EXOTHERMIC AND /OR INSULATING SLEEVES AND FLEXIBLE BOARDS FOR USING IN FOUNDRY

1.0 GENERAL:

This specification governs the requirement of riser lining material in the form of cylindrical / oval sleeves, and rectangular or square flexible boards.

2.0 APPLICATION:

The material shall be used for riser lining in order to enhance riser efficiency in making castings.

3.0 COMPLIANCE WITH NATIONAL STANDARDS:

There is no National standard in compliance with this specification.

4.0 PROPERTIES:

4.1 The material shall be Exo-Iso or insulating in nature. It can be of duplex type also i.e., exothermic material in metal contact surface and insulating material on outer side.

4.2 The sleeves / boards shall be homogeneously bonded and shall have smooth and well finished surface, free from cracks, blow holes, cavity, patches. Edges and corners should be sharp and intact.

4.3 **Strength:** The sleeve shall have strength to withstand the compressive pressure of rammed moulding sand and should not develop crack, significant dilation (±2% max.) or collapse. The compressive strength shall be 10-12 kg/cm^2.

4.4 When unpacked and taken out from the wrapper, moisture content should not exceed 1% in sleeve material.

4.5 The bulk density shall be in the range of 0.7 gm/cc to 0.8 gm/cc.

4.6 Permeability shall be in the range of 120-150.

4.7 The minimum Modulus Extension Factor (MEF) shall be as given below but material with higher MEFs shall be preferred.

Sleeve ϕ(mm)	Min MEF	
	Exo-Iso	Insulating
upto 150 mm	1.55	1.35
180-225 mm	1.45	1.30
250-300 mm	1.4	1.30
325 and above	1.3	1.2

4.8 When the material is in cylindrical form the thickness shall be 10% of the internal diameter. In case of oval shaped sleeves, thickness shall be 12.5% of minor axis length rounded off to nearest 5 mm or as agreed between supplier and BHEL. Height shall be as agreed between supplier and BHEL. In case of boards – flexible, square or rectangle thickness shall be as per agreement. The tolerance on thickness shall be ±10% or ±2 mm whichever is less. In case of boards – flexible, square or rectangular, thickness shall be as agreed between supplier and BHEL.

4.9 While the riser lining material is used, the covering powder and its quantity for the lined riser shall be as agreed between customer and supplier, for which purpose a table is to be provided by the supplier.

5.0 TESTING:

Random samples shall be taken from each batch of the consignment for checking the properties as per clause No. 4.0 (Except clause 4.7).

The recommended MEF, volumetric efficiency and extent of gas evolution and entrapment shall be verified by BHEL representative at supplier's site.

The method of verification of MEF, volumetric efficiency and gas evolution and entrapment shall be as agreed between customer and supplier. Typical examples are given in annexures enclosed.

6.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order. In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information :

AA 536 18, Rev 01: Exothermic and /or insulating sleeves and flexible boards for using in foundry
BHEL order No
Specification No.: Exo-Iso / insulating / duplex riser lining material
Supplier reference / trade mark
Identification No/batch no.
Properties as per Clause No.4.0
Any other specific information which the supplier would like to convey.

7.0 INSPECTION, DEVIATION AND REPLACEMENT:

BHEL reserves the right to inspect material at site before despatch. The supplier shall intimate in advance enclosing a copy of test certificate of the material offered for inspection. However inspection at BHEL shall be final. The supplier shall offer BHEL representative all reasonable facilities without charge to satisfy the latter that the material is being furnished in accordance with this specification. The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works, the supplier shall make necessary arrangements for carrying out the prescribed tests elsewhere.

If the material received at CFFP is not found in accordance with the requirements, it shall be rejected and the supplier will have to replace it free of cost at the earliest.

For any deviation from the specification demanded by the supplier, prior approval of BHEL must be obtained in writing.

8.0 PACKING AND MARKING :

The material shall be suitably packed to avoid damage, breakage and moisture pickup during transit and storage.

