TENDER

Civil & Structural work for construction of BHEL Tower (Package-1) at Plot no. 25, Sec-16A, Noida(UP)

Contents:

Volume-1: Techno-commercial Bid
Volume-1A: Notice Inviting Tender
Volume-1B: General Conditions of Contract(GCC)
Volume-1C: Special Conditions of Contract(SCC)
Volume-1D: Specific Conditions for GRIHA & LEED CERTIFICATIONS
Volume 1E: Technical Conditions of Contract(TCC)
Volume 1F: Forms and Procedures
Volume 1G: Tender Drawings
Volume 2- Price Bid

ISMG & Corporate Administration
BHARAT HEAVY ELECTRICALS LTD.
New Delhi-110049

CONTRACTOR
(Sign with name, designation and date)

Civil & Structural work for construction of BHEL Tower
(Package-1)
at
Plot no. 25, Sec-16A, Noida(UP)

VOLUME-1
TECHNO-COMMERCIAL BID

ISMG & Corporate Administration
BHARAT HEAVY ELECTRICALS LTD.
AGVC, Siri Fort, New Delhi-110 049

CONTRACTOR
(Sign with name, designation and date)

Civil & Structural work for construction of BHEL Tower
(Package-1)
at
Plot no. 25, Sec-16A, Noida(UP)

VOLUME-1A
NOTICE INVITING TENDER

ISMG & Corporate Administration
BHARAT HEAVY ELECTRICALS LTD.
AGVC, Siri Fort, New Delhi-110 049

CONTRACTOR
(Sign with name, designation and date)

NOTICE INVITING TENDER (NIT)- AA:GAX:18:NBP:001R

==========

Sub : Civil & Structural work(Package-1) for construction of New Building at Plot no. 25, Sec-16A, Noida(UP).

Sealed offers in two part bid system are invited from reputed & experienced bidders (meeting PRE QUALIFICATION CRITERIA as mentioned in Annexure-I of Volume-I) for the subject work by the undersigned on behalf of BHARAT HEAVY ELECTRICALS LIMITED. Following documents/information with respect to the tender may please be referred and bid be submitted in compliance with the requirement contained therein.

1.0 **Salient Features of NIT**

S. N	Particulars	DESCRIPTION	
i	**Broad Scope of work**	Civil & Structural work for construction of BHEL Tower at Plot no. 25, Sec-16A, Noida(UP).	
ii	**DETAILS OF TENDER DOCUMENT**		
a	Volume-1 A	*Notice Inviting Tender (NIT)*	*Applicable*
b	Volume-1B	*General Conditions of Contract (GCC)*	*Applicable*
c	Volume-1C	*Special Conditions of Contract (SCC)*	*Applicable*
d	Volume-1D	*Specific conditions for GRIHA & LEED Certification*	*Applicable*
e	Volume-1E	*Technical Conditions of Contract (TCC)*	*Applicable*
f	Volume-1F	*Forms and Procedures*	*Applicable*
g	Volume-1G	*Tender Drawings*	*Applicable*
h	Volume-2	*Price Bid*	*Applicable*
iii	**Issue of Tender Documents**	Tender documents shall be available on BHEL website www.bhel.com & Central Public Procurement Portal website www.eprocure.gov.in for downloading from 11.06.2018	*Applicable*
iv	**DUE DATE & TIME OF OFFER SUBMISSION**	Date: 09.07.2018 Time: 14:00 Hrs	*Applicable*
v	**Venue for Bid submission**	***Location of Tender Box: Ground Floor, behind the reception Area, Gate No. 3, BHEL House, Sirifort, New Delhi-110049***	*Applicable*
vi	**OPENING OF TENDER**	***Date:09.07.2018, Time: 14:30 Hrs*** *Notes:* *(1) In case the due date of submission & opening of tender becomes a non-working day, then the due date & time of offer submission and opening of tenders shall get extended to the next working day.* *(2) Bidder may depute authorized representative to witness the opening of tender along with authorization letter.*	*Applicable*
vii	**EMD AMOUNT**	*Rs 1,40,00,000.00*	*Applicable*
viii	**COST OF TENDER**	---	*Not Applicable*

ix	**LAST DATE FOR SEEKING CLARIFICATION**	*Date: 28.06.2018* *Along with soft version also, addressing to contact address given below:* *1) Name: Rajan Yadav* *Designation: Dy G M* *Deptt: ISMG & HR-GAX* *Address: BHEL House, Sirifort, New Delhi* *Phone: (Landline/Mobile) 011-66337404/+91 9810506306* *Email: admry@bhel.in* *Fax:011 66337428* *2) Name: Meenakshi Singh* *Designation: Engineer* *Deptt: HR-GAX* *Address: BHEL House, Sirifort, New Delhi* *Phone: (Landline/Mobile) 011-66337553* *Email: meenakshis@bhel.in*	*Applicable*
x	**INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)**	*For format of Integrity Pact refer Volume-1F Forms and Procedures.* *Details of IEM: Shri D.R.S Chaudhary, IAS(Retd.)* *Address: Flat No. L-202 & L-203 (1st Floor)* *Ansal Lake View Enclave, Shamla Hills,* *Bhopal- 462 013 (M.P.)* *Contact details: Ph: +91 755 4050495* *email- dilip.chaudhary@icloud.com*	*Applicable*
xi	**Latest updates**	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com -->Tender Notifications →View Corrigendums) **and not in the newspapers**. Bidders to keep themselves updated with all such information	

2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them, duly signed & stamped on each page, as part of offer. **Rates/Price including discounts/rebates, if any, mentioned anywhere/in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.**

3.0 Bidder shall deposit EMD in the prescribed form given in Volume 1B- GCC. EMD shall be enclosed with techno-commercial bid. In case of non-submission of EMD of prescribed amount in prescribed form, BHEL reserves the right to reject the tender without giving an opportunity to the bidder for re-submission. BHEL's decision in this regard shall be final & binding on the bidders.

'One Time EMD' will not be considered for this tender. All the bidders who have 'One Time EMD' with BHEL and want to participate in this tender, would also submit the requisite amount of EMD as mentioned in Clause No. 1, Salient Features of NIT, Sl. No. (vii) above.

For Electronic Fund Transfer the details are as below-:

Name of the Beneficiary -: Bharat Heavy Electricals Limited

Bank Name	Kotak Mahindra Bank
Bank Telephone No.(with STD code)-:	011-43543659
Branch Address	Kotak Mahindra Bank. G-F 3A-3J, Ground Floor Ambadeep Building, 14 Kasturba Gandhi Marg New Delhi-110001
Bank Fax No. (with STD code)	011-23350900
Branch Code	0172
9 Digit MICR Code of the Bank Branch	110485002
Bank Account Number	9011196535
Bank Account Type	Current Account
Digit IFSC Code of Beneficiary Branch	KKBK0000172

4.0 **Procedure for Submission of Tenders**: The Tenderers must submit their Tenders addressed to Officer inviting Tender, as detailed below:

- PART-I (Techno Commercial Bid)- in sealed and superscribed envelope (ENVELOPE-I)
- PART-II (Price Bid) – in sealed and superscribed envelope (ENVELOPE-II)
- One set of tender documents shall be retained by the bidder for their reference

5.0 The contents for ENVELOPES and the superscription for each sealed cover/Envelope are as given below. **(All pages to be signed and stamped)**

SN	Description
	Part-I
	ENVELOPE – I superscribed as : PART-I (TECHNO COMMERCIAL BID) TENDER NO: AA:GAX:18:NBP:001R NAME OF WORK: Civil & Structural work for construction of BHEL Tower at Plot no. 25, Sec-16A, Noida(UP). DUE DATE OF SUBMISSION:
	CONTAINING THE FOLLOWING IN THE SEQUENCE AS DISCRIBED BELOW:-
i.	Covering letter/Offer forwarding letter of Tenderer.
ii.	EMD of prescribed amount and in prescribed form.
iii.	Duly filled-in `No Deviation Certificate' as per prescribed format to be placed after document under sl no (i) above. **Note:** a. In case of any deviation, the same should be submitted separately for technical & commercial parts, indicating respective clauses of tender against which deviation is taken by bidder. The list of such deviation shall be placed after document under sl no (i) above. It shall be specifically noted that deviation recorded elsewhere shall not be entertained. b. BHEL reserves the right to accept/reject the deviations without assigning any reasons, and BHEL decision is final and binding. i). In case of acceptance of the deviations, appropriate loading shall be done by BHEL ii). In case of unacceptable deviations, BHEL reserves the right to reject the tender

iv.	Supporting documents/ annexure/ schedules/ drawing etc as required in line with Pre-Qualification criteria. It shall be specifically noted that all documents as per above shall be indexed properly and credential certificates issued by clients shall distinctly bear the name of organization, contact no, FAX no, etc.
v.	All Amendments/ Correspondences/ Corrigenda/ Clarifications/ Changes/ Errata etc. pertinent to this NIT.
vi.	Integrity Pact Agreement (Duly signed by the authorized signatory)
vii.	Duly filled-in annexures, formats etc. as required under this Tender Specification/NIT
viii.	Volume – 1 A : Notice inviting Tender (NIT)
ix.	Volume – 1 B : General Conditions of Contract (GCC)
x.	Volume – 1 C : Special Conditions of Contract (SCC)
xi.	Volume- 1 D : Specific Condition for GRIHA & LEED certifications
xii.	Volume – 1 E : Technical Conditions of Contract (TCC)
xiii.	Volume – 1 F : Forms & Procedures
xiv.	Volume – 1 G : Tender Drawings
xv.	Volume – 2 Un-priced price bid format duly signed by the tenderer along with techno-commercial bid by mentioning "Quoted" in the column where quote is to be offered by the bidder.
xvi.	Any other details preferred by bidder with proper indexing.

	PART-II
	ENVELOPE-II superscribed as: PART-II (PRICE BID) TENDER NO : AA:GAX:18:NBP:001R NAME OF WORK : Civil & Structural work for construction of BHEL Tower at Plot no. 25, Sec-16A, Noida(UP). DUE DATE OF SUBMISSION:
	CONTAINING THE FOLLOWING
i	Covering letter/Offer forwarding letter of Tenderer enclosed in Part-I
ii	Volume II – PRICE BID (Duly Filled in total price of the package at the location indicated – price to be entered in words as well as figures)

	OUTER COVER
	ENVELOPE-III (MAIN ENVELOPE / OUTER ENVELOPE) superscribed as: TECHNO-COMMERCIAL BID & PRICE BID TENDER NO: AA:GAX:18:NBP:001R NAME OF WORK: Civil & Structural work for construction of BHEL Tower at Plot no. 25, Sec-16A, Noida(UP). DUE DATE OF SUBMISSION: **Note:** Name and address of the bidder should be present on the outer envelope **CONTAINING THE FOLLOWING:**
	o Envelopes I o Envelopes II

SPECIAL NOTE: All documents/ annexures submitted with the offer shall be properly annexed and placed in respective places of the offer as per enclosure list mentioned in the covering letter. BHEL shall not be responsible for any missing documents.

6.0 **Deviation with respect to tender clauses and additional clauses/suggestions in Techno-commercial bid / Price bid shall NOT be considered by BHEL. Bidders are**

requested to positively comply with the same. BHEL reserve the right to accept or not to accept any deviation without assigning any reason.

7.0 BHEL reserves the right to accept or reject any or all offers without assigning any reasons thereof. BHEL also reserves the right to cancel the Tender wholly or partly without assigning any reason thereof. Also BHEL shall not entertain any correspondence from bidders in this matter (except for the refund of EMD).

8.0 Since the job shall be executed at site**,** bidders must visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation, applicable wage structure, wage rules, etc before quoting for this tender. They may also consult this office before submitting their offers, for any clarifications regarding scope of work, facilities available at sites or on terms and conditions.

9.0 For any clarification on the tender document, the bidder may seek the same in writing or through e-mail, as per specified format, within the scheduled date for seeking clarification, from the office of the undersigned. BHEL shall not be responsible for receipt of queries after due date of seeking clarification due to postal delay or any other delays. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.

10.0 BHEL may decide holding of pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.

11.0 In the event of any conflict between requirement of any clause of this specification/ documents/drawings/data sheets etc. or requirements of different codes/standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages/ other clerical errors in the tender documents, noticed must be pointed out before pre-bid meeting/submission of offer, else BHEL's interpretation shall prevail. In this regard decision of BHEL shall be final and binding.

12.0 Unless specifically mentioned otherwise, bidder's quoted price shall deemed to be in compliance with tender including PBD.

13.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), along with techno-commercial bid. This pact shall be considered as a preliminary qualification for further participation. **The names and other details of Independent External Monitor (IEM) for the subject tender is as given at Clause No. 1, Salient Features of NIT, Sl. No. (x) above.**

Integrity Pact (IP)

1. IP is a tool to ensure that activities and transactions between the Company and its Bidders / Contractors are handled in a fair, transparent and corruption free manner. A panel of Independent External Monitors (IEMs) have been appointed to oversee implementation of IP in BHEL.

   The IP as enclosed with the tender is to be submitted (duly signed by authorized

signatory who signs in the offer) along with techno-commercial bid. Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification. Details of IEM for this tender is given at point 1(xi) above.

2. Please refer Section-8 of the IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to the IEM mentioned in the tender.

No routine correspondence shall be addressed to the IEM (phone / post / email) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. All such clarification / issues shall be addressed directly to the tender issuing (procurement) department.

For all clarifications/issues related to the tender, contact details are as per **Clause No. 1, Salient Features of NIT, Sl. No. (ix) above.**

14.0 The Bidder has to satisfy the Pre-Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of satisfying the Pre-Qualification Criteria specified in this NIT as per Annexure-I (as applicable), past performance etc. and date of opening of price bids shall be intimated to only such bidders. BHEL reserves the right not to consider offers of parties under HOLD.

15.0 In case BHEL decides on a `Public Opening', the date & time of opening of the sealed PRICE BID shall be intimated to the qualified bidders and in such a case, bidder may depute one authorised representative to witness the price bid opening. BHEL reserves the right to open 'in-camera' the 'PRICE BID' of any or all Unsuccessful/Disqualified bidders under intimation to the respective bidders.

16.0 Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) unless specified otherwise.

17.0 (a) BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on www.bhel.com) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

(b) Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'Process compliance form' (to the designated service provider) as well as 'Online sealed bid' in the Reverse Auction. Non-submission of 'Process compliance form' or 'Online sealed bid' by the agreed bidder(s) will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).

(c) The bidders have to necessarily submit online sealed bid less than or equal to their envelope sealed price bid already submitted to BHEL along with the offer. **The envelope sealed price bid of successful L1 bidder in RA, if conducted, shall also be opened after RA and the order will be placed on lower of the two bids (RA closing price & envelope sealed price) thus obtained. The bidder having**

submitted this offer specifically agrees to this condition and undertakes to execute the contract on thus awarded rates.

(d) If it is found that L1 bidder has quoted higher in online sealed bid in comparison to envelope sealed bid for any item(s), the bidder will be issued a warning letter to this effect. However, if the same bidder again defaults on this count in any subsequent tender in the unit, it will be considered as fraud and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).

(e) If reverse auction process is unsuccessful, sealed envelope price bids of all the techno-commercially qualified bidders shall be opened and the tender shall be processed accordingly. However, the envelope sealed bid(s) of techno-commercially acceptable bidder(s) who had agreed to participate in the RA and had failed to submit the online sealed bid shall not be opened.

18.0 On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.

19.0 In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.

20.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.

21.0 The bidder shall submit documents in support of possession of 'Qualifying Requirements' duly self-certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents/proofs, these shall be submitted immediately.

22.0 The bidder may have to produce original document for verification if so decided by BHEL.

23.0 The offers of the bidders who are on the banned/ hold list as also the offer of the bidders, who engage the services of the banned/ hold firms, shall be rejected. The list of **banned/ hold firms** is available on BHEL web site www.bhel.com.

27.0 It may please be noted that **guidelines/rules** in respect of Suspension of Business dealings', 'Vendor evaluation format', 'Quality, Safety & HSE guidelines', milestone/ completion certificate, etc may **undergo change** from time to time and the latest one shall be followed. The abridge version of extant 'Guidelines for suspension of business dealings with suppliers/ contractors' is available on www.bhel.com on "**supplier registration page".**

The offers of the bidders who are under suspension as also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL website (www.bhel.com).

27.1 Integrity commitment, performance of the contract and punitive action thereof:

27.1.1 **Commitment by BHEL:**
BHEL commits to take all measures necessary to prevent corruption in connection with the tender Process and execution of the contract. BHEL will

during the tender process treat all Bidder(s) in a transparent and fair manner, and with equity.

27.1.2 **Commitment by Bidder/ Supplier/ Contractor:**

i. The bidder/ supplier/ contractor commit to take all measures to prevent corruption and will not directly or indirectly influence any decision or benefit which he is not legally entitled to nor will act or omit in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India.

ii. The bidder/ supplier/ contractor will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to relevant guidelines issued from time to time by Govt. of India/ BHEL.

iii. The bidder/ supplier/ contractor will perform/ execute the contract as per the contract terms & conditions and will not default without any reasonable cause, which causes loss of business/ money/ reputation, to BHEL.

If any bidder/ supplier/ contractor during pre-tendering/ tendering/ post tendering/ award/ execution/ post-execution stage indulges in mal-practices, cheating, bribery, fraud or and other misconduct or formation of cartel so as to influence the bidding process or influence the prices or acts or omits in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India, then, action may be taken against such bidder/ supplier/ contractor as per extent guidelines of the company available on www.bhel.com and / or under applicable legal provisions.

29.0 The Bidder along with its associate/ collaborators/ sub-contractors/ sub-vendors/ consultants/ service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice.

30.0 Penalty: Applicable (Refer relevant clause of GCC)

31.0 Bid should be free from correction, overwriting, using corrective fluids, etc. Any interlineation, cutting, erasure or overwriting shall be valid only if they are attested under full signature(s) of person(s) signing the bid else bid shall be liable for rejection.

32.0 Order of Precedence: In the event of any ambiguity or conflict between the Tender Documents, the order of precedence shall be in the order below:

a. Amendments/ Clarifications/ Corrigenda/ Errata etc issued in respect of the tender documents by BHEL
b. Notice Inviting Tender (NIT) —Volume-1A
c. Price Bid/ BOQ- Volume 2
d. Technical Conditions of Contract (TCC)—Volume-1E
e. Special Conditions of Contract (SCC) —Volume-1C
f. Specific Condition for GRIHA & LEED certification – Volume- 1D
g. General Conditions of Contract (GCC) —Volume-1B
h. Forms and Procedures —Volume-1F

for BHARAT HEAVY ELECTRICALS LTD

CONTRACTOR
(Sign with name, designation and date)

ANNEXURE - 1

PRE QUALIFYING REQUIREMENTS (PQR)

The Bidders / Firms who fulfil the following requirements shall be eligible to apply. Joint ventures/ Consortium bidders are not accepted.

1.0 TECHNICAL

Experience of having successfully completed at least one work of multi-storied commercial/office/ institutional building with minimum height of 50m (to be measured from lowest basement floor level to top of the building) with at least 1 level basement for any Central Govt. / State Govt./ PSUs/ Public Limited Company/ Private Limited Company during last 7 years ending last day of month previous to the one in which applications are invited.

2.0 FINANCIAL

2.1 Average Annual financial turnover (Audited) during the last 3 years, ending 31st March of the financial year 2016-17 (i.e. FY2014-15, 2015-16, 2016-17), should be at least Rs.39.0 Crores.
(In case audited Financial statements have not been submitted for all the three years as indicated against 2.1 above, then the applicable audited statements submitted by the bidders against the requisite three years, will be averaged for three years i. e. total divided by three).

2.2 Experience of having successfully executed Residential/Non-residential multi-storied building works for any Central Govt. / State Govt./ PSUs/ Public Limited Company/ Private Limited Company during last 7 years ending last day of month previous to the one in which applications are invited should be either of the following:

i) One (1) work of value not less than Rs.104.00 Crores.

OR

ii) Two (2) works of value not less than Rs.65.00 Crores each.

OR

iii) Three (3) works of value not less than Rs.52.00 Crores each.

3.0 Bidder must have valid PAN no. and GST no.

4.0 Bidder must submit the integrity pact duly signed and stamped by the authorized person.

CONTRACTOR
(Sign with name, designation and date)

DOCUMENTS REQUIRED

The tenderers should submit documents in support of possessing Qualifying requirements as under, duly certified and stamped by their authorized signatory:

SN	Documents Required
1	Copy of Income Tax return of previous three financial years i.e. 2014-15, 2015-16 and 2016-17.
2	Copy of balance sheet, PL A/c duly certified & audited by CA for FY 2014-15, 2015-16, 2016-17
3	Covering letter with calculation of average financial turnover, Net worth and PBT of previous three years i.e. of 2014-15, 2015-16 and 2016-17 duly certified by CA.
4	Details of work successfully completed in support of qualification requirements as per format given in Volume-1F Forms and Procedures along with supporting.
5	Work orders / LOA (Letter of Award) along with BOQ (as applicable) and completion certificates with covering letter / indexing of the same.
6	Copy of PAN No. & GST registration certificate, PF & ESI registration.
7	Un-priced price bid format duly signed by the tenderer along with techno-commercial bid by mentioning “Quoted” at the place where quote is to be offered by the bidder.
8	A copy of tender enquiry duly signed and stamped on each and every page along with techno-commercial bid as a token of acceptance of T&C. Tenders shall be signed by persons duly authorized / empowered to do so.
9	**No Deviation Certificate duly signed as per format** given in Volume-1F Forms and Procedures
10	Details of the bidders duly filled and signed as per format given in Volume-1F Forms and Procedures.

ANNEXURE - 2

CHECK LIST

NOTE:- Tenderers are required to fill in the following details and no column should be left blank

1	Name and Address of the Tenderer	
2	Details about type of the Firm/Company	
3.a	Details of Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Email ID: Fax No:
3.b	Details of alternate Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Email ID: Fax No:
4	EMD DETAILS	DD/Cheque/PO No: Date : Bank : Amount:
		BG No. : Date : Bank: Amount:
5	Validity of Offer	To be valid for SIX MONTHS from due date of Offer submission

		APPLICABILITY(BY BHEL)	ENCLOSED BY BIDDER
6	Whether the format for compliance with **PRE QUALIFICATION CRITERIA** (ANNEXURE-1) is understood and filled with proper supporting documents referenced in the specified format	Applicable	YES / NO
7	Audited profit and Loss Account for the last three years	Applicable	YES/NO
8	Audited Balance sheet for the last three years	Applicable	YES/NO
9	Covering letter with calculation of average financial turnover, Net worth and PBT of previous three years duly certified by CA	Applicable	YES/NO
10	Details of similar work successfully completed in support of qualification requirements as per format along with supporting.	Applicable	YES/NO
11	Work orders along with BOQ and completion certificates with covering letter / indexing of the same.	Applicable	YES/NO
12	Copy of PAN & GST Registration	Applicable	YES/NO
13	Copy of PF & ESI registration	Applicable	YES/NO
14	Un-priced price bid format duly signed by the tenderer along with techno-commercial bid by mentioning “Quoted” at the place where quote is to be offered by the bidder.	Applicable	YES/NO
15	Whether all pages of the Tender documents including annexures, appendices etc are read understood and signed	Applicable	YES/NO
16	Integrity Pact	Applicable	YES/NO
17	Declaration by Authorised Signatory	Applicable	YES/NO

CONTRACTOR
(Sign with name, designation and date)

18	No Deviation Certificate	Applicable	YES/NO
19	Declaration confirming knowledge about Site Conditions	Applicable	YES/NO
20	Declaration for relation in BHEL	Applicable	YES/NO
21	Non-Disclosure Certificate	Applicable	YES/NO
22	Bank Account Details for E-Payment	Applicable	YES/NO
23	Power of Attorney for Submission of Tender/Signing Contract Agreement	Applicable	YES/NO
24	Participation confirmation in Reverse Auction if resorted by BHEL	Applicable	YES/NO
25	Authorization of representative who will participate in the online Reverse Auction Process	Applicable	YES/NO

DATE :

AUTHORISED SIGNATORY

(With Name, Designation and Company seal)

CONTRACTOR
(Sign with name, designation and date)

ANNEXURE - 3

Authorization of representative who will participate in the online Reverse Auction Process;

1	NAME & DESIGNATION OF OFFICIAL	
2	POSTAL ADDRESS (COMPLETE)	
3	TELEPHONE NOS. (LAND LINE & MOBILE BOTH)	
4	FAX NO.	
5	E-MAIL ADDRESS	
6	NAME OF PLACE/ STATE/ COUNTRY, WHEREFROM S/HE WILL PARTICIPATE IN THE REVERSE AUCTION	

Director/CMD/Partner/Proprietor

CONTRACTOR
(Sign with name, designation and date)

ANNEXURE – 4

Feedback Form: From where did you get information reg. this tender

1	NEWSPAPER ADVERTISEMENT (NAME)	
2	BHEL WEBISTE (TENDER NOTIFICATION)	
3	CENTRAL PUBLIC PROCUREMENT PORTAL OF GOVERNMENT OF INDIA (CPP PORTAL)	
4	EMAIL COMMUNICATION FROM BHEL	
5	ANY OTHER SOURCE	

CONTRACTOR
(Sign with name, designation and date)

Civil & Structural work for construction of BHEL Tower
(Package-1)
at
Plot no. 25, Sec-16A, Noida(UP)

VOLUME-1B
GENERAL CONDITIONS OF CONTRACT (GCC)

ISMG & Corporate Administration

BHARAT HEAVY ELECTRICALS LTD.

AGVC, Siri Fort, New Delhi-110 049

CONTRACTOR
(Sign with name, designation and date)

TABLE OF CONTENTS

1. Chapter-1 Instructions to Tenderers

1.1. Dispatch Instructions
1.2. Submission of Tenders
1.3. Language
1.4. Price Discrepancy
1.5. Qualification of Tenderers
1.6. Evaluation of Bids
1.7. Data to be enclosed
1.8. Authorization and Attestation
1.9. Earnest Money Deposit
1.10. Security Deposit
1.11. Return of Security Deposit
1.12. Bank Guarantee
1.13. Validity of offer
1.14. Execution of Contract Agreement
1.15. Rejection of Tender and other Conditions

2. Chapter-2 General Conditions

2.1. Definitions
2.2. Law Governing Contract and Court Jurisdiction
2.3. Issue of Notice
2.4. Use of land
2.5. Commencement of Work
2.6. Measurement of Work and Mode of Payment
2.7. Rights of BHEL
2.8. Penalty
2.9. Responsibilities of Contractor in respect of Local Laws, Employment of Workers etc
2.10. Progress Monitoring, Monthly Review and Performance Evaluation
2.11. Time of Completion
2.12. Extension of Time for Completion
2.13. Quantity Variation
2.14. Price Variation Compensation & Over Run Compensation
2.15. Insurance
2.16. Force Majeure
2.17. Settlement of dispute
2.18. Arbitration
2.19. Retention Amount
2.20. Payments
2.21. Performance Guarantee for Workmanship
2.22. Closing of Contracts
2.23. Reverse Auction
2.24. Strikes & Lockout
2.25. Other Issues

CHAPTER -1

1. INSTRUCTION TO TENDERERS

1.1. DESPATCH INSTRUCTION:

a. The General Conditions of Contract form part of the Tender specifications. All pages of the tender documents shall be duly signed, stamped and submitted along with the offer in token of complete acceptance thereof. The information furnished shall be complete by itself. The tenderer is required to furnish all the details and other documents as required in the following pages.

b. Tenderers are advised to study all the tender documents carefully. Any submission of tender by the tenderer shall be deemed to have been done after careful study and examination of the tender documents and with the full understanding of the implications thereof. Should the tenderers have any doubt about the meaning of any portion of the Tender Specification or find discrepancies or omissions in the drawings or the tender documents issued are incomplete or shall require clarification on any of the technical aspect, the scope of work etc., he shall at once, contact the authority inviting the tender well in time (so as not to affect last date of submission) Tenderer's request for clarifications shall be with reference to Sections and Clause numbers given in the tender documents. The specifications and terms and conditions shall be deemed to have been accepted by the tenderer in his offer. Non-compliance with any of the requirements and instructions of the tender enquiry may result in the rejection of the tender.

c. Integrity pact (IP) shall be applicable for all tenders / contracts if indicated in NIT. This integrity pact shall be issued as part of the Tender documents and shall be returned by the bidder along with Techno-commercial bid duly filled, signed and stamped by the authorized signatory who signs the bid. Only those vendors / bidders who have entered into such an IP with BHEL shall be considered qualified to participate in the bidding. Entering into this pact shall be a preliminary qualification.

1.2. SUBMISSION OF TENDERS:

1.2.1. The tenderers must submit their tenders to Officer inviting tender as per instructions in the NIT.

1.2.2. Tenders submitted by post shall be sent by 'REGISTERED POST ACKNOWLEDGEMENT DUE / by COURIER' and shall be posted with due allowance for any postal/courier delays. BHEL takes no responsibility for delay, loss or non-receipt of tenders sent by post/courier. The tenders received after the specified time of their submission are treated as 'Late Tenders' and shall not be considered under any circumstances. Offers received by Fax/Email/Internet shall be considered as per terms of NIT.

1.2.3. Tenders shall be opened by authorised Officer of BHEL at his office at the time and date as specified in the NIT, in the presence of such of those tenderers or their authorised representatives who may be present.

1.2.4. The Tenderers are required to quote for the complete scope of work as mentioned in tender enquiry and BOQ. Tenders for part of the work or incomplete work in any respect are liable to be rejected. Tenderers shall certify in the Techno- commercial bid that rates for all the items have been quoted.

1.2.5. Tenderers whose bids are found techno commercially qualified shall be informed the date and time of opening of the Price Bids / Reverse auction and such Tenderers may depute their representatives to witness the opening of the price bids. BHEL's decision in this regard shall be final and binding.

1.2.6. Before submission of Offer, the tenderers are advised to inspect the site of work and the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, position of material and labour, means of transport and access to Site, accommodation, etc. No claim will be entertained later on the grounds of lack of knowledge of any of these conditions.

1.2.7. Tenderers whose bids are found techno commercially qualified shall be informed the date and time of opening of the Price Bids / Reverse auction and such Tenderers may depute their representatives to witness the opening of the price bids. BHEL's decision in this regard shall be final and binding.

1.2.8. Before submission of Offer, the tenderers are advised to inspect the site of work and the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, position of material and labour, means of transport and access to Site, accommodation, etc. No claim will be entertained later on the grounds of lack of knowledge of any of these conditions.

1.3. LANGUAGE

1.3.1. The tenderer shall quote the rates in English language and international numerals. These rates shall be entered in figures as well as in words. For the purpose of the tenders, the metric system of units shall be used.

1.3.2. All entries in the tender shall either be typed or written legibly in ink. Erasing and over-writing is not permitted and may render such tenders liable for rejection. All cancellations and insertions shall be duly attested by the tenderer.

1.4. PRICE DISCREPANCY

1.4.1. **Conventional (Manual) Price Bid opening:** In the case of price bid opening without resorting to Reverse Auction, if there are differences between the rates given by the tenderer in words and figures or in amount worked out by him, the following procedure for evaluation and award shall be followed:

a. When there is a difference between the rates in figures and in words, the rates which corresponds to the amounts worked out by the contractor, shall be taken as correct.
b. When the amount of an item is not worked out by the contractor or it does not correspond with the rate written either in figure or in words, then the rate quoted by the contractor in words shall be taken as correct.
c. When the rate quoted by the contractor in figures and words tallies but the amount is not worked out correctly, the rate quoted by the contractor shall be taken as correct and not the amount.
d. In case of lump sum price, if there is any difference between the amount in figures and in words, the amount quoted by the bidder in words shall be taken as correct.
e. In case of omission in quoting any rate for one or more items, the evaluation shall be done considering the highest quoted rate obtained against the respective items by other tenderers for the subject tender. If the tenderer becomes L-1, the notional rates for the omission items shall be the lowest rates

quoted for the respective items by the other tenderers against the respective omission items for the subject job and the 'Total quoted price (loaded for omissions)' shall be arrived at. However, the overall price remaining the same as quoted originally, the rates for all the items in the 'Total quoted price (loaded for omissions)' shall be reduced item wise in proportion to the ratio of 'Original' total price and the 'Total quoted price (loaded for omissions)''.

f. The 'Final Total Amount' shall be arrived at after considering the amounts worked out in line with 'i' to 'v' above.

1.4.2. **Reverse Auction:** In case of Reverse Auction, the successful bidder shall undertake to execute the work as per overall price offered by him during the Reverse Auction process. In case of omission of rates, the procedure shall be as per 'Guidelines for Reverse Auction' enclosed.

1.5. QUALIFICATION OF TENDERERS

1.5.1. Only tenderers who have previous experience in the work of the nature and description detailed in the Notice Inviting Tender and/or tender specification are expected to quote for this work duly detailing their experience along with offer.

1.5.2. Offers from tenderers who do not have proven and established experience in the field shall not be considered.

1.5.3. Offers from tenderers who are under suspension (banned) by any Unit/Region/Division of BHEL shall not be considered.

1.5.4. Offers from tenderers who do not comply with the latest guidelines of Ministry/Commissions of Govt of India shall not be considered.

1.6. EVALUATION OF BIDS

1.6.1. Techno-commercial Bids submitted by the tenderer will be opened first and evaluated for fulfilling the Pre-Qualification criteria and other conditions in NIT/Tender documents, based on documentary evidences submitted along with the offer.

1.6.2. In case the same qualifying experience is claimed by more than one agency, then the agency who has executed the work as per documentary evidence submitted shall only be qualified. Scope of qualifying work should be totally with the agency who has executed. Further, BHEL reserves the right to ask for further proofs including submission of TDS certificates for the said job.

1.6.3. In case the qualifying experience is claimed by private organizations based on Work Order and completion certificates from another private organization, BHEL reserves the right to ask for further proofs including submission of TDS certificates for the said job.

1.6.4. Price Bids of shortlisted bidders shall only be opened either through the conventional price bid opening or through electronic Reverse Auction, at the discretion of BHEL. Evaluation of the Tenderers will be done on overall quote basis for the complete work and entire job will be awarded to the successful tenderer.

1.6.5. Work order will be placed on lowest bidder for the complete scope of work for which the bidder has qualified in the Techno-commercial Bid and subsequently

has emerged as lowest bidder in the evaluation of price bid / Reverse auction. In case the price quoted by two or more bidders is same, then L-1 bidder shall be decided by calling snap bids from such bidders.

1.6.6. Price Bids of unqualified bidders shall not be opened. Reasons for rejection shall be intimated in due course after issue of LOI/LOA to successful bidder and receipt of unqualified acceptance from the successful bidder.

1.7. DATA TO BE ENCLOSED

1.7.1. Full information shall be given by the tenderer in respect of the following. Non-submission of this information may lead to rejection of the offer.

1.7.2. **INCOME TAX PERMANENT ACCOUNT NUMBER:** Certified copies of Permanent Account Numbers as allotted by Income Tax Department for the Company/Firm/Individual Partners, etc. shall be furnished along with tender.

1.7.3. **ORGANIZATION CHART:** The organization chart of the tenderer's organization, including the names, addresses and contact information of the Directors/Partners shall be furnished along with the offer.

1.7.4. An attested copy of the Power of Attorney, in case the tender is signed by an individual other than the sole proprietor

1.7.5. **IN CASE OF INDIVIDUAL TENDERER:** His / her full name, address and place & nature of business.

1.7.6. **IN CASE OF PARTNERSHIP FIRM:** The names of all the partners and their addresses, A copy of the partnership deed/instrument of partnership dully certified by the Notary Public shall be enclosed.

1.7.7. **IN CASE OF COMPANIES:** Date and place of registration including date of commencement certificate in case of Public Companies (certified copies of Memorandum and articles of Association are also to be furnished).

1.7.8. Nature of business carried on by the Company and the provisions of the Memorandum relating thereof.

1.8. AUTHORISATION AND ATTESTATION

Tenders shall be signed by a person duly authorized/empowered to do so. An attested copy of the Power of Attorney, in case the tender is signed by an individual other than the sole proprietor shall be submitted along with the tenders

1.9. EARNEST MONEY DEPOSIT

1.9.1. EMD is to be paid by tenderers for securing fulfilment of any obligations in terms of the NIT.

1.9.2. **Modes of deposit :**
The EMD may be accepted only in the following forms:
(i) Cash deposit as permissible under the extant Income Tax Act (before tender opening)
(ii) Electronic Fund Transfer credited in BHEL account (before tender opening)

(iii) Banker's cheque/ Pay order/ Demand draft, in favour of BHEL (along with offer)

In case total EMD amount is more than ` 20 Lakh, the amount in excess of ` 20 lakh may be accepted in the form of Bank Guarantee from scheduled bank in the prescribed format. The Bank Guarantee in such cases shall be valid for atleast six months.

1.9.3. EMD shall be enclosed with techno-commercial bid. In case of non-submission of EMD of prescribed amount in prescribed form BHEL reserves the right to reject the tender without giving an opportunity to the bidder for re-submission. BHEL's decision in this regard shall be final & binding on the bidders.

1.9.4. **Forfeiture of EMD:**

EMD by the Tenderer will be forfeited, if:

i) After opening the tender and within the offer validity period, the tenderer revokes his tender or makes any modification in his tender which is not acceptable to BHEL.

ii) The Contractor fails to deposit the required Security deposit or commence the work within the period as per LOA.

EMD by the tenderer shall be withheld in case any action on the tenderer is envisaged under the provisions of extant "Guidelines on Suspension of business dealings with suppliers/ contractors" and forfeited/ released based on the action as determined under these guidelines.

1.9.5. EMD shall not carry any interest.

1.9.6. EMD given by all unsuccessful tenderers shall be refunded normally within fifteen days of award of work.

1.9.7. EMD of successful tenderer will be retained as part of Security Deposit.

1.10. SECURITY DEPOSIT

1.10.1. Upon acceptance of Tender, the successful Tenderer should deposit the required amount of Security Deposit towards fulfilment of any obligations in terms of the provisions of the contract. The total amount of Security Deposit will be 5% of the contract value. EMD of the successful tenderer shall be converted and adjusted towards the required amount of Security Deposit.

1.10.2. The balance amount to make up the required Security Deposit of 5% of the contract value may be accepted in the following forms.

a. Cash (as permissible under the extant Income Tax Act).
b. Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL.
c. Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (held in the name of Contractor furnishing the security and duly endorsed/ hypothecated/ pledged, as applicable, in favour of BHEL).
d. Bank Guarantee from Scheduled Banks/ Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format for Security Deposit shall be in the prescribed formats.
e. Fixed Deposit Receipt issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL).

f. 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.

Note: 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.

1.10.3. Atleast 50% of the security Deposit should be furnished before start of the work by the contractor.

1.10.4. The Security Deposit shall not carry any interest.

1.10.5. In case the value of work exceeds / reduces from the awarded / accepted value, the Security Deposit shall be correspondingly enhanced / reduced as given below:

a. The enhanced part of the Security Deposit shall be immediately deposited by the Contractor or adjusted against payments due to the Contractor.
b. There will be no reduction in Security Deposit value in case of variation in contract value upto the lower limit specified in Quantity variation clause. In case of reduction of contract value beyond the lower limit specified in Quantity Variation clause, then the Security Deposit shall be re adjusted in proportion.
c. In case of reduction, the reduced Contract value shall be certified by BHEL Project Manager after ascertaining / freezing of BOQ / Drawings from the Design / Engineering Centre. The reduced Security Deposit value can only be considered after taking into account the adequacy of the securities held by BHEL to meet the liabilities of the contractor for the contract, and the performance of the contract in general. In such cases, the revised value of Security Deposit shall be worked out only after execution of not less than the lower limit of the revised scope of work/contract value as per quantity variation clause, and as certified by Construction Manager. This reduction in value of Security Deposit shall not entitle the contractor to any amendment of Contract and shall be operated at the discretion of BHEL.
d. The recoveries made from running bills (cash deduction towards balance SD amount) can be released against submission of equivalent Bank Guarantee in acceptable form, but only once, before completion of work, with the approval of BHEL.

1.10.6. The validity of Bank Guarantees towards Security Deposit shall be initially up to the completion period as stipulated in the Letter of Award + 3 months, and the same shall be kept valid by proper renewal till completion of maintenance period which necessarily required certification of BHEL.

1.10.7. BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the Contractor's failure to fulfill any of the contractual obligations or in the event of termination of contract as per terms and conditions of contract. BHEL reserves the right to set off the Security Deposit against any claims of other contracts with BHEL.

1.11. RETURN OF SECURITY DEPOSIT

Security Deposit shall be refunded/ Bank Guarantee(s) released to the Contractor along with the 'Final Bill' after deducting all expenses / other amounts due to BHEL under the contract / other contracts entered into with them by BHEL.

1.12. BANK GUARANTEE

Where ever Bank Guarantees are to be furnished/submitted by the contractor, the following shall be complied with:

a. Bank Guarantees shall be from Scheduled Banks / Public Financial Institutions as defined in the Companies Act.

b. The Bank Guarantees shall be as per prescribed formats.

c. It is the responsibility of the bidder to get the Bank Guarantees revalidated/extended for the required period (subject to a minimum period of six months), as per the advice of BHEL Project Manager. BHEL shall not be liable for issue of any reminders regarding expiry of the Bank Guarantees.

d. In case extension/further extensions of any Bank Guarantees are not required, the bidders shall ensure that the same is explicitly endorsed by the Project Manager and submitted to the Regional HQ issuing the LOI/LOA.

e. In case the Bank Guarantees are not extended before the expiry date, BHEL reserves the right to invoke the same by informing the concerned Bank in writing, without any advance notice/communication to the concerned bidder.

f. Bidders to note that any corrections to Bank Guarantees shall be done by the issuing Bank, only through an amendment in an appropriate non judicial stamp paper.

g. The Original Bank Guarantee shall be sent directly by the Bank to BHEL under Registered Post (Acknowledgement Due), addressed to the Subcontracting Department of the respective Region.

1.13. VALIDITY OF OFFER

The rates in the Tender shall be kept open for acceptance for a minimum period of SIX MONTHS from latest due date of offer submission (including extension, if any). In case BHEL (Bharat Heavy Electricals Ltd) calls for negotiations, such negotiations shall not amount to cancellation or withdrawal of the original offer which shall be binding on the tenderers.

1.14. EXECUTION OF CONTRACT AGREEMENT

The successful tenderer's responsibility under this contract commences from the date of issue of the Letter of Intent/ Award by Bharat Heavy Electricals Limited. The Tenderer shall submit an unqualified acceptance to the Letter of Intent/Award within the period stipulated therein.

The successful tenderer shall be required to execute an agreement in the prescribed form, with BHEL, within a reasonable time after the acceptance of the Letter of Intent/Award, and in any case before releasing the first running bill. The contract agreement shall be signed by a person duly authorized/empowered by the tenderer.

1.15. REJECTION OF TENDER AND OTHER CONDITIONS

1.15.1. The acceptance of tender will rest with BHEL which does not bind itself to accept the lowest tender or any tender and reserves to itself full rights for the following without assigning any reasons whatsoever:-

a. To reject any or all of the tenders.
b. To split up the work amongst two or more tenderers as per NIT
c. To award the work in part if specified in NIT
d. In case of either of the contingencies stated in (b) and (c) above, the time for completion as stipulated in the tender shall be applicable.

1.15.2 Conditional tenders, unsolicited tenders, tenders which are incomplete or not in the form specified or defective or have been materially altered or not in accordance with the tender conditions, specifications etc., are liable to be rejected.

1.15.3 Tenders are liable to be rejected in case of unsatisfactory performance of the tenderer with BHEL/ any PSU/ Government Department / Financial Institutions / Court, or tenderer under suspension (hold/banning /delisted) by any unit / region / division of BHEL or any PSU/ Government Department /Financial Institutions /Court or tenderers who do not comply with the latest guidelines of Ministry/Commissions of Govt. of India. The decision of BHEL will be final in this regard.

1.15.4 If a tenderer who is a proprietor expires after the submission of his tender or after the acceptance of his tender, BHEL may at their discretion, cancel such tender. If a partner of a firm expires after the submission of tender or after the acceptance of the tender, BHEL may then cancel such tender at their discretion, unless the firm retains its character.

