TENDER DOCUMENT

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FOR

Tender for Civil and Structural Steel works for Construction of “Augmentation of Fuel & Flux crushing facilities of Bhilai Steel Plant (BSP).” (Package - 64), at Chattisgarh.

VOLUME – III

TECHNICAL SPECIFICATION
(TS)

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01.01 INTRODUCTION

Bhilai Steel Plant (BSP), SAIL, was conceived in the Second Five Year Plan with a steel production capacity of 1.0 MT per annum. BSP has expanded its production capacity in two phases. First phase expansion to 2.5 MTPA of steel was completed in 1967 and second phase expansion to 4.0 MTPA of steel was completed in 1988. The corporate plan of BSP envisages expansion of its production capacity to 7.0 MTPA of Crude Steel by 2011-12.

The capacity of the present system of receiving, storing and transporting coal for Coke oven will increase in view of the increase in crude steel production to 7.0 MTPA. To meet the additional requirement of coke for new proposed blast furnace no. 8, one new coke oven battery no. 11 has been envisaged. The system of feeding coal to new coal tower and coke sorting plant for the new battery has been envisaged in this specification.

Presently, Blast furnace returns are being transported through C-line belt conveyors to the Junction house 127 of Sinter Plant III (SP-III). These belt conveyors are crossing the proposed Coke Dry & Cooling Plant (CDCP, which shall be executed through other package). Therefore, Dismantling and re-routing of these belt conveyors are envisaged in this package. This package shall also cover the transportation & integration of Proposed BF#8 return fines with re-routed C-line conveyor up-to the existing JH-127 of SP-III.

Further, in order to cater to increased requirement of fuel and flux for the new sinter machine of SP-III, following three facilities have been envisaged under this package:

1. Up gradation/addition of coke crushing and screening facilities.
2. Up gradation/addition of Coke Grinding facilities
3. Upgradation of Flux crushing & screening facilities.

The project, once implemented, shall ensure a smooth operation in transportation of the coking coal to new battery no. 11 and coke & sinter to new blast furnace no. 8, which in turns caters to enhancement of raw material required for the 7.0 MTPY of Crude steel stage.

01.02 INTENT OF SPECIFICATION

The contract specification for Package-064 (Augmentation of Fuel & Flux Crushing Facilities) has been prepared in two volumes:

Vol. 1 - Commercial
Vol. 2 - Technical

This contract specification (CS) calls for complete turnkey execution of the job covering the design, engineering, manufacture, supply, handling, storage, dismantling, erection, painting, testing, commissioning of plant & equipment complete with civil, structural, electrical & process control, compressed air & water facilities, ventilation & air-conditioning, various facilities like area-repair-shop, electrical sub-stations and control rooms, etc. and demonstration of performance guarantee parameters of the system of above mentioned area in a coordinated and integrated manner as per the relevant clauses of the specification including retrofitting of new facilities with the existing layout.

The Contractor shall receive necessary utility services not covered in this CS at battery limits and a predetermined leveled site for installation of Plant & Equipment. The details of the same have been elaborated in the succeeding chapters.

The contract specification shall be read in conjunction with other contract documents like General Technical Specification (GTS), Commercial volume, etc. of BSP, SAIL, list of correspondences and any other
document enclosed by Employer for design, supply & installation of plant and equipment (Turnkey basis). The provisions given in these documents shall be complimentary to one another. However, in case of any conflict between the provisions of these documents with respect to technical matter, the provisions in the contract specification will prevail. In case of discrepancy between IPSS and IS/International codes, IPSS shall prevail.

This specification is a guideline only and the design & engineering shall be complete in all respect and any equipment or facility not covered in this specification but considered essential for proper installation, operation and maintenance of Augmentation of Fuel & Flux Crushing Facilities shall be deemed to be included in the scope of contractor.

All handling and transport charges of plant and equipment, raw materials for site erected structures etc. including double handling as required for completion of the work in accordance with time schedule are deemed to be included in the scope of work of the Contractor. The execution of the proposed project would call for meticulous planning, monitoring and control during construction stage. Contractor is supposed to have visited the site and familiarized himself with the general and local site conditions as well as all others matters which can, in any way, affect the work covered in this specification.

The contractor has studied the specification along-with related documents and satisfy himself thoroughly regarding suitability of the plant and equipment and system, specified in the bid document and take full responsibility for guaranteed operation of the equipment with respect to output, reliable working as well as ease of operation, inspection and maintenance including replacement with minimum down time.
The contractor has satisfied himself, the nature and location of work place, kind of equipment, facilities, services, etc needed during performance of work, general and local conditions as well as all other matters which can, in any way, affect the work covered in this specification. Site & meteorological information of plant i.e. location, climate condition, earthquake factor, connectivity of the site with railways road, ports etc. are furnished in GTS which contractor to consider the same.

The physical and chemical analysis of the raw materials, wherever applicable shall be treated as indicative figures only. The contractor, if he feels necessary, shall take the samples and test them in laboratories (either in India or abroad) as may be required and satisfy themselves from the point of view of firming up of process and sizing of all plant & equipments supplied in this package.

The contractor shall bear full responsibility for deduction and conclusions as to the nature and conditions under which the work is to be executed, including effect of climate, rainfall etc. Failure to do so shall not absolve the contractor of his responsibilities about the proper execution of the job. Since the execution shall be turnkey in nature, no claims for extra payments due to any special site conditions and ignorance of site conditions shall be considered. During engineering stage, if any item or facility felt necessary to be included for proper functioning of the plant which is not envisaged in the offer of contractor, the same shall also be provided by the contractor without any extra claims.

The contractor shall be responsible for coordinating the supplies covered in the different parts of this Specification from different sources and execute the contract within agreed time schedule.
The enclosed specification drawings are deemed to be sufficient for the contractor to assess the nature and quantity of work involved within the contract price for the above job. No price increase on account of deviation from specification drawings shall be admissible. Approval of drawings by the Employer/Consultant will not relieve the contractor of his responsibilities for correctness, adequacy of the design & completeness of his work as per the contract.

Inspection and testing of plant and equipment shall be carried out by consultant/employer at the works of contractor during manufacturing and/or on final product to ensure conformity of the same with the acceptable criteria of technical specifications, approved drawings, manufacturing drawings and applicable national/international standards. General specification on quality system, inspection & test of plant and equipment at manufacturer’s premises are furnished in detail in GTS Chapter GS 05. Contractor is requested to consider the same.

All handling and transport charges of plant and equipment, raw materials for site fabricated structures etc. including double handling as required for completion of the work in accordance with time schedule are deemed to be included in the scope of work of the contractor.

Contractor to note that the battery limits of this package involves interfacing with Coke Oven Battery, Sinter Plant –III, BF#8, CDCP packages coming under 7.0 MTPY expansion of BSP Bhilai.

This is a turnkey project and all the facilities required for proper functioning of the plant and achieving the rated production in an integrated manner with the other units shall be deemed to be covered in the contract specification, unless specifically excluded from the contractor’s scope. The contractor shall be fully responsible for
undertaking all type of work, which are required and generally envisaged for doing modification/ alterations in an old plant like this.

Contractor may note that modifications in any other area within battery limits, which is not specifically mentioned here, but necessary for completeness of the project, safe and trouble free functioning of plant shall also be included in the scope.

The shall endeavor to use maximum indigenous equipment / facilities which may be available in India / be manufactured in India by Indian associates based on manufacturing drawings to be supplied by the contractor / his sub-suppliers. All indigenous equipment / components shall be selected from the list of Preferred Makes as enclosed in GTS

01.03 The following agencies shall remain parties to the contract

a. Employer: M/s. Bhilai Steel Plant (BSP), Bhilai, Steel Authority of India Ltd.

b. Consultant : M/s. Mecon Ltd., Ranchi

c. Contractor: M/s. EPIL, New Delhi

01.04 The contractor shall open a well-equipped site office, which will act as single window operation for all co-ordination, project execution and monitoring activities. Employer / Consultant shall communicate through this site office for all activities of the project.

01.05 All correspondence shall be in English language and technical data shall be in SI units.

01.06 The Contractor shall ensure supply of engineering deliverables and all materials matching the overall project execution sequence.

01.07 Name Plate
Each equipment will be provided with a name plate installed at convenient location indicating unique equipment identification no., equipment name, capacity and other technical parameters.

01.08 Equipment Numbering System
Contractor will indicate equipment / component number of all items being considered. The equipment numbering system shall be finalized during kick off meeting.

01.09 Drawing Numbering System
The drawing numbering system shall be finalized during the kick off meeting. However the nameplate of the drawings shall be as per the format given in GTS.
02.00 SCOPE OF WORK AND BATTERY LIMITS

02.01 SCOPE OF WORK

The broad turnkey scope of work shall be as per the following:

001 Design, manufacture, inspection, shop & primary coat of paint & supply of complete plant & equipment, fabrication (shop & site) of building structures & technological structures, civil construction works, power distribution, shop electrics, instrumentation & automation, illumination, telecommunication, all utilities & services (including water for firefighting/ dust suppression/ drinking water etc.), in-plant road networks, drainage systems, landscaping, fire detection & alarm system, laboratory facilities, fire fighting pump house, Control room, maintenance room as required, for complete & trouble free operation of Coal Handling Plant and Coke Sorting Plant of COBP # 11 in an integrated manner and on other phase, Augmentation in Fuel & Flux Crushing and Screening facilities of Sinter Plant III with re-routing of BF return C-line and BF#8 fines conveyors in an integrated manner.

002 Basic engineering, detail engineering and reference category of drawings, operating software and documents, in requisite copies, for approval of BSP / MECON. Further, the Contractor will furnish final basic & detail engineering drawings, manufacturing drawings of fast wearing items and non-standard items, as built drawings, erection drawings/ documents, operating software, operation and maintenance manuals in soft editable format.

003 Receipt of material, loading / unloading, storage, watch & ward, civil construction, complete erection, testing, commissioning, handing over of plant to Employer, demonstration of performance guarantee and post commissioning services. Preparation and approval of erection survey / alignment schemes, grouting clearances, painting clearances, testing of welds, pressure testing protocols and other related site protocols.

004 Deputation of representatives of equipment suppliers and technology suppliers to site for supervision of erection, testing and commissioning.

005 Applying final finish coat of paint as per approved procedure & shades before handing over, first fill of lubricant & oil, special tools & tackles, mobile equipment, handling & hoisting equipment etc.

006 Supply of all commissioning spares and insurance spares.
007 Progress reporting as per agreed formats, providing documentary evidence of purchase orders on sub vendors with addresses of contact persons, attending all site progress review / engineering review meetings at BSP, Bhilai or at MECON, Ranchi; opening an equipped site office with coordinator over seeing all activities.

008 Arrangement of all erection equipment viz. cranes, hoists, winches, etc, and safety appliances as required for erection of plant & equipment. Appointment of safety officer by the contractor shall be included.

009 Specialised training of Employer’s / Consultant’s personnel considered a period of 30 man months for operation, maintenance, for smooth handing over the plant.

010 Testing and cold trial run of Coal handling plant & Coke Sorting plant as systems/ sub - systems and integrated testing shall be carried out by the Contractor on continuous basis for complete Coal Handling System and Coke Sorting Plant along with associated facilities followed by commissioning. On commissioning of the various sub-systems of the CHP/CSP/SP-III, Performance Guarantee test of the entire plant shall be carried out as elaborated in the relevant chapter.

011 Receiving delivery of items at site, their proper storage, and handling at site, watch and ward services, removal of debris to a location specified by the Employer etc.

Site shall be handed over to the Employer in clean and orderly manner to the satisfaction of the site engineers after commissioning of the project.

012 Getting Employer’s/ consultant’s approval for the drawings prepared by the Contractor, obtaining required approval from statutory authorities, providing adequate personnel, equipment, tools & tackles for timely completion of the project.

013 For detailed scope of work and design parameters on various sub-systems & facilities, respective chapters under Chapter-04 of the Contract Specification shall be referred to.

02.02 All the facilities required for proper functioning of the system and achieving the rated production shall be deemed to be covered in the technical specification, unless specifically excluded from the Contractor’s scope. The entire work shall be carried out on turnkey basis.
The **major scope of work of Coal Handling Plant** of COBP # 11 is given below:

- Addition of 5 nos. of RCC mixing bins (Silos), each of 500t storage in 3rd row of silos.
- Each silo shall be provided with a PLC Controlled Belt Weigh Feeder (BWF) for controlled feeding on collecting conveyor. The capacity of each BWF shall vary between 20 to 200 TPH.
- Provision 2 nos. of additional reversible hammer mills (designated as hammer mill 7&8), each of capacity 300t/h in existing row of hammer mills after extending the existing final crushing station suitably.
- Up rating & modification of existing collecting conveyors Y7-12 & Y7-13 to 1000 t/hr. capacity in the existing location with minimum shutdown.
- Connecting conveyor stream, connecting new coal tower no.7 with existing coal handling plant.
- Two reversible shuttle conveyors each of about 18 m length shall be provided for proper distribution of coal in the new coal tower no 7.
- Connecting conveyors for new silos & new crushers to the existing Coal Handling Plant.
- one no. mobile belt changing device & two nos. hot Vulcanising system shall be provided.
- Dust Suppression System (DFDS) shall be provided.

Flow diagram drawing no. MEC/S/9101/11/17/55/01/064.12/R0 Sheet 1 & 2 of 2 and layout drawing no. MEC/S/9101/11/17/55/01/064.11/R0 showing the location of proposed units and related sectional drawings (No. MEC/S/9101/11/17/55/01/064.13, 14, 15 & 16/R0) are enclosed for reference.

02.03 **BATTERY LIMITS FOR COAL HANDLING PLANT**

Following battery limits shall be considered.

- From & including new bifurcated chute on existing conveyor Y7-49 discharge end to feed existing conveyor Y7-50 & new
conveyor Y11-125 to up to discharge chute on new conveyor Y11-126.

- The new conveyors nos Y11-126 will feed new silos. Conveyors Y11-127 & 128 will finally feed existing conveyor Y7-35. conveyor

- Modification of existing conveyor Y7-36 including provision of chute with split gate feeding to existing conveyor Y7-51 & new conveyor Y11-129.

- Up rating & modification/ lengthening at tail end of existing conveyor Y7-12.

- Belting specification for Y -12 & Y -13 shall be 1400x1050/4x5/2 NN. M-24. Other conveyors shall be 1400x800/4, ~M-24.

- Up rating the existing conveyor Y7-13 including bifurcated discharge chute with split gate on conveyor Y7-13 feeding existing conveyor Y-14 & Y-18. The conveyor no Y-13 will be up rated to 1000 tph.

- From & including bifurcated chute on existing conveyor Y-14 feeding existing conveyor Y-15 & proposed new conveyor Y11-131 to up to discharge chutes on new shuttle conveyors Y11-135 & Y11-136 feeding to the new coal tower no.7. Tracks for shuttle conveyors are also included in the scope.

- Dismantling of existing briquette conveyor BQC-15A along with charging chute is also included in scope of work.

- All chutes shall be lined with 8mm thick 409 M SS.

02.04 The major scope of work of Coke Sorting Plant comprising of Coke crushing station, coke screening station, coke breeze bunkers, emergency coke storage yard, coke dedusting units, junction houses, traveling tripper bridge, galleries and associated mechanical, civil, structural, electrical works of COBP # 11 is given below:

- 2 nos. grizzly screens (80mm), capacity 300 t/h.

- Grizzly shall be of high Manganese steel casting and the underpass chute liners should be cast Basalt 110mm thick

- 2 nos. coke cutters (+80mm) capacity 180 tph.
- 2 nos. vibrating screens, (30 mm) capacity 300 t/h. Screen wires should be 5 mm dia SS.

- 2 nos. grizzly screens (60 mm), capacity 200 t/h. Grizzly disc should be of high Manganese steel castings and under pass chute to be lined with Cast Basalt/ Ceramic Liner.

- Conveyor stream capacity 300/150 t/h.

- 2 nos. variable speed belt weigh feeders 20t/h to 100 t/h.

- Chain samplers – 2 nos., one each for different BF coke fractions.

- Belt conveyors as per conveyor data sheets.

- Return idlers & troughing rollers of all 1400 mm wide conveyor belts should be of 159 dia & 1600mm and Dia 159 x 530mm respectively. Other details shall be furnished by the client to the contractor.

- Belt weighers shall be provided on Coke Sorting plant and sinter returns fines K11-7 & K11-6A, K11-10C, K11-10D, K11-21, K11-22, K11-18, KA-6, C3AC2 & 2nos. on conv. C4C1, C4C2.

- Capacity upgradation of existing conveyor KD-1 to 400tph from 300tph, with a fixed tripper to transfer coke from CSP-1 to CSP-4.

- All chutes should be box design to avoid direct fall of Coke on Chute liners. Only Cast Basalt/ Ceramic liners are to be used in Coke Transfer Chutes.

- Dust Extraction (DE) system shall be provided for dust suppression at all transfer points.

- Control room & maintenance room shall be provided in coke screening station.
- Automation & control facilities shall be interfaced with coke oven battery operation.

- Belt changing facilities shall be provided for all conveyors.

- One number hot vulcanizing unit shall be provided.

- The extension of existing conveyor stream comprising conveyors KA-2/KA-3 to the new breeze bunkers of CSP-4 for onward conveyance to SP-3.

- Wagon loading shall be provided for BF coke in the coke screening station of CSP-4.

- Breeze Bunkers shall be line with 409M SS.

- Shift in-charge & supervisor room shall be air conditioned.

- Maintenance post with Air Conditioned Supervisors room along with shift in changes room and toilet block is to be provided in the Coke Screening Station.

- Compressed air facilities shall be considered for DFDS, bag filter cleaning, and general plant cleaning purpose.

- The bypass chute from conveyor K11-11, K11-12 to conveyor K11-13 and K11-14 respectively shall be considered.

The above Coke Sorting Plant no. 4 has been proposed to process the coke produced in COBP # 11 into different fractions as required by different consumer units viz. BF # 8, Sinter plant no. 3, etc and same has been included in this package.

Coke produced from existing COBs 2, 3 & 4 shall also be used for BF-8 and other users for which proper connections have been proposed through conveyor KD-1 & KA-2.

02.05 Battery Limits for Coke Sorting Plant

Following design limits are to be considered for the proposed Coke Sorting Plant (CSP-4)

a) From & including surge hopper in the junction house no.1. Junction house no.1 is included in the scope.
b) Up to & including junction house no. Z17 and up to & including discharge chutes of conveyors K11-17 & K11-18.

c) Including revamping of existing conveyor no. KD-1, modification of gallery of KD-1 is included in the scope of the Contractor.

d) For coke breeze from the proposed conveyor KA-3 to the coke breeze bunkers.

02.06 **Scope of Work for** Augmentation in Flux - Fuel Preparation and Plant return fines handling for SP III facilities *comprises of the following:*

- Connecting existing Blast furnace return fines C-Line conveyors with new BF#8 return fines conveyor.

- Up gradation / Addition of coke crushing, screening and grinding facilities.

- Up gradation/ Addition of Flux crushing & screening facilities.

- Dismantling of C-line conveyors & Junction houses (including foundation of Junction houses & trestle of conveyors with an undulation of about +500mm) & Re-routing of existing sinter fines conveyors (C-lines). De-dusting equipments shall be designed for all old & new conveyors.

- Transportation of Coke Breeze from CSP#4 to Conveyor C102 in an integrated manner

The existing Flux and fuel crushing & screening facilities shall be upgraded/ added as detailed above. BF return fines conveyor shall be re-routed and installed along-with the new return conveyor of BF#8 upto the existing (modified) Junction house JH-127 of Sinter plant III.

02.07 **Battery Limits for** Augmentation in Flux - Fuel Preparation and Plant return fines handling for SP III facilities *comprises of the following:*

- Receipt of inter plant return fines from existing Blast Furnace nos.1 to 7 through conveyor C2 (From existing JH32) in junction house JH-C2.
• Receipt of iron ore/sinter/coke fines from new proposed Blast Furnace no 8 through vibro feeders (vibro feeder by other supplier) onto new conveyors C5-C1/C5-C2 in fines building.

• Receipt of coke breeze for Fuel crushing facility of SP III at existing belt conveyor C-104 of existing coke storage yard. Belt conveyor C-104 shall be suitably modified & extended and discharge onto new reversible conveyor RC 106.

• Receipt of limestone & dolomite for Flux crushing facility of SP III at existing belt conveyor L105 to surge bin of existing flux crushing building. Existing belt conveyor L 105 shall be extended to new proposed extension of flux crushing building

• Receipt of oversized flux from existing belt conveyor L117 to new proposed conveyor L-118 of existing flux crushing building

• Discharge of coke breeze from new proposed conveyor C 102A onto existing conveyor C 102 in pent house

• Discharge of inter plant return fines from new proposed conveyor J127 C1 onto existing conveyor F 101

• Discharge of crushed, screened and grinded coke breeze onto existing conveyor C 114 in existing and proposed coke grinding building of SP III

• Discharge of screened flux onto existing conveyors L 115(Oversize) and L 120(undersize) in existing and proposed flux screening building of SP III

02.08 Handling & Hoisting facilities: All Junction houses shall be equipped with suitable handling & hoisting facilities. Junction house below 6m high shall have suitable capacity/ 2t min. of manual hoists and more than 6m high shall have at least 5t electric hoists unless otherwise specified. Under slung & EOT cranes as specified in TS and other handling facilities as specified in system description shall be provided.

02.09 Electric/Manual Hoist, EOT Crane U/S Crane etc. wherever required for the system, apart from mentioned in CS, shall be included in scope of Contractor.
02.10  OBLIGATIONS OF EMPLOYER

001  Employer shall allot leveled land with an undulation of about ±500mm from the predetermined level as per the layout drawing for installation of the Coal Handling & Coke sorting Plant.

002  Employer shall provide construction power, drinking water during construction and space for storage and site office as per GTS. The Contractor shall indicate the details required by them in the prescribed format.
03.00 BRIEF SYSTEM DESCRIPTION

03.01 DESCRIPTION OF EXISTING COAL HANDLING PLANT

03.01.01 Coal Preparation Plant No. 1

i) Rotary wagon tippler unloads incoming coal from WT#1 and 2 each having capacity of 800 tph and receives in two conveyor stream Y9-68 & Y9-69. Both the wagon tipplers are provided with electric pusher car on the inhaul side. The empty wagons are released over a gradient.

ii) Coal from both the streams is fed, through a series of belt conveyors to the CPP-1 coal yard. One stream has toothed roller crusher while other stream has no crusher. Each of the streams has a capacity of 800 tph.

iii) CPP-1 storage yard No. 1 has a storage capacity of 180,000 t.

iv) Out of the three Nos. of gantry cranes in coal storage yard No.1 (i.e. CPP-1) only two nos. are existing at present which are planned to be phased out in future.

v) Reclaimed coal from the storage yard is fed to storage cum blending bunker (15nos) in two rows via. Conveyor series of Y5-Y6. Coal is withdrawn from silos and conveyed to coal tower No. 1, 2 and 4 via junction house J3, J4, J5 and J6. (Presently battery no 5&6 are under rebuilding. After replacement of coal gallery Y6-38, CHP will feed coal to CT-3 also).

vi) CHP has 4 nos. of hammer crusher of capacity 250 tph and two nos. of 200 tph.

03.01.02 Coal preparation Plant No.2

i) Incoming coal is unloaded by rotary wagon tippler No. WT# 3 on conveyor no. Y9-87, Y9-88, Y9-90, Y9-91 (and finally stacked through stacker-cum-reclaimer I & II through yard conveyors Y9-94 & 95). Wagon tippler is provided with Electric Pusher Car on the inhaul side. The empty wagons are released over a gradient. Under rail hoppers are provided for manual unloading of coal from sick wagon.

ii) Coal from the conveyor stream like Y9-87, Y9-88, Y9-90, Y9-91 etc. are fed to the series of belt conveyor by passing the preliminary crusher to the coal storage yard No.2 (CPP-2). The single line conveyor capacity is 800 tph upto the storage yard.
iii) Coal storage yard No.2 (CPP-2 existing) have storage capacity of 120,000 t.

iv) Provision of direct despatch of coal to the storage cum blending bunkers by passing the storage yard has been kept. The conveyor stream capacity from the storage yard to the top of the storage cum blending bunkers is 800 tph.

v) Coal is withdrawn from 14 nos silos in two rows- 7 nos in each row according to predetermined blend ratio in two streams and fed to the final crushing station No.2.

vi) Four reversible hammer crushers of 300T/h have been provided for final crushing in crushing station No.2.

vii) From final crushing station No.2, crushed coal blend is despatched to junction No. 3F and finally to coal towers No. 5 and 6 and coal tower no 4 in case of constraint in coal supply of CHP.

viii) Also new conveyors Y9-99A and Y9-99B have been commissioned in the year 2002 to have the provision for taking coal from CPP-2 coal yard to conveyor Y9-80 and Y9-81, so that coal can be fed to silos of batteries 1 to 8.

ix) Blending is done through 14 nos of Belt weigh feeders/ Automatic Proportioning Device (APDs).

03.02 DESCRIPTION OF PROPOSED COAL HANDLING PLANT FOR COAL TOWER NO.- 7 OF COB#11 COMPLEX

1. General

In order to meet the enhanced required of coal for coke making, following additions, augmentation & modification to the existing coal handling plant is proposed:

- Addition of 5 nos. of RCC mixing bins (Silos), each of 500t storage in 3rd row of silos parallel to existing two rows of silos.

- Installation of 2 nos. additional reversible hammer mills (designated as hammer mill 7&8), each of capacity 300t/h in existing row of hammer mills after extending the existing final crushing station suitably.

- Replacement of existing hammer mills no. 5 & 6 by new hammer mills of 300 t/h capacity each, along with 630 KW slip ring reversible electric motors. Room for resistance banks & control panels for hammer mill no.
5, 6, 7 & 8 shall be provided in the new portion of the final crushing station.

- Upgrading & modification of existing collecting conveyors Y7-12 & Y7-13 to 1000 t/hr. rated capacity in the existing location with minimum shutdown.

- Connecting conveyor stream, connecting new coal tower no.-7 with existing coal handling plant.

- Connecting conveyor for new silos & new crushers to the existing Coal Handling Plant.

- 4 nos. split gates for coal handling plant on conveyors Y7-36, Y11-130, Y7-13 and Y11-134.

Flow diagram drawing no. MEC/S/9101/11/17/55/01/064.12/R0 (Sheet 1 of 2 & Sheet 2 of 2) and layout drawing no. MEC/S/9101/11/17/55/01/064.13/R0 showing the tentative location of proposed unit are enclosed for reference.

New conveyor Y11-125 will take feed from existing conveyor Y7-49 in the existing junction house 2C and feed conveyor Y11-126 with a traveling tripper to feed the individual silos (5 nos. new). Each silo will be of 500 tonne effective storage capacity. The vertical portion at a height of 1m and conical portion (slope 60°) shall be lined with 409M 8mm thick SS liner plate.

Each silo will be provided with identical Belt Weigh Feeder with PLC being provided in existing SILOS.

Silos shall be provided with pneumatic blow down facility. Bunker discharge mouth level shall be +10.2m and shall have floor at +6.2m level for laying conveyor Y11-127.

Belt weigh feeders will feed the coal to proposed conveyor Y11-127 and through conveyor Y11-128, the coal will be fed to existing conveyor Y7-35, which also carries coal from existing 2nd row of similar bunkers. The rated capacity of conveyor Y7-35 shall be 600t/hr. Conveyor Y7-35 will feed to modified conveyor Y7-36. The modification & strengthening of these conveyors are in the scope of contractor. Apart from replacing existing one way chute with split gate, conveyor Y7-36 shall be modified for accommodating split gate and upgraded to 600 tph.

Modified conveyor Y7-36 will feed the coal to existing conveyor Y7-51 & new conveyor Y11-129 through a bifurcated chute & split gate. Coal
from conveyor Y11-129 will be fed to the new hammer mill nos. 7 & 8 through conveyors Y11-130 & bifurcated chute with split gate.

The existing final crushing building shall be extended suitably to accommodate new hammer mills (No. 7 & 8) and related items & electrics. The building shall be of RCC upto top floor with structural roofing. Each hammer mill shall have independent foundation.

In order to collect crushed product from the new hammer mills, the existing conveyor Y7-12 will be extended at the tail end adequately & it’s capacity shall be upgraded to 1000 t/h rated capacity. The existing conveyor Y7-13 will also be upgraded to 1000 t/h rated capacity and will be provided with a bifurcated chute with split gate to enable feeding of existing conveyors Y14 & Y18. These two conveyors shall have stand-by drives. The upgraded conveyor shall be provided with new drive (1W+1S), belt, 35 degree carrying and 10 degree return idlers. The drives of upgraded conveyor Y7-12 and Y7-13 shall be of 1 step higher rating. The belting shall be 1400mm wide and N/N grade of 1250 kN/m rating minimum.

The proposed stream connecting the new Coal Tower no.-7, comprises of new belt conveyor nos. Y11-131, Y11-132, Y11-133, Y11-134 & reversible shuttle conveyors Y11-135 & Y11-136. the existing chute feeding to the existing conveyor no. Y-15 will be replaced by a bifurcated chute fitted with a 2 position motorised diverter gate to feed the new conveyor no. Y11-131. The coal will be conveyed to the new coal tower no.-7 via new conveyors Y11-131, Y11-132 & Y11-133 through new junction house no. 11A & 11B. The stream rated capacity shall be 600 t/h.

Reversible shuttle conveyors Y11-135 & 136 shall be provided at the top of the coal tower no.-7. These shuttle conveyors shall be fed by conveyor Y11-134 through a split diverter gate. Each of the shuttle conveyors will be of 400 t/h capacity and shall be mounted on parallel tracks and can be placed on different compartments of the coal tower to uniformly distribute the coal charge in the coal tower. For this purpose suitable nos. of limit switches shall be provided.

Additionally, the coal tower shall be provided with 18 nos. of level monitors for giving continuous measurement of level of coal in the coal tower.

A belt weigh scale shall be provided on the new conveyor no. Y11-132 to indicate the flow rate & total quantity of coal fed to the coal tower.
The new equipment & conveyors shall be interlocked & controlled with the existing coal handling plant from the existing control room.

The existing system of LSTB shall be extended to all the new units up to the top of new Coal Tower no.-7 for communication.

Facilities for dust suppression, fire fighting facilities and proper illumination of galleries and junction house is included in the scope of work.

The conveyor drives of 30 KW and above shall be provided with fluid coupling. All coupling bolts shall be replaceable without shifting of drive components. Chutes shall be lined with 8mm thick 409M SS liners. Each discharge legs of the chutes shall be provided with chute jam indicators.

Flap/ Diverter gates shall be lined with 8mm thick SS 409M liner plates.

Each junction house shall be provided with Electric hoist. The Capacities of EOT Cranes / Electric Hoists for maintenance shall be at least 1.2 times the heaviest load or the Capacity & approximate height of some Junction houses are indicated as below:

- Silo top - 3t capacity - 37m lift - 1no.
- Jn. House 11E - 2t capacity - 24m lift - 1 no.
- Final crushing station- 10t capacity - 10m lift - 2 nos.
- New junction house no.11A-2t capacity - 30m lift - 1 no.
- New junction house no.11B -3t capacity - 45m lift - 1 no.
- Top of coal tower no.7- 3t capacity - 50m lift - 1 no.

03.03 DESCRIPTION OF PROPOSED COKE SORTING PLANT FOR COB#11

01 Design Limits

Following design limits are to be considered for the proposed Coke Sorting Plant (CSP-4)

a) From & including surge hopper in the junction house no.1. Junction house no.1 is included in the scope of the contractor.

b) Upto & including junction house no. Z17 and upto & including discharge chutes of conveyors K11-21 & K11-22.

C) Including upgradation of existing conveyor no. KD-1, modification of gallery of KD-1 is included in the scope of the Contractor.

D) For coke breeze from the proposed conveyor KA-3 to the coke breeze bunkers & C3A-C2 with two way Diverter gate at Junction house JH-C3A. Nut coke from CSP coke breeze bunkers shall be disposed off by
wagons and conveyor C3A-C2, for any exigency 100% disposal facilities by wagon will be provided.

e) The discharge chute with pneumatically operated sector gate for coke car track from surge hopper in JH – 1 is in the scope of contractor.

f) 3 nos. bin vibrators shall be considered for each bunker; hence, total no. of vibrators for coke sorting plant shall be 6.

02 Brief Description

A coke sorting plant of 300t/h capacity has been envisaged for the plant. The coke sorting plant will sort out the coke into three fractions i.e. 30-60 mm, 60-80mm & (-) 30mm. The coke will pass through a series of screens and coke cutters for this purpose. Flow diagram, layout, sections etc. are shown in drgs. MEC/S/9101/11/17/55/01/064.01 to 064.08.

The (-) 30mm fraction will be sent and stored in the 150t capacity RCC bunkers, after screening at 15mm. The other coke fractions will be sent through conveyors to Blast furnace stock house. In addition to the above, an open mechanized emergency coke storage yard of about 2500t capacity will be provided. Required conveyor streams, traveling trippers will be provided for storage of coke. Coke will be reclaimed by an underground reclaiming conveyor as shown in the drawings.

Additionally a 1400mm wide 200 t/h conveyor streams shall be provided to carry BF coke from existing CSP-1 and feed to two numbers of 100t capacity RCC surge hoppers provided over conveyors K11-13 & K11-14. Each surge hopper shall be provided with level meters & belt weigh feeders to properly proportion the coke coming from CSP-1 & the new CDCP plant.

To take tapping from existing conveyor KD-1 a fixed tripper with a bifurcated gate shall be provided. One leg of the chute will feed coke to the new conveyor KA-1 of 1400mm wide & the other leg will feed the conveyor KD-1. A split gate shall be provided to enable feeding of coke to both the conveyors simultaneously. The walkway of conveyor KD-1 shall be suitably modified in the vicinity of the fixed tripper to facilitate movement of plant personnel.

All the buildings, junction houses, conveyor galleries will have adequate facilities like ventilation, illumination, hoisting and handling equipment, dust suppression facilities, etc. wherever necessary. All buildings shall be provided with LSTB system for communication.

Further, a dust extraction system shall be provided in the proposed Coke Dedusting Unit (CDU). A brief description of the same is given below:
03 **Dust Extraction System with Air Blasting Unit**

03.01 **Brief Description**

A dust extraction system with an air-blasting unit is to be provided in the coke-dedusting unit (CDU).

The system shall comprise dust extraction unit and air blasting unit. The dust extraction unit shall comprise suction hoods on the coke dedusting chute, ducting network, electrically operated dampers, bag filter unit, centrifugal fans, stack, electrics & control.

Bag filter unit shall consist of distribution chamber, filtering chamber with filter bags & fitting for the bags, outlet chamber, dust collection hopper with rotary air lock valves & screw conveyor, dust storage cum disposal hopper with rack & pinion gate and disposal chute, structural stair case and platform, timers etc. and one multiclone and one spark arrestor in the ducting network at the inlet side of distribution chamber of bag filter unit. (these two equipment are required to collect the hot/ glowing coke particles thereby preventing them to enter into bag filter). Two suction ducts of the ducting network shall be provided with electrically operated dampers & flanges for connecting them with the coke dedusting unit (CDU) chambers (2 nos.) separately.

The air blasting unit shall consist of air intake louver, transition piece, centrifugal blasting fan, main duct and two numbers of branch ducts with electrically operated dampers & flanges.

03.02 **Arrangements and the Components:**

The air intake louver of air blasting unit shall be installed in the opening of wall exposed to ambient. This shall be connected to suction side of blasting fan through transition piece. The delivery side of this fan shall be connected to ducting network. The branch ducts (2 nos.) shall be connected to both the coke deducting unit (CDU) chambers through the flanges separately. There shall be two air stream/ paths, one working & one standby, from air blasting unit to dust extraction unit, through CDU chamber. The material flow in the CDU chambers conceptually shall be perpendicular to the airflow of air stream from blasting unit to dust extraction unit. Electrically operated dampers provided in the air stream at the both sides of CDU chamber shall be interlocked with the operation of CDU chambers; this is required to isolate the stand by CDU from air stream and to take the working CDU into air stream of our above system.
03.03 **Functional Description**

While running the CDU, air blasting unit fan shall suck ambient air through air intake louver & transition piece and blast/ supply the air into the CDU through the ducting network.

The working of the dust extraction unit shall suck the air dust laden air including blasting air shall be sucked from CDU and hot/unburnt glowing coke particles shall be collected in multiclone and spark arrestor placed in the ducting network at the suction side of bag filter. The dust disposal from bag filter, multiclone & spark arrestor shall be through discharge into a central pneumatic system (through dust storage hopper). However, central pneumatic system shall not be in the scope of Contractor.

04 **Major Facilities**

04.01 **The major scope of work of Coke Sorting Plant** comprising of Coke crushing station, coke screening station, coke breeze bunkers, emergency coke storage yard, coke dedusting units, junction houses, traveling tripper bridge, galleries and associated mechanical, civil, structural, electrical works of COBP # 11 is given below: -

- 2 nos. grizzly screens (80mm), capacity 300 t/h.
- Grizzly shall be of Manganese steel casting DISC and the underpass chute liners should be cast Basalt 110mm thick
- 2 nos. coke cutters (+80mm) capacity 180 tph.
- 2 nos. vibrating screens, (30 mm) capacity 300 t/h. Screen wires should be 5 mm dia SS.
- 2 nos. grizzly screens (60 mm), capacity 200 t/h. Grizzley specifications and chute liners shall be same as mentioned above.
- Conveyor stream capacity 300/150 t/h.
- 2 nos. variable speed belt weigh feeders 20t/h to 100 t/h.
- Chain samplers – 2 nos., one each for different BF coke fractions.
- Belt conveyors as per conveyor data sheets.
- Belt weighers shall be provided on Coke Conveyors K11-11, K11-12, K11-15, K11-16 & conveyor K11-18.
- Capacity upgradation of existing conveyor KD-1 to 400tph from 300tph.
- Capacity of conveyor staying from conveyor KD-1 to the CSP-4 shall be 300t/h.
- All chutes should be box design to avoid direct fall of Coke on Chute liners.
- Only Cast Basalt/ Ceramic liners of 110 mm thk are to be used in Coke Transfer Chutes.
- DE system shall be provided for dust extraction at all transfer points.
- Control room & maintenance room shall be provided in coke screening station.
- Automation & control facilities shall be interfaced with coke oven battery operation.
- The extension of existing conveyor stream comprising conveyors KA-2/KA-3 to the new breeze bunkers of CSP-4 for onward conveyance to SP-3.
- Wagon loading shall be provided for BF coke in the coke screening station of CSP-4.
- Shift in-charge & supervisor room shall be air condition.
- Maintenance post with Air Conditioned Supervisors room along with shift in changes room and toilet block is to be provided in the Coke Screening Station.
- Handling & Hoisting facilities: All Junction houses shall be equipped with suitable handling & hoisting facilities. Junction houses below 6m height shall have suitable capacity (2t min.) manual hoist and more than 6m height shall have electric hoists. Under slung & EOT cranes as required in CS and other handling facilities as specified in system description shall be provided.
- 1 no. mobile belt coiler / decoiler type belt changing device and 2 nos. hot vulcanizing unit suitable for 1600 mm belt width. Contractor shall also to provide guide rollers at required locations for coiling / de-coiling of belt near each junction house / take up unit.
05 **Other Features**

In addition to the above, following is to be provided in this package by the Contractor.

1. The capacity of the belt weighers shall be 1.2 times the rated capacity of the respective conveyors.

2. The two way diverter gates shall be of robust design and of wear resistant material for longer life.

3. Flap/ Diverter gate drives shall be of adequate rating to take care of dirty conditions of the chute’s interior.

4. Flap/ Diverter/ split gate, surge hoppers etc shall be lined with 10 mm thick ‘Hardox 500’ material with CSK bolting.

5. RCC bunkers/ under-ground hoppers shall be lined with 8mm thick SS-409M Stainless Steel.

6. Scraper/ breeze chutes should have a minimum inclination of 70 degree and should be made up 409M SS.

7. In case of bifurcated chutes, where steep angle scraper chute is not possible, the scraper shall be provided in the main chute with proper design to ensure easy accessibility for removal of scraper for maintenance purpose.

8. Suitable windows shall be provided in chutes & scraper chutes to enable proper cleaning of the chute’s interior.

9. The yard surface slope shall be such that drainage is outward.

10. Side sheeting & roofing shall be of suitable material and shall be properly fixed to ensure longer life in corrosive atmosphere.

11. Fiber glass roofing & sheeting shall be provided at suitable intervals for proper illumination in the galleries.

12. Each underground hopper in the stockyard shall be provided with manually operated sector gates.

13. Yard reclaim conveyor K11-10D shall be 1600mm wide with 35° troughing angle and without skirt board.

14. Discharge chutes shall be lined with 110mm thk. liners/ cast basalt liners.
15. Anti-corrosion painting shall be provided on all structures.

16. Silos shall be lined with 8mm thick SS-409M with SS steel coping at 1m high in vertical & complete in slope portion.

17. DE system shall be provided for dust extraction at all transfer points.

18. Grizzly screens discs shall be of high manganese cast steel.

19. All types of gear boxes shall be supplied with input shaft with matching gear wheel assly.

20. Control room & maintenance room shall be provided in coke screening station.

21. Automation & control facilities shall be interfaced with coke oven battery operation.

22. The control room shall be provided with package type AC.

23. Existing conveyor KD-1 shall be renovated with following features.
   i) Capacity : 400t/h
   ii) Belt width : 1400m
   iii) Troughing Angle : 35°
   iv) To be provided with fixed tripper
   v) Drive to be changed accordingly.

   i) For disposal of coke breeze from CSP-1, the existing conveyor stream comprising conveyors KA-2/KA-3 shall be extended to the new breeze bunkers of CSP-4 for onward conveyance to SP-3. Nut coke from CSP coke breeze bunkers shall be disposed off by wagons and conveyor C3A-C2. For any exigency 100% disposal facility by wagon will be provided.

   ii) Nut coke from CSP-1 shall disposed off by wagons as per present practice.

   iii) Nut coke from CSP-4 bunkers shall also be disposed off by wagons/ road. Facility for the same shall be provided.

24. Wagon loading shall be provided for BF coke in the coke screening station of CSP-4.
25. Maintenance post with Air Conditioned Supervisors room along with shift in changes room and toilet block is to be provided in the Coke Screening Station.

Conveyor belt width, troughing angle and belt width will be properly selected to prevent coke spillage. Conveyors galleries, buildings will follow IPSS norms and will be provided with adequate maintenance facilities and space.

Coke crushing station, coke screening station, coke bunkers and junction house no. 1 & coke dedusting unit shall be of civil construction upto the top floor, above which it shall be of steel structure.

Other Junction Houses & travelling Tripper Bridge shall be of steel structure with RCC flooring.

Electric hoists/ manual hoist of suitable capacity & lift shall be provided in each junction house & buildings to cater to the maintenance needs. Electric hoists shall be provided wherever height of lift is more than 6 meters.
Brief System Description of Augmentation in Flux - Fuel Preparation and Plant return fines handling for SP III

The turnkey package of this CS also comprises of the following sub-systems:

- Up gradation / Addition of coke crushing and screening and grinding facilities
- Up gradation/ addition of Flux crushing & screening facilities in an integrated manner.
- Transportation of Fines from Blast Furnace nos.1 to 7 & BF # 8 to Existing Junction house JH-127
- Transportation of Coke Breeze from CSP#4 to Conveyor C102 in an integrated manner.

Brief descriptions of the various sub-systems are given below and are also reflected in the drawings enclosed. However the Contractor shall consider the contract drawings only as indicative and any changes for completeness and improvement shall be finalized during submission of basic engineering document for approval by the Contractor.

RECEIPT OF RAW MATERIAL

Presently iron ore fines and fluxes are being conveyed to SP-III from existing Ore Handling Plant (OHP) through two series of belt conveyors and coke from existing Coke Sorting Plant (CSP) by dump-cars unloaded in an underground hopper & through a series of belt conveyors. All the three conveyors pass through JH-111A. This system is adequate to feed both strands (existing & proposed) of Sinter Plant-III.

Sieve analysis of raw material input to fuel & flux crushing & Screening circuit
1. Lime Stone (received from Koteswar)

<table>
<thead>
<tr>
<th>Max</th>
<th>Min</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 75 mm</td>
<td>- 60 mm</td>
<td>2.0%</td>
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<tr>
<td>- 75 mm</td>
<td>to + 60 mm</td>
<td>15.0%</td>
</tr>
<tr>
<td>- 60 mm</td>
<td>to + 50 mm</td>
<td>16.6%</td>
</tr>
<tr>
<td>- 50 mm</td>
<td>to + 30 mm</td>
<td>40.2%</td>
</tr>
<tr>
<td>- 30 mm</td>
<td>to + 25 mm</td>
<td>9.2%</td>
</tr>
<tr>
<td></td>
<td>- 25 mm</td>
<td>17.0%</td>
</tr>
</tbody>
</table>

Moisture- 15%

2. Raw Dolomite

<table>
<thead>
<tr>
<th>Max</th>
<th>Min</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 60 mm</td>
<td>- 50 mm</td>
<td>1.3%</td>
</tr>
<tr>
<td>- 60 mm</td>
<td>to + 50 mm</td>
<td>7.3%</td>
</tr>
<tr>
<td>- 50 mm</td>
<td>to + 20 mm</td>
<td>44.9%</td>
</tr>
<tr>
<td>- 20 mm</td>
<td>to + 10 mm</td>
<td>16.7%</td>
</tr>
<tr>
<td>- 10 mm</td>
<td>to + 6 mm</td>
<td>14.3%</td>
</tr>
<tr>
<td></td>
<td>- 6 mm</td>
<td>15.5%</td>
</tr>
</tbody>
</table>

Moisture- 15%

3. Coke Breeze

<table>
<thead>
<tr>
<th>Max</th>
<th>Min</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ 25 mm</td>
<td>- 25 mm</td>
<td>4.3%</td>
</tr>
<tr>
<td>- 25 mm</td>
<td>to + 15 mm</td>
<td>12%</td>
</tr>
<tr>
<td>- 15 mm</td>
<td>to + 10 mm</td>
<td>11.5%</td>
</tr>
<tr>
<td>- 10 mm</td>
<td>to + 5 mm</td>
<td>15.3%</td>
</tr>
<tr>
<td>- 5 mm</td>
<td>to + 3 mm</td>
<td>16.5%</td>
</tr>
<tr>
<td></td>
<td>- 3 mm</td>
<td>40.4%</td>
</tr>
</tbody>
</table>

Moisture- 10% (normally), 15% (in rainy season)

Tentative size distributions of raw material (sizes as required in this CS) are shown in Table: 05.01 below. Further, the product/output of crushed fuel & flux shall be in accordance with the sizes is also given below:

<table>
<thead>
<tr>
<th>Sl no</th>
<th>Material</th>
<th>Size Distribution (mm)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Iron ore fines</td>
<td>- 8 mm</td>
<td>+8mm (5% max.)</td>
</tr>
<tr>
<td>2</td>
<td>Raw stone/ Dolomite (Crushed)</td>
<td>- 5mm</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 3 mm</td>
<td>95% (Minimum)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- 1 mm</td>
<td>70%(Minimum)</td>
</tr>
</tbody>
</table>
02 ADDITIONS/ MODIFICATIONS AND UPGRADATION IN EXISTING RAW MATERIAL PREPARATION SYSTEM

02.01 EXISTING FUEL crushing and screening facility

There is a provision of covered storage for coke breeze received from blast furnace adjacent to coke crushing and screening building. The coke breeze is reclaimed by front end loaders and conveyed to coke crushing and screening building through series of conveyors C101, C102, C103, C104, C105 and finally C106. The coke breeze gets crushed by 2 roll crusher to -10 mm from -25 mm size and subsequently screened by Mogensen sizer. 

+3mm output from the sizer is conveyed to coke grinding building by conveyor C111 and discharged onto reversible conveyor C112. Conveyor C112 discharges into 2 nos. surge bins from where belt feeders extracts material and feeds to rod mill (2 nos.) where it gets crushed to -3mm. (-)3 mm size from crushing and screening building is directly conveyed and discharged onto conveyor C114 through conveyors C110 and C113, which in turn discharges to conveyor C115.

02.02 Existing FLUX crushing and screening facility

Limestone and dolomite required for the existing machine of Sinter Plant III is drawn from bunkers of flux proportioning building and conveyed by conveyor 105 to surge bin of existing flux crushing building. The material is discharged onto reversible shuttle conveyor L106 from where it is
discharged onto bins. The material is withdrawn by vibratory feeder and fed to primary hammer mill (3 nos.) of 250 tph capacity. From the hammer mills the crushed flux is conveyed by conveyors L109, L110 and L111 onto secondary hammer mills (3 nos.) These three conveyors carry crushed flux to flux screening building and discharge into surge bins (3 nos.). Material is withdrawn from each of the two openings by traveling vibro feeder (6 nos.) and fed to flux screens (6 nos.) for screening -3 mm size fraction. The undersize (-3 mm) from each of the six screens is fed to a common conveyor L120 which conveys the material onward to storage and proportioning bin building. The oversize (+3 mm) is fed to a common conveyor L115 and recycled back to flux crushing building for further crushing.

02.03 PROPOSED Fuel and Flux Crushing and Screening Facility

In order to cater to increased requirement of fuel and flux for the new sinter machine, following three facilities have been envisaged under this package which shall form part of scope of this Contract:

- Up gradation / Addition of coke crushing and screening facilities.
- Up gradation / Addition of Coke Grinding facilities
- Up gradation/Addition of Flux crushing & screening facilities.

The existing facilities also need to be modified/ extended so as to integrate the existing with proposed facilities.

02.03.a UP gradation / Addition of coke crushing and screening and grinding facilities

A similar facility for coke breeze crushing, screening & grinding with related facilities shall be added adjacent to the existing one.

As described earlier that the coke breeze is being received from the existing track hopper via belt conveyors C101, C102, C103, C104 to the coke storage yard. It is now proposed that Coke breeze & BF return fines
shall also be received by conveyor C-102 for further transportation to coke storage yard. Belt conveyor C-104 shall be suitably modified & extended and discharge onto new reversible conveyor RC 106. RC 106 shall be able to discharge either onto existing conveyor C106 or onto new conveyor C106A in a new Junction house CK-1. Conveyor C-106A shall carry the material to feed over a hopper of capacity 200m3 (effective volume) with suitable gate at proposed New Coke crushing house CK-2. A reversible belt conveyor RC-CK2 will receive the material from bunker and feed either to the two roll crusher or bypass the crusher and feed to conveyor C107A as shown in the flow diagram. The two roll crusher shall be of capacity 50 tph and shall receive -25mm (10-15% moisture) coke breeze, crush and discharge over conveyor C-107A. Conveyor C-107A shall further transfer Crushed/ bypassed uncrushed material to Junction house CK-3 and discharge over a Mogensen Sizer of capacity 50 tph for product size of (-3) mm. The oversize (+ 3 mm) from sizer shall be discharged onto conveyor C-111A which shall convey and discharge the material onto new conveyor C- 112A in new coke grinding building. Conveyor C-112A shall discharge into either of two nos. surge bins of effective capacity ~100 m3 each from where material shall be withdrawn by Belt feeder and fed to rod mill. Sized material (-3mm) from rod mill shall be discharged onto existing conveyor C-114, which shall further convey the material to existing storage and proportioning bin building through existing conveyors C115, C115A and C115B.

It may be noted that input material of size -25mm and product material of size -3mm is the basic system requirement of the integrated fuel crushing and screening system. The facilities envisaged between input stage to output stage have been given in the CS. Crushing of coke at two roll crusher, screening at coke sizer and grinding at rod mill shall be decided by the contractor in an integrated manner to given the plant output of -3mm.
02.03.b Up gradation/Addition of Flux crushing & screening facilities

An additional stream similar to the existing one consists of Primary & Secondary Hammer Mill with surge bin & vibro-feeders and related facilities shall be provided by extending flux crushing building. Further screens with surge bin & vibro feeders in screen building with feeding conveyor from crushing building to screen building shall be provided.

Limestone and dolomite required for the existing machine of Sinter Plant III is drawn from bunkers of flux proportioning building and conveyed by the conveyor L105 to surge bin of existing flux crushing building. It is proposed to extend the existing conveyor L 105 by nearly 7.3 m to new proposed extension of flux crushing building.

The existing reversible shuttle conveyor L-106 shall be replaced by new one of larger length so that it can feed existing three crushing series surge bins as well as a new crushing series surge bin (200 m³ effective volume each). New series having a Primary hammer Mill shall receive the material from respective surge bin through vibro-feeder and after crushing it will discharge onto a new conveyor L111A. Conveyor L111A shall further feed the crushed material to secondary Hammer Mill. After crushing in secondary crusher, the material shall be conveyed to new surge bin in the screen building (100m³ Effective volume) with the help of a new belt conveyor L114A. The surge bin of this screen building shall have two discharge points so as to feed the new two nos. Screens.

