VOLUME – IA
Part I & II

TECHNICAL CONDITIONS OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED

Tender Specification No.: BHEL: PSSR: SCT: 2181

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VOLUME-IA PART-I CHAPTER-I
PROJECT INFORMATION
BHEL Transit Flat, Residential Quarters basement and common areas renovation works

BHEL Transit Flat, Residential Quarters basement and common areas renovation works at Ashok Nagar, Chennai is being done by **BHARAT HEAVY ELECTRICALS LIMITED** at existing Transit Flat and Residential Quarters at Ashok Nagar, Chennai, Tamilnadu, India. The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

1.1	Project Title	:	BHEL Ashok Nagar Transit Flat, Residential Quarters basement and common areas renovation works
1.2	Plant capacity	:	-
1.3	Type of project	:	Renovation Works
1.4	Owner	:	BHARAT HEAVY ELECTRICALS LIMITED (BHEL)
1.5	Site location	:	BHEL Guest House, 7A, Inner Ring Road, Ashok Nagar (Opposite to Udhayam Theatre), Chennai, Tamil Nadu - 600083
1.7	Nearest Village	:	Jafferkhanpet
1.8	Nearest Town & City	:	Chennai
1.9	State Capital	:	Chennai
1.10	Nearest Railway Station	:	Chennai Central at 14 KM Chennai Egmore at 11 KM
1.11	Nearest Airport	:	Domestic airport at Chennai (10 KM)
1.12	Nearest Seaport	:	Chennai Port (20 KM)
1.13	Nearest Road access	:	Grand Southern Trunk Road / Jawaharlal Nehru Road
2.0	Meteorological Condition		
2.1	Climate	:	Chennai has a tropical wet and dry climate. The weather is hot and humid for most of the year. The city gets most of its seasonal rainfall during the northeast monsoon period from mid-October to mid-

			December. Cyclones in the Bay of Bengal sometimes hit the city.
2.2	Site Elevation	:	The topography is almost flat and the ground level in the district slightly rises up to +6.70 m above MSL
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	35-40°C
b.	Annual Minimum Mean Temperature	:	15-22°C
c.	Dry bulb Temperature(DBT) for Design Purpose	:	Max 37°C & Min 19°C
2.4	Relative Humidity for Design purpose		Max 97% & Min 42%
2.5	Annual Rainfall		
	Average	:	Max 1541 mm & Min 353 mm
2.6	Basic Design Wind Pressure	:	Design wind speed is 39 m/sec as per IS: 875 Part III Mean Wind Speed (max): 20.6 km/h as per IS: 875 (Latest Edition)
2.7	Seismic zone	:	Zone: II as defined in IS:1893-2002
2.8	High Flood Level		High Flood Level for site: RL 2.50 m

VOLUME-IA PART-I CHAPTER-II
SCOPE OF WORKS

1.2.1 The scope of works covers Civil & Architectural works of BHEL Transit Flat, Residential Quarters basement and common areas renovation at Ashok Nagar, Chennai including supply of all materials, labour & mobilization of tools and plants as per the relevant standards, specification and as per the instruction of Engineer in charge.

1.2.2 The scope of works is as mentioned below. However, the scope of work is indicative only, but not limited to the given below,

Transit Flat:

1) Rooms inner wall ceiling putty & painting works.
2) All floors electrical wiring to be changed to new wiring with switch box.
3) All bathroom doors to be changed to new door.
4) All bathroom & dressing room tiles replacement.
5) All bathroom and dressing room sanitary fittings / closets to be replaced to new fittings and closets and damaged water lines to be replaced.
6) All ventilators to be changed to UPVC ventilators with fan.
7) SS handrails to be provided on the glass panel side of the staircase.
8) Roof waterproofing.
9) RCC water tank to be replaced with Sintex Tank.
10) Ground floor tiles to be replaced with new tiles.
11) All floor room doors & openings to be converted to rectangle type and doors to be replaced along with required accessories.
12) Ground floor rooms shall be converted to Suit rooms with suitable modifications.
13) False ceiling works.
14) Replacement of electrical fittings (LED Lights, decorative lights, etc.)
15) Replacement of electrical items based on the condition (Fridge, Television, Geyser, etc.)
16) CCTV for Transit Flat
17) Replacement of Furniture & Furnishings
18) External Painting including attending the cracks
19) Plumbing line replacement.

Residential Quarters basement & Common Areas:

1) Replacement of electrical fittings in Basement
2) Column Strengthening in basement
3) Replacement of Lift
4) Basement Flooring
5) Rain water sump with suitable drain & pumping arrangements
6) Water ingress protection in RR masonry walls
7) Pavement level raising & relaying of paver blocks

Note: The above provided list of works is indicative only for the bidder's guideline. Any other works not mentioned above, but required for completion of the scope of work – "Renovation of BHEL Transit Flat & Residential Quarters basement at Ashok Nagar, Chennai" in total, deemed to have been included in the bidder scope under this contract. Such work will be executed under this contract by bidder as per the direction of Engineer in charge. If any item of work not available in the rate schedule of this contract, the rate will be fixed in line with clause 2.15.7 of GCC.

1.2.3 Material makes:

Sl. No.	Material	Manufacturers / Makes
1	Cement PPC	Ultratech / ACC or Equivalent
2	AAC Block	Aerocon / Birla or Equivalent
3	Aluminium Frame	Jintal / Hindal or Equivalent
4	MDF board	Green Ply / Century Ply / Archid ply
5	Laminate sheet	Merino / Green lam / Archid Lam
6	Veneer Finish	Greenlam / Century / Archid
7	Glass Partition	Dormakaba / JEB / Alloy
8	Glass	Saint Gobain / AIS or Equivalent
9	Emulsion Paint	Asian / Berger / Nippon
10	Wall Papers	Asian / Ddecor or Equivalent
11	Vitrified Flooring Tile	Nitco / Kajaria / Johnson / RAK

12	Vitrified Wall Tile	Nitco / Kajaria / Johnson / RAK
13	LVT Vinyl tile	Armstrong / Pergo / LG
14	Laminated wooden Flooring	Armstrong / Pergo / Ego
15	Gypsum False ceiling	Saint Gobain(Gyproc) / USG boral / Anutone
16	Mineral Fibre	Armstrong / Anutone / Daiken
17	Acrylic Emulsion	Asian or Equivalent
18	Patch Fitting Door	Dormakaba / JEB / Alloy
19	Manual Sliding Glass Door	Dormakaba or Equivalent
20	Sliding Clean room Door	Trio India or Equivalent
21	Work station	Featherlite / Godrej / Monarch
22	Furniture	Featherlite / Godrej / Monarch
23	Chairs	Featherlite / Godrej / Monarch
24	Roller Blinds	Vista/Hunter Douglus or Equivalent
25	Clear Glass / Tinted Glass	Saint Gobain / AIS or Equivalent
26	Compactors	Godrej / Guardwel / Shield
27	Frosted Film	3M or Equivalent
28	Reinforcement Steel	Vizag / JSW / Sail
29	Tile Fixing adhesive	Weber / Pidilite / Sika / 3M or Equivalent
30	Sofa	Featherlite / Godrej / Monarch
31	Locker	Featherlite / Godrej / Monarch / Guardwel /Shield
32	Iron Mongeries	Dorma / Godrej / Ebco / Yale
33	SS Sink	Nirali / Franke or equivalent.
34	CP Sink Cock	Kohler or Equivalent
35	Angle Stop Cock	Kohler or Equivalent
36	UPVC Pipe	Ashirvad / Finolex / Astral
37	PVC Pipe	Ashirvad / Finolex / Astral
38	Floor Trap	Ashirvad / Finolex / Astral
39	Motor	V-Guard / Kirloskar / Suguna / Grundfos
40	Water proofing	Asian / Sunandha chemicals / Dr Fixit / Fosroc
41	PU Flooring	Asian / Ardex Endura / Flowcrete
42	FRLS copper wire	Finolex / Salzer / RR Kabel / Kundan / Polycab / Anchor Panasonic
43	Modular switches and sockets	MK / Salzer / Panasonic Vision / Legrand / Northwest/wipro / Anchor Roma Plus

44	MCBs and DBs	Siemens / Salzer / Legrand / GE / ABB / Anchor Panasonic
45	UG cables (1.1)	Polycab / Kei / Universal / Finolex
46	Tel cable	RR Kabel / Anchor / Delton / Finolex / Anchor Panasonic
47	MCCB	L&T / Schenider / Siemens / HPL / Anchor Panasonic
48	PVC conduits (ISI)	Avon / Aeroplat / Sun / Javeri / Anchor Panasonic
49	MS conduits (ISI)	BEC / Vimco / Gupta / Javeri
50	Krone block housing	Henzel
51	Capacitors	Epcos / Electronica / Baluk / L&T / Satyato
52	Timers	Schenider / L&T / Legrand / L&T
53	Contactors	GE / Salzer / Siemens / Schenider / L&T
54	Speaker	Bosch / Philips
55	Music system cable	Finolex / RR Kabel
56	APFC/Harmonic panel	Wave form / IEE / Unitech / Volton
57	Change over switch	HPL / Salzer / Standard / CS / L&T
58	Multi function meter	ICD / Socomec / Conserve
59	Exhaust fan& ceiling fan	Crompton / Bajaj / Usha / Almonard / Anchor Panasonic
60	Light fittings	Wipro / Crompton / Philips / K-lite / Panasonic

Note: Materials from the above Manufacturers/Makes or equivalent make may be used only on prior approval. Decision of BHEL Engineer In-charge for selecting the makes / manufacturer is final.

1.2.4 The works to be performed under this contract consist of providing all labour, supervision, material, scaffolding, construction equipment's, tools and plants, temporary works, supplies including Petroleum, oil & lubricants (POL), transportation and all incidental items not shown or specified but reasonably implied or necessary for the proper completion of work in all respects.

1.2.5 The area of work shall be cleared of all rubbish and other objectionable matter and materials removed shall be burnt or otherwise disposed of as directed by the Engineer-in-Charge. No separate payment for these operations shall be made. The cost of all these operations shall be deemed to have been included in the unit rates derived for the different items under bill of quantities.

1.2.6 All the works areas shall be adequately illuminated to the satisfaction of the Engineer-in-Charge when the work is in progress during the night shifts.

1.2.7 The unit rates shall include all material equipment, fixtures, labour construction plant, temporary works and everything whether of permanent or temporary nature necessary for the completion of job in all respects.

1.2.8 The unit rates for various items of B.O.Q shall include all the stipulations mentioned in technical specifications and nothing extra over B.O.Q rates shall be payable.

1.2.9 The bidder should fully apprise himself of the prevailing conditions at the proposed site, local conditions, site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may have not been specifically brought out in the specifications.

1.2.10 Bidder shall visit site for better clarification against present status of civil works in various area for proper assessment of pending works. The work covered under scope of works shall be taken up on AS IS WHERE IS basis, as applicable in site as per the instructions of BHEL Engineer in charge.

VOLUME-IA PART-I CHAPTER-III
FACILITIES & CONSUMABLES IN THE SCOPE OF CONTRACTOR / BHEL

1.3.3 **OPEN SPACE**

1.3.3.1 Open space as available and possible at the site location, will be provided at free of charges to the contractor, for storage and for preparatory works for construction purpose.

1.3.3.2 Availability of land within BHEL Transit Flat and Residential Quarters boundary is very limited and the contractor has to plan and use the existing land. The contractor will be responsible for handing over back all lands, as handed over to him by BHEL.

1.3.3.3 Contractor has to make his own arrangements for labour colony at his cost. The contractor shall provide adequate water arrangement for drinking/ utilities and shall provide adequate arrangements for electricity for labour colony at the cost of contractor.

1.3.4 **ELECTRICITY**

1.3.4.1 In general, Construction power will be provided to the contractor on prevailing rates of TANGEDCO on chargeable basis at one single point WITHIN THE PLANT AREA by BHEL. The contractor to Provide necessary energy meter for measuring the power consumption. The contractor shall make his own arrangement for further distribution with necessary isolator/LCB etc. However, based on request of Contractor and requirement of project, BHEL Site in charge, at his discretion, may provide construction power at multiple point (as close to work area as possible), for smooth execution of the work at site. If, BHEL provides electricity at more than one point (as close to work area as possible), it will be responsibility of the contractor to provide all the support necessary for enabling BHEL for extending such provision to contractor. Any dispute, BHEL engineer's decision shall be final and binding on contractor.

1.3.4.2 Provision for distribution of electrical power from the given common point to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.

1.3.4.3 BHEL is not responsible for any loss or damage to the contractor's equipment as a result of variations in voltage / frequency or interruptions in power supply.

1.3.4.4 Contractor has to make their own arrangements for electricity requirement for labour colony at his own cost.

1.3.4.5 As there are bound to be interruptions in regular power supply, power cut/ load shedding in any construction sites, contractor should make his own arrangement for alternative source of power supply through deployment of adequate number of DG sets at their cost during the power breakdown / failure to get urgent and important work to go on without interruptions. No separate payment shall be made for this contingency.

1.3.5 **WATER**

1.3.5.1 Construction Water required for construction purposes will be provided to the contractor by BHEL, free of charges. The required pumps & accessories, pipes for drawing water from the given point and further distribution will be arranged by the contractor at their cost to go on without interruptions.

1.3.5.2 Contractor has to make his own arrangements for his water requirement for his labour colony at his cost.

1.3.5.3 Drinking Water shall be arranged by the bidder at his cost.

1.3.6 **MATERIAL SUPPLY**

1.3.6.1 Supply / providing aggregate and all other materials required for the work are in the scope of the contractor.

Fine aggregate source shall be manufactured crushed stone or rock sand (M-sand), excluding fines which are by products/rejects of coarse aggregate production. The crushed stone sand shall be graded from fine to coarse with the coarse sizes predominating to give maximum density.

The amount of fine particles as ascertained by the laboratory sedimentation method shall not exceed 10% for crushed stone sand. The amount of material passing a 75 micron sieve (IS test sieve) shall not exceed the following limits:-

a) Crushed stone sand concrete subject to abrasion 1% by weight

b) All other concrete 3% by weight.

There shall be no clay or fine silt present. The amount of hollow shells like to form voids or remain partially unfilled and present in material retained on a IS 2.36 mm sieve, determined by direct visual separation, shall not exceed 3% by weight of the entire sample. Fine aggregate shall not contain appreciable

amounts of flaky and/or elongated particles. The water absorption of fine aggregate, determined in accordance with BS 812 shall not exceed 2.0% by weight. Fine aggregate subjected to five cycles of the soundness test, specified in IS:2386 (Part-5), shall not show a loss exceeding 10% when sodium sulphate solution is used and 15% when magnesium sulphate solution is used, except where approved otherwise. Tests are to be executed in accordance with IS:2386. The grading of fine aggregate for concrete work shall comply with the requirements of IS:383. The grading of the aggregates should be such as to produce a concrete of the specified proportions which will work readily into position without segregation and without the use of excessive water content. The grading should be controlled throughout the work so that it conforms closely to that used for the preliminary tests. A check on the moisture content of sand should be made at least once a day before concreting. The amount of water to be added to the concrete mix should be adjusted accordingly. Any washing, screening, classifying and other operations on the fine aggregate required to meet this specification shall be done by the Contractor. Washing is required if the content of salt adhering to the aggregate is found to be unacceptably high.

1.3.6.2 Regarding supply of cement, the cement shall be supplied in Bags for RCC works, masonry, flooring works etc.

1.3.7 CONSUMABLES

All consumables, like gas, electrodes, chemicals, lubricants etc. required for the scope of work, shall be arranged by the contractor at his cost unless otherwise specifically mentioned in the contract.

In the event of failure of contractor to bring necessary and sufficient consumables, BHEL may arrange for the same at the risk and cost of the contractor. The entire cost towards this along-with overhead shall be paid by the contractor or deducted from the contractor's bills.

1.3.8 LIGHTING FACILITY

Adequate lighting facilities such as flood lamps, hand lamps and area lighting shall be arranged by the contractor at the site of construction, and contractor's material storage area etc. at his cost.

1.3.9 CONTRACTOR'S OBLIGATION ON COMPLETION

On completion of work, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and leveled and debris shall be removed as per instructions of BHEL by the contractor at his cost. In the event of his failure to

do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.

VOLUME-IA PART-I CHAPTER-IV
T&Ps TO BE DEPLOYED BY CONTRACTOR

1.4.1 All the tools & plants/vehicles and MMEs required for satisfactory completion of the work are to be arranged by the contractor within the quoted rates. Necessary accessories for the tools & plants shall also be provided by the contractor.

1.4.2 Contractor shall deploy all necessary T&P to meet the schedules & as prescribed by BHEL engineer and required for completion of work in time without any delay.

VOLUME-IA PART-I CHAPTER-V
T&Ps PROVIDED BY BHEL

1.5.1 BHEL will not provide any T & Ps for this scope of work.

1.5.2 All the tools and plants required for execution of the above work are in contractor's scope.

1.5.3 In case if the contractor fails to provide T&P and other equipment's, BHEL will arrange for the same and the cost will be recovered from the contractor's bill with BHEL overheads, as applicable from time to time which may vary during contract period.

VOLUME-IA PART-I CHAPTER-VI
TIME SCHEDULE

1.6.1 TIME SCHEDULE

1.6.1.1 The commencement of work at site shall be mutually agreed date between bidder and BHEL engineer in charge to start the work.

1.6.1.2 The entire scope of work of Renovation of BHEL Transit Flat, Residential Quarters basement and common areas at Ashok Nagar, Chennai for the package as detailed in the Tender Specification shall be completed **within 90 days** from the date of commencement of work.

1.6.1.3 During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.

1.6.1.4 The contractor is required to refer Form 15 provided at Chapter-8 in Part II Volume IA Technical Conditions of Contract for all the instructions to be taken immediately after receipt of LOI.

1.6.2 GUARANTEE PERIOD FOR THE PACKAGE

Guarantee period of 12 months shall commence from the date of completion of the whole work certified by the BHEL Engineer.

1.6.3 CIVIL WORKS SCHEDULE FOR RENOVATION OF BHEL TRANSIT FLAT & RESIDENTIAL QUARTERS AT ASHOK NAGAR, CHENNAI

Tentative schedule for the scope of works is as given below.

Sl. No	Area	Completion from the date of commencement of work
1	Civil & Architectural work of BHEL Transit Flat, Residential Quarters and Common areas at Ashok Nagar, Chennai	90 days

1.6.4 The bidder must submit a detail schedule (area wise) for completion of work to meet the work schedule given in clause no. 1.6.3 within 2 days from the date of issue of LOI.

1.6.5 RECORDS TO BE MAINTAINED AT SITE

1.6.5.1 Record of Quantity of FREE/Chargeable items issued by BHEL must be maintained during contract execution. Also reconciliation statement to be prepared at regular intervals.

1.6.5.2 The under mentioned Records/ Log-books/ Registers, as applicable to be maintained.

i. Hindrance Register.
ii. Site Order Book.
iii. Test Check of measurements.
iv. Cement Supply and Consumption Daily Register
v. Records of Test reports of Field tests.
vi. Records of manufacture's test certificates.
vii. Records of disposal of scraps generated during and after the work completion.
viii. List of T&Ps and MMEs

VOLUME-IA PART-I CHAPTER-VII
TERMS OF PAYMENT

1.7.0 TERMS OF PAYMENT

1.7.1 Secured Advance

Not applicable

1.7.2 Advance for Mobilization

Not applicable

1.7.3 Interim Payment

1.7.3.1 Interim bills in the form of monthly running bills prepared by the contractor in soft as well as Hard copies shall be based on the quantities executed and measured.

1.7.3.2 95% item rate shall be released after completion of works certification by Engineer in charge.

1.7.3.3 5% of the item rate shall be released after submission of the quality check formats as per the quality plan for the quantum of work billed and duly certified by engineer.

1.7.3.4 Retention amount applicable be as per GCC.

1.7.3.5 BHEL Site Engineer, at discretion, may operate the part rate of the items in line with the BHEL GCC clause 2.23.1.V

1.7.4 Royalty / seignior age charges

The royalty/ seignior age charges shall be inclusive within the quoted rate. No extra payment shall be applicable to the vendor.

1.7.5 METHOD OF MEASUREMENT

Mode of measurement shall be as per relevant clauses of IS 1200 in conjunction of IS code 3385 shall be adopted. In case the same is also not available, the standard procedure adopted in CPWD shall be adopted. In case, the same is also not available in CPWD, the measurement of the work done will be based on the mutual agreement between BHEL and contractor. In all the above cases, the interpretation of BHEL will be final and binding to the contractor. Measurement guidelines as a ready reference are also available in the technical specification.

1.7.6 NO CLAIM WHAT SO EVER MAY BE, WILL BE ENTERTAINED UNDER THIS CONTRACT, AFTER DULY SIGNING THE FINAL BILL ALONG WITH MEASURMENT BOOKS AND ACCEPTED BY BHEL.

VOLUME-IA PART – I CHAPTER-VIII
TAXES AND DUTIES

1.8.1 All taxes and duty other than GST & Cess and BOCW Cess

The contractor shall pay all (**except the specific exclusion viz GST & Cess and BOCW Cess, both of which are dealt separately**) taxes, fees, license charges, deposits, duties, tools, royalty/ seigniorage, commissions, Stamp Duties, or other charges / levies, which may be levied on the input goods (including construction material viz. sand, coarse aggregates, moorum, borrowed earth, etc.) & services consumed and output goods & services delivered in course of his operations in executing the contract **and the same shall not be reimbursed by BHEL**. In case BHEL is forced to pay any of such taxes, BHEL shall have the right to recover the same from his bills or otherwise as deemed fit.

1.8.2 Goods and service Tax (GST) -

For GST Registered bidder:

1.8.2.1 The successful bidder shall furnish proof of GST registration under GST Law, covering the supply and services under this contract. Registration should also bear endorsement for the premises from where the billing shall be done by the successful bidder on BHEL for this project/ work. The bidder to specify in their offer the category of registration under GST i.e. Regular dealer or composite dealer**.**

1.8.2.2 Bidder's price/rates shall be exclusive of GST & GST Compensation Cess (herein after termed as GST).

1.8.2.3 Vendor / Contractor require to ensure that all Input Tax benefits as per existing laws have been considered.

1.8.2.4 Price quoted by the composite dealer shall be considered as inclusive of GST. In the event of any change in the status of vendor / Contractor from composite to regular dealer after the submission of the bid but before completion of supply of services or goods, Contract value shall be amended to remove the embedded GST and any ITC benefit arising due to change of status, which shall be passed on to BHEL. GST paid on the amended contract value shall be reimbursed at actuals against the Tax invoice if BHEL is able to take input tax credit. However, no reimbursement of GST shall be made if BHEL is not able to take input tax credit. The decision of BHEL in this regard will be final and binding on the vendor/contractor.

1.8.2.5 It is the responsibility of the vendor / contractor to adhere to all the provisions of E- Invoicing under GST Act (if applicable). As per the E-Invoicing provisions vendor / Contractor has to generate IRN and QR Code from the E-Invoicing system and the same need to be printed in the invoice submitted to their customer. Invoices that do not comply to the above requirements, will not be accepted by BHEL. If the successful Bidder is not falling under the preview of E-Invoicing, then he has to submit a declaration in that respect along with relevant financial statements. However, applicability of E-invoicing, shall be verified from the E-Invoicing portal on submission of vendor / Contractor GSTN. BHEL shall reimburse GST only if all the provisions of E-invoicing are complied with.

1.8.2.6 It is the responsibility of the vendor/ Contractor to issue the Tax Invoice strictly as per the format prescribed under the GST Act within the prescribed time period in order to enable BHEL to avail input tax credit within the due date. Invoices shall be submitted on time to the concerned BHEL Engineer In Charge. Tax invoice should also contain below details

a. Contractor Name and Contact details.
b. GST No of Contractor
c. PAN No of Contractor
d. Document Type: Tax Invoice/ Debit Note/ Credit Note
e. Category: B2B / B2C (B2B is only applicable w.r.t BHEL)
f. Customer Name and Contact details / Bill To Details (as mentioned below)
g. Unique Tax Invoice Number
h. Invoice Date
i. IRN No, QR Code, Acknowledgment No and Acknowledgment Date generated from E-Invoice Portal as per E-invoicing provisions under GST Act (If applicable)
j. Place of Supply (as mentioned below)
k. Description of service provided
l. 8 Digit SAC code
m. GST Rate
n. Gross value of Invoice
o. Taxable Value
p. Tax / GST Amount
q. Total Invoice value including GST.

Above are inclusive and not exhaustive list of requirements.

1.8.2.7 Bidder should mention the "Bill To "and "Place of supply" as below in the Tax Invoice

Bill To: Location of BHEL Site office

---,

State: ---
GSTN of BHEL: ---

Place of Supply: Location of BHEL Site office

---,

State: ---
GSTN of BHEL: ---

(Above details will be given later, contractors may contact BHEL, PSSR before billing)

1.8.2.8 In case of supply of goods contract, the successful bidder must promptly provide details of the dispatched items on the same day they are removed for shipment to the BHEL site. This intimation must include all relevant information and documents about the goods and a scanned copy of the tax invoice. If any financial liabilities arise for BHEL due to non-compliance with GST laws resulting from the bidder's delay in providing this information, the bidder will be held liable, unless the delay is directly attributable to BHEL.

1.8.2.9 BHEL will reimburse the GST amount claimed by the Vendor/Contractor against a tax invoice along with the amount due to the contractor in the RAB. However, If the Vendor/Contractor fails to fulfill the GST compliance requirements detailed below for any preceding invoice, BHEL reserves the right to recover an amount equivalent to the reimbursed GST from the subsequent bills as a measure against statutory non-compliance. Additionally, an amount equivalent to the GST claimed in subsequent bills will be withheld until statutory compliance for the prior invoice is ensured.

In the case of one-time vendors/contractors or the Vendor/Contractor's final bill, BHEL will withhold an amount equivalent to the GST claimed from the same bill towards pending statutory compliance. This withheld amount will only be released once the following GST compliance requirements are fully satisfied.

GST Compliance Requirements:

a. Vendor / Contractor must provide the original copy of Tax invoice /debit note as per the prescribed format under the GST act within the prescribed time period in order to enable BHEL to avail input tax credit within the due date.

b. The details of the invoice or debit note referred to in clause (a) must be furnished/filed by the Vendor/ Contractor in the statement of outward supplies (presently in GSTR1 or IFF) and such details should get reflected in the BHEL GST login (both in GSTR 2A and GSTR 2B) in the manner specified under GST Act.

c. Details of vendor/contractor invoice reflected in BHEL GST login should match with the details in the tax invoice submitted by the vendor/contractor, including the invoice number, invoice date, GSTIN, and place of supply. Additionally, the status of GSTR-1 and GSTR-3B filings must be "Yes."

d. The tax charged in the invoice /debit note referred to in clause (a) must be paid to the Government by the Vendor/Contractor, either in cash or through the utilization of input tax credit.

1.8.2.10 In case, any GST credit is delayed/denied to BHEL or BHEL has to incur any liability (like interest / penalty) due to non/delayed receipt of goods or submission of tax invoice after the expiry of timeline prescribed in the relevant GST Act for availing ITC, or any other reasons not attributable to BHEL, Then the same shall be recovered from the vendor/contractor along with interest levied/ leviable on BHEL.

1.8.2.11 GST shall be levied on recoveries, wherever applicable and same shall be recovered from payments. BHEL shall issue / raise Tax invoice on contractor/vendors for such recoveries.

1.8.2.12 E-way bills / Transit passes / Road Permits, if required for materials / T&P etc., bought into the project site is to be arranged by the Vendor / Contractor themselves. BHEL shall not issue or raise any Road Permit/ E- Way Bill for this purpose. Any claim or demand raised by the GST department for non-generation / non-submission of E-way bill shall be to the contractor/ vendor account

1.8.2.13 BHEL shall not reimburse any expenditure incurred by the contractor towards demand, additional liability or interest / penalty etc., raised by the GST

department due to issues such as wrong rates / wrong classification of services or goods.

1.8.2.14 Where GST is payable by BHEL under reverse charge basis, any demand raised or any interest or penalty levied / leviable by the GST department due to non-submission or delayed submission of invoice by the contractor or for any other reason not attributable to BHEL, the same shall be recovered from the vendor/contractor.

1.8.2.15 Tax Deduction at Source (TDS) as per Sec 51 of the CGST Act shall be deducted (if applicable). GST TDS certificate in Form GSTR -7A shall be issued to be contractor. However, GST TDS certificate can be generated only if the contractor accepts the TDS details uploaded by BHEL and files his return. If any specific exemption from GST TDS is applicable to any contractor/vendor, then a declaration to that effect along with relevant documents as may be required by BHEL, substantiating such exemption in line with GST law provisions or notification, shall be submitted by the vendor/contractor.

For GST Unregistered bidder:

1.8.2.16 In case, bidder is not required to register under Goods and service Tax (GST) & Cess, the same is to be specified in the offer.

1.8.2.17 Successful bidder to furnish a Self-declaration that registration under GST is not required or not applicable as per the provisions of GST Law along with relevant document and provisions in the GST law.

1.8.2.18 In case BHEL has to incur any liability (like interest / penalty etc.) due to non-compliance of GST law in respect of the invoice submitted by the contractor, for the reasons attributable to the contractor, the same shall be recovered from the contractor.

1.8.2.19 TDS under GST (as & when applicable) shall be deducted at prevailing rates on gross invoice value.

1.8.2.20 If RCM is made applicable at a later date, GST will be paid by BHEL to the department at applicable rate treating the quoted the price as inclusive of GST if BHEL is not able to take Input tax credit.

1.8.2.21 In the event of any change in the status of bidder from unregistered to registered under the GST law after the submission of bid but before the completion of supply of services or goods, the same need to be intimated and all the clauses applicable for Registered bidder need to be followed. The vendor/ contractor is required to pass on the ITC benefit arising due to change of status, to BHEL. Contract value shall be amended accordingly. GST paid on the amended contract value shall be reimbursed at actuals against the Tax invoice only if BHEL is able to take input tax credit.

1.8.3 Statutory Variations

1.8.3.1 BHEL shall pay statutory variation only for GST, and no other variations shall be payable

1.8.3.2 In general, Statutory variation for GST is payable to the Vendor/Contractor during the contract period including extension thereof. Beyond the contract period, BHEL will reimburse the actual applicable tax only if BHEL is able to take the input tax credit. However, the decision of BHEL in this regard will be final and binding on the vendor/contractor

1.8.4 New Taxes/Levies –

In case Government imposes any new levy / tax after submission of bid during the tenure of the contract, BHEL shall reimburse the same at actual on submission of documentary proof of payment subject to the satisfaction of BHEL that such new levy / tax is applicable to this contract. However, Contractor/ Vendor shall obtain prior consent from BHEL before depositing new taxes and duties.

Any benefits arise out of new tax levies and/or abolition of existing taxes must be passed on to BHEL.

The decision of BHEL in this regard will be final and binding on the vendor/contractor.

1.8.5 Direct Tax

1.8.5.1 Vendor/ Contractor is required to update himself on its own and comply with provisions of Indian Income Tax Act as notified from time to time. Purchaser shall not be liable towards liability of income tax accruing to the vendor/contractor of whatever nature including variations thereof, arising out of this Order/ Contract, as well as tax liability of the vendor/ Contractor and his personnel

10.8.5.2 Deductions of Tax at source as per Income Tax Act, at the prevailing rates shall be effected by the Purchaser before release of payment, as a statutory obligation, if applicable. TDS certificate will be issued by the Purchaser as per the statutory provisions. The Vendor/Contractor has to mention their Permanent Account Number (PAN) and GSTIN in all invoices.

1.8.6 BOCW Act & BOCW Welfare Cess Act

1.8.6.1 Contractor's price/rates shall be exclusive of BOCW Cess .

1.8.6.2 The Contractor should Register their Establishment under BOCW Act 1996 read with rules 1998 by submitting Form I (Application for Registration of Establishment) and Form IV (Notice Of Commencement / Completion of Building other Construction Work) to the respective Labour Authorities i.e.,

a. Assistant Labour Commissioner (Central) in respect of the project premises which is under the purview of Central Govt.–NTPC, NTPL etc.
b. Appropriate State authorities in respect of the project premises which is under the purview of State Govt.

1.8.6.3 The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL.

1.8.6.4 The contractor should ensure compliance regarding Registration of Building Workers as Beneficiaries, Hours of work, welfare measures and other conditions of service with particular reference to Safety and Health measures like Safety Officers, safety committee, issue of Personal protective equipments, canteen, rest room, drinking water, Toilets, ambulance, first aid centre etc.

1.8.6.5 The contractor irrespective of their nature of work and manpower (Civil, Mechanical, Electrical works etc) should register their establishment under BOCW Act 1996 and comply with BOCW Welfare Cess Act 1996.

1.8.6.6 Contractor shall make remittance of the BOCW Cess as per the Act in consultation with BHEL as per the rates in force (presently 1%). BOCW remittance should be made only after obtaining prior consent from BHEL. BHEL shall reimburse the same upon production of documentary evidence. However, BHEL shall not reimburse the fee paid towards the registration of establishment, fees paid towards registration of Beneficiaries and Contribution of Beneficiaries remitted.

1.8.6.7 Non-compliance to Provisions of the BOCW Act & BOCW Welfare Cess Act is not acceptable. In case of any non-compliance, BHEL reserves the right to withhold any sum as it deems fit. Only upon total compliance with the BOCW Act and the discharge of total payment of Cess (in consultation with BHEL) under the BOCW Cess Act by the Contractor, BHEL shall consider refund of the amounts.

VOLUME-IA PART-I CHAPTER-IX
BILL OF QUANTITY

1.9.1 As mentioned in the Volume II, Price bid, Part C

NOTE TO BOQ:

1. The Price bid contains the consolidated list of BOQ with brief description of items. The quantity indicated in the BOQ / Price bid is approximate only and is liable for variation. Payment will be as per actual quantity executed as certified by BHEL Engineer.
2. Before filling the Rates in the Price bid, the bidder shall go through the detailed specification of all items of BOQ as well as Scope of Work as specified in relevant clause of this document.
3. Bidders shall refer Volume II, Price Bid, Part –A for Instructions regarding quoting.

VOLUME-IA PART-I CHAPTER-X
GENERAL

The scope of the work will comprise of but not limited to the following:
(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.10.1 Successful Bidder is requested to furnish the following at PSSR-HQ Chennai immediately after release of Letter of Intent (LOI)

i) Security Deposit

ii) Unqualified Acceptance for LOI, Detailed LOI / Work Order.

iii) Rs.100/- Stamp Paper for preparation of Contract Agreement.

1.10.2 Successful Bidder are requested to furnish the proof of documents for the following at the respective PSSR- Site

i) PF Regn No.

ii) Labour License No.

iii) Workmen Insurance Policy No.

1.10.3 In addition to the clause 2.8 of General Conditions of Contract (Volume-1C of Book-II) the contractor shall comply with the following:

1.10.3.1 PROVIDENT FUND

1.10.3.1.1 The contractor is required to extend the benefit of Provident Fund to the labour employed by you in connection with this contract as per the Employees Provident Fund and Miscellaneous Provisions Act 1952. For due implementation of the same, you are hereby required to get yourself registered with the Provident Fund authorities for the purpose of reconciliation of PF dues and furnish to us the code number allotted to you by the Provident Fund authorities within one month from the date of issue of the letter of intent. In case you are exempted from such remittance an attested copy of authority for such exemption is to be furnished. Please note that in the event of your failure to comply with the provisions of said Act, if recoveries therefore are enforced from payments due to us by the customer or paid to statutory authorities by us, such amount will be recovered from payments due to you.

1.10.3.1.2 The final bill amount would be released only on production of clearance

certificate from PF / ESI and labour authorities as applicable.

1.10.3.2 OTHER STATUTORY REQUIREMENTS

1.10.3.2.1 The Contractor shall submit a copy of Labour License obtained from the Licensing Officer (Form VI) u/r25 read with u/s 12 of Contract Labour (R&A) Act 1970 & rules and Valid WC Insurance copy or ESI Code (if applicable) and PF code no. along with the first running bill.

1.10.3.2.2 The contactor shall submit monthly running bills along with the copies of monthly wages (of the preceding month) u/r78(1)(a)(1) of Contract Labour Rules, copies of monthly return of PF contribution with remittance Challans under Employees Provident Fund Act 1952 and copy of renewed WC Insurance policy or copies of monthly return of ESI contribution with Challans under ESI Act 1948 (if applicable) in respect of the workmen engaged by them.

1.10.3.2.3 The Contractor should ensure compliance of Sec 21 of Contract Labour (R&A) Act 1970 regarding responsibility for payment of Wages. In case of "Non-compliance of Sec 21 or non-payment of wages" to the workmen before the expiry of wage period by the contractor, BHEL will reserve its right to pay the workmen under the orders of Appropriate authority at the risk and cost of the Contractor.

1.10.3.2.4 The Contractor shall submit copies of Final Settlement statement of disbursal of retrenchment benefits on retrenchment of each workmen under I D Act 1948, copies of Form 6-A (Annual Return of PF Contribution) along with copies of PF Contribution Card of each member under PF Act and copies of monthly return on ESI Contribution – Form 6 under ESI Act 1948 (if applicable) to BHEL along with the Final Bill.

1.10.3.2.5 In case of any dispute pending before the appropriate authority under ID Act 1948, WC Act 1923 or ESI Act 1948 and PF Act 1952, BHEL reserve the right to hold such amounts from the final bills of the Contractor which will be released on submission of proof of settlement of issues from the appropriate authority under the act.

1.10.3.2.6 In case of any dispute prolonged / pending before the authority for the reasons not attributable to the contractor, BHEL reserves the right to release the final bill of the contractor on submission of Indemnity bond by the contractor indemnifying BHEL against any claims that may arise at a later date without prejudice to the rights of BHEL.

1.10.4 Site Visit by the Bidder

1.10.4.1 The bidder shall, prior to submitting his tender for the work, visit, examine and acquire full knowledge & information and necessary conditions prevailing at the site and its surroundings of the plant premises together with all statutory, obligatory, mandatory requirements of various authorities about the site of works at his own expense, and obtain and ascertain for himself on his own responsibility that may be for preparing his tender and entering into a contract, and take the same into account in the quoted contract price for the work.

1.10.4.2 The bidder shall satisfy themselves about the following factors:

i). Site conditions including access to the site, existing and required roads and other means of transport/communication for use by him in connection with the work including diverting and re-routing of services.

ii). Requirement and availability of land and other facilities of his enabling works, establishment of his nursery, office, stores etc.

iii). Ground conditions including those bearing upon transportation, disposal, handling and storage of materials required for the work or obtained there- from.

iv). Source and extent of availability of suitable materials, including water etc., and labour (skilled and unskilled) required for work, and laws and regulations governing their use and employment.

v). Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work.

vi). The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping.

vii). The type of equipment and facilities needed, for and in the performance of the work;

viii). The extent of lead and lift required for the work in complete form over the entire duration of the contract, and

ix). All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

1.10.4.3 The bidder should note that information, if any, in regard to the local conditions, as contained in these tender documents, has been given to tenderer merely for guidance and is not warranted to be complete.

1.10.4.4 A bidder shall be deemed to have full knowledge of the site, whether he inspects it or not, and no extra charges consequent on any misunderstanding or otherwise shall be allowed.

1.10.4.5 The bidder and any of his personnel or agents will be granted permission by the Site-In-Charge or his authorized nominee, on receipt of formal application in respect thereof a week in advance of the proposed date of inspection of site, to enter upon his premises and lands for purpose of such inspection, but only on the express condition that the tenderer (and his personnel and agents) will relieve and indemnify the Employer (and his personnel and agents) from and against all liability in respect thereof and will be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused which, but for the exercise of such permission, would not have arisen.

1.10.5 The work covered under this specification is of highly sophisticated nature, requiring the best quality workmanship, engineering and construction management. The contractor must have adequate quantity of tools, construction aids, equipments etc., in his possession. He must also have on his rolls adequate trained, qualified and experienced supervisory staff and skilled personnel.

1.10.6 It is not the intent to specify herein all details of all material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.

1.10.7 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.

1.10.8 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer s recommendations.

1.10.9 The contractor shall carry out additional tests, if any, which the Engineer feels necessary because of site conditions and also to meet system specification.

1.10.10 The work shall be executed under the usual conditions without affecting power plant construction / operation and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co- operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a

whole.

1.10.11 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer s decision regarding the correctness of the work and method of working shall be final and binding on the contractor.

1.10.12 Wherever Construction sequences are furnished by BHEL, the contractor shall follow the same sequence. Contractor shall execute the supply and works as per sequence prescribed by BHEL at site engineer. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of execution of similar job in any other site or for any reasons whatsoever.

1.10.13 If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.

1.10.14 Contractor shall, transport all materials to site and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.

1.10.15 Contractor shall retain all T&P / Testing instrument / Material handling equipment's etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.

1.10.16 The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.

1.10.17 The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances. However, completion time for construction, agreed will be subject to the condition that contractor's work is not hampered by the agencies.

1.10.18 Contractor has to work in close co-ordination with other agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time. Activities and Construction program have to be planned in such a way that the milestones are achieved as per schedule/ plans. Contractor shall arrange &

augment the resources accordingly.

1.10.19 The contractor must obtain the signature and permission of the security personnel of the customer / BHEL for bringing any of their materials inside the site premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside. Surplus materials including steel item brought at site by the contractors with proper documentation and Gate pass, shall be allowed to taken out of the project premises after completion of relevant works, on certification by BHEL in charge.

1.10.20 Contractor shall remove all scrap materials periodically generated from his working area and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor s risk and cost if there is any failure on the part of contractor in this respect.

1.10.21 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge.

1.10.22 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or scaffolding works. Contractor shall arrange himself all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.

1.10.23 No member of the already erected structure / buildings, other component and auxiliaries should be removed / modified without specific approval of BHEL engineer.

1.10.24 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on latest ISO 9001 Standards.

1.10.25 Sometimes, it may be required to re-schedule the activities to enable other agencies to commence/ continue the work so as to keep the overall project schedule.

1.10.26 The terminal points decided by BHEL are final and binding on the contractor for

deciding the scope of work and effecting the payment for the work done up to the terminals.

1.10.27 Crane operators deployed by the contractor shall be tested by BHEL before he is allowed to operate the cranes.

1.10.28 On Completion of work, all the temporary buildings, structures, pipe lines, cable etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.

1.10.29 It is the responsibility of the contractor to do the checking, testing etc. if necessary, repeatedly to satisfy BHEL Engineer with all the necessary tools and tackles, manpower etc. without any extra cost. The testing will be completed only when jointly certified so, by the BHEL Engineer.

1.10.30 If any item not covered but requires being executed, same shall be carried out by the contractor. Equivalent or proportional unit rate shall be considered wherever possible from the BOQ. The rates quoted by the contractor shall be uniform as far as possible for similar items appearing in rate schedule.

1.10.31 The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors. Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.

1.10.32 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be effected for such excess drawls at the rate prescribed by manufacturing units.

1.10.33 Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer for other agencies, like Boiler, piping, Turbine, Generator erection, Cabling, instrumentation, insulation etc., to commence their work from / on the equipments coming under this scope.

1.10.34 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum KW demand.

1.10.35 SITE INSPECTION

1.10.35.1 The Owner or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the Owner or his authorized agents without any extra cost to the Owner or his authorized agents. No cost whatsoever such duplication of inspection of work be entertained.

1.10.35.2 BHEL / Owner will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by Owner / BHEL.

1.10.35.3 The contractor shall maintain at site a joint protocol for recording actual measurement of work carried out at site, inspection and witnessing of various tests conducted by the contractor.

1.10.35.4 Field Quality Assurance (FQA) Formats: -

It is the responsibility of the contractor to collect and fill up the relevant FQA log sheets of BHEL and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL and Owner as token of their acceptance. Payment to the contractor will be inked with the submission of these FQA log sheets.

1.10.35.5 Site testing wherever required shall be carried out for all items / materials installed by the contractor to ensure proper installation and functioning in accordance with drawings, specifications and manufacturer s recommendations.

1.10.35.6 Contractor shall, transport all materials to site and unload at site / working area for inspection and checking. All material handling equipment required shall be arranged by the contractor.

VOLUME-IA PART – I CHAPTER – XI
PROGRESS OF WORK

The scope of the work will comprise of following but not limited to the following:

1.11 PROGRESS AND MONITORING OF WORK

1.11.1 Refer forms F -14 and F-15 furnished in Volume 1A, Part II, Chapters 7 & 8 as well as to forms F-16, F-17, F-18 of volume I D (Forms & Procedure) of volume - I Book-II. Plan and review will be done as per the formats.

1.11.2 Contractor is required to draw mutually agreed monthly construction programs in consultation with BHEL well in advance monthly as per the Form-14. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.

1.11.3 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.

1.11.4 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials report, consumables (gases / electrodes / ferules / lugs) report, T&Ps availability report and other reports as per Performa considered necessary by the Site Engineer as per the BHEL formats.

1.11.5 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding construction progress, labour availability, equipment deployment, testing, etc.

1.11.6 The progress reports shall indicate the progress achieved against plan, indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.

1.11.7 The contractor to reflect actual progress achieved during the month and will be submitted to BHEL, so that slippages can be observed and necessary action taken in order to ensure that the situation does not get out of control will update the construction schedule forming part of this contract each month.

VOLUME-IA PART-II CHAPTER-I

CORRECTIONS / REVISIONS IN SPECIAL CONDITIONS OF CONTRACT, GENERAL CONDITIONS OF CONTRACT AND FORMS & PROCEDURES

Sl. No.: 01

Following Clauses in General Conditions of Contract (GCC) are modified/ revised/ added:

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
1.	GCC Clause 1.9.1, Sl. No. (ii)	The following mode of deposit, Sl. No. (e) is added: e) Insurance Surety Bonds
2.	GCC Clause 1.10.3, Sl. No. (vi)	**The following Clause, Sl. No. (vi) is deleted**: Security deposit can also be recovered at the rate of 10% of the gross amount progressively from each of the running bills of the contractor till the total amount of the required security deposit is collected. However, in such cases at least 50% of the required Security Deposit, including the EMD, should be deposited in any form as prescribed before start of the work and the balance 50% may be recovered from the running bills as described above
3.	GCC Clause 1.10.3, Sl.No.(vii)	The following mode of deposit, Sl. No. (vii) is added: e) Insurance Surety Bonds
4.	Note mentioned under the GCC Clause 1.10.3	Note mentioned under GCC Clause 1.10.3 is revised as below: Note: **(1)** BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith. **(2)** In case of delay in submission of security deposit, enhanced security deposit which would include interest (Repo rate +4%) for the delayed period, shall be submitted by the bidder.
5.	GCC Clause 1.10.8	**GCC Clause 1.10.8 is revised as below:** Bidder agrees to submit security deposit required for execution of the contract within the time period mentioned. In case of delay in submission of security deposit, enhanced security deposit which would include interest (Repo rate+4%) for the delayed period, shall be submitted by the bidder. Further, if security deposit is not submitted till such time the first bill becomes due, the amount of security deposit due shall be recovered as per terms defined in NIT / contract, from the bills along with due interest
6.	GCC Clause 2.22.1	**GCC Clause 2.22.1 is revised as:** Retention Amount shall be 5% of the Contract Value and shall be furnished through BG in line with clause 1.12 of GCC before payment of first RA Bill. The validity of the said BG shall be initially for the contract period & shall be extended, if so required, up to

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		acceptance of final bill. In case of increase in contract value, additional BG for 5% of differential amount shall be submitted by Contractor before payment of next RA Bill due. Retention Amount can also be recovered at the rate of 10% of the gross amount progressively from each of the running bills of the contractor till the total amount of the required retention amount is collected. In case, contractor opts cash deduction from RA bills in the beginning & subsequently offers to submit BG later on, then refund of deducted retention amount may be permitted against submission of BG for 5% of the Contract Value.
7.	New Clause for "Breach of Contract, Remedies and Termination" is added in place of existing clause of Risk & Cost (i.e. 2.7.2.1 to 2.7.3)	**1.Clause 2.7.2 and 2.7.3 are revised as:** **2.** **3.2.7.2 <u>Breach of Contract, Remedies and Termination</u>** **2.7.2.1** BHEL shall terminate the contract after due notice of a period of 14 days in any of the following cases, which if not rectified/ improved within the time period mentioned in the notice, then, 'Breach of Contract' will be considered to have been established: i). Contractor's poor progress of the work vis-à-vis execution timeline as stipulated in the Contract, backlog attributable to contractor including unexecuted portion of work does not appear to be executable within balance available period considering its performance of execution. ii). Withdrawal from or abandonment of the work by contractor before completion of the work as per contract. iii). Non-completion of work by the Contractor within scheduled completion period as per Contract or as extended from time to time, for the reasons attributable to the contractor. iv). Repeated failure of contractor in deploying the required resources, to comply the statutory requirements etc. even after given by BHEL is writing. v). Strike or Lockout declared is not settled within a period of one month. vi). Termination of Contract on account of any other reason (s) attributable to Contractor. vii). Assignment, transfer, subletting of Contract without BHEL's written permission. viii). Non-compliance to any contractual condition or any other default attributable to Contractor. **2.7.2.2 <u>Remedies in case of Breach of Contract is established</u>** In case 'Breach of Contract' is established, Security Deposit and Retention Amount shall be encashed/ forfeited. This is without prejudice to BHEL's right to levy of liquidated damages, debarment

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		etc. which shall be applied as per the provisions of the contract. Sequence of recovery to be made in case of breach of contract is established, is as below: a) In case the value of Security Deposit & Retention Amount, available for the Contract, is less than 10% of the Contract Value, the balance amount shall be recovered from dues available in the form of Bills payable to contractor, BGs against the same contract etc. b) Demand notice for deposit of balance recovery amount shall be sent to contractor, if funds are insufficient to effect complete recovery against dues indicated in (a) above. c) If contractor fails to deposit the balance amount to be recovered within the period as prescribed in demand notice, following action shall be taken for balance recovery: i) Dues payable to contractor against other contracts in the same Region shall be considered for recovery. ii) If recovery cannot be made out of dues payable to the contractor as above, balance amount to be recovered, shall be informed to other Regions/Units for making recovery from the Unpaid Bills/Running Bills/SD/BGs/Final Bills of contractor. iii) In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor. Note: 1) In addition to above, levy of liquidated damages, debarment, termination, short-closure etc. shall be applied as per provisions of the contract. 2) If tendering is done for the balance work, the defaulted contractor (including all the members/partners in case of JV/ partnership firm) shall not be eligible for either executing the balance work or to participate in the tender(s) for executing the balance work. **2.7.3** In case Contractor fails to deploy the resources as per requirement informed by BHEL in writing to expedite the work, BHEL can deploy own/hired/otherwise arranged resources and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.
8.	GCC Clause 2.7.7	**GCC Clause 2.7.7 is revised as:** BHEL may permit or direct contractor to demobilize and remobilize at a future date as intimated by BHEL in case of following situations for reasons other than Force majeure conditions and not attributable to contractor: i) suspension of work(s) at a Project either by BHEL or Customer,

S.No	GCC Clause Reference	Modification / Revision / Addition in GCC Clause
		or ii) where work comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than three months 4. In such cases, charges towards demobilization and remobilization shall be as decided by BHEL after successful remobilization by contractor at site, and decision of BHEL shall be final and binding on the contractor. After remobilization, all conditions as per contract shall become applicable. In case Contractor does not remobilize with adequate resources or does not start the work within the period as intimated, then BHEL reserves the right to terminate the contract and effect remedies under Clause 2.7.2.2. Duration of the contract/time extension shall be revised suitably. In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.
9.	GCC Clause 2.11.3	**GCC Clause 2.11.3 is revised as:** However, if any 'Time extension' is granted to the contractor to facilitate continuation of work and completion of contract, due to backlog attributable to the contractor alone, then it shall be without prejudice to the rights of BHEL to impose penalty/LD for the delays attributable to the contractor, in addition to any other actions BHEL may wish to take under clause 2.7.2 of GCC i.e. "Breach of Contract, Remedies and Termination".
10.	GCC Clause 2.19.1	**GCC Clause 2.19.1 is revised as:** The contractor will be fully responsible for all disputes and other issues connected with his labour. In the event of the contractor's labour resorting to strike or the Contractor resorting to lockout and if the strike or lockout declared is not settled within a period of one month, it may be considered as 'Breach of Contract' under Clause 2.7 and the remedies under Clause 2.7.2.2 may be executed, at the discretion of BHEL.
11.	GCC Clause 2.24.1	**GCC Clause 2.24.1 is revised as:** Even though the work will be carried out under the supervision of BHEL Engineers the Contractor will be responsible for the quality of the workmanship and shall guarantee the work done for a period of Twelve months from the date of commencement of guarantee period as defined in Technical Conditions of Contract, for good workmanship and shall rectify free of cost all defects due to faulty erection detected during the guarantee period. In the event of the Contractor failing to repair the defective works within the time specified by the Engineer, BHEL may proceed to undertake the repairs of such defective works, by itself, without prejudice to any other rights and recover the cost incurred for the same along with 5% overheads from the Security Deposit.

Sl. No.: 02

In addition to The EARNEST MONEY DEPOSIT (EMD) clause 1.9 and The SECURITY DEPOSIT (SD) clause 1.10 published in General Conditions of Contract (Volume I Book II) following is added for FDR

1. FDR should be Lien marked in favour of M/s BHEL.
2. Bank issuing FDR should agree to the following conditions and submit duly signed letter addressed to BHEL, confirming the following points:

a)There is no Lock in Period for Encashment of the Said FDR

b)The amount under the Said FDR would be paid to BHEL-PSSR on Demand, at any point of Time before, or upon Maturity, without any reference to the …… (Contactor Name).

c)Encashment whether premature or otherwise would not require any clearance from any other authority /Person.

d)FDR will be auto renewed for such period/s initially mentioned in the FDR and the intimation of Such renewal shall be sent to BHEL, PSSR and …… (Contractor), immediately after the renewal.

e)FDR will not be closed, Encashed, Changed or Discharged without the Written permission/Confirmation from M/s BHEL PSSR.

f)Bank to acknowledge and agree that the Lien created on the FDR shall be in Force until M/s BHEL PSSR, gives a Discharge Letter in this regard.

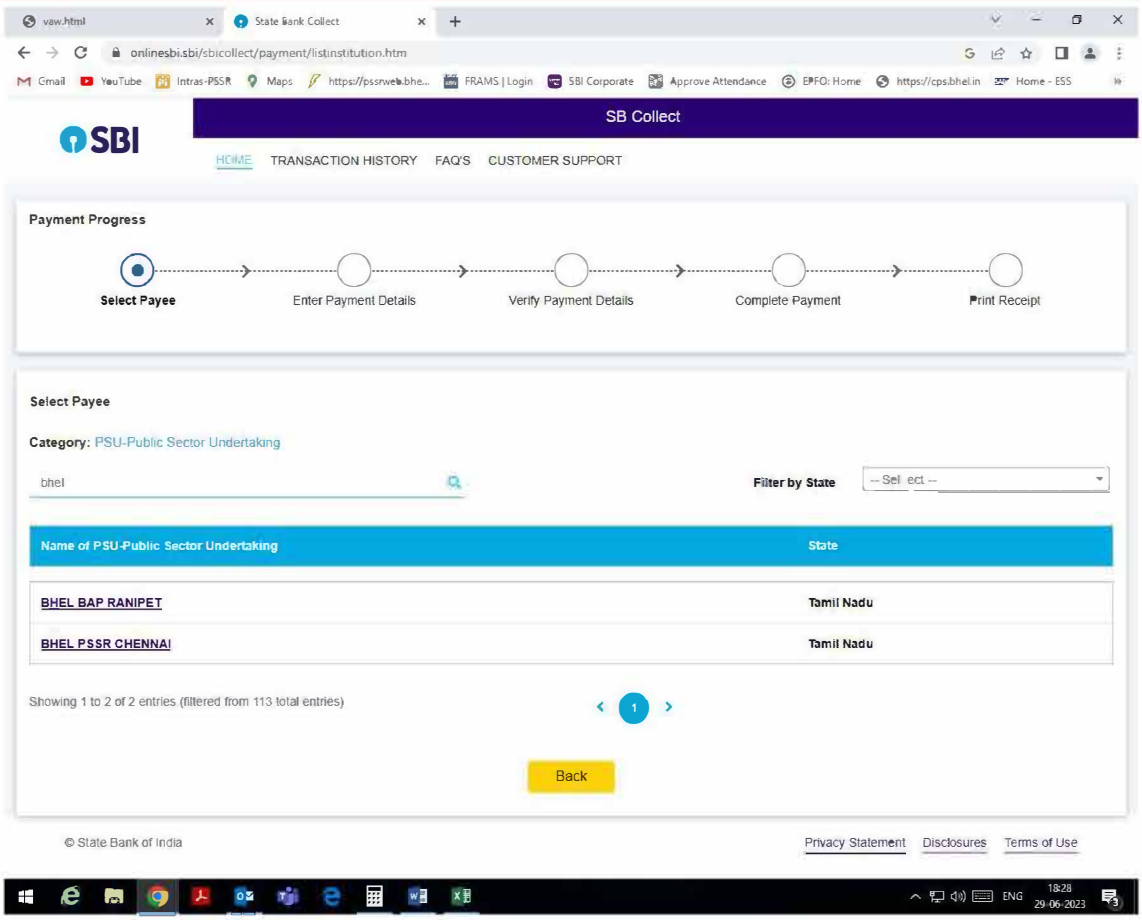
Sl. No.: 03

Detailed Instruction for EMD / Security deposits through SBI e-collect:

Step 1: Vendors may visit SBI collect website, the URL of which is https://www.onlinesbi.sbi/sbicollect where they get the home page with various categories of institutions.

Step 2: Select PSU - Public Sector Undertakings – leading to a page with list of PSUs

Step 3: Type BHEL and search, they get to see all BHEL divisions wherein they shall select BHEL PSSR Chennai. The screen shot of the same is given below.



Step 4: Select EMD receipts. Having selected the Payee in the Payment Progress, it will lead to the payment details – a drop down list of values. From that list, vendors shall select EMD receipts. Upon clicking the entry EMD receipts, a form will open asking for the remitters details and the details of the tender.

Step 5: Confirm details and pay

Fill in all the details correctly, verify the details, and complete the payment as it is leading to the payment gateway.

Step 6: Take a printout on completing the payment and enclose the copy of the same along with the bid submission. Store the copy of receipt for future reference.