1.15.5 BHEL will not be bound by any Power of Attorney granted by changes in the composition of the firm made subsequent to the execution of the contract. They may, however, recognise such power of Attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the contractor concerned.

1.15.6 If the tenderer deliberately gives wrong information in his tender, BHEL reserves the right to reject such tender at any stage or to cancel the contract if awarded and forfeit the Earnest Money/Security Deposit/any other money due.

1.15.7 Canvassing in any form in connection with the tenders submitted by the Tenderer shall make his offer liable to rejection.

1.15.8 In case the Proprietor, Partner or Director of the Company/Firm submitting the Tender, has any relative or relation employed in BHEL, the authority inviting the Tender shall be informed of the fact as per specified format, along with the Offer. Failing to do so, BHEL may, at its sole discretion, reject the tender or cancel the contract and forfeit the Earnest Money/Security Deposit.

1.15.9 The successful tenderer should not sub-contract part or complete work detailed in the tender specification undertaken by him without written permission of BHEL's Project Manager. The tenderer is solely responsible to BHEL for the work awarded to him.

1.15.10 The Tender submitted by a techno commercially qualified tenderer shall become the property of BHEL who shall be under no obligation to return the same to the bidder. However unopened price bids and late tenders shall be returned to the bidders.

1.15.11 Unsolicited discount received after the due date and time of Bid Submission shall not be considered for evaluation. However, if the party who has submitted the unsolicited discount/rebate before opening of tender becomes the L-1 party, then the awarded price i.e contract value shall be worked out after considering the discount so offered.

1.15.12 BHEL shall not be liable for any expenses incurred by the bidder in the preparation of the tender irrespective of whether the tender is accepted or not.

CHAPTER-2

2. GENERAL CONDITIONS

2.1 **DEFINITION:** The following terms shall have the meaning hereby assigned to them except where the context otherwise requires

i) "BHEL" shall mean Bharat Heavy Electricals Limited (of the respective Power Sector Region inviting the Tender), a company registered under Indian Companies Act 1956, with its Registered Office at BHEL HOUSE, SIRI FORT, NEW DELHI – 110 049, or its Power Sector Regional Offices or its Authorised Officers or its Site Engineers or other employees authorised to deal with any matters with which these persons are concerned on its behalf.

ii) "COMPETENT AUTHORITY" shall mean Executive Director/Director/CMD of BHEL as per delegation of power as per company's extant policy.

iii) "PROJECT MANAGER" shall mean an Officer of BHEL as may be duly appointed and authorized by BHEL to act as overall site in-charge on its behalf for the purpose of the Contract, to perform the duty set forth in this General Conditions of Contract and other Contract documents.

iv) 'CONSTRUCTION MANAGER' shall mean an officer as may be duly appointed & authorized by Project manager for the purpose of the contract.

v) 'ENGINEER-IN-CHARGE' shall mean an officer duly appointed by the Project Manager. He shall be authorized to represent and act on behalf of the BHEL on a day-to-day basis for a particular package/work of the Project.

vi) "SITE" shall mean the location of **BHEL Tower at Plot No. 25, Sector-16A, Noida, UP.**

vii) "CONTRACTOR" shall mean the successful Bidder/Tenderer who is awarded the Contract and shall include the Contractor's successors, heirs, executors, administrators and permitted assigns.

viii) "CONTRACT" or "CONTRACT DOCUMENT" shall mean and include the Agreement of Work Order, the accepted appendices of Rates, Schedules, Quantities if any, General Conditions of Contract, Special Conditions of Contract, Instructions to the Tenderers, Drawings, Technical Specifications, the Special Specifications if any, the Tender documents, subsequent amendments and the Letter of Intent/Award/Acceptance issued by BHEL. Any conditions or terms stipulated by the contractor in the tender documents or subsequent letters shall not form part of the contract unless, specifically accepted in writing by BHEL in the Letter of Intent/Award and incorporated in the agreement.

ix) "GENERAL CONDITIONS OF CONTRACT" shall mean the 'Instructions to Tenderers' and 'General Conditions of Contract' pertaining to the work for which above tenders have been called for.

x) "TENDER SPECIFICATION" or "TENDER" or "TENDER DOCUMENTS" shall mean General Conditions, Common Conditions, Special Conditions, Price Bid, Rate Schedule, Technical Specifications, Appendices, Annexures, Corrigendums, Amendments, Forms, procedures, Site information, etc. and drawings/documents pertaining to the work for which the tenderers are required to submit their offers. Individual specification number will be assigned to each Tender Specification.

xi) "LETTER OF INTENT/ AWARD" shall mean the intimation by a Letter/Fax/email to the tenderer that the tender has been accepted in accordance with provisions contained in the letter. The responsibility of the contractor commences from the date of issue of this letter and all terms and conditions of the contract are applicable from this date.

xii) "COMPLETION TIME" shall mean the period by 'date/month/year' specified in the 'Letter of Award' for handing over of the intended scope of work, the erected equipment/plant which are found acceptable by the Project Manager, being of required standard and conforming to the specifications of the Contract.

xiii) "PLANT" shall mean and connote the entire assembly of the plant and equipment covered by the contract.

xiv) "EQUIPMENT" shall mean equipment, machineries, materials, structural, electricals and other components of the plant covered by the contract.

xv) "TESTS" shall mean and include such test or tests to be carried out on the part of the contractor as are prescribed in the contract or considered necessary by BHEL, in order to ascertain the quality, workmanship, performance and efficiency of the contractor or part thereof.

xvi) "APPROVED", "DIRECTED" or "INSTRUCTED" shall mean approved, directed or instructed by BHEL.

xvii) "WORK or CONTRACT WORK" shall mean and include supply of all categories of labour, specified consumables, tools and tackles and Plants required for complete and satisfactory site transportation, handling, stacking, storing, erecting, testing and commissioning of the equipment to the entire satisfaction of BHEL.

xviii) "SINGULAR AND PLURALS ETC" words carrying singular number shall also include plural and vice versa, where the context so requires. Words imparting the masculine Gender shall be taken to include the feminine Gender and words imparting persons shall include any Company or Associations or Body of Individuals, whether incorporated or not.

xix) "HEADING" – The heading in these General Conditions are solely for the purpose of facilitating reference and shall not be deemed to be part thereof or be taken as instructions thereof or of the contract.

xx) "MONTH" shall mean calendar month unless otherwise specified in the Tender.

xxi) Day' or 'Days' unless herein otherwise expressly defined shall mean calendar day or days of twenty-four (24) hours each. A week shall mean continuous period of seven (7) days.

xxii) "COMMISSIONING" shall mean the synchronization testing and achieving functional operation of the Equipment with associated system after all initial adjustments, trials, cleaning, re-assembly required at site if any, have been completed and Equipment with associated system is ready for taking into service.

xxiii) "WRITING" shall include any manuscript type written or hand written or printed statement or

electronically transmitted messages, under the signature or seal or transmittal of BHEL.

xxiv) "TEMPORARY WORK" shall mean all temporary works for every kind required in or for the execution, completion, maintenance of the work.

xxv) 'CONTRACT PRICE' or 'CONTRACT VALUE' shall mean the sum mentioned in the LOI/LOA/Contract Agreement subject to such additions thereto or deductions there from as may be made under provisions hereinafter contained

xxvi) "COMMENCEMENT DATE" or "START DATE" shall mean the commencement/start of work at Site as per terms defined in the Tender

xxvii) "SHORT CLOSING" or "FORE CLOSING" of Contract shall mean the premature closing of Contract.

xxviii) "TERMINATION" of Contract shall mean the pre mature closing of contract due to reasons as mentioned in the contract

xxix) "DE MOBILISATION" shall mean the temporary winding up of Site establishment by Contractor leading to suspension of works temporarily for reasons not attributable to the contractor

xxx) "RE MOBILISATION" shall mean the resumption of work with all resources required for the work after demobilization.

2.2 LAW GOVERNING THE CONTRACT AND COURT JURISDICTION

The contract shall be governed by the Law for the time being in force in the Republic of India. The Court having original Civil Jurisdiction at Delhi shall alone have exclusive jurisdiction in regard to all matters in respect of the Contract.

2.3 ISSUE OF NOTICE

2.3.1 Service of notice on contractor

Any notice to be given to the Contractor under the terms of the contract shall be served by sending the same **by Registered Post / Speed Post to** or leaving the same at the Contractor's last known address of the principal place of business (or in the event of the contractor being a company, to or at its Registered Office). In case of change of address, the notice shall be served at changed address as notified in writing by the Contractor to BHEL. Such posting or leaving of the notice shall be deemed to be good service of such notice and the time mentioned to the condition for doing any act after notice shall be reckoned from the date so mentioned in such notice.

2.3.2 Service of notice on BHEL

Any notice to be given to BHEL in-charge/Region under the terms of the Contract shall be served by sending the same by post to or leaving the same at BHEL address or changed address as notified in writing by BHEL to the Contractor.

2.4 USE OF LAND

No land belonging to BHEL under temporary possession of BHEL shall be occupied by the contractor without written permission of BHEL.

2.5 COMMENCEMENT OF WORK

Refer relevant clause of Special conditions of Contract(SCC).

2.6 MEASUREMENT OF WORK AND MODE OF PAYMENT:

2.6.1 All payments due to the contractors shall be made by e-mode only, unless otherwise found operationally difficult for reasons to be recorded in writing.

2.6.2 For progress running bill payments: - The Contractor shall present detailed measurement sheets in triplicate, duly indicating all relevant details based on technical documents and connected drawings for work done during the month/period under various categories in line with terms of payment as per contract. The basis of arriving at the quantities, weights shall be actual execution of work based on relevant documents and drawings approved by BHEL. These measurement sheets shall be prepared jointly with BHEL Engineers and signed by both the parties.

2.6.3 These measurement sheets will be checked by BHEL Engineer and quantities eligible for payment under various groups shall be decided by BHEL Engineer. The abstract of quantities so arrived at based on the terms of payment shall be entered in Measurement Book and signed by both the parties.

2.6.4 Based on the above quantities, contractor shall prepare the bills in prescribed format and work out the financial value. These will be entered in Measurement Book and signed by both the parties. Payment shall be made by BHEL after effecting the recoveries due from the contractor.

2.6.5 All recoveries due from the contractor for the month/period shall be effected in full from the corresponding running bills unless specific approval from the competent authorities is obtained to the contrary.

2.6.6 Measurement shall be restricted to that portion of work for which it is required to ascertain the financial liability of BHEL under this contract.

2.6.7 The measurement shall be taken jointly by persons duly authorized on the part of BHEL and by the Contractor.

2.6.8 The Contractor shall bear the expenditure involved if any, in making the measurements and testing of materials to be used/used in the work. The contractor shall, without extra charges, provide all the assistance with appliances and other things necessary for measurement.

2.6.9 If at any time due to any reason whatsoever, it becomes necessary to re-measure the work done in full or in part, the expenses towards such re measurements shall be borne by the contractor unless such re measurements are warranted solely for reasons not attributable to contractor.

2.6.10 Passing of bills covered by such measurements does not amount to acceptance of the completion of the work measured. Any left out work has to be completed, if pointed out at a later date by BHEL.

2.6.11 Final measurement bill shall be prepared in the final bill format prescribed for the purpose based on the certificate issued by BHEL Project Manager that entire works as stipulated in tender specification has been completed in all respects to the entire satisfaction of BHEL. Contractor shall give unqualified "No Claim" Certificate. All the tools and tackles loaned to him should be returned in satisfactory condition to BHEL. The abstract of final quantities and financial values shall also be entered in the Measurement Books and signed by both parties to the contract. The Final Bill shall be prepared and paid within a reasonable time after completion of work.

2.6.12 The contractor shall give notice/ reasonable time in writing to BHEL or its authorized representative for measurement.

2.7 RIGHTS OF BHEL

BHEL reserves the following rights in respect of this contract during the original contract period or its extensions if any, as per the provisions of the contract, without entitling the contractor for any compensation.

2.7.1 To withdraw any portion of work and/or to restrict/alter quantum of work as indicated in the contract during the progress of work and get it done through other agencies to suit BHEL's commitment or in case BHEL decides to advance the date of completion due to other emergent reasons.

2.7.2 To terminate the contract or get any part of the work done through other agency or deploy BHEL's own/hired/otherwise arranged resources, at the risk and cost of the contractor after due notice of a period of two weeks by BHEL, in the event of: -

i) Contractor's continued poor progress
ii) Withdrawal from or abandonment of the work before completion of the work
iii) Contractor's inability to progress the work for completion as stipulated in the contract
iv) Poor quality of work
v) Corrupt act of Contractor
vi) Insolvency of the Contractor
vii) Persistent disregard to the instructions of BHEL
viii) Assignment, transfer, sub-letting of contract without BHEL's written permission
ix) Non fulfillment of any contractual obligations
x) In the opinion of BHEL, the contractor is overloaded and is not in a position to execute the job as per required schedule

2.7.3 To meet the expenses including BHEL overheads on the differential cost at 15% over and above the penalties arising out of "Risk & Cost" as explained above under sl. no. 2.7.2. BHEL shall recover the amount from any money due from Contractor, or from any money due to the Contractor including Security Deposit, or by forfeiting any T&P or material of the contractor under this contract or any other contract of BHEL or by any other means or any combination thereof

2.7.4 To terminate the contract or to restrict the quantum of work and pay for the portion of work executed in case BHEL's has to abandon the project due to any order of any Statutory Authority.

2.7.5 To effect recovery from any amounts due to the contractor under this or any other contract or in any other form, the moneys BHEL is statutorily forced to pay to anybody, due to contractor's failure to fulfill any of his obligations. BHEL shall also levy overheads of 15%, on all such payments along with interest as defined elsewhere in the GCC.

2.7.6 While every endeavour will be made by BHEL to this end, they cannot guarantee uninterrupted work due to conditions beyond their control. The Contractor will not be normally entitled for any compensation/extra payment on this account unless otherwise specified elsewhere in the contract.

2.7.7 In case the execution of works 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 two months, due to reasons not attributable to the contractor and other than Force Majeure conditions, BHEL may consider permitting the contractor to de mobilize forthwith and re mobilize at an agreed future date. Cost of such demobilization/remobilization shall be mutually agreed. The duration of contract/time extension shall accordingly get modified suitably. In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.

2.7.8 In the unforeseen event of inordinate delay in receipt of materials, drawings, fronts, etc, due to which inordinate discontinuity of work is anticipated, BHEL on its own or contractor's request at its discretion may consider to short close the contract in following cases:

a) The balance works are minor vis a vis the scope of work envisaged as per the contract.
b) There has been no significant work in past 6 months OR no significant work is expected in next 6 months
c) The balance works cannot be done within a reasonable period of time for reasons not attributable to the contractor.
d) Work does not start within six months of LOA date.

At the point of requesting for short closure, contractor shall establish that he has completed all works possible of completion and he is not able to proceed with the balance works due to constraints beyond his control. In such a case, the estimated value of the unexecuted portion of work shall however be reduced from the final contract value as assessed by BHEL.

2.8 PENALTY

Refer relevant clause of Special conditions of Contract(SCC).

2.9 RESPONSIBILITIES OF THE CONTRACTOR IN RESPECT OF LOCAL LAWS, EMPLOYMENT OF WORKERS ETC.

The following are the responsibilities of the contractor in respect of observance of local laws, employment of personnel, payment of taxes etc. The subcontractor shall fully indemnify BHEL against any claims of whatsoever nature arising due to the failure of the contractor in discharging any of his responsibilities hereunder:

2.9.1 As far as possible, Unskilled Workers shall be engaged from the local areas in which the work is being executed.

2.9.2 The contractor at all times during the continuance of this contract shall, in all his dealings with local labour for the time being employed on or in connection with the work, have due regard to all local festivals and religious and other customs.

2.9.3 The contractor shall comply with all applicable State and Central Laws, Statutory Rules, Regulations, Notifications, etc. such as Payment of Wages Act, Minimum Wages Act, Workmen Compensation Act, Employer's Liability Act, Industrial Disputes Act, Employers Provident Act, Employees State Insurance Scheme, Contract Labour (Regulation and Abolition) Act, 1970, Payment of Bonus & Gratuity Act, Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, The Building and Other Construction Workers' Welfare Cess Act, 1996 and other Acts, Rules, and Regulations for labour/workers as applicable and as may be enacted by the State Government and Central Govt. during the tenure of the Contract and having force or jurisdiction at Site. The Contractor shall also comply with provisions of and give all such notices to the local Governing Body, Police and other relevant Authorities as may be required by the Law.

2.9.4 The Contractor shall obtain independent License under the Contract Labour (Regulations and Abolition) Act, 1970 for engaging contract labour as required from the concerned Authorities based on the certificate (Form- V) issued by the Principal Employer.

2.9.5 The contractor shall pay and bear all taxes, fees, license charges, Cess, duties, deposits, tolls, royalties, commission or other charges which may be leviable on account of his operations in executing the contract.

2.9.6 While BHEL would pay the inspection fees and Registration fees of statutory authority, all other arrangements for site visits periodically by the Inspectorate to site, Inspection certificate etc. will have to be made by contractor. However, BHEL will not make any payment to the Inspectorate in connection with contractor's Welders/Electricians qualification tests etc.

2.9.7 Contractor shall be responsible for provision of Health and Sanitary arrangements (more particularly described in Contract Labour Regulation & Abolition Act), Safety precautions etc. as may be required for safe and satisfactory execution of contract.

2.9.8 The contractor shall be responsible for proper accommodation including adequate medical facilities for personnel employed by him.

2.9.9 The contractor shall be responsible for the proper behavior and observance of all regulations by the staff employed by him.

2.9.10 The contractor shall ensure that no damage is caused to any person/property of other parties working at site. If any such damage is caused, it is responsibility of the contractor to make good the losses or compensate for the same.

2.9.11 All the properties/equipment/components of BHEL loaned with or without deposit to the contractor in connection with the contract shall remain properties of BHEL.

2.9.12 The contractor shall use such properties for the purpose of execution of this contract. All such properties/equipment/components shall be deemed to be in good condition when

received by the contractor unless he notifies within 48 hours to the contrary. The contractor shall return them in good condition as and when required by BHEL. In case of non-return, loss, damage, repairs etc, the cost thereof as may be fixed by BHEL Project Manager will be recovered from the contractor

2.9.13 Any delay in completion of works/or non-achievement of periodical targets due to the reasons attributable to the contractor, the same may have to be compensated by the contractor either by increasing manpower and resources or by working extra hours and/or by working more than one shift. All these are to be carried out by the contractor at no extra cost.

2.9.14 The contractor shall arrange, coordinate his work in such a manner as to cause no hindrance to other agencies working in the same premises.

2.9.15 All safety rules and codes applied by the BHEL at site shall be observed by the contractor without exception. The contractor shall be responsible for the safety of the equipment/material and works to be performed by him and shall maintain all light, fencing guards, slings etc. or other protection necessary for the purpose. Contractor shall also take such additional precautions as may be indicated from time to time by the Project Manager with a view to prevent pilferage, accidents, fire hazards. Due precautions shall be taken against fire hazards and atmospheric conditions. Suitable number of Clerical staff, watch and ward, store keepers to take care of equipment/materials and construction tools and tackles shall be posted at site by the contractor till the completion of work under this contract.

The contractor shall arrange for such safety devices as are necessary for such type of work and carry out the requisite site tests of handling equipment, lifting tools, tackles etc. as per prescribed standards and practices.

Contractor has to ensure the implementation of Health, Safety and Environment (HSE) requirements as per directions given by BHEL. The contractor has to assist in HSE audit by BHEL and submit compliance Report. The contractor has to generate and submit record/reports as per HSE plan/activities as per instruction of BHEL.

2.9.16 The contractor will be directly responsible for payment of wages to his workmen. A pay roll sheet giving all the payments given to the workers and duly signed by the contractor's representative should be furnished to BHEL site for record purpose along with each RAB and whenever as asked by BHEL.

Contractor shall create awareness amongst their workforce by helping & encouraging in opening bank accounts and to encourage them to adopt digital mode of transactions. While releasing wages/ salary to their workers/ supervisors/ staff, Contractor shall comply with the GOI's guidelines for maximizing such transactions through Non-Cash / digital means.

2.9.17 In case of any class of work for which there is no such specification as laid down in the contract, such work shall be carried out in accordance with the instructions and requirements of the Project Manager.

2.9.18 Also, no idle charges will be admissible in the event of any stoppage caused in the work

resulting in contractor's labour and Tools & Plants being rendered idle due to any reason at any time.

2.9.19 The contractor shall take all reasonable care to protect the materials and work till such time the plant/equipment has been taken over by BHEL whichever is earlier.

2.9.20 The contractor shall not stop the work or abandon the site for whatsoever reason of dispute, except force majeure conditions. All such problems/disputes shall be separately discussed and settled without affecting the progress of work. Such stoppage or abandonment shall be treated as breach of contract and delay on this account shall solely be attributable to the contractor.

2.9.21 The contractor shall keep the area of work clean and shall remove the debris etc. While executing day-to-day work. Upon completion of work, the contractor shall remove from the vicinity of work, all scrap, packing materials, rubbish, unused and other materials and deposit them in places specified by the Project Manager. The contractor will also demolish all the hutments, sheds, offices, etc. constructed and used by him and shall clean the debris. In the event of his failure to do so, the same will be arranged to be done by the Project Manager and the expenses recovered from the contractor.

2.9.22 The contractor shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and timely execution shall be the essence of this contract. The contractor shall be responsible to ensure that the quality, assembly and workmanship conform to the dimensions and clearance given in the drawings and/ or as per the instructions of the Project Manager.

2.9.23 The Contractor to note that some of BHEL's T&Ps/MMDs may not be insured. The Contractor will take necessary precautions and due care to protect the same while in his custody from any damage/ loss till the same is handed over back to BHEL. In case the damage / loss is due to carelessness/ negligence on the part of the contractor, the Contractor is liable to get them repair/ replaced immediately and in case of his failure to do so within a reasonable time, BHEL will reserve the right to recover the loss from the contractor.

2.10 PROGRESS MONITORING, MONTHLY REVIEW AND PERFORMANCE EVALUATION

Refer relevant clause of Special conditions of Contract(SCC).

2.11 TIME OF COMPLETION

Refer relevant clause of Special conditions of Contract(SCC).

2.12 EXTENSION OF TIME FOR COMPLETION

Refer relevant clause of Special conditions of Contract(SCC).

2.13 QUANTITY VARIATION

Refer relevant clause of Special conditions of Contract(SCC).

2.14 PRICE VARIATION COMPENSATION & OVER RUN COMPENSATION

The price quoted shall remain firm during the contract period including any extension of the original contract period and no price variation compensation shall be paid by BHEL for whatsoever reason.

While every endeavor shall be made by the BHEL, it cannot guarantee uninterrupted work due to condition beyond its control. The contractor will not be entitled to any compensation/extra payment/overrun compensation on this account.

2.15 INSURANCE

2.15.1 It is the sole responsibility of the contractor to insure his materials, equipment, workmen, etc. against accidents and injury while at work and to pay compensation, if any, to workmen as per Workmen's compensation Act. The work will be carried out in a protected area and all the rules and regulations of BHEL in the area of project which are in force from time to time will have to be followed by the contractor.

2.15.2 If due to negligence and or non-observation of safety and other precautions by the contractors, any accident/injury occurs to the property / manpower belong to third party, the contractor shall have to pay necessary compensation and other expense, if so decided by the appropriate authorities.

2.15.3 The contractor will take necessary precautions and due care to protect the material, while in his custody from any damage/ loss due to theft or otherwise till the same is taken over by BHEL. For lodging / processing of insurance claim the contractor will submit necessary documents. BHEL will recover the loss including the deductible franchise from the contractor, in case the damage / loss is due to carelessness / negligence on the part of the contractor. In case of any theft of material under contractor's custody, matter shall be reported to police by the contractor immediately and copy of FIR and subsequently police investigation report shall be submitted to BHEL for taking up with insurance. However, this will not relieve the contractor of his contractual obligation for the material in his custody.

2.16 FORCE MAJEURE

2.16.1 "Force Majeure" shall mean any event beyond the reasonable control of the parties including but not limited to fire, flood, earthquake or other acts of God, war, riots, civil war and restraints of Governing States, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected. The following events are explicitly excluded from Force Majeure and are solely the responsibilities of the non-performing party: a) any strike, work-to-rule action, go-slow or similar labour difficulty (b) late delivery of equipment or material (unless caused by Force Majeure event) and (c) economic hardship.

2.16.2 If either party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within 15 (fifteen) days after the occurrence of such event.

2.16.3 The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party's performance is prevented, hindered or delayed. The Time for Completion shall be extended by a period of time equal to period of

delay caused due to such Force Majeure event.

2.16.4 Delay or non-performance by either party hereto caused by the occurrence of any event of Force Majeure shall not

- Constitute a default or breach of the Contract.
- Give rise to any claim for damages or additional cost or expense occasioned thereby, if and to the extent that such delay or non-performance is caused by the occurrence of an event of Force Majeure.

2.17 SETTLEMENT OF DISPUTES:

Except as otherwise specifically provided in the contract all disputes concerning questions of fact arising under the contract shall be decided by the construction manager/project manager subject to a written appeal by the contractor to the construction manager/project manager, whose decision shall be final to the parties hereto.

Any disputes or differences including those considered as such by only one of the parties arising out of or in connection with the contract shall be to the extent possible settled amicably between the parties.

If amicable settlement cannot be reached then all disputed issues shall be settled by arbitration as provided in relevant clause.

2.18 ARBITRATION

2.18.1 All disputes between the parties to the Contract arising out of or in relation to the Contract, other than those for which the decision of the Project Manager in the Contract or any other person is expressed to be final and conclusive, shall after written notice by either party to the contract to the other party, be referred to sole arbitration of the General Manager or his nominee. The Arbitration shall be conducted in accordance with the provisions of Arbitration and Conciliation Act 1996 (India) or any amendments or statutory modifications or re-enactments thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause.

2.18.2 The parties to the Contract understand and agree that there will be no objection that the General Manager or the person nominated as arbitrator had earlier in his official capacity directly or indirectly dealt with the matters to which the Contract relates or that in the course of his official duties had expressed views on all or any of the matters in dispute or difference. The award of the arbitrator shall be final and binding on the parties to this contract.

2.18.3 Work under the contract shall be continued by the contractor during the arbitration proceedings, unless the matter is such that the work cannot possibly be continued until the dispute or differences are settled by the arbitration and save as those which are otherwise expressly provided in the contract.

2.18.4 The arbitration proceedings shall be held at New Delhi. The jurisdiction of courts for these proceeding shall be at New Delhi.

2.18.5 In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable:

In the event of any dispute or difference relating to the interpretation and application of the provisions of the Contract, such dispute or difference shall be referred by either Party for arbitration to the sole arbitrator in the Department of Public Enterprises The award of the arbitrator shall be binding upon the Parties to the dispute, provided, however, any Party aggrieved by such award may make further reference for setting aside or revision of the

award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary or Additional Secretary when so authorized by the Law Secretary, whose decision shall bind the Parties hereto finally and conclusively.

2.19 RETENTION AMOUNT

Refer relevant clause of Special conditions of Contract(SCC).

2.20 PAYMENTS

Refer relevant clause of Special conditions of Contract(SCC).

2.21 PERFORMANCE GUARANTEE FOR WORKMANSHIP

Refer relevant clause of Special conditions of Contract(SCC).

2.22 CLOSING OF CONTRACTS

The Contract shall be considered completed and closed upon completion of all contractual obligations and settlement of Final Bill or completion of Guarantee period whichever is later. Upon closing of Contract, BHEL shall issue a completion certificate as per standard format, based on specific request of Contractor.

2.23 REVERSE AUCTION

BHEL reserves the right to go for Reverse Auction for Price Bid Opening by BHEL appointed service provider, instead of opening the submitted sealed price bid in the conventional way. The Business Rules for Reverse Auction shall be as per BHEL guidelines issued from time to time.

2.24 STRIKES & LOCKOUT

2.24.1 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, BHEL shall have the right to get the work executed through any other agencies and the cost so incurred by BHEL shall be deducted from the Contractor's bills.

2.24.2 For all purposes whatsoever, the employees of the contractor shall not be deemed to be in the employment of BHEL

2.25 OTHER ISSUES

2.25.1 Value of Non judicial Stamp Paper for Bank Guarantees and for Contract Agreement shall be not less than Rs 100/- unless otherwise required under relevant statutes.

2.25.2 In case of any conflict between the General Conditions of Contract and Special Conditions of Contract, provisions contained in the Special Conditions of Contract shall prevail.

2.25.3 Unless otherwise specified in NIT, offers from consortium/ JVs shall not be considered.

Civil & Structural work for construction of BHEL Tower
(Package-1)
at
Plot no. 25, Sec-16A, Noida(UP)

VOLUME-1C
SPECIAL CONDITION OF CONTRACT (SCC)

ISMG & Corporate Administration
BHARAT HEAVY ELECTRICALS LTD.
AGVC, Siri Fort, New Delhi-110 049

CONTRACTOR
(Sign with name, designation and date)

TABLE OF CONTENTS

1. Definitions
2. Scope, Extent, Intent etc.
3. Project Manager and Contractor's representative
4. Site
5. Nature of contract
6. Taxes, Duties, etc.
7. Notices, fees, Byelaws, Regulations, etc.
8. License and Permits
9. Royalties and Patent rights
10. Insurance
11. Contractor's site organization and resources
12. Labour regulations
13. Contribution towards employee benefits
14. Setting out & site surveys
15. Drawings, specifications, interpretations, etc.
16. Water and Electricity
17. Assignments and sub-letting
18. Sub-contractors
19. Separate Contracts
20. Co-ordination of work
21. Use of contractor's facility by others
22. Overtime work
23. Materials, workmanship, storage, inspections, etc.
24. Samples, Shop Drawings
25. Constructions Programme, Schedules and Progress Reports
26. Bureau of Indian Standards
27. Tolerances
28. Protections and cleaning of works & clearing of site
29. Method of Measurement- Works to be measured jointly
30. Covering up
31. Withholding of payments
32. Payment to sub-contractor/vendor
33. Rectification of improper work noticed
34. Progress Monitoring, Monthly review and Performance Evaluation
35. Extra works/ Extra items of work
36. Non-tendered/Extra items & Quantity exceeding the tendered quantities
37. Commencement of Work
38. Time for completion
39. Extension of Time for completion
40. Quantity Variation
41. Penalty
42. Payments
43. Retention Amount
44. Performance Guarantee for workmanship
45. Deductions for work not done as per specifications
46. No financial or other compensation for delays

47. Sufficiency of tender
48. Propriety and occupations of executed work
49. Indemnity
50. Rectification of work before virtual completion of works
51. Virtual completion of works
52. Guarantees
53. Defects liability
54. Intellectual property rights
55. Governing Law
56. Standards of conduct
57. Technical Audit by Third Party
58. Changes in contractor's constitution
59. Grounds for withholding payments
60. Accounts & Audit
61. Contract signing
62. Project Manager's/ Architect's instructions
63. Drawings
64. Quality assurance and control Programme
65. Reports & checklist by contractors
66. Inspection & testing of Materials
67. Testing of installations
68. Drilling, cutting, etc.
69. Dewatering & flooding control
70. Other site facilities
71. Labour wages

1. DEFINITIONS:

In the Contract (as hereinafter defined) the following words and expressions shall have meanings hereby assigned to them, except where the context otherwise requires: (In alphabetical order)

1.1 **Approved/Approval:**

Approved/Approval shall mean and include approved/approval accorded by the Project Manager in writing.

1.2 **Approved Equal:**

Approved Equal shall mean an alternative product or service approved by the Project Manager as being equivalent to that specified in the Contract Documents.

1.3 **Architect:**

Architect shall mean the duly appointed agency by BHEL for providing architectural & engineering consultancy for the project.

1.4 **Structural Consultants:**

Structural Consultants shall mean a consultant duly appointed by the architect for structural engineering & design.

1.5 **Basic/Base Rate - Material:**

Basic/Base Rate shall mean the landed cost at site including all taxes, royalties, cartage, handling etc. but excluding wastage.

1.6 **Communication:**

Wherever in the Contract provision is made for giving or issue of any notice, consent, certificate or determination by any person, unless otherwise specified such notice, consent, approval, certificate or determination shall be in writing and the words 'notify', 'certify' or 'determine' shall be construed accordingly.

1.7 **Construction Programme**

Construction Programme shall mean the programme to be furnished by the Contractor as per relevant clause.

1.8 **Contractor's Representative:**

The Contractor's Representative shall mean the person or party duly appointed by the Contractor to act for and on its behalf on a day-to-day basis during the construction of the Work and the Project. Any action to be taken by the Contractor may be taken on the Contractor's behalf by the Contractor's Representative. The Contractor's Representative shall be considered a "key person" for purpose of the contract.

1.9 **Contract Value:**

Shall mean the sums referred to in the Contract Documents for the Contractor's performance of the Work. The Contract value shall be inclusive of all taxes including ESIC, PF, Conditions of Contract contribution and all other statutory taxes and levies if any applicable to the contractors/workers etc. but excluding GST.

The Contract is neither a fixed lump sum contract nor a piece work contract, but is an item rate contract to carry out the Work according to the actual measured quantities at the rates contained in the Priced Schedule of Rates (as determined in accordance with methodology specified at foot note of Price Schedule) along with estimated quantities with Detailed Specifications. The Contract value shall not exceed the amount indicated in the Letter of Acceptance, unless otherwise approved in the Change Orders. Amounts in excess of this number, not approved in advance by the BHEL's Representative shall

be at the Contractor's expense. The Contractor has to closely monitor the quantities and cost and obtain an Approval from the BHEL well in advance for any change outside the scope of the Work which would cause the cost of the Work to exceed the Contract Value as indicated in the Letter of Acceptance. Prices will be firm until the end of the contract.

No escalation in prices shall be allowed for any reason whatsoever during the period of the project. Claims for revision in rates / prices or compensation in any other form whatsoever shall not be entertained by the BHEL on account of fluctuations in the following but not limited to:

- Foreign Exchange Rates
- Cost of Materials
- Electricity & Water charges
- Labour wages & conditions
- Statutory payments like PF, ESIC, etc.
- Royalties and patent rights
- Licenses and permit fees
- Insurance Charges
- Freight charges / transportation costs
- Cost of fuel & lubricants
- Or any other rates, costs or conditions whatsoever.

1.10 **Contract Period:**
Contract Period means the period during which the Contract shall be executed or agreed between Contractor and BHEL in the Contract.

1.11 **Consultant:**
Shall mean any person or persons duly appointed by the BHEL / Architect to act as 'CONSULTANT' to render consultancy services in any area/field of activity connected with and arising out of the Contract under a separate agreement setting out the consultant(s) responsibilities and terms.

1.12 **Daywork Schedule:**
Daywork Schedule means the document so named which are comprised in Conditions of Contract.

1.13 **Defect(s) Liability Period:**
Defect(s) Liability Period is the period after Virtual Completion and any period extended as a result of rectification of the Work/change orders, between the Virtual Completion and the Final Completion of the Work, and during which period the Contractor shall be bound to replace and/or rectify and make good all defective materials, equipment and/or workmanship which arise in the Works or come to notice subsequent to the Virtual Completion of the Works and prior to the Final Completion of the Works.

1.14 **Drawings:**
'Drawings' means all drawings, details and sketches along with the technical information therein, furnished by the Architect through the Project Manager to the Contractor under the Contract and any modifications of such drawings or such other drawings as may be from time to time be furnished or approved in writing by Project Manager. All drawings, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature submitted by the Contractor shall also be referred as 'drawings'.

1.15 **Final Completion:**
Final Completion will be deemed to have been achieved when at the end of the Defects Liability Period a Final Completion Certificate has been issued by the Project Manager when all the requirements of the Contract have been met and complied with and when all the defective items of Work and defects have been replaced and/or rectified and made good as directed by and to the satisfaction of the Project Manager / BHEL.

1.16 **Insolvency:**
The term "Insolvency" means any act of insolvency as defined by the Presidency Towns Insolvency Act or the Provincial Insolvency Act or any amending statute.

1.17 **Labour Rate:**
Labour: As per Local Administration labour rates notified and fixed from time to time.

1.18 **BHEL's Representative:**
BHEL's Representative shall mean and include the Project Manager, construction manager, Engineer-in-charge and / or any other person duly appointed and authorized by the BHEL to act for and on its behalf at the Site during the progress of construction of the Project.

1.19 **Project:**
Project shall mean and include the execution of the Work to be performed under this Contract plus works of all later phases necessary to complete the construction to make it habitable, according to the standards adopted by the Project Manager.

1.20 **Singular or Plural / Typographic Errors:**
Words in the singular also include the plural and vice versa, where the context so requires. Words implying persons include persons and corporations. Typographic or spelling errors shall not be cause to vitiate the contract.

1.21 **Specifications:**
"Specifications" shall mean and include the specifications for the Work included in the tender documents, and any modification thereof or addition thereto.

1.22 **Sub-contractors:**
"Sub-Contractors" shall mean and include the persons, firms, companies or agencies who after approval of the Project Manager, have entered into a direct Contract with the Contractor in respect of any part of the Work and any later package of the Project, and include the Sub-contractors' legal representatives, successors and permitted assignee. The Contractor shall have full responsibility for the actions and work of any Subcontractor whether contracted by the Contractor to perform portions of the Work or for any later package of the Project.

1.23 **Tender:**
"Tender" shall mean and include the Contractor's offer to construct and maintain the Work in strict accordance with the Contract Documents as set forth on the Tender Form

1.24 **Terms "/", "and", "or", "and/or":**
The terms "/", "and, "or", "and/or" used in context with the description or enumeration of two or more items or components of work of documentation or anything similar shall mean as is relevant and applicable to the text and context.

1.25 **Urgent Works:**
"Urgent works" shall mean any urgent measures which in the opinion of the Project Manager becomes necessary during the progress of the work to obviate any risk of

accident or failure or which become necessary for security for completing the overall project within the stipulated time.

1.26 **Tests on completion:**
Tests on completion shall mean all the system testing required to be done by the Contractor, to the entire satisfaction of BHEL, prior to Handing over the facility.

1.27 **Unforeseeable:**
Unforeseeable means not reasonable foreseeable and against which adequate preventive precautions could not be taken by an experienced contractor by the date of submission of the Tender.

1.28 **Change Order:**
Change Order means any change approved as a Change Order.

1.29 **Vendors:**
"Vendors" shall mean and include all suppliers, contractors, sub-contractors, and trade contractors engaged for same / later phase(s) of the Project, when such Vendors are in Contract with the Project Manager / BHEL.

1.30 **Virtual Completion:**
Virtual completion will be deemed to have been achieved upon a Virtual Completion Certificate being issued by the Project Manager, when the Work, according to the Project Manager, have been completed in every respect in conformity with the Contract Documents and any change /Variation / rectification orders and are ready and fit for the intended purpose, complete with all systems and services having been tested and commissioned.

1.31 **Written Notice:**
Written Notice shall be deemed to have been duly served if delivered in person to the **authorized representative** of the firm / company for whom it is intended, or if delivered at and a written delivery receipt obtained or sent by registered mail to the last business address known to them, who gives the notice.

1.32 **Work:**
"Work" shall mean and include the items of work included in this Contract Document, all materials, Plant & machinery, equipment, tools and labour necessary to complete all components of the Project in full compliance with the requirements of the Contract Document.

1.33 **Public Holiday:**
'Public Holiday' shall mean any day which is declared as a public holiday by the Government of India or the State Government.

1.34 **HSE Plan**
"HSE plan" means Health, Safety and Environmental Plan prepared by the Contractor for implementation at site, based on and including, without limitation to various Clauses of the Conditions of Contract pertaining to Safety, Health and environment; and approved by the Project Manager.

2. SCOPE, EXTENT, INTENT ETC.:

2.1 **Scope:**
The following Special Conditions shall be read in conjunction with the "General Conditions of Contract". The following clauses shall be considered as an extension of and not as a limitation of the obligation of the Contractor (s). If there are any provisions

in the General Conditions of Contract, which are at variance with the provisions in these Special Conditions, the Provisions in these special conditions shall take precedence.
The general character and the scope of the Work shall be as illustrated and defined in the Drawings, Specifications, Schedule of Rates/ *Bill of Quantities* and other Contract Documents.

2.2 **Extent:**
The Contractor shall carry out and complete the Work under the Contract in every respect, and his work shall include the supply of all labour, equipment, materials, plant and machinery, tools, transportation, form work, scaffolding and everything else necessary for the proper execution and completion of the Work in accordance with the Contract Documents and to the directions and satisfaction of the Project Manager. The Contractor shall be fully responsible and liable for everything and all matters in connection with or arising out of or being a result or consequence of his carrying out or omitting to carry out any part of the Work. Where any parts of the Work may be executed by Sub-Contractors, such responsibility and liability of the Contractor shall cover and extend to the work of all such Sub-Contractors.

2.3 **Intent:**
The Contract Documents are complementary and what is called for by any one shall be binding as if called for by all. Wherever it is mentioned in the Contract Documents that the Contractor shall perform certain work or provide certain facilities, it is understood that the Contractor shall do so at his own cost. Materials or work described in words which so applied have a well-known technical or trade meaning shall be held to refer to such recognized standards as are applicable.

2.4 **Instructions of Project Manager:**
The Project Manager may from time to time, issue further supplementary Drawings, written instructions, details, directions, and explanations, which shall be collectively referred to as the Instructions of Project Manager. The Contractor shall forthwith comply with and duly execute the work comprised in such Instructions of Project Manager, provided always that verbal instructions, directions and explanations given to the Contractor or his works representative by Project Manager shall, if involving a variation, will be got confirmed in writing from the Project Manager, by the contractor.

2.5 **Approval of Project Manager:**
Approval of the Project Manager shall always mean approval in writing. The onus shall be on the Contractor to obtain all the necessary approvals in writing. Such approvals, however, shall not relieve the Contractor of any of his responsibilities under the Contract.

2.6 **Increases/Decreases to scope of Work:**
The Project Manager reserves the right to increase or decrease the scope of the Work on any or all items or to change the nature of the Work involved in any or all items or to completely delete any items of the Work under the Contract.

2.7 **Items of work for completion:**
The Contractor is bound to carry out any items of work necessary for the completion of the Work even though such items of work may not be expressly described in the Contract Documents / Drawings.

3. PROJECT MANAGER AND CONTRACTOR'S REPRESENTATIVE:

The status, duties and responsibilities of the Project Manager, and Contractor's Representative shall be as detailed below:

3.1 Role and responsibilities of the Project Manager:

i. The BHEL will be represented for the purpose of the execution of the Contract by the Project Manager. The Project Manager shall be responsible for the day-to-day supervision, quality control checks, progress monitoring, co-ordination and direction of the Work, and generally to ensure that the Work is carried out in all respects in strict conformity with the Contract Documents.

ii. The Project Manager shall have the authority to stop the work whenever such stoppage may be necessary to ensure the proper execution of the Work. The Contractor shall provide all the necessary facilities to the Project Manager in the performance of his duties. The Contractor shall refer all matters relating to the performance of the Contract to the Project Manager.

iii. The Project Manager shall observe sound and established engineering practices using latest standards, codes and regulations, as applicable for the purpose specified and suitable for respective uses intended.

iv. The Project Manager shall exercise intimate, constant and continuous supervision and control over the workmanship and materials, plant, machinery, equipment etc used in the Work and may when required, get them inspected.

v. The Project Manager shall check the measurements of the Contractor's bills and forward the same for payments.

vi. To process the bills and release payments to the Contractor as appropriate.

vii. **PROFESSIONAL INTEGRITY AND TEAM SPIRIT:** It is the intent of the Project Manager that this Project will be executed in a spirit of teamwork and full professional integrity.

viii. In case of disagreement in interpretation of any clause(s) of the tender, Project Manager's decision shall be final & binding on the contractor.

ix. **Decision:** The Project Manager shall make decisions on all matters relating to the execution and progress of the Work, including the claims and queries of the Contractor. The decision, opinion, direction and interpretation of the Project Manager, with respect to any or all matters shall be final and binding on the Contractor.

3.2 Role and responsibilities of the contractor's representative:

i. The Contractor shall be represented at the Site by the Contractor's Representative. The Contractor's Representative shall be on Site at all times during performance of the Work and the Project Coordination Services and shall be responsible for the day-to-day interaction with the Project Manager.

ii. The Contractor's Representative shall have the authority to make and communicate all decisions called for in this Contract to be made by the Contractor or the Contractor's Representative. The Contractor's Representative shall be responsible for the day-to-day supervision and overseeing of the Project Coordination Services, including, without limitation, the implementation Plan.