The undersized material (-3mm) shall be received by the existing conveyor L120. The tail end, horizontal gravity take up arrangement, electrics, control, etc. of belt conveyors L120 shall be suitably extended backward to receive the above material from Screens.
The over sized material (+3 mm) shall be recycled through existing conveyors L115, L116 & L117 to the Crushing building. The tail end, horizontal gravity take-up arrangement, electrics, control, etc. of belt conveyors L115 shall be suitably extended backward to receive the above material from Screens. Belt conveyor L117 shall further discharge the material onto the new reversible shuttle conveyor L118. The existing reversible shuttle conveyor L118 shall be replaced by new one of larger length so that it can feed existing three surge bins as well as a new surge bin (75m³ EV). The surge bins will then discharge the material over the same (as referred above) new secondary Hammer Mill with the help of Vibro-Feeder. The material shall be further crushed and fed to the screens as described above.


02.04 RE-ROUTING OF EXISTING SINTER FINES CONVEYORS (C-LINES).

The existing series C-line conveyor is feeding BF return fines from existing Blast furnaces to the sinter return fines (IPRF) conveyor F101 of SP-III at JH-127. It is now proposed to dispatch these return fines straight to the same conveyor with strengthening & modification of gallery. The same shall be executed by dismantling & re-routing of the existing C-line conveyors so as to install new CDCP unit in place of C-line Belt conveyor no. C3, and hence the existing C3, C4, C5 & C6 belt conveyors require relocation.

Dismantling of the existing belt conveyors C3, C4, C5 & C6, related galleries & junction houses no.-3, 4, 5 & 6 is included in the scope of the contractor. Junction house - C2 shall be suitably modified to re-install the
tail end of new conveyor-C3 from perpendicular direction as shown in General layout drg. No. MEC/S/9101/11/14/0/00/0064.03/R0.

Belt conveyor no. C3 shall be re-routed and re-installed (two conveyors C3A-C1 & C3-C1) along the existing gallery of JH124 & 123A/B adjacent to railway tracks so as to feed the fines at relocated junction house -C3. Belt Conveyor C3A-C1 shall receive BF return fines at JH-C2 and discharge onto conveyor C3-C1 as well as conveyor C3A-C2 shall receive coke breeze from CSP#4 and discharge onto conveyor C3-C2 at Junction house JH-C3A. These two belt conveyors i.e. C3-C1 & C3-C2 together carry the material through common gallery and discharge onto belt conveyor C4-C1 & C4-C2 respectively. Belt conveyor C5-C1 (Sinter/ ore fines) and C5-C2 (Coke fines) shall receive the material from BF#8 Stock house and discharge over C6-C1 and C7-C1 respectively at JH-C5. Also Conveyor C4-C1 and C4-C2 shall discharge the material over conveyor C5-C1 & C5-C2 respectively at JH-C4. Conveyor gallery C5-C1 & C5-C2 shall cross over the existing gallery of conveyors between JH-120 & Emergency Sinter Storage Building.

Belt conveyor C6-C1 shall carry the Iron bearing fines (BF return) and discharge over conveyor J127-C1 at JH-C6 and in turn to F101 existing Belt conveyor at JH-127. Junction house JH-127 shall be suitably modified so as to accommodate drive and discharge end of belt conveyor J127-C1. Existing drive and discharge of belt conveyor C6 shall be dismantled before installation of new conveyor J127-C1. Belt conveyor C7-C1 shall discharge the material over belt conveyor C102A at Junction house JH-C7 and in turn feed to existing belt conveyor C102 at pent house. As a storage capacity of 12 hrs. has been envisaged in BF#8 return coke bunker in BF#8 itself, no separate storage/ surge bin has been considered in C102A to C102 conveyor transfer points. Suitable gallery structure to place drive/ discharge end of conveyor belt C102A, de-dusting system, skirt board & impact idlers
on existing conveyor C-102 shall be provided to receive coke breeze. The pent house roof shall be locally dismantled to enable erection of transfer house and discharge onto conveyor C-102. However, after installation of new Junction house over pent house, the roof & structure of pent house may again be utilized to cover remaining part of pent house.

Two dedicated routes shall be provided to transport Iron bearing material (BF return fines) till existing belt conveyor F101 of SP-III and coke fines from coke sorting plant & BF#8 stock house till existing belt conveyor C102 of SP-III. A common gallery may be considered for all parallel conveyors.

Floors of Conveyor galleries of all return line conveyors from junction house C2 to new junction house J127 & pent house of C102 shall be of chequered plate construction (Minimum 8mm O/P) with semi circular hood over conveyor.

Rerouting of these conveyor series shall be so meticulously planned that minimum shut down is required in the existing plant. Design, supply, erection, commissioning and performance guarantee test of the Rerouted conveyors are under the scope of the Contractor. Existing equipments/ components of dismantled (by the Contractor) conveyor/gallery/ junction houses shall not be re-used.

All Proposed junction houses shall have Electric hoist. The capacity & lift may be followed as per CS. Junction houses (where these facilities are not considered) of below 6m height shall have suitable capacity (2t min.) manual hoist and more than 6m height shall have at least 5t cap. Electric hoists. Under slung & EOT cranes as specified in CS and other handling facilities as specified in system description shall be provided.
04.00 CONTRACT SPECIFICATION

04.01 TECHNOLOGICAL

04.01.01 General

Contract specifications for major technological equipments are furnished in this chapter. However, most of the common Material Handling equipments are separately covered in the “General Technical Specification – Material Handling Equipment chapter”. (GS 06).

The equipments covered in the GTS are: -

- Belt Conveyors and related equipment, Belt Feeder, Shuttle Conveyor and Reversible Shuttle Conveyor System.
- Crushers
- Screens
- Vibratory Feeders
- Vibratory Grizzly Feeders
- Gates
- Motorised Diverter Gate
- Weigh Hoppers
- Belt Weigh Scales (BWS)
- Vibration Isolation System
- Travelling Tripper and Bunker Sealing Arrangement
- In-line Magnetic Separator (ILMS) & Suspended Magnets
- Metal Detectors (MD)
- Charging hatches
- Cranes and Hoists
- Elevators
- Transfer Cars
- Battery Operated Forklift Trucks
- Vulcanising Machine and Mobile Belt Changing units

Although, specification envisaged in GTS are applicable for all individual CS, some equipments or components envisaged in GTS needs further
clarification or changes to suit the specific requirement of Coal Handling Plant and Coke Sorting Plant. This chapter shall cover following equipments envisaged in Coal Handling Plant and Coke Sorting Plant Package only as listed below:

2. Double roll toothed crusher
3. Vibrating Screens
4. Grizzly Screens
5. Liners (other than Coal handling & Coke sorting plant)
6. Handling & Hoisting facility (for fuel & flux related facilities)

In case of conflict between various clauses of this CS and GTS, the points indicated in CS shall prevail over that of GTS. The Contractor may note that the plant shall be complete with all equipment & facilities. Further, some of the equipment whether specifically mentioned or not in this CS, but for successful and trouble free operation of the plant shall also be included in the scope of supply. Technical parameters furnished against each equipment are broad in nature. However, the same shall be taken care of during detail engineering.

Following points shall be considered in view of changes as given below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Clause (As per GTS)</th>
<th>Description (As per GTS)</th>
<th>Description CS to be followed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CI.- 01.02, sub clause-04</td>
<td>Three roll inline troughing idlers of equal length shall be used throughout..... Carrying Idlers – 114.3 mm Outer Diameter for 500 mm and 650 mm belt and 139.7 mm for higher width belt with 4.5 mm shell thickness....... Transition idlers of above...... Return idlers for wet or sticky material shall</td>
<td>FOR COAL HANDLING &amp; COKE SORTING PLANT FOR COBP #11 3 roll,159mm dia. staggered type idlers on the carrying side shall be provided through out the conveyor. In line type troughing rollers under loading points only. However on the return</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Clause (As per GTS)</td>
<td>Description (As per GTS)</td>
<td>CS to be followed</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------</td>
<td>--------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td>be of rubber disc type of two roller trough design. Flat return idlers only shall be used under the &quot;V&quot; scrapers and in high tension areas.....</td>
<td>side double roll V type (10degree/15degree trough) shall be considered.</td>
</tr>
<tr>
<td>2.</td>
<td>Cl.- 01.02, sub clause-09</td>
<td>Automatic counter....in length. Horizontal gravity take up/VGTU shall be provided wherever feasible. Take-up travel shall be as per IS:4774 (part-I).....</td>
<td>The minimum clearance between tail pulley and ground for HGTU trolley shall be 500mm</td>
</tr>
<tr>
<td>3.</td>
<td>Pg.4 of 21 Pt.5</td>
<td>In coal conveyors 3.15mm thick MS Deck plates should be used though out the length. Deck plate should be supported on 50x50 angles at the joint and in the middle. Whereas in coke conveyors 3.15mm SS deck plate to be used through out the length.</td>
<td>Refer point no. 5 below</td>
</tr>
<tr>
<td>4.</td>
<td>Cl.- 01.02, sub clause-04</td>
<td>Three roll inline troughing idlers of equal length shall be used throughout..... Carrying Idlers – 114.3 mm Outer Diameter for 500 mm and 650 mm belt and 139.7 mm for higher width belt with 4.5 mm shell thickness....... Transition idlers of above....... Return idlers for wet or sticky material shall be of rubber disc type of two roller trough design. Flat return idlers only shall be</td>
<td>FOR AUGMENTATION IN FUEL-FLUX PREPARATION FOR SP III All rollers should confirm to IPSS standards as adopted by BSP and bottom rollers should be of straight/ flat type.</td>
</tr>
</tbody>
</table>
### Sl. No. | Clause (As per GTS) | Description (As per GTS) | Description CS to be followed
--- | --- | --- | ---

6 | Cl.- 01.02, sub clause-08-Hold Back and Brakes with panel | D.C. Electro-magnetic brake shall be provided on all conveyors after calculating the coasting time. | D.C. Electro-magnetic brake of BCH make shall be provided on all conveyors which are more than 25 m long except belt feeders/ shuttle conveyors.

Contractor to note the following:

1. Conveyor components like Pulley, bearing pedestals, bearing etc to be as per GTS/IPSS.
2. Belt of conveyors shall be super heat resistant type for CSP. Fire resistant Belt for Coal/Coke and Nylon/Nylon belt for other shall be considered unless otherwise specified.
3. The troughing angle of all the carrying idlers shall be 35°.
4. The zero speed switches shall be of non contact type
5. Conveyor deck plates shall be as below:
   - For coal handling circuit – 2mm SS-304.
   - For Coke sorting Circuit – 3.15mm SS-304.
   - For fuel & flux - 3.15mm thk. MS plates.
   Decking shall be provided in full length of all conveyors.
6. All belt conveyors shall be provided with under speed monitors.
7. Antifriction bearing with adapter sleeve shall be considered for all pulleys UOS.
8. All flap/ diverter/ split gates shall be motorized.

10. Belting specification of all conveyors shall be min. 1400x800/4, ~M-24. Return idlers & troughing rollers of all 1400 mm wide conveyor belts should be of 159 dia x 6.3 thk. and Dia 159x 6.3 thk & 530mm respectively.

11. All Conveyor galleries shall be provided with cast-in-situ RCC in full width. However, for all return fines for SP-III route conveyors, covered gallery with structural floor shall be considered.

12. Structural shed over RCC silos of coal handling plant shall be provided.

13. Hammer crusher (Primary) fluid coupling should be of variable speed type.

14. Hammer crusher all door opening to be hydraulically operated.

15. Secondary hammer crusher rotor, body, frames etc to be identical to P.H.C.

16. Hammer crusher r.p.m shall not more than 750 r.p.m.

17. Gear box body shall be of Cast Steel/ Fabricated.

18. Plummer blocks to be of cast steel, grade min. 280-520, IS:1030.

19. All fluid coupling except primary hammer crusher to be delayed fill type.

20. Suspended electromagnet with monorail, to dispose off the material, shall be provided. The capacity shall be 50Kg.

21. All gear boxes shall have external type of hold back on the non drive end of input shaft.

22. Industrial water pipeline should be laid at ground level, wherever possible. All pipelines shall be laid inside the gallery for the ease of maintenance.

04.01.02 Scope of work

The scope of work shall include design, engineering, fabrication, manufacture, assembly, testing, erection, testing and performance
guarantee of plant and equipment on turnkey basis as elaborated in various clauses of this chapter for the and in chapter 04 of this Contract Specification.

04.01.03 **Contract Specification of Hammer Mills**

01 **Design parameters and functional details**

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1)</td>
<td>Equipment</td>
</tr>
<tr>
<td>2)</td>
<td>Capacity</td>
</tr>
<tr>
<td>3)</td>
<td>Material to be crushed</td>
</tr>
<tr>
<td>4)</td>
<td>Feed size</td>
</tr>
<tr>
<td>5)</td>
<td>Bulk density of coal</td>
</tr>
<tr>
<td>6)</td>
<td>Moisture content of coal</td>
</tr>
<tr>
<td>7)</td>
<td>Ash content of coal</td>
</tr>
<tr>
<td>8)</td>
<td>HGI of coal</td>
</tr>
<tr>
<td>9)</td>
<td>Feeding system</td>
</tr>
<tr>
<td>10)</td>
<td>Product size</td>
</tr>
<tr>
<td>11)</td>
<td>Output to be fed to</td>
</tr>
<tr>
<td>12)</td>
<td>Mode of Operation</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reversible Hammer crusher</td>
</tr>
<tr>
<td></td>
<td>300 t/h</td>
</tr>
<tr>
<td></td>
<td>Coking coal</td>
</tr>
<tr>
<td></td>
<td>(-)50 mm, occasionally going up to (-) 75 mm</td>
</tr>
<tr>
<td></td>
<td>0.74 to 0.78 T/m³</td>
</tr>
<tr>
<td></td>
<td>10 % (Max.)</td>
</tr>
<tr>
<td></td>
<td>8.0 to 12 .0%</td>
</tr>
<tr>
<td></td>
<td>50-55</td>
</tr>
<tr>
<td></td>
<td>Conveyor chute</td>
</tr>
<tr>
<td></td>
<td>81 % (-) 3 mm and (-)0.5 mm content shall be less than 35%</td>
</tr>
<tr>
<td></td>
<td>1400 mm wide belt conveyor</td>
</tr>
</tbody>
</table>

Shall be operated from control room as well as from local panel. The reversal of motor should also be done from control room as well as from local panel. In case of excessive temperature rise in the bearing of motor winding the motor should trip to prevent burning of motor. Facilities shall be provided for continuous temperature display of motor and motor winding in the control room. Speed monitors for each crusher shall be provided. Facilities shall be provided for cooling of electric motor. The mills shall be provided with suitable spring with damping pad arrangement for isolation of loads.
02 Constructional Features

1. Grinding Walls:

Two sets of grinding walls or breaker plates, suspended from casing top and arranged around the rotor. Material shall be of special steel to ensure long life.

2. Casing

The casing shall be dust tight and shall consist of segments manufactured from heavy rolled plates and lined with replaceable high manganese steel liner plates. The wear resistant liner plates shall have operating life of minimum 2 years. The casing shall have opening of crusher housing by hydraulic cylinders.

The internal arrangement of the hammer crusher casing shall be so designed that it shall remain free from clogging even at higher moisture content. The contractor shall also guarantee for noise level not to exceed 85 dB at one meter distance from the equipment.

3. Hammer Heads

The hammer heads shall be of forged alloy steel with top edge hard faced compatible with duty requirements. The hammer shall have facilities for rebuilding and shall have maximum life in terms of coal throughout (>0.5 million tones / set of hammers). The hammers shall be easily replaceable in shortest time and with minimum manpower.

4. Hammer Arms

The hammer heads and hammer arms shall held together by advanced method of fixing for quick and easy removal and shall be fitted to the disc mounted on the rotor shaft. The hammer arms material shall be forged steel En-24.

5. Shaft


6. Breakers plates and Grate bars
The breaker plates and grate bars shall have facilities for easy replaceability and shall give minimum life of 2.0 million tones / set. The wear resistant grinding jibs fitted with breaker plate shall be of annealed Chrome Molybdenum Alloy Steel. The grate bars shall have proper arrangement to prevent vibration. The grate bars material shall be forged steel with proper hardness for longer life and does not need frequent replacement.

7. **Bearings**

Antifriction double row self aligning roller type bearings in dust proof housing shall be provided. The housing shall have provision to install instrument for measuring bearing temperatures and display in the control room.

8. **Adjustment**

All adjustments required for achieving the targeted granulometry and proper functioning of the hammer crushers shall be provided.

9. **Lubrication**

Manually operated centralised grease lubrication system along with grease pump shall be provided for each crusher.

10. **Base frames & Foundation bolts**

All the equipment & drives shall be supplied complete with base frames, foundation fittings & Foundation bolts. Base frames shall be of robust welded construction of rolled heavy steel sections & Plates.

11. **Rotor speed**

Rotor speed shall be carefully selected to achieve the designed fineness of the coal blend with generation of fines within specified limits. In no case rotor speed should be more than 1000rpm.

12. **Drive arrangement**

The crusher shall generally be driven directly by a squirrel cage induction motor of 1000 rpm coupled with variable speed fluid coupling.
13. **Duty Cycle**

Continuous three shift operation per day.

14. **Other features**

Facilities shall be provided for continuous temperature display of motors and motor winding in the control room. Speed monitor for each mill shall be provided. Necessary facilities for cooling of Electric Motor shall be provided.

### 03. Conveyor Data Sheet for Coal Handling Plant

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Conveyor No.</th>
<th>Capacity (t/h)</th>
<th>Belt Width (mm)</th>
<th>Horizontal Length (m)</th>
<th>Lift (m)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Conveyor No. Y11-125</td>
<td>600</td>
<td>1200</td>
<td>48</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Conveyor No. Y11-126</td>
<td>600</td>
<td>1200</td>
<td>42.8</td>
<td>0</td>
<td>With tripper</td>
</tr>
<tr>
<td>3.</td>
<td>Conveyor No. Y11-127</td>
<td>600</td>
<td>1200</td>
<td>40.8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Conveyor No. Y11-128</td>
<td>600</td>
<td>1200</td>
<td>23.8</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Conveyor No. Y11-130</td>
<td>300</td>
<td>1200</td>
<td>12.6</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Up-gradation of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conveyor No. Y7-12</td>
<td>1000</td>
<td>1400</td>
<td>54</td>
<td>0</td>
<td>With stand-by drives</td>
</tr>
<tr>
<td>8.</td>
<td>Up-gradation of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conveyor No. Y7-13</td>
<td>1000</td>
<td>1400</td>
<td>28</td>
<td>8</td>
<td></td>
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<tr>
<td>9.</td>
<td>Conveyor No. Y7-36</td>
<td>600</td>
<td>1400</td>
<td>17.5</td>
<td>0</td>
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<tr>
<td>10.</td>
<td>Conveyor No. Y11-131</td>
<td>600</td>
<td>1400</td>
<td>6.5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Conveyor No. Y11-132</td>
<td>600</td>
<td>1400</td>
<td>147.3</td>
<td>27.3</td>
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<tr>
<td>12.</td>
<td>Conveyor No. Y11-133</td>
<td>600</td>
<td>1400</td>
<td>44.6</td>
<td>10.1</td>
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<td>13.</td>
<td>Conveyor No. Y11-134</td>
<td>600</td>
<td>1400</td>
<td>10.7</td>
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<tr>
<td>14.</td>
<td>Rev. Shuttle</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conveyor No. Y11-400</td>
<td>400</td>
<td>1200</td>
<td>18.0</td>
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<thead>
<tr>
<th></th>
<th>400</th>
<th>1200</th>
<th>18.0</th>
<th>0</th>
</tr>
</thead>
</table>


<table>
<thead>
<tr>
<th></th>
<th>600</th>
<th>1400</th>
<th>No new belt to be supplied</th>
<th>Upgradation of capacity</th>
</tr>
</thead>
</table>

Note : Troughing angle of all conveyor shall be 35°.

04. CONTRACT SPECIFICATION OF DOUBLE ROLL TOOTHED CRUSHERS

i) SCOPE OF SUPPLY

The scope of supply for the contractor covers, design, fabrication, manufacture, inspection, no load testing at works, packing, transportation to site, supply supervision of erection, testing and commissioning of two (2) nos. of two-roll toothed crushers complete in all respects. The crusher shall be complete with, coupling, V belts, drive motor, gear unit and sheet metal guards. The scope of supply shall also include required quantities of commissioning spares and necessary special tools and tackles, if any, for maintenance/ testing/ inspection.

ii) GENERAL

Two-roll toothed crushers shall be required to be installed in the coke crushing station of coke sorting plant. Run of CDCP (Coke Dry Cooling Plant) coke shall be fed to the crushers after screening out 80 mm fraction using single deck grizzly screens. All components of the crushers shall be designed for operation in dusty atmosphere.

iii) DESIGN PARAMETERS

a) Equipment : Two roll toothed crusher for coke
b) Nos. required : 2 (Two) sets.
c) Capacity of each crusher: 180 t/h (rated) of run of CDCP coke (+80mm)
d) Roll dia of crusher : 800 mm
   Indicative
e) Roll width of crusher : 1800 mm
f) Approximate size analysis: 
   + 100 mm = 33 - 49%
   80-100 mm = 20 - 25%
   60-80 mm = 18-22%
   40-60 mm = 6-11%
   25-40 mm = 2-5%
   0 – 25mm = 4-8%

   g) Type of coke: Run of CDCP Coke Size (+) 80mm to be fed to crusher: Maximum size of coke (-) 250mm

   h) Product size:
      0 - 80 mm = 90% min
      (-) 8 mm = 5% max
      + 80mm = 5% max

   i) Bulk density of coke: 0.5 t/m³

   j) Duty: Continuous

   **iv) Constructional feature of crusher**

   a) Crushing Rolls

   One of the crushing rolls shall be designed as floating roll. Toothed rings shall be made of Sayalloy Gr.3 composition Mn steel Gr.3 as per IS:276-1978, Mn-11.5 to 14%, Cr-1.5 to 2.5% Hardness – 220 BHN and be fitted to the roll body of welded construction. The shaft shall be of forged steel and arranged within roll body carried in self aligning roller bearings. Bearings shall be rigidly secured to the welded frame & sealed to prevent ingress of dust.

   Toothed rings shall be fitted to the rotor body so that it can take the impact of crushing load and tooth profiles should not get knocked out during intense crushing. There shall not be any relative movement between the crushing rings and the rotor body causing shearing force.

   b) Base frame

   The crusher shall be supplied with sturdy base frame of welded construction. Base frame for mounting the gear box and drive motor shall be provided.
c) Housing

Housing shall be multiple parted type to facilitate quick changing of crushing rolls & segments made of strong structural steel plates provided with wear resistance side liner and necessary inspection facility.

d) Bearings

Bearings shall conform to Indian Standard and should be most suitable for the purpose. Antifriction self-aligning spherical roller bearing with shaft of forged steel as per IS:2004-1978. Dust seal mounted on tapper sleeves shall be preferred. Bearing blocks shall be sealed against entry of dust by grease packed labyrinth alloys. Bearings housing shall be made of cast steel.

e) Adjustments

It shall be possible to effect gap adjustments during operation of crushers. The adjustment mechanism shall be arranged centrally and form one unit with the overload protection device with spring arrangement.

The parallel movement of the rolls must be ensured for the uniform gap to be maintained throughout the crushing operation and to prevent skew loading of the bearing and shaft. The adjustment shall ensure shifting of rolls parallel to the axis if foreign matter enters the crushers.

f) Drive unit:

The transmission of power from motor to rolls should be through flexible couplings, gearboxes and V belt.

g) Lubrication

A manual centralized lubricating system for each lubrication points with grease nipples shall be provided. The system shall enable use of grease pump.

h) Safety device

To ensure safety of motor against overload, speed monitors shall be provided.
i) Safety Guards

Metals 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.

v) Performance Guarantee

Following performance guarantee shall be furnished by the contractor.

a) Product size : (+)30–80mm=85%, +80mm=5% Max.
    : (-) 30mm = 10% Max.

b) Duty : Continuous

c) Life of the Toothed Rings : 300,000 tonnes approx.

d) The noise level shall not exceed 85 dB at 1 meter distance.

05. CONTRACT SPECIFICATIONS FOR VIBRATING SCREENS

i) SCOPE OF SUPPLY

The scope of supply for the Contract consists of design, fabrication, manufacture, inspection, no load testing at works, packing, transportation to site, supply supervision of erection, testing and commissioning of 2 nos. of vibrating screens.

ii) GENERAL

For 30 mm Vibrating screens

The vibrating screen (classifier) located in coke screening station of coke sorting plant receives coke of 0-80mm size. Oversize of the screen is delivered into 60mm grizzly screen while the undersize of the screen is fed to conveyor K11-17.

The screen bed steel plate shall be S/S wire rod of minimum 5mm dia.

The screens with a by-pass chute with electric drive arrangement shall be mounted on rail tracks for travel.
iii) DESIGN PARAMETERS AND CONSTRUCTIONAL FEATURES

Characteristics of coke

Bulk density : 0.5t/m³
Moisture content (max) : 2%
Angle of repose : 35°
Temperature : Less than 200°C
Size of feed coke : -80mm

Equipment parameters

The equipment shall be suitable for following working characteristics:

The screen is floor mounted type vibrating screen having linear motion. The inclination of screen shall be suitable for easy flow. The deck shall be placed on four sets of springs. Weight adjustment facilities shall be provided. The screen bed shall be made of perforated stainless steel plate or SS wire rod of dia. 5mm minimum.

i) Following are the design requirement.

- No. of screens : 2 sets
- Rated Capacity : 300 TPH each
- Feed size : 0-80mm
- Separation size : (-) 30mm
- Separation efficiency: 95%
- No. of decks : Single
- Speed : During DE stage
- Motor power : During DE stage
- Quantity : 2 nos.
- Duty : Continuous
- Noise level : 85 db at 1M distance

ii) Supporting spring

The screen frame shall be mounted on four soft compression type steel coil springs to keep vibration transmission to a minimum.
iii) Screen cloth

The screen bed is made of 5mm thick SS plate with suitable perforations or SS wire rod of 5mm dia. minimum.

iv) Drive Unit

This will consist of sheave pulley including keys to be mounted on screen shaft, base frame for drive motor, electric motor, V-belts. V-belt drive shall be avoided.

06. CONTRACT SPECIFICATIONS FOR GRIZZLY SCREENS

i) SCOPE OF SUPPLY

The scope of supply of the Contractor consists of design, fabrication, manufacture, inspection no load testing at works, packing transportation to site, and supply supervision of erection, testing and commissioning 4 nos. of Grizzly Screens. The scope of supply shall also include Rails along with fasteners, required quantities of commissioning spares and necessary special tools and tackles (if any) for maintenance/ testing/ inspection.

The Contractor shall quote separately item wise prices for supply of spares required for two years of operation and also insurance spares (if any). First fill of lubricant is also included in the scope of the Contractor.

ii) GENERAL

a) FOR 80 MM GRIZZLY SCREENS (2 NOS.) WITH A BYPASS CHUTE

This single deck screen received coke of (0-250) mm size from belt conveyor Nos. K11-11 and K11-12 of coke sorting plant and feed the oversize to the Two roll toothed crushers. The screen shall be installed in coke crushing station of coke sorting plant. The bypass chute with electric drive arrangement shall travel on the same rail track.

b) FOR 60 MM GRIZZLY SCREENS (2 NOS.)

This single deck grizzly screen shall receives coke of (30-80) mm size from 30mm vibratory screens of coke sorting
plant. Undersize of the screen is fed to the conveyor Nos. K11-16 and oversize to the conveyor Nos. K11-15. The screen shall be installed in coke screening station of coke sorting plant. The screens with a bypass chute shall travel on the same track with electric drive.

c) MATERIAL CHARACTERISTICS

The characteristics of run of CDCP (Coke Dry Cooling Plant) coke are given below:

i) Max lump size - 250mm
ii) Bulk density - 0.5t/m³
iii) Moisture content (Max.) - 2%
iv) Angle of repose - 35°
v) Temperature - Less than 200°C

vi) Indicative size analysis of feed

a) For 80 mm Grizzly Screen

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>+100 mm</td>
<td>33-49%</td>
</tr>
<tr>
<td>80-100 mm</td>
<td>20-25%</td>
</tr>
<tr>
<td>60-80 mm</td>
<td>18-22%</td>
</tr>
<tr>
<td>40-60 mm</td>
<td>6-11%</td>
</tr>
<tr>
<td>25-40 mm</td>
<td>2-5%</td>
</tr>
<tr>
<td>0-25 mm</td>
<td>4-8%</td>
</tr>
</tbody>
</table>

b) For 60mm Grizzly Screen

The feed size of (30–80mm) coke will contain (-) 30mm fraction of about 5%.

iii) Equipment parameters

The 80mm Grizzly Screen shall be suitable to screen (-) 80mm size fraction of run of CDCP coke. The 60mm grizzly screen shall be suitable to screen out (-) 60mm fraction from the undersize coke (-80mm) received from grizzly screen & crushed coke from two roll toothed crusher.

The equipment shall be suitable for following working characteristics:
### For 80mm Grizzly Screen

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed rated capacity</td>
<td>300 TPH</td>
</tr>
<tr>
<td>Feed size</td>
<td>0-250mm</td>
</tr>
<tr>
<td>Separation size</td>
<td>(-) 80 mm</td>
</tr>
<tr>
<td>No. of deck</td>
<td>Single</td>
</tr>
<tr>
<td>Quantity</td>
<td>Two Nos.</td>
</tr>
<tr>
<td>Duty</td>
<td>Continuous</td>
</tr>
<tr>
<td>Product</td>
<td>Overflow (+) 80mm, Underflow (-) 80mm</td>
</tr>
<tr>
<td>Separation efficiency</td>
<td>Percentage of (+) 80mm fraction in ‘Under flow’ and (-) 80mm fraction in ‘Over flow’ shall not be more than 1%</td>
</tr>
</tbody>
</table>

### For 60mm Grizzly Screen

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed rated Capacity</td>
<td>200 TPH</td>
</tr>
<tr>
<td>Feed size</td>
<td>30-80mm</td>
</tr>
<tr>
<td>Separation size</td>
<td>(-) 60mm</td>
</tr>
<tr>
<td>No. of deck</td>
<td>Single</td>
</tr>
<tr>
<td>Quantity</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>Duty</td>
<td>Continuous</td>
</tr>
<tr>
<td>Product</td>
<td>Overflow (+) 60mm, Underflow(-) 60mm</td>
</tr>
<tr>
<td>Separation efficiency</td>
<td>Percentage of (+) 34mm fraction in ‘Under flow’ and (-)</td>
</tr>
</tbody>
</table>
34mm fraction in ‘Over flow’ shall not exceed 1%

Other characteristics (Indicative)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Unit</th>
<th>60 mm Grizzly</th>
<th>80 mm Grizzly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Screen width</td>
<td>mm</td>
<td>1850</td>
<td>1850</td>
</tr>
<tr>
<td>2.</td>
<td>Number of rollers</td>
<td>Piece</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Pitch of roller</td>
<td>mm</td>
<td>272</td>
<td>400</td>
</tr>
<tr>
<td>4.</td>
<td>Screen length (Number of GAP x pitch)</td>
<td>mm</td>
<td>3264 (12x272)</td>
<td>3600 (9x4000)</td>
</tr>
<tr>
<td>5.</td>
<td>Screen inclination</td>
<td>Degree</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>6.</td>
<td>Roller revolution</td>
<td>RPM</td>
<td>33-61</td>
<td>19-43</td>
</tr>
<tr>
<td>7.</td>
<td>Disc. Circumferential speed</td>
<td>M/Sec</td>
<td>0.48-0.89</td>
<td>0.45-1.12</td>
</tr>
<tr>
<td>8.</td>
<td>Capacity</td>
<td>T/H</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>9.</td>
<td>Rating and RPM of electric motor (Indicative)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9a.</td>
<td>Main drive motor</td>
<td>kW RPM</td>
<td>18 725</td>
<td>15 725</td>
</tr>
<tr>
<td>9b.</td>
<td>Long travel motor</td>
<td>kW RPM</td>
<td>2.4 900</td>
<td>2.4 900</td>
</tr>
<tr>
<td>9c.</td>
<td>Lubrication Pump</td>
<td>HP RPM</td>
<td>1 1450</td>
<td>1 1450</td>
</tr>
</tbody>
</table>

The characteristics of Grizzly screen given above are indicative only. Contractor may offer their own design specifying the characteristics.

Constructional feature of screens

Screens shall consist of:-

1. Screen frame shall be of welded structure made of rolled steel plates. Screen rolls consisting of steel shaft with toothed sleeve of Mn. Steel (10-14% Mn) as per IS:276 (Pt-1)-1992 to withstand wear and tear of screening action. Rollers shall be suitably spaced to allow undersize coke to pass through. The rollers shall be driven at one end by respective line shaft made of rolled steel C-45 as per IS:1570-1987 or En-8, BS970-1988.

2. Each roller shall be supported at both the ends by antifriction bearing unit. The bearing units are duly sealed to protect against
ingress of dust and dirt. Grease nipples shall be provided on bearing unit for occasional re-greasing purpose.

3. Each screen shall be driven by squirrel cage induction motor through helical gear boxes and couplings. A line shaft shall run along side of the screen to transmit power from the respective drive unit to screen rollers. Power from line shaft shall be transmitted to rollers by a pair of bevel gears. Operating shaft with rolls shall be connected to the drive by means of suitable coupling for replacement of shafts without dismantling the drive. All gears shall be machine cut and made of hardened steel.

4. DC electromagnetic brake for carriage travel mechanism shall be operated from a fixed switch, conveniently located in the building.

5. The trailing cable arrangement for power supply to carriage travel mechanism, shall be designed to cover the full travel of grizzly. The supply of the cable and its accessories shall be under contractor’s scope of supply.

6. Suitable guards for all rotating parts shall be provided.

7. The parallel movement of the rolls shall be ensured for the uniform gap to be maintained throughout the screening operation and to prevent skew loading of the bearing and shaft.

8. Rotating disc type screen shall be mounted on rails with electric motor for travel. Parking space for maintenance in the building shall be provided by client. It shall have automatic lubrication system for gear train of grizzly shafts.

iv) MOUNTING

Each grizzly screen shall, have screening deck mounted on a carriage. The carriage will house the drive unit for rollers, long travel drive mechanism and lubrication system. The carriage will be fitted with wheels for mounting on rails.

To facilitate maintenance job, the drive mechanism of the two grizzlies (of each type i.e. 80mm & 60mm) shall be located on the carriage in such a way that one is mirror image of the other.

v) OPERATION
This screen is having parallel axles across the flow and fitted with rotating grizzly discs. The axles are rotated simultaneously in increasing speed by a gear train system. The frame containing these discs are mounted on wheels which in turn can move to and for on a pair of rails. The traction is provided by an electric motor and gear system.

vi) PERFORMANCE GUARANTEE

a) For 80mm Grizzly Screen, percentage of (+) 80mm fraction in underflow and (-) 80mm fraction in overflow shall not be more than 15%.
b) For 60mm Grizzly Screen, percentage of + 60mm fraction in underflow and (-) 60mm fraction in overflow shall not be more than 15%.
c) Life of the roller/shaft to be indicated by the contractor.

07. CONTRACT SPECIFICATIONS FOR VIBRATING SCREEN

i) SCOPE OF SUPPLY

The scope of supply of the Contractor consists of design, fabrication, manufacture, inspection no load testing at works, packing transportation to site, supply supervision of erection, testing and commissioning 1 no. of Vibrating Screen. The scope of supply shall also include Rails along with fasteners, required quantities of commissioning spares and necessary special tools and tackles (if any) for maintenance/testing/inspection.

ii) The equipment shall be suitable for following working characteristics:

For 15mm vibrating Screen

Feed rated capacity - 100 TPH
Feed size - 0-30mm
Separation size - (-) 15 mm
No. of deck - Single
Quantity - one no.
Duty - Continuous

Product - Overflow (+) 15mm
Underflow (-) 15mm

Separation efficiency - Percentage of (+) 15mm
fraction in ‘Under flow’ and (-) 15mm fraction in ‘Over flow’
shall not be more than 1%

iii) Other characteristics shall be as per CS mentioned elsewhere &
GTS.

08. CONVEYOR DATA SHEET FOR COKE SORTING PLANT

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Conveyor No.</th>
<th>Capacity (TPH)</th>
<th>Belt Width (mm)</th>
<th>Horizontal length (M)</th>
<th>Lift (M)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Conveyor K11-7</td>
<td>300</td>
<td>1400</td>
<td>102.5</td>
<td>13.6</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Conveyor K11-8</td>
<td>300</td>
<td>1400</td>
<td>102.5</td>
<td>13.6</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Conveyor K11-9</td>
<td>300</td>
<td>1400</td>
<td>5.0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Conveyor K11-10</td>
<td>300</td>
<td>1400</td>
<td>5.0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Conveyor K11-9A</td>
<td>300</td>
<td>1400</td>
<td>8.5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Conveyor K11-10A</td>
<td>300</td>
<td>1400</td>
<td>8.5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Conveyor K11-9B</td>
<td>300</td>
<td>1400</td>
<td>22.2</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Conveyor K11-10B</td>
<td>300</td>
<td>1400</td>
<td>22.2</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Conveyor K11-10C</td>
<td>300</td>
<td>1400</td>
<td>152.969</td>
<td>0</td>
<td>With tripper</td>
</tr>
<tr>
<td>10.</td>
<td>Conveyor K11-10D</td>
<td>300</td>
<td>1600</td>
<td>180.9</td>
<td>9.2</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Conveyor K11-10E</td>
<td>300</td>
<td>1400</td>
<td>26.0</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Conveyor K11-11</td>
<td>300</td>
<td>1400</td>
<td>98.0</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Conveyor K11-12</td>
<td>300</td>
<td>1400</td>
<td>98.0</td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Conveyor K11-13</td>
<td>300</td>
<td>1400</td>
<td>107</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Conveyor K11-14</td>
<td>300</td>
<td>1400</td>
<td>107</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Conveyor K11-15</td>
<td>150</td>
<td>1200</td>
<td>32.5</td>
<td>0</td>
<td>Reversible</td>
</tr>
<tr>
<td>17.</td>
<td>Conveyor K11-16</td>
<td>150</td>
<td>1200</td>
<td>29.5</td>
<td>0</td>
<td>Reversible</td>
</tr>
<tr>
<td>18.</td>
<td>Conveyor K11-17</td>
<td>100</td>
<td>1200</td>
<td>11</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Conveyor K11-18</td>
<td>100</td>
<td>1200</td>
<td>123.1</td>
<td>17.75</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Conveyor K11-19</td>
<td>150</td>
<td>1200</td>
<td>157.5</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Conveyor K11-20</td>
<td>150</td>
<td>1200</td>
<td>160.5</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Conveyor K11-21</td>
<td>150</td>
<td>1200</td>
<td>104.5</td>
<td>15.3</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Conveyor K11-22</td>
<td>150</td>
<td>1200</td>
<td>107.5</td>
<td>15.3</td>
<td></td>
</tr>
</tbody>
</table>
Troughing angle for all conveyors should be 35°

09. Brief Details for Bins / Bunkers / Hoppers / Chutes etc. at fuel/ flux crushing & screening and fines conveyor route

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Conveyor</td>
<td>Power</td>
<td>L.P.M.</td>
<td>HP</td>
</tr>
<tr>
<td>24.</td>
<td>Conveyor KA-1</td>
<td>300</td>
<td>1400</td>
<td>148.224</td>
</tr>
<tr>
<td>25.</td>
<td>Conveyor KA-3</td>
<td>80</td>
<td>800</td>
<td>197.523</td>
</tr>
<tr>
<td>26.</td>
<td>Conveyor KA-4</td>
<td>80</td>
<td>800</td>
<td>11.552</td>
</tr>
<tr>
<td>27.</td>
<td>Conveyor KA-5</td>
<td>80</td>
<td>800</td>
<td>342.5</td>
</tr>
<tr>
<td>28.</td>
<td>Conveyor KA-6</td>
<td>80</td>
<td>800</td>
<td>14.272</td>
</tr>
<tr>
<td>29.</td>
<td>Conveyor C3A-C2</td>
<td>150</td>
<td>800</td>
<td>74</td>
</tr>
</tbody>
</table>

A. CHUTES/ GATES etc

<table>
<thead>
<tr>
<th>Type of Chutes</th>
<th>Fabricated Steel Construction of Carbon Steel with stiffened plates of 10 mm thk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Various.</td>
</tr>
<tr>
<td>Material to be stored</td>
<td>Various</td>
</tr>
<tr>
<td>Bins construction / Shape</td>
<td>As per drawing</td>
</tr>
<tr>
<td>No. of outlets/ bunker</td>
<td>One each</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Liners</th>
<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>
<td></td>
</tr>
<tr>
<td>20-80</td>
<td>40 thk rubber liner</td>
<td>- do-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-20 mm</td>
<td>8mm thk SS-409M</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. SKIRT BOARD

<table>
<thead>
<tr>
<th>Type of skirt boards</th>
<th>Fabricated Steel Construction of Carbon Steel with stiffened plates of 10 mm thk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Various places at receiving point of belt conveyors</td>
</tr>
<tr>
<td>Material to be stored</td>
<td>Various</td>
</tr>
</tbody>
</table>
### C. LIME DOLO CRUSHING BUILDING

#### (Total No. of Bunkers-2)

#### i) Lime Dolo Surge Bin (Above Primary Hammer Mill)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Bin / Bunker</td>
<td>Fabricated Steel Construction of Carbon Steel with stiffened plates of 10 mm thk.</td>
</tr>
<tr>
<td>Quantity</td>
<td>1 No.</td>
</tr>
<tr>
<td>Effective volume of bunker</td>
<td>100 m³</td>
</tr>
<tr>
<td>Material to be stored</td>
<td>Lime stone/ Dolomite mix</td>
</tr>
<tr>
<td>Bulk density</td>
<td>1.6 t/m³</td>
</tr>
<tr>
<td>Material size</td>
<td>(-)50 mm</td>
</tr>
<tr>
<td>Moisture</td>
<td>8 %</td>
</tr>
<tr>
<td>Bins construction / shape</td>
<td>As per drawing</td>
</tr>
<tr>
<td>No. of outlets/ bunker</td>
<td>One each</td>
</tr>
<tr>
<td>Liners</td>
<td>10mm SS liner, AISI-409</td>
</tr>
<tr>
<td>Level Indicating System</td>
<td>Yes</td>
</tr>
<tr>
<td>Sealing</td>
<td>Air Cannon</td>
</tr>
<tr>
<td>Air Blaster/Bin Vibrator</td>
<td>None</td>
</tr>
</tbody>
</table>

#### ii) Lime - Dolomite Surge Bin (above Secondary Hammer Mill)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Bin / Bunker</td>
<td>Fabricated Steel Construction of Carbon Steel with stiffened plates of 10 mm thk.</td>
</tr>
<tr>
<td>Quantity</td>
<td>1 No.</td>
</tr>
<tr>
<td>Effective volume of each bunker</td>
<td>75 m³</td>
</tr>
<tr>
<td>Material to be stored</td>
<td>Lime Stone &amp; Dolomite Mix</td>
</tr>
<tr>
<td>Bulk density</td>
<td>1.6 t/m3</td>
</tr>
<tr>
<td>Material size</td>
<td>(-)50 mm</td>
</tr>
<tr>
<td>Moisture</td>
<td>8 %</td>
</tr>
<tr>
<td>Bins construction / shape</td>
<td>As per drawing</td>
</tr>
<tr>
<td>No. of outlets/ bunker</td>
<td>One each</td>
</tr>
<tr>
<td>Liners</td>
<td>10 thk SS line, AISI-409</td>
</tr>
<tr>
<td>Level Indicating System</td>
<td>Yes</td>
</tr>
<tr>
<td>Sealing</td>
<td>Air Cannon</td>
</tr>
<tr>
<td>Air Blaster/Bin Vibrator</td>
<td>None</td>
</tr>
</tbody>
</table>
### D. LIME DOLO SCREEN BUILDING (LDS) (Total No. of Bunkers-1)

<table>
<thead>
<tr>
<th>i) Lime Stone &amp; Dolomite Bunker</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Bin / Bunker</td>
<td>Fabricated Steel Construction of Carbon Steel with stiffened plates of 10 mm thk.</td>
</tr>
<tr>
<td>Quantity</td>
<td>1 No.</td>
</tr>
<tr>
<td>Effective volume of bunker</td>
<td>100 m³</td>
</tr>
<tr>
<td>Material to be stored</td>
<td>Lime stone &amp; Dolomite mix</td>
</tr>
<tr>
<td>Bulk density</td>
<td>1.6 t/m³</td>
</tr>
<tr>
<td>Material size</td>
<td>(-)50 mm</td>
</tr>
<tr>
<td>Moisture</td>
<td>8 %</td>
</tr>
<tr>
<td>Bins construction / shape</td>
<td>As per drawing</td>
</tr>
<tr>
<td>No. of outlets/ bunker</td>
<td>Two nos.</td>
</tr>
<tr>
<td>Liners</td>
<td>Vertical – PU 25 mm thk. Conical (2m above) – 60 mm Steel reinforced rubber</td>
</tr>
<tr>
<td>Level Indicating System</td>
<td>Yes</td>
</tr>
<tr>
<td>Sealing</td>
<td>Air Cannon</td>
</tr>
<tr>
<td>Air Blaster/ Bin Vibrator</td>
<td>None</td>
</tr>
</tbody>
</table>

### E) COKE BREEZE FINES BUILDING (Total No. of Bunkers-3)

<table>
<thead>
<tr>
<th>Type of Bin / Bunker</th>
<th>Fabricated Steel Construction of Carbon Steel with stiffened plates of 10 mm thk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>3 Nos.</td>
</tr>
<tr>
<td>Effective volume of each bunker</td>
<td>75 m³</td>
</tr>
<tr>
<td>Material to be stored</td>
<td>Coke Fines</td>
</tr>
<tr>
<td>Bulk density</td>
<td>0.5 t/m³</td>
</tr>
<tr>
<td>Material size</td>
<td>(-) 8 mm</td>
</tr>
<tr>
<td>Moisture</td>
<td>8 %</td>
</tr>
<tr>
<td>Bins construction / Shape</td>
<td>As per drawing</td>
</tr>
<tr>
<td>No. of outlets/ bunker</td>
<td>One each</td>
</tr>
<tr>
<td>Liners</td>
<td>Vertical – PU 25 mm thk. Conical (2m above) – 8mm thk. Stainless Steel SS - 409</td>
</tr>
<tr>
<td>Level Indicating System</td>
<td>Yes</td>
</tr>
<tr>
<td>Sealing</td>
<td>Air Cannon</td>
</tr>
<tr>
<td>Air Blaster/ Bin Vibrator</td>
<td>Bin Vibrator</td>
</tr>
</tbody>
</table>
10. Handling & Hoisting facilities:

Some of the handling & hoisting facilities are given hereunder tentatively:

<table>
<thead>
<tr>
<th>SL NO.</th>
<th>DESCRIPTION</th>
<th>LOCATION</th>
<th>QTY.</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ELECTRIC HOIST, CAP.- 2T, LIFT-10m</td>
<td>JH-CK1</td>
<td>1</td>
<td>At RMHS area of SP-III</td>
</tr>
<tr>
<td>2.</td>
<td>3T ELECTRIC HOIST Lift-24m</td>
<td>Coke breeze crushing bldg.</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>3.</td>
<td>10T x13.0M SPAN EOT CRANE, Lift = 24m</td>
<td>- do -</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>4.</td>
<td>5T ELECTRIC HOIST LIFTING, LIFT-22m</td>
<td>Coke breeze screening bldg.</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>5.</td>
<td>ELECTRIC HOIST, CAP 2T WITH TROLLEY, LIFT-18m</td>
<td>JH-CK3</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>6.</td>
<td>DG EOT CRANE 16/5 T Lift=10m, span-11m</td>
<td>Coke breeze grinding bldg.</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>7.</td>
<td>ELECTRIC HOIST, CAP.- 3T, LIFT-15m</td>
<td>- do -</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>8.</td>
<td>ELECTRIC HOIST, CAP.- 2T, LIFT-19m</td>
<td>- do -</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>9.</td>
<td>MANUAL HOIST, CAP.- 1T, LIFT-8m</td>
<td>- do -</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>10.</td>
<td>ELECTRIC HOIST, CAP.- 5T, LIFT-26m</td>
<td>Flux crushing bldg.</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>11.</td>
<td>ELECTRIC HOIST, CAP.- 2T, LIFT-15m</td>
<td>Flux screening bldg.</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>12.</td>
<td>2t EH, Lift = 13m</td>
<td>JH-C3A</td>
<td>1</td>
<td>RETURN FINES</td>
</tr>
<tr>
<td>13.</td>
<td>3t EH, Lift = 19m</td>
<td>JH-C3 (Relocated)</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>14.</td>
<td>3t EH, Lift = 19m</td>
<td>JH-C4 (Relocated)</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>15.</td>
<td>5t EH, Lift = 19m</td>
<td>JH-C5 (Relocated)</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>16.</td>
<td>3t EH, Lift = 19m</td>
<td>JH-C6 (Relocated)</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>17.</td>
<td>2t EH, Lift = 15m</td>
<td>JH-C7</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>18.</td>
<td>3t EH, Lift = 17m</td>
<td>JH-127</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Location</td>
<td>Quantity</td>
<td>Notes</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>----------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td>19</td>
<td>2t EH, Lift = 9m</td>
<td>JH-102 (Pent House)</td>
<td>1</td>
<td>- do -</td>
</tr>
<tr>
<td>20</td>
<td>Under slung crane, Cap- 7.5t, lift-12m</td>
<td>Compressor house</td>
<td>1</td>
<td>For Coke sorting plant</td>
</tr>
</tbody>
</table>

Above facilities are indicative & based on proposed Junction Houses. The Bottom height of Mono Rail/ Rail Top/ Span/ Lift/ capacity may change according to the position of conveyor/ equipment during detail engineering.

Electric/Manual hoists, EOT crane, U/S crane etc. wherever required for the adequate handling and maintenance of the plant/ system, apart from mentioned in CS, shall be included in the scope of Contractor.
04.02  CIVIL WORKS

04.02.01 This section of the specification covers entire civil engineering work for buildings, technological structures, new equipment and facilities for all production, auxiliary and ancillary units, foundation for all buildings, structures and main equipment described elsewhere in this specification on a Turnkey basis for Augmentation OF Fuel & FLUX CRUSHING FACILITIES.

Augmentation OF Fuel & FLUX CRUSHING FACILITIES will come up in the area as indicated in the general layout drawing. Paved areas, approach roads, drainage and sewerage as required, trenches, pits and all other miscellaneous civil engineering works, including demolition, relocation and diversion [if necessary] of the existing foundations, pits, trenches, drains, underground and overhead services, roads, tracks, buried cables, etc., for the proposed Plants.

04.02.02 The proposal is to install Coal Handling and Coke Sorting Plant for COBP#11 and augmentation of fuel and flux for the new sinter machine of SP-III in an area indicated in the general layout drg and situated within the Bhilai Steel Plant boundary. The contractor has been advised to visit the site and acquaint himself of the site condition and collect all such data as may be necessary. The scope shall cover complete civil engineering work for the proposed plant within its battery limit, on turnkey basis including design supply of all materials and execution. Please refer clause 02.00 for scope of work and battery limits.

04.02.03 Soil Characteristics

Detail soil investigation report along-with Bore log data available with the Employer shall be considered by contractor for estimation and design. Foundation recommendation given in the report shall be final and binding on the contractor.

04.02.04 The major civil works involved
A. For installation of the Coal Handling shall pertain to the following areas:

- Addition of 5 nos. of RCC mixing bins (Silos), each of 500t storage in 3rd row of silos.
- Provision 2 nos. of additional reversible hammer mills (designated as hammer mill 7&8), each of capacity 350t/h in existing row of hammer mills after extending the existing final crushing station suitably.
- Up rating & modification of existing collecting conveyors Y7-12 & Y7-13 to 1000 t/hr. capacity in the existing location with minimum shutdown.
- Connecting conveyor stream, connecting new coal tower no.7 with existing coal handling plant.
- Connecting conveyors for new silos & new crushers to the existing Coal Handling Plant.

B. For installation of the Coke Sorting Plant shall pertain to the following areas:

The major scope of work of Coke Sorting Plant comprising of Coke crushing station, coke screening station, coke breeze bunkers, emergency coke storage yard, coke dedusting units, junction houses, traveling tripper gallery, galleries and associated mechanical, civil, structural, electrical works of COBP # 11

C. For Augmentation in Flux - Fuel Preparation and Plant return fines handling for SP III facilities comprises of the following:

- Connecting existing Blast furnace return fines C-Line conveyor with new BF#8 return fines conveyor.
- Up gradation / Addition of coke crushing and screening and grinding facilities.
- Up gradation/ addition of Flux crushing & screening facilities.
- Dismantling of C-line conveyors & Junction houses (including foundation of Junction houses & trestle of conveyors with an undulation of about +500mm) & Re-routing of existing sinter fines conveyors (C-lines).
04.02.05 The materials and services shall include but not be limited to the following

i. Earthwork for foundations, pits, trenches, basements, tunnels, drains, sumps, sewers, etc including final grading up to +/- 500mm at the locations of proposed units with disposal of surplus earth up to a distance of 10 KM.

ii. Reinforced concrete for foundations, channels, tunnels, basements, pits, trenches, sumps, etc.

iii. Soling and sub-grade work for all foundations, flooring, trenches, pits and other underground structures

iv. All doors, windows, gates, etc.

v. Reinforced concrete work in columns, beams, floors, slabs, frames and other superstructures

vi. Reinforced concrete work in supporting structures of equipments

vii. All masonry work in superstructure and partition. Fly ash cement bricks shall be used in masonry constructions.

viii. All finishing work in flooring, wall-cladding and ceiling

ix. All necessary waterproofing, heat resisting, fireproofing and anti-corrosive treatment to building structures and foundations

x. All plumbing, rainwater drainage, sanitary sewerage works for all buildings, roadway, parking, paved areas and open spaces within the battery limits of this specification

xi. All temporary buildings, offices, roads, tracks and services for construction of the above package.

xii. Removal of all materials, cleaning, and handing over of site in a presentable manner.

xiii. Walkways of ground portals shall be of RCC over 75mm thick PCC.

xiv. All conveyor galleries shall be of cast in situ RCC in full width However for all return fines for SP-III route conveyors, covered gallery with structural floor shall be provided.