Sl. No.: 04

GCC Clause 2.12 shall be amended as
NO OVERRUN COMPENSATION IS APPLICABLE

Sl. no 05.
GCC Clause 2.17 shall be amended as
NO PRICE VARIATION COMPENSATION IS APPLICABLE

Following Clauses are modified in the Special Conditions of Contract (SCC)

Sl. No.: 06
Clause No. 10.5 on RA Bill Payments, in Special Conditions of Contract (SCC), Volume- IB, Book- II, is revised as under:

"The payment for running bills will normally be released within 30 days of submission of running bill complete in all respects with all documents. It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc., and other dues in the meanwhile."

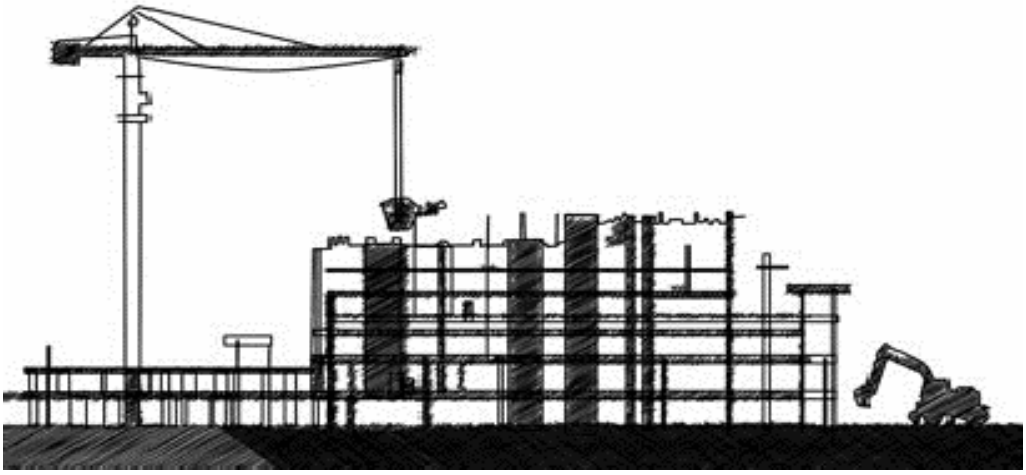
VOLUME-IA PART – II

Next chapters are as below

Chapter - 2	HSE Plan for Site Operations by Subcontractor	131 pages
Chapter - 3	Hire Charges	13 pages
Chapter - 4	Technical Specification	76 pages

HSEP14

Health, Safety & Environment Plan for Site Operations by Subcontractors



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SECTION A

CRITICAL RESOURCES FOR HSE IMPLEMENTATION

1. SHARING OF OPERATING COSTS OF FACILITIES

TABLE A.1

SN	FACILITY
1	Ambulance with 24 hr. First Aid Trained Driver (Specs in Annexure A)
2	Operation of Medical center, Nurses, Medical Consumables etc. (Specs in Annexure A)
3	Training Center Consumables
4	Water sprinkling for dust suppression
	(Others:)

Note:

i. Responsibility of operation of above facilities shall rest with BHEL
ii. Operating cost of the above shall be deducted from subcontractors on 'proportional to contract' value basis. Sample deduction table enclosed as Annexure A.1
iii. "Contract value" defined above & subsequently in the document shall be considered as "Awarded contract value".
iv. No overhead cost/ enabling cost of BHEL shall be levied on the contractors for common facilities.
v. These running costs shall be recovered from all the available subcontractors at site for the complete operational duration of the site
vi. No overheads shall be charged on shared operating costs

2. RESOURCES TO BE PROVIDED SOLELY BY THE SUBCONTRACTOR

TABLE A.2

SN	ITEM	SPECIFICATIONS
1.	HSE DISPLAYS, Posters and signage	Annexure B
2.	HSE Tools/ Equipment/ Devices	Annexure C
3.	Rest Sheds for Workers	Annexure D
4.	Labor Colony	Annexure E
5.	Toilets (Latrines & Urinals) - in Site and Labor Colony	Annexure F
6.	Fire Extinguishers	Annexure G

Note:

In case subcontractor fails to provide the required resources, same will be procured and deployed by BHEL with applicable overhead on total procurement cost

3. ESTABLISHMENT OF COMMON FACILITIES

In green field projects BHEL shall arrange and provide the following facilities which shall be used by all subcontractors for their employees and workers. These shall be

i. Medical Centre
ii. Safety park with facilities of audio-visual training & vertigo test center.
iii. No cost shall be deducted from the subcontractors for the structure part only.
iv. The running cost with basic inputs already mentioned at Point 1 above shall be shared by all contractors.
v. The sub-contractors shall be required to ensure participation in trainings, medical checkup and vertigo test as per the guidelines laid in this document and required as per statutory HSE requirements.

vi. However, in projects where in these facilities are not provided by BHEL, subcontractors shall ensure the training, medical/ vertigo test of all workers at site in consultation and guidance of BHEL HSE team at site in line with provisions of this document.

vii. The overall onus of compliance to HSE practices pertaining to training, medical checkup including vertigo test shall lie on the subcontractor only.

4. CRITICAL REQUIREMENTS W.R.T. EQUIPMENT & PPES

i. Conventional Hydra crane with carriage in front shall not be permitted. Pick & carry tyre mounted Front Cabin mobile crane (FX or TRX/ NextGen series of 'ESCORT" or equivalent make) shall only be permitted.

ii. Any Heavy equipment (cranes, winch machines, etc.) shall be deployed only after pre-safety Inspection by safety dept. Valid AMCs/ Fitness/ other statutory clearances as per local rules shall be required to be submitted before mobilizing the equipment at site.

iii. All other Hand tools and power tools should not be older than 5 years.

iv. For Chimney passenger lift, winch to have double drum rope for passenger and double safety devices must be used. Winch should not more than 3 years old and winch rope must be inspected with valid certificate from competent authority within 6 months and should meet the IS standard 9507 provision of OLR and push back button arrangement or dead man switch.

v. Gate pass for all the lifting T&Ps and construction machinery/ equipment shall be made after obtaining written acceptance (Pre-entry Safety Clearance) from BHEL Site Safety Department after physical verification and checking all requisite documents/ compliance to Safety norms

vi. All motor vehicles should have valid registration certificate, insurance, Pollution under control (PUC) and fitness certificate as per Motor Vehicle Act 2020. The certificates should be pasted in the glass from inside.

vii. PPEs shall be from reputed manufactures viz. 3M, Udyogi, Karam, Frontier, Freedom, Honeywell, Liberty, Bata, Nomex, Acme, Unicare, Life Gear or equivalent. In case Subcontractor recommends any other name the same can be approved at site level by the Construction manager & Site HSE

viii. For height work, where fall could result in death or disability, a secondary means of fall protection (Safety Net, Retractable Fall Arrestor etc.) shall be mandatorily provided by the subcontractor, failing which, a penalty of INR 10000 per case will be imposed. In addition, there should be constant supervision for such critical height work. Any non-erection activities at height eg. Housekeeping etc. shall also fall under the category of height work

ix. **Scaffold Tagging**

Scaffolds being erected, modified or dismantled must be tagged as suitable for use. Tagging shall be done with standard tag holder. Scaffolding tag should be certified by scaffolding inspector having valid certificate.

- **GREEN** scaffold tag- shall be fixed when scaffold is complete and safe for use, signed and dated by the scaffolding competent person daily.
- **RED** scaffold tag – to be fixed if scaffold is in some way defective and cannot be used or is still under erection.
- **YELLOW** scaffold tag – to be fixed if scaffold is in under construction/ maintenance.

FIG. A.4.1 SAMPLE SCAFFOLD TAGS AND TAG HOLDER

x. **T&P Color Coding:**

a. Inspections and tests shall be documented by means of color coding which shall verify that inspections or testing are current and that all receptacles, portable Power tools, Lifting Tools & Tackles have been inspected and tested as required. The color codes used on the project shall be:

GREEN	BLUE	YELLOW	PURPLE
January	April	July	October
February	May	August	November
March	June	September	December

TABLE. A.4.2: T&P COLOR CODES

b. The cycle of colors shall be Quarterly as a minimum or as decided by BHEL. The color code tape / Sticker shall be clearly visible to designate the period for which the inspections and tests were conducted.

c. Following the initial inspection, the equipment must be color-coded quarterly as per color-coding instructions that will be issued by the subcontractor.

d. Fire extinguisher with the current month color-coding inspection sticker must be provided and secured in the platform.

e. All slings shall be regularly inspected in accordance with the requirement of the project for frequent and periodic inspections and discard immediately if they fail to meet the minimum requirements of the project.

f. The Subcontractor's HSE Officer shall ensure that all PPE is inspected prior to its issue. He is to ensure all subcontractor personnel are using safe and proper PPE equipment. Regular

inspections on the PPE shall be carried out and personnel not adhering to those inspections shall be removed immediately from the site.

g. A Ten (10) day interval period shall be given into each monthly color code change. During this Ten (10) day period either color shall be acceptable.

xi. **T&P Tagging:**

All deployed Wire Rope Slings, Chain Pulley Blocks, Hooks, slings etc. shall be Tagged using aluminum or any other metal tag with punching.

5. HSE PERSONNEL TO BE PROVIDED SOLELY BY THE SUBCONTRACTOR

5.1. NUMBERS OF HSE PERSONNEL (APPLICABLE FOR EACH WORK SHIFT)

Number of HSE Officers and Supervisors shall be in proportion to number of workers as per Table A.6 below

TABLE A.5

No. of Workers	No. of HSE Supervisors	No. of HSE Officers
Up to 100	1	1
101 to 250	2	1
251 to 500	4	1
501 to 1000	6	2
1000 to 2000	6+ One additional supervisor up to every additional 250 workers	3
2000-3000	10+ One additional supervisor up to every additional 250 workers	4
3000-4000	14+ One additional supervisor up to every additional 250 workers	5

5.1.1. DEPLOYMENT PLAN

i. Above requirement is for every shift for each unit.

ii. The dynamic deployment plan of Safety manpower at various locations containing names, areas, time periods, shifts etc. shall be submitted to BHEL for approval by subcontractor

iii. BHEL may modify the deployment plan based on nature and volume of jobs, Risks and hazards associated etc.

iv. For less than 20 workers HSE Officer is not mandatory. In case the number of workers exceed 20 for 3 consecutive months, HSE Officer is to be engaged. The HSE Officer shall be deployed for a minimum period of 6 months even if the number of workers fall below 20 in any month subsequent to deployment. If within that 6-month period, the number of workers is more than 20 for at least 3 months, the deployment duration of HSE Officer will extend further 6 months after completion of previous 6-month period.

v. For Site Material Management/ Handling (Loading/ Unloading) contracts, 1 no. HSE Officer shall be required irrespective of the total manpower deployed.

vi. HSE Officers/Supervisors of all the vendors may be required to report directly to BHEL HSE Officer at site & shall comprise as a total team for handling all HSE issues. However, each safety officer/ agency shall be individually responsible for the safe execution of work in their respective areas.

5.2. QUALIFICATION & EXPERIENCE REQUIREMENTS OF HSE PERSONNEL

5.2.1. HSE OFFICER

First HSE Officer to be mandatorily as per Option I as under and shall be designated Senior HSE Officer. In case of non-availability of HSE Officers with Option I configuration, the subsequent HSE Officers can be as per Option II below with recorded reasons and approval of Site Construction Manager of BHEL. All these deviations should be reported to Region HSE and PSHQ HSE.

A. Option I

i. possesses a recognized degree in any branch of engineering or technology or architecture and had a practical experience of working in a building or other construction work in a supervisory capacity for a period of not less than two years or possesses a recognized diploma in any branch of engineering or technology and has had practical experience of building or other construction work in a supervisory capacity for a period of not less than five years;

ii. possesses a recognized degree or diploma in industrial safety with at least one paper in construction safety (as an elective subject/ part thereof);

iii. has adequate knowledge of the language spoken by majority of building workers from the construction site in which he is to be appointed.

B. Option II:

Graduation Degree in Science with Physics & Chemistry and degree or diploma in Industrial Safety (All Degrees/ Diploma from any Indian institutes recognized by AICTE or State Council of Technical Education of any Indian State) with practical experience of working in a building, plant or other construction works (as HSE Officer, in line with Indian Factories Act, 1958 or BOCW Act, 1996) for a period of not less than five years

Note:

i. HSE Officer as per Option II shall be valid only on availability of Senior HSE Officer as per Option I at site.

ii. In case of resignation of the Senior HSE Officer, the same has to be replaced within 15 days else all subsequent HSE Officers as per Option II (in case of multiple HSE Officers with a single agency) shall not be considered as valid.

iii. The penalty shall be deducted considering non-availability of any HSE Officer at site.

5.2.2. HSE SUPERVISOR: EITHER OF X OR Y BELOW

X. Recognized Degree in any branch of Engineering OR Diploma in any branch of engineering with at least one-year construction experience

OR

Y. A recognized graduation Degree in Science (with Physics & Chemistry) or a recognized diploma in Engg. or Tech.

Additional requirements for option (Y) above

i. Trained in fire-fighting as well as in safety / occupational health related subjects, with:
ii. Minimum Two years of practical experience in construction work environment or in the field of safety and

Note:

i. Option a above is by default, b is under special approval from Site HSE & Construction manager

ii. In both cases the candidate should possess requisite skills to deal with construction & fire safety related day-to-day issues.

5.3. HSE IN-CHARGE

In case there is more than one HSE Officer with any subcontractor, one of them, who is senior most by experience & meets qualification as per option 1 as mentioned in clause 2.1 A above (in HSE discipline), may be designated as HSE In-charge who will be the nodal point of contact on HSE matters.

5.4. SUPPORTING STAFF TO HSE TEAM

i. Supporting Staff shall include scaffolders, scaffolding inspectors, riggers, skilled and unskilled manpower
ii. Subcontractor shall provide adequate number of workers as and when required, in order to attend and comply to Safety observations raised by BHEL/ Customer.

5.5. AVAILABILITY AND PENALTY FOR NON-DEPLOYMENT

i. The subcontractor shall submit the certificates of qualification & experience of HSE manpower before deployment for BHEL to assess suitability as per requirement detailed in this document
ii. In case of rejection, subcontractor shall arrange additional candidates and submit resume to BHEL. Penalties will be applicable during the period of non-deployment in such cases as well.
iii. Subcontractor shall ensure physical availability of safety personnel at the place of specific work locations.
iv. The Subcontractor shall deploy the HSE Officers as per the site's requirement. Non-deployment shall lead to stoppage of the work and final decision shall rest with Site HSE & Construction manager.
v. The Subcontractor shall prepare an organization chart identifying the areas of operations, responsibilities and reporting structure of all safety personnel for each shift and submit the same to BHEL.
vi. The subcontractor shall deploy sufficient HSE Officers, supervisors, as per numbers & qualifications mandated in this Section since mobilization of first batch of manpower and add more in proportion to the added strength in work force. Any delay in deployment will attract a penalty at following rates:

Non-deployment of HSE Officer –	Rs. 75,000 per man-month
Non-deployment of HSE Supervisor –	Rs. 50,000 per man-month

vii. Penalty shall be collected for the period of non-availability of safety personnel after allowing a grace period of 15 days for finding a replacement. The same shall be deducted on pro-rata basis till the required manpower is deployed.

viii. In case of abnormal delay & frequent rejections of candidates proposed by the subcontractor, BHEL shall exercise the right to deploy the safety manpower & deduct the amount from subcontractor's running bill with applicable overheads. In such cases also, the provision of logistics, transportation, food and other logistical support to the HSE personnel shall be in the scope of subcontractor in addition to the salary. After deployment of manpower by BHEL, the penalty for non-deployment specified above shall not be applicable.

6. COMPETENCY OF OPERATORS/ DRIVERS OF CRANE, WINCH, LIFTING/ CONSTRUCTION EQUIPMENT ETC.

i. The Operators/ Drivers of crane, winch, construction/ lifting equipment etc. shall be experienced and have valid driving license for the class of vehicle / machinery as applicable (like Crane/ Forklift/ Rig, Construction equipment driving license etc.).

ii. Minimum HMV driving license is required for all heavy equipment/ heavy vehicle (trailer/ Hyva /dumper /TM) operators at site.

iii. The subcontractor shall certify competence of these persons in writing as and when they are posted at site.

iv. Crane, Winch, Construction & lifting equipment operator should have certificate on subject course or experience certificate in employer letterhead.

v. Where state is providing license for operating crane, tractor and other construction vehicles, same to be ensured.

Note: In case the statutory requirements i.e. State or Central Acts and / or Rules as applicable like the Building and Other Construction Workers' Regulation of Employment and Conditions of Service- Act,1996 or State Rules (wherever notified), the Factories Act, 1948 or Rules (wherever notified), etc. are more stringent than above, the same shall be followed.

7. In case of any stringent requirement of BHEL's customer over and above the specifications mentioned in current document, the same shall also be required to be complied at site by subcontractor.

8. REFERENCES

The Safety Rules for Construction & Erection as outlined hereunder, while setting out a broad parameter of safety norms, are not exhaustive. The subcontractor and his agencies are advised to refer to the following statutory provisions as amended from time to time for details and strict compliance therewith.

8.1. FOR GREENFIELD PROJECTS

a) Building and Other Construction Workers (regulation of employment and conditions of service) Act, 1996 (briefly referred to as BOCW Act),
b) Building and other construction workers (regulation of employment and conditions of service) Central Rules, 1998 (briefly referred to as BOCW Rules) as adopted by the various State Governments,

8.2. For Expansion, Modification, Alteration and, Or Construction Activity Within An Existing Plant Operating As Per Approved Site Plan Under The Factories Act

a) Factories Act, 1948,
b) Factories Rules, as adopted by the various State Governments
c) BOCW Act
d) BOCW Rules
e) In case a new act/ statutory guideline/ modification/ consolidation of acts is implemented the same shall be required to be adhered by the subcontractor.
f) The latest amendment of the above-mentioned acts/ rules shall be followed at site.

9. BHEL POWER SECTOR HSE MANAGEMENT SYSTEM

The Systems and procedures of BHEL Power Sector HSE Management System shall be implemented by the subcontractor, including:

- HSE Procedure for Register of OHS Hazards and Risks
- HSE Procedure for Register of Environmental Aspects and Impacts
- HSE Procedure for Register of Regulations
- HSE Procedure for Training and Awareness
- HSE Procedure for Emergency Preparedness and Response Plan
- HSE Procedure for Permit to Work
- HSE Inspection and Other Formats

Note:

i. BHEL reserves the right to revise/ update these systems and procedure as per requirement to address any changing HSE needs

ii. BHEL will provide hard / soft copies of applicable HSE Procedures, Work Permits, Operational Control Procedures, Inspection/ Other Formats etc. that are necessary for ensuring safe work to the successful bidder at Site. It is the responsibility of the subcontractor to ensure availability of these documents before commencing work at site.

iii. The subcontractor can get soft copies of these documents from respective Region SCT/ HSE for reference. The signed hard copies of the same shall not be required to be submitted along with tender document

iv. Subcontractor shall use the Digital (Web & App-Based) HSE management Software Systems provided by BHEL whenever provided. In case not provided, hard copy systems will continue to be used. All information technology resources (Computers, mobile phones, mobile data, internet access etc.) for the use of such systems shall be ensured by the subcontractor.

10. CLEARANCE OF MONTHLY RUNNING BILLS SUBJECT TO SAFETY COMPLIANCE

i. The monthly running Bills of the subcontractor shall be released subject to compliance to HSE requirements as per checklist in Annexure H
ii. BHEL site HSE Head and Package In-charge shall be authorized to issue the clearance
iii. Site Construction Manager of BHEL shall be the final authority on the matter.

11. HSE PERFORMANCE EVALUATION

i. Subcontractor shall be assessed on monthly basis for HSE Compliance by BHEL Safety In-charge at site.
ii. The HSE evaluation shall be based on HSE Performance Evaluation System of BHEL covering the contractual, statutory and regulatory requirements of HSE.
iii. BHEL shall reserve the right to use these performance scores for evaluating bidder's capacity for future tenders
iv. If safety record of the subcontractor in execution of the awarded job is to the satisfaction of safety department of BHEL, issue of an appropriate certificate to recognize the safety performance of the subcontractor may be considered by BHEL after completion of the job, provided the execution performance is satisfactory.

12. HSE PENALTIES

i. Nonconformity of safety rules and safety appliances will be viewed seriously and BHEL has right to impose fines on the subcontractor for every instance of violation noticed.
ii. As per contractual provision HSE penalties shall be imposed on subcontractors for non-compliance on HSE requirement as per following format.
iii. Following are the applicable penalties for various Safety violations:

Sub: MEMO for Penalty for non-compliances in Safety

Following lapse (tick marked) was observed and penalty (in Rs.) is imposed as stated at the bottom of this memo. It is requested that such occurrences be please avoided in future.

S. No	Nature of Non - Compliance	Penalty (in INR)	Remarks
A. System Violations			
1	Working without valid Work Permit/ HIRA/ Method Statement / JSA	2000	Per case
2	Controls as per Work Permit/ HIRA/MS/JSA not ensured	2000	Per case
3	Reported Safety Violations Not Closed within Stipulated Time	1000-10000	Per case
4	Absence of required Subcontractor Officials (Site Head, HS Head) in Safety Reviews/Meetings	5000	Per case
5	Not providing required PPEs (Safety Harness, Lifeline, Safety Net, Fall arrestor, Safety Helmet, Gloves, Shoes etc.) for the work by subcontractor	2000	Per case
B. Competency/ Training/ Induction Violations			

1	Incompetent personnel deployed for specialized jobs like height work, hot work, rigging, vehicle operation etc. (without valid license/ certificate etc.)	3000	Per case
2	Work without induction training & medical check	2000	Per case
3	Height Work without Vertigo Test and height work training	2000	Per case
C. PPE Violations – Height Work			
1	Not wearing/ hooking Double Lanyard Safety Harness while working at height (> 1.2 meters) or not anchoring to lifeline	1000	Per case
2	Not Providing Lifeline for height work	3000	
3	Unsafe platforms – without Top, Mid Rails and Toe-Guards for Height Work	3000	
4	Not providing secondary means of fall protection for height work (Safety Nets, Retractable Fall Arrestors etc.)	3000	Per case
D. PPE Violations – General			
1	Not wearing safety helmet	1000	Per case
2	Wearing of helmets without chin straps	1000	Per case
3	Not Wearing safety shoes	500	Per case
4	Not wearing gloves	500	Per case
6	Not using grinding goggles/ face shield during grinding/ cutting	2000	Per case
E. Electrical Safety Violations			
1	Broken/ exposed wires/ cables	2000	Per case per day
2	Electrical plug not used for connection/ hand machines	1000	Per case per day
3	Not using proper ELCBs for electrical equipment	2000	Per case per day
4	Improper earthing of welding & Other electrical machines (Lack of double earthing, improper/ untested earth pit etc.)	2000	Per case per day
5	Not using 24 V supply for lighting in confined spaces	2000	Per case
6	Cables haphazard/ blocking way/ not organized properly	1000	Per case per day
F. Lifting & Rigging Violations			
1	Using Sling/ Chain Pulley Block and other Small T&Ps without proper, traceable Tag and Test Certificate	2000	Per T&P per day
2	Using damaged slings or not slinging properly	2000	Per T&P per day
3	Use of lifting equipment without having valid Test certificate	5000	Per equipment per seven days
4	Lifting hooks used without latches	2000	Per hook per day
5	Not effectively barricading area below lifting activity	5000	Per case
6	Using untrained/ unqualified rigger	5000	Per case
G. Housekeeping			
1	Non-removal of scrap from platforms	5000	Per Event Per location per 7 days
2	Not conducting scheduled housekeeping drives	5000	Per drive
H. Hot Work Safety Violations			
1	Gas cutting without flash back arrestor at both ends	5000	Per machine per incidence
2	Gas cutting at height without fire blanket	2000	Per event

3	Not keeping gas cylinders vertically	2000	Per event
4	Lifting cylinders without cage or rolling of cylinders	2000	Per incidence
5	Leakage in gas cylinder	2000	Per incidence
I. Vehicle Safety/ Operation			
1	Not having valid driving license for the type of vehicle/ T&P	2000	Per driver per incidence
2	Two-wheeler entry in construction area	2000	Per vehicle
3	Using Hydra for material movement at site in unsafe manner	2000	Per case
4	Using Two Hydra in Tandem for material movement without proper precautions as per OCP	2000	Per case
5	Vehicles, Hydras, Cranes, Dumpers and Earth Movers not having automatic back horns linked to gear	2000	Per Equipment per day
6	Not providing proper hard barricades around excavations/ unpermitted areas	5000	Per location per day
7	Not using guide rope while transporting material using Hydra or Cranes	2000	Per event
8	Over speeding	5000	Per case
9	Using Conventional Hydra crane	50000	Per day /crane
J. Accidents/ Incidents/ Near Misses			
1	Non-reporting of Near Miss/ Incident	20000	Per case
2	Major Accident – Worker unable to resume work within 48 hrs	100000	Per incident
3	Fatal Accident	500000	Per incident
K. Miscellaneous			
1.	Not providing the facility (drinking water, rest shed, labor colony etc. as per the specifications/ requirement)	5000	Per month per violation
2.	Not nominating the required number of workers for training as per plan	5000	Per incidence
3.	Lack of proper arrangement for disposal of sewage/ waste water/ effluents etc.	10000	Per incidence

Details (if any) related to non- compliance (Name of persons, Nature of deficiency, etc.):
_____
_____
_____

Penalty Amount:

1. Rate as per above chart
2. No. of Persons/ machine/ event/ labor
3. No. of times the same error is repeated: Repetition factor
4. Total Penalty= 1. X 2. X 3. =

Witnessed by:

(Sub- Subcontractor representative) (BHEL representative)

Signature _____

_____

Name _____

_____

Distribution: 1 Copy: to Sub- subcontractor Site In-charge,
1 Copy to Site Construction Manager (BHEL)
1 Copy to Site Finance

Note:

i. In case the amount of penalty imposed by BHEL's Client on BHEL for Safety violation/ incident due to or in the area of the subcontractor is more than those indicated above, same shall be imposed back-to-back on the subcontractor. However, in case such an amount is less than the specified above, penalty amount indicated above shall be imposed on the subcontractor.

ii. For same violation only one penalty (higher of the two mentioned below) shall be applicable
   a. Penalty imposed by BHEL's Customer over BHEL.
   b. Penalty as indicated in current document.

iii. For repeated violation for the same equipment/ location, the penalty would be double of the previous penalty. Date of "Repeated violation" will be counted from subsequent days.

iv. For repeated fatal incident in the same Unit incremental penalty shall be imposed: The subcontractor will pay 2 times the previously paid penalty in case there is repeated major/ fatal incident under the same subcontractor for the same package in the same unit.

v. Any other non-conformity noticed not listed above will also be fined as deemed fit by BHEL. The decision of BHEL engineer is final on the above.

vi. If principal customer/statutory and regulatory bodies impose some penalty on HSE due to the non-compliance of the subcontractor the same shall be passed on to them.

vii. The penalty amount shall be recovered by BHEL Finance department from subcontractors from the RA/Final bill.

13. PUNITIVE ACTIONS FOR "CRITICAL SAFETY VIOLATIONS":

"Critical Safety Violations" include:

i. Not wearing required PPEs when provided and not following safe work procedure

ii. Taking unnecessary risks especially in height work, hot work, radiation work, lifting activity

iii. Coming to work under influence of sedatives like alcohol, drugs etc.

iv. Coming to work without ID Card/ Gate Pass (if provided)

v. Intimidating/ threatening at work

vi. Using cell phones during height work, hot work, lifting activity, driving.

In case any worker carries out any of the critical safety violations as above, BHEL reserves the right to enforce punitive action in following manner:

First Offence:	1 Punch on Gate Pass/ Induction Card/ ID Card etc. and 1-hour HSE Training. With one day off from duty
Second Offence:	2 Punches and 2-hours HSE Training with one day off from duty

Third Offence:	3 Punches and the worker will be dismissed. Gate pass to be confiscated

In case any employee of subcontractor carries out any of the critical safety violations as above, subcontractor Site In-charge shall issue warning letter to concerned employee with copy to BHEL

Note:

i. For above violations, guilt of the worker/ employee has to be established through appropriate evidences and records maintained.

ii. If worker/ employee has not been given the required PPEs and safety equipment by the agency and/or not facilitated by the agency to follow safety rules, he/ she will not be considered liable but the agency will be penalized as per penalty provision in this document. In such cases, the subcontractor shall not pass the penalty over to the worker/ employee through wage deduction etc.

iii. These critical safety violations and their consequences shall be shared with all workers and employees during induction and other training programs/ meetings, toolbox talks etc.

iv. Gate Pass shall have provision of Tagging as indicated above

v. The appellate authority (only for final dismissal) in this case shall be the BHEL Site In-charge whose decision shall be final on the matter and binding on all parties.

14. LEGAL IMPLICATIONS

Any legal Costs incurred by BHEL, on account of accidents taking place in the activities of the subcontractor, shall be debited to the subcontractor on actual cost basis.

For any accident occurring at site to any worker/ employee of the subcontractor leading to legal implications to BHEL Employee/ Management shall be safeguarded by BHEL legal department. All legal expenses incurred by BHEL on this account shall be recovered from the subcontractor. The accident also includes fire, loss of property or life at site.

15. HSE REVIEW MEETING

i. Subcontractor Site In-charge and HSE In-charge shall attend the HSE Review Meeting as and when called by BHEL.

The indicative agenda points are given below:

a) Implementation of earlier MOM points
b) Compliance Status of HSE Observations
c) Incidents & Near Misses, their Root Causes and Actions Taken
d) HSE performance review
e) HSE inspection findings
f) HSE audit and CAPA
g) HSE training
h) Health check-up camp
i) HSE planning for the erection and commissioning and installation activities in the coming month

j) HSE reward and promotional activities

ii. MOM on the discussion along with HSE observations will be circulated to the subcontractor for action.

iii. The subcontractor shall close the observations to the satisfaction of BHEL within stipulated time frame

16. OTHER REQUIREMENTS

i. If the subcontractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given reasonable opportunity to do so and/or if the subcontractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instruction regarding safety issued by BHEL, BHEL shall have the right to take corrective steps and the cost shall be debited to the subcontractor with applicable overheads.

ii. If the subcontractor succeeds in carrying out its job in time without any fatal or disabling injury incident and without any damage to property BHEL may, at its sole discretion, favorably consider to reward the subcontractor suitably for the performance.

iii. In case of any damage to property due to lapses by the subcontractor, BHEL shall have the right to recover the cost of such damages from the subcontractor after holding an appropriate enquiry.

iv. The subcontractor shall take all measures at the sites of the work to protect all persons from incidents and shall be bound to bear the expenses of defense of every suit, action or other proceeding of law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the subcontractor be paid to compromise any claim by any such person, should such claim proceeding be filed against BHEL, the subcontractor hereby agrees to indemnify BHEL against the same.

v. The subcontractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.

vi. The subcontractor shall notify BHEL of his intention to bring to site any equipment or material which may create hazard.

vii. BHEL shall have the right to prescribe the conditions under which such equipment or materials may be handled and the subcontractor shall adhere to such instructions.

viii. BHEL may prohibit the use of any construction machinery, which according to the organization is unsafe. No claim for compensation due to such prohibition will be entertained by BHEL.

17. MEMORANDUM OF UNDERSTANDING:

After award of work, subcontractors are required to enter into a memorandum of understanding as given below:

Memorandum of Understanding

BHEL, Power Sector Region is committed to Health, Safety and Environment Policy (HSE Policy).

M/s……..do hereby also commit to comply with the same HSE Policy while executing the Contract Number _____

M/s……..have gone through and understood all the HSE requirements of the contract including HSE manpower, tools & equipment, systems & procedures, and agree to fulfill the same as a minimum. Any additional resources and support required for ensuring fulfillment of HSE Objectives shall be provided by subcontractor at no extra cost.

M/s…….. agree that in case they fail to comply to the HSE requirements as stipulated in the contract, BHEL shall have the right to implement the same and the cost shall be recovered from the subcontractor with applicable overheads.

M/s…….. shall ensure that safe work practices as per the HSE plan. Spirit and content therein shall be imbibed in all workers and supervisors for compliance.

In addition to this, M/s……..shall comply to all applicable statutory and regulatory requirements which are in force in the place of project and any special requirement specified in the contract document of the principal customer.

M/s……..shall co-operate in HSE audits/inspections conducted by BHEL /customer/ third party and ensure to close any non-conformity observed/reported within prescribed time limit.

M/s…….. agree that the subcontractor shall seek HSE clearance as per BHEL format before each RA bill as mentioned in clause no. 9. The penalty amounts for not providing Safety manpower and various Safety violations have also been reviewed and agreed.

M/s…….. agree to share the HSE Costs (running costs) of common facilities created by BHEL on proportional to contract value basis as calculated at Site by BHEL.

Signed by authorized representative of M/s ----------

Name :

Place & Date:

SECTION B

OPERATIONAL REQUIREMENTS

1. PURPOSE:

1.1. The purpose of this HSE Plan is to provide for the systematic identification, evaluation, prevention and control of general workplace hazards, specific job hazards, potential hazards and environmental impacts that may arise from foreseeable conditions during installation and servicing of industrial projects and power plants.

1.2. This document shall be followed by BHEL's subcontractors at all installation and servicing sites. In case customer specific documents are to be implemented, this document will be followed in conjunction with customer specific documents in complementary manner.

1.3. Although every effort has been made to make the procedures and guidelines in line with statutory requirements, in case of any discrepancy wherein the relevant statutory guidelines supersedes this document, the same shall be followed.

1.4. In case there's any specific HSE requirement from BHEL's Client, not explicitly indicated in this document the same shall be required to be fulfilled as per the decision of BHEL Site construction manager.

2. SCOPE:

The document is applicable to BHEL's Subcontractors at all installation / servicing activities of BHEL Power Sector as per the relevant contractual obligations

3. OBJECTIVES AND TARGETS:

i. To achieve "Zero Incident at Site"
ii. 100% compliance to all legal/statutory requirements related to EHS.
iii. 100% Health, Safety and Environmental Induction training attendance for all workers.
iv. 100% High Risk activities to be carried out only after approved Method Statement, HIRA / Aspect-Impact / JSA / OCP and Permit to Work are implemented.
v. 100% PPEs compliance in high and medium risk activities.
vi. 100% incident reporting, recording and reviewing for corrective actions.
vii. Regular Safety Reviews to assess HSE program compliance and closure of any recognized gaps to improve safety management and incident prevention
viii. Prevent injury and ill health of all workers at site ('Workers' refers to all personnel including managerial, supervisory, professional, technical, clerical and other workers including contract laborers)
ix. Prevent pollution to environment
x. Ensure the Health and Safety of all persons at work site is not adversely affected by the work.
xi. Ensure protection of environment of the work site.
xii. Comply at all times with the relevant statutory and contractual HSE requirements.
xiii. Provide trained, experienced and competent personnel. Ensure medically fit personnel only are engaged at work.
xiv. Provide and maintain plant, places and systems of work that are safe and without risk to health and the environment.

xv. Provide all personnel with adequate information, instruction, training and supervision on the safety aspect of their work.
xvi. Effectively control, co-ordinate and monitor the activities of all personnel on the Project sites including subcontractors in respects of HSE.
xvii. Establish effective communication on HSE matters with all relevant parties involved in the Project works.
xviii. Ensure that all work planning considers all persons that may be affected by the work.
xix. Ensure fitness testing of all T&Ps/Lifting appliances like cranes, chain pulley blocks etc. are to be certified by competent person.
xx. Ensure timely provision of resources to facilitate effective implementation of HSE requirements.
xxi. Ensure continual improvements in HSE performance.
xxii. Ensure conservation of resources and reduction of wastage.
xxiii. Capture the data of all incidents including near misses, process deviation etc. Investigate and analyze the same to find out the root cause.
xxiv. Ensure timely implementation of correction, corrective action and preventive action. The subcontractor shall also comply with HSE Targets stipulated by BHEL from time to time.

4. BHEL HEALTH, SAFETY & ENVIRONMENT POLICY:

In BHEL, Health, Safety and Environment (HSE) responsibilities are driven by our commitment to protect our employees and people we work with, community and environment. BHEL believes in zero tolerance for unsafe work/non-conformance to safety and in minimizing environmental footprint associated with all its business activities. We commit to continually improve our HSE performance by:

- Developing safety and sustainability culture through active leadership and by ensuring availability of required resources.
- Ensuring compliance with applicable legislation, regulations and BHEL systems.
- Taking up activities for conservation of resources and adopting sound waste management by following Reduce/Recycle/Reuse approach.
- Continually identifying, assessing and managing environmental impacts and Occupational Health & Safety risks of all activities, products and services adopting approach based on elimination/ substitution/reduction/control.
- Incorporating appropriate Occupational Health, Safety and Environment criteria into business decisions, design of products & systems and for selection of plants, technologies and services.
- Imparting appropriate structured training to all persons at workplace and promoting awareness amongst customers, subcontractors and suppliers on HSE issues.
- Reviewing periodically this policy and HSE Management Systems to ensure its relevance, appropriateness and effectiveness.
- Communicating this policy within BHEL and making it available to interested parties.

Chairman & Managing Director/ BHEL

5. ILLUSTRATIVE RESPONSIBILITIES OF SUBCONTRACTOR EMPLOYEES

5.1 HSE - A LINE RESPONSIBILITY

i. HSE is a “Line Responsibility”.

ii. The term "Line" includes management, Executives, Supervisors, Foremen, and Workers who are part of the workforce. Line is to be fully involved in HSE Planning & Implementation with the aid and advice of HSE organization.

iii. “Line”, having control of resources and manpower is responsible for overall implementation of HSE Systems and closure of HSE observations.

5.2 SITE IN -CHARGE:

i. Shall sign Memorandum of Understanding (MoU)

ii. Shall ensure availability of all necessary resources required for implementation of HSE at Site

iii. Shall engage qualified HSE Officer(s) and supervisors (s)

iv. Shall adhere to the rules and regulations mentioned in this code, practice very strictly in area of work in consultation with concerned engineer and the safety coordinator.

v. Shall screen all workmen for health and competence requirement before engaging for the job and periodically thereafter as required.

vi. Shall not engage any employee below 18 years.

vii. Shall arrange for all necessary PPEs like safety helmets, belts, full body harness, shoes, face shield, hand gloves etc. before starting the job.

viii. Shall ensure that all T&Ps engaged are tested for fitness and have valid certificates from competent person.

ix. Shall ensure closure of all HSE non-conformities reported by BHEL or observed during internal inspection by providing appropriate resources in a timely manner.

x. Shall ensure the implementation of provisions of applicable acts and rules pertaining to HSE.

xi. Shall ensure availability of updated (Hazard Identification and Risk Assessment) Register for the area of activity

xii. Shall ensure availability of Method Statements & Job Safety Analysis for all hazardous activities

xiii. Shall ensure necessary controls to minimize risk in all applicable hazardous activities including Height Work, Hot Work, Lifting & Rigging, Confined Space, Maintenance, excavation, Radiography, Loading/ Unloading, Drilling/ Blasting etc.

xiv. Shall ensure implementation of HSE requirements mentioned in this document and as specified in the BHEL HSE management System including training, inspection, awareness, reporting etc.

xv. Shall ensure that person working above 2.0 meter should use Safety Harness tied to a life line/stable structure.

xvi. Shall ensure a secondary means of fall protection (Safety Net, Retractable Fall Arrestor etc.) for preventing fall from height

xvii. Shall ensure that materials are not thrown from height. Cautions to be exercised to prevent fall of material from height.

xviii. Shall report all incidents (Fatal/Major/Minor/Near Miss) to the Site engineer /HSE officer of BHEL.

xix. Shall ensure that Horseplay is strictly forbidden.

xx. Shall ensure that adequate illumination is arranged during night work.

xxi. Shall ensure that all personnel working under subcontractor are working safely and do not create any Hazard to self and to others.

xxii. Shall ensure display of adequate signage/posters on HSE.

xxiii. Shall ensure that mobile phone is not used by workers while working.

xxiv. Shall ensure conductance of HSE audit, mock drill, medical camps, induction training and training on HSE at site.

xxv. Shall ensure full co-operation during HSE audits.

xxvi. Shall ensure submission of look-ahead plan for procurement of HSE equipment's and PPEs as per work schedule.

xxvii. Shall ensure good housekeeping.

xxviii. Shall ensure adequate valid fire extinguishers are provided at the work site.

xxix. Shall ensure availability of sufficient number of toilets (preferably bio-toilets) /restrooms and adequate drinking water at work site and labor colony.

xxx. Shall ensure adequate emergency preparedness.

xxxi. Shall be member of site HSE committee and attend all meetings of the committee

xxxii. Power source for hand lamps shall be maximum of 24 v.

xxxiii. Temporary fencing should be done for open edges if Hand – railings and Toe-guards are not available

xxxiv. To record all incidents including near miss and report to BHEL and to ensure analysis & corrective actions for the same

xxxv. Shall conduct weekly Safety Walks in the work area and record the findings.

xxxvi. Construction of Canteen at Site, Office Infrastructure: Printer, PC, Fire Extinguishers etc.

xxxvii. Shall analysis HSE Performance regularly in work area and take steps to improve the same

xxxviii. Shall ensure stoppage of work in case of unacceptable Safety hazards

5.3 HSE OFFICER:

i. Carry out safety inspection of Work Area, Work Method, Men, Machine & Material, P&M and other tools and tackles.

ii. Facilitate inclusion of safety elements into Work Method Statement and creation of Job Safety Analysis (JSA)

iii. (HSE Head) To prepare deployment plan of HSE personnel for all shifts, so as to ensure constant supervision of all areas. The plan to be submitted to BHEL

iv. Highlight the requirements of safety through Tool-box / other meetings.

v. Help concerned HOS to prepare Job Specific instructions/ JSA for critical jobs.

vi. Conduct investigation of all incident/dangerous occurrences & recommend appropriate safety measures.

vii. Advice & co-ordinate for implementation of HSE Systems & Procedures.

viii. To stop work in case of any critical safety violation until the violation is cleared

ix. Convene HSE meeting & minute the proceeding for circulation & follow-up action.

x. Plan procurement of PPE & Safety devices and inspect their healthiness.
xi. Report to BHEL on all matters pertaining to status of safety and promotional program at site level.
xii. Facilitate administration of First Aid
xiii. Facilitate screening of workmen and safety induction.
xiv. Conduct fire Drill and facilitate emergency preparedness
xv. Design campaigns, competitions & other special emphasis programs to promote safety in the workplace.
xvi. Apprise BHEL on safety related problems.
xvii. Notify site personnel non-conformance to safety norms observed during site visits / site inspections.
xviii. Recommend to Site In charge, immediate discontinuance of work until rectification, of such situations warranting immediate action in view of imminent danger to life or property or environment.
xix. To decline acceptance of such PPE / safety equipment that do not conform to specified requirements.
xx. Encourage raising Near Miss Report on safety along with, improvement initiatives on safety.
xxi. Shall work as interface between various agencies such customer, package-in-charges, subcontractors on HSE matters.

5.4 HSE SUPERVISOR:

i. All requirements as per 5.1
ii. To monitor allotted area for Safety violations, take required action and inform the concerned Safety Supervisor / Officer
iii. To assist HSE Officer

5.5 PACKAGE IN-CHARGES, ENGINEERS & ALL EMPLOYEES:

i. To be aware of, get involved in and ensure implementation of all HSE related Systems and Procedures including but not limited to:
    a. BHEL HSE Management System including HSE Procedures and OCPs, HIRA, JSA etc.
    b. Work Permit System
    c. Emergency Preparedness Response Plans
    d. Contractual HSE requirements
    e. Legal Requirements
    f. Penalty System
    g. Training requirements
ii. To ensure that the persons engaged in respective area follow the safety rules like using appropriate PPEs.
iii. To develop Method Statements and ensure availability of Job Safety Analysis for all activities in scope
iv. To ensure that the reported HSE non-conformities in the work area are resolved immediately before resuming work
v. To record all incidents including near miss and report to BHEL.

vi. To adopt safe working practices at all times and act as role model for Safety
vii. To take immediate corrective action actions in case any non-conformity is observed on product / process / system with respect to Occupational Health, Safety and Environment.
viii. In case any particular activity / work has extremely high consequential risk or high environmental impact, same shall be brought to the notice of BHEL Package In-charge before starting the work.
ix. To interfere/ stop work as & when identified unsafe.
x. To maintain & promote improved level of house-keeping all the time at site.
xi. To support/co-operate with audit team members as & when safety audits are carried out.
xii. To involve in investigation, if any incident occurs in his work area.
xiii. To participate in safety promotional programs
xiv. To attend the safety committee meeting, if member/invitee
xv. To ensure that only fit T&Ps and qualified persons are engaged for all activities.
xvi. Shall ensure that person working above 2.0 meter should use Safety Harness tied to a life line/stable structure.
xvii. Shall ensure that materials are not thrown from height. Cautions to be exercised to prevent fall of material from height.
xviii. Shall ensure that all T&Ps engaged are tested for fitness and have valid certificates from competent authorities.

6. HSE PLANNING BY SUBCONTRACTOR:

6.1 HAZARD ANALYSIS & RISK ASSESSMENT (HIRA), METHOD STATEMENT (MS) & JOB SAFETY ANALYSIS (JSA):

i. Subcontractor shall identify all OHS Hazards and Risks applicable to all activities in scope and plan & implement the required control measures. HIRA Register shall be maintained.
ii. Subcontractor shall develop Method Statements & Job Safety Analysis documents for all hazardous activities in scope and ensure the required control measures. Job Safety Analysis is to be attached along with any Work Permit request

6.2 REGISTER OF REGULATIONS:

Subcontractor shall prepare a register of applicable rules and regulations in the scope and plan to ensure compliance.

HIRA Register, Method Statements, Job Safety Analysis and Register of Regulations are dynamic documents and shall be revised (as applicable):

i. At fixed frequency of 3 months
ii. Addition/ deletion/ modification of a process/ activity
iii. After an accident/ incident
iv. After any change in applicable rules/ regulations/ laws.

6.3 MONTHLY HSE PLAN COVERING THE FOLLOWING AS A MINIMUM SHALL BE PREPARED AND SUBMITTED TO BHEL FOR APPROVAL:

i. HSE Trainings covering all activities/ hazards/ workers

ii. HSE Inspection Plan covering all areas/ activities/ equipment/ hazards

iii. HSE Activities: Safety walks, Awards, housekeeping, reviews etc.

Note: Online/ App-based system shall be used for HSE Planning and Implementation/ Update whenever provided by BHEL otherwise Hard-copy based system shall continue

6.4 MONTHLY HSE PLANNING & REVIEW OF HSE ACTIVITIES ALONG WITH BHEL:

Monthly planning and review of HSE activities shall be carried out by subcontractor as per provided **format** jointly along with BHEL

7. MOBILIZATION OF MACHINERY/EQUIPMENT/TOOLS BY SUBCONTRACTOR:

i. Subcontractor shall notify the engineer, of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create a hazard. The Engineer shall have the right to prescribe the condition under which such equipment or container may be handled and used during the performance of the works and the subcontractor shall strictly adhere to such instructions. The Engineer shall have the right to inspect any construction tool and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition will be entertained.

ii. As a measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and complies with legislative and owner requirement, inspection shall be arranged by in-house competent authority for acceptance as applicable. Inspection by Third Party competent person shall be arranged:
    a. Before first time use at site
    b. After carrying out any modification
    c. After repairs subsequent to involvement in any accident/ incident

iii. As a further measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and comply with legislative and owner requirement, inspection as per provided format shall be arranged by in-house expert / competent authority (preferable) for acceptance. The equipment considered for this purpose shall include all those in the T&P list in the tender document.

8. MOBILIZATION OF MANPOWER BY SUBCONTRACTOR:

i. As a measure to ensure that manpower being mobilized to the construction site is fit and competent for safe working, screening arrangement shall be made by the sub-subcontractor to ensure competency and fitness through following measures:

a) **Medical Checkup:** Examination of medical fitness shall be conducted through qualified medical professional for all workers to be deployed as per provided **format**. For height workers, vertigo (height phobia) test to be carried out as qualification criteria as per Annexure K and recorded in provided **format**.

b) **Induction Training**: Induction training of all workers to be ensured as per **provided procedure and format**. Training evaluation to be carried out and training to be repeated if not passed

c) Only on successfully meeting above criteria, permanent gate passes to be issued

ii. The subcontractor shall arrange induction and regular health check of their employees as per schedule VII of BOCW rules by a registered medical practitioner.

iii. The subcontractor shall take special care of the employees affected with occupational diseases under rule 230 and schedule II of BOCW Rules. The employees not meeting the fitness requirement should not be engaged for such job.

iv. Ensure that the regulatory requirements of excessive weight limit (to carry/lift/ move weights beyond prescribed limits) for male and female workers are complied with.

v. Appropriate accommodation to be arranged for all workmen in hygienic condition.

vi. Cost of contractual, statutory and regulatory requirements like Training, medical checks, PPEs etc. shall not be transferred to the workers and such activities shall be considered as part of the job.

9. PROVISION OF PERSONAL PROTECTIVE EQUIPMENT (PPEs):

i. Personnel Protective Equipment (PPEs), shall be provided by the subcontractor to all workers as per requirement of the job.

ii. The choice of PPEs to ensure multiple (at least more than 1) means of protection against any hazard. All applicable safety precautions for a job shall be ensured notwithstanding the duration or perceived importance of the task.

iii. The applicability of PPEs shall be as per the concept of Hierarchy of controls, i.e.:

iv. Elimination->Substitution->EngineeringControls->AdministrativeControls-PPEs

v. Relying solely on PPEs without ensuring necessary controls to be strictly avoided.

vi. The following matrix recommends usage of minimum PPEs against the respective job.

Activity	**Type of Protection**						**Remarks, if any**
	Hand	**Eye**	**Ear**	**Body**	**Respiratory**	**Others**	
Gas Welding & Cutting	LG	WG	-	LA	*SCBA/ OLBA	-	* for confined space
Electric Arc Welding	LG	HMWS	-	LA	*SCBA/ OLBA	-	* for confined space
Rigging	CG	SG	-				--
Working at Height	-	SG	-	DLFBH	-	*FAS	* for vertical columns
Grinding & Chipping	CG	FS / SG	-	LA	-	-	--
Working in High Noise	-	-	EP / EM	-	-	-	--
Handling of Cement Concrete	RG	SG	-	-	DM	-	

Blasting	CG	SG	EP*	-	-	-	* at noise area
Excavation	CG	SG	-	-	DM	-	*Gum boot in place of Safety shoe for foot
Chemical Handling	PVCG	CSG	-	PVCA	-	-	*Full body rubber suit with hood
Electrical and C&I	ERG*	SG	-	-	-	-	*For high voltages
Sand/shot blasting	CG	-	EP/ EM	CA	SAMH	-	

ABBREVIATIONS: FS: Face Shield, CSG: Chemical splash goggles, HMWS: Helmet mounted welder's shield, GB: gum boot, DLFBH: Double lanyard full body harness, SG: Safety goggles, DM: Dust mask, SAMH L Supplied air mask/hood, EP/EM: Ear plug/Ear Muff, CG: Cotton hand gloves, LG: Leather hand gloves, LA: Leather apron, RG: Rubber gloves, PVCG: PVC Gloves, PVCA: PVC Apron, SCBA: Self-contained breathing apparatus, WG: Welding goggles, ERG: Electrical Rubber Gloves. OLBA: Online breathing apparatus

The list is not exhaustive. Additional PPEs to ensure Safe Work may need to be deployed as per the requirement of the task at no additional cost.

vii. The PPEs shall conform to the relevant standards as below (illustrative list) and bear ISI mark.

RELEVANT IS-CODES FOR PERSONAL PROTECTION

PPEs	IS Codes
Industrial Safety Helmets.	IS: 2925 – 1984
Rubber gloves for electrical purposes.	IS: 4770 – 1968
Industrial Safety Gloves (Leather &Cotton Gloves).	IS: 6994 – 1973 (Part-I)
Leather safety boots and shoes.	IS: 1989 – 1986 (Part-I-II)
Industrial and Safety rubber knee boots.	IS: 5557 – 1969
Code of practice for selections care and repair of Safety footwear.	IS: 6519 – 1971
Leather Safety footwear having direct molding sole.	IS: 11226 – 1985
Eye protectors.	IS: 5983 – 1978
Ear protectors.	IS: 9167 – 1979
Eye & Face protection during welding	IS: 1179-1967
Industrial Safety Belts and Harness	IS: 3521 – 1983
Guide for selection of industrial Safety equipment for body protection	IS:8519 -1977
Respiratory Protective Devices	IS:9473-2002,14166-1994,14746-1999

viii. Where workers are employed in sewers and manholes, which are in use, the subcontractor shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into manhole, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent incident to the public

ix. All the personnel and visitors shall mandatorily use safety helmet (with company logo), safety shoe and reflective vests, in addition to any other PPEs as deemed appropriate for the area of work/ visit.

x. Following Color scheme for Helmets shall be followed:
   a. Workmen: Yellow
   b. Safety staff: Green or white with green band
   c. Electrician: Red
   d. Others including visitors: White
   e. For height workers, special marking on helmets besides indication on Gate Pass/ ID Card

xi. The subcontractor shall maintain register for issue and receipt of PPEs.

xii. All the PPEs shall be checked for quality before issue and the same shall be periodically re-checked. The users shall be advised to check the PPEs themselves for any defect before putting on. The defective ones shall be replaced.

xiii. The Helmets shall have logo or name (abbreviation of agency name permitted) affixed or printed on the front.

xiv. The body harnesses shall be serial numbered.

10. ARRANGEMENT OF INFRASTRUCTURE:

10.1 DRINKING WATER:

i. Drinking water shall be provided and maintained at suitable places at different elevations such that minimum quantity of 5 liters is available for each worker during the day.

ii. Drinking water tank shall be so installed so as to be available within 200 meters of each working area

iii. Container should be labeled as “Drinking Water” in languages understood by the workers

iv. Cleaning of the container shall be ensured at least once in a week. Mild cleaning detergents as used for cleaning vessels shall be applied and scrubbers (3M or equivalent) shall be used for removing scales and deposits on the inside surface. The tank shall be thoroughly cleaned with potable water only before it is refilled (also applicable to labor colony).

v. Suitability of water source for drinking to be tested as per IS10500 at least once in six months.

10.2 WASHING FACILITIES:

i. In every workplace, adequate and suitable facilities for washing shall be provided and maintained.

ii. Separate and adequate cleaning facilities shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic condition and dully illuminated for night use.

iii. Water suitable for washing and not for drinking shall be clearly indicated as “Not for Drinking” in language understood by workers.

iv. Overalls shall be supplied by the subcontractor to the workmen and adequate facilities shall be provided to enable the painters and other workers to wash during the cessation of work.

10.3 LATRINES AND URINALS:

i. Latrines and urinals shall be provided in every work place as indicated in Section A
ii. Urinals shall also be provided at different elevations.
iii. They shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times, by appointing designated person.
iv. Separate facilities shall be provided for the use of male and female worker if any.

10.4 PROVISION OF REST SHEDS FOR WORKERS DURING REST PERIOD:

Proper Rest Shed (s) with shelter shall be provided for rest during break so as to accommodate all workers as indicated in Section A

10.5 MEDICAL FACILITIES:

10.5.1 GENERAL

i. Provision of Medical Center, Ambulance etc. shall be as per Section A of this document
ii. Medical waste shall be disposed as per prevailing legislation (Bio-Medical Waste – Management and Handling Rules, 1998)
iii. Every injury shall be treated, recorded and reported.
iv. All First Aid injuries shall be recorded as per provided Format
v. List of qualified first aiders and their contact numbers to be displayed at conspicuous places.

10.5.2 FIRST AIDER/ FIRST AID BOX

i. The first aider along with facilities should be available at a point nearest to the work location wherein majority of the workers are working.
ii. The subcontractor shall provide necessary first aid facilities as per schedule III of BOCW. At every work place first aid facilities shall be provided and maintained.
iii. The first aid box shall be kept by first aider who shall always be readily available during the working hours of the work place. His name and contact no to be displayed on the box.
iv. The first aid boxes should be placed at various elevations so as to make them available within the reach and at the quickest possible time.
v. The first aid box shall be distinctly marked with a Green Cross on white background.
vi. Details of contents of first aid box is given in Annexure J
vii. A slip of contents shall be pasted on the First Aid Box with following details
viii. Monthly inspection of First Aid Box shall be carried out by the owner as per provided format
ix. The subcontractor should conduct periodical first –aid classes to keep his supervisor and Engineers properly trained for attending to any emergency.

10.5.3 HEALTH CHECK UP

The persons engaged at the site shall undergo health check-up as per provided format before induction. In addition, the persons engaged in the following works shall undergo health check-up at least once in a year:

i. Height workers
ii. Drivers/crane operators/riggers
iii. Confined space workers
iv. Shot/sand blaster
v. Welding and NDE personnel

10.5.4 HEIGHT PHOBIA/ VERTIGO TEST:

i. The persons engaged in working at heights (above 2 meters) to be assessed for Vertigo and associated conditions and recorded as per provided format. Suggested Vertigo Test Procedure is given in Annexure K
ii. Such workers are to be allowed only on successful completion of test, otherwise shall be allocated ground-based jobs.
iii. IDs / Height passes shall be issued to such workers, besides special markings on helmets for easy identification.

10.5.5 PROVISION OF CANTEEN FACILITY:

i. Canteen facilities shall be provided for the workmen of the project inside the project site where worker strength is 250 or more.
ii. Proper cleaning and hygienic condition shall be maintained.
iii. Proper care should be taken to prevent biological contamination.
iv. Adequate drinking water should be available at canteen.
v. Fire extinguisher shall be provided inside canteen.
vi. Regular health check-up and medication to the canteen workers shall be ensured as per applicable regulations.
vii. Canteen waste to be disposed of in hygienic manner

10.6 PROVISION OF ACCOMMODATION/LABOR COLONY FOR WORKFORCE:

i. Proper accommodation for workforce to be provided in line with minimum requirements indicated in Section A
ii. Labor colony shall be inspected each week by HSE Officer and report submitted to BHEL as per provided format

10.7 PEST CONTROL:

Regular pest control should be carried out at all offices, mainly laboratories, canteen, labor colony and stores.