3.3 Architect's Role and Obligations:

i. The Architect shall be responsible for undertaking the design, the specification and the production of drawings for the Work.

ii. The Architect shall be responsible for periodic supervision of works to evaluate contractor's works and to ensure that the work is executed as per the desired quality standards, integrity, building design, safety, statutory compliance and conformance with design, conceptual and contractual intent.

iii. The Architect shall be responsible to issue control samples and to inspect samples/ mock-ups to ensure that they are as per the desired specifications and quality standards.

iv. The Architect shall review, verify, evaluate and provide its recommendation to the Project Manager on the shop-drawings, design calculations, product data, samples, mock-ups, selection of sub-contractors etc. proposed by the Contractor.

v. Where necessary the Architect shall perform plant inspection at workshops of the contractor.

vi. The Architect shall assist the Project Manager in joint inspection of the buildings on their completion to maintain and provide list of items to complete, defects to correct, virtual & final completion certificates to the Project Manager.

vii. The Architect shall make and communicate all decisions to the Project Manager as called for in this Contract to be made by the Architect.

3.4 Access for Architect and Project Manager to The Works:

The Project Manager, the Architect, and their respective consultants shall at all times have access to the Work and the Site and to the workshops or other places of the Contractor where the Work is to be so prepared and in workshops or other places of Sub-Contractors and suppliers. The Contractor shall by a term in its Sub-Contracts so far as possible, secure a similar right of access to those workshops or places for the Project Manager, Architect, and their respective consultants and shall do everything for the purposes of carrying out inspections to ascertain and ensure that work is being carried out in conformity with the Contract Documents or for any other purpose in connection with the Work under the Contract.

3.5 Contractor's responsibilities:

The Contractor shall have the following responsibilities in carrying out the Work and the Project Coordination Services, respectively:

i. The Contractor shall, on the instruction of the Project Manager, immediately dismiss from the Work any person employed thereon by him who may, in the opinion of the Project Manager, be incompetent or who engages in unlawful or disorderly conduct, and such persons shall not be re-employed on the Work without the prior written permission of the Project Manager.

ii. Contractor shall indemnify the BHEL for loss suffered by the BHEL on account of any act/omission/neglect of the Contractor's, workers, employees, Sub-Contractors etc.

iii. The Contractor shall comply with all safety standards to the satisfaction of the Project's Manager.

iv. The Contractor shall take full responsibility for the management & supervision of the Sub-Contractors.

v. The Contractor shall ensure that all Sub-Contractors engaged exercise all such skill, care and technical competence as represents a high standard within their respective professions or trades as is appropriate for the satisfactory execution of their work and services.

vi. The Contractor shall not assign/sublet any part of this Contract to any other agency without the consent of the Project Manager. The Project Manager reserves the right to review and approve each Sub-Contractor which the Contractor recommends at any time to engage to perform any services before such Sub-Contractor is hired or performs any service.

vii. The Contractor shall be responsible for the care of the Work and the management and supervision of the Sub-Contractors.

viii. The Contractor shall exercise constant and continuous supervision and control over the workmanship, materials, plant, machinery, equipment etc used in the Work and report on the status of the same to the Project Manager.

ix. The Contractor will be responsible for obtaining all necessary permits, approvals, certificates and the like.

x. All the obligations and responsibilities of the Contractor under the Contract shall be discharged by him subject to the satisfaction of the Project Manager.

xi. Any activity conducted or responsibility assumed by the BHEL shall not relieve the Contractor of any of its obligations and responsibilities under the Contract.

xii. The contractor shall use latest standards, codes and regulations, as applicable for the purpose specified and suitable for respective uses intended. The contractor must keep at site the latest IS codes in CD form for quick referencing.

xiii. The contractor shall ensure that all work complies with statutory norms and regulations.

xiv. The contractor shall ensure that technically competent persons or firms holding valid licenses shall only carry out any special service installations included in the scope of the Work.

xv. **SITE ORDER BOOK:** The Contractor shall maintain a Site order book in the prescribed proforma at the Site office. All instructions received from the Project Manager relating to the Work shall be retained in the file.

xvi. **PHOTOGRAPHS:** Besides submitting progress charts, reports, etc., the Contractor shall submit progress photographs as directed by Project Manager, every four weeks in triplicate along with negatives.

xvii. The Contractor shall fully co-operate with all agencies concerned to fulfill this objective.

4. SITE:

4.1 **Contractor to satisfy himself about site conditions:**
The Contractor represents that before tendering for the Work the Contractor has visited the Site and satisfied himself about the Site conditions for construction and for logistics and smooth flow of workmen and materials as well as permission from Authorities for this purpose. The Contractor has examined the Site and taken note of character of the soil and of the excavations, the correct dimensions of the Work, and facilities for obtaining any special articles called for in the Contract Documents. The Contractor has also made its own assessment and obtained all information on the Site constraints and on all matters that will affect the execution, continuation and progress, and completion of the Works. Any extra claims or extension of time made in consequence of any misunderstanding, incorrect information on any of these points or on the grounds of insufficient description or information shall not be entertained or allowed at any stage. It is pertinent to note that three buildings are already existing on the plot in the vicinity of the proposed construction area and the contractor is required to take all possible measures to avoid any inconvenience to the people working in these buildings. He has also to ensure utmost care not to cause any loss or damage to the property or people in the vicinity.

4.2 **Access to site by the contractor:**
The access to the Site will be shown immediately on award of the Contract to the Contractor and the Site shall be shared with other Vendors and Sub-Contractors as applicable. The Contractor shall upon being given such access commence the Work and

diligently proceed with the execution of the Work in accordance with the Contract Documents. Access to the Site by the Contractor shall be merely a licence for carrying out the construction of the Work under the Contract, and the Contractor shall not by his being allowed such entry on the Site, acquire any right, lien or interest either in the Work carried out by him under the Contract or anything appurtenant or attached thereto or to any part of the Site, and his claim will only be in the nature of money found due and payable to him in accordance with the certificates issued by the Project Manager under the provisions contained herein. The Work shall be free from all liens, charges or claims of whatsoever nature from any party other than the BHEL. The BHEL shall have a lien over all work performed by the Architect, the Contractor, Sub-Contractors and Vendors and also for the materials and equipment brought on Site by them.

4.3 **Treasures, Antiquities found are property of BHEL:**
All fossils, antiquities and other objects of interest or value, which may be found on the Site at the commencement or during the progress of the Work shall be the property of the BHEL. The Contractor shall carefully take out and preserve all such fossils, antiquities and objects and shall immediately deliver the same in their discovered state into the possession of the BHEL.

4.4 **Entry to site:**
The Project Manager, at his discretion has the right to issue passes to control the admission of the Contractor, his agents, employees and work people to the Site of the Work or any part thereof. Passes shall be returned at any time on demand by the Project Manager.

5. NATURE OF CONTRACT:

5.1 **ITEM RATE Contract**:
The Contract is neither a fixed lump sum contract nor a piece work contract, but is an item rate contract to carry out the finished Work according to the contract documents, drawings/ instructions issued by the Project Manager during the course of the contract and as per the description and at prices given in the Schedule of Rates/ Bill of Quantities and Technical Specifications.

5.2 **CONTRACT PRICE**
The Contract Price is the Total amount of cost of all items of finished work, as given in the Schedule of Rates/ Bill of Quantities attached with the Letter of Intent and as given in the contract documents. The quoted price shall include all taxes and duties (except GST) and shall remain firm during the entire contract period. GST shall be paid separately as per applicable rate at the time of execution.

The Contract Price includes payment for the supply of all labour (including payment to his Sub-Contractors), equipment, materials, plant and machinery, tools, transportation, framework, scaffolding, works, distribution of power and water and all services and activities constituting the Scope of Work under this tender and all applicable taxes including the Construction Workers Welfare Cess and any other statutory taxes and levies as applicable to the contractors/ workers etc., levies, royalties, fees, insurance premiums, contributions towards employees benefits including ESI and PF and funds excluding GST. The BHEL shall not be responsible in any way whatsoever to pay for the same. The Contract Price shall also include the Contractor's establishment, infrastructure, overheads & profits and all other charges, and shall generally be inclusive of every cost and expense required by the Contract to be borne by the Contractor and necessary for the proper execution and completion of the Work under the Contract, in conformity with the Contract Documents and the best engineering and construction practices and to the satisfaction of BHEL.

The items of work and/ or their quantities, as given in the Schedule of Rates/ Bill of Quantities are provisional and estimated, subject to change/ revision as required by the Project Manager. This being an item rate contract, the final contract price may be altered and will be based on actual quantities of work done and measured, including due to any change/ Variation orders/ extra items of work as ordered/ approved by the Project Manager, rates for which shall be approved in accordance with the procedure given in the contract.

No escalation in prices shall be allowed for any reason whatsoever and the prices given in the Schedule of Rates/ Bill of Quantities shall be deemed to be firm during the period of the project until the completion of the project (Stipulated / extended).

6. TAXES, DUTIES ETC.:

(i) No reimbursement on account of increase/ decrease in the rate of taxes, levies, duties etc. on input goods/ services/ work shall be made. Bidder has to make his own assessment of the impact of future variation if any, in rates/ duties/ levies etc. in his price bid.

(ii) In case the Government imposes any new tax/ levy on the output services / work after the date of NIT, the same shall be reimbursed by BHEL at actuals. All necessary documents as required by BHEL shall have to be provided by the contractor. However, in the event of delay in work/ services execution solely attributable to the contractor the new taxes/ levies imposed during the delay period shall not be reimbursed to the contractor.

(iii) To enable BHEL to avail GST Input tax credit, contractor shall submit GST compliant Tax invoice containing all the particulars as stipulated under Invoice Rules of GST Law. Payment shall be made to the contractor only after submission of GST complaint Tax invoice. The successful bidder shall raise GST complaint invoice affixing GSTIN of BHEL. GST shall be paid against documentary evidence.

(iv) BHEL reserves the right to protect its interest against any loss on account of availability of GST credit.

(v) GSTIN of BHEL will be provided to the contractor along with the work order.

(vi) Payment to the contractor will be subjected to TDS as per rules in force from time to time. The Tax Deduction at Source (TDS) shall be done as per the provisions of Income Tax Act & GST, as amended from time to time and a certificate to this effect shall be provided to the contractor by BHEL.

7. NOTICES, FEES, BYELAWS, REGULATIONS, ETC.:

The Contractor shall comply with all applicable laws and Government Acts including the Byelaws or regulations of Central and / or Local Authorities relating to the Work in so far as labour, construction, fabrication and installation activities are concerned, and he shall obtain from the Central and / or Local Authorities all permissions and approvals required for the plying of trucks, construction machinery etc., and also for construction of temporary offices, labour camps, stores and other temporary structures in connection with the Work, and the Contractor shall give all notices and pay all fees and charges that are and that can be demanded by law thereunder. In the Contract Price for the Work, the Contractor shall allow for such compliance and work, and for the giving of all such notices, and shall include the payment of all such fees and charges.

8. LICENSE AND PERMITS:

The Contractor shall directly obtain all licenses and permits for the materials under Government control, and those required to be obtained by the Contractor for the execution of the Work. The Contract Price shall include all transportation charges and the other expenses that may be incurred in this connection.

Except for the following statutory approvals/clearances , all other statutory approvals/ clearances for construction related activities like excavation, transportation, labour license, EPF, ESI, etc. are to be arranged by the contractor at his cost for uninterrupted work execution and completion:

1. Building Permit from Noida Development Authority
2. NOC from UP Fire Department
3. Consent to establish (CTE) and Consent to operate (CTO) from UP Pollution control Board
4. NOC from Airport Authority of India for building height
5. Environment Clearance from MOEFCC
6. Tree cutting/felling permission from UP Forest Department
7. Occupancy Certificate

9. ROYALTIES AND PATENT RIGHTS:

All royalties or other sums payable by the contractor in respect of the supply and use of any patented articles, processes or inventions for the carrying out of the Work as described by or referred to in the Contract Documents, shall be deemed to have been included in the Contract Price. The contractor shall keep the BHEL indemnified against all such demands as may arise on account of payment of royalties.

10. INSURANCE:

The successful contractor shall take out Contractors' All Risk (CAR) Insurance Policy and other necessary policies in the name of the contractor beneficiary**.** The original policies shall be deposited with the BHEL within 10 days of issue of LOA and acceptance by the contractor. The policies shall cover the clauses as under**:**

10.1 The Contractor shall at all times indemnify and keep indemnified the BHEL and its officers, servants, agents and any other guest or person against all third party claims, whatsoever, which may arise out of or in consequence of the construction & maintenance of works, (including but not limited to property loss or damage, personal accident, injury or death of/to property or person of any sub-contractor and/or the servants or agents of the contractor, any sub-Contractor(s) and/or the BHEL) and the contractor shall at his own cost and initiative at all times up to the successful conclusion of the defect liability period, maintain all insurable liabilities under this clause, including but not limited to third party insurance and liabilities under the Motor vehicles Act, workmen's Compensation Act, fatal Accident Act, Personal injuries Act and/or other industrial legislation from time to time in the BHEL, and such policy (ies) shall be of not lesser limit then the limits hereunder specified with reference to the matters hereunder specified, namely.

a. **Workmen's compensation Insurance** – to the limit to which compensation may be payable under the laws of the Republic of India.

b. **Third Party Insurance including Cross Liability:** To cover for any damages to third party to the limit of not less than Rs.500000 /- (Rs. Five Lacs only) in each accident at each job site and to a limit of not less than Rs.2500000 (Rs. Twenty Five Lacs only) for all

accidents at all job sites. The Policy shall be valid up to the end of the Defects Liability Period and shall include any damage to the properties and/or injury including death to the persons of the general public and anyone else deemed to be third party.

10.2 Provided that the limits specified above shall operate only as a specification of minimum limits for insurance purposes, but shall not in any way limit the contractor's liability to terms of this clause to the limit(s) specified.

Should the Contractor fail to take out and/or keep current insurance as provided for in the foregoing sub-clause, the BHEL shall be entitled (but without obligation to do so) to take out and/or keep current such insurance at the cost and expenses of the Contractor, and without prejudice to any rights or remedies of the BHEL in this behalf, to deduct the sum(s) incurred, from the dues of the contractor.

10.3 Period of policies: All Insurance covers mentioned above shall be kept alive during the completion period of contract and defects liability period.

10.4 Copies of said Insurance Policies shall be lodged with the BHEL, or BHEL's authorized representative prior to contractor's start of work on site.

10.5 **INJURY TO PERSONS AND PROPERTY**

a. The Contractor shall be liable for and shall indemnify the BHEL against any liability, loss claim or proceedings whatsoever arising under any statute or at common law in respect of personal injury to or the death of any person whomsoever arising out of or in the course of or caused by carrying out of the works, unless due to any act or neglect of the BHEL or of any person for whom the BHEL is responsible.

b. Except for such loss or damages as is at the risk of the BHEL (if any), Contractor shall be liable for and shall indemnify the BHEL against any expense, liability, loss, claim or proceedings in respect of any injury or damage whatsoever to any property real or personal in so far as such injury or damage arises out of or in the course of or by reason of the carrying out of the works and provided always that the same is due to any negligence, omission of default of the contractor, his servants or agents of any subcontractor, his servant or agent.

10.6 **Insurance against injury to persons and property**
Without prejudice to his liability to indemnify the BHEL under these conditions, the contractor shall maintain and shall cause any subcontractor to maintain:

a. Such insurance as are necessary to cover the liability of the Contractor or as the case may be of such subcontractor in respect of personal injuries or deaths arising out of or in the course of or caused by the carrying out of the work:
b. Such insurances as may be specifically required in respect of injury or damage to property real or personal arising out of or in the course of or by reason of the carrying out of the work and caused by any negligence, omission or default of the contractor, his servants or agents or as the case may be of such subcontractor, his servants or agents.

10.7 The Contractor shall produce or cause any subcontractor to produce for inspection the relevant policy or polices of insurance together with the receipts in respect of premiums paid under such policy or policies as and when required so to do by BHEL provided always that as and when may be reasonably required by BHEL the production by either the contractor or any subcontractor of firm which shall have issued the policy or policies aforesaid shall be a good discharge of the contractors obligation to produce or to cause the production of the policy or policies and the receipts in respect of premium paid.

a. The Contractor shall maintain in the joint names of the BHEL and contractor such insurance as may be required in respect of any expense, liability, loss, claim or proceedings which the BHEL may incur or sustain by reason of injury or damage to property real or personal arising out of or in the course of or by reason of the carrying out of the work and caused otherwise than by the negligence, omission or default of the contractor, his servants of any subcontractor, his servants or agents.
b. Any such insurance as is referred to in the immediately preceding paragraph shall be placed with insurers to be approved by BHEL and the Contractor shall have to deposit with him the policy or policies and the receipts in respect of premium paid.

10.8 Should the Contractor or any subcontractor make default in insuring or in continuing to insure as provided in sub-clauses (1) and (2) of this condition the BHEL may himself insure against any risk with respect to which the default shall have occurred and may deduct a sum equivalent to the amount paid in respect of premium from any moneys due to or become due to the contractor.

10.9 **Insurance of the works against fire etc.**

a. The Contractor shall in the joint names of the BHEL and Contractor insure against loss or damage by fire, storm, tempest, lighting, flood, earthquake, air craft or anything dropped there from, aerial objects, riot and civil commotion for the fully value thereof all work executed and all unfixed materials and goods intended for deliver to and placed or adjacent to the work, but excluding temporary building, plant, tools and equipment owned or hired by the Contractor or any subcontractor and shall keep such work materials and goods so insured until with insurers approved by the BHEL and the contractor shall deposit with the BHEL the policy or policies and receipts in respect of premiums paid and should the contractor make default in insuring or continuing to insure as aforesaid the BHEL may himself insure against any risk with respect of which the default shall have occurred and deduct a sum equivalent to the amount paid by him in respect of premium from any moneys due to or to become due to the Contractor.
b. Provided always that if the Contractor shall independently of his obligations under this contract maintain a policy of insurance which covers (interim alia) the said work, materials and goods against the aforesaid contingencies to the full value thereof then the maintenance by the Contractor of such policy shall if the BHELs interest is endorsed thereon, be a discharge of the contractors obligation to insure in the joint names of the BHEL and contractor and the production by the contractor as and when may reasonably be required by the BHEL of a current certificate of insurance from the company or firm which shall have issued the aid policy shall be discharge of the contractors obligations to deposit with BHEL a policy or policies and the receipts in respect of premium paid.
c. Upon settlement of any claim under the insurance aforesaid the Contractor with due diligence shall restore work damaged, replace or repair unfixed materials or goods which have been destroyed or injured, remove or dispose of any debris and proceed with the carrying out and completion of the work. All moneys received from such insurances shall be paid to the contractor by installments under certificates of BHEL issued at the period of interim certificates named in the appendix to these conditions. The contractor shall not be entitled to payment in respect of the restoration of work damaged, the replacement and repair of any unfixed materials or goods and the removal and disposal of debris other than the moneys received under the said insurances.

11. CONTRACTOR'S SITE ORGANIZATION AND RESOURCES:

11.1 **Contractor's representative and supervisory staff:**
The Contractor shall at his cost provide and ensure continued effective supervision of the Work with the help of the Contractor's Representative, assisted by team of qualified, experienced and competent engineers, supervisors and adequate staff, to the satisfaction

of the Project Manager for the entire duration of the Work. The Contractor shall submit his proposed site organization chart for the approval of the Project Manager. The Contractor's Representative shall be on the Site at all times as the Work and the Project progresses and shall be responsible for carrying out the Work to the true meaning of the Drawings, Specifications, Conditions of Contract, Schedule of Rates, the other Contract Documents, and instructions and directions of the Project Manager. The instructions and directions given in writing to the Contractor's Representative or to any of his assistants at the Site by the Project Manager shall be deemed to have been given to the Contractor officially. Attention is called to the importance of the Contractor requesting written instruction from the Project Manager before undertaking any Work where the Project Manager's direction or instructions are required. Any such Work done in advance of such instructions will be liable to be removed at the Contractor's expense and will not be paid for unless specifically approved in writing by the Project Manager, as the case may be.

All key staff employed at the Site by the Contractor shall be considered essential to the performance of the Work and the Project Co-ordination Services, and all key staff shall be subject to the approval of the Project Manager. However such approval shall not relieve the Contractor of any of his Contractual obligations. No staff including the resident engineer and other technical supervisory staff shall be removed or transferred from the Work without the prior written permission of the Project Manager. The Project Manager shall, however, have the authority to order the removal from Site of any undesirable personnel. If key staff becomes unavailable for assignment to the Work or the Project Co-ordination Services for reasons beyond the Contractor's control, the Contractor shall immediately notify the Project Manager to evaluate the impact on the project. Prior to substitution or addition of any key staff, the Contractor shall obtain the Project Manager's written consent as to the acceptability of replacements or additions to such personnel. The Contractor shall at all times be fully responsible for the acts, omissions, defaults and neglect of all of his representatives, agents, servants, workmen and suppliers and those of his Sub-Contractors.

11.2 **Man-power and plant and machinery:**

The Contractor shall at his own cost provide and install all equipment, materials, plant/machines. Concrete Pumps, Cranes, and Material Hoists each of adequate capacity, will be required. Other equipment like (weigh batchers for design mixes), ladders, and scaffolding etc., necessary for the execution of the Work in conformity with the Contract Documents and to the satisfaction of the Project Manager will also be provided by the contractor at his own cost in adequate quantity. Also, all machines, tools, trucks, formwork material, man-power and everything else necessary for the proper and satisfactory execution and completion of the Work in accordance with the Contract Documents shall be provided by the Contractor at his own cost. The Contractor shall within two weeks of the award of Contract submit a complete list of his manpower, plant and machinery for the approval of the Project Manager, whose approval, however, shall not relieve the Contractor of any of his responsibilities, obligations and liabilities under the Contract. The Contractor shall augment his manpower, plant and machinery without extra cost to the BHEL whenever required or so directed by the Project Manager in order to conform to the approved construction programme for the achievement of milestones and Virtual Completion. (Ready mixed concrete) to be supplied from approved manufactures.

11.3 **Contractor store, site offices and other facilities:**

Contractor has inspected the site and has made his own assessment towards the availability of space at site for his stores, yards, offices, steel & shuttering yards, cranes, material hoists and other facilities. A mutually determined area within the constraints of the Site will be allowed to the Contractor free of cost for the purpose of storing his tools, plant, materials, Site office, cement godown, canteen, plant & machinery etc. In case contractor is not able to accommodate his facilities within the site, or in the opinion of the

Project Manager contractor's facilities are to be removed or relocated in the interest of the progress of work (contractor's and / or any other agency's / vendor's) the contractor shall make his own arrangements elsewhere outside the site at his own cost for the same. Water tank for the purpose of construction, Site offices, toilets, workshops and storage sheds etc. shall be built by the Contractor at the Contractor's cost. Water tank/s constructed for the purpose of construction should be of such dimensions as to provide storage for at least two days consumption. Site offices shall be of such dimensions to accommodate the Contractor's own office. A separate sanitary facility shall be provided and maintained for, Engineers and workers. The same shall be cleared after construction period. The Contractor shall remove all the temporary construction constructed by him at the Site for the purpose of completing the Work after the Project is completed. Costs of all such facilities including construction & removal shall be borne by the Contractor. Construction of labour hutments will NOT be allowed inside on the Site. Contractor has to make his own arrangement for space for labour hutment including transportation of labour to site. Nothing extra will be paid. The Contractor shall at his own cost make all arrangements for space, lodging, transportation etc. for the labour. No person will be allowed to stay on Site except the security and watchman except during night construction when the Work is in progress. Furnished Air-conditioned accommodation of 700 sq. ft. carpet area with toilets which will be maintained by contractor till 3 months after virtual completion, with insulated walls for Project Manager & his staff with conference room, toilets etc. as per design shall be provided. Nothing extra will be paid on this account.

11.4 **Security:**

The Contractor shall at his cost provide at all times adequate number of watchmen to guard the Site, materials and equipment, to the satisfaction of the Project Manager. The Contractor shall at all times be fully responsible for the security of all materials and equipment on the Site, whether his own or those of any Sub-Contractor. BHEL shall not be responsible for any loss due to theft, fire, accident or any other reasons, whatsoever.

11.5 **Telephone / Communication:**

The contractor shall make his own arrangement for the telephones and mobile phones at site with information to the Project Manager. The Contractor shall provide his representative and key personnel with mobile phone for round the clock communication with Project Manager. Contractor shall also at his own cost ensure two way communication either by way of providing, maintaining and running the walkie-talkie or mobile phones of adequate range at site, between the Project Manager's team members and contractor's own key personnel (from Project In-charge to function / area In-charge level) deputed at site, with whom Project Manager would be required to interact on day to day basis.

11.6 **Survey Equipment:**

The Contractor shall keep & provide sufficient number of required survey equipment at site for his own use. The contractor will provide at his own cost for the sole use of the Project Manager survey equipment as required by the Project Manager.

11.7 **Sanitary Convenience:**

The Contractor shall at his expense provide and erect with prior permission and details to the Project Manager all necessary sanitary conveniences including septic tank and soak pits at the Site for the staff and all workmen of his own, his Sub-Contractors, the Project Manager & his staff. The sanitary conveniences shall be strategically located around the Site to provide ready access to all site operatives and employees. The Contractor shall maintain such convenience in a clean, hygienic, orderly condition and shall clean, disinfect and deodorize the ground after their removal, and meet all statutory requirements.

11.8 **Scaffolding, staging, guard rails, barricades:**

The Contractor shall at his cost provide steel scaffolding, staging, guard rails, barricades and safety barriers around all excavations, openings and at all edges, temporary stairs and other temporary measures required during construction. The supports for the scaffolding, staging guard rails, barricades and safety barriers and temporary stairs shall be strong, adequate for the particular situations, tied together with horizontal pieces and braced properly. The temporary access to the various parts of the building under construction shall be rigid and strong enough to avoid any chance of mishaps. The entire scaffolding arrangement together with the staging, guard rails, barricades and safety barriers, and temporary stairs shall be to the approval of the Project Manager whose approval however shall not relieve the Contractor of any of his responsibilities, obligations and liabilities for safety and for timely completion of the Work. The use of wooden scaffolding on the Site is strictly forbidden.
Traffic diversion / management during construction time shall be in scope of contractor & nothing extra shall be payable.

11.9 **Temporary Roads:**
The Contractor shall at his cost construct and maintain temporary roads/access ways to suit Site requirements at locations mutually agreed with the Project Manager. Such roads/access ways will also be used by other Vendors working at the Site.

11.10 **Safety Equipment & Personnel:**
The Contractor shall provide sufficient helmets, safety boots/shoes, nets and protective clothing for use by the Project management team, his own staff and staff of its sub-contractors. The Contractor shall make available at all times when work is being undertaken, a vehicle suitable for the emergency evacuation of personnel from the site to a hospital staffed and equipped to receive injured personnel.

The contractor shall provide a fulltime, experienced and suitably qualified Safety Officer at site who shall be responsible for incorporation, implementation and enforcement of all safety measures and requirements for maintaining safe working conditions, safety of manpower and equipment, general safety and security of Site as per the various safety codes and stipulations mentioned in contract documents.

11.11 **Temporary Lighting:**
The Contractor shall make his own arrangement in respect of the provision of adequate lighting at all places where his workmen are engaged for carrying out the Work and also provide general lighting of site as a whole in a proper safe and satisfactory manner. Contractor shall ensure that all staircases, lobbies and basements are well lighted by providing at least one tube light at each landing of every staircase and also in each lift lobby plus adequate lighting in the working area as directed by the Project Manager. The Contractor shall provide general lighting in basement by installing at least one tube light per 100 sqm area at his own cost. Wiring shall be done in conformity with best practices and following all safety norms strictly.

11.12 **Protection Of Environment:**
The Contractor understands that the Site is free from pollutants at the time of access to the Site and commencement of the Work. The Contractor shall comply with all applicable environmental laws and regulations and shall ensure that the Site is and remains free from pollutants at the end of the Project. The Contractor shall ensure inter-alia, that neither the soil nor the ground water is polluted or contaminated by fuels or lubricants emitted by machinery operated on the Site or by other dangerous or poisonous substances which are or are deemed to be hazardous to the environment. Notwithstanding the above, the Contractor shall comply with all the directions and decisions of the Project Manager in this regard.

11.13 **First Aid Equipment & Medical Facilities:**

The Contractor shall establish a fully equipped and staffed (trained) first aid centre on the Site to deal with accidental injuries and workers health. Contractor shall ensure that a qualified & registered doctor is engaged to regularly visit the site for labour welfare. The Contractor shall provide such first aid and medical facility to at his own cost.

The Contractor shall make necessary arrangements with a local hospital and with local doctors so that his sick or injured persons may receive prompt medical treatment with minimum delay at any hour of the day or night.

12 LABOUR REGULATIONS:

12.1 **Regulations:**

The Contractor shall be wholly and solely responsible for full compliance with the provisions under all labour laws and /or regulations such as Payment of Wages Act 1948, Employees Liability Act 1938, Workmen's Compensation Act 1923, Employees State Insurance Act 1948, Employees Provident Fund Act 1952, Industrial Disputes Act 1947, the Maternity Benefit Act 1961, the Contract Labour (Regulation and Abolition) Act 1970, Building and Other Construction Workers' 'Welfare Cess Act. 1996 the Factories Act 1948 or any modifications thereof and any other applicable Construction Workers Welfare Cess or any other law relating thereto and rules there under introduced from time to time. The Contractor shall assume liability and shall indemnify the BHEL from every expense, liability or payment by reason of the application of any labour law, act, rules or regulations existing or to be introduced at a future date during the term of the Contract. Insurance cover towards the above shall be effected by the Contractor as called for in the contract. In general, in respect of all labour directly or indirectly employed in the Work for the performance of Contractor's part of the Contract, the Contractor shall comply with all the rules framed by the Government authorities concerned from time to time for protection of the health and welfare of the workers. The Contractor shall at his own cost obtain a valid license for himself and the BHEL / Principal Employer under the Contract Labour (R & A) Act 1970 and the Contract labour (Regulation and Abolition) Central Rules 1971 and under any other applicable rules before the commencement of the Work and continue to have a valid licenses until the completion of the Work.

12.2 **Labour welfare cess:**

The contractor shall comply with all provisions of the BOCW Act and shall indemnify BHEL against all claims that may arise due to non-compliance of any provision of the said act by the contractor. BHEL shall deduct labour cess from the Running/ Final bills at applicable rates and deposit it in the account of UP Building and other construction workers welfare board in the office of Dy. Labour Commissioner, Noida. The project has already been registered under BOCW Act. The rates quoted by the bidder shall be inclusive of Labour welfare cess.

12.3 **Payment of wages:**

The Contractor shall pay to labour employed by him either directly or through Sub-Contractors wages not less than fair wages as defined in the relevant Central / Local Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act 1970 and the Contract Labour Regulation and Abolition of Central Rules 1971, wherever applicable. He shall also abide by the minimum wages and other

regulations applicable to the labour engaged in the Work, as laid down by the concerned Central / local authorities.

In case the contractor fails to pay fare wages as required by the authorities then the BHEL shall be entitled to do so and receives such amounts including associated cost incurred by them in doing so from the contractor.

12.4 **Model Rules:**
The Contractor shall at his own expense comply with or cause to be complied with, Model Rules for labour welfare framed by Government or other local bodies from time to time for the protection of health and for making sanitary arrangements, Malaria control, etc. for workers employed directly or indirectly on the Work and in the workers hutment area. In case the Contractor fails to make arrangements as aforesaid, the BHEL shall be entitled to do so and recover the cost thereof from the Contractor.

12.5 **Safety Codes:**
In respect of all labour, directly or indirectly employed on the Work for the performance and execution of the Contractor's Work under the Contract, the Contractor shall at his own expense arrange for all the safety provisions as listed in (i) Safety codes of C.P.W.D. and Bureau of Indian Standards, (ii) The Electricity Act, (iii) The Mines Act, and Regulations, (iv) Regulations of employment & conditions of service Act 1996, Rules and Orders made there under and such other acts as applicable.

Precautions as stated in the safety clauses are of minimum necessity and shall not preclude the Contractor taking additional safety precautions as may be warranted for the particular type of work or situations. Also mere observance of these precautions shall not absolve the Contractor of his liability in case of loss or damage to property or injury to any person including but not limited to the Contractor's labour, the BHEL's, Architect's, or any member of the public or resulting in the death of any of these.

12.6 **Safety Equipment:**
Protective gear such as safety helmets, boots, belts, gloves, spectacles, nets, fire extinguishers etc. shall be provided by the Contractor at his own cost to all his manpower at the Site. The Contractor shall impose such requirements on all Sub-Contractors and Vendors also. It shall be the responsibility of the Contractor to ensure that such protective gear is worn at all times by all personnel working at the Site during the term of the Project. The Project Manager shall each have the right to stop any person not wearing such protective gear from working on the Site.

In case the Contractor fails to make arrangements and provide necessary facilities as aforesaid, the Project Manager shall be entitled (but not obliged) to do so and recover the costs thereof from the Contractor. The decision of the Project Manager in this regard shall be final and binding on the Contractor.

12.7 **Safety/Site Conditions:**

i. The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and ensure that the methods of carrying out the Work and the Project by the Contractor including his workmen, employees, Sub-Contractors and Vendors meet all the necessary safety standards and requirements of the SHE Plan. In order to fulfil this obligation the Contractor shall appoint a permanent, full time and suitably qualified safety officer for the Site.

ii. The Contractor shall institute and implement to the satisfaction of the Project Manager a construction safety programme, including:

a. Preparing a Site-specific written safety programme consistent with the SHE Plan, Indian law and best practices. As a minimum, the programme shall require applicable safety equipment

for all workers, use of barriers and barricades around potentially dangerous areas, protection of workers working under elevated conditions, accident reporting, medical & first aid provisions, lighting, housekeeping, sanitation etc.

b. Weekly safety reviews and 'risk assessments' shall be carried out in conjunction with the Project Manager in order to identify potential safety hazards and to militate against them. Contractor shall be required to maintain proper records of these inspections along with the checklists.

c. The Contractor will be required to provide all personnel entering the Site a safety rules card with instructions on Do's and Don'ts and verbal explanation of the safety programme.

d. Requiring all Sub-Contractors and other workers under the responsibility of the Contractor (including the Vendors or later phases of the construction of the Project) to adhere to the written safety programme.

The Contractor has full responsibility for maintaining the Site in good and clean condition and removing all trash and debris on a daily basis to the satisfaction of the Project Manager. The Contractor is responsible for providing adequate sanitary facilities and maintaining them in a clean and healthy condition. If the Contractor fails to comply with the above the Project Manager will have the authority to get the same cleaned by an external agency and debit the expenses incurred on the same to the Contractor's account; but without being under any legal obligation to do so.

If, by reason of any accident, or failure, or other event occurring to, in, or in connection with the Project, or any part thereof, either during the execution of the Work, or during the Defects Liability Period, any remedial or other work is, in the opinion of Project Manager urgently necessary for the implementation of the safety programme of the Project by the Contractor and the Contractor is unable or unwilling at once to do such work, the Project Manager shall be entitled to employ and pay other persons to carry out such work as the Project Manager may consider necessary. If the work or repair so done by the Project Manager is work which, in the opinion of the Project Manager, the Contractor is liable to do at its own cost, then all costs consequent thereon or incidental thereto shall be recoverable from the Contractor and may be deducted by the Project Manager from any of the Retention Money and any moneys due or to become due to the Contractor and the Project Manager shall notify the Contractor accordingly, provided that the Project Manager shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof.

The Contractor shall ensure that all operations by the Contractor, his workmen, employees, Sub-Contractors to complete the Project and the remedying of any defects therein shall, so far as compliance with the requirements of this Agreement permit, be carried on so as not to interfere unnecessarily or improperly with:

- The convenience of the public, or
- The access to, use and occupation of public or private roads, railways and footpaths to or of properties whether in the possession of BHEL or of any other person.
- The BHEL's operation and utilization of the facility at the Site; and
- The Work of Vendors.

If any hazardous or obnoxious materials (as defined by Indian law) are specified for use or are being used by Sub-Contractors or Vendors, the Contractor shall keep record of such material and forthwith give written notice to the Project Manager and shall ensure that the Sub-Contractors and Vendors, as applicable, use, store and dispose of such hazardous or obnoxious materials strictly in accordance with all applicable laws.

12.8 **Additional Safety Regulations:**

The Contractor shall continuously maintain adequate protection for the Work against fire and other hazards and shall protect the BHEL's property from damage or loss during the performance of this Contract. The Contractor also shall adequately protect property adjacent to the Work.

The Contractor shall take all necessary precautions for the safety of its employees, Subcontractors and the Vendors performing the Work and later phases of the Project and shall comply with all applicable safety laws and regulations to prevent accidents or injury to persons on, about, or adjacent to the Site.

The Contractor shall be responsible for co-ordinating a safe working programme with the Project Manager. Such a programme shall include, and the Contractor shall be responsible for maintaining, the following safe working conditions and practices:

i. All combustible material, food matter, garbage, scrap, and other debris generated during the performance of the Work shall be collected and removed from the Site on daily basis. Arrangements for scrap burning should be discussed with Project Manager.

ii. An adequate number and type of fire extinguishers and sand buckets shall be provided at the Site for fire control and shall be kept/maintained in satisfactory and effective working condition, at all times.

iii. Rescue operation team with availability of stretchers and transport vehicle. This team shall conduct mock drills at regular intervals. The report of which shall be submitted by the contractor to the Project Manager.

iv. **FIRE PRECAUTIONS:** The Contractor shall take all precautions and preventive measures against fire hazards at the Site and shall assume full responsibility for the same.

12.9 Requirement of Fire Extinguishers

Each gas welding or burning, arc welding unit, tar pot, or open flame unit requires a fire extinguisher and sand buckets with it during operation.

12.10 Requirement of Equipment

The availability of fire blankets is recommended. Other equipment related conditions are as follows:

- The Contractor shall use only safe equipment in good condition. The Contractor shall not use or permit to be used the BHEL's equipment and the BHEL shall not use the Contractor's equipment without prior written permission of the other.
- When working in an occupied building or area, the Contractor must before commencement of work familiarize itself with the hazards of that area, such as the location of flammable substances and toxic fumes.
- Materials and equipment intended for installation in the Work as well as the BHEL's equipment and materials already in place are to be protected at all times from debris, weather, or any damage. The Contractor shall take all steps necessary to ensure the preservation condition of such equipment.
- The Contractor's materials, tools, and equipment shall be stored only in areas approved by the BHEL for this purpose.
- Site access and parking by the Contractor's personnel shall be at locations designated by the Project Manager. Only the Contractor's personnel necessary for the performance of the Work shall be permitted access to the Site. The Contractor and its employees and Sub-contractors shall adhere to all speed limits and traffic regulations at the Site.
- The Contractor and its employees and subcontractors shall strictly obey all "No Smoking" restrictions.

- The Contractor shall not operate or use or manipulate utilities at the Site without the BHEL's prior written approval.
- No valves shall be turned off or on, or electrical disconnect switches operated except in an emergency. Any required utility "shut downs" will be scheduled and co-ordinate by the Project Manager.
- The Contractor shall make any requests for utility manipulation or "shut downs" in writing on least two (2) days' notice.

12.11 Safety with regard to site and housekeeping:

- The use of intoxicants or unlawful drugs at the Site, in any degree, shall be strictly prohibited. The Contractor shall rigorously enforce this regulation.
- When overhead work is in progress in or around an occupied area, signs to denote such work prominently displaying “Overhead Work” shall be used or the area shall be protected by barricade.
- Dusty work, such as concrete breaking or demolition, in or near occupied areas, shall proceed only after wetting down the area and taking steps necessary to prevent dust from penetrating occupied areas and creating a nuisance.
- Care shall be taken not to block any door, passageway, safety exit, firefighting equipment, or safety equipment with materials or equipment.
- Contractor shall maintain general cleanliness at site. All waste and debris shall be stored at designated place and disposed regularly.
- Materials must be piled, stacked, or stored in a neat and orderly manner. All stacking, whether inside or outside a building, shall be parallel to or at right angles to the building line or fence.
- When noisy operations of a prolonged nature are necessary in or near an occupied area, arrangements must be made with the Project Manager for scheduling to minimize any nuisance in the occupied area.

12.12 Non-compliance of Regulations:

If the Project Manager notifies the Contractor of non-compliance with all or any of the foregoing regulations, the Contractor shall immediately, if so directed, or in any event not more than eighteen (18) hours after receipt of such notice, make all reasonable efforts to correct such non-compliance. If the Contractor fails to do so, the Project Manager may suspend all or any part of the Work. When the Contractor has undertaken satisfactory corrective action, Project Manager shall lift the suspension of the Work. The Contractor shall not claim any extension of time to complete the Work or additional fees due to any such work suspension.

12.13 Implementation of Safety Measures:

Notwithstanding anything herein before contained, the Contractor shall be liable to ensure and implement all safety measures, whether or not statutorily prescribed, to safeguard, preserve and protect the life, health and welfare of every workman employed/deployed/engaged directly or indirectly by the Contractor on the Site and in relation to or connected with the Work and all Vendors employed in later phases of the Project in addition to installing, providing every prescribed safety and protective equipment, clothing etc., and the mere absence of any reference to or specification of a particular statute or rule or regulation in this Contract shall not absolve the Contractor of an obligation to comply with every such law, rule or regulation. The obligations stipulated in the contract shall not in any manner be deemed to limit or restrict any obligation or duty that any law, rule or regulation may otherwise impose upon the Contractor. The Contractor shall be liable for all consequences/liabilities arising out of his violating any of the aforesaid provisions, including fines, penalties, compensations, damages, prosecutions, proceedings, medical expenditure and costs, rehabilitation costs and all other expenses connected therewith.

12.14 Child Labour:

The Contractor shall not employ any labour less than 18 years of age on the job. If female labour is engaged, the Contractor shall make necessary provisions at his own expense for safeguarding and care of their children and keeping them clear of the Site. No children shall be permitted on the Site.

12.15 Crèches:

If women workers are employed on the Work, the Contractor shall provide at his expense two rooms of -reasonable dimensions plus toilet facilities for the use of their children under the age of six years. One room shall be used as a playroom and the other as the bedroom of the children. The rooms shall be built to reasonably good specifications in consultation with the Project Manager. The rooms shall be well lit and well ventilated.

The Contractor shall provide adequate number of toys and games in the playroom and sufficient number of cots and beddings in the bedroom. The rooms shall be maintained absolutely clean, employing sweepers.
The Contractor shall provide Dai (ayah) to look after the children in the crèche. The use of the rooms earmarked as crèches shall be restricted to children, their attendants and mothers of the children.

13. CONTRIBUTION TOWARDS EMPLOYEE BENEFITS, FUNDS ETC.:

The Contractor shall include in the Contract Price all expenses necessary to meet his obligations for making contributions toward employee benefits funds (Such as provident fund, ESI benefits, old age pension and/or any other benefits/compensation legally payable) in compliance with all the statutory regulations and requirements. All records in this connection shall be properly maintained by the Contractor and produced for scrutiny by the concerned authorities and BHEL whenever called for.

13.1 **Employees' State Insurance Scheme (ESI)**

The Contractor shall be liable to pay his contribution and Employee's contribution to the State Insurance Scheme in respect of all labour/ employees employed by him or for the execution of the contract in accordance with the provision of "The Employee's State Insurance Act, 1948" as amended from time to time, as applicable during the contract period.

13.2 **Employees Provident Fund (EPF)**

The Contractor shall obtain prescribed recommendations from the Regional Provident Funds Commissioner under the Employees' Provident Fund and Misc. Provisions Act, 1952 and shall cause provident fund contribution from all eligible employees and Contractor's contribution to be deposited regularly with the prescribed authority and in token of which shall submit every month necessary receipts/ documentary evidence as may be required by the Project Manager. The contractor shall also provide its P.F. registration number/ certificate to Project Manager.

In case the contractor fails to comply with above provisions as required by the authorities then the Project Manager shall be entitled to do so and recover such amounts including the associated costs incurred by them in doing so, from the contractor.
The Contractor must fully satisfy himself as to these points and allow coverage for the same in the rates while giving his tender. Nothing extra shall be paid on these accounts.