It shall include all works required for completeness of the project. All the materials and workmanship shall conform to relevant Bureau of Indian Standard norms and specifications.
04.02.06 Design parameters

i. Loading, design of structures, permissible stresses and other design criteria shall generally be in accordance with the latest edition of relevant I.S. Codes and practices, viz., IS – 456; IS – 875; IS – 1893; IS – 2974; IS –3370; IS – 1786; IS – 432; etc.

ii. All buildings and supporting structures including connections and foundations shall be designed to withstand the most adverse combination of loads

iii. Rigidity of the building structures in both directions and stability of structures for worst combination of loadings shall be ensured. Other precautions like waterproofing, dust proofing, protection from heat, sound and corrosion etc. shall also be considered.

iv. SBC shall be as per approved Geo Technical report for designing of foundations water table to be considered at ground level

v. Earth pressure for all underground structures shall be calculated using co-efficient of earth pressure at rest, co-efficient of active or passive earth pressure as applicable.

vi. Contractor shall submit drawings with design calculations in soft (readable/editable) and hard copies.

vii. Contractor shall establish quality control lab at site and concrete mix produced from batching plant shall be used in works.

viii. All civil engineering works shall be designed and executed as per relevant IS codes.

04.02.07 Concrete and reinforced concrete structures
i. Concrete and reinforced concrete structures including superstructures and underground construction shall be designed and constructed in accordance with I.S. Codes. However, concrete of following minimum grades shall be used:

Leveling courses/Mudmat M7.5/M 10
R.C.C. M25
For flooring / paving etc. M 20 grade concrete may be used.

ii. The mix-design shall be adopted for proper strength, workability and service requirement.

iii. Additives and retarding agents for concreting, floor hardening additives, acid resisting and integral waterproofing compounds shall be added to the concrete depending upon requirements.

04.02.08 Finishes

i. All floor finishes shall be as per B.I.S./ specification and shall meet the functional requirements.

ii. The wall finishes shall be as per B.I.S./ specification and shall meet the functional requirements.

iii. The roof finishes shall be as per B.I.S./ specification and shall meet the functional requirements.

04.02.09 Necessary false ceiling shall have to be provided as per technological requirements and specified elsewhere in this specification.

04.02.10 All concrete roofs exposed to weather shall be provided with waterproof treatment of polymer based cementsation material of SIKO,CIKA,FOSROC. Drainage of rainwater from roof shall be ensured by rainwater down comers and proper slope.

04.02.11 All doors and windows shall be provided as per technological requirements.
04.02.12 Adequate natural lighting and ventilation shall be planned and provided for general buildings.

04.02.13 The connections of the roads, drains and sewer lines, being provided for the project shall be properly co-ordinated with the existing lines.
   i. The roadways shall be so laid as to facilitate movement of materials, equipment, products, etc. as well as operators and executives.
   ii. Necessary paved areas shall be provided around plant and auxiliary units for car-parking.
   iii. Roads with 2m berm on both sides shall be provided for all the facilities under the scope of contractor. Roads shall be of bituminous (WBM type)

04.02.14 Drainage and sewerage
   i. All rain water drainage, sanitary, faecal sewerage and plumbing system for all buildings and open areas shall be provided, as required.
   ii. All service pipelines, water supply, plumbing and other utility pipelines and electrical wiring within the ancillary and auxiliary buildings of RC/ Masonry construction, will be concealed within the masonry, concrete work etc.
   iii. All auxiliary and ancillary buildings housing toilets/ drinking water facilities shall be provided with water storage tanks at roof of the building separately for drinking and sanitary purposes.
   iv. All surface drains shall be covered with pre cast slabs/ gratings, as per requirements where ever necessary.
   v. Road side drains shall be of RCC and garland drains around buildings shall be of masonry.

04.02.15 The contractor shall divert, at his own cost, any unforeseen underground facilities, pipelines that need to be diverted during civil construction in consultation with the Employer.

04.02.16 The Contractor shall indicate the quantities of major civil engineering works like excavation, PCC, RCC, reinforcing steel, inserts, shuttering, brickwork, roadwork, pipelines, etc. under his scope of work as indicated
under ANNEXURE -I. The Contractor shall not make any additional claim if the total concrete quantity or quantity of any of the civil engineering items required for completion of the entire package as per terms of contract exceed the quantity indicated by the Contractor in Annexure-I of this section. The Contractor shall also indicate soil investigation and site/ topographical survey, if any, to be undertaken by him.

04.02.17 The Contractor shall indicate the estimated number of civil engineering drawings. [in equivalent A1 size]

04.02.18 The Contractor shall submit all basic engineering, schematic and subsequently detailed civil engineering drawings along with relevant load data and design calculations for Employer’s approval as indicated under ANNEXURE -II as per schedule/ documentation requirements.

04.02.19 **General instructions**

1) **Local conditions**

The Contractor, before submitting his tender, shall visit the site and ascertain the local conditions, labour rules, availability of construction materials, traffic restrictions, all obstructions in the area and also ascertain all site conditions including the sub-soil conditions and shall allow for any extras likely to be incurred due to all such conditions in his quoted prices. After the award of work no additional claims will be entertained on these accounts under any circumstances, whatsoever, from the Contractor.

2) **Setting out and leveling**

The Contractor shall set out and level the work and will be responsible for the accuracy of the same. He is to provide all instruments and proper qualified staff with labour for getting his work checked by Engineer, if so desired by the Engineer. Such checking, if any, shall not, however, relieve the Contractor in any way, of his responsibility for correct setting out.
3) **Safety**

The Contractor shall take adequate precautions to ensure complete safety and prevention of accidents at site and shall be responsible for the same. The safety precautions shall conform to the safety regulations prescribed by the Safety Code for constructions and relevant Indian Standard Codes, some of which are stated below:

- IS 4014:1967 : Safety Regulations for scaffolding work
- IS 4081:1986 : Safety Code for drilling and blasting operations
- IS 7923:1985 : Safety Code for working with Construction machinery

4) **Keeping work free from water**

The Contractor shall provide and maintain at his own cost, pumps and other equipments to keep the works free from water and continued to do so until the handing over of the works.

**Rubbish**

The Contractor shall keep the site clear on a continuous basis of all rubbish etc. which may arise out of the work executed by him and dispose them suitably in allotted areas.

5) **Bench Marks, Reference Pillars etc.**

The Contractor shall protect all benchmark, and reference pillars /lines including ground water gauges from damage or movement during working. In case of any damage the Contractor shall have to restore the same to its original condition at his own cost.
6) Standards

Unless otherwise mentioned in the specifications, all applicable codes/standards as published by the Bureau of Indian Standards on the date of award of contract shall govern the work in respect of design, workmanship, quality and properties of materials, method of testing and other pertinent features. In case of variance between this specifications and IS Codes/Standards, the provisions of this specification shall prevail up to the extent of such variance.

7) Drawings

Work shall be carried out as per drawings prepared by the Contractor and approved by the Employer. The drawings shall include General Arrangement, shuttering, excavation, anchorage plans, bolt plans, insert plan and details, conduit plans, etc required for execution of the job. Also, the design calculations shall be submitted in requisite number of copies (as mentioned elsewhere) for the approval by the Employer.

8) This specification shall be read in conjunction with the general conditions of contract and other project requirement provided in the other volumes containing special conditions of contract, instruction to contractors, special instructions to contractors etc.

Specification for civil works comprises, besides this section, one volume of General Technical Specification (11-CIVIL–GS-07) for civil engineering works. This volume shall also form part of this section and therefore shall be read in conjunction with this section.
Estimated Quantities for Civil Works

1) Excavation
2) RCC
3) PCC
4) Shuttering
5) Reinforcement Steel
6) PCC Flooring
7) Finishing
8) Inserts/ Bolts
9) Any miscellaneous items deemed necessary for successful completion of civil works of the proposed plant.
List of Civil Engineering Drawings and Documents for Approval/Information

Group – 1 : For Approval

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Drawing numbering system</td>
</tr>
<tr>
<td>2.</td>
<td>List of drawings, with drawing Nos. and title</td>
</tr>
<tr>
<td>3.</td>
<td>Basic design criteria and loading for all buildings, structures and foundations.</td>
</tr>
<tr>
<td>4.</td>
<td>Site plan/layout drawing with battery limit in 1:500 scale</td>
</tr>
<tr>
<td>5.</td>
<td>Design calculations along with load data for buildings, foundation for equipment and structures, auxiliary etc, (design calculations shall be submitted along with or before submission of G.A. and design drawings).</td>
</tr>
<tr>
<td>6.</td>
<td>General arrangement plan and sectional drawings with all dimensions and details for foundation of equipment and structures , auxiliary facilities etc.</td>
</tr>
<tr>
<td>7.</td>
<td>Layout and sectional details of drainage, sewerage network with all invert levels slopes, sizes, dimensions, manholes top level etc.</td>
</tr>
</tbody>
</table>

Group – 2 : For information and comments, if any

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Detail reinforcement drawings.</td>
</tr>
<tr>
<td>2.</td>
<td>Detail of bolts, inserts/ embedment , coverings, etc.</td>
</tr>
</tbody>
</table>
04.03 STRUCTURAL WORKS

SECTION-1 GENERAL

1.1 This specification for structural works furnished herein are intended as guidelines for execution of the works satisfying the Employer's requirements as also complying with all technical norms in totality.

This specification is to be read in conjunction with GTS (Turnkey) for structural works of the project.

1.2 Units:

Structural steel work under the scope of this contract cover the following main facilities envisaged for Coal Handling Plant & Coke Sorting plant of COBP # 11 and BF return, Coke Breeze & Fuel and Flux Crushing-Screening Facilities at SP-III (Package no – 064 ) of Bhilai Steel Plant . Technological layout drawing & Flow diagrams which are issued along with Contract Specification shall be referred to in this context.


Junction Houses and other Buildings : JH-1 , JH-2 , JH-3 , JH-4, JH-5 , JH-6 , JH-7, JH-8 , JH-9 , JH-10 , JH-11 , JH-12 , JH-13 , JHZ-17, Surge Bunker Building, Coke De-dusting Unit, Coke Crushing Station, Coke
Screening Station, Coke Breeze Bunker, Take -up Unit, Coke Car Repair Shop, Return Car Bunker, etc.

New units (BF return, Coke Breeze & Fuel and Flux Crushing- Screening facilities at SP-III):

Conveyor Galleries : C3A-G1 , C3-G1, C4- G1, C4-G2,C5-G1,C6-G1, C6-G2 , C7-G1, J127-G1, C102-G1, CK1-G1, CK2-G1, CK3-G1, CK4-G1 (to Screen Bldg.), C111A-G1, C113A-G1, L114A-G1.


Further to the above-mentioned units, any other units not mentioned here but required for technological requirement shall also to be included in the scope of work.

Modification, Addition & Strengthening of Existing Units

- Suitable modification and strengthening in existing galleries/ junction house and other units are required to receive up taking materials for which Flow Diagram of the System shall be referred.

1.3 List of Steel Structures

Columns ( rolled section or built-up ), column bracings, Crane Girder, Surge Girder, Gable Platforms, Rails & Fixtures, Monorail beams and supports, Roof Trusses, Roof Girders, Bunker Girder, Bunker, Liner
Plate, Purlins, Roof hand rails, Floor Beams, Sheeting Posts, Side runners, Louvers, Bracings, Sag angles, Sag rods, wind-ties on roof, Wind girders, Platforms, Walk-ways, Stairs, Ladders, Hand rails, Gutters and Down comers, Gallery truss, Gallery Trestles, Bracings, rafter & rafter bracings for gallery truss, End portal, Top & Bottom chord Bracings for Gallery Trusses, Roof & side Cladding with Troughed colour coated galvalume metal sheets and FRP sheets.

1.4 The work to be performed under this specification consists of design, engineering, dismantling, modification, strengthening, addition of new floors, supply, fabrication, erection and cladding, as well as providing all labour, materials, consumables, equipment, temporary works, temporary labour and staff colony, constructional plant, fuel supply, transportation and all incidental items not shown or specified but reasonably implied or necessary for the completion and proper functioning of all the above units and auxiliaries, all in strict accordance with the specifications, including revisions and amendments thereto as may be required during the execution of the work.

1.5 Supply of all materials including structural steel, roof cladding & side-cladding sheets, fasteners, paints, consumables like gas, electrodes etc. and all other materials as deemed necessary for proper completion of the work, are included in the scope of the Contractor.

1.6 The work shall be carried out according to the design/drawings to be developed by the Contractor and approved by the Owner/Consultant. For all buildings and structures, necessary layout and details are to be developed by the Contractor keeping in view the statutory & functional requirements of the plant and facilities and providing enough space and access for operation, use and maintenance. Certain minimum requirements are indicated in this specification for guidance purpose only. However, the Contractor’s offer shall cover the complete
requirements as per the best prevailing practices and to the complete satisfaction of the Owner.

1.7 Fabrication of structures shall be carried out out-side BSP Plant Premises.

1.8 Junction house flooring shall be RCC construction. Conveyor gallery flooring shall be of cast in situ RCC construction in full width. Coke dedusting unit, coke crushing station shall be of RCC up to top floor, above which these shall be steel structure. All bunkers including breeze bunkers and surge bunkers of RCC with structural steel roofing.

1.9 Sheeting of Conveyor Gallery, Junction Houses and others shall be colour coated (non-insulated) troughed galv-alume metal sheets ( Zinc aluminium alloy coated, not less than 150 gms / sq.m, having high tensile steel sheet (Fy 550 MPa) of 0.5 mm minimum thickness (BMT). The outside face (exposed face) shall be permanently colour coated with PVF2 paint of minimum DFT 20 microns over primer and inner side (internal face) shall be coated with same paint of minimum DFT 12 microns.

1.10 3 mm thick fibre glass reinforced polyester (FRP) sheets of profile matching with permanently colour coated sheets shall be used for Translucent sheets for natural lighting. The sheet shall have light diffusion classification = III as per table 3 of IS – 12866-1989.

1.11 Conveyor Gallery shall be covered on Roof & Sides.

SECTION - 2 SCOPE OF WORK

2.0. The scope of work shall cover, but shall not be exclusively limited to, the following:
• collection of all site related data & conducting site investigations,

• design, preparation of all design drawings, fabrication drawings,

• Dismantling, Modification, Addition of Floors, Strengthening of Existing Units.

• obtaining Owner's/Consultant's approval on general arrangements and design of structures

• Dismantling, retrieval, sorting and storing of any existing structures as directed by the owner.

• supply of all materials viz, raw steel, sheeting for roof and side cladding, and paints

• supply of fasteners like bolts, nuts, washers etc

• supply of consumables like electrodes for welding, gases for gas cutting etc

• supply of plant & machinery, tools tackles, instruments for fabrication and erection

• providing facilities for testing of materials and conducting NDT

• providing facilities for transport and handling

• deploying requisite skilled and unskilled manpower

• making arrangements for all services like approach to site, electricity, water etc
• fabrication of structures, their transport and proper storing at site
• erection of structures, claddings, gutters, down pipes etc
• application of paints at shop after fabrication and at site after erection
• providing all reasonable facilities for inspection by Owner/Consultant
• conducting NDT as stipulated by the Owner and making test results available to Owner/Consultant for evaluation
• compliance with primary acceptance tests/inspection, liquidation of defects; compliance with final acceptance tests/inspection, liquidation of defects;
• carrying out field-engineering decisions as desired by the Owner
• Preparation of "As Built" drawings for all the structures and hand over to the Owner the completed structural work to the Owner’s full satisfaction.
• Any other work deemed incidental for the completion of the overall work but not included in the above detailed scope.

SECTION – 3 DESIGN OF BUILDING STRUCTURES

3.1 Design considerations

3.1.0 General

3.1.01 Structures shall be designed such that they are economical and safe and meet the functional and service requirement of the technological process
for which they are designed. The architectural planning of the building shall be based on technological requirements.

3.1.02 The structures shall be designed conforming to the relevant safety regulations, Factory Acts, Electricity Rules and stipulations of Statutory bodies as applicable to the project and as per relevant Indian Codes of Practice or, any International Code approved by the Owner.

3.1.03 Natural ventilation shall be provided ensuring that it does not permit rain water entry into the building. Scope of natural lighting shall be used to the maximum possible extent.

3.2 **Design**

3.2.01 **Design of structures**

a) Design of steel structures shall be done in accordance with IS: 800-1984 or any equivalent international code of practice that may be acceptable to the Owner.

b) Structures subjected to fluctuating/reversal of stress (e.g. Rail Supp. Beams) shall be designed in accordance with IS: 1024-1979.

c) Resonance in structures: Structures supporting vibratory/reciprocating equipments shall be designed so as to obviate occurrence of resonance. The ratio of applied frequency to natural frequency shall not lie within the range 0.7 to 1.2.

3.2.02 **Loading codes**

a) All live loads shall be considered in accordance with IS: 875(Part-2) -1987.
b) Wind loads shall be in accordance with IS: 875(Part-3) -1987 and any other consideration specific to the site.

c) Seismic loads shall be in accordance with IS: 1893- Part 1, 2002 & IV, 2005 and important factor mentioned in the latest code shall be considered.

SECTION-4  FABRICATION OF STEEL STRUCTURES

4.1 Drawings

The Contractor shall prepare fabrication drawings, erection drawings, bill of materials, drawing office despatch lists / shipping documents, schedule of bolts and nuts and as built drawings. All drawing work shall be in metric system and all writing work shall be in English.

4.2 Material of Construction

4.2.1 All steel and other materials used for steelwork and in association with steelwork shall conform to appropriate Indian standards. Only tested materials shall be used unless written authority is obtained for the use of untested materials for certain secondary structural members.

Unless otherwise specified in the drawings

a) All rolled sections and plates up to & including 20 mm thickness shall conform to Grade "A" as per IS : 2062.

b) Plates of thickness above 20 mm and Plated structures subjected to dynamic loading shall conform to Grade "B" as per IS: 2062.
c) For High Tensile steel requirements, material conforming to IS: 8500 or SAIL- MA (HYA or HYB) shall be used.

4.2.2 Steel sheets shall conform to IS: 1079.

4.2.3 Steel tubes for structural purpose shall conform to IS: 1161 (of Grade Yst 240)

4.2.4 Translucent sheets shall be fibreglass reinforced polyester sheets of matching profile as per IS: 12866.

4.2.5 Colour coated sheets shall be as per appropriate standard.

4.2.6 Gutters shall be of copper bearing steel conforming to Grade "A" as per IS: 2062.

4.2.7 Rails shall conform to IS: 3443.

4.2.8 All black bolts, nuts and locknuts shall conform to IS: 1363 and IS: 1364 (for precision and semi precision hexagonal bolts) of property class 6.4 unless otherwise specified. Washers shall conform to IS: 6610.

4.2.9 All tapered washer shall be as per IS: 5372 for channels, and IS: 5374 for Joists. Spring washers shall conform to IS: 3063.

4.2.10 All HSFG bolts shall conform to IS: 3757. Assembly of joints using HSFG bolts shall conform to IS: 4000. Nuts and washers for HSFG bolts shall be as per IS: 6623 & IS: 6649 respectively.

4.2.11 Covered electrodes for arc welding shall conform to IS: 814.

4.2.12 Certified mill test reports of materials used in the work shall be made available for inspection by the Owner / Consultant upon request.
4.3 Fabrication

4.3.1 Fabrication of all structural steelwork shall be in accordance with IS: 800 or their equivalent foreign national standard of the country of origin of supply unless otherwise specified, and in conformity with various clauses of the Technical Specification.

4.3.2 Wherever practicable and wherever perfect matching of parts is required at site, members shall be shop assembled before despatch to minimise site work. Parts not completely assembled in the shop shall be secured, to the extent possible, to prevent damage during despatch.
5.1 Scope

The scope of work under erection includes in addition to provision of erection and transport equipments, tools and tackles, consumables, materials, labour and supervision, the following:

a) Storing and stacking at site of erection of all fabricated structural components/ units/assemblies till the time of erection.

b) Transportation of structures at site.

c) Receiving at site of structures including site handling /movement, unloading, storing and stacking at site of erection of technological structures such as bunkers and the related structures.

d) All minor rectification / modification such as:

i) Removal of bends, kinks, twists, etc. for parts damaged during transportation and handling;

ii) Cutting chipping, filing, grinding, etc., if required, for preparation and finishing of site connections;

iii) Reaming for use of next higher size bolt for holes which do not register or which are damaged.

iv) Welding of connections in place of bolting for which holes are either not drilled at all or wrongly drilled during fabrication.

e) Other rectification work such as

i) Re-fabrication of parts damaged beyond repair during transportation and handling or incorrectly fabricated.
ii) Fabrication of parts omitted during fabrication by oversight or subsequently found necessary.

iii) Plug-welding and re-drilling of holes which do not register and which cannot be reamed for use of next higher size bolt.

f) Fabrication of minor items/missing items or such important items as directed by the Owner / Consultant.

g) Assembly at site of steel structural components wherever required including temporary supports and staging.

h) Making arrangements for and providing all facilities for conducting ultrasonic X-ray or gamma ray tests on welds; getting the tests conducted by reputed testing laboratories, making available test films/ graphs, reports and interpretation.

i) Rectifying at site, damaged portions of shop primer by cleaning and touch-up paint.

j) Erection of structures including making connections by bolts/high strength friction grip bolts / welding.

k) Alignment of all structures true to line, level plumb and dimensions within specified limits of tolerances as per IS :12843 “Tolerance for Erection of Steel Structures”.

l) Application of second coat of primer paint and two coats of finishing paint at site after erection.

m) Grouting of all column bases after proper alignment of columns and only after obtaining clearance from Owner / Consultant.

n) Conducting preliminary acceptance and final acceptance tests.
o) Preparation of as built drawings, preparing of sketches/drawings to suit field engineering decisions, availability of material, convenience of fabrication, transportation and erection and changes during fabrication and erection. All such works are subject to approval by the Owner / Consultant.

SECTION-6 PAINTING OF BUILDING STEEL STRUCTURES

6.1 All steel structural work shall be painted as follows unless otherwise stated in the drawing / Technical Specification.

6.2 Surface preparation

The steel surface which is to be painted shall be cleaned of dirt and grease, and the heavier layers of rust shall be removed by chipping prior to actual surface preparation to a specified grade.

Following are the type and standards of surface preparation to be followed based on the requirement of a particular painting system or as specified in the design drawings.

Manual/Power tool cleaning: - Manual/Power tool cleaning shall be done as per Grade St-2 or St-3 of Swedish Standard Institution SIS 05 5900 or cl. 6.2.1.1 & 6.2.1.2 of IS: 1477 - 1987 (Part - 1).

Grade St-2:- Thorough scraping and wire brushing, machine brushing, grinding etc. This grade of preparation shall remove loose mill scale, rust and foreign matter. Finally the surface is to be cleaned with a vacuum cleaner or with clean compressed air or clean brush. After preparation, the surface should have a faint metallic sheen. The appearance shall correspond to the prints designated St-2.
If no grade of surface preparation is specified, St-2 grade of preparation as per Swedish Standard shall be followed.

6.3 **Paint System**

(2P1+ 2F1) as per GTS of Paint shall be adopted.

All paints shall be of approved and shade as per Employer / Consultant's requirements.

6.4 **Paint and Painting**

Manufacture of paints, mixing of paints, etc. shall be generally according to the relevant IS codes of practice.

Generally compatibility between primer intermediate and finishing paint shall be certified by the paint manufacturer supplying the paints.

Guarantee period shall commerce from the date of completion of finishing coat of paint on entire structures. The guarantee period shall be indicated depending on the type of surface preparation and system of painting. To fulfil this obligations, the Contractor may obtain from the painting manufacturer, guarantee for the performance of paint/painted surfaces.

Application of paint shall be by spraying or brushing as per IS: 486-1983 and IS: 487-1985 and in uniform layers of 50% overlapping strokes by skilled painters. Painting shall not be done when the temperature is less than 5 degree C or more than 45 degree C and relative humidity is more than 85% unless manufacturer's recommendations permit. Also painting shall not be done in foggy weather. During application, paint agitation
must be provided where such agitation is recommended by the manufacturer.

Painting shall be applied at painting manufacturer's recommended rates. The number of coats shall be such that minimum dry film thickness specified is achieved. The dry film thickness (DFT) of painted surfaces shall be checked with ELCOMETER or measuring gauges to ensure specified DFT.

All structures shall receive one coats of primer paint at shop after fabrication before despatch after surface preparation has been done as per requirements.

Unless otherwise specified all structures after erection shall be given one coat of primer and two coats of finishing paint of approved colour and quality. The under coat shall have different tint to distinguish the same from the finishing coat.

The proposed make, quality and shade of paint shall have the approval of Employer / Consultant.

SECTION-7  Quantities of Structural Items.

The Contractor shall indicate the estimated quantities of structural items of work i.e. fabrication/ erection tonnage, sheeting in sq.m etc. Contractor shall not make any additional claim if structural quantity of any items required for completion of entire package as per terms of contract exceeds the quantity indicated by the Contractor.
4.04 FIRE PROTECTION SYSTEM

Contract Specification for Complete fire protection system has to be provided for CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors is given below.

4.04.01. INTRODUCTION

In order to combat any occurrence of fire in various areas/units of the proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors, an elaborate system of fire protection will be provided. The system has to be planned in conformity with Tariff Advisory Committee' guidelines, BIS and other relevant standard/codes.

Major Facilities envisaged are as following:

i. Fire detection and alarm system

ii. Fire Hydrant System

iii. Water spray system comprising of MVWS.

iv. Automatic clean agent system IG-541 only

v. Portable fire extinguishers

vi. Passive fire protection

4.04.02. SCOPE OF WORK AND SERVICES

The scope of work covers on turnkey basis design & engineering, supply, erection, painting, testing, commissioning, and handing over of complete Fire Protection System envisaged for the CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors of Bhilai steel plant 7.0 MT expansion. List of Two years operation and maintenance spares, necessary tools, spanners etc. required for regular operation/ maintenance of systems shall be supplied along with the equipment. Major work comprises of
following:

a/ Fire fighting water at a single point within the battery limit of the contractor shall be provided however Contractor has to tap water from this point and further design and supply of the entire fire fighting facilities under their scope of work.

b/ Fire Hydrant system consisting of internal as well as external hydrants for the entire area.

c/ Medium velocity water spray system (MVWS) for all Cable premises viz. cable tunnels / galleries / vaults / cellars and in all coal and coke conveyor galleries for CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors.

d/ Automatic Clean agent (IG 541 - Inergen) total flooding system for computer rooms/ PLC room/control rooms along with associated piping and equipment. IG-541 system shall be provided for computer rooms/ PLC room/control rooms of CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors.

e/ Microprocessor based Fire detection and Alarm system for various plant premises.

f/ Portable fire extinguishers as per GS-10.

g/ Piping, valves, sluice gates etc.

h/ All civil & structural works

i/ All electrics.

j/ Controls and instrumentation.

k/ Shop and site painting for all equipments, pipes etc.

l/ Erection, testing, commissioning, PG test and Warranty for the complete fire protection system
m/ All the requirements of TAC for complete FPS shall be incorporated by the contractor in their scope irrespective of whether the details are described in specification and/or shown in the drawings or not.

n/ Passive Fire Protection measures.

04.04.03. The scope of work and services to be rendered by the Contractor for installation of fire protection systems shall include but shall not be limited to the following activities.

i/ Design & engineering, handling at site, preparation of erection drawings, fabrication and erection as per approved drawings, site testing, painting, commissioning and fulfillment of guarantee of all fire protection systems, sub-systems and integrated systems as described above and also covered in general technical specification (GTS).

ii/ Miscellaneous materials and services shall include but not limited to the following:

a/ All piping integral to and/or between any equipment furnished under this specification, except as otherwise specified.

b/ Coupling guards for all exposed shafts and couplings.

c/ Foundation bolts, base plates, thrust blocks, duck-foot bends, matching flanges, supporting materials and shims.

d/ All necessary instruments, power and control wiring integral to any equipment furnished under this specification. This shall include terminal blocks and integral wiring to these terminal blocks for equipment requiring external connection.

e/ Earthing strips of all panels, & other fire fighting equipments supplied by the contractor shall be connected to the nearest earthing ring available at site.

f/ Digging of under ground trenches, laying of cables, laying of protection
slab/bricks over the cable routes, back filling of trench and levelling of earth if required.

g/ GI pipes/ conduits and other accessories wherever required for laying of cables.

h/ Other erection materials like cable supporting structures, channels, brackets, clamps and other hardware materials, as required, for laying of cables.

i/ All erection accessories, consumables and miscellaneous materials, though not specifically indicated in this specification, but actually required for completing the job in all respects.

j/ All necessary connections for hook-up with other system, if required and as per instruction of the employer.

k/ Erection, testing and commissioning materials.

l/ Initial fill of gas and other fire extinguishing media (including quantity required for PG test) and demonstration.

m/ Valve chambers for all isolation valves.

n/ Housing for deluge valves.

o/ Cylinder battery racks.
04.04.04. **All Civil works elaborated in Civil specification.**

Civil works pertaining to underground buried pipelines such as excavation, laying, backfilling, compacting, construction of valve chambers, manholes, laying of encasing pipes below roads shall also be in the scope of the Contractor as a part of pipe laying. In case group of existing or proposed pipes are crossing road, RCC culverts to be provided below the roads and the same are included in the scope of the contractor. Contractor has to also protect the existing services line found in course of laying of pipeline.

All civil works for completeness of fire protection systems which may not have been described but required technically.

04.04.05. **DRAWINGS AND DOCUMENTS**

**Drawings/documents to be furnished**

a/ Scope of work with general description of system and equipment supplied specifying the important features supplemented with scheme drawings. The contractor has to give a confirmation with respect to the scope of work as detailed in this specification excepting for the deviations, if any, to be listed in the schedule of deviation. The description to be accompanied by single line diagrams, and equipment layout to enable the Employer to have a proper appreciation of the equipment supplied and its operation.

b/ Specification of equipment/material along with their makes/catalogues. Approval certificate from authorizing bodies for various components of the systems.

c/ Time Schedule (Bar Chart L1) for implementation of jobs and number of persons to be deputed at site along with their experience/qualification and period of posting at site.

d/ List of mandatory spares.

f/ List of special tools and tackles.

g/ Certificate of approval from TAC and similar other authorising body for various component of the system.

04.04.06. **CONTRACT SPECIFICATION**
Contractor has to refer General Technical Specification (GS) for various fire protection systems / facilities for detailed specification. However a brief description is provided herewith.

04.04.06.01. Fire detection and alarm system

Fire detection and alarm will confirm to GTS (GS-10) and minutes of meeting. The detail TS for fire detection & alarm system is also included in separate chapter.

04.04.06.02. Fire Hydrant

Internal hydrant will be located at 30m interval and external hydrant will be located at 45 m interval. Internal hydrant will be provided on all the floors of the buildings, Junctions houses, office building, along the conveyor galleries, other process building etc. Landing valve / yard hydrant shall be as per IS: 5290, Type-A. (For detail of piping for hydrant system GS for water supply facilities which is included in separate chapter will be followed).

The hose cabinet shall be fabricated out of fiber reinforced plastic (thickness 2.5 mm) of size 750 mm x 600 mm x 250 mm. The top shall have pressed edge slightly projecting outside to prevent water (while cleaning etc.) from entering the cabinet. The cabinet shall be fitted with glass fronted door. The door shall be provided with a knob and a lock with duplicated key on the body of the door with a glass cover. The glass of the key box shall be easily replicable. Suitable hooks, etc, shall be provided in the cabinet to hold the hose reels etc. mentioned above. Suitable wall mounting bracket shall be provided with the cabinet. The Contractor has to furnish a fully dimensioned general arrangement drawing indicating materials of construction, relevant specifications, etc. for approval.

Each hydrant shall be provided with 15m long delivery hose (Type B IS636) with SS coupling and accessories.
04.04.06.03. **Water Spray System comprising of MVWS**

For protection of all Cable premises viz. cable tunnels / galleries / vaults / cellars and in all coal and coke conveyor galleries from fire Medium velocity water system will be provided.

MVWS envisaged is a special fixed pipe system connected to a reliable supply of adequate quantity of water and equipped with spray nozzles (projectors) for specific water discharge and impingement over the surface or area to be protected. The piping system is to be connected to the water supply through an automatically actuated valve (deluge valve) which can initiate flow of water. Deluge valves for the spray system are to be actuated by an automatic detection system for all Cable premises viz. cable tunnels / galleries / vaults / cellars and in all coal and coke conveyor galleries. All instrumentation points actuated by the FDA system will be addressable and controlled by FDA panel.

04.04.06.04. **Automatic IG 541 Clean Agent System Only**

All Computer rooms / PLC rooms / Control rooms Automatic Clean agent fire extinguishing system (IG 541) will be provided. These systems will function in automatic mode by actuation from Fire detection & alarm system in the respective premises. There shall be provision for manual operation also with a selector toggle.

When detectors detect fire, the signal will be communicated to the main control panel, which shows the address (along with location) of the actuated detector. On confirmation of fire by next detector falling in different software zone in the same premises, the respective Air-conditioning & Ventilation system will first trip and evacuation alarm signal will appear in the premises provided with these system followed by actual discharge of the gas(after time lag). The system shall be designed according to NFPA 12 and NFPA 2001. 100% reserve cylinders will be provided for all systems.

04.04.06.05. **Portable Fire Extinguishers**

Different types of portable fire extinguishers will be deployed in various area of the complex as a measure of first-aid fire fighting. Portable extinguishers will be conforming to IS codes mentioned below
and detailed specification provided in the GS-10.
Mechanical Foam (9L.) - IS: 10204-2001
DCP extinguisher - IS 2171-1999
CO2 extinguishers - IS:2878-1986
Water type (gas cartridge) - IS:940-2003
Fire Bucket - IS: 2546-1974

In addition clean agent portable fire extinguisher (Heptafluoro propane of 5.0 Kg capacity) shall be also provided as per distribution norm of clean agent extinguishers in the computer/Control rooms.

04.04.06.06. Passive Fire Protection System

Passive fire protection are an integral part of a complete fire protection system and are essential for prevention of spread of fire through openings in walls or floors. Following measures shall be provided:

- Fire Retardant Coating/Painting of cables for vertical runs & PVC conduit with fire retardant water based in-tumescent / ablative compound not toxic resistance to hydrocarbon acid. Alkali attack, water and oil resistance.
- Fire Retardant Coating/Painting of cables for horizontal run of cables and conduit 1m length of fire retardant coating will be provided at every 20 m interval. Cable shall have fire retardant water base in-tumescent/ ablative compound non toxic resistance to hydrocarbon, acid, alkali attack, water & oil resistance.
- Sealing of Cable Openings
- Partitions in Cable Channels /Tunnels / Galleries & Fire doors

04.04.06.07. Erection, Testing, Commissioning & Performance Guarantee

The erection of all plant and equipment shall be carried out according to the latest engineering practices and according to the working drawings, erection specification, instructions etc. duly approved by the Employer. The Contractor shall carry out the work in the presence and/or as per the instructions of site engineer/ supervisory personnel deputed by the Employer. The erection shall be carried out by highly skilled workmen.

The Contractor shall be responsible for paying strict attention to statutory regulations for prevention of accidents and to other safety rules. The regulations for prevention of accidents shall be deployed at appropriate
places and should be distinctly visible to all personnel working in the area.

The Contractor shall supply all required consumables, construction and erection materials, petrol, diesel oil, kerosene, solvents, sealing compound, tapes, brazing and soldering materials, welding and brazing gases, erection bolts, nuts and packing sheets/compounds, temporary supports, wooden blocks, spacers, templates, jute and cotton wastes, sand and emery paper etc. as required for the satisfactory completion of work.

The Contractor shall make his own arrangement for handling the equipment and pipelines at the stores and transporting it to the site of installation. In addition to the above, the Contractor shall follow all the relevant erection clauses/conditions stated under various chapters in the contract specification.

The Contractor shall provide all tools, labour including necessary subsistence, erection supervision, equipment, materials, accessories, to erect/install and make ready for operation, functionally complete total fire protection system for as described and specified in this specification.

**04.04.07 Testing, Commissioning & Performance Guarantee of the Complete System**

**Testing**

All tests and inspection of the installation shall be done in conformity with the functional and statutory requirement of the system. Contractor has to carry out testing and commissioning in presence of Chief Fire Officer (CFO) / Fire Brigade representative or MECON before the commissioning of the main units. The Contractor shall furnish a detailed testing and commissioning procedure for all the systems for approval by the employer. As soon as a given facility or a portion thereof is completed and ready to energize and start-up, the employer may test run and operate it without relieving the Contractor of his responsibility or guarantee.

**Start-up and commissioning**

i/ Contractor shall provide the services of all technicians, erection and start-up engineers necessary to bring the complete installation of fire
protection system into operation.

The Contractor shall be responsible for the integrated commissioning of the plant & equipment supplied by him including trials, commissioning and demonstration of performance guarantee test.

ii/ The Contractor shall render the following services:

a) Prepare equipment for trial runs and start-up

b) Start-up and commissioning of equipment.

c) Preliminary operation, initial operation, trial operation and Final acceptance test.

The Contractor shall be required to clean up the equipment and surrounding area and prepare it for trial runs and operation.

Priming connections, cooling water supply to bearings, lubrication piping to bearings, stuffing box jackets and sealing glands of all rotating equipment shall be checked by the Contractor.

Sequence checking of all control systems, pneumatic and cable connections, checking operation of all interlocks and protective devices shall be done by the Contractor.

Blow down of all piping systems, installations and removing strainers in piping and equipment, as required shall be done by the Contractor.

Calibration and adjustment of relay settings, instruments etc., disconnecting and reconnecting the driven and driving parts of any equipment and drives, as required, during the trial runs and rectification, if any shall be done by the Contractor.

The Contractor shall provide personnel as required for assisting starting up and commissioning of equipment as well as adjustments, repairs and rectifications of defects in erection of the equipment during commissioning of the equipment and upto final acceptance.

Commissioning
On completion of the trial operation, all the systems shall be under observation in operative condition. The Contractor shall provide skilled personnel including necessary tools and consumables wherever necessary to rectify the deficiencies observed.

04.04.08 Performance Guarantee

The performance guarantee tests shall be completed within a time schedule to be mutually agreed upon between the Employer and the Contractor. Details of the performance tests, test procedures and test schedules for the demonstration of the performance guarantee on NFPA Codes/TAC Regulations shall be submitted to the Employer and shall be mutually agreed upon.

The Contractor shall conduct the operation during the performance tests and shall take full responsibility of the operations.

If the Contractor is unable to achieve the performance values as a whole or in part during the performance tests, the Contractor shall repeat the tests for demonstrating the performance values. Before repeating the tests the Contractor shall take any and all measures as may be needed, at his own cost in order that the performance values can be achieved.

The observations of each performance test shall be recorded and signed by the Employer and the Contractor. If such data conform to the performance test values, the Contractor shall be entitled for the "Final Acceptance Certificate" from the Employer.

If even with two repetitive tests and if necessary, by using additional operating personnel from the Contractor's crew and at his own expenses, the performance values are not reached the Contractor shall undertake at his own cost such modification or replacement as are considered necessary to obtain the performance guarantee values and the responsibility to demonstrate performance guarantee shall continue to remain with the Contractor till so established.
04.05 GENERAL LAYOUT & TRANSPORTATION

04.05.01 General Layout

Introduction

SAIL - Bhilai Steel Plant, located at Bhilai in Durg District of Chhattisgarh, is planning for its expansion of Existing Steel plant to achieve hot metal production of 7.0 Mt with matching Steel making facilities. The Steel Plant is well connected by rail and road network. The nearest railway station is Bhilai on Howrah – Mumbai Line of the SEC Railway. The proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors will be almost located centrally of the plant. It is proposed to dismantle the existing SP-I (dismantling of SP-I by others). The proposed area for area of augmentation is well connected by rail and road network.

General Information about Land

The land for the proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors is generally flat and will require minor earthwork. However the earthwork is not covered under the scope of this package and the Contractor will be given a fairly leveled ground.

Notwithstanding with this micro-levelling upto 500 mm is included in the scope of work of contractor. Apart from this any earthwork required for roads and drainage will also be in the Contractor’s scope. Connection of internal roads, drain & sewerage to main roads, drains, sewerage within the battery limit is included in Contractor’s scope of work.

Proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors is coming within the existing area as such in general area clearance has been covered in separate package, however Contractor has to plan / ensure that existing facilities coming in the area should not be affected due to the proposed expansion.

General Layout of the Plant under Scope of Work of the Contractor

An Area Layout of the proposed CHP & CSP of COBP-11 and augmentation of Fuel & Flux Crushing & Screening facilities of SP–3 with rerouting of BF return C-Line Fines Conveyors is enclosed with this specification. This layout has been developed keeping in the view available space, smooth and uninterrupted flow of materials in
accordance with the technological requirements, safety clearances and statutory provisions.

The disposition of coal feeding conveyor along with new coal silos, extension of existing Hammer mill & coke sorting plant main technological units which are included in the scope of work of the contractor has been kept strictly in consonance with process and logistics vis-à-vis other units like Coke Oven Battery No. 11 whose approximate centre line co-ordinates have been kept as $X+4640.00$ approximately and CDCP along with total battery lies between $Y+7586.86$ approximately and $Y+7281.38$ approximately. In addition to this contractor has to note the following points.

The coal conveyor no. Y11-132 connecting the new coal tower-7 is running over existing cable tunnel, as there is no other space available. As such Civil & structural portion of the trestles for the above conveyor gallery are to be planned/designed in such a way that the existing cable tunnel is not disturbed.

5 nos. of coal silos of each 6m diameter have been proposed for coal blending. Civil foundations of supporting columns of the silos will be also designed in such a way that the existing cable tunnel running by the side of it should not get affected.

The proposed conveyor gallery no. Y11-132 is also running parallel to existing conveyor Y7-49 as such the new gallery will be designed in keeping in mind that both conveyor gallery should not foul in plan as well as elevation.

Dismantling / rerouting of existing facilities in vicinity of existing hammer crusher building extension is included in the scope of work of the Contractor.

The survey of the entire proposed alignment of conveyor and proposed area under scope of work w.r.t plant grid system is included in the scope of work of the contractor. The contractor has to carry out survey prior to submitting engineering drawing for BSP / MECON approval.

**Rerouting of Existing BF Sinter Return Conveyor**

Certain portion of Blast Furnace Sinter return conveyor gallery require rerouting to avoid fouling with the existing facilities, this has been marked on the general layout drawing. The alignment of conveyors planned within the battery limit of this package also coming within the existing areas. As such Contractor has to keep adequate clearances
with these existing facilities during detailing of the conveyor gallery & finalization of locations of their trestles with prior approval of BSP.

Coke Sorting plant

The proposed Coke Sorting plant is located in the dismantled portion of the SP-I.

The centre line of proposed new coal conveyor has been shown on the drawing together with new coal Silos and Hammer crusher building extension. Contractor has to ensure that all proposed facilities should not interfere with any of the existing facilities.

Relative locations of units have been shown on drawing no. MEC/S/9101/11/14/0/A/00/064.2522/R2.

New coke fines conveyor from New Coke sorting plant (CSP) has been also envisaged for evacuation of fines. This will also form part of the scope of work of the Contractor.

An internal road network has been planned to cater to the needs of various plant units and auxiliary services. These roads will be connected to main plant roads which are outside the scope of this package. A railway network has been planned for evacuation of coke breeze from the coke breeze bunker building.

04.05.02 Transportation

Railway Track Work

Contractor will include supply of rails, sleepers, turnouts, all necessary permanent way materials, ballast and laying of all railway tracks within the Coke sorting area basically coke loading track of about 500m length with one no. of turnout & buffer stop. Apart from this certain portion of existing tracks has to be provided with temporary diversion during construction period which is also included in the scope of work of the Contractor. The tracks will extended and connected to the main track as shown on general layout drawing. The portion of main track between the connection points and beyond by a rail length will be within the scope of supplier (this is marked up in the layout drawing MEC/S/9101/11/14/0/A/00/064.2522/R2.

All materials and track work will conform to the relevant latest Indian Railway Standards (IRS). Some salient features are given below:

Rails : 60 kg / m IRS rails as per IRS T-12.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleepers</td>
<td>Pre-stressed concrete sleepers as per relevant standards below normal tracks, turnouts and level crossings.</td>
</tr>
<tr>
<td>Sleeper density</td>
<td>18 sleepers per rail length (13 m) for Coke Car track connection with the existing RMHS Station No. 1 tracks.</td>
</tr>
<tr>
<td>Ballast cushion</td>
<td>250 mm</td>
</tr>
<tr>
<td>Turnouts</td>
<td>Standard 1 in 8.5 turnouts (crossing angle 60° 42’ 35” and lead radius 232.26 m) with Cast Manganese Steel (CMS) crossing, 6400 mm long curved switches made from T-12 specification rail on pre-stressed concrete sleepers.</td>
</tr>
<tr>
<td>Curvature</td>
<td>200 m radius preferred. However, smaller radius upto 130 m may be provided in case of space constraint with prior approval of BSP.</td>
</tr>
<tr>
<td>Track centres</td>
<td>5.5 m minimum</td>
</tr>
<tr>
<td>Min. horizontal clearance</td>
<td>2.75 m</td>
</tr>
<tr>
<td>of centre of track to face of structure</td>
<td></td>
</tr>
<tr>
<td>Min. vertical clearance</td>
<td>6.0 m</td>
</tr>
<tr>
<td>from top of rail</td>
<td></td>
</tr>
</tbody>
</table>
04.06 DUST EXTRACTION, DRY FOG DUST SUPPRESSION, AIR CONDITIONING & VENTILATION SYSTEM

04.06.00 DUST EXTRACTION SYSTEM

001 DUST EXTRACTION SYSTEM FOR COKE SORTING FACILITY OF COB NO. 11

Dust extraction system shall be provided at junction houses, coke breeze bunkers, coke dedusting building, coke screening & coke crushing station.

Dedusting system comprises on line pulse jet bag filter, supporting structure of bag filter, service platform, staircase, dust disposal system, centrifugal fan, suction hoods, ducting, flexible joints, duct supports, dampers in duct line (to adjust suction air quantity), mounted electrics, bag filter control panel, instruments, exhaust duct /stack etc.

Collected dust at bag filter hoppers shall be taken to storage hopper & from there dust will be disposed by truck. Clear height below storage hopper shall be minimum 4500 mm to facilitate truck entry.

Suitable capacity of chain pulley block will be provided for Fan impeller, motor weight less than 2t. Electric hoist with suitable capacity will be provided for Fan impeller, motor weight more than 2t for dedusting system of DE-1 & DE-2.

Schedule of Dust Extraction Systems of Coke Sorting Facility of COB No. 11

<table>
<thead>
<tr>
<th>Dust Extraction System</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE-1</td>
<td></td>
</tr>
<tr>
<td>Dust Extraction system for Coke dedusting unit (CDU)</td>
<td>Dedusting system comprises</td>
</tr>
<tr>
<td></td>
<td>2 nos. single module bag filter (1w+1s),</td>
</tr>
<tr>
<td></td>
<td>Blasting fan : 2x 35000 m³/hr (1w+1s)</td>
</tr>
<tr>
<td></td>
<td>Static pressure of blasting fan : 200 mmwc</td>
</tr>
<tr>
<td></td>
<td>Blasting fan will throw air in the dedusting chute between conveyors K-5/K-5A &amp; K-6/K-6A</td>
</tr>
<tr>
<td></td>
<td>Suction fan will suck the air from blasting fan</td>
</tr>
<tr>
<td></td>
<td>Suction fans : 2x40000 m³/hr (1W+1S)</td>
</tr>
<tr>
<td></td>
<td>Static Pressure of suction fan : 300 mmwc</td>
</tr>
<tr>
<td>Dust Extraction System</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>DE-2</td>
<td>Dedusting system comprises 1 No. four module bag filter &amp; 2 No. suction fan (1w+1s)</td>
</tr>
</tbody>
</table>

**DE-2**

Dust Extraction System Description

- Dedusting system for junction house JH-1, JH-3, JH-5, JH-6, JH-11, JH-12, JH-9, JH-10, coke crushing station, surge bunker, coke screening station, JH-7, JH-4, JH-13, coke breeze bunker, JH-2 & JH-Z17 and other conv transfer points of CDU not considered in DE-1

**002 DUST EXTRACTION SYSTEM FOR FLUX CRUSHING AND SCREENING FACILITIES AT SP-III**

Dust extraction system shall be provided for both existing and new extended part of flux crushing & screening building and cover all the material transfer points, crushers, vibrating feeders, bins, screens etc.

Dedusting system comprises ESP, dust disposal system, centrifugal fan, suction hoods, ducting, flexible joints, duct supports, dampers in duct line (to adjust suction air quantity), stack etc. Two nos. fan shall be provided (1w+1s)

Dust from ESP hoppers shall be disposed to down stream conveyor by screw conveyor/ chain conveyor.

The existing bag filter based dedusting system shall be dismantled & new ESP based dedusting system shall be installed in that location.

**003 Work zone dust concentration**

Work zone dust concentration (at 5-7m distance from source) shall not be more than 5 mg/Nm³ above ambient level.

**004 Motor rating shall be minimum 20 % more than the BKW. Motor shall be derated for the ambient temperature of 50 °C.**

**005 At conveyor transfer points suction hoods shall be provided at both receipt & discharge points. Suction air quantity shall be considered minimum 3500 m³/hr per meter width of conveyor. Suction air quantity from screen shall be considered minimum 1200 m³/hr per square meter of screen.**
006 The contractor shall furnish the pressure drop calculation.

04.06.01 EQUIPMENT SPECIFICATION

001 BAG FILTER

The cleaning operation of bag filter shall be automatic on line cleaning. The bags shall be cleaned by means of compressed air pulse jet through solenoid operated pulse valves & programmable sequence timer. The time interval of cleaning operation & compressed air pulse duration & frequency shall be adjustable. The sequence timer shall be interlocked with pressure switch (at compressed air line) and DP switch (across bag filter) so that cleaning operation takes place when there is sufficient compressed air pressure & pressure drop across bag filter is above the set value. Sequence timer shall be provided for each module separately.