10.8 SCRAPYARD:

i. In consultation with customer, scrapyard shall be developed to store metal scrap, wooden scrap, waste, hazardous waste.
ii. Scrap/Waste shall be segregated as Bio-degradable and non-bio-degradable and stored separately.

10.9 ILLUMINATION:

i. The subcontractor shall arrange at his cost adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. at various levels for safe and proper working operations at dark places and during night hours at the work spot as well as at the pre-assembly area.

ii. Lamp (hand held) shall not be powered by mains supply but either by 24V or dry cells.

iii. Lamps shall be protected by suitable guards where necessary to prevent danger, in case of breakage of lamp.

iv. Emergency lighting provision for night work shall be made to minimize danger in case of main supply failure.

v. Adequate and suitable light shall be provided at all work places & their approaches including passage ways as per IS: 3646 (Part-II).

SUITABLE ILLUMINATION LEVELS FOR VARIOUS AREAS SHALL BE DECIDED BASED ON BROAD GUIDELINES INDICATED BELOW:

S. No.	Location	Lux Level (lumens/sqm)
A.	**Construction Site**	
1	Outdoor areas like store yards, entrance and exit roads	20
2	Platforms	50
3	Entrances, corridors and stairs	100
4	General illumination of work area	150
5	Rough work like fabrication, assembly of major items	150
6	Medium work like assembly of small machined parts	300
7	Fine work like precision assembly, precision measurements etc.	700
8	Sheet metal works	200
9	Electrical and instrument labs	450
B.	**Office**	
1	Outdoor area like entrance and exit roads	20
2	Entrance halls	150
3	Corridors and lift cars	70
4	Lift landing	150
5	Stairs	100
6	Office rooms, conference rooms, library reading tables	300
7	Drawing table	450
8	Manual telephone exchange	200

vi. Illuminations shall be inspected on weekly basis as per provided **format** using a calibrated lux meter.

11. HSE TRAINING & AWARENESS:

11.1 TRAINING PLAN:

i. All training programs to be carried out in a planned manner. Monthly/ Annual Training Calendar to be submitted to BHEL for approval and shall cover HSE Training requirements of all activities, workers, hazards applicable to the area(s) of work.
ii. Subcontractor shall nominate workers as per the schedule of specific training plan, failing which, penalty shall be imposed.
iii. Training records of all workers along with attendance, signatures, faculty details etc. shall be maintained in soft/ hard copy as per provided **formats**.
iv. Each labor should undergo at least 0.5% of total man-hours worked in HSE training.

11.2 HSE INDUCTION TRAINING

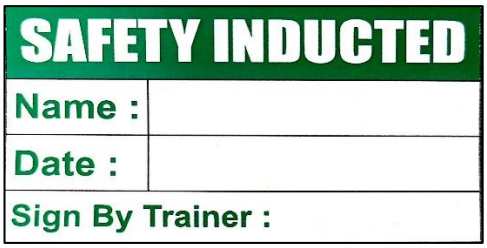
i. All persons entering into project site shall be given HSE induction training by the HSE officer of BHEL /subcontractor before being assigned to work.
ii. The induction training shall be imparted through audio-visual medium (Classroom specialized training), and shall be minimum of 1 Complete Day.
iii. Evaluation to be carried out after training and training shall be repeated in case of failure.
iv. Safety Induction Card shall be printed by Subcontractor and provided to all trained workers. A Safety induction book shall also be printed and issued to each worker after induction training (Format for the same may be provided by BHEL).
v. Induction training subjects shall include but not limited to:

   a. Briefing of the Project details.
   b. Safety objectives and targets.
   c. Site HSE rules.
   d. Critical Safety Violations and consequences
   e. Site HSE hazards and aspects.
   f. First aid facility.
   g. Emergency Contact No.
   h. Incident & Near Miss reporting.
   i. Fire prevention and emergency response.
   j. Rules to be followed in the labor colony (if applicable)
   k. Accident case studies

vi. General:

   a. Proper safety wear & gear must be issued to all the workers being registered for the induction (i.e., Shoes/Helmets/Goggles/Leg guard/Apron etc.)
   b. They must arrive fully dressed in safety wear & gear to attend the induction.
   c. Any one failing to conform to this safety wear& gear requirement shall not qualify to attend.

d. On completing attending subcontractor's in-house HSE induction, each employee shall sign an induction training form to declare that he had understood the content and shall abide to follow and comply with safe work practices.
e. They may only then be qualified to be issued with a personal I.D. card, for access to the work site subject to clearing the medical fitness test.



ABOVE STICKER SHALL BE PASTED ON HELMET OF WORKERS AFTER SAFETY INDUCTION TRAINING

11.3 JOB-SPECIFIC SKILL BASED HSE TRAINING

The contracting agency shall also impart job specific skill-based safety training to all its employees (Minimum one day) on various related safety topics using internal/external safety professionals/consultants as per the matrix given below. Record of such trainings and attendance particulars shall be maintained in a register for ready reference to statutory authorities/engineer-in charge as per provided format.

TRAINING MATRIX

Name of topic	Executives	Supervisors	Skilled Workmen	Other Workers
Safety Induction	Y	Y	Y	Y
Accident_ Causes, factors, cost	Y	Y	Y	-
Industrial hazards & Accident Prevention	Y	Y	Y	-
Investigating, reporting, records	Y	Y	-	-
Personal Protective Equipment	-	Y	Y	Y
Construction Safety & Role of Supervisory personnel	-	Y	-	-
Permit to Work (PTW)	-	Y	Y	y
Statutory Provisions (BOCW Act/Rules, Factories Act 1948 etc.)	Y	Y	y	y
Material handling	-	y	Y	Y
Emergency Management	Y	Y	Y	-
Electrical Safety	-	Y	Y	-
Fire safety	Y	Y	Y	Y
First Aid & CPR (cardio pulmonary resuscitation)	-	Y	Y	Y (Selected)
Safety in Welding & Cutting	-	-	Y	-
Safety Audit	Y	Y	-	-
Safety in Lifting Tools & Tackles	-	Y	Y	y

Safety in Working at height	-	Y	Y	Y
Safety in Confined space work	-	Y	Y	Y
Defensive Driving	-	Y*	Y*	Y*

*for construction vehicle operators, helpers & crane operators

Y=YES

Note:

i. Subcontractor shall prepare a training plan/ matrix covering all hazards and implement the same after approval of BHEL.
ii. It is to be ensured that every worker undergoes Job-Specific training once every 3 months.
iii. Records of training programmes along with attendance shall be maintained by the subcontractor
iv. Each worker to be issued a Card indicating the types of trainings undergone.

11.4 HSE TOOL-BOX TALK:

i. HSE tool Box talk shall be conducted by frontline foreman/supervisor of subcontractor to specific work groups prior to the start of work and shall be randomly attended by subcontractor engineers/ officials. The agenda shall consist of the following:

    a. Details of the job being intended for immediate execution.
    b. The relevant hazards and risks involved in executing the job and their control and mitigating measures.
    c. Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
    d. Recent non-compliances observed.
    e. Appreciation of good work done by any person.
    f. Any doubt clearing session at the end.

ii. Tool box talk to be conducted before start of work in every shift.
iii. During toolbox talk, visual check-up of workers regarding health, any signs of fatigue, intoxication etc. shall be conducted and any suspected workers to be acted upon.
iv. Record of Tool box talk shall be maintained as per provided **format**

11.5 TRAINING ON HEIGHT WORK:

i. Training on height work shall be imparted to all workers working at height by in-house/external faculty at least once every 3 months.
ii. For Height Workers Separate pass shall be provided by the subcontractor.
iii. The training shall be of minimum 2-hour duration, through audio-visual medium and followed by evaluation. In case of poor scoring, training shall be repeated.
iv. The training shall include following topics:

    a. Proper use of PPEs – safety harness, lanyard, fall arrester, retractable fall arrester, life line, safety nets etc.
    b. Provision of secondary means of fall protection

c. Safe climbing through monkey ladders.
d. Inspection of PPEs.
e. Medical fitness requirements.
f. Mock drill on rescue at height.
g. Dos & Don'ts during height work.
h. Accident case Studies

11.6 RE-INDUCTION TRAINING

The induction training shall be repeated for every worker after at least 1 year and shall be a pre-requisite for renewal of Gate Pass/ ID card.

11.7 PENALTY TRAINING

The personnel involved in Safety Violations/ Incidents shall mandatorily undertake penalty training pertaining to the violation/ incident. Penalty training shall be at least half-day duration.

11.8 HSE PROMOTION-SIGNAGE, POSTERS, COMPETITION, AWARDS ETC.:

i. HSE Displays shall be installed as indicated in Section A
ii. Contracting agencies shall arrange for display of safety hoardings depicting suitable safety cartoons/messages/ cautionary notices at appropriate places of project site to remind the workers to perform their duties safely.
iii. Apart from safety hoardings, each agency should maintain a safety bulletin board at all their work locations. Such safety bulletin boards should depict the activities being planned for the day, good practices, permit details etc.
iv. Safety suggestion boxes shall be kept at each subcontractor's office at site for obtaining safety suggestions from the workers. Best suggestions should be implemented and may be rewarded suitably to encourage the workers for safety.
v. Safety awareness campaigns, competitions, plays, movie shows, songs etc. to be organized for workers at Site and Labor colony from time to time to enhance Safety Awareness

11.9 HSE REWARDS & INCENTIVE SCHEME

Subcontractor shall implement a reward & incentive scheme for workers & supervisors displaying adherence to safety principles. Such workers shall be felicitated in a monthly function, attended by Subcontractor top management and BHEL representatives. Suitable gift shall be given to such workers for encouragement.

11.10 HSE AWARENESS PROGRAM FOR OFFICIALS:

Subcontractor shall arrange monthly HSE awareness program on different topics including medical awareness for all engineers/ supervisors / officials working at site. This program can be part of progress/ safety review meetings.

12. HSE COMMUNICATION AND PARTICIPATION:

12.1 HSE INCIDENT REPORTING, INVESTIGATION & CORRECTIVE ACTION:

i. All incidents (near misses, property damage, first-aid cases, minor, major and fatal incidents) shall be reported to BHEL as they happen immediately through SMS and Hard/Soft copy as per provided format

ii. All incidents including near miss, minor, major and fatal incidents shall be recorded

iii. All incidents shall be investigated for Root Causes and corrective actions ensured to prevent recurrence shall be implemented.

iv. Work shall be put on hold in the area till corrective actions are verified by BHEL

v. The Root Cause Analyses and Corrective actions taken shall be recorded

12.2 HSE EVENT REPORTING:

i. Important HSE events like HSE training, Medical camp etc. organized at site shall be reported to BHEL site management in detail with photographs for publication in different in-house magazines

ii. Celebration of important days like National Safety Day, World Environment Day etc. shall also be reported as mentioned above.

12.3 MONTHLY HSE REPORTING:

i. All routine and non-routine HSE activities shall be reported to BHEL on monthly basis by the subcontractor as per provided format. The reporting medium can be hard/soft as per BHEL requirement.

ii. The period of reporting shall be 25th of the preceding month to 24th of the present month and shall be submitted by the end of the calendar month.

iii. Report shall include good quality images of HSE Activities

12.4 DAILY HSE ACTIVITY REPORTING:

Daily HSE activities shall be reported by subcontractor to BHEL as per provided format

12.5 HSE SUGGESTIONS:

All workers and employees shall be encouraged to provide suggestions for improvement in Health, Safety & Environment performance at site. The suggestions shall be recorded in a “Suggestions Register” as per provided format. Suggestions found suitable for implementation shall be implemented and recognition / reward to be given to the submitter.

Suggestion Register to be placed at Site and Labor Colony and shall be reviewed on periodic basis

12.6 CLIENT COMMUNICATION:

All HSE related communication from BHEL, customer / external statutory and regulatory agencies to be handled on priority. Same to be recorded and issues to be resolved in expeditious manner

13. SAFETY DURING WORK EXECUTION:

Safety during work execution shall be ensured by following appropriate Safety Rules, providing adequate resources, deploying competent and trained manpower, regular training & inspection and non-conformity resolution. Main aspects are indicated as under:

13.1 OPERATIONAL CONTROL PROCEDURES:

In order to reduce the risk associated with hazardous activities, applicable OCPs (Operational control procedures) will be followed by subcontractor as per BHEL instructions, outcomes of Hazard Analysis & other requirements. This will be done as part of normal scope of work. Illustrative list of reference OCPs is given below.

TABLE 13.1 ILLUSTRATIVE LIST OF REFERENCE OCPS

No.	Topic	No.	Topic	No.	Topic
0	General Safety	**22**	Steam blowing	**44**	Material preservation
1	Handling of chemicals	**23**	Working in confined area	**45**	Electro-resistance heating
2	Electrical safety	**24**	Operation of passenger lift, material hoists & cages	**46**	Blasting
3	Energy conservation	**25**	Vehicle/ Crane maintenance	**47**	Transformer charging
4	Welding and gas cutting operation	**26**	Radiography	**48**	Handling of battery system
5	Fire safety	**27**	Waste disposal	**49**	DG set
6	Use of hand tools	**28**	Handling & storage of mineral wool	**50**	Sanitary maintenance
7	First aid	**29**	Working at night	**51**	Piling rig operation
8	Food safety at canteen	**30**	Computer operation	**52**	Passivation
9	Use of cranes	**31**	Storage in open yard	**53**	EDTA Cleaning
10	Storage and handling of gas cylinders	**32**	Drilling, reaming and grinding(machining)	**54**	Chemical cleaning of Pre boiler system
11	Manual arc welding	**33**	Stress relieving	**55**	Boiler Light up
12	Use of helmets	**34**	Hydraulic test	**56**	Rolling and Synchronization
13	Good house keeping	**35**	Trial run of rotary equipment	**57**	Loading of Unit

14	Safe excavation	**36**	Batching	**58**	Air compressor
15	Working at height	**37**	Cable laying/tray work	**59**	Hydra Operation
16	Filling of hydrogen in cylinder	**38**	Spray insulation	**60**	Duct Pre-assembly
17	Illumination	**39**	Compressor operation	**61**	Resumption of construction activities after lockdown and prevention of coronavirus infection during site operations
18	Handling and erection of heavy metals	**40**	Gas distribution test		
19	Acid cleaning	**41**	Cleaning of Hot well / Deaerator		
20	Oil flushing	**42**	Electrical maintenance	**61A**	Prevention of Covid-19 infection in labour colony
21	Alkali boil out	**43**	O&M of control of AC plant & system	**62**	Truss/ Structure fit-up and alignment

a. The reference OCPs shall be suitably modified by subcontractor as per specific requirements to control the hazards.

b. In case any other OCP is found to be applicable during the execution of work at site, then subcontractor will prepare and follow those as well.

13.2 WORK PERMIT SYSTEM:

i. The following activities shall be carried out by the subcontractor strictly after obtaining Permit to Work from BHEL
   a) Height working
   b) Hot working
   c) Confined space Work
   d) Excavation more than 2-meter depth
   e) Radiography
   f) Heavy / Complex / Critical Lifting Activity
   g) Night / Holiday Work
   h) Material Loading / Unloading
   i) Grating, Safety Net, Safety Facility Removal
   j) Live Electrical Maintenance etc. - Lockout / Tagout
   k) Beam / truss/ duct/ structure alignment

ii. The Work Permit Formats shall be provided by BHEL at Site. It is the responsibility of the subcontractor to ensure their availability

iii. The above list is not exhaustive. BHEL reserves right to introduce additional Permits or modify requirements for usage of existing Permits. The conditions for using the Permit are specified in the Format (General Requirements).

iv. Where customer is having separate Work Permit System the same shall be followed in conjunction / merged to ensure all activities and checks are covered in all systems.

v. Details of working Group to be attached along with work permit request.

vi. All the Permits along with JSA/HIRA must be initiated by Agency Execution Team

vii. Permit applicant shall apply for work permit of particular work activity at particular location before starting of the work with Job Hazard Analysis.

viii. All Permit signatories (including subcontractor's package in-charge and HSE Officer) shall physically visit the work area and check that all the safety control measures necessary for the activity are in place. Only then the permit shall be issued.

ix. Signatory shall physically visit the area of work and ensure all required safeguards before signing the Permit

x. Signatory shall periodically visit the area to confirm the availability of required safeguards throughout the currency of the permit

xi. In case any Permit requirement is not available, work will be stopped till it is made available

xii. Permit holder shall implement and maintain all control measures during the period of permit. The permit will be closed after completion of the work.

xiii. Online Work Permit System shall be used whenever provided by BHEL, otherwise hard copy shall be used

13.3 ACTIVITY-SPECIFIC PRECAUTIONS/ CONTROLS

Detailed HSE precautions for various activities undertaken at Site by the subcontractors are specified in **Annexure I**. Same are to be ensured by the Sub-subcontractor while carrying out respective activities at Site

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SN	Description	Page No.
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2.2	Working Platform	4
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3.1	Excavation	8
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14. ENVIRONMENTAL CONTROL & SOCIAL RESPONSIBILITY

i. Environment protection has always been given prime importance by BHEL. Environmental damage is a major concern of the principal subcontractor and every effort shall be made, to have effective control measures in place to avoid pollution of Air, Water and Land and associated life. Banned substances like asbestos and Chlorofluorocarbons such as carbon tetrachloride and trichloroethylene shall not be used. Waste disposal shall be done in accordance with the guidelines laid down in the project specification.

ii. Any chemical including solvents and paints, required for construction shall be stored in designated bonded areas around the site as per Material Safety Data Sheet (MSDS).

iii. In the event of any spillage, the principle is to recover as much material as possible before it enters drainage system and to take all possible action to prevent spilled materials from running off the site. The subcontractor shall use appropriate MSDS for clean-up technique

iv. All subcontractors shall be responsible for the cleanliness of their own areas

v. Regular dust suppression using sprinklers shall be carried out in respective area

vi. The subcontractors shall ensure that noise levels generated by plant or machinery are as low as reasonably practicable. Where the subcontractor anticipates the generation of excessive noise levels from his operations the subcontractor shall inform to Construction Manager of BHEL accordingly so that reasonable &practicable precautions can be taken to protect other persons who may be affected.

vii. It is imperative on the part of the subcontractor to join and effectively contribute in joint measures such as tree plantation, environment protection, contributing towards social upliftment, conversion of packing woods to school furniture, enhancing good relation with local populace etc.

viii. The subcontractor shall carry out periodic air and water quality check and illumination level checking in his area of work place and take suitable control measure.

15. HOUSEKEEPING

i. Keeping the work area and access roads clean/ free from debris, removed scaffoldings, scraps, insulation/sheeting wastage /cut pieces, temporary structures, packing woods etc. will be in the scope of the subcontractor. Such cleanings have to be done by subcontractor within quoted rate, on daily basis.

ii. If such activity is not carried out by subcontractor / BHEL is not satisfied, then BHEL may get it done by other agency and actual cost along with BHEL overheads will be deducted from subcontractor's bill. Such decisions of BHEL shall be binding on the subcontractor

iii. Dedicated Housekeeping gangs shall be deployed, who shall be provided all required PPEs and safety training

iv. Mass housekeeping shall be carried out for half a day in a week

v. Proper housekeeping to be maintained at work place and the following are to be taken care of on daily basis.

vi. All surplus earth and debris are removed/disposed off from the working areas to identified locations.

vii. Unused/Surplus cables, steel items and steel scrap lying scattered at different places/elevation within the working areas are removed to identified locations.

viii. All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from workplace to identified locations.

ix. Sufficient waste bins shall be provided at different work places for easy collection of scrap/waste. Scrap chute shall be installed to remove scrap from high locations.

x. Access and egress (stair case, gangways, ladders etc.) path should be free from all scrap and other hindrances.

xi. Workmen shall be educated through tool box talk about the importance of housekeeping and encourage not to litter.

xii. Labor camp area shall be kept clear and materials like pipes, steel, sand, concrete, chips and bricks, etc. shall not be allowed in the camp to obstruct free movement of men and machineries.

xiii. Fabricated steel structures, pipes & piping materials shall be stacked properly.

xiv. No parking of trucks/trolleys, cranes and trailers etc. shall be allowed in the camp, which may obstruct the traffic movement as well as below LT/HT power line.

xv. Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas.

16. WASTE MANAGEMENT

i. Take suitable measures for waste management and environment related laws/legislation as a part of normal construction activities. Compliance with the legal requirements on storage/ disposal of paint drums (including the empty ones), Lubricant containers, Chemical Containers, and transportation and storage of hazardous chemicals will be strictly maintained.

ii. Details of E-Waste, Hazardous Waste, biomedical waste etc. and their disposal plan, shall be submitted to BHEL every 6 months as per provided **formats**.

16.1 BINS AT WORK PLACE

i. Sufficient rubbish bins shall be provided close to workplaces.
ii. Bins should be painted yellow and numbered.
iii. Sufficient nos. of drip trays shall be provided to collect oil and grease.
iv. Sufficient qty. of broomsticks with handle shall be provided.
v. Adequate strength of employees should be deployed to ensure daily monitoring and service for waste management.

16.2 STORAGE AND COLLECTION

i. Different types of rubbish/waste should be collected and stored separately.
ii. Paper, oily rags, smoking material, flammable, metal pieces should be collected in separate bins with close fitting lids.
iii. Rubbish should not be left or allowed to accumulate on construction and other work places.
iv. Do not burn construction rubbish near working site.

16.3 SEGREGATION

i. Earmark the scrap area for different types of waste.
ii. Store wastes away from building.
iii. Oil spill absorbed by non-combustible absorbent should be kept in separate bin.
iv. Clinical and first aid waste stored and incinerated separately.

16.4 DISPOSAL

i. Sufficient containers and scrap disposal area should be allocated.
ii. All scrap bin and containers should be conveniently located.
iii. Provide self-closing containers for flammable/spontaneously combustible material.
iv. Keep drainage channels free from choking.
v. Make schedule for collection and disposal of waste.

16.5 WARNING AND SIGNS

i. Appropriate sign to be displayed at scrap storage area
ii. No toxic, corrosive or flammable substance to be discarded into public sewage system.
iii. Waste disposal shall be in accordance with best practice.
iv. Comply with all the requirements of Pollution Control Board (PCB) for storage and disposal of hazardous waste.

17. TRAFFIC MANAGEMENT SYSTEM

17.1 SAFE WORKPLACE TRANSPORT SYSTEM

i. Traffic routes in a work place shall be suitable for the persons or vehicles using them. This shall be sufficient in number and of sufficient size. This shall reflect the suitability of traffic routes for vehicles and pedestrians.

ii. Where vehicles and pedestrians use the same traffic routes there shall be sufficient space between them. Where necessary all traffic routes must be suitably indicated. Pedestrians or vehicles must be able to use traffic routes without endangering those at work. There must be sufficient separation of traffic routes from doors, gates and pedestrian traffic routes.

iii. For internal traffic, lines marked on roads / access routes and between buildings shall clearly indicate where vehicles are to pass.

iv. Temporary obstacles shall be brought to the attention of drivers by warning signs or hazard cones.

v. Speed limits shall be clearly displayed for each kind of vehicle.

vi. Speed ramps preceded by a warning signs or marker are necessary.

vii. The traffic route should be wide enough to allow vehicles to pass and re-pass oncoming or parked traffic and it may be advisable to introduce on-way system or parking restrictions.

viii. Safest route shall be provided between places where vehicles have to call or deliver.

ix. Avoid vulnerable areas/items such as fuel or chemicals tanks or pipes, open or unprotected edges and structures likely to collapse

x. Safe areas shall be provided for loading and unloading.

xi. Avoid sharp or blind bends. If this is not possible hazards should be indicated e.g. blind corner.

xii. Ensure road crossings are minimum and clearly signed.

xiii. Entrance and gateways shall be wide enough to accommodate a second vehicle without causing obstruction.

xiv. Set sensible speed limits which are clearly sign posted.

xv. Where necessary ramps should be used to retard speed. This shall be preceded by a warning sign or mark on the road.

xvi. Forklift trucks shall not pass over road hump unless of a type capable of doing so.

xvii. Overhead electric cable, pipes containing flammable hazardous chemical shall be shielded by using goal posts height gauge posts or barriers.

xviii. Road traffic signs shall be provided on prominent locations for prevention of incidents and hazards and for quick guidance and warning to employees and public. Safety signs shall be displayed as per the project working requirement and guideline of the state in which project is done. Vehicles hired or used shall not be parked within the 15m radius of any working area. Any vehicle, that is required to be at the immediate/near the vicinity, shall be approved by the person in-charge of the site.

17.2 TRAFFIC ROUTE FOR PEDESTRIANS

i. Where traffic routes are used by both pedestrians and vehicles road shall be wide enough to allow vehicles and pedestrians safely.

ii. Separate routes shall be provided for pedestrians to keep them away from vehicles. Provide suitable barriers/guard at entrances/exit and the corners or buildings.

iii. Where pedestrian and vehicle routes cross, appropriate crossing shall be provided.

iv. Where crowd is likely to use roadway e.g. at the end of shift, stop vehicles from using them at such times.

v. Provide high visibility clothing for people permitted in delivery area.

17.3 WORK VEHICLE

Work vehicle shall be as safe stable efficient and roadworthy as private vehicles on public roads. Site management shall ensure that drivers are suitably trained. All vehicle e.g. heavy motor vehicle forklift trucks dump trucks mobile cranes shall ensure that the work equipment conforms to the following:

i. A high level of stability.
ii. A safe means of access/egress.
iii. Suitable and effective service and parking brakes.
iv. Windscreens with wipers and external mirrors giving optimum all round visibility.
v. Provision of horn, vehicle lights, reflectors, reversing lights, reversing alarms.
vi. Provision of seat belts.
vii. Guards on dangerous parts.
viii. Driver protection - to prevent injury from overturning and from falling objects/materials.
ix. Driver protection from adverse weather.
x. No vehicle shall be parked below HT/LT power lines.
xi. Valid Pollution Under Control certification for all vehicles
xii. Wheel stopper shall be use during the parking of vehicle
xiii. Helper to be deployed in each vehicle as per site requirement.

17.4 DAILY CHECK BY DRIVER

1. There should also be daily safety checks containing below mentioned points by the driver before the vehicle is used.

Brakes	Mirrors	Warning signals
Tires	Windscreen waters	Specific safety systems i.e. controls & interlocks
Steering	Wipers	

2. Management should ensure that drivers carry out these checks.

17.5 TRANSPORTATION OF PERSONNEL AND MATERIALS BY VEHICLES

i. All drivers shall hold a valid driving License for the class of vehicle to be driven and be registered as an authorized BHEL driver with the Administration Department.

ii. Securing of the load shall be by established and approved methods, i.e. chains with patented tightening equipment for steel/heavy loads. Sharp corners on loads shall be avoided when employing ropes for securing.

iii. All overhangs shall be made clearly visible and restricted to acceptable limits

iv. Load shall be checked before moving off and after traveling a suitable distance.

v. On no account is construction site to be blocked by parked vehicles Drivers of vehicles shall only stop or park in the areas designate by the stringing foreman.

vi. Warning signs shall be displayed during transportation of material.

vii. All vehicles used by BHEL shall be in worthy condition and in conformance to the Land Transport requirement.

viii. Wheel stopper shall be use during the parking of vehicle

ix. Helper to be deployed in each vehicle as per site requirement.

17.6 MAINTENANCE

All Vehicles used for transportation of man and material shall undergo scheduled inspections on frequent intervals to secure safe operation. Such inspections shall be conducted in particular for steering, brakes, lights, horn, doors etc. Site management shall ensure that work equipment is maintained in an efficient, working order and in good repair. Inspections and services carried out at regular intervals of time and or mileage. No maintenance shall be carried below HT/LT power lines.

18. EMERGENCY PREPAREDNESS AND RESPONSE

i. Emergency preparedness and response capability of site shall be developed as per Emergency Preparedness and Response plan issued by BHEL

ii. Availability of adequate number of first aiders and fire warden shall be ensured with BHEL and its subcontractors

iii. All the subcontractor's supervisory personnel and sufficient number of workers shall be trained for fire protection systems. Enough number of such trained personnel must be available during the tenure of contract. Subcontractor should nominate his supervisor to coordinate and implement the safety measures.

iv. Assembly point shall be earmarked and access to the same from different location shall be shown

v. Fire exit shall be identified and pathway shall be clear for emergency escape.

vi. Appropriate type and number of fire extinguisher shall be deployed as per Fire extinguisher deployment plan and validity shall be ensured periodically through inspection

vii. Adequate number of first aid boxes shall be strategically placed at different work places to cater emergency need. Holder of the first aid box shall be identified on the box itself who will have the responsibility to maintain the same.

viii. First aid center shall be developed at site with trained medical personnel and ambulance

ix. Emergency contact numbers (format given in EPRP) of the site shall be displayed at prominent locations.

x. Tie up with fire brigade shall be done in case customer is not having fire station.

xi. Tie up with hospital shall be done in case customer is not having hospital.

xii. Disaster Management group shall be formed at site

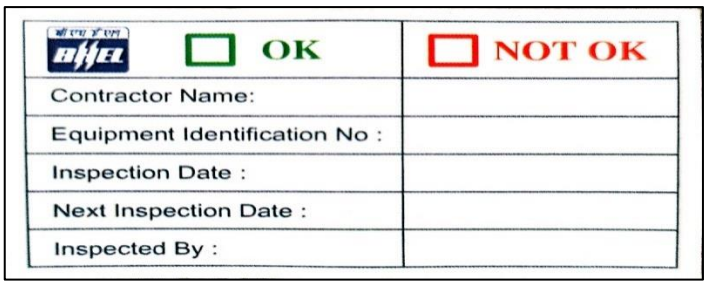
xiii. Mock drill shall be arranged at regular intervals. Monthly report of the above to be given to BHEL HSE Officer as per prescribed BHEL formats

xiv. Mock drill shall be conducted on different emergencies periodically to find out gaps in emergency preparedness and taking necessary corrective action

19. HSE INSPECTION

Inspection on HSE for different activities being carried out at site shall be done to ensure compliance to HSE requirements. The subcontractor shall maintain and ensure necessary safety measures as required for inspection and tests HV test, Pneumatic test, Hydraulic test, Spring test, Bend test as applicable, to enable inspection agency for performing Inspection. If any test equipment is found not complying with proper safety requirements then the Inspection Agency may withhold inspection, till such time the desired safety requirements are met.

Online/ App-based HSE Inspection system shall be used for inspection whenever provided by BHEL otherwise Hard-copy based system shall continue



BHEL ☐ OK	☐ NOT OK
Contractor Name:	
Equipment Identification No :	
Inspection Date :	
Next Inspection Date :	
Inspected By :	

Every Inspected Equipment shall display above sticker

19.1 INSPECTION PLAN

Subcontractor shall prepare an inspection plan covering all areas/ activities/ equipment/ hazards and implement the same after getting approval of BHEL. Responsibility to ensure coverage of all areas/ activities rests with the subcontractor.

All Inspections shall be witnessed by BHEL – only then they shall be considered as valid

19.2 INSPECTION REPORTS

Monthly inspection reports as per plan shall be submitted to BHEL HSE Head

19.3 NON-CONFORMANCES

Any non-conformances identified during inspection observed shall be addressed on priority.

The responsibility of resolution shall rest with the Subcontractor Site In-charge

In case immediate closure of non-conformities is not possible:

a. work to be halted in the area
b. non-conformance to be generated and submitted to responsible person and BHEL
c. non-conformance to be resolved through responsible agency / person

Only after closure of non-conformances, work to be allowed to resume

19.4 DAILY HSE CHECKS

Both the Site Supervisors and HSE Officer of Subcontractor are to conduct daily site Safety inspection around work activities and premises to ensure that work methods and the sites

are maintained to an acceptable standard. The following are to form the common subjects of a daily safety inspection:

i. Personal Safety wears & gear compliance.
ii. Complying with site safety rules and permit-to-work (PTW).
iii. Positions and postures of workers.
iv. Use of tools and equipment etc. by the workers.

The inspection should be carried out just when work starts in beginning of the day, during peak activities period of the day and just before the day's work ends.

19.5 Indicative List of Inspections And Periodicities

Indicative list & periodicity of Inspections is given as under. It is the responsibility of the subcontractor to develop an inspection plan covering all areas & activities in the scope.

SL. No.	Format Name	Frequency of check (if applicable)
01	Inspection of First Aid Box	Weekly
02	Inspection of PPE	Weekly
03	Inspection of T&Ps	Monthly
04	Inspection of Cranes	Monthly
05	Inspection of Winches	Monthly
06	Inspection on Height Working	Weekly
07	Inspection on Welding & Gas Cutting	Monthly
08	Inspection on Electrical Installation	Monthly
09	Inspection on Elevator	Weekly
10	Inspection of Excavation	Weekly
11	Inspection of Labor Colony	Monthly
12	Inspection of Illumination Levels	Weekly

The checklists shall be provided by BHEL at Site. It is the responsibility of the subcontractor to ensure their availability before start of work

19.5.1 Inspection Of PPE

i. PPEs shall be inspected by HSE officer at random once in a week as per provided **format** for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.
ii. The applicable PPEs for carrying out particular activities are listed below.

19.5.2 Inspection Of Tools & Plants (T&Ps)

i. A master list of T&Ps shall be maintained by each subcontractor in provided **format**.
ii. All T&Ps being used at site shall be inspected by HSE officer once in a month as per provided **format** for its healthiness and maintenance.
iii. The T&Ps which require third party inspection shall be checked for its validity during inspection. The third-party test certificate should be accompanied with a copy of the concerned competent person's valid qualification record.

iv. BHEL shall be given advance intimation of Third-Party Inspection. BHEL shall associate with Inspection as per discretion.
v. The validity of T&P shall be monitored as per provided **format**

19.5.3 INSPECTION OF CRANES AND WINCHES

i. Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
ii. Cranes and Winches shall be inspected by HSE officer once in a month as per provided **format** for healthiness, maintenance and validity of third-party inspection.
iii. The date of third-party inspection and next due date shall be painted on cranes and winches.
iv. The operators/drivers shall be authorized by sub-subcontractor based on their competency and experience and shall carry the I-card.
v. The operator should be above 18 years of age and should be in possession of driving license of HMV man & goods), vision test certificate and should have minimum qualification so that he can read the instructions and check list.

19.5.4 INSPECTION OF HEIGHT WORKING

i. Any activity carried out at more than 2 m height is classified as height work.
ii. Inspection of height working shall be conducted daily by Supervisors before start of work to ensure safe working condition including provision of
   a. Fall arrestor
   b. Lifelines – connected to rigid & independent structure
   c. Safety nets deployed below all height work activities
   d. Fencing and barricading
   e. Warning signage
   f. Covering of opening
   g. Proper scaffolding with access and egress.
   h. Illumination
iii. For full duration of height work, constant supervision to be maintained by dedicated HSE personnel
iv. Inspection on height working shall be conducted once in a week by HSE officer as per provided **format**.
v. Medical fitness of height worker shall be ensured.
vi. Height working shall not be allowed during adverse weather.

19.5.5 INSPECTION OF WELDING AND GAS CUTTING OPERATION

i. Supervisor shall ensure that no flammable items are available in near vicinity during welding and gas cutting activity.
ii. Gas cylinders shall be kept upright.
iii. Use of Flash back arrestor shall be ensured at both ends.

iv. Inspection during welding and gas cutting operations shall be carried out by HSE officer once a month as per provided **format**.
v. Use of fire blanket to be ensured to avoid falling of splatters during welding or gas cutting operation at height.
vi. Availability of fire extinguisher at vicinity shall be ensured.

19.5.6 INSPECTION OF ELECTRICAL INSTALLATION / APPLIANCES

i. Ensure proper earthing in electrical installation
ii. Use ELCB at electrical booth
iii. Electrical installation shall be properly covered at top where required
iv. Use appropriate PPEs while working
v. Use portable electrical light < 24 V in confined space and potentially wet area.
vi. Inspection shall be carried out as per provided **format**.

19.5.7 INSPECTION OF ELEVATOR

i. Elevators shall be inspected by concerned supervisors once in a week as per provided **format**
ii. All elevators shall be inspected by competent person and validity shall be ensured.
iii. The date of third-party inspection and next due date shall be painted on elevator.

19.5.8 INSPECTION OF EXCAVATION

Excavation activities shall be inspected as per provided **format**

19.5.9 INTERNAL/ EXTERNAL HSE AUDITS/INSPECTIONS

i. All non-conformities and observations on HSE identified during internal or external HSE audit shall be disposed of by site in a time bound manner and reported back the implementation status.
ii. Corrective action and Preventive action on HSE issues raised by certification body issued by BHEL shall be implemented by site and reported to Site management.

20. TERMS AND DEFINITIONS:

1. **Incident**
   Work- related or natural event(s) in which an injury, or ill health (regardless of severity), damage to property or fatality occurred, or could have occurred.

2. **Near Miss:**
   An incident where no ill health, injury, damage or other loss occurs, but it had a potential to cause, is referred to as “Near-Miss”.

3. **Man-Hours Worked:**
   The total number of man hours worked by all employees including subcontractors working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contract labors. Man-hours worked shall be calculated from the payroll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the

period covered by the number of hours worked per day. The total number of workdays for a period is the sum of the number of men at work on each day of period. If the daily hours vary from department to department separate estimate shall be made for each department and the result added together.

4. **First Aid Cases:**
   First aids are not essentially all reportable cases, where the injured person is given medical treatment and discharged immediately for reporting on duty, without counting any lost time.

5. **Lost Time Injury:**
   Any work injury which renders the injured person unable to perform his regular job or an alternative restricted work assignment on the next scheduled work day after the day on which the injury occurred.

6. **Medical Cases:**
   Medical cases come under non-reportable cases, where owing to illness or other reason the employee was absent from work and seeks Medical treatment.

7. **Type of Incidents & Their Reporting:**
   The three categories of Incident are as follows:

8. **Non-Reportable Cases:**
   An incident, where the injured person is given medical help and discharged for work without counting any lost time.

9. **Reportable Cases:**
   In this case the injured person is disable for 48 hours or more and is not able to perform his duty.

10. **Injury Cases:**
    These are covered under the heading of non-reportable cases. In these cases, the incident caused injury to the person, but he still continues his duty.

11. **Total Reportable Frequency Rate**
    Frequency rate is the number of Reportable Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula read as:

    Number of Reportable LTI x 1,000,000/ Total Man Hours Worked

12. **Severity Rate:**
    Severity rate is the Number of days lost due to Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula reads as:
    Days lost due to LTI x 1,000,000/ Total Man Hours Worked

13. **Incidence Rate:**
    Incidence Rate is the Number of LTI per one thousand manpower deployed. Mathematically, the formula reads as:
    Number of LTIx1000/Average number of manpower deployed

14. HIRA:

Hazard Identification and Risk Assessment (HIRA) is a process of identifying Hazards in work area and then assessing them properly

15. Method Statement:

A method statement is prepared by the Execution/ Engineering Department detailing the steps, equipment, competencies and safety precautions required for carrying out any activity

16. Job Safety Analysis:

A job safety analysis (JSA) is a procedure which helps integrate accepted safety and health principles and practices into a particular task or job operation. In a JSA, each basic step of the job is to identify potential hazards and to recommend the safest way to do the job. Other terms used to describe this procedure are job hazard analysis (JHA) and job hazard breakdown.

17. Safety Walk:

It's conducted periodically by an official - it's a walk through a portion or whole of a site as a HSE officer who notes down HSE observations, speak to concerned workmen and supervisor on observation, get the same corrected with personal follow up- this sends out a strong message on Management's commitment to safety.

18. Heavy & Complex Lifting:

A heavy and complex lifting activity includes:

1. Lifting above 20 Tons
2. Tandem Lifting using multiple cranes
   Total load exceeding 75% of capacity of crane. Depending up the condition of cranes, hydra cranes, winch machines & other lifting accessories
3. Lift of unusual difficulty or geometry or rigging
4. Lift over operating units
5. Any other lift as decided by site HSE / Erection

19. Safety Committee:

As per the BOCW, Safety Committee shall be constituted if there are more than five hundred or more construction workers are employed at any site. As per the Factories Act, 1948 it is for 250 workers. It shall be represented by equal number of representatives of employer and construction workers.

20. Night Work:

Work conducted after sunset when only a fraction of total manpower is available

Tender Specification No.: BHEL: PSSR: SCT: 2181

ANNEXURES

ANNEXURE A

Medical Centre & Ambulance

A. Medical Centre

1. Paramedical staff
    a. When < 500 workers, 1 Trained Male Nurse (round the clock deployment)
    b. When >=500 workers*:
        i. Registered Medical Practitioner (Qualified MBBS) to be deployed for at least 8 hours in a day, 5 days per week
        ii. 2 Trained Male Nurses (round the clock deployment)
2. All articles as per Schedule IV of BOCW Central Rules, 1998 to be made available in the Medical Centre (given under for convenience)
3. Basic Facilities/ Requirements to be provided as per location eg. Refrigerator, Air Conditioner, Anti Venom Serums etc.
4. Tie-ups with speciality hospitals to be ensured for referring serious patients

* In case the number of workers is envisaged to exceed 500, a medical practitioner is to be engaged.

SCHEDULE IV (BOCW CENTRAL RULES, 1998) ARTICLES FOR AMBULANCE ROOM
[SEE RULE 226 (C)]

i. A glazed sink with hot and cold water always available.
ii. A table with a smooth top at least 180 cm x 105 cm.
iii. Means for sterilising instruments.
iv. A couch.
v. Two stretchers.
vi. Two buckets or containers with close fitting lids.
vii. Two rubber hot water bags
viii. A kettle and spirit stove or other suitable means of boiling water.
ix. Twelve plain wooden splints 900 cm x 100 cm x 6 cm.
x. Twelve plain wooden splints 350 cm x 75 cm x 6 cm.
xi. Six plain wooden splints 250 cm x 50 cm x 12 cm.
xii. Six woollen blankets.
xiii. Three pairs of artery forceps.
xiv. One bottle of spiritus annemia aremations (120 ml).
xv. Smelling salt (60 gm).
xvi. Two medium size sponges.
xvii. Six hand towels.
xviii. Four kidney trays.
xix. Four cakes of toilet, preferably antiseptic soap.
xx. Two glass tumblers and tow wine glasses.
xxi. Two clinical thermometers.
xxii. Two tea spoons.
xxiii. Two graduated (120 ml) measuring glasses.
xxiv. Two minimum measuring glasses.
xxv. One wash bottle (1000 cc) for washing eyes.
xxvi. one bottle (one litre) carbolic lotion 1 to 20.
xxvii. Three chairs.
xxviii. One screen.
xxix. One electric hand torch.
xxx. Four first-aid boxes or cupboards stocked to the standards prescribed in
xxxi. An adequate supply of tetanus toxide.
xxxii. Injections—morphia, pethidine, atrophine, adrenaline, coramine, novocaine (6 each).
xxxiii. Cramine liquid (60 ml).
xxxiv. Tablets—antihistaminic antispasmodic (25 each).
xxxv. Syringes with needles—2 cc, 5 cc, 10 cc and 500 cc.

xxxvi. Three surgical scissors.
xxxvii. Two needle holders, big and small.
xxxviii. Suturing needles and materials.
xxxix. Three dissecting forceps
xl. Three dressing forceps
xli. Three scalpels.
xlii. One stethoscope and a B. P. apparatus.
xliii. Rubber bandage—pressure bandage.
xliv. Oxygen cylinder with necessary attachments.
xlv. Atropine eye ointments.
xlvi. I. V. Fluids and sets 10 nos.
xlvii. Suitable, foot operated, covered, refuse containers.
xlviii. Adequate number of sterilised, paired, latex hand gloves.

B. Ambulance

1. When number of workers is <500:
   If the distance to a major hospital capable of handling critical injuries expected at Site is <= 50 KM from Site, then 1 BLS (Basic Life Support)/ Type B Ambulance otherwise ALS* (Advanced Life Support)/ Type D Ambulance
2. If no. of workers increases to >2000 workers one additional BLS Ambulance to be deployed
3. Minimum Articles as per Schedule V of BOCW Central Rules to be ensured in each Ambulance. (given under for convenience)

*Final call to be taken at Site in consultation with all the contractors

SCHEDULE V (BOCW CENTRAL RULES, 1998)
CONTENTS OF AMBULANCE VAN OR CARRIAGE
[SEE RULE 227]

The Ambulance Van shall have equipment prescribed as under:

a) General—a portable stretcher with folding and adjusting devices with the Head of the stretcher capable of being tilted upward. Fixed suction unit with equipment. Fixed oxygen supply with equipment. Pillow with case, sheets, blankets, towels, emergency bag, bed pan, urinal glass.
b) Safety Equipment-Flaros with life of three thousand minutes, floor lights, flash lights, fire extinguishers (dry power type), insulated guntlets.
c) Emergency Care Equipment—
   i. **Resuscitation**—Portable suction unit, portable oxygen unit, bag valve mask, hand operated artificial ventilation unit, airways, mouth gag tracheostomy adapters, short spine board, I.V. FLUIDS with administration unit, B. P. manometer cuff stethoscope.
   ii. **Immobilisation**—Long and short padded boards, wire ladder splints, triangular bandage—long and short spine boards.
   iii. **Dressing**-Gauze pads—100 m x 100 mm universal dressing 250 x 1000 mm, roll of aluminium foils—soft roller bandages 150 mm x 5 mm yards adhesive tape in 75 mm roll safety pins, bandage sheets, burn sheets.
   iv. **Poisoning**—Syrup of Ipecac, activated charcoal pre packeted dose, snake bit kit, drinking water.
   v. **Emergency Medicines**—As per requirement (under the advice of construction Medical Officer).

ANNEXURE A.1

Sample calculation for deduction of operational cost of facilities

Annexure A.1

Cost Calculation Methodology of Operation of Facilities (Data is indicative only)

(Period of 48 months is considered - shall be on actual basis)

A. Project Info:

Total time of Project	48 months
Project cost	1000 Crore
No. of packages	10 (A1-A10)

B. Item-wise Calculation:

Item	Nos.	Rate	Unit	Amount
Ambulance with Driver	2		Monthly/Unit	170000
Nurse/First aider	2 X 2 shifts	15000	Per month	30000
Training center one time cost	1	100000	Once	100000
Medical center one time cost	1	200000	Once	200000
Medicines at medical center	1	10000	Monthly	10000
Dust supression water tank	2	2000	Monthly	4000
Doctor	1	70000	Monthly	70000
Cleaning staff	1	12000	Monthly	12000
			Recurring monthly expenditure	296000
			Total one-time expenditure	300000

C. Package-wise Deduction Plan for a period of 48 months

Period (In Months)	6	36	6
	For 1-6 months	For 7-42 months	For 43-48 months
Cost to be incurred from contractors	7%	81%	12%
	1.17% per month	2.25% per month	2.00% per month

D. Calculation For One-Time Running Cost

Packages/ Contracts	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10			
Contract Values (in Thousands)	100000	250000	2000000	200000	500000	1500000	1000000	1000000	250000	200000	7000000		
Share of common facilities one time running cost (in Thousands)	4	11	86	9	21	64	43	43	11	9	Individual Pkg value X Total one time running cost / All Pkg award values		
Timeline of work	1-6	1-8	2-48	6-36	7-15	10-48	6-48	7-40	40-48	41-48			
Month Count of work	6	8	47	31	9	39	43	34	9	8			
Deduction per month (in Thousands)	1	1	2	0	2	2	1	1	1	1	Total of One time Running cost (in thousands)	% deduction share of one time running cost per month	Nos. of active packages in month
Month No.													
1	1	1									2	1%	2
2	1	1	2								4	1%	3
3	1	1	2								4	1%	3
4	1	1	2								4	1%	3
5	1	1	2								4	1%	3
6	1	1	2	0			1				5	2%	5
7		1	2	0	2		1	1			8	3%	6
8		1	2	0	2		1	1			8	3%	6
9			2	0	2		1	1			7	2%	5
10			2	0	2	2	1	1			8	3%	6
11			2	0	2	2	1	1			8	3%	6
12			2	0	2	2	1	1			8	3%	6
13			2	0	2	2	1	1			8	3%	6
14			2	0	2	2	1	1			8	3%	6
15			2	0	2	2	1	1			8	3%	6
16			2	0		2	1	1			6	2%	5
17			2	0		2	1	1			6	2%	5
18			2	0		2	1	1			6	2%	5
19			2	0		2	1	1			6	2%	5
20			2	0		2	1	1			6	2%	5
21			2	0		2	1	1			6	2%	5
22			2	0		2	1	1			6	2%	5
23			2	0		2	1	1			6	2%	5
24			2	0		2	1	1			6	2%	5
25			2	0		2	1	1			6	2%	5
26			2	0		2	1	1			6	2%	5
27			2	0		2	1	1			6	2%	5
28			2	0		2	1	1			6	2%	5
29			2	0		2	1	1			6	2%	5
30			2	0		2	1	1			6	2%	5
31			2	0		2	1	1			6	2%	5
32			2	0		2	1	1			6	2%	5
33			2	0		2	1	1			6	2%	5
34			2	0		2	1	1			6	2%	5
35			2	0		2	1	1			6	2%	5
36			2	0		2	1	1			6	2%	5
37			2			2	1	1			6	2%	4
38			2			2	1	1			6	2%	4
39			2			2	1	1			6	2%	4
40			2			2	1	1	1		7	2%	5
41			2			2	1		1	1	7	2%	5
42			2			2	1		1	1	7	2%	5
43			2			2	1		1	1	7	2%	5
44			2			2	1		1	1	7	2%	5
45			2			2	1		1	1	7	2%	5
46			2			2	1		1	1	7	2%	5
47			2			2	1		1	1	7	2%	5
48			2			2	1		1	1	7	2%	5
Total	4	11	86	9	21	64	43	43	11	9	300	100%	

D. Calculation For Recurring Running Cost

Packages/ Contracts	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10		
Contract Values (in Thousands)	100000	250000	2000000	200000	500000	1500000	1000000	1000000	250000	200000	7000000	
Timeline of work	1-6	1-8	2-48	6-36	7-15	10-48	6-48	7-40	40-48	41-48	Total of Recurring cost (in thousands)	Nos. of active packages in month
	6	8	47	31	9	39	43	34	9	8		
Month No.												
1	85	211									296	2
2	13	31	252								296	3
3	13	31	252								296	3
4	13	31	252								296	3
5	13	31	252								296	3
6	8	21	167	17			83				296	5
7		15	120	12	30		60	60			296	6
8		15	120	12	30		60	60			296	6
9			126	13	31		63	63			296	5
10			95	10	24	72	48	48			296	6
11			95	10	24	72	48	48			296	6
12			95	10	24	72	48	48			296	6
13			95	10	24	72	48	48			296	6
14			95	10	24	72	48	48			296	6
15			95	10	24	72	48	48			296	6
16			104	10		78	52	52			296	5
17			104	10		78	52	52			296	5
18			104	10		78	52	52			296	5
19			104	10		78	52	52			296	5
20			104	10		78	52	52			296	5
21			104	10		78	52	52			296	5
22			104	10		78	52	52			296	5
23			104	10		78	52	52			296	5
24			104	10		78	52	52			296	5
25			104	10		78	52	52			296	5
26			104	10		78	52	52			296	5
27			104	10		78	52	52			296	5
28			104	10		78	52	52			296	5
29			104	10		78	52	52			296	5
30			104	10		78	52	52			296	5
31			104	10		78	52	52			296	5
32			104	10		78	52	52			296	5
33			104	10		78	52	52			296	5
34			104	10		78	52	52			296	5
35			104	10		78	52	52			296	5
36			104	10		78	52	52			296	5
37			108			81	54	54			296	4
38			108			81	54	54			296	4
39			108			81	54	54			296	4
40			103			77	51	51	13		296	5
41			120			90	60		15	12	296	5
42			120			90	60		15	12	296	5
43			120			90	60		15	12	296	5
44			120			90	60		15	12	296	5
45			120			90	60		15	12	296	5
46			120			90	60		15	12	296	5
47			120			90	60		15	12	296	5
48			120			90	60		15	12	296	5
Total	143	388	5676	329	235	3102	2334	1772	132	96	14208	

ANNEXURE B

HSE Displays

A. Types of Displays

1. Based on Content

SN	Type
1.	**HSE Hazards & Precautions** Height Work, Housekeeping, Fire Safety, PPEs, Hot Work, Lifting & Rigging Activity, Site-specific Hazards – eg. for Refineries, Nuclear plants etc.; COVID Precautions; Environment Protection etc.
2.	**Other Displays, Signage etc.** HSE Policy, ISO Certificate, Safety Statistics, Assembly Area Location/ Route, Emergency Contact Numbers, Site Safety Rules & Regulations, Speed Limit, Work in Progress, Lock-Out Tag-Out (LOTO) Boards etc.

2. Based on Mounting

[Type 1]	[Type 2]	[Type 3]
Flex Sign Boards of Wooden Frame – directly mounted on Structures (walls, stairs, railings etc.)	Flex Sign Boards with Wooden Frame – mounted on metallic/ wooden legs – preferably double-sided	Coloured weather-proof Paintings on Walls (after due concurrence of BHEL/ Customer – Type 1 in case of no concurrence/ space)

B. <u>General Requirements:</u>

a. Displays should be weather-proof as per installation location, i.e. rain-proof, wind-proof and sun-proof.
b. Installation location and size to ensure visibility for the intended viewers (workers and moving personnel)
c. Displays to have at least 50% graphical elements preferably (as applicable). Language should be understandable by majority of the workers
d. Displays to be relevant to the hazards in the area
e. Proper installation to ensure boards don't obstruct activities and should not be prone to fall so as to pose danger
f. In case of multiple elevations (eg. Boiler, Power-house etc.), each elevation to have displays for applicable hazards including Height-Work, Housekeeping
g. For temporary work locations, posters/ boards may be erected and shifted after task is over
h. Minimum size of displays should be A1 unless otherwise specified
i. In case of damage, displays shall be reviewed and repaired/ replaced
j. In areas where night work is envisaged, fluorescent displays shall be installed and these should comprise of at least 20-30% of total displays
k. Total Number of displays to be not less than 1 per 10 workers and are to be dynamically updated based on number of workers

C. Area-wise Displays

Below is list of Area-wise displays that are to be installed at Sites (Numbers, locations may be adjusted for specific requirements)

SN	Area	Suggested Subjects	Minimum Size	Minimum Quantity	Locations
1	**Walls/ Foundations/ Cement Structures etc. belonging to the package area**	Safety Hazards Prevention and other HSE Awareness content	**[Type 3]**	As per BHEL assessment from time to time	
2	**Site Interior Roads belonging to the package area**	At least every 20 meters: 1. Speed Limit Indication, Safe Driving board 2. Boards for hazard awareness	1.As needed **[Type 2]** **2.** A1 or equivalent each [**Type 2]**	As indicated	Sides of Roads; Height to ensure good visibility
3	**Specific Package Areas**	**A. Common** At entry to respective Package/ Work Area, each contractor to put up daily updated board with following for each shift: 1. Scope of work and start date 2. Emergency Contact Numbers 3. Emergency Assembly Location, Escape Plan 4. Locations and supervisors of various gangs in the area, 5. Current Work permit Details 6. Safety Supervisor Location assignments - Names, Mobile Nos., Assigned Locations 7. Details (Name, Contact No. etc.) of Package In-charge - Contractor & BHEL 8. Details (Name, Contact No. etc.) of Safety In-charge - Contractor & BHEL 9. LTI Free Man-days & details of last LTI also to be indicated In addition, Area-Specific Displays as indicated in Table 1	**A0** **[Type 2]**	1 per Package Area	Entry/ Ground Level

Table 1

(Area/ Package-wise HSE Display Plan – As applicable)

Prepared By (Subcontractor)				
S. No.	**Area**	**Suggested Minimum No. of Displays & Types**	**Type**	**Numbers Installed**
1	Boiler	3 per working elevation	**[Type 1]**	
2	Powerhouse	5 per elevation	**[Type 1]**	
3	ESP	5 Per Pass	**[Type 1]**	
4	Buildings	5 per elevation	**[Type 1]**	
5	Cooling Tower (NDCT/ IDCT/ ACC)	20 per Structure	**[Type 1]**	
6	Chimney	20 per Structure	**[Type 1]**	
7	Fabrication Yard	10 per Yard	**[Type 2]**	
8	Batching Plant	5 per Plant	**[Type 1]**	
9	Material Storage Yard – Open	20 per Yard	**[Type 2]**	
10	Material Storage Shed – Semi-Closed/ Closed	10 per Shed	**[Type 1]**	
11	Electrical Booths	2 per booth + Line diagram, Emergency contact details	**[Type 1]**	
12	Medical & First Aid Centre	2 per Centre	**[Type 1]**	
13	Rest Shed	2 per Shed	**[Type 1]**	
14	Canteen	2 per Canteen	**[Type 1]**	
15	Drinking Water Area	1 Per Outlet	**[Type 1]**	
16	Washing Water Area	1 Per Outlet	**[Type 1]**	
17	Training Centre	10 per room	**[Type 1/2]**	
18	Assembly Area	5	**[Type 1/2]**	
19	Stairs	1 per landing elevation	**[Type 1]**	
20	Cylinder Storage Area	5 + Signage: Type of Gas, Empty, Filled etc.	**[Type 1/2]**	
21	Labor Colony	Electrical Safety with Distribution Plan/ Line Diagram - 1 COVID Precautions Posters – 5 Safety Awareness Posters – 10 Hygiene awareness posters - 2	**[Type 1]**	
22	Others	As per requirement	**[Type 1/2]**	

Date:

Sign (Contractor) **Sign (BHEL)**

ANNEXURE C

HSE Tools/ Equipment/ Devices

Following equipment conforming to relevant IS/ISO/BS Codes/ Standards in indicated quantities shall be ensured by subcontractor. This list is tentative, not exhaustive. Quantity and date/ period of deployment shall be as per site requirement.

