TECHNICAL SPECIFICATION

FOR

FLOWABILITY STUDY FOR COAL BUNKERS

SPECIFICATION NO. PE-TS-STD-161-14000-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA
1.0 **SCOPE OF WORK**

A comprehensive flow-ability study of crushed coal shall be conducted by the bidder, for the coal bunker to ensure smooth flow of coal in all seasons with different moisture contents and different percentage of fines. The bunkers are required to promote mass flow without choking and rat holing problems.

Typical capacity of coal bunkers are as follows:

<table>
<thead>
<tr>
<th>Plant Rating(MW)</th>
<th>Capacity Range(Tonnes)</th>
<th>Type of bunker</th>
</tr>
</thead>
<tbody>
<tr>
<td>210/250/300</td>
<td>Up to 500</td>
<td>Rectangular</td>
</tr>
<tr>
<td>500/600</td>
<td>700-800</td>
<td>Circular</td>
</tr>
<tr>
<td>660</td>
<td>800-1050</td>
<td>Circular</td>
</tr>
<tr>
<td>800</td>
<td>900 – 1150</td>
<td>Circular</td>
</tr>
</tbody>
</table>

The report of study shall contain the followings:

a) Sample preparation & Size analysis - Preparation of required samples of coal for flow-ability studies, Size analysis of as received sample.

b) Bulk density determination.

c) Bulk density variation with normal stress (compressibility test).

d) Coal flow-ability tests (Shear tests) at minimum four different moisture levels (out of these one moisture level shall be as per project specific coal analysis) to establish wall angle of friction against liner like mild steel (MS), stainless steel (SS 304), stainless steel (SS409), UHMWPE, Effective angle of friction, Flow Functions, Flow Factor and Storage time effect at 24 and 72 hours for all flow-ability condition.

e) Evaluation of Mass Flow design parameters viz, slope of hopper with specified material of construction and critical outlet diameter to prevent cohesive arching.

f) Estimation of peak bunker wall pressures during filling and extraction as per IS-9178 part III standard

g) Values of critical outlet dimensions and hopper slopes for mass flow bunkers with different moisture levels and hopper material.

2.0 The following tentative information based on which flow-ability study for the bunker shall be conducted:-

a) Type of bunker – circular on top with conical/hyperbolic hopper profile for circular bunkers OR rectangular bunker with trapezoidal hopper.

b) Outlet diameter / size of bunker – 914 mm.

c) No liner is provided in the cylindrical/rectangular portion of bunker. Liner shall only be provided in conical/trapezoidal portion of the bunker.

d) Maximum extraction rate of the bunker shall be informed project to project basis.
e) Flow-ability test shall be conducted considering the points indicated in Annexure – I.

f) Capacity and tentative size of the bunker will vary based on coal consumption, number of mills and bunker bay dimensions and same shall be provided based project to project basis.

g) Coal analysis will be provided based on project to project basis.

3.0 In addition to above inputs, any other inputs required for carrying out the flow-ability study shall be included in bidder’s offer.

**ANNEXURE – I**

**Points to be considered while conducting flow-ability test**

a) For design of coal bins and loading hopper IS: 9178 (part I to III) shall be followed.

b) Transverse coal pressure on bunker / silo / hopper walls shall be calculated using Walker’s theory and IS: 9178. The coal bunker / silo / hopper shall be designed for the following conditions :-

i. The bunker / silo / hopper is full up to its full capacity with top surface nearly horizontal.

ii. The bunker / silo / hopper is partially empty with the top surface of coal at an angle of repose of 37 degrees.

c) Particle size inside the bunker shall be -25 mm. Flow-ability test shall be conducted for -25 mm coal size. In case, it’s not feasible to conduct on lumps, bidder shall conduct the test on coal fines and extrapolate their findings for lumps (-25mm coal size).

d) Test shall be carried out at different moisture saturation level.

e) In addition to the result for worst condition, results at project specific moisture content shall also be included in the study report.

f) Bunker outlet size shall be 914 mm. Bidder shall recommend valley angle for different liners and at different moisture content for 914 mm outlet size. In case, under storage effect, rat-holing or any other flow problem is anticipated, bidder shall recommend flow assisting measures e.g., poke holes, Vibrators, Air blasting etc with complete details and elevations for the installation.

g) For all capacity (volume) calculation and structural design (load calculation) unit weight of coal shall be assumed as 800 kg/m³ and 1200 kg/m³ respectively.

**Input Variation for Coal Flow-ability Study**

<table>
<thead>
<tr>
<th>Sl.no</th>
<th>Parameters</th>
<th>Value/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Outlet Size</td>
<td>914 mm (Standard)</td>
</tr>
<tr>
<td>2</td>
<td>Bunker profile</td>
<td>Circular with Conical/hyperbolic hopper profile OR Rectangular with trapezoidal hopper.</td>
</tr>
<tr>
<td>3</td>
<td>Storage effect</td>
<td>Instantaneous/24 hours/72 hours</td>
</tr>
<tr>
<td>4</td>
<td>Liner</td>
<td>SS 304/409/MS rusted/UHMWPE etc, Surface finish of liner shall be informed based on project requirement.</td>
</tr>
<tr>
<td>5</td>
<td>Moisture</td>
<td>Project specific based on coal analysis. Other percentage shall be decided by bidder based on critical moisture and saturation level.</td>
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