BHILAI STEEL PLANT

AUGMENTATION OF FUEL & FLUX CRUSHING FACILITIES (PKg-64) AT BHILAI, CHHATTISGARH

DESIGN CRITERIA FOR BELT CONVEYORS

APPROVED WITHOUT PREJUDICE TO CONTRACTUAL OBLIGATIONS AND LIABILITIES

SIGN: S.M. GANDHARVA
DATE: 01.12.11

MECON LIMITED

CONSULTANT

ENGINEERING PROJECTS (INDIA) LTD.

CONTRACTOR

AUGMENTATION OF FUEL & FLUX CRUSHING FACILITIES (PKG. 064)

DESIGN CRITERIA FOR BELT CONVEYORS

CATEGORY OF DRG APPROVAL INFORMATION REFERENCE RECORD CONSTRUCTION

BHILAI STEEL PLANT, BHILAI, CHHATTISGARH 7.0 MTPA EXPANSION

MECON LIMITED

CONSULTANT

ENGINEERING PROJECTS (INDIA) LTD.

CONTRACTOR

PACKAGE DESCRIPTION

AUGMENTATION OF FUEL & FLUX CRUSHING FACILITIES (PKG. 064)

DESIGN P.S TITLE DESIGN CRITERIA FOR BELT CONVEYORS

DRAWN S.S

CHKD S.K.C SCALE: NTS

APPROVED A.G

EPI-BSP- 064- 01 - BE - 00027

PROJECT DOCUMENT NO.

BSP- EPI- 02- 064- 02- 000 - 55 - BE - 00027

REV 01

REV NO. DESCRIPTION

DATE

22.11.11

REvised AS PER MECON COMMENTS

PS S.K
DESIGN CRITERIA FOR BELT CONVEYOR SYSTEM:

1. Design basis and hierarchy of specifications:
   a) Contract Specification (CS)
   b) General Technical Specification (GTS)
   c) Inter Plant standard for steel industries (IPSS)
   d) Indian standard (IS)

2. Conveyor Beltings:
   - Nylon/Nylon fabric heavy duty cut edge construction.
   - The rubber cover used in the top and bottom cover of the belting shall be of M-24 grade.
   - Super Heat Resistant type for CSP and Fire Resistant type for Coke/Coal and Nylon/Nylon belt for others shall be considered unless otherwise specified.
   - For Nylon/Nylon belting maximum 80% utilization of working tension has been considered and factor of safety as 10.
   - Belt designation will be as follows.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Area</th>
<th>Belt Cover Grade</th>
<th>Belt Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coke Sorting Plant (CSP)</td>
<td>Super Heat Resistant</td>
<td>Belt Designation as per Calculation x 6/3 NN.</td>
</tr>
<tr>
<td>2</td>
<td>Coal Handling Plant (CHP)</td>
<td>Fire Resistant</td>
<td>800/4 x 5/2 NN. (m)</td>
</tr>
<tr>
<td>3</td>
<td>Coal Handling Plant for Y7-12 &amp; Y7-13</td>
<td>Fire Resistant</td>
<td>1250/4 x 5/2 NN.</td>
</tr>
<tr>
<td>4</td>
<td>Upgradation of Fuel (Coke) Crushing/Screening Facility</td>
<td>Fire Resistant</td>
<td>Belt Designation as per Calculation x 6/3 NN.</td>
</tr>
<tr>
<td>5</td>
<td>Upgradation of Flux (Lime and Dolo) Crushing/Screening Facility</td>
<td>M-24</td>
<td>Belt Designation as per Calculation x 6/3 NN.</td>
</tr>
<tr>
<td>6</td>
<td>Bf#8 Return and Re-Routing of Return Fines</td>
<td>M-24</td>
<td>Belt Designation as per Calculation x 6/3 NN.</td>
</tr>
<tr>
<td>7</td>
<td>Return Coke from CSS-4</td>
<td>Fire Resistant</td>
<td>Belt Designation as per Calculation x 6/3 NN.</td>
</tr>
</tbody>
</table>
3. Conveyor Pulleys:

- Pulley diameter shall be selected as per IPSS. All pulleys shall be of welded steel construction. All welds shall be properly stress relieved and Pulleys are to be statically balanced. All pulley shafts shall be key fitted.