A. HSE Tools/ Equipment/ Devices

SN	Item
1	Lifelines
2	Retractable Fall Arrestors
3	Safety Nets (10m X 5m) fire proof double mesh
4	Sky Climbers
5	Fire Blanket
6	Honey Bee Removal Suit & Kit
7	Scaffolding Pipes
8	Flashback Arrestors
9	Barricading Tape
10	Binoculars
11	Walkie-Talkies
12	LOTO kit
13	24-Volt light
14	Sand Buckets
15	Hard barricading Pipes
16	Standby Fire kits
17	Hand-held Megaphone
18	Small Public Address System
19	Foldable Stretcher
20	Height Rescue Kit (Non-Motorized)
	(Others:)

B. Test & Measurement Devices

SN	Device
1	ELCB Tester
2	Multi meter (Light cables)
3	Earth Resistance Meter
4	Lux Meter
5	Sound Meter
6	Anemometer
7	Breath Analyzer (Alcohol)
8	Multi-gas dozi-meter/ detector
9	Gas leakage detector / alarm
10	Gas monitor (confined space)
11	Radiation meter & Badges
12	Blood Pressure Monitor
13	Fire detectors
14	Hand held signaling light
	(Others:)

ANNEXURE D

Rest Sheds

1. Determining the Number, Sizes and Locations of Rest Shelters

i. **Numbers:**

The number of rest shelters shall be determined based on maximum number of workers at any one time (across all shifts). Formula is:

Wmax = Maximum number of workers at any time in the Site

Space per worker = 1.1 sq meter

Total space required, Tspace = Wmax X 1.1

Based on total space requirement calculated above, the number of rest sheds can be decided according to availability of locations and concentration of workers – so as to ensure the required space.

ii. **Locations:**

The rest sheds should be so located so as to minimize the distance to be travelled by the workers from their locations of work considering all the practical constraints

iii. **Other:**

The Rest shelter should be fenced so that it cannot be used as parking area.

2. Design & Construction of Rest Sheds

a. Permanent/ Long duration Rest Sheds

i. For locations where, permanent rest sheds can be constructed without possibility of removal for relatively long period of time, a semi-closed shed can be constructed covered with tin roof and supported with well-grouted beams. The floor of the shed to be preferably cemented/ solidified.

ii. Adequate structural requirements suitable to the local weather (wind/ rain etc.) to be ensured.

iii. The design of the rest shed to be approved by Civil Engineering Department of BHEL Site before commencing work

b. Temporary/ Movable/ Portable Rest Sheds

i. For locations where, permanent rest sheds cannot be constructed either due to non-availability of permanent location or other reasons, temporary rest shed shall be constructed.

ii. Temporary rest sheds shall comprise of Tent arrangement carried out by professional agencies

3. Amenities in Rest Sheds

a. Essential Amenities

Following amenities shall be essentially ensured in a rest shed:

i. Hygienic environment with regular cleaning and housekeeping (with records)
ii. Adequate illumination
iii. Adequate ventilation/ heating as per weather conditions
iv. Clean Drinking water source
v. Hand Washing area
vi. Toilets & Urinals
vii. Benches/ mats for sitting/ lying
viii. Any other essential requirement deemed necessary by the Site
ix. Dust bins of sufficient quantity/ size that are vacated each day/ as per requirement

b. Additional/ Optional Amenities

Following amenities are optional but are recommended to enhance the level of satisfaction of work force:

i. Hot/ Cold drinks (Tea, Coffee, Glucose etc.) as per requirement
ii. Snacks
iii. Fans/ Coolers/ Heating arrangements as per requirement and weather conditions
iv. A nice, welcoming interior design, music etc.
v. Water cooler

4. Health & Safety Requirements of Rest Sheds

Use of asbestos in construction is banned and shall not be used.
In addition, following essential Safety features shall be ensured in Rest sheds:

i. Availability of Fire extinguishers (preferably CO2 type)
ii. Display of Safety Posters
iii. Pest/ reptile protection
iv. Mosquito prevention measures

5. Note:

Any suitable closed spaces/ newly constructed buildings etc. available at project may also be used for the purpose of rest shed with due concurrence of BHEL

ANNEXURE E

Labor Colony

1. These Guidelines suggest minimum requirements. However, additional requirements based on feasibility and circumstances, while adhering to directions of GOI/District Administration/Local Authority guidelines to be considered
2. Norms for social distancing, training/ awareness, face masks, disinfection, sanitization, gate entry, quarantine, medical, action in case of suspect cases of COVID and other communicable diseases etc. to be followed as per Govt. and BHEL guidelines issued from time to time
3. Labor colony to be developed as close to the Site as possible to avoid lengthy commute
4. A "Suggestion Register" shall be made available at the labor colony for residents. The feedback shall be reviewed on weekly basis and acted upon by concerned Contractor. Same shall be reviewed periodically by authorized BHEL Site Official.
5. **Canteens, Latrines & Urinals, Washing Facilities, Creches, Residential Accommodation and other infrastructure/ facilities:**
   Numbers/ Quantities and Features of these facilities shall be in line with the following as applicable:

   a. BOCW Act & State Rules
   b. The Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act & State Rules
   c. Factories Act & State Rules
   d. Other Relevant Acts & Rules

6. **Cleanliness & Hygiene/ Housekeeping:**
   a. Regular cleaning of the labor colony to be ensured.
   b. Daily cleaning of Sanitary facilities.
   c. Proper drainage system to prevent water-logging
   d. Regular fogging to prevent spread of mosquitoes
   e. Prevention of foul smell through necessary interventions
   f. Dust suppression as per requirement
   g. Cutting of Grass at regular intervals and other necessary measures to prevent pests & reptiles
   h. Stray animals to be banned from labor colony.
   i. Outside every common facility, eg. Toilet, washroom, food hall/ canteen etc., provision of washbasin with flowing water and soap (preferably liquid soap) to be ensured
7. **Power Supply Layout:**
   Electrical supply Layout of Labor Colony shall have the provision of Safety devices like MCBs, ELCBs etc. and to be clearly displayed
8. **Washing & Drinking Water Availability**
   a. Adequate water to be provided in line with: "Estimation of Water Requirements for Drinking and Domestic Use (Source: National Building Code 2016, BIS)"
   b. Drinking water tank to be cleaned every week and sticker for the same pasted on the tank
   c. Drinking water source should be tested as per IS 10500
9. **Waste Disposal:** Separate bins for dry, wet and biomedical waste to be installed. These bins to be evacuated regularly
10. **Training & Awareness/ Displays**
    a. **HSE Awareness Displays**: Posters/ banners/ boards to be displayed in labor colony. Subjects of displays shall be precautions for applicable hazards at work site.
    b. **Emergency Contact Numbers** including that of Doctor, Hospital, Labor Colony Supervisor, HSE Officials to be displayed prominently

11. **Doctor Visits:**
    Regular and need-based visits by Doctors to be ensured through tie-ups etc.
12. **Inspection & Review:** Regular inspection of labor accommodation to be carried out by the Contractor as per prescribed format. Last inspection date, inspector and next due date to be prominently indicated near main gate
13. Provision of a Fair Price shop in the premises to be ensured as per requirement
14. Adequate arrangements to be ensured in case of children/ families

ANNEXURE F

Toilets

Toilets (Latrines and urinals shall be ensured at Site and Labor Colony in accordance with the Inter-State Migrant Workmen Act, 1979 as given below:

LATRINES	URINALS
1. Latrines shall be provided in every establishment on the following scale, namely: - a. Where females are employed, there shall be at least one latrine for every 25 females; b. Where males are employed, there shall be at least one latrine for every 25 males: Provided that where the number of males or females exceeds 190, it shall be sufficient if there is one latrine for 25 males or females, as the case may be, up to the first 100, and one for every 30 thereafter 2. Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.	1. There shall be at least one urinal for male workers up to fifty and one for female up to fifty employed at a time: Provided that where the number of male or female workmen, as the case may be, exceeds 500 it shall be sufficient if there is one urinal for every fifty females up to the first 500 and one for every 100 or part thereof thereafter. 2. The urinals shall be designed and located so as to ensure privacy.

Important:

1. Where workers of both sexes are employed there shall be displayed outside each block of latrine and urinal a notice in the language understood by the majority of the workers 'For Men Only', or For Women Ónly', as the case may be.
2. The notice shall also bear the figure of a man or of a woman, as the case may be.
3. The latrines and urinals shall be conveniently situated and accessible to workers at all times at the establishment.
4. The latrines and urinals shall be adequately lighted and shall be maintained in a clean and sanitary condition at all times.
5. Latrines and urinals other than those connected with a flush sewage system shall comply with the requirements of the public health authorities.
6. Water shall be provided by the means of tap or otherwise so as to be conveniently accessible in or near the latrines and urinals.
7. At Site, on ground, Modular Bio-toilets as per industry standard specifications and regular professional cleaning shall be ensured. The toilets should be sufficient in number and easily accessible to workers from every work area
8. At Site, in various elevations, suitable urinals with proper drainage to be ensured at each elevation in line with IS 2064 (1993). Same to be cleaned regularly

ANNEXURE G

Fire Extinguishers

SN	Type of Fire Risk (Class of Fire)	Extinguishing Medium & Relevant INDIAN STANDARD	Scale of Equipment (Minimum recommended)
1.	**CLASS 'A'** Fires involving ordinary combustible materials like wood, paper, textiles, rubber etc. (Ordinary hazard or low fire load)	WATER Soda acid type, water type (gas pressure) and water type (constant air pressure) IS: 934 -1976; IS: 940 -1976; IS: 6234 -1971	For every 600 square meter floor area or part, one 9-litre capacity. Minimum 4 numbers per floor or room; should not be required to travel more than 15 meter to reach any extinguisher.
2.	**CLASS 'A'** (Extra hazard &high fire load)	-do	-do – (Also, consult local fire authority).
3.	**CLASS 'A'** (Special hazards)	-do	-do – Extra provision For every 100 square meter floor area or part, one 4.5 Kg. CO2; minimum 2 numbers per room; should not be required to travel more than 10 meter to reach any extinguisher.
4.	**CLASS 'B'** (Fires in flammable liquids like oils, solvents, petroleum, products, varnishes, paints, etc. where blanketing effect is essential) (Storage and handling in small quantities)	FOAM / CARBON DIOXIDE / DRY CHEMICAL POWDER IS: 933 -1976; IS: 2878 1976; IS: 2171 1976; IS: 4308 -1982	For every 50 square meter floor area or part, 2 numbers 9 -liters foam or 5 kg dry powder; should not be required to travel more than 10 m in the area of storage to reach any extinguisher.
5.	**CLASS 'B'** (Bulk storage other than in tank form))	-do -	-do- (but minimum 3 numbers per room)
6.	**CLASS 'C'** (Fires involving gaseous substances under pressure where it is necessary to dilute the burning gas at a very fast rate with an inert gas or powder) (storage and handling of gas cylinders)	CARBON DIOXIDE / DRY CHEM. POWDER. The best way to extinguish such fire is by stopping the flow of fuel gas to the fire. Container is kept cool with water spray. IS: 2878 1976; IS: 2171 -1976; IS: 4308 -1982	For every 100 square meter floor area or part; 2 numbers, 10 kg powder extinguisher or 6 kg C02; minimum 3 nos. per room; should not be required to travel more than 10 meter to reach any extinguisher.
7.	**CLASS'D'** Fires involving metals like magnesium, aluminum, zinc, potassium etc. where the burning metal is reactive to water and which require special extinguishing media or technique	SPECIAL DAY POWDER IS: 2171 -1976 IS: 4861 -1968	For every 50 square meter floor area or part, 2 nos. 5 kg special dry powder; minimum 3 nos. per room; should not be required to travel more than 10 meter to reach any extinguisher.
8.	**MIXED OCCUPANCY** (electrical); Generators; Transformers; etc.	CARBON DIOXIDE DRY POWDER, IS: 2878 1976; IS: 2171 -1976	For every 100 square meter floor area or part one 10 kg C02. Minimum 2 numbers for every location should not be required to travel more than 10 meter to reach an extinguisher.
Note: Due to peculiarities of the power plant construction sites, there would be locations in the construction areas of Boiler, Turbine, Generator, Transformer, etc. where different types of fire risk (classes of fire) may co-exist. Special care shall be taken while selecting and installing portable fire extinguishers for such locations so that all types of fire risk that may co-exist, are adequately covered. Similar special care shall be taken for storage areas.			

a. All Electrical welding booths shall be equipped with appropriate Fire Extinguisher

b. Appropriate Fire Extinguishers shall be made within easy reach of all welding operations
c. Fire extinguishers shall be regularly tested and last checked date to be indicated on each. Master list shall be prepared with location and details
d. Providing appropriate fire-fighting equipment at designated work place and nominate a fire officer/warden adequately trained for his job.
e. Subcontractor shall provide enough fire protecting equipment of the types and numbers at his office, stores, temporary structure in labour colony etc. Such fire protection equipment shall be easy and kept open at all times.
f. The fire extinguishers shall be properly refilled and kept ready which should be certified at periodic intervals. The date of changing should be marked on the Cylinders.
g. All other fire safety measures as laid down in the “codes for fire safety at construction site” issued by safety coordinator of BHEL shall be followed.
h. Non-compliance of the above requirement under fire protection shall in no way relieve the subcontractor of any of his responsibility and liabilities to fire incident occurring either to his materials or equipment or those of others.
i. Emergency contacts nos. must be displayed at prominent locations
j. Tarpaulin being inflammable should not be used (instead, only non-infusible covering materials shall be used) as protective cover while preheating, welding, stress relieving etc. at site.

ANNEXURE H

HSE Compliance Certificate

Bill Ref no:_____Date:_____

NAME OF THE AGENCY: _____ Work-Area/Package:_____

Sl. No.	Description	Remarks
1	**HOUSE KEEPING**:	
1.1	All working areas at site (specific to the agency) are free from garbage's, scraps & any other undesired non-plant materials. There is no encroachment in safe passage of man, material & T&P to carry out activities safely	
1.2	All the plant materials under the custody of the agency are stacked & stored properly.	
2	**GENERAL ILLUMINATION**:	
2.1	ALL the working areas at site & office of the agency including passages are having proper & sufficient illumination.	
3	**STATUTORY & REGULATORY REQUIREMENT**:	
3.1	Sufficient water for drinking & other purposes and sanitation in work area and labour colony are available.	
3.2	Periodical Medical check-up of workers & staff done regularly & report submitted to BHEL	
3.3	Regular EYE testing is done for Crane operators/Welders and data's are available with agency	
3.4	All the T&P, Cranes etc used by the agency are having proper T.Cs & Fitness certificate available from competent authority.	
4	**SAFETY COMPLIANCE:**	
4.1	Number of Tool box meetings between Safety officers, erection staff & workers of the agency held in this month with location mentioned	
4.2	All precautions & Safety measures including PPE compliances are taken before working at HEIGHT	
4.3	Permit for working at Height is taken & complied accordingly	
4.4	ELCB is used in Construction Power Supply source by the agency & Proper Distribution board and electrical cabling has been used by the agency and regularly checked by electrician & safety officer of the agency	
4.5	Unsafe areas barricaded properly &unsafe opening closed properly	
4.6	Proper Platforms & Hand-rails used In areas earmarked earlier	
4.7	Proper safety signage's, Slogans & Emergency contact phone numbers including FIRE contact nos. are made available by the agency in locations mentioned	
5	Whether any penalty imposed by BHEL towards non-compliance of above points.	

VENDOR'S SIGNATURE	
Erection Engineer	
HSE Officer	
Site-in-Charge	

BHEL'S SIGNATURE	
Erection Engineer	
HSE Officer	
Package-in-Charge	

ANNEXURE I

Activity-Specific Safety Precautions/ Controls

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General

The philosophy of hierarchy of controls as below shall be followed

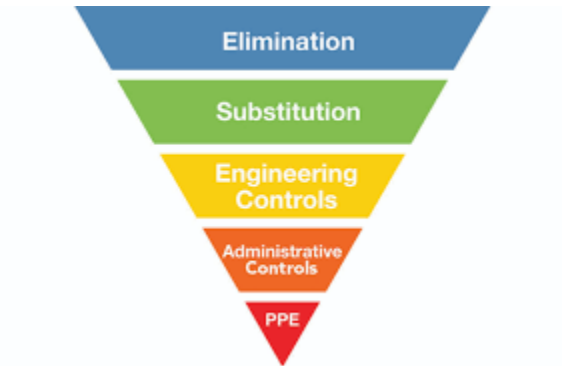


Fig. 1.1

It shall be ensured that there are multiple protections against any accident/ incident. For example, for height work there shall be safe platforms and walkways, Safety Nets and Lifelines for hooking double lanyard Safety harness by workers.

Monitoring and modifying worker behavior shall be part of ensuring safety. All personnel should be competent and trained for the job

Brief Safety guidelines for various hazardous activities are indicated below, besides the mandatory requirements based on Hazard Identification studies, HSE Procedures, Operational Control Procedures, Work Permits, applicable Indian Standard Codes and other provisions detailed in this document. Constant supervision at all times to be maintained by Execution & Safety Team to ensure implementation of these provisions.

1. WORK AT HEIGHT:

a. All work at height above 2 meter above ground level without complete platforms, handrails and other related fall protection shall require a work permit in the prescribed form. This shall require approval by the competent authority. The HSE officer of sub-contractors shall follow the checklist religiously by physically verifying the condition of the work area before recommending for approval.

b. Prior to the start of work at elevation, the HSE Officer involved with the work must meet the work supervisor to review the scope of work, and must review all the possible fall hazards and effective safety responses. The evaluation / analysis must be documented and kept on file and on site by the HSE Officer.

c. Whenever a fall hazard or other exposure exists for working at heights more than 2.0m/6ft, the nature and scope of work will be evaluated for conditions and environmental factors before selecting the appropriate fall protection system (active, passive or a combination of measures, as appropriate).

d. All Engineering and Administrative Controls including barricading, safe platform, Safety Nets etc. shall be made available at work location. Under no circumstances, there shall be total reliance on PPEs only

e. **Safety Nets**

   i. Contractor shall maintain sufficient stock of Safety Nets for deployment

   ii. Safety Nets as per IS: 11057:1984 should be used extensively for prevention / arrest men and materials falling from height.

   iii. The safety nets shall be fire resistant, duly tested and shall be of ISI marked.

iv. Safety Nets shall be deployed below all platforms where height work is envisaged. Duration of work, delay shall be no excuses for non-installation of Safety Net

f. Reaching beyond barricaded area without lifeline support, moving with support of bracings, walking on beams without support, jumping from one level to another, throwing objects and taking shortcut must be discouraged.
g. Monkey Ladder shall be fitted with cages. Rope ladder should be discouraged.
h. In case of pipe-rack, persons should not walk on pipes and walk on platforms only.
i. In case of roof work, walking ladder/ platform should be provided along with lifeline and/ or fall arrestor.
j. For chimney or structure painting, both hanging platform and men should be anchored separately to a firm structure along with separate fall arrestor.
k. The procedures for the safety response to identified fall hazards developed and rescue plans must be reviewed with all individuals exposed to the hazards.
l. The HSE Officer must establish an inspection process of fall protection systems. Some equipment requires documented inspections by its manufacture on a regular schedule. Such equipment must have evidence of the inspection and re-certification process on it. This information must be reviewed before the equipment is actually used. Individuals must visually inspect the fall protection equipment before each use. Failure to complete this inspection process could result in serious injury or death.
m. Immediately remove from service any fall protection equipment that is identified as defective, damaged, or has been subjected to an impact. Damaged fall protective equipment must be destroyed to prevent re-use and not be discarded into trash containers, as the worn or damaged equipment could be unintentionally re-used.
n. Aerial lifting devices, excluding scissor lifts require the use of full body harnesses and lanyards in any elevated position.
o. Where Height related works are applicable then rescue team (consist of 5- 10 person) shall be identified and trained for potential rescue.

1.1 Personnel fall protection system must include:

a. Safety Harness

All height workers must use Full Body Safety harness with double lanyards with shock absorber (only). The primary lanyard is never unhooked until the secondary lanyard is secure. The design of the working platform should be such that under no circumstances, worker should have both lanyards unhooked while at height.

b. Lanyard

i. The type of work and the environment conditions determine lanyard and lifeline selection. If welding, chemical cleaning that may damage lanyards, connectors or lifelines, sandblasting, etc., either protect the components or use more appropriate type of system.
ii. Lanyards and lifelines must incorporate, or be used with, an appropriate deceleration (shock absorbing) device. Deceleration devices include rope grabs, rip-stitch lanyards, specially woven lanyards, tearing, or deforming lanyards, automatic self-retracting lifelines and lanyards which dissipate or limit the energy imposed on the employee during fall arrest.
iii. Once in use, the system's effectiveness is to be monitored. In some cases, a program for cleaning and maintaining the system may be necessary. Lanyard and lifelines must use locking snap hooks only and under

no circumstances must two lanyard snap hooks be connected.

c. Lifeline

All lifelines in general are to be made of min 12mm dia. steel rope (plastic coated) and tied to columns with 3 clamps at each end. Wherever columns are not available to tie the lifelines, the vertical posts as per the design below are to be provided after carrying out drop load test initially. A load of 240kg to be dropped off the mid-point of lifeline in this test.

d. Lifeline Post

DIAGRAM : LIFELINE POST

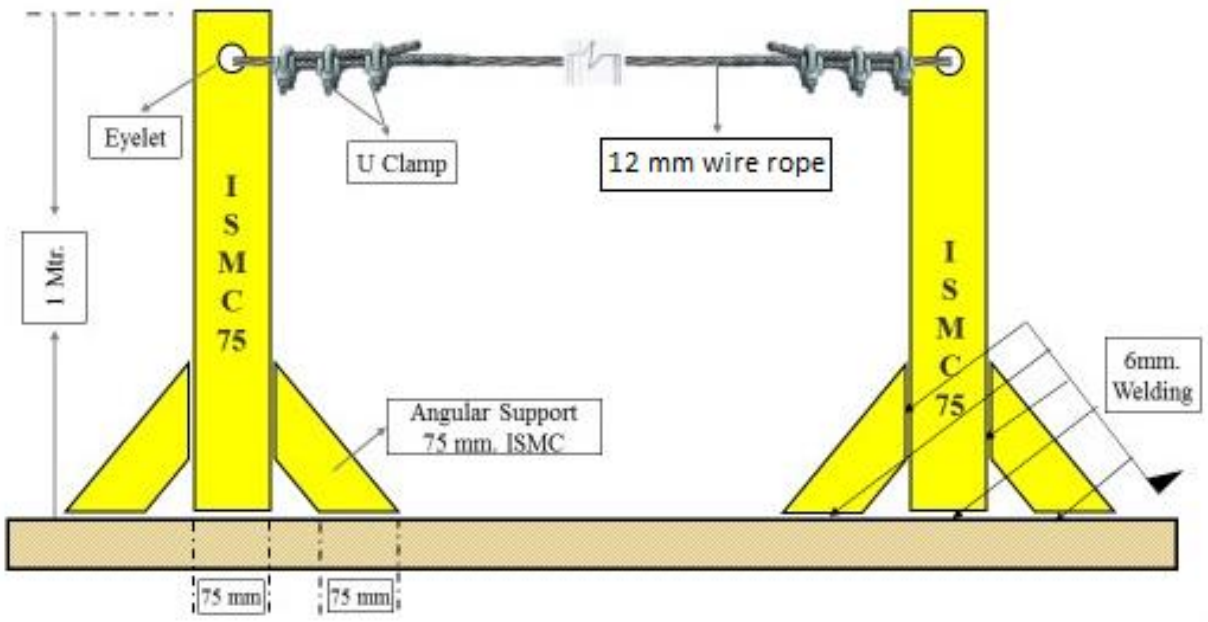


Fig. 2.1 Lifeline Post

i. The support at vertical post shall be fixed at end-to-end (welded/ bolted). The maximum length of one end to another end shall be 6 meters

ii. If the length of a lifeline is more than 6 meters, then intermediate vertical post(s) are to be used. Such intermediate post(s) will act as supports and the lifeline rope should simply pass through the eyelets (holes) of such supports without being anchored

iii. The lifeline need not be wrapped / clamped to any intermediate post

iv. Such intermediate posts must be used at an interval of every 6 meters

v. The post(s) in which the original lifeline is to be installed should be capable of sustaining a tensile stress of 2268 Kgs.

vi. In a horizontal lifeline installation, maximum allowable sagging is 500-600 mm

vii. For a single spun lifeline, no more than 3(Three Nos.) persons are allowed to work; for more than two workers, another lifeline should be installed

viii. Horizontal lifeline should be so installed that it does not impede safe movement of workers

ix. All the installation work must be carried out by competent person with adequate knowledge

1.2 Working Platform

a. Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform gangways provided is more than 3.6 m above ground level or

floor level, they shall be closely boarded and shall have adequate width, which shall not be less than 750 mm and be suitably fenced.

b. <u>Precautions against the fall of Materials, Persons and Collapse of Structures:</u>

i. Every opening in the floor or a building or in a working platform shall be suitably barricaded to prevent the fall of persons by providing suitable fencing or railing whose minimum height shall be 90 cm.

ii. Adequate precautions should be taken such as the provision of fencing, or barriers to protect any person who might be injured by the fall of materials, or tools or equipment being raised or lowered. Hard barricading shall be made at such places made of scaffolding pipe & clamps covered with reflective net. Cradle may be used for lifting materials - however this shall be made of MS angles and flats only and duly certified by the HSE officer. Operators may also use designed containers for lifting small tools.

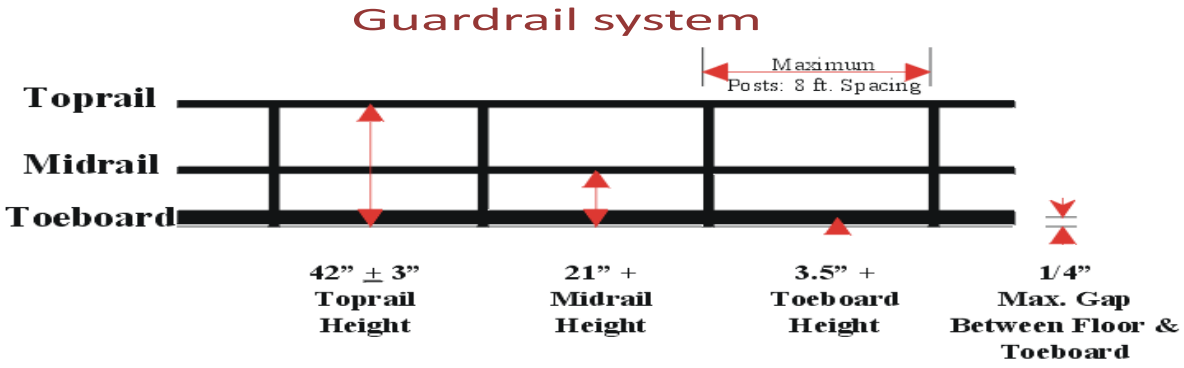
iii. Guardrails (including scaffolding) erected over/adjacent working areas must have the guardrails screened (opening < 0.5), to prevent material from falling outside the platform/decking.

iv. Guardrails must be able to withstand a 200-pound force exerted in any one direction.

v. Where necessary to prevent danger, guys, stays or supports should be used or other effective precautions should be taken to prevent the collapse of structures or parts of structures that are being erected, maintained, repaired, dismantled or demolished.

vi. All openings through which workers are liable to fall should be kept effectively covered or fenced and indicated in the most appropriate manner.

vii. Guardrails and toe-board/barricades and sound platform conforming to IS: 4912-1978 and other Indian laws and regulations as depicted below should be provided.



<u>Fig. 2.2 Guard Rail System</u>

viii. Guardrails shall be provided to protect workers from falling from elevated work places. The rails are generally made of MS pipes of suitable dia. Rebar shall not be used for any handrails, ladder or cover purpose. Wherever the guard-rails and toe-boards cannot be provided:

a. adequate safety nets or safety sheets shall be erected and maintained; or
b. adequate safety harnesses shall be provided and used and / or
c. adequate fall arrestor shall be provided and used.

As mentioned under PPE clause, all these PPEs shall be defect free and regularly inspected for any defect. The full body safety harness shall have double lanyard only with max 1.8m length.

ix. The monkey ladders shall have sufficient fall arrestors. Adequate lifelines of 8mm steel wire rope shall be provided across the work area.

x. The HSE officer shall recommend appropriate PPEs after analyzing hazards and risks involved.

1.3 Scaffolding

All scaffolds shall be conformant to the relevant standards including IS 3696 and IS 4014 as applicable. A sketch of the scaffolds proposed to be used shall be prepared and approval of the BHEL Engineer obtained prior to construction / use. Only cup lock type scaffoldings will be allowed in site. Where cup lock type scaffolding arrangement is not feasible by the virtue of the location, in that case only pipe and clamp type scaffolding will be allowed.

a. The scaffolding work must be carried out by a competent person, who shall train the scaffold users on safety aspects
b. All scaffolds shall be erected / dismantled by scaffolding crew under direct supervision of competent scaffolding supervisors.
c. All scaffolds shall be capable of supporting 4 times maximum intended load and erected on sound, rigid footing, capable of carrying the maximum intended load without settling or displacement. Bamboo scaffolding is not permitted for use on site.
d. Each employee on the scaffold shall use an approved safety harness attached to an independent lifeline. The lifeline is to be securely attached to substantial members of the structure (not the scaffold itself) or to securely rigged lines, which shall safely suspend a worker in event of a fall.
e. Guard rails and toe boards shall be installed on all open sides and ends of platforms more than (2) meters above ground or floor
f. Scaffold planks must be at least 5 cm x 25 cm (2" x 10") full thickness lumber scaffold grade or better.
g. Scaffold planks shall not span distances greater than 2.5 meters (8 feet).
h. Scaffold planks shall extend over end supports not less than 6 inches nor more than 12 inches and be secured to the scaffold. Scaffolding and accessories with defective parts shall be immediately repaired or replaced.
i. All scaffolding must be a minimum of two planks wide. No one may work from a single plank.
j. Scaffold planks must be inspected before use. Planks that have been damaged must be removed from the site.
k. Access ladders must be provided for each scaffold. Climbing the end frames is prohibited unless the design incorporates an approved ladder.
l. Adequate mudsills or other rigid footing capable of withstanding the maximum intended load must be provided.
m. Scaffolds more the 6 meters (20 feet) in height must be tied to the building or structure at intervals which do not exceed 4 meters (13 feet) vertically and 6 meters (20 feet) horizontally.
n. Do not overload scaffolds. Material should be brought up as needed. Scaffolding must not be loaded in excess of its rated capacity.
o. Barrels, boxes, kegs, blocks or similar unstable object must never be used as work platforms or to support scaffold.
p. Where persons must work under or pass under a scaffold then a 18 gauge wire mesh screen must be installed between the toe board and guard rail.
q. Employees exposed to overhead hazards while working on a scaffold will be protected by 5 cm (2") thick planks.
r. Wooden/bamboo ladders shall not be allowed at any cost. Ladder's rungs shall be fitted /welded

properly. Before every use the rungs should be checked for safe use.

s. Wooden scaffolds shall not be used in areas where fire / fire products are expected

t. Ropes made of jute / Plastic and other fire prone material shall not be used to tie up scaffolding components together

u. The platform should have permanent hand rail and mid rail with Toe board without fail.

v. All platforms are to be tightly planked for the full width of the scaffold, except as may be necessary for entrance openings. Platforms shall be secured in place.

w. On suspension scaffolds designed for a working load of 500 pounds, no more than two workers are permitted to work on the scaffold simultaneously. On suspension scaffolds with a working load of 750 pounds, no more than three workers are permitted on the scaffold simultaneously.

x. Requirements for different types of Scaffolds:

A. Suspended Scaffold

i. Suspended scaffolds are platforms suspended by ropes, or other non-rigid means, from an overhead structure.

ii. Requirements for use are to be preapproved by HSE Head, under a specific Permit to Work.

B. Rolling Scaffolds

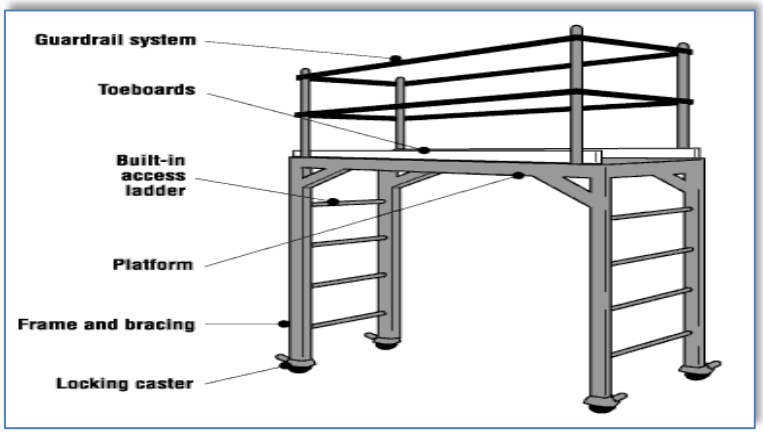
i. The height of rolling scaffolds shall not exceed three times the minimum base dimension.

ii. The minimum base dimension of rolling scaffold will be 1.25 meters (4 feet).

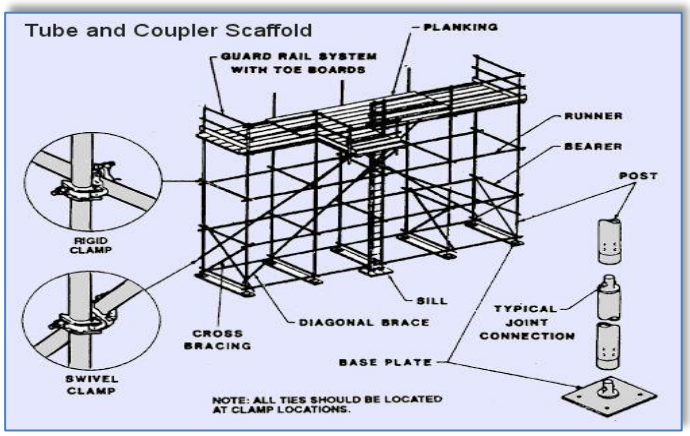
iii. Adequate help must be provided when moving a rolling scaffold.

iv. Secure or remove all loose materials, equipment and tools before moving a rolling scaffold.

v. No one is permitted to ride a rolling scaffold when it is being moved. Castor brakes must be locked-on when the scaffold is not being moved.



Rolling Scaffold



Tube & Coupler Scaffold

Fig. 2.3 Types of Scaffolds

1.4 Ladder Safety

A sketch of the ladders proposed to be used shall be prepared and approval of the BHEL Engineer obtained prior to construction / use

a. Safe Use of Ladders:

i. Fall protection is required when working on a ladder above 2 meters and when climbing above nearby guardrails.

ii. Ladders must be inspected prior to use and by a competent person quarterly, with documentation.
iii. Use portable ladders for height up to 4 M only
iv. Provide fixed ladders for height above 4 M
v. Place the ladder at an angle of 75 degrees (approx.) from the horizontal (1:4)
vi. Extend ladder at least 1 M above the top landing
vii. Secure top and bottom of the ladder firmly to prevent displacement- anti skid lining at the bottom
viii. Ensure that the width of the ladder is not less than 300 mm and distance between rungs is not more than 300 mm
ix. Provide landings of minimum size 600 x 600 mm at intervals not more than 6 M for fixed ladders. Check the ladders daily for any defects
x. Ensure that the areas around base and top of the ladder are clear. Getting on and off the ladder is more hazardous than using it. Use a mudsill if the ladder is to rest on soft, lose or rough soil
xi. Do not use ladders of conducting material near power lines, and only use ladders near power line or other energize system with exposed parts if they are confirmed locked-out and de-energized.
xii. Stand no higher than the fourth rung from the top for carrying out any job standing on a ladder.
xiii. Never reach out from a ladder to perform work where your belt buckle protrudes past the ladder rung.
xiv. Always face the ladder while climbing up or down
xv. Maintain three-point contact while climbing up or down a ladder i.e. two hands and one foot or two feet and one hand on the ladder at all the times.
xvi. Avoid climbing up or down a ladder while carrying anything in hands. Lift tools, equipment and materials with a rope.
xvii. Work from portable and extension ladders near guardrail where fall expose exists over the guardrail regardless of height, and above 2.0 mtr. heights from the working/walking surface will require the use of personal fall arrest equipment

2. EXCAVATION & CIVIL WORKS

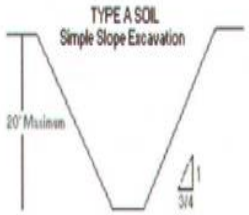
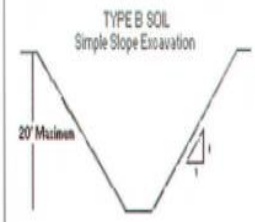
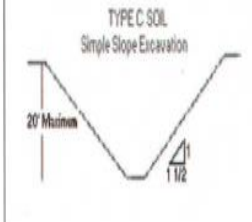
All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

2.1 Excavation

The following safety measures are to be ensured before and during excavation:

a. All Excavation activities more than with depth of 1.22 meter or more shall require and Excavation Work Permit
b. Check for underground utilities like electrical / telephone cables, sewage, water lines and proper care has to be exercised to protect and prevent damage to it.
c. Electrical cables and service lines to be identified using cable detector/locator device before carrying out the excavation work
d. Proper and adequate slope is maintained while excavating
e. Adequate shoring or sheeting is done wherever require to prevent soil sliding
f. Safe access through ladder or steps for exit & entry to excavation
g. No material /excavated soil is kept within one meter from the edge
h. Safe way is planned and provided for movement of HEM /transport equipment near excavation
i. Safety helmet and shoes/gum boots are provided and worn by the workmen at excavation works

j. Dewatering arrangement is made where water seepage is prevailed.
k. Stop blocks are provided to avoid vehicles reversing into the excavated trenches
l. Danger signs /Caution boards are displayed at work spot
m. Hard Barricading is provided at excavated pits. It should be made of scaffolding pipe and clamp with reflective nets.
n. All Excavated area of depth 3mtr or more is to be hard barricaded with pipe.

Soil Type	Height/Depth ratio	Slope Angle
Stable Rock	Vertical	90 deg.
Type A	¾ : 1	53 deg.
Type B	1 : 1	45 deg.
Type C	1½ : 1	34 deg.
		

Determining Soil Type		
Type	Description	Examples
A	Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot or greater.	Clay, silty clay, sandy clay, clay loam and in some cases: silty clay loam and sandy clay loam.
B	Cohesive soils with unconfined compressive strength greater than 0.5 tsf but less than 1.5 tsf.	Angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases silty clay loam and sandy clay loam.
C	Cohesive soils with unconfined compressive strength greater than 0.5 tsf or less.	Granular soils such as gravel, sand and loamy sand; submerged soil or soil from which water is freely seeping; submerged rock that is not stable.

Fig. 3.1 Excavation Reference

2.2 Piling

Ensure the following precautionary measures before starting piling works:

a. Inspection of piling equipment by responsible person for its condition before initiating piling operation.
b. Checklist and OCP for piling to be prepared using manufacturer's instructions and used
c. Testing and its certification wire rope, slings, D-shackles, chain pulley blocks using in the process of piling work by competent person
d. Adequate support and secured foundation of the piling equipment to avoid toppling
e. Hoses should be lashed and adequately secured
f. Proper work platform is to be provided on piling frame
g. Safe work procedures and close supervision to prevent unsafe acts of operators/any unsafe conditions that may arise
h. Only experienced and trained operators are engaged for the piling operation
i. Provision of Personal Protective Equipment (PPE) like safety shoes/gumshoes/safety helmet/safety belt etc. and its use by their workmen.
j. Special care and precautions If work is near electrical live cables/ electrical equipment
k. Cordoning of work area to prevent un authorized entry
l. Guarding of revolving parts
m. Specific measures to prevent over turning of pile driver/missing of hammer/ hammer movement out of range

2.3 Batching Plant Operation

Following Safety considerations for batching plant are to be ensured:

1. Modern type batching plant should be used in which all the moving parts are protected and emergency

and safety features are incorporated.

2. Installation of external Electric moto-vibrators in the feeding hopper of all batching plants to reduce human intervention.
3. Installation of safety devices like pull-chord on both the sides of conveyor for stopping the conveyor in emergency
4. Workers carrying cement / sand to be given appropriate PPEs like respiratory masks & gloves.
5. Conveyor belt/rotating parts must be guarded properly.
6. Safety awareness shall be inculcated in workmen about the risk involved in rotating parts.
7. The agency shall ensure to erect the batching plant as per drawing including installation of all safety devices as provided by manufacturer and witnessed by BHEL Engineer in charge before starting of machine in future.
8. Safety audit to also focus on Batching plant.
9. The site shall impose penalty on the agency who has violated the safety norms as per contract.

2.4 Mobile Plant

Mobile plant includes tractors, trailers, dumpers, excavators, bulldozers, road rollers etc. for earthmoving purpose and concrete mixers, concrete transit mixtures, concrete pumps etc for concreting purpose. Due to the very nature of their function and movement in difficult terrains, congested areas, working in tandem with manual work and other operations the danger is inherent.

Automatic reverse camera with reverse horn connected with reverse gear is compulsory for all moving machineries.

Following Safety measures to be ensured for Mobile Plant:

a. Where movement around site is involved, routes should be planned, obstruction free and well maintained
b. Observe specified speed limits
c. Operating personnel should be aware of associated risks and its preventive measures
d. Only experienced, trained and authorized persons with valid license (wherever applicable) should operate the mobile equipment/vehicles
e. Provide and use Warning lights and reverse horn for cautioning the people around
f. Operation should be on level and stable ground with adequate working clearance.
g. Loading of out riggers/stabilizers should be well within safe ground bearing capacity
h. No person should be on equipment or vehicle during loading and unloading of material
i. Operators should be protected by warning barriers or switching off power when working in close proximity of overhead power lines
j. The equipment /vehicles should be well maintained and provided with effective brake system and other safety devices (wherever require)
k. Rotating parts of equipment should be adequately guarded
l. Provide necessary personal protective appliances and ensure its use by the operating personnel Ensure effective measures at source to control harmful emissions, dust, fumes contaminating atmosphere and cause health hazards to the operators and people in the vicinity.
m. No overloading/over stressing of vehicles/plant is allowed
n. Hoses, pipes, receivers, gauges and valves involved in carrying out hydraulic fluid/ compressed air should be checked for leaks and tested prior to operation.

o. Adequate safe clearance for swing and movement is to be judged during operation of Concrete mixer
p. Setting of machines on firm and level ground with wheel locked to prevent movement of machine
q. Proper instructions and Special precautions are to be ensured to prevent entry in to the danger zone of projectile of bucket while dropping bucket
r. Operator leaving work spot should ensure that the equipment/vehicle is kept in neutral position and place on firm and level ground.
s. The hand brake should be kept in position and block road wheels as additional safety measure
t. Blades/buckets should be kept low while moving
u. The dozer blades should not be used as brakes except in emergency
v. The ground should be examined for its bearing capacity and general safety especially when operating road roller at the edges of slopes, embankments.
w. The roller should not be moved downhill with the engine out of gear
x. If operating near excavations the following precautionary measures are to be ensured
y. Barricading, edge protection to prevent fall of persons/vehicles over running while reversing etc.
z. Suitable support system and adequate allowance to avoid the danger of side collapsing
aa. Experienced signaler /attendant should be always accompanied with operator/driver for proper direction /signal and also to caution others in the working Zone during operation of mobile plant

2.5 Concrete Vibrators

a. Revolving parts/belt drives should be adequately guarded and Vibrating unit shall be completely enclosed and have suitable overload relays and effectively earthed
b. Ensure sufficient length of cable to the Vibrator.
c. Ensure electric starters and other accessories are firmly fixed adequately supported
d. Ensure locking of needle load while inserting needle in to the vibrator,
e. Ensure periodical lubrication and maintenance

2.6 Concrete Mixers

a. Setting of machines on firm and level ground with wheel locked to prevent movement of machine
b. Proper instructions and Special precautions are to be ensured to prevent entry in to the danger zone of projectile of bucket while dropping bucket

3. WELDING & GAS CUTTING SAFETY (HOT WORK)

a. All Hot Work shall require a Hot Work Permit
b. Inbuilt Voltage Reduction Device (VRD) equipped arc welding machine will only be allowed for work.
c. There shall be flash-back arrestors conforming to IS-11006 at both cylinder and burner ends. Damaged tube and regulators must be immediately replaced.
d. All safety precautions shall be taken for welding and cutting operations as per IS-818.
e. When possible, items to be welded, cut, heated, etc. shall be moved to a safe location free of combustible or flammable material. If this is not possible, then all combustibles/ flammables that can be removed from the area shall be removed within a 35-foot circumference and a positive means of confining arcs and sparks generated by the process shall be ensured and additional person(s) shall be stationed as fire-watch for the area(s) still exposed, along with obtaining the Hot Work Permit as applicable.
f. Appropriate fire-fighting equipment is to be available in close proximity of any welding and gas cutting operations at all times suitable for the type of Fire.

g. Drums, tanks, and similar containers that have contained flammable or toxic material shall not be welded, cut, or heated until they have been made safe by water filling, thorough cleansing or similar accepted practices. The container shall also be ventilated during the welding, cutting, or heating process.
h. Proper ventilation is required for any welding or torch operations performed in a confined space.
i. Any welding or gas cutting operations performed on metals of toxic compounds or coating such as zinc, stainless steel, lead, cadmium, chromium, and beryllium shall be properly ventilated and/or proper respiratory protection shall be worn by any person that could be exposed to fumes, vapors, and gasses created by the welding and gas cutting processes.
j. Wherever it is practical, all arc welding operations shall be shielded to prevent direct light rays or sparks from contacting persons in the vicinity or from reaching areas normally used to travel through or into the vicinity. Where this is not practical, persons who shall be in the area are to use proper eye and skin protection. Other persons who are not participating in the welding or gas cutting operations are not to be allowed into the hazard zone.
k. Welders and other employees who are exposed to arc welding radiation shall wear suitable clothing and protective apparel to prevent burns and other types of ultraviolet radiation damage to the skin.
l. Arc welding machines shall be shut down when being moved or when they are not in continuous use. Electrode holders left unattended shall have electrodes removed and shall not be left where they might contact employees or conducting objects.
m. Arc welding power supply cable shall be of proper rating and material, e.g. copper.
n. Welders shall guard against allowing materials adjacent to or behind them to reflect radiation back toward them or towards others in the area. Reflected radiation can cause skin burns and eye flash burns.
o. Valve caps shall be in place when cylinders are not in use. Valve caps shall never be used for lifting the cylinder vertically.
p. Torches shall only be lit by approved strikers; never with matches, cigarette lighters, or hot-work.
q. Splatter / Slag Collector:

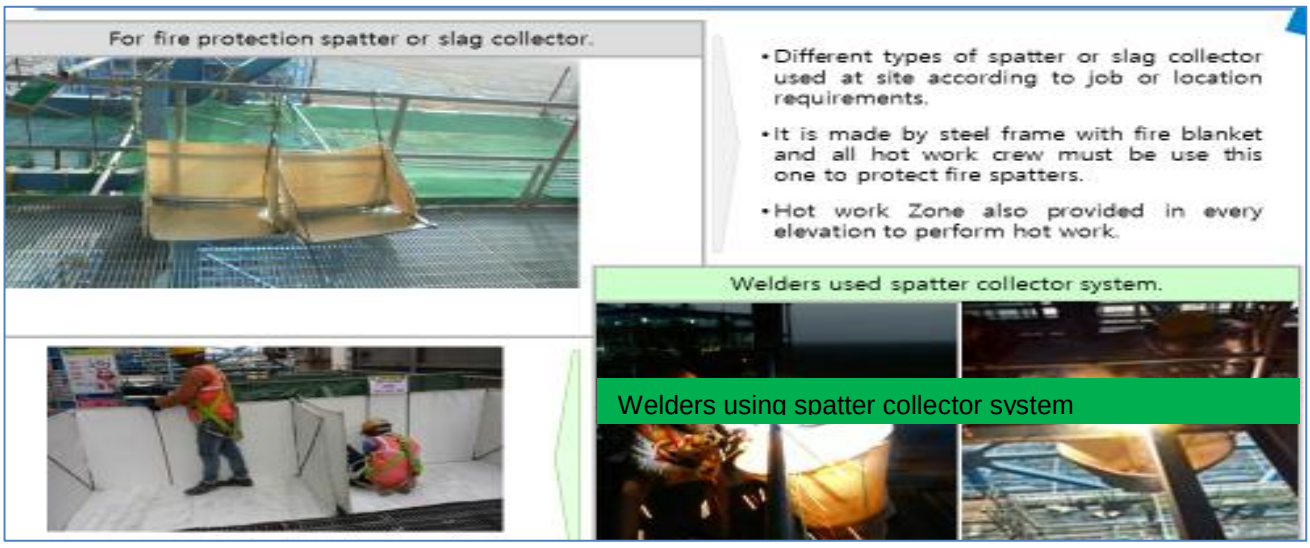


Fig. 4.1 Splatter / Slag Collector

While carrying out job at height, the sparks or molten slag shall be prevented from falling down by putting a fire-resistant (non-asbestos) sheet or patter/ slag collector or even MS Sheet. The passage of falling sparks

or molten slag shall be barricaded till ground floor and any cable/ tubes/ any other objects interfering in the passages hall either be removed or covered with Fire-resistant sheet or MS Sheet.

r. COMPRESSED GAS

i. All cylinder valves shall be closed when any work is finished and when any Cylinders are empty or being moved. Valve protection caps shall be placed and secured properly before gas cylinders are transported, moved or stored.

ii. Compressed gas cylinders shall be secured in an upright position with chain or appropriate means during storage & use. However, a trolley shall be used for transportation.

iii. Compressed gas cylinders shall always be secured from tipping or falling, whether in use, in storage or in transit. The cylinders shall always be secured upright, except during times when actually being hoisted or carried.

iv. When cylinders are transported by powered vehicle they shall be secured in a vertical position.

v. Regulators shall be removed when cylinders are not in use or are in transit, unless the cylinder is firmly secured on a special carrier designed for this purpose.

vi. Gas cylinders are not allowed to be used in man-basket when occupied.

vii. Cylinders containing oxygen or fuel gasses shall not be taken into confined spaces.

viii. Oxygen cylinders shall be stored a minimum of 6 meters from fuel gas cylinders or shall have an approved firewall between them.

ix. All cylinders shall be kept at a safe distance from welding or cutting operations or shielded from arc/ sparks / slag.

x. All cylinders shall be placed where they cannot become part of the electrical circuit.

xi. Oxygen and acetylene shall not be stored together. Oxygen must be separated from acetylene (or ANY fuel gas) or combustible material by at least 20ft or a barrier with a 30-minute fire resistance rating.

xii. All Cylinders should be stored upright in a designated area with labels for the type of gas. All applicable precautions to be ensured during storage

xiii. Oxygen and fuel gas regulators, hoses and associated equipment shall not be altered and shall be in proper working order while in use.

xiv. Compressed air can be extremely dangerous if allowed to penetrate the skin. As such, the use of compressed air to clean off yourself or other workers shall be strictly prohibited.

xv. All gas cylinders shall be stored in upright position. Suitable trolley shall be used for cylinder movement, the design of which shall be submitted to BHEL Engineer for approval.

xvi. No of cylinders shall not exceed the specified quantity as per OCP

xvii. Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dragged, struck or permitted to strike each other violently.

xviii. All cylinder should be kept only in cylinder trolley.

xix. Cylinder shall be transported in upright vertical position by suitable mean.

4. LIFTING & RIGGING SAFETY

a. All Heavy / Complex Lifting operations as defined in Clause 6.12 shall require a Lifting Work Permit. A written rigging procedure and plan must be prepared for all individual heavy/ complex lifting operations.

b. All the cranes and lifting tools & tackles shall be inspected on daily / weekly basis as well as monthly by expert as per applicable formats.
c. In addition, inspection / certification as mandated by law shall be carried out wherein these shall be tested and certificates of fitness shall be obtained from 3rd party State Govt. approved competent agency before deploying at site and later periodically. BHEL shall be given advance intimation of any such inspections
d. The last date of Third-Party Inspection and the next Due date shall be conspicuously displayed on all cranes. A copy of certificate shall be pasted on operator's cabin of all the lifting equipment.
e. Specifically designed heavy steel plates lifting clamps shall be used for lifting heavy metal sheets. Manmade lifting clamp chapa shall not be used for lifting/shifting of plates.
f. Following requirements shall be mandatorily followed, wherever applicable:
    i. The manufacturer's instruction for maintenance shall also be followed. All safety measures shall be followed.
    ii. All tools tackles, lifting appliances; material-handling equipment etc. used by the subcontractor shall be of safe design and construction.
    iii. The operators, slingers and signalers shall be qualified as per IS 13367 (part-1):2003 "Safe use of cranes- code of practices".
    iv. There shall be a person responsible for co-ordination among cranes where multiple cranes are used, and lifting over load chart of the crane to be avoided.
    v. Mobile phone should be banned for crane operator and lifting operation. Only walkie talkie shall be allowed in rigging/Lifting purpose.
g. Lifts/Movements between 5 Tons and 20 Tons:
    i. Shall include a rigging plan, detailing schematic representation of the handling/lifting operations that must be included on the Method Statement.
    ii. When performing similar lifts of identical items, only one rigging plan need be prepared, provided each of the lifts can be performed in accordance with the rigging plan.
h. Lifts/Movements Less Than 5 Tons:
    i. An equipment rigging plan is not required for lifts less than 5 tons, safety measures are covered in the JSA. This could change as per BHEL requirement

i. Personnel Lifts (Man-Basket / Jhoola):

The design of personnel man basket shall be submitted to BHEL Engineer for approval before use. Relevant permit (Height work & others as applicable) shall be completed prior to lifting any people, along with a rigging plan.

i. A separate Lifeline / fall arrestor anchored to a fixed structure outside of Jhoola shall be provided for the workers inside the basket. All occupants of the basket shall have Safety Harnesses equipped with rope grabs, which are to be hooked to the vertical lifeline.
ii. Man-basket shall be used where access through ladders or scaffolding is not feasible.
iii. Man-baskets shall be designed and engineered by a manufacturer (job made man-baskets are not allowed, unless designed and tested by a certified engineer), and built robust with MS Angles and flats or plates or channels only.
iv. Guard rails top and mid, must be in place and screened-in to avoid material from falling out of

basket. The factor of safety shall be 200%.

v. It shall have a door with double latches and shall open inside. Anchor points shall be identified within the man-basket.

vi. The man-basket shall be thoroughly inspected and load tested and a trial run performed without personnel before being put to job.

vii. It shall be treated as a lifting tool (T&P Item) and shall undergo same certification cycle and inspection as other lifting equipment.

viii. An additional sling of required lifting capacity shall be fixed the man-basket main lifting point and attached to the crane above the ball or block.

ix. While lifting man-basket, the crane shall maintain a uniform speed of lift without any swing.

x. Once man-basket reaches the destination, the lift brakes shall be locked as long as the basket
   a. remains at that point. The same care shall be taken in its descent.

xi. As for hanging man-basket, the same shall be hung off a rigid structure with help U-shaped handle welded to man-basket. This shall be tested once in a year by a competent person.

xii. Use of Rebar steel for making and monkey-ladder must be avoided.

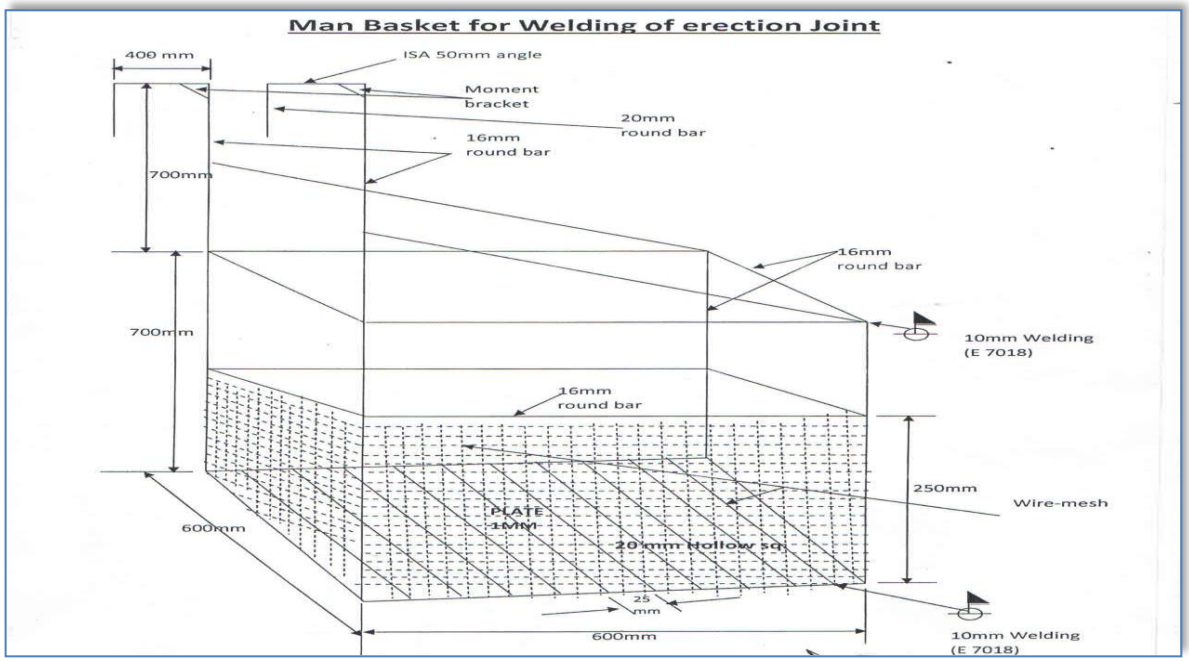


Fig. 5.1 Man Basket for Welding Erection Joint

4.1 Cranes & Hoisting Equipment:

This section provides the guidelines to ensure proper rigging and lifting activities are accomplished safely and in accordance with applicable specifications, codes, and regulations.