Bag filter assembly shall consist of the following

(i) Modular shell
(ii) Hopper for each module with manual slide gate & motorized RAV
(iii) Inlet & outlet manifolds
(iv) Manual damper at inlet & outlet of each module
(v) Access door
(vi) Tube sheet
(vii) Filter bags & cages
(viii) Solenoid operated pulse valves (24 V DC)
(ix) Pulse controller (Sequential timer)
(x) Bag filter control panel
(xi) Compressed air line with valve, filter regulator & manifold tank
(xii) Level switch in bag filter hopper & storage hopper
(xiii) Pressure switch at compressed air line
(xiv) DP switch across bag filter
(xv) Pressure gauge at inlet & outlet of bag filter and at compressed air line
(xvi) Weather cowl over bag filter
(xvii) Supporting structure of bag filter with service platforms & approach staircases
Technical Data of Bag Filter:

<table>
<thead>
<tr>
<th>(i)</th>
<th>Inlet dust concentration</th>
<th>10 gm/ Nm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ii)</td>
<td>Type of dust</td>
<td>Coke</td>
</tr>
<tr>
<td>(iii)</td>
<td>Guaranteed outlet emission</td>
<td>Less than 50 mg/ Nm³</td>
</tr>
<tr>
<td>(iv)</td>
<td>Air to cloth ratio (maximum)</td>
<td>1.5 m³/min/ m²</td>
</tr>
<tr>
<td>(v)</td>
<td>Type of filter bag</td>
<td>Polyester needle felt with 5% SS fibre inserts</td>
</tr>
<tr>
<td>(vi)</td>
<td>Bag thickness (minimum)</td>
<td>2 mm</td>
</tr>
<tr>
<td>(vii)</td>
<td>Bag weight (minimum)</td>
<td>550 gm/ m²</td>
</tr>
<tr>
<td>(viii)</td>
<td>Bag size (approx)</td>
<td>160 mm dia &amp; 4800 mm long</td>
</tr>
<tr>
<td>(ix)</td>
<td>No. of hopper</td>
<td>Separate hopper for each module</td>
</tr>
<tr>
<td>(x)</td>
<td>Dust discharge device below hopper</td>
<td>Dust from bag filter hoppers disposed to storage hopper through RAV &amp; screw conveyors.</td>
</tr>
<tr>
<td>(xi)</td>
<td>Thickness of casing, top cover &amp; hopper</td>
<td>5 mm MS as per IS : 2062, Gr A</td>
</tr>
<tr>
<td>(xii)</td>
<td>Tube sheet</td>
<td>6 mm MS as per IS : 2062, Gr A</td>
</tr>
<tr>
<td>(xiii)</td>
<td>Cages</td>
<td>3 mm stainless steel wire</td>
</tr>
<tr>
<td>(xiv)</td>
<td>Ventury</td>
<td>Cast steel</td>
</tr>
<tr>
<td>(xv)</td>
<td>Storage hopper</td>
<td>Made of 6 mm MS as per IS : 2062, Gr A).</td>
</tr>
<tr>
<td>(xvi)</td>
<td>Dust discharge device below storage hopper</td>
<td>Through rotary feeder &amp; telescopic chute</td>
</tr>
<tr>
<td>(xvii)</td>
<td>Valley angle of hoppers</td>
<td>65°</td>
</tr>
<tr>
<td>(xviii)</td>
<td>Clear height below storage hopper</td>
<td>4500 mm from bottom of RAV</td>
</tr>
<tr>
<td>(xix)</td>
<td>Flexible joints</td>
<td>At bag filter inlet/ outlet duct connection &amp; between bag filter hoppers &amp; storage hoppers</td>
</tr>
</tbody>
</table>
Electrostatic precipitator shall include:

- Housing assembly of fabricated plate work
- Inlet & outlet socket with gas distribution screens
- Dust hopper assembly of fabricated plate work
- Hopper heaters with RTD control
- Discharge electrode
- Dust collecting electrode
- Rapping units for inlet gas distribution screen, discharge & collecting electrode. Rapping mechanism shall feature microprocessor based adjustable rapping frequency for each field.
- ESP supporting structure with service platforms and staircase.
- Non-metallic expansion joints at ESP inlet & outlet socket with matching flanges
- Electrical hoist with monorail for handling of TR sets
- Slide bearing
- TR sets with microprocessor based control panel
- Weather tight insulator compartment
- Bus duct between TR unit & discharge system
- Oil trough for TR units with common drain up to ground level
- Weather enclosure for TR sets
- Heating element (with temperature switch) for support & shaft insulators
- Mechanical key interlocking system for inspection doors

Technical Data of ESP:

<table>
<thead>
<tr>
<th>(i)</th>
<th>Inlet dust concentration</th>
<th>10 gm/ Nm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ii)</td>
<td>Type of dust</td>
<td>Lime/ dolo</td>
</tr>
<tr>
<td>(iii)</td>
<td>Guaranteed outlet emission</td>
<td>Less than 50 mg/ Nm³</td>
</tr>
<tr>
<td>(iv)</td>
<td>No of cell</td>
<td>1</td>
</tr>
<tr>
<td>(v)</td>
<td>No. of field</td>
<td>4</td>
</tr>
<tr>
<td>(vi)</td>
<td>No of hopper</td>
<td>4</td>
</tr>
</tbody>
</table>
(vii) No. of TR sets | 4
(viii) Specific collection area | 65 m² per m³/sec
(x) Dust discharge device below hopper
- Slide gate
- Rotary air lock valve
- Chain conveyor/ screw conveyor.
(xi) Thickness of collecting electrode | 1.25 mm as per IS : 513 CR sheet
(xii) ESP casing & hopper | 6 mm MS as per IS : 2062, Gr A
(xiii) G.D screen | 4 mm MS as per IS : 2062, Gr A
(xvi) ESP inlet & outlet connection piece | 6 mm MS as per IS : 2062, Gr A
(xvii) Valley angle of hoppers | 65°
(xviii) Access grating, stair case
- Access grating : 40 depth, 6 thk
- Staircase : 40 C/C, 38° slope
- Max ht of riser 200 mm

003 PLATFORMS AND ACCESS STAIRCASE:

The minimum platform width shall be 1.2 metres. Platforms shall be located at the different levels required for maintenance and operation of the bag filter/ESP, RAVs, dampers, instruments & approach to inspection doors. Guard rail shall be provided on the platform. Access to the platforms shall be provided by providing stairways and railing.

Following minimum structural member shall be considered:

Hand rail : 32 NB, IS:1239
Post : 40 NB, IS:1239
Access grating : 40 depth, 6 thick
Stair : 40 C/C, 38° slope

004 ROTARY AIR LOCK VALVE (RAV)
RAV casing shall be made of cast steel with carrying side hard faced and shaft shall be of EN-8. Rotor blades shall be of MS construction & hard faced. Hard facing shall be done by 20x15 diamond weld beads (3 mm height) to achieve 300 BHN hardness. RAV capacity shall be based on 50% filling volume.

Manual slide gate shall be provided before all rotary air lock valves.

RPM of rotary air lock valve shall not exceed 20

005 CENTRIFUGAL FAN

General

Dedusting system fans are single width single inlet centrifugal type with inlet box. The fan will be arranged horizontally, rigidly mounted on concrete foundation. The fan shall be directly coupled to drive motor. Fan rpm shall not exceed 1000. One bearing on each side (supported by independent pedestals) of fan shall be provided with shaft extending through the inlet box. Fan housing shall be self supporting type.

Fan casing, impeller & shaft shall have provision for thermal expansion. Non metallic flexible joint (EPDM quality canvas) shall be provided at fan inlet & outlet.

Silencer at fan outlet shall be provided, if required, to achieve noise level 85 dB (A) at 1 m distance.

Fan characteristics curve shall be such that the maximum pressure is 15 to 20% more than the design pressure. The design point should be chosen at a point located to the right of the optimum efficiency on the fan characteristic curve. The distance between the design point and the maximum pressure limit shall be minimum 40%, referred to the volumetric rate.

Manual cum electrically actuated damper (open/close type) shall be provided at fan inlet. Manual damper shall be provided at fan outlet.

Casing:

The volute casing together with the inlet boxes shall have a horizontal split for removing the impeller. Splitting lines shall be flanged & supplied with
gaskets. For reinforcement of the casing continuously welded ribs shall be provided. Fan casing shall be with insulation anchors. Acoustic insulation shall be provided to limit the noise level within 85 dB(A) at 1 m distance.

Hinged inspection doors shall be provided on casing & inlet boxes.

Provision for fixed points and guides must ensure casing expansion.

Impeller:

Backward curved blades (non overloading type) shall be provided. The blades shall be welded between the impeller discs. The impeller connection shall be flanged on the shaft for an adequate torque protection and centring to take care of thermal expansion. Post weld heat treatment shall be done for stress relieve of welds.

The impeller shall be balanced dynamically complying with a balancing grade of at least Grade 6.3 according to ISO 1940 Part 1. The quiet running of the fan shall be within the range "good" in conformity with VDI 2056 machine group "G" or "T".

Fan impeller blade shall have composite liner (6mm base plate & 3mm hard facing) of hardness 650 BHN (minimum)

Shaft:

Shaft dimensioning shall be such that the first critical speed for bending, taking into consideration the bearing elasticity, is at least 25% above the working speed of the fan. The fan shaft has to be balanced dynamically, individually, or together with the impeller. The balancing grade must be at least Grade 6.3 according to ISO 1940 Part 1.

Shaft Seal:

The sealing between shaft and casing shall be designed as a set collar or a carbon ring seal, preferably to be fastened to the bearing or bearing pedestal and flexibly connected with the casing. The same shall be replaceable from outside fan casing without disturbing shaft/bearing.

Bearings:
The impeller shaft shall be supported on grease lubricated antifriction bearings. The locating bearing at the drive end must be able to absorb axial forces in either direction.

Bearing pedestal & sole plate shall be suitable for rigid concrete foundation.

Coupling:
A elastic and flexible coupling with coupling guard shall be provided between fan and motor.

The coupling with a half key shall be balanced dynamically at a balancing grade of not less than Grade 6.3 according to ISO 1940 Part 1.

The coupling shall be dimensioned in accordance with the max. allowable starting torque of the drive.

Material of Construction
Casing (side plate/ scroll plate) : 6 mm Thk (IS:2062, Gr A)
Inlet Box : 6 mm Thk (IS:2062, Gr A)
Impeller Blade : 8 mm Thk (Sailma 350/ equivalent)
Impeller Shroud : 8 mm Thk (Sailma 350/ equivalent)
Back plate : 12 mm Thk (Sailma 350/ equivalent)
Shaft : EN- 8

006 DUCTS

The ductwork for dust extraction system shall be of circular cross section. It shall be fabricated from sheets conforming to IS: 2062, Gr A. Minimum thickness of duct shall be as follows:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 600 mm</td>
<td>6 mm</td>
</tr>
<tr>
<td>600 mm to 1200 mm</td>
<td>6 mm</td>
</tr>
<tr>
<td>Above 1200 mm</td>
<td>8 mm</td>
</tr>
</tbody>
</table>

Thickness of bends

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 600 mm</td>
<td>6 mm</td>
</tr>
<tr>
<td>600 mm to 1200 mm</td>
<td>8 mm</td>
</tr>
<tr>
<td>Above 1200 mm</td>
<td>10 mm</td>
</tr>
</tbody>
</table>
Ducting Network shall comprise of suction hood, ducting, duct support, measuring hatch, cleaning hatch, duct line dampers & flexible joints as required.

Suitable ceramic rope/rubber packing shall be provided at the flanged joint to make the system leak-proof.

Ducts between suction hoods and bag filter, the velocities of air shall be 17-22 m/sec and for ducts between bag filter & fan and after fan, the velocity of air shall be about 15 m/sec. Velocity of air at suction hood shall be limited to 2 m/sec.

Hinged cleaning hatches shall be provided on the ducting near the bends & interconnection of ducts. Measuring ports shall be provided on the ducting near each suction point and on ducting before & after the centrifugal fan to measure the flow rate and pressure. Platform with ladder shall be provided for approach to cleaning hatches & measuring ports.

The ducts shall be supported with the building structure wherever possible and trestle support shall be provided for the duct outside the building. While considering the load on support, the dust load shall be considered (for horizontal ducts) 25% cross sectional area of duct filled with dust.

The ducting system shall be designed as a balanced one. However, manual damper shall be provided in the duct line for adjustment of air quantity in different branch ducts during testing & commissioning.

007 Self Supported Stack

Self-supported stack shall be provided to discharge the cleaned air to atmosphere. The height of the stack shall be 40 m.

Stack shall conform to ES22 of GS-08 of “General Technical Specification”.

04.06.02 DUST SUPPRESSION SYSTEM

Dry fog dust suppression (DFDS) system shall be provided at different material transfer points as given below

Re-routing of existing sinter fines conveyors and transportation of coke breeze from CSP No. 4 to conveyor 102 & transportation of fines from B.F to JH 127
<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Location</th>
<th>Description of DFDS application points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>JH-2</td>
<td>Conveyor discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receipt on conveyor C3A-C1</td>
</tr>
<tr>
<td>2</td>
<td>JH-3CA</td>
<td>conveyor C3A-C1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receipt on conveyor C3-C2 or C3-C1 from C3A-C1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C3A-C2 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Receipt on conveyor C3-C2 from C3A-C2</td>
</tr>
<tr>
<td>3</td>
<td>JH-C3</td>
<td>Conveyor C3-C2 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C4-C2 receipt from C3-C2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C3-C1 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C4-C1 receipt from C3-C1</td>
</tr>
<tr>
<td>4</td>
<td>JH-C4</td>
<td>Conveyor C4-C2 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C5-C2 receipt from C4-C2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C4-C1 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C5-C1 receipt from C4-C1</td>
</tr>
<tr>
<td>5</td>
<td>JH-C5</td>
<td>Conveyor C5-C2 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C7-C1 receipt from C5-C2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C5-C1 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C6-C1 receipt from C5-C1</td>
</tr>
<tr>
<td>6</td>
<td>JH-C6</td>
<td>Conveyor C6-C1 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor J127-C1 receipt from C6-C1</td>
</tr>
<tr>
<td>7</td>
<td>JH-127</td>
<td>Conveyor J127-C1 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor F101 receipt from J127-C1</td>
</tr>
<tr>
<td>8</td>
<td>JH-C7</td>
<td>Conveyor C7-C1 discharge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conveyor C102A receipt from C7-C1</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Transfer stations of conveyor C1, C2 &amp; C7</td>
</tr>
</tbody>
</table>

**Coke crushing and screening and grinding facilities**

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Location</th>
<th>Description of DFDS application points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>JH-CK1</td>
<td>Conveyor RC-106 discharge</td>
</tr>
<tr>
<td>Receipt on conveyor C106A from RC-106</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 JH-CK2 Conveyor C-106A discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor RC-CK2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor C107A from roll crusher or RC-CK2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 JH-CK3 Conveyor RC-107A discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor C107B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Screening building Discharge of conveyor 107B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor C111A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor C110A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Coke Grinding Bldg. Conveyor C111A discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor C112A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt feeder receipt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt feeder discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor C114 from rod mill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt feeder receipt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt feeder discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor C114 from rod mill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt on conveyor C114 from C113A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONVEYOR STREAM FEEDING TO COAL TOWER-7**

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Location</th>
<th>Description of DFDS application points</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>JH-4</td>
<td>Discharge point of conveyor Y-14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recieving point on conveyor Y11-131 or Y-15</td>
</tr>
</tbody>
</table>
## Additional silos, junction houses & final crushing station

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Location</th>
<th>Description of DFDS application points</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>JH-2C</td>
<td>Discharge point of conveyor Y7-49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reciving point on conveyor Y11-125 or Y7-50</td>
</tr>
<tr>
<td>(ii)</td>
<td>JH-11C</td>
<td>Discharge point of conveyor Y11-125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reciving point on conveyor Y11-126</td>
</tr>
<tr>
<td>(iii)</td>
<td>5 nos. new mixing bin</td>
<td>Discharge point of belt feeder (5 point)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reciving point on conveyor Y11-127 (5 point)</td>
</tr>
<tr>
<td>(iv)</td>
<td>JH-11D</td>
<td>Discharge point of conveyor Y11-127</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reciving point on conveyor Y11-128</td>
</tr>
</tbody>
</table>
(vi) JH-11E  
Discharge point of conveyor Y11-128
Recieving point on conveyor Y7-35

(vi) JH-3C  
Discharge point of conveyor Y7-35
Recieving point on conveyor Y7-36
Discharge point of conveyor Y7-36
Recieving point on conveyor Y11-129 or Y7-51

(vii) JH-11F  
Discharge point of conveyor Y11-129
Recieving point on conveyor Y11-130

(viii) Crushing station  
Discharge point of conveyor Y11-130
Recieving point on conveyor Y7-12
Discharge point of conveyor Y7-12

There shall be minimum 2 nos. DFDS system, one for re-routing of existing sinter fines conveyors, coke crushing, coke screen facilities and the other for conveyor streams feeding to coal tower-7 and additional silos, junction houses and final crushing station. In each DFDS pumping station 2 nos. pumps (1W + 1S) shall be provided. DFDS system will also be provided at transfer stations of conveyor C1, C2 & C7.

04.06.03  INSTRUCTIONS TO CONTRACTOR
The dust suppression system vendor shall have experience of execution of at least 2 installation of DFDS system, already commissioned and under operation successfully from last one year. DFDS system vendor shall be from M/s F Harley/ TPS/ Spraying System

04.06.04 APPLICABLE CODES AND STANDARDS

The execution of the work covered under this specification shall conform to the latest Indian Standards specification where the same are available or the reputed standards acceptable to the owner / consultant. In case such specifications are not available, the work shall be according to good engineering practice and norms acceptable to owner / consultant.

04.06.05 DESIGN CRITERIA

1) Work zone dust concentration (at 5-7m distance from source) shall not be more than 5 mg/Nm3 above ambient condition.

2) Water line velocity shall be maintained less than 1.5 m/sec. Water pipe line shall be supported at regular interval. Make-up water, quick fill, drains and overflow connection shall be included at each pump station tank. Duplex strainer shall be included at inlet to dust suppression system pumps. IS-1239 heavy class, ERW, G.I pipe line shall be used in the water line. Water pipe line shall be preferably be laid over ground along conveyor gallery. In case of non-availability of same suitable supporting scheme shall be provided to suit site. Underground pipeline (wherever provided) shall have wrapping and coating as per IS – 10221 (preferably wrapping coating shall be coal tar based). Hume pipe protection shall be laid at road crossing area.

3) IS-1239 heavy class, ERW, G.I pipe line shall be used in the compressed air line. Compressed air pipeline network over ground laying shall be preferred with a minimum slope of 10 mm in 1m (1: 100) along flow and moisture trap with drain provision at regular interval. Compressed air pipeline shall be preferably laid along conveyor gallery or can be supported from building supporting structure. In case of non-availability of same suitable supporting scheme to be developed by the contractor to suit site.

4) In DFDS pumping station, 2 nos. pumps (1w+1s) shall be provided. A pressure relief valve shall be provided to by pass water to storage tank in case the pressure increases above the set value.
(5) Spray Nozzles/ Spray bar for DFDS systems at transfer points (at both conveyor discharge & receiving points) shall be selected so as to ensure complete coverage. Solenoid valves shall be mounted on each spray nozzle header at material transfer points. Solenoid valves shall be interlocked with the operation of conveyor running with material. For this necessary load sensor units shall be designed, installed and hook up with conveyor drives/panel. At reversible shuttle conveyor spray nozzles shall be provided at both sides.

(6) The DFDS system nozzles shall have air driven acoustic oscillator capable of producing super fine atomization of water droplets of size as that of dust particles & blanket of extremely fine fog. The approximate water addition shall not be more than 0.2% of the weight of material being handled.

(7) Compressed air receiver and water tank at different pumping station shall be provided with connecting valve, pipe fitting, and instruments for quality checking.

(8) At each pump station air receiver capacity shall be considered @ 16% of the compressed air consumption in m3/min or 2 m3 capacity, whichever is higher.

(9) MS tank of 6 mm thick with stiffener for 1-hour storage capacity shall be provided at pump stations of DFDS system by the contractor. The inside surface of MS tank shall be epoxy painted.

(10) The contractor shall provide platform, walkway, staircase adequate for the necessary approach to the equipment for operation & maintenance point of view.

(11) Duplex strainer with SS filter element shall be provided at inlet to dust suppression system pumps to remove all suspended particles exceeding 100 micron

(12) The contractor shall provide the following minimum instruments

- High level and low level switch in water tank. Low level switch interlocked with pump operation.
- Spring loaded operated pressure release valve (adjustable) at pump discharge line for by passing water line to tank to avoid shut-off condition.
- Pressure gauge at all pump discharge line.
- Pressure gauge at air-receivers, safety valve and drain provision
- At consumer application points following instruments shall be provided:
04.06.06 EQUIPMENT SPECIFICATIONS

The equipment for "DFDS" dust control system is grouped into two main categories.

**Main Equipment**

The main equipment shall include spray bar assemblies fitted with dual-fluid air driven acoustic oscillator atomizing nozzles, pressure regulating units, and flow activation stations for ON-OFF control of the system and instrumentation for auto operation.

**Auxiliary Equipment**

The auxiliary equipment shall include water storage and pumping unit with duplex water filter and associate electrical works, air and water piping, enclosures, necessary hoods and skirt boards on belt conveyors / equipment to suit spray nozzle operation.

Starter cum control panel shall be provided at pumping station and local control panel shall be provided at different application points.

Brief Specifications of various components of the system are given below

**Main Equipment**

**Spray bar assemblies**

The spray bar assemblies shall be manufactured from stainless steel tubing drilled and tapped for connection of nozzle adapters. A specially designed
and selected dual fluid atomizing nozzle shall be fitted into each of the adapters. These nozzles are fitted with acoustic oscillators for atomizing the water into droplets of micronic size by passing them through a field of high frequency sound waves. The nozzles shall be of stainless steel while the adaptors shall be of brass. Each spray bar shall be provided with mounting brackets and flexible hoses for connection to the air & water pipeline.

### Pressure regulating units (PRU)

The performance of "Dry Fog" type dust control system is critically related to the size of water droplets. The nature and particle size of dust generated in the material handling system changes with change in size and characteristic of the material. In practice, the sizes of the dust particles have a very wide spectrum (1-800 microns).

A careful control of air and water flow & pressure is therefore necessary to obtain optimum dust suppression results. For this purpose, pressure regulating units shall be provided in the system. The pressure regulating unit shall consist of diaphragm type pressure regulator with pressure gauge and ball valve for isolation of air and water line. The operator can adjust both the air and water pressures independently to change the fog characteristics to obtain optimum dust suppression results vis-a-vis the site requirements. The pressure regulators shall be installed in a metallic enclosure with inspection door with rubber sealing arrangement. Flexible hose shall be provided for connection of PRU to the air & water pipeline.

The number of pressure regulating units shall depend upon the position / elevation of spray bars. Generally independent pressure regulating units shall be provided when the elevation of spray bars exceeds 3 m. Further the number of nozzles operating from one PRU should not exceed 6 ~ 8.

### Flow activation stations (FAS)

The flow activation station shall consist of solenoid valves in air & water line, pressure switch in the airline, selector switch, and indication lamps. Isolation ball valves shall be provided in the air & water line. All the equipment shall be installed in a metallic enclosure with inspection door with rubber sealing arrangement. Flexible hoses shall be provided with each FAS for connection to air and water pipeline.

The "ON - OFF" control of the fogging system shall be through the flow activation stations with facility for both manual and auto mode. A three-position selector switch shall be provided to select the mode of operation. The switch when energized shall open the electric solenoid valves, which shall
permit compressed air and water to enter into the pressure regulating units and spray bars.

In addition, a pressure switch shall be installed in the airline to ensure that air and water solenoid valves are energized only when sufficient air pressure is available in the line. This will ensure that the system cannot operate without sufficient air pressure to the nozzles and reduces the chance of un-atomized water to pour into the dust source. Flow activation shall have indication for:

- System ON
- System OFF due to lower air pressure

**Auto operation**
The flow activation stations shall have provision for both manual and automatic operation. For manual operation, the system shall become operational with selector switch in manual mode and in auto mode, the fogging operation starts on receiving a signal either from a speed switch cum belt load monitor or limit switches installed at a strategic location in the material conveying line or potential free contact from the drive motor of equipment as per requirements.

Each dust suppression system location shall be provided with requisite number of spray bar assemblies with DFDS atomizing nozzles. Pressure regulating units shall be provided at each location to regulate the pressure of compressed air and water.

The dust suppression system shall be divided into independent circuits taking into account the flow diagram, operational requirements, distances between dust suppression locations etc. Flow activation stations with instruments for auto operation are provided for each circuit for ON/OFF control of the dust suppression system.

**Centrifugal Pump**
Horizontal back pull out pump shall be provided. Pump casing shall be vertically split type. Impeller rpm shall generally not exceed 1450. However, for pumps with low capacity & high head may be provided with 2900 rpm. Pump shall be coupled to motor with flexible coupling. Spacer type coupling shall be provided. Pump shall conform to IS : 1520.

Pump shall give satisfactory performance at any point on the H-Q curve over a range of 40% of rated flow to 120% of the rated flow. The maximum efficiency shall preferably be within ± 10% of the rated design flow. The total
head-capacity curve shall be continuous rising towards the shut off without any zone of instability and with a minimum shut-off head of 15% more than the design head.

Pumps shall have shaft seal by gland packing. Pump shall be fitted with double wearing rings, one is fitted in the front of the impeller on the casing and the other is fitted in the back of the impeller on the impeller itself.

Impeller shall be dynamically balanced. The magnitude of peak to peak vibration shall be limited to 75 micron. Pump impeller shall be non overloading type. Impeller shall be made in one piece & keyed to the shaft.

**Material of construction**

- **Casing** - C.I
- **Impeller** - Bronze
- **Bearing Bracket** - C.I
- **Shaft protection sleeve** - Bronze
- **Wearing ring** - Bronze
- **Shaft** - EN-8
- **Common base frame for pump & motor** - M.S

Common base plate for pump & motor shall be in one piece & made of welded steel construction. Adequate space shall be provided between pump drain connection and base plate for installation of minimum 15 mm drain piping. Pumps shall be supplied with suitable drain pans or drain rim type base plates with tapped drain connections. Critical speed of the shaft shall be at least 30 percent above the operating speed.

**Water Piping and Fittings**

Water piping up to 150 mm NB size shall be GI, ERW, heavy class and conforming to IS-1239 Part-1. Pipe ends shall be beveled. Pipe fittings shall be as per IS 1239, Part-2 for pipes of size up to 150 NB.

Plate type pipe flanges (as per IS 6392) shall be provided.

Pipes shall be of welded joints. Welding (manual metal arc welding) shall be as per relevant IS code and only certified welders shall be employed.
All piping systems shall be hydro tested at 1.5 times the design pressure.

Auto air venting valves shall be provided at highest point of the pipe lines & drain valves shall be provided at lowest points of the pipelines in different segments.
Pipe supports comprising pipe shoes, saddles, base plate, clamps & structural members like channels, angles etc. shall be provided

**Valves**
Butterfly Valves shall be provided in water line of size 65 NB and above and ball valve shall be provided for pipe size below 65 NB. However, ball valve shall be provided in the pipe line (irrespective of sizes) when flow control is required.

Specification of butterfly valve, ball valve & check valve shall conform to ES24 of GS-08 of “General Technical Specification”.

**Air Receiver (1 no for each pump station)**
Vertical self supporting in cylindrical design with dished end at both ends having minimum capacity of 2 m³ volume. The air receiver shall be designed for a working pressure of 8 kg/cm² g. Design, manufacture, inspection and testing of air receiver shall be in accordance with IS:7938 and IS : 2825 -1969 (RA 1984), Class-2, Dished ends IS:4049 Part-I, 1979 (RA 1991). Material of construction shall be as follows:

- **Shell and dished ends** : IS: 2002 Gr2 or equivalent
- **Supports pad, leg, skirt, base** : IS: 2062-1992
- **Plate, nozzles** : A 105 (below 300 mm NB)
  - A 106 Gr B (above 300mm NB)
- **Flanges & matching flanges** : A 105

The air receiver shall be supplied with following accessories:
- Circular skirt welded to the bottom portion of the shell.
- Circular base plate welded to the skirt with holes for foundation bolts.
- Foundation bolts/ studs, nuts, washers.
- Nozzles for inlet and outlet with weld neck flanges.
- Manhole nozzle at an accessible height with weld neck flange and cover having devit arrangement.
- Safety valve of sufficient blowing capacity mounted at a suitable height connected through a flanged joint to nozzle welded on the receiver shell.
- Safety valve shall be provided with test lever and gagging arrangement.
- Vent valve at the highest point of the dished end for releasing the air during hydro test.
- Water drain nozzle at the lowest point with drain isolation valve, trap station and by pass valve.
- Companion flanges with bolts, nuts and gaskets for inlet and outlet nozzles and other valves.
- Stubs for pressure indicator for local measurement of pressure.

**Pressure Gauge**

Manufacturing Standard : IS 3624  
Range : 0 – 6 Kg/ cm² or 0-10 Kg/ cm²  
Range (at pump suction) : (-)2 to (+) 2 Kg/ cm²  
Dial Diameter : 100 mm  
Accuracy : ± 1% of FSD  
Degree of protection : IP 65  
Sensing element : Bourdon tube  
Bourdon tube material : AISI SS316  
Connection : Screwed  
Connection size : ½ “ BSP (M)  
Mounting : Direct with bottom entry  
Case : Die cast Al stove enamelled black finish  
Bezel (screwed) : Die cast Al stove enamelled black finish  
Dial window : Shatter proof glass  
Pointer : Al anodised black  
Dial : Al white with black letters  
Movement assembly : AISI 304SS  
Shank : AISI 3166SS  
Adjustable pulsation damper: Yes

Pressure gauges shall be provided with isolation valves (Ball valves)

**04.06.07 AIR CONDITIONING AND VENTILATION SYSTEMS**

**04.06.07.01 Scope of work**

The air conditioning systems shall be provided for control rooms/ dispatcher rooms, intelligent MCC rooms, VVVF panels area in MCC room, office premises, etc.

Air washer type pressurized plenum ventilation system shall be provided for
the HT/LT sub station, switchgear room, MCC room, cable vault/ basement, pump house etc.

Plenum ventilation system shall be provided for cable tunnel & conveyor tunnel with filtered air.

Exhaust ventilation shall be provided for compressor house, battery rooms, transformer rooms, store, toilets and other areas not catered by air conditioning system & plenum ventilation systems.

Contractor shall furnish schedule & brief specification of air conditioning/ ventilation system with the offer.

**04.06.07.02 Design Criteria for Air Conditioning and Ventilation Systems**

The ambient atmospheric conditions are as follows

<table>
<thead>
<tr>
<th>SEASON</th>
<th>TEMPERATURE (DBT)</th>
<th>°C</th>
<th>RELATIVE HUMIDITY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMMER</td>
<td>45</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>MONSOON</td>
<td>33</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>WINTER</td>
<td>10</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

The different air conditioned rooms shall be maintained at 23±2 °C and 55±5 % RH.

The temperature of the premises (plenum ventilation by air washer system) shall be maintained at < 37 °C. The supply air quantity shall be minimum 15 air change/ hour (for MCC room & other electrical premises) & 10 air change/ hour for cable vault/basement. If cooling load calculation requires more supply air quantity, then the same shall be provided. 2-3 mm wc pressurisation shall be maintained.

The temperature of the areas being exhaust ventilated shall not exceed 3 °C above the ambient.

AC & ventilation plant room shall be provided adjacent to the served premises

All fasteners shall be hot dip galvanized unless stated otherwise.
Noise level of equipment shall be limited to 85 dB(A) at 1 m distance from the equipment unless stated otherwise elsewhere. Noise level inside the air conditioned & ventilated premises shall be limited to 65 dB(A).

Motor rating shall be minimum 20% more than the BKW

Fusible link type fire damper system shall be provided for all served electrical premises, cable basement, cable tunnel premises & susceptible fire hazard premises.

Monorail with chain pulley block shall be provided for handling of equipment of weight more than 300 Kg.

Cooling load calculations (as per CARRIER HANDBOOK GUIDELINES) and system capacity & configuration shall be submitted by contractor before submitting any detail engineering drawing.

04.06.07.03 System Description

01 AIR CONDITIONING FACILITIES

Type of air conditioning system to be provided as per the following guidelines

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of Air Conditioning System</th>
<th>Premises</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Split air conditioner/ ductable split air conditioner</td>
<td>Office premises with cooling load less than 5 TR (with minimum 1 no. standby).</td>
</tr>
<tr>
<td>(ii)</td>
<td>Water cooled package air conditioners (with minimum 1 no. standby)</td>
<td>Control rooms/ dispatcher rooms, intelligent MCC rooms, VVVF panels area in MCC room</td>
</tr>
</tbody>
</table>

Air Conditioning System with Water Cooled Package Air Conditioners:

Air conditioning system shall include water cooled package air conditioners with starter panel (starting control), microprocessor based control panel (safety & operating controls) & sensors.

The air conditioning system shall include condenser water pumps, induced draft FRP cooling tower, make up water tank for cooling tower (minimum 16 hrs water holding capacity), condenser water piping, G.I ducting, air supply grills/ diffusers, thermal insulation of ducts (for ducts passing through the non air conditioned area & tail end of long ducts in air conditioned area), acoustic insulation of ducts (up to 5 to 7m length) at outlet of package air conditioners,
under deck insulation of all exposed roofs in air conditioned premises, MCC/starter panels, necessary electrics, instrumentation etc.

Cooling tower shall be installed at the highest point of condenser water circuit. Make up water tank (5 mm thick & internal surface epoxy painted) shall be provided at higher elevation than the cooling tower basin.

Pressure gauge & temperature gauge shall be provided at inlet & outlet water line of condenser. Pressure gauge at pump inlet & outlet shall be provided. Differential pressure switch shall be provided at package A.C inlet & outlet water line & interlocked with compressor.

Minimum 1 no. standby package air conditioner & 1w+1s condenser water pumps shall be provided.

R-22/ R134a refrigerant shall be used. Refrigerant compressor shall be either scroll or semi-hermetic reciprocating type.

Chemical dosing system shall be provided at package air conditioner recirculation water.

002 VENTILATION FACILITIES

The air washer system shall comprise dry panel air filter, air washer, centrifugal fan, pumps (with 100% standby), piping & ducting network, air supply grills, gravity damper, electrics & instrumentation etc.

Exhaust fan rpm shall not exceed 900, suitable for 3 phase power supply, motor with class F insulation & IP 55 protection, dynamically balanced. Non-return louver shutter shall be provided at fan discharge side. Exhaust fan casing shall be made of heavy gauge MS sheet & impeller shall be made of die cast aluminium.

Exhaust fan for battery room shall be of acid proof construction and flame proof construction (class IIB). Motor shall not come in contact with the air stream.

04.06.07.04 Equipment Specification

001 MONOBLOCK PUMP

Mono block pump shall be provided for capacity 15 m3/hr & less. Pump shall conform to IS: 9079-1989. Pump casing will be of C.I & impeller will be of bronze & shall have stuffing box arrangement for gland packing. IP-55 protection motor shall be provided.

002 HORIZONTAL BACK PULL OUT PUMP:
Horizontal back pull out pump shall be provided for capacity more than 15 m³/hr.

003 COOLING TOWER
Type: Induced draft counter flow
Casing/Basin: FRP
Frame Work: MS hot dip galvanized
Fills: PVC
Nozzles: Brass
Bolts, nuts, miscellaneous hardware: MS electro galvanized
Fan hub & blades: Cast Aluminium
Fan type: Axial flow, direct drive
Fan speed: 720 rpm
Degree of protection of motor: IP 55 (temperature rise limited to class B)
Ladder: Galvanised steel ladder with safety cage & hand railing up to the top of tower. Inclined to 30° to the vertical
Eliminators: No. of deflector to be arranged to reduce drift loss < 0.2% of water circulation.
Cooling Tower Accessories:
(i) Level switch at cooling tower basin (to be interlocked with pump)
(ii) Make up connection with float valve (float made of copper) & back up ball valve
(iii) Quick fill connection with ball valve
(iv) Overflow connection
(v) Drain connection with ball valve
(vi) GI wire mesh 18 gauge strainer
(vii) Equalizing line of cooling towers with isolation valves

004 PRE- FILTER BEFORE PACKAGE A/C UNIT
Filtering media shall be of 5 ply HDPE mesh, stiched and pleated to provide maximum filtration area. Filter media shall be supported on either side by galvanised wire mesh. Suitable aluminium spacer shall be provided to segregate the folds to ensure uniform distribution of air flow through the filter. Filter frame shall be fabricated from 18 G GI sheet. Filter frame shall be provided with suitable handles. Filter frame shall be provided with neoprene sponge rubber. Filters shall be capable of being cleaned by compressed air/water flushing. Face velocity of air through filter shall be limited to 2.5 m/s. Efficiency of filter shall not be less than 90% for dust sizes down to 10 micron.
GI DUCTING

The following codes & standard shall be followed

IS : 226 Specification for structural steel (standard quality)
IS : 655 Specification for metal air duct.
IS : 277, 2003 Specification for galvanized steel sheets
SMACNA Sheet Metal and Air Conditioning Contractors National Association

The air distribution system shall be sized to have a constant frictional drop along its length. The maximum air velocity shall be restricted to 7.5 m/sec for air conditioning and 10 m/s for ventilation ducts.
Ducts shall be supported by 10 mm MS Rods and 40x40x3 MS angles. The duct supports shall be at a distance of not more than 2500 mm. The MS rods shall be hung by dash fasteners fixed to the ceiling slab.

Flexible connection of at least 150 mm width shall be provided where the duct connects to the package AC, AHU, fan etc. Flexible connection shall be closely woven, rubber impregnated double layer canvas or neoprene coated fiber glass.

DIFFUSERS AND GRILLS

Diffusers/grills shall be of extruded aluminium powder coated. All supply air diffusers/grills shall be complete with volume control dampers. Supply air grills/diffuser shall be double deflection type. Air volume control damper shall be operated by a key from the front of grills/diffusers.

Thickness of Grills, Diffuser, Damper shall be as follows:
(a) Frame 16 gauge
(b) Louvers 18 gauge

Suitable vanes shall be provided in duct collar to have uniform/proper air distribution. Bank of baffles wherever required shall also be provided.
Air velocity through diffusers & grills shall not exceed 2 m/sec (for A/C system) and 4 m/sec (for ventilation system).

INSULATION
The surface to be insulated both thermally and acoustically shall be thoroughly cleaned. Pressure/Hydrostatic tests shall be carried out before application of insulation.

Two coats of primer paint shall be applied on the clean surface and then CPRX Compound (Shalimar Tar products or equivalent) shall be uniformly applied @ 1.5 kg/sqm on the surface to be insulated. Thereafter insulation shall be fixed. Vapour barrier shall be applied over the insulation followed by 24 G Al cladding or sand cement plaster in 2 layers, totaling 12.5 mm

### Insulation Material Specification

- **Resin bonded glass wool:** Density 48 Kg/m3, IS :8183
- **PUF:** Density 35 + 3 Kg/m3, IS: 12436

#### Type of Insulation

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Surface Material</th>
<th>Insulation material</th>
<th>Insulation</th>
<th>Thickness (mm)</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Acoustic insulation</td>
<td>Resin bonded glass wool</td>
<td>Slab</td>
<td>12</td>
<td>Fiber glass tissue &amp; perforated Al sheet</td>
</tr>
<tr>
<td>(ii)</td>
<td>Under deck thermal insulation</td>
<td>PUF</td>
<td>Slab</td>
<td>50</td>
<td>22 GI sheet cladding</td>
</tr>
<tr>
<td>(iii)</td>
<td>Duct thermal insulation</td>
<td>PUF</td>
<td>Slab</td>
<td>25 (tail end ducting) 40 (exposed ducting)</td>
<td>26 G Al cladding</td>
</tr>
</tbody>
</table>

### 008 AIR WASHER

The Air Washer type ventilation system shall have following component & feature:

- Centrifugal SISW fan with drive motor and accessories such as flexible connections made of EPDM quality canvas, inlet cone for smooth flow of air, VIV at fan inlet, slide rail for motor, common channel base frame etc. Fan shall be coupled to motor with V belts. Fan rpm shall not exceed 900. Fan shall be dynamically balanced at least grade 6.3 according to ISO 1940.
Impeller critical speed minimum 25% above operating speed. The fan shall have following minimum thickness of materials for different parts

Capacity below 20000 m³/hr:

- Casing: 3.15 mm
- Back plate: 5 mm
- Impeller: 4 mm

Capacity above 20000 m³/hr and below 50000 m³/hr:

- Casing: 4 mm
- Back plate: 6 mm
- Impeller: 5 mm

- Air washer with GI spray sets, brass nozzles, GI air distributor, PVC water eliminator (5 row deep), tank, casing, water tight inspection door. Air washer spray chamber minimum 4 mm thick & water tank 6 mm thick and inner surface epoxy painted
- Intermediate chambers (800 mm length) before & after spray chamber with inspection door & drilled flange at both ends
- Transition piece with drilled flanges at both ends to connect the intermediate chamber with fan inlet through flexible connection.
- Circulating water pumps with drives (with standby)
- Circulating water pipeline, quick fill line, make-up water pipe line with float valve (float made of Cu ball) & back up isolation valve, overflow line, drain pipe line (minimum 40 NB size) with pipe fittings, valves, instruments etc.
- Water spray 1 m³/ hr per 1000 m³/ hr of air quantity.
- Y strainer at pump inlet
- Ducting network with damper, supply air grill/ diffuser.
- Dry panel filters (pre-filter) with fixing frame
- Gravity damper.
- Saturation efficiency of air washer shall not be less than 90%.
- The face velocity of air through air washer shall not be more than 2.5 m/sec.
- Low level switch at water tank of air washer and this shall be interlocked with pump
- Temperature gauges & pressure gauges at pump outlet pipe line. Temperature gauge before & after spray chamber of air washer.
- The water proof lights inside the air washer chamber.

009 TEMPERATURE GAUGE
Type : Bi-Metal thermometer
Rigid Stem
Accuracy : ± 1% of FSD
Stem of connection metals: AISI 316SS
Immersion length: To suit pipe size
Enclosure : Cast Al stove enameled black with weather proof as per IP65
Dial Size : 100 mm
Sensor : Bi-Metal strip
Stem dia : 8 mm
Connection : ½” BSP (m)
Mounting : Vertical
Entry : Bottom
Range : 0-60 °C
Thermo well : To be provided
04.07  COMPRESSED AIR FACILITY

01.00  INSTRUCTION TO CONTRACTOR

01.01 Dedusting system of Coal Handling & Coke Sorting plant for COB #11 plant will require substantial quantity of compressed air. To meet the air requirement, a compressed air station along with interconnecting inter-shop and in-shop piping system upto the individual consumers will be provided in the Coal Handling & Coke Sorting plant area on turnkey basis.

01.02 The Contractor will furnish all the drawings, documents, data like fault diagnosis, operation and maintenance manuals, general details and layout drawings, design calculations and equipment specification of plant and equipment, together with 'as built' drawings for all mechanical, electrical, civil, structural and instrument & control.

01.03 Meteorological data

The following meteorological data will be taken into account for design of plant and equipment. Site conditions will be assumed to be as follows.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>48°C (Max)</th>
<th>9°C (Min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maximum: 100%
Minimum: 25%
Altitude above MSL: 307m

*Design ambient condition for the compressors will be taken as 45°C temperature and 60% RH. Design ambient temperature for Electrics will be considered as 50°C.*

01.04 Delivery Schedule

Delivery schedule will be matched with schedule of the overall package.
02.00 SCOPE OF WORK

The Scope of work will include design, engineering, manufacture, assembly, shop testing at manufacturer's works, painting, supply, transportation and delivery F.O.R. site of all the plant & equipment and connected utilities of compressed air facility, handling and storage at site, erection, testing, commissioning, demonstration of performance guarantee tests and final handing over of all plant and equipment with connected accessories along with the following facilities.

The compressors will be housed inside a building (compressed air station). The Air receivers will be installed outside but adjacent to the building. The building and equipment foundations including grouting and chipping works, structural works, etc. are also covered under the scope of this specification. The routing of inter-shop and in-shop compressed air piping system will be overhead.

The compressed air facility will comprise of following main equipment :

i) Three (3) sets (2 W + 1SB) of 36 Nm3/min (@ 8 kgf/cm²(g) discharge pressure after aftercooler) oil free, water cooled rotary screw packaged type air compressors with electric motor and all its accessories & auxiliaries including the following:
   a) Intercooler, aftercooler, moisture separator with trap station,
   b) Suction air filter cum silencer,
   c) Lube oil system.
   d) Cooling water system including duplex type filters in supply line.
   e) Acoustic enclosure along with exhaust fan and necessary illumination.
   f) Each Compressor will have dual type control system, which will permit operation of each compressor in either of the following way:
      (a) Continuous Variable Load /unload regulation
      (b) Automatic Start-Stop Regulation.

ii) 2 no. Refrigerant type of Air Dryer’s of Capacity 4 Nm3/min each will be provided.

iii) 1 no. of Air Receiver of 4 m³ capacity for instrument air and 1 no. Air Receiver of capacity 12 m³ for plant air at 8 kgf/cm²(g) operating pressure, complete with all fittings such as safety valves, drain connection with auto condensate trap and bypass valve, vent connections and all inlet and outlet connections with companion flanges, supporting arrangement, access platforms, instruments etc. The material of construction will be as per IS – 2002 – Gr. –
2A. The air receiver will be designed, manufactured and tested according to IS – 7938, 1976 (RA 1991).

iv) All necessary interconnecting pipes (from compressors outlet up to the consumer points), valves, fittings including supports and supporting structures.

v) Drain pipelines from compressed air station to nearest drain/drain pit.

vi) Miscellaneous structures, access platforms for operation and maintenance of equipment parts, valves, instruments, etc. forming part of the equipment.

vii) A complete new and unused set of all special tools & tackles required for operation and maintenance.

viii) Electrics and C&I.

ix) Contractor will furnish list of itemwise spares for 2 years O&M along with unit rate. The item rates will be valid up to 12 months from last consignment at site.

x) All anchor bolts & nuts, washers, foundation bolts, shear lugs, counter flanges for inlet and outlet of each compressor, receivers and connected piping & base frame for equipment. Miscellaneous materials and services, if not otherwise specifically mentioned will be included, but not limited to nuts, bolts, washers, gaskets, necessary connections for hook up with employer’s pipe network and equipments.

xi) Special tools & tackles (along with list), Nil - as per Annexure-B.

xii) Supply of first fill of lube oil & consumables and also for testing, commissioning and performance guarantee. Specification of all consumables will be indicated.

xiii) Commissioning spares (All spares used until the plant is handed over to the employer), Nil, as per Annexure-B.

xiv) Training of O&M staff of Employer for 10 mandays.
Electrics

The Contractor will supply complete electrical equipment for compressors. All the technical specifications of the electrical equipment/system including LT switchgear, MCC, Metering and protection, cables, etc., will be as per GTS/TS.

The scope of supply for electrics will include the following:

i. Drive motors for compressors & lubrication system as well as for motor operated valves.

ii. Control Cabinet/ Console: one for each compressor.

iii. Double compression brass cable glands and cable lugs for all electrical equipment supplied by the Contractor.

iv. For compressor motor bearing and winding temperature detection, monitoring, interlocking, signaling & annunciation, micro processor based temperature controller will be provided for each motor by the Contractor. The scanner will be housed in an independent control panel.

v. Contactor will note that the HT Power for the Compressed Air Station will be fed from the near by HT sub-station SS-45 through 3 nos. 6.6kV feeders. Supply, laying & termination of the incoming cables from the HT substation to the compressed Air station along with terminations at both ends will be done by the Contactor. The cables will be routed through under ground trench. Further distribution of HT and LT power will be done by the contactor.

vi. All erection/installation accessories, cable trenches, cable support structures/cable gallery, cable termination at both ends, cable fixing, support materials etc. for all equipment within the scope of supply of Contractor within the plant area including cables from HT switch board at HTSS-45.

vii. Power and control cables from the control cabinets, for interlocking & inter connection to all motors, instruments, consumers etc.

viii. Junction boxes with required number of terminals including 20% spare terminals.

ix. All other equipment, accessories, field devices, safety switch etc required for safety interlocks, process control & interlocking etc.
x. The contractor will include all power and control cables in adequate quantities in turnkey/lot basis as per actual requirement at site.

xi. Contractor will include commissioning spares in their scope. They are also furnish the list of commissioning spares.

xii. Make of all the equipment will be restricted to the list of preferred makes given in the TS.

xiii. HT compressor motor will be provided with Flux compensated magnetic amplifier (FCMA) type soft starter enclosed herewith. The HT soft starter to be designed considering the incoming feeder line distance from the supply feeder end. Motor soft starter to be connected in line side of motor.

xiv. LT Power to the compressed air station will be fed from a dedicated MCC cum PDB which will have 2 incomers with bus-coupler arrangement.

xv. Local push button stations

xvi. UPS as per requirement will be provided.

xvii. LDBs / Junction Boxes, etc. (as per the requirement).

xviii. Earthing for all equipment within the scope of supply.

xix. Cable trestle, supporting structures, conduits, prefabricated GI cable trays, cable racks, other associated accessories like cable glands, lugs, termination/jointing kits, ferrules, clamps including trefoil clamps for single core cables, cable markers, cable identification tags, and all other hardware material as per requirement.

xx. Fire sealing materials for laying termination and sealing of cables.

xxi. Complete electrics of material handling equipment like cranes, lifts, hoists, etc (if any).

xxii. Complete electrics of ventilation systems for area under battery limit.
xxiii. Water drainage pumps in required numbers with complete electrics including source feeders, pumps/motors, cable laying, etc.

xxiv. Fire protection system including Fire Detection and Alarm System for the complete plant, etc.

xxv. Welding sockets, 240 V power sockets and 24 volts AC sockets with transformers.

xxvi. Illumination for the entire plant and boundaries.

xxvii. Installation, erection accessories.

xxviii. Safety items.

**SPECIFICATIONS OF MOTOR SOFT STARTER**

To avoid impact on electrical system due to heavy motor starting current, a soft start system limiting motor current to 2 to 2.5 times will be provided to ensure voltage drop at motor terminals limited to 15% with a provision of DOL starting. Contractor to submit the voltage drop calculation, considering adequate fault level at 6.6 kV board.

The soft start system will be based on principle of flux compensated non-saturated magnetic amplifiers for control of motor starting current. Also, the starter should not introduce any harmonics into the system.

The flux compensated magnetic amplifiers will work on principle of flux opposition and operate in the linear non saturable zone of magnetic circuit. The system will work on constant mode in the starting zone so as to result in smooth start.

The enclosure class will be IP52.

The Sheet steel thickness will be 1.6 mm.

The control circuit will utilize auxiliary contacts and timers for starting function.

Lamp indication will be provided using LED type lamps.

Ammeter will be provided on front door.
The cubicle will have cable entry and exit from bottom through gland plate.

Bypass device used will be 6.6kV contactor.

04.07.03 CONTROL & INSTRUMENTATION

04.01 General

Electronic type instruments generally working on 4-20 mA DC signal system will be used. The instrument panel will be suitably installed in the compressor room. All instrumentation items will be selected to function satisfactorily in shop floor environment.

04.02 List of measurements & controls

For each compressor, the list of measurements & controls will include, but not limited to, the following:

i) Equipment/ local panel mounted measurements

1. Indication of differential pressure across suction air filter for each compressor.

2. Indication of pressure of compressed air after after-cooler and after compressor.

3. Indication of temperature of compressed air after after-cooler and air compressor.

4. Indication of pressure of compressed air in air receiver.

5. Indication of pressure of lube oil before & after oil cooler.

6. Indication of temperature of lube oil before & after oil cooler.


8. Indication of temperature at the inlet & outlet of common header of compressor cooling water circuit.

9. Indication of pressure at the outlet of common header of compressor cooling water circuit.

10. Indication of flow of compressed air.

ii) Alarms and interlocks
Following audiovisual alarms and interlocks will be provided for each compressor:

1. Differential pressure of air across suction air filter high - alarm only.
2. Temperature of air after air compressor high - alarm only.
3. Temperature of air after air compressor too high - alarm and trip.
4. Pressure of air after after-cooler high - alarm only.
5. Pressure of air after after-cooler too high - alarm & trip.
6. Differential pressure across lube oil filter high - alarm only.
7. Pressure of lube oil to compressor low - alarm only.
8. Pressure of lube oil to compressor too low - alarm & trip.
9. Temperature of lube oil to compressor high - alarm only.
10. Cooling water supply pressure low - alarm only.
12. Motor over load - alarm & trip.
04.07.04 PIPES, FITTINGS & VALVES

1. Pipe sizing will be done considering a velocity of 10 -12 m/s. The pipes will be hydro tested at shop as well as at site.

2. All pipes and valves will be as per the following tables.

**Specification of Pipes & Fittings**

<table>
<thead>
<tr>
<th>SI</th>
<th>Service</th>
<th>Size</th>
<th>Pipes</th>
<th>Fittings</th>
<th>Flanges</th>
<th>Gaskets</th>
<th>End Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Compressed Air System</td>
<td>≤50NB</td>
<td>A53 Gr.B or IS 1239, Heavy Grade</td>
<td>ASTM A105 Or IS 1239, Part-II</td>
<td>ASTM A105</td>
<td>Teflon</td>
<td>Plain End</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;65NB</td>
<td>A53 GR.B or IS 1239, Heavy Grade</td>
<td>ASTM A234 Gr.WPB</td>
<td>ASTM A105</td>
<td>Teflon</td>
<td>Welded/Flanged</td>
</tr>
</tbody>
</table>

**Specification of valves**

<table>
<thead>
<tr>
<th>SI</th>
<th>Service</th>
<th>Size</th>
<th>Body/Bonnet</th>
<th>Disc</th>
<th>Stem</th>
<th>Hand Wheel</th>
<th>Valve ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Compressed Air System</td>
<td>&gt;65NB</td>
<td>ASTM A216 Gr. WCB</td>
<td>ASTM A216 Gr. WCB</td>
<td>ASTM A479 Type 410-2</td>
<td>ASTM A47 Gr. 32510</td>
<td>Flanged Raised Face</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;25 ≤ 50 NB</td>
<td>ASTM A105</td>
<td>ASTM A479 Type 410-2</td>
<td>ASTM A47 Gr. 32510</td>
<td>Flanged Flat Face</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ 25 NB</td>
<td>ASTM A105</td>
<td>ASTM A479 Type 410-2</td>
<td>ASTM A47 Gr. 32510</td>
<td>Socket Welded</td>
<td></td>
</tr>
</tbody>
</table>

(*) Testing of valve body, seat and back seat will be as per ANSI B16.34.
04.07.05 TESTING

Unless otherwise stated, main equipment, valves and other ancillary units will be tested to various stipulations stated in Indian Standards of BIS or any other reputed international standard listed.

Recommended tests on Air Compressors are listed hereunder. Compressors may be tested using a suitable shop motor.

i) Volumetric and overall efficiency (type test)
ii) Capacity (Routine test)
iii) Specific power consumption from no load to full load (Routine test)
iv) Speed (Routine Test)
v) Testing of unloader (Routine test)
vi) Safety valve test (Routine test)

All other tests will be performed in accordance with IS:5456.