- Drive pulley – 12mm thick rubber lagging (diamond), hardness 55° (min.) shore A scale. Pulley shell thickness 16mm minimum.

- Non-Drive pulley – 10mm thick plain rubber lagging hardness 45° (min.) shore A scale. Pulley shell thk. 12 mm. (min.)

- Pulley face width – As per IS: 8531 – 1986 (Re-affirmed 1998).

- Pulley grooving width & depth shall be 6 mm at 30 mm interval.

- Deflection of drive pulley shaft at bearing shall not exceed 1/2000.

- All Pulley shaft – up to 100 mm dia. Class-IV, IS: 1875-1992, more than 100 mm dia shall be heat treated (class-4 normalised) Forged steel, 45C8, IS: 2004-1992

- Bearing: Self-aligning double row spherical roller bearing with adapter sleeve. Life – 40,000 hrs.

- Plummer Block – Material of Plummer Block shall be of cast steel IS: 1030, Grade-280-520W (min).

4. Idlers

- **Outer Diameter for Idlers:**
  - Carrying Idler: Staggered type [Length (L) shall be reviewed], 3 roll of 159 mm dia (As per BSP standard).
  - Impact Idler: 190 mm.
  - Return Idler: Single roll return idlers/ 10° V type for CHP & CSP (As per BSP standard).
  - All Pipe thickness of min. 6.3mm is provided.
  - Inline impact idler shall be provided in the loading zone.
  - Troughing angle of all carrying idlers shall be 35°.

- **Bearing dia. for idlers:**
  - For belt width 800, 1000, 1200 and 1400 mm carrying (As per BSP standard).

- **Idler Spacing:**
  a) Carrying idler spacing: 1000 mm. Spacing in the convex curve position of conveyor shall be limited to half the nominal spacing of conveyor idlers.
  b) Return idler spacing: 3000mm spacing.
  c) Self aligning idler spacing:
     i) For carrying side : 15 m
     ii) For return side : 30 m
d) Impact idler spacing : 500 mm (min. 6 nos. per feed point)
   - Idler bearing. Life (B-10 life) will be 40,000 hrs.

5. Belt Cleaners:

   External scraper: 2 nos. (Primary scraper + Secondary scraper)
   - Multi sprung blade type in segments provided on discharge pulley.
   - Material scrapped shall fall into main chute.
   - Blade material - Sprung Metallic Blade with tungsten carbide tips (For secondary scraper).
     - Polyurethane blade (For primary scraper).

   Internal scraper:
   - Type: V- plough shaped mounted on the upper side of the return belt near tail end.
   - Mountings: mounted on carrier assemblies with elasto-mount and non metallic polyurethane blade.

6. Gear Boxes:

   - All conveyors except shuttle conveyor will be provided with in line Helical Reducers as far as practicable in the layout and shuttle conveyor will be provided with Bevel Helical Reducer. All inclined conveyors will be provided with roller type integral hold back. Hold back rating shall be 1.5 times of max calculated torque.
   - All Gear-Boxes will be selected with a service rating of minimum 1.5 times of motor KW or 1.8 times the calculated KW whichever is higher.
   - Thermal capacity of gear –Box shall be better or equal to motor.
   - The transmission efficiency of the gearing shall not be less than 0.98 per stage.
   - All Gear Boxes shall have External Type of Hold back on the Non-Drive end of the input shafts.
   - Gear Box bodies shall be of Cast Steel / Fabricated.