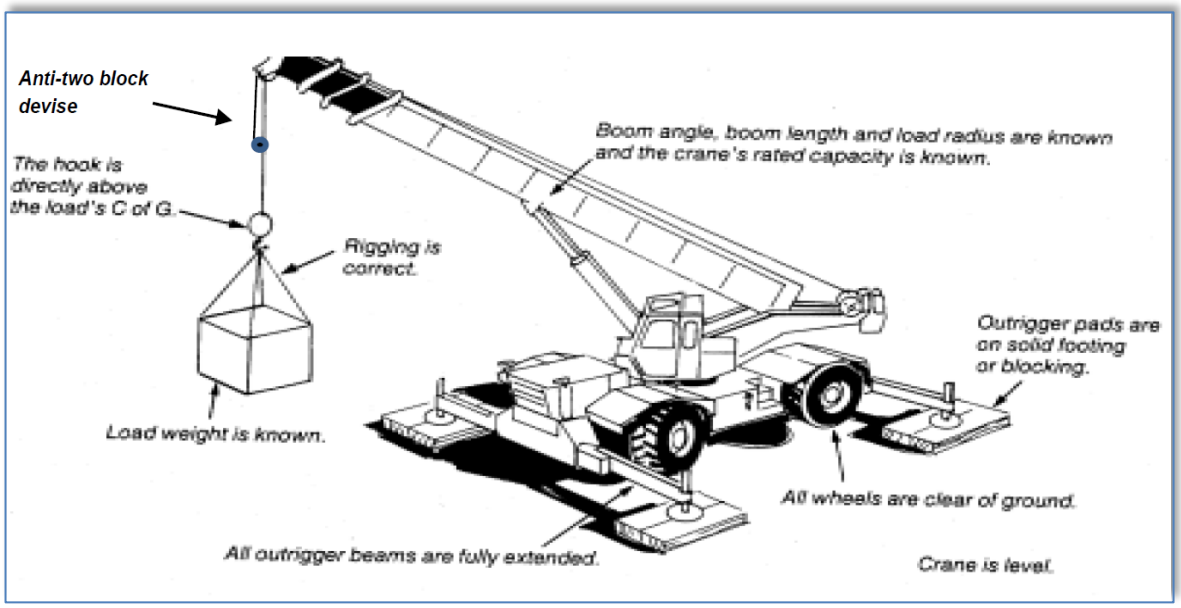


Fig. 5.2 Proper Crane Setup

a. On every crane or piece of hoisting equipment notices of all rated load capacities, recommended operating speeds, and any hazard warnings or special instructions shall be conspicuously posted. All instructions and warning shall be visible from the equipment operator 's station.
b. Cranes shall have an Anti-Two-block safety device installed
c. All mobile cranes shall have overload and backup alarms, load angle indicators and limit switches
d. All areas within swing radius of cranes that are potentially accessible by pedestrian, vehicular, or equipment movement shall be barricaded to prevent anyone or any vehicle or equipment from being struck by the crane or hoisting equipment, or its load(s).
e. No part of the lifting equipment or its load shall be within the distance as specified in the Indian Electricity Act from an energized power line
f. Cranes shall have annual certified third-party inspection and be inspected before use by the operator. Any defects shall be corrected before use. Logs of crane inspection shall be kept with the crane.
g. Make certain that the rigging personnel, material, and equipment have the necessary capabilities for the job and are in safe condition.
h. Communicate with person(s) directly responsible for accomplishing the work and / or work area to establish requirements/responsibilities and make certain that all preparatory work is complete.
i. Mats/Pads must be used on all lifting equipment, equipped with out riggers.
j. Pick and carry must have the load secured to the rig in front.
k. Only BHEL Approved Plate Lifting Spreader Beam configuration shall be used (Sample in Fig. 11.3.5.3)
l. Crane operators must follow the following:
    i. Pass an annual Operator's Physical examination
    ii. Carry a valid training certification card at all time while operating issued by the Govt. or other recognized institute.

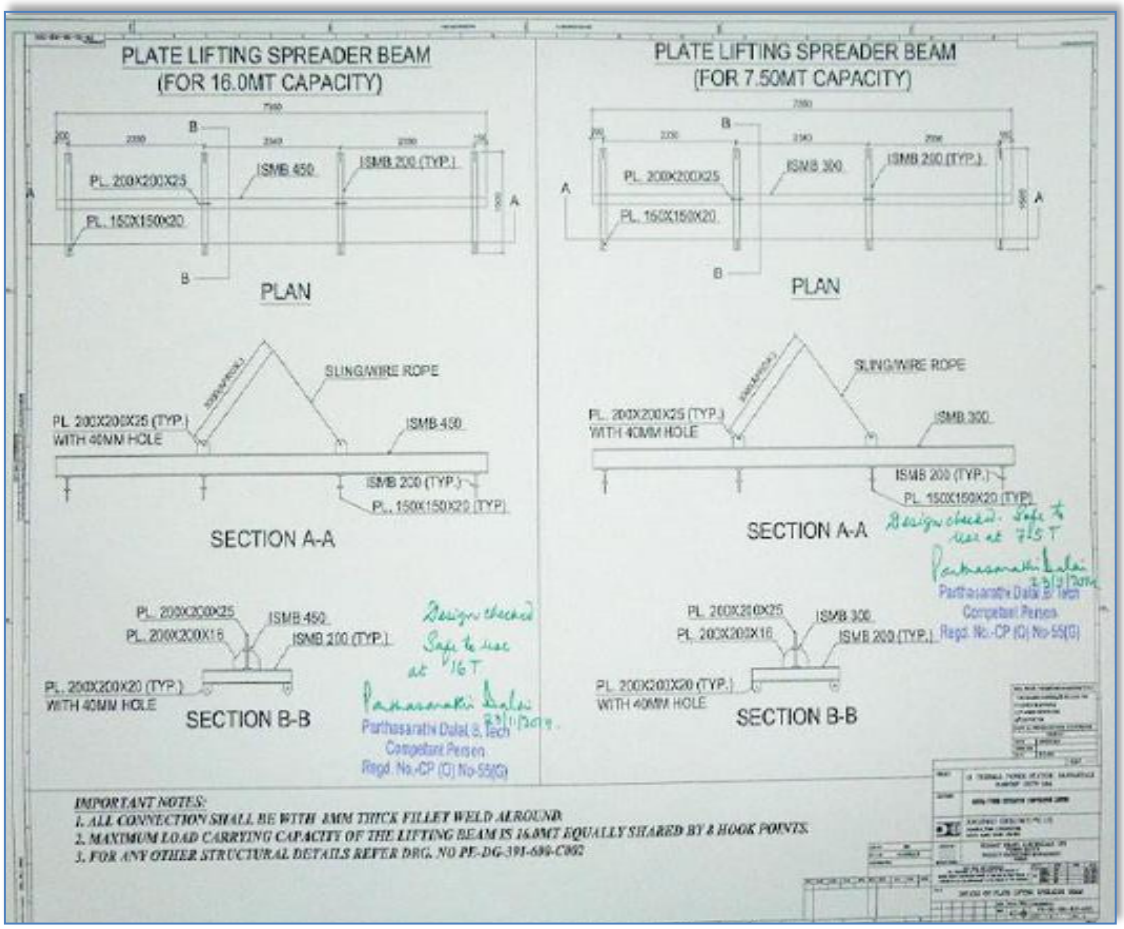


Fig. 5.3 Typical Plate Lifting Spreader Beam Configuration for 7.5 MT and 15 MT Loads

m. Safe Rigging Practices

i. Review the planned operation and requirements with the operator and rigging crew.

ii. Ensure a pre-lift meeting is conducted with crane operator, tagline operator, signal personnel, and Safety Manager.

iii. Designate a qualified person from the rigging crew to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desire clearance by visual means.

iv. Clear the lift area of all unnecessary personnel.

v. Hydras shall only be allowed for loading & unloading works & shall not be allowed to move with load

n. Rules for Safe Rigging

i. Use loops, thimbles and corner pads to prevent damage to slings when used around corners or on cutting edges.

ii. Never allow wire rope to lie on the ground for any length of time or on rusty steel or near solvents, chemicals or corrosive substances.

iii. Slings must not be pulled from between or under loads with load resting on the sling.

iv. Keep all rope away from flame cutting or welding operations.

v. Never use rope as sling material.

vi. Never wrap a wire rope completely around a hook.

vii. Do not bend wire rope near any attached fitting.

viii. The sling must be selected to suite the most heavily loaded leg rather than the total weight when using multi-legged sling to lift loads in which one end is heavier than the other.

ix. When using 3 and 4-legged sling configurations, any two legs must be capable of supporting the entire load.

x. Where possible, wire rope choker hitches must include a shackle with the eye around the shackle pin to prevent breaking wires of the choke. The choker hitch must be “snugged down” prior to lifting, not after tension is applied.

xi. Unless authorized by the hook manufacturer when more than two rope eyes are placed over a hook, install a shackle, pin resting in the hook, and place the rope eyes in the bowl of the shackle.

xii. Properly rig all loads to prevent dislodgment of any part.

xiii. Use guide ropes or tag lines to prevent the rotation or uncontrolled motion of the load when necessary.

xiv. Loads must be safely landed and properly blocked before being unhooked and unslung. Tag lines must not be used in situations that jeopardize the safety of the lift.

xv. Lifting beams must be plainly marked with their weight and designed working load and must only be used in the manner for which they were designed.

xvi. The hoist rope or chain must never be wrapped around the load. The load must be attached to the hook by slings or other rigging devices that are adequate for the load being lifted.

xvii. Multiple part lines must not be twisted around each other.

xviii. The hook must be brought over the center of gravity of load before the lift is started.

xix. If there has been a slack rope condition, determine that the rope is properly seated on the drum and in the sheaves prior to lifting.

xx. Keep hands away from pinch points as the slack is being taken up.

xxi. Leather gloves are recommended when handling wire rope.

xxii. Avoid impact loading caused by sudden jerking when lifting or lowering. Lift the load gradually until the slack is eliminated.

xxiii. Never ride on a load that is suspended.

xxiv. Avoid allowing the load to be carried over the heads of any personnel.

xxv. Never work under a suspended load until the load has been adequately supported from the floor and all conditions have been approved by the supervisor in charge of the operation.

xxvi. Never leave a load suspended unless emergency evacuation is required.

xxvii. Never make temporary repairs to sling.

xxviii. The capacity of a sling is determined by its angle, construction, type of hitch and size.

xxix. Never lift loads with one leg of a multi-leg sling until the unused legs are made secure.

xxx. Never point load a hook unless it is especially designed and rated for such use.

xxxi. Make certain that the load is broken free before lifting and that all legs are taking the load.

xxxii. When using two or more slings on a load make certain all slings are made from the same materials.

xxxiii. Lower the loads on to adequate blocking to prevent damage to the slings.

xxxiv. Materials and equipment being hoisted must be loaded and secured to prevent any movement which could create a hazard in transit.

xxxv. The weight of the hook, load block and any material handling devices must be included when determining crane capacity.

xxxvi. Calculated weights cannot exceed load chart without written approval.

xxxvii. Personnel must be completely clear of loads being picked up or set down by crane. Tag lines will be used to control the loads. Loads must not be touched by hand while placing/ moving.

o. <u>Slings</u>

The following are rules for safe use of synthetic slings:

i. Synthetic slings must be marked to show the rated capacity for each type of hitch and type of web material.

ii. Nylon web slings must not be used where fumes, vapors, sprays or mists or liquids of acids or phenolic are present. Web slings with aluminum fittings must apply in this category.

iii. Synthetic web slings must be removed from service and destroyed if any of the following conditions are present:

a. Acid or caustic burns
b. Melting or charring of any part of the sling surface
c. Snags, punctures, tears or cuts
d. Broken stitches
e. Distortion of fittings
f. Synthetic web slings of polyester or nylon must not be used at or come in contact with temperatures in excess of 82°C
g. Polypropylene web slings must not be used at or come in contact with temperatures in excess of 93°C
h. Insulated hooks must be tested yearly to ensure insulation integrity to at least manufacturer's specifications.

p. <u>Wire Rope Slings must be removed from service and destroyed if any of the following conditions are present:</u>

i. In (10) randomly distributed wires broken in one (1) rope lay, or five (5) broken wires in one (1) strand in one (1) rope lay.
ii. Wear or scraping of one-third the original diameter of outside wires.
iii. Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure such as:
iv. Evidence of heat damage.
v. End attachments that are cracked, deformed worn.
vi. Corrosion of the rope or end attachments.

q. <u>Metal mesh slings must be immediately removed from service if any of the following conditions are present:</u>

i. A broken weld or broken brazed joint along the sling edge.
ii. Reduction in wire diameter of 25 percent due to abrasion or 15 percent due to corrosion.
iii. Lack of flexibility due to distortion or corrosion.

r. <u>Requirements of Plate Clamps:</u>

i. The rated load of the plate clamp must be marked on the main structure.

ii. Care must be taken to make certain the load is correctly distributed for the plate clamp being used.

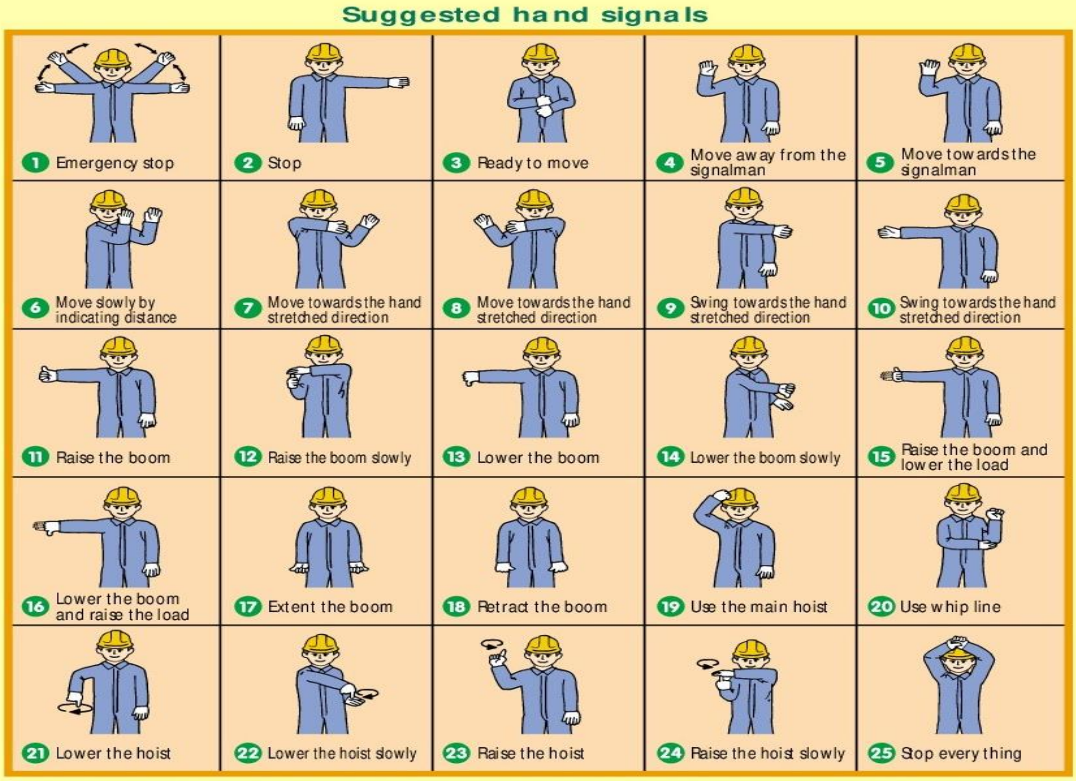
iii. Do not allow load or plate clamp to come into contact with any obstruction.

iv. The plate clamp must not be used for side pulls or sliding the load.

v. When lifting stainless steel or special alloys, ensure plate clamp is designed for use on the specific metal.

s. <u>Signaling Practices:</u>

- The "slinger" is responsible for attaching and detaching the load to and from the crane. He shall:
  - have received appropriate training on general safe lifting operations;
  - be capable of selectings lifting gears suitable for the loads;
  - liaise with the operator and direct the movement of the crane safely.
- The "signaller" is responsible for relaying the signal from the slinger to the crane operator. He shall:
  - have received appropriate training on general safe lifting operations;
  - be able to direct the movement of the crane and loads.



<u>Fig. 5.4 Recommended Signaling Practices</u>

5. DEMOLITION WORK

Before any demolition work is commenced and also during the process of the work the following shall be ensured, besides using the Work Permit:

a. All roads and open areas adjacent to the work site shall either be closed, suitably protected or restricted for movement

b. No electric cable or apparatus which is liable to be a source of danger nor a cable or an apparatus used by the operator shall remain electrically charged.

c. All practical steps shall be taken to prevent danger to persons employed from the risks of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render them unsafe.

6. T&PS GENERAL

a. All T&Ps/ MMEs should be of reputed brand/appropriate quality & must have valid test /calibration certificates bearing endorsement from competent authority of BHEL.
b. Subcontractor to also submit monthly reports of T&Ps deployed and validity test certificates to BHEL safety Officer as per the format/procedure of BHEL.
c. Tagging and punching in all lifting tool is compulsory with SWL, sr. no. and due date.
d. All T&Ps shall be inspected by authorized Third Party agency as per applicable frequency. BHEL shall be kept informed of any such scheduled inspection
e. All T&Ps shall be internally inspected in each quarter and colour coded.

7. CHEMICAL HANDLING

a. Displaying safe handling procedures & MSDS for all chemicals such as lube oil, acid, alkali, sealing compounds etc. at work place.
b. Where it is necessary to provide and/or store petroleum products or petroleum mixture & explosives, the subcontractor shall be responsible for carrying out such provision / storage in accordance with the rules & regulations laid down in the relevant petroleum act, explosive act and petroleum and carbide of calcium manual, published by the chief inspector of explosives of India. All such storage shall have prior approval if necessary from the chief inspector of explosives or any other statutory authority. The subcontractor shall be responsible for obtaining the same.
c. The used containers of chemicals shall be segregated and disposed of suitably
d. In case the used containers need to be re-used, all traces of the chemical to be removed by thorough cleaning with detergents etc. under trained supervision

8. ELECTRICAL SAFETY

a. Only electricians licensed by appropriate statutory authority shall be employed by the subcontractor to carry out all types of electrical works. The subcontractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installations.
b. No PDB or any other distribution board shall be more than 03 (three) years of purchase. Only modern PDB with industrial sockets as shown in layout below to be allowed to use at site.
c. Power supply to all equipment at site to be routed through MCBs of appropriate rating. A 'Power Supply Distribution Plan' shall be prepared and submitted to BHEL Engineer for approval
d. All power supplies through cables shall be underground or overhead with height > 3mtrs.
e. All power distribution boxes shall be locked and the key controlled by site management of concerned subcontractor.
f. All individual equipment & tools at site shall be powered through Earth Leakage Circuit Breakers of 30 mA sensitivity.
g. These MCBs and ELCBs shall be regularly tested as per Clause 14
h. All fuses and fuse wires shall be of standard size and rating.
i. All electrical appliances used in the work shall be in good working condition and shall be properly double earthed other that armour earthling.

j. All extension boards shall have separate switches for all sockets / connections.

k. All portable electric tools used by the subcontractor shall have safe plugging system (industrial top & socket) to source of power and be appropriately earthed.

l. Providing adequate no. of 24 V sources and ensure that no hand lamps are operating at voltage level above 24 Volts especially in confined spaces like inside water boxes, turbine casings, condensers etc.

m. Electrical appliance shall have proper earthing and for appliances equal to & more than 415V shall have two separate earthing (as per IS-3043-1987)

n. Portable Electric Lights

i. Portable electric lights used in wet or potentially wet locations must be either low voltage type (24 volts or less) or protected by a GFI (ground fault interrupter).

ii. They must be visually checked before each use and periodically while in use to assure their original integrity is maintained.

iii. Cords with cuts, breaks, deep abrasions, etc. shall be taken out of service immediately.

iv. Repairs to extension cords shall only be performed by qualified/ licensed electricians.

v. Must not be allowed to lie in wet or potentially wet areas.

o. Underground Cables:

i. Every electric line or cable of unknown origin that is discovered or exposed during a digging, drilling, probing, or similar operation is to be considered as energized and life threatening.

ii. The senior company employee on the site will ensure that all necessary safety precautions are taken in order to isolate the line from all workers and the public.

iii. Such precautions may include halting the operation if appropriate.

iv. The senior company employee on the site is to then contact the proper authorities to have the line identified and either confirmed to be abandoned and/or made safe for continuing the work.

v. Any and all underground lines that are discovered or become severed must be considered energized on both sides, and be treated accordingly.

p. Details of earth resource and their test date to be given to BHEL safety officer as per the prescribed formats of BHEL

q. The subcontractor shall use only properly insulated and armoured cables and conform to the requirement of Indian Electricity Act and Rules for all wiring, electrical applications at site.

r. BHEL reserves the right to replace any unsafe electrical installations, wiring, cabling etc. at the risk & cost of the subcontractor.

s. No maintenance work shall be carried out on live equipment

t. Adequate precautions shall be taken to prevent danger for electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public

u. The subcontractor shall carefully follow the safety requirement of BHEL/ the purchaser with the regard to voltages used in critical areas.

v. Wiring and Branch Circuits Must be protected by a proper amperage over-current device such as a HRC fuse or circuit breaker. Such installations must be located so as to prevent physical damage to the wire conductors & panels.

w. The sub-contractor shall supply modern power distribution board of different combination (1-phase & 3-phase). All the distribution of power should be through modern PDB. Equipment drawing is mentioned below.

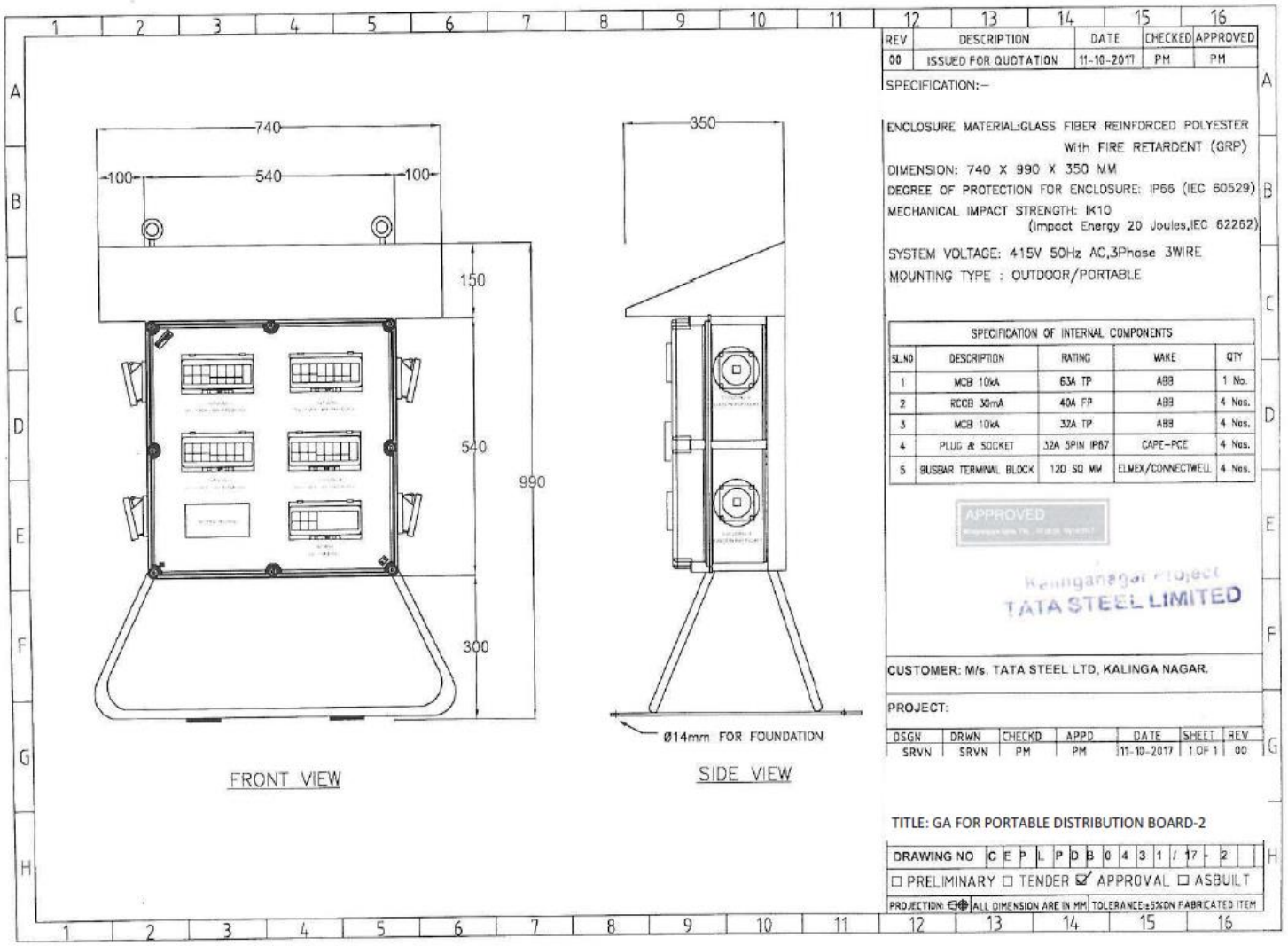


Fig. 9.1 Layout of a modern Power Distribution Board

x. General Electrical Safety

i. In general, equipment or machinery being moved or transported must maintain minimum clearances of 25 ft. to all power lines.

ii. TAG IN/ TAG OUT must be in force in Switch Room and all Distribution Boxes for live power line. The authorized person's name and contact no shall be displayed

iii. Ensure "double insulated" three - core cables and three pin connectors are used and are properly ground "all insulated" types, all electrical tools and appliances must be manufactured for industrial use.

iv. All connections shall be electrically and mechanically sound and properly insulated. Taped joints are not permitted. Connections to socket outlets must be made with proper plugs (industrial top and socket).

v. Splices in electrical cords are not permitted. Repairs must be made at the socket connection and retain the same mechanical and dielectric condition of the original connection.

vi. Damaged or defective electric tools, equipment and extension cords, etc. must not be used and shall be tagged out of service, removed from the work area and taken back to stores.

vii. Only licensed electricians are authorized to repair and work on electrical equipment. Tampering with electric tools or equipment by others could result in termination.

viii. Temporary electric cabling should be elevated 2.2 meters above the floor/ground or covered for protection. It must be kept clear of walkways and other locations where it may be exposed to damage or create a tripping hazard.

ix. Energized wiring in junction boxes, circuit breaker panels and similar places must be covered and locked at all times.

x. Areas with live high voltage wires or terminals must be barricaded against entry and warning signs posted Danger – High Voltage and Authorized Personnel Only.

xi. Personnel should never work on energized equipment, de-energizing (lockout/tag out) the equipment is always the first requirement.

xii. The lockout and tag out procedure will be used when testing or working on, or around, energized installation.

xiii. Working around energized equipment should never be done alone. A second electrician must always be available for assistance.

xiv. If lockout/tag out of the work is infeasible (must be demonstrated), work on energized electrical circuits must be approved by the Site In-charge. All safety precautions necessary must be taken, PPE use must be evaluated per the exposure and used, i.e high/low voltage gloves, insulated shoes, overcoats/aprons, face shields, and other protective equipment like insulated tools, blankets, mats, etc. must be used.

xv. The welding machines earth leads shall be properly fixed without loose contacts. The earth cable only has to be used. No steel members shall be used as earth leads.

xvi. Electrical crews must be qualified for the equipment and tools they work on, including being trained in Cardio-Pulmonary Resuscitation (CPR) methods and First Aid for rendering help in the event of electric shock.

y. Qualified Persons for Electrical Works

(One who is trained and wiremen licensed to Govt. of Respective State and familiar with the construction, operation and safety hazards of the equipment upon which they are permitted to work.)

i. Qualified persons are intended to be only those who are well acquainted/experienced with and thoroughly conversant in the electric equipment and electrical hazards involved with work being performed.

ii. Only qualified persons may be permitted to work on or near exposed energized parts. Such persons are required to have been trained in three specific areas:

iii. Qualified persons must be capable of working safely on energized circuits;

iv. Must be familiar with the proper use of special precautionary techniques and procedures bases on equipment and exposure; and

v. Must be familiar with required personal protective equipment, insulating and shielding materials, and insulated tools.

vi. Qualified persons are expected to be able to evaluate unknown situations and adjust their activities in such a way that only safe work practices are used. Such behavior is the responsibility of the qualified person.

vii. It is possible and likely for an individual to be 'qualified' with regard to certain equipment in the work place, and unqualified on other equipment they must know their limitation and stop work if not qualified on what equipment they were to work on.

viii. An employee who is undergoing on-the-job training, who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training, and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties. The process must be documented as proof.

z. Mandatory PPEs of electrical work on LV & HV

i. HV arc flash suit with protective hood (for protection of face and head) as specified for hazard risk category-4 in NFPA-70E or similar IS specification for working on HT switch gear (for all voltage >690 V) to the concerned licensed electrician or competent person.

ii. LV arc flash jacket/FR as specified for hazard risk category-4 in NFPA-70E or similar IS specification having ATPV rating of 8.5 to 9 cal/cm2 for working on LV (>260V and <=690V) to the concerned licensed electrician or competent person.



iii. The LV arc flash jacket as shown above shall be worn continuously while working on LV (>260V and <=690V). The color specification of LV arc flash jacket should be blue.

iv. Electrical hand gloves should have following specification: Flame resistance, arc flash and cut protection of voltage rating (>260V and <=690V).

v. Electrical safety over shoe of relevant IS make for foot protection of licensed electrician or competent person while working in HV & LV line or equipment.

9. USE OF HAND TOOLS AND POWER-OPERATED TOOLS

a. General Provisions

i. All hands and power tools and similar equipment, shall be maintained in safe condition.

ii. When power operated tools are designed to accommodate guards, they shall be equipped

iii. with such guards, when in use;

iv. Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains and other reciprocating, rotating or moving parts of the equipment shall be similarly guarded;

v. Personnel using hand and power tools and exposed to the hazard of falling, flying, abrasive, and splashing objects, or exposed to harmful dusts, fumes, mists, vapors, or gases shall be provided with the particular personal protective equipment necessary to protect them from the hazards;

vi. All hand-held powered platen sanders, grinders, grinders with wheels of 5 cm or less, routers, planers, laminate trimmers, nibblers, shears, scroll saws and jigsaws with blade shanks of 0.5 cm wide or less shall be equipped with only a positive on-off control.

vii. All hand-held powered drills, tappers, fastener drivers, horizontal, vertical or angle grinders with wheels greater than 5 cm in diameter, disc sanders, belt sanders, reciprocating saws, saber saws and other operating powered tools shall be equipped with a momentary contact on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.

b. Hand Tools

i. The subcontractor shall not issue or permit the use of unsafe hand tools;

ii. Wrenches including adjustable pipe end and socket wrenches shall not be used when saws are sprung to the point that slippage occurs;

iii. Impact tools such as drift pins, wedges and chisels shall be kept free of mushroomed heads;

iv. The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight on the tools.

c. Power Operated Tools

i. Electric power operated tools shall be either of the approved double-insulated type or shall be grounded;

ii. The use of electric cords for hoisting or lowering loads shall not be permitted;

iii. Pneumatic power tools shall be secured to the hose or whip by some positive means to prevent the tool from becoming incidentally disconnected;

iv. Safety clips or retainers shall be securely installed or maintained on pneumatic impact (percussion) tools to prevent attachments from being incidentally expelled;

v. All pneumatically riveting machine staplers and other similar equipment provided with automatic fastener feed, which operate at more than 7 kg/cm2 pressure at the tool a safety device on the muzzle to prevent the tool from ejecting the fasteners unless the muzzle is in contact with the work surface;

vi. Compressed air shall not be used for cleaning purposes except when the pressure is reduced to less than 2 kg/cm2 and that too with effective chip guarding. The 2 kg/cm2 pressure requirement does not apply to concrete form, mill scale and similar cleaning purposes;

vii. The manufacturer's safe operating for hoses, pipes, valves, filters and other fittings shall not be exceeded;

viii. Only personnel who has been trained in the operation of the particular tool shall be allowed to operate power-actuated tools;

ix. The tool shall be tested each day before loading to see that the safety devices are in proper working condition. The method of testing shall be accordance with the manufacturer's recommended procedure;

x. Any tool found not in proper working order, or that which develops a defect during use, shall be immediately removed from service and not used until properly repaired;

xi. Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any other person. Hands shall be kept clear of the open barrel end;

xii. Loaded tools shall not be left unattended;

xiii. Fasteners shall not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tiles, surface hardened steel, glass block, live rock, face brick or hollow tiles;

xiv. Driving into materials that can be easily penetrated shall be avoided unless backed by a

xv. substance that will prevent the pin or fastener from passing completely through and creating a flying missile hazard on the other side;

xvi. No fastener shall be driven into a palled area caused by an unsatisfactory fastening;

xvii. Only non-sparking tools shall be used in an explosive or flammable atmosphere;

xviii. All tools shall be used with the correct shield, guard or attachment as recommended by the manufacturer.

d. Abrasive Wheels and Tools

i. All grinding wheel must be ISO certified only.

ii. All grinding machines shall be supplied with sufficient power to maintain the spindle speed at safe levels under all conditions of normal operation;

iii. Grinding machines shall be equipped with suitable safety guards;

iv. The maximum angular exposure of the grinding wheel periphery and sides shall not be more than 900, except that when the work requires contact with the wheel below the horizontal plane of the spindle, the angular exposure shall not exceed 1200. In either case, the exposure shall begin not more than 8.650 above the horizontal plane of the spindle. Safety guards shall be strong enough to withstand the bursting of the wheel;

v. Floor and bench-mounted grinders shall be work-rests, which shall be rigidly supported and readily adjustable. Such work-rests shall be kept at a distance not to exceed 5 mm from the surface of the wheel;

vi. Cup type wheels used for external grinding shall be protected by either revolving cup guard or a band type guard;

vii. When safety guards are required, they shall be mounted as to maintain proper alignment with the wheel and the guard and the guard and its fastening shall be adequate strength to retain the fragments of the wheel in case of incidental breakage. The maximum angular exposure of the grinding wheel periphery and sides shall not exceed 1800;

viii. Portable abrasive wheel used for internal grinding shall be provided with suitable safety flanges;

ix. When safety flanges are required, they shall be used only with wheels designed to fit the flanges. Only safety flanges, of a type and design and properly assembled so as to ensure that the pieces of the wheel will be retained in case of incidental breakage, shall be used;

x. All abrasive wheels shall be closely inspected and ring tested before mounting to ensure that they are free from cracks or defects;

xi. Grinding wheels shall fit freely on the spindle and shall not be forced on. The spindle nut shall be tightened only enough to hold the wheel in place;

xii. All employees using abrasive wheels shall be protected by suitable eye protection equipment.

e. Wood Working Tools

i. All fixed power-driven woodworking tools shall be provided with a disconnect switch that can either be locked or tagged in the off-position;

ii. The operating speed shall be attached or otherwise permanently marked on all circular saws over 0.5 m in diameter or operating at over 3000 peripheral rpm. Any saw so marked shall not be operated at a speed other than that marked on the blade. When a marked saw is re-tensioned for a different speed,

the marking shall be corrected to show the new speed;

iii. Automatic feeding devices shall be installed on machines wherever the nature of the work will permit. Feeder attachments shall have the feed rolls or other moving parts covered or guarded so as to protect the operator from hazardous points;

iv. All portable power-driven circular saws shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to the covering position.

10. START UP, COMMISSIONING AND TESTING:

There are various activities involved prior to commissioning- the major ones are -Hydraulic Test, Steam Blowing, Transformers Charging, Boiler Light Up, Rolling and Synchronisation and Full loading of unit.

a. These activities shall be personally supervised by the site executive along with the commissioning engineer.
b. Appropriate Work Permits shall be taken as applicable
c. The readiness of upstream and downstream system shall be ensured before taking up.
d. These shall be handled strictly by the authorized persons only and the team shall be suitably briefed about the activity including hazards & risks involved and control plan by the concerned executive-in-charge before start.
e. Entry of persons to the area of activity shall be suitably restricted and the emergency functions like Ambulance, first aid center and Fire station shall be intimated about the plan well in advance.
f. Tag-in/ Tag-out shall be in place while charging transformer and whenever necessary.
g. Electricians with valid wiremen license only shall be permitted to work on power lines.
h. The area and the passage shall be adequately illuminated.

11. FIRE SAFETY

a. The Fire Prevention, Protection and Preparedness Program is an integral part of the overall HSE Program. Effort and consideration must be given to safety, life and potential for delays in construction schedules and plant startup, as well as protection of property on a given project. The purpose of which is to prevent
    i. Inception of fire
    ii. Loss of life or personal injury
    iii. Loss of Property
    iv. Interruption of operations
b. Site-in-charge / Safety Officer will make periodical review of the site Fire Protection, Prevention Preparedness Programme, Site conditions and available fire protection equipment. It is very imperative that the Sub-contractors along with BHEL to establish good contact with Local fire station for availability of Fire tender in case of emergencies, in additional to their own fire equipment.
c. Fire Protection, Prevention and Preparedness Inspections - The Contractor /Sub-Contractor will be required to make frequent fire prevention inspections of his work site and operating facilities.
   Deficiencies will be corrected at once.
d. Area where Hot work activities are carried out (Gas cutting / Welding/ any other spark producing work)

above a working spot, a GI / fire-resistant non-asbestos sheet or suitable material shall be placed to prevent the fall of hot sparks. A bucket of water shall be kept nearby while doing hot work

e. Hot work shall be preferably carried out in a designated area with a standing Hot Work Permit, to be renewed monthly. The designated area shall have fire extinguishers.
f. Any hot work outside designated area shall require a Hot Work permit and fire watch. No flammable material shall be stored within 35 feet from any fire load.

12. PAINTING:

a. Requirements provide a detailed procedure to be implemented by all concerned employees and sub-contractors involved in painting activities.
b. Significant Environmental Hazards:
   i. Chemical hazard due to inhalation of lead fumes (lead containing paint)
   ii. Chemical hazard due to inhalation of VOC's from paining operations
   iii. VOC's from painting and coating operation
   iv. Disposal of paints and coats drums
c. Control Procedure for Paining:
   i. Chemical products used in painting and coating operation shall have proper MSDS sheet in place. Whenever any doubt arises with respect to handling and safety point of view it should be accessed to all concerned.
   ii. Toxic substances and hazards relate the toxic chemicals shall be identified.
   iii. Proper PPE shall be used including plastic gloves appropriate overall etc.,
   iv. Arrangement for cleaning of spillage shall be ensured
d. Only trained workers shall be allowed and proper training should be imparted to the works.
e. Exposure limits of the toxic substances shall be checked before starting the work and nobody shall be allowed to carry the work beyond the permissible limit.
f. Ventilation or exhaust facility shall be provided at place where painting and coating operations are carried out.
g. Overalls shall be supplied by the contractors/subcontractors to the workmen and adequate facilities shall be provided to enable the painters to wash at the cessation of work.
h. Smoking, open flames or sources of ignition shall not be allowed in places where paints and other flammable substances are stored.
i. A caution board in national /regional language "**smoking strictly prohibited**" shall be displayed in the vicinity.
j. Suitable fire extinguishers/sand buckets shall be kept available at places where flammable paints are stored, handled or used.
k. In case of indoor painting or painting in confined spaces, exhaust ventilating shall be provided. If adequate ventilation is not provided a proper respirator shall be provided and used by persons who are trained and fit tested.
l. The VOC's from painting and coating operations shall not exceed the permissible level of CPCB/ SPCB norms. The paints and coats must be selected as per the guidelines.
m. Workers shall thoroughly wash their hands and feet before leaving the work.

13. "HAZARDOUS ENERGY" CONTROL PROCEDURE/ LOCKOUT/TAGOUT (LOTO)

Hazardous Energy Control Procedures, known as "Lockout/Tagout (LOTO)" refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities.

Contractors must develop and submit a written LOTO program This requires that a designated qualified individual turns off and disconnects the machinery or equipment from its energy source(s) before performing service or maintenance and that the authorized employee(s) either lock and tag the energy- isolating device(s) to prevent the release of hazardous energy and test the machine or equipment to verify that the energy has been isolated effectively.

a. Minimum Requirements:

The following are minimum requirements that must be included in the Contractor's LOTO program:

i. Inspection of equipment by a trained individual who is thoroughly familiar with the equipment operation and associated hazards.

ii. Identification and labeling of lockout devices. Purchase of locks, tags, and blocks Development of a standard written operating procedure, permitted through a controlling authority that is followed by all workers.

b. General Requirements

The following steps must be taken to protect workers that install or service equipment and systems:

Follow the hazardous energy procedures and statutory regulations. Follow the manufacturer's service/repair instructions. Identify and label all sources of hazardous energy. Before beginning work, accomplish the following:

i. De-energize all sources of hazardous energy:

ii. Disconnect or shut down engines or motors.

iii. De-energize electrical circuits.

iv. Block fluid (gas or liquid) flow in hydraulic or pneumatic systems.

v. Block or secure machine parts against motion.

vi. Block or dissipate stored energy.

vii. Discharge capacitors.

viii. Release or block springs that are under compression or tension.

ix. Vent fluids from pressure vessels, tanks, or accumulators—but never vent toxic, flammable, or explosive substances directly into the atmosphere

c. Lockout and tag out all forms of hazardous energy including electrical breaker panels, control valves, etc. Make sure that only one key exists for each of your assigned locks and that access to the key is controlled. Verify by test and/or observation that all energy sources are de- energized.

d. After completion of the work, accomplish the following:

i. Inspect repair work before removing the lock and activating the equipment.

ii. Make sure that only the worker that installed the lock removes his/her assigned lock.

iii. Make sure that all workers are clear of danger points before re-energizing the system.

e. LOTO Procedure

PURPOSE AND SUMMARY

This procedure provides the requirements and responsibilities of Hazardous Energy Control and the process for Lockout / Tag out (LOTO) of energy isolating devices (valves, circuit breakers, disconnect, etc.). Its use

shall ensure that machinery, equipment, or systems are isolated from all potentially hazardous energy to prevent unexpected energization, startup, or release of stored energy which may cause personnel injury or property damage.

This procedure applies to all BHEL personnel and subcontractors working on the WBPDCL (1X660MW) STAGE-III projects where equipment must be taken out of service for the performance of work activities such as installation, maintenance, repair, construction, or equipment removal. The procedure may also be used to isolate equipment of which the energization or operation may present danger to personnel or property.

Lockout / tag out are not required for electrical equipment that can be unplugged from the source and the person performing the work has control of the plug.

This procedure shall be applied to prevent injury or damage caused by the unexpected release of active or stored energy. Hazardous energy sources could be in the form of the following:

- Electrical
- Hydraulic
- Chemical
- Thermal
- Mechanical
- Pneumatic

Preplanning of work activities includes the identification of all potential hazardous energy sources so that they may be properly controlled and isolated, locked, and tagged out.

Prior to initiating work activities on or around locked out / tagged out equipment, the equipment must be tested and tried by or in the presence of the person(s) performing the work activities.

RESPONSIBILITIES

- The Engineers in Charge is responsible for implementing and enforcing this procedure and approving lockouts /tag outs that impact the operation of the project.
- The Engineer in Charges responsible for authorizing Lockout /Tag out Requests.
- The Lockout / Tag out Coordinator is responsible for maintaining the Lockout / Tag out Log. Each shift should have a designated Lockout / Tag out Coordinator.
- The Isolator is responsible for determining the proper isolation devices and device positions required to isolate all potential energy sources so that the work stated on the Lockout /Tag out Request Permit may be safely performed. The Isolator must be familiar with the equipment and energy type(s) that require isolation. For this reason, in some cases the Isolator may be more than one person (i.e. Engineer, System Operator and/or Electrician). The Isolator shall position the specified device points, and apply locks and tags, and sign the tags and the LOTO Permit isolation point blocks.
- The Safety Manager is responsible for conducting an annual audit that is documented to ensure all procedures and requirements are current and being followed as written.

DEFINITIONS

Affected Employee: -

An employee whose job requires him/her to operate or use machinery or equipment on which servicing or maintenance is being performed under a lock out/tag out procedure or whose job requires him/her to work in an area in which servicing or maintenance is being performed under a lockout/tag out procedure

Authorized Employee: -

An employee who implements a lockout/tag out procedure on machinery, equipment, or systems in order that servicing or maintenance may be performed. Often an authorized employee and an affected employee may be the same person.

Danger "Do Not Operate" Tag

A tag used to identify energy isolation devices and specify the required position of the device. The tag should be affixed to the isolation device such that it is in plain view of anyone attempting to operate the device. The tags shall be sequentially numbered and shall specify the lockout/ tag out request number. The tag shall also state the purpose, and the expected duration of the lockout /tag out

Isolation Device

A device that is designed and intended to prevent the passage of energy. These devices, usually located at the energy source, are typically valves, circuit breakers, etc. Isolation devices should have a means of being locked in position

Lockout Device

A device that uses a positive physical means such as a lock, either key or combination type to maintain an energy isolation device in the safe position and prevent the in advertent energization of machinery, equipment, or systems. Device locks should serve no other purpose other than hazardous energy control isolation

Lockout Tag out Request Permit

A pre-numbered form used to request that machinery, equipment or systems be taken out of service. A Lockout/Tagout Request Permit may be initiated by any one requiring energy isolation for work activities or for taking faulty equipment out of service

Lockout / Tag out Request Log

A record of all Lockout /Tag out Request Permits shall be maintained by the Lockout /Tag out Coordinator.

PROCEDURE

1. REQUESTING A LOCKOUT / TAGOUT PERMIT

When machinery, equipment, or systems are partially or completely taken out of service for work activities or equipment protection, a lockout / tag out shall be requested. The requestor shall be familiar with scope of work required and shall provide a brief description of the work on the Lockout / Tag out Request Permit. The requestor shall also provide the proposed start time and estimated duration of lockout / tag out. If familiar with the machinery, equipment, or system to be taken out of service, the requestor may identify the devices that are required to be isolated. The LOTO Request Permit shall be forwarded to the Authorized Lockout / Tag out Coordinator for reviewed and signature, along with Permit to Work number to be entered on the LOTO Request Permit.

a. The Lockout / Tag out Coordinator shall record the necessary information on the Lockout / Tag out Request Log and forward the request to the Engineer in Charge for approval.
b. The Safety Manager or Engineer in Charge shall review the Lockout / Tagout Request Permit for impact on project operations. Project operations could be impacted by the equipment being taken out of service or by the required isolation to take the equipment out of service. If project operations are impacted by the Lockout / Tagout, the request shall be forwarded to the Engineer in Charge for approval.
c. The Engineer in Charge shall provide the lockout / tag out isolation points necessary to perform the task stated on the request. The device identification, device location, device position, and locking mechanism

shall be entered into the appropriate blocks on the Lockout / Tag out Request Permit.

d. The Engineer in Charge indicates approval of the Lockout / Tagout Request Permit by signing in the appropriate space on the request. If the Lockout /Tag out Request Permit is rejected, the Engineer in Charge shall return it to the requestor, via the Lockout / Tagout Coordinator with a written explanation of the rejection.
e. Once approved, the Lockout / Tag out Request Permit shall be forwarded to the Lockout / Tag out Coordinator to assign tags and locks.
f. The log shall show current status of all Lockout / Tag out Request Permits from submittal to approval, through lifting of locks and tags to final closeout. The log shall be maintained by the Lockout / Tag out Coordinator in their office.

2. PLACEMENT OF LOCKS AND TAGS

a. The tags shall be filled out to match the information on the LOTO Request Permit. Appropriate locks for the types of isolation devices specified shall be collected and placed with the tags and the Lockout / Tag out Request Permit.
b. The isolator(s) shall take the device locks, tags, and the Lockout / Tagout Request Permit to position the specified isolation devices, sign and hang the tags, and place the locks. If the isolator does not agree with or understand the Lockout / Tagout Request Permit, or has a problem performing the isolation, the problem should be brought to the attention of the Safety Representative or Area Supervisor immediately and the lockout / tag out should be postponed until the situation is resolved.
c. Once the Isolator has placed all "locks" on isolation points, they will "test "and "try" the machinery, equipment, or system to ensure all hazardous energy has been completely removed and the isolation is one totally accomplished, and has initialed and signed the Lockout /Tag out Request Permit indicating all isolation points have been confirmed. Examples of "lock", "test" and "try":
    - by checking that all locks on the LOTO Request Permit have been applied and are in the specified position open/closed, on/off, etc.; metering test of electrical circuits, opening of drain valves, checking pressure gauges or indicators; and try by pushing start buttons and on/off switches, etc.
    - Testing shall be performed by person(s) knowledgeable of the energy source(s) being isolated (e.g., an electrician should meter electrical circuits).
d. A copy of the completed Lockout /Tag out Request Permit shall remain with the Work Package and used as part of the daily Pre-Job Briefings

3. WORKING UNDER A LOCKOUT / TAGOUT REQUEST

a. Prior to starting the work activity, the person(s) performing the work shall review the Lockout / Tag out Request Permit and place the necessary tags and personal locks on the identified isolation devices. Personal locks may be placed only on devices that have already been locked and tagged in accordance with the Lockout / Tag out Request Permit.

- All personal locks shall be accompanied by a tag that is signed and dated by the worker(s) and specifies the work activity being performed.
- Personal locks should be of a different color than device locks for ready identification.

b. Verification of the effectiveness of the isolation by the Isolator shall be performed for Worker's working under the lockout / tag out, by demonstrating the checks on "lock", "test" and "try",
c. When the work activity is finished, personal locks and tags shall be removed and the Safety Representative

shall be notified that the Lockout / Tagout is no longer required. If work under a lockout / tag out is to be delayed or interrupted for a period in excess of 24 hours, personal locks shall be removed until the work restarts. Personal locks shall be removed prior to the worker(s) leaving the project at the end of shift unless the key(s) are maintained at the project.

4. REMOVAL OF LOCKS AND TAGS

a. When the lockout / tag out is no longer required, the Safety Representative or Area Supervisor shall obtain the Lockout / Tagout Request Permit from the work package for LOTO removal. Prior to removing locks or tags that may allow equipment to be energized, a check shall be made to verify that the equipment is free to safely operate (i.e., will not cause damage or injury). The locks and tags shall be removed and returned to the Lockout / Tagout Coordinator. Isolation devices may be repositioned at the discretion of the Engineer in Charge according to operational requirements. The Isolator shall complete the Lockout / Tagout Request Permit indicating each lock and tag has been removed and the Safety Representative or Area Supervisor forward to the Lockout / Tagout Coordinator.

b. The Lockout / Tagout Coordinator shall discard the tags and maintain the completed Lockout / Tagout Request Permit for future reference.

c. In the event that an employee leaves the job site without removing the personal lock I tag, the following measures shall be taken and documented. The measures listed below are a minimum set of guidelines and under all circumstances, refer to the site-specific safe work plan for detailed procedures:

- Attempt calling / contacting the employee to return to the site for removal.
- In the event an employee cannot be contacted, the Site Manager and Safety Manager shall sign an Emergency Lockout/Tagout Removal Form, which has been completed by the Area Supervisor.
- Employee shall be notified upon returning to the site, prior to beginning any work.

5. INTERRUPTION OF A LOCKOUT / TAGOUT

Operational Emergency

The Engineer in Charge / Safety Manager /Area Supervisor may deem it necessary to temporarily remove the locks and tags from isolation devices, prior to the end of the work activity. The standard procedure for removal of locks and tags shall be followed. Extreme caution shall be taken by the Isolator removing the locks and tags to prevent personnel injury.

Testing

When the performance of a work activity requires the functional testing of a machine, component, or system, the locks and tags may be temporarily removed in accordance with the tag removal, to perform the test. As a result of the testing, if it is determined that the equipment needs further work, the locks and tags shall be positioned back on to the device. If it is not necessary to replace all the locks and tags, then the unnecessary locks and tags may be returned to the Lockout / Tagout Coordinator. The Engineer in Charge shall initial the Lockout / Tag out Request Permit in the removal block to indicate that these locks and tags have been removed. When testing has been satisfactorily completed, the locks and tags shall be removed.

ISOLATION DEVICES

- In most industrial applications, there are isolation devices that were not designed to accommodate a locking device. In these instances, an acceptable alternative that physically obstructs or prevents the use of the isolation device shall be found. Chains shall be placed on valves or electrical panels. Wires shall be determinate, pulled back, taped, and secured.

- If an isolation device does not accept a lock, a tag only is acceptable; however, all possible precautions shall be undertaken to provide a level of safety for the workers. The tag shall be readily visible to anyone attempting to operate the device.
- If more than one Lockout / Tagout Request Permit requires that a single isolation device be locked and tagged, a lock and tag for each request shall be placed. Each lock in itself prevents the inadvertent operation of the device.

GROUP / COMPLEX LOCKOUT

In a multiple lockout / tag out procedure, each person working on the machinery or equipment must place a lock or tag on the energy isolating device. If the energy isolating device will not accept multiple locks or tags, a hasp (a multiple lockout device, may be used. The locks or tags must be placed in such a way that energy cannot be restored to the machinery or equipment until every lock or tag is removed. As each employee involved no longer needs to maintain lockout / tag out protection that employee removes his - her lock and/or tag. The employee attaching the lock or tag is the only person authorized to remove the lock or tag.

6. TRAINING

The training must include recognition of hazardous energy source, type and magnitude of energy available, methods and means necessary for energy isolation and control. Each authorized employee shall receive adequate training. The training should address that all affected employees are instructed in the purpose and use of the energy control procedure. There should be training provisions included for any other employee whose work operations are or may be in an area where energy control procedures may be utilized. The employee training should also address when tag out systems are used including the limitations of a tag (tags are warning devices and do not provide physical restraint). The training should also include that a tag is not to be removed without authorization. The tag is never to be ignored or defeated in any way. Retraining is required when there is a change in job assignments, in machines, a change in the energy control procedures, or a new hazard is introduced. All training and I or retraining must be documented with employee's name and dates of training.

7. PROGRAM REVIEW

The lockout / tag out program must be reviewed at least annually. The review must ensure that procedures are being followed and that they are effective. A documented review of the inspection must include the date, the equipment, employees involved & the inspector. The inspector must be someone other than those actually using the lockout / tag out in progress.

ATTACHMENTS

#1. Danger (DO NOT OPERATE) Tags

#2. Device & Personal Locks and Multi Lock Hasp:

#3. Lockout / Tagout Request Permit

BHEL	**LOCKOUT / TAGOUT REQUEST PERMIT**	LOTO Request Permit No.:
		Work Permit No.:

Equip. Out of Service:	LOTO Date Required by: _____/_____/_____	Estimated Duration:	**LOTO Requested** Date:
Scope of Work:			**LOTO Authorization** Signed by:
			Date:
			LOTO Removal Authorization Signed by:
			Date: Time:

Tag No.	Device to be Tagged / Locked I.D. No.	Device Location	Device Position *OPEN / CLOSED* -	Lock No.	Tag/Lock Placed by Print/Sign - Date/Time		Tag /Lock Removed by Print/Sign - Date/Time	

Comments Instructions: **Attachment 3.Lockout / Tag out Request Permit:**

#4. Lockout / Tag out Request Log

LOTO Permit No.	**Requestor Name**	**Equipment & Location**	**Est. Work Completed Date**	**Approval Date**	**LOTO Placed Date**	**LOTO Removed Date**	**Comments**

14. RISK ASSESSMENT

Risk and Hazard Analysis

In order to produce an overall Project EHS Plan, a project must be assessed for its risks. There are two components to the risk and hazard analysis. The procedure used to examine and plan for the identified risks and hazards is called a General Hazard and Risk Assessment.

JSA/HIRA review

Prior to commence the following activities Method statement and JSA/HIRA to be prepared by the concern engineer in coordination with EHS officer and submit to the client for review and approval. After getting approval the work will be started under PTW after clearance. For HIRA and criteria for the defining the high, medium & low risk the relevant annexure be referred. In case any deviations required in the approved method statement the concerned engineer/supervisor has to prepare additional HIRA/JSA to cover the new activities and associated risk. Following activities to be covered,

- Deep excavation (more than 5 feet)
- Significant concrete pouring (like heavy foundation, TG deck, Slab casting etc.)
- Confined entry
- Blasting
- Working on electrical/ energized equipment's
- Steel erection more than 5-Ton weight
- Working at height prior to completion of stairs/ladders/hand railing etc.

Definition:

HAZARD - Any potential or present danger to persons or property within the project site, e.g., oil on the floor is a hazard.

INCIDENT - An unintended happening that may result in injury, loss or damage, e.g., Slipping on the oil is an Incident.

INJURY – Physical harm, the result of an Incident, e.g., a sprained wrist from the fall would be an injury.

Hazard Analysis Document

- For high risk and dangerous work identified, the Applicant shall complete and submit a Hazard Analysis Document together with the PTW request. It will be a JSA (Job Safety Analysis) or Preliminary Hazard Analysis Checklist. And it shall be reviewed and approved by respective Construction and HSE Representatives.
- Issues such as work interface, coordination, drawings, toolbox meetings and work type/duration shall be detailed and included with supporting documentation for the Applicant's request for PTW.
- If applicable, Hazard Analysis Document shall be used as the foundation for development of Safe Work Method Statement. Each hazard identified shall be addressed in the Safe Work Method Statement and be submitted as part of the Applicant's submittal package.

Evaluation of Sub-contractor Risk Assessments includes

- Experience and expertise in performing similar type work.
- Duration of work performed
- Location of the work to be performed.

- Nature of the work to be performed.
- Potential for a subcontractor performing the work to expose themselves, other persons or employees, to hazards.
- Potential for exposure to work site hazards.

Review of Subcontractor specific issues

Preventive and protective measures must be introduced according to the following order of priority

- Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc.
- Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc.
- Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
- Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

15. HSE PREPAREDNESS FOR ADVERSE CLIMATES AND WEATHER

All Preventive and Precautionary measures to ensure Health & Safety of workers in all possible adverse weather conditions based on the analysis of the local area conditions to be taken by the subcontractor

15.1 SUMMER

1. The Working Time and Lunch Hour will be as per instruction of Statutory Authorities (no work between 11am to 3:30pm). However, in case temp comes down due to rain/cloudy weather work will continue as per normal routine.
2. During long lunch break, worker will be allowed to go back home for rest. Those who will like to stay back will avail at the facility of rest shed or other designed area.
3. They will be allowed to take small break during work as per their need.
4. Water sprinkling will be done on roads to reduce dust concentration.
5. Workers will be provided with adequate cool drinking water and Butter milk/Lemon water etc.
6. Adequate ORS stock will be made available at the work location in the First-Aid Box for use as needed and at First-aid Centre for emergency need.
7. Fire prevention shall be on high alert, with removal of dry grass and bushes, etc, inside and outside the surrounding work areas. No smoking, and control of open flame/sparks shall be maintained and monitored.
8. Worker will be informed about the Do's and Don'ts to be followed during summer in the Pre Job Brief.

Dos & Don'ts

1. Drink plenty of cool water and other non-alcoholic fluid and keep body well hydrated.
2. Eat salt in food to replenish loss of salt through sweating.
3. Avoid over physical exercise.
4. Have adequate sleep at night.
5. Eat light and less spicy food
6. Avoid eating food which was cooked long time ago.

7. Nobody should use small water bodies such as pits, running rain water through crevices etc. for drinking and cleaning purpose as it may be unhygienic.