04.07.06 STANDARDS AND CODES

The complete system as a whole and individual equipment will be in accordance with the Indian Standards, British Standards, DIN or American Standards like ASME, ANSI or any other internationally accepted codes.

04.07.07 GUARANTEE AND PENALTIES

The Contractor will guarantee individual as well as integrated performance of all the equipment supplied by them for period as stipulated in the GCC prior to the date of issue of taking over certificate by the Employer. The final acceptance certificate will be issued by the Employer after successful commissioning of the Plant by the Contractor showing all the performance test at specified parameters.

The following parameters will be guaranteed as regards to Air compressor at the design ambient conditions: Temp. 45°C, 60% RH, cooling water temp. 34°C.

Air Compressor:

* Rated Capacity at lowest frequency : 36 Nm³/min (each)

* Rated discharge pressure at the outlet of after cooler : 8 kgf/cm² (g)

* Discharge temperature after after cooler at rated capacity and pressure : 45°C

* Oil content in the air at the : Oil free
outlet of air compressor,

* Specific Power consumption : To be indicated by the Contractor
   of the compressor at the rated condition mentioned above (kwh/Nm3)

* Noise Level : 80 dB(A)

* Volumetric efficiency of each compressor : To be indicated by the Contractor

* Inter cooler/ After cooler pressure drop : 0.2 kgf/cm2 (max)

Tolerance on guarantee values of energy consumption, volumetric efficiency, intercooler & after cooler pressure drop is ± 0.00%

09.00 LIST OF PREFERRED MAKES

- Compressor
  M/s Atlas Copco, M/s ELGI, M/s Ingersoll Rand, M/s Kirloskar Pneumatics.

10.00 Technical Particulars furnished by the Contractor

A. Air compressors

01. Manufacturer's Name & address : During detail Engineering
   Model No. : During detail Engineering
   Type : as per TS
   No. provided : 3 Nos. (2W+1S)
   Rated capacity Nm³/min : 36 (each)
   Rated discharge pressure, kgf/cm²g : 8
   kW input at motor terminal : during detail engineering
   Motor rating : During Detail Engineering
   Air temp. at delivery after after-cooler at rated capacity and pressure, deg.C. : 45 °C
Screw Speed, rpm
  1st stage (male & female)  
  2nd stage (male & female)  

Oil content in the air at outlet of air compressor, ppm. : Oil Free

Noise level at source when the compressor running at rated capacity, dB (A). : 80

Cooling water requirement : During Detail Engineering

Pressure drop across compressor : As per TS

Temp. rise : During Detail Engineering

02. **Inter cooler & after cooler**

No. per compressor

Design standard/code
Make
Max. working pressure, kgf/cm²g

i) Water side

ii) Air side

Tube material, size and thickness:

Shell material and thickness, mm

Moisture content in air after aftercooler, ppm

Space required for pulling out tube assembly of intercooler & aftercooler : During Detail Engineering

03. **Moisture separator**

Make

Type : During Detail Engineering

Model

Number
### Design standard/code for pressure vessel

During Detail Engineering

### Shell material and thickness

### Design pressure, kgf/cm² (g)

### Moisture content after separator

### B. Motor

i). Type

ii). Make

iii). Rated kW at 50 deg.C

iv). Rated kW at 40 deg.C

v). Rated voltage & system condition

vi). Frame size.

vii). Class of insulation

viii). Rated speed & direction of rotation

ix). Starting system

### C. Air Receiver

Number : 2 Nos.


Capacity : 12 m³ 1 No & 4 m³ - 1 No as per TS

Overall dimensions

Wall plate thickness

Plate material : AS PER TS & STANDARD

Design Pressure

Working Pressure : 8 Kgf/cm² (g)
### Annexure-A

LIST OF SPARES FOR 2 YEARS OPERATION & MAINTENANCE FOR AIR COMPRESSOR

<table>
<thead>
<tr>
<th>Interval working hours</th>
<th>Description</th>
<th>Quantity (nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>Easy-change filter 20 bar</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>LUB OIL 20L special screw compressor</td>
<td>6</td>
</tr>
<tr>
<td>3000</td>
<td>Wearing parts minimum pressure valve</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Easy-change filter 20 bar</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Suction filter cartridge replacement</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Oil separator</td>
<td>8</td>
</tr>
<tr>
<td>6000</td>
<td>Easy-change filter 20 bar</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Suction filter cartridge replacement</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Oil separator</td>
<td>8</td>
</tr>
<tr>
<td>9000</td>
<td>Easy-change filter 20 bar</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Suction filter cartridge replacement</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Oil separator</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>LUB OIL 20L special screw compressor</td>
<td>6</td>
</tr>
<tr>
<td>12000</td>
<td>Easy-change filter 20 bar</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Suction filter cartridge replacement</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Oil separator</td>
<td>8</td>
</tr>
</tbody>
</table>

Note: This list is tentative and it may vary upto any extent during detail engineering.

### Annexure-B

LIST OF COMMISSIONING SPARES FOR AIR COMPRESSOR

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Quantity (nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No commissioning spares are required for Air compressor</td>
<td>Nil</td>
</tr>
</tbody>
</table>

LIST OF SPECIAL TOOLS & TACKLES FOR AIR COMPRESSOR

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Quantity (nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No special tools &amp; tackles are required for Air compressor</td>
<td>Nil</td>
</tr>
</tbody>
</table>
04.08  WATER SYSTEM

04.08.00  Scope of work

The scope of work shall include design, engineering, fabrication, manufacturing, assembly & supply, erection/construction/laying, commissioning, testing & performance guarantee tests etc of plant & equipment and piping etc of complete water supply facilities including pump house buildings, civil & structural work & technological structures, electrics, instrumentation, automation, telecommunication, air-conditioning & ventilation, material handling & hoisting equipment etc as specified and required for complete water systems technological structures, pipe-support structures, etc as specified and required for the complete water system for proposed plant as specified in this chapter as well as various chapters of this contract specification in line with General Technical Specification (GTS) and subject to Employer's approval, complete in all respect on turnkey basis.

The scope of work shall include the following activities.

i) Design, engineering, manufacture /fabrication, assembly, shop testing, painting, packing sequential delivery FOR site, unloading, unpacking, storage at site, preparation & submission of all drawings for civil, mechanical, structural, piping, construction & erection drawings, construction & erection as per approved drawings, site-testing, painting, commissioning and fulfillment of guarantee performance of all plant & equipment of water supply facilities for the proposed plant including drinking water system, industrial service/make-up water system and water based fire-fighting system, in accordance with the water system requirements of the proposed plant.

ii) Supply of pipeline supports, thrust blocks/ anchor blocks, R.C.C. pedestals etc. for over head / on-ground /underground pipelines.

iii) Supply of all technical literature, drawings & documents, general arrangement drawings, assembly & sub-assembly drawings of all the plant & equipment, construction & erection drawings, as-built drawings, operation & maintenance manuals, manufacturing drawings, etc.

iv) Submission of all drawings at (iii) above, design calculations, data sheets for various equipments, pipeline sizing calculation and for approval of Employer/ Consultant and finalizing the same as per approval of Employer/ Consultant. The approval of the same however does not absolve the contractor from his responsibilities.
v) Supply of commissioning spares & consumables; a list there of shall be submitted by the Contractor.

vi) Contractor shall submit an itemized price-list of two years operation and maintenance spares.

vii) Supply of special tools, tackles for construction, erection operation and repair & maintenance of the plant & equipment.

viii) Supply of special tools and tackles, spares as mentioned in GTS shall be in the scope of Contractor.

ix) All necessary connections for hook-up with Employer’s system at battery limits.

x) Supply of erection, testing & commissioning equipment and material.

xi) Piping network flushing fluids, chemicals & consumables.

xii) First fill of oils, lubricants, filter media, resins, chemicals reagents and other consumables.

xiii) Inspection and performance testing of individual equipment and system as a whole.

xiv) Participation in design conference with the Employer & Consultant as and when called for.

xv) Contractor shall provide two nos drainage pumps for each underground premises, one working, one standby, of suitable capacity and head to drain out the seepage water and rain water from the underground premises. The pumps shall be capable of handling slurry water. The exact numbers, capacity and type of pump shall be finalised during engineering stage.

The Contractor’s scope also covers extension of fire-fighting line, drinking water line and industrial water line from the battery limits to various consumer points of the proposed plant in line with the present Contract technical specification and GTS.

Water supply system/ sub-systems shall be complete in all respects and any equipment or material not specifically mentioned in this specification, but required for safe, efficient & smooth operation and guaranteed performance of the plant shall be deemed to be included under the scope of work of the Contractor. Diversion of existing overhead / underground water pipelines (including those identified
during package execution) required for installation of the proposed units covered under this package is included in the scope of work of the Contractor. However, the price & other terms and conditions shall be mutually discussed and agreed during the execution of job by the Contractor.

04.08.01 Battery Limit

a) Industrial water

Industrial quality make-up water (quality as indicated in GTS, Maroda-I) will be made available to the Contractor at only one point within 100m from the proposed plant at a pressure of approx. 1.5 to 2.0 kgf/ cm² (g). The top of the pipeline (carbon steel) shall be approximately 1.2 m below the area ground level. Tapping of industrial make-up water shall be based on two points feeding and shall conform to provisions of GTS. Contractor shall extend the same through isolation gate valves in valve-pit along with flow meter (complete with isolation valves and by-pass arrangement) to his proposed systems for service/make-up water requirement for the entire plant area.

Contractor shall indicate the make-up water quantity requirement, pipe size, end connection, MOC of pipeline, etc. at the battery limit.

b) Drinking water

Drinking water will be made available to the Contractor at only one point within 100m from the proposed plant at a pressure of approx. 1.0 kgf/cm² (g). The top of the pipeline (carbon steel) shall be approximately 1.2 m below the area ground level. Tapping of drinking water shall be based on two points feeding and shall conform to provisions of GTS. Contractor shall extend the same from the battery limit through isolation gate valves in valve-pit to his proposed systems/shops, offices, toilets, drinking water platforms, water coolers, etc. for the entire plant area.

The Contractor shall indicate the drinking water quantity requirement, pipe size, end connection, MOC of pipeline, etc. at the battery limit.

c) Fire-fighting water

Industrial quality water (quality as indicated in GTS) will be made available to the Contractor at one point within 100m from the proposed plant at requisite pressure. The top of the pipeline (carbon steel) shall be approximately 1.2 m below the area ground level. Tapping of industrial make-up water shall be based on two points feeding and shall conform
to provisions of GTS. Contractor shall extend the same from battery limit through isolation gate valves in valve-pit to the entire plant area.

d) Construction Water

Construction water arrangement shall be in the scope of contractor. The location of borewells, if planned by the Contractor for construction water requirement would require clearance / approval from BSP/MECON.

04.08.02 Specification and Description of Work

Water System Facilities:

Water system shall in general include the following facilities:-

a) Cooling water system,
b) Make-up water system,
c) Water conditioning system,
d) Water supply system for air conditioning & ventilation system,
e) Drinking water system,
f) Water based fire-fighting system,
g) Service Water System,
h) Dewatering system for underground premises
i) Interplant pipelines,
j) Water pollution control & conservation.

a) Cooling Water System

1. For cooling of plant and equipment of the air-compressor unit there shall be a separate cooling water re-circulation system for each unit / sub-system with pumps, cooling towers and piping network. Contractor shall provide a separate pump house to house compatible group of pumps. Separate group of pumps and separate piping shall be provided for each sub-system to enable flexibility in operation.

2. The cooling water system shall be supplied in line with the GTS with regard to design norms (including no. of standby pumps, type of pumps, valves and piping design) and subject to Employer's approval.

3. The cooling water circuits shall be provided with chemical conditioning system to control corrosion and scaling and prevent bio-fouling. To reduce blow-down higher cycle of concentration shall be targeted.
4. Pump houses shall be provided with air-washer based air-conditioning and ventilation system.

5. With a view to conserve and save upon fresh water requirement, the Contractor will plan to utilize/reuse/recycle the reject/blow-down from the cooling water systems in the plant with necessary treatment etc. as specified by the Employer.

b) Make-up Water System

1. Make-up water for various usage including cold sump of cooling water circuit for air-compressor, air-conditioning and ventilation systems etc. and for supply of industrial service water will be tapped from the existing industrial water network and will be conveyed to the various consumers through a pipe network, preferably over-ground.

2. Quality of industrial make-up water is furnished in the GTS. This water will be supplied as make-up water to proposed plant unit for process & cooling needs at only one point for the entire needs of the proposed plant unit at battery limit as specified. The Contractor shall provide necessary treatment facility, wherever required, to make the water suitable for cooling and other purposes.

3. The water loss in the various processes in evaporation, process/system, minor leakages including service water requirement etc. shall be replenished by a separate common make-up water system to be provided by the Contractor.

4. The Contractor shall indicate make-up water requirement duly corroborated by back-up calculation.

5. Make up water system will include extension of pipelines from the battery limit with isolation gate valves in valve pit, along with pumps (if required), valves, valve pits, sumps etc., to the cooling water recirculation system, ACVS, service water requirement as well as process needs.

6. Online booster shall not be accepted. A makeup water sump with pumps and piping (pump house and sump are to be provided by the Contractor), if required, shall be provided.
c) Water Conditioning System

1. To prevent the circulation water system from corrosion and scale formation and to bring the make up water to the condition suitable for the cooling water requirement in the proposed plant there shall be a water conditioning facility as per system requirement and inline with the details given in GTS.

2. It shall consist of dosing tanks, pumps, valves, pipes, fitting, pipe supports and associated civil, structural, electrical, instrumentation, material handling, air-conditioning & ventilation etc. The scope of work for all these remains the same as specified for cooling water system.

3. These pumps may also be housed in the same pump-house for cooling water system or separately.

4. The Contractor shall furnish the details of chemical dosing proposed for the system.

5. The Contractor shall include in the scope of supply three months chemicals requirement for the chemical conditioning system.

d) Water Supply System for air-conditioning & ventilation

1. The entire piping network for water supply for air-conditioning and ventilation and other Systems/ Sub-systems is in the scope of the Contractor.

2. It shall consist of pumps, valves, pipes, fitting, pipe supports and associated civil, structural, electrical, instrumentation, material handling, air-conditioning & ventilation etc.

3. The details and specification of pumps, valves, pipes, fitting, pipe supports and associated civil, structural, electrical, instrumentation, material handling, air-conditioning & ventilation etc. as specified for cooling water system is applicable for this system also.

4. Makeup water for the system shall be provided by the Contractor from the make-up water network provided for the main plant. No separate connection at battery limit will be provided for this purpose.
5. Pumphouses shall be provided with air-washer based air-conditioning and ventilation system.

e) Drinking Water System

1. The drinking water shall be made available at one point near proposed plant within battery limit as specified. The Contractor shall extend the pipeline from battery limit with isolation gate valves in valve-pit upto various drinking water consumers.

2. The Contractor shall indicate drinking water requirement duly corroborated by back-up calculation.

3. If the pressure, as indicated in battery limit parameters, is felt inadequate for the area under the scope of the Contractor. Contractor shall provide separate sump and drinking water pumps along with piping and electrics etc. to meet the requirement. Online booster shall not be accepted.

4. The details and specification of pumps, valves, pipes, fitting, pipe supports and associated civil, structural, electrical, instrumentation, material handling, air-conditioning & ventilation etc. for cooling water system is applicable for this system also.

f) Water based Fire-Fighting System

To cater to the needs of water based fire-fighting system, a fire water piping network shall be planned with provision of yard hydrants and internal hydrants at regular intervals. The proposed network shall be connected with the existing network at the battery limits with isolation gate valves in valve-pit.

The following specification of work shall be considered:-

i) Category of hazard - ordinary (as par TAC)
ii) Yard hydrants - at 45 m intervals
iii) Internal hydrants - at 30 m intervals
iv) Min. pressure at remotest hydrant - 3.5 kg/cm²

Two nos. of 15 m long hose shall be provided alongwith fittings for each yard hydrant and 2 nos. of 15 m long hose shall be provided along with fittings for each internal hydrant.

The water based fire fighting system shall be designed, supplied & erected in line with the stipulations under various clauses of GTS-02 and
subject to Employer’s / Consultant’s approval. The details of the MVWS system have been dealt with separately.

The Contractor shall indicate fire fighting water requirement duly corroborated by back-up calculation.

g) **Service Water System**

For Service Water, pipeline network shall start from common pump house to all the transfer points of each floor and conveyor gallery. In each floor, 1 no. tapping point will be provided and for the conveyor gallery the tapping point shall be provided at every 50metre interval. For each tapping point 1 no. gate valve, hose and quick fix connection shall be provided.

For service water line each tapping point discharge rate will be 2m³/hr. and maximum 6 Nos. points can be operated at a time.

Service water system shall be supplied in line with the GTS with regard to design norms (including no. of standby pumps, type of pumps, valves and piping design) and subject to Employer’s approval.

h) **Dewatering system for underground premises**

Dewatering system for underground sumps shall be provided for underground portion of the proposed plant. The water from the sumps will be pumped to the nearest surface drainage system through pumping arrangement to be provided as per GTS and subject to Employer’s approval.

i) **Interplant Pipelines**

Industrial water for make-up water supply and general plant usage will be met through the proposed pipeline to be laid from the tapping point to these units.

Drinking water network and fire water network will be provided to various consumption points in the proposed industrial premises.

All the water lines including make-up water, fire water and drinking water lines, process and cooling water lines will generally be laid over-ground preferably on structural trestles.
j) Water Pollution Control and Conservation

Extensive recycling shall be adopted in the design of plant water systems. Quality of circulating water will be maintained through dosing of conditioning chemicals for controlling corrosion, scale deposit and microbial growth.

Through cascaded reuse of blow down, the water scheme will ensure minimization of waste water discharge from the industrial water circuits.

Any discharge being made into the Employer's existing network shall conform to the local pollution control norms fulfilling the statutory requirements.

The cooling water systems will generally comprise the following main units:

a) Open Indirect Industrial Water Cycle:
   - Cooling tower,
   - Pumpsets,
   - Strainers,
   - Interconnecting piping,
   - Chemical conditioning System,
   - Electrics, instrumentation & control system.

b) Miscellaneous and Common Facilities:
   - Make-up water system,
   - Interplant pipelines,
   - Water based Fire Fighting system,
   - Drinking Water System.

04.08.03 Design Criteria

Efficiency, reliability and flexibility of operation and maintenance will be the guiding criteria of the design of the water system for the proposed plant. Following design criteria in addition to GTS provisions shall be followed:

1. Water System will be designed as per the provisions of GTS in respect of various design aspects including type of pumps, no. of standby pumps, piping, pipe specification, type of valves, cooling
tower, side-stream filtration, handling & hoisting facilities, air-conditioning and ventilation facilities etc.

2. Each circulation system shall be connected with two nos. of delivery headers from the pumphouse and two nos hot return water headers from the consumers to the cooling tower/pumphouse / treatment unit. The water carrying capacity of each header shall be such that incase one of the headers is under maintenance the other header should be in a position to carry the required quantity of water to the consumers, i.e., 100% of designed flow so that normal production of unit is not affected with only one delivery / return header in operation. There shall be proper isolating facilities in these headers so that supply of water in any circuit or to any area of the Complex is not affected due to leakage in one of header line.

3. All sumps shall be compartmentalised as per GTS and each pump shall have independent suction.

4. Each pump shall have independent suction. Each pump shall be provided with a gate valve on the suction side and a non-return valve and gate valve on delivery side. The delivery line of each pump shall be connected to the main header with isolating header gate valves for isolating pumps’ delivery valves. Motorised gate valves shall be provided in automated pumping system for pumps’ suction & delivery.

5. Suitable number of header valves shall be provided such that delivery valve of a pump can be isolated for maintenance without affecting other stand-by pump’s availability.

6. All the valves of diameter 450 mm and above and the valves requiring remote control operation shall be electrically / pneumatically operated. Electrically operated valves shall be provided with limit switches as a safety measure. Electrically operated valves shall have provision for manual operation also. All manual valves of sizes DN 350 and above shall be gear operated. Frequently operated delivery valves and header valves below diameter 450 mm shall also be electrically operated.

7. Total no. of pumps in a pumping circuit shall be as per GTS. Pump type shall be as per the provisions of the GTS. Pump rpm shall be governed by the kW rating in line with the provisions of the GTS.
8. Drainage pumps (split casing, self priming and horizontal centrifugal pumps) will be one reserve pump for one working pump. The pumps shall not be of mono-block design.

9. All gate valves shall be cast steel with SS internals, NRVs shall have SS internals, rest of the design features shall be as per GTS.

10. Following MOC to be considered for valves:

   a) Gate valve:


   b) Butterfly valve:

      Body: ASTM A216 Gr WCB, Disc: CF8, Seat: EPDM (integral with the body), shaft: AISI 410 self-lubricated PTFE lined bearings for both drive end and non-drive end, hand lever /hand wheel: pressed/forged steel, end connection: Flanged to IS6392, T-17.

11. Pipe materials shall be as per CRLA,RSP,SAIL.

12. Sluice gates will have SS internals.

13. Butterfly valves usage shall be accepted for non-critical applications for flow modulation purpose at the express approval of the Employer.

14. Contractor will consider provision of strainers in each header as follows:

   - open industrial water circuit : for 100% flow, simplex strainers, 1W+1S,

15. Material handling facility for the units of the Water System shall be as per GTS.
16. Pump houses shall be provided with air-washer based air-conditioning and ventilation system.

17. Design criteria of the cooling tower shall be as per GTS.

18. Special maintenance tools and spares as mentioned in cl. no. 01.05 in ‘Design Criteria for Cooling Towers’, list of spares & tools & tackles as listed in cl. no. 8.18, list of tools and tackles as listed in cl. no. 8.18.02 of GTS for Water System shall be supplied by the Contractor.

19. Tapping of industrial make up water, drinking water & fire-fighting water shall be based on two points feeding as explained elsewhere in this chapter and shall conform to provisions of GTS.

20. Pipe thicknesses shall be as per GTS provisions.

21. As for as possible pipelines shall be laid above ground or in concrete trenches / tunnels. Wherever, it is not possible then only pipelines shall be laid underground.

04.08.04 Description of Cooling Water System

Open Industrial Water Cycle

Open industrial water circuits with filtered industrial water as the cooling medium shall be provided for indirect cooling of compressor unit.

Hot industrial cooling water after cooling compressor unit will reach the cooling towers under residual pressure for cooling. Cold water from the cooling tower basin will flow into the cold well of the pump house. From the cold well separate group of pumps shall pump water to the various consumers.

Make-up water shall be added in the cold well to make-up the losses in the system.

04.08.05 Erection, Testing and Commissioning

i. The erection of all plant and equipment shall be carried out according to the latest engineering practices and according to the drawings, specifications, Instructions etc. duly approved by the Employer/Consultant.
ii. The welding work should be carried out as per the approved WPS and PQR.

iii. The Contractor shall supply all required manpower, tools and related equipment, all hoisting equipment, all necessary scaffoldings, all necessary transporting equipment, consumables. Construction and erection materials, petrol, diesel oil, kerosene, solvents, sealing compound, tapes, brazing and soldering materials, welding and brazing gases, erection bolts, nuts and packing sheets/compounds, temporary supports, wooden blocks, spacers, templates, jute and cotton wastes, sand/emery paper etc. as required for the satisfactory completion of work.

iv. After erection, all equipment having moving part, subject to pressures or voltages shall be given trial operation. The trial operation shall consist of 72 hours of continuous operation. All modifications and rectifications required during the trial operation or required for proper operation shall be done at his own cost by the Contractor as accepted by the Employer/Consultant.

v. Rotating equipment shall be checked for proper direction of rotation and shaft alignment. Equipment subject to pressures shall be carefully examined for leakage. All equipment, such as pressure taps, temperature measurement connections, flow measurement devices etc. shall be provided by the Contractor.

vi. On completion of the work, the Contractor shall remove and dispose off all rubbish and other unsightly materials caused by his working to a distance of five kilometer from the proposed plant area or as directed by the Employer and thereby leaving the premises in good, clean, safe and operable condition.

vii. Before giving call for final inspection, all the documents shall be furnished to the Employer. The record of manufacturing details, inspection and tests carried out by the Contractor shall be made available to the final inspecting authority. However, approval and final inspection at the manufacturing works shall not relieve the Contractor of responsibility of replacing at his cost any defective part/material which may be detected by the employer during erection and commissioning or guarantee period.

viii. All materials required for fabrication, construction, testing and inspection shall be supplied by the Contractor. No material shall be free issue to the Contractor.
ix. No equipment or part item shall be dispatched without final inspection and issuance of inspection certificate.

x. All equipment, assemblies, sub-assemblies shall be shop tested as per relevant standards and the test certificates shall be submitted by the supplier.

xi. Erection, testing & commissioning of various equipments and piping etc shall be done also inline with details given in various chapters of GTS.

04.08.06 Painting

The Contractor shall follow the painting procedure as mentioned in GTS.

04.08.07 Drawings & documents

04.08.08 Drawings/documents to be furnished by the Contractor for approval

1. Process flow diagram indicating the water consumption figures complete with temperature, pressure and quality requirements.
2. Process & instrumentation diagrams for the water systems indicating location of all instruments, alarms and interlocks functions using ISA symbols.
3. General arrangement and cross-sectional drawings, characteristics curves and technical details of all the equipments (pumps, diesel engine, cooling tower, sluice gates, fire hydrants, etc.) valves and piping including GA drawings showing plan, elevation and sectional views of the water system.
4. List of instruments comprising bill of materials and instrumentation data sheets.
5. Layout of piping system indicating pipe routing, location of supports, valves and other fittings as required.
6. General arrangement drawings of pump houses and sump / tank (including civil, structural and other facilities) showing dispositions of various equipment and piping.
7. Data sheets, characteristic curves and technical details of all the equipments, valves and piping.
8. List of safety interlocks.
9. Test procedures for preliminary and final acceptance tests.
11. All equipment and piping sizing calculations.
12. GA drawings and details of air conditioning & ventilation facilities.
13. Test certificates for the following:
14. Material test certificate for all major equipment and their components.
15. Hydraulic test of equipment, pipe fittings & valves.
16. Static and dynamic balancing of all rotary parts/ equipments
17. Any other drawing/ documents as required by the Employer.

04.08.09 Drawings / documents to be furnished by the Contractor for reference and record

1. The Contractor shall submit required sets of all the approved drawings, documents and manuals for Employer’s record and use. After erection of equipment, the Contractor shall submit one set of linen tracings/ reproducible in required number of prints along with soft copies in CD (in AutoCAD format) of each “As built drawings”.
2. Operating and maintenance manual.
3. Spare parts recommendation and price list.
4. Instruction for erection, testing and commissioning.
5. Manufacturer’s test certificates.
6. Lubrication schedule and quantity and quality of lubricant for one year’s normal operation.
7. Various equipment assembly drawings and bill of material.
8. Welding procedure.
11. Characteristics curves of the pumps, motors and other equipments.
12. Operation and maintenance manuals for all equipments, valves and complete water system along with soft copies.
13. Test and calibration certificates.
15. Technical literature, catalogues and manufacturer’s drawings for all brought out equipment, valves and other items.
16. All inspection/ test report/ certificates.
17. Any other drawing/ documents as required by the Employer/Consultant.

04.08.10 Preferred Makes
The Contractor shall follow the list of proffered makes as per the following:

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Item Description</th>
<th>Manufactures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Horizontal centrifugal Pumps</td>
<td>Kirloskar Brothers, KSB, Beacon Weir, Voltas, Mather &amp; Platt, Jyoti, WPIL (Worthington).</td>
</tr>
<tr>
<td>2.</td>
<td>Submersible pumps</td>
<td>KSB, SU Motors, Kirloskar Brothers.</td>
</tr>
<tr>
<td>3.</td>
<td>Dosing Pump</td>
<td>Shapo Tools, Asia LMI (Madras), Toshniwal, Milton Roy India.</td>
</tr>
<tr>
<td>5.</td>
<td>Sluice Gates</td>
<td>Jash, IVPL.</td>
</tr>
<tr>
<td>7.</td>
<td>Rubber expansion joints</td>
<td>BDK, CORI Engineers.</td>
</tr>
<tr>
<td>8.</td>
<td>Hoses</td>
<td>Senior Flexonics, Hydrocrimp</td>
</tr>
<tr>
<td>9.</td>
<td>Pipe a) MS/GI</td>
<td>SAIL, TATA, Jindal, MAN, SAW, Welspun, Prakash, PSL, MSL.</td>
</tr>
<tr>
<td></td>
<td>b) DI</td>
<td>Electro Steel Casting</td>
</tr>
<tr>
<td>10.</td>
<td>MS/GI Pipe Fittings</td>
<td>Tube bends, Stewards &amp; Lloyds, BST, Jindal.</td>
</tr>
<tr>
<td>12.</td>
<td>Fire hydrants</td>
<td>New Age Industries, Steelage Industires, ASCO, Strumech, Vijay Fire, Zenith</td>
</tr>
</tbody>
</table>
Valves

1. **C.S. Gate /Globe Valve**
   
   A. *(Non-IBR- for all Sizes and Ratings):*
   
   - M/s. BHEL, Tiruchirapalli.
   - M/s. K.S.B. Pumps Ltd, Kolkata.
   - M/s. Larsen & Toubro Ltd., (Audco), Chennai.
   - M/s. Leader Valves Ltd., Jalandhar.
   - M/s. Oswal Industries Ltd., Ahmedabad.

2. **Butterfly Valve**:

   - M/s. Avcon Control Pvt. Ltd., Mumbai (For Actuator operated Valves)
   - M/s. Fisher Xomox Sanmar, Trichinapalli.
   - M/s. Inter Valves (Pvt.) Ltd., Pune.
   - M/s. Larsen & Toubro Ltd., (Audco), Chennai.
   - M/s. Tyco Valves, Baroda.
   - M/s. Virgo Engineers Ltd., Pune.

3. **Ball Valve**:

   - M/s. Fisher Xomox Sanmar, Trichinapalli.
   - M/s. Flowchem Ind., Ahmedabad.
   - M/s. Inter Valves, Pune.
   - M/s. Larsen & Toubro Ltd., (Audco), Chennai.
   - M/s. Oswal Industries Ltd., Ahmedabad.
   - M/s. Virgo Engineers Ltd., Pune.

4. **CI/Sluice Gate Valves**

   A. **For all Sizes and Ratings:**

   - M/s. Calsens Private Ltd., Kolkata.
**B. For Sizes upto NB 100 mm & PN 10 Rating:**

- M/s. Ronex Engg. Company, Kolkata
- M/s. Upadhyaya Valve Manuf. Pvt. Ltd., Kolkata
- M/s. Steam & Mining Industries, Kolkata.
  (Vendors appearing under ‘A’ shall be eligible for ‘B’ also)

**5. Plug Valve:**

- M/s. Fisher Xomox Sanmar Ltd., Chennai.

**6. Cock Valve for Gas applications:**


**7. Check Valve/Non Return Valve:**

- M/s. Inter Valves (Pvt.) Ltd., Pune.
- M/s. K.S.B. Pumps Ltd, Kolkata.
- M/s. Oswal Industries Ltd., Ahmedabad.

**8. Fabricated Gate Valve.**

- M/s. Zimmermann & Janseen, Duren, Germany.

**9. Piston Valve:**

- M/s. Uni-Klinger Ltd., Pune.
10. **Knife Edge Gate Valve:**

- M/s. Energo Engg., Delhi.
- M/s. Orbinox India Pvt. Ltd., Coimbatore.

11. **Non-Ferrous Valve:**

- M/s. Leader Valves Ltd., Jalandhar.
- M/s. Zoloto Ind., Jalandhar.
04.09  INSTRUMENTATION & CONTROL

04.09.01  GENERAL

01. This document is intended to define the basic requirements for instrumentation system for Coal Handling Plant & Coke Sorting Plant for COB #11 and Flux & Fuel Preparation and Plant Return Fines Handling for SP-III coming under the 7.0 MTPA expansion of Bhilai Steel Plant (BSP) with a view to achieve smooth, efficient, safe and reliable operation of the process.

02. This document, read together with the Instrumentation & Automation part of the General Technical Document (No.GS-03), General Conditions of Contract (GCC) and other commercial terms & conditions, will form the Contract document pertaining to Instrumentation & Control System of Coal Handling Plant & Coke Sorting Plant for COB #11 and Flux & Fuel Preparation and Plant Return Fines Handling which will be complied by the Contractor while executing the package.

03. Measurement and control equipment supplied for the process will be complete in all respect in line with this document. Any equipment / accessories not explicitly indicated in this document, but considered essential for proper functioning of technological equipment and process are included in Contractor’s scope of work and supply.

04. Monitoring, sequential operation, alarm & interlock functions for the process & equipment of the Coal Handling Plant & Coke Sorting Plant for COB #11 and Flux & Fuel Preparation and Plant Return Fines Handling for SP-III will be achieved through automation system. All instrumentation facilities will be interfaced with automation system accordingly. The requirement regarding automation system has been separately described under ‘Automation system (level-1)’ chapter of this Document.

05. Instrumentation system of the plant will be in general, Field Bus compatible and will be interfaced with the automation system having Field Bus interface modules. However, in cases, where some instruments are not available with Field Bus compatible features, conventional instrumentation equipment (SMART & 4-20 mA DC signal output) will be supplied. Signals from these instruments will be interfaced through hardware input/ output modules of the automation system.

06. All field-mounted level transmitters will be radar type. Suitable enclosures will be provided at field for the controller/ electronic unit of the level transmitters. Other features of the instrumentation facilities will be as
indicated in the Instrumentation part of General Technical Document (No.GS-03). Level transmitters will measure accurately & reliably the level of bulk solids and powders during fill cycle regardless of the dust or material variation in density or moisture.
For high level interlock, suitable contact type level switches to be considered.

07. If required, air purging of level sensor (radar type) will be provided. All necessary tubes/pipes, valves, pipe fittings etc. for the same will be provided by Contractor.

08. The field signals which are to be interfaced with the I/O system or Field Bus interface modules of automation system, will be connected to the nearest Remote I/O stations of the automation system considered for that area/ unit. Suitable junction boxes will be considered as per the finalized requirement. The cabling activities will be carried out as per the finalised cable schedule and wiring & termination drawings of the Contractor.

09. All the instrumentation equipment will be brand new & supplied from the latest product ranges of reputed manufacturers as per the List of Preferred Makes, indicated at clause no. 04.09.06. Employer/ Consultant reserve the right of selecting particular make and model of instrumentation equipment with a view of standardisation of the whole plant. Contractor will comply with such requirements. In case, certain instruments to be supplied by Contractor as per his standard design and system requirement whose make has not been indicated in the document, Contractor will propose make of such items with credentials and catalogues for Employer/ Consultant’s consideration.

10. Contractor will execute complete instrumentation package on turnkey basis to the satisfaction of Employer/ Consultant. Contractor will comply with all the requirements indicated under General; Scope of Work and Supply; List of measurement, control, alarm & interlock; Submission of drawings & documents and other related clauses/ annexure included in this document.

11. Temperature measurement under package units & motors will be connected directly to respective automation system’s temperature input card.

12. All correspondences / documents will be in English language and for all the data, drawings & documentation metric or SI units will be followed.
04.09.02 SCOPE OF WORK AND SUPPLY

Contractor’s scope of work and supply will include design; engineering; manufacture/procurement; assembly; calibration; shop testing; inspection at works & at site; painting; packing; transportation to site including loading, unloading, storage & handling of all instrumentation equipment including electrical accessories, cables, pipes, erection accessories, panels/ cabinets and all associated hardware, as required for completeness of instrumentation system in all respect along with site fabrication, erection, testing, commissioning of the complete instrumentation system for completeness & satisfactory stable operation of Coal Handling Plant, Coke Sorting Plant for COB #11, Flux & Fuel Preparation and BF Return Fines Handling for SP-III. The scope of work will also include liquidation of defect points, participation in tests for establishment of plant performance guarantee (PG) and post commissioning activities till issue of final acceptance certificate (FAC) by BSP.

The scope of work and supply will also include, but not limited to, the following:

1. Instrumentation equipment as per the measurement list covered under clause number 04.09.03 of this document.
2. Field bus devices, Field bus interface modules, Field bus cables, terminators, couplers, connectors, power supply modules, power conditioners, surge suppressors, repeaters, Field bus junction boxes, T devices, pull boxes, etc., required for completeness of implementation of Field Bus based system.
3. All maintenance, diagnostic tools & devices required for implementation, maintenance & trouble-shooting of Field Bus system.
4. For air purging of instruments to remove/avoid dust accumulation (if required), all required with piping, pipe, fittings valves etc.
5. Supply of testing equipment, tools & tackles as per clause no. 04.09.05.
6. All electrical accessories for instrumentation system including UPS and other instrument power supply equipment as applicable.
7. All types of control, signal, LT power & special cables, as required for this package.
8. Fully wired cabinets/ panels, junction boxes, pull boxes, transmitter cabinets, etc. Suitable panels for electronics units of the level transmitters and transmitter cabinets/ junctions boxes for the transmitters & connectors for the field bus based instruments, etc., will be provided and properly located at the field/ rooms.
9. Galvanized trays, conduits, protection pipes, fittings, steel structures & frames, erection hardware & accessories, as required for this package.
10. Submission of drawings and documents as defined in this document.
11. Erection, testing, calibration and commissioning of the total equipment included in this document. Contractor will arrange tools, tackles and consumables as may be required for erection, testing, calibration and commissioning activities.

12. One no. hand held universal type calibrator (Laptop based) having sufficient memory capacity and with battery & battery charger as required for calibration of all level transmitters. All the necessary software will be loaded in the calibrator.

13. Preparation of earthing pit, supply of earthing materials including cables and installation of separate earthing system for case earthing, power and instrument signal earthing.

14. Arrangement of and participation in inspection of Instrumentation equipment by Employer/Consultant. Inspection and Testing will be carried out in compliance with the Quality Assurance Plans, to be approved during detailed engineering stage.

15. Scope includes arranging visits by respective instrumentation equipment manufacturer's representatives at site, as & when required, during erection & commissioning.

16. Providing training to Client's personnel on special instrumentation equipment, at manufacturer's works and also at site.

17. Two years maintenance spares, if the order is separately placed by Employer.

18. Commissioning spares and three months consumables.

19. Supply of all instrumentation items from “list of preferred makes” as indicated at clause no. 04.09.06. From the list, for any particular type of instrument, only those vendors will be selected which are field bus compatible. However, for a particular type of instrument, if no vendor can provide field bus compatible instrument, then conventional type can be supplied.


04.09.03. LIST OF MEASUREMENTS

An indicative list of measurements, alarms & interlocks for Coal Handling Plant, Coke Sorting Plant for COB #11, Flux & Fuel Preparation and Plant Return Fines Handling for SP-III is given below. However, Contractor will supply all the measurements, alarms & interlocks as may be required for efficient & satisfactory operation of the system. Unless specifically mentioned, all monitoring of the process parameters will be achieved in level-1 automation system and displayed in HMI stations and field instrumentation equipment will be supplied accordingly.
A) Coal Handling Plant:

The measurements for Coal Handling Plant will include, but not limited to, the following:

i. Level measurement of coal towers (18 nos.): For each tower minimum one no. of level transmitter (radar type) and one no. of high level switch will be provided. These signals will be hooked up with the automation system for alarms and necessary interlocks. The required no. of level transmitters will be provided as per the bunker design. For interlocks, separate high level switches for each bunker will be provided as per the process requirement, no. of feeding points etc.

ii. Level measurement of new silos (5 nos.): For each silo, 2 numbers of radar type level transmitters and 4 numbers of level switches per silo will be provided. These signals will also be hooked up with the automation system for alarms and necessary interlocks.

B) Coke Sorting Plant:

The measurements for Coke Sorting Plant will include, but not limited to, the following:

i. Level measurement of bunkers (4 nos.): For each bunker one no. of level transmitter (radar type) and one no. of high level switch will be provided. These signals will also be hooked up with the automation system for alarms and necessary interlocks.

C) Fuel & Flux Crushing & Screening system:

The measurements for Fuel & Flux Crushing & Screening system will include, but not limited to, the following:

i. Level measurement of bunkers (6 nos.): For each bunker one no. of level transmitter (radar type) and one no. of high level switch will be provided. These signals will also be hooked up with the automation system for alarms and necessary interlocks.

ii. Level measurement of bunkers (1 no.): For this bunker two nos. of level transmitters (radar type) and two nos. of high level switches will be provided. These signals will also be hooked up with the automation system for alarms and necessary interlocks.
04.09. 04. LIST OF DRAWINGS & DOCUMENTS

Following drawings and documents will be submitted by the Contractor for Instrumentation system:

I) For Approval:

01. Finalised process and instrumentation (P & I) diagram indicating all local & remote measurements, alarms and interlock functions, using ISA symbols and using suitable tag numbers against each instrumentation equipment.
02. Finalised list of measurements, alarms & interlocks, along with BOQ and document of each instrumentation item indicating make, model number, scale range, quantity, application and tag number (as per P&I diagram).
03. Detailed specification datasheet for each instrumentation item, filled in as per the format finalized for this plant.
04. Overall general arrangement drawings & sectional views of various cabinets, panels, consoles, etc., showing internal disposition of all components/ units, with dimensional details and bill of materials.
05. Single line power supply diagram with document and bill of quantities of electrical accessories along with that of UPS.
06. Quality assurance plan for each instrument & control system.

II) FOR SCRUTINY AND RECORDS

01. Detailed technical literature/ catalogue for each instrumentation item.
02. Instrument Installation/ Hook up diagrams with bill of materials.
03. Instrumentation layout drawings showing location of instruments and route of cables from these upto control room.
04. Wiring and termination diagrams with details of termination of field signals to local JBs/ panels and from JBs to panels/ marshalling racks/ cabinets including internal wiring drawings.
05. Cable schedule.
06. Manufacturer’s test, calibration and guarantee certificates for all instruments.
07. Operation and maintenance manuals for instruments.
08. ‘As-built’ documentation.
09. Soft copy of all the above drawings & documents in CD-ROMs/ DVDs.

04.09. 05 LIST OF TESTING EQUIPMENT

Following testing equipment pertaining to Instrumentation will be supplied by the Contractor:
1. 4-1/2 Digit Digital Portable Multimeter

<table>
<thead>
<tr>
<th>Make</th>
<th>Fluke/ Yokogawa/Philips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>Type</td>
<td>Portable &amp; handheld type</td>
</tr>
<tr>
<td>Display</td>
<td>4-1/2 digit, LCD</td>
</tr>
<tr>
<td>Range:</td>
<td></td>
</tr>
<tr>
<td>DC Voltage --</td>
<td>Selectable upto 1000 V min.</td>
</tr>
<tr>
<td>DC Current –</td>
<td>Selectable upto 10 A min, and will be capable to measure mA signals for instrument use</td>
</tr>
<tr>
<td>AC Voltage –</td>
<td>Selectable upto 1000 V min.</td>
</tr>
<tr>
<td>AC Current –</td>
<td>Selectable upto 10 A min</td>
</tr>
<tr>
<td>Resistance—</td>
<td>Selectable upto 50 M Ohm min.</td>
</tr>
<tr>
<td>Capacitance—</td>
<td>Selectable upto 10 mF min.</td>
</tr>
<tr>
<td>Frequency--</td>
<td>10.00 KHz to 199.99 KHz.</td>
</tr>
<tr>
<td>Other facilities</td>
<td>The multimeter will have the facilities like Diode testing, Continuity testing, Data hold facility, Auto hold facility, Auto power off facility, and with alligator clips, holster, temperature probe, battery, user manual &amp; operator’s guide. Multimeter will be suitable for true RMS measurement of AC voltage and current.</td>
</tr>
</tbody>
</table>

2. Laptop based programmer for level transmitters: 1 no.

3. Tools & Tackles

<table>
<thead>
<tr>
<th>Make</th>
<th>Taparia/ Everest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tester</td>
<td>5 nos.</td>
</tr>
<tr>
<td>Allen key set, Size: 1.5 mm to 10 mm (one set consisting of 8 pieces)</td>
<td>1 set</td>
</tr>
<tr>
<td>D Spanner set, Size: 6 mm to 20 mm (one set consisting of min. 8 pieces)</td>
<td>1 set</td>
</tr>
<tr>
<td>Ring Spanner set, Size: 6 mm to 20 mm (one set consisting of min. 8 pieces)</td>
<td>1 set</td>
</tr>
<tr>
<td>Screw drivers (champion set)</td>
<td>1 set</td>
</tr>
<tr>
<td>Combination Pliers, Size: 6&quot; &amp; 8&quot;</td>
<td>1 set</td>
</tr>
<tr>
<td>Nose Pliers Size: 6&quot;</td>
<td>1 no.</td>
</tr>
<tr>
<td>Hammers</td>
<td>1 no.</td>
</tr>
<tr>
<td>Files,Size:12” flat, 12” half round, 12” round</td>
<td>1 set</td>
</tr>
<tr>
<td>Slide (adjustable) wrench, Size: 8&quot;, 12&quot;, 18”</td>
<td>2 sets</td>
</tr>
<tr>
<td>SL. No.</td>
<td>ITEM DESCRIPTION</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>1.</td>
<td>PRESSURE INSTRUMENTS</td>
</tr>
<tr>
<td></td>
<td>B). Pressure / Differential Pressure switches. (Electronic Type)</td>
</tr>
<tr>
<td>2.</td>
<td>TEMPERATURE INSTRUMENTS/SENSORS</td>
</tr>
<tr>
<td>2.1</td>
<td>Temperature gauges</td>
</tr>
</tbody>
</table>
2. Ashcroft,  
3. **Budenberg**  
4. Waaree instruments  

| 2.2 Thermocouple & RTD / thermo well | 1. Tempsens,  
2. Toshniwal Industries,  
3. Detriv.  
4. **Temptech**, |

| 2.3 Temperature Switch | 1. WIKA,  
2. Switzer  
3. Ifm. |

| 2.4 Temperature transmitter | 1. Emerson (Rosemount),  
2. Yokogawa,  
3. Honeywell,  
4. MTL  
5. Phoenix.  
6. Siemens |

| 2.5 Infrared radiation pyrometer/portable | 1. Land,  
2. Ircon,  
3. Raytek,  
4. **Impac**,  
5. **Keller HCW** |

### 3 FLOW INSTRUMENTS

| 3.1 Rotameters | 1. Forbes-Marshall,  
2. Chemtrols,  
3. Rota Instruments.  
4. Eureka instruments  
5. SMC |

| 3.2 Orifice Plate & flanges Assembly/ Venturi, Flow nozzle | 1. Engineering Specialties,  
2. Micro-precision,  
3. Instrumentation Ltd,  
4. **Uni-control** |

| 3.3 DP type Flow / Level Transmitters | 1. Emerson (Rosemount),  
2. Honeywell,  
3. Yokogawa, |
4. Siemens,  
5. ABB  
6. E&H,  

| 3.4 | Flow Switch | 1. Ifm.  
  |     |         | 2. Kobold  
  |     |         | 3. Mobrey  
  |     |         | 4. Sitron  
| 3.5 | Electromagnetic flow meter | 1. Yokogawa,  
   |     |         | 2. Emerson (Rosemount),  
   |     |         | 3. Forbes -Marshall,  
   |     |         | 4. Endress & Hauser.  
| 3.6 | Vortex Flow meter | 1. Emerson (Rosemount)  
   |     |         | 2. Forbes -Marshall  
   |     |         | 3. Yokogawa  
   |     |         | 4. Endress & Hauser  
| 3.7 | Mass (coriolis) flow meter | 1. Emerson (Rosemount)  
   |     |         | 2. Yokogawa  
   |     |         | 3. Forbes –Marshall  
   |     |         | 4. Endress & Hauser,  

4  LEVEL INSTRUMENTS  

| 4.1 | Level gauge (magnetic & reflex type) | 1. Chemtrol  
   |     |         | 2. Forbes Marshall  
   |     |         | 3. Mobrey  
   |     |         | 4. Hi-Tech (levelstat)  
| 4.2 | Level Switch (Conductivity type) | 1. Vega  
   |     |         | 2. Endress & Hauser  
   |     |         | 3. Pepperl &Fuchs  
| 4.3 | Level Switch (Capacitance/RF type) | 1. Vega  
   |     |         | 2. Endress & Hauser  
   |     |         | 3. EIP Bulk  
   |     |         | 4. Sapcon  
| 4.4 | Level Switch (Tuning fork/Rod type) | 1. Chemtrol (Vega)  
   |     |         | 2. Endress & Hauser  
   |     |         | 3. Pepperal &Fuchs  

| 4.5 | Level Switch (Float type) | 1. Emerson  
2. Forbes Marshall  
3. V-Automat  
4. Mobrey |
|-----|-------------------------|-----------------------------------------------|
| 4.6 | Level Switch/ Transmitter (Displacer type) | 1. Emerson  
2. Chemtrols (Eckard)  
3. Mobrey  
4. Masoneilan |
| 4.7 | Level Switch/ Transmitter (Ultrasonic type) | 1. Endress & Hauser  
2. Forbes –Marshall  
3. Siemens (Miltronics)  
4. Sick  
5. Pepperal &Fuchs |
| 4.8 | Level Switch/ Transmitter (Radar type) | 1. Emerson (Rosemount)  
2. Endress & Hauser  
4. Sick  
5. Mobrey |
| 4.9 | Level Switch/ Transmitter (Nucleonic type) | 1. Concord International (Dr. Berthold)  
2. Emerson (Kay Ray)  
3. E&H |
| 5 | CONTROL VALVES AND ACCESSORIES | |
| 5.1 | Control valve | 1. Fisher-Xomox  
2. Instrumentation Ltd  
3. Masoneilan  
4. Valflo  
5. Samson Controls  
6. Forbes Marshall (Arca), |
| 5.2 | Electrical Actuator | 1. Auma  
2. Limitorque  
3. Instrumentation Ltd(Bernard)  
4. Beck |
| 5.3 | Pneumatic Actuator | 1. Fisher-Xomox |
|   | 5.5 Self-regulating pressure control valve | 1. Samson Controls  
|   |                                           | 2. Forbes Marshall  
|   |                                           | 3. Instrumentation Ltd.  
|   |                                           | 4. Nirmal Industries  
|   |                                           | 5. *Fisher-Xomox*  
| 5.6 | I/P converters | 1. Forbes Marshall (Moore products)  
|   |                                           | 2. ABB  
|   |                                           | 3. Emerson  
|   |                                           | 4. *Honeywell*  
| 5.7 | Pneumatic Positioner, | 1. Instrumentation Ltd  
|   |                                           | 2. Dresser Industries (Masoneilan)  
|   |                                           | 3. Samson Controls  
|   |                                           | 5. *SMC*  
|   |                                           | 6. *Fisher Xomox*  
| 5.8 | Electro-pneumatic positioner | 1. Fisher-Xomox  
|   |                                           | 2. Siemens  
|   |                                           | 3. Masoneilan  
|   |                                           | 4. Samson Controls  
|   |                                           | 5. Instrumentation Ltd.  
|   |                                           | 7. ABB  
| 5.9 | Solenoid Valve | 1. Herion,  
|   |                                           | 2. Rotex  
|   |                                           | 3. Schrader-Schovill  
|   |                                           | 4. Asco  
|   |                                           | 5. *Mac*  
|   |                                           | 6. *Burkert*  

*Note: * Bolded names indicate the primary supplier for each category.
## 5.10 Air filter regulator
1. Shavo-Norgren
2. Marsh-Bellofram
3. Placka
4. Schrader-Schovill.

