rails at each of the 5 sites.
  - vi. The working speed, while grinding shall be maintained as specified. The depth of metal removed shall be measured by measuring the depth of cut before and after 3 grinding pass. as per para no. 8.3/F/v. Measurement to be done with Contact based Rail profile measurement Device with or better precision/accuracy.
  - vii. The average of the 25 observations at each site for each rail shall be worked out. The average depth of metal removal per pass for the site shall be the average depth of material removed for all 25 test points.
  - viii. None of the average depth of metal removal per pass for a site, out of 5 selected sites for both rails should be less than as specified at clause 3.9 for the respective grinding speed.
- G. Stoppages of work not attributable to machine shall be discounted.
- H. At least 90% of the measurements should deviate by less than  $\pm 0.3\text{mm}$  from target rail profile.
- I. The machine will also be operated at suitable locations in working mode for continuous 5 hours to ensure the stone's continuous working capability for this type of work and test the life of the stones. Life of all of the sample stones should be as specified at clause 3.12.

8.4. If the sample fails, the whole lot of stone supplied shall be rejected and supplier shall be asked to lift his supply within 15 days of receipt of rejection invoice. No payment shall be made to Supplier for sample stones used for acceptance test. Supplier shall be asked to supply fresh batch of stones confirming to specifications and again

acceptance test shall be carried out as per clause no. 8.0. If sample fails again, the contract shall be terminated duly following the procedure. No payment shall be made for sample stones used for acceptance test.

- 8.5. Prior to participating in tender bid, if any vendor wants to confirm whether their stones meet the specifications, can do so by supplying sample stones free of cost to consignee Railway. The acceptance test shall be carried out as per clause no. 8.0 and test results shall be informed to supplier.

**INSPECTION CERTIFICATE**

**CERTIFICATE OF INSPECTION OF STONE ( )**

**BY INSPECTING OFFICAL AND APPROVAL FOR DESPATCH OF MACHINES**

**(STRIKE OUT WHICHEVER NOT APPLICABLE)**

This is to certify that I have inspected the stone------(type) bearing SL No.-----from (date) ----- to----- (at place) ----- for its conformity/non-conformity with respect to the laid down Technical Specifications in contract Agreement No.----- dated ----- -- between President of India through \_\_\_\_\_ and M/s (Name of Supplier)-----.

The detailed inspection Note regarding its conformity/non-conformity to the laid specifications is enclosed along with an Annexure 'A'. It is observed that (strike out whichever is not applicable):-

- The stone conforms to all laid down specifications.
- The stone conforms to all the laid down specifications except those at Sl.No. -----
- The above deviations are minor/major affecting/not affecting the performance of the stone in substantial way.

The following T and P/manuals/drawings are to be supplied along with the machine:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Based on the above, the stone is certified/not certified to be conforming to the specifications.

The stone is approved/not approved for despatch to \_\_\_\_\_ (consignee) Indian Railway.

For M/s \_\_\_\_\_  
\_\_\_\_\_

SIGNATURE AND DATE  
INSPECTION OFFICIAL  
(NAME AND DESIGNATION)