7. Couplings:

   - Traction type fluid coupling will be used between motor and gear-box for drives of 30 kW to 100 KW and Delayed filled chamber type fluid coupling for LT motors above 100 KW and scoop controlled fluid coupling (Air cooled type) for HT motors shall be provided. For Motor power below 30 kW, gear coupling/resilient coupling will be provided. All output couplings (low speed couplings) shall be gear coupling.
   - The fluid coupling will be selected as per GTS (GS-06; clause 01.02.07; page 08 of 156)
   - Tolerance for alignment of all coupling shall be ±0.025mm.

8. Take-Up Unit

   - Screw take-up – for conveyor length up to 40 m. Screw of Screw Take Up shall be of square thread type stainless steel construction with brass nut.
9. Chutes:

- All the chutes shall be fabricated from 10 mm plates of MS (IS: 2062) plate.
- Vibrator to be installed in all chutes of the conveyors.
- The chutes shall be designed on the basis of minimum chute valley angle of 60°.
- Discharge hood shall be made of IS: 2062 of 6 mm thick for portion above pulley frame and of 10 mm thick below pulley frame & up to 500 mm below the floor.
- All chutes shall be provided with clogging device.

10. Liners For chute:

For Coal Handling Plant:
Chute shall be lined with 8mm thick 409M SS liners.

For Coke Sorting Plant/BF#8 Return line conveyors:
Chutes shall lined with 110mm thick Cast Basalt/ Ceramic Liners.

For fuel/ flux crushing & screening and fines conveyor route:
Chutes liners shall be as follows:

<table>
<thead>
<tr>
<th>Lump size, mm</th>
<th>Primary impact</th>
<th>Secondary impact</th>
<th>Flow zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>+80 mm</td>
<td>Min. 60mm reinforced rubber liner</td>
<td>Min. 40mm reinforced rubber liner</td>
<td>Min. 10mm thk High Mn.Steel (Sailhard /tiscral /equiv.)</td>
</tr>
<tr>
<td>20-80</td>
<td>40 thk rubber liner</td>
<td></td>
<td>- do-</td>
</tr>
<tr>
<td>-20 mm</td>
<td>8mm thk SS-409M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. Technological Structure:

- The technological structure shall be made of MS.
- Stringer minimum ISMC-125 for 800, 1000, 1200 & 1400 mm belts.
- For short post ISMC-125 for 800mm, 1000mm, 1200 & 1400 mm belt widths (As per BSP Standard).
- For tie ISMC-125 is used (As per BSP Standard).
- Wire mesh guard shall be provided for Tail, bend pulley, couplings and take-up counter weight.
The frame of the conveyors shall be standard design to resist conveyor load and made of MS section / rolled section.

12. Deck Plate:

Conveyor Deck Plates shall be of the following specification:
   a. For Coal Handling Circuit: 2 mm (SS-304).
   b. For Coke Sorting Circuit: 3.15 mm (SS-304).
   c. For Fuel & Flux Circuit: 3.15 MM MS Plates.
   d. Decking plate shall be provided in full length of all conveyors.

13. Brakes:

D.C. electromagnetic brake of BCH make will be provided on all conveyors which is more than 25 m long except belt feeders/ shuttle conveyors.
Brake shall have minimum 1.5 times the max. Torque rating

14. Skirt board:

Shall be fabricated from 10 thk. Carbon Steel with stiffened plates. Modular segmented skirt rubber sealing arrangement shall be provided. Liner of 10mm thick High Mn Steel (TISCRA/SAILHARD) will be provided. Thickness of rubber curtain to be 10mm (min.) with shore hardness of skirt rubber shall be min 55 A.

15. Belt sway switch:

One pair of BSS shall be provided near (≤ 5M) head & tail end and rest @100m interval.

16. Zero speed switches:

One no. non contact type zero speed switch shall be provided near tail pulley or non drive pulley away from the drive. All belt conveyors shall be provided with under speed monitor.