## 6 CABLES

### 6.1 Instrumentation Cable
1. Universal Cables
2. Delton
3. Lapp cables
4. Brooks Cables
5. *Asian cables*
6. *Belden*
7. *MEM*

### 6.2 Thermocouple Compensating Cable
1. Toshniwal Cables
2. Paramount Cables
3. Udey pyro-cables
4. Brooks
5. *MEM*

## B. CONTROL ROOM INSTRUMENTATION

### 7.1 Distributed Control System (DCS)
1. Yokogawa (CS 3000)
2. Honeywell (Experion +C 300)
3. Emerson (Delta-V)

### 7.2 Programmable Logic Controllers.
Refer Electrical

### 7.3 Digital Indicator
1. PEPL
2. Masibus
3. Lectrotek
4. Honeywell.
5. *Yokogawa*
6. *ABB*
7. *Micro controls*
8. *Radix*

### 7.4 Bar graph Indicator
1. Masibus Instruments
2. Lectrotek
### 7.5 Recorders (Chart less)

- **1.** Eurotherm
- **2.** Yokogawa
- **3.** Honeywell
- **4.** ABB

### 7.6 Microprocessor based controller

- **1.** Yokogawa
- **2.** Siemens
- **3.** Honeywell
- **4.** Eurotherm
- **5.** Forbes Marshall
- **6.** Toshiba

### 7.7 Digital scanners

- **1.** Masibus Instruments
- **2.** Lectrotek
- **3.** Radix
- **4.** Micro Controls
- **5.** PEPL

### 7.8 DC Power Supply Unit

- **1.** Aplab
- **2.** Phoenix
- **3.** Schneider
- **4.** P&F
- **5.** Siemens

### 7.9 IS Interface/Zenner Barrier

- **1.** Pepperl & Fuchs
- **2.** MTL
- **3.** Stahl

### 7.10 Signal isolators

- **1.** Pepperl & Fuchs
- **2.** MTL
- **3.** Yokogawa
- **4.** Forbes Marshall (Protech)
- **5.** Phoenix
### 7.11 Annunciation system
1. IIC  
2. Minilec  
3. Procon  
4. *Digicont*  
5. *MTL*  
6. *BETA instruments*

### 7.12 Instrument Panels/ Control Desk
1. Rittal  
2. Pyrotech  
3. Instrumentation Ltd.

### 7.13 Manual loaders
1. Masibus  
2. PEPL  
3. Lectrotek

### 7.14 Totalizer
1. Masibus  
2. PEPL  
3. Lectrotek  
4. Bivak

### C. ANALYTICAL / SPECIAL INSTRUMENTS

#### 8.2 Gas Detectors
1. Dragger  
2. *Crowcon*  
3. *MSA*  
4. *BW Technologies*  
5. *Reiken-Keiki Japan*  
6. *Bieler & Lang*

#### 8.4 Moisture Analyzers (Nucleonic)
1. Concord International (Dr. Berthold)  
2. Emerson (Analytical).  
3. Sick  
4. Thermo Electron

#### 8.6 IR type Moisture analyzer
1. Moistech  
2. NDC(EMC)
8.8 Vibration sensors & monitors
   A. For turbines and other high speed critical machines
   B. For other applications
       1. Bentley Nevada
       2. *Shinkawa (Forbes –Marshall)*

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>8.9 Opacity/Dust concentration meter</td>
<td>1. Codel (Forbes- Marshall)</td>
</tr>
<tr>
<td></td>
<td>2. Durag</td>
</tr>
<tr>
<td></td>
<td>3. Emerson</td>
</tr>
<tr>
<td></td>
<td>4. Land</td>
</tr>
<tr>
<td></td>
<td>5. GESensing</td>
</tr>
<tr>
<td></td>
<td>6. Chemtrol</td>
</tr>
</tbody>
</table>

8.11 SPM analyzer

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8.12 SOx- NOx analyzer</td>
<td>1. Emerson</td>
</tr>
<tr>
<td></td>
<td>2. Yokogawa</td>
</tr>
<tr>
<td></td>
<td>3. Durag</td>
</tr>
<tr>
<td></td>
<td>4. ABB</td>
</tr>
<tr>
<td></td>
<td>5. Honeywell</td>
</tr>
</tbody>
</table>

8.13 Moisture Sensor & Transmitter

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8.13 Moisture Sensor &amp; Transmitter</td>
<td>1. Invensys (Foxboro)</td>
</tr>
<tr>
<td></td>
<td>2. Bartec</td>
</tr>
<tr>
<td></td>
<td>3. GE-Panametrics</td>
</tr>
</tbody>
</table>
04.10 ELECTRICAL POWER DISTRIBUTION, DRIVES, CONTROL & ILLUMINATION

04.10.01. General

This section covers major features of Power distribution System, Shop-Electrics, Drives, Control, Automation and Illumination System to be supplied by Contractor for the Coal Handling Plant (CHP) & Coke Sorting Plant (CSP), Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (FFP).

The Contractor will refer to General Technical Specification for Electrics (GS-03) for detailed specification of equipment/components. This Contract Specification (CS), General Technical Specification (GTS) including Preferred Makes for Equipment and supplies (GS-13) and other attached documents/ Annexure E-01(Tools & Tackles), E-02(Commissioning Spares), E03, E-04, E-05 considered, as a whole will comprise the complete Contract Specification. These are complementary and anything laid down in one and not in other will be deemed as binding, as though laid down in the Contract specification as a whole. In case of conflict between the Contract specification and GTS, the Contract specification (CS) will prevail.

04.10.02. HT Power Supply System & Battery Limit

Power supply for the Coke Sorting Plant and Coal Handling Plant will be made available from the 11/6.6 kV switchboards proposed to be installed at HT substations (HTSS) near COB#11(HTSS-48), under a separate package by EMPLOYER (package no. 071).

Power supply for the Augmentation in Flux - Fuel Preparation And Plant Return Fines Handling for SP III of SP-3 Complex will be made available from the 11/6.6 kV HTSS for SP-III -HTSS-43 and HTSS-45 (beside HTSS-42) Complex under a separate package by EMPLOYER (package no. 071).

Refer typical power distribution drawing no.MEC/S/9101/11/E1/06/00/00/064.01/R1 for HTSS

The scope of work of the Contractor will commence from the outgoing terminals of 11/6.6 kV switchboard located at HTSS-48, HTSS-45 and HTSS-43 Complex for the respective facilities.
This 11/6.6 kV Switchboards at HTSS will be used to supply power to all LT substations (LTSS) and all 6.6 KV HT Motors under the scope of this package. Supply, laying and termination (at both ends) of all HT & Control Cables from HT switchboard to LTSS & HT motors will be in the scope of Contractor. Power to all the HT motors will be supplied from the 6.6kV HT Switchboards.

Adequate number of LT Substations (LTSS), (at suitable locations to be decided by the Contractor) each comprising of LT switchboard along with two transformers will be included by the Contractor in his scope of work. The transformer rating will be worked out on the basis of guidelines given in General Technical Specification. However, the rating of transformers will be 2000/1000 kVA depending upon the load. The interconnection between transformer secondary and LT switchboard will be through bus ducts.

The Contractor will indicate the numbers of 11KV and 6.6 kV feeders required by them from HTSS during Basic Engineering to provide HT feeders by Employer. The Contractor will indicate the details of connected load (KW) & Maximum Demand in 15 min. duration for each feeder and also the overall expected maximum demand in 15 min duration for the entire plant under normal operating conditions.

The following are to be considered in addition to the equipment specification spelt out in GTS.

a) The vector group for all distribution transformers (LT S/S) will be of Dyn11 only to take care of circulation of harmonic currents. However, care should be taken not to envisage mixing of supply with the existing LT power sources of 2.5 MT area as the existing distribution transformers are of Yy0 vector group.

b) Separate analogue voltmeters for line voltage & bus voltage and ammeter in each of the three phases will be provided.

c) All out going ACBs will be 800A, 1000A or 1600 A as per requirement with protection settings selectable at site.
d) Check-synchronising relay will be provided wherever sectionalizing is envisaged between two different sources of power supplies.

e) Care should be taken to avoid location of LT Substations under Conveyor galleries/ dust prone areas.

f) LT Bus-duct insulators will be of porcelain.

g) The CT mounting arrangement inside the cable chambers of all feeders will be such that CTs and secondary connections will be easily accessible for maintenance, replacement, etc.

Each of the LT substations will have the following facilities:

a) The substation design will be dust proof and all entry points will be provided with double door arrangements.

b) Sufficient quantity of fire extinguishers at various locations will be provided as part of safety equipment inside sub-station.

c) Air cooling facility will be provided in all LT substations with air washing.

d) Lighting circuits of different rows will be controlled by different MCBs for better energy saving.

e) Breaker handling facilities will be provided.

f) Tools & tackles along with store room facilities will be provided.

g) Two nos of 4 legged wooden stools of height 1m and 4m each will be provided.

h) Chain pulley block or telpher arrangement will be provided.

04.10.03. Scope of Work

The scope of work of Contractor will cover design, basic and detailed engineering, submission of drawings for approval, manufacture, testing, inspection by EMPLOYER/Consultant, packing, loading, forwarding, delivery at Plant site, loading/unloading, storage, handling of material/equipment for erection, erection, no-load and load testing, commissioning, PG test, PAT/FAT and liquidating the defects and handing overall electrics related to Power Distribution, drives & control, illumination for complete & satisfactory operation of Coal Handling Plant(CHP) & Coke Sorting Plant(CSP), Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (FFP) on Turnkey basis.
Any item or equipment not specifically mentioned but essential for proper installation, operation, maintenance and safety of plant, equipment and personnel will be included by the Contractor in his scope of work.

The scope of work for this package will include but not limited to the following:

I) Power Distribution Equipment

1. Adequate numbers of Double ended 11/0.433 kV or 6.6/0.433 kV LT substations (LTSS)

2. Each double ended substation will comprise of 11/0.433 kV or 6.6/0.433 kV Distribution transformers, 415 V PCC, 415 V Bus-duct, ACDB, MLDB, LDB, HT/ LT power & control cables and other necessary items as required for completion and successful operation of the power distribution network, in an integrated manner.

3. Vacuum circuit breaker (VCB) without protections in the transformer room if transformer is fed from remote HT switchboard for tripping of upstream breakers
   - Push Button stations with trip PBs (press to lock and turn to release) in the transformer room if transformer is fed from HT switchboard located in the same building for tripping of upstream breakers.

4. Power and control cables, Cable termination kits, laying and termination (at both ends) of all associated power and control cables from the EMPLOYER’s 11/6.6 kV switchboard. Only 11kV (UE) grade cable will be used for 6.6kV (UE) applications.

5. AC distribution boards (PDB) - Single front, non draw-out type, sheet steel enclosed, modular construction with IP54 enclosure, having two incomer with a bus coupler will be provided for auxiliary equipment of LTSS.

6. Contractor to provide 2 feeders of 400A each in the CSP LTSS for EMPLOYER’s use.

Construction Power Supply:

The facilities for distribution of construction power supply will be in the
scope of the Contractor.

For construction power supply, one no. outgoing feeder of 415V AC, 3ph, 50 Hz will be made available at the nearest construction power substation by the EMPLOYER for each Coal Handling Plant, Coke Sorting Plant and additional Flux & Fuel crushing & Fines handling system respectively.

Supply, erection, testing and termination at both ends of incoming power cable to Contractor’s construction power distribution board, further distribution and regular maintenance of the construction power supply network will be under the scope of Contractor.

II) DRIVES, CONTROLS AND ILLUMINATION SYSTEM

1. All HT and LT AC/DC motors, actuators, brakes etc. as per technological and process requirement.
   - HT motor winding and bearings, temperature sensors, vibration sensors will be hooked up with PLC for monitoring.
   - For HT motor, surge suppressor to be installed near the motor.
   - Generally Squirrel Cage Induction Motor with DOL starter / VFD / Soft Starter will be provided.
   - Suitable Rotor contactor panels and SS-grid Resistance Boxes will be provided for starting and speed control of slip ring motors wherever required as per Technological requirement.
   - All HT conveyer motors will be S1 duty.
   - All LT motors for conveyors will be S6 duty and will have class F insulation with temperature rise limited to class B.
   - Inverter duty motors (used for VFD application) will have class H insulation with temperature rise limited to class F.

2. Indoor 415 V LT MCC and Control panel with CT, PT, metering and Protection etc. as required.
   - Motor Control Centres for Coal Handling Plant and Coke Sorting Plant area will be Intelligent, draw out type with two incomers and bus coupler for control of drives of rating up to 90kW, of various technological units having communication with Plant Automation System.
   - Motor Control Centres for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be Conventional,
drawout type with two incomers and bus coupler for control of drives of rating up to 90kW, of various technological units.

- For control of drives of rating from 110kW to 200kW of various technological units, Intelligent type Motor control panels (MCPs) for CHP, CSP and FFP area having communication with Plant Automation System.

- Control panel for Tripper car, crane, hoist, small machines and Auxiliaries will be conventional type, non draw-out control panel. All control panels on the mobile machines will be mounted on anti vibration pad.

- Electronic over load relay for motors upto 90kW and Motor Protection Relays for motors above 90 kW will be used in conventional type (non-intelligent) MCC / Control panel. The electronic overload relay will be of Manual Reset type.

- Local/Remote selector switch will be mounted on MCC & Control Panel.

- Motor feeders up to 45 kW rating will have MPCB and MCCB beyond 45 KW rating.

- Current monitoring for all drives of rating above 30kW

- Conveyors feeding to Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (FFP) C7-3.5KW, C1-30KW & C2-45KW will be fed from new MCC under the scope of package. Contractor will consider Power cable for feeding the same. These Conveyors will be connected and controlled by new PLC envisaged in this package of FFP. Suitable control cable and other accessories will be considered.

### 3. VVVF converters:

- VVVF converters for 415 V motor drives having requirement of speed control where process requirement calls for variable speed application. All drives will have communication capability with Plant Automation System.

- VVVF Converter having communication capability as above at medium voltage (like 690 V) complete with 3 winding Converter transformer (for 12 pulse configuration) & incoming ACBs for higher rated motors.

- VFD will have following features:
  - Minimum rating of AC drives and reactors will be 150% of the full load current of the motor.
  - Automatic disconnection of individual Motor in case of failure of AC drive.
4. Soft Starter:
   - All HT Motors for conveyor drives will be provided with Flux Compensated Magnetic Amplifier (FCMA) Soft starter for low starting current. FCMA soft starter will have suitable By-pass contactors and controls to ensure running of the motor at full speed. FCMA soft starter will be indoor duty, rugged in construction, user friendly and maintenance free.
   - FCMA Soft starter for HT conveyor motors will be connected to motor at neutral end with suitable enclosure to prevent the dust entry.
   - Soft starter will be provided for LT motors of rating more than 75kW.

5. Dual parallel redundant UPS system consisting of SMF battery bank for 30 minute back up incase of power failure, Battery charger, UPS Power distribution boards & sub-distribution boards for distribution of UPS power supply to control & Automation equipments, Instrumentation system equipment, FDA system, Weighing system & any other equipment as per requirements.

6. Local control stations housing push buttons, indication lamps etc. for all drive. LCS for HT motor will have Ammeter also. All Local control stations will have double doors. LCS for conveyors will have belt sway switch bypass. Local/Remote selector switch will be mounted on MCC & Control Panel and not on LCS.

7. Power distribution boards (PDB) with two incomers and one bus coupler for repair network like welding sockets, maintenance cranes and hoists. All PDBs to be mounted in Technological/Auxiliary/Service buildings (Other than Electrical room) will have double doors. Enclosure Class will be IP54.

8. Main Lighting Distribution Boards (MLDB) with two incomers and one bus coupler for Power supply to various Lighting distribution Boards (LDB). Enclosure Class of MLDB & LDB will be IP54. Adequate nos. of LDBs and Sub Lighting distribution boards for providing power to light fittings.

9. Emergency lighting distribution boards (ELDBs) with two incomers and
one bus coupler for Power supply to various Emergency Sub Lighting distribution Boards (ESLDBs) and feeding arrangement will be as per GTS. Adequate nos. of Emergency Sub Lighting Distribution Boards (ESLDBs) for providing power to emergency light as given below:

- 20% Emergency lighting in all Junction houses, Process / technological buildings, pump houses, compressor houses, conveyor tunnels, underground premises, LTSS, Despatcher / Control rooms, staircases, entry / exit of building, office rooms, attendant / operators rooms, shift in charge rooms, canteen / rest rooms etc.
- 10% Emergency lighting in conveyor galleries.

10. Exit light from UPS distribution board for the following areas:
   - LTSSs / Electrical premises.
   - Dispatcher / Control rooms.

11. Portable Emergency lights will also be provided in strategic areas like LTSSs, Electrical premises, control rooms, staircases, entrance of cable tunnels / basements, escape routes, attendant / operators room in the technological buildings etc.

12. DCEM Brakes with economizing resistance will be used for Conveyors and brake panels will be housed in MCC room. A Brake panel will not feed power to more than 2 nos. of brakes.

13. Surge protection device will be provided at the incoming side of MCCs, VFDs, Soft starters, PLCs/Remote I/O stations etc. to protect the system/equipment as required.

14. All field devices, valves, safety switches like Pull chord switches and belt sway switches, zero speed switch, chute jamming switches and Proximity switches, Warning hooters, level sensors, relays, limit switches, isolators, speed sensors etc. as necessary for the process and control of the material handling equipment / system and its all associated / auxiliary equipment / systems.
   - Addressable type PCS, Addressable type BSS, ZSS and Belt rupture protection switches will be provided for all new and existing conveyors being upgraded.
   - Proximity type Limit switches will be used for shuttle conveyors, tripper car etc.
   - Sensing distance of proximity in the Zero Speed Switch will be 60 mm.
• RF admittance type chute clogging switches flush with chute body will be provided.
• Infrared type Belt rupture protection switches will be provided in all conveyors. The minimum set of belt rapture switches will be provided as given below:
  ▪ 1 set for conveyors of length up to 50m.
  ▪ 2 sets for conveyors of length above 50m and below 100m.
  ▪ 3 sets for conveyors of length above 100m.
• Chute Jamming switches in all chute including chute in Tripper Car.

15. All HT/LT Power, control, signal, communication cables (fiber optic/electrical), special cables, rubber insulated flexible cables, illumination cables etc. as required.
   • All HT and LT Power cables will be XLPE insulated.
   • All HT Power cables will be 11kV UE grade and FRLS sheathed.
   • LT Control cables will be PVC insulated.
   • Minimum size of Control cables will be 2.5 sq. mm.
   • Copper cable will be used for imported motors, crane and moving equipment.

16. 415V, 100A interlocked switch socket outlets for repair network, welding sockets at different floor, premises, buildings and other areas. Maximum 3 nos. Welding sockets will be connected to one feeder with 100Amp MCCB rating & minimum size of cable will be 3.5 x 70sqmm.

17. 240V, 15A and 24V, 5A receptacles from Lighting Distribution Board/Sub Lighting Distribution Board.

18. Load break isolators for maintenance crane, hoists, tripper car etc. to be located near the equipment.

19. Power and control junction boxes will be made up of SS sheet with weatherproof enclosure for termination of field cables.

20. Power trolley line conductor (DSL) / Festoon Cable trolley system / Plastic Cable Carriage system including rails/angles, supporting brackets, insulator assembly, junction box etc. will be provided as follows:
   • Festoon Cable trolley system for hoists etc.
   • Plastic Cable Carriage system for power and control trailing cables for shuttle conveyors, EOT cranes etc.
21. Cable Reeling Drum with stall torque induction motor will be provided for Tripper Car. Tripper car will have interlocking of chute clogging switch with conveyor through wireless radio communication. Interlocking with the CRD control cable will be given as back-up.

22. Illumination of the plant covering new storage yard, outdoor area lighting, peripheral lighting, coal tower top, shuttle conveyor floor, Road in and around the proposed units, Sub- stations, MCC rooms, Control rooms, Ventilation rooms, conveyors, Junction houses, various technological / auxiliary buildings and other installations of the plant by providing Lighting Transformer, Main Lighting Distribution Board, Lighting Distribution Boards, Sub-lighting Distribution Boards, Feeder pillars, Light Fittings, Lighting towers, high mast, low voltage switch sockets, conduits, Ceiling fans, Exhaust Fans, all lighting cables etc.

New plant lighting system will comprise of the following categories of lighting system.
- Normal /240V AC lighting system.
- 24V AC maintenance lighting system.
- Emergency lighting system.

23. Illumination, AC, Ventilation, 240V, 5A/ 15A sockets, Exhaust fan for toilet etc. for office building etc.

24. Complete electrics including motors, control panel, LCS, Brakes with panel, field devices, cables etc. for Conveyors, Screens, Actuators, valves, gates, vibro feeders, belt feeders etc. as required.

25. Complete electrics including motors, control panel, LCS, Brakes with panel, field devices, cables etc. for Shuttle conveyors, Tripper cars, Cranes, Hoists etc.

26. Complete electrics and load cell for Weigh feeders, Weigh hoppers, Belt scales etc. as required.

27. Complete electrics required for Suspended magnets, In Line Magnetic Separators, Metal presence detectors etc.

28. Complete electrics, controls, instruments, level controllers, solenoid valves, Bag filters, Timer controls etc. for the Dust suppression system, Dust extraction system, Ventilation, Air Conditioning system as required.
29. Completes electrics including motors, control panel, LCS, level sensors, cables etc. for sump pumps, slurry and dewatering pumps will be provided in underground floor of technological building/ Junction houses, Tunnels, cellar etc. 415V, 100A Sockets will also be provided near sumps.

30. Completes electrics including motors, control panel, LCS, level sensors, cables etc. for all pump houses, fire fighting system etc.

31. Complete electrics for Bin vibrators with rectifier panels and Air Blaster with solenoids, control panels, cables etc. for Bunkers as required.

32. Complete electrics for sampling systems covering motors, control panels, cables LCS etc.

33. Complete electrics for all Crushers including the followings:
   - Motors for main and auxiliary drives with necessary accessories and brakes as required.
   - Rotor contactor panels, Resistance boxes for Slip ring motors / VFD or DOL or Soft starter for Squirrel Cage motors as required.
   - Control Panel, Local control stations, field devices, safety devices, Limit switches, speed relays, solenoids, Power & Control Junction Boxes etc. as required.
   - Power and control panel for roll grinding attachment including drive motors for roll crusher.
   - Control panel for hydraulic and lubrication system including drive motors as required.
   - All power, control and special / instrument cables etc.
   - Earthing.
   - Hammer crusher will have local control station in which necessary Push buttons, Ammeter, Temperature Monitoring facility, indication lamp, hooter etc. will be provided to operate locally as well as from control desk.
   - Hammer crusher will be operated from Local Control Post. Apart from LCS, Local Control Post will be provided which will be kept in same crusher building. AC for Local Control Post will be provided. Extensive monitoring of HT drive will be done from Local Control Post and the information will be sent to Dispatcher for monitoring.

34. All LCS for outdoor application will be made of SS sheet. All control Push Button will be covered with Silicon Rubber Boot to prevent dust
35. Scope of work and Battery limit for Electrics and Automation for upgrading, modification, integration of existing drives / mechanism is defined in the Clause No. 04.10.11.

36. Automation system:
   a) PLC based Automation system of proposed Coal Handling Plant Pkg-064, will be interfaced with Automation system of Coal Transportation Plant (Pkg-062) being arranged by the EMPLOYER through a separate package (as indicated in Automation Configuration Drawing enclosed) so that entire coal transportation from silos to all coal towers can be operated in an integrated way from a common dispatcher / control room D2 (under EMPLOYER’s scope). The PLC based Level-1 automation system of CHP will be provided as mentioned in the automation chapter.

   b) PLC based Level-1 automation system of proposed Coke Sorting Plant will be provided as mentioned in the automation chapter for running the new Coke Sorting Plant from a new control room/despatcher under the scope of Contract.

   c) PLC based Level-1 automation system of Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III which will be connected to existing PLC through suitable gateway. The new PLC & HMIs will be housed in existing Control Room 1(CR-1). The existing HMIs will suitably be upgraded to match the new HMIs for operation of the entire existing and new FFCS plant.

37. Contractor to provide following feeders for EMPLOYER’s use in Electrical Premises near Coke Dedusting unit of Coke Sorting Plant:
   • 2 no. feeders of 100A each in MLDB/LDB.
   • 2 nos. of power supply feeder of 100A each in PDB.

38. CCTV camera with cleaning facility will be provided in the following tentative locations with monitors at Despatcher / Control room for extensive monitoring of given below areas:
   a) Coke Sorting Plant.
      • 2 Nos. for Coke storage area.
      • 2 Nos. at Coke Screening Station.
      • 2 Nos. at Coke Crushing Station
   b) Coal Handling Plant
      • 2 nos. for new silos
• 2 nos. at New Coal Tower no.-7

Final location will be decided during detailed engineering.

39. Electrical equipment will be supplied as per the Make list given in GTS (GS-13). However, in case of non-availability or delay in delivery, the Contractor will take prior approval of BSP/MECON for additional make before ordering. Make of Plastic Cable Carrier system will be IGUS / Kable Schlepp.

III) Control Rooms, Electrical Premises, Ventilation, Air-Conditioning & FDA System

1. All civil construction work for cable basement/cellar, cable tunnel and concrete cable trenches, MCC Rooms, Despatchers/Control rooms, Electrical premises etc. including their associated utility areas like Ventilation rooms, Stairs, Toilet etc.

2. Control for the proposed Coal Handling Plant will be from Despatcher (D2) building being arranged by EMPLOYER under separate package (62). The Contractor will furnish space requirement and assignment to the EMPLOYER for making the provision in the Despatcher-D2.

3. Control of Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be done from existing Control Room 1(CR-1). Necessary modification, if required for laying of cables and mounting equipment in the existing control room, the same will be provided by the Contactor.

4. Control of Coke Sorting Plant will be done from a new control room/despatcher under the scope of Contract.

5. Cable Tunnels / Structures for overhead cable bridge as required.

6. Intelligent, microprocessor based, addressable type automatic fire detection and alarm system for all MCC rooms, Electrical Premises, Cable cellar, Despatcher cum Control room using smoke detectors, heat detectors with cross zoning.

7. Air conditioning system for Control rooms cum Despatchers (housing Operator control/HMIs, Servers, Engg. stations, Instrument panels, UPS etc).
8. Air conditioning system at (35 deg C max.) for premises housing Intelligent MCCs, MCPs & VVVF panel rooms and other local control rooms complete with instruments, electrics, controls etc.

9. Ventilation system for substation building, Cable tunnels, Cable basement / cellar consisting of suitable capacity fan, Pumps, GI ducting etc.

10. Exhaust ventilation system for toilets, storerooms, Battery rooms etc.

11. Excavation, back filling, and leveling of cable trenches within battery limits.

12. Cable cellar for all Electrical premises/ LTSS/ MCC room etc.

13. MCC room and LTSS can be combined building with a separation wall and with a door for interconnection.

14. Cable supporting structures in the Electrical Premises, Despatchers / control rooms, cable cellars, cable tunnel, cable channel or overhead cable bridge for interplant cabling.

15. The tentative location of LTSS: **CHP** – LTSS opposite 5 silos, **CSP**-LTSS near JH-11 and Coke Screening station and **FFP**-LTSS near JH-117 and Coke breeze storage yard. If the nos. of LTSSs increases during Basic Engineering to suit the technological requirement in line with GTS, the same will be proposed by Contractor during Basic Engineering.

### IV) Earthing and Lightning Protection

1. Measurement of soil resistivity test at site for designing earthing system.

2. Lightning protection system for entire plant including Air termination, separate dedicated earthing stations, conductors, testing links, interconnections and accessories as per IS.

3. Supply and installation of complete earthing system including earth pits, earth grid with GI strips for the substations, neutral earthing of transformers, earthing of all electrical equipments in electrical premises, Junction houses, process / technological building etc.
4. Special earthing system (including earth pits, earth grid with GI strips, Copper Cables as required) for earthing of PLC, RIO panels, VFD, other Electronics equipment & automation system as per their manufacturer’s recommendation. It will be distinct and separate from the power and lightning equipment earthing system.

V) Erection accessories, spares, safety items, documentation & other miscellaneous items

1. Supply of all erection accessories and materials, all steel members (angle, channel, plate, steel sheet, etc.) for installation of electrical equipment, GI pipes, GI conduits, bends, clamps, nut, bolts, ladder and perforated type cable trays, tray installation materials & accessories, cable supporting structures, heat protection materials, flexible metallic hoses, sealing materials for openings/conduits, double compression cable glands, cable lugs, cable tags, cable fasteners, insulating tapes, ferrules, RCC slabs, sand, bricks for under ground cable laying, GI pipes for protection of cables at road crossings and other places, cable markers, cable jointing & termination kits and materials, earthing strips of different sizes, junction boxes, pull boxes, heat resistance paints and all consumable materials for complete laying & termination of cables, erection of electrical equipment and earthing system etc.

2. Arranging construction power supply including PDB, power (both incoming and outgoing) and control cables, cable trays, cable laying etc.

3. Submission of basic and detailed engineering drawings, design calculations etc.

4. Supply of As-built drawings, operation and maintenance manuals. CD in duplicate and reproducible of all As built drawings.

5. Supply of all commissioning spares as required till the plant is commissioned and handed over to BSP. List of minimum commissioning spares will be supplied as per attached Annexure E-02.

6. List of two years Maintenance / operational spares will be finalized during detailed engineering stage.
7. Supply of Special tools & tackles, measuring instruments etc. as per Annexure - E-01.
8. Canopy of all outdoor electrical equipment, if any.
9. First fill of all consumables, printers, papers, cartridges, floppy, CDs etc.
10. Safety items like hand gloves, shock treatment charts, discharge rods, rubber mats (of required voltage classes) in front and rear of all panels, danger/caution boards, fire extinguishers, fire sand buckets, nicely framed As built Single Line Diagram of LTPCCs, MCCs, PDBs, MLDBs, LDBs, SLDBs keys and key boxes etc.
11. Supply and installation of GI pipes for protection of cables at road crossings and other places where cables may be subjected to mechanical stress and damage.
12. Supply and installation of cable supporting structures in the LT substation building, cable cellars, cable tunnel, cable channel or overhead cable bridge for interplant cable routing.
13. Walkable Cable Bridge between EMPLOYERs’s HT Substations to Contractor’s LTSSs and further for routing outgoing cables to different consumers / buildings etc. as required.
14. Intershop outdoor cable route will be through only walkable Overhead Cable Bridge/ conveyor gallery/ cable tunnel. No underground buried cable will be provided. Concrete cable trench covered with pre cast slab is accepted only in covered shed or indoor area.
15. Cables of one area/conveying route will not cross and will not be laid through conveyor of other area/conveying route.
16. Minimum 1 No. electrical area repair shop (Min. size –18M X9M X 6M) in Coke Sorting Plant will be considered with a facility of rest room, repair area, store, provision to keep tools and tackles, measuring instruments/testing instrument including megger, clamp tester, hand held tachometer, CRO, multimeter, vibrometer etc.
17. Furniture for the monitor, control rooms etc.
18. Training of EMPLOYER's engineers at manufacturer's works/training
centers for Automation system, UPS system, AC drives, Weighing system etc.

19. Any additional items/equipment which is necessary for achieving specified performance and completeness of the system will be provided by the Contractor within the time schedule unless it has been excluded from the scope of the Contractor.

04.10.04. Approval of Statutory Authorities

The Contractor will obtain necessary approval of statutory authority as per rules of State Government and Central Electricity Authority for the work under his scope, before energizing/charging the equipment. However, EMPLOYER will extend all assistance in this regard, like submission of application, relevant documents and payment of statutory fees etc.

04.10.05. Installation

For installation work at site, the contractor will be fully responsible for arranging the required tools and tackles, welding sets, pipe bending machine, cable crimping tools, gauges, scaffoldings, ladders, temporary water and power connections.

On completion of the installation but before energisation of the system, all installation will be physically checked and properly tested. These checks and tests will be conducted by the contractor under the supervision of BSP / MECON. The contractor will furnish the final status and test results. Any defect observed during such check and tests will be rectified by the contractor free of cost within contract completion period.

All clamps brackets, bolts, nuts, screws, markers, ferrules, lugs and glands and other hardware necessary for erection work, will be included in the scope of work and will be arranged by the contractor. Equipment will be painted to withstand the heavily polluted and saline environment prevailing in at site.

04.10.06. Design basis for equipments & installations

Ambient conditions of shop units

Generally following ambient temperature will be considered in Electrical /
Control Rooms.

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Area</th>
<th>Ambient Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Electrical Rooms</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>LT Sub-station/ switchgear room (Pressurized ventilation)</td>
<td>+ 45 Deg. C</td>
</tr>
<tr>
<td>2.</td>
<td>MCC rooms (housing intelligent MCCs, VFD panels, TR controllers, RI/Os etc.)</td>
<td>+ 35 Deg. C</td>
</tr>
<tr>
<td>3.</td>
<td>Cable basements / tunnels</td>
<td>+ 50 Deg. C</td>
</tr>
<tr>
<td>B.</td>
<td>Control Rooms</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Control rooms – Air conditioned</td>
<td>+ 24 Deg. C</td>
</tr>
</tbody>
</table>

- Equipment selection and derating will generally be based on ambient temperature of + 50 Deg.C. For specific areas and shops, the ambient temperature conditions indicated above will be taken into consideration and equipment suitably derated wherever necessary.

- Equipment installed in MCC rooms/Control rooms will be designed for + 50 deg C so that in case of failure of Air-conditioning/ventilation facilities also the equipment should not be affected.

- The equipment offered should be suitable for smooth, efficient and trouble free service in the tropical humid climate prevailing at plant site and under the ambient temperature conditions indicated above for the different shops and areas. In hot areas of higher temperature conditions, the equipment will be adequately protected against damage from radiant heat and hot air.

- The equipment will be designed to give efficient and reliable performance under heavy steel mill conditions and will be such that the risks of accidental short-circuit due to animals, rodents and vermin are obviated.

- The quantities of equipment, cables, cable terminations, straight through joints, cable supporting structures, earthing / lightning and erection materials, will be as per actual requirement in accordance with the approved detail engineering drawings.

- All equipment will strictly conform to the General Specification,
except where any deviations have been explicitly spelt out, specifically discussed and mutually agreed upon between the Contractor and the EMPLOYER.

- The detailed specification and schedule of quantities will be worked out based on the detailed engineering to be carried out by the Contractor, for complete and proper execution of the specified tasks.

- The final ratings of the circuit breakers, CTs, busbars will be adequate for the actual loads and considering the derating factors as substantiated by temperature rise test on the 415 V switchboards. All CT ratios / VA burdens, ranges of meters and instruments, types of relays and relay setting ranges will be submitted for EMPLOYER’s approval during detail engineering.

- All HT cables will be 11 kV (UE) grade of size 3x185 sq mm (min).

04.10.07. Design basis for electrical premises for the proposed units

GTS is to be referred for designing of electrical premises & layouts, selection of equipment and installation. In addition to this, following points will be considered.

- Motor Control Centre (MCC), RIO stations, PDB, MLDB etc. to be installed in various MCC rooms, will be provided near various shop/technological units.
- Wherever required, MCC rooms and LT substation rooms (including rooms for distribution transformers) can be combined with separation wall and independent entry for both LTSS and MCC rooms considering the location of Substation and shop unit. Each LTSS building will have store facility.
- No under ground cable basement to be provided below MCC buildings.
- PLC, CPU panels, Operator panel / HMIs, Engg stations, UPS, UPS battery will be located in the air-conditioned room in the control room floor.
- For high rise buildings structural walkway will be provided for maintenance of light fittings.

04.10.08. Design Basis for Illumination System
GTS is to be referred for designing of Illumination System, selection of equipment and installation. In addition to this, following points will be considered.

- Illumination levels of all units will be as indicated elsewhere in this specification.

- The maintenance factor for design of illumination level will be considered as 0.6 for all areas.

- For arriving at utilization factor, manufacturer's recommendation will be followed.

- All rooms with false ceilings will be provided with recessed type decorative mirror optics fittings.

- All MCC Rooms will have lighting switches near doors.

- All decorative type fittings will be mirror optics type.

- All buildings will be provided with peripheral lighting.

- The power factor of lighting system will be improved to 0.9 by providing in built capacitors with individual light fittings.

- Area, outdoor and peripheral lighting will be fed from separate LDB/SLDBs having two modes of control - AUTO and Manual. Under AUTO mode lights will be automatically switched ON/OFF through 24Hrs Timer & Contactor where as in Manual mode, lights will be switched ON/OFF through local control station located in Despatcher/Control room. Selector switch for mode of control will be located on local control station.

- Lighting in conveyor gallery and junction houses (floors above ground) will be connected to separate lighting circuit and the same will be switched ON/OFF by PLC based control from HMI at Despatcher.

- Area lighting, wherever applicable, will be provided through 400W, HPSV flood light fittings mounted on lighting towers.

- Road lighting will be provided with 250W HPSV street light fittings.

- All the offices will be provided with ceiling fans.
- For indoor lighting, outgoing feeders in MCB DBs will be 20A SPN MCBs. Each feeder will not be loaded more than 2 kW. Incomer to MCB DB will be suitably rated heavy-duty switch and ELCB for detection of leakage current.

- For area and road lighting, 3 phase & neutral feeders may be used and accordingly suitably rated 4 core cables may be provided.

- HPSV lamp fittings will be provided with external electronic igniters and a built in sensor to sense failure of lamp and switch off igniters.

- Single phase/three phase circuits are connected to RYB phase such that total connected load to each phase equal and phase balancing is achieved.

- Stroboscopic effect will be corrected by providing power factor improvement capacitor and power phase distribution.

- Point wiring will be done through PVC insulated PVC sheathed Copper cable.

- Single phase 3 pin 230V, 15A and 5A, switch-socket outlets will be provided with interlocked switches (male and female units) at the following locations:
  - At each floor of building at every 30 m intervals or minimum one for each row/side.
  - Two numbers each in switch gear room, cable basement, control room and MCC room.

- Group control and sectorial control will be envisaged through MCBs provided in the respective LDBS. Separate control switches will be envisaged for light points and fan points.

- Near every chute in Junction houses and other technological buildings sufficient no. of 24V, 5A sockets will be provided for maintenance lighting by hand lamp.

**04.10.09. Cable Routes, Cables**

Contractor will note the following requirements.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Requirement</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EMPLOYER's HT Substations to Contractor's LTSSs</td>
<td>Walkable Cable Bridge</td>
</tr>
<tr>
<td>2.</td>
<td>Inter shop cable routing</td>
<td>Through walkable overhead cable bridge/ structure/Cable Tunnel/ Conveyor gallery. No underground buried cable will be provided. Concrete cable trench covered with pre cast slab is accepted only in covered shed or indoor area.</td>
</tr>
<tr>
<td>3.</td>
<td>Bottom most level of cable trench in MCC room</td>
<td>Above ground level</td>
</tr>
</tbody>
</table>

04.10.10. Control and Operational Requirement:

1. All the necessary controls, interlocks and annunciation as required for smooth, efficient and safe operation of the plant will be provided.

2. Contractor will provide suitable PLC based automation system including all hardwares and softwares to run the existing and new material handling plant in an integrated manner.
   a) PLC based Automation system of proposed Coal Handling Plant Pkg-064, will be interfaced with Automation system of Coal Transportation Plant being arranged by the EMPLOYER through a separate package (Pkg-062) (as indicated in Automation Configuration Drawing enclosed) so that coal transportation from silos to coal tower can be operated in an integrated way from a common despatcher / control room. The PLC based Level-1 automation system of CHP will be provided as mentioned in the automation chapter.
   b) PLC based Level-1 automation system will be provided as mentioned in the automation chapter for running the new Coke Sorting Plant from a new control room/ despatcher which is to be provided by the Contractor.
   c) PLC based Level-1 automation system will be provided as mentioned in the automation chapter for running the Flux - Fuel Preparation and Plant Return Fines Handling for SP III from a existing Control room CR-1 as indicated in the automation configuration diagram.
3. All HT drives will be provided with extensive monitoring facilities for fault detection and alarm annunciation. Alarm annunciation will be provided for over winding temperature, over bearing temperature, overload etc.

4. Alarm annunciation system will cover all the equipment of the electrical system.

5. Mode of control:
   i) Plant will have four modes of control.
      • Local de-interlock mode for control of individual drive motor from local push button station (LCS).
      • Local interlock mode for running the drive motor in sequence interlock mode from LCS.
      • REMOTE interlocked individual drive control from the HMI at Dispatcher/Control room.
      • REMOTE interlocked route wise control of conveying system from the HMI at Dispatcher/Control room.
   ii) Mechanism selector switch for selection of above modes of operation of each drive motor will be provided in the MCC/Control Panel/MCP. A selector switch box will be provided near respective Remote I/O station for HT motors. Local selection of any drive will be shown on the HMI screen with some sort of caution.
   iii) The local de-interlock mode is meant for testing and maintenance purpose only. However, all safety interlocks (Pull Chord Switches, motor Over Load & emergency stop etc.) will be connected in LOCAL de-interlock mode of operation. In local de-interlock mode the mechanism is not interlocked with other drive and after receive of permission from operator/PLC drive/equipment can be started from LCS independently.

      The stop P.B. of local control station will be able to stop the drive mechanism selected for any mode of control. Hooter PB will be provided in LCS for pre start warning.
   iv) In Local interlock mode the drive/equipment can be run in sequence
interlock from LCS. Selector switch will be put in local interlocked position and permission from operator / PLC will be a condition for operation in this mode. Start, stop, motor Over Load, emergency stop, Pull Chord and Belt Sway Switches, Zero Speed Switch, chute jamming switches will be connected in the circuit in addition to sequence interlock with successive drives. All the above will be connected through hardwire.

v) In Remote interlocked individual mode of control the drives/mechanisms in the material flow path will be started in succession sequentially opposite to direction of material movement from operating station / HMI. On tripping of any conveyor/drive/mechanism, all the mechanisms feeding to the affected (tripped) mechanisms will stop according to material flow diagram. All the mechanism selector switches of the selected material flow path will be set to REMOTE position in this case. Programmable Logic controller will be used for the control, interlocking, operation, and monitoring of the equipment.

vi) In Remote interlocked Route-wise control, following operations is to be carried out from HMI by the operator before starting of a conveying route:
   a) Selection of material flow path including source and destination as per requirement.
   b) Selection of mechanisms within the selected material flow path.
   c) Selection of switching devices, flap gate etc. in a conveying route
   d) Selection of control mode in REMOTE of master selector switch for each material flow path block chain.

   On receiving start permissive signal from HMI, the operator will give ON command to start the desired conveying route.

vii) Normal stop and Emergency stop of mechanism for each material flow path, P.B, switches for pre-start warning signal for each material flow path, start & stop P.B. switches of drives with independent operation etc. will also be mounted on desk/ HMI.

viii) A pre-start audio warning signal through hooters will be given in the premises where the mechanisms are to be started before start of the mechanism. The duration of the pre-start audio signal will be as per requirement. Sequential start of the mechanism will be possible only after the pre-start audio signal is over.
ix) The conveying system will be integrated with the associated auxiliary / other system for interlocking, sequencing and monitoring.

x) Stopping of mechanisms:

a) For regular stop, the feeding equipment will be stopped first to stop the material flow in the conveying path and then after some time delay the equipment in the route will be stopped in sequence from feeding end ensuring no material is in the conveying path.

b) Emergency stop push button will be provided on the Control desk for emergency stop of material flow path.

c) In case of tripping due to fault of any drive, the part of the conveying route before the faulty drive will stop. There will have signaling of the stopped mechanisms by changing color in the graphic. This will give an indication of the fault.

6. Signaling:

A) Status of ON, OFF, Trip/Fault, Route selection etc. for all mechanisms of conveying system, dedusting system, dust suppression system, weigh feeder etc. will be available in the operator work station.

B) When a drive in a conveying route is shifted to local controls, indication will be available in the HMI.

C) The annunciation will be provided on HMI for each drive fault and actuation of safety and limit switches.

a) Annunciation for O/L & fault of each drive motor.

b) Individual annunciation for all HT motors trip due to high bearings and winding temperature.

c) Combined fault HT switch gear for Each HT motor including power supply to MPR failure separately.

e) Switching devices, flaps etc failed to close or open.

f) Individual annunciation for HT motors bearings and winding temperature high alarm.

g) Individual annunciation for following conditions of electrical system:
   - 11KV and 6.6 kV switchgear trouble
   - 415 switchgear trouble
   - Transformer trouble alarm.
- Combined fault/trouble in bag filter system of D.E
- Unhealthiness of various machines
- Any other failures

h) Every unplanned stoppage or abnormal condition will be brought to the notice of operator.

7. Current readings of all HT and LT motors connected to Intelligent MCC will be available in HMI at Dispatcher. Current monitoring for drives of rating above 30KW.

8. Drainage/sump/slurry pump will be provided with Auto/Local mode of operation. Under automatic mode of operation any one of the pump motors will start automatically at set level and if the level rises further the second/ reserve pump will start automatically at second set level and both the pumps will stop at set low level. If the first pump trips, second pump will start automatically. Emergency high level annunciation will be available in the control room.

Under local mode of operation, the pump motors will start/stop locally through local control boxes depending on level.

9 For fire fighting system, suitable control system will be provided for main fire water pump, jockey pump, hydro pneumatic tank etc. with line pressure switch.

04.10.11. ELECTRICS AND AUTOMATION FOR EXISTING DRIVES

Scope of work for Electrics and Automation for up gradation, modification and integration of existing conveyors to be upgraded as per technological requirements and will consist of Complete new MCC, PLC, field switches, LCS, Power and control cables and New Brake panel and associated cables.

Gallery lighting of existing conveyors under up-gradation will be in the scope of Contractor. Dismantling of the existing light fittings, cables etc. will also be under the scope of the Contractor.

Contractor will provide new PLC based automation system for new and existing drives (to be upgraded as per technological requirements) for integrated operation of the overall CHP, CSP, and FFP with respective existing/new units as shown in configuration diagram and elsewhere.

The approval / clearance of BSP / their representative will be taken
before carrying out new installation for upgradation for existing conveyors / equipment.

For the EMPLOYER’s approval / clearance, Contractor will submit detailed shut down plan of the existing drives indicating temporary arrangement to be made by the Contractor for running suitable alternative conveying routes so that plant can maintain production level.

In the temporary arrangement in case any electrics is required, the same will be provided by the Contractor without any price implication.

Scope of work:

- Except MCC, Contractor will dismantle existing motor, LCS, safety and limit switches, associated power and control cables, Jn. Boxes, earth wire, GI strip etc. related to the particular drives. The same will be removed from site to facilitate new installation as per requirement of TS and GTS and for running the equipment.

- Contractor will provide complete new electrics including motor, suitable intelligent type motor feeder in MCCs/MCPs, brake panels, all safety and limit switches, local control station (LCS), Junction boxes, necessary hardware and software for PLC based automation (including power supply, input, output and communication cards etc.) all power, control and signal cables, earthing.

04.10.12. ELECTRICS AND AUTOMATION FOR ADDITIONAL FLUX AND FUEL CRUSHING AND FINES HANDLING SYSTEM

All the equipments for this facility will be new.

04.10.13. TECHNICAL SPECIFICATION

04.10.13.01. General

GTS will be referred for technical specification of various electrical equipment. However for specific application following TS will be considered.

04.10.13.02. Non intelligent type Control Panel

01. Control panel for Tripper car, crane, hoist and small machine will have conventional non draw-out type and mounted on anti vibration
02. Constructional Features

- Non-Draw out type.
- All other features will be similar to Intelligent type indicated in GTS.

03 Incoming Feeder

The incoming feeder will have:
- MCCB
- Ammeter and voltmeter with selector switch.
- 3 nos. current transformers
- 3 nos. indicating LED type lamps (R, Y, B)
- 3 nos. indicating LED type lamps (ON, OFF, TRIP)

04 Outgoing Feeders

Each outgoing motor feeder will have following:
- MCCB (above 45 kW motor) / Motor Protection Circuit Breaker (up to 45 kW motor)
- Three pole contactor
- Ammeter with CT & Selector switch.
- Stop & Test Push Buttons
- ON/ OFF/ Trip indication LEDs
- Digital microprocessor based overload relay with SPP & manual reset facility
- Motor Protection Relays for motors above 90 kW rating.

Each outgoing non motor feeders will have following:
- MCCB.
- ON/OFF indication LEDs.

05 All motors will be operable from Control desk, pendant or LCS. Only the facilities for testing the control circuit by-passing the power circuit will be provided.

06 Two number of DC power pack feeders complete in all respects with change over scheme will be provided for DC power supply to
solenoid valves etc as required.

07. Ammeters for essential drive motors will be provided.

08. Major components will conform to General Technical Specification (GTS).

04.10.13.03. Motorized Damper, Switching Device, Slide Valve, Diverter Gate, Flap Gate Etc.

01 The motor will be 3 phase squirrel cage TEFC class F insulated (temperature rise limited to 70 deg. C. over an ambient of 50 deg. C), IP-55 enclosure both for motor switches & its terminal box, and with high starting torque and high stalling torque. The duty cycle will be S2-10 min or S4/ S5-1200 cycles per hour or S4/ S5-600 cycles per hour depending upon the rating and application of the actuator.

02 Each actuator will be provided with 'Open' and 'Close' torque and position limit switches. Once the torque switch has tripped in either direction, it can only be reset by operation of the actuator in the opposite direction. Each switch will have 2 NO + 2 NC potential free double break contacts. Switch contact ratings on inductive circuits will be 5A AC at 230 V AC. Actuator will be provided with motor over-riding feature like hand wheel for emergency manual operation and a limit switch will be provided which contacts will be used in the motor control circuit to forbid the motorised operation during manual operation by hand wheel. Also when the motor is switched 'ON' the hand wheel connection will be disengaged automatically. Motor operation will always have priority over manual operation.

Internal wiring will be tropical grade PVC insulated, stranded copper conductor cable of 10A rating for control circuits and required ratings for motor. All wires will be clearly numbered at both the terminal block and component ends. Cable ferrules will be robust and numbers will be indelible in nature.

The voltage grade of cables/ wires will be 1100V. Power terminals will be separated from the control terminals by means of an insulating cover. Separate terminal block fitted to switching unit will be provided. The terminal box will be designed for the protection class or IP-65. A durable terminal identification card showing plan or terminals will be provided attached to the inside of the terminal box cover indicating serial number,
external voltage values, wiring diagram number and terminal layout.

The actuator will be suitable for operation at specified ambient temperature. All actuators will be neoprene O-ring sealed water tight and dust proof to IP-67 protection and will at the same time have an inner watertight neoprene O-ring seal between the terminal box and the internal electrical elements of the actuator, fully protecting the switch mechanism, motor and all other internal electrical elements of the actuator from ingress of moisture and dust when the terminal box cover is removed on site for cabling/maintenance.

The actuators will be operated from the Remote Control Station and Local control station (LCS) will be provided separately for local operation of the actuator for testing and maintenance purpose. Isolator along with starter for the actuator motor will be located in the Contractor's MCC. Separate power cable will be used for motor wiring.

04.10.13.04.  Belt Weigh Feeders

General Technical Specification (GTS) will be referred for detailed specification of Belt Weigh Feeders.

04.10.13.05.  Belt Weigh Scales

General Technical Specification (GTS) will be referred for detailed specification of Belt Weigh Scale.

04.10.13.06.  Suspended Electromagnet/ ILMS

The magnet will be of high permeability cast steel as per IS : 4491 with an integral terminal box of adequate size. Leads will be brought to the terminal box through a water tight sealed gland. An earthing terminal will be provided inside the terminal box. The coil of the magnet will be designed for continuous duty for full supply voltage. The magnet will be fed from 220V DC obtained through rectifier panels.

The magnet coil will be Fiber glass wound copper wire and class H insulation will be used.

Control panel will be free standing, floor mounted, front attended, made of CRCA sheet steel of thickness not less than 2mm with IP54 enclosure class. In-comer feeder will have load break switch interlocked with the door.
Panel will have air cooled control transformer, full wave, silicon diode rectifier bridge having 220V DC output and complete with RC circuit across each diode, PIV of diode will not be less than 1560V.

Complete safety and protection equipment against surge voltages, discharge resistance in DC load side will be provided. Electronic temperature sensing circuits for protection against excessive temperature in the magnet coil will also be provided.

For In Line Magnetic Separator necessary electrics will be included.

**04.10.13.07. Dust Suppression System**

Control Panel for DS system will have necessary starter for Pump motors and 24V DC power supply arrangement for Solenoid valves. Valves will be energised either by Local Push button station or by under belt switch depend upon selection of control mode. Necessary electrics will be provided for desired operation of pumps, compressors, valves etc. for DS system. DS system will be interlocked with corresponding conveyors / technological equipment. DS system will have local manual and remote auto mode control. Compressor may be connected to nearest MCC considering location of Compressor house.

Control panel for outdoor application will have weatherproof enclosure.

**04.10.13.08. DUST EXTRACTION SYSTEM**

The Dust Extraction System will be started first and will be suitably interlocked with corresponding conveyors / technological equipment. The equipment of D.E. system will be operated in sequence as per requirement in the REMOTE mode from the HMI. Power supply to bag filter panel will be interlocked with the DE fan. Bypass arrangement will be provided such that technological equipment may be operated without operation of DE system in case need arises.

**Electrics for Bag Filter System of DE System.**

The bag filters of D.E. system will consist of pressure switches cum indicator in the compressed air line, differential pressure switches, solenoid valves, control panel and all other associated equipment. The brief specification of the major components will be as given below:
Control panel for Bag filter

The control panel will be free standing floor mounting fabricated from 2.5 mm thick CRCA sheet steel on a base channel or 250 mm height provided with cable gland plates, having synthetic rubber gasketting provided with double door & canopy and enclosure conforming to IP-55. The control panel will be factory assembled, wired with 1.1 kV grade PVC flexible wire of copper conductor (minimum size 2.5 sq.mm), factory painted. The control panel will be provided with following major equipment:

a) Incoming switch (minimum 30A, AC23 duty) with operating handle inter-locked with the door, HRC fuses, contactors, MPCBs in the various circuits.

b) Control transformer or required VA rating having +/-5 percent and +/- 2.5 percent tapings in the primary side of the control transformer with Isolating switches/ MCBs in the primary & secondary sides.

c) 24V DC power pack complete with fitter and protective elements and also isolation cum short circuit protection both at AC and DC sides for power supply to solenoid valves.

d) Auxiliary contactor for control power supply monitoring interlocking, and controls etc.

e) Auto-manual selector switches, push button switches, indication lamps, various monitoring devices, terminals (with 20 percent spare terminals) and other circuit elements required for control and monitoring

f) Solid State Bag filter timers.

The bag filter timer will be solid state device suitable for dusty, tropical and specified aggressive environment. The bag filter- timer will be provided with internal semi-conductor fuse protection and will have provision for pulse frequency setting and pulse duration setting through independent operating knobs. The number of contacts in the timer will be equal to number of solenoid operated valves so that the timer will energise only one solenoid valve at a time.