14. SETTING OUT AND SITE SURVEYS:

The Contractor shall establish, maintain and assume responsibility for all bench marks and grid lines, and all other levels, lines, dimensions and grades that are necessary for the execution of the Work, in conformity with the Contract Documents. The Contractor shall

establish his relation to the permanent benchmarks and boundary lines established at the Site. The Contractor shall verify and co-relate all the survey data available at the Site before commencing the Work and shall immediately report in writing any errors or inconsistencies to the Project Manager. Commencement of Work by the Contractor shall be regarded as his acceptance of the correctness of all survey and setting out data available at the Site and no claims shall be entertained or allowed in respect of any errors or discrepancies found at a later date. If at any time error in this regard appears during his progress of the Work, the Contractor shall at his own expense rectify such error to the satisfaction of the Project Manager

The approval by the Project Manager of the setting out by the Contractor shall not relieve the Contractor of any of the responsibilities, obligations, and liabilities under the Contract.

The Contractor shall be entirely and exclusively responsible for the horizontal, vertical and other alignment for all levels and dimensions and for the correctness of every part of the Work, and he shall rectify effectively any errors or imperfections therein. All such rectifications shall be carried out by the Contractor at his own cost and to the instructions and satisfaction of the Project Manager

The Contractor shall employ qualified surveyors to carry out all the surveys and setting out works.

15. DRAWINGS, SPECIFICATIONS, INTERPRETATIONS ETC.:

15.1 For guidance of the bidder, **Architectural and Structural drawings are enclosed with these Tender Documents**. These drawings are broadly indicative of the work to be carried out. These drawings are not the 'Construction Drawings' and details indicated there in are for guidance only and are liable to be modified by the Project Manager during course of actual construction. No claim what so ever shall be admissible on account of changes that may be introduced later by the Project Manager.

15.2 The Project Manager shall provide three copies of working drawings to the Contractor as the Work progresses. The timing of the provision of drawings shall be mutually agreed between the Contractor and Project Manager in conformity with the construction programme and with due regard for the need to order and specify materials and equipment to the Site. **Additional copies of construction status drawings will be supplied on payment at actual cost basis.**

15.3 In general, the Drawings shall indicate the dimensions, positions and type of construction, the Specifications shall stipulate the quality and the methods and performance criteria, and the Schedule of Rates shall indicate the rates for each item of work. However, the above Contract Documents being complementary, what is called for by any one shall be binding as if called for by all. **Wherever there is a discrepancy between drawings and specifications, the drawings shall be followed. In case of any contradiction, the following order of decreasing importance shall be followed:**

- **Drawings**
- **BOQ**
- **Technical Specifications**

15.4 Matters not contained in the specifications and in case of any ambiguities in written specifications of the contract, the works shall be executed as per relevant BIS codes. If such codes have not been framed, the decision of the BHEL shall be final.

15.5 Any work indicated on the Drawings and not mentioned in the Specifications or vice versa, shall be deemed as though fully set forth in each. Work not specifically detailed, called for, marked or specified shall be the same as similar parts that are detailed, marked or specified.

15.6 From time to time during the progress of the Work, the Contractor will be issued with revisions of Drawings and written instructions by the Project Manager in connection with and necessary for the proper execution and completion of the Work. All such revisions of Drawings and written instructions shall be part of the Contract Documents and the Contractor shall be bound to carry out the work that is shown and detailed on all such Drawings and shall be bound to follow and comply with all such instructions.

15.7 The Project Manager will issue all Drawings and their subsequent revisions via listing on transmittals / Register to the Contractor. The Contractor shall maintain a Drawing register listing all Drawings and their latest revisions. All superseded Drawings shall be so stamped and withdrawn from circulation at the Site and returned to the Project Manager. It shall be the responsibility of the Contractor to ascertain and ensure that all the Work is carried out in accordance with the latest revisions of the Drawings issued to him. Should the Contractor fail to do this, all the rectifications and remedial work that may be required to conform to the latest revisions of the Drawings shall be at the Contractor's expense.

15.8 Wherever it is mentioned in the Conditions of Contract, Specifications, and other Contract Documents that the Contractor shall perform certain work or provide certain facilities, it is understood that the Contractor shall do so at his own cost, unless otherwise provided in the Documents.

15.9 No deviations shall be made by the Contractor, in the execution of the Work from the Drawings, Specifications, and other Contract Documents. Only the Project Manager shall issue interpretations and clarifications.

15.10 The Contractor shall immediately in writing bring any errors or inconsistencies in the Drawings and Specifications to the attention of the Project Manager for interpretation or correction before proceeding with the affected portion of the Work, and no claims or losses alleged to have been caused by such discrepancies shall be entertained or allowed at any stage. Local conditions, which may affect the Work, shall likewise be brought to the Project Manager’s attention at once. If at any time it is discovered that work, which has been done or is being done is not in accordance with the approved Drawings and Specifications, the Contractor shall correct the work immediately. Correction of such work shall be at the expense of the Contractor and shall not form a basis for any claims for payment or extension of time. The Contractor shall carry out all the rectification work only after obtaining approval for the same from the Project Manager.

15.11 No scaling of any Drawing shall be done to obtain the dimensions. Figured dimensions on the Drawings shall be used for carrying out the Work. Drawings with large-scale details shall take precedence over small scale Drawings. Where any Drawings and details have not been provided but are necessary for the execution of the Work, it shall be the responsibility of the Contractor to seek these drawings and details in writing from the Project Manager at least four weeks prior to the latest date by which the Contractor needs these drawings and details to suit the programmed execution of the Work. No extension of time shall be allowed for any delays caused due to the Contractor's failure to seek such details.

15.12 Drawings, Schedule of Rates, Specifications, and other Contract Documents, and all copies thereof furnished by the Project Manager shall become the BHEL's property. They shall not be used on any other work and shall be returned to the BHEL at his request or at the completion of the Contract.

16. WATER AND ELECTRICITY:

16.1 WATER SUPPLY

Contractor has to make his own arrangement for water supply from outside the site premises and BHEL shall not be responsible for the same. Contractor, under no circumstances, shall use underground water / Noida water supply. Contractor to submit an affidavit in this regard.

16.2 POWER SUPPLY

The electricity required for execution Work shall be arranged by the Contractor from the authorities and / or generators at his own cost. Contractor shall be responsible for all distribution points as may be required for the Work. The contractor is also required to install at his own cost, a standby generator of required capacity, which shall conform to Pollution Control Norms, including distributions and connections and in the event of non-availability of power so that there is no delay in progress of Work as per execution schedule submitted by him and approved by BHEL (all the generators shall be approved as per latest CPCB guideline & Indian Electricity Act). The Contractor shall also share electricity from his Generators and electric connection with other Contractors, Sub-contractors, Vendors & BHEL etc. and share proportionate cost with them at tariff prevalent in the market as per State Electricity Board. The point of supply shall be at Generator / Electric supply Board. The cost of energy meter shall be borne by the respective allied contractors. Contractor shall ensure adequate capacity of generators to support such load sharing with other vendors

It shall be the responsibility of the contractor to provide and maintain the complete installation on the load side of the supply with due regard to safety and proper circuit protection requirement at site. All cabling, equipment, installations etc. shall comply in all respects with the latest statutory requirements and safety provisions i.e. as per the central/state electricity acts and rules etc. The contractor will ensure that his equipment and electrical wiring etc., are installed modified, maintained by a licensed electrical/supervisor. A test certificate is to be produced to the Project Manager for this approval, before power is made available. Non adherence of safety code shall render the contractor to be penalized a deemed fit by the Project Manager.

The BHEL is not liable for any loss or damage to the contractor’s equipment as a result of variation in voltage or frequency or interruption in power supply or other loss to the contractor arising there from.

The contractor shall ensure at his cost that all electric lines and equipment and all installations are approved by the State Electricity Inspector.

All statutory Fees & miscellaneous expenses and costs for electric power and Water connection for construction purposes shall be borne by the Contractor.

17. ASSIGNMENT AND SUB-LETTING:

The Contractor shall not assign/Sublet any part of this Contract to any other agency without the approval of the Project Manager. The Contractor may, however, sub-contract any part of the Work with the prior written consent of the Project Manager. Any

permission to sub-contract parts of the Work shall not relieve the Contractor from any of his responsibilities, obligations, and liabilities under this Contract.

18. SUB-CONTRACTORS:

As soon as practicable, but at **least four weeks** before awarding any Sub-Contract, the Contractor shall submit to the Project Manager in writing the names of the Sub-Contractors along with their profiles and work experience proposed for any part of the Work, for the approval of the Project Manager. The Contractor shall employ such Sub-Contractors only after he has received confirmation in writing of such approval from the Project Manager. Such approval, however, shall not relieve the Contractor of any of his responsibilities, obligations and liabilities under the Contract. The Contractor shall be responsible for the acts, defaults and neglect of all Sub-Contractors and their agents, servants and workmen. The Contractor shall not employ any Sub-Contractor to whom the Project Manager, objects and/or does not approve.
The sub-contractor for main structural steel work should have a) Own fabrication unit having a production capacity of 12,000 MT per annum or more, b) Precision machines for fabrication, punching machine, Experienced Manpower, testing facilities/labs as per relevant standards. c) Quality certification, ISO etc. d) TEKLA or equivalent software for fabrication/shop drawing.

Upon approval of sub-contractor by BHEL, quality control plan for structure steel works need to be got approved by BHEL before start of work.

19. SEPARATE CONTRACTS:

The BHEL reserves the right to let other contracts in connection with the Project. The Contractor shall afford other contractors reasonable opportunity for their access to the Site, for the storage of their materials, and for the execution of their work, or if specified give assistance to such contractors for such purposes as are specified. The Contractor shall properly connect and co-ordinate his Work with that of the other contractors that may be employed or engaged by the BHEL and shall co-ordinate, communication among the Project Manager, Architect, the Contractor, its Sub-Contractors and the Vendors and provide the facilities and oversee construction schedule, construction co-ordination and Site Safety for the Project. If any part of the Contractor's Work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report in writing to the Project Manager any defects in such work that render it unsuitable for such proper execution and results. The Contractor's failure to so inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for receiving the work of the Contractor.

20. CO-ORDINATION OF WORK:

At the commencement of the Work, and from time to time, the Contractor shall co-operate with other contractors, Sub-Contractors, persons engaged on separate contracts in connection with the Project, Vendors, the Project Manager, and the Architect for the purpose of the co-ordination and execution of various parts / phases of the Project. The Contractor shall determine and ascertain from the Vendors and persons engaged on separate contracts, in connection with the Project, the extent of all chasings, cutting and forming of all openings, holes, details of all inserts, sleeves, etc. that are required to accommodate the various services.

The Contractor shall determine and ascertain the routes of all services and positions of all floor and wall openings, outlets, traps, the details of all inserts, equipment and services and shall carry out the construction and making good of all "builder's work" in accordance with

and as shown, described and/or measured in the drawings, Specifications, and other Contract Documents. Also, the Contractor shall ensure that all required services, inserts, sleeves, embedment etc. are in place/position before he proceeds with his work. Should the Contractor fail to comply with these requirements and the consequence of such failure necessitates the breaking, re-doing and making good of any work, then the cost of all such breaking, re-doing and making good of any work shall be to the account of the Contractor and shall be borne by him. No breaking and cutting of completed work shall be done unless specifically authorized in writing by the Project Manager. No work shall be done over broken or patched work without first ascertaining that the broken surface is adequately prepared and reinforced to receive and hold further work, as determined by the Project Manager.

In order to ensure proper co-ordination is being undertaken, weekly meetings, chaired by the Project Manager, will be held with the various contractors, at which co-ordination will be discussed and minutes of actions proposed circulated.

In the event of a particular floor/part of construction being handed over to another agency for carrying out further work related to MEP/finishing/furnishing etc., the contractor shall not be absorbed of his responsibilities w.r.t. workmanship of the executed work and its defect liability during the contract duration & also during warranty period.

21. USE OF CONTRACTOR'S FACILITY BY OTHERS:

Contractor shall allow the use of his access ways, temporary staging, lighting, and sources of temporary power and water, by other Contractors, Sub-contractors and Vendors etc., where necessary for their legitimate work, without let or hindrance, but in a coordinated manner. Should there be conflict, then direction of the Project Manager shall be final and all parties shall be bound by it for consumption of water/ Electricity the charges will be payable by other contractors/subcontractors and vendor at specify rate to be agreed mutually with the approval of the Project Manager.

22. OVERTIME WORK:

22.1 If it is necessary for the Contractor or any Sub-Contractor to work on other than working days or outside the normal working hours in order to keep up to the time schedule and meet the Construction Programme, the Contractor shall obtain the prior approval of the Project Manager in writing, whose approval shall not be unreasonably withheld. The additional cost of wages and any other costs incurred as- a result of overtime or any shift work shall be borne by the Contractor.

22.2 Where work is being carried out in or around an operating plant / office or occupied building /premises and is liable to cause disturbance or interruption in working of the Plant / Office or inconvenience to the occupants of the premises, the Contractor shall work only at specified places and times as mutually arranged between the Contractor and the Project Manager so as not to cause any disturbance. Due to this the Contractor may be required to work during off-hours, Sundays and holidays. The Contractor shall not be entitled for any extra payment for doing work in the manner described above.

22.3 For timely completion of work, Contractor, if required by the Project Manager, shall work in two or three shifts without any extra payment. The normal working hours will be 8.30 A.M. to 5.30 P.M. However, if contractor wishes to work extra hours for completing the work schedule, he shall obtain permission from Project Manager for working extra hours.

23. MATERIALS, WORKMANSHIP, STORAGE, INSPECTIONS ETC.:

23.1(A) BHEL Supplied Material: -

This item be treated as null & void. There will be no BHEL supplied material.

23.1(B) Contractor Supplied material: -

23.1.1 All the materials shall be procured by the contractor. Basic rates for selected materials and fixtures in the tender are provided to enable the contractor to quote the item rates accordingly. Quoted rate to include labour, basic cost of material, cost of accessories, taxes, payment to suppliers, transportation, handling, storage, safety, wastage, accounting and reconciliation and to provide Form 'C' & '38' and any other documents/formalities for purchase of materials, cost of electricity, water, GST as & when applicable and contractor's overheads and profits etc.

23.1.2 In case the Contractor fails / refuses to procure and provide any material, the Project Manager in the interest of the work may resort to procure and provide such materials at the risk and cost of the Contractor. Under such circumstances a penal recovery @ 15% of the respective item rates shall be imposed on the Contractor and recovered from his bills / any outstanding payments.

23.1.3 The materials shall be fully accounted for by the Contractor as required hereinafter. In accounting for the materials, allowances against each item, will be made to cover all wastages and losses that may have been incurred in the process of handling, storing, cutting, fabrication, fixing and installing. The contractor shall submit statement of account and reconciliation of material lying in Contractor's stores along with each Running Account Bill and consolidated statement of reconciliation along with Final Bill.

23.1.4 The Contractor shall, at all times when requested, satisfy the Project Manager by the production of records or books or submissions of returns that the materials are being used for the purpose for which they are procured and the Contractor shall at all times keep the records updated to enable the Project Manager to apply such checks as he may desire to impose. The Contractor shall, at all times, permit the Project Manager to inspect his godown. The Contractor shall not, without prior written permission of the Project Manager, utilise or dispose of the materials for any purpose other than intended in the Contract.

23.2 Materials and workmanship:

The Contractor shall be responsible for the establishment of a full and comprehensive quality control system for the Work. The system shall include, but not be limited to, the means of controlling the testing and receipt of materials, the inspection of the Work, the filing and ordering of drawings and correspondence and the duties and responsibilities of staff members.

All materials and equipment to be incorporated in the Work shall be new. The materials, equipment, and workmanship shall be of the best quality of the specified type, in conformity with Contract Documents and the best engineering and construction practices, and to the complete satisfaction of the Project Manager. This requirement shall be strictly enforced at all times and stages of the Work and no request for change whatsoever shall be entertained on the grounds of anything to the contrary being the prevailing practice. **The Contractor shall immediately remove from the Work any materials, equipment and/or workmanship which, in the opinion of the Project Manager, are defective or unsuitable or not in conformity with the Contract Documents and best engineering and construction practices, and the Contractor shall replace such rejected materials, equipment and/or workmanship with proper, specified, required and approved materials, equipment and/or workmanship, all at his own cost within a period of seven (7) days from the date of issuance of such notice.**

The Contractor shall, whenever required to do so by the Project Manager, immediately submit satisfactory evidence and necessary test results as to the kind and quality of the materials and equipment.

23.2 **Special makes or brands:**

Where special makes or brands are called for, they are mentioned as a standard. Others of equivalent quality may be used provided that Project Manager considers the substituted materials as being equivalent to the brand specified, and prior approval for the use of such substituted materials is obtained in writing from the Project Manager. **Unless substitutions are approved by the Project Manager in writing in advance, no deviations from the Specifications and other Contract Documents shall be permitted, the Contractor shall indicate and submit written evidence of those materials or equipment called for in the Specifications and other Contract Documents that are not obtainable for incorporation in the Work within the time limit of the Contract. Failure to indicate this in writing within one month of the signing of the Contract will be deemed sufficient cause for denial of any request for an extension of time and /or additional cost because of such circumstances.**

Alternative equivalent brands if suggested by the Contractor during construction may be considered if approved brand is not available in market, provided the suggested brand fully meets the requirements and is acceptable to the Project Manager. The contractor has to furnish the rate analysis of all such items and get its prior approval from Project Manager before execution.

23.3 **Proper scheduling and delivery of materials:**
All materials and equipment shall be scheduled and delivered so as to ensure a speedy and uninterrupted progress of the Work, and the same shall be properly stored. Within fifteen days of signing of the Contract, the Contractor shall submit the material procurement schedule for approval of Project Manager for all materials to be procured by the Contractor.

23.4 **List of Materials:**
Within fifteen days of the award of the Contract, the Contractor shall submit for the approval of the Project Manager a complete list of all materials and equipment the Contractor and his Sub-Contractors propose to use in the Work, of definite brands or makes, which differ in any respect from those specified, or the particular brand where more than one is specified as standard. The Contractor shall also list materials and the items not specifically mentioned in the Contract Documents but which are reasonably inferred and are necessary for the proper execution and completion of the Work.

23.5 **Storage of materials and equipment at site**
The Contractor shall, at his own cost, provide adequate storage sheds and yards at the Site, at locations pre-approved by the Project Manager, for all materials and equipment that are to be incorporated in the Work. This shall be for all the materials and equipment, supplied by the Contractor or any Sub-Contractor. In addition to being watertight and weatherproof, the storage facilities shall be of such a manner that all the materials and equipment are adequately protected in every way from any deterioration or contamination or damage whatsoever, to the complete satisfaction of the Project Manager. The method of storing of all the materials and equipment shall be in conformity with the Specifications and/or to the directions and instructions of the Project Manager. At no time shall any material or equipment be stored in open or in contact with the ground. Should any of the materials or equipment deteriorate or be contaminated or damaged in any way due to improper storage or for any other reason then such materials and equipment shall not be incorporated in the Work and shall be removed forthwith from the Site and the replacement of all such materials and equipment shall be entirely at the cost and expense of the

Contractor. The Contractor shall be responsible for also providing, at his own cost, proper and adequate security for all the materials and equipment stored at the Site so as to prevent any theft, pilferage etc., and the Contractor shall be responsible and liable for all the matters in connection with such security or the lack thereof. Where, after permission has been sought and obtained from the Project Manager, any material or equipment is kept on any portion of the structure, this shall be done in such a manner as to prevent any overloading whatsoever of the structure, to the complete satisfaction of the Project Manager. The cost associated with any damage to any portion of the structure in this respect shall be to the account of the Contractor and shall be borne by him.

Should delays be caused on account of removal and replacement of any materials or equipment or on account of any lack of security, the Contractor shall not be entitled to any extension of time or increase in the Contract Price.

Wherever applicable the storage of materials shall be in accordance with the relevant Indian Standard Specifications.

Cement storage capacity of the Contractor shall be of minimum 1500 bags to store substantial quantity of cement, keeping in view the tight schedule of the Work. Sand and aggregates shall be stored over hard concrete base or paved brick platforms. Reinforcement bars shall be stored diameter-wise over raised sleepers and protected from rain in suitable manner as approved by the Project Manager. Similarly, structural steel sections shall also be stored in the yard in a proper orderly manner.

23.6 **Right Type of Workmen, Plant and Machinery, Jigs, Tools, etc.:**
The Contractor shall employ the right type of workmen, plant and machinery, jigs, tools etc. to fabricate and/or install all materials and equipment. They shall be fabricated and/or installed without any damage and in accordance with the manufacturer's instructions and manuals, and to the satisfaction of the Project Manager.

23.7 **Inspection:**
All materials, equipment, and workmanship shall be subject to inspection, examination and testing by the Project Manager at all times and stages during construction, manufacture and/or installation, and they shall have the right to reject and order the removal and replacement of any defective material, equipment and / or workmanship or require its correction and rectification. The Contractor shall not proceed with any operation or sequence or trade of the Work until the previous operation or sequence or trade has been inspected and approved by the Project Manager. No embedded items or any other work shall be covered up unless these have been inspected and approved by the Project Manager. The onus shall be on the Contractor to get such inspections carried out and obtain such approvals. Should the Contractor fail to comply with these requirements, then all additional or redoing of work necessitated as a consequence thereof shall be at the Contractor's cost and expense. No inspection or approval shall relieve the Contractor of any of his responsibilities, obligations and liabilities under the Contract. No defective workmanship shall be repaired or patched up in any way without inspection and direction of the Project Manager.

Rejected workmanship shall be immediately corrected and rectified and rejected materials and equipment shall be removed and replaced with proper, specified and required materials and equipment, by the Contractor to the approval and satisfaction of the Project Manager. The cost of all such correction and rectification and such removal and replacement shall be to the account of the Contractor and shall be borne by him, and also, the Contractor shall be responsible for all delays in this regard. The Contractor shall promptly segregate and remove the rejected materials and equipment from the Site and shall not reuse them in the Work. If the Contractor fails to proceed at once with the

correction and rectification of rejected workmanship and/or the removal and replacement of rejected materials and equipment, the Project Manager shall have the right to employ other persons / agencies to correct and rectify such workmanship and/or remove and replace such materials and equipment, and recover the cost thereof from the Contractor, or the Project Manager may terminate the right of the Contractor to proceed further with the Work.

The Contractor shall furnish promptly and without any charge, all facilities, access, labour, materials, plant and tools required and necessary for enabling the Project Manager, to carry out inspections and tests in a safe and convenient manner. The Contractor shall ascertain and ensure that the facilities and access provided for the carrying out of all inspections are completely safe in every respect and the Contractor shall be fully responsible and liable for all matters in connection with such safety.

23.8 **Testing:**

All the tests on materials, equipment, and workmanship that shall be necessary in connection with the execution of the Work, as decided by the Project Manager and as called for in the Contract Documents, shall be carried out at the cost of the Contractor at the place of work or of manufacture or fabrication or at the Site or at an approved testing laboratory or at all or any such places. The Contractor shall provide all assistance, instruments, machines, labour and materials as are required for the examining, measuring and testing as described above, which shall be got calibrated from approved laboratory at the specified frequency to ensure accuracy of results, the testing and all expenses connected with the tests as described above shall be borne by the Contractor.

23.9 **Certificates:**

The Contractor shall furnish, at his own cost, test certificates, calibration certificates for the various materials and equipment as called for by the Project Manager. Such test certificates should be for the particular consignment/lot/piece as decided by the Project Manager. The details in respect of the test and calibration certificates shall be as decided by the Project Manager for the relevant items.

24. SAMPLES, SHOP DRAWINGS:

After the award of the Contract, the Contractor shall furnish for the approval of the Project Manager, all samples of materials and shop drawings called for in Contract Documents or required by the Project Manager. The samples and shop drawings shall be delivered as directed by the Project Manager. The Contractor shall construct prototypes of works as laid down in the Contract Documents or as instructed by the Project Manager, such prototypes or samples, of works, after approval by the Project Manager shall serve as the standards to be achieved in the final construction. No extra payment shall be due to the Contractor for submission of material sample and preparation of shop drawings and prototypes. A schedule giving dates of the submission of samples and shop drawings shall be included in the time schedule. Samples / materials approved by the Project Manager, shall be kept at Site under safe custody of Contractor and on completion of the Work handed over to the Project Manager.

25. CONSTRUCTION PROGRAMME, SCHEDULES AND PROGRESS REPORTS:

25.1 **Construction Programme:**

i. Every contractor should furnish along with his tender an overall construction programme utilizing a known CPM software package like Microsoft Project, latest version. The construction programme shall clearly show all the sequential activities of work required to be carried out from the commencement of the Work up to the Virtual Completion.

ii. The Tenderers proposed Construction programme be submitted along with the tender defining various mile stones of floor levels.
iii. Every, or sooner if required by the Project Manager, the approved programme charts shall be reviewed in relation to the actual progress of the Work, and shall be updated as necessary. If at any time it appears to the Project Manager that the actual progress of the Work does not conform to the approved programme, the Contractor shall produce, at its expense and without reimbursement therefor, a revised programme showing the modifications to the approved programme and the additional input of resources by the Contractor necessary to ensure completion of the Work within the time stipulated for completion.
iv. The submission to and approval by the Project Manager of such programmes or the furnishing of such particulars shall not relieve the Contractor of any of his responsibilities, obligations and liabilities under the Contract.

25.2 **Construction Schedules**:
Along with the construction programme, the Contractor shall also submit the following monthly schedules in the prescribed format:

i. Manpower Schedule.
ii. Cash-flow Schedule.
iii. Plant and Equipment Schedule
iv. Materials Schedule (including status and mobilisation programme)
v. Material samples Schedule
vi. Shop drawings Schedule (including status and delivery)

25.3 **Daily site reports:**
The Contractor shall throughout the contract period, submit daily site reports on an approved / prescribed proforma to the Project Manager. The reports will include, but not be limited to:

i. Record of the Site progress
ii. Number of employees on the Site
iii. Number of men employed on individual trades
iv. Plant and machinery at site (including an indication as to whether the plant is working or standing)
v. Notification of accidents, if any
vi. Events influencing the progress of the Work

25.4 The records should include all staff employed by the Contractor as Sub-contractors.

25.5 **Site Register:**
The Contractor shall maintain a site register that records the name and time of arrival and departure, at Site, of any visitors.

25.6 **Progress Reports:**
At the end of each month the Contractor shall submit a Weekly progress report in a prescribed / agreed format with the Project Manager. The reports shall include sets of progress photographs taken from pre-determined locations, which illustrate the progression of the Work.

25.7 **Employee Records:**
The records should include all staff employed by the Contractor and Subcontractors.

25.8 **Meetings:**
The designated site incharge from contractor's side will attend and participate in the weekly progress review meetings, schedule review meetings and any other meetings convened by

Project Manager where their presence is required, as determined by Project Manager. The designated site safety incharge of contractor shall attend all safety meetings conducted at job site and also participate in Weekly progress meetings, as required by Project Manager.

26 BUREAU OF INDIAN STANDARDS:

26.1 A reference made to any Indian Standards Specifications in the Contract Documents shall imply reference to the latest version of that Standard, including such revisions/amendments as may be issued, during the currency of the Contract, by the Bureau of Indian Standards and the corresponding clause/s therein shall hold valid in place of those referred to. The Contractor shall keep copies at the Site of all latest publications of relevant BIS Codes and Indian Standards Specifications applicable to the Work at the Site and as listed in the Specifications for quick referencing.

26.2 Amendments to BIS codes announced after finalization of the Contract shall be followed.

27. TOLERANCES:

27.1 The Contractor shall exercise every care to ensure that all structural members are plumb and true to line, level and dimensions called for on the Drawings, for the purposes of structural requirements as well as in order to receive finishes, equipment and similar items. The details of the finishing items are based upon allowing tolerances as per the most stringent requirements laid down in the Contract Documents/Indian Standard Specifications/Best Trade practices and the limits of tolerances shall be in strict conformity with such Documents and Standards. Any variations beyond such limits shall require, in accordance with the directions and to the approval of the Project Manager, rectifications in the structural members and/or wall openings or the remaking or replacing of the finishing elements and / or equipment, fabricated to fit into the openings or spaces shown on the Drawings. All such rectifications or remaking or replacing of work, shall immediately be carried out by the Contractor at his own cost and expense, and he shall be responsible for all delays in this regard. All such costs and expenses shall be recovered from the Contractor and shall be deducted by the BHEL from any money that may be payable or that may become payable to the Contractor.

27.2 In case of separate Contracts the Contractor or Sub-Contractor whose work does not conform to the dimensions and limits of tolerances specified in the Contract Documents and/or the Indian Standard Specifications shall be liable for all costs and expenses incurred for rectifications and/or replacements of any other Contractor's and/or Sub-Contractor's work required, in accordance with the directions of the Project Manager, for the proper installation of the finishing elements and/or equipment, and/or for structural purposes. The Project Manager's decision in this respect shall be final and binding on the Contractors and Sub-Contractors, and all such costs and expenses shall be recovered from the pertinent Contractors and Sub-Contractors and shall be deducted by the BHEL from any money that may be payable or that may become payable under the Contract to such pertinent Contractors and Sub-Contractors for and on behalf of the Contractor.

28. PROTECTIONS AND CLEANING OF WORKS AND CLEARING OF SITE:

28.1 **Protection of works:**
The Contractor shall take full responsibility for the proper care and protection of the Work from commencement of work until completion and handing over of the complete work to the Project Manager at no additional cost. The Contractor shall protect and preserve the Work in every way from any damage, fire or accident, including by providing temporary roofs, boxing or other construction as required by the Project Manager. This protection shall be provided for all property on the Site as well as adjacent to the Site. The Contractor shall

adequately protect, to the satisfaction of the Project Manager, all the items of finishing work to prevent any chipping, cracking, breaking of edges or any damage of any kind whatsoever and to prevent such work from getting marked or stained or dirty. Should the Contractor fail to protect the Work or any part thereof and should any damage be caused to the same, the Contractor shall be responsible for all replacement and rectification, as directed by the Project Manager, and all costs and expenses in connection with such replacement and rectification shall be to the account of the Contractor and shall be borne by him.

28.2 The Contractor shall in connection with the Work provide and maintain at his own cost all lights, security guards, fencing and anything else necessary for the protection of the Work and for the safety of the public and everyone associated with the Work, all to the approval and satisfaction of the Project Manager.

28.3 All operations necessary for the execution of the Work shall be carried out so as not to interfere with the convenience of the public, or with the traffic, or the access to, use and occupation of public or private roads and footpaths or of properties whether in the possession of the BHEL or of any other person. The Contractor shall indemnify BHEL in respect of all claims, proceedings, damages, costs, charges, and expenses whatsoever arising out of or in relation to any such matters.

28.4 **CLEANING OF WORKS AND CLEARING OF SITE: The Contractor shall maintain the Site, adjoining areas within 20 meters all around site and all Work thereon in neat, clean and tidy-conditions at all times.** The Contractor shall remove all rubbish and debris from the Site and adjoining areas on daily basis and as directed by the Project Manager. Suitable steel skips shall be provided at strategic locations around the Site to receive waste and packaging materials.

28.5 Just prior to the Virtual Completion of the Work, or whenever so directed by the Project Manager, the Contractor shall carry out all the work necessary to ensure that the Site & 20 meter area all around site is clear and the Work are clean in every respect, the surplus materials, debris, sheds and all other temporary structures are removed from the Site, all plant and machinery of the Contractor are removed from site, the areas under floors are cleared of rubbish, the gutters and drains are cleared, the doors and sashes are eased, the locks and fastenings are oiled, all electrical, plumbing and other services are tested and commissioned, the keys are clearly labelled and handed to the Project Manager, so that at the time of Virtual Completion the whole Site and the Work are left fit for immediate occupation and use, to the approval and satisfaction of the Project Manager.

28.6 Should the Contractor fail to comply with the cleaning requirements, whether progressively or before completion, or fail to clear the Site and 20 meter area all around site as directed and required, then the Project Manager, after giving due notice in writing to the Contractor, shall have the right to employ other persons or agencies to carry out the cleaning and/or clearing work and all costs incurred on such work shall be recovered from the Contractor and shall be deducted by the BHEL from any money that may be payable or that may become payable to the Contractor.

29. METHOD OF MEASUREMENT: - WORKS TO BE MEASURED JOINTLY

29.1 The Project Manager shall, except as otherwise stated, ascertain and determine by measurement **carried out jointly with the contractor's authorized representative,** the value of work done in accordance with the contract. He shall, when he requires any part or parts of the works to be measured, give notice to the Contractor's authorized agent or representative who shall forthwith attend or send a qualified agent to make measurements of the work done in the presence of the Project Manager or his

representative and shall furnish all particulars required by the Project Manager for his approval. Should the Contractor not attend or neglect or omit to send such agent or to furnish all particulars required by the Project Manager, the measurements made by the Project Manager or approved by him shall be taken to be the correct measurements of the work. Any measurements made by contractor or the Project manager and approved by the Project manager, if found to be incorrect at a later stage will be corrected subsequently and the contractor shall fully cooperate in doing so with the Project manager.

29.2 For the purpose of measuring such permanent work as is to be measured by record drawings, the Contractor's representative shall prepare record drawings month by month of such work done or as and when called upon to do so by the Project Manager in writing and submit the same to the Project Manager for his approval. Should the Contractor neglect or omit to prepare and submit such record drawings, the Project Manager will have the same prepared himself and they shall be taken to be correct.

29.3 **Method of Measurement:**
Where works have to be measured for any purpose, whatsoever, it shall be in accordance with IS-1200 unless, otherwise, specifically indicated in the contract.

30. COVERING UP:

The Contractor shall give at least 24 hours clear notice in writing to the Project Manager before covering up any of the Work in foundations or any other such areas in order that inspection of the Work may be carried out for maintaining proper quality control. In the event of the Contractor failing to provide such notice he shall, at his own expense, uncover such Work as required to allow the inspection to be taken and thereafter shall reinstate the Work to the satisfaction of the Project Manager.

31. Withholding of payments:

The Project Manager may withhold payment or, on account of subsequently discovered evidence, nullify the whole or a part of any payment certificate to such extent as may be necessary to protect the BHEL from loss on account of including but not limited to the following:

i. Defective work not remedied by the Contractor.
ii. Failure of the Contractor to make payments properly and regularly to his own workers, to his Sub-Contractors, to his suppliers.
iii. Damage by the Contractor to the work of other Contractors, Sub-Contractors or Vendors.
iv. A reasonable doubt that the Contract cannot be completed for the balance unpaid amount.
v. A reasonable doubt that the Contractor intends to leave work items incomplete.
vi. Failure of the Contractor to execute the Work in conformity with the Contract Documents.
vii. Failure of the Contractor to meet or keep-up with the approved Construction Programme.
viii. Failure of the Contractor to comply with and fulfill all contractual obligations and liabilities stipulated in the Contract Documents.

32. PAYMENT TO SUB-CONTRACTOR / VENDOR:

The final payment of the contractor shall be made subject to submitting an indemnity bond on Rs. 100/- stamp papers stated as under:

"We undertake that payment against subject work order have been made in full to all sub-contractors, vendors. In case any claim is lodged by our sub-contractor, vendor, we shall bear the same and cost thereof and shall not hold BHEL or any of its employee responsible".

33. RECTIFICATION OF IMPROPER WORK NOTICED:

If it shall appear to the Project Manager during the progress of the Work that any work has been executed with unsound, imperfect or unskilful workmanship or with materials of any inferior description or that any materials or articles provided by the Contractor for the execution of the Work are unsound or of a quality inferior to that contracted for or otherwise not in accordance with the Contract, the Contractor shall, on demand in writing from the Project Manager specifying the work, materials or articles complained of, notwithstanding that the same may have been passed and certified, forthwith rectify or remove and reconstruct the work so specified in whole, or in part as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own proper charge and cost and in the event of his failing to do so within a period so specified by the Project Manager in his demand aforesaid, the Project Manager may rectify or remove and re-execute the work or remove and replace with others, the materials or articles complained of as the case may be at the risk and expense in all respects of the Contractor, and deduct the expenses from the Retention Money or any sums that may be due at any time thereafter may become due to the Contractor or from his performance bond.

34. PROGRESS MONITORING, MONTHLY REVIEW AND PERFORMANCE EVALUATION:

34.1 A detailed plan / programme for completion of the contractual scope of work as per the time schedule given in the contract shall be jointly agreed between BHEL and Contractor, before commencement of work (Clause No. 2.5.4 of GCC may be referred). The above programme shall be supported by month wise deployment of resources viz Manpower, T&P, Consumables, etc. **The detailed plan/ program for completion of the contractual scope of work shall require to be furnished by the contractor within 15 days from the date of LOA/ Handing over of vacant site whichever is later for approval of BHEL.**

34.2 Progress will be reviewed physically on a periodic basis (Daily/Weekly/Monthly) vis - a - vis this jointly agreed programme. The Contractor shall submit periodical progress reports (Daily/Weekly/Monthly) and other reports/information including manpower, consumables, T&P mobilization etc. as desired by BHEL.

34.3 Progress shall also be reviewed financially on a periodic basis. If at any point of time, the exceedance of contract value is anticipated, the same shall be immediately brought to the notice of BHEL by the contractor. The contractor shall in no case proceed with the work beyond the contract value without written permission from BHEL's Project Manager. The contractor to note that the tendered work is against a capital project and requires approval of competent authority for any exceedance in value as per extant BHEL's policy.

34.4 Monthly progress review between BHEL and Contractor shall be based on the agreed programme as above, availability of inputs/fronts etc, and constraints if any, as per prescribed formats. Manpower, T&P and consumable reports as per prescribed formats shall be submitted by contractor every month. Release of RA Bills shall be contingent upon certification by BHEL Site Engineer of the availability of the above prescribed formats duly filled in and signed.

34.5 The burden of proof that the causes leading to any shortfall is not due to any reasons attributable to the contractor is on the contractor himself. The monthly progress review shall record shortfalls attributable to (i) Contractor, (ii) Force Majeure Conditions, and (iii) BHEL. For recording all sort of hindrances in project execution, a hindrance register should be maintained at site in the prescribed format and to be jointly signed by BHEL as well as contractor whenever such recording is done.

34.6 Performance of the Contractor shall be assessed as per prescribed formats and shall form the basis for 'Annual/Overall Performance Evaluation' of the Contractor and also for 'Assessment of Capacity of Bidder' for Tenders where the Contractor is a bidder. BHEL reserves the right to revise the evaluation formats during the course of execution of the works.

35. EXTRA WORKS/ EXTRA ITEM OF WORKS

35.1 Any work which is not part of the scope of contract but essentially required to be carried out for successful accomplishment of the task envisaged under the contract shall be termed as extra work. This may be an act of simple omission and/or alteration/modification/change as ordered by Project Manager to suit to the requirement. This may or may not necessitate execution of extra item. Extra item is an item which is not provided in the Price Schedule/BOQ.

35.2 The need for execution of extra item may be necessitated also because of omission of relevant item in original price schedule which is considered essential for the completion of task envisaged in the scope of work.

35.3 The need for execution of extra item may be necessitated also because of substitution of an existing item in original price schedule which is considered essential for the completion of task envisaged in the scope of work due to improvement envisaged during execution or non-availability or obsolescence of the item provided in the price schedule. One item of original schedule may require to be substituted by one or more extra items

35.4 In the event of arising of situation as above, the contractor shall immediately bring it to the notice of BHEL in writing. The issue shall be examined by BHEL for its admittance as extra work/extra item of work in the back drop of tender specification & scope of work. BHEL shall inform the contractor regarding admissibility/inadmissibility of the notified extra work/extra item of work within 7 (seven) days from receipt of such notice from the contractor.

35.5 The contractor shall proceed with the execution of such extra work/extra item of work only after written permission from the project manager. The decision of BHEL Project Manager with respect to extra work/extra item of work shall be final and binding on the contractor. The contractor shall not suspend or abandon the work for any reason whatsoever including finalization of rates of extra item and proceed with the work once written order for execution of extra work/ extra item of work is given by the Project Manager.

35.6 The claim of such extra work/extra item of work shall be settled in the manner as mentioned below:

34.6.1 If item for the identical work is already available in the price schedule of the contract, it shall be paid as per the rate awarded for the item and shall not be construed as extra item.

34.6.2 If item is not available in the price schedule of the contract, it will be paid under the head 'extra item'. The rate of the extra items shall be determined as under:

34.6.2.1 **From DSR (Delhi Schedule of Rates) item:** If the extra item is available in DSR, the rate of DSR-16 of the item shall form the basis for derivation of preliminary rate. All input taxes on material shall be taken out for deriving preliminary rate. Over and above the preliminary rate so arrived, % tender excess [plus (+) or minus (-)] shall be applied to arrive at final rate of extra item. For the calculation of tender excess, total value of all DSR items of the price schedule based on DSR -16 rate shall be calculated after due accounting of input tax credit in each DSR item's rate as above and the total value so arrived shall be compared with total value of all DSR items of Price Schedule worked out on the basis of awarded rate.

34.6.2.2 **From similar DSR item with rates of material & labour component as per DSR:** If the rate of the extra item cannot be decided in the manner above, the preliminary rate shall be derived on the basis of DAR (Delhi Analysis of Rates) of similar item available in DSR by substitution of material component in the rate analysis by relevant material component for which rate(s) is/are available elsewhere in DSR-16 with deduction for all input taxes as per 34.5.2.1. Over and above the preliminary rate so arrived, % tender excess [plus (+) or minus (-)] shall be applied to arrive at final rate of extra item.

34.6.2.3 **From similar DSR item with rates of material & labour component as prevalent in the market:** If the rate of the extra item cannot be decided in any of the manners above, the preliminary rate shall be decided on the basis of DAR of similar item available in DSR considering market rate of material (excluding all taxes) including transportation, packing & forwarding, insurance complete (i.e. FOR site rate) & labour rate of various categories prevalent (as notified by the state Government) at the time of start of execution of extra item. Over and above preliminary rate, employer contribution towards PF & ESI @ 16.75% on labour portion shall be added. Over the value so arrived BOCW @ 1% shall be added to arrive at the final rate of extra item.

34.6.2.4 **Extra Item rate derived purely on the basis of market rates with actual consumption of material & labour:** If the rate of extra item cannot be determined in any of the manners specified above then the rate for such item of work shall be determined on the basis of actual consumption of materials, including wastages if any and actual use of labour, as detailed below. For actual consumption of material & labour a joint record shall be maintained at site.

i. Cost of materials excluding all taxes actually incorporated in work including wastages & transportation if any at market rate (FOR site) prevalent at the time of start of execution of extra item.
ii. Cost of labour actually used in the work at the prevailing rates of labour of various categories at work site (as notified by state

Govt.) at the time of start of execution. If the category of labour deployed is different from the categories notified by State Government. The rate as prevalent in the market shall be applied.

iii. 15% of the costs worked out as above at (i) and (ii), towards Contractor's establishment, water & electricity charges, tool & plants, all other incidental costs, overheads & profit to be added to derive preliminary rate.

iv. Over & above preliminary rate employer contribution towards PF & ESI @ 16.75% on labour portion as worked out at (ii) above shall be added. On the value so arrived BOCW@ 1% shall be added to arrive at final rate of extra item.

v. For this purpose, the Contractor shall submit to the Project Manager detailed analysis of the rate proposed by the Contractor supported by relevant vouchers along with the estimated quantity of item of work involved.

Note:

1. For the purpose of consideration of market rate of material component and prevalent rate of labour component, the time of start of execution of extra item shall be reckoned from the date of written permission to the contractor for execution of extra item
2. The contractor shall submit the detailed proposal for approval of extra item as admitted along with proposed rate determined in the manner specified above within a period of 15 days from the date of issue of letter by BHEL with regard to admissibility of extra work/ extra item of work except for items falling under 34.6.2.4. For items under 34.6.2.4, proposal can be submitted upon execution of the item to the extent required for fair assessment of quantities of material & labour.
3. BHEL shall independently verify the market rate of material and labour (for un- notified category by State Government). Rate of extra item shall be analyzed as per rate of material & labour so verified by BHEL. BHEL's decision in this regard shall be final & binding on the contractor.
4. The decision of BHEL Project Manager with respect to extra work/extra item of work shall be final and binding on the contractor.
5. The extra item proposal submitted by the contractor complete in all respect with all supporting documents & clarifications shall be processed within 90 days from the receipt of the same.
6. For derivation of rates of extra item, similar item's rate of price schedule shall not form the basis. Derivation of rates of extra items shall only be done in the manner specified above.