Emergency Handling

In case of emergency due to heat disorder:

1. Rescue the victim from workplace and place under shed.
2. If to be rescued from height, use stoke basket or rescue kit.
3. Inform Ambulance immediately.
4. If nearby any air conditioned room/shed is available, place him inside the room/shed.
5. Administer First aid by trained First aider for Heat Disorder
6. If conscious, give him ORS solution to drink.
7. If required send the victim hospital immediately.

15.2 MONSOON

A. Height Work & Structural Safety:

1. Ensure that all height work platforms are barricaded and avoid any highly hazardous
2. Height work.
3. Ensure that all personnel have good quality and intact safety shoes
4. Stop all dangerous height work during rain
5. Explain Do's and Don'ts to workers during Tool Box Meetings
6. Ensure that there are no weak structures, boards etc. that can fall during high winds
7. Do not allow any loose material (e.g. GI sheet, Ply board, empty cement bag, aluminium foil, foam sheets etc.) on roof sheds or top of structures.
8. Do not permit any one to ride up or come down scaffolds frame work during heavy wind or rain.
9. Provide "anchor" of adequate strength to scaffolds and other high-rise structures.
10. All rest sheds and GI sheds will be anchored into the round and wall and roof panels will be secured with J hook to prevent shed from blowing over or parts/pieces becoming airborne. Proper earthing per IS standard is also to be installed.
11. Do not go alone nor permit anyone to stay at tower-tops, roof-tops, high structures or on electrical poles during the course of stormy weather or heavy rain.

B. Electrical:

1. All electrical connections / loads have to be routed through ELCB / RCCB (residual current circuit breaker) whose rating should be 30mA.
2. RCCB operational checks need to be done DAILY / WEEKLY during monsoon season.
3. Avoid joints on power cables which need to be laid over-head or under-ground, better not to have any joint at all. In case joints become essential, such cables must be housed rigidly and insulation must be provided as per approved standard. The joint shall be suitable for outdoor use.
4. All electrical distribution board shall be properly covered at top and sides to protect from rain water. Extension boards shall be protected from rain water.
5. Ensure proper "earthing" for each and every electrical appliance.
6. Double earthing need to be provided for 3-phase power supply and for voltage more than 220V.

7. Provide lightening arrestors at the top of Boiler 3 and boiler 4 and rest sheds which are not covered by existing lightening arrestor of other installation.

C. Others:

1. Maintain smooth flow on open drains. i.e. no obstruction or blockade shall be made on storm water drains. If required, make temporary drains.
2. Arrange back-filling of excavated pits on war-footing basis.
3. Arrange bringing down booms of all cranes, hydra machines during stormy weather (wind speed 40-50 km/hr)
4. Confirm that all gantry cranes are effectively choked to prevent rolling and toppling.
5. Do not forget to deep ready a dew battery operated lights at site-offices during rainy season.
6. Avoid using wet damp clothes.
7. Hard Barricade excavated zone filled with water with scaffolding pipe & clamp with reflective net
8. Engage diesel operated water pump to dewater work area. For electrically operated water pump, the starter shall be protected from rain water. All rotating parts shall be guarded. Ensure availability of sufficient water pumps.

D. Health and hygiene:

1. Monsoon reduces the immunity of our body and makes us vulnerable to many diseases which are commonly associated with this season. It is time for us to keep our body challenging against disease by boosting our immunity and taking safety measures against these diseases.
2. The diseases associated with monsoon are Malaria, Jaundice, Gastro-intestinal infections, like typhoid, cholera etc. apart from these viral infections like cold and cough also make their presence felt. Majority of above said diseases are on account of:
3. Puddle of water formed due to rain become breeding grounds for mosquitoes which spread disease like, malaria and dengue fever. As a precautionary measure against mosquito-bite disease one can use mosquito net around the end which is better choice to mosquito repellents like mats and coils.
4. Pollution of drinking water during monsoon is very common. It is very necessary to drink clean and pure water when water-borne monsoon diseases like diarrhoea and gastro-intestinal infections threaten us.
5. Walking in dirty water during rainy season leads of numerous fungal infection which affect toes and nails. Diabetic patients have to take a special care about their feet. Keeping feet always dry and clean is very necessary. Avoid walking in dirty water. Keep shoes socks and raincoats dry and clean.

E. Workmen will be made aware of following Do's and Don'ts:

1. Do not sleep in daytime.
2. Avoid over physical exertion.
3. During lightning and thunder storm, do not take shelter under tree. Take shelter inside rest shed or store room.
4. Wash vegetables with clean water and steam them well to kill germs.
5. Avoid eating un-cooked foods and salads should be washed properly before consumption.
6. Drink plenty of water and keep body well-hydrated.
7. Always keep the surrounding area dry and clean. Don't allow to get water accumulated around.
8. Keep body warm as viruses attack immediately when body temperature goes down.

9. Do not enter air conditioned room with wet hair and damp cloths.
10. Dry your feet and webs with soft dry cloth whenever they are wet.
11. Eat light and less spicy food.
12. Avoid eating food which was cooked long time ago.
13. Eat salt in food to replenish loss of salt through sweating.

15.3 EMERGENCY WEATHER CONDITIONS

Cyclone/Severe thunder storm

In the event of Cyclone/Severe thunder storm, alert will be issued by subcontractor on notification received by Govt. authorities/Metrological departments Customer or BHEL.

The actions required during cyclone/rough weather:

1. Check and advice subcontractors to clean-up work area. Pick up all loose and unused material of respective supervisor's area.
2. Tie to secure all gas cylinders to avoid displacement and unsafe conditions which could be due to wind pressure.
3. Secure portable electricity generating sets and other equipment, pumps, hoses etc.
4. Make preparation for removal of water logging.
5. Take review of work activity and make preparation for removal of equipment and material from vulnerable areas.
6. Isolate/turn off all electrical power form the main panel/switches. Secure and anchor panels properly.
7. Recheck anchorage/tie of all temporary structures/sheds, tall objects, cranes, rigs, scaffolds etc. to avoid toppling due to wind force.
8. Cranes boom shall be secured, either locked or lowered the booms as reasonably and practicably possible and rigs to safe position for the safety point of view.
9. Group up all trash barrels, wooden pallets, forms; wooden decks etc. and anchor properly.
10. Welding machines, air compressors and such equipment are to be grouped together and secured to the stable objects. Welding leads, electrical cables, hoses are to be rolled up and secured properly.
11. Set on site vehicles on high ground in the site area with brakes set firmly.
12. Anchor all tanks, vessels, gas cylinders that may be moved by high wind and water.
13. Evacuate job site.

Personnel Evacuation:

1. Personnel Evacuation will be required if predicted wind speed and storm surge heights are beyond acceptable limits as per the instructions from Govt. Authorities/ Metrological departments or Customer.
2. Once the warning is received for personnel evacuation, an emergency response team shall be formed. The team will work with local authorities and other agencies formed/deployed to evacuate and transport all personnel involved in the project to the cyclone shelter.
3. Cyclone may be followed by the calm "EYE", be aware of it. If the wind suddenly drops, don't assume the cyclone is over. Violent wind may resume from the opposite side direction. Wait for the official "All clear Signal".

4. After the cyclone, do not go outside until officially communicated about safe situation outside. Use recommended routes for returning. Do not panic or rush while returning.
5. Checking of gas leaks and well-being of electrical appliances is essential before leaving the site.
6. Follow local communications for official warning and advice. The construction Manager shall also obtain updates from customer/metrological departments and communicate to the personnel on project site.

15.4 PREVENTION OF COVID-19 (COVID-19 HERE TO BE READ AS COVID-19 AND OTHER PANDEMICS/ COMMUNICABLE DISEASES) AT PROJECT SITE & LABOUR COLONY:

Resumption of Construction Activities after Lock Down and Prevention of Coronavirus Infection during Site Operations and OCP 61A: Prevention of COVID-19 Infection in Labor Colony will be strictly followed.

A. <u>Preventive measures at project site:</u>

- BHEL and Agencies shall nominate COVID Marshalls, who will be responsible for monitoring the COVID prevention measures and apprising management on the same.
- Mandatory health check-up for every worker/ official joining the site
- All activities to be carried out using least amount of paperwork and physical proximity as far as possible.
- ***HSE Observer App*** to be used to monitor HSE Activities and follow up with agencies for closure of non-conformities.

<u>a. Strict Control at the Gate/ Banning Entry to Anyone Not Wearing Masks</u>

i. Security personnel at the gate may erect a barricade preferably approx. 10 meters from the gate and only allow personnel who are wearing proper masks inside.

ii. Public address system may be used to warn any non-compliant visitors

iii. Near entry gate, round markers at minimum 1-meter distance to be ensured so that distancing is ensured

iv. A hand-wash or hand sanitiser facility is preferable at the gate to allow entry after hand wash or hand sanitisation. These are also to be provided at key locations to enable hand wash / hand sanitisation before starting work, before eating, etc.

v. Gutkha, Paan, tobacco etc. to be banned from the site. Spitting to be strictly prohibited.

<u>b. Screening at Gate with Contactless Thermometer & Action on Suspected Cases</u>

i. Security Personnel at the Gate to screen each person entering the premises using a non-contact infrared thermometer, which is duly serial numbered and calibrated.

ii. In case any site worker/ official is found to have fever more than 99 Degrees Fahrenheit or found coughing/ sneezing, he/she may be advised rest till recovery and entry to be permitted after obtaining clearance from medical officer/assistance/attendants.

- Parcel to be collected from gate by concerned person preferably with provision of Special Box
- Any construction material received at site, unless properly sanitized, to be kept undisturbed for at least 3 days and to be used only after that period.
- During Toolbox Talks, minimum 1-meter distance between any two workers to be ensured

<u>c. During site execution activities:</u>

For all site execution activities, social distancing is to be maintained. In case this is not possible due to nature of work, speciality of work, etc, ensure sensitisation of the labour/staff involved and use of appropriate PPEs, especially mandatory face mask. In any case, close working to be allowed only in special

circumstances and ensuring these activities are preferably time staggered to the extent possible

d. In office premises:

i. Sharing of items like pens, water bottles etc. in office premises to be avoided

ii. Doors preferably to be in open condition to avoid contact

iii. All common touch points to be frequently disinfected in a day.

e. Regular disinfection of all Areas, Equipment and facilities

i. A dedicated disinfectant gang to be identified for the task by each agency. The disinfectant gang to be provided full body suits for the task.

ii. All areas (including office premises, site areas, chairs, tables, furniture etc.), tools & equipment to preferably be disinfected by dedicated gang every day before resumption of work.

iv. Common touch points like handrails, lift buttons, door/window knobs or handles, vehicle door handles, taps, conference room & dining hall tables/chairs, common sofas/chairs, visitor sofa/chairs, files & folders, etc to preferably be disinfected regularly at frequent intervals every day.

v. Pool vehicles, to be disinfected after every use. Social distancing to be maintained inside the common pool vehicles as per Govt./ statutory body guidelines.

f. Disinfecting the operator/driver touch points of Vehicles/cranes, T&Ps etc.

Disinfection to also be carried out for all Cranes, Vehicles, Equipment, consoles, T&Ps etc. which come into contact with operating personnel.

g. Posters on COVID-19

Sufficient Posters on COVID-19 to be ensured across the site in languages understood by most workers.

h. Brief guidelines for hand washing are as below:

i. Soap to be provided at each wash basin and replenished regularly.

ii. Washing with soap for at least 20 seconds is recommended.

iii. As a general guideline, for every 100 workers, 1 wash-basin may be provided at site areas.

iv. Close queue to be avoided near wash-basins and 1-meter distance to be maintained. Round markers at 1-meter distance can be ensured as guidance

Composition of Disinfectant:

i. Readily available 1% hypochlorite solution or 4%

ii. Liquid chlorine-1% solution

Iii. Surgical spirit-95% alcohol content

iv. Hand sanitizer should have: Isopropyl alcohol-75%, Gycerol-1.45%, Hydrogen Peroxide-0.125%

B. Prevention of COVID-19 Infection in Labor Colony:

- Spacing of minimum 2 meters between living areas of workers inside a room may be maintained. Preferably, the living area of each worker may be partitioned using sheet of cloth, plastic etc.
- Rooms to be properly ventilated as far as possible
- Sanitation to be given prime importance and personal hygiene to be promoted
- Face masks shall be worn by everyone inside the colony premises
- Spitting of Pan. Gutkha etc. inside the colony and urinating etc. outside the toilets to be strictly avoided
- Regular visits by Doctors to the labor colony can be arranged on non-working day for check-up of all workers
- **Identification of "COVID Wardens" (CWs) by each agency for maintaining the following:**

  i. Keeping an eye on the health of workers and report any suspected cases of fever, coughing etc. to the

management

ii. Keeping an eye on the social distancing measures in the labor colony and report any non-conformances to the management.

iii. Educate the workers about social distancing and COVID prevention measures.

- Training/ Awareness regarding COVID-19 to be provided to workers regularly.
- Workers to be instructed to maintain social distancing of minimum 1 m at all time
- **Posters on COVID-19:** Sufficient Posters on COVID-19 to be ensured across the labor colony in languages understood by most workers.
- All workers to be instructed to inform any suspected cases of illness (individual or others) to an emergency contact number of CW, the emergency contact numbers and CW contact numbers to be displayed at prominent locations
- **Inspection & Review**

  i. Daily Inspection by concerned COVID Wardens and reporting to Agency

  ii. Regular inspection by Agency & BHEL

15.5 Noise Mitigation

High noise is harmful to the human health and it can cause impairment if exposed for long duration at regular intervals, and also cause disruption in nearby communities.

- Noise monitoring shall be carried out in all construction locations periodically.
- Use of silent DG is allowed at site during construction.
- Low noise generation equipment's to be preferred.
- Work areas where noise levels exceed the 85db shall be posted as hearing protection required.
- Use of PPEs / ear plug/ear muff for personnel entering into high noise area.
- Activities generation High noise will be planned in day shift.

Noise Level Chart

Parameter	Night Noise level dBA	Daytime Noise Level dBA
At 1-meter from each piece of equipment	85	85
At Property boundary	70	70

ANNEXURE J

First-Aid Box

Details & Contents of First Aid Box as per Contract Labor (Regulation & Abolition Act), Central Rules, 1971

(1) The first-aid box shall be distinctively marked with a Red Cross on a white background and shall contain the following items, namely:

(a) For establishments in which the number of contract labor employed does not exceed fifty, each first aid box shall contain the following equipment:

(i)	6 small sterilized dressings
(ii)	3 medium size sterilized dressings
(iii)	3 large size sterilized dressings
(iv)	6 pieces of sterilized eye pads in separate sealed packets.
(v)	6 roller bandages 10 cm wide.
(vi)	6 roller bandages 5 cm wide.
(vii)	One tourniquet
(viii)	A supply of suitable splints
(ix)	Three packets of safety pins.
(x)	Kidney tray.
(xi)	3 large sterilized burn dressings.
(xii)	1 (30ml) bottle containing a two percent alcoholic solution of iodine
(xiii)	1 (30 ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label
(xiv)	1 snake bite lancet
(xv)	1 (30gms) bottle of potassium permanganate crystals.
(xvi)	1 pair scissors
(xvii)	1 copy of the First-Aid leaflet issued by the Director General, Factory Advice Service and Labor Institutes, Government of India.
(xviii)	A bottle containing 100 tablets (each of 5 grains) of aspirin
(xix)	Ointment for burns
(xx)	A bottle of suitable surgical anti-septic solution

(b) For establishment in which the number of contract labor exceeds fifty each first-aid box shall contain the following equipment:

(i)	12 small sterilized dressings
(ii)	6 medium size sterilized dressings
(iii)	6 large size sterilized dressings.
(iv)	6 large size sterilized burn dressings
(v)	6 (15 grams) packets sterilized cotton wool
(vi)	12 pieces of sterilized eye pads in separate sealed packets.
(vii)	12 roller bandages 10 cm wide.
(viii)	12 roller bandages 5 cm wide.
(ix)	One tourniquet.
(x)	A supply of suitable splints.
(xi)	Three packets of safety pins.
(xii)	Kidney tray.
(xiii)	Sufficient number of eye washes bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
(xiv)	4 per cent Xylocaine eye drops, and boric acid eye drops and soda by carbonate eye drops.
(xv)	1 (60ml) bottle containing a two percent alcoholic solution of iodine
(xvi)	One (two hundred ml) bottle of mercurochrome (2 per cent) solution in water.
(xvii)	1 (120ml) bottle containing Sal volatile having the dose and mode of administration indicated on the label.
(xviii)	1 roll of adhesive plaster (6 cmX1 meter)
(xix)	2 rolls of adhesive plaster (2 cmX1 meter)
(xx)	A snake bite lancet.
(xxi)	1 (30 grams) bottle of potassium permanganate crystals.
(xxii)	1 pair scissors
(xxiii)	1 copy of the First-Aid leaflet issued by the Director-General, Factory Advice service and labor Institutes, Government of India.
(xxiv)	a bottle containing 100 tablets (each of 5 grains) of aspirin
(xxv)	Ointment for burns
(xxvi)	A bottle of a suitable surgical anti septic solution.

(2) Adequate arrangement shall be made for immediate recoupment of the equipment when necessary.

ANNEXURE K

Vertigo Test

Vertigo Test Procedure/ Guidelines

This document specifies minimum requirements for vertigo test. These may be supplemented by any additional requirements deemed fit by the medical examiner/ HSE department)

Fear of height may be physiological or psychological. Therefore, to rule out any possibility of physiological factor, detailed medical check-up of workers is carried out before vertigo test. Medical check-up of workers includes the following:

history of past illnesses (like epilepsy, drug allergy, diabetics/ hypertension, unconsciousness etc.), general physical examination (like height, weight, BMI, build and nourishment etc.), measurement of pulse rate, Blood Pressure, respiratory rate.

After this check-up, those who are found suitable for height work by examining doctor, are allowed to undergo vertigo test.

During this health check-up, psychology of workers is also studied. If any worker finds it extremely difficult/ frightening to climb the monkey ladder & walk on the beam, during/after performing vertigo test or even before performing, then he is treated as disqualified.

As per standard, during vertigo test, worker is allowed to climb on a foundation through monkey ladder, walk on a beam, then steps down at the other end of beam, through monkey ladder. Height of the beam should be at least six feet from ground level. All necessary safety precautions are taken during this test. Worker has to wear full body harness with double lanyard. A horizontal lifeline is run parallel to the beam and worker has to put his lanyards into the lifeline. Additionally, a safety net is also put below the beam for rescue of the victim in case of a fall from beam.

Following activities are suggested to be carried out during testing:

1. **Walking Bench Training:**
   a. Person should walk over the channel. He should maintain balance & walk without much problem.
   b. If the person has problem to balances himself on repeated chances, he may be having flat foot or some other problem. So, he may not be fit for height work.
2. **Rope Climb Training:**
   Person should be able to climb the rope up to the top channel for ensuring that in case of fall, a person hanging on the safety harness, will be able to safely climb back to the platform within minimum time period before the safety harness start breaking down under the load.
3. **Height Work Training:**
   Person should walk freely on the middle channel while holding the top channel with the help of safety harness.
4. **Ladder for Vertical fall arrestor Training:**
   Vertical fall arrestor rope is fixed from top to bottom of the ladder. It will ensure:
   - Usage of vertical fall arrestor.
   - Usage of two lanyards of a safety harness.
   - Ensure 3-point contact on the ladder while climb.
5. **Chair for work at height Training:**
   - Climb though vertical ladder with two lanyard ropes.
   - Hooking of two lanyard ropes to life line. With this safe arrangement, he can walk to chair.
   - Sits in the chair safely, comes out & walks back to the vertical ladder & come down from vertical ladder. After completion of vertigo test, blood pressure of worker is again measured. If it is not within acceptable limits for any worker, concerned worker is denied height pass.

Only those who pass the above training are to be considered as fit for height work.

Annexure
C1

T&P HIRE CHARGES

DATE:31/08/2021

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (BEYOND USEFUL LIFE)
I.	CRANES:-			
1	Portal Gantry Crane 500T	15	24500.00	24500.00
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	11370.00	10940.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	56290.00	53560.00
4	PORTAL CRANE, 360T	15	14070.00	13390.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	55460.00	52770.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	68610.00	65280.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	33510.00	31880.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	20940.00	19920.00
9	MANITOWOC M-250T TRUCK CRANE	15	30160.00	28690.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	31660.00	30130.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	26390.00	25110.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	36110.00	34580.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	15130.00	14390.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	18850.00	18050.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	16750.00	15940.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	21780.00	20720.00
15	CRAWLER CRANE SUMITOMO, 150T	15	10890.00	10360.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	13400.00	12750.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	10830.00	10420.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	10720.00	10200.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	8880.00	8440.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	10050.00	9560.00
20	CRAWLER CRANE 100 T (KH 500)	15	10050.00	9560.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	5410.00	5210.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6140.00	5880.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5370.00	5150.00
24	Mobile Crane, 55MT (TIL)	12	4410.00	4230.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3030.00	2910.00
26	MOBILE CRANE, 20MT (TIL)	10	2270.00	2180.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2270.00	2180.00
28	MOBILE CRANE ESCORTS- 14MT	10	710.00	680.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	390.00	370.00

Annexure

C1

DATE:31/08/2021

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR
SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (BEYOND USEFUL LIFE)
30	FORK LIFT 5T	5	650.00	640.00
31	FORK LIFT 3T	5	540.00	530.00

Annexure C2 DATE:31/08/202

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2019 to 31/8/2021 (BEYOND USEFUL LIFE)
I.	CRANES:-			
1	Portal Gantry Crane 500T	15	27230.00	27230.00
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	10	12630.00	12160.00
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	15	62550.00	59520.00
4	PORTAL CRANE, 360T	15	15630.00	14880.00
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	15	61620.00	58630.00
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	15	76230.00	72540.00
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	15	37230.00	35420.00
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	15	23270.00	22140.00
9	MANITOWOC M-250T TRUCK CRANE	15	33510.00	31880.00
10	270 MT Class Crawler Crane- Manitowoc Model 2250	15	35180.00	33480.00
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	15	29320.00	27900.00
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	15	40120.00	38420.00
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	15	16810.00	15990.00
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	15	20950.00	20060.00
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	15	18610.00	17710.00
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	15	24200.00	23020.00
15	CRAWLER CRANE SUMITOMO, 150T	15	12100.00	11510.00
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	15	14890.00	14170.00
17	CRAWLER CRANE, 120 T Fushun Model QUY120	10	12030.00	11580.00
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	15	11910.00	11330.00
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	15	9860.00	9380.00
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	15	11170.00	10620.00
20	CRAWLER CRANE 100 T (KH 500)	15	11170.00	10620.00
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	10	6010.00	5790.00
22	ROUGH TERRAIN CRANE 75T (RT880)	12	6830.00	6540.00
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	12	5970.00	5720.00
24	Mobile Crane, 55MT (TIL)	12	4900.00	4700.00
25	CRAWLER CRANE, 25T -Tata Model TFC75	10	3370.00	3240.00
26	MOBILE CRANE, 20MT (TIL)	10	2520.00	2430.00
27	MOBILE CRANE, 20MT (ESCORTS)	10	2520.00	2430.00
28	MOBILE CRANE ESCORTS- 14MT	10	790.00	760.00
29	HYDAULIC PICK & CARRY CRANE, 8/9/10/11/12 MT	10	430.00	410.00

REVISED RATES OF T&P HIRE CHARGES FOR CRANES & TRAILERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	USEFUL LIFE (IN YRS)	Revised rates (Rs./Hour) valid from 01/09/2021 to 31/8/2023 (WITHIN USEFUL LIFE)	Revised rates (Rs./Hour) valid from 01/09/2019 to 31/8/2021 (BEYOND USEFUL LIFE)
30	FORK LIFT 5T	5	720.00	710.00
31	FORK LIFT 3T	5	600.00	590.00

Annexure I

RATES FOR INTER REGIONAL HIRE CHARGES FOR CRANES OF CAPACITY 75 TON OR MORE FOR PERIOD 01-09-2021 TO 31-08-2023

Dt : 31/08/2021

SL NO.	ITEM DESCRIPTION	Rates (Rs./MONTH) valid from 01/09/2021 to 31/8/2023
I.	CRANES : –	
1	Portal Gantry Crane 500T	1243192
2	100MT Crawler Crane ZOOMLION CRANE-QUY-100	631183
3	Heavy Lift Crawler Crane 600MT Class DEMAG Model CC2800	2717358
4	PORTAL CRANE, 360T	679333
5	600MT Class Crawler Crane- Manitowoc Model 18000-UPGRADED	2676917
6	600MT Class Crawler Crane- Liebherr Model LR1600-2 (Upgraded version)	3311783
7	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH RINGER)	1617475
8	CRAWLER CRANE FMC/LINKBELT 718, 250T (WITH-OUT RINGER)	1010917
9	MANITOWOC M-250T TRUCK CRANE	1455725
10	270 MT Class Crawler Crane- Manitowoc Model 2250	1528508
11	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1	1273758
11.A	300MT Crane Crawler Crane LIEBHERR Model LR-1350/1 (UPGRADED)	1754150
12	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2	730283
12.A	250MT Class Mid range Crawler Crane- Kobelco Model CKE2500-2 (UPGRADED)	915892
13	LINKBELT LS- 248H CRAWLER CRANE (180T)	808733
14	MANITOWAC MODEL 888 CRAWLER CRANE (200 MT)	1051358
15	CRAWLER CRANE SUMITOMO, 150T	525675
16	All Terrain Crane, 150MT- Liebherr Model LTM1150	646983
17	CRAWLER CRANE, 120 T Fushun Model QUY120	601125
18.A	CRAWLER CRANE 135MT Kobelco Model CK1350- 1F	517592
18.B	CRAWLER CRANE 135MT Kobelco Model CK1350	428625
19	CRAWLER CRANE 120MT - Tata-Sumitomo Model SCX1200-2	485242
20	CRAWLER CRANE 100 T (KH 500)	485242
21	Hydraulic Crawler Crane 80MT, Fushun Model QUY 80B	300558
22	ROUGH TERRAIN CRANE 75T (RT880)	321758
23	CRAWLER CRANE, 75T -Tata Model 955ALC/TFC280	281533

ANNEXURE-T I
DT: 31/08/2021

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	20930
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	310
3	MULTI SHEAVE PULLEY BLOCK 100T	630
4	MULTI SHEAVE PULLEY BLOCK 150T	1260
5	ELCTRIC WINCH 5T	1270
6	ELCTRIC WINCH 10T	2360
7	ELECTRIC WINCH 15 T	2150
8	PASSENGER CUM GOODS HOIST 1T	2270
9	FURNACE MAINTENANCE PLATFORM	5040
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2100
II	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	16380
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	8190
3	WELDING GENERATOR 320/300 A	300
4	WELDING RECTIFIER 400A/300A	300
5	WELDING RECTIFIER 600A	400
6	DIESEL WELDING GENERATOR 400A/300A	400
7	TRANSFORMER,600A	300
8	TRANSFORMER 300/400A	200
III	SERVICE PLANTS & ALLIED EQUIPT.	0
1	500KVA DIESEL GENERATOR	3800
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	6370
3	-DO- , WITH STORAGE TANK	7280
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	910
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON OIL)	1360
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON OIL)	1820
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON OIL)	3640
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750 LPH	1270
9	Low Vacuum de-hydration unit	630
10	DIESEL GENERATING SET,250 KVA	1770
11	DIESEL GENERATING SET,25 KVA	500

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
12	VACUUM PUMP(ABSOLUTE V.C.)	540
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1090
14	ACID TRANSFER PUMP 20/50 T/HR	540
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	80
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4240
17	AIR COMPRESSORS 250/300/330/360/350 CFM	2730
18	AIR COMPRESSORS 140/150/190/210 CFM	910
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	1820
20	Industrial Blower 2000CFM	1270
21	Air Leak Test Blower (Flow: 40000 m^3/Hr)	1160
22	Air Blower (Flow: 20000 m^3/Hr)	940
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	630
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1630
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	1800
4	-do- Gun with nose Assembly only	540
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	36980
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	800
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1090
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1270
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1330
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2230
7	BOLT STRETCHING DEVICE	910
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	3640
9	ULTRASONIC FLAW DETECTOR	2730
10	MPI TEST KIT	360
11	GAS LEAK DETECTOR	270
12	VIBRATION/SOUND LEVEL METER IRD-306	360
13	VIBRATION/SOUND LEVEL METER IRD-308	360
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1450
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2540
16	SHOCK PULSE METER	630
17	HV.DC TEST KIT UPTO 50 KV	540
18	HV.DC TEST KIT ABOVE 50 KV	1000
19	HV.AC TEST KIT UPTO 50KV	810
20	HV.AC TEST KIT ABOVE 50KV	2910
21	MOTORISED MEGGER 2.5KV	400
22	MOTORISED MEGGAR 5KV	450
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	450
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1090
25	WAVEFORM ANALYSER	910
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1630
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1090
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	910

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
29	DIGITAL LOW RESISTANCE METER	630
30	DC POTENTIOMETER	180
31	PRECISION DEAD WEIGHT TESTER	1000
32	OPTICAL ALIGNMENT KIT	1360
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1200
34	VERNIER THEODOLITE,PRECISION	1200
35	VERNIER THEODOLITE,ORDINARY	200
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	120
37	ISKAMATIC 'A'	3200
38	CALIBRATOR '03'	1000
39	48 POLE EXTENDER CARD	200
40	MULTIJET NPM	400
41	OSCILLOMETER	10190
42	VOC EQUIPMENT	1400
43	BINARY SIGNAL GENERATOR	290
44	ELECTRIC COUNTER	690
45	FREQUENCY GENERATOR	1000
46	DBF 3 VIBRATION RECORDER/ANALYSER	3270
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	490
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1180
49	VIBROPORT 41/FFT ANALYSER	5460
50	ELCID kit	10010
51	UNIVERSAL CALIBRATION SYSTEM	2730
52	NATURAL FREQUENCY TESTER	2910
53	DIGITAL HARDNESS TESTER	360
54	ADRE 208 VIBRATION ANALYSER	7280
55	PCB DIAGONISTIC REPAIR KIT	2000
56	SECONDARY INJECTION RELAY TEST KIT	5270
57	MICRO OHM METER	1450
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 μΩ TO 20KΩ	3230
59	PMI Machine OLYMPUS make	3350
60	Mobile Lighting Mast - 9 metres (4X400 W)	860
61	10KVA RESISTANCE BRAZING MACHINE	140
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	460
63	HYDROGEN GAS LEAK DETECTOR	50
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	4980
65	WEDGE DEFLECTION KIT	80
66	TILE PRESSING MACHINE FOR GAS TURBINE	270
67	INDUCTION BRAZING MACHINE	4870
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	3640
69	ULTRASONIC FLOW METER	180
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	40
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. ; FLOW 60 M3/HR	470
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. ; FLOW 15 M3/HR	430

RATES OF T&P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILERS ETC. FOR SUB-CONTRACTORS WORKING FOR BHEL FOR DOING BHEL JOBS

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	1810
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1260
75	5KV Insulation Tester	450
76	4 Channel Digital Oscilloscope /Fast Recorder	1710
77	4 Channel Oscillographic Recorder	580
78	Sound Level Meter	230
79	Thermal Imaging Camera	770
80	Videoscope (Video Boroscope)	1510
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1310
82	Conductivity Meter	80
83	Core Flux Test Kit	7280
84	Primary Current Injection Kit (2000A)	870
85	3 Phase Secondary Injection Kit (Relay Test)	3760
86	FRF Filtration Kit	1330
87	FFT Analyser	2290
88	Flue Gas Analyser	1030
89	Oil Test Kit (Mineral Oil)-Transformer	1010
90	Winding Resistance kit (R L C Load)	880
91	SFRA test Kit	1190
92	Tan Delta test Kit	4060
93	PF Meter	330
94	Ultrasonic Flow Meter	830
95	Oil Particle Counter	360
96	Plasma Cutting Machine (With complete accessories)	310
97	JCB make DG Set 80 KVA	670
98	Diesel Generating Set 82.5 KVA	610
99	Portable Jacking Oil Pump	1080
100	Alloy Analyser	1770

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
I.	LIFTING EQUIPMENTS	
1	Strand Jack System for Boiler Drum Lifting	23250
2	MULTI SHEAVE PULLEY BLOCK 40/50T/60T	350
3	MULTI SHEAVE PULLEY BLOCK 100T	700
4	MULTI SHEAVE PULLEY BLOCK 150T	1400
5	ELCTRIC WINCH 5T	1410
6	ELCTRIC WINCH 10T	2620
7	ELECTRIC WINCH 15 T	2390
8	PASSENGER CUM GOODS HOIST 1T	2520
9	FURNACE MAINTENANCE PLATFORM	5600
10	Gang Operated Hydraulic Jack (Set of 4 Jacks - 175 MT each)	2330
II	WELDING & HEAT TREATMENT EQUIPMENT	
1	125KW, 3KHZ, AIR-COOLED INDUCTION HEATING EQUIPMENT	18190
2	75KW, 10 KHZ, COMPACT INDUCTION HEATING EQUIPMENT	9090
3	WELDING GENERATOR 320/300 A	330
4	WELDING RECTIFIER 400A/300A	330
5	WELDING RECTIFIER 600A	440
6	DIESEL WELDING GENERATOR 400A/300A	440
7	TRANSFORMER,600A	330
8	TRANSFORMER 300/400A	220
III	SERVICE PLANTS & ALLIED EQUIPT.	
1	500KVA DIESEL GENERATOR	4220
2	TRANSFORMER OIL FILTERATION EQUIPMENT 6000LPH CAPACITY WITHOUT STORAGE TANK	7070
3	-DO- , WITH STORAGE TANK	8080
4	OIL FILTERATION M/C, 250/500 LPH (OTHER THAN SILICON OIL)	1010
5	OIL FILTERATION M/C, 250GPH/1000LPH (OTHER THAN SILICON OIL)	1510
6	OIL FILTERATION M/C, 500GPH/2500LPH (OTHER THAN SILICON OIL)	2020
7	OIL FILTERATION M/C, 1000GPH/5000LPH (OTHER THAN SILICON OIL)	4040
8	Portable Lube Oil Purification Unit (Centrifuge M/c) Capacity: 750 LPH	1410
9	Low Vacuum de-hydration unit	700
10	DIESEL GENERATING SET,250 KVA	1970
11	DIESEL GENERATING SET,25 KVA	560
12	VACUUM PUMP(ABSOLUTE V.C.)	600
13	ACID CIRCULATING PUMP WITH MOTOR 120M HEAD, 150T/HR	1210
14	ACID TRANSFER PUMP 20/50 T/HR	600
15	DEWATERING PUMP (Kirloskar make,11KW/15HP)	90
16	HP Air compressor (32 Kg/Sq. Cm, 150 CFM)	4710
17	AIR COMPRESSORS 250/300/330/360/350 CFM	3030
18	AIR COMPRESSORS 140/150/190/210 CFM	1010

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
19	ACID CIRCULATING PUMP WITH MOTOR & STARTER, 200T/HR, 150M, 220 HP	2020
20	Industrial Blower 2000CFM	1410
21	Air Leak Test Blower (Flow: 40000 m^3/Hr)	1290
22	Air Blower (Flow: 20000 m^3/Hr)	1040
IV	METAL FORMING /CUTTING EQUIPMENT	
1	TUBE EXPANDING M/C PNEUMATIC 60-100 MM	700
2	ELECTRO HYDRAULIC PIPE BENDING M/C 4"	1810
3	BOLTING MACHINE (ALCOA/AVLOCK/ HUCK)	2000
4	-do- Gun with nose Assembly only	600
V	TESTING/INSPECTION EQUIPMENT	
1	DATA LOGGER for PG TESTING	41090
2	MOTORISED HYDRAULIC TEST PUMP 250kg/cmsq	880
3	MOTORISED HYDRAULIC TEST PUMP 400-450kg/cmsq	1210
4	MOTORISED HYDRAULIC TEST PUMP 600 KG/CMSQ	1410
5	HYDRAULIC TEST PUMP 800 KG/CMSQ	1480
6	HYDRAULIC TEST PUMP 1000 KG/CMSQ	2480
7	BOLT STRETCHING DEVICE	1010
8	BOROSCOPE/FIBROSCOPE FLEXIBLE TYPE (FLEXUX) IMPORTED	4040
9	ULTRASONIC FLAW DETECTOR	3030
10	MPI TEST KIT	400
11	GAS LEAK DETECTOR	300
12	VIBRATION/SOUND LEVEL METER IRD-306	400
13	VIBRATION/SOUND LEVEL METER IRD-308	400
14	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 350	1610
15	VIBRATION ANALYSER/DYNAMIC BALANCING M/C IRD 360	2830
16	SHOCK PULSE METER	700
17	HV.DC TEST KIT UPTO 50 KV	600
18	HV.DC TEST KIT ABOVE 50 KV	1110
19	HV.AC TEST KIT UPTO 50KV	900
20	HV.AC TEST KIT ABOVE 50KV	3230
21	MOTORISED MEGGER 2.5KV	440
22	MOTORISED MEGGAR 5KV	500
23	OSCILLOSCOPE-DUAL BEAM INDIGENOUS	500
24	OSCILLOSCOPE-DUAL BEAM IMPORTED	1210
25	WAVEFORM ANALYSER	1010
26	OSCILLOGRAPH/UV RECORDER 24 CHANNEL	1810
27	OSCILLOGRAPH/UV RECORDER 12 CHANNEL	1210
28	OSCILLOGRAPH/UV RECORDER 6 CHANNEL	1010
29	DIGITAL LOW RESISTANCE METER	700
30	DC POTENTIOMETER	200
31	PRECISION DEAD WEIGHT TESTER	1110
32	OPTICAL ALIGNMENT KIT	1510
33	BOROSCOPE/FIBROSCOPE(NON FLEXIBLE)	1330
34	VERNIER THEODOLITE,PRECISION	1330
35	VERNIER THEODOLITE,ORDINARY	220

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
36	ENGINEERS PRECISION LEVEL/DUMPY LEVEL	130
37	ISKAMATIC 'A'	3550
38	CALIBRATOR '03'	1110
39	48 POLE EXTENDER CARD	220
40	MULTIJET NPM	440
41	OSCILLOMETER	11320
42	VOC EQUIPMENT	1550
43	BINARY SIGNAL GENERATOR	320
44	ELECTRIC COUNTER	760
45	FREQUENCY GENERATOR	1110
46	DBF 3 VIBRATION RECORDER/ANALYSER	3630
47	L&T GOULD OSCILLOGRAPH 2-CHANNEL	540
48	L&T GOULD OSCILLOGRAPH 6-CHANNEL	1310
49	VIBROPORT 41/FFT ANALYSER	6060
50	ELCID kit	11120
51	UNIVERSAL CALIBRATION SYSTEM	3030
52	NATURAL FREQUENCY TESTER	3230
53	DIGITAL HARDNESS TESTER	400
54	ADRE 208 VIBRATION ANALYSER	8080
55	PCB DIAGONISTIC REPAIR KIT	2220
56	SECONDARY INJECTION RELAY TEST KIT	5860
57	MICRO OHM METER	1610
58	DIGITAL MICRO OHM METER MEASURING RANGE: 200 μΩ TO 20KΩ	3590
59	PMI Machine OLYMPUS make	3730
60	Mobile Lighting Mast - 9 metres (4X400 W)	960
61	10KVA RESISTANCE BRAZING MACHINE	160
62	RECURRENT SURGE OSCILLOGRAPH (RSO) TEST KIT WITH PORTABLE HANDHELD OSCILLOSCOPE.	510
63	HYDROGEN GAS LEAK DETECTOR	60
64	STATOR WEDGE ANALYZER KIT WITH COMPLETE ACCESSORIES	5530
65	WEDGE DEFLECTION KIT	90
66	TILE PRESSING MACHINE FOR GAS TURBINE	300
67	INDUCTION BRAZING MACHINE	5410
68	MAGNETIC COHESIVE FORCE (MCF) EQUIPMENT	4040
69	ULTRASONIC FLOW METER	200
70	PORTABLE VIBRATION ANALYSER (MODEL 811T)	50
71	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -14KG/SQ CM. ; FLOW 60 M3/HR	520
72	CENTRIFUGAL PUMP SET FOR ACID CLEANING (WITH MOTOR AND PANEL) : PRESSURE -30KG/SQ CM. ; FLOW 15 M3/HR	480
73	HI SPEED MEMORY RECORDER, MAKE -YOKOGAWA, MODEL DL850E-Q-HE/B5/HD1	2010
74	TROLLEY MOUNTED HYDRAULIC JACK (100 MT)	1400
75	5KV Insulation Tester	500

ANNEXURE-T II
DT: 31/08/2021

RATES OF T & P HIRE CHARGES FOR ITEMS OTHER THAN CRANES & TRAILLERS ETC. FOR OUTSIDE AGENCIES

SL NO.	ITEM DESCRIPTION	Revised rates (Rs./Day) valid from 01/09/2021 to 31/8/2023
76	4 Channel Digital Oscilloscope /Fast Recorder	1900
77	4 Channel Oscillographic Recorder	650
78	Sound Level Meter	260
79	Thermal Imaging Camera	860
80	Videoscope (Video Boroscope)	1680
81	DO (Dissolve Oxygen) Meter (0 to 1500 ppb)	1460
82	Conductivity Meter	90
83	Core Flux Test Kit	8090
84	Primary Current Injection Kit (2000A)	960
85	3 Phase Secondary Injection Kit (Relay Test)	4180
86	FRF Filtration Kit	1480
87	FFT Analyser	2550
88	Flue Gas Analyser	1140
89	Oil Test Kit (Mineral Oil)-Transformer	1120
90	Winding Resistance kit (R L C Load)	970
91	SFRA test Kit	1320
92	Tan Delta test Kit	4510
93	PF Meter	360
94	Ultrasonic Flow Meter	920
95	Oil Particle Counter	400
96	Plasma Cutting Machine (With complete accessories)	340
97	JCB make DG Set 80 KVA	740
98	Diesel Generating Set 82.5 KVA	680
99	Portable Jacking Oil Pump	1200
100	Alloy Analyser	1970

TECHNICAL SPECIFICATION

INTERIOR WORKS

GENERAL PREAMBLE TO THE BILL OF QUANTITIES

1. The Bill of Quantities must be read with the Drawings, and the Specification and the tenderer shall be deemed to have examined the Drawings, Specifications, and to have acquainted himself with the Works to be done and the way in which they are to be carried out.

2. Not withstanding that the work has been sectionalized, every part of it shall be deemed to be supplementary to and complementary of every other part and shall be read with it or into it so far as it may be practicable to do so.

3. The detailed description of work and materials, given in the Specification are not necessarily repeated in the Bill of Quantities.

4. Each individual item in the Bill of Quantities is to be priced or if any items are not priced it is to be indicated under which item or items the value of the work has been included. If the tenderer omits to price an item the cost of the work of such item shall be held to be spread over and included in the prices given for other items. He is not to mark items "included" when the rate is asked for. Exactly similar items in different sections shall be priced similarly.

5. For the sake of convenience the Bill of Quantities is sectionalized to cover one structure or a group of structures.

6. The quantities in Sections of the Bill of Quantities are for the official designs. In case the tenderer quotes for the official designs, payment will be made according to the actual quantities of works ordered and carried out, as measured and valued at the rates and prices quoted in the Bill of Quantities.

7. Unit Rates will be used as basis of payment for schedules and variation orders.

8. Rates and prices set against items are to be the full inclusive value of the finished work shown on the Drawings and/or described in the specification or which can reasonably be inferred there from and are to cover the cost of marking layout of buildings, fixing permanent grid points, establishing bench mark, provision of plant, labour, supervisions, materials, erection, insurance, maintenance, overheads and profits and every incidental and contingent cost and charges whatsoever including all taxes such as turnover tax, Excise duty, customs duty, sales tax, sales tax on works contract and general tax, if any and every kind of temporary work executed or used in connection therewith and all the Sub Contractor's obligations under the sub contract and all matters and things necessary for the proper completion and maintenance of the Works.

9. The specification is intended to cover the supply of material and the execution of all works necessary to complete the Works. Should there be any details of construction or materials which have not been referred to in the Specification or in the Bill of Quantities and Drawings, but the necessity for which may reasonably be implied or inferred there from or which are usual or essential to the completion of all works in all trades, the same shall be deemed to be included in the rates and prices named by the tenderer in the Bill of Quantities. If there is inconsistency between the Bill of Quantities, Specification or Drawings, the description in the Bill of Quantities shall prevail.

10. The abbreviations used in the Specification and Bill of Quantities shall be read as follows:

IS	-	Indian Standard
BS	-	British Standard
A.S.T.M.	-	American Society for Testing and Materials
A.W.S	-	American Welding Society
mm	-	Millimetre /s
cm	-	centimetre /s
km.	-	kilometre /s
l.m.	-	linear metre /s
r.m	-	running metre /s
gm.	-	gram
kg.	-	kilogramme
N.B.	-	Nominal Bore
Tonne/t/MT	-	metric ton/s (1000 Kilogrammes)
n.e.	-	not exceeding
dia.	-	diameter
wt.	-	Weight
sq.cm.	-	square centimetre
incl	-	including

sq.m.	-	square metre
cu.cm.	-	cubic centimetre
cum	-	cubic metre
YST	-	yeild stress
no.	-	number
Drg.No.	-	drawing number
Qty.	-	quantity
E.O.	-	Extra Over
P.C.C.	-	Plain Cement Concrete
R.C.C.	-	Reinforced cement concrete
Rs.	-	rupees
P.	-	paise
L.S.	-	lump sum
P.S.	-	provisional sum
H.T	-	High tensile
M.S.	-	Mild Steel

1. General

These specification are for work to be done, items to be supplied, materials, to be used in the work shown and defined on the drawing and described herein, to the satisfaction of the Employer / Architect

1.1 The workmanship is to be the best possible and of a high standard. The Contractor shall take all steps immediately to make deficiencies if any noticed by the Client / Architect. Use must be made of special tradesman in all aspects of the work and allowances must be made in the rates for the same.

1.2 The materials to be provided by the contractor shall be accordance with the samples already got approved from the Client / Architect by the contractor and in conformity with

specification and approved; list of manufactures and brand The contractor shall produce all invoices, vouchers or receipts for any materials if called upon to do so by The Client / Architect.

1.3 Samples of all materials are to be submitted to the Client/Architect for the approval before the contractor orders or deliver the materials to the site. Samples together with their packing are to be provided free of charge by. The contractor and should any materials to be rejected, they will be removed from the site at the contractor's expenses. All samples will be retained by the Client / Architect for comparison with materials which will be delivered at site. Also the contractor will be required to submit the specimen finishes of colours, fabrics etc., for the approval of the Client / Architect before proceeding with the work.

1.4 The contractor shall be responsible for providing and maintaining temporary coverage required for the protection of finished work. He is also to clean out all wood· shaving, cut ends and other waste from all parts of the work before covering or in filling is constructed.

1.5 Contractor shall maintain uniform quality and consistency in workmanship throughout the execution of the work.
1.6 Site order Books / reports for the purpose of quick communication between the Architect / Architect's representative and the contractor or his agent or representative, site instruction books shall be maintained at site in the manner as described below.

1.7Any communication, relating to the works may be conveyed through records in the site instruction book. Such communication from the Architect / Architect's representative to the contractor shall be deemed to have been adequately served in terms of the contract. Each site instruction book shall have machine number pages in triplicate and shall be carefully maintained and preserved by the contractor at site. Any instruction or others which the Architect / his representative may like to issue to the contractor may be recorded by him in the site instruction book and one copy thereof issued to the contractor.

1.8 The contractor shall check and verify all site levels and measurements whenever requested by the other specified contractors to enable them to prepare there own shop drawings and pass on the information with sufficient promptness. A copy of all such information passed on shall be given to the consultants.

1.9 Templates, boxes and moulds shall be accurately set out rigidly constructed so as to remain accurate during the time they are in use.

1.10 All unexposed surface of timber eg: - partition/paneling frames, false ceiling, backing, fillets, backs of door frames, cupboards framing, grounds etc are to be treated with two coats of approved timber preservative and anti termite paints before fixing or converging.

1.11 All concealed surface of MDF/Plywood with 0.80mm thick Laminate.

1.12 All Exposed edges to be finished with 2mm thick PVC Edge banding with suitable adhesive to the satisfaction of the Client/Architect.

2. Joinery in woodwork

2.1 The contact surface between internal frame and skinning shall be glued with approved adhesive in addition to fixing with necessary screws etc.

2.2 After preparing proper surface of skinning by sand preparing etc., the laminate or veneers shall be fixed on it with the help of approved adhesive.

2.3 Frame work for full height partition shall be rigidly fixed to the floor, walls and ceiling soffit. The partition height shall be measured up to bottom of false ceiling and framing members / ply going above will not be measured.

2.4 Any portion that are warped or found with other defects are to be replac^{0}d. The whole of the work is to be framed and finished in a workman- like manner in accordance with detailed drawings and the direction of Client / Architect and whenever required, fitted with all necessary metals ties, straps, screws, adhesive etc. Joinery work generally to be finished with fine sand/glass paper.

2.5 All joins shall be standard mortise and tenon, dowel, or cross-halved. Screws, nails, etc. will be of standard iron or wire. Tenon should fit the mortises exactly.

2.6 Nailed or glued butt joints will not be permitted.

2.7 Whenever screw heads are on finished surfaces those will be sunk and the hole plugged with a wood plug of the same wood and grain to match the colour.

2.8 The contact surfaces of dowels, tenons, wedges etc., shall be glued with approved adhesives. Were glued, joinery and carpentry works is likely to come into contact with moisture, the glue should be water proof.

3. Timber

3.1 All the Sal wood, Steam, Beach wood, CP teak, BTC to be used shall be properly seasoned, of natural growth and shall be free from worm holes, loose or dead knots or other defects, sawn square and shall not suffer from warping, spitting or other defects.

3.2 The moisture content shall not exceed 12%

3.3 All internal frameworks shall be treated with approved wood preservative, anti termite and with fire retardant treatment/paint.

3.4 All wood brought to site to be clean; it shall not have any preservatives or other coating / covering.

3.5 All rejected, decayed, bad quality wood shall be immediately removed from site.

3.6 All the dimensions mentioned for T.W. members are finished sizes.
All wood brought to site should be stacked, stored properly as per instructions.

4. Plywood

Plywood should be accordant as per the specification stipulated in bills of quantities.
Commercial Ply wood should generally confirm to IS :303, bonded with Phenol formaldehyde, BWR grade treated with wood preservative.
Particle boards should be phenol formaldehyde bonded and generally confirm to 15:3087 - 1965
Only 3mm to 4mm thick straight grain group matching approved veneers should be used.
MDF if used in places as per specification should be confirming to 15:12406 - 1988

5. Hardware and Metals

5.1 The hardware throughout shall be of approved manufacture or supplier well made and equal to in every respect to the sample to be deposited with architect. The contractor may be required to produce and provide samples from many different sources before the Client/Architect to take decisions and he should allow his rates for doing so.

5.2 All the screw/bolts with nuts to be used shall have oxidized finish (unless required otherwise) of approved shapes, size and quality.

5.3 Fittings shall be of brass oxidized heavy duty unless specified otherwise.

5.4 Samples of all hardware are required to be got approved in advance from Architects/Client.

5.5 The agency should cover up and protect the brass surface by thick grease or other suitable material veneer as necessary and subsequently clean it away at the same time of handing over.

5.6 All hardware shall be fitted with good workmanship without the surrounding edges being damaged.

Aluminum and stainless steel shall be of approved manufacture and suitable for its particular application. Generally the surface of aluminum shall have an anodized finish and both shall comply with samples approved by Client/Architects.

6. Laminate

6.1 All laminate shall be specified in Bill of Quantity and of approved make.

6.2 The contractor shall get the sample showing the surface texture, pattern and colour approved by Client / Architect.

6.3 All edges, beading, etc shall also be finished in Lip pings

7. Fabrication in Metal

7.1 All brazing and welds are to be executed in a clean and smooth manner, rubber down and finished in flat and tidiest way, particularly where exposed.

8. Glass Works

8.1 All glass is to be of approved manufacture, complying with 1.5. 3548-1960, or as per approved quality and sample, to be of the qualities specified and free from bubbles, air holes, waviness and other defects.

8.2 In cutting glass, proper allowances shall be made for expansion. Each square or rectangle of glazing to be in one whole sheet.

8.3 Glass for mirror shall be silvering quality (5.Q.) conforming to 1.5.3458-1958 or as approved sample and quality.

8.4 On completion, all glass surfaces shall be cleaned inside and out. All cracked, scratched glass/ mirror shall be replaced.

8.5 Sun control film shall be non-reflective type, of approved make and shade. The fixing shall be without any defects such as air bubbles/ creases / adhesive marks, etc.

9. Paint and Polishes

9.1 All material required for the work shall be specified ands approved manufacture, delivered to the site in the manufacture's containers with the seals, etc. unbroken and after use empty containers shall be stored till finally cleared by the Employer.

9.2 All iron or steel/metal surfaces shall be thoroughly scraped and rubbed down with wire brushes and shall be entirely free from rust, mill scale etc. before applying the primer coat.

9.3 Melamine polish finishes shall be properly finished, without any flow marks, spots, roughness etc.

Painting work shall be of high standard, without any brush marks on the finished surfaces and no spots on adjacent furniture, glass, etc.

Spray painting with approved machines will be permitted only if written approval has been obtained from the Client/Architect prior to painting. Neither spraying will be permitted in the case of priming coat nor where the soiling of adjacent surfaces is likely to occur. The buzzle and pressure to be so operated has to give and even coating throughout to the satisfaction of the Client/Architect. The paint used for spraying is to comply generally with the specification concerned and is to be specially prepared by the manufacture for spraying. Thinning of paint made for brushing will not be allowed.

All brushes, tools, pots, kettles etc. used in carrying out the painting works shall be clean and free from foreign matter and to be thoroughly cleaned out before use with a different type of class of material.

Prior to painting, the surface preparation should be done as per IS code i 4177 1994 para 4.2.1, 5.2.1.1, 5.2.2.1, 5.2.3. In the case of maintenance operation, the surface preparation should be done as per para 7.00 of IS 14177:1994

For primer and finist1ing coat, the painting work should be carried out strictly as per 5.2.1.2, 5.2.1.3, 5.2.2.2 and 5.2.2.3 of IS Code.

Painting should be done invariably using airless spray equipment as per IS : 141771994 wherever recommended.

Proper care should be taken for deciding the compatibility of primer paint with paints used for finishing coats, including thinner on the basis of manufacturer's recommendation.

Enamel paint should confirm to IS 133 - 2004

Wood filler, transparent liquid should confirm to IS: 345 - 1952 (with amendment Nos. 1 and 2 reaffirmed 1986).

French Polish if to be done as per specific requirement should confirm to IS 348 1968 (First revision, with amendment No's 1, reaffirmed 2001)

Painting on concrete, masonry and plastered surfaces should confirm to IS : 2395 (. pt - I) - 1994 (Operations workmanship re affirmed 2005)
Plastic emulsion painting for interior use should confirm to IS 5411 (Pt.I) - 1974 (with amendment No: 1, reaffirmed 1993)

10. Civil Work

10.1 The Contractor shall use cement of approved make only.

10.2 Only first quality ceramic tiles / vitrified tiles of approved make shall be used. All tiles joints shall be filled up properly using cement slurry mixed with matching pigments.

10.3 Only best quality granite and marbles of the basic rate specified and of approved shade shall be used. (Basic rates wherever mentioned are ex-go down and excluding taxes). The granite/marble shall be from the same lot and without colour / shade variations or any other defects.

10.4 All edge chamfers / cutting of granite / marble shall be mirror polished and no extra shall be paid for the same. In the case of Urinal partitions / sink partitions, the granite slab used for partition should be polished on both sides.

11. Upholstery
This will be of first call standard workmanship with webbing, no sag spring, coiled springs, padding and filling as specified on drawing. Covering fabrics will be seen tufted and corded as shown on the drawing and as approved by the Client/Architect.

Cushion Vents- Brass Cushion vents should be installed at the back or under side of seat cushions (especially those covered in leather vinyl plastics or very tightly woven fabrics) to allow air to escape easily and to prevent tearing.

Materials- Finished timber shall be of the type specified. Furnishing fabrics, colour, pattern, substance to be as specified and manufacture, or supplied by the company specified, no variations of this will be permitted unless with prior approval of the consultants. The sample of the upholstery should be got certified from the Client! Architect, before placing orders.

12. Polish

12.1 French Polish

The basic material shall be shellac dissolved non methylated spirit
The timber must be well sanded and clean and the grain filler. Any staining must be done before applying the polish.

By pad of cotton with soft white linen or cotton fabric, apply evenly over the surface with a slow figure of eight motion until the timber is coated with a thin layer of polish. Allow the work to stand for at least 8 hours, and the fresh rubber with double thickness of cover material and charges it with methylated spirit.

12.2 Wax Polish

Wax polish shall contain silicon's and driers. A good silicon wax is to be used not a creamy or sprays. Timber shall be sealed first with another finish such as Ron seal, before applying wax.

Apply a light coat of the sealer by brush or cloth direct to the unfilled timber, working it well in and finishing evenly with the grain. Allow to dry thoroughly then sand lightly with fine paper. Apply a heavy coat of wax by cloth or on flat surfaces with a stiff brush. Work it well into the timber and finish of by stroking with grain before leaving to harden. Leave for several hours before rubbing up with a soft brush. Finally buff the grain with a soft cloth.

12.3 Transparent colored Polyurethane (Melamine)

This shall be applied where natural grain of the wood is required to show.
Polyurethane gives tough surface which resist chipping, scratching and boiling water .
Clean off all grease and wax with an abrasive and white spirit, this should not be applied in humid conditions. Apply the first coat, preferably of clear hard glaze with a cloth pad. Leave this to dry for at least six hOlJi s, and then apply further coats with a paintbrush. If you wait for longer than 24 hours between coats, rub down the previous coat with fine glass paper or a medium grade steel wool. Obtain a matt finish, if required, by giving a final coat of clear Ron seal Matt Coat.

VIII. MODE OF MEASUREMENTS

The measurements will be made in terms of relevant IS codes and will be made in meters and will be as per I.S code. The method of measurements for each item is as given under:

1. DOORS, WINDOWS, ROLLING SHUTTERS AND GRILLS
Clear area over one face inclusive of frame shall be measured. Hold fasts and portions embedded in masonry or flooring shall not be measured.

2 PARTITIONS IN WORK
The partition height shall be measured up to bottom of false ceiling finished level and framing members / ply going above shall not be measured.
3CARPETS
The actual area covered by the carpet shall be measured. No extra shall be allowed for wastage.