The Bag Filter Timer will provide timed sequential energisation of 24V DC operated solenoid valves of bag filters LEDs for each
solenoid energisation. Power ON in PCB feed back relay will be provided with potential free contacts which will close under following conditions:

i) Fault in the PCB.

ii) Open contact in the output side connected to individual solenoid valves. The contact will not close in the event of power failure to the controller.

iii) The sequential control (i.e. process) will start when the Differential Pressure (DP) switch is actuated at the first set point for normal operation. The process will continue till the pressure differential drops below the set value. When again the DP switch is actuated the process will continue from the previous position (i.e. next solenoid valve). However, when the power supply to sequential controller trips, the process will stop and sequential controller is reset to first load position enabling the process to start from the beginning.

iv) Sufficient space will be provided for installation of bag filter panel with required front clearances for operation and maintenance including side and back clearances as required.

04 Differential Pressure Switch

i) The differential pressure switch will have two sets of independent micro switches. The first set will be used for normal sequential cleaning operation of the bag filters as per lower set value of differential pressure. This set point will be independently adjustable.

ii) The second set of N.O. contact will close at upper set value of differential pressure representing clogging condition of bag filter and will be used for signaling and monitoring. This set point will also be independently adjustable. The contacts will be rated for 5 Amp, 240V AC.

iii) The DP switch will be suitable for outdoor installation. The DP switch casing will be made of pressure die cast Aluminium with enclosure conforming to IP-65.

iv) One number differential pressure switch with two set points will be
provided for each module of the Bag filter. Alternatively, two numbers of DP switches may be provided for each module one for initiation of bag cleaning operation and other for signaling and monitoring of clogging condition.

05 Solenoids

The solenoid coil will have encapsulated coil (class 'F' insulated with a water proof (IP-65) plug-on connector. The coil will be suitable for 24V DC. The coil will be made of copper conductor.

06 Air Pressure Switch cum indicator

One number compressed air pressure switch cum indicator will be provided for each DE system in the incoming compressed air pipe line of the bag filter. The pressure range will match with the operating pressure. The switches will be snap action type with 1 NO + 1 NC contacts of SA, 230 V AC. These contacts will be wired up to terminals in the bag filter control panel. The enclosure of the air pressure switch will be pressure die cast aluminium conforming to IP-55.

04.10.13.09. Type of Light Fittings and Illumination Levels

Illumination level and light fittings will be provided for different units as indicated below:

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>UNITS</th>
<th>ILLUMINATION LEVEL (LUX)</th>
<th>TYPE OF LIGHT FITTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Electrical rooms, substations, MCC Rooms etc.</td>
<td>200</td>
<td>Trough type, 2x40W, fluorescent tube light fittings with reflectors.</td>
</tr>
<tr>
<td>2.</td>
<td>Junction Houses and Conveyor Galleries / tunnels</td>
<td>100</td>
<td>70W/150W, HPSV, well glass fittings and 250W High bay as required.</td>
</tr>
<tr>
<td>3.</td>
<td>Crusher house, other process and Technological Building</td>
<td>150</td>
<td>70W/150W, HPSV, well glass fittings and 250W High bay fitting as required.</td>
</tr>
<tr>
<td>4.</td>
<td>Office rooms</td>
<td>300</td>
<td>Trough type/Decorative recessed type, 2x40W, fluorescent tube light fittings.</td>
</tr>
<tr>
<td>SL. NO.</td>
<td>UNITS</td>
<td>ILLUMINATION LEVEL (LUX)</td>
<td>TYPE OF LIGHT FITTINGS</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Corridors, walkways, staircase</td>
<td>100</td>
<td>Trough type, 2x40W fluorescent tube light fittings with reflectors.</td>
</tr>
<tr>
<td>6</td>
<td>Control room, laboratories, instrumentation rooms</td>
<td>300</td>
<td>Decorative type, 2x40W fluorescent tube light fittings with mirror optics.</td>
</tr>
<tr>
<td>7</td>
<td>Battery room</td>
<td>100</td>
<td>Corrosion/Vapour proof, 2x40W fluorescent tube light fittings.</td>
</tr>
<tr>
<td>8</td>
<td>Battery Charger/ UPS room</td>
<td>200</td>
<td>Decorative type, 2x40W fluorescent tube light fittings with mirror optics.</td>
</tr>
<tr>
<td>9</td>
<td>Periphery of buildings and cooling towers</td>
<td>50</td>
<td>70W, well glass fittings with HPSV lamps.</td>
</tr>
<tr>
<td>10</td>
<td>Pump Houses</td>
<td>200</td>
<td>70W/150W, well glass fittings with HPSV lamps.</td>
</tr>
<tr>
<td>11</td>
<td>Area lighting through flood light towers</td>
<td>20</td>
<td>400W, flood light fittings with HPSV lamps.</td>
</tr>
<tr>
<td>12</td>
<td>Area and road lighting</td>
<td>20</td>
<td>250/400W, flood light fittings with HPSV lamps and 250W, street light fittings with HPSV lamps.</td>
</tr>
</tbody>
</table>

Number of light fittings will be decided on the basis of specified lux level, maintenance factor 0.6 and appropriate co-efficient of utilization as per manufacturer's recommendation.

04.10.14. DRAWINGS AND DOCUMENTS

Contractor’s scope of work for all design drawings and documents will be as given below.

The Contractor will submit a list of all drawings and documents he proposes to submit within 2 weeks of LOI. The list will be approved by Client / MECON and may be modified if necessary. Each drawing/documents in the list will be identified with a serial number, description and scheduled date of submission. All the drawings will have
complete forward & backward reference.

Contractor will also furnish soft copies of all the drawings indicated below and drawings of technological layout/units.

All design, engineering and manufacturing drawings will be required to be approved by EMPLOYER/Consultant.

Work will be carried out exactly as indicated on the approved drawings and specification. No alterations will be made without prior written approval by EMPLOYER / his consultant.

The Contractor will check all the drawings prepared by them and/or received from their vendors/supplier/sub-supplier and satisfy themselves about the correctness of drawings before issuing to EMPLOYER/Consultant. After checking, properly stamped drawings will be sent to EMPLOYER/Consultant for approval / clearance.

Comments on all drawings will be forwarded to the Contractor for incorporation and resubmission.

The approval of drawings by EMPLOYER or their authorised representative does not absolve or relieve the supplier from any of his obligations under this contract and he will be wholly and solely responsible for the satisfactory operation and guaranteed performance of equipment / system / plant.

A. Basic Engineering drawings (To be Submitted For Approval)

1. List of drawings (Basic Engg /Detailed Engg/ Reference) and drawing numbering system along with schedule of submission.

2. Single line diagrams of HT/LT switchgear equipment, PCCs, MCCs /Control Panels, PDBs, MLDBs, LDBs, SLDBs, Main fire detection and alarm panel etc. with rating of components, cable sizes and details of protection and metering etc.

3. HT & LT Motor and component list including field mounted electrics

4. HT and LT Motor data sheets as per enclosed format.

5. Type-II Co-ordination chart as per IS: 13947-1993 for MPCB/ MCCB, Contactor and Overload relay.
6. Schematic drawing of different feeders, control, alarm, indications, interlocking and other schematics.

7. Shop/Unit wise Maximum Demand calculations

8. Relay settings with calculations for total network to ensure proper co-ordination.

9. Busbars sizing calculation with respect to temperature rise & short circuit withstand capacity.

10. Design Calculations for selection of main equipment such as transformers, drive motors, AC drives, bus bars, cables, batteries etc.

11. Typical schemes of DOL, RDOL feeders indicating inputs & outputs applicable to the various feeders indicated in SLDs.

12. Power and regulation schemes of AC drives.

13. Calculation for temperature rise of busbars.

14. Layout of substations, electrical rooms and control rooms including ventilation and air-conditioning rooms, handling facilities. The layout drawings indicating cable trench, wall openings, conduit inserts, plate inserts, Minimum clearances from electrical panels for installation of panels, cable trays, conduits for concealed wiring etc.

15. Electrical Equipment Layout of all electrical rooms, control rooms indicating panel dimensions, space available for future expansion with building dimensions.

16. General arrangement of equipment with plan, front view and sectional views, comprehensive bill of materials with description, quantity, make and type.

17. Cable layout drawings in cable tunnel, cable channels, overhead cable structures/bridge and incoming cable route etc.

18. Interplant cable route drawings.

19. Type tests certificates of all major equipment like transformers,
switchgear etc.

20. Level-1 automation system configuration & I/O lists, Belt Scale, Belt Weigh feeder, UPS & VVVF single line diagrams.

21. Functional description, control philosophy for the plant indicating start up, shut down, control locations, interlocking and annunciation system, mimic pages, report/data formats (for reference).

22. Scheme for Illumination system & emergency lighting system indicating sizes, ratings & locations of various LDBs & SLDBs.

23. Tentative Dimensions of panels.

24. Earthing and lightning protection scheme and layout of earthing and lightning protection network with calculations.

25. Basic interconnection scheme for FDA, Telecommunication & PA system.

26. Quality assurance plan for various electrical equipment.

B. Detailed engineering drawings. (To be Submitted For Approval)

1. Civil/Structural engineering design drawings of Electrical buildings, Electrical rooms, Control rooms, Motor foundations, Cable tunnels, Overhead cable structures/Bridge etc.

2. General arrangement of all electrical equipment/electronic panels/controllers with plan, front view and sectional views, comprehensive bill of material with description, quantity, make and type.

3. Equipment and cable layout drawings in LT Substation, Electrical premises, Control rooms etc.

4. Schematic drawing of different feeders, control, alarm, indications, interlocking, inputs/outputs to PLC and other schematics.

5. Single line diagrams of all ACDBs, PCCs, MCCs/ Control Panels, PDBs, MLDBs, LDBs, SLDBs, UPS, other equipment Control panel for sump pump, magnet and other auxiliary system etc. Module wiring diagrams indicating all interlocks, terminal numbers. Wiring
terminal plan drawings with cable connections.

6. Single line diagram of VVVF Drives, Soft Starter etc.

7. GA, BOQ, Layout drawings, dimensional details for LT switchgear equipment, MCCs/Control Panel, PDBs, MLDB, LDBs, SLDBs, Main fire detection and alarm panel etc. with rating of components, cable sizes and details of protection and metering etc.

8. Level-1 automation system software and graphic displays.

9. I/O listing in specified format to be finalised during engineering.

10. Sizing calculation of the UPS and the backup battery. UPS panel wiring diagram and circuit diagrams.

11. Wiring terminal plan drawings with cable connections.

12. Technical data sheets for Motor, Brake, Proximity switches & all field mounted electrics, GA drawings.

13. Interplant cable route drawings.

14. Layout of cable trays in cable cellars inside the substation & other electrical premises, cable channels, cable tunnel, overhead cable structures, cable shafts etc.

15. Cable layout drawings in cable tunnel, cable channels, overhead cable structure (as applicable), and incoming cable route etc.

16. Power & control cable schedules

17. GA drawing for erection accessories like cable trays, supporting structures etc.

18. Installation drawings of all equipment with layout of equipment, cables.

19. Illumination layout of all the indoor & outdoor premises. Layouts at each floor of Electrical/Technological building with details and numbers & locations of light fittings, Lighting distribution boards etc. SLDs of Lighting distribution board.
20. Detail scheme of FDA system, List of annunciation/alarm points (location wise) & wiring scheme

21. Earthing and lightning protection scheme and layout of earthing and lightning protection network with calculations including special electronics earthing.

22. Relay settings with calculations for total network to ensure proper co-ordination.

23. Communication cable (Field bus) routing and procedure for laying of communication cable.

24. QAP for all items covered in this specification

C. For Reference/Erection purposes

1. Schedule of electrics, and their location.

2. HT/LT feeder requirement with individual maximum demand.

3. Control circuit diagrams. The control circuit diagram should be available on / inside of respective panel / LCS.

4. Static and dynamic loading of all major equipment

5. External connection diagram (panel wise and scheme wise).

6. Composite drawings showing circuitry of switch-gear remote panels, and other items pertaining to complete circuit for its proper functioning.

7. Power & regulation schemes for AC drive, UPS, soft starter including FCMA type.

8. Motors & field devices.

9. Speed-torque, current vs. time, thermal withstands characteristics for motors.

10. List of interfaces between Contractor’s equipment and EMPLOYER’s equipment.
11. Cable termination plans with terminal block arrangement and markings.
12. Interconnection diagrams.
13. Internal wiring diagrams of equipment.
15. Motor and electric consumer list.
17. Procedure for testing and commissioning of the entire plant, electrical & automation equipment. This will also be furnished in soft copy.
18. Erection specification with bill of materials of erection materials, earthing materials, junction box, GI conduits etc. This will also be furnished in soft copy.
19. Spare part list and drawings.
20. Instruction for storage /erection, testing & commissioning.
22. Detailed technical literature / catalogue of manufacturers.
23. Graphic display sheets, report/data generation, fault listing etc.
24. Terminal plan drawings
25. System grounding/ earthing scheme
26. Application software program listings with detailed documentation.
27. Ladder Logic diagram /Statement Lists and software details.
28. Formats and work sheets for generation and display of overview, groups, loops, graphics, alarms, operator’s guide messages, real time and historical trends Log and shift formats.
29. List of drawings & spare parts.

30. Final test & calibration certificates and guarantee certificate / warrantee certificate.

31. As built Control description with Operational instruction use of various commands, instruction for control of plant and equipment from Operator workstation.

32. Drawings/documents for inspection of equipment:
   a) Type test certificate for identical equipment.
   b) Sub-supplier's/vendor's catalogue/technical literature.
   c) Test reports for internal inspection.
   d) Test certificate of components.
   e) Technical specification & data sheets of equipment.
   f) All “Approved” drgs./ “Commented” drgs as applicable.

33. Automation systems.
   a) Software including media and documentation.
   b) Description of all components of the user system with functional description, overview flow diagram, interface listing, mathematical models, and fault message lists, operator commands, simulation facilities, etc.
   c) Source code of the user system.
   d) Object code of the user system.
   e) I/O listing
   f) Ladder/block diagrams, etc.
   g) Factory Acceptance Tests & procedures for PLC/DCS

34. Other Drawings/documents:
   a) Operation & maintenance manual.
   b) Catalogues and manuals.
   c) All "As-built" drawings.
   d) Soft copies of all drawings.
   e) Technical specification/data sheet of equipment.
   f) Instructions for storage/erection/testing/commissioning
   g) Commissioning report.

The Contractor will submit all the drawings in Si-graph or equivalent format along with the multi user system software.
D. As built drawings

Upon installation and commissioning supplier will incorporate revisions/modifications if any in the reproducible and submit 'as built' drawings for EMPLOYER's record as per general condition of contract.

Complete and comprehensive instruction manuals for operation and maintenance of the equipment with drawings. This will include the following:

1. Log sheets indicating daily/hourly recordings of power system parameters to be noted down by customers operating personnel. The parameters will indicate loading of various electrical equipment quality of power supply, energy consumption of various units, energy consumption and maximum demand of the plant.

2. Preventive maintenance schedule for equipment.

3. Procedure for shut down and energisation.

4. Safety procedures for safe operation of equipment and complete system.

5. Specification of equipment installed.

6. Test procedure for site tests.

7. All as built drawings.

8. Spares list for each equipment for 2 year operation and maintenance.

9. At least two sets of clearly legible site corrected drawings will be submitted after commissioning.

10. As built drawings will be first Copy / Clear photo copy and will be properly arranged in suitable folders. The folders will have a list of all the drawings it contains on the front inside cover. Different folders will be used for different major categories like 11 kV switchgears, MCC / PDB, Drives etc.

04.10.15. FORMAT FOR MOTOR DATA SHEET
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PROJECT :</td>
</tr>
<tr>
<td>2.</td>
<td>MAKE :</td>
</tr>
<tr>
<td>3.</td>
<td>DRIVEN EQUIPMENT :</td>
</tr>
<tr>
<td>4.</td>
<td>MOTOR TAG NO. :</td>
</tr>
<tr>
<td>5.</td>
<td>QUANTITY :</td>
</tr>
<tr>
<td>6.</td>
<td>VOLTAGE WITH VARIATION :</td>
</tr>
<tr>
<td>7.</td>
<td>NO. OF PHASES/CONNECTION/ NO OF TERMINALS :</td>
</tr>
<tr>
<td>8.</td>
<td>FREQUENCY WITH VARIATION :</td>
</tr>
<tr>
<td>9.</td>
<td>FAULT LEVEL (MVA) &amp; DURATION :</td>
</tr>
<tr>
<td>10.</td>
<td>MOTOR TYPE AND DUTY :</td>
</tr>
<tr>
<td>11.</td>
<td>kW RATING/POLE :</td>
</tr>
<tr>
<td></td>
<td>• AT 40 DEG. C. :</td>
</tr>
<tr>
<td></td>
<td>• AT SPECIFIED AMBIENT TEMP. :</td>
</tr>
<tr>
<td></td>
<td>• WITH DERATING. :</td>
</tr>
<tr>
<td></td>
<td>• BHP/BKW OF DRIVEN EQPT. :</td>
</tr>
<tr>
<td></td>
<td>AT RATED LOAD :</td>
</tr>
<tr>
<td>12.</td>
<td>FRAME SIZE/MOUNTING :</td>
</tr>
<tr>
<td>13.</td>
<td>INSULATION CLASS WITH TEMP RISE :</td>
</tr>
<tr>
<td>14.</td>
<td>ENCLOSURE TYPE :</td>
</tr>
<tr>
<td>15.</td>
<td>FULL LOAD SPEED :</td>
</tr>
<tr>
<td>16.</td>
<td>FULL LOAD TORQUE (FLT) :</td>
</tr>
<tr>
<td>17.</td>
<td>STARTING TORQUE AS % OF FLT :</td>
</tr>
<tr>
<td>18.</td>
<td>PULLOUT TORQUE AS % OF FLT :</td>
</tr>
<tr>
<td>19.</td>
<td>FULL LOAD CURRENT (FLC) :</td>
</tr>
<tr>
<td>20.</td>
<td>STARTING CURRENT AS % OF FLC :</td>
</tr>
<tr>
<td>21.</td>
<td>STARTING TIME ON RATED LOAD AT :</td>
</tr>
<tr>
<td></td>
<td>• RATED VOLTAGE :</td>
</tr>
<tr>
<td></td>
<td>• 85 % OF RATED VOLTAGE :</td>
</tr>
</tbody>
</table>
22. LOCKED ROTOR WITHSTAND TIME
   • COLD :
   • HOT :
23. ROTATION VIEWED FROM DRIVING END
24. GD SQUARE OF MOTOR :
25. GD SQUARE OF DRIVEN EQUIPMENT:
26. WEIGHT OF MOTOR :
27. POWER FACTOR AT
   • 50 % LOAD :
   • 75 % LOAD :
   • 100 % LOAD :
28. EFFICIENCY AT
   • 50 % LOAD :
   • 75 % LOAD :
   • 100 % LOAD :
29. SPACE HEATER WATTS/VOLTS :
30. TERMINAL BOX TYPE &
    NO. OF TERMINALS
31. NO. OF STARTS PER HOUR :
32. NOISE LEVEL AT A DISTANCE OF 1M:
    FROM THE MOTOR
33. THERMAL WITHSTAND TIME :
34. COOLING :
35. APPLICABLE STANDARD :
36. LOCATION :
37. HAZARDOUS AREA CLASSIFICATION :
38. BEARING DETAILS
   • TYPE OF DE/NDE :
   • SIZE OF DE/NDE :
STEEL AUTHORITY OF INDIA LIMITED
BHILAI STEEL PLANT (BSP)
CONTRACT AGREEMENT FOR
“AUGMENTATION OF FUEL & FLUX CRUSHING FACILITIES”
(PKG NO. 064)

- MAKE :

39. LOCATION OF TERMINAL BOX :
POSITION FROM DE SIDE

40. LUBRICATION TYPE :

41. CABLE SIZE :

42. PAINT SHADE :

43. G.A., DIMENSIONS & MOUNTING : YES/NO
DETAIL DRAWINGS ENCLOSED

44. DETAILS DRAWINGS FOR T.B. : YES/NO

45. PERFORMANCE CHARACTERISTICS : YES/NO
CURVES VIZ. SPEED V/S CURRENT & SPEED V/S TORQUE ENCLOSED

TOOLS & TACKLES (ANNEXURE-E01)
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Item</th>
<th>Quantity (Nos.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>True RMS Digital Multimeter (hand held)</td>
<td>8</td>
</tr>
<tr>
<td>2.</td>
<td>Digital tong tester (hand held)</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>Testing Jig for PLC (OEM supplied)</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Low range ohm meter</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Megger (0– 500V)</td>
<td>8</td>
</tr>
<tr>
<td>6.</td>
<td>Megger (0-1000V)</td>
<td>5</td>
</tr>
<tr>
<td>7.</td>
<td>Megger (0-2500V)</td>
<td>6</td>
</tr>
<tr>
<td>8.</td>
<td>Earth Meggar</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Milli ohm meter</td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>Combination pliers</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>Nose pliers</td>
<td>6</td>
</tr>
<tr>
<td>12.</td>
<td>Hand drills (pistol)</td>
<td>8</td>
</tr>
<tr>
<td>14.</td>
<td>Ratcher Spanner Set</td>
<td>6 Sets</td>
</tr>
<tr>
<td>15.</td>
<td>Ring Spanners of different sizes</td>
<td>7 Sets</td>
</tr>
<tr>
<td>16.</td>
<td>DE Spanners of different sizes</td>
<td>8 Sets</td>
</tr>
<tr>
<td>17.</td>
<td>Vibration monitor (hand held)</td>
<td>6</td>
</tr>
<tr>
<td>18.</td>
<td>Soldering / de-soldering station</td>
<td>3</td>
</tr>
<tr>
<td>19.</td>
<td>Testing table / bench for installation of testing / repair equipment complete with single phase / three phase power supply points and separate electronic earthing</td>
<td>1</td>
</tr>
<tr>
<td>20.</td>
<td>Blower cum vacuum cleaner (portable)</td>
<td>5</td>
</tr>
<tr>
<td>21.</td>
<td>Tool kit (screw driver set, spanner set etc.)</td>
<td>8 sets</td>
</tr>
<tr>
<td>22.</td>
<td>Component storage steel rack (pigeon hole)</td>
<td>3</td>
</tr>
<tr>
<td>23.</td>
<td>Steel Almirah for storage of test equipment</td>
<td>10</td>
</tr>
<tr>
<td>24.</td>
<td>Bench vice</td>
<td>6</td>
</tr>
<tr>
<td>25.</td>
<td>Power saw suitable for bakelite / hilem board cutting</td>
<td>1</td>
</tr>
<tr>
<td>26.</td>
<td>Cable Preparation &amp; Termination Toolkit (for special cables), including Crimping Tool</td>
<td>1 set</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Quantity</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>27.</td>
<td>HT Line Tester</td>
<td>5 Nos.</td>
</tr>
<tr>
<td>28.</td>
<td>Steel chairs</td>
<td>12</td>
</tr>
<tr>
<td>29.</td>
<td>Steel tables</td>
<td>4</td>
</tr>
<tr>
<td>30.</td>
<td>Radio communication Equipment testing Jig</td>
<td>1 Set</td>
</tr>
<tr>
<td>31.</td>
<td>F.O Cable Testing Kit including OTDR</td>
<td>1 Set</td>
</tr>
<tr>
<td>32.</td>
<td>Field bus Analyzer</td>
<td>1 Set</td>
</tr>
<tr>
<td>33.</td>
<td>Radio communication Analyzer</td>
<td>1 Set</td>
</tr>
<tr>
<td>34.</td>
<td>Tools for backup &amp; storage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- DVD-RW</td>
<td>50 Nos</td>
</tr>
<tr>
<td></td>
<td>- Thumb drives</td>
<td>10 Nos</td>
</tr>
<tr>
<td></td>
<td>- Backup Tape for Servers</td>
<td>20 Nos</td>
</tr>
<tr>
<td></td>
<td>- Cleaning Tape</td>
<td>2 Nos</td>
</tr>
<tr>
<td></td>
<td>- Disk Imaging S/W for Server &amp; clients</td>
<td>1 Set</td>
</tr>
<tr>
<td>35.</td>
<td>Ethernet Analyzer</td>
<td>1 Set</td>
</tr>
<tr>
<td>36.</td>
<td>Portable Oscilloscope</td>
<td>1 Set</td>
</tr>
<tr>
<td>37.</td>
<td>Hydraulic fan puller</td>
<td>1 Set</td>
</tr>
<tr>
<td>38.</td>
<td>Box Spanner Set</td>
<td>1 Set</td>
</tr>
<tr>
<td>39.</td>
<td>Hydraulic Coupling Puller</td>
<td>1 Set</td>
</tr>
<tr>
<td>40.</td>
<td>Hydraulic Bearing Puller</td>
<td>1 Set</td>
</tr>
<tr>
<td>41.</td>
<td>Cable Fault Locator Machine</td>
<td>1 Set</td>
</tr>
<tr>
<td>42.</td>
<td>Motorized torque range</td>
<td>1 Set</td>
</tr>
<tr>
<td>43.</td>
<td>PCB Cutter</td>
<td>1 Set</td>
</tr>
<tr>
<td>44.</td>
<td>Motor Checker</td>
<td>1 Set</td>
</tr>
<tr>
<td>45.</td>
<td>Current Recording meter</td>
<td>1 Set</td>
</tr>
<tr>
<td>46.</td>
<td>1.5 mm/ 2.5 sq.mm Crimping Tool</td>
<td>1 Set</td>
</tr>
<tr>
<td>47.</td>
<td>AC/DC Digital tongue tester</td>
<td>1 Set</td>
</tr>
<tr>
<td>48.</td>
<td>Welding Transformer</td>
<td>1</td>
</tr>
<tr>
<td>49.</td>
<td>Power Hack Saw</td>
<td>2</td>
</tr>
<tr>
<td>50.</td>
<td>Grinding machines</td>
<td>2</td>
</tr>
</tbody>
</table>
ANNEXURE – E-02

SCHEDULE OF MINIMUM COMMISSIONING SPARES FOR ELECTRICAL EQUIPMENT FOR PKG.-064

The Contractor will supply following minimum commissioning spares along with the main equipment. However, during testing and commissioning of the plant, in case of requirement of any additional commissioning spares, same will be supplied by Contractor without any extra cost to the Employer. The Contractor will hand-over / deliver these spares directly at the Employer's stores. During testing and commissioning in case of requirement of any commissioning spares, same will be brought by the Contractor from Employer's stores. All unused commissioning spares will remain with the Employer.

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Transformer</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>HT Bushing</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Winding temperature indicator with alarm &amp; trip contacts</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Gasket</td>
<td>1 No.</td>
</tr>
<tr>
<td>II.</td>
<td>LT Switch Gear</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Auxiliary Contact Set</td>
<td>5% of each type &amp; rating. (minimum 1 set/No. of each type &amp; rating)</td>
</tr>
<tr>
<td>2</td>
<td>Closing Coils</td>
<td>- DO -</td>
</tr>
<tr>
<td>3</td>
<td>Tripping Coils</td>
<td>- DO -</td>
</tr>
<tr>
<td>4</td>
<td>Ammeters</td>
<td>- DO -</td>
</tr>
<tr>
<td>5</td>
<td>Voltmeters</td>
<td>- DO -</td>
</tr>
<tr>
<td>6</td>
<td>Coils for the Contactors &amp; Aux. Contactors</td>
<td>- DO -</td>
</tr>
<tr>
<td>7</td>
<td>Control Isolating &amp; Selector Switch</td>
<td>- DO -</td>
</tr>
<tr>
<td>8</td>
<td>Push Button of Various Colours</td>
<td>- DO -</td>
</tr>
<tr>
<td>III.</td>
<td>MCCs, PDBs, MLDB/LDBs</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td><strong>Air Circuit Breakers</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Fixed arcing contact</td>
<td>- DO -</td>
</tr>
<tr>
<td></td>
<td>b) Moving arcing contacts</td>
<td>- DO -</td>
</tr>
<tr>
<td></td>
<td>c) Arc chute</td>
<td>-DO-</td>
</tr>
<tr>
<td></td>
<td>d) Cluster contacts</td>
<td>-DO-</td>
</tr>
<tr>
<td></td>
<td>e) Arc barriers</td>
<td>- DO -</td>
</tr>
<tr>
<td></td>
<td>f) Trip coil assembly</td>
<td>- DO -</td>
</tr>
<tr>
<td></td>
<td>g) MWS complete kit</td>
<td>-DO-</td>
</tr>
<tr>
<td></td>
<td>h) Closing coil assembly</td>
<td>-DO-</td>
</tr>
</tbody>
</table>
### CHAP-04.10 ELECTRICAL POWER DISTRIBUTION, DRIVES, CONTROL & ILLUMINATION

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. MPCB of different ratings</td>
<td>- DO -</td>
</tr>
<tr>
<td>3. MCCB of different ratings</td>
<td>- DO -</td>
</tr>
<tr>
<td>4. Handles of MCCB of different ratings</td>
<td>-DO-</td>
</tr>
<tr>
<td>5. Power contactors of different ratings</td>
<td>-DO-</td>
</tr>
<tr>
<td>6. Moving contacts of Power contactors of different ratings</td>
<td>- DO -</td>
</tr>
<tr>
<td>7. Fixed contacts of Power contactors of different ratings</td>
<td>- DO -</td>
</tr>
<tr>
<td>8. Coil for Power contactors of different ratings</td>
<td>-DO-</td>
</tr>
<tr>
<td>9. Auxiliary contacts for Power contactors</td>
<td>-DO-</td>
</tr>
<tr>
<td>10. MPR Overload relays of different ranges</td>
<td>-DO-</td>
</tr>
<tr>
<td>11. Micropressor based Over load relay for Conventional type MCC</td>
<td>- DO -</td>
</tr>
<tr>
<td>12. Intelligent module/cards for intelligent MCC / MCP</td>
<td>- DO -</td>
</tr>
<tr>
<td>13. Auxiliary contactor (2NO+2NC)</td>
<td>- DO -</td>
</tr>
<tr>
<td>14. Coils for auxiliary contactors</td>
<td>-DO-</td>
</tr>
<tr>
<td>15. Add on block for auxiliary contactors</td>
<td>-DO-</td>
</tr>
<tr>
<td>16. CTs</td>
<td>- DO -</td>
</tr>
<tr>
<td>17. PTs</td>
<td>- DO -</td>
</tr>
<tr>
<td>18. Voltmeters</td>
<td>-DO-</td>
</tr>
<tr>
<td>19. Ammeters</td>
<td>-DO-</td>
</tr>
<tr>
<td>20. Ammeter selector switch</td>
<td>- DO -</td>
</tr>
<tr>
<td>21. Voltmeter selector switch</td>
<td>- DO -</td>
</tr>
<tr>
<td>22. Control switches</td>
<td>-DO-</td>
</tr>
<tr>
<td>23. Control MCBs</td>
<td>-DO-</td>
</tr>
<tr>
<td>24. Indicating lamps (LED) with holder</td>
<td>- DO -</td>
</tr>
<tr>
<td>25. Busbar support insulators</td>
<td>- DO -</td>
</tr>
<tr>
<td>26. Push buttons switches (start &amp; stop)</td>
<td>-DO-</td>
</tr>
<tr>
<td>27. Contact block (2NO+2NC) for start &amp; stop PB</td>
<td>- DO -</td>
</tr>
<tr>
<td>28. Actuator head for start &amp; stop PB</td>
<td>-DO-</td>
</tr>
<tr>
<td>29. Local-off-Remote selector switch</td>
<td>- DO -</td>
</tr>
<tr>
<td>30. Control switch spring return type</td>
<td>- DO -</td>
</tr>
</tbody>
</table>

### IV. LOCAL CONTROL STATIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Push buttons (start)</td>
<td>5% of each type &amp; rating. (minimum 1 set/No. of each type &amp; rating)</td>
</tr>
<tr>
<td>2. Push buttons (stop)</td>
<td>- DO -</td>
</tr>
<tr>
<td>3. Contact block (2NO+2NC) for start &amp; stop PB</td>
<td>- DO -</td>
</tr>
<tr>
<td>4. Actuator head for start &amp; stop PB</td>
<td>-DO-</td>
</tr>
<tr>
<td>5. Ammeters</td>
<td>-DO-</td>
</tr>
</tbody>
</table>
### V. MOTORS (OF EACH TYPE & RATING)

1. **Bearing (DE)**  
   5% of each type & rating.  
   (minimum 1 set/No. of each type & rating)
2. **Bearing (NDE)**  
   -DO-
3. **Cooling Fan**  
   -DO-
4. **Terminal Block**  
   -DO-
5. **Grease Nipple & Plug, Grease pump with motorised.**  
   -DO-

### VI. PLC/automation

1. **Digital input module with connection unit if applicable.**  
   10% of each type & rating.  
   (minimum 1 set/No. of each type & rating)
2. **Digital output module with connection unit if applicable.**  
   - DO -
3. **Analog input module with connection if applicable.**  
   - DO -
4. **Analog output module with connection if applicable.**  
   -DO-
5. **Processor card**  
   -DO-
6. **Power supply unit for PLC**  
   - DO -
7. **Memory board (Part of CPU Board)**  
   - DO -
8. **Communication modules**  
   -DO-
9. **Control modules of any other type**  
   -DO-
10. **Control fuse set consisting of 3 nos.**  
    - DO -
11. **Fan unit**  
    -DO-
12. **Fused terminals with LED**  
    -DO-
13. **Special connectors/cables/ TERMINATORS**  
    -DO-
14. **Racks / Chassis**  
    -DO-
15. **Interposing relays / Relay Boards**  
    -DO-
16. **Ethernet switches**  
    -DO-
17. **Media converter**  
    -DO-
18. **Radio comm. Equipment including antenna**  
    -DO-
19. **Load power supply**  
    -DO-
20. **Special cards in PC / servers/ clients / PG**  
    -DO-

### VII. UPS

1. **Thyrstors cell (Complete assembly)**  
   5% of each type & rating.  
   (minimum 1 set/No. of each type & rating)
2. **Semiconductor fuses set consisting of 3 Nos.**  
   - DO -
### CHAP-04.10 ELECTRICAL POWER DISTRIBUTION, DRIVES, CONTROL & ILLUMINATION

#### VIII. VVVF DRIVES / SOFT STARTER

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGBT of each type</td>
<td>5% of each type &amp; rating. (minimum 1 set/No. of each type &amp; rating)</td>
</tr>
<tr>
<td>Diode of each type</td>
<td>- DO -</td>
</tr>
<tr>
<td>Fuses of each type</td>
<td>- DO -</td>
</tr>
<tr>
<td>Regulation Cards of VVVF, each type</td>
<td>- DO -</td>
</tr>
<tr>
<td>Pulse transformer unit</td>
<td>- DO -</td>
</tr>
<tr>
<td>Trigger Pulse Generator</td>
<td>- DO -</td>
</tr>
<tr>
<td>RC Snubber Unit</td>
<td>- DO -</td>
</tr>
<tr>
<td>HRC Fuse Link</td>
<td>- DO -</td>
</tr>
<tr>
<td>Push Button actuator with contact element (Red &amp; Green)</td>
<td>- DO -</td>
</tr>
<tr>
<td>Mushroom head push button actuator</td>
<td>- DO -</td>
</tr>
<tr>
<td>LED indication lamp (Red, Green, Yellow)</td>
<td>- DO -</td>
</tr>
</tbody>
</table>

#### IX. BELT SCALES

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Cell</td>
<td>5% of each type &amp; rating. (minimum 1 set/No. of each type &amp; rating)</td>
</tr>
<tr>
<td>Electronic cards</td>
<td>- DO -</td>
</tr>
<tr>
<td>Display Units</td>
<td>- DO -</td>
</tr>
</tbody>
</table>

#### X. SAFETY AND LIMIT SWITCHES

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Types of Limit Switches</td>
<td>5% of each type &amp; rating. (minimum 1 set/No. of each type &amp; rating)</td>
</tr>
<tr>
<td>Level Sensor / Switches</td>
<td>- DO -</td>
</tr>
<tr>
<td>Photo Electric Sensor</td>
<td>- DO -</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>4.</td>
<td>Transducers</td>
</tr>
<tr>
<td>5.</td>
<td>Flow Switches</td>
</tr>
<tr>
<td>6.</td>
<td>Temperature Switches</td>
</tr>
<tr>
<td>7.</td>
<td>Proximity Switches</td>
</tr>
<tr>
<td>8.</td>
<td>Encoders</td>
</tr>
<tr>
<td>9.</td>
<td>Magnetic Switches</td>
</tr>
<tr>
<td>10.</td>
<td>Code Reader for Oven identification</td>
</tr>
</tbody>
</table>

**XI. HYDRAULIC UNIT**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Solenoid Valves</td>
<td>5% of each type &amp; rating. (minimum 1 set/No. of each type &amp; rating)</td>
</tr>
<tr>
<td>2.</td>
<td>Oil Seals</td>
<td>-DO-</td>
</tr>
<tr>
<td>3.</td>
<td>O-rings</td>
<td>-DO-</td>
</tr>
</tbody>
</table>

**XII. ILLUMINATION**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MCBs</td>
<td>5% of each type &amp; rating. (minimum 1 set/No. of each type &amp; rating)</td>
</tr>
<tr>
<td>2.</td>
<td>Ballast for High bay, well glass, street light fittings etc.</td>
<td>- DO -</td>
</tr>
<tr>
<td>3.</td>
<td>Chokes, starter, holder for fluorescent tubular fittings</td>
<td>- DO -</td>
</tr>
<tr>
<td>4.</td>
<td>Igniter for Flood light, High bay, well glass, street light fittings etc.</td>
<td>-DO-</td>
</tr>
<tr>
<td>5.</td>
<td>Capacitor, holder, control gear for Flood light, High bay, well glass, street light fittings etc.</td>
<td>-DO-</td>
</tr>
<tr>
<td>6.</td>
<td>Fluorescent fixture</td>
<td>- DO -</td>
</tr>
<tr>
<td>7.</td>
<td>Well glass HPSV lamp fittings</td>
<td>- DO -</td>
</tr>
<tr>
<td>8.</td>
<td>Flood light, High bay, Street light fittings etc.</td>
<td>- DO -</td>
</tr>
<tr>
<td>9.</td>
<td>40W fluorescent lamps</td>
<td>- DO -</td>
</tr>
<tr>
<td>10.</td>
<td>70W, 150W, 250W, 400W HPSV lamps</td>
<td>-DO-</td>
</tr>
<tr>
<td>11.</td>
<td>Terminal blocks</td>
<td>- DO -</td>
</tr>
</tbody>
</table>
## ANNEXURE – E-03

### ADDITIONAL POINTS FOR AUTOMATION WITH RESPECT TO GTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>GS Clause</th>
<th>Additional Points for Automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ch-1, 06.03.01</td>
<td>Drawings of all listed categories (except fabrication drawings) will be submitted to EMPLOYER in minimum 6 sets.</td>
</tr>
<tr>
<td>2.</td>
<td>Ch-1, 06.03.03</td>
<td>Original hardcopy documentation and manuals are to be supplied, for all relevant hardware, software, network, technology, etc.</td>
</tr>
<tr>
<td>3.</td>
<td>Ch-3(Elect), 1.02.15.01.A.2.0</td>
<td>For all equipment with redundant power supply, supply from two separate sources will be drawn.</td>
</tr>
<tr>
<td>4.</td>
<td>Ch-3 (Elect), 1.01.15.02.A</td>
<td>No mode selection at LCS.</td>
</tr>
<tr>
<td>5.</td>
<td>Ch-3 (Elect), 1.02.21.02 (10)</td>
<td>Conduits carrying special cables will be painted, coded, marked as per plant norms.</td>
</tr>
<tr>
<td>6.</td>
<td>Ch-3(Elect), 1.02.15.01.B.16.0</td>
<td>Provisions to be made for off-line testing of Level-I systems prior to actual deployment.</td>
</tr>
<tr>
<td>7.</td>
<td>Max CAT-6 length of 30m for shop floor installations.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Necessary facility/software will be supplied for remote management and monitoring of the entire network.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Network teams from multiple switches to be employed for all the important machines (computers).</td>
<td></td>
</tr>
</tbody>
</table>
### ANNEXURE-E04

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The HT and control cable from HTSS to the respective technological package will be routed through covered structural overhead cable gallery only.</td>
</tr>
</tbody>
</table>
| 2. | All circuit breakers used for 6.6 KV and 11 KV unearthed system should be  
   1. VCB’s  
   2. They will be horizontal isolation type, trolley mounted and ground operated (non cassette type)  
   3. The jaw contacts (female) will be mounted on the breaker and will be drawout along with the breaker.  
   4. The male contact will be of flat type with mounting on bus side  
   5. Type tests pertaining to BIL requirements (7.2/28/60KV for 6.6 KV and 12/35/75 KV for 11 KV) will be witnessed by EMPLOYER.  
   6. Minimum panel width will be 800 mm. |
| 3. | Continuous current of Variable speed AC drives will be 150% of motor full load rated current at continuous duty operation. |
| 4. | Insulation level for MCC & MCP: One minute power frequencies withstand voltage will be 1500V for control circuit. |
| 5. | Contact rating for Push Button will be  
   AC15, 6A at 230V  
   DC13 ,4A at 230 V |
| 6. | MCB short circuit rating capacity will not be less than 10 KA at 0.8 power factor |
| 7. | LT Switchboard Incomer & Bus-coupler Circuit Breaker ratings will be 2000A for 1000KVA transformer |
| 8. | Control terminal block will be ELMEX type suitable for terminating 2 cores of 2.5 sq mm wire. |
| 9. | Terminal type  
   Power terminal: Stud type- with maximum 2 connections on one terminal.  
   Control terminal for CT: Disconnecting type |
### ANNEXURE-E05

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>All HT motor will have FCMA based soft starter.</td>
</tr>
<tr>
<td>2.</td>
<td>For HT motor surge suppressors to be installed near the motor.</td>
</tr>
<tr>
<td>3.</td>
<td>All HT motors will have fluid coupling.</td>
</tr>
<tr>
<td>4.</td>
<td>HT motors less than 2.0 MW, condition monitoring equipment (temperature monitoring, vibration monitoring etc.) to be envisaged. For more than 2.0 MW, condition monitoring equipment (temperature monitoring, vibration monitoring and partial discharge monitoring etc.) to be envisaged.</td>
</tr>
<tr>
<td>5.</td>
<td>Isolated transformer will be provided for VVVF drive of more then 90 KW, and series rector will be provided for VVVF drive less than 90 KW.</td>
</tr>
<tr>
<td>6.</td>
<td>Copper cable will be used for imported motors, crane and moving equipment.</td>
</tr>
<tr>
<td>7.</td>
<td>For all LT motors for more than 75KW soft starter will be provided.</td>
</tr>
<tr>
<td>8.</td>
<td>All HT cable will be of FRLS type.</td>
</tr>
</tbody>
</table>
04.11 AUTOMATION SYSTEM (LEVEL-1)

04.11.01 GENERAL

01. This specification is intended to define the basic requirements for Automation (Level-1) system of the Coal Handling Plant (CHP) and Coke Sorting Plant (CSP) and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (FFP) coming under the 7.0 MTPA Expansion of BHILAI Steel Plant (BSP) with a view to achieve smooth, efficient, safe, integrated and reliable operation of the process.

02. Monitoring, Control, Interlocking and Sequential functions for the entire Coal Handling Plant and Coke Sorting Plant and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be achieved through PLC based Level-1 automation system.

03. Coal Handling Plant

- A common dispatcher cum control room (D-2) under package no. - 062, is being arranged by the employer for operating the entire coal blending, crushing and transportation from existing & new silos to existing batteries (10 nos.) and new battery (1 no.) with a provision to install the automation equipment of proposed CHP package-064 as shown in the attached Automation Configuration Drg. No. - MEC/S/9101/11/E9/55/01/064.01/R1). Contactor will provide PLC-4 with all hardware and software and integrate the offered system with that of Pkg 062(New Coal Handling Plant).

- To understand the interfacing points, enclosed Material flow diagram (Drg No-MEC/S/9101/11/17/55/01/064.12, Sheet 1&2) and a schematic drg (Drg. No.-MEC/S/9101/11/E9/00/00/00/064.03) may be referred.

- The Contactor will furnish assignment drawing and space requirement to the employer to keep the provision in the Despatcher-D2.

04. Coke Sorting Plant-

- Control, Monitoring, Interlocking and Sequential functions of new drives and equipment proposed for Coke sorting plant covered under this specification as per technological layout and material flow diagram with new automation. Proposed CSP will receive material from CDCP (for COB#11), Existing Coke Sorting Plants CSP-1 through Conveyor KA1 and KA2 which in turn after crushing &
screening material will transport to Stock House of BF#8 and SP-III through C-line conveyor (Pkg064) in line with technological material flow diagram.

- For operation of Coke sorting plant, a separate new Dispatcher will be provided by the Contactor with dedicated PLC based automation system as per Automation Configuration Diagram (MEC/S/9101/11/E9/55/01/064.02/R1).
- In the new Automation system, provision will be kept for interfacing employer's PLC and /or Remote I/O stations for all source and destination conveyors.

05. **Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III** - Control, Monitoring, Interlocking and Sequential functions of new drives and equipment proposed for Augmentation of Flux and Fuel crushing and screening circuit as described below in line with material flow diagram:

i. Feeding of coke breeze from coke breeze bunker of coke sorting plant(CSP4) to existing conveyor C102

ii. BF fines from existing BFs through conveyor C7, new conveyor C3A-C1 to existing Conveyor F101 in junction house JH 127.

iii. Feeding of sinter /ore fines from BF8 fines storage bins to existing conveyor F101 in junction house JH 127

iv. Feeding of coke fines from BF8 fines storage bins to existing conveyor C102.

v. New Fuel & Flux Crushing and Screening system

vi. New Conveyor route starting from C104 through Rod Mill feeding to existing Proportioning building.

vii. New Conveyor route starting from L105 through Hammer Crusher feeding to existing Proportioning building.

The above will be achieved by providing new hot redundant PLC with suitable remote I/O station. New PLC will be integrated to the existing PLC based Automation system by providing suitable gateway as shown in the enclosed Automation Configuration Diagram. For interfacing with New Sinter machine suitable gateway also will be provided for establishing interlocking, signal, monitoring etc.
The Automation system facilities will be generally offered inline with the basic ‘Automation System Configuration’ diagram (Drg. No: MEC/S/9101/11/E9/55/01/064.04/R3) enclosed with this specification for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III.

Contractor will provide gateways, all hardware and software required for integrated operation of the new drives defined above along with the existing equipments for flux and fuel crushing & screening facility and the associated conveyors in existing Rockwell make 5-60/5-80 series PLC based Automation system.

Conveyors feeding to Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III i.e. C7-3.5KW, C1-30KW & C2-45KW will be fed from new MCC under the scope of package. These Conveyors will be connected from new PLC of Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III. Suitable control cable and other accessories will be considered.

Necessary modification, if required for laying of cables and mounting equipment in the existing control room CR1, the same will be provided by the Contractor.

This specification should be read together with the General Technical Specification (No. GS-03) separately attached with this specification, General Conditions of Contract (GCC) and other commercial terms & conditions.

Automation equipment considered for the process will be complete in all respect in line with this specification. Any equipment / accessories, not explicitly indicated in this specification, but considered essential for proper functioning of technological equipment and process (including utilities) will be included by Contactor in their scope of work and supply.

All the automation equipment will be supplied brand new & from the latest product ranges of reputed manufacturers as per the List of Preferred Makes, furnished in this Contract document. Employer/Consultant reserve the right of selecting particular make and model of Automation equipment with a view of integration with employer's Automation system and standardization of the whole plant. Contactor will comply with such requirements.

Contactor will execute the entire automation work as part of turnkey package of the CHP and CSP, Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III to the satisfaction of
Employer/ Consultant. Contactor will comply with all the requirements indicated under General; Salient Features of Automation system, Scope of Work and Supply; Submission of Drawings & Documents and other related clauses/ annexure stipulated in this specification. Design aspects and selection criteria of PLC systems and also other hardware/ peripheral units have been elaborated in GTS. The GTS (GS-03) is being issued as a separate document along with this Contract, which will also be complied with.

10. Interfacing:

- **Coal Handling Plant**: Automation systems of CHP (Pkg-062), new Coke Oven Battery-11, etc. will be separately arranged by Employer along with its technological package. The proposed PLC based automation system of Coal Handling Plant (Pkg-064) will be interfaced with CHP (Pkg-062), new Coke Oven Battery-11 & existing plants / shops as per Technological Material Flow Diagram for information exchange, interlocking and monitoring of the plant. Contactor will provide required hardware & software for interfacing of the offered automation system with the automation system of the above plants. The required communication bus from the PLC of the above plants to respective Despatcher / Control Room of the Contactor’s offered Coal Handling Plant will be included under this package. Details of interfacing requirement will be finalised during detailed engineering stage.

- **Coke Sorting Plant**: Automation systems of CDCP (for Coke Oven Battery-11), Stock House of Blast Furnace # 8, etc. will be separately arranged by Employer along with its technological package. The PLC based automation system of CSP (Pkg-064) will be interfaced with CDCP (for Coke Oven Battery-11), Stock House of Blast Furnace # 8, Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (Pkg-64) & existing CSP 1 plant as per Technological Material Flow Diagram for information exchange, interlocking and monitoring of the plant. Contactor will provide required hardware & software for interfacing of the offered automation system with the automation system of the above plants. The required communication bus from the PLC of the above plants to respective Despatcher / Control Room of the Contactor’s offered Coke Sorting Plant will be included under this package. Details of interfacing requirement will be finalised during detailed engineering stage.

- **Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III**: Automation systems of Blast Furnace #8, Sinter Plant#3 etc. will be separately arranged by Employer along with its technological package. The PLC based automation system of
Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (Pkg-064) will be interfaced with stockhouse of Blast Furnace #8, Sinter Plant #3, CSP (Pkg-64), Existing Coke handling, crushing and screening facility, Existing Flux crushing and screening facility, etc. as per Technological Material Flow Diagram for information exchange, interlocking and monitoring of the plant. Contactor will provide required hardware & software for interfacing of the offered automation system with the automation system of the above plants. The required communication bus from the PLC of the above plants to respective Despatcher / Control Room of the Contactor’s offered Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be included under this package. Details of interfacing requirement will be finalised during detailed engineering stage.

11. The Automation system facilities for CHP, CSP and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III of this package (064) will be generally offered inline with the basic ‘Automation System Configuration’ diagram (Drg. No: MEC/S/9101/11/E9/55/01/064.04/R1) for CHP & Drg. No: (MEC/S/9101/11/E9/55/01/064.04/R1) for CSP and (Drg. No: MEC/S/9101/11/E9/55/01/064.04/R3)MEC/S/9101/11/E9/00/00/064.04/R3 for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III enclosed with this specification. Client-server based architecture will be considered for automation. Contactor will submit configuration diagram of the automation system provided by them accordingly. Requirements of Controllers & their division, Workstations/Servers, Engineering stations, Printers etc. will be indicated in the configuration drawing.

12. Automation system of proposed plants will have three level Ring Architecture type communication buses as follows:

   a) HMI-level Ethernet for HMI Stations, MIS Servers, MIS Clients, Higher-level systems etc. Contactor to provide for CSP in line with Automation Configuration drawing.

   b) Control-level Ethernet for connecting PLCs, Servers, Emergency Work Stations, Engineering Stations etc. Contactor to provide for CSP in line with Automation Configuration drawing.

   c) I/O level communication bus. Contactor to provide for CHP & CSP in line with Automation Configuration drawing.

13. 1 No. field programming unit for CHP, 2 Nos. field programming units for CSP and 2 Nos. field programming units for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling For SP III will be in the scope of Contactor. Apart from standard features, these field
programming units will be capable of connection from every Remote I/O station for engineering and troubleshooting purposes.

14. 2 Nos. MIS servers each will be included in the Automation system of CSP and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III.

15. All printers provided with PCs will be laser jet type.

16. The design will be done in such a manner that involvement of cabling and wiring is minimum.

17. All the automation equipment will be configurable to a user configurable fail-safe state to avoid dangerous situations in case of any failures due to power failure, communication failure etc.

18. Different levels of networks will be inter-connected through intelligent devices which are capable of high speed switching at least at Layers 3 & 4 with access control. For all important systems firewall will be provided, taking care at Layers 3 to 7.

19. Temperature monitoring of all remote I/O stations will be provided through respective PLC.

20. Power & Control Supply monitoring of all mechanisms will be provided through PLC.

21. Status of UPS to be monitored through PLC / HMI.

22. All new PLCs supplied in this package, will be interfaced to Main PLC on Ethernet. Apart from main PLC as described in automation configuration drg., other PLCs (if) coming under this package shall interface with main PLC of CHP/CSP/FFP

23. The communication networks will be duly tested & certified by authorized agency.

24. For better co-ordination, the complete automation system will be ordered on one sub-vendor i.e. the OEM of PLC system.