36. NON-TENDERED/EXTRA ITEMS AND QUANTITIES EXCEEDING THE TENDERED QUANTITIES:

The contractor shall immediately and before procurement and execution of the work obtain a written approval of the variation order from the Project Manager for non-tendered /extra items and quantities exceeding the tendered quantities. No payments will be entertained without the Project Manager's written approval of the change / variation order. The onus shall be on the Contractor to obtain such prior written variation order from the Project Manager.

37. COMMENCEMENT OF WORK:

37.1 The contractor shall commence the work as per the time indicated in the Letter of Award from BHEL and shall proceed with the same with due expedition without delay.

37.2 If the contractor fails to start the work within stipulated time as per LOA or as intimated by BHEL, then BHEL at its sole discretion will have the right to cancel the contract. The Earnest Money and/or Security Deposit with BHEL will stand forfeited without any further reference to him without prejudice to any and all of BHEL's other rights and remedies in this regard.

37.3 All the work shall be carried out under the direction and to the satisfaction of BHEL.

37.4 The bidder has to mobilize all resources and commence the work with-in 15 days from the date of award of work or handing over of vacant site whichever is later with due expedition without delay. The responsibility of contractor under this Contract commences from the date of issue of the Letter of Intent.

37.5 The contractor shall submit a detailed implementation/execution schedule using MS Project/ Prima Vera software in hard & soft copy, within 15 days from the date of award of work considering the overall project completion schedule for approval of BHEL. On non-submission of detailed execution schedule the contractor may not be allowed to start the work and delay to this account shall be attributable to the contactor only. This schedule shall be approved by BHEL and the same will form the basis for monitoring the progress of work.

38. TIME OF COMPLETION:

38.1 **Time as the essence of the contract:** The time allowed for carrying out the Work as entered in the tender shall be strictly observed by the Contractor and shall be deemed to be of the essence of the Contract. The Work shall proceed with due diligence until Final Completion. The Contractor shall prepare a Construction Programme with time schedule keeping in view the completion period stipulated for specific portions of the Work and also the overall completion time and submit the same for the approval of the Project Manager. The Contractor shall comply with the time schedule as approved by the Project Manager. In the event of the Contractor failing to comply with the overall and individual milestones contained in the time schedules as applicable, he shall be liable to pay penalty as provided for in this Contract.

38.2 Entire work as detailed in tender specification shall be completed within 15 months (456 days) from the date commencing after the end of the mobilization period as stipulated in LOA including rainy season and intermittent rainy spell if any.

38.3 Milestone wise completion period shall be as per the following schedule:

- **Milestone-1:** Completion of structure work upto Ground level – 180 days from the date of commencement of work.
- **Milestone-2:** Completion of structure work upto 4th floor – 235 days from the date of commencement of work.
- **Milestone-3**: Completion of structure upto 9th floor – 278 days from the date of commencement of work.
- **Milestone-4:** Completion of structure upto 14th floor – 321 days from the date of commencement of work.

- **Milestone-5:** Completion of structure upto terrace level – 364 days from the date of commencement of work.
- **Milestone-6:** Completion of façade work – 456 days from the date of commencement of work.

Also refer Implementation chart in Volume 1F Forms and Procedures.

38.4 The entire work shall be completed by the contractor within this time schedule or within such extended periods of time as may be allowed by BHEL under relevant clause of the tender.

39. EXTENSION OF TIME FOR COMPLETION:

39.1 If the completion of work as detailed in the scope of work gets delayed beyond the contract period, the contractor shall request for an extension of the contract and BHEL at its discretion may extend the Contract.

39.2 Based on the monthly reviews jointly signed, the works balance at the end of original contract period less the backlog attributable to the contractor shall be quantified, and the number of months of 'Time extension' required for completion of the same shall be jointly worked out. Within this period of 'Time extension', the contractor is bound to complete the portion of backlog attributable to the contractor. Any further 'Time extension' or 'Time extensions' at the end of the previous extension shall be worked out similarly.

39.3 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 for the delays attributable to the contractor, in addition to any other actions BHEL may wish to take at the risk and cost of contractor.

39.4 A joint programme shall be drawn for the balance amount of work to be completed during the period of 'Time Extension', along with matching resources (with weightages) to be deployed by the contractor as per specified format. Review of the programme and record of shortfall shall be done every month of the 'Time extension' period in the same manner as is done for the regular contract period.

39.5 During the period of 'Time extension', contractor shall maintain their resources as per mutually agreed program and will not stop the work. Any delay due to stoppage of work shall be attributable to the contractor.

39.6 At the end of total work completion as certified by BHEL Project Manager, and upon analysis of the total delay, the portion of time extensions attributable to (i) Contractor, (ii) Force majeure conditions, and (iii) BHEL, shall be worked out and shall be considered to be exhausted in the same order. The total period of time extensions shall be the sum of (i), (ii) and (iii) above and shall be equal to period between the scheduled date of completion and the actual date of completion of contract. Penalty shall be imposed/levied for the portion of time extensions attributable to contractor and recoverable from the dues payable to the contractor.

39.7 **Causes of delay for which claims for extension of time may be considered;** The Contractor shall be entitled to claim for extension of time,

subject to the Conditions herein, should he be delayed or impeded in the execution of the Work by reason of the following:

i. Force Majeure as defined in the contract.

ii. Delay in the receipt of 'construction status' drawings from the Architect provided that, in the opinion of the Project Manager, the Contractor has made every effort and endeavor to minimize the effect of such delays.

iii. Any change orders directed by the Project Manager, which in the opinion of the Project Manager entail the requirement of additional time for completion of the Work.

39.8 **Extension of Time** - In respect of conditions mentioned above, the Contractor shall submit in writing to the Project Manager his intention to claim for an extension of time within seven (7) working days of any of the above mentioned reasons or events causing a delay. Any claim of extension of time in respect of item (iii) shall be notified by the Contractor before such change order is actually issued. The Contractor shall thereafter detail and submit his claim for the extension of time within fourteen (14) working days of such delay having occurred. If the Contractor does not comply with both these conditions for each and every delay caused by any of the above-mentioned reasons or events, then he shall not be entitled to any extension of time.

39.9 **Claim of Extension of Time -** The Project Manager shall study and verify the particulars of the claim for extension of time submitted by the Contractor and shall then reject or amend or accept the claim. He will extend the time by notifying the Contractor in writing for completion of the Work by such period as he shall think adequate with the prior approval and the time for completion of the Work so extended shall for all purposes of the Contract be deemed the time specified for completion of the Work. The decision of the Project Manager in this regard shall be final and binding on the Contractor. No extension of time shall be granted separately for any concurrent or parallel activities, and only a delay, caused by any of the above-mentioned reasons or events, in a critical activity, which has a direct effect on the overall completion of the Work, shall form a basis for granting extension of time.

39.10 **Deletion or changes in the scope of work -** Should any deletions or changes in the scope of the Work reduce the time required to complete the Work under the Contract, then the time savings accruing from such deletions may be considered by the Project Manager in offsetting the durations awarded for an extension of time.

40. QUANTITY VARIATION:

40.1 The quantities given in the contract are tentative and may change to any extent (both in plus side and minus side) limited to ±15 % of the awarded contract value. The quoted rates for individual items shall remain firm irrespective of any variations in the individual quantities. No compensation becomes payable in case the variation of the final executed contract value is within the limits of Minus (-) 15% of awarded contract value.

40.2 Compensation due to variation of final executed value in excess of the limits defined in clause above, shall be as follows:

- In case the finally executed contract value reduces below the lower limit of awarded Contract Value due to quantity variation specified above, the contractor will be eligible for compensation @ 15% of the difference

between the lower limit of the awarded contract value and the actual executed contract value.

- In case the finally executed contract value increases above the awarded Contract Value due to quantity variation, there will be no upward revision in the rates for the individual items and also contractor is not eligible for any compensation.

41. PENALTY:

41.1 The total work under scope is to be completed within the completion time mentioned under clause no. 38 of special conditions of the contract. Required clearances, approvals, drawings, materials and other inputs in the scope of BHEL shall be made available to the contractor in time matching with the approved execution/ implementation schedule. The contractor is required to ensure completion of each milestone mentioned under the contractual completion schedule within the period indicated against them. Delay in completion of the individual milestone that may take place beyond contractual schedule OR any extension thereof for the reasons attributable to the contractor shall be subject to imposition of penalty at the rate of 0.5 % of the total value of work covered under the milestone (as per awarded rates) for every week of delay or part thereof subject to maximum ceiling of 10% (for all milestones combined together) of the total contract value.

41.2 However, the penalty so recovered from RA Bills shall be released with the final bill on prorate basis for the makeup of delay in the overall completion schedule as per contract.

42. PAYMENTS:

Monthly running bills will be paid against actual execution of work and submission of the bills by the contractor. Payment of each running bill will be limited to 95% and balance 5% of each running bill amount will be retained by BHEL as retention amount. The running bill of the contractor will be processed & payment shall be released within 15 days from the date of submission of the bill complete in all respects with all required documents enclosed as per contract.

The processing of bill shall also require signing of measurement books by the contractor when called for to do so. In the event of delay in signing of MB by the contractor the processing of bill may get delayed, BHEL shall not be responsible for any delay in release of payment on account of this.

The date of submission of bill complete in all respect shall be reckoned from the date of submission of the last required document/ clarifications pertaining to the bill by the contractor. No interest shall be payable on any amount due to the contractor including EMD & SD.

Payments to Contractors are made in any one of the following forms

42.1 Running Account Bills (RA Bills)

i) These are for interim payments when the contracts are in progress. The bills for such interim payments are to be prepared by Contractor in prescribed formats (RA Bill forms).

ii) Payments shall be made according to the extent of work done as per measurements taken up to the end of the calendar month and in line with the terms of payments described in the Tender documents

iii) Recoveries on account of electricity, water, statutory deductions, etc are made as per terms of contract

iv) Full rates for the work done shall be allowed only if the quantum of work has been done as per the specifications stipulated in the contract. If the work is not executed as per the stipulated specifications, BHEL may ask the contractor to re do the work according to the required specifications, without any extra cost. However, where this is not considered necessary 'OR' where the part work is done due to factors like non-availability of fronts 'OR' non availability of drawings, fraction payment against full rate, as is considered reasonable, may be allowed with due regard for the work remaining to be done. BHEL decision in this regard will be final and binding on the contractor.

v) In order to facilitate part payment, Project Manager at his discretion may further split the contracted rates/percentages to suit site conditions, cash flow requirements according to the progress of work

vi) Following documents are required to be submitted by the contractor for payments:
(i) Invoice – original+3 copies ii) Running Account Bill (RAB) signed by Contractor. Original + 3 copies iii) GST paid challan for Previous RAB: 4 Copies iv) ESI/ EPF/ Proof of Wages Paid (as applicable): 4 Copies v) Bank Guarantee (for Security Deposit), if opted by contractor: Original + 3 Copies, along with Measurement Book (MB) jointly signed by BHEL Engineer and Contractor.

42.2 Final Bill

Final Bill' is used for final payment on closing of Running Account for works or for single payment after completion of works. 'Final Bill' shall be submitted as per prescribed format after completion of works as per scope and upon material reconciliation, along with the following:

i) 'No Claim Certificate' by contractor

ii) Clearance certificates where ever applicable, various Statutory Authorities like Labor department, PF Authorities, Commercial Tax Department, etc.

iii) Indemnity bond as per prescribed format

BHEL shall settle the final bills after deducting all liabilities of Contractor to BHEL. The payment against final bill shall be released within 60 days from the receipt of bill with complete documentation, clarifications & formalities required as per contract.

43. RETENTION AMOUNT:

Retention amount shall be 5% of executed contract value and shall be recovered at the rate of 5% from each running bill admitted. Refund of Retention Amount shall be as follows: -

1. 50% of retention amount along with the final bill.
2. Balance 50% of retention amount shall be retained towards 'Performance Guarantee for Workmanship' and shall become refundable after expiry of Guarantee period, provided all the defects noticed during the guarantee period have been rectified to the satisfaction of BHEL Project Manager, and after deducting all expenses/ other amounts due to BHEL under the

contract/other contracts entered into by BHEL with them. This portion of the retention amount can be released on commencement of the Guarantee period, on submission of equivalent bank guarantee.

44. PERFORMANCE GUARANTEE FOR WORKMANSHIP:

44.1 Even though the work will be carried out under the supervision of Project Manager 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 Defects Liability period**, 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 Project Manager, BHEL may proceed to undertake the repairs of such defective works at the Contractor's risk and cost, without prejudice to any other rights and recover the same from the Guarantee money.

44.2 The Defects Liability Period shall commence from the date of issue of Virtual Completion Certificate by the Project Manager.

44.3 BHEL shall release the guarantee money subject to the following

i) Contractor has submitted 'Final Bill'
ii) Guarantee period as per contract has expired
iii) Contractor has furnished 'No Claim Certificate' in specified format
iv) BHEL Project Manager has furnished the 'No Demand Certificate' in specified format
v) Contractor has carried out the works required to be carried out by him during the period of Guarantee and all expenses incurred by BHEL on carrying out such works is included for adjustment from the Guarantee money refundable.

45. DEDUCTIONS FOR WORK NOT DONE AS PER SPECIFICATIONS:

45.1 If the Project Manager deems it inexpedient to get corrected or rectified any work of the Contractor which is defective or damaged or of substandard quality or is generally not in accordance with the Contract Documents, then an equitable and appropriate deduction shall be made thereof from the Contract Price, and the Project Manager's decision in this respect shall be final and binding on the Contractor.

45.2 Furthermore if, by reason of any accident, or failure, or other event occurring to, in or in connection with the Work, or any part thereof, either during the execution of the Work or during the Defects Liability Period, any remedial or other work or repair shall, in the opinion of the Project Manager, be urgently necessary for the safety of the Work, or any part thereof, and the Contractor is unable or unwilling to immediately and at once do such work or repair, the Project Manager may employ and pay other persons or agencies to carry out such work or repair as the Project Manager may consider necessary. If the work or repair so done by other persons or agencies is work which, in the opinion of the Project Manager, the Contractor was liable to do at his own expense under the Contract, then all expenses incurred by the BHEL in connection with such work or repair shall be recovered from the Contractor and shall be deducted by the BHEL from any money that may be payable or that may become payable to the Contractor or from the Contractor's performance bond.

45.3 The defective or uncorrected work of the Contractor at any stage (during or after completion of work) may adversely affect or damage the work of other Vendors. Contractor shall at his own cost immediately rectify, correct or replace both his defective work as well as the work of the other Vendors so damaged, with in the time period stipulated by the Project Manager, so as not to effect the progress and quality of other Vendor's work. In case the Contractor fails to do the necessary corrections to the satisfaction of Project Manager or unduly delays the correction work, then the Project Manager shall be at liberty to get the correction work done and if the correction work is not possible, then any extra work necessary to cover the defect or damage, done through same / any other Vendor at Contractor's cost.

Actual costs including any incidentals thereof incurred by the BHEL on such corrections / extra works shall be recovered from the payments or any amounts due to the Contractor.

46. NO FINANCIAL OR OTHER COMPENSATION FOR DELAYS:

The Contractor shall not be entitled to any compensation for any loss suffered by him on account of delays in commencing or in executing or in completing the Work, whatever might be the cause of the delay.

47. SUFFICIENCY OF TENDER:

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the Works and of the rates and prices stated in the priced bill of quantities and the schedule of rates and prices, if any. The tender rates and prices shall cover all his obligations under the Contract and all matters and things necessary, for the proper completion and maintenance of the Work.

48. PROPRIETY & OCCUPATION OF EXECUTED WORK:

All executed work, whether in part or in whole shall be the exclusive property of the BHEL. The Contractor or any of his Sub-Contractors or their employees or workmen or servants or agents shall not be entitled to the use of any such work except for the purpose of carrying out subsequent work that is required to be carried out under the Contract or to complete the Project. The BHEL shall have the right to occupy and take over the Work or any part thereof at any time during the progress of the Work or upon their completion, irrespective of any pending claims or disputes that the Contractor may have against the BHEL. Such occupation shall not relieve the Contractor of any of its obligations under the Contract.

49. INDEMNITY:

49.1 The Contractor shall indemnify, defend and hold and keep indemnified, the BHEL, including their employees, officers, representatives, servants, agents, suppliers, vendors and any other persons claiming through or under them from and against all actions, suits, claims costs, liabilities and demands brought or made against the BHEL in respect of:

i) any matter or thing done or omitted to be done by the Contractor or any of his Sub-Contractor(s) or their employees, workmen, representatives, agents, servants or suppliers in the execution of or in connection with the Work; or

ii) any matter or thing done or omitted to be done by the Contractor or any of his Sub-Contractor's about performance under this Contract; or

iii) against any loss or damage to the BHEL in consequence of any action or suit being brought against the Contractor or any of his Sub-Contractor(s) or their employees, workmen, representatives, agents, servants or suppliers for anything done or omitted to be done in execution of the Work and the Project Coordination Services under this Contract; including but not limited to a) meeting the Project milestones, b) non-compliance with the applicable laws and regulations of the government and local authorities, c) not obtaining the relevant licenses and permits, d) infringing any patents rights specifically regarding use, storage and disposal of hazardous materials. The obligations of the Contractor under this clause shall survive the termination or expiry of this Contract.

49.2 The Contractor shall ensure that the Sub-Contractors indemnify, defend and hold, and keep indemnified the BHEL, including their employees, officers, representatives, servants, agents, suppliers, vendors and any other persons claiming through or under them harmless from all actions, suits, claims, costs, fines, judgements and liabilities in respect of:

a) any matter or thing done or omitted to be done by the Sub-Contractors or their employees, workmen, representatives, agents, servants and suppliers in execution of or in connection with the Work; or

b) any matter or thing done or omitted to be done by the Sub-Contractors or their employees, workmen, representatives, agents, servants and suppliers arising out of or in any way alleged to be in connection with Sub-Contractors' performance under this Contract; including but not limited to a) not meeting the Project milestones, b) non-compliance with the applicable laws and regulations of the government and local authorities, c) not obtaining the relevant licenses and permits, d) infringing any patents rights and specifically regarding the storage, use or disposal by the Sub-Contractors of hazardous materials in, on or under the Site or at any location whatsoever in connection with the Project in any way.

The Sub-Contractors' responsibility under this indemnification shall also include any and all hazardous materials introduced to the Site by their agents, representatives, employees, workmen, servants and suppliers. The obligations of Sub-Contractors under this clause survive the termination or expiry of this Contract.

50. RECTIFICATION OF WORK BEFORE VIRTUAL COMPLETION OF WORKS:

The Project Manager shall conduct an extensive inspection just prior to the Virtual Completion of the Work and shall prepare a list of materials, equipment, and workmanship which are defective or damaged or of substandard quality or improperly executed or generally unacceptable due to not being in conformity with the requirements stipulated in the Contract Documents. The Contractor to the satisfaction of the Project Manager shall promptly remove, replace, re-execute, rectify and make good, to conform to the requirements stipulated in the Contract Documents, all such materials, equipment, and/or workmanship included or itemized in the said list and the Contractor shall bear and pay for all expenses in connection therewith and consequent thereon and incidental thereto, including the cost for all remedial work on the work of other contractors destroyed or damaged by such removal, replacement, re-execution, rectification and making good. If the Contractor fails to remove, replace, re-execute, rectify and make good the rejected materials, equipment, and/or workmanship within a reasonable time, fixed by written notice,

the BHEL may employ and pay other persons or agencies to carry out such removal, replacement, re-execution, rectification and making good and all expenses incurred in connection therewith, including all damages, losses and expenses consequent thereon and incidental thereto shall be recovered from the Contractor and shall be deducted by the BHEL from any money that may be payable or that may become payable to the Contractor. It is clarified that all materials shall be procured by the Contractor at his own cost for construction of work.

51. VIRTUAL COMPLETION OF WORKS:

51.1 The Works shall be considered as Virtually Complete only upon fulfillment of the procedure laid down in contract, and only after the Work has been completed in every respect in conformity with the Contract Documents and after all the systems and services have been tested and commissioned, and after the Site has been cleared and the Work cleaned in accordance with contract and when the Project Manager has certified in writing that the Work is Virtually Complete. **The Defects Liability Period shall commence from the date of such Certificate of Virtual Completion.**

51.2 Should, before Virtual Completion, the BHEL decide to occupy any portion of the Work or use any part of any equipment, the same shall not constitute an acceptance of any part of the Work or of any equipment, unless so stated in writing by the Project Manager.

51.3 **Prior to the issue of the Virtual Completion Certificate, the Contractor shall submit and hand-over to the BHEL the keys to all locks, all operation and maintenance manuals for systems and services, material reconciliation statements, warrantees, as built drawings, any spares called for in the Contract,** and everything else necessary for the proper use and maintenance of the Work complete with all systems and services.

52. GUARANTEES:

The Contractor understands and agrees that the BHEL is expressly relying and will continue to rely on the skill and judgment of the Contractor in executing the Work and remedying any defects in the Work. The Contract represents and warrants that:

i. The Contractor shall perform the Work in a timely manner, in strict accordance with the Contract Documents, and consistent with generally accepted professional, construction and construction-supervision practices and standards provided by an experienced and competent professional contractor and construction supervisor rendered under the same or similar circumstances.

ii. The Contractor is and will be responsible to the BHEL for the acts and omissions of all Sub-Contractors and their respective employees, agents and invitees and all the persons performing any of the Work.

Besides the guarantees required and specified elsewhere in the Contract Documents, the Contractor shall in general guarantee all work executed by the Contractor and the Sub-Contractors for Defects Liability Period from the date of issue of the Virtual Completion Certificate. Those parts of the Work or equipment or installations, for which extended guarantee periods are stipulated elsewhere in the Contract Documents, shall be guaranteed for such periods that are so stipulated. The duration of the Defects Liability Period, unless specified otherwise, shall be the extent of length of such guarantee periods.

The Contractor represents, warrants and guarantees to the BHEL, inter alias that:

i. The construction of the Project shall be approved and capable of use, operation, performance and maintenance for accomplishing the purpose for which it has been built and acquired.
ii. The Work shall comply with the Specifications, Drawings, and other Contract Documents.
iii. The Work shall, for Defect Liability Period from the date of issue of the Virtual Completion Certificate, be free from all defects and the Project shall be of structural soundness, durability, ease of maintenance, weather tightness etc.
iv. The materials, workmanship, fabrication and construction shall be of the specified and agreed quality and all materials shall be new.
v. The Work performed for the BHEL shall be free from all liens, charges, claims of whatsoever nature from any party other than the BHEL.

Where, during such guarantee periods as mentioned above, any material or equipment or workmanship or generally any item of work fails to comply or perform in conformity with the requirements stipulated in the Contract Documents or in accordance with the criteria and provisions of the guarantee, the Contractor shall be responsible for and shall bear and pay all costs and expenses for replacing and/or rectifying and making good such materials, equipment, workmanship, and items of work and, in addition, the Contractor shall be also responsible for and shall bear and pay all costs and expenses in connection with any damages and/or losses suffered as a consequence of such failure.

All guarantees required under the Contract shall be in the format approved by the Project Manager and submitted to the Project Manager by the Contractor when requesting certification of the final bill.

53. DEFECTS LIABILITY:

The Defect Liability Period shall be 12 months from the date of issue of Virtual Completion Certificate by the Project Manager as mentioned in the Contract.

53.1 **Maintenance by contractor during defects liability period:** All defective items of work and defects noticed and brought to the attention of the Contractor during the Defects Liability Period shall be promptly and expeditiously attended to and replaced and/or rectified and made good by the Contractor at his own cost, to the complete satisfaction of the BHEL.

53.2 **Replacement and/or rectification and making good by contractors of all defective materials, equipment and/or workmanship during defects liability period:**

The Contractor shall replace and/or rectify and make good, at his own cost, and to the satisfaction of the BHEL, all defective items of work and defects arising, in the opinion of the Project Manager, from materials, equipment, and/or workmanship not performing or being in accordance with the Drawings or Specifications or the instructions of the Project Manager or other Contract Documents or the best engineering and construction practices, and which may appear or come to notice within Defects Liability Period after Virtual Completion of the Work. **Any item, material or matter repaired or replaced shall receive a new Defects Liability Period of like duration beginning from the date of the repaired or replaced item, material or matter is returned for use to the BHEL, provided that the aggregate guarantee period shall not exceed 24 months.** The Contractor shall be also liable for all costs associated with damages and/or

losses which are a consequence of such defective items of work and defects, and such costs shall be recouped by Project Manager from the Contractor and shall be recovered from the Retention Money held and/or from the Contractor's final bill (if the final bill has not been certified and paid for at the time), or the same would otherwise be recovered from the Contractor.

It is clarified that all materials shall be procured by the contractor at his own cost for carrying out work. No charges shall be paid on this account.

On failure of the contractor to rectify, correct or replace the defective works or on undue delay on part of the contractor for the same, the Project Manager shall be at liberty to undertake the correction works by itself of through any Vendor at the Contractor's cost. All such costs including any incidentals thereof incurred by the Project Manager shall be recovered from the Contractor's payments or from any amounts due to the Contractor.

Taking over of the works prior to completion of the Defects Liability Period by the Project Manager, shall not discharge the contractor of his responsibilities for the balance Defects Liability Period and the Defects Liability Period shall remain in force till completion of Defects Liability Period as mentioned in the contract.

On removal of all the defects, handing over to the Project Manager and successful completion of the Defects Liability Period by the Contractor, the Project Manager shall take over and issue the Final Completion Certificate to the contractor and the Defects Liability Period shall deemed to be complete.

53.3 **Response Time for attending complaints during defect liability period:** Response time shall be within 15 days from the notice given to the contractor by BHEL regarding defect observed during defect liability period. For every day delay beyond 15 days in mobilizing the resources for attending the complain/issues shall attract penalty of Rs. 2000 per day which shall be adjusted from any amount due to the contractor available with BHEL including retention amount.

53.4 **Final completion of the work:**
The Work shall be considered as finally complete at the end of the Defects Liability Period subject to the Contractor having replaced and/or rectified and made good all the defective items of work and defects and hand over the building in accordance with clause above, to the satisfaction of the Project Manager, and provided that the Contractor has performed all his obligations and fulfilled all his liabilities under the Contract, and when the Project Manager has certified in writing that the work are finally complete.

54. INTELLECTUAL PROPERTY RIGHTS:

54.1 It is hereby acknowledged and agreed that the BHEL has commissioned the Work in connection with the Project and accordingly BHELship of all intellectual property rights, including but not limited to property rights in the design and in all Drawings, Specifications and documents prepared by the Architects, the Contractor and any Sub-Contractors or Vendors belongs and

shall be assigned solely to the BHEL who shall be entitled to deal with the designs, Drawings, Specifications and documents in whole or in part, in any manner in the BHEL's sole discretion, directly or through the Project Manager. The Contractor hereby disclaims any right whatsoever on these intellectual property rights in which cases the BHEL shall be duly informed in that regard. This intellectual property right entitlement shall extend to any maintenance, repair and renewal, reinstatement and enlargement of the Project. The Contractor shall ensure that any provisions of this type necessary to protect the intellectual property rights of the BHEL are included in all its contracts with Sub-Contractors.

54.2 All communications, whether written or oral, including but not limited to this Contract, its Annexures, Drawings, data sheets, Specifications, bills of material, sketches, calculations, designs and all other materials shall be treated as confidential and shall be the exclusive property of the BHEL unless otherwise agreed in writing and must be given to the BHEL upon request, but in any event all such materials shall be delivered to the BHEL upon termination/expiry of this Contract.

54.3 The Contractor agrees that it and its employees, agents, Sub- Contractors and consultants shall not (without the prior written consent of the BHEL) during the term of this Contract or thereafter, disclose, make commercial or other use of, give or sell to any person, firm or corporation, any information received directly or indirectly from the BHEL or acquired or developed in the course of the Work, Project or this Contract, including by way of example only, ideas, inventions, methods, designs, formulae, systems, improvements, prices, discounts, business affairs, trade secrets, products, product specifications, manufacturing processes, data and know-how and technical information of any kind whatsoever unless such information has been publicly disclosed by authorized officials of the BHEL. The Contractor agrees that prior to assigning any employee or agent or hiring any Sub - Contractor or consultant to work on this Project, such employee, agent, Sub-Contractor or consultant shall be required to execute a document containing in substance and form, a confidentiality provision similar to this provision.

54.4 The Contractor shall not, without the Project Manager’s prior consent:

i. Take any photographs or videos of the Project (or any part thereof) for use otherwise than in connection with carrying out and completion of the Project;
ii. Write for publication, or cause, information or comment or pictures about the Project;
iii. Supply to any third person such as actual and prospective clients, contractors, publishers, other interested parties and the like, the designs and any articles or information relating to the Project; and
iv. Give interviews to the press including television, radio print and the like regarding the Project or the Contractor’s involvement in the Work.

54.5 Notwithstanding the foregoing, this provision shall not limit the obligation of the Contractor to take photographs and/or videos on a regular basis for the purpose of providing the progress reports required by this Contract.

54.6 The Contractor, Sub-Contractors and their respective employees, representatives, agents, servants, workmen and suppliers shall not, during or after the termination/expiry of this Contract, disclose any information

pertaining to this Contract or the Project to any person without the prior written consent of the BHEL except when called upon to do so by a valid and lawful direction or order of a statutory or Government authority or an order of a court of law or where any of the parties require production of this document and related information for establishing their respective legal rights.

55. GOVERNING LAW:

The governing law of the Contract shall be Indian law.

56. STANDARDS OF CONDUCT:

56.1 The Contractor, in performing its obligations under this Contract, shall establish and maintain appropriate business standards, procedures and control, including those necessary to avoid any real or apparent impropriety or adverse impact on the interests of the BHEL. The BHEL will in no event reimburse the Contractor for any costs incurred for purposes inconsistent with such policies.

56.2 Compliance with Laws, Rules and Regulations:

Contractor represents, warrants, certificates and covenants that in connection with performance under this contract that:

i. It shall, and the Work to be provided hereunder shall, comply with all applicable Local, National, and Central Laws, rules and regulations, including but not limited to those governing building constructions, environmental, safety of persons and property, ESI, workmen compensation, PF and applicable industrial/labour laws, and land development laws, rules and regulations.

ii. No services provided hereunder will be produced using forced, indentured or convict labour or using the labour of persons in violation of the minimum working age law in the country where the Work are rendered;

iii. It shall comply with all laws regarding improper or illegal payments, gifts or gratuities; and Contractor agrees not to pay, promise to pay or authorize the payment of any money or anything of value, directly or indirectly, to any person or entity for the purpose of illegally or improperly inducing a decision or obtaining or retaining business or any advantage in connection with this Contract;

iv. It has not paid or provided and shall not pay, any gratuity for the benefit of any agent, representative or employee of the BHEL other than in accordance with the BHEL's applicable policies; and

v. It has not, and shall not, engage in any sharing or exchange of prices, costs or other competitive information or take any other collusive conduct with any third party supplier or bidder in connection with the preparation or submission of any bid or proposal to the BHEL or the negotiation of this Contract.

vi. It will also comply with all rules and regulations of the BHEL which may be in effect at the Facility site regarding employment, passes, badges, smoking, fire prevention, safety and conduct or property. On behalf of the BHEL, Contractor shall request and monitor that such is observed by any Contractor, subcontractors, vendors and each of their employees.

57. TECHNICAL AUDIT BY THIRD PARTY:

The Contractor represents that all Documents, including invoice, vouchers, and financials to settlements, billings and other reports submitted or to be submitted by the Contractor to the BHEL in support of an application payment are true, correct, complete and accurate in all respects. Upon request of the BHEL, the Contractor agrees to cooperate fully with the BHEL in the conduct of a billing and technical audit by an independent agency of the billings by the Contractor for the Work.

The Contractor accepts that the contract / work shall be subject to the technical audit by an independent technical auditor appointed by the BHEL to audit the quality and quantities of the works done by the contractor, and agrees to render all necessary assistance to such agencies / professionals, whose reports / assessments shall be final and binding. Contractor shall fulfill the requirements as per the auditor's assessments at his own cost with in the time stipulated by the Project Manager.

58. CHANGES IN CONTRACTOR'S CONSTITUTION:

58.1 Where the contractor is a Partnership, prior approval in writing shall be obtained from the Project Manager before any change is made in the Constitution of the partnership.

58.2 Where the Contractor is an individual or a Hindu Undivided Family business, such written approval from the Project Manager shall likewise be obtained before Contractor enters into any partnership agreement in which the partnership would have the right to carry out the work previously to be undertaken by the Contractor.

58.3 If such written prior approval is not obtained by the Contractor, the contract shall be deemed to have been assigned in the contravention of contract and same action taken and consequences ensue, as provided for in the Contract.

59. GROUNDS FOR WITHHOLDING PAYMENTS:

The BHEL may withhold the whole or part of any compensation due to the Contractor to the extent necessary to protect the BHEL from any loss on account of any breach of Contractor's obligations under the Contract. When the cause for withholding is rectified, such amounts then due and owing shall be paid or credited to the Contractor.

60. ACCOUNTS AND AUDIT:

The Contractor agrees to maintain true and accurate financial statements and books of accounts, recording all income and expenditure in relation to the Project ("Books of Accounts"). The Books of Accounts shall, at all times, be maintained at the Site or at the office of the Contractor. The Contractor agrees that the BHEL, shall have the right to conduct (or cause to be conducted) an independent audit of the Books of Accounts at any time during the subsistence of the Contract. **Additionally, the Contractor agrees that the Books of Accounts shall be maintained for 36 months subsequent to the expiry/termination of the Contract.**

61. CONTRACT SIGNING:

61.1 **LETTER OF INTENT/ WORK ORDER**

After scrutiny, negotiations and discussions, the BHEL shall issue a Letter of Intent to a selected contractor out of the tenderers, intimating to him the intent/ decision of the BHEL to award the work contract to him.

61.2 **CONTRACT AGREEMENT**

The successful Tenderer shall enter into agreement with the BHEL on non-judicial stamp paper of appropriate value as per 'Articles of Agreement' enclosed in the tender document with such modifications as may be necessary, within 10 days of intimation. Expenses for the agreement including cost of stamp papers etc. shall be borne by the contractor. In case of delay, the Earnest Money Deposit (EMD) may be forfeited and the Tender cancelled or the contract enforced as per terms of the Tender and the Tenderer shall thus be bound even though the formal agreement has not been executed and signed by the Tender.

62. PROJECT MANAGER/ ARCHITECT'S INSTRUCTIONS:

62.1 Project Manager may, at his absolute discretion and from time to time, issue further drawings and/ or verbal/ written instructions, details, directions, & explanations, which are hereafter collectively referred to "Protect Manager's Instructions" in regard to:

i. Variation or modification of the design, quality or quantity of works or the addition or omission or substitution of any work.
ii. Any discrepancy in the drawings or between the Schedule of Quantities and/or drawings and/or Specifications.
iii. Removal from the site of any materials brought therein by Contractor and the substitution of any other material therefore.
iv. Removal and/or re-execution of any work executed by Contractor.
v. Dismissal from the works of any persons employed therein.
vi. Opening up for inspection of any work covered up.
vii. Amending and making good of any defects.

62.2 Contractor shall forthwith comply with and duly execute any work comprised in such "Project Manager's Instructions" provided always that verbal instructions, directions and explanations given to contractor or his representative upon the works by Project Manager shall, if involving a variation, be confirmed in writing by the contractor from the Project Manager within seven days.

62.3 The Contractor shall maintain a Site instruction file at the Site office. All instructions received from the Project Manager relating to the Work shall be retained in the file.

63. DRAWINGS

Drawings forming part of the Contract are listed in Annexure B. Further supplementary Drawings furnished by the Project Manager from time to time shall also be deemed to form part of the Contract.

63.1 **WORKING DRAWINGS:**

Three copies of Working Architectural/ Structural drawings marked 'Good for Construction' and duly signed by the Architect / Consultants shall be issued by the Project Manager from time to time during the contract period, based on which the contractor shall prepare 'Shop drawings', 'Bar Bending Schedules', etc. as required for approval of the Project Manager and proceed with construction work. Working drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the direction of the Project Manager and with the prior approval of the Project Manager.

i. Architectural drawings shall take precedence over Structural drawings, which in turn shall take precedence over services drawings in regard to all dimensions.

ii. The Contractor shall verify all dimensions at the Site and bring to the notice of the Project Manager discrepancies if any, the Project Manager's decision in this respect shall be final.

63.2 **REFERENCE DRAWINGS:**

The Contractor shall maintain on site one set of all Drawings issued to him for reference.

63.3 **SHOP DRAWINGS:**

The Contractor shall prepare and submit, during the currency of the project, to the Project Manager four (4) hard copies and one soft copy of all shop drawings for approval of the BHEL. Shop drawings shall be submitted generally for the following:

i. Construction and installation details for shuttering and formworks
ii. Structural Steelwork, especially joint details.
iii. For specific areas requiring detailing as called for by the Project Manager.
iv. Manufacturer's and/or Contractor's fabrication drawings for equipment supplied by Contractor.

a) Shop drawings shall be submitted for approval sufficiently in advance of planned delivery and installation of any materials to allow Architect/Consultant ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved programme.

b) **Manufacturer's drawings, catalogues, pamphlets, equipment characteristics data, performance charts and other documents submitted for approval shall be in four sets.** Each item in each set shall be properly labeled, indicating the specific services for which material or equipment is to be used, giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.

c) Samples of all finishing materials like Tiles (vitrified and ceramic), Indian marble & granite, paints, door shutters, door locks & other hardware etc. other than materials so specified shall be submitted to the Project Manager prior to procurement. These will be submitted in triplicate for approval and retention by Project Manager and shall be kept in their site office for reference and verification till the completion of the Project.

d) Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contractor.

e) Where the contractor proposes to use an item of equipment, other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundation, piping, wiring or any other part of the mechanical, electrical or architectural layouts; he shall inform the Project Manager well in advance and no delays resulting from such re-design shall be admissible. He shall also submit all related information as may be required for such redesign to the Project Manager.

f) Where the work of the contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Project Manager, the contractor shall prepare composite working drawings and sections at a suitable scale not less than 1:50, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make all the necessary changes without extra cost to the BHEL.

g) Within four weeks of approval of all the relevant shop drawings, the contractor shall submit four copies of a comprehensive variation in quantity statement, and itemized price list of recommended (by manufacturers) imported and local spare parts and tools covering all equipment and materials in this contract.

63.4 **COMPLETION/ AS BUILT DRAWINGS**

a. Contractor shall maintain adequate records of all changes to the works and shall issue the same from time to time as required by the Project Manager. Contractor shall prepare accurate and complete “As built drawings” of the work as constructed. Such drawings shall include all concealed construction, field changes, and other details not indicated in initial contract drawings.

b. On completion of the Work, the Contractor shall submit one (1) Reproducible/ soft copy and two (2) Prints of the site produced drawings and marked "AS BUILT" drawings verified and approved by the Architect to the Project Manager. These drawings shall include and show all the changes / deviations made from the working drawings during the course of construction and also the other details as called for by the Project Manager. During the execution of the Works a set of drawings shall be retained in the Contractor’s Site Offices for the exclusive purpose of recording changes made to the Work as the construction proceeds. The drawings shall be prepared on computer through AutoCAD Software and provided to the Project Manager on CD.

c. Final payment to contractor shall depend in part upon receipt and approval of all necessary “As built drawings”.

d. Contractor is deemed to have included for the cost of production of “As built drawings” in his Tender.

64. QUALITY ASSURANCE AND CONTROL PROGRAMME:

The Contractor shall establish an effective quality control system at the Site and implement the same through an independent team consisting of the Contractor’s Representative and qualified and experienced engineers and technical personnel to enforce quality control on all items of the Work and the Project at all stages.
The contractor shall submit field quality program(FQP) within 15 days of Award of work to project manager for his approval.

65. REPORTS & CHECKLISTS BY CONTRACTOR:

Within 15 days of award of contract the contractor shall submit the draft formats for various reports and Checklists for the approval of the Project Manager. During progress of the Work the Contractor shall prepare and submit to the Project Manager various

checklists, for having checked various Works at different stages of progress and reports as per the approved formats and at specified frequency.

The Contractor shall file daily category-wise labour return. The report shall indicate scheduled requirement against actual strength.

The Contractor shall prepare weekly reports of planned and actual progress of the Work and the subsequent week's scheduled Work. These will also include material procurement status.

These reports shall be submitted to Project Manager and shall be reviewed in weekly co-ordination meeting.

The Contractor shall submit monthly progress report along with monthly bills.

Further progress charts and schedules shall be prepared by the Contractor as directed by the Project Manager.

Contractor shall submit a safety procedure manual or Company policy on safety. Complying with the SHE Plan and outlining its implementation by the Contractor and including:

i. Quality Assurance and Control System (Sample format).
ii. Realistic construction programme/schedule.

Contractor shall maintain and make available all the records pertaining to reports, returns and checklist to the Project Manager during audits (internal as well as external) and make necessary corrections, additions and actions based upon the findings / observations of the audits.

66. INSPECTION AND TESTING OF MATERIALS:

66.1 The Contractor shall, if so required, produce manufacturers' test certificates for any particular batch of materials supplied by him. The tests carried out shall be as per relevant Indian Standards and shall be carried out at Government approved test facility specified by the Project Manager.

66.2 For checking setting out and testing materials at the Site the Contractor shall provide the following minimum testing equipment:

i. One theodolite & tripod capable of reading to 20 seconds
ii. One level with horizontal circle and tripod.
iii. Two metric levelling staffs not less than 3.5mtr high.
iv. One 100 metre rust less steel band, one 30 metre rust less steel tape & two 30 metre linen tapes.
v. An adequate number of ranging rods drop arrows, wooden setting-out pegs, etc.
vi. Weighing machines
vii. Spirit levels, plumb bobs
viii. Micro meters
ix. Thermometers
x. Hydraulic testing machines
xi. Smoke test machines
xii. Moisture meters
xiii. Complete sets of sieves
xiv. Oven.
xv. Compression Testing Machine for concrete and bricks
xvi. Slump testing apparatus.
xvii. Sieve sets for testing of fine and coarse aggregate balance
xviii. Cube moulds – Minimum 12 nos.

xix. Balance

All such equipment shall be calibrated at specified frequency for accuracy at a Testing Facility approved by the Project Manager and calibration certificates will be submitted to the Project Manager.
The Contractor shall get other tests carried out at his own cost at approved laboratory as per the directions of the Project Manager.

67. TESTING OF INSTALLATIONS:

All water retaining structures and the basement shall be tested as specified for the waterproof qualities, in the presence of the Project Manager. The Contractor shall also perform all such tests as may be necessary and required by the Project Manager to ensure quality of the executed works and by local authorities to meet Municipal and other bye-laws, regulations in force. The Contractor shall provide all labour, equipment, and materials etc., required for the performance of the tests.

68. DRILLING, CUTTING ETC.:

All cutting and drilling of walls or other elements of the building for the proper entry/installation of inserts, boxes, equipment, etc. shall be carried out using electrically operated tools only. **Manual drilling, cutting, chiseling, etc. shall not be permitted. No structural member shall be cut or chased without the written permission of the Project Manager.** Cutting and drilling of structural members shall be carried out using vibration free diamond wire sawing and diamond drilling only with prior permission from the Project Manager. The costs for procurement and using such equipment are deemed to be included in the Contract and no extra costs will be paid.

69. DEWATERING AND FLOODING CONTROL

The Contractor is deemed to have allowed for any and all temporary dewatering, during the execution of his Work. Such work shall include but not necessarily be limited to the safe disposal of the resulting water; removal, replacement and/or recompaction of the water logged soils/surfaces; backfilling plugging of all temporary sumps, ditches, temporary materials and devices.

Contractor shall be deemed to have allowed for all costs associated with removal of flood waters and any associated sludge debris etc. from the basement level or any other part of the building so effected in the event of flooding due to heavy rains during his construction activities and after basement, superstructure work is completed until such time as Contractor has completed and handed over all his works under the Contract.