4. TILE WORK

The work mentioned in this section (shall be measured in Sq.ft or Sq.m. and shall be priced per unit of Sq. mt. In all paving work, the slabs shall be touching the walls and go well under the plaster, but the measurements shall be the clear measurements of the rooms or areas when finished. No allowance shall be made for portions going under the plaster. The wall dado will also be measured as per the clear measurements of the visible area only.

5. FALSE CEILING

For false ceiling work, the measurement shall be for the actual area covered. The vertical faces will be measured as per the actual visible area. No deduction shall, be made for the cutouts, for light fittings, speakers, column up to 1.5 Sqm.

6. PAINTING

The rates include all scaffolding, ladders, paints, cans, brushes and other appliances required for the efficient execution of the work. The rates also include conveyance, delivery, handling, unloading, storing, wastage, protective cover and cleaning stains from floors and walls, glass panes etc and also preparatory works such as knotting, priming stopping and rubbing down, burning off or stripping etc.
The rates for special conditions of works not mentioned in the tender will be finalized by Client / Architect considering tile site conditions and nature of specialty required, which will be final and binding on the contractor.
Measurements

No deduction will be made for openings not exceeding 0.5 Sq.m each and no addition will be made for painting to beading, mouldings, edges, jambs, soffits, sill etc. of such openings.

Corrugated sheet surfaces will be included with plain surfaces after increasing their areas by the following percentages :-

(i) Corrugated sheets 14%
(ii) Asbestos cement sheets corrugated 20%
(iii) Asbestos cement sheets semi corrugated:- 10%

Areas of uneven surfaces will be converted into equivalent plain areas in accordance with table given below:

Table of Equivalent Plain Ares of uneven Surfaces

Sl.No.	Description of work	How measured	Multiplying factor
1	Panelled or framed and brazed or ledged and battened or ledged, battened and brazed joinery	(not 11.30 (for Measured flat (not girthed) including frame. Edges, chocks, cleats etc. should be deemed to be included in this item	1.30 (for each side)
2	Flush joinery	Do	1.20 (for each side)
3	Fully glazed or gauged joinery	Do	0.80 (for each side)
4	Partly paneled and partly glazed or gauged joinery	Do	1.00 (for each side)
5	Fully Venetianed or lovered joinery	Do	1.80 (for each side)
6	Weather boards	Measured flat (Not girthed) supporting frame work shall not be measured separately.	1.20 (for each side)
7	Guard Bars, Balustades gales, gratings, grills, expanded metal and railings, gates and open for open palisade fencing including standard braces, rails stays etc .	Measured flat overall. No deduction shall be made for open spaces. Supporting members will not be measured separately.	1.00 (for painting all over)
8	Carved or enriched work	Measured flat	2.00 (for each side)
9	Steel rolling shutters	Measured flat (size of opening) overall, jamb guides, bottom rails and locking arrangement, etc., shall be included in the item (top cover will be measured separately)	1.10 (for each side)
10	Plain sheet steel doors and windows	Measured flat (not girthed) including frame, edges etc.	1.10 (for each side)
11	Fully glazed or gauged steel	Do	0.50 (for each side)

12	Partly Paneled and partly glazed steel doors.	Do	0.80 (for each side)
13	Collapsible gate	Measured flat (size of opening)	1.50 (for each side)

PREAMBLE TO THE BILL OF QUANTITIES : IRON AND STEEL WORKS

Unless otherwise specified the rates quoted shall include for the following :

1. Work at all heights and at all levels.

2. The steel casement windows and ventilators, including all its fittings, shall be manufactured to conform to IS 1038 and I.S. 7452.

3. Appropriate sections having the specified Weight characteristics only shall be used.

4. Shutters of all windows and ventilators shall be as per drawing.

5. Projecting type stainless steel hinges / pivot hinges must be provided for all side hung shutters.

6. All the members should be finished with one coat of Anti- corrosive primer after through cleaning of the surface to remove rust/scale, oil etc., in accordance with I.S. 1038.

7. The fittings supplied shall be sturdy and samples of all fittings shall be got approved before fabrication.

8. The workmanship and finish of the windows, ventilators and fittings should be of first class and shall be got approved.

9. All hardware fittings such as Peg stays with screws, Standard Handles, Spring, catches, lugs with suitable screws, Glazing clips, Transomes, Mullions, Coupling bars, Weathering bars, where necessary Cast aluminium alloy or pressed steel stove enameled wrinkle finish.

10. Supply of hardware fittings like coupling, mullions, and additional fixing like clamps, bolts, nuts, washers etc., for continuous fastening of windows / structural steel members.

11. All reinforcement steel shall be of Fe-500 or Fe-415 or Mild steel conforming to IS 432 or HYSD bar conforming to IS 1786.

12. Cutting and waste, straightening, bending, hoisting, fixing, supporting in position with precast spacer blocks or chairs / spacer rods and tying with GI annealed wire, welding with electrodes wherever required, including allowance for laps.

13. Submission of reinforcement for testing and submission of test reports for approval, prior to use.

14. All materials supplied shall be free from manufacturing defects and defective workmanship and guaranteed. Any defects noticed shall be made good by the Contractor at his own cost, without claim for any extra.

PREAMBLE TO THE BILL OF QUANTITIES - FLOORING WORKS

Unless otherwise specified rates quoted shall include for the following :

1. Work at all heights and at all levels.

2. Work at any floor, any height and in any position or shape as directed with necessary scaffolding with all leads and lifts, cost and conveyance of all required materials to site of work, royalty charges, required tools and plant etc.

3. Final preparation of base sub-grade or sub-floor by cleaning of all dust/dirt, loose particles, caked mortar dropping by scrubbing with coir or steel wire brushes, haul king etc. Roughening surface if so directed, cleaning with water and keeping surface wet for 12 hours and removing surplus water by mopping before topping is laid and minor trimming of the base to remove undulations.

4. Cleaning and watering immediately before laying the floor as directed.

5. Providing bedding layer of mortar as specified in the case of slabs, tiles, etc. to correct levels gradients or steps as called for.

6. Cutting, rubbing and polishing where applicable (both machine and hand) including grinding, rubbing, acid cleaning, wax and tin-oxide polishing etc.

7. Keeping the surface wet for a minimum period of one week.

8. For all Marble flooring, skirting, dadooing to be done with neat white cement slurry coat to the required thickness over bed mortar before laying the marble slab. All cladding works in marble slab, granite, etc., shall be arranged with requisite brass / gun metal clamps / stainless steel clamps and keys in required sizes and pattern as directed.

9. All ceramic / glazed tile flooring shall have bedding layer of mortar as specified in the bill of quantities and skirting shall have bedding layer of "ROFF TILE" Water proof Tile Adhesive for fixing and pointing shall have 'Roff Tile – Joint Fillers' of approved shade and colour as per Manufacturer's Specification.

10. All ceramic / glazed tile dadoing shall have final light acid cleaning and pointing with "ROFF TILE" Joint Fillers compound of approved shade and colour as per manufacturer's specification.

12. Work in jambs soffits and sills of openings for lifts entrance in marble shall be arranged to match with the surroundings and as directed.

13. Formation of vertical grooves on vertical surfaces and provision of mortar bed of required thickness to achieve proper level/slope.

14. Provision in small quantities, narrow width, mitered and returned ends, sinking, risers, set back and any other sundry items for cutting, fixing, making good upto and which may be required for forming base.

PREAMBLE TO THE BILL OF QUANTITIES: PAINTING AND FINISHING WORKS

Unless otherwise specified rate quoted for all items shall include for the following:

1. Work at all heights and depths and also internally and externally.

2. Erection of necessary double scaffolding and removal of the same and other equipments etc.

3. Providing all materials like paints, brushes and other materials and application of paint as per Manufacturers specification conforming to relevant item in bill of quantities.

4. Cleaning of plastered surface of walls, all surfaces of wooden / steel / aluminium joinery etc., removal of dirt, dust by sand paper, chemical removal of rust etc. filling in crevices at any level and puttying the surface complete and leaving the work neat as directed.

5. Eventhough the number of coats have been specified against each item of work, any additional coat is required shall be given without any extra cost to bring the surface to the desired finish, before handing over the site.

    - Neat finishing of junctions of plaster, skirting, dadoing and cladding.

    - All the junctions of Painting surface and joinery works should be protected with peel off foil or protective tape.

6. All paints should be of best quality of approved make and colour.

1. TECHNICAL SPECIFICATION FOR CONCRETE WORKS

This specification covers the general requirements for plain and reinforced cement concrete of different grades.

The requirements for concrete shall be materials, storage of materials, design of concrete mix, sampling and testing, form and formwork, construction joints, preparation and placement of concrete including batching, mixing, conveying, depositing and curing, finishing, grouting,

inspection, clean-up etc. The concrete shall generally comply with the requirements of latest IS : 456.

Unless otherwise specified, the rates for all RCC will be exclusive of reinforcements. Reinforcements will be paid for separately. Unless otherwise specifically mentioned, the rates for all plain and RCC works shall be inclusive of formwork, centering and shuttering.

MATERIALS :

1. **Cement :**

Unless otherwise specified, ordinary Portland cement of 43 grade conforming to latest IS : 8112 shall be used for all concrete works. Test certificates from the manufacturers to show that the cement brought by the contractor to site for use in the works fully complies with the relevant IS Specification shall be submitted to the Engineer at the Contractor's own cost. In addition, field test shall be conducted for every consignment of cement for the purpose of concrete design mix. Cement shall be stored and neatly packed in piles not exceeding 10 bags high in weather proof sheds with raised wooden plank flooring to prevent deterioration by dampness or intrusion of foreign matter. It shall be stored in such a way as to allow the removal and use of cement in chronological order of receipt, i.e. the first received being first used. Cement deteriorated and/or clotted shall not be used on work but shall be removed at once from the site. Daily record of cement received and consumed shall be maintained by the contractor in an approved form and a copy submitted to the Engineer once a week. Not withstanding the above, the Engineer, for any reasons whatsoever, may at his discretion order to retest, the cement brought to site in an approved testing laboratory and fresh certificate of its soundness shall be produced at the Contractor's own cost. Cement ordered for retesting shall not be used for any work pending results of re-test.

2. **Aggregates :**

Fine and coarse aggregates shall conform to IS 383. If required, the aggregates shall be washed and screened. Sampling and testing shall be as per IS : 2386.

Each size of aggregate shall be stored on a separate platform and shall avoid mixing and contamination with foreign material. Segregated aggregates shall be rejected.
Cost of stacking, washing, screening and cost of all tests, sampling etc. shall be borne by Contractor.

a) **Fine Aggregate :**

Sand shall conform to IS: 383. It shall pass through I.S sieve 4.75 mm (3/16 B.S) test seive, leaving a residue not more than 5%. It shall be from a natural source approved by the Engineer. It shall be washed if directed to reduce the percentage of deleterious

substances to acceptable limits at Contractors own cost. Sand shall not contain any trace of salt and sand containing any trace of salt shall be rejected.

The fine aggregate for concrete shall be graded within limits as specified in IS : 383 and the fineness modules shall range between 2.60 to 3.20.The fine aggregate shall be stacked carefully on a clean hard dry surface so that it will not get mixed up with deleterious foreign materials. If such a surface is not available a platform of planks or corrugated sheets or brick floor or concrete floor shall be prepared.

IS Sieve Designation	**Percentage Passing**			
	Grading Zone I	**Grading Zone II**	**Grading Zone III**	**Grading Zone Iv**
10 mm	100	100	100	100
4.75	90 - 100	90 - 100	90 - 100	95 - 100
2.36	60 - 95	75 - 100	85 - 100	95 - 100
1.18	30 - 70	55 - 90	75 - 100	90 - 100
600 Micron	15 - 34	35 - 59	60 - 79	80 - 100
300 Micron	5 - 20	8 - 30	12 - 40	15 - 50
150 Micron	0 - 10	0 - 10	0 - 10	0 - 15

c) **Coarse Aggregate :**

Coarse aggregate shall conform to IS : 383. It shall consist of crushed or broken stone, 95% of which shall be retained on 4.75 mm IS test sieve. It shall be obtained from crushed granite, trap, besalt or similar approved stones from approved quarry. Coarse aggregate shall be chemically inert when mixed with cement & shall be angular in shape and free from soft friable thin porous laminated or flaky pieces. It shall be free from dust and other foreign matter. Gravel/shingle of desired grading may be permitted as a substitute in part or full in plain cement concrete if the Engineer is otherwise satisfied about the quality of aggregate.

IS Sieve Designation	A						B			
	% Passing for single sized aggregate of nominal size						% Passing of graded aggregate of nominal size			
	63 mm	40 mm	20 mm	16 mm	12.5 mm	10 mm	40 mm	20 mm	16 mm	12.5 mm
80 mm	100	-	-	-	-	-	100	-	-	-
63 mm	85 - 100	100	-	-	-	-	-	-	-	-
40 mm	0 - 30	85 - 100	100	-	-	-	95 - 100	100	-	-
20 mm	0 - 5	0-20	85 - 100	100	-	-	30 - 70	95 - 100	100	100
16 mm	-	-	-	85 - 100	100	-	-	-	90 - 100	-
12.5 mm	-	-	-	-	85 - 100	100	-	-	-	90 - 100
10 mm	0-5	0-5	0-20	0-30	0-45	85 - 100	10-35	25-55	30-70	40-85
4.75 mm	-	-	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36 mm	-	-	-	-	-	0-5	-	-	-	-

Unless otherwise specifically stated for all RCC works, the size of coarse aggregate shall be 20 mm and down size.

3. **Water :**

Water used for mixing concrete and curing shall be potable quality, fresh, clean, free from oil, salts, acids, alkali and shall be in accordance with the clause 4.3 of IS 456. The contractor shall produce test results of water proposed to be used on the job for approval by the Engineer for the mixing before casting any concrete.

4. **Reinforcement :**

Refer separate specification given elsewhere.

5. **Admixtures :**

The use of admixtures may be allowed only if approved by the Engineer and his decision in this regard shall be final.

Concrete :

Concrete shall be specified in various graded designations as M-10, M-15, M-20 & M-45 etc. The letter 'M' refers to the mix and the number to the minimum compressive strength in N/Sq.mm to be established by 28 day of 15 cms works cube tests with the probability of not more than 1 test out of 10 falling below that minimum.

The proportions of ingredients for concrete shall be such that in addition to complying with the strength requirement, the concrete shall have adequate workability and proper consistency to permit it to be worked readily into the forms and around reinforcement, under the conditions of placement to be employed without excessive segregation or bleeding.

All ingredients shall be proportioned and measured by Weight using approved weigh-batching equipment. There shall be full field control of (1) predetermined grading of all aggregates that go into concrete (2) predetermined proportion of course aggregate, fine aggregate, cement and water for the required strength.

Design Mix :

The Contractor is responsible for the design of the concrete mix. The Contractor shall design the mix and submit for the approval of the Engineer. No concreting works shall be commenced without the approval of the design mix of concrete.

The Contractor shall make trial mixes using coarse aggregates, sand, water and cement actually available at site to be used for making concrete. Before making trial mixes all the ingredients shall be tested in the field laboratory and should conform to the relevant IS Specifications. Suitable proportions of sand and the several sizes of coarse aggregates for each grade of concrete shall be selected to give as nearly as practicable the maximum density, this is to be determined by mathematical means, laboratory tests, field trials or other means.

The minimum cement contents for design mix concrete of various grades shall be as under :

Grade of concrete	**Cement per cum of concrete**
M-10	220 Kgs
M-20	320 Kgs
M-25	330 Kgs

The mix required to produce, place and compact the specified grade of concrete shall be designed by the Contractor. He shall carry out preliminary tests of specimen at his own cost at field laboratory as per IS : 456 and IS : 516 and he shall furnish to the Engineer a statement of proportions proposed to be used for various concrete mixes and grades of concrete for approval.

The minimum strength requirements shall be as follows :

Minimum compressive strength of 15 cm cubes at 7 days and 28 days after mixing, conducted in accordance with IS : 516.

Grade of Concrete	**Preliminary Test N/Sqmm**		**Work Test N/Sqmm**	
	At 7 days	**At 28 days**	**At 7 days**	**At 27 days**
M - 10	9.0	13.5	7.0	10
M - 20	17.5	26	13.5	20
M - 25	22.0	32	17.0	25

Once a mix including water cement ratio has been determined and specified for use by the Engineer, that W/C ratio shall be maintained.

Details of design mix concrete approved by the Engineer shall be submitted to the Engineer for record along with the results of sieve analysis and such other tests on cement, aggregates and water etc. The approved design mix shall then be followed for subsequent concreting operations at site till a variation in some characteristics of any ingredient is observed or till a variation in the degree of quality control necessitates a change in the mix.

Batching and Mixing of Concrete :

All materials for controlled concrete shall be batched as per approved design mix in suitable weigh batcher of adequate capacity and of approved design. Mixers for concrete may be stationary mixers of either the tilting or non-tilting type, or truck mixers of approved design. Thorough mixing of the concrete is essential and mixers shall be

capable of combining the materials into a uniform mixture, uniform colour and of discharging this mixture without segregation. The mixers should always be operated at the speed and time recommended by the makers. The mixers shall be maintained in sati's operating condition, and mixer drums shall be kept free of hardened concrete. The consistency of the concrete produced from the mixers should have sufficient workability to enable it to be well consolidated, to be worked into the corners of the shuttering and around the reinforcements.

The slump for concrete as determined by slump tests as per Indian Standard 1199 latest edition, shall not exceed the maximum slumps indicated below for each type of construction using high frequency vibration unless otherwise approved or directed by the Engineer.

Workability	**Slump in mm**		**Type of construction**
	Min.	**Max.**	
Medium	40	80	All RCC works

The contractor shall not place concrete having a slump outside the limits specified without the approval of the Engineer.

Atleast one slump test shall be made for every compressive strength test carried out. More frequent tests shall be made if there is a distinct change in job conditions, or if required by the Engineer.

Transporting :

Concrete shall be conveyed from the place of mixing to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of any of the ingredients. If segregation does occur during transport, the concrete shall be remixed before being placed. Normally not more than 30 minutes shall lapse between mixing and consolidation in position. All means of conveyance shall be adopted to deliver concrete of the required consistency and plasticity without segregation or loss of slump.

Concrete should be transported only by transit mixers

Placing :

Method of placing shall be such as to preclude segregation and as far as practicable the placing shall be continuous. Special care shall be taken in accordance with latest IS : 456 while laying concrete under extreme weather.

Concrete shall be transported by transit mixers and placed in position without segregation. It is important that the concrete be placed in its final position before the cement reaches its initial set. The concrete should normally be compacted in its final position within 30 min. of leaving the mixer, and once compacted, it should not be disturbed. Before the concrete is actually placed in position, the insides of the forms should be inspected to see that they have been cleaned and oiled, care being taken to see that the reinforcements do not get contaminated. Temporary openings should be provided to facilitate inspection, especially at the bottom of columns, to permit the removal of all sawdust, wood shavings etc. Openings should be placed so that the water used to flush the forms will drain away. No water should be left in the forms. The concrete should be spread evenly in the form to avoid segregation and should completely fill all corners of the form work and the space between the reinforcement. Vibrator should not be used for spreading the concrete. Concreting should be carried on without interruption between predetermined construction joints.

Compacting :

The object of compacting concreting is to achieve maximum density. The concrete should therefor, be placed a little in excess of its specified depth so that after proper compaction its final desired depth is obtained. Manually Roding and tapping the concrete and tapping the form work on its external face shall be continuously carried out at the actual pouring head, while compacting the concrete with mechanical vibrators shall be done sufficient distance away from the pouring head, so that the vibrator is utilised only to compact the concrete and not to spread it. The Engineer may, however, at his absolute discretion, permit concreting by increasing the slump and correspondingly increasing the cement contents at contractor's cost. Except for shallow or inaccessible concrete the vibrator shall be penetrated vertically and at regular distance intervals, not at an angle and not at haphazard intervals. At corners, obstructions, embedded fixtures and congested reinforcement areas, the vibrators shall be manipulated with the utmost care and handled only by the most experienced workmen.

The number and type of vibrator to be used shall be subject to the approval of the Engineer and in general immersion type vibrators shall be used. Consolidation by using immersion vibrator will be in accordance with IS Code : 3558. Sufficient number of reserve vibrators in good working condition shall be kept on hand at all times, so as to ensure that there is no slacking of interruption in compacting.

Protection of Concrete :

All freshly placed concrete surfaces shall be protected from damages by workmen equipment or any other cause. The surface shall be protected from dry wind and direct sun rays. The Contractor shall provide and use, where directed by the Engineer enough tarpaulins or other suitable materials to cover completely or enclose all freshly finished concrete.

Curing :

As soon as the concrete is hardened sufficiently, it shall be cured by maintaining the concrete in a damp condition by application of wet sacking or other approved moisture retaining covering for a period of 28 days after placing the concrete. In floors curing should be carried out by ponding and covering with polythene sheets to reduce evaporation losses. Extreme care should be taken to ensure that all surfaces are kept in a moist condition and no local area shall be allowed to dry out intermittently. Curing shall be done with potable water free from sediments of any kind.

Construction Joints :

Construction joints in exposed concrete work shall be made only where shown on the drawings or directed by the Engineer and shall be in accordance with the details shown or approved by the Engineer. The procedure given in clause 20.1.4.2 of IS : 456 shall be followed for general guidance. All foreign matters shall be removed from the concrete before it is allowed to fully harden. The removal shall be effected by scrubbing the concrete surface with wire and with bristle brushes and washing down to expose clearly the aggregate. However care shall be taken to avoid dislodgment of particles of aggregate. If concrete has been allowed to harden excessively the surface shall be chipped over its whole surface and thereafter thoroughly washed. Before fresh concrete is added on the construction joints, the surface of the old concrete shall be thoroughly wetted and covered with a thin layer of cement mortar 1:1.

Construction joints in concrete floors and walls of basement, water tanks or any other structures in contact with water or earth, shall be provided with PVC water stops of approved make coated on either side with hot asphalt. The longitudinal joints, in water stops, shall preferably be not welded or overlapped atleast 200 mm.

Sampling and strength test of concrete :

Sampling and testing of concrete shall be conducted in accordance with the latest issue of Indian Standard 1199, 516 and 456.

During the progress of construction compression tests shall be made to determine whether the concrete being produced complies with the strength requirements specified. The test will be made in accordance with Indian Standard 516 latest edition.

The minimum frequency of sampling of concrete of each grade shall be in accordance with the following :

Quantity of concrete in the work, Cum	**Number of Samples**
1 - 5 6 - 15 16 - 30 31 - 50 51 and above	Plus one additional sample for each additional 50 Cum or part thereof

NOTE :

At least one sample shall be taken from each shift

A set of six specimens from random mixer batches, shall constitute a test, three being tested for 7 days and three being tested for 28 days strength.

The strength test result shall be the average strength of the three companion test specimens, tested at 28 days, except that, if one specimen in a test shows manifest evidence of improper sampling, molding or testing the result shall be discarded and the remaining two strengths averaged. Separate procedures shall be established when cements other than Portland cement are used.

Normally, 7 day and 28 day tests shall be made on specimens. For any mix, a correlation between 7 day and 28 day strengths may be made in the laboratory. Soon after a job starts, a similar correlation will evolve for samples of concrete taken from the mixer. After that correlation has been established, the results of the 7 day tests may be used as an indicator of the compressive strengths which should be expected at 28 days, provided such results are consistent. If 7 day tests show compressive strengths that are too low, measures shall be taken at once, at the Engineer's direction, without waiting for the results of the 28 day tests.

A. The concrete shall be deemed to comply with the strength requirements if:

a) every sample has a test strength not less than the characteristic value ; or

b) the strength of one or more samples though less than the characteristic value, is in each case not less than the greater of ;

i) the characteristic strength minus 1.35 times the standard deviation; and

ii) 0.80 times the characteristic strength and the average strength of all the samples is not less than the characteristic strength plus

$$1.65 - \frac{1.65}{\sqrt{\text{number of samples}}} \text{ times the standard deviation}$$

B. The concrete shall be deemed not to comply with the strength requirements if :

a) The strength of any samples is less than the greater of:

i. the characteristic strength minus 1.35 times the standard deviation and;

ii. 0.80 times the characteristic strength; or

b) the average strength of all the samples is less than the characteristic strength plus

$$1.65 - \frac{3}{\sqrt{\text{number of samples}}} \text{ times the standard deviation}$$

C. Concrete which does not meet the strength requirements as specified in Para (A) but has a strength greater than that required by Para (B) may be accepted as being structurally adequate without further testing by the Engineer in consultation with designer.

In the event that concrete tested in accordance with the requirements of the above clause, fails to meet the specification, the Engineer shall have the right to require any one or all the following :

a) Changes in the concrete mix proportions for the remainder of the work

b) Coring and testing of the concrete represented by the tests which failed as per IS : 456.

c) Load tests on part of structures as per IS : 456.

d) Removal and replacement of any such portions of the structure.

e) Extended curing of the concrete represented by the specimen.

The Contractor shall carryout all such measures as directed at his own expense, if the concrete cannot be accepted due to reasons attributable to the Contractor.

The unit rate of concrete shall be inclusive of all tests and remedial measures.

FORM WORK :

The formwork shall conform to the shapes, lines and dimensions for all the elements as shown on the drawing. The formwork shall be designed and constructed so that the concrete can be properly placed and thoroughly compacted to obtain the required shape, position and level subject to specified tolerances. The designed formwork arrangement shall be got approved by the Engineer. Approval of the proposed formwork by the Engineer will not diminish the Contractor's responsibility for the satis performance of the formwork, nor for the safety and co-ordination of all operations.

Formwork for architectural shapes for columns, ring, beams, circular or spherical walls, shell roofs or bottoms in the case of water reservoirs or any other structure shall be made from approved wrought and put up timber or steel plates and frames.

The formwork to be used shall be of an approved system type

Erection of Formwork :

The following shall apply to all formwork.

1. The contractor shall obtain the approval of the Engineer for the design of forms and the type of material used before fabricating the forms.

2. All shutter planks and plates shall be adequately backed to the satisfaction of the Engineer by a sufficient number and size of walers or framework to ensure rigidity during concreting. All shutters shall be adequately strutted, braced and propped to the satisfaction of the Engineer to prevent deflection under dead weight of concrete and superimposed live load of workmen, materials and plant, and to withstand vibration and wind. No joints in props shall be allowed.

3. Vertical props shall be supported on wedges or other measures shall be taken where the props can be gently lowered vertically during removal of the formwork. Props for an upper storey shall be placed directly over those in the storey immediately below and the lowest props shall bear on a sufficiently strong area.

4. Care shall be taken that all formwork is set plumb and true to line and level or camber or batter where required and as specified by the Engineer.

5. If formwork is held together by bolts or wires, these shall be so fixed that no iron will be exposed on surface against which concrete is to be laid. In any case wires shall not be used with exposed concrete formwork. The Engineer may at his discretion allow the Contractor to use tie-bolts running through the concrete and the Contractor shall decide the location and size of such tie-bolts in consultation with the Engineer. Holes left in the concrete by these tie-bolts shall be filled as specified by the Engineer at no extra cost. No through tie will be permitted in all cases where water is likely to be retained and gas tightness of the structure is to be ensured.

6. Provision shall be made in the shuttering for beams, columns and walls for a port hole of convenient size so that all extraneous materials that may be collected could be removed just prior to concreting.

7. Formwork shall be arranged as to permit removal of forms without jarring the concrete Wedges, clamps and bolts shall be used wherever practicable instead of nails.

8 An approved mould oil or other material shall be applied to faces of formwork in contact with the wet concrete to prevent adherence of concrete. The use of oil which darkens the surface of the concrete shall not be allowed. Oiling shall be done before reinforcement has been placed and care shall be taken that no oil comes in contact with the reinforcement while it is being placed in position. The formwork shall be kept thoroughly wet during concreting and the whole time that it is left in place.

9. Formwork for beams and slabs shall be so erected that the shuttering on the side of the beams and soffits of slabs can be removed without disturbing the beam bottoms.

Immediately before concreting is commenced, the formwork shall be carefully examined to ensure the following :

a) Removal of all dirt, shavings, sawdust and other refuse by brushing and washing.

b) The tightness of joints between panels of sheathing and between these and any hardened core.

c) The correct location of tie bars, bracing and spacers, and especially connections of bracing.

d) That all wedges are secured and firm in position.

e) That provision is made for traffic on formwork not to bear directly on reinforcing steel.

The Contractor shall obtain the Engineer's approval for dimensional accuracies of the work and for the general arrangement of propping and bracing. It is imperative that for scaffolding heights of 3.6 M and above, timber posts or steel scaffolding be used with adequate bracings in horizontal and vertical planes. The Contractor shall be entirely

responsible for the adequacy of propping and for keeping the wedges and other locking arrangements undisturbed through the decentering period.

Clean-up :

Upon the completion of concrete work, all forms, equipment, construction tools, protective coverings and any debris, scraps of wood etc. resulting from the work shall be removed and the premises left clean.

1. **MATERIALS :**

The materials used for the construction shall conform to IS- 456 latest.

2. **MOULD :**

The mould used for manufacturing precast components normally consist of two parts, (a) bottom mould, and (b) side moulds. The bottom mould can be made out of timber, masonry, concrete, steel, FRP, plastic or any other material acceptable to the Engineer. The side moulds similarly can be of timber, steel, FRP, or plastic. When using masonry or concrete moulds, the top surface shall be finished to the required accuracy and made smooth.

In case of masonry moulds, the use of chicken mesh or fibre reinforcements in the top surface will help in making the mould last longer for higher efficiency.

In the case of cored units the voids can be created either by an extrusion process, by inflated tubes, Mild steel tubes, timber, cardboard / hard paper or any other materials.

The castellations / depressions / roughening of required depth shall be provided in the sides of the precast units. Suitable provisions in the side shutters of the mould may create better keying between in situ concrete and precast concrete units at the joints.

In case of concealed wiring, conduits may be placed within the joints along the length or within the screed before concreting. If adequate thickness is available this may be concealed within the floor / roof finish.

Holes, openings and fixtures required to be provided within the precast units shall be fixed accurately with adequate embedment at the precasting stage. Drilling of holes / cutting of edges shall not be made unless permitted by the Engineer.

defective work or ask for demolition and replacement of such defective work at the risk and cost of the contractor.

2. TECHNICAL SPECIFICATION FOR FLOORING WORKS

FLOORING :

This specification covers the general requirements for different types of flooring and dadoing works.

GENERAL :

All works shall be carried out as per relevant Indian Standard Specifications and as directed by Engineer. The rates shall include preparation of base, including chipping extra concrete roughening of surface and skin removed, cleaning, screeding, leveling etc.

Before the operation for laying any floor is started, the surface of base concrete, structural slab shall be thoroughly cleaned of all dirt, loose particles, caked mortar roppings etc. by scrubbing with coir or steel wire brushes. If so directed by the Engineer the surface shall be roughened by chipping or hacking at close intervals. The surface shall then be cleaned with water and kept wet for 12 hours and surplus water shall be removed by mopping before the topping is laid. The tiles / slab should be laid over cement mortar 1:4 20mm thick, unless otherwise specified.

Cement	:Ordinary Portland cement of 43 Grade conforming to IS: 8112 shall be used and as specified under concrete work.
Coarse Aggregates	:As specified under concrete works and conforming to IS : 383
Fine Aggregates	:As specified under concrete works and conforming to IS : 383
Water	: As specified under concrete works.

BASE CONCRETE :

The base concrete may be deposited in the whole area at a stretch. Before placing the concrete the sub-base shall be properly wetted and well rammed. The concrete shall then be deposited between the forms where necessary, thoroughly tamped and the surface finished level with the top edges of the forms. The surface of base concrete shall be left rough to provide adequate bond for the topping. Two or three hours after the concrete has been laid in position, the surface shall be brushed with a hard brush to remove any scum or laitance and swept clean so that coarse aggregate is exposed.

SAMPLES :

Samples of all typical metal work such as, doors, windows, railings and other metal components as called for shall be fabricated, assembled and erected or submitted to the Engineer as directed by him, for his approval atleast thirty days in advance of their use at site.

APPROVED MANUFACTURER :

All doors, windows, railings & other metal works as called for shall be manufactured by a manufacturer/fabricator approved by the Engineer. The entire work shall be carried out by workmen skilled in the kind of work as called for in a shop fully equipped to carry out all phases of fabrication in accordance with the best accepted practices and as approved by the Engineer.

INTERNAL DOORS :

Internal door frames where called for shall be of pressed mild steel sections as per IS:4351 of the size and details as shown on drawings or other documents. The sections shall be pressed from 18 gauge mild steel sheet unless otherwise specified to the profile shown, by means of a mechanical press of adequate capacity. The pressed section shall be true to profile and also true to dimensions called for.

The frame members shall be of one piece and the corners of the frames shall be mitred, electrically welded and ground smooth. Mechanical jointing of members may be accepted subject to approval of the jointing arrangement by the Engineer.

Necessary provisions shall be made in the frames for fixing silencers, tower bolts, door closers and other hardwares. Slots for receiving lock and latch shall be shop punched and not made at site. The size and the location of the slots shall match the type of lock specified and at the height shown on the drawings / documents, hinges of specified type, make and size shall be fixed to the frames in the fabrication shop. The hinges shall be so fixed that the hinge flap is flush with the face of the frame. A reinforcing metal plate of 16 mm thickness with holes drilled and threaded to receive machine screws from the hinges shall be welded to the frames at hinge locations as shown on the drawings. Holdfasts where called for shall be of mild steel flats of shapes and sizes as shown on the drawings/documents and shall be welded to frames.

The frames shall be phosphated and then given a coat of redoxide zinc chromate primer. The surfaces shall be as specified under 'PAINTING' as approved by the Engineer. Base ties of mild steel angles shall be provided for all door frames to retain the size and shapes of the frames during transportation, handling, storage at site and erection.

FITTINGS :

Hinges, locks, tower bolts, rubber buffers, door closers and other fittings shall be provided as given in Bill of Quantities.

UNLOADING AND STACKING :

The fabricated frames shall be transported, bundled, unloaded and stacked in a careful manner. They shall be stacked on edge on level bearers and supported evenly. All precautions shall be taken to ensure that the frames are not damaged or distorted in any manner.

FIXING :

The door frames shall be fixed at the top & bottom through M.S. cleats as shown on the drawings. M.S. cleats of size and detail as shown or called for shall be anchored to the floor and roof slab concrete at the time of casting the concrete. The frame shall be securely fixed to the outstanding leg after erecting in true and correct position. When the frames are to be fixed to column/wall faces, they shall be fixed with rawl bolts/expansion bolts of approved make. The frames shall be fixed into position true to line and level using adequate number of expansion machine bolts (RAWL BOLTS) of approved size and manufactured in an approved manner. The holes in concrete / masonry members for housing anchor bolts shall be drilled with an electric drill.

The doors assembled as shown on drawings/documents shall be placed in correct final position in the openings and marks made on concrete members at jambs, sills, and heads against holes provided in the frames for anchoring. The frames shall then be removed from the openings and laid aside. Neat holes with parallel sides of appropriate size shall then be drilled in the concrete members to house the expansion bolts. The expansion bolts shall then be inserted in the holes, struck with a light hammer till the nut is forced into anchor shell. The frames shall then be placed in final position in the openings and anchored to the supports through cadmium plated machine screws of required size threaded to expansion bolts. The entire operation shall be subject to the approval of the Engineer.

The frames shall be set in the openings by using wooden wedges at supports and be plumbed in position. The wedges shall invariably be placed at the meeting points of glazing bars and frames.

The contractor shall be responsible for the doors being set straight, plumb, level and for their satis AUDITORIU Moperation after fixing is complete.

In case of brick wall, precast cement concrete (1:2:4 mix) blocks shall be provided at locations where the frames are to be anchored, at the time of building the wall. The rawl bolts shall then be anchored to these blocks.

Hollow of frames abutting concrete/masonry shall be filled with cement grout (1 cement : 3 coarse sand) densely packed and finished neat.

All steel frames and other steel members shall be enamel painted as provided under "PAINTING" or as specified after the installation of the shutters, glazing, etc.

DOOR SHUTTERS :

Pivoted shutters shall have "EVERITE" floor springs at the bottom suitably fixed to the floor and pivots fixed at the top as shown in drawings or as called for in the specifications. The shutters shall be fabricated with M.S. light gauge roll formed sections conforming to I.S. specification including welding all the joints and panels made out of 18 gauge M.S. sheets cut to size and shape as shown in the drawings and fixed to the shutter frame by means of brass screws and cup washers as called for in the drawings. The contractor shall however get the shop drawings and the sample approved by the Engineer before executing.

All the steel surfaces shall be thoroughly cleaned free of rust, scale or dirt and millscale by picking or phosphate and before erection painted with one coat of approved primer and after erection painted with two finishing coats of synthetic enamel paint of approved shade and quality.

PAINTING :

All exposed glazing, frames shall be treated with solignum stained to the tint approved by the Engineer. Door shutters, shall be enamel painted to approved finish. All painting, shall be carried out as specified under 'PAINTING' or as specified.

PROTECTION OF WORK :

The contractor shall be responsible for the temporary doors and closing in openings necessary for the protection of work during progress. He shall also provide & maintain any other temporary covering required for the protection of finished wood work that may be damaged during the progress of work if left unprotected.

MAKE GOOD DEFECTIVE WORK :

The contractor shall be responsible for any shrinkages or warping or any other defects which may appear in any joinery work. All defective or damaged work shall be taken down and renewed or repaired to the entire satisfaction of the Engineer.

RAILING :

Railing to stairs and other locations where called for shall have hand rail of steel pipe or other material as called for of size as shown, supported by mild steel balusters anchored to concrete railing as shown on drawings. The mild steel verticals shall be 25 dia tube and as shown on drawings and shall be embedded & anchored in the concrete members in their correct assigned positions at the time of casting the concrete members. No breaking or disturbing of any completed concrete members shall be allowed. The hand rail shall be fixed to the baluster verticals by means of Tee joints as detailed on the drawing. The drilling of holes, counter

sunking, etc., shall be carried out by skilled fitters in a precise,neat and workman like manner,as called for on the drawings and as directed by the Engineer. The finished railing shall be true to plumb, line and levels as called for. The mild steel balusters and other exposed mild steel members shall be painted as specified under 'PAINTING' or as specified.

6. **Glazing :**

Glazing shall be done with flawless sheet glass of best approved quality without waviness, distortion, coloration/discoloration, of specified thickness, in sizes as shown in the drawings, fixed as required with special glazing clips, putty, neoprene/PVC gaskets. The gasket shall be extruded EPDM synthetic rubber wrap around U channel type with bevelled edges to run continuously around the perimeter of the glass. All glass shall be cleaned thoroughly before they are fixed in position.

The thickness of glass shall be as specified in the item specification under B.O.Q. and Drawings. The following types of glasses shall be used.

1. Building - Clear glass or tinted glass or as specified in the Schedule of Quantities.

2. Toilets & Kitchen - Clear glass or frosted or tinted glass or as specified in schedule of quantities.

3. Partitions - Clear or tinted or frosted float glass.

4. Sky light roofing - Frosted Glass

7. **Fitting :**

The handles shall be of cast aluminium anodised two point handles of high quality and of approved design and shape. Peg stays shall be of anodised wrought aluminium. All fittings shall be of high quality to design and / or type approved by the Engineer.

8. **Sealing :**

Sealing shall be done using a non-hardening silicon sealant single part gun applied to provide water tight seal between the window and the surrounding construction.

9. **Protection and Cleaning :**

The Contractor shall be responsible for the protection of all aluminium works during the course of construction of the building and for cleaning all aluminium works after painting and finishing of building is completed.

The aluminium manufacturers shall give specific performance guarantee against defects in materials or workmanship for a period of one year from the date of installation.

The rates quoted shall include :-

a) Providing all aluminium doors, windows, ventilators, glazings, railings etc. of the best manufacture and as per prior approval of the Engineer.

b) Providing necessary couplings, transoms and mullions.

c) Providing a protective thick layer of clear transparent lacquer based on methaorylates or cellulose butyrate, for protection of surfaces of various units during transportation and installation and removal of the same after installation is complete.

d) Each shutter of sliding window shall have 2 Nos. Nylon sleeved rollers. Lock and handle shall be provided in Nylon / PVC / Aluminium samples of which shall be got approved to prevent air infiltration to openable shutters with stainless steel ball bearing.

e) Sealing the junction of windows or glazing frame with openings and / or wooden base lining around the opening with epoxy resin or other approved sealant to make the junction water tight.

f) Fixing of aluminium units in the openings with lugs 15 mm x 3.15 mm x 10 Cms long in cement concrete blocks of 15 mm x 10 mm x 10 Cms size 1:3:6 (1 cement : 3 coarse Sand:6 Hard stone aggregate 20 mm nominal size) or with wooden plugs and screws or with rawl plugs and screws or with bolts and nuts as required.

g) Door shutters shall have heavy duty double action hydraulic floor springs pivoted top and bottom with a minimum of One year guarantee.

h) Necessary locking arrangements of approved design shall be provided to door shutters including flush type tower bolts for each shutter as directed.

i) The Contractor shall furnish detailed fabrication drawings to suit site installation for approval before taking up the work.

Providing single row continuous, neoprene or PVC weather strip to prevent air infiltration to open able shutters.

j) Hoisting and working at any height including required scaffolding etc., and protecting the aluminium sections and glass from any damage, scratches etc., till being taken over by the Engineer. Rate shall include final cleaning of all items to the Engineer Satisfaction before final handing over.

k) The manufacture of the aluminium framed glazed doors & windows etc., shall conform to current Indian Standard.

l) Aluminium Sections shall be of standard extrusion and shall conform to IS 733. and shall be in accordance with the Engineer's drawing.

m) All Aluminium Sections shall be finished in natural colour electro chemical anodised to 15 microns and a piece of anodised materials shall be got approved before fabrication.

n) All doors, windows, etc., shall befinished and the frame joints shall be absolutely water tight. All frames and shutters shall be properly jointed ensuring adequate mechanical strength and absolute right angleness.

o) All doors shall be provided with Hi-bronze finish anodized aluminium push plates.

p) The glasses for doors, windows fixed glazing shall be fixed with aluminium anodized hi-bronze finish snap on glazing chips and gasket rubber. PVC weather strip shall be provided.

q) Matching Sections shall be perfectly aligned for compactness.

r) Samples of Sections for outer frame, shutter frame, hardware etc., shall be produced for prior approval.

s) The size and details of doors etc., shall generally be as per the drawings prepared by the Engineer. The Contractor shall take exact site measurements, for all the items before fabrication to avoid any discrepancies.

t) The rates quoted shall be for supply, delivery and erection etc., complete including packing and all other incidental charges.

Detailed fabrication drawings shall be furnished to suit the site installation for approval before taking up the work.

TOILET DOORS :

A. **EXTERNAL DOORS :**

Formica / Decolam laminated 300 mm wide from bottom over one side plastic coated flush door as per manufacturer specifications including necessary finishings and fittings etc.

B. **INTERNAL DOORS :**

Formica / Decolam laminated 300 mm wide from bottom over both sides plastic coated flush door as per manufacturer specifications including necessary finishings and fittings etc.

NOTE :

All timber for joinery or wrought formwork shall be of best Indian Teakwood unless otherwise specified and or specified quality, carefully selected free from sap and subject to inspection and approved before delivery. All teakwood to be used in this work shall be seasoned in an approved manner.

The joiner work shall be framed and put together immediately but not to be wedged up until required for fixing. The approval of the Engineer shall be obtained before any primer coat is applied.

The whole of joinery to be finished to the dimensions and sizes indicated in the drawings are subject to a tolerance to 1.50 mm of each planed face, but no allowance shall be given to flush doors, shutters, ply and other manufactured board etc.

All block boards etc. shall correspond to respective IS specifications. Flush doors shall correspond too relevant IS specifications. Samples of all block board, plywood, flush doors, etc. shall be got approved by the Engineer before placing order. All such items shall be of standard manufacture of reputed quality. Unless otherwise specified, all flush shutters shall be teak veneered on both sides. All flush shutters shall be of solid core and shall be provided with teakwood external lipping.

If after execution any shrinkage or bad workmanship is found, the Contractor shall forthwith replace or refix the same at his own cost, all as directed by the Engineer.

Rate quoted shall include for all framing, usual waste and cuttings and no extra rates or claims will be entertained on this account.

The rate for wood work shall include the cost of all sawing, planing, jointing, framing, labour and materials for raising and fixing and all workmanship and fixing and supplying of all strips, bolts, nails, triennials, spikes, keys, wedges, pins, screws etc. necessary for the framing as per

specification and drawings. Edges of the beams, joists, posts, frames etc. shall be rounded, moulded or chamfered as directed without extra charges.

The Contractors shall be responsible to deliver all items at site of work. The Contractor will submit a programme of work in such a way that requirements for each floor commencing from ground floor is completed before the requirement of the next floor and arrange to have them fixed in position as the General Builders work progresses.

Timber in contact with masonry or concrete shall be treated with solignum paint or any approved anti-termite treatment before fixing.

The Contractor will be making necessary holes in concrete and masonry for fixing in position and grouting. The Contractor will be responsible for the proper fixing of partitions true to plumb and alignment until completion and grouting pockets with cement concrete and make good affected portions without claim to any extra.

The iron monger fittings shall be of heavy type cast brass oxidised and of approved manufacture. Samples of all iron monger items shall be got approved by the Engineer prior to procurement.

INTERIOR DOOR SHUTTERS :

Interior wood door shutters, unless otherwise noted or specified, shall be 35 mm thick phenol formal-dehyde synthetic resin thermo pressed flush shutters, teak veneered faced on both faces. The shutters shall conform to IS:2202 (Part-I). Shutter make shall be approved by the Engineer.

The solid core shall be wood laminate prepared from battens of well seasoned and treated good quality wood having straight grains. The battens shall be of uniform size of about 2.5 cm width. These shall be properly glued and machine pressed together, with grains of each piece reversed from that of adjoining one. The Longitudinal joints of the battens shall be staggered and no piece shall be less than 50 cm. in length. Alternatively, the core shall be of solid teak particle board. Edges of the core shall be lipped internally with first class teak wood battens of 4 cm. minimum depth, glued and machine pressed along with the core.

The core surface shall then have two or three veneers firmly glued on each face. The first veneer (called cross band) shall be laid with its grains at right angles to those of the core and the second and the third veneers with their grains parallel to those of the core. The under veneers shall be of good quality, durable and well seasoned wood. The face veneers shall be of minimum 1 mm thickness and of well matched and seasoned first class teak, laid along with grains of the core battens. The combined thickness of all the veneers on each face shall not be less than 4 mm. Thermosetting synthetic resin conforming to I.S. 303 or moisture-proof plywood grade M.P.F.I. shall be used in manufacture. All doors shall have external lipping alround 6 to 10 mm thick in addition to internal lipping.

Block boards and ply for various items of work called for shall be of approved make. Unless otherwise shown all block boards and ply shall be teak veneered faced on both faces.

Samples of flush doors, block boards, etc., shall be submitted to the Engineer for his approval and all shutters, etc., to be used in the work shall conform to the approved sample in all respects.

HARDWARE FITTINGS :

All hardware fittings and fixtures shall be made with structural properties to sustain safety and withstand strains and stresses to which they are normally subjected, such as opening and closing, wind pressure etc. The fittings shall generally conform to relevant specifications.

They shall be made true, clean, straight, with sharply defined profiles and unless otherwise shown or specified, with true smooth surfaces and edges, free from defects, screw holes shall be counter sunk to suit the head of wood screws.

The metal shall be treated with finish as specified in the Schedule of Quantities.

Butt Hinges :

These shall be treated with finish as specified in the Schedule of Quantities.

M.S. Butt Hinges shall conform generally to the latest version of I.S.205.

M.S Butt hinges shall be manufactured from M.S sheets of approved gauges. Hinges shall be finished as specified in the respective items. The size of butt hinges shall be taken as length of the hinge.

Aldrops :

These shall be of anodised aluminium or as specified and shall be capable of smooth sliding action. Aldrops shall be finished as specified and shall conform generally to the latest version of I.S.281.

In case of single leaf door, hole of suitable size shall be made in the door frame and a plate cut to shape shall be fixed at the face of the hole. The size of aldrop shall be taken as the length of the rod.

Sliding bolts/Latches :

These shall be of M.S. Brass or as specified and shall be capable of smooth sliding action. These shall be finished as specified. The size of latch shall be taken as the length of the bolt catch.

Tower Bolts :
These shall be as specified viz., anodised aluminium tower bolts from external section.
In the case of brass and aluminium tower bolts, steel spring and ball shall be provided between the sheet and the barrel.

The size of tower bolts shall be taken as the length of barrel without top socket. The bolt shall be finished as specified.

Handles :

These shall be as described in the Schedule of Quantities and finished as specified.

PRESERVATIVE TREATMENT :

All wood work in contact with masonry shall be painted with approved asphalt or bitumen paint before placing. Care shall be taken to keep exposed faces clear from tar, etc. Tarfelt shall be used to isolate wood from masonry wherever practically possible. All concealed wood members in ceiling, partitions, cabinet work, etc., shall be treated fully and liberally with solignum before placing in position.

MODE OF MEASUREMENT :

The method of measurement for various items in the tender shall be generally in accordance with the IS : 1200 subject to the following :

All work shall be measured net as fixed. No extra measurement will be given for shape, joints, splayed, meeting stiles of doors and windows and shall be measured in unit of square metre.

Area over one face inclusive of exposed frame thickness (excluding width of cover mould) shall be measured in case of doors, windows and ventilators when frames are included in the item. Portions embedded in masonry or flooring shall not be measured.

3. TECHNICAL SPECIFICATION FOR PAINTING WORKS

PAINTING GENERAL :

The specification covers the general requirements for various types of painting and finishing of all surfaces throughout the interior and exterior of the building. The scope shall include furnishing of all materials, labour, scaffolding, tools and appliances to do all painting and / or white / colour washing of both interior and exterior surfaces of plastering, ceiling and all carpentry works. This also include painting structural and miscellaneous steel, railings, gratings, steel doors and frames, steel sashes, windows, louvers and frames, steel rolling shutters, MS grills etc. The number of coats required in various situations and also the types of finish required for the several items of work such as cement based paint, plastic emulsion paint, oil bound distemper, synthetic enamel paint, etc., are specified in the schedule of quantities and specifications.

Before the commencement of the work the contractor shall provide sample panels of painting at his own cost for the approval of the Engineer to enable him to keep an accurate check on the materials supplied and final shade to be painted. It is however the express responsibility of the contractor to provide any deviations and defects shall have to be rectified by the contractor at his own cost.

Contractor shall protect not only his own work at all times but also all the adjacent work and materials by suitable covering, protection or other methods acceptable to the Engineer during progress of painting. It is the responsibility of the contractor upon completion of painting work to remove all paint and varnish spots from floors, walls, glass panes and other surfaces and restore them to the original conditions. The work generally to be touched up shall be attended to after all other workmen have left. All accumulated material, rubbish etc. have to be cleared and the premises left in clean, orderly and acceptable conditions.

Contractor shall provide scaffolding wherever necessary erected on double supports tied together by horizontals, no ballies, bamboo's or planks shall rest on or touch the surface which is being painted. Contractor is deemed to have considered the following while tendering and no extra claim on account of these will be entertained

A) Supplying the paint and other materials required of approved colour and brand.

B) Preparing the surfaces to be painted.

C) Providing and erecting scaffolding and removing the same after completion of the work.

D) Lifting of materials to any height and painting at all levels.

E) Application of paint as per the specification & to manufacture's instructions.

F) Curing, protecting the painted surface, adjacent work and thoroughly cleaning of the premises.

All doors, partitions etc., shall be finished in the manner specified in the drawing, specifications and schedules, wherever painting and polishing are specified, although three coats finishes specified are to be included in the rates quoted, the contractor shall be required to carry out additional coats of paint/polish to obtain uniform and good finish at no extra cost, wherever such additional coats are considered necessary in the opinion of the Engineer. If directed, putty shall be applied over the entire surface to ensure smooth and neat finish at no extra cost.

MATERIAL :

The paint shall generally conform to the chemical composition and other characteristics laid down in the relevant Indian standard specification. The entire materials required for painting work shall be obtained direct from approved manufacturers or their authorised agents and brought to site in original manufacturer's containers with seals unbroken.

Paint shall be ready mixed and of 1st quality of the approved brand and manufacture. Mixing of paint by the contractor at site will not be allowed, except with preparation of ingredients and their quality shall be strictly maintained as per manufacturer's instructions and all as directed by the Engineer. All the materials shall be kept properly protected when not actually in use. Lids of containers shall be kept closed. Materials which have become stale or flat (in the opinion of the Engineer) shall not be permitted to be used on the works and shall be removed from site forthwith. Wherever the word 'approved' occurs in these specifications it shall mean that the competent authority for such approval is the Engineer. Any materials found not conforming to the relevant specification shall have to be removed by the contractor from the site at his own expenses. Colours shall be uniform and non-fading.

Protruding timber fibres shall be removes and all holes shall be filled with teakwood batten. The nail marks shall be covered with putty. The work shall then be sanded first with G/80 sand paper followed by G/120 or G/150 sand paper. Sanding should be taken up only when it can be followed immediately by painting.

The surface shall be thoroughly cleaned sand papered and / or rubbed with emery cloth if necessary to remove grease, mortar or any other foreign materials. In case of rusted surface, it shall be first cleaned with steel wire brushes till the corroded crust is removed. The cleaned surface shall be shiny and free from brush marks, patches, blisters and other irregularities. The surface thus finished shall be got approved before painting.

Concrete / plaster and cement plastered surfaces shall be thoroughly cleaned of mortar droppings and other stickings. All loose scales and flakes shall be removed by rubbing with hessian cloth or sand papering. All holes shall be filled and the surface rubbed smooth to get evenness of the existing surface. Area to be distempered shall be applied with one coat of white chalk solution mixed with required quantity of glue or plaster of paris and shall be sand papered before distempering. The area to be cement painted shall be wetted by sprinkling of water with fine

spray. The surface shall be sprayed several times with a few minutes intervals between each spraying to allow the moisture to seek into the surface.

The sanded surface shall be dusted and a priming paint, brush coated in thin even layers. For all flush doors and teakwood approved aluminium wood primer shall be applied. If some time passes after priming another coat of primer shall be applied before under coating is done.

The cleaned surface shall be dusted and a priming coat of anticorrosive paint shall be applied.

Stopping and filling carpentry work should be done when the primer is just dry. For deep scratches, holes etc. stopping shall be done with putty of plastic wood (IS 423). Putty can be white lead with linseed oil base or synthetic metal putty.

For all minor scratches and rough surfaces, like flush door's faces filling made out of one part of white lead, two parts of whiting (powdered chalk) mixed and kneaded in double boiled linseed oil shall be evenly applied and rubbed down with G/220 or G/240 sand paper after allowing it to dry overnight.

Painting shall be done by skilled labourers in a workmanlike manner. All materials shall be evenly applied so as to be free from sags, runs, crawls, or other defects. All coats shall be of proper consistency and shall be well brushed out, so that no brush marks are visible, except varnish and enamels which shall be uniformly flowed on. The brushes shall be cleaned and in good condition before application of paint. No work shall be done under conditions that are unsuitable for production of good results.

The undercoating should be nearest to the specified colour of the finishing coat. Ready mixed synthetic enamel paint or fill paint may be used for the undercoat. The undercoat shall be uniform and free of all brush marks.

Undercoats should be completely dry before finishing coat is taken up. For synthetic enamels overnight and for oil paints, a whole day shall be left between undercoat and finishing coat. The undercoat shall then be rubbed with G/240 sand paper and dusted clean. The finishing coat of approved paint shall then be applied. If the surface is not satisadditional finish coats shall be applied at no extra cost. The paints shall be applied with bristle brushes and not horse hair ones.

The manner of taking measurements will be in accordance with IS 1200.

WHITE WASHING WALLS AND CEILINGS :

Lime used shall conform to IS 712. The wash shall be prepared from lime of approved quality.

White wash shall be prepared from fat lime or shell lime slaked on site mixed with just enough water to make a thick paste and allowed to remain for atleast 7 days before use. At the time of using, the paste shall be diluted with just sufficient water and stirred until the mixture attains the consistency of a thin cream and strained through clean and coarse cloth. Four kgs. of gum

dissolved in hot water shall be added to each cu.metre of the lime used. Ultra marine blue shall be added to give required whiteness. The number of coats shall be specified in the bill of quantities and shall be applied by using flat brushes or spray pumps, on surface prepared. Before the wash is applied the surface shall be thoroughly cleaned of all dust, dirt, scales, marks and mortar drops. All holes and depressions shall be filled in with cement mortar 1:4 or lime putty. The wash shall be applied with brush with alternate coats of horizontals and verticals. When a coat is being given it shall be ensured that the previous one has dried up complete. Two or more coats of wash (as specified in the schedule of quantities) shall be applied to give uniform finished surface without any patches or cracks and brush marks. It should not come off when rubbed hard with hand. One coat of white wash shall consist of one stroke from top downwards, another from bottom upwards over the first stroke, and another from left to right before the previous one dries up. The final coat shall be perfectly uniform in appearance and free from brush marks.

COLOUR WASH :

Colour wash shall be prepared by adding mineral colours or approved pigments not affected by lime or light. Colour wash shall be applied as specified under 'white wash'. Approval of the Engineer shall be obtained in regard to exact shade before applying colour wash.

CEMENT PAINT :

The number of coats shall be indicated in the bill of quantities. The surface to be cement painted shall be thoroughly cleaned of dust, dirt, grease, oils marks, cement marks, loose scales, etc. by the use of a stiff wire brush or by coir rope. The cleaned surface should be wetted with clean water either by spray gun or any other convenient method, to ensure complete absorption. Cement paint shall not be applied on dripping or wet surface. All holes, depressions, cavities, etc. shall be filled in with cement mortar 1:4 or as directed by the Engineer, to render the entire surface smooth and even to receive the paint, at no extra cost. All fungus or organic matters, which may be present, shall be removed by scrapping and sand papering and the surface rendered smooth.