25. Ethernet network (FO and UTP)
   - GTS GS-12 shall be referred for specifications related to ethernet network
• FO link from CSP IV control room to main control room of COB#11(Battery and CDCP) and from existing SP3 CR1 to main control room of SP 3 machine 2 for exchange of needed information.
• FO link to be used (Not UTP) if link taken outside building or shop floor.
• All FOC/UTP carrying conduits/pipes to be paint marked as per standard color code specified by employer

04.11.02 SCOPE OF WORK AND SUPPLY

Contactor’s scope of work and supply will include design, engineering, manufacture/ procurement, assembly, calibration, shop testing, inspection at works & at site, painting, packing, transportation to site including loading, unloading, storage & handling of all Automation equipment including electrical accessories, cables, GI pipes, erection accessories, panels/ cabinets and all associated hardware, as required for completeness of Automation system in all respect along with site fabrication, erection, testing, commissioning of the complete automation system and interfacing with different PLCs as described else where in the contract for completeness & satisfactory operation of the entire Coal Handling Plant, Coke Sorting Plant and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III as per technological layout and material flow diagram. The scope of work will also include liquidation of defect points, participation in tests for establishment of plant performance guarantee (PG) and post commissioning activities till issue of final acceptance certificate (FAC) by BSP.

The scope of work and supply will include but not limited to the following:

1. Automation system as per the facilities indicated in the Automation System Configuration diagram (Drg. No: MEC/S/9101/11/E9/55/01/064.01/R1) for CHP & Drg. No: (MEC/S/9101/11/E9/55/01/064.02/R1)for CSP and (Drg. No: MEC/S/9101/11/E9/55/01/064.04/R3)MEC/S/9101/ 11/E9/00/00/064.04/R3 for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III and as described in ‘General’ and ‘Salient Features of CHP, CSP and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III’.

   a. For CSP this will mainly include independent PLC systems with redundancy in: - processors, power supply modules, communication modules, network interface modules, MIS servers etc. for plants/units. Number of operator’s station and engineering work station shall be as automation configuration diagram.
Communication bus will be ring architecture type. The automation system will be client-server based configuration. All the required facilities & features for interfacing of PLC systems will be considered and provided accordingly.

b. For CHP, the Contactor will provide PLC based automation system, with redundancy in:- processors, power supply modules, communication modules etc in line with GTS. Number of operator's station and engineering work station shall be as automation configuration diagram. Remote I/O stations, I/O Level communication Bus, necessary gateway (associated hardware and software) for interfacing with employer Automation network, Engineering station, HMI shall be as shown in Automation Configuration drawing.

c. For Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III, the Contactor will mainly provide PLC based automation system, with redundancy in :- processors, power supply modules, communication modules, network interface modules as per GTS. Number of operator's station and engineering work station shall be as automation configuration diagram. 0perator's and engineering workstations, Remote I/O stations, I/O Level communication Bus, Control-level bus, necessary gateway (associated hardware and software) for interfacing with employer Automation network, Engineering station, HMI shall be as shown in Automation Configuration drawing.

2. Required nos. of local/remote I/O panels with adequate quantity of various types of I/Os cards, i.e. Digital, Analogue, RTD, Thermocouples, Pulse, power supply cards, communication cards, Relays with NO contacts for outputs etc. at different locations. Contactor will also consider input interposing relays for field mounted proximity switches in the I/O chassis.

3. Preferred Makes of individual equipment i.e. PLC systems, Workstations, Servers, Engineering stations, printers etc., will be in line with GS-13. All the Hardware in Individual Systems will be from the same product series.

4. All required software i.e. System software, HMI software, Application programmes etc. for PLC, Workstations, Servers, communication interface amongst various automation systems etc. Required number of software licenses will also be provided.
5. All maintenance, diagnostic tools & devices required for implementation, maintenance & trouble shooting.

6. 1 No. field programming unit for CHP, 2 Nos. field programming units for CSP and 2 Nos. field programming units for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be in the scope of Contactor. Apart from standard features, these field programming units will be capable of connection from every Remote I/O station for engineering and troubleshooting purposes.

7. All Network components like Gateways / interfacing modules, cables, multi-port switches (if applicable) etc., as required for interfacing.

8. Optical Link Modules, Light Interface Unit, Redundant link modules, Power supply Cards, Converters, Terminators etc. as per requirements.

9. Other than the PLC systems specified in the configuration diagram, if any separate PLC systems are required for operation of the auxiliary units of the proposed CHP, CSP and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III the same will also be offered and suitably interfaced with the main automation system.

10. All types of system cables, communication cables, LT power cables, special cables, etc., as required. This will also include the required communication interface and cable for interfacing with the PLCs of conveying system of COB#11, Blast Furnace Stock House, Sinter Plant, CDCP etc. (as described in ‘Interfacing’ in CTS), located at respective control rooms.

11. Necessary co-ordination with employer / Mecon for establishing interfacing and integration requirement by providing new PLC, multiplying relays as required, interconnecting cabling between employer’s MCC/ other panels and Contactor’s PLC/ Remote I/O stations etc.

12. Fully wired cabinets/ panels, etc with MCBs, Fuses, CFL Lamps, Universal type service sockets, Earth strips, etc.

13. Control room furniture for CSP dispatcher

4 monitors will be replaced by new TFT monitor of size 22”, identical to new monitors for aesthetic looks.

15. Submission of drawings and documents as per mentioned at clause no. 06.11.05 of this CS.

16. a) In the automation system for CHP, few facilities from Pkg-062 are proposed to be used. These facilities include Fault-tolerant HMI server, Fault-tolerant history and process support server, Fault-tolerant MIS server, Network at Despatcher-D2, etc. Contactor will be responsible for all necessary activities, including coordination, with the supplier of Pkg-062 towards licensing requirements, development of application for Pkg-064, deployment of clients, network etc.

   b) Erection, testing, calibration and commissioning of the total Automation equipment / system of CHP, CSP and FFP included in this specification. Required interfacing with employer’s PLCs by providing necessary hardware and software and interconnecting cables. This will also include laying and termination of system bus cables as required.

17. Contactor will arrange tools, tackles and consumables as may be required for erection, testing, calibration and commissioning activities.

18. Contactor will arrange inspection of Automation equipment by Employer/ Consultant. Inspection and Testing will be carried out in compliance with the Quality Assurance Plans and FAT document, to be approved during detailed engineering stage.

19. Contactor will arrange visit by respective Automation manufacturer’s representatives at site, as & when required, during erection & commissioning.

20. Testing tools & equipment for automation system

21. Special tools will be provided in sufficient number for tracing, location, testing, jointing, fault location & rectification, termination etc. for all cables including special cables.

22. Contactor will involve Employer / Mecon in control philosophy development, design of application software and hardware, drawing up of software specifications, software development, off-line testing etc.
23. All tests on software, hardware, network, communication etc. will be carried on the basis of a pre-agreed protocol clearly listing out steps involved in testing with its responsibility and minimum expected results as per specifications, engineering and other documents.

24. Troubleshooting manual for all application software, system software, configuration, hardware, network etc. will be provided clearly spelling out possible causes, checks and measures for corrective action.

25. Contactor will arrange training for Employer’s personnel on the automation system at manufacturer’s works and also at site.

26. Two years maintenance spares, if the order is separately placed by Employer.

27. Commissioning spares and three months consumables.

04.11.03 SALIENT FEATURES OF CONTROL & AUTOMATION SYSTEM FOR COAL HANDLING PLANT, COKE SORTING PLANT AND AUGMENTATION IN FLUX - FUEL PREPARATION AND PLANT RETURN FINES HANDLING FOR SP III

01. For monitoring, control, interlocking and sequential operation of CHP, CSP and FFP, PLC based automation systems will be provided. Considering information exchange & operational requirement all the systems will be suitably interfaced. All the printers will be provided with network connectivity.

02. In Client server based Automation system, hot redundant servers will be considered. This architecture will have 3 level ring type bus system. The PLC systems will communicate with each other and the servers through a common ring topology bus. All the HMI stations will be interfaced with the servers through a separate higher level bus. Respective PLCs will have independent engineering station. Suitable communication cards will be provided in respective I/O panels for interfacing with HT switch-boards; Intelligent MCCs, Remote I/O station, Weighing Controllers, TR controllers etc.

03. Each Operator Workstations will have 22” Flat dual TFT Monitor as shown in Configuration drawings.

04. The automation system will be powered from UPS of suitable rating. Details of UPS have been separately indicated in this TS and GTS.
05. All the new MCCs of CHP and CSP and MCPs of CHP, CSP and FFP will be of Intelligent Type. i.e. every controller (DOL/RDOL feeder) will have an intelligent relay having capability to communicate directly with PLC Controller. Power supply feeders in MCC need not to communicate with PLC except of those feeders which feed to other Process MCCs & ACB/MCCB incomers.

06. All the HT breakers & LT breakers in PCC will also have communication ability to Automation system.

07. All the weighing controller/Indicator panels, VFD etc. will communicate directly with PLC Controller.

08. Optical link module will be used for converting Electrical bus to Optical bus.

09. Contactor will consider Remote I/O panels at each electrical premises with all kinds of Remote I/Os.

10. Additional Engineering spare Remote I/Os will be carefully planned at each location in such a way that they can be used in the unlikely event of non-establishment of communication with field devices having bus communication.

11. One Remote I/O panel (with required numbers interface modules/types of I/Os) will be planned in each electrical premises, each electrical floor (in case of multi-story rooms) & junction houses / Technological Buildings for interfacing of field switches.

12. All the communication cables will be laid in GI pipes. Separate pipes with separate routes (to the extent possible) will be used for ring tropology type communication bus.

GENERAL CONTROL REQUIREMENT

13. All the drives will generally be provided with following modes of operation and control:

- Local De-interlock
- Local interlock
- Remote

Mode of selection will be carried out for all drives with the help of selector switch provided on the MCCs / MCPs and required nos. of wall mounted boards / boxes for HT motors.
14. For local operation of drives, permission from Operator at Despatcher Control room will be obtained which will be named as automation permission. For this purpose, specific menu will be provided with operator workstation for such drives.

15. Local De-interlock mode of operation will be used only for adjustment, maintenance and testing purpose. After the selector switch at MCC / MCP is selected to Local De-interlock mode and Operator/PLC permission is obtained from Control room, the drives/valves can be started/opened/closed from Local control stations using start/open/close push buttons. Under this mode of operation, all safety interlocks (Pull Chord Switches, motor over load, Emergency switch etc.) will be provided through hardwire in the circuit.

The stop push button provided in Local Control station will stop the drive under all mode of operation. In case of emergency Stop, alarm will be provided at the Operator workstation at control room to warn the operator. Hooter PB will be provided in LCS for pre start warning.

16. Local interlock mode for running the drive in sequence interlocked mode from LCS. Selector switch will be put in local interlocked position and permission from operator / PLC will be pre requisite condition. In this mode start, stop, motor over load, emergency stop, Pull Chord & Belt Sway Switches, Zero Speed Switch, chute jamming switches will be in the circuit through hardwire in addition to interlock with successive conveyor / equipment.

17. Under remote mode of operation, following control modes for all drives will be provided through Operator workstation.
   
   i. Remote Manual
   
   ii. Automatic

Selection of remote manual or automatic mode of operation will be carried out using command menus through Operator workstations.

Remote Manual mode

Under remote manual mode of operation, individual drives will be started/stopped from Operator workstation. However, necessary safety interlocks will be provided by automation system. This mode can be used for testing of individual drives from Control room.
Automatic mode

Under Automatic mode, the plant/equipment will be controlled, started/stopped automatically in sequence by automation system using various command menus from any of the Operator workstations.

04.11.04  CONTROL ROOM / DESPACHER ROOMS

A. COAL HANDLING PLANT:-

Route wise operation of offered CHP (under Pkg-064) of the Contactor and Coal transportation system (under Pkg-062) of the employer will be operated from a common dispatcher D2. The Despatcher D2 building is located near COB#11 and is in Employer’s scope covered under Package 062. The Contactor will supply PLC, Engineering Station, Work Station, Emergency Work Station etc. as per Automation Configuration Drawing (No.- MEC/S/9101/11/E9/000/00/064.01/R1) of CHP. The Contactor will furnish assignment drawing and space requirement to the employer to keep the provision in the Despatcher-D2.

B. COKE SORTING PLANT:-

One no. Despatcher will be provided by the Contactor for control of transportation of coke from JH-1 to various destination as per Material Flow Diagram & Technological layout. Despatcher will be a new building near Coke Screening Station under Contactor’s scope. Civil, Structural, floor & Ceiling requirements for the Despatcher / Control Building are described elsewhere in the TS.

C. New PLC with RIO’s will be provided for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III which will be connected to existing PLC through suitable gateway. The new PLC & HMIs will be housed in existing Control Room 1(CR-1). The existing HMIs will suitably be upgraded to match the new HMIs for operation of the entire existing and new Flux & Fuel Crushing & Screening plant.

D. COMMON POINTS:-

01. The Despatcher / Control Buildings will be air-conditioned and provided with false ceiling & false flooring. The respective rooms will have following suitable aluminum framed glass partitions as listed below:

a. At one partition called as operator room will house the operator workstations, printers and other peripherals of the automation
system along with Control desk (for work stations/printers) & operator chairs.

b. A separate partition in the control room / Despatchers will be used for installation of Engineering Stations, Servers (if applicable) & Software/Hard-ware related documentation.

c. A separate partition will be used for installation of PLC Panels, I/O panels, Instrumentation panels, Weighing panels, & all other electronic panels as per the detail engineering.

02. All the above partitions will be accessible directly from a common walkway.

03. Control room and Despatcher will also have facility of Toilet block. Central control room will have one conference room (with Table & Chairs for 12 persons) & Pantry. However Contactor may accommodate some of these facilities on floor below Control room also, during detail engineering.

04. Control desk (for installation of HMIs & Engineering Stations etc) will be of most modern & aesthetic design with Cable Management system.

04.11.05 LIST OF DRAWINGS & DOCUMENTS

Following drawings and documents will be submitted by the Contactor:

A. TO BE SUBMITTED BY THE CONTACTOR DURING DETAILED ENGINEERING

I) FOR APPROVAL:

01. Finalised system configuration diagram for the automation system along with its peripherals with list of hardware and write-up on the system.

02. Bill of Materials & Data Sheets of all the hardwares i.e. Processors, Communication modules, Power supply cards, RLM, OLM, Operator stations, Eng Stations, Servers, Bus cables etc.

03. Overall General arrangement drawings & sectional views of various cabinets, panels, consoles, etc., showing internal disposition of all components/units, with dimensional details and bill of materials.
04. Interconnecting diagram between existing MCCs & other panels of employer and PLC / Remote I/O stations of the Contactor.

05. Single line power supply diagram with specification and bill of quantities of electrical accessories.

06. Quality assurance plan & Factory Acceptance Test procedures for Automation system.

07. Control room layout drawing showing disposition of panels, consoles, desks, etc with dimensional details.

II) FOR SCRUTINY AND REFERENCE

01. Detailed technical literature/ catalogue for Automation system with peripherals, highlighting the model number.

02. Input/ Output list.

03. Terminal diagram of all the RI/O & Marshalling panels.

04. Cable schedule and specification.

05. System grounding scheme.

06. Formats and work sheets for generation and display of overview, groups, loops, graphics, alarms, operator’s guide messages, real time & historical trends, log & shift formats.

07. Detailed listing of application software, system software, HMI software, etc and the number of licenses.

08. Application software formats and details in documentation and CDs.

09. Manufacturer’s test, calibration and guarantee certificates for all instruments and automation system.

10. Operation and maintenance manuals for Automation system.

III As-built drawings and documents.

1. Drawings and documents of complete automation systems

2. Soft copy of all the above drawings & documents in CDs/DVDs.
04.12 TELECOMMUNICATION FACILITIES

General

This contract covers the technical requirement of Telecommunication facilities for Coal Handling & Coke Sorting for COBP # 11 & Flux & Fuel Preparation & Plant return fines for S.P - III of BSP.

04.12.1 Scope of Work

The scope of work of the contractor will cover design, basic and detailed engineering, supply, submission of drawings for approval, manufacture, testing, inspection by Employer/Consultant, packing, loading, forwarding, delivery at Plant site, loading/unloading, storage, handling of material/ equipment for erection testing, laying of cables, commissioning, PG test, PAT/FAT and liquidating the all defects related to Communication equipment for complete & satisfactory operation of the system on turnkey basis.

Any item or equipment not specifically mentioned but essential for proper installation, operation, maintenance and safety of plant, equipment and personnel will be included by the contractor in his scope of work.

The scope of work for this package will include but not be limited to the following:

a) LOUDSPEAKER TALK BACK (LSTB) SYSTEM

This contract covers the technical requirement of LSTB system for Coal Handling Plant, Coke Sorting Plant and Flux & Fuel Preparation & Plant return fines for S.P - III of BSP.

Loudspeaker talk back system will be provided for facilitating reliable two-way intercommunication between various strategic points of the plant complex. The subscriber stations will be provided at locations having very high ambient noise level.

The system having the requisite number of subscribers will be provided in various units of the plant complex for smooth flow of information between process points.

No. of subscribers for Coke Sorting Plant = 15
No. of subscribers for Coal Handling Plant = 5
No. of subscribers for Flux & Fuel Preparation & Plant return fines for S.P- III = 1
List of subscribers with type of station will be finalized during Basic Engineering stage.

For other technical details of system, equipment and cables refer GTS.

b) PLANT TELEPHONE CABLES & ACCESSORIES

i) This contract covers the technical requirement of Plant Telephone Cables & Accessories for Coke Sorting Plant of BSP.

Cable network inside the shop will be designed by the contractor keeping 50% spare capacity cable pairs and will terminate all cables in a cabinet / DB in the design limit. From this cabinet, the package contractor will bring the cable to the near by EPABX located in the administrative office / welfare building of the COB – 11 & terminate the cable in the subscriber side of the MDF of the said EPABX & charge the telephone lines.

The size of the telephone cable will be 50 pair armoured P.I.J.F. (i.e. cable from the cabinet / DB to the EPABX located in the administrative building / welfare building of COB-11).

Telephone connections will be provided in Shift – in – charge’s room & dispatcher room. One number of telephone set will be provided in each of the shift-in charge’s room & dispatcher room. Telephone handsets will be provided by the other package vendor.

ii) 15 nos of plant telephone connections have been considered for Fuel & Flux for crushing & screening (upgraded) area. Here the cable network will be designed by the shop package contractor keeping 50% cable pairs & will terminate the cable in a cabinet / DB in their design limit & from this cabinet /DB the package contractor will bring the integrated cable (minimum 50 pair Armoured PIJF cable) to the near by EPABX, located at the coal Handling Plant area (Approximately 700m away) and terminate the cable in the subscriber side of the MDF of the said EPABX & charge the telephone connection. However, the telephone handset will be provided by client / other package vendor. The proposed cable from the DB / cabinet to the EPABX will be minimum 50 pairs P.I.J.F cable.

For other technical details of system, cables and accessories refer GTS.
04.13 Laboratory facilities

04.13.01 Introduction

Under the proposed expansion program of Bhilai Steel Plant, it is envisaged to set up a new coke oven battery (No. 11) to cater to the metallurgical coke requirement of the iron making plant. Coke handling and sorting plant forms a part of the above coke oven battery complex. In order to check the physical properties of the coke produced, it is envisaged to have a well-equipped coke sample preparation and physical testing laboratory.

04.13.02 Functions

- Preparation of coke samples
- Physical testing of coke samples

04.13.03 Scope of work

The scope of work shall include design, manufacture, supply, installation, testing, calibration, successful commissioning and demonstration of performance guarantee of the coke sorting plant laboratory equipment. In addition to the laboratory equipment, the scope of supply for the coke sorting plant laboratory shall also include laboratory rooms, all the services requirement like power, water, air conditioning and ventilation, elaborate de-dusting facility for the laboratory rooms, compressed air, voltage stabilizer, uninterrupted power supply system (wherever required), fire fighting facilities, etc., for the laboratory building. The scope of supply shall also include commissioning spares, spares for two years of operation and maintenance, starter and switch fuse unit, standard accessories, foundation bolts, initial fill of oil and lubricants, all type of consumables like oils and lubricants, etc. for twelve months of operation after commissioning, local dust extraction system for dust generating equipment and any other item which is not mentioned in this specification but is required for smooth and proper functioning of the equipment for the intended purpose. Further, any equipment/facility, which is specifically not mentioned in this specification but is required for sample preparation and physical testing of coke samples as per the relevant standards, shall also be included in the scope of supply of the Contractor. The Contractor shall refer to the latest amendments of all the relevant standards pertaining to the sample preparation and physical testing of metallurgical coke and shall offer various equipment accordingly. Microprocessor controlled equipment, (if any), shall be kept inside air conditioned room.
• The Contractor shall stand guarantee for the overall performance of all the offered equipment, for which, these are going to be procured.

• The components of all equipment shall be designed, assembled and tested in accordance with the latest amendments of relevant Indian Standards and standards of the country of manufacture (in case of imported equipment).

• Full technical details and makes and models of all the offered equipment along with catalogues / drawings shall be furnished by the Contractor. All the offered equipment shall be of standard and reputed make and shall be of latest model. Detailed technical specifications, catalogues and literatures of all the offered equipment shall be furnished by the Contractor.

• The scope of work of the Contractor shall include special tools and tackles.

• The laboratory for the coke handling and coke sorting plant shall include, but not be limited to the list of equipment indicated in table 04.13.01 below. The Contractor shall indicate and include any other equipment in laboratory, which he considers necessary for such coke handling and coke sorting plant laboratory.

• Exact location of the coke handling and coke sorting plant laboratory shall be decided by the Contractor at a suitable dust and vibration-free location.
### List of major equipment with broad specification for coke oven laboratory

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<th>Sl. No.</th>
<th>Description</th>
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<tbody>
<tr>
<td>04.13.1</td>
<td>Ro-tap sieve shaker</td>
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<td></td>
<td>The equipment shall be used for determination of size fractions of samples of coke. It shall impart circular as well as tapping motion to provide uniform shaking. The equipment shall be sturdy in construction. It shall accommodate six test sieves of diameter 200 mm, height 50 mm. The sieves shall have spun brass frame without any circumferential joints and made of stainless steel wire. It shall be complete with motor, timer from 0-60 minutes, speed controller to provide number of revolution from 280-290 rpm, number of tapping 150 per minute, etc. A set of test sieves as per IS 460 (latest version), with apertures of 5 mm, 4.75 mm, 3.35 mm, 1.70 mm, 850 micron, 600 micron, 300 micron, 212 micron and 150 micron, with pan and cover shall also form a part of supply. The scope of supply shall include spares for two years of operation and maintenance, commissioning spares, push-button type direct online starter and switch fuse unit standard accessories, foundation bolts, initial fill of oil and grease, consumables for three months of operation after commissioning, and any other item which is not mentioned in this specification but is required for smooth and proper functioning of the equipment for the intended purpose.</td>
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<tr>
<td>04.13.2</td>
<td>Multi-deck vibrating screen</td>
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<td>The screen shall be used for determination of various size fractions of coke, produced in a coke oven plant. The screen shall have reciprocating type shaking arrangement with slow speed and large stroke. The shaking motion shall be imparted to the screen by an eccentric shaft with cam arrangement. The screen decks will be mounted on sturdy steel frame at a convenient height so that different size fractions may be collected in trays either at the floor or at the front end of the desk. The machine shall be fitted with sieves of 80 mm and 60 mm in upper deck and 40 mm and 30 mm in lower deck. The sieves shall be made of mild steel plates with square punched holes. In the upper deck, the sieves shall be fitted in such a manner that top end shall have 60 mm screen and discharge shall have 80 mm screen. In the lower deck the order of fixing the sieves shall be 30 mm and 40 mm respectively. The sieves shall be fabricated as per IS: 460 (latest version). The perforated plates used in the manufacture of test sieves shall</td>
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</table>
The machine shall have provision for adjustment of the angle of inclination of the screen and also for adjustment for increasing /decreasing the amplitude of vibration. The machine shall have feeding skirt to avoid splashing of coke while charging on to the screen. It shall have discharging chute. The fractions as over flow at the screen’s front end shall be collected in trays suitably mounted on structural frame which shall be bolted with the main frame structure. The overall dimensions of the machine shall not exceed 2500 mm along the length, 1500 mm along the width and 2000 mm along the height. The machine shall be complete with 4 Nos. of test sieves, 5 Nos. of collecting trays, frame for the deck, supporting structure for the motor, starter, V-belts, belt guards, etc.

**Major parameters of the equipment**

- **Type of screen**: Shaking (upper), Semi-vibrating (lower)
- **Screen slope**: 6-8 degrees (upper), 6-9 degrees (lower)
- **Eccentricity of Vibrator**: 15mm (upper), 5 mm (lower)
- **Speed of vibration**: 330 rpm (upper), 655 rpm (lower)
- **Capacity**: 900-1200 kg/h
- **Fractions to be separated**: (+) 80mm, (-) 80 to (+) 60 mm, (-) 60 mm to + 40 mm, (-) 40 mm to + 30 mm, (-) 30mm

The broad technical parameters of the screen, furnished above are indicative only and shall be checked and confirmed by the Contractor.

The screen shall be provided with charging hopper, discharging chutes, motor of reputed make, push-button starter, switch fuse unit, V-pulley with belt-guard, cover, etc. Appropriate dust extraction arrangement shall also be provided. The scope of supply shall include spares for two years of operation and maintenance, commissioning spares, standard accessories, foundation bolts, initial fill of oil and grease and consumables for three months of operation.
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<tr>
<td>04.13.3</td>
<td>Single deck vibrating screen</td>
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<td>It shall consist of a single deck having frame size 600 x 450 mm. It shall be capable of mounting detachable square hole punched plate screen. A screen with 50 mm square aperture shall be used for screening of coke, received before conducting micum test in line with IS 1354 (latest edition). A cover and appropriate dust exhaust system shall be provided with the screen. The scope of supply shall include spares for two years of operation and maintenance, commissioning spares, standard accessories, foundation bolts, initial fill of oil and grease and consumables for three months of operation after commissioning.</td>
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<tr>
<td>04.13.4</td>
<td>Double deck vibrating screen</td>
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<td>It shall be floor mounted type with double deck and shall be used for determination of size fractions of metallurgical coke. Effective screen area shall be about 800 x 600 mm with arrangement for easy / fast replacement of screens of different apertures. A set of sieves with square apertures of 80 mm, 60 mm, 50 mm, 40 mm, 30 mm, 20 mm, 16 mm, 12.5 mm, 10 mm, 9 mm, 5 mm, 6.3 mm and 500 micro meter shall be supplied along with collecting pans, made of G.I. sheets. The vibrating mechanism shall be fully circular positive throw type. Deck inclination, amplitude of vibration, machine rpm, etc. shall be suitable to obtain around 95% screening efficiency. The screen shall be provided with charging hopper, discharging chutes, motor of reputed make, push-button starter, switch fuse unit, V-pulley with belt-guard, cover, etc. Appropriate dust extraction arrangement shall also be provided. The scope of supply shall include spares for two years of operation and maintenance, commissioning spares, standard accessories, foundation bolts, initial fill of oil and grease and consumables for three months of operation after commissioning.</td>
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<td>04.13.5</td>
<td>Platform balance</td>
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<td>Capacity 300 kg</td>
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<td></td>
<td>Graduations 100g</td>
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<td>04.13.6</td>
<td>Platform balance</td>
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<td>Capacity 100 kg</td>
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<td>Graduations 100g</td>
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<td>04.13.7</td>
<td>Weighing scale</td>
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<td></td>
<td>Capacity 50 kg</td>
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<td>Graduation 20g</td>
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<td>Sl. No.</td>
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<tr>
<td>04.13.8</td>
<td>Weighing scale</td>
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<td></td>
<td>Capacity 10 kg</td>
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<td></td>
<td>Graduation 20g</td>
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<tr>
<td>04.13.8</td>
<td>Micum test apparatus</td>
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<td>The equipment shall be used to measure the resistance of coke to degradation by abrasion and shall be in line with the stipulations of IS ; 1354 (latest version). It shall basically consist of one mild steel drum of (1000 +/- 0.5) mm internal length and made of plates of 6 mm thickness. A horizontal shaft having around 65 mm diameter shall be welded to both the end plates of the drum. This shaft shall be mounted on suitable bearings to drive the drum. The drum shall be provided on the side with a door of size 600 x 500 mm, for introducing and removing the sample, the door being made dust-tight with a rubber washer and so fastened as to give a smooth inner surface. The equipment shall be complete with a motor of standard make, push button type direct on-line starter, gears, switch fuse unit, revolution counter, etc. A set of round hole punched plate screens having 60 mm, 40 mm, 20 mm and 10 mm as diameter of the apertures shall also form a part of the supply. The scope of supply shall include commissioning spares, spares for two years of operation and maintenance, standard accessories, foundation bolts, initial fill of oil and grease and consumables for three months of operation after commissioning.</td>
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<td>04.13.9</td>
<td>Drying oven</td>
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<td>The drying oven shall be electrically heated, floor mounted type and shall be designed with gravity convection to produce uniform temperature throughout the chamber. It shall have suitable thermostat to control the temperature from ambient to (110 ± 5) °C. The oven shall be of double-walled construction with heavy gauge stainless steel interior and painted mild steel sheet outer cover. All sides shall be insulated with 75 mm (approx.) thick fire and moisture proof glass wool. The oven shall have a hinged single door, which shall be backed by stainless steel and insulated properly by glass wool, with corners protected for temperature leakage. Each oven shall be provided with 3-heat control switches, high grade nichrome heater, two indicating neon lamps (one for main connection and the other for load), thermometer fitted from top, etc.</td>
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The inside chamber of the oven shall be provided with three stainless steel trays.

**Major parameters of the equipment**
- Range of temperature : Ambient to (110 ± 5 °C)
- Accuracy of temperature : (±) 1 °C.
- Inside chamber size : 450 x 450 x 600 mm

The scope of supply shall include commissioning spares, spares for two years of operation and maintenance, standard accessories, initial fill of oil and grease, consumables for three months of operation after commissioning and any other item which is not mentioned in this specification but is required for smooth and proper functioning of the equipment for the intended purpose.

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<td>04.13.10</td>
<td><strong>Infra-red moisture analyzer</strong></td>
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This equipment shall be used for accurate and rapid determination of moisture content in samples of coal and coke. The instrument shall consist of 500 watt infrared lamp and a torsion balance along with sample pan. All the above shall be housed in a compact metallic cabinet having robust design and smooth painted finish.

The infrared radiation from the lamp shall be used for heating the sample. The drying and weighing of the samples shall be done simultaneously. The temperature shall be controlled by solid state control. The sensitive torsion balance shall use magnetic damping to damp the vibrations of pan. The instrument shall be directly calibrated in percentage of moisture form 0-100%.

**Major technological parameters**
- Capacity : 100g
- Range : 0-100%
- Accuracy : ± 0.2%
- Sensitivity : 0.001 gms
- Least count : 0.1%
- Display : 10-digit alphanumeric LCD

The supply shall be complete with a pair of stainless steel pans, a pair of forceps, an automatic timer with alarm etc, and other essential items, if any.

The scope of supply shall include commissioning spares, spares for two years of operation and maintenance, standard accessories,
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<td>initial fill of oil and grease, consumables for three months of operation after commissioning and any other item which is not mentioned in this specification but is required for smooth and proper functioning of the equipment for the intended purpose.</td>
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<td>04.13.11</td>
<td>Telpher</td>
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<tr>
<td>Capacity : 3t</td>
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<tr>
<td>04.13.12</td>
<td>Box for coke, 125 kg capacity</td>
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<td>It shall be fabricated from MS plate of approx. 5 mm thickness. The approximate inside dimensions shall be 900 mm long, 600 mm wide, 900 mm height and it shall be used for collection and carrying approximately 125 kg coke.</td>
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<td>It shall be provided with welded rings on all fours sides centrally to handle the box by means of hoist sling.</td>
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<tr>
<td>04.13.13</td>
<td>Box for coke, 50 kg capacity</td>
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</tr>
<tr>
<td>It shall be fabricated from MS plate of approx. 5 mm thickness. The approximate inside dimensions shall be 800 mm long, 500 mm wide, 600 mm height and it shall shall be used for collection and carrying approximately 50 kg coke.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It shall be provided with welded rings one each on all fours sides centrally to handle the box by means of hoist sling.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04.13.14</td>
<td>Tool cabinet</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04.13.15</td>
<td>Miscellaneous items</td>
<td>1 set</td>
</tr>
<tr>
<td>Vacuum cleaner</td>
<td>: 1 No</td>
<td></td>
</tr>
<tr>
<td>Numbering punches</td>
<td>: 2 sets</td>
<td></td>
</tr>
<tr>
<td>Hammer</td>
<td>: 2 Nos</td>
<td></td>
</tr>
<tr>
<td>04.13.16</td>
<td>Laboratory furniture (Working table: 2 Nos. Ordinary chair: 3 Nos., Almirah 1 No. etc.)</td>
<td>1 set</td>
</tr>
</tbody>
</table>

**04.13.04. Data / information to be furnished by the Contractor**

- i) Printed catalogues, descriptive literature and General Arrangement drawing for each equipment indicating make and model offered
- ii) Equipment disposition plan with dimensions showing locations of major equipment and overall area requirement
iii) A write-up on proposed scheme of sampling, sample transportation, preparation, etc.

iv) List of essential accessories, commissioning spares and spares for 2 years of operation and maintenance for all the equipment shall be furnished by the Contractor.

04.13.05. LIST OF PREFERRED MAKES FOR COKE OVEN LABORATORY EQUIPMENT:

I. Raw material sample preparation and physical testing:
   EASTMAN CRUSHER/ BB ENGG.

II. Weighing machines
    AVERY / EQUIVALENT

III. Furniture
    GODREJ/ AAKAR SCIENTIFIC/ GORDHANDAS DESAI
05. SPARES, CONSUMABLES, TOOLS & TACKLES AND CONSTRUCTION EQUIPMENT

05.01 Commissioning Spares and Insurance Spares

Supply of commissioning spares and insurance spares as required shall be in the scope of supply of the Contractor along with the equipment. The list of commissioning spares has been indicated in ANNEXURE - C of Commercial Volume.

It shall cover requirements of erection, cold tests, startup and initial operation of the plant till integrated testing & commissioning and commencement of commercial production up to a period of six months.

Any leftover commissioning spares shall be the property of the Employer. Any commissioning spares required over and above the list given by the Contractor shall have to be provided by the Contractor free of cost up to the commissioning & commencement of commercial production of the plant and equipment. The Contractor shall supply adequate insurance spares to ensure smooth operation and maintenance of the plant.

05.02 Consumables

The Contractor shall supply all consumables such as initial fill of lubricants, oils, grease, chemicals, refractories, resins etc. as required to complete the plant till commissioning and shall have a shelf life of minimum one year. The scope of consumables shall include electrodes, shims, packings, bolts, nuts, gaskets, rivets, washers etc. The Contractor shall also fulfill the entire requirement given in ANNEXURE – A-2 of Commercial Volume.

The Contractor shall also furnish Indian equivalent of oils, lubricants, refractories and other consumables alongwith necessary specifications, drawings, catalogues etc. to enable the Employer to procure them from indigenous sources.
The Contractor shall indicate the annual requirement of all such consumables.

05.03 Operating, Maintenance and Two Years' Spares

05.03.01 The Contractor shall ensure the interchangeability of the parts wherever possible. The Contractor shall furnish an itemized list of interchangeable spares as given in Commercial volume.

05.03.02 The list of spares as necessary and recommended by the respective manufacturer for two years' of reliable and trouble free operation and maintenance of all equipment under this package has been listed in ANEEXURE – D of Commercial Volume. The Contractor shall furnish complete specification of the same.

05.03.03 Spares list giving complete list of the replaceable parts, fully illustrated, shall be supplied. The list shall include the following information:

- Item designation
- Reference drawings
- Quantity installed
- Quantity recommended for two years' normal operating including the insurance spares
- Weight of each spare part
- Supplier or sub-supplier's catalogue number
- Recommended minimum stock
- Expected replacement time
- Installation instruction in detail shall be supplied both for original installation and future, for replacement of major electrical equipment, circuit wiring diagram shall be provided
05.04 General Erection/ Maintenance Tools and Tackles

05.04.01 The Contractor shall supply a complete and unused set of all the special tools and tackles including required number of toolboxes as required for erection, maintenance, overhaul or complete replacement of the equipment and components required for the plant. The Contractor has furnished a list of such special erection and maintenance tools and tackles which is enclosed as Annexure- B2 of Commercial Volume. All the tools shall be supplied in separate containers clearly marked with the name of the equipment for which they are intended.

05.04.02 All the tools shall be supplied in separate containers clearly marked with the name of the equipment for which they are intended.

05.04.03 The Contractor shall indicate list of construction machineries, handling equipment and other facilities including tower crane or equivalent for erection at high elevation required for the execution of work based on their previous experience, considering site conditions and other considerations of work and furnish resource deployment plan. The Contractor shall mobilize these equipment at site for the execution of work and this is an important requirement of the project. The availability of required facilities shall be ensured for completeness of the project in time.

05.04.04 For any fabrication/ control assembly (necessary for erection) work to be done in the plant premises the plan shall be indicated by the Contractor. The necessary equipment such as plate bending machines, special purpose welding machines, fixtures, tools & tackles and other equipment required for fabrication shall be arranged by the Contractor.

05.04.05 The Contractor shall carry out the testing of welded joints by radiographic and ultrasonic methods. They must have only qualified/certified welders with them for completing all the welding jobs.
05.04.06 All the measuring instruments shall be calibrated having reference to NPL (National Physics Laboratory).

05.04.07 All tools and tackles, apparatus, special instruments required for erection, testing, commissioning and establishment of the Performance Guarantee Test, measurements required for establishing the pollution control norms and such other instruments, as required, shall be arranged by the Contractor. After commissioning, the Contractor shall handover all the special tools & tackles to the Employer as per the requirement given in Commercial volume.

05.04.08 The Contractor shall supply all required consumables, initial fill, oil, lubricants, construction and erection materials including but not limited to shims, packing plates, joining compounds, kerosene, solvents, sealing compounds, tapes, connectors, brazing and soldering materials, welding and brazing gases and rods, electrodes and wires, erection bolts, nuts, rivets, piano wire, packing sheet and packing compounds, temporary supports, spacer templates, jute and cotton waste cloth, sand and emery paper etc. for the commissioning of the plant.

05.04.09 For load testing of handling equipment, loads shall have to be arranged by the Contractor. Electrical/ operation tests, as per standard practice, shall also be arranged and completed by them.

05.04.10 All materials, equipment, tools, tackles etc. brought at site by the Contractor within the plant area shall not be removed without the written permission of the Employer. Similarly, all enabling works built/erected and/or acquired by them within the plant premises shall not be dismantled and removed without the written permission of the Employer.
06. PERFORMANCE GUARANTEE

06.01 General

On completion of erection of the plant units along with utilities and auxiliaries by respective package contractors as per approved drawings / documents as well as detailed drawings, the Contractor shall undertake preliminary Acceptance Test (PAT) i.e. cold test, to prove that the unit has been supplied as per agreement and after erection the unit is fit to be started up and commissioned. The PAT shall be followed by commissioning (hot trials) to demonstrate that the unit is fit for commercial production.

06.01.01 Preliminary Acceptance Test (PAT)

001 Cold tests shall be performed on the individual sub-assemblies of the unit and shall be designed to conduct the systematic check of the components and of the functional operation thereof.

002 Cold tests shall comprise idle, no-load tests. Cold tests shall be conducted by the Contractor under his sole responsibility. The Employer will provide skilled operating personnel during the cold test.

003 A detailed programme of cold tests shall be drawn up by the Contractor and shall be subject to the approval of the Employer / consultant. Such programme may be revised and adjusted as may be required by the Employer during the test run.

004 Results of cold tests shall be recorded jointly by the Contractor and the Employer.

005 On completion of preliminary acceptance tests, and liquidation of the defects list, preliminary acceptance certificates shall be issued by the Employer.

06.01.02 Commissioning (Hot Trials)

001 After issue of preliminary acceptance certificates, the Contractor shall start-up and commission the unit in an integrated manner under his sole responsibility as per commercial volume of contract.

002 During the start-up and commissioning, the Contractor shall perform the required adaptation, adjustment and hot run the Plant & Equipment to demonstrate its production capacity.
003 The Employer shall, for the purpose of start-up and commissioning, provide operating personnel as may be available with him for normal operation, who shall work under the instructions and guidance of the Contractor.

004 Start-up and commissioning of the unit shall be taken up only when material handling system, electrical power system, inter-plant fluid system and auxiliaries serving the unit as well as the preceding / succeeding plant units are under normal operation and / or feed material is available. The Contractor shall rectify the defects observed during commissioning.

005 The quantities of starting material and facilities necessary for conducting the commissioning shall be mutually determined by the Contractor and Employer.

006 Commissioning of the unit shall be deemed to be only completed, when the total commercial production of about 10,000 tonnes of material – or -ten(10) days of rated material is transported, for the particular circuit.

007 Results of start-up tests and commissioning shall be recorded jointly by the Contractor and the Employer.

008 On completion of commissioning of the unit and its commencement of commercial production as per clause 06.01.02.006, commissioning certificate shall be issued by the Employer within 15 days.

009 The unit shall be taken over by the Employer when:

   a) Commissioning certificate as per clause 06.01.02.008 has been issued by the Employer.

   b) The Contractor has submitted all final documents in compliance with the provisions of this specification.

   c) The Contractor has supplied all consumables, change parts, special tools and tackles and commissioning spares.

   d) The Contractor has met, to the satisfaction of the Employer, all the observation, if any, contained in the Preliminary Acceptance certificate.
06.02 Performance Guarantee Tests (PG)

001. After commissioning of the plant & equipment, the Contractor shall offer the plant for conducting performance guarantee tests as mutually agreed upon between the Employer and Contractor. PG test shall be carried out on full load within six months from commissioning.

002. The Contractor shall supervise and carry out the operation under their instruction and guidance during performance guarantee tests and shall take full responsibility of the operation. The Employer will make available necessary operating and maintenance personnel as per the agreed manning schedule as well as the raw materials, utilities and services etc, as specified.

003. The Contractor shall submit the scope, general preconditions, test procedures, guaranteed values and test evaluation methods.

004. The performance tests for all plant equipment shall be carried out to satisfy all operating parameters as per the relevant clauses of the Technical specification for the equipment under consideration.

Performance Guarantee Test

01 Performance Guarantee Parameters

i) Conveyor capacity shall be as per rated capacity given in conveyor data sheets.

ii) Crusher capacity should not be less than 300 tph.

iii) The equipment shall operate at rated capacity without undue vibration and undue noise etc. Noise level shall not exceed 85 dB at 1 meter distance.

iv) Granulometry of the product

   (-) 3 mm size: 81 % minimum
   (-) 0.5 mm size: 35 % maximum

v) Hammer life in term of throughput : Not less than 0.5 Mill.tonnes/Set of hammers

vii) Life of breaker plates / grate bar : Not less than 2 Mill.tonnes/set
Acceptable Limits & LD

The performance guarantee parameters, PG value and their acceptance limits with Liquidated Damages (LD) shall be as follows:

### PERFORMANCE GUARANTEE FOR COAL HANDLING PLANT

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Acceptable</th>
<th>Acceptable with LD</th>
<th>Liquidated Damages</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Conveyor capacity</td>
<td>As per rated capacity indicated in data sheet</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Less than rated capacity</td>
</tr>
<tr>
<td>2.</td>
<td>Discharge from Reversible hammer crusher</td>
<td>300 tph</td>
<td>289 to 299 tph</td>
<td>0.25% of Order value for every 1 tph decrease</td>
<td>Less than 289 tph</td>
</tr>
<tr>
<td>3.</td>
<td>Product size (-3 mm) from the Crusher.</td>
<td>-3 mm size upto 81 %</td>
<td>-3 mm size upto 79 %</td>
<td>0.25% of Order value for every 0.5% decrease</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-)0.5mm size up to 35 %</td>
<td>(-)0.5mm size more than 35 to up to 38 %</td>
<td>0.25% of Order value for every 0.5% increase</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Environment Norms</td>
<td>As specified in TS</td>
<td>Not achieving norms</td>
<td>Not achieving norms</td>
<td></td>
</tr>
</tbody>
</table>
## PERFORMANCE GUARANTEE FOR COKE SORTING PLANT

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Acceptable with LD</th>
<th>Liquidated Damages</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Conveying capacity</td>
<td>As per rated capacity</td>
<td>Nil</td>
<td>Not applicable</td>
</tr>
<tr>
<td>2.</td>
<td>80mm grizzly screen</td>
<td>Total misplacement ≤15%</td>
<td>1 to 15%</td>
<td>0.125% of order value for every 3% increase</td>
</tr>
<tr>
<td>3.</td>
<td>Coke crusher</td>
<td>+80% &lt;5%</td>
<td>1 to 5%</td>
<td>0.25% of order value for every 1% increase</td>
</tr>
<tr>
<td>4.</td>
<td>30mm vibrating screen</td>
<td>Total misplacement ≤15%</td>
<td>1 to 15%</td>
<td>0.125% of order value for every 3% increase</td>
</tr>
<tr>
<td>5.</td>
<td>60mm Grizzly screen</td>
<td>Total misplacement ≤15%</td>
<td>1 to 15%</td>
<td>0.125% of order value for every 3% increase</td>
</tr>
<tr>
<td>6.</td>
<td>Dust Suppression</td>
<td>Up to 5mg/Nm³</td>
<td>1mg/mg³ to 5mg/Nm³</td>
<td>0.3% of order value for every 1mg/Nm³ increase</td>
</tr>
</tbody>
</table>
PERFORMANCE GUARANTEE FOR AUGMENTATION OF FUEL & FLUX PREPARATION FOR SP III & FINES CONVEYORS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Acceptable</th>
<th>Acceptable with LD</th>
<th>Liquidated Damages</th>
<th>Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Flux crushing at output of closed circuit (-) 5mm</td>
<td>- 100%</td>
<td>- 95%</td>
<td>Nil</td>
<td>Below value</td>
</tr>
<tr>
<td></td>
<td>Fuel crushing (-) 3mm</td>
<td>- 95%</td>
<td></td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>Fuel (Coke) crushing (-) 5mm</td>
<td>- 100%</td>
<td>(-) 3mm - 90%</td>
<td>Nil</td>
<td>Below value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-) 1mm &lt; 50%</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-) 0.5mm &lt; 30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>Conveying capacity</td>
<td>As per rated capacity</td>
<td>-</td>
<td>Not applicable</td>
<td>Less than rated capacity</td>
</tr>
</tbody>
</table>

However, total liquidated damage on all account shall be limited to 7.5% of contract value.

The performance guarantee test shall be performed for each sub section continuously for 7 days. Continuity of operation however, be limited by availability of raw materials for unloading and stacking and availability of storing capacity on delivering end. Wherever equipment in the sub section is of stand by nature, each such equipment shall operate for at least 10 hours on load in the period.

The performance guarantee test shall also be performed for the complete system for 5 days on round the clock basis.

In case the test is disrupted due to equipment or facilities supplied by others, the performance is to be repeated for two more times after rectification of fault of the equipment or facilities supplied by others. Repair / Rectification of fault shall be done by others. If the test is disrupted even after that, the performance test shall be on the basis of total hours of uninterrupted operation of the system, 200 hours for sub section and 100 hours for total system. However, there should not be any failure of the equipment supplied by Contractor between starts and finish of this time counting. If the operation stops due to failure of any
item supplied by contractor, the operating hours prior to such failure will not be counted.

In case some equipment can not be tested within the period of testing because of failure of equipment or facility provided by others, the same will be accepted on the basis of load test result for the limited period or no – load test result where load test could not be performed at all.

The contractor shall prepare and submit a draft performance test procedure for each equipment and system within 12 months of order. The final performance test procedure will be prepared jointly by the Employer / consulting engineers and the contractor based on the draft performance test prepared by the contractor and various requirement indicated in the contract specification and the order.
07.00 PROJECT SCHEDULE & PROGRESS MONITORING

Project will be completed in 22 months from Effective date of Contract as defined in commercial volume document. Commissioning of the system will be completed as per commercial volume / technical specification document. The Contractor has submitted an overall project bar chart schedule which is included in the contract as Appendix- 2.

07.01 Project Schedule

07.01.01 The Contractor will be provided following construction facilities (indicative):

- Construction water – Contractor shall make their own arrangement of construction water. Location of bore wells, if planned by the contractor, will require clearance from BSP.
- Construction power – 500 KVA during peak
- Construction and storage area – Battery limit area shall be utilized for construction and storage. Open area available near coke sorting plant (approx. 4000 m²) may also be utilized for storage purpose.

07.01.02 The Contractor shall submit the following documents:

- Off-site/on-site organization chart
- Construction man power deployment schedule
- Deployment schedule of equipment and machinery, tools & tackles, etc, required for civil work, structural work and equipment erection.

07.01.03 The Contractor shall have to submit the following:

1. The Level-II network (detailed project schedule) both in hard and editable soft copy (in Primavera 6.1 version) covering further details of project activities, area-wise, for the total scope of the package,
within 2 months of Effective date of contract for approval and finalization of the Employer / Consultant.

II. The format of progress report to be discussed and agreed upon within 1 month from Effective date of contract.

III. Updated Level-II network (detailed project schedule) shall be submitted every month along with progress reports (on approved format).

07.02 Progress Monitoring

07.02.01 A progress monitoring system will be evolved by the contractor to ensure timely completion of all project activities. A monthly progress report showing current status of various activities shall be submitted by the Contractor to the Employer and his consultants. The monthly progress report shall indicate progress of activities against targeted dates and targeted quantities. Reasons for shortfalls, if any, shall be clearly brought out and proposed remedial measures to arrest the delays shall be indicated by the Contractor in the progress report, wherever applicable. In general, progress of the following major activities is to be reported.

• Issue of ordering / technical specifications and placement of orders on sub-vendors for bought out items / components

• Detailed design and engineering including submission of drawings / documents for approval/ reference.

• Manufacturing activities at the works of the Contractors / associates / sub-vendors.

• The progress report on inspection status.

• Dispatch of equipment to site.

• Site activities including receipt of material / equipment at site, erection, testing and commissioning.

• Before start of site activities, the Contractor shall submit a schedule for site-execution, along with quantitative program in terms of month-wise physical targets for various disciplines of work.
• The Contractor shall also furnish information on site activities viz: daily, weekly and monthly progress reports for construction, receipt of equipment, monthly construction / erection plan, etc. The Contractor shall also indicate resource deployment at site, highlights of critical areas and constraints in the progress reports.

• Other information related to site activities as may be required by the Employer / his consultants shall also be submitted by the Contractor. In the interest of timely completion of the project, if required, the priority of construction / erection may be altered by the Employer, in consultation with the contractor.

07.02.02 The Employer/Consultant shall also have the right to:

• Invite the Contractor for monthly / fortnightly meetings to review the progress of each activity.

• Depute Employer’s authorized representatives for ascertaining / expediting progress at Contractor’s works.

• Suggest remedial actions to bridge-up time gap between planned progress & observed progress.
08. DRAWINGS AND DOCUMENT TO BE SUBMITTED

All Drawings and document to be submitted by the contractor are indicated in the respective contract specification of the various equipments covered in the GTS or in Chapter 04.00 of this contract Specification.

The contractor shall go through the list of Drawings and document and submit all relevant drawings/ document as stipulated.
09. **LIST OF DRAWINGS**

List of drawings enclosed with this Contract Specification is furnished below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>CS Drawing Number</th>
<th>REV</th>
<th>Description of Drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1</td>
<td>MEC/S/9101/11/17/55/01/064.01/R0</td>
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<td>TECHNOLOGICAL LAYOUT</td>
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<td>A 2</td>
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<td>FLOW DIAGRAM</td>
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<td>MEC/S/9101/11/17/55/01/064.03/R0</td>
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<td>KEY PLAN &amp; SECTION C-C &amp; SECTION D-D</td>
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<td>KEY PLAN &amp; SECTION F-F &amp; K-K</td>
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<td>KEY PLAN &amp; SECTION E-E, H-H &amp; M-M</td>
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<td>PROPOSED COAL HANDLING PLANT</td>
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<td>MEC/S/9101/11/17/55/01/064.12/R0 SHEET 1 OF 2</td>
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<td>INTER CONNECTION BETWEEN EXISTING CONV. STREAM TO THE TOP OF NEW COAL TOWER-7 FLOW DIAGRAM</td>
</tr>
<tr>
<td>B 3</td>
<td>MEC/S/9101/11/17/55/01/064.12/R0 SHEET 2 OF 2</td>
<td>0</td>
<td>ADDITIONAL SILOS &amp; HAMMER MILLS FLOW DIAGRAM</td>
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<tr>
<td>B 4</td>
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<td>COAL TOWER TOP SECTION G-G</td>
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<td>Sl. No.</td>
<td>CS Drawing Number</td>
<td>REV</td>
<td>Description of Drawing</td>
</tr>
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<td>-----------------------------------</td>
<td>-----</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>C</td>
<td>GENERAL LAYOUT</td>
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<td>GENERAL LAYOUT - 2 sheets</td>
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<td>D</td>
<td>AUGMENTATION IN FUEL-FLUX PREPARATION FOR SP III</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Sheet 1 &amp; 2 of 2</td>
<td></td>
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</tr>
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<td>CONVEYOR LIST</td>
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<td>ELEVATION DRAWING FROM C104 TO C106 &amp; C106A VIA RC106</td>
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<td>ELEVATION DRAWING FROM C106A TO CRUSHER HOUSE AND TO JH-CK2</td>
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<td>ELEVATION DRAWING FROM JH-CK3 TO SIZER BUILDING TO ORIGINAL STREAM</td>
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