Each consignment is to be legibly marked or labeled with the following information :

AA 536 18 : Exothermic and /or insulating sleeves and flexible boards for using in foundry
BHEL order No.
Specification No.: Exo-Iso / insulating / duplex riser lining material
Manufacturer's/Supplier's name and trade mark, if any.
Batch No.
Size and quantity supplied.
Date of manufacture

Any material found broken, damaged, solid due to improper packing or mishandling during transportation or otherwise shall be rejected and has to be replaced in equal quantity by the supplier within 15 days of intimation.

9.0 REFERRED STANDARDS (Latest Publications Including Amendments):

DIN 1690, Pt II

ANNEXURE – I

Verification of Module Extension Factor (MEF) as recommended by supplier.
Testing shall be done on a cube casting provided with a circular lined riser.

1. Minimum feed safety margin to be considered as 20% of lined riser filling height.
2. The contact surface of riser base to casting top shall be considered non-cooling.
3. After covering the riser top with recommended covering powder, the cooling coefficient of riser top shall be treated equal to side surfaces of lined riser.
4. The cooling coefficient of cube top which is not in contact of riser base shall have the value equal to other sides ($a^2 - (\pi/4)^* d^2$) for cube of side 'a' and riser diameter 'd')
5. Riser shall be parted off from casting by sawing – not by gas cutting. The riser then shall be splitted vertically to physically observe shrinkage pattern and measuring the feed safety margin.
6. The cube casting shall be subjected to UT as per **DIN1690 Part II Quality level 1.**
7. The UT shall be done to check shrinkage only and not for any other defect e.g., inclusion, segregation, crack, etc.
8. If felt necessary, the cube casting can be parted off in pieces by sawing and verifying for shrinkage defects.
9. Liquid metal shall be plain C steel (economic consideration) at 1565±10°C. Moulding sand shall be either sodium silicate bonded sand or phenol resin bonded sand. Non-pressurised gating system shall be at the ratio of 1:2-3: 4-5 (from sprue to ingate). The riser top shall have provision to accommodate the recommended quantity of covering powder. Addition of covering powder shall be done immediately after pouring.
10. Boiling tendency of liquid metal, if any, in the sleeve riser shall be noted. If boiling continues for more than 2 minutes, gas evolution in sleeve shall be considered excessive and liable for rejection.

Example:

When recommended MEF for ϕ250 sleeve is 1.4, for a sleeve riser of H=D.
Modulus = (250/5) X 1.4 = 70 mm.
If ϕ250 lined riser is placed on a cube of 320 mm side, all 5 surfaces of cube shall have cooling coefficient of 1 and the top surface under riser shall have cooling coefficient equivalent to
(320 X 320 – 0.785 X 250 X 250) / (320 X 320) = 0.5208
Hence casting modulus = 320 / (5+(0.52/1)) = 57.97 mm

Hence, riser modulus/casting modulus = 1.2075

Hence ϕ250 HT250 mm sleeve, with MEF 1.4, shall be sufficient to feed a cube of 320 mm.

ANNEXURE I

Verification of Modulus Extension Factor (MEF) as recommended by supplier.

Alternative method for finding cube size

Suppose the test cube has side 300 mm. A sand riser has been placed on it.
Considering sand riser covering the total top surface of cube,
cube modulus = 300/5 = 60 mm.
The corresponding desired riser modulus = 60 X 1.2 = 72 mm.
For H=D sand riser, the riser size shall be 72x5 = ϕ360.
If the riser lining material (including the covering powder) have MEF of 1.4, then the size of the lined riser shall be (72/1.4) X 5 = ϕ250.14 approximated to ϕ250.

- Here the cooling effect of portion of cube not covered by riser has not been considered.
- In this method for 300 mm cube size, ϕ250 H=D riser with MEF = 1.4 shall work whereas according to other method the same riser shall feed 320 mm cube.