Geo-Technical Investigation report is enclosed with the tender document. The bidders may go through the same for assessment of requirement of dewatering, if any, during execution before quoting. Please note that no extra payment shall be made if any incidental variation is encountered at the time of execution.

70. OTHER SITE FACILITIES

70.1 **Accommodation/Transportation**
The contractor shall make his own arrangement for living accommodation of staff, labour, local conveyance etc. at his own cost. No living accommodation shall be permitted for staff and labour within the site.

70.2 **Limitations of space & facilities to be provided**

Due to the constructed and sensitive nature of the site, the following limitations are imposed:

a. Contractor shall be deemed, should he so elect to have allowed for all costs and time associated with the manufacture of pre-cast concrete/ reinforcement steel at an off-site location, its transportation to site and placement at final location.

b. Should the contractor elect to manufacture said pre-cast units on site, the site location, if available for said manufacture and storage shall have the prior approval of the Project Manager.

c. Contractor is advised that on-site parking, other than legitimate construction traffic for loading/unloading purposes in the designated areas shall be limited and must have the Project Manager's prior approval.

d. Contractor shall immediately remove any illegally parked on site any company or private vehicles when required by Project Manager.

70.3 **Project Managers Office**

a. The Contractor shall supply, erect and satisfactorily maintain in good repair until final completion of the Project, at no additional cost, where directed within the site, office accommodation including water supply, plumbing, sanitary, electrical fittings/ fixtures, air conditioners (for all rooms) for the Project Manager and his staff. This accommodation shall be well lighted and ventilated and provided with the following facilities.

   i. Free water, stabilised power and lighting as required for the duration of the Project.
   ii. Sanitation facilities for the duration of the Project.
   iii. Janitorial and Housekeeping of PM office on daily basis.

b. The building will be maintained by the contractor during the contract period. The cost of this construction/ maintenance of this building shall be borne by the contractor.

c. The accommodation will be demolished when directed.

70.4 **Sign Boards**

The contractor is not entitled to do any publicity on account of the project. Contractor shall not put any hoarding, publish any advertisement, put any banner or circulate any pamphlet or adopt any other publicity method save and except with prior written approval of the Project Manager.

A Sign Board of overall size approximately 2.5m x 2.0m may be made and displayed by the Contractor at his own cost at the Site at some approved place. The drawing of the Name Board shall be got approved from the Project Manager. The contents of the board shall be as follows:-

i. Name of the Project.
ii. Name of the Owner:
iii. Project Manager/ Architect / Consultants with their addresses.
iv. Contracting Agency.
v. Other Contracting Agencies.

Care should be taken to see that the height of letters especially for the Architects should not be more than 2" to abide by the code of professional conduct prescribed by the Indian Institute of Architects. The colour, texture etc., of the board shall be as per the Architect's instructions.

70.5 **Barricading / Safety Precautions**

a. The contractor shall provide around all excavations, of whatsoever nature, temporary barricades and/or fencing including warning signs, signals, notices and lights as appropriate to the particular situation, and of sufficiency and strength suitable for said situation. Same shall be maintained continuously until the particular potential hazards are no longer there. In like manner same shall be maintained at, but not necessarily be limited to, such works as demolition, dismantling, erection etc.

b. **The Contractor shall also provide around the site boundary temporary barricading of 6 m height in the stretches along the existing buildings and of 3 m height in balance stretches.** High CGI sheets using steel sections not more than 3 m apart including lockable security steel gate and leaving the barricading until completion of work. The barricading shall be painted as per the instructions of the Project Manager.

c. The same is required to be maintained in place till the expiry of warranty period. The above has to be done at contractor's own expense and nothing additional is payable on this count. Barricading provided shall remain to be the property of the contractor on completion of the work. Earlier removal of barricade before expiry of warranty period shall require written approval from Project Manager. Nothing shall be payable on account of above barricading around the site boundary and the same is deemed to be included in the quoted price.

d. The item of barricade of 2 m height provided in the price bid is a portable barricade and it is for specific requirement to be executed strictly with the written instruction of BHEL.

e. Site Boundary wall existing at site shall be maintained by the Contractor at his own cost till completion of the Project.

f. Contractor is deemed to have considered all direct or associated costs arising thereof, when tendering for the work.

70.6 **Watching and Guarding**

a. The Contractor shall provide and maintain at his own expense, all lighting, guards, fencing, warning notices, and watching wherever and whenever necessary to ensure the safe and effective execution of the works, or as required by the Project Manager, and to ensure the safety of all persons employed on the work in whatever capacity, all visitors to the works, and members of the General Public within or adjacent to the works.

b. Any instruction/ requirement of the Project Manager with regard to safety shall not relieve Contractor of his absolute responsibility under this or any other relevant contract condition.

c. The Contractor shall be held entirely responsible for the security of the site and the protection of the works at all times inclusive of non-working hours, during the contract period. He shall be deemed to have included for all costs associated therewith.

70.7 **Maintenance of roads, pathways, traffic control**

Contractor shall be entirely responsible for maintaining public roads and private entrance road to the site. These areas shall be free from any materials of whatever nature being delivered to or removed from the site and kept in a generally clean and safe condition. With this in mind, Contractor shall ensure adequate traffic control at the entrance and at progress points of the site – both temporary and permanent and ensure no parking on public roads, pavements or adjacent land.

70.8 **Protection/ Preservation of Trees**

Contractor shall take all measures necessary to ensure the protection and preservation of existing trees within / outside the boundary of the site. Contractor shall be responsible of any damage / casualty to the trees happing as a result of his working at site and for any action, claim, penalty or expenses imposed by the forest / any other department. No claim / payment shall be payable to the contractor on this account.

70.9 **Common facilities**

a. The contractor is required to provide the following common facilities at site free of cost.
   i. General cleaning
   ii. Security
   iii. General lighting
   iv. General hygiene

b. These facilities shall be of general nature and all specific requirements of the contractor shall be fulfilled by himself, and he shall be responsible for the same. Contractor shall not be entitled to demand any specific facility from the BHEL as a right.

71. LABOUR WAGES

The Contractor shall have no claim whatsoever, if on account of any rules and regulations or otherwise, he is required to pay wages in excess of fair wages called for under the contract.

Civil & Structural work for construction of BHEL Tower
(Package-1)
at
Plot no. 25, Sec-16A, Noida(UP)

VOLUME-1D
SPECIFIC CONDITION FOR GRIHA AND LEED CERTIFICATION

ISMG & Corporate Administration

BHARAT HEAVY ELECTRICALS LTD.

AGVC, Siri Fort, New Delhi-110 049

CONTRACTOR
(Sign with name, designation and date)

Green Building Procedures during Pre-Construction Stage & Construction Stage

1.0 The Standard conditions mentioned below are complying by the contractor with GRIHA and LEED requirements.

The Employer (BHEL) desires to obtain **Five STAR rating** of **GRIHA** and **LEED Gold Rating,** for the proposed Office complex at Noida. The design of the complex has, therefore, been carried out keeping in view the green building norms. (Refer Appendix 1 enclosed).

To ensure that the desired green building rating is achieved, it is necessary to follow certain **"Green Building Compliance Procedures"** during construction stage also as per The contracting agency, finalized for construction of this work, will be required to follow these procedures strictly in order to achieve the targeted credits points. All such procedures to be complied with have been listed in the subsequent pages. The tenderers are required to go through the same before preparing their offer for the job. The rates quoted by the tenderers shall be inclusive of any expenses involved for compliance with the "**Green Building Procedures"** during construction.

List of Green Building Procedures to be complied during Construction:

All relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 will be adhered to.

1.1 Adequate safety measures for workers during handling of materials at site will be taken up

1.2 The contractor will comply with the regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations and safe means of entry and exit.

1.3 **Eliminate Risk from Electrical Equipment:**

- The contractor will comply the relevant industrial electrical safety legislations.
- The Contractor will take adequate precautions to prevent danger from electrical equipment i.e., no material will be so stacked or placed as to cause danger or inconvenience to any person or the public.
- All necessary fencing and lights will be provided to protect the public.
- All electric machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer-in-charge.
- The contractor will arrange for a first aid kit including the adequate supply of sterilized dressing materials and appliances to meet emergencies. He will also arrange suitable transport to take injured or sick person(s) to the nearest hospital.
- The contractor will provide, erect and maintain informatory height/safety signs, hoardings written in English and Hindi wherever required or as suggested by the Engineer-in-charge.

1.4 **SANITATION, LIVING & SAFETY FACILITIES:** The contractor will ensure adherence to following minimum practices for safety during construction.

- Provide safety and protective equipment shows, helmets, boots, gloves, life jackets, harness for workers working at height, welding goggles for welders and any other

necessary PPE (personnel protective equipment) as necessary for all workers, personnel available at site and visiting the site.

- Barricade at the edge, open slabs and deep/excavated areas as per site requirement.
- Provide safety net wherever required.
- Designate emergency assembly area and install signage indicating the same.
- Install 'DANGER' signage on electric panels. Guarding all parts of dangerous machinery,
- Install signage communicating and educating the site personnel regarding the safety that need to be followed.
- Not allow an individual to work on site while his ability or alertness is impaired by fatigue, illness or some other cause which might expose him to injury.
- Precautions for working on machinery,
- Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in good condition,
- Welder's protective eye-shields to workers who are engaged in welding works.
- Earplugs to workers exposed to loud noise and workers working in crushing, compaction, or concrete mixing operation.
- Safety belts to the labourers working at construction site over the drain.
- The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.
- Contractor will provide facemasks for use to the workers when paint is applied in the form of spray
- Following amenities need to be provided for construction labour working for the project,
    - Clean, Lit and Ventilated hutments
    - Hygiene and separate toilets for male and female with water facility at project site and at hutments
    - Clean washing area with water facility for washing clothes and utensils
    - Crèche
    - Potable water for drinking at site.
    - Potable water for drinking, cooking, food cleaning and food cooking at hutments.
- Potable water meeting IS standard for drinking, cooking and cleaning food at site and hutments as applicable.
- Maintain the area near hutments clean and with no stagnation of water near hutments, washing area, bathing area and toilets.
- Place fire extinguishers and sand buckets as applicable, near DG, Electric panels.
- Provide first-aid facility on site and install signage indicating first-aid facility area. The first aid box shall be marked with a red cross on a white background.

1.5 **The contractor will make sure that during the construction work:**

- Providing measures to prevent fires. Fire extinguishers and buckets of sand to be provided in a fire-prone area and elsewhere,
- Providing sufficient and suitable light for working during the night,
- Measures to protect workers from materials of construction, transportation, storage, and other dangers and health hazards, and
- Safety policies of the construction firm/division/company are stringently adhered to.

1.6 **On-site basic facilities for construction workforce to be provided: -**

- Adequate housing to meet or exceed local/ labour bye-law requirement.
- Sanitary measures to meet or exceed local/ labour bye-law requirement (OR) provide at least one toilet seat/ urinal for every 50 workers in any shift, whichever is more stringent.
- The sanitary measures should be provided separately for men and women.
- First-aid and emergency facilities.
- Adequate drinking water facilities.
- Personal protective equipment (by developer / contractor).
- Dust suppression measures.
- Adequate illumination levels in construction work areas.
- Day care/ crèche facility for workers' children (only if, more than 50 female building workers are ordinarily employed).

1.7 All vehicles, equipment and machinery to be procured for construction will confirm to the relevant Bureau of Indian Standard (BIS) norms.

1.8 Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that emission levels comply with environmental emission Standards/norms.

1.9 Noise limits for construction equipment's will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free area, as specified in the Environment Protection Act,1986, schedule VI part E, as amended on 19th May, 1993. The maximum noise levels near the construction site should be limited to 65 dB (A) Leq (5min.) in project area.

1.10 Utmost care shall be taken to keep the noise level to the barest minimum so that no disturbance as far as possible is caused to the occupants / users of adjacent buildings.

- For controlling the noise from Vehicles, Plants and Equipment's, the Contractor will ensure conformance the following:
- All vehicles and equipment used in construction will be fitted with exhaust silencers.
- Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.

- Noise emission from compactors (rollers) front loaders, concrete mixers, cranes (movable), vibrators and saws should be less than 75 dB (A).

1.11 As per the Standards/Guidelines for control of Noise Pollution from Stationary Diesel Generator (DG) Sets, noise emission in dB(A) from DG set (15 - 500 KVA) should be less than 94+10 log10(KVA). The standards also suggest construction of acoustic enclosure around the DG set and provision of proper exhaust muffler with insertion loss of minimum 25dB (A) as mandatory.

1.12 **AIR POLLUTION CONTROL MEASURES:**

- Following measures to reduce air pollution during construction will be taken:
- Clearing vegetation only from the areas where work will start right away
- Vegetating/mulching areas where vehicles do not ply
- Applying gravel/landscaping rock to the areas where mulching/paving is impractical
- Identifying roads on-site that would be used for vehicular traffic. Upgrading vehicular roads (if these are unpaved) by increasing the surface strength by improving particle size, shape, and mineral types that make up the surface and base. Add surface gravel to reduce source of dust emission. Limit amount of fine particles (smaller than 0.075 mm) to 10%–20%
- Limiting vehicular speed on-site to 10 km/hr. Wheel washing facility at entrance and exit points of vehicles and install signage as 'Wheel Washing Area'.

1.13 Water spraying by wetting the surface by spraying water on any dusty materials before transferring, loading, and unloading, areas where demolition work is being carried out, any unpaved main-haul road, and areas where excavation or earth-moving activities are to be carried out over and enclosure to be done by:

- Providing barricading of Min **3 m** high along the site boundary, excavated area next to a road or other public area. Barricading height near the adjacent Existing building shall be provided more than 3m as per the site requirement to avoid any dust ingress to the operational buildings.
- Providing dust screens, sheeting or netting to scaffold along the perimeter of a building, covering stockpiles of dusty material with impervious sheeting.
- Covering dusty load on vehicles by impervious sheeting before they leave the site, and vehicles transferring, handling/storing dry loose materials like bulk cement and dry pulverized fly ash inside a totally enclosed system.
- Instruct the material supplier to cover dusty load on vehicles. Maintain date stamped photographs as a documentary evidence.
- Provide DG exhaust at height 3 meter from site level and DG shall meet the CPCB pollution norms.

1.14 **The following are guidelines to be followed to avoid wastage of curing water.**

- Curing chemicals should be sprayed on concrete structures and free flowing water should not be cured.

- After curing on the first day, all concrete structures should be painted with curing chemicals. This will stop daily water curing and save water.
- Water should be sprayed on concrete structures after covering them with cloth/gunny bags. This decreases water rebound and ensures sustained and complete curing.
- Ponds should be made using cement and sand mortar to avoid water flowing away from the flat surface while curing.
- Water ponding should be done on all sunken slabs. This also highlights the importance of having an impervious formwork.

1.15 **CONSTRUCTION WASTE MANAGEMENT:** Following are the guidelines **to ensure maximum resource recovery and safe disposal of wastes** generated during construction (Typical construction debris in residential projects include broken bricks, steel bars, broken tiles, glass, wood waste, paint cans, cement bags, packing materials, etc.) and to reduce the burden on the landfill. Logs are to be maintained by contractor and all calculations for are to be provided for green building documentation. **Copy of bills is to be provided for any scrap materials sold to local recycler.**

- Install waste collection bins to collect and segregate recyclable, hazardous and other waste separately. Install signage to educate site personnel regarding which waste to be put in which bins.
- Provide central waste collection area, where, all the segregated waste from bins is placed and stored separately. Designate with signage a 'Central Waste Collection Area'. Sell the recyclable waste to recycling vendors and maintain the challan for waste sold indicating the material sold, quantity and units (like, kg, ton, sqm etc.,)
- Employ measures to segregate the waste on-site into inert, chemical or hazardous wastes.
- Maintain record indicating the total waste generated, sold to recyclers, reused on site and sent to landfill.
- Reuse/Recycle the segregated waste and unused chemical/ hazardous wastes such as oil, paint and batteries.
- Inert waste to be disposed-off by municipal corporation/local bodies at landfill sites.

1.16 The contractor will ensure proper waste management on the site to limit the amount of Construction waste sent to landfill by maximum of 5% of total waste generated. This can be achieved by minimizing waste generation, using the waste generated within the site for a purpose and selling to recyclers. Copy of bills is to be provided for any scrap materials sold to local Recycler. Provide segregated waste collection bins on site during construction to collect following type of materials in separate bins,

  - Hazardous
  - Recyclable (For selling to recyclers)
  - Reusable in construction again
  - Other waste

1.17 Allocate a separate space for the collected waste before transferring it to the recycling/disposal stations to prevent the mixing up of segregated waste before processing or disposal.

1.18 Use different coloured bins for the collection of different categories of wasted from the building.

1.19 Soil erosion control measures for pre-construction and during construction to conform to the best management practices highlighted in the National Building Code (NBC) of India, Part 10, Section 1, Chapter 4 – Protection of Landscape during Construction and Chapter 5 – Soil and Water Conservation

1.20 **Top Soil and Vegetation preservation:**

- Existing Top 20 cm soil on site from areas which are going to be disturbed (like proposed for buildings, roads, paved areas and external services) during construction activity shall be preserved in layer of 40 cm height with grass mulching or temporary vegetation to maintain fertility of soil.
- This preserved Fertile top soil shall be used in project landscape at reuse later stage.
- Temporary storm water channels need to made along the top soil preservation area and further connected temporary sedimentation tank.
- During construction, preserve the existing trees those are not cut, by providing brick work or barricading with green net around the trees. Such that, construction activity does not damage the trees.
- If any vegetation is planned during the construction for making it part of post-construction or operational phase landscape, consider native trees for the same. Also, protect this vegetation with brick work or green net.

1.21 **Soil Erosion and Spill Control:**

- Temporary sedimentation tank need to be made on the site, as necessary, to allow settling of soil eroded before discharging to storm water outside the site.
- Construct temporary storm water channels and connect to sedimentation tanks, as necessary, to route storm water to sedimentation tank.
- Store diesel tanks and chemicals on hard floor to avoid contamination of soil in case of spill.
- Avoid stagnation of water on site.

1.22 Measures such as temporary and permanent seeding, mulching, earth dikes, silt fencing, sediment traps, and sediment basins, as appropriate to be adopted

1.23 Appropriate measures to address soil erosion, post occupancy to be adopted

1.24 Contractor has to collect all material and equipment certificates to document green building requirements and the collected documents to be submitted to project owner on fortnightly basis.

1.0 As per USGBC- LEED V4 New Construction and aspiring for "GOLD" Rating.

1.1 As part of Tender specifications and drawings, several GREEN features have been incorporated in material selection and specification. GREEN certification process also lays emphasis on certain measures during Construction stage.

1.2 GREEN process requires documentation in terms of sourcing of materials and its components, particularly, with reference to eco friendliness, energy efficiency, water efficiency, recycle content, avoidance of harmful chemicals in the process, distance from where procured etc. The above information needs to be submitted in a prescribed format – Green fact sheets appended below. These Green fact sheets should be submitted to GREEN consultants before procurement for validation and approvals. These GREEN fact sheets necessarily issued by manufacturers as per USGBC- LEED V4 New Construction norms.

1.3 The contractor shall maintain a log sheet for construction waste management shared by the GREEN Consultant, to record month wise procurement of building materials, waste generated and the places it was re-used in. The contractor shall share construction waste management sheet once every month with photographs of reuse – as per required Format.

1.4 The Contractor shall be responsible to supply materials and equipment complying with the green building specification spelt out in the tender documents strictly and the specification of material and equipment shall be submitted for the specific items covered in the green building requirements for the review of GREEN Consultant prior to ordering the material and equipment.

1.5 The above process does not involve any change of specifications except for the need for supportive documentation. Hence this activity and support required from the successful bidder does not entail any additional time and cost implication or change in the Contract value.

1.6 The Contractor has to make sure that the proposal given for the GREEN Consultant approval shall comply with the GREEN rating and requirements.

1.7 To comply with this requirement, wherever called for, the Contractor shall provide necessary documents / shop drawings issued by the manufacturers and this document shall generally cover, test certificates, Letter of authorization in terms of standards, thermal values, and relevant data, MSDS, write-ups / detailed description of the particular material / equipment, as stipulated by the GREEN consultant prior to ordering the materials and after the supply of materials or at appropriate stages.

1.8 The contractor shall verify with the GREEN consultant regarding the correctness of the green specification before ordering and procurement of materials and equipment supplied to the project. This requirement shall be strictly complied by the Contractor or after supply, if the specification, the shop documents, drawings and the relevant documents are not meeting the specified GREEN norms; it is the sole responsibility of the Contractor to satisfy the specified GREEN norms by replacing the materials / equipment's on prior approval of the Clients / PMC.

Please therefore confirm by returning this copy duly signed that you accept the above requirements and agree to comply with the same during the execution of work should your firm be selected and share document as mentioned below:
The following are the select green building construction practices to be followed by the contractor to secure the highest USGBC- LEED V4 New Construction rating

---

CONTRACTOR
(Sign with name, designation and date)

1. Top 20 cm soil (if fertile), should be excavated & preserved in the site for landscaping at later stage.

- ☐ Photographs

2. Barricading the site perimeter during construction.

- ☐ Photographs

3. Spraying of water around the work area to stabilize the loose soil.

- ☐ Photographs

4. Permanent sedimentation basin/ pit with screen filter should be created at the lowest point and storm water should be channelized to this facility to remove suspended solids & debris, before going out of the site.

- Photographs
- Screen Filter cut sheets

Procurement Procedure:

- Procure civil and interior materials with high recycled contents (At least 25% of total civil material cost) like.
- Materials be procured from locally available manufacturing plant and also need to be extracted/harvested locally, i.e. within 160 Km radius from project site (At least 25% of total civil material cost).

5. Construction wastes generated should be segregated & stored in labelled debris yards (Temporary) and the wastes should be reused onsite/ off site or sent for scrap dealers. Accountability of the same should be maintained in the provided format addressing 95% of the waste generated during construction has been recycled or reused within the site or outside the site or sold to the scrap dealer.

- Construction waste management log sheet
- Scrap dealer declaration letter
- Photographs of storage yards with label for different construction material
- Photographs of scrap yards with label for different construction material
- Onsite waste reuse photographs (if any)

Maximum Allowable VOC Limit for various applications

Anti-Corrosive and Anti-Rust Paints Coating Type	VOC Limit g/L (lb/gal) Minus Water
Gloss	250g/L (2 lb/gal)
Semi-Gloss	250g/L (2 lb/gal)
Flat	250g/L (2 lb/gal)

Architectural Applications	VOC Limit (g/L less water)	Specialty Applications	VOC Limit (g/L less water)
Indoor carpet adhesives	50	PVC welding	510
Carpet pad adhesives	50	CPVC welding	490
Wood flooring adhesives	100	ABS welding	325
Rubber floor adhesives	60	Plastic cement welding	250
Subfloor adhesives	50	Adhesive primer for plastic	550
Ceramic tile adhesives	65	Contact adhesive	80
VCT and asphalt adhesives	50	Special purpose contact adhesive	250
Drywall and panel adhesives	50	Structural wood member adhesive	140
Cove base adhesives	50	Sheet applied rubber lining operations	850
Multipurpose construction adhesives	70	Top and trim adhesive	250
Structural glazing adhesives	100		

Substrate Specific Applications	VOC Limit (g/L less water)	Sealants	VOC Limit (g/L less water)
Metal to metal	30	Architectural	250
Plastic foams	50	Nonmembrane roof	300
Porous material (except wood)	50	Roadway	250
Wood	30	Single-ply roof membrane	450
Fiberglass	80	Other	420
Sealant Primers	**VOC Limit (g/L less water)**		
Architectural, nonporous	250		
Architectural, porous	775		
Other	750		

SAMPLE FORMATS
Construction Waste Management sheet format to be submitted once every month along with
Photographs of reuse/ document proof

Green Building: Construction Waste Management - Log Sheet

Sl no	Materials	Total Quantity used for the project (kg)	Quantity of Waste Generated at site (Kg)	Quantity of waste sent for recycling/reuse	Quantity of waste send for Dumpyard (Kg)	Location of waste recycled/reused	Scrap dealer name
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
* letters are required from vendors at the end of the project, highlighting the total qty taken from site and qty recycled							

Company

Authorised person & signature

Date

Green Fact Sheet: Recycled Content & Distance

Project Name & Location

Green Features	Availability	Alternatives/ Quantum	Remarks
Product Application:			
Post Industrial –Recycled Content % :	Y/N	__%	
Post-Consumer – Recycled Content % :	Y/N	__%	
Regional Materials - Distance of the manufacturing facility from the project site :	__%	__kms (Radial Distance)	
Distance from the materials extracted, harvested to the project Site :	__%	__kms (Radial Distance)	
Other Green Features:			

Company Name & Location :
Authorised person & signature :
Date :

The required letter from the manufacturer should reach the site along with the materials and strictly no deviation.

3.0 PENALTY

3.1 Liable Charges to be recovered from contractor for non-compliance of Green Building norms during construction

To ensure that the desired green building rating is achieved, it is necessary to follow certain “Green Building Compliance Procedures” during construction stage also. The contracting agency, finalized for construction of this work, will be required to follow the procedures strictly in order to achieve the targeted credits points. All such procedures to be complied with have been listed in the subsequent pages. The tenderers are required to go through the same before preparing their offer for the job. The rates quoted by the tenderers shall be inclusive of any expenses involved for compliance with the “Green Building Procedures” during construction. The penalty shall be charged as per mentioned below in the table and shall be deducted from the final payment of the contractor. Non-Compliance with mandatory criteria under GRIHA shall render the project ineligible for GRIHA Rating. The GRIHA rating authority would be conducting a total of 3 or more site visits (at the start of construction, midway through the construction and at the time of building operation). After each site visit, a report shall be furnished by the GRIHA rating authority. 15 days shall be provided by the rating authority to rectify any shortcomings found. The penalty stated below shall stand void for all such GRIHA Version 2015 clauses that is

found as not applicable as per site conditions and the non-applicability of the clause is mentioned in the site visit reports furnished by the GRIHA rating authority.

3.2 **Charges:**

Shortcoming in compliance of Green Building norms during construction shall be informed to the contractor in writing for necessary compliance within 07 days failing which the contractor shall be liable to be charged @ Rs. 10000/- per incidence per week. Project Manager shall have the discretion to stop the contractor's work/ get the shortcoming complied at contractor's risk & cost if further continuance of work may arise to unsafe working condition.

4.0 The proposed building is a Green Building under GRIHA /LEED-USGBC system. The site requirement and mandatory criterions during construction or preconstruction period are under the scope of the contractor and no claim/cost against requisite activities such as providing and erecting barricading, signage, labour hutment, health and safety etc. as mentioned above shall be entertained.

FORM OF TENDER- Appendix- 1
(UNDERTAKING FOR GREEN BUILDING GRIHA VERSION 3 and LEED VERSION 4)
We do hereby undertake that we will follow all the guidelines of GRIHA Version 3 and LEED Version 4 & Compliance report of SCC applicable for this project.

STAMP & SIGNATURE OF AUTHORISED SIGNATORY

Note:

1. The undertaking shall be signed by authorized signatory of the tenderer.

Civil & Structural work for construction of BHEL Tower
(Package-1)
at
Plot no. 25, Sec-16A, Noida(UP)

VOLUME-1E
TECHNICAL CONDITION OF CONTRACT (TCC)

ISMG & Corporate Administration
BHARAT HEAVY ELECTRICALS LTD.
AGVC, Siri Fort, New Delhi-110 049

CONTRACTOR
(Sign with name, designation and date)

1.0 GENERAL

The conditions of contract and the drawings shall be read in conjunction with the specifications and matters referred to, shown or described in one are not necessarily repeated in the other. These specifications are comprehensive but may exceed the requirements of this project. Any ambiguity between the Specifications, the Bill of quantities and tender drawings, shall be referred to the Engineer In-Charge for clarification not later than 10 days before the date fixed for delivery of tenders. Any ambiguity may be referred to the Engineer In-Charge after signing of the contract and Engineer In-Charge shall give a ruling which shall prevail. No claim for additional cost due to above, however, will be entertained.
Notwithstanding the sub-division of the specification into various headings, every part of it is to be deemed supplementary to every other part and is to be read with it, so far as it may be practicable so to do, or when the context so admits.

In this contract, reference is made to the Indian Standards or CPWD specification as approved by Engineer In-Charge and these references shall be deemed to include the latest editions or issue of standards, specifications or By-Law including all revisions upto the date of invitation of Tenders. The contractor shall ensure that all materials and workmanship in so far as they apply to this contract shall comply in every specifications or any other equivalent or specification approved by the Engineer In-Charge.

The Contractor shall keep at site copies of all relevant standards and codes of practice referred in these specifications throughout the period of contract. These shall be the latest editions and shall include all revisions/addendums thereof.
All items or materials shall be delivered to the site in the manufacturers original unopened containers with the manufacturers brand and name clearly marked on.

All items or materials shall be assembled, mixed, fixed, applied or otherwise incorporated in the works in accordance with the printed instructions of the manufacturer of the item or materials.

Date of construction to be written on all respective items for monitoring curing.

Contractor shall follow the pour card/check list for all the concrete/finishing items on prescribed formats.

1.1 SCOPE

This specification applies to the Civil & Structural Works to be executed by the Contractor. It is to be read in conjunction with the drawings, the schedule of rates and such other documents as may from time to time be agreed upon as comprising part of this contract and subject to the general & special conditions of contract. Where these specifications are not clear, relevant BIS codes and CPWD specifications shall be followed with prior permission of Engineer In-Charge. In case any item is not covered under specification then the same shall be carried out as per CPWD specification and applicable Standards and Codes. Any item for which specification is not provided herein and is not covered under CPWD specification shall be executed as per approved manufacturer's guideline.

The brief scope of work comprises of, but not limited to, the following:

2. Construction of Diaphragm wall including soil anchors,
3. Construction of multi storeyed office building having two level basement i.e. (B1+B2+G+18).
4. Speed floor system or metal deck system for floors as per option in schedule of rates chosen by bidder.

5. Providing Façade envelope
6. Providing façade cleaning System on top of building.
7. External development work including boundary wall, road & drain, paving, gates, security room etc. within BHEL premises.
8. RCC structure for STP and ETP, UGT, Fire static tank, Overhead tanks (above building)
9. Fire proofing of structural steel members as per specification.
10. Dismantling of existing shed/ structure, repair of existing road, boundary wall, drain etc., re-routing of services such as sewerage line, water supply line, power, communication & data cables etc. fouling with the construction work as per the direction of Engineer-In-Charge. Drawings indicating the existing service lines crossing/interfering with the construction site is enclosed with the tender documents for ready reference. No overhead services fouling with construction site exist. All removable temporary structures like porta cabin and vehicles from the construction area shown in barricading drawing shall be removed by BHEL before handing over the site.
11. Maintaining Green building & HSE guidelines during construction activity of buildings.

Other related works to complete the building where interface with other vendors is envisaged.

1.2 SITE CLEARANCE

1.2.1 Before the earth work is started, the area coming under cutting and filling shall be cleared of shrubs, rank vegetation, grass, brushwood, trees and saplings of girth up to 30cm measured at a height of one metre above ground level and rubbish removed up to a distance of 50 metres outside the periphery of the area under clearance.

1.2.2 The trees of girth above 30 cm measured at a height of one metre above ground shall be cut only after permission of the Engineer-in-Charge is obtained in writing. The roots of trees shall also be removed as specified in 1.2.1. Payment for cutting such trees and removing the roots shall be made separately.

1.2.3 Existing structures and services such as old buildings, culverts, fencing, water supply pipe lines, sewers, power cables, communication cables, drainage pipes etc. within or adjacent to the area if required to be diverted/removed, shall be diverted/dismantled as per directions of the Engineer-in-Charge and payment for such diversion/dismantling works shall be made separately.

1.2.4 The contractor shall visit the site, inspect the same and decide for himself the nature of the ground and the sub-soil to be excavated. No claim on account of extras will be entertained in consequences of any misunderstanding or incorrect information or ignorance of the existing conditions.

1.3 SITE LEVELS

The contractor shall carry out the survey of the site and shall establish sufficient number of grids and level marks to the satisfaction of the Engineer In-Charge, who shall decide on the basis of this information, the general level of the plot and the plinth.

1.4 BENCH MARKS

Prior to commencement of construction, the contractor shall in consultation with the Engineer In-Charge, establish several site datum bench-marks, their number depending

on the extent of the site. The bench-marks shall be sited and constructed so as to be undisturbed throughout the period of construction.

1.4 SITE INVESTIGATION

Geotechnical Investigation of the site has already been done and the report is enclosed for ready reference. The contractor shall however inspect the site and study the findings from the trial pits or bores in order to assess the problems involved in and methods to be adopted for excavation and earthwork. The contractor shall ascertain for himself all information concerning the sub-soil conditions, ground water table periods and intensity of rainfall, flooding of the site and all data concerning excavation and earthwork. Any extra work required on this account, nothing will be paid.

The bidder shall fully apprise himself of the prevailing conditions at the proposed site. Climatic conditions including monsoon patterns, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specifically brought out in the specifications. All considerations under the Government's Green Rating of Integrated Habitat Assessment- GRIHA - to be mandatorily followed by the contractor while executing all aspects of the works. Any extra work required on this account, nothing will be paid.

1.5 SETTING OUT THE WORK

The contractor shall set out the works and during the progress of the building shall amend at his own cost any errors arising from inaccurate setting out.

During the execution of the work contractor must cross check his work with the drawings. The contractor shall be responsible for all the errors in this connection and shall have to rectify all defects and/or errors at his own cost, failing which the Engineer In-Charge reserves the right to get the same rectified at the risk and cost of the contractor.
Level and date of concreting shall be marked on the building from outside at every floor level with proper paint, etc.

1.6 CLEANING UP AND HANDING OVER

Upon completion of the work all the areas should be cleaned. All floors, surface, etc. shall be cleaned down in a manner which will render the work acceptable to the Engineer In-Charge. All rubbish due to any reason, shall be removed daily from the site and an area of up to ten metres on the outer boundaries of the premises will be cleaned by the contractor as a part of the contract. Upon completion of the project, the contractor shall turn over to the Engineer In-Charge the following:

a) Written guarantee and certificates.
b) Maintenance manuals, if any, and
c) Keys.

1.7 SAMPLES

The contractor shall submit to the Engineer In-Charge samples of all materials for approval and no work shall commence before such samples are duly approved. Samples of façade items, water proofing items, masonry items, steel items, building insulation etc. and every other work requiring samples in the opinion of the Engineer In-Charge shall be supplied to the Engineer In-Charge, and these samples will be retained as standards of materials and workmanship. The cost of the samples shall be borne by the contractor.

Throughout this specification, types of material may be specified by manufacturer's name in order to establish standard of quality, price and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the tenderers may assume the price of 'approved equivalent' except that the burden is upon the contractor to prove such equality, in writing.
A detailed programme shall be submitted by the Contractor for the material approvals, within four weeks of the Engineer In-Charge's order to commence. The detailed programme shall include but not limited to:

Date/s of submitting the various material samples.
Date/s by which the Engineer In-Charge's approval is required.
Date/s of placing orders on the Manufacturers/Suppliers.
Date/s of arrival of the approved material/s on to the site.

Date/s of the completion of the `Mock-ups', wherever required, and the Date/s by which the Engineer In-Charge's inspection of such `Mock-ups' should be completed and the Date/s by which the Engineer In-Charge should fully approve the said Mock-ups.

1.8 TESTS

All materials and methods of tests shall conform to the latest rules, regulation and/or specifications of the following authorities where specified herein as applicable. Bureau of Indian Standards (BIS), British Standards Code of Practice (BS) in case no equivalent BIS is available. The Engineer In-Charge will have the option to have any of the materials tested and if the test results show that the materials do not conform to the specifications, such materials shall be rejected. A reasonable number of representative tests will be deemed to be included in the rates tendered.

1.9 MEASUREMENTS

All measurements will be taken in accordance with IS 1200 latest issue unless otherwise specified subject to the following:
Pre-measurements to be recorded for all dismantling items before starting of the works.

2.0 EARTHWORK IN EXCAVATION AND BACKFILLING

2.0.0 SCOPE

This specification covers excavation in all types of soil, soft and decomposed rock not requiring blasting, shoring, dewatering, filling around foundations and to grade, compaction of fills and approaches, protective fencing, lighting, etc. relevant to structures and locations covered under the scope of this contract.

2.1.0 GENERAL

Work to be provided for by the Contractor

The work to be provided for by the Contractor, unless specified otherwise, shall include but not be limited to the following :

a) Supplying and providing all labour, supervision services, earth moving machineries, surveying instruments including facilities as required under statutory labour regulations, materials, scaffolds, equipment, tools and plants, transportation, etc. required for the work.

b) Prepare and submit working drawings showing the approaches, slopes, berms, shoring, sumps for dewatering, including drains and outfall for drainage, space for temporary stacking of spoils, disposal area, fencing, etc. and all other details as may be required by the Engineer.

c) To carry out sampling and testing and submit to the Engineer, results of soil compaction tests whenever required by the Engineer to assess the degree of compaction.

2.1.1 **Work to be provided for by others**

No work under this specification will be provided by any agency other than the Contractor unless specifically mentioned elsewhere in the Contract.

2.1.2 **Codes and Standards**

All works under this specification, unless specified otherwise, shall conform to the latest revision and/or replacement of the following or any other Indian Standard Specifications and Codes of Practice. In case any particular aspect of work is not covered specifically by Indian Standard Specification any other standard practice as may be specified by the Engineer shall be followed :-

IS:1200 (Part-I)	Method of Measurement of Building and Civil Engineering work; Part - I Earthwork.
IS:2720 (Part-II)	Determination of Moisture Content
IS:2720 (Part-VII)	Determination of Moisture content / Dry Relation using Light Compaction.
IS:2720 (Part-xiv)	Determination of Density Index (Relative Density) of cohesion less soils.
IS:2720 (Part-xxix)	Determination of Dry Density , in place, by core cutter method.
IS:2720 (Part- xxviii)	Determination of Dry Density of soils, in place, by sand replacement methods.
IS:3764	Safety code for Excavation work.

2.1.3 **Conformity with Designs**

The contractor shall carry out the work as per the approved drawings/ contractor's drawings which are approved by the Engineer , specification and as directed by the engineer.

2.1.4 **Materials to be used**

All materials required for the work shall be of best commercial variety and approved by the Engineer. For the purpose of identifying the various strata encountered during the course of excavation, refer clause no. 2.3.0 for the classification of earth strata.

2.1.5 **Material for Filling**

Material to be used for back filling shall be free from vegetation, roots, salts, rubbish, lumps, organic matter and any other harmful chemicals etc. and shall be got approved by the engineer. Normally excavated earth shall be used for back filling. In case such earth contains deleterious materials, the same shall not be used. All clods of earth shall be broken or removed.

2.1.6 **Quality Control**

The Contractor shall establish and maintain quality control for the various aspects of the work, method, materials and equipment used. The quality control operation shall include but not be limited to the following items of work :

a) Lines, Levels and Grades : i) Periodic surveys

ii) Establishment of markers, boards etc.

b) Back-filling : i) Checking the quality of fill material

ii) Checking moisture content of the backfill

iii) Checking the degree of compaction

2.1.7 **Information regarding site conditions**

Surface and Sub-surface data regarding the nature of soil, sub-soil water etc. shown on drawing or otherwise furnished to the Contractor shall be taken as a guidance only and variation there from shall not affect the terms of the contract. The Contractor must satisfy himself regarding the character and volume of all work under this contract and expected surface, sub-surface and / or sub-soil water to be encountered. He must also satisfy himself about the general conditions of site and ascertain the existing and future construction likely to come up during the execution of the contract so that he may evolve a realistic programme of execution.

2.2.0 **EXECUTION**

2.2.1 **Setting Out**

The Contractor will prepare and submit to the Engineer, detailed drawings of the excavation work as proposed to be executed by him showing the dimensions as per drawings and specification adding his Proposals of slopes, shoring, approaches, dewatering sumps, berms, etc. On receiving the approval from the Engineer with modifications and corrections, if necessary, the Contractor will set out the work from the control points furnished by the Engineer and fix permanent points and markers for ease of future checking.

These permanent points and markers will be fixed at intervals prescribed by the Engineer and checked by the Engineer and certified by him after which the Contractor will proceed with the work. Engineer shall be provided with necessary men, material and instructions for such checking. It should be noted that this checking by the Engineer prior to start of the work will in no way absolve the Contractor of his responsibility of carrying out the work to true lines and levels

and grades as per drawing and subsequent corrections, if necessary, in case any errors are noticed in the Contractor's work at any stage.

2.2.2 **Initial Levels**

Initial levels of the ground either in a definite grid pattern or as directed by the Engineer will be taken by the Contractor jointly with the Engineer over the original ground prior to starting actual excavation work and after setting out. These initial levels will be used for preparing cross-sections for volume measurement or for cross-checking the depths obtained from tape measurements.

All records of levels, measurements etc. and also any drawing, cross section etc. made therefrom, shall be jointly signed by the authorized representative of the contractor and the Engineer before the commencement of work and they shall form the basis of all payments in future.

2.2.3 **Clearing and Grubbing, etc.**

The area to be excavated or filled shall be cleared out of fences, trees, logs, stumps, bush, vegetation, rubbish, slush, etc. and levelled up. Trees up to 300mm girth shall be uprooted. Trees above 300 mm girth to be cut, shall be approved by the Engineer and then marked.

Before earthwork is started, all the spoils and unserviceable materials and rubbish shall be removed from the site to approved disposal areas as may be specified. Ash shall be spread or removed. Useful materials, saleable timber, firewood, etc. shall be the property of the Owner and shall be stacked properly at the worksite in a manner as directed by the Engineer.

2.3.0 **Classification**

All earthwork shall be classified under the following categories :

No distinction will be made whether the material is dry or wet.

a) **Ordinary Soil**

This shall comprise vegetable or organic soil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose moorum, a mixture of these and similar material which yields to the ordinary application of pick and shovel, rake or other ordinary digging implement. Removal of gravel or any other nodular material having diameter in any one direction not exceeding 75 mm occurring in such strata shall be deemed to be covered under this category.

b) **Hard Soil**

This shall include :

i) stiff heavy clay, hard shale, or compact moorum requiring grafting tool or pick or both and shovel, closely applied ;

ii) gravel and cobble stone having maximum diameter in any one direction between 75 and 300 mm ;

iii) soling of roads, paths, etc., and hard core ;

iv) macadam surfaces such as water bound, and bitumen/tar bound;

v) lime concrete, stone masonry in lime mortar and brick work in lime/cement mortar, below ground level ;

vi) soft conglomerate, where the stones may be detached from the matrix with picks ; and

vii) generally any material which requires the close application of picks, or scarifiers to loosen and not affording resistance to digging greater than the hardest of any soil mentioned in (i) and (vi) above.

In case of any dispute regarding classification, the decision of the Engineer-in-charge shall be final.

2.4.0 **Excavation for Foundations and Trenches**

General

All excavations shall be done to the minimum dimensions as required for safety and working facility. Prior approval of the Engineer shall be obtained by the Contractor, in each individual case, for the method he proposes to adopt for the excavations including dimension, side slopes, shoring, dewatering, disposal, etc. This approval, however, shall not in any way make the Engineer responsible for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner.

All excavation in open cuts shall be made true to line, slopes and grades shown on the drawing or directed by the Engineer. No material shall project within the dimension of minimum excavation lines marked. Boulders projecting out of the excavated surfaces shall be removed, if in the opinion of the Engineer they are likely to be a hindrance to the workers.

Method of excavation shall be in every case subject to the approval of the Engineer and the Contractor shall ensure the stability and safety of the excavation, adjacent structures, services and works.

The Contractor shall have full responsibility of the stability of the excavation and safety of the workmen. If any slip occurs, the Contractor shall remove all slipped material from the excavated pit.

All loose boulders, semi-detached rocks, not directly in excavation but so close to the area to be excavated as to be liable, in the opinion of the Engineer, to fall or otherwise endanger the workmen, equipment of the work, etc., shall be stripped off and removed away from the areas of excavation. The method used shall be such as not to shatter or render unstable or unsafe the portion which was originally sound and safe. Any materials not requiring removal as contemplated in the work, but which, in the opinion of the Engineer, is later to become loose or unstable shall also be promptly and satisfactorily removed as directed by the Engineer.