The cement paint shall be prepared in exact conformity and workable consistency as per specifications of the manufacturer. Approval of the Engineer shall be obtained in regard to the exact shade and colour before applying the cement paint. Cement paint shall be applied with good quality flat brush horizontally or vertically to ensure perfect covering. The first coat should be well brushed into the surface to form a good film appearance. The second or subsequent coats shall be applied carefully to give a good final satisfinish and may be applied by brushing or spraying. Each cement paint application should be wetted at the end of the day with a fine water spray. Twentyfour hours after the first coat has been applied, saturate the surface with water and second or subsequent coats can be applied when the surface is damp to touch. Rewater the surface with ample water after 24 hours to ensure perfect setting of the paint film.

PAINTING OIL/ENAMEL/ACRYLIC EMULSION ETC. :

Ready mixed oil paint, acrylic emulsion paint, ready mixed synthetic enamel paint, Aluminium paint, etc. shall be brought in original containers and in sealed tins. If for any reason thinner is necessary the brand and quantity of thinner recommended by the manufacturer or as instructed by the Engineer shall be used.

The surface shall be prepared as specified above and a coat of approved primer shall be applied. After 24 hours drying, specified quality paint shall be applied evenly and smoothly. If required a filler putty coating may be given to give smooth finish. Each coat shall be allowed to dry out thoroughly and then lightly rubbed down with sand paper and cleaned of dust before the next coat is applied. Number of coats shall be as specified in the item and if however the finish of the surface is not uniform additional coats as required shall be applied to get good and uniform finish at no extra cost. After completion no hair marks from the brush or clogging of paint puddles in the corners of panel angles of mouldings shall be left on the work. The glass panes floor etc., shall be cleaned of stains.

When the final coat is applied, if directed, the surface shall be rolled with a roller or if directed it shall be stippled with a stippling brush.

Proposed Interior work for TRANSIT BUILDING BHEL Ashok nagar, Chennai

1.0 GENERAL

1.1 Quality:

1.1.1 The methodologies and systems to be followed for quality assurance and the quality control aspects are elaborated in the Conditions of Contract and Additional Conditions of Contract. The technical requirements, for various types of work are indicated in these specifications.

1.1.2 The requirements in regard to materials, procedures and workmanship and their sampling and testing as specified herein shall be strictly adhered to, failing which a Defect, in terms of the Contract, shall be deemed to have occurred.

1.1.3 All work shall be in conformity with the requirements of codes, guidelines and specifications of applicable standards such as those of Bureau of Indian Standards, etc., whether or not indicated as such in these Specifications.

1.1.4 In the absence of applicable standards as above, the work shall be in line with the requirements of British, American or German standards and / or generally accepted practices, as may be directed by the Engineer.

1.1.5 Where any material / system of construction is not covered herein, the guidelines of the manufacturer / system-provider of such material / system in respect of storage, application, use, procedures, testing, etc. shall be strictly adhered to.

1.1.6 In all the aforesaid cases, it is the responsibility of the Contractor to submit the details thereof in time and obtain approval of the Engineer.

1.1.7 Materials and manufactured items are to be carefully selected, to meet the requirements of these specifications, the applicable Standards, the drawings and instructions of the Engineer.

1.2 Preferred makes:

1.2.1 Makes and brands of certain manufactured materials and items that are to be chosen in preference to others may be listed in these specifications and / or indicated in the Bill of Quantities / Price Schedules. The tendered rates are deemed to correspond to the costliest of these.

1.2.2 The Client / Engineer has the right to choose any of the makes / brands from the given list of preferred makes.

1.2.3 Such substitution shall attract a rebate in the rate against the Bill of Quantities / Price Schedule Item pertaining to the particular material or item, worked out in detail by the Contractor, with all supporting data and documents, and to be approved by the Engineer-in-charge.

1.2.4 ISI stamped / marked items may or may not be treated as technical equivalents to the makes / brands specified in the above list of preferred makes / Bill of Quantities / Price Schedule, solely at the discretion of the Engineer.

1.2.5 For fabricated items, local manufacturers can be considered, at the sole discretion of the Engineer.

1.2.6 All items / components / equipments, etc. supplied / installed shall be new. Refurbished, prefabricated, or recycled items are expressly prohibited. An undertaking

to this effect shall be furnished to the Engineer, wherever and whenever he deems it necessary.

1.2.7 The conditions in respect of quality, makes and related aspects as stipulated in this tender document, are contractually binding.

1.3 Drawings:

1.3.1 The drawings enclosed to this tender document and / or available with the Engineer-in-charge for perusal of the tenderers / contractors shall form the basis for the drawings to be developed by the Contractor, at his cost.

1.3.2 Anything in the above drawings that requires review by the Engineer-in-charge, to facilitate proper functioning / installation / drawing details pertaining to the work under this Contract, shall forthwith be brought to the Engineer's notice, by the Contractor, in writing.

1.3.3 The Contractor shall examine all architectural, structural, plumbing and other services drawings, pertaining to works by him or other Contractors and as available for perusal with the Engineer, before starting his work under this Contract and report to the Engineer-in-charge anything that does not correlate with the work under this Contract or any rules / regulations / norms.

1.3.4 All work shall correlate well with the dimensions and conditions actually available at site, with due regard to the drawings enclosed to this tender document or any drawings made available by the Engineer and / or any drawing to be prepared by the contractor. To this end, the Contractor is required to physically ascertain the dimensions and site conditions, at his own responsibility and cost.

1.3.5 Within one month after the award of the contract, the Contractor shall furnish, for the approval of the purchaser, detailed shop and installation drawings of all equipment and materials including control wiring layouts required to complete the project as per specification and as required by this Contract.

1.3.6 The drawings shall contain name plate particulars of the individual equipment / items and the details of construction, size, arrangement, operating clearances, and performance characteristics and also the details of all related items of work by other contractors, if any.

1.3.7 As fitted schematic diagrams of the control system, electrical system, etc. shall be exhibited, permanently, for the guidance of the operating and maintenance personnel and the users, to the extent directed by the Engineer. The formats, sizes, material of the display and locations of such exhibits shall be as approved by the Engineer.

1.4 Statutory approvals:

1.4.1 The Contractor shall render all assistance that may be required by the Engineer and obtain the approval of State Electricity Board / electricity supply company and Electrical Inspectorate for the electrical system under his scope and carry out changes as called for by the Electrical Inspector at no extra cost to the Engineer. Only the deposits required for the power will be borne by the client.

1.5 Licenses:

1.5.1 The Contractor executing this work shall be an electrical contractor of the approved class who shall have a valid license issued by the State Government for carrying out

installation work of the voltage class involved under the direct supervision of a person holding a certificate of competency for the same voltage classes, issued or recognized by the State Government.

1.5.2 In addition to the above stipulations, all other stipulations in the General Conditions of Contract in respect of drawings, including as-built / completion drawings, shall be applicable.

1.6 Time factor:

1.6.1 No stipulation herein shall become diluted in the context of time or the effect of prevailing conditions on the time available.

1.7 Costs:

1.7.1 The tenderer is deemed to have visited the site and ascertained the local conditions, entry, traffic restrictions, obstructions, if any, climatic conditions and also the site conditions, statutory requirements and any other aspect that may have a bearing on the work, its progress, completion and maintenance.

1.7.2 The tenderer is also deemed to have studied the Specifications, bill of quantities / price schedules, tender drawings and other drawings that may be available with the Engineer for perusal of tenderers, all before preparation and submission of his tender.

1.7.3 The tenderer is deemed to have taken into account all the above in his tender, fully covering all the costs and expenditures in respect of any and all extras likely to be incurred due to all the above, including quality and time aspects, contingencies, etc. as well as the General and Special Conditions of Contract and other documents forming the Contract.

1.8 Measurements and coverage of costs in rate:

1.8.1 Unless otherwise indicated in the BOQ/ Price Schedules, the rates for the various Items of work are deemed to include the cost of all materials, consumables, wastages, necessary scaffolding for working at various heights, all necessary hardware and consumables required for the entire installation, transportation, labour, supervision, tools, tackles, plant, machinery, sampling, samples, testing, documentation, obtaining and transferring guarantees and warranties from manufacturers / specialist agencies, preparing and furnishing as-built drawings.

1.8.2 The rates in the BOQ / Price Schedules are also deemed to include all costs towards licenses, patents, royalties, cess, seignorages, taxes, insurance, safety practices, watch and ward, security, medical aid, temporary works, utilities and services, adherence to all applicable local and government rules and regulations, cost of money, capital and funds and bidding for and operating under the Contract.

1.8.3 Measurements for electrification works shall be as per standard practice.

1.9 Safety:

a) The Contractor shall take adequate precautions to ensure complete safety and prevention of accidents at site, during installation, testing and commissioning and during operation, as elaborated in the General Conditions of Contract and / or Special Conditions of Contract.

b) The safety precautions shall conform to the relevant Indian Standard Codes and international codes and recommendations wherever applicable.

2. SCOPE OF WORK

2.1 The scope of work covered by this specification includes the supply and installation of all the electrical equipment and materials including testing and commissioning, unless indicated to the contrary in the Bill of Quantities / Price Schedules.

2.2 Any equipment, device and component of work not specifically mentioned in this specification but considered essential for proper design, installation and operation shall be included by the tenderer in his offer.

2.3 The successful tenderer shall carryout the installation as per the arrangement and details shown in the construction drawings, standards and instructions given by the Engineer-in-charge.

2.4 Any variation or changes to be carried out at site shall be done with the approval of the Engineer-in-charge.

2.5 The scope of work shall include, but not be limited to the supply, installation, testing and commissioning of the following:

2.5.1 415V LT Switchboards.

2.5.2 Excavation of cable trenches and backfilling.

2.5.3 1.1 KV grade aluminium / copper conductor XLPE / PVC insulated and PVC sheathed armoured / unarmoured power / control cables and cable terminations.

2.5.4 Power and communication system cable trays.

2.5.5 Distribution boards.

2.5.6 Miniature Circuit Breaker Distribution Boards, MCBs, MCCBs, ELCBs, RCCBs and RCBOs.

2.5.7 Earth electrode stations and earthing conductors.

2.5.8 Switch / socket boxes, junction boxes, draw boxes and inspection boxes.

2.5.9 Switches, sockets and accessories.

2.5.10 Wiring materials such as conduits, conduit clamping accessories.

2.5.11 Telecom / telephone conduiting & cabling.

2.5.12 Networking system conduiting & cabling.

2.5.13 Closed circuit television system conduiting & cabling.

2.5.14 1.1 KV grade copper conductor, FRLS multistranded PVC insulated wires.

2.5.15 All other installation materials, hardware and consumables.

2.5.16 Preparation of drawings for approval of electricity utility / CEIG.

2.5.17 Obtaining Safety Certificates.

3. STANDARDS

3.1 The equipment and the installation work shall conform to the requirements of the Indian Electricity Rules with it latest amendments and all relevant Standards and codes of practice of the Bureau of Indian Standards which shall include but not be limited to the following:

IS 732	Code of practice for electrical wiring installation
IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
IS 1293	Plugs and socket outlets of rated voltage upto and including 250 volts and rated current upto and including 16 amperes
IS 1554	PVC insulated (heavy duty) electric cables
IS 2705	Current transformers
IS 3043	Code of practice for earthing
IS 5216	Safety procedures and practices in electrical work
IS 5578	Guide for marking of insulated conductors
IS 5831	PVC insulation and sheath of electric cables
IS 8130	Conductors for insulated electric cables and flexible cords
IS 9537	Conduits for electrical installations
IS 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals
IS 13947	Specification for low voltage switchgear and control gear

4.1 Galvanising:

4.1.1 Wherever galvanising is specified, it shall mean hot-dip galvanising with zinc coating in the range of 710-810 g/sq.m. of surface area.

4.2 Painting:

4.2.1 All enclosures and metal parts of the electrical equipment and installation shall be cleaned of oily substances and foreign materials such as dirt, rust, scale, oil, grease, welding flux, etc. by surface treatment encompassing degreasing, de-rusting and phosphatising.

4.2.2 Unless otherwise specified, all enclosures / metal parts of electrical equipment other than the panel shall be painted with two coats of primer followed by powder-coated paint or stoving grade enamel. The shade of the final coat shall be subject to Engineer's approval.

4.3 Earthing:

4.3.1 The metallic enclosures of single-phase equipment shall be earthed at one point while those of three-phase equipment shall be earthed at two points.

4.3.2 The earth electrode stations conforming to IS 3043 specifications of shall be installed to obtain an effective earthing system. The earth stations shall be provided with heavy duty SFRC / RCC covers of appropriate size.

4.3.3 The distance between two earth electrodes shall not be less than 3 meters. A minimum clearance of 1.5 meters shall be ensured from buildings.

4.3.4 Joints in the GI strips shall be welded with a lap weld of 20 mm length while those in copper shall be brazed. The welded joints shall be painted with bituminous paint and covered with bituminous gunny tape. All wires shall be terminated with tinned copper crimping type lugs.

4.3.5 The sizes of the earthing conductors shall be as indicated in the Bill of quantities

4.3.6 The armour of the cables shall be effectively earthed at the cable gland by earthing the gland using copper earth clips.

4.3.7 All galvanized iron / copper earthing conductors to the earth stations shall be laid at a depth of not less than 600mm from formed ground level.

4.3.8 All the metal conduits / enclosures shall be earthed at one point.

4.3.9 The earthing conductor wires unless otherwise specified shall be as follows:

a) Main earthing conductor from Main switch board to the earth electrode: 2 runs of 25 x 3 mm copper strip.

b) Earth conductor inside the MSB and between MSB and all sub-switch boards: 1 run of 25 x 3 mm copper strip.

4.4 Electricity supply particulars:

4.4.1 All equipment and installation covered under the scope of work shall be designed for electricity supply of the following specification:

Voltage	415 V /240 V ⊚ 10%
No. of phases	3/1
Type of system	3-phase, 4-wire / 1-phase, 2-wire
Frequency	50 Hz ⊚ 3%
type of neutral earthing	Solidly earthed
Short circuit level	Not exceeding 35 MVA at 415 V

5.EQUIPMENTS AND ACCESSORIES

5.1 LT PANEL BOARDS

1. General

a) The SBs shall be manufactured and installed as per CEIG standards.

b) The enclosures shall be designed to take care of normal stress as well as abnormal electromechanical stress due to short circuit current.

2. Body and construction

a) The Switch Boards (SBs) shall be floor mounted free standing or wall-mounting type, as specified, form-4b category, multi-tier compartmental cubicle type fabricated out of 2 mm (14G) CRCA sheet steel.

b) The SBs shall be single front, fixed design, having individual compartments to house each of the circuits and shall be extensible on either side.

c) The load bearing members of SB's shall be fabricated out of 3.15 mm thick sheet steel or 40 x 40 x 6mm MS angle.

d) The SBs shall be provided with a fabricated base frame of 75 mm height at the bottom, having adequate provision for grouting the Switchboards (SB's) on the foundation, in case of floor-mounting type.

e) The SBs shall have a degree of protection of not less than IP54 as specified in IS 13947.

f) The rear cover of SBs shall be welded to the framework, while dished type side doors shall be bolted to the framework.

g) All doors shall be provided with fixed neoprene gaskets. The doors shall be provided with quick opening type Bakelite moulded knobs with circlips.

h) All hardware to be used shall be zinc-passivated.

i) The SB's shall be painted as specified elsewhere to this specification and shall undergo suitable pre-treatment prior to painting.

3 . ***Busbar:***

a) The SBs shall be of single/double busbar type with horizontal / vertical busbars.

b) A horizontal / vertical busbar chamber shall be provided to connect individual feeders.

c) All joints in busbars system shall be of the bolted type and spring washers shall be provided at all such joints.

d) The busbar chamber shall be totally segregated from the rest of the compartments and shall be inaccessible under normal operating conditions.

e) No equipment shall be mounted on the busbar chamber.

f) The busbar shall be of aluminium/copper and shall have a continuous rating as indicated in the drawings. The neutral busbar shall be half the size of the phase busbar.

g) The busbar shall be covered with heat shrinkable PVC sleeves in the colours red, yellow, blue for the phase busbars and black for the neutral busbar.

h) The busbar shall be supported with high quality non-hygroscopic resin bonded on DMC / SMC insulators designed for the specified short circuit level.

i) The higher rating panels shall be supplied along with the test certificate to guarantee the fault withstanding capability of 25MVA at 415 Volts.

j) Tappings from the busbars to the feeder switch shall be by means of insulated or sleeved busbars depending on the rating and terminal capacity of the switch.

4 . ***Switch board interconnection***

a) All connection and tap offs shall be through adequately sized connectors appropriate for fault level at location.

b) This shall include tap off to feeders and instrument / control transformers. Alternatively current limiters of approved make and type shall be used.

c) For unit ratings upto 100 Amps, FRLS PVC insulated copper conductor wires of adequate size to carry full load current shall be used.

d) The terminations of such interconnections shall be crimped properly.

e) Solid connections shall be used for all rating of 100 amps and above.

f) All connections, tappings, clampings shall be made in an approved manner to ensure minimum contact resistance.

g) Before assembly joint surfaces shall be filed or finished to remove burrs, dents and oxides and silvered to maintain good continuity at all joints.

h) All screws, bolts, washers shall be cadmium plated.

i) Approved spring washers shall be used with cadmium plated high tensile steel bolts with BSF threads.

5 . Draw out features

a) Air Circuit Breakers shall be provided in fully draw out cubicles, unless otherwise stated.

b) These cubicles shall be such that draw out is possible without disconnection of the wires and cables.

c) The power and control circuits shall have self aligning and self isolating contacts.

d) The fixed and moving contacts shall be easily accessible for operation and maintenance.

e) Mechanical interlocks shall be provided on the draw out cubicles to ensure safety and compliance to relevant Standards.

6 . Instrument Accommodation

a) The meters shall not be mounted on the fuse switch / switch fuse / MCCB / MCB compartment door for which a separate and adequate compartment shall be provided and the instrumentation shall be accessible for testing and maintenance without danger of accidental contact with live parts of the Switchboard.

b) The current transformers for metering and for protection shall be mounted on the solid copper aluminum bus bars with proper supports.

7 . Earthing:

a) Two runs of galvanized iron earth strip of size 25 x 3 mm shall be provided between the earth electrode and the panel board.

b) Each compartment shall be connected to the earth strip at the bottom of the board with a PVC insulated multistranded copper wire of size 6 sq.mm.

c) A galvanized iron earth strip of size 25 x 3 mm shall be provided at the bottom throughout the length of the board with arrangements to join with external earth strip at both ends.

d) The door shall be earthed with the main body through flexible copper wire.

8 . General features:

a) Clamping arrangement shall be provided in the alley. All cable entries shall be from the top / Vertical cable alley common to vertical sections shall be provided for running cables. Cable bottom as per site condition or as directed by the Engineer-in-charge.

b) Each compartment door shall be interlocked with the switch handle such that the door cannot be opened with the switch in ON position.

c) The size and layout of each compartment shall be as such as to enable easy maintenance of the equipment mounted therein.

d) The height of the SBs shall be restricted to 2300mm including the busbar compartment at the top and the base frame at the bottom.

e) The minimum operating height shall not be less than 200mm for switches with a rating

of less than 100A and 400mm for switches with a rating of 100A and above. The maximum operating height shall not exceed 1800mm.

f) The SB's shall be powder coated to Siemen's grey shade after undergoing 7-tank treatment process.

9 . Electrical components:

a) All equipment shall be fixed in the compartments in such a way that they are removable and replaceable from the front only.

b) The current transformers shall be of the epoxy moulded window type suitable for busbar mounting.

c) Metering current transformers shall be of Class-1 type.

d) The ratio and rated burden of the current transformers shall be as specified in the drawings.

e) The meters shall be flush-mounting type. The voltmeter and ammeter on the incoming & outgoing feeders shall be of suitable size digital meter.

f) All switches and fuse-switch / switch-fuse units / change over switches shall conform to duty category AC 23 as specified in IS 13947.

g) All contactors shall conform to utilisation category AC 3 as specified in IS 2959.

h) The isolators for the switch fuse units shall be on the busbar side and the fuses on the load side. Shrouds shall be provided to screen the live parts.

i) The fuses shall be of the HRC link type capable of clearing the fault level specified.

j) All energy meters, ammeters and voltmeters shall be mounted in a separate meter compartment and shall be located at a convenient reading height.

10 . Circuit:

a) The following colour code shall be adopted for the wiring of the Switch Boards (SBs):
Phase: Red, Yellow & Blue; Neutral: Black; Earth: Green.

b) Plastic engraved labels shall be provided for each circuit and for the board itself.

c) Details of the feeders of the switchboard shall be as shown in drawing.

d) The Board shall be of CPRI approved, supplied and installed as per CEIG standards.

11 . Name plates and labels

a) Suitable engraved white on black nameplates and identification labels of metal for all Switchboards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

12 . Drawings:

a) The Contractor shall submit for approval four sets of general arrangement and wiring drawings of the switchboard before commencing manufacture.

b) The drawings are subject to the approval of the Engineer-in-charge.

c) No fabrication works shall be taken up without the approval of the Engineer-in-charge.

5.2 MOULDED CASE CIRCUIT BREAKER (MCCB)

1. MCCB should be suitable for working on 415 V, 50 Hz supply.

2. It should be manually operated fixed type.

3. It should be double break type.

4. The breaker should be tested as per IS: 13947-2, IEC 60947-2, EN 60947-2.

5. The rated short time withstand capacity of the breaker should be 16KA/25KA/36KA, RMS for 1 second.

6. The operating and tripping levers / emergency stop switches should be provided.

7. The MCCB shall be of suitable breaking capacity as specified in drawing with microprocessor/thermal release suitable for adjustment upto 70%. Terminals should be suitable for termination of copper / aluminum conductor cable.

8. Doors interlock defeat facility, push to trip facility & with following accessories are required:
   - Shunt release
   - Under voltage release
   - Auxiliary contact block
   - Trip alarm contact
   - Rotary operating handle.
   - Spreader.

5.3 MINIATURE CIRCUIT BREAKER (MCB):

1. The MCBs shall be of the thermal-magnetic type and shall have a short circuit rating of not less than 9KA, suitable for DIN rail mounting and shall be ON in the up position and OFF in the down position of the operating knob.

2. The Miniature circuit breaker (MCB) shall be heat resistant, moulded type designated, manufactured at tested as per (IS8828).

3.

4. The MCB shall have inverse time tripping characteristic against overloads and instantaneous trip against short circuit.

5.4 RESIDUAL CURRENT CIRCUIT BREAKER (RCCB/RCBO):

1. Residual Current circuit breaker shall be 415 / 240V, 4 / 2-pole current-operated type, with a sensitivity of 30 milliamps in 30 milliseconds or less tripping time & with a

sensitivity of 100 milliamps in 20 milliseconds or less tripping time, suitable for DIN rail mounting inside MCB DBs.

2. The RCBO/RCCB shall work on direct-current operating principle using core balance current transformer.

3. The unit shall have a test button for testing its function.

4. The RCBO/RCCBs shall not have a bypassing arrangement.

5.5 FUSE SWITCH UNIT / CHANGE OVER SWITCH:

1. The fuse switch unit shall be of continuous rating and of heavy-duty load break type.

2. The unit shall be housed in dust proof 2 mm thick sheet steel enclosure having top and bottom knockout entries.

3. The unit shall be suitable for GI pipe / PVC conduit / metal conduits / cable entry and have adequate wiring space.

4. The switch-operating handle shall be interlocked with the door such that it opens only when the switch is in OFF position.

5. The unit shall be provided with sealing facility and shall contain HRC fuses with ratings as per the drawings.

5.6 MCB / MCCB DISTRIBUTION BOARD (MCB/MCCB DB):

1. The Distribution board shall be factory-made pre- wired, phase-segregated type having an enclosure made from 1.6 mm (16 SWG) CRCA sheet, with welded back and sides and detachable gland plates or suitable knockouts at top and bottom. All removable plates shall be provided with neoprene gaskets.

2. Only the operating handle of the MCB/MCCB shall be projecting outside the cover plate.

3. The incoming switch terminals shall be suitably shrouded to avoid accidental contact. Each phase or way shall also be suitably shrouded with hylam sheet.

4. The incoming and outgoing terminals shall be suitable for terminating cables as per the termination sheet.

5. The MCB Distribution board shall undergo suitable pretreatment followed by two coats of primer and two coats of stoving grade synthetic enamel paint or powder coated, as specified elsewhere in this specification.

6. The connections to the busbars shall be by solid copper links.

7. The DB's shall have phase / Neutral / Earth terminal blocks for termination of incoming and outgoing wires.

8. All the device wires and terminal blocks within the board shall be clearly identified by

durable and legible tags corresponding to those in applicable drawings. All wiring shall be easily identified by ferrules (interlocking type) accessible for maintenance checks.

9. Terminal blocks should be suitable for termination of conductors / cable of required size but minimum rated cross section of the terminal block should be 6 sq.mm.

10. Terminal block shall be made of flame retardant polymide material. Coloured terminal blocks & FRLS wires shall be used for easy identification of RYB phases, neutral and earth.

11. The design of the Distribution board shall be such that the MCBs/MCCBs can be mounted without additional wiring.

12. All the low voltage internal wiring of the distribution boards shall be of 1.1KV grade stranded copper conductor, FRLS PVC insulated, PVC sheathed wires of core size 2.5 sq.mm for control wiring.

13. The DB should have name plate with its designation inscribed on it. The name plate shall be made of durable material with legible lettering. Refer its relevant SLD's for designation of DB's.

14. The Distribution board shall be suitable for DIN rail mounting type MCBs. The MCBs shall be mounted on the Distribution board in one or more horizontal rows such that the MCBs are ON in the up position and OFF in the down position of the operating knob.

15. The busbars shall be made of cadmium-coated copper and shall have a continuous rating of not less than 100A.

16. The DB's shall be of recess / surface mounted type with integral loose wire box. The type of DB (recessed / surface mounted) shall be subject to Engineers approval.

17. Multi-way neutral and earth connectors / busbar shall be provided inside the MCB Distribution board to terminate the incoming and outgoing neutral / earth conductors.

18. The connector / busbar shall be made of cadmium coated brass and shall have a continuous rating of not less than 50% of the busbar rating.

19. Plastic engraved identification labels shall be provided for each circuit and Distribution board itself.

20. Proper danger plate shall be provided on each board as per relevant IS.
The MCB Distribution board shall be supplied and installed as per electricity utility / CEIG Standards.

5.7 MCCB/MCB IN SHEET STEEL ENCLOSURE:

1. The MCCB/MCB shall have an enclosure of 1.6mm (16 G) CRCA sheet.

2. The enclosure shall have welded back and sides, suitable knockouts at the top and bottom and a removable front cover.

3. The front cover shall have a suitable cutout such that the dolly of the MCB is accessible

from the front.

4. The enclosure shall be painted as specified elsewhere in this specification.

5.8 CABLES:

1. Cable shall be XLPE / PVC insulated and PVC sheathed, GI round / flat armoured / unarmoured, 1.1 KV grades, with copper or aluminium/ copper conductor conforming to IS 1554.

2. The insulation thickness and sheathing of cable shall be as per relevant standards.

3. The LT underground cables shall carry ISI Certification and should be insured against fire for transporting and storage.

4. The LT Underground Cables of size 6 sq.mm. and above, shall have multi-stranded conductors.

5. Cable glands shall be of single compression Siemens type made of brass with earth clip.

6. Cable lugs shall be of tinned copper and shall be of crimping type.

7. The insulation thickness of cable shall be as per table 1 of IS 1554 (Part I).

8. The sheathing of cable shall be extended type, as per Table-3 & 6 of IS 1554 (Part 1).

5.9 General requirements for all types of trays:

1. Trays shall not have sharp edges, burrs or projections injurious to cables.

2. All bolts, nuts and fasteners shall be as approved by the engineer.

3. Anchor fasteners shall be of 750 kg pull-out class and of approved type.

4. Trays shall be installed to correct line, level, plumb and alignment and shall present a neat and clean appearance.

5. **Clearances for all types of trays:**

a. For horizontal trays :

i. A clear gap of 200 mm shall be maintained between the tray and the ceiling and ceiling projections.

ii. The vertical spacing between the trays in multi-tier stretches shall be as approved by the Engineer and in no case lesser than 250 mm.

iii. The distance between the ceiling / ceiling projections and the bottom of the tray shall be as per Engineer's requirements and shall take care of other items of the building such as false ceiling, light fixtures, etc.

6 . **For vertical trays**

a) A clear gap of atleast 100 mm shall be maintained between the tray and the walls behind.

b) This shall be achieved by approved spacers.

5.10 METALLIC CONDUITS AND FITTINGS:

1 . Metallic conduits shall conform to standards such as IS 9537 Part-II and IS 1653. They shall be treated to prevent corrosion.

2 . The conduits and fittings shall have a wall thickness of not less than 1.6 mm(16SWG)for conduits upto 32mm diameter not less than 2mm(14SWG) for conduit above 32mm diameter.

3 . No conduits less than 20mm in diameters shall be used.

4 . Saddles for surface conduit work on wall shall not be less than 0.55mm (24 gauges) & 19mm width for conduits up to 25mm dia and not less than 0.9mm (20 gauges) & 25mm width for larger diameter.

5 . Matching inspection bends, couplers and draw boxes shall be provided at suitable locations and the sizes shall be in accordance with the respective conduit sizes.

5.11 PVC CONDUITS AND ACCESSORIES:

1 . PVC conduits and fittings shall be of the heavy class conforming to IS 9537 Part III.

2 . The conduits and accessories shall have a wall thickness of not less than 1.6 mm(16SWG) for conduits laid @ wall, and not less than 2mm(14SWG) for conduit laid @ concrete (ceiling).

3 . No conduits less than 20mm in diameters shall be used.

4 . PVC bends couplers and draw boxes shall be provided at suitable locations and the sizes shall be in accordance with the respective conduits.

5 . Elbows shall not be used.

6 . ***Rack :***

a) The rack doors shall be of wall mountable type and it shall have suitable lock and key arrangement.

b) The glass doors should be minimum 4mm thick.

c) It shall have provision for cable entry at the bottom / top of the rack as directed by the Engineer based on site condition.

d) The rack shall be made of CRCA sheets minimum 1.2mm thick.

e) The rack shall have louvers from the bottom to the top to ensure smooth airflow and circulation.

6. INSTALLATION MATERIALS AND ACCESSORIES

6.1 **Wires for electricity**

6.1.1 PVC insulated multi-stranded copper FRLS wires of 1.1 KV grade as per IS 694 and ISI certification shall be used.

6.1.2 The type and size of wires to be used shall be as indicated in the drawings.

6.1.3 No joints are permitted in the runs of wires.

6.1.4 The following colour code shall be adopted for the wiring:

Three phase wiring	:	Red, Yellow, Blue
Single phase wiring	:	Red
Switched phase / wire from switch to light fan, bell, etc.	:	White
Neutral	:	Black
Earth	:	Green

6.2 **Switch and socket Boxes**

6.2.1 Boxes for the mounting of switches, sockets and for regulators, etc. shall be made of 1.6 mm (16G) CRCA sheet and shall be hot dip galvanised after fabrication.

6.2.2 The boxes shall have a provision for earthing from inside.

6.2.3 In case of modular system of switch / socket boxes and plate switches / sockets, the plates shall be directly mounted on the switch / socket box such that the joint between the box and the surrounding plaster is covered by the plate.

6.2.4 The size of switch boxes shall be selected so as to accommodate all the switches, sockets and regulators as indicated in the drawings.

6.3 **Switches and Sockets**

6.3.1 All switches for lighting, ceiling fans and 6A/16A sockets shall be of modular type 240V, 6A/16A rating, suitable for flush mounting, as indicated in the bill of quantities / price schedule or as shown in the drawings.

6.3.2 The 6A socket shall be of universal 5-pin type, whereas 16A sockets shall be of universal type, having both 16A and 6A, 5 pin outlets.

6.3.3 The sockets shall be flush mounting type. The 16A socket shall have independent fuse and indicator.

6.3.4 A separate switch shall control each socket.

6.3.5 Switches / sockets are to be installed at locations and heights that may be indicated in the drawings.

6.3.6 Sockets to be installed at heights less than 1000mm above FFL shall have safety shutters.

6.4 **Ceiling Roses**

6.4.1 Ceiling roses shall be made of PVC white colour suitable for mounting on junction box / wall surface with three-way connector.

6.5 **PVC conduits and accessories**

6.5.1 PVC conduits and fittings shall be of the heavy class conforming to IS 9537 Part III.

6.5.2 PVC bends couplers and draw boxes shall be provided at suitable locations and the sizes shall be in accordance with the respective conduits.

6.5.3 Elbows shall not be used.

6.6 **Metallic conduits and fittings**

6.6.1 Metallic conduits shall conform to standards such as IS 9537 Part-II and IS 1653. They shall be treated to prevent corrosion.

6.6.2 The conduits and fittings shall have a wall thickness of not less than 1.6 mm.

6.6.3 Matching inspection bends, couplers and draw boxes shall be provided at suitable locations and the sizes shall be in accordance with the respective conduit sizes.

6.7 **Junction Boxes**

6.7.1 Junction boxes for luminaire shall be made of PVC.

6.7.2 The junction boxes to be installed in slabs shall be of 65 mm dia and 65 mm deep. The junction boxes on wall shall be 65 mm dia and 30 mm deep.

6.7.3 They shall have two or four number of knockouts with extension for conduit entry, suitable for particular diameters of the conduits.

6.8 **Fan hook boxes**

6.8.1 Fan hook boxes shall be 95 mm dia and 60 mm deep and made of 16G CRCA sheet with 10 mm dia MS hook cum lug and 25 mm dia x 25 mm long conduit extension closed at one end, suitable for insertion of bolts with 4 numbers of knockouts for conduit entry, hot-dip galvanised after fabrication.

6.8.2 These shall be painted with two coats of red oxide primer of approved brand.

6.8.3 Fan hook boxes shall be submitted and approved by the Engineer / Consultant / Employer before execution.

6.9 **Draw Boxes and Inspection Boxes**

6.9.1 Draw boxes of approved sizes shall be made from 1.6mm (16G) CRCA sheets and shall be hot-dip galvanised after fabrication.

6.9.2 The boxes shall be covered with 3 mm thick white hylam sheet fixed to the box with brass cup washers and full threaded brass screws.

6.9.3 In the case of concealed flush mounting, the hylam sheet shall project 6mm beyond the box so that the sheet covers the joint between the box and the surrounding plaster.

6.10 **Telephone cables**

6.10.1 The telephone cables (10/20 pair) shall be as per relevant ITD specifications.

6.10.2 No joints are permitted in the runs of wires.

6.11 **Computer Networking & Data Cables**

6.11.1 CAT-6/6A/5E shielded type FRLS cables shall be laid through heavy-duty PVC conduits, taking the shortest route between the patch panel / switch port and various nodes, complete with RJ-45 Information outlet sockets.

7. INSTALLATION

7.1 INSTALLATION OF SWITCH BOARD

7.1.1 Switch Boards shall be mounted in the electrical rooms / any other location as indicated in the drawings, on pre-formed / pre-excavated trenches.

7.1.2 The portion of the trenches not covered by the switchboard shall be covered with 7 mm thick chequered steel plates with proper fastening arrangements.

7.1.3 All unused cable entries shall be closed with suitable blind plugs or plates made from 2 mm hot dip galvanised CRCA sheet steel bolted to the gland plates.

7.2 INSTALLATION OF MCB UNIT:

7.2.1 The MCB unit shall be installed in the distribution boards using zinc-passivated bolts and nuts grouted in the wall.

7.3 INSTALLATION OF CHANGE OVER SWITCH:

7.3.1 The change over switch shall be installed in the panels / enclosures are using zinc-passivated bolts and nuts grouted in the wall.

7.4 INSTALLATION OF CABLES

7.4.1 Cable installation shall be properly coordinated at site with the routing of services, utilities and wherever necessary suitable adjustment shall be made in the cable routings with a view to avoid interference with any part of the buildings, structures, equipment, utilities and services.

7.4.2 Wherever cables are required to enter the building, they shall be drawn through hume

pipe / GI pipe. Suitable packing / sealing shall be made at both ends of the pipe to make the entry points fully watertight.

7.4.3 Where cables are required to cross the roads or cables and pipes of other services the cable shall be drawn through Hume pipe or GI pipe. Suitable sealing shall be made at both ends of the pipes.

7.4.4 All cables shall be provided with identification tags indicating cables numbers in accordance with the cable/circuit schedule. Tag shall be fixed at both ends of all cables laid in the ground. In case of cables lay on walls or over the false ceiling tags shall be fixed on both ends and at 20M spacing.

7.4.5 When a cable passes through a wall, tags shall be fixed at both sides of the wall. The tags shall be of durable fiber or aluminium sheet with the numbers punched on them Vertical runs of cables along the wall shall be laid through medium class-B GI pipe of and securely attached to the cables with non-corrosive wire.

7.4.6 For single core cables, wires shall be of non-ferrous materials.

7.4.7 Suitable diameter up to a height of 900 mm above finished floor level. The GI pipe shall be clipped to the wall with brass clamps and brass screws. The distance between the clamps shall not exceed 400 mm.

7.4.8 Standard cable grips and reels shall be utilised for cable pulling. The maximum pulling tension shall not exceed the recommended values.

7.4.9 Sharp bends shall be avoided in the cable runs. The bending radius shall not be less than 12 times the diameter of the cables (12D).

7.4.10 No joints shall be normally permitted in the runs of the cables unless the length of the run is more than the length of the standard drum supplied by cable manufacturers. In such cases when jointing is unavoidable the same shall be made by means of standard cable joint boxes/kits.

7.4.11 Where more than one cable has to be laid along the same route, the cables shall be laid horizontally touching each other and not one above the other.

7.4.12 The armour of the cables shall be effectively earthed at all terminations.

7.4.13 Suitable phase identifiers shall be provided at the terminals.

7.4.14 All cables shall be tested for proper insulation prior to laying.

7.4.15 The cable drums shall be transported on wheels to the place of work and the cables shall be laid out in proper direction as indicated on the drum using cable drum stands.

7.4.16 In case of higher size cables, the laid out cables shall run over rollers placed at close intervals and finally transferred carefully onto the trenches and racks.

7.4.17 Care shall be taken so that kinks and twists or any mechanical damage does not occur

in the cables. Only approved cable pulling grips or other devices shall be used.

7.4.18 Adequate length of cables shall be pulled inside the switchboards, control panels, terminal boxes, etc., so as to permit neat termination of each core / conductor.

7.4.19 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC perforated tapes and suitably supported to key them in position at the terminal block. All spares cores shall be neatly dressed and suitably taped at both ends.

7.4.20 Power cable termination shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamp near the terminals.

7.4.21 All power cable terminations shall be by means of crimping type cable lugs and the torque shall be 2 to 3 N-M.

7.4.22 Control cables shall be terminated by crimping or directly clamped in the terminal blocks by screws.

7.4.23 The voltage drop between cable strands and the respective product / switch / MCB terminal must be less than 10 millivolt.

7.4.24 All cable entry openings in the equipment shall be sealed and made entry-proof against creeping reptiles.

7.4.25 Cables laid in cable trays shall be clamped by means of single or multiple galvanised MS saddles and accessories. The saddles shall be placed at intervals of 1500 mm in both horizontal and vertical straight runs, at each bends and at turnings from horizontal to vertical direction vice versa.

7.4.26 Fire barrier with glass wool packing or suitable material shall be provided between cable ducts / trays and room.

7.5 EARTHING

a) The metallic enclosures of single-phase equipment shall be earthed at one point while those of three-phase equipment shall be earthed at two points.

b) GI plate earth stations conforming to IS: 3043 specifications of shall be installed to obtain an effective earthing system. The earth stations shall be provided with heavy duty CI/RCC covers of appropriate size.

c) Copper plate earth stations conforming to IS: 3043 specifications of shall be installed to obtain an effective earthing system. The earth stations shall be provided with heavy duty CI/RCC covers of appropriate size.

d) The distance between two earth electrodes shall not be less than 3 meters. A minimum clearance of 1.5 meters shall be ensured from buildings.

e) Joints in the GI strips shall be welded with a lap weld of 20 mm length while those in copper shall be brazed. The welded joints shall be painted with bituminous paint and covered with bituminous gunny tape. All wires shall be terminated with tinned copper crimping type lugs.

f) The sizes of the earthing conductors shall be as indicated in the Bill of quantities.

g) The armour of the cables shall be effectively earthed at the cable gland by earthing the gland using copper earth clips.

h) All copper earthing conductors to the earth stations shall be laid at a depth of not less than 600mm from formed ground level.

i) All the metal conduits / enclosures shall be earthed at one point.

j) The earthing conductor wires unless otherwise specified shall be as follows :

i. Main earthing conductor from Main switch board to the earth electrode: 2 runs of 25 x 3mm copper strip.

ii. Earth conductor inside the MSB and between MSB and all sub-switch boards: 1 run of 25 x 3mm copper strip.

7.6 WIRES FOR ELECTRICITY

a) PVC insulated multi-stranded copper FRLS wires of 1.1 KV grade as per IS 694 and ISI certification shall be used.

b) The type and size of wires to be used shall be as indicated in the drawings.

c) No joints are permitted in the runs of wires.

d) The following colour code shall be adopted for the wiring:

Three phase wiring :	Red, Yellow, Blue
Single phase wiring :	Red
Switched phase / wire from switch to light fan, bell, etc. :	White
Neutral :	Black
Earth :	Green

7.7 SWITCH AND SOCKET BOXES

7.7.1 Boxes for the mounting of switches, sockets and for regulators, etc. shall be made of 1.6 mm (16G) CRCA sheet and shall be hot dip galvanised after fabrication.

7.7.2 The boxes shall have a provision for earthing from inside.

7.7.3 In case of modular system of switch / socket boxes and plate switches / sockets, the plates shall be directly mounted on the switch / socket box such that the joint between the box and the surrounding plaster is covered by the plate.

7.7.4 The size of switch boxes shall be selected so as to accommodate all the switches, sockets and regulators as indicated in the drawings.

7.7.5 Switch / Socket Boxes shall be concealed in the wall and the mounting height of the boxes shall be as indicated in the drawings.

7.7.6 The switch and socket cover plates shall project 6 mm beyond the switch/socket box. In the case of concealed conduit wiring, the joint between the box and the surrounding plaster is covered by the cover plate. The cover plate shall be fixed with brass cup washers and full threaded brass screws.

7.7.7 Switch boxes are required to be mounted in partition walls also. Suitable fixing accessories shall be included for such requirements.

7.7.8 Where more than one Switch / Socket Box is required to be provided at close proximity, they shall be positioned in a convenient fashion.

7.7.9 Switchboxes shall be fixed in position using cement mortar. Cement concrete with small size aggregates shall be used where the gap exceeds 20mm. The front lips shall be flush with the face of wall plaster.

7.8 SWITCHES AND SOCKETS

7.8.1 All switches for lighting, ceiling fans and 6A/16A sockets shall be of modular type 240V, 6A/16A rating, suitable for flush mounting, as indicated in the bill of quantities / price schedule or as shown in the drawings.

7.8.2 The 6A socket shall be of universal 5-pin type, whereas 16A sockets shall be of universal type, having both 16A and 6A, 5 pin outlets.

7.8.3 The sockets shall be flush mounting type. The 16A socket shall have independent and indicator.

7.8.4 A separate switch shall control each socket.

7.8.5 Switches / sockets are to be installed at locations and heights that may be indicated in the drawings.

7.8.6 Sockets to be installed at heights less than 1000mm above FFL shall have safety shutters.

7.9 CEILING ROSES

7.9.1 Ceiling roses shall be made of PVC white colour suitable for mounting on junction box / wall surface with three-way connector.

7.10 MCB DISTRIBUTION BOARD:

7.10.1 MCB Distribution Board shall be fixed with bolts and nuts grouted to the wall in the cupboards / niches provided by civil agency and as shown in the drawings.

7.11 MCB UNIT:

7.11.1 The installation shall be carried out in accordance with the Indian Electricity Rules, the Codes of Practice of the Bureau of Indian Standards and other relevant regulations.

7.11.2 The MCB unit shall be installed in the distribution boards using zinc-passivated bolts and nuts grouted in the wall.

7.12 CIRCUIT BREAKERS:

7.12.1 The installation shall be carried out in accordance with the Indian Electricity Rules, the Codes of Practice.

7.13 WIRING

7.13.1 PVC insulated wires shall be drawn through concealed PVC conduits and / or surface mounted PVC conduits.

7.13.2 The wires of a circuit shall not run through the conduits, junction boxes, and switch / socket boxes of another circuit. Common draw boxes with hylam barriers separating individual circuit wires may be adopted to minimise the number of draw boxes.

7.13.3 The maximum number of PVC insulated wires which can be drawn in conduits of various sizes shall be as given below :

Nominal cross-sectional area of wire (sq.mm.)	Sizes of conduit			
	20 mm	25 mm	32 mm	40 mm
1.5	5	10	12	-
2.5	5	8	12	-
4.0	3	6	8	-
6.0	2	5	7	-
10.0	2	4	5	8
16.0	-	2	3	6

7.13.4 Wires shall be terminated at the switch boxes with suitable crimping type tinned copper lugs.

7.13.5 Wiring shall be carried out by looping the phase conductors at the switch box and the

neutral conductors at the lights, fans and sockets.

7.13.6 For looping of wires in switch boxes, shrouded type multi-way 10A/20A rated connectors shall be used.

7.13.7 The circuit wiring shall be in accordance with the drawings.

7.14 CIRCUIT WIRING

7.14.1 Circuit wiring shall mean wiring from the MCB distribution board to first switch box and subsequent switch boxes of the circuit and shall include necessary length of wires in the circuit, draw box connectors, ferrules, lugs, etc.

7.14.2 Circuit chart shall be prepared and fixed inside the distribution board doors.

7.14.3 Circuit wiring shall be terminated with copper lugs, sockets and ferruling has to be carried out as per circuit chart.

7.15 POINT WIRING

7.15.1 Point wiring shall include all work necessary to complete wiring of a switch / socket circuit of any length from the tapping point of the distribution circuit to socket / light / fan / call bell / starter, etc. points. The point wiring shall include all the materials as indicated in the Point Wiring Chart forming part of this specification.

7.16 CEILING FANS

7.16.1 Concealed type fan hook boxes shall be used for mounting of the ceiling fans.

7.16.2 The fan shall be fixed to the hook in such a way that the canopy covers the opening of the fan hook box. The down rod shall be exactly in the centre of the box.

7.17 EXHAUST FANS

7.17.1 Exhaust fans shall be mounted on a galvanised MS ring, which, in turn shall be fitted in the openings provided for the purpose.

7.18 CONDUITS:

7.18.1 Conduiting shall comprise the conduits and necessary bends and couplers for vertical dropping and for joining together conduits respectively.

7.18.2 The diameter and routes of the conduits shall be as indicated in the drawings, which are to be prepared and furnished by the contractor, based on the fittings layout & single line diagram and such other drawings made available by the Engineer-in-charge.

7.18.3 Draw boxes shall be provided at every 10m length of conduiting meant for wiring, in stretches involving more than two bends and where the alignment passes through ceiling slabs which are at different levels as well as at points where specifically called for as per drawings or as directed by the Engineer. Elbows shall not be used. Top of the box 100mm to 300 mm below the ceiling level, unless indicated to the contrary by the Engineer-in-charge.

7.18.4 The draw boxes and junction boxes shall be covered with 3 mm thick hylam sheet of approved colour fixed to the box with brass cup washers and full threaded brass

screws.

7.18.5 In case of concealed flush mounting, the hylam sheet shall project 6mm beyond the box so that the sheet covers the joint between the box and the surrounding plaster.

7.18.6 GI fish wires shall be provided in the conduits.

7.18.7 All openings shall be sealed to prevent entry of concrete or creatures.

7.18.8 Conduits, draw boxes, junction boxes, fan hook boxes, etc., which would be concealed, shall be secured in position by tying to the reinforcement bars using binding wire or appropriate check nails in case of masonry.

7.18.9 Conduits, accessories, junction boxes and fan hook boxes to be concealed in masonry shall be set into necessary chases, secured in position and the chase patched up using cement mortar. The dimensions of the chases shall be appropriate for the sizes of the concealed items and as approved.

7.18.10 PVC items shall be jointed together using approved adhesive only.

7.18.11 The conduits, accessories, junction boxes and fan hook boxes fixed in position shall be inspected thoroughly during concreting and concealing, for any displacements, damages, etc. Sufficient stock of materials and workmen shall be deployed to immediately attend to any rectifications. A thorough check for any damages or chokages shall also be carried out after concealment. All such measures and rectifications shall be at the Contractor's own cost.

7.18.12 Conduits and sleeves meant for passage of cables, etc. shall be fixed on / through masonry / RCC members or laid in excavated / pre-formed trenches, all as approved by the Engineer. Curves in the alignment of metallic conduits shall be achieved by bending to profile using non-heat methods only, without the use of elbows.

7.18.13 Wherever the masonry walls are chased for concealing the conduits and switch boxes, it shall be plaster using cement mortar until get good finish.

7.19 LUMINAIRES

7.19.1 The installation of luminaires shall be at locations indicated in the drawings with necessary fixing accessories and down rods wherever required, etc.

7.20 CONTROL CABLES

7.20.1 Control cable cores entering switchboard or control panels shall be neatly bunched and strapped with PVC perforated tapes and suitably supported to key them in position at the terminal block. All spares cores shall be neatly dressed and suitably taped at both ends.

7.20.2 Control cables shall be terminated by crimping or directly clamped in the terminal blocks by screws.

7.21 DATA NETWORKING / TELEPHONE / PA / CCTV SYSTEM CONDUITS

7.21.1 Separate conduits shall be provided for each wiring/cabling.

7.21.2 Conduits shall be laid from the communication room/shaft to respective outlet box,

made of 1.6mm Zinc passivated CRCA sheet steel and of size 100x100x50mm.

7.21.3 The height of the telephone/data outlet box shall be as per the drawings/or directed by the Engineer.

7.21.4 The outlet box shall be covered with 3 mm thick hylam sheet of approved colour on which the telephone/data socket pin will be fixed.

7.21.5 The covers of outlet box shall be provided with designation label with inscription "Telephone/Data" as the case may be.

7.21.6 The label tags shall be engraved plastic type with white lettering on black background. The size of the labels shall not exceed 60 x 20mm.

8. TESTING

8.1 Routine tests as per relevant Indian Standards shall be conducted on switchboards and other parts of the installation.

8.2 Any tests required to be done in response to the requirement of statutory authorities shall also be carried out.

8.3 Six copies of test certificates shall be submitted to the Engineer.

8.4 The following tests shall be carried out by the Contractor at site in the presence of the Engineer:

α) Insulation resistance tests

β) Continuity tests

χ) Polarity test of switches.

10. ABBREVIATIONS

10.1 The abbreviations mentioned below, wherever they appear in the Specifications and Bill of Quantities or elsewhere shall have the meaning or implication thereby assigned to them.

Abbreviation	Meaning	Abbreviation	Meaning
%	Percent	M.S. / MS	Mild Steel
◎C	Degrees Celsius	mm	Millimetre
A	Ampere	MSB	Main switch board
AC	Alternating current / air conditioning	MVA	Mega volt ampere
BIS	Bureau of Indian Standards	OD	Outer dimension
C.I. / CI	Cast Iron	P.C.C. / PCC	Plain Cement Concrete
CEIG	Chief Electrical Inspector to Government	PVC	Polyvinyl chloride
Cm	Centimetre	R.C.C. / RCC	Reinforced Cement Concrete
CPCB	Central Pollution Control Board	Rm / RM	Running metre or Linear metre
CRCA	Cold rolled cold annealed	RMC	Ready-mixed concrete
cu.m.	Cubic metre	RR	Random rubble
Dia	Diameter	Rs.	Rupees
ELCB	Earth Leakage Circuit breaker	Specification	Technical Specification
etc.	Etcetera	sq.mm.	Square millimetre
◎	Diameter	SS	Stainless steel
G.I. / GI	Galvanised Iron	SWG / G	Gauge
kV	Kilo volt	V	Volts
m or M	Metre	IE	Indian Electricity
HRC	High rupture capacity	IP	Ingress protection
Hz	Hertz	IS	Indian Standards

11. MATERIALS FOR POINT WIRING

11.1 The following "Point Wiring Chart" indicates the scope of materials to be covered in

point wiring supply and installation:

Sl. no.	Description	Fluorescent luminaire	Wall mounting luminaire	Ceiling mounting luminaire	Bulk head luminaire	Ceiling Fan with regulator	6 A Socket dependent / independent	16 A socket independent	Wall-mounting fan & exhaust fan
	Legend : ✓ Included X Not included								
1	Switch / socket box.	✓	✓	✓	✓	✓	✓	✓	✓
2	6 / 16 Amps flush type switches.	✓	✓	✓	✓	✓	✓	✓	✓
3	Ceiling roses (three pin connectors).	✓	✓	✓	✓	✓	X	X	✓
4	Universal type socket, 6 Amps, 5-pin.	X	X	X	X	X	✓	X	X
5	Universal type socket, 16 Amps, 5-pin.	X	X	X	X	X	X	✓	X
6	1.5 sq.mm. PVC insulated FRLS multistranded copper wire three runs (phase, earth & neutral).	✓	✓	✓	✓	✓	X	X	✓
7	2.5 sq.mm. PVC insulated FRLS multistranded copper wire two runs (phase & neutral) and 1.5 sq.mm. PVC insulated FRLS multistranded copper wire one run (earth)	X	X	X	X	X	✓	X	X
8	4 sq.mm. PVC insulated FRLS multistranded copper wire two runs (phase & neutral) and 2.5 sq.mm. PVC insulated FRLS multistranded copper wire one run (earth)	X	X	X	X	X	X	✓	X
9	Bakelite connectors, crimping type ferrules copper lugs, draw boxes, and cover plates (3mm thick hylam sheet of approved colour shade), brass cup washers, and brass screws.	✓	✓	✓	✓	✓	✓	✓	✓
10	Fan hook with boxes & round sheet	X	X	X	X	✓	X	X	X

11	Conduits.	✓	✓	✓	✓	✓	✓	✓	✓
12	Batten holder.	X	X	✓	X	X	X	X	X
13	Angle holder.	X	✓	X	X	X	X	X	X
14	Ceiling / wall plate	✓	✓	✓	✓	X	X	X	✓
15	Ceiling rose (with three-way connector)	✓	✓	✓	✓	✓	X	X	✓
16	Conduits & Junction boxes	✓	✓	✓	✓	✓	✓	✓	✓
17	2M Stepped regulator	X	X	X	X	✓	X	X	X

Proposed Interior work for BHEL,Transit building Ashok nagar, Chennai

1.0 TECHNICAL SPECIFICATIONS:

1.1 SCOPE

The scope of this section comprises the supply, erection testing and commissioning of Variable Refrigerant Flow System conforming to these specifications and in accordance with the requirements of Drawing and Schedule of Quantities.

1.2 TYPE

Units shall be air cooled, variable refrigerant volume air conditioner consisting of one outdoor unit and multiple indoor units. Each indoor units shall have the capability to cool or heat independently for the requirement of the rooms.

The indoor units on any circuit can be of different type and also controlled individually. Following type of indoor units shall be connected to the system:

Ceiling mounted cassette type (Multi flow)
Ceiling mounted High static Duct type
Wall mounted hiwall type

Compressor installed in each modular outdoor unit shall be equipped with multi inverter compressors for higher reliability, improved life, better backup and duty cycling purpose. The system shall be capable of changing the rotating speed of inverter compressor by inverter controller to follow variations in cooling and heating load.

Outdoor unit shall be suitable for mix match connection of all type of indoor units.

The refrigerant piping between indoor units and outdoor unit shall be possible to extend up to 175m with maximum 50m level difference without any oil traps**.**

Both indoor units and outdoor unit shall be factory assembled, tested and filled with first charge of refrigerant before delivering at site.

1.3 OUTDOOR UNIT

The outdoor unit shall be factory assembled, weather proof casing, constructed from heavy gauge mild steel panels and coated with baked enamel finish. The unit should be completely factory wired, tested with all necessary controls:

Each modular inverter outdoor shall be DC twin rotary compressor/ Scroll.

- In case of modular outdoor units, the outdoor unit shall have at least 1 inverter compressor so arranged that the operation is not disrupted with failure of any inverter compressor and if one inverter compressor malfunctions, other continues to provide emergency operation smoothly till repair is affected.

- It should also be provided with duty cycling for multiple inverter compressor switching starting sequence for better stability and prolonging equipment life.

- The outdoor unit shall be modular in design and should be allowed for side-by-side installation.

- The unit shall be provided with its own microprocessor control panel.

- The outdoor units should have anti-corrosion paint free base plate for easy mounting of unit.

- The machine must have a sub cool feature to use coil surface more effectively thru proper circuit/bridge so that it prevents the flushing of refrigerant from long piping due to this effect thereby achieving energy savings.

- The outdoor unit should be fitted with low noise, aero spiral design fan with aero fitting grill for spiral discharge airflow to reduce pressure loss and should be fitted with DC fan motor inverter type for better efficiency.

- The condensing unit shall be designed to operate safely when connected to multiple fan coil units.

1.4 REFRIGERANT CIRCUIT

The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valves at condenser end.

The equipment must have in built refrigerant stabilization control for proper refrigerant distribution.

All necessary safety devices shall be provided to ensure the safely operation of the system.

Refrigerant shall be R410a or R 407.

1.5 INSULATION:

THERMAL INSULATION OF PIPE:

a. All the pipes and equipment, operating at temperatures lower than the ambient shall be insulated in the manner specified.

b. Insulation of 50 mm thick TF quality thermocole with 26 G Aluminium cladding will be provided for the piping in the plant room and other open, visible areas and 50 mm thick TF quality thermocole insulation with cement plastering will be provided for the piping in the shafts and over the false ceiling.

c. The method of insulation is as under:
Clean the surface to be insulated.
Apply 2 coats of non-flammable cold adhesive as specified by the manufacturer.
Fix the insulation of the specified thickness over the surface of the pipe tightly.
Seal all the joints of the insulation with cold bitumen.
Cover the above with jute hessian cloth.
Fix 22 G GI wire netting over the hessian.
Apply two layers of sand cement plaster of 12mm total thickness / cladding with 26 G aluminium over the insulation.

THERMAL INSULATION OF DUCT:

The tail end duct shall be insulated in the following manner.

a. The insulation material for the ducting shall be 12mm Nitrile rubber material, laminated with Aluminium foil.

b. The method of insulation is as under:
   - Clean the surface to be insulated.
   - Apply one coat of primer paint.
   - Fix the insulation of the specified thickness over the surface of the duct tightly.
   - Seal all the joints with 75mm wide PVC tapes.