17. Pull cord switch:

One pair of PCS shall be provided near (≤ 4M) head & tail end and rest @ 30m interval on both sides of conveyor.

18. Miscellaneous:

- The Conveyor system has been designed based on IS: 11592: 2000 (Reaffirmed 2005).
- Design and rated capacity has been considered mentioned in Contract drawing of CS for calculating motor power, selection of different equipment and technological structure.
- Belt width of the conveyors as specified in the contract Specification.
- Approx 80% volumetric capacity has been envisaged for all conveyors.
- Troughing angle has been considered 35 degree.
Artificial co-efficient of friction factor (for kW calculation) 0.03 has been considered.

- The maximum belt sag will be limited to 2%.
- Minimum 210° degree wrap angle will be provided for single snub drive pulley.
- The belt width for Belt Feeders will be as per manufacturer's recommendation.
- Coefficient of friction between Belt and Pulley is 0.25.
- Radius of curvature shall be as per IS: 11592-2000 (Re-affirmed -2005).
- The conveyor galleries shall be provided with platform and ladders for cross-over at 150 m apart as per IPSS. A clear walkway at sheeting ends of 800 mm (min.) shall be provided excluding any service/ utilities
- Hand railing for conveyor walkways shall be provided.
- Approximately 1000mm all around space shall be provided around all drives & conveyor component in Junction House.
- Material characteristics: Material used shall be suitable for efficient operation and reliable service in steel plant condition.
- Bulk Density of the material shall be considered as per the CS.
- RCC floor shall be provided in all galleries (cast in-situ complete across the gallery) & junction houses. However, for all return fines for SP-III route conveyors, covered gallery with structural floor shall be considered.
- All conveyors with magnetic separator at head end shall have non-magnetic SS pulleys shafts & discharge.
- In all conveyors drive brake drum should be such that fluid coupling can be easily removed by shifting brake drum only without removing motor.
- Metal sheet guards shall be provided for all rotating parts viz. Coupling, Roller, V-Belt etc. for protection of workmen against any damage due to there.

19. Design Considerations (As per IS 11592: 2000, Reaffirmed 2005) for Belt Conveyors

a) For Belt Speed:

Lump size factor as per table-4 : 3
Abrasiveness factor as per table-5 : 4
Hence speed factor as per clause 8.1.3 : 7
As speed factor = lump size factor + abrasiveness factor
Max. Recommended belt speed in m/sec for speed factor as per table-6
Are as follows:

- For 800 mm BIW = 2.05
- For 1000 mm BIW = 2.35
- For 1200 mm BIW = 2.62
- For 1400 mm BIW = 2.62

Belt speed adopted for conveyors:
- Coke sorting plant – 1.8 m/s
- Fuel & Flux crushing/screening facilities – 1.6 m/s
- BF#8 Re-routing line – 1.6 m/s
- Coal handling plant – 2 m/s
Hence selected belt speed is ok. However speed shall be finalised as per the requirement wherever integration with existing system is planned.

b) For Idler Pitch:

Max. Recommended carrying idler spacing for handled material and selected belt width as per table -17

<table>
<thead>
<tr>
<th>Belt Width</th>
<th>Idler Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 &amp; 1000 mm B/W</td>
<td>1.0 m.</td>
</tr>
<tr>
<td>Above 1000 mm B/W</td>
<td>1.0 m.</td>
</tr>
</tbody>
</table>

Adopted carrying idler spacing in meter is:-

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Idler Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>For BF#8 re-routing line</td>
<td>1.0 m.</td>
</tr>
<tr>
<td>For all other conveyors</td>
<td>1.0 m.</td>
</tr>
</tbody>
</table>

Hence selected carrying idler spacing is ok.

Max. Recommended return idler spacing for handled material and selected Belt width as per table -17: 3.0
Adopted return idler spacing in m: 3.0
Hence return idler spacing selected is ok.