Prior to starting the excavation, the ground level at the location shall be checked jointly with the Engineer.

The rough excavation may be carried upto a maximum depth of 150 mm above the final level. The balance shall be excavated with special care. If directed by the Engineer, soft and undesirable spots shall be removed even below the final level. The extra excavation shall be filled up as instructed by the Engineer.

If the excavation is done to a depth greater than that shown on the drawing, or directed by the Engineer, due to the Contractor's fault, the excess depth shall be filled up to the required level (with cement concrete not leaner than 1:4:8 ordinary concrete or richer) as directed by the Engineer in each individual case.

2.4.1 **Excavation in All Type of Soil**

The excavation in all type of soil shall be carried out as per the approved proposal and as directed by the engineer. The work shall be carried out in a workmanlike manner without endangering the safety of nearby structures/services or works and without causing hindrance to any other activities in the area. Foundation pits shall not be excavated to the full depth unless construction is imminent. The last 150mm depth shall be excavated once concreting work is imminent. At the discretion of the engineer, the full depth may be excavated and the bed be covered with lean concrete as specified after watering and compacting the bed. As the excavation reaches the required dimensions, lines, levels and grades etc, the work shall be got checked and approved by the engineer. In cases where deterioration of the ground, upheaval, slips etc are expected, the engineer may order to suspend the work at any stage and instruct the contractor to carry out the protection works before the excavation will be restarted.

2.5.0 **Disposal**

The excavated earth will be disposed of in any or all the following manners :

a) By using it for backfilling straightway.

b) By stacking it temporarily for use in backfilling & garden purposes at a later date during execution of the Contract. Preservation of top layer of soil is to be ensured in-line with clause no. 1.20 of Special conditions for GRIHA & LEED (Volume 1D). Due to space constraints at site the contractor may be required to carry out this preservation activity in near-by BHEL Township in Sector-17, Noida including loading, transportation, unloading, stacking, etc. complete to the satisfaction of Engineer-in-charge.

c) i) By either spreading, or

ii) spreading and compacting at designated filling areas and / or disposal areas.

d) By selecting the useful material and stacking it neatly in areas designated by the Engineer for use in backfilling & landscaping by some other agency.

2.5.1 **Disposal of Surplus earth**

All surplus material from excavation shall be carried away from the excavation site by contractor to any lead and lift at contractor's own risk including taking necessary approval from authority for disposal if needed.
All assorted materials of dismantled structures shall be the property of the Owner.

2.6.0 **Protection**

The Engineer shall be notified by the Contractor as soon as the excavation is expected to be completed within a day so that it may be inspected by him at the earliest. Immediately after approval of the Engineer, the excavation must be covered up in the shortest possible time. But, in no case the excavation shall be covered up or worked on before approval and measurement by the Engineer. Excavated material shall be placed beyond 1.5 meters from the edge of the pit or trench or half the depth of the pit or trench whichever is more or further away if directed by the Engineer.

Excavation shall not be carried out below the foundation level of structure close by until required precautions have been taken.

The Contractor shall protect all under-ground services exposed by excavation. The Contractor shall also divert all surface drains, etc. affected by the excavation to maintain the working area neat and clean.

2.6.1 **Dealing with Surface Water**

All working areas shall be kept free of surface water as far as reasonably praticable. Works in the vicinity of cut areas shall be controlled to prevent the ingress of surface water.

No works shall commence until surface water streams have been properly intercepted , redirected or otherwise dealt with.

Where works are undertaken in the monsoon period, the Contractor may need to construct temporary drainage systems to drain surface water from working areas.

2.6.2 **Dewatering**

All excavations shall be kept free of water and slush. Grading in the vicinity of excavations shall be controlled to prevent surface water running into excavated areas. The Contractor shall remove by pumping or other means approved by the Engineer any water inclusive of rain water and subsoil water accumulated in excavation and keep the trench dewatered until the construction of foundation structure and backfilling are complete in all respects. Sumps made for dewatering must be kept clear of the foundations. Method of pumping shall be approved by the Engineer but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping.

The bidder shall fully apprise himself of the prevailing conditions at the proposed site. Climatic conditions including monsoon patterns, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid. Bidder has to plan suitable dewatering arrangement if any

prior to construction keeping in view the site condition, draining out of water to nearby nallah, water body etc. at his own cost.

2.6.3 **Treatment of Slips**

The Contractor will take all precaution to avoid high surcharges and provide proper surface drainage to prevent flow of water over the sides. These precautions along with proper slopes, berms, shoring and control of ground water should cause no slips to occur. If however slips do occur due to causes beyond the control of the Contractor, the same shall be removed by him and payment shall be made to him on appropriate item rate of earthwork. Slips caused due to negligence of the Contractor will be cleared and back-filled later by him.

2.7.0 **Back-filling**

2.7.1 **General**

The material used for backfilling shall consist of material, approved by the Engineer obtained from excavated earth. The material shall be free from lumps and clods, roots and vegetation, harmful salts and chemicals, organic materials, etc.

In certain locations, the Engineer may direct sand fillings. The sand should be clean, well graded and be of acceptable quality.

2.7.2 **Filling and Compaction in Pits and Trenches around Structures**

As soon as the work in foundations has been accepted and measured, the spaces around the foundation structures in pits and trenches shall be cleared of all debris, brick bats, mortar droppings, etc., and filled with earth in layers not exceeding 200 mm in loose thickness each layer being watered, rammed and properly compacted to achieve a dry density of not less that 95% of proctor's dry density at optimum moisture content as per IS-2720 (Part-VII) where backfilling with cohesive soil and sandy silt containing high percentage of silt. For back filling with sand having little or no silt, each layer shall be compacted to a relative density of 75% as per IS-2720 part XIV. Earth shall be rammed with approved mechanised compaction machine. Usually, no manual compaction shall be allowed unless specifically permitted by the Engineer. The final surface shall be trimmed and levelled to proper profile as shown in the drawing and as desired by the Engineer.
Since the degree of compaction depends on the moisture content of the soil, a close watch should be kept on it and corrections done to optimise the moisture content.

2.7.3 **Plinth Filling**

The plinth shall be filled with earth in layers not exceeding 200 mm in loose thickness, watered and compacted as stated under clause no. 2.7.2 with approved compaction machine or manually, if specifically permitted by the Engineer. When the filling reaches the finished level, the surface shall be flooded with water for at least 24 hours, allowed to dry and then rammed and compacted, in order to avoid any settlement at a later stage. The finished level of the filling shall be trimmed to the slope intended to be given to the floor.

2.7.4 **Filling in Trenches for Water Pipes and Drains**

Earth used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken or removed.

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed.

Where the trenches are excavated in soil, the filling shall be done with earth on the sides and top of pipes in layers not exceeding 150 mm, watered, rammed and compacted taking care that no damage is caused to the pipe below. Filling of trenches shall be carried out simultaneously on both sides of the pipe in such a manner that unequal pressures do not occur.

2.7.5 **Approaches**

The Contractor should provide and maintain proper approaches for workmen and for inspection. The roads and approaches around the excavated pits should be kept clear at all times so that there is no hindrance to the movement of men, material and equipment of various agencies connected with the Project

2.7.6 **Lighting**

Full scale area lighting is to be provided if night work is permitted or directed by the Engineer. If no night work is in progress, red warning lights should be provided at the corners of the excavated pit and the edges of the fill.

2.8.0 **TESTING AND ACCEPTANCE CRITERIA**

2.8.1 **Excavation**

On completion of excavation, the dimensions of the pits will be checked as per the drawings after the pits are completely dewatered the work will be accepted after all undercuts have been set right and all over excavations filled back to required lines, levels and grades by placing ordinary concrete of 1:4:8 proportion and/or richer and/or by compacted earth, as directed by the Engineer. The excavation work will be accepted after the above requirements are fulfilled and all temporary approaches encroaching inside the required dimension of the excavation have been removed.

2.8.2 **Back-filling**

The degree of compaction shall be sufficient to achieve a dry density of not less than 95% of proctor's dry density at optimum moisture content as per IS-2720 (Part - VII) or a relative density of 75% as per IS-2720 (Part-XIV) as applicable depending on the nature of back filling material as stated in clause no. 2.7.2 of this specification. The work of back-filling will be accepted after the Engineer is satisfied with the degree of compaction achieved.

2.9.0 **MODE OF MEASUREMENT**

Method of measurements are specified as below:

a) The length, breadth and depth shall be measured correct to the nearest centimetre if measurements are taken by tape. Rounding of numerical shall be as per relevant IS Codes. If the measurements are taken with staff and level, the

levels shall be recorded correct to 5mm. The area and volume shall be worked out in square meter and cubic meter respectively correct to the nearest of two decimal places.

b) For earth work in excavation, the ground levels shall be taken before and after completion of the work in the actually excavated area. The quantity of earth work in excavation shall be computed from these levels in cubic meter.

c) PCC plan area and vertical depth as per drawing shall be measured for payment and no payment shall be made for cutting in slope, slope protection, creating working space, extra excavation, its filling & dewatering, disposable of excavated earth.

d) Tree cutting having girth more than 300mm shall be measured in number and are separately payable as deemed not covered in excavation items of work in the schedule of quantities.

e) No claim shall be entertained against taxes, duties, royalty etc. in excavation & disposal of surplus excavated earth.

2.10.0 Post-construction Anti-termite treatment

i) **Chemicals**

The chemicals used for the soil treatment shall be any one or a combination of the following with concentration shown against each in adequous emulsion:

Chemicals (EC's)	Concentration
Chlorpyriphos / Landane	20% EC By weight

Chemicals are available in concentrated form in the market and concentration is indicated on the sealed containers. To achieve the percentage of concentration specified above, chemical should be diluted with water in required quantity before it is used. Graduated containers shall be used for dilution of chemical with water in the required proportion to achieve the desired percentage of concentration. e.g. to dilute chemical of 30% concentration add 59 parts of water to one part of chemical to achieve 0.5% concentration.

Chemical shall be brought to site of work in sealed original containers. The material shall be brought in at a time in adequate quantity to suffice for the whole or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer In-Charge. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from Engineer In-Charge.

Hand operated pressure pump shall be used to carry out spraying operations to facilitate proper penetration of chemicals in the earth. To have proper check for uniform spraying of chemical, graduated containers shall be used. Proper check should be kept that the specified quantity of chemical is used for the required area during the operation.

ii) **Treatment along outside of building:**

The soil in contact with the external wall of the building shall be treated with chemical emulsion. Approximately 12 mm diameter holes shall be drilled around concrete or masonry apron of the building, as close as possible to the plinth wall about 300 mm apart, deep enough to reach the soil below and the chemical emulsion pumped into these holes to soak the soil below at the rate of 2.25 litres per linear metre.

In soils which do not allow percolation of chemicals to desired depth, the uniform disposal of the chemical to a depth of 300 mm shall be obtained by suitably modifying the mode of treatment depending on site condition.

iii) **Safety precautions**

All chemicals used for anti-termite treatment are poisonous and hazardous to health. These chemicals can have an adverse effect upon health when absorbed through the skin, in haled as vapours or spray mists or swallowed. Person using or handling these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely source of accidental poisoning. They should be cautioned to observe carefully the safety precautions given below:

These chemicals are usually brought to site in the form of emulsifiable concentrates. The containers should be clearly labelled and should be stored carefully so that children and pet cannot get at them. They should be kept securely closed.

Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water, especially before eating and smoking. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash in to the eyes they shall be flushed with plenty of soap and water and immediate medical attention should be sought.

The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing.

Care should be taken in the application of chemicals to see that they are not allowed to contaminate wells or springs, which serve as sources of drinking water.

A pressure pump shall be used to carry out spraying operations to facilitate proper penetration of chemicals in to the earth.

2.10.1 Measurements :

All dimensions shall be measured correct to a cm. The measurements shall be made of the surface actually provided with anti-termite treatment.
For treatment along outside of external wall of building, measurements shall be made in running metres taking length along the plinth of the building.

3.0 CEMENT CONCRETE (PLAIN & REINFORCED)

This specification covers all the requirements, described hereinafter for general use of Plain and Reinforced Cement Concrete work in Structures and locations, cast-in-situ or precast, and shall include all incidental items of work not shown or specified but reasonably implied or necessary for the completion of the work.

This specification shall also apply to the extent it has been referred to or applicable with the special requirements of structures covered in SCOPE of IS:456.

IS:456 shall form a part of this specification and shall be complied with unless permitted otherwise. For any particular aspect not covered by this Code, appropriate IS Code, specifications and/or replacement by any International Code of practice as may be specified by the Engineer shall be followed. All codes and Standards shall conform to its latest revisions. A list of IS codes and Standards is enclosed hereinafter for reference.

3.1.0 **Work to be provided for by the Contractor**

The work to be provided for by the Contractor, unless otherwise specified shall include but not be limited to the following: -

a) Furnish all labour, supervision, services including facilities as may be required under statutory labour regulations, materials, forms, templates, supports, scaffolds, approaches, aids, construction equipment, tools and plants, transportations, etc. required for the work.

b) Prepare Bar bending Schedules for reinforcement bars showing the positions and details of spacers, supports, chairs, hangers etc.

c) Prepare working drawings of formworks, scaffolds, supports, etc.

d) Prepare shop drawings for various inserts, anchors, anchor bolts, pipe sleeves, embedment, hangers, openings, frames etc.

As decided by the Engineer some or all of the drawings & schedules prepared under item (b) to (d) above will have to be submitted for approval.

e) Submit for approval detailed schemes of all operations required for executing the work, e.g. Material handling, Concrete mixing, Placement of concrete, Compaction, curing, services, Approaches, etc.

f) Design and submit for approval concrete mix designs required to be adopted on the job.

g) Furnish samples and submit for approval results of tests of various properties of the following :

i) The various ingredients of concrete
ii) Concrete
iii) Embedments
iv) Joint seals

h) Provide all incidental items not shown or specified in particular but reasonably implied or necessary for successful completion of the work in accordance with the drawings and specifications.

i) For supply of certain materials normally manufactured by specialist firms, the Contractor may have to produce, if directed by the Engineer, a guarantee in approved proforma for satisfactory performance for a reasonable period as may be specified, binding both the manufacturers and the Contractor, jointly and severally.

3.1.1 Work by Others

No work under this specification will be provided by any agency other than the Contractor unless specifically mentioned elsewhere in the contract.

3.2.0 Information to be submitted by the Tenderer

3.2.1 With Tender

The following technical information are required with the tender :

a) Source and arrangement of processing of aggregates proposed to be adopted.
b) Type of plant and equipment proposed to be used.
c) Names of firms with which association is sought for to execute the special items of work in the contract.
d) Types of formwork proposed to be used.

3.2.2 **After Award**

The following information and data including samples where necessary, shall be submitted by the Contractor progressively during the execution of the contract.

a) **Programme of Execution**
Within 30 days of the award of contract, the Contractor will submit a Master Programme for completion of the work.

This Master Programme may have to be reviewed and updated by the Contractor, quarterly or at more frequent intervals as may be directed by the Engineer depending on the exigencies of the work.

Detailed day to day programme of every month is to be submitted by the Contractor before the end of the previous month.

b) **Samples**
Samples of the following materials and any other materials proposed to be used, shall be submitted as directed by the Engineer, in sufficient quantities for approval. Approved samples will be preserved by the Engineer for future reference. The approval of the Engineer shall not, in any way, relieve the Contractor of his responsibility of supplying materials of specified qualities :

i) Coarse and fine aggregates.

ii) Admixtures.

iii) Plywood for Formwork.

iv) Embedded and anchorage materials as may be desired by the Engineer.

v) Joint sealing strips and other waterproofing materials.

vi) Joint filling compounds.

c) **Design Mix**
Design mix giving proportions of the ingredients, sources of aggregates and cement, along with accompanying test results of trial mixes as per relevant I.S. codes, is to be submitted to the Engineer for his approval before it can be used on the works.

d) **Conformity with Design**
The Contractor will prepare check lists in approved proforma which will be called 'Pour Cards'. These Pour Cards will list out all items of work involved. The Contractor will inform the Engineer, sufficiently in

advance, whenever any particular pour is ready for concreting. He shall accord all necessary help and assistance to the Engineer for all checking required in the pour. On satisfying himself that all details are in accordance to the drawings and specifications, the Engineer will give written permission on the same 'Pour Card' allowing the Contractor to commence placement of concrete. Details of all instructions issued by the Engineer and the records of compliance by the Contractor, deviations allowed by the Engineer and any other relevant information will be written on accompanying sheets attached to the Pour Cards. These sheets, termed as 'Progress Cards', will be prepared by the Contractor on approved proforma. The Pour Cards along with accompaniments will be handed over to the Engineer before starting placement of concrete. One of the mix designs developed by the Contractor as per the I.S. Specifications and established to the satisfaction of the Engineer by trial mixes shall be permitted to be used by the Engineer, the choice being dictated by the requirements of designs and workability. The methods of mixing, conveyance, placement, vibration, finishing, curing, protection and testing of concrete will be as approved or directed by the Engineer.

3.3.0 Materials to be used

General Requirement

All materials whether to be incorporated in the work or used temporarily for the construction shall conform to the relevant IS Specifications unless-stated otherwise and be of best approved quality.

3.3.1 Cement

Cement shall in general comply the following specifications:-

i) **Type:** The cement used shall be ordinary Portland cement conforming to IS 8112 - 1989 (Latest revision) of grade 43/ IS 12269 - 2013 (Latest revision) of grade 53. Minimum 15% Fly ash by mass to be used as part replacement of ordinary Portland cement with maximum up to 25% for all works except where specifically mentioned in the Drawings and/or directed by the Engineer In-Charge. Portland pozzolana Cement confirming to 1489 (Part I) - 1991 (Latest revision) can also be allowed without additional fly ash. Fly ash conforming to grade I of IS 3812 (Part-1) only to be used as part replacement of OPC as per IS : 456. Uniform blending with cement to be ensured in accordance with clauses 5.2 and 5.2.1 of IS:456 -2000 in the items of BMC and RMC.

All cement shall be fresh when delivered. Cement shall be delivered in sound and properly secured bags or other packages ready for immediate use and shall be used direct from the bag. The contractor shall maintain for Engineer In-Charge' inspection a record of receipts and consumption of cement indicating the source, the age and the date of receipt of cement. Cement containing lumps which cannot be broken by a light touch of fingers shall not be used in the works. Admixtures shall not be used without written consent of the Engineer In-Charge.

ii) **Sources**

Cement shall be obtained from sources, which are approved by the Engineer In-Charge. Makes and sources of cement shall not be varied from those used for trial mixes; should a change be unavoidable the contractor shall submit his proposals for the prior approval of the Engineer In-Charge and then carry out

new trial mixes unless otherwise directed by the Engineer In-Charge. Cement of different kinds shall not be mixed at any stage.

iii) Manufacturers' Test Certificates for Cement

The Contractor shall request the cement manufacturer to forward to his site office the Certificate of conformity in accordance with IS (Latest Revision), and he shall cause a copy to be supplied to the Engineer In-Charge within 48 hours of the arrival of the certificate, which shall not be later than 14 days from the day of delivery of the relevant consignment. The test certificate shall be related to the date of delivery at site of consignment. The frequency of deliveries shall be such as to ensure that no cement is more than 3 months old when used in the works.

iv) Samples of Cement

Samples of cement to be used in the works shall be deposited with the Engineer In-Charge for his approval together with a certificate stating the name and address of the Manufacturer, the name and address of the supplier from whom it was purchased. The Engineer In-Charge may from time to time take samples of the cement being used in the works for testing.

v) Storage of Cement

The contractor shall provide a proper separate weatherproof store building with raised floor for cement storage on the site and shall at all times protect the cement from damp or any other deleterious influences. Each consignment of cement shall be kept separately and the contractor shall be careful to ensure the consignments are used in the order in which they are received.

Incase cement gets affected from damp or any other deleterious influence, such cement shall not be used for construction work.

3.3.2 Aggregates

Materials used as aggregates shall be obtained from a source known to produce aggregates satisfactory for concrete and shall be chemically inert, strong, hard, durable, of limited porosity and free from adhering, coating, clay lumps, coal residues and organic or other impurities that may cause corrosion of reinforcement or may impair the strength or durability of the concrete. Aggregates shall be tested in accordance with the requirements of IS. 383 or IS. 515 and the results of such tests shall be as hereinafter specified, the percentages being by weight unless the context indicates otherwise.

i) **Fine Aggregate**

Aggregate smaller than 4.75 mm and within the grading limits and other requirements set in IS: 383 are termed as Fine Aggregate or Sand. Only Fine Aggregate from approved sources and conforming to the above IS Specification will be allowed to be used in works. Sand shall be hard, durable, clean and free from adherent coatings or organic matter and clay balls or pellets. Sand when used as fine aggregate in concrete shall conform to IS:383. For plaster, it shall conform to IS:1542 and for masonry work to IS:2116.

ii) Coarse Aggregate

Aggregate of sizes ranging between 4.75 mm and 150 mm will be termed as Coarse Aggregate. Coarse aggregate for concrete shall be chemically inert, hard, strong durable against weathering, of limited porosity, and free from deleterious materials. It shall be properly graded. Coarse aggregates shall be either

crushed gravel or stone. All aggregates shall meet the requirement of IS:383:1970. Only Coarse Aggregate from, approved quarries and conforming to IS-383 will be allowed to be used on the works.

3.3.3 Steel Reinforcement

a) Type

Reinforcement shall be as per relevant IS Specification as mentioned in the Contract/Drawing/Instructions. All bars shall be of tested quality.

b) Storage of Reinforcement

Before and after bending, reinforcement shall be stored on raised racks in separate lots by size and type and protected from damage, contamination and the effects of the weather. For the purposes of identification each lot shall be marked plainly and securely by approved methods.

3.3.4 Water

Water for use in Concrete shall be clear and free from injurious oils, acids, alkalis, organic matter, salt, silts, or other impurities. Generally, IS: 3550 will be followed for routine tests. Acceptance of water shall be as per IS: 456.

3.3.5 Admixture

Only admixtures of approved quality will be used when directed or permitted by the Engineer. The different types of admixtures, which may be necessary to satisfy the concrete mix and the design requirement, shall be as per IS-9103 and may be one of the followings:

a) Accelerating admixture
b) Retarding admixture
c) Water reducing admixture
d) Air entraining admixture
e) Water proofing admixture

The contractor shall inform the Engineer about the type of admixture which he is planning to use in different areas within the scope of work for the approval of the Engineer. The admixture shall be of proven make and from a reputed manufacturer. It should not have any adverse effect on strength, durability of concrete and reinforcement. Super plasticizers conforming to IS: 9103 or ASTMC-494 shall only be used as admixture having the above properties either individually or in a combination as per the direction of the Engineer.

3.4 Quality Assurance Plans and Supervision :

A competent person shall be employed full time whose first duty will be to supervise all stages in the preparation and placing of the concrete. All test on materials, the making and testing of cubes and the maintenance and calibration of all mixing and measuring plant shall be carried out under his direct supervision in the presence of the Engineer In-Charge. Contractor shall set up a laboratory with all testing arrangement at site. On award of the work contractor shall submit their quality assurance plans, complete methodology & sequence of construction for all activities.

3.4.1 Quality Control

Contractor shall establish and maintain quality control for different items of work and materials as may be directed by the Engineer to assure compliance with contract requirements and maintain and submit to the Engineer records of the same. The quality

control operation shall include but not be limited to the following items of work:

a) Admixture: Type, quantity, physical, and chemical properties that affects strength, workability, and durability of concrete.For air entraining admixtures, dosage to be adjusted to maintain air contents within desirable limits.

b) Aggregate: Physical, chemical and mineralogical qualities. Grading, moisture content and impurities.

c) Water: Impurities tests.

d) Cement: Tests to satisfy relevant IS Specifications.

e) Formwork: Material, shapes, dimensions, lines, elevations, surface finish, adequacy of form, ties, bracing and shoring and coating.

f) Reinforcement: Shapes, dimensions, length of splices, clearances, ties and supports. Quality and requirement of welded splices. Material tests or Certificates to satisfy relevant IS Specification.

g) Grades of Concrete: Usage and mix design, testing of all properties.

h) Batching & Mixing: Types and capacity of plant, concrete mixers and transportation equipment.

i) Joints: Locations of joints, water stops and filler materials. Dimension of joints, quality, and shape of joint material and splices.

j) Embedded and Anchorage Items: Material, shape, location, setting.

k) Placing: Preparation, rate of pouring, weather limitations, time intervals between mixing and placing and between two successive lifts, covering over dry or wet surfaces, cleaning and preparation of surfaces on which concrete is to be placed, application of mortar/slurry for proper bond, prevention of cold joint, types of chutes or conveyors.

l) Compaction: Number of vibrators, their prime mover, frequency and amplitude of vibration, diameter and weight of vibrators, duration of vibration, hand-spreading, rodding and tamping.

m) Setting of base & Bearing plates: Lines, elevations, and bedding mortar.

n) Concrete Finishes: Repairs of surface defects, screening, floating, steel trowelling and brooming, special finishes.

o) Curing: Methods and length of time.

Copies of records and tests for the items noted above, as well as, records of corrective action taken shall be submitted to the Engineer for approval as may be desired.

3.5 INSTALLATION

All installation requirements shall be in accordance with IS: 456 and as supplemented or modified herein or by other best possible standards where the specific requirements mentioned in this section of the specification do not cover all the aspects to the full satisfaction of the Engineer.

3.5.1 Washing and Screening of Aggregates

Washing and screening of coarse and fine aggregates to remove fines, dirt, or other deleterious materials shall be carried out by approved means as desired by the Engineer.

3.5.2 Admixture

All concrete shall be designed for normal rate of setting and hardening at normal temperature. Variations in temperature and humidity under different climatic conditions will affect the rate of setting and hardening, which will, in turn, affect the workability and quality of the concrete. Admixtures including plasticisers of approved make may be used with the Engineer's approval in accordance with IS-456 to modify the rate of hardening, to improve workability or as an aid to control concrete quality. The Engineer reserves the right to require laboratory test or use test data, or owner satisfactory reference before granting approval. The admixture shall be used strictly in accordance with the manufacturer's directions and/or as directed by the Engineer.

3.5.3 Grades of Concrete

Concrete shall be in one of the grades designated in IS: 456. Grade of concrete to be used in different parts of work shall be as shown on the drawing. In case of liquid retaining structures, IS: 3370 will be followed. Minimum cement content shall be as per IS: 456.

3.5.4 Proportioning and Works Control

“Design Mix Concrete” and “Nominal Mix Design” is defined as follows for use in this specification:

1. Proportioning of ingredients of concrete made with preliminary tests by designing the concrete mix. Such concrete shall be called "Design Mix Concrete".
2. Proportioning of ingredients of concrete made without preliminary tests adopting nominal concrete mix. Such concrete shall be called "Nominal Mix Concrete".

As far as possible, design mix concrete shall be used on all concrete works. Nominal mix concrete, in grades M-15 or lower only may be used if shown on drawings or approved by the Engineer. In all cases the Proportioning of ingredients and works control shall be in accordance with IS: 456 and shall be adopted for use after the Engineer is satisfied regarding its adequacy and after obtaining his approval in writing.

3.5.5 Mix Design Criteria

Concrete mixes will be designed by the Contractor to achieve the strength, durability, and workability necessary for the job, by the most economical use of the various ingredients. In general, the design will keep in view the following considerations

a) Consistent with the various other requirements of the mix, the quantity of water should be kept at the lowest possible level.

b) The nominal maximum size of coarse aggregate shall be as large as possible within the limits specified.

c) The various fractions of coarse and fine aggregates should be mixed in such a proportion as to produce the best possible combined internal grading giving the densest and most workable mix.

d) The finished concrete should have adequate durability in all condition, to

withstand satisfactorily the weather and other destruction agencies, which it is expected to be subjected to in actual service.

e) The mix design shall have required workability and characteristic strength as per IS: 456. The quantity of cement, aggregates, and admixtures shall be determined by mass.

The requirement of adequate structural strength is catered for by the choice of proper grade of concrete in structural design. The Contractor will strictly abide by the same in his design of concrete mix installation. Various trials shall be given by the contractor with specific cement content on each trial. In some cases, plasticizers and other admixtures may be necessary to achieve the desired results.

3.5.6 Strength Requirements

The strength requirements of both design mix and nominal mix concrete where ordinary Portland Cement or Portland Pozzolona cement is used, shall be as per IS:456. All other relevant clauses of IS:456 shall also apply.

3.5.7 Minimum Cement Content

The minimum cement content for each grade of concrete shall be as per IS: 456. Contractor has to consider actual environmental exposure condition at site. Based on various tests results and as per Engineer, the environment condition shall be adopted for which minimum cement content shall be considered. No extra payment shall be made on account of any variation in environment condition.

a) Sufficient number of trial mixes (to be decided by the Engineer) will be taken at the laboratory for the various designs and graphs of w/c ratio Vs crushing strengths at various ages will be plotted.

b) All tests will be done in presence of the Engineer who shall be the final authority to decide upon the adoption of any revised minimum cement content. The Contractor will always be responsible to produce quality concrete of the required grade as per the acceptance criteria of IS: 456.

c) The Engineer will always have the unquestionable right to revise the minimum cement content as decided above, if, in his opinion, there is any chance of deterioration of quality on account of use of lower cement content or any other reason.

3.5.8 Water-Cement Ratio

The choice of water-cement ratio in designing a concrete mix will depend on:-

a) The requirement of strength.

b) The requirement of durability.

3.5.9 Strength Requirement

In case of "Design Mix Concrete" the water-cement ratio of such value as to give acceptable test results as per IS: 456, will be selected by trial and error. The values of water-cement ratios for different grade and mix designs will have to be established after conducting sufficiently large number of preliminary tests in the laboratory to the satisfaction of the Engineer. Frequent checks on test will have to be carried out and the water-cement ratios will be revised if the tests produce unsatisfactory results. Notwithstanding anything stated above the Contractor's responsibility to produce satisfactory test results and to bear all the consequences in case of default remains unaltered.

In case of nominal mix concrete, the maximum water-cement ratio for different grades of concrete is specified in Table-5 of IS: 456 and no tests are necessary. The acceptance test criterion for nominal mix concrete shall be as per IS: 456.

3.5.10 Durability Requirement

Tables 4 & 5 of IS: 456 give the maximum water-cement ratio permissible from the point of view of durability of concrete subjected to adverse exposure to weather, sulphate attacks, and contact with harmful chemicals. Impermeability may also be an important consideration.
Whenever the water-cement ratio dictated by Durability consideration is lower than that required from strength criteria, the former should be adopted.
In general the water cement ratio between 0.4 and 0.45 will be desirable to satisfy the durability requirement and from the consideration of impermeability of concrete. The contractor may propose lower water cement ratio as mentioned above by addition of a suitable plasticizer/super-plasticizer. Trial mix shall be carried out accordingly. However, the contractor has to propose specifically along with field trials in the event of lower cement content if found suitable along with a plasticizer.

3.5.11 Workability

Only specified quantity of water shall be added to the cement and aggregate during mixing to produce concrete having a sufficient workability to enable it to be well consolidated, to be worked in to the corners of the shuttering and around the reinforcement to give the specified surface finish, and to have the specified strength. Water cement ratio shall be maintained as per IS. 456-(latest) unless specified otherwise. When a suitable amount of water has been determined, the resulting consistency shall be maintained throughout the corresponding parts of the work and tests shall be conducted to ensure the maintenance of this consistency according to the standard method of test for consistencies of concrete (slump test) as below:

In case of pumpable concrete the slump & workability required for pumping the concrete shall be achieved by the contractor at his own cost. Nothing extra shall be paid for use of extra cement and / or plasticisers.

The workability of concrete shall be checked at frequent intervals by slump tests.

3.5.12 Size of coarse Aggregates

The maximum size of coarse aggregates for different locations shall be as follows unless otherwise directed by the Engineer

Very narrow space	- 12 mm
Reinforced concrete	- 20 mm
Lean concrete	- 40 mm

Grading of coarse aggregates for a particular size shall conform to relevant I.S. Codes and shall also be such as to produce a dense concrete of the specified proportions, strength and consistency that will work readily into position without segregation. Coarse aggregate size wise will normally be stacked separately in properly designed stockpiles

3.6 Batching and Mixing

3.6.1 Machine batched at site:

Ingredients of the concrete mix shall be measured by weight. Concrete shall always be mixed in mechanical mixer. Water shall not normally be charged into the drum of the mixer until all the cement and aggregates constituting the batch are already in the drum and mixed for at least one minute. Mixing of each batch shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency, but in no case shall mixing be done for less than 2 (two) minutes and at least 40 (forty) revolutions after all the materials and water are in the drum. When absorbent Aggregates are used or when the mix is very dry, the mixing time shall be extended as may be directed by the Engineer. Mixers shall not be loaded above their rated capacity as this prevents thorough mixing.

The entire contents of the drum shall be discharged before the ingredients for the next batch are fed into the drum. No partly set or remixed or excessively wet concrete shall be used. Such concrete shall be immediately removed from site. Each time the work stops, the mixer shall be thoroughly cleaned & when the next mixing commences, the first batch shall have 10% additional cement at no extra cost to the Owner to allow for loss in the drum.

Regular checks on mixer efficiency shall be carried out as directed by the Engineer as per IS: 4634 on all mixers employed at site only those mixers whose efficiencies are within the tolerances specified in IS: 1791 will be allowed to be employed.

Batching Plant shall conform to IS: 4925. The measuring gauges of batching plant shall be periodically calibrated for which the contractor shall provide standard weights. The accuracy of all gauges shall be within limits prescribed by the Engineer.

When hand mixing is permitted by the Engineer, for unimportant out of the way locations in small quantities, it shall be carried out on a water-tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency.

In case of hand-mixing, 10% extra cement shall be added to each batch at no extra cost to the owner.

3.6.2 Ready Mix Concrete

Ready-mixed concrete used shall be manufactured in a approved central automatic weight Batching plant and transported to the job in agitating transit mixer. The maximum size of coarse aggregate shall be limited to one-third of the smallest inside diameter of the hose or pipes used for pumping. Provision shall be made for elimination of over-sized particles by screening or by careful selection of aggregates. To obtain proper gradation it may be necessary to combine and blend certain fractional sizes to aggregates. Uniformity of gradation throughout the entire job shall be maintained. The quantity of coarse aggregate shall be such that the concrete can be pumped, compacted and finished without difficulty.

Fine aggregates:

The gradation of fine aggregate shall be such that 15 to 30 percent should pass the 0.30 mm screen and 5 to 10 percent should pass 0.15mm screen so as to obtain a pumpable concrete. Sands that are deficient in either of these two sizes should be blended with selected finer sands to produce these desired percentages. With this gradation, sands having a fineness modulus between 2.4 and 2.8 are generally satisfactory. However, for uniformity, the fineness modulus of the sand should not vary more than 0.2 from the average value

used in proportioning.

Water, Admixtures and slump:

The amount of water required for proper concrete consistency shall take into account the rate of mixing, length of haul, time of unloading and ambient temperature conditions.

Additions of water to compensate for slump loss should not be resorted to nor should the design maximum water-cement ratio be exceeded. Additional dose of retarder/plasticizer/superplasticizer shall be used with prior approval of Engineer to compensate the loss of setting time and slump at contractor's cost. Retempering water shall not be allowed to be added to mixed batches to obtain desired slump.

Transportation:

The method of transportation used should efficiently deliver the concrete to the point of placement without significantly altering its desired properties with regard to water-cement ratio, slump, and homogeneity.

The revolving-drum truck bodies of approved make shall be used for transporting the concrete. The number of revolutions at mixing speed, during transportation, and prior to discharge shall be specified and agreed upon. Reliable counters shall be used on revolving-drum truck units. Standard mixer uniformity tests, conforming to ASTM standards C 94-69 "Standard Specifications for Ready Mix Concrete", shall be carried out if desired by Engineer to determine whether mixing is being accomplished satisfactorily.

Pumping of concrete:

Only approved pumping equipment, in good working condition, shall be used for pumping of concrete. Concrete shall be pumped through a combination of rigid pipe and heavy-duty flexible hose of approved size and make. The couplings used to connect both rigid and flexible pipe sections shall be adequate in strength to withstand handling loads during erection of pipe system, misalignment, and poor support along the lines. They should be nominally rated for at least 3.5 Mpa pressure and greater for rising runs over 30 m. Couplings should be designed to allow replacement of any section without moving other pipe sections, and should provide full cross section with no construction or crevices to disrupt and smooth flow of concrete.

All necessary accessories such as curved sections of rigid pipe, swivel joins and rotary distributors, pin and gate valves to prevent backflow in the pipe line, switch valves to direct the flow into another pipe line, connection devices to fill forms from the bottom up, extra strong couplings for vertical runs, transitions for connecting different sizes of pipe, air vent for downhill pumping, clean-out equipment etc. shall be provided as and where required. Suitable power controlled booms or specialized crane shall be used for supporting the pipe line.

Field control:

Sampling at both truck discharge and point of final placement shall be employed to determine if any changes in the slump and other significant mix characteristics occur. However, for determining strength of concrete, cubes shall be taken from the placement end of line. The RMC supplier should

nominate a technically qualified representative at site for sampling, testing and placing of concrete.

Planning :

Proper planning of concrete supply, pump locations, line layout, placing sequence and the entire pumping operation shall be made. The concrete production, transportation and placing shall be planned in such a manner that duration between addition of water during mixing and placing of concrete in desired location is well within time limits prescribed by the RMC manufacturer, however, this is subjected to fulfillment of slump and other properties of concrete as specified in tender. On failure to adherer to the time schedule by the supplier the Engineer may reject the concrete.

The pump wherever used should be as near the placing area as practicable, and the entire surrounding area shall have adequate bearing strength to support concrete delivery pipes. Lines from pump to the placing area should be laid out with a minimum of bends. For large placing areas alternate lines should be installed for rapid connection when required. Standby power and pumping equipment should be provided to replace initial equipment, should breakdown occur.
The placing rate should be estimated so that concrete can be ordered at an appropriate delivery rate.

As a final check, the pump should be started and operated without concrete to be certain that all moving parts are operating properly. A grout mortar should be pumped in to the lines to provide lubrication for the concrete, but this mortar shall not be used in the placement.

When the form is nearly full and there is enough concrete in the line to complete the placement, the pump shall be stopped and a go-devil inserted and shall be forced through the line by water under pressure to clean it out. The go-devil should be stopped at a safe distance from the end of the line so that the water in the line will not spill into the placement area. At the end of placing operation, the line shall be cleaned in the reverse direction.

SUBMISSION OF DOCUMENTS FROM RMC MANUFACTURER:

Following document shall be submitted by the RMC manufacturer through the contractor along with checklist for RMC.

1. Design Mix
2. Manufacturer's Test Certificate for cement and plasticizer
3. Lab test certificates for all ingredient of concrete
4. Delivery docket sheet mentioning the grade of concrete, quality of ingredient used, slump, transit mixer vehicle no. placement, location, time of concrete production and placing etc

3.6.3 Conveying Concrete

Concrete shall be handled and conveyed from the place of mixing to the place of laying as rapidly as practicable by approved means and placed and compacted in the final position before the initial setting of the cement starts. Concrete should be conveyed in such a way as will prevent segregation or loss of any of the

ingredients. For long distance haulage, agitator cars of approved design will be used. If, in-spite of all precautions, segregations does occur during transport, the concrete shall be properly re-mixed before placement. During very hot or cold weather, if directed by the Engineer, concrete shall be transported in deep containers, which will reduce the rate of loss of water, by evaporation or loss of heat. If necessary, the container may have to be covered and insulated. Conveying equipments for concrete shall be well maintained and thoroughly cleaned before, commencement of concrete mixing. Such equipments shall be kept free from set concrete.

3.6.4 Placing and Compacting Concrete

Where specifically covered, the relevant I.S. Code will be followed for the procedure of surface preparation, placement, consolidation, curing, finishes, repairs and maintenance of concrete. If, however, there is no specific provision in relevant I.S. code for any particular aspect of work, any other standard code of practice, as may be specified by the Engineer, will be adopted. Concrete may have to be placed against the following types of surfaces:
a) Earth foundation
b) Formwork
c) Construction joint in concrete or masonry

The surface on or against which concrete is to be placed has to be cleaned thoroughly. Old construction joint has to be roughened by wire brushing, chipping, sand blasting or any other approved means for proper bond. All cuttings, dirt, oil, foreign and deleterious material, laitance, etc. are to be removed by air water jetting or water at high pressure. Earth foundation on which direct placement of concrete is allowed, will be consolidated as directed by the Engineer such that it does not crumble and get mixed up with the concrete during or after placement, before it has sufficiently set and hardened.

Formwork, reinforcement, preparation of surface, embedment, joint seals etc., shall be approved in writing by the Engineer before concrete is placed. As far as possible, concrete shall be placed in the formwork by means approved by the Engineer and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 1500 mm shall have to be approved by the Engineer.

Construction joint will be kept moist for at least 72 hours prior to placement. Concrete will be placed always against moist surface but never on pools of water. In case the foundation cannot be dewatered completely, special procedure and precaution, as directed by the Engineer will have to be adopted.

Formwork will be cleaned thoroughly and smeared lightly with form oil or grease of approved quality just prior to placement.
A layer of mortar of thickness 12 mm of the same or less w/c ratio and the same proportion as that of the concrete being placed or cement slurry will be spread thoroughly on the construction joint just prior to placement of concrete.

After concrete has been placed, it shall be spread, if necessary & thoroughly compacted by approved mechanical vibration to maximum, subsidence without segregation and thoroughly worked around shape. Vibrators shall not be used for pushing concrete into adjoining areas. Vibrators must be operated by experienced workmen and the work carried out as per relevant IS Code of Practice: In thin members with heavy congestion of reinforcement or other

embedments, where effective use of internal vibrator is, in the opinion of the Engineer, doubtful, in addition to immersion vibrators the contractor may have to employ form vibrators conforming to IS: 4656. For slabs and other similar structures, the contractor will additionally employ screed vibrator as per IS: 2506. Hand tamping may be allowed in rare cases, subject to the approval of the Engineer. Care must be taken to ensure that the inserts, fixtures, reinforcement, and formwork are not displaced or distorted during placing & consolidation of concrete.

The rate of placement of concrete shall be such that no cold joint is formed and fresh concrete is placed always against green Concrete, which is still plastic and workable. No concrete shall be placed in open, during rains. During rainy season, no placement in the open is to be attempted unless sufficient tarpaulins or other similar protective arrangement for completely covering the still green concrete from rain is kept at the site of placement. If there has been any sign of washing of cement and sand, the entire affected concrete shall be removed immediately. Suitable precautions shall be taken in advance to guard against rains before leaving the fresh concrete unattended. No accumulation of water shall be permitted on or around freshly laid concrete.

Slabs, beams, and similar members shall be poured in one operation, unless otherwise instructed by the Engineer. Mouldings, throating, drip course, etc., shall be poured as shown on the drawings or as directed by the Engineer. Holes shall be provided and bolts, sleeves, anchors, fastenings, or other fixtures shall be embedded in concrete as shown on the drawings or as directed by the Engineer. Any deviation there from shall be set right by the Contractor at his own expense as instructed by the Engineer.

In case the forms or supports get displaced during or immediately after the placement and bring the concrete surface out of alignment beyond tolerance limits, the Engineer may direct to remove the portion and reconstruct or repair the same -at the Contractor's expense.
The Engineer shall decide upon the time interval between two placements of concrete of different ages coming in contact with each other, taking in consideration the degree of maturity of the older concrete, shrinkage, heat dissipation and the ability of the older concrete to withstand the load imposed upon it by the fresh placement.

Once the concrete is deposited, consolidated and finished in its final position, it shall not be distributed.

3.7.0 Construction Joints and Cold Joints

3.7.1 Construction Joints

It is always desirable to complete any concrete structure by continuous pouring in one operation. However, due to practical limitation of methods and equipment and certain design considerations, construction joints are formed by discontinuing concrete certain predetermined stages. These joints will be formed in a manner specified in the drawings/Instruction.
Vertical construction joints will be made with rigid stop-board forms having slots for allowing passage of reinforcement rods and any other embedment and fixtures that may be shown. Next stage concrete shall be placed against construction joint as per clause 3.6.4
Where the location of the joints are not specified, it will be in accordance with the following:

a) In a column, the joint shall be formed 75 mm below the lowest soffit of the beam framing into it.
b) Concrete in a beam shall preferably be placed without a joint, but if Provision of a joint is unavoidable, the joint shall be vertical and at the middle of the span.
c) A joint in a suspended floor slab shall be vertical and at the middle of the span and at right angles to the principal reinforcement.
d) Feather-edges in concrete shall be avoided while forming a joint.
e) A construction joint should preferably be placed in a low-stress zone and at right angles to the direction of the principal stress.
f) In case the Contractor proposes to have a construction joint anywhere to facilitate his work, the proposal should be submitted well in advance to the Engineer for study and approval without which no construction joint will be allowed.

3.7.2 Cold Joint

An advancing face of a concrete pour, which could not be covered by fresh concrete before expiry of initial setting time (due to an unscheduled stoppage or delay on account of breakdown in plant, inclement weather, low rate of placement or any other reason), is called a cold joint. The Contractor should always remain vigilant to avoid cold joints.
If, however, a cold joint is formed due to unavoidable reasons, the following procedure shall be adopted for treating it:

a) If the concrete is so green that it can be removed manually and if vibrators can penetrate the surface without much effort, fresh concrete can be placed directly against the old surface. The old concrete should be covered by fresh concrete as quickly as possible and the joint thoroughly and systematically vibrated.

b) In case concrete has hardened a bit more than (a) but can still be easily removed by a light hand pick, the surface will be raked thoroughly and the loose concrete removed completely without disturbing the rest of the concrete in depth. A rich mortar layer 12 mm in thickness, will be placed on the cold joint fresh concrete shall be placed on the mortar layer and the joint will be thoroughly and systematically vibrated penetrating the vibrator deep into the old layer of concrete.
c) In case the concrete at the joint has become so stiff that it cannot be remoulade and mortar or slurry does not raise inspite of extensive vibration, the joint, will be left to harden for at least 12 - 24 hrs. It Will then be treated as a regular construction joint, after cutting the concrete to required shape and preparing the surface as described earlier.

3.8.0 Repairs, Finishes, and Treatment of Concrete surfaces

3.8.1 Adequate and sound concrete surfaces, whether formed or unformed, can be obtained by employing a concrete mix of proper design, competent formwork, and appropriate methods of handling, placing, and consolidation by experienced workmen.
Unsound concrete resulting from improper mix design, incompetent methods, equipment and formwork, poor workmanship and protection will not be accepted and will have to be dismantled, removed and replaced by sound concrete at the Contractor's cost. The Engineer may, at his sole discretion, allow to retain concrete with minor defects provided the Contractor is able to repair it by approved methods at no extra cost to the Owner, All concrete work shall be inspected by the Contractor immediately after the forms are removed & he will

promptly report occurrence of any defects to the Engineer. All repair works will be carried out as per the instructions and in the presence of the Engineer or his representative. Generally, repair work will consist of any or all of the following operations:

a) Sack rubbing with mortar and stoning with carborundum stone.
b) Cutting away the defective concrete to the required depth shape.
c) Cleaning of reinforcement & embedments. It may be necessary to provide an anti-corrosive coating on the reinforcement.
d) Roughening by sand blasting or chipping.
e) Installing additional reinforcement/welded mesh fabric.
f) Dry packing with stiff mortar.
g) Plastering, guniting, shotcreting etc.
h) Placing and compacting concrete in the void left by cutting out defective concrete.
i) Grouting with cement sand slurry of 1:1 mix.
j) Repairing with a suitable mortar either cement or resin modified mortars.
k) Polymer modified patching and adhesive repair& mortar for beams & columns.

3.8.2 Finishing unformed Surface

The contractor shall provide normal finishes in unformed surfaces which can be achieved by screeding, floating, trowelling etc. A few typical and common cases of treatment of concrete surface are cited below:

a) Floor

Whenever a non-integral floor finish is indicated, the surface of reinforced concrete slab shall be struck off at the specified levels and slopes and shall be finished with a wooden float fairly smooth removing all laitance. No over trowelling, to obtain a very smooth surface, shall be done, as it will prevent adequate bond with the subsequent finish. If desired by the Engineer, the surface shall be scored and marked to provide better bond.

Where monolithic finish is specified or required, concrete shall be compacted and struck off at the specified levels and slopes with a screed, preferably a vibrating type and then floated with a wooden float. Steel trowelling is then started after the moisture film and shine have disappeared from the surface and after the concrete has hardened enough to prevent excess of fines and water to rise to the surface but not hard enough to prevent proper finishing of aberrations. Steel trowelling properly done will flatten and smoothen sandy surface left by wooden floats and produce a dense surface free from blemishes, ripples, and trowel marks.

A fine textured surface that is not slick and can be used where there is likelihood of spillage of oil or water can be obtained by trowelling the surface lightly with a circular motion after initial trowelling keeping the steel trowel flat on the surface.

To provide a better grip the Engineer may instruct marking the floor in a regular geometric pattern after initial trowelling.

b) Beams, Columns & Walls

If on such or any other concrete structure it is intended to apply plaster or such concrete surfaces against which brickwork or other allied works are to be built, the Contractor shall hack the surface adequately as soon as the form is stripped off so that proper bond can develop. Pattern, adequacy, and details of such hacking shall meet with the approval of the Engineer, who shall be informed to inspect such surfaces before they are covered up.

3.8.3 Protection and Curing of concrete

Newly placed concrete shall be protected by approved means from rain, sun, and wind. Concrete placed below the ground level shall be protected against

contamination from falling earth during and after placing. Concrete placed in ground containing deleterious substances, shall be protected from contact with such ground, or with water draining from such ground, during placing of concrete and for a period of at least three days, or as otherwise instructed by the Engineer. The ground water around newly poured concrete shall be kept to an approved level by pumping out or other adequate means of drainage to prevent floatation or flooding. Steps, as approved by the Engineer, shall be taken to protect immature concrete from damage by debris, excessive 'Loadings, vibration, abrasion, mixing with earth or other deleterious materials, etc. that may impair the strength and durability of the concrete.

As soon as the concrete has hardened sufficiently, it shall be covered either with sand, hessian, canvas, or similar materials and kept continuously wet for at least 14 (fourteen) days after final setting. Curing by continuous sprinkling of water will be allowed if the Engineer is satisfied with the adequacy of the arrangements made by the Contractor. Quality of water for curing shall be as per IS: 456.

If permitted by the Engineer, liquid curing compound may be used for prevention of premature water loss in concrete and thereby effecting curing of concrete. This type of curing compound shall be sprayed on newly laid concrete surfaces to form a thin film barrier against premature water loss without disturbances to normal setting action. The curing compound shall be emulsified paraffin based and shall comply with ASTM requirements for acceptance.

The curing compound shall be applied following the final finishing operation and immediately after disappearance of water from concrete surface. It is important not to apply the curing compound when standing water is still present on concrete.

The contractor shall arrange for the manufacturer's supervision at no extra cost.The Contractor shall remain extremely vigilant and employ proper equipment and workmen under able supervision for curing. The Engineer's decision regarding the adequacy of curing is final. In case the Engineer notices any lapse on the part of the Contractor, he will inform the Contractor or his supervisor verbally or in writing to correct the deficiency in curing. If no satisfactory action is taken by the Contractor within 3 (three) hours of issuance of such instruction, the Engineer will be at liberty either to employ sufficient means through any agency to make good the deficiency and recover the cost thereof from the Contractor, or deduct certain amount from contractor's payment for the part where inadequate curing was noticed entirely at the discretion of the Engineer.

3.9.0 Reinforcement

Mild steel round bars, TMT bars, Hot rolled deformed bars or cold twisted deformed bars as medium tensile or high yield strength steel, plain hard drawn steel wire fabric etc, will be used as reinforcement as per drawings and directions. In an aggressive environment an anti-corrosive coating on the reinforcement may be provided as per IS: 9077, as shown on the drawing or as directed by the Engineer.

3.9.1 Bar Bending Schedules

The Contractor shall submit to the Engineer for approval Bar Bending Schedules with working drawings in triplicate, showing clearly the arrangements proposed by the Contractor to match available stock of reinforcing steel, within one month of receipt of the Letter of Intent or of the

receipt of the relevant design drawings, whichever is later. Upon receipt of the Engineer's final approval of the Bar Bending Schedule , the Contractor shall submit 3 (three) prints of the final Bar bending Schedule after incorporating necessary modifications or corrections, for final record and distribution. Approval of such detailed Bar bending Schedule by the Engineer shall not relieve the Contractor of his responsibility for correctness nor of any of his obligations to meet the other requirements of the Contract.

3.9.2 Cleaning

All steel for reinforcement shall be free from loose scales, oil, grease, paint or other harmful matters immediately before placing the concrete.

3.9.3 Bending

Unless otherwise specified, reinforcing steel shall be bent in accordance with the procedure specified in IS: 2502 or as approved by the Engineer. Bends and shapes shall comply strictly with the dimensions corresponding with the final Bar Bending Schedules. Bar Bending Schedules shall be rechecked by the Contractor before any cutting, bending is done.

No reinforcement shall be bent when already in position in the work, without approval of the Engineer, whether or not it is partially embedded in concrete. Bars shall not be straightened in a manner that will injure the material. Rebending can be done only if approved by the Engineer. Reinforcing bars shall be bent by machine or other approved means producing a gradual and even motion. All the bars shall be cold bent unless otherwise approved. Bending hot at a cherry-red heat (not exceeding 845°C) may be allowed under very exceptional circumstances except for bars whose strength depends on cold working. Bars bent hot shall not be cooled by quenching.

3.9.4 Placing in Position

All reinforcements shall be accurately fixed and maintained in position as shown on the drawings by such approved and adequate means like mild steel chairs and/or concrete spacer blocks. Bars intended to be in contact at crossing points, shall be securely tied together at all such points by No. 20 G annealed soft iron wire or by tack welding in case of Bar larger than 25 mm dia., as may be directed by the Engineer. Binders shall tightly embrace the bars with which they are intended to be in contact and shall be securely held. The vertical distance between successive layers of bars shall be maintained by provision of mild steel spacer bars. They should be spaced such that the main bars do not sag perceptibly between adjacent spacers. Before actual placing, the Contractor shall study the drawings thoroughly and inform the Engineer in case he feels that placement of certain bars is not possible due to congestion. In such cases he should not start placing any bar before obtaining clearance from the Engineer.

Lapping shall normally do splicing of reinforcement. For M.S. reinforcement bars, butt-welding may be done, if permitted by the Engineer, under certain conditions. The work should be done with suitable safeguards in accordance with relevant Indian Standards for welding of mild steel bars used in reinforced concrete construction as per IS: 2751 and IS: 456. For High yield strength deformed bars, lap welding may be done, if permitted by the Engineer, under certain conditions. The work should be done with suitable safeguards in accordance with relevant Indian Standards as per IS: 9417. Splicing of reinforcement using mechanical coupler may be done, if permitted by the Engineer, under certain conditions. The work should be done with suitable safeguards in accordance with relevant Indian standards for “Reinforcement couplers for mechanical splices of bars in concrete” as per IS: 16172. **No extra shall be payable on account of welding of laps of reinforcement and for providing & fixing reinforcement couplers for mechanical splices of bars in concrete.**

The placing of reinforcements shall be completed well in advance of concrete pouring. Immediately before pouring, the reinforcement shall be examined by the Engineer for accuracy of placement and cleanliness. Necessary corrections as directed by him shall be carried out. Laps and anchorage lengths of reinforcing bars shall be in accordance with IS: 456, unless otherwise specified. The laps shall be staggered as far as practicable and as directed by the Engineer. Arrangements for placing concrete shall be such that reinforcement in position does not have to bear extra load and get disturbed. The cover for concrete over the reinforcements shall be as shown on the approved drawings unless otherwise directed by the Engineer. Where concrete blocks are used for ensuring the cover and positioning reinforcement, they shall be made of mortar not leaner than 1 (one) part cement to 2 (two) parts sand by –volume and cured in a pond for at least 14 (fourteen) days. The type, shape, size and location of the concrete blocks shall be as approved by the Engineer.

3.9.5 Cold Weather Concreting

When conditions are such that the ambient temperature may be expected to be 5°C or below during the placing and curing period, the work shall conform to the requirement of IS: 456 and IS: 7861.

3.9.6 Hot Weather Concreting

When depositing concrete in very hot weather, the Contractor shall take all precautions as per IS: 7861 and stagger the work to the cooler parts of the day to ensure that the temperature of wet concrete used in massive structures does not exceed 38°C while placing. Positive temperature control by precooling, post cooling or any other method, if required, will have to be done by the contractor at no extra cost.

3.9.7 Concreting under water

When it is necessary to deposit concrete under water it shall be done in accordance with the requirements of IS: 456.

3.9.8 Placing of concrete in wet weather

Concrete shall not be mixed and or placed in rainy weather or when there is likelihood of impending heavy showers. If it becomes necessary to place concrete during rainy weather, the contractor shall provide adequate protection by means of tarpaulin or similar other water proof material to immediately cover fresh concrete to prevent rain falling over it. This protection shall be left on the concrete for a period of 24 hours after placing of concrete.

3.9.9 Maintenance of Plant and Equipment

The contractor shall keep Batching Plant, weigh batching machines, mixing machines, compressors, vibrators and other plant and equipment for concrete and mortar work clean, well maintained and adjusted and where appropriate, shall check the accuracy of the measuring devices at regular intervals, all to the approval of the Engineer In-Charge's Representative. Mixer blades shall be replaced when worn down by 20 mm.

3.9.10 Night Work

Concrete shall not be mixed, placed, compacted or finished during the hours of darkness, except where necessary to complete a pour. However, concreting in darkness for these exceptions shall be only after obtaining the express permission in writing from the Engineer In-Charge's representative and in his presence only.

3.10 Acceptance Criteria

The general Acceptance Criteria of any and all of the concrete work shall be as per the relevant Clauses of IS. 456.

a) Cube tests

Acceptance of concrete is based on the 28th day results. However, the contractor shall establish a relationship between 7 days and 28 days strengths by carrying out 7 days tests at the time of performing the laboratory testing and from subsequent quality control testing. This relationship shall be used in interpreting any further test results to predict the probable value of the corresponding 28 days cube strengths. The contractor shall without delay advise the Engineer In-Charge of any sample that appears likely to fail to meet the specification and the contractor shall take any necessary action to minimize the effect of such failure.

If any of the works tests are not up to the standard, the Engineer In-Charge shall have the power to stop the work until the reason is investigated and steps taken to prevent further low results. The contractor shall not be entitled to any claims on account of such delays. Any concrete carried out from the batch that is afterwards found to be faulty, will be liable for rejection and if so directed, the contractor shall at his own expenses dismantle and replace the defective work and any work built thereon or shall take such other measures as may be deemed necessary by the Engineer In-Charge. At the discretion of the Engineer In-Charge, the contractor may be allowed to prove by means of a load test to be carried out at his own expense, that the concrete is capable of safely withstanding the loads as specified in the test.

3.11.0 Form Work and scaffolding / Staging

If it is so desired by the Engineer, the contractor shall prepare, before commencement of actual work, designs and working drawings for formwork and centring and get them approved by the Engineer. The formwork shall conform to the shape, grade, lines, levels and dimensions as shown on the drawings.

Materials used for the formwork inclusive of the supports and centring shall be capable of withstanding the working load and remain undistorted throughout the period it is left in service. All supports and scaffolds should be manufactured from structural or tubular steel except when specifically permitted otherwise by the Engineer.

The centring shall be true to vertical, rigid and thoroughly braced both horizontally and diagonally. Rakers are to be used where forms are to support inclined members. The forms shall be sufficiently strong to carry without undue deformation, the dead weight and horizontal pressure of the concrete as a liquid as well as the working load. In case the contractor wishes to adopt any other design criteria, he has to convince the Engineer about its acceptability before adopting it. Where the concrete is vibrated, the formwork shall be strong enough to withstand the effects of vibration without appreciable deflection, bulging, distortion or loosening of its components. The joints in the formwork shall be sufficiently tight to prevent any leakage of slurry or mortar.

To achieve the desired rigidity, tie bolts, spacer blocks, tie wires and clamps as approved by the Engineer shall be used but they must in no way impair the strength of concrete or cause stains or marks on the finished surface. Where

there are chances of these fixtures being embedded, only mild steel and concrete of adequate strength shall be used. Bolts passing completely through liquid retaining walls/slabs for the purpose of securing and aligning the formwork shall not be used.

The formwork shall be such as to ensure a smooth uniform surface free from honeycombs, air bubbles, bulges, fins and other blemishes. Any blemish or defect found on the surface of the concrete must be brought to the notice of the Engineer immediately and rectified as directed by him.

For exposed interior and exterior concrete surfaces of beams, columns and wall, plywood or other approved form shall be thoroughly cleaned and tied together with approved corrosion-resistant devices. Rigid care shall be exercised in ensuring that all column forms are in true plumb and thoroughly cross-braced to keep them so. All floor and beam centring shall be crowned not less than 8 mm in all directions for every 5 metres span. The formwork should lap and be secured sufficiently at the lift joints to prevent bulges and offsets.

Temporary openings for cleaning, inspection and for pouring concrete shall be provided at the base vertical forms and at other places, where they are necessary and as may be directed by the Engineer. The temporary openings shall be so formed that they can be conveniently closed when required, during pouring operations without leaving any mark on the concrete.

3.11.1 Cleaning and Treatment of Forms

All parts of the forms shall be thoroughly cleaned of old concrete, wood shavings, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish, loose concrete, chippings, shavings, sawdust etc. shall be scrupulously removed from the interior of the forms before concrete is poured. Compressed air jet and/or water jet along with wire brushes brooms etc. shall be used for cleaning. The inside surface of the formwork shall be treated with approved non-staining oil or other compound before it is placed in position. Care shall be taken that oil or other compound does not come in contact with reinforcing steel or construction joint surfaces. They shall not be allowed to accumulate at the bottom of the formwork. The oiling of the formwork will be inspected just prior to placement of concrete and redone wherever necessary.

3.11.2 Design

The formwork shall be so designed and erected that the forms for slabs and the sides of beams, columns, and walls are independent of the soffits of beams and can be removed without any strain to the concrete already placed or affecting the remaining formwork.

Removing any props or repropping shall not be done except with the specific approval of the Engineer. If formwork for column is erected for the full height of the column, one side shall be left open and built up in sections, as placing of concrete progress. Wedges, spacer bolts, clamps or other suitable means shall be provided to allow accurate adjustment and alignment of the formwork and to allow it to be removed gradually without jarring the concrete.

3.11.3 Inspection of Forms

Casting of' Concrete shall start only after the formwork has been inspected and approved by the Engineer. The concreting shall start as early as possible within 3 (three) days after the approval of the formwork and during this period the formwork shall be kept under constant vigilance against any interference. In case

of delay beyond three days, a fresh approval from the Engineer shall be obtained.

3.11.4 Removal of Forms

Formwork shall be kept in position after casting of concrete for a minimum period as mentioned in IS: 456, however the period of retaining form in position can be extended as per drawing, instruction of Engineer or as required for satisfactory completion of work without any extra cost. Before removing any formwork, the Contractor must notify the Engineer well in advance to enable him to inspect the concrete if the Engineer so desires.

The Contractor shall record on the drawing or in any other approved manner, the date on which concrete is placed in each part of the work and the date on which the formwork is removed there from and have this record checked and countersigned by the Engineer regularly. The Contractor shall be responsible for the safe removal of the formwork and any work showing signs of damage through premature removal of formwork or loading shall be rejected and entirely reconstructed by him without any extra cost to the Owner, The Engineer may, however, instruct to postpone the removal of formwork if he considers it necessary.

If any other type of cement other than ordinary Portland cement and Rapid hardening cement is used, the time of removal of forms shall be revised such that the strength of this cement at the time of removal of forms match with strength of Portland cement at the time of removal of form.

3.11.5 Tolerance

The formwork shall be so made as to produce a finished concrete, true to shape, lines, levels, plumb and dimensions as shown on the drawings subject to the following tolerances unless otherwise specified in this specification or drawings or directed by the Engineer:-

For - a) Sectional dimension - ± 5 mm
b) Plumb - 1 in 1000 of height
c) Levels - ± 3 mm before any deflection has taken place

The tolerance given above are specified for local aberrations in the finished concrete surface & should not be taken as tolerances for the entire structure taken as a whole or for the setting and alignment of formwork, which should be as accurate as possible to the entire satisfaction of the Engineer. Any error, within the above tolerance limits or any other as may be specially set up by the Engineer, if noticed in any lift of the structure after stripping of forms, shall be corrected in the subsequent work to bring back the surface of the structure to its true alignment.

3.11.6 Re-use of Forms

Before re-use, all forms shall be thoroughly scraped, cleaned, joints and planes examined and when necessary repaired, and inside surface treated as specified hereinbefore. Formwork shall not be used/re-used if declared unfit or unserviceable by the Engineer.

3.11.7 Classification

Generally, the "ordinary" class formwork shall be used unless otherwise specified.

a) Ordinary: These shall be used in places where ordinary surface finish is required and shall be composed of steel and/or approved good quality partially seasoned timber.

b) Plywood/ purpose-made metal: These shall be used in exposed surfaces, where specially good finish (fair face) is required and shall be made of approved brand of heavy quality plywood, purpose-made metal or hardboard lined form work to produce a perfectly uniform and smooth surface conforming to the shape

described in the drawing with required grain texture on the concrete. Re-use may only be permitted after special inspection and approval by the Engineer. He may also permit utilization of used plywood for the "ordinary" class, if it is still in good condition.

c) Ornamental: These shall be used where ornamental and curved surface are required and shall be made of selected best quality well-seasoned timbers or of plywood, which can be shaped correctly.

3.11.8 Opening, Chases, Grooves, Rebates, Blockouts etc.

The Contractor shall leave all openings, grooves, chases, etc. in concrete work as shown on the drawings or as specified by the Engineer.

3.11.9 Surfaces of concrete

The contractor shall ensure that the finished face of concrete offers a suitable keyed surface for the application of the finishing media, e.g. plaster, sand and cement screed, etc. The contractor shall also ensure that where thin films of finished, e.g. skim coats "Snowcem", paint, etc. are to be applied that the previous provisions regarding supporting of form work are complied with, so that the concrete faces to be treated are left smooth, unblemished and true to line both vertically and horizontally and require no making good before applying the finish.

Should the contractor fail however, to comply with the provision of this Clause, he shall submit details of his proposed method of redoing the situation to the Engineer In-Charge and must obtain written consent from the Engineer In-Charge to the proposals before continuing with any further work on the affected surfaces.

Tolerances in concrete surfaces

The permissible tolerance in the surface of the hardened concrete shall not exceed the following limits :

Type of irregularity		
Departure of member planes from position and level.	+	12 mm
Variation in cross-sections	+	6 mm
Sharp changes in plane	+	2 mm
Departure from 3 M. template of any part of planes	+	3 mm

3.11.10 Hacking-Out

a) Immediately after removal of forms, the concrete surfaces to be plastered shall be roughened with a bush-hammer or with chisel and hammer as directed by the Engineer to make the surface sufficiently coarse and rough to provide a key for plaster.
b) At all construction joints in the beams, slabs and columns etc. laitance and any other loose concrete shall be chipped off immediately after striking the formwork. The chipped surface shall then be thoroughly cleaned with a jet of water.

3.12.0 Anchor Bolts, Anchors, Sleeves, Inserts, Hangers/Conduits/Pipe and other misc. Embedded Fixtures

The Contractor shall build into concrete work all the items noted below and shall embed them partly or fully as shown on drawings and secure the same as may be required. The materials shall be as specified and be of best quality available according to relevant Indian Standards of approved manufacture and to the satisfaction of the Engineer. Exposed surfaces of embedded materials are to

paint with one coat of approved anti- corrosive paint and/or bituminous paint without any extra cost to the Owner. If welding is to be done subsequently on the exposed surface of embedded material, the paint shall be cleaned off the member to a minimum length of 50 mm beyond each side of the weld line.

Necessary templates, jigs, fixtures, supports etc. shall be used as may be required or directed by the Engineer.

Items to be embedded

a) Inserts, hangers, anchors, frame around openings, manhole covers, frames, floor clips, sleeves conduits and pipes.
b) Anchor bolts and plates for machinery, equipment and for structural steel work.
c) Steel structure to be left embedded for future extension, special connection etc.
d) Dowel bars, etc. for concrete work falling under the scope of other contractors.
e) Lugs or plugs for door and window frames occurring in concrete work.
f) Flashing and jointing in concrete work.
g) Any misc. embedment and fixture as may be required.

Correct location and alignment, as per drawings/instruction of all these embedded items shall be entirely the responsibility of the Contractor.

3.13.0 Expansion and Isolation Joints

Expansion and isolation joints in concrete structures shall be provided at specific places as per details indicated on the drawings. The materials and types of joints shall be as specified hereinafter. In case of liquid retaining structures, additional precautions shall be taken to prevent leakage of liquids as may be specified on the drawings or as directed by the Engineer. All materials are to be procured from reliable manufacturers and must have the approval of the Engineer. Where it is the responsibility of the Contractor to supply the material, the Engineer may demand test certificates for the materials and/or instruct the Contractor to get them tested in an approved laboratory free of cost to the Owner. Joints shall be formed true to line, level, shape, dimension, and quality as per drawings and specifications. Prior approval of the method of forming the joints should be obtained from the Engineer before starting the work.

a) Bitumen Compound

When shown in drawing or directed, the gap in expansion joints shall be thoroughly cleaned and bitumen compound laid as per manufacturer's specifications. The compound to be used shall be of approved manufacture and shall conform to the requirements of IS: 1834.

3.14.0 Grouting under Machinery or Structural Steel Bases

If required, grouting under base plates of machines or structural steel etc. shall be carried out by the Contractor. In general, the mix shall be 1 (one) part cement and 1 (one) part sand and just enough water to make it flow as required. The areas to be grouted shall be cleaned thoroughly with compressed air jet and/or with water in locations where accumulated surplus water can be removed. Where directed by the Engineer, 6 mm down stone chips may have to be used in the mix. Surface to be grouted shall be kept moist for at least 24 hours in advance. The grout shall be placed under expert supervision, so that there is no locked up air. Edges shall be finished properly. If specified on drawings, admixtures like Aluminium powder, "Ironite" etc. may have to be added with the grout in required proportions. Premixed non-shrink grout of approved manufacture having proper strength shall be used with Engineer's approval for important machineries.

3.15.0 Waterproofing Admixtures

The waterproofing admixture for concrete and cement mortar/plaster shall conform to IS: 2645. The admixture shall not cause decrease of strength of concrete/plaster at any stage and it shall be free from chlorides and sulphates. The admixture shall not affect the setting time by more than 5%. The maximum permissible dosage of admixture will be 3% (three percent) by weight of cement, but a lower dosage will always be preferred. The product shall be stored in strong moisture proof packings. However, in case of important structures where M25 or higher grade concrete is specified, the use of melamine based, high range water reducing concrete admixture shall be used to provide a waterproof concrete, For achieving high strength concrete having cement content around 400 kg/cu.m. a melamine based super plasiticizer will be preferable.

a) In concrete: The admixtures shall be procured from reliable and reputed manufacturers and approved by the Engineer. The method of application and other details shall conform to the manufacturer's specification and/or as instructed by the Engineer. The Contractor shall have the services of the manufacturer's supervisor at no extra cost to supervise the work, if desired by the Engineer.

b) In Plaster: The concrete surface, to be plastered, shall be hacked to Engineer’s satisfaction, cleaned thoroughly and kept wetted for 24 hours. The plaster shall be in cement sand mortar mixed in proportion varying from 1:1 to 1:4 by volume along with the approved waterproofing admixture and laid in appropriate thickness and in layers not exceeding 15 mm/layer or as per manufacturer's specification. The additive shall be of quality and type approved by the Engineer. If desired by the Engineer, the Contractor shall have the work supervised by the manufacturer's supervisor at no extra cost. On completion, the plastered surface shall be cured continuously for a minimum period of 14 days like concrete.

c)

3.16.0 SAMPLING AND TESTING

The Contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and as supplemented herein for the following items at his own cost unless otherwise specified in this specification. The Contractor shall get the specimens tested in a laboratory approved by the Engineer and submit to the Engineer the teat results in triplicate within 3 (three) days after completion of the test.

3.16.1 Cement

Representative samples will be taken from each consignment of cement received from the manufacturer/supplier for carrying out the tests for fineness (by hand sieving), setting time and compressive strengths as per guidelines of IS: 269. Soundness Tests may also be required to be carried out if required by the Engineer. The Contractor shall carry out the tests without any expense to BHEL. No cement from a particular consignment/batch will be used on the works unless satisfactory 3 (three) days and 7 (seven) days test results for compressive strength are known. The Engineer and Contractor will jointly associate themselves with the tests irrespective of whether they are carried out by the BHEL or the Contractor. These tests are of great importance, as their results will have a bearing on the acceptance of concrete or otherwise as per the terms and conditions of the Contract.

3.16.2 Aggregates

The contractor shall carry out any or all the tests on aggregates as may be required by the Engineer in accordance with IS: 2386 PARTS-I to VIII. The acceptance criteria of the samples tested shall be in accordance with the requirements of the relevant Indian Standards.

3.16.3 Water

Sampling and Testing of water being used for concrete works as per IS: 3550 will be carried out by the Contractor at regular intervals and whenever directed by the Engineer. The acceptance criteria will be as per IS: 456.

3.16.4 Admixture

a) Air Entraining Agents

Initially, before starting to use A.E.A., relationship between the percentage of air entrained and the cylinder cube crushing strength vis-a-vis quantity of A.E.A. used for all types of concrete will be established by the Contractor by carrying out sufficiently large number of tests. After that, at regular intervals and whenever directed by the Engineer, the Contractor will check up the actual percentages of air entrained and corresponding crushing strengths to correlate with the earlier test results.

b) Other Admixtures

Tests for establishing the various properties of any other admixtures, which may be required to be added, shall be carried out by the Contractor.

3.16.5 Concrete

The sampling of concrete, making the test specimens, curing and testing procedure etc. shall be in accordance with IS: 516 and IS: 1199, the size of specimen being 15 cm cubes. Normally, only compression tests shall be performed but under special circumstances the Engineer may require other tests to be performed in accordance with IS: 516. Sampling procedure, frequency of sampling and test specimen shall conform to IS: 456. To control the consistency of concrete from every mixing plant, slump tests shall be carried out by the Contractor every two hours or as directed by the Engineer. Slumps corresponding to the test specimens shall be recorded for reference. The acceptance criteria of concrete shall be in accordance with IS: 456. Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specification by the Contractor at his own cost. In the course of dismantling, if any damage is done to the embedded items or adjacent structures, the same shall be made good, free of charge by the Contractor, to the satisfaction of the Engineer.

3.17.0 ACCEPTANCE CRITERIA

3.17.1 Standard Deviation

Standard deviation shall be based on test results and determination of Standard deviation shall conform to IS: 456.

3.17.2 Acceptance Criteria

The strength requirements and acceptance criteria shall conform to IS: 456.

3.17.3 Inspection and Core Tests

Inspection of concrete work immediately after stripping the formwork and core test of structures shall conform to IS: 456.

3.17.4 Load Test

Load tests of structural members as per IS:456 may be required by the Engineer, when the strength of test specimen results falls below the required strength.

If the member shows evident failure, the Contractor shall make the structure adequately strong free of cost to BHEL.

The entire cost of load testing shall be borne by the Contractor. If a portion of the structure is found to be unacceptable, it shall be dismantled and replaced by a new structure as per specification. The entire cost of dismantling and replacement and restoration of the site being borne by the Contractor.

If, in the course of dismantling, any damage is done to the embedded items and or other adjacent structures, the same will be made good, free of charge by the Contractor to the satisfaction of the Engineer.

3.18.0 RATES AND MEASUREMENTS

3.18.1 CAST –IN- SITU CONCRETE

Rates

a) The unit rates shall include the cost of labour, materials, equipment, handling, transporting, batching, mixing, placing in position, vibrating, compacting, finishing, curing, testing etc. This shall include the cost of curing by regular wetting or by using curing compound.

b) The unit rates shall include for all working conditions including at locations under water, liquid, mud, in or under foul positions and extreme weather conditions.

c) The unit rates for exposed concrete works shall include all incidentals, rendering, smoothening with carborandum stone, finishing with a paste of cement sand mortar, curing, etc.

d) The unit rates shall include all arrangement for maintaining stability of structure during execution.

e) Nothing extra shall be payable for the handling/mixing of extra cement on account of any reason or pouring of second stage concrete.

f) Nothing shall be payable to the Contractor on account of facilities and arrangement provided by him for conducting Non Destructive test or other relevant tests to ascertain grade and quality, etc. of the concrete in case the concrete quality is in doubt and contractor has to establish the quality by further tests. In case of any defects, the Contractor shall rectify the same by cement/epoxy grout at his own cost.

g) Nothing extra shall be payable for controlling of the temperature of concrete i.e storing and mixing of ice, water, cooling of aggregate etc.

h) The quoted rate shall include the cost of MIX design, making of all trial mixes using admixtures and mixing in concrete etc. complete.

Measurements

a) Actual volume of concrete work as executed or as per drawings issued, whichever is less shall be measured in cubic metres to the nearest two decimals.

b) No deductions shall be made for the following:

i) Ends of dissimilar materials embedded inside for example, beams, posts, girders, rafters, purlins, trusses, corbels and steps upto 500 sqcm in cross section;

ii) Opening upto 0.1 sq.m.

iii) Volume occupied by reinforcement, sleeves, anchor bolts, and similar items.

iv) Volume occupied by pipes, conduits, sheathing, etc. not exceeding 100 sq.cm. each in cross sectional area.

c) The concrete works of different grades; below and above ground floor finished level shall be measured separately, unless otherwise specified in the schedule of items. Accordingly rates shall be applied for concrete in foundation for concrete below ground floor finished level and concrete in superstructure for concrete above ground floor finished level.

3.18.2 REINFORCEMENT

Rates

a) The unit rates shall include for cover block, providing binding wire, welding, reinforcement couplers, separator pieces between two or more layers of reinforcement required for keeping the steel in position, etc. at all floors and heights.

b) No extra will be paid for transportation from stores, cleaning, straightening of steel, cutting, bending, binding with annealed wire, welding, tack welding, placing the reinforcement, modification of already embedded reinforcement, if required, due to faulty fabrication or placement and other cost of tools and plants, materials, labours, return of unused steel to the store, etc.

c) No extra shall be paid for preparing and getting approved bar bending schedules (including all revisions).

d) Generally members are straight and have straight edges. However, for bending, binding, placing of reinforcement in any curved member in length or cross section or both, no extra payment shall be made.

Measurements

a) Bar or any other type of reinforcement used like hard drawn steel wire fabric etc. for reinforced concrete shall be measured by weight in Kg/tonnes. The weight shall be arrived at by multiplying the actual or theoretical length measured alongwith standard hooks, cranks, bends, authorized laps, etc. whichever is less by the sectional weights. Claims for payment for this item shall be submitted with supporting documents giving the schedule of bars with sketches. The sectional weight to be adopted shall be IS Section weight. Nothing extra will be payable to the Contractor on account of, difference in weight, if any, due to different methods adopted for issue and measurement.

b) Standard hooks, cranks, bends, authorised laps, supports, hangers and chairs which are covered in approved bar bending schedule shall be measured in kg/tonnes.

3.18.3 Formwork and Staging

Rates

a) The unit rates shall be inclusive of all staging, scaffolding, making the formwork watertight, etc. for all elevations and in all types of works unless otherwise specified in the schedule of items.

b) No separate payment shall be made for providing fillets, for rounding or chamfering at junctions, comers, etc.

c) The unit rates shall include the cost of labour, materials etc. and the extra time, which shall be required for the removal of shuttering/ support for satisfactory completion of work.

d) No extra payment shall be made on account of difficulty, wastage etc. for placement/removal of formwork between the network of closely placed steel beams or for the lacing/bracing portions and ribbed slab constructions.

Measurements

a) Formwork for different classes (types) shall be measured separately as the actual surface in contact with the concrete and paid on area basis unless included in the rate for concrete. The unit of measurement shall be in sq.m.

b) Openings upto 0.1 sq.m or boxing left for inserts etc. for facility of Contractor's work, shall be neglected as if nonexistent for the purpose of formwork measurement of surface in which the openings occur.

For suspended floor, no deduction shall be made for flange area of secondary steel beams.

No measurement shall be taken for the formwork in pockets, openings, chases, blockouts, etc. in concrete, the contact surface area is less than or equal to 0.1 sq.m. in each case.

c) Formwork, if required, for joints shown on drawing or instructed by the Engineer, shall be paid for the 'leading side' only.

3.18.4 Embedded Parts

Rates

a) The unit rate for MS pipe embedments and MS inserts/ embedments shall include cutting, welding, fabrication, erection, embedding, and transportation to site. Unit rate shall also include the cost of the pipes.

b) Rate for expansion fasteners shall include cost of fasteners, installation, and fixing including cost of washers and nuts and site testing if required.

Measurements

a) The measurement of the embedded steel parts fabricated and installed by the Contractor shall be based on the calculated weight of steel sections in kg/tonne corrected to second place of decimal.

b) For PVC pipes/conduits, measurements shall be in quintals correct to second place of decimal for the net weight.

c) For mild steel pipes, measurement shall be in kg/quintals, correct to second place of decimal, for the net weight of the steel pipe supplied, fabricated, and installed.

e) The lugs shall be measured in Kg. correct to second place decimal for the net weight.

f) The expansion fasteners shall be measured in number.

3.18.5 Groutings

Rates

Rate shall include the cost of surface preparation, admixtures, and curing.

Measurements:

a) Measurement shall be in cubic meters.

b) Measurement for grouting shall be by volume of the block out, pockets or bolt hole upto the top surface of foundation concrete and shall be calculated from the dimensions shown on the drawings.

c) Measurement for underpinning shall be by volume between the top surface of the foundation concrete and the underside of the base plate, the plan dimensions being as indicated on the drawings.

d) No deduction shall be made for shims, bolts, shear keys and such other embedment.

3.18.6 LIST OF IS CODES AND STANDARDS FOR REFERENCE

All work under this specification shall, unless specified otherwise, conform to the

latest revisions and/or replacements of the following or any other Indian Standard Specifications and Codes of Practice. In case any particular aspect of work is not specifically covered by Indian standard Specifications, any other standard practice, as may be specified by the Engineer, shall be followed:-

IS: 383 - Indian Standard Specification for Coarse and Fine Aggregates from Natural Sources for Concrete
IS: 432 - Indian Standard Specification for Mild Steel and Medium Tensile Steel Bars and Hard Drawn Steel Wire for concrete Reinforcement
IS: 456 - Indian Standard Code of Practice for Plain and Reinforced Concrete
IS: 516 - Indian Standard Specification for Methods of Test for Strength of Concrete
IS: 1199 - Indian Standard Specification for Methods of Sampling and Analysis of Concrete
IS: 1322 - Indian Standard Specification for Bitumen Felts for Waterproofing and Damp-proofing
IS: 1489 - Indian Standard Specification for Portland Pozzolona Cement
IS: 1566 - Indian Standard Specification for hard drawn steel wire fabric for concrete reinforcement.
IS: 1786 - Indian Standard Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement.
IS: 1791 - Indian Standard Specification for Batch Type Concrete Mixers.
IS: 1838 - Indian Standard Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type.
IS: 2386 - Indian Standard Specification for Methods of Test for Aggregates for Concrete - Part-I to VIII
IS: 2502 - Indian Standard Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement
IS: 2505 - Indian Standard Specification for Concrete Vibrators, Immersion Type
IS: 2506 - Indian Standard Specification for Screed Board Concrete Vibrators
IS: 2514 - Indian Standard Specification for Concrete Vibrating Tables
IS: 2571 - Code of practice for laying in-situ cement concrete floors.
IS: 2645 - Integral cement water proofing compound
IS: 2722 - Indian Standard Specification for Portable Swing Weigh Batchers for Concrete (Single and Double Bucket type)
IS: 2750 - Indian Standard Specification for steel scaffoldings.
IS: 2751 - Code of Practice for Welding of Mild Steel Bars used for Reinforced Concrete Construction
IS: 2770 - Indian Standard Specification for Method of Testing Bond in Reinforced Concrete
IS: 3025 - Indian Standard specification for Methods of Sampling and Test (Physical and Chemical) for Water used in Industry
IS: 3067 - Code of practice for general design details and preparatory work for damp proofing and water proofing of building.

IS: 3370 - Indian Standard Specification for Code of Practice for Concrete Structures for Storage of Liquids
IS: 3414 - Code of practice for design and installation of joints in buildings.
IS: 3558 - Code of Practice for use of Immersion vibrators for Consolidating Concrete
IS: 3696 - Safety Code for Scaffolding and Ladders
IS: 3812 - Indian Standard Specification for Fly Ash for Use as Admixture for Concrete
IS: 4014 - Code of practice for steel tubular scaffolding.
IS: 4082 - Indian Standard Specification for Recommendation on Stacking and Storage of Construction Materials at site
IS: 4634 - Indian Standard Specification for Method of Testing Performance of Batch-type Concrete Mixes
IS: 4656 - Indian Standard Specification for Form Vibrators for Concrete
IS: 4925 - Indian Standard Specification for Concrete Batching and Mixing Plant
IS: 4926 - Indian Standard Specification for Ready Mixed Concrete
IS: 4990 - Indian Standard Specification for Plywood for Concrete Shuttering work
IS: 5512 - Indian Standard Specification for Flow Table for use in Tests of Cement and Pozzolanic materials
IS: 5513 - Indian Standard Specification for vacate Apparatus.
IS: 5515 - Indian Standard Specification for Compaction Factor Apparatus.
IS: 5525 - Recommendation for detailing of reinforcement in reinforced concrete works.
IS: 5624 - Indian Standard Specification for foundation bolts.
IS: 5816 - Indian Standard Specification for Method of Test for Splitting Tensile strength of Concrete Cylinders.
IS: 5892 - Indian Standard Specification for transit mixer and agitators.
IS: 6925 - Indian Standard Specification for Method of Test for Determination of Water Soluble Chloride in Concrete Admixtures.
IS: 7242 - Indian Standard Specification for Concrete Spreaders.
IS: 7251 - Indian Standard Specification for Concrete Finishers.
IS: 7293 - Safety code for working with construction machinery.
IS: 7320 - Indian Standard Specification for Concrete Slump Test Apparatus.
IS: 7861 - Indian Standard Specification for Recommended Practice Part-I&II for Extreme Weather Concreting.
IS: 7969 - Safety Code for Storage and Handling of Building Materials.
IS: 8112 - Indian Standard Specification for high strength Ordinary Portland Cement.
IS: 8142 - Indian Standard Specification for Determining Setting time of concrete by Penetration Resistance.
IS: 8989 - Safety Code for Erection of Concrete Framed Structures.
IS: 9012 - Recommended method for shortcreting.
IS: 9013 - Indian Standard Specification for Method of Making, Curing, and determining compressive Strength of Accelerated-cured Concrete Test Specimens.
IS: 9103 - Indian Standard Specification for Admixtures for Concrete.
IS: 10262 - Recommended Guidelines for Concrete Mix Design.
IS: 13311 - Non-destructive testing of concrete.
SP: 34 - Handbook of concrete, reinforcement and detailing.

4.0 DIAPHRAGM WALL

The specification is to be read in conjunction with the contract specification and all other relevant specification and drawings.

Where works are ordered to be performed by the contractor, but are not specified in this specifications, the contractor shall carry out with full diligence and expedience as are expected for works of the same.

4.1.1 Scope of work

The work shall be carried out as per IS9556 and this specification and drawings supplied to the contractor and any other instructions issued by the Engineer or his representative from time to time.
Diaphragm wall shall also serve as permanent wall for basement.

The contract comprises the provision of all labor, materials tools, plant etc. necessary for the following works: -

i) Supply and installation of diaphragm wall panels to the specified depth suitable to site condition as per drawings.
ii) Trench excavation, the design and construction of guide walls and insertion of stop ends to prevent horizontal movement during concreting or to the adjacent soil and structure.
iii) Supply installation, maintenance, measurement and recording of monitoring devices of diaphragm walls.
iv) Fixing of insert plate and providing and exposing/straightening of dowels bar along with casting of diaphragm wall.
v) Providing soil anchor as per drawing.
vi) Any other incidental works necessary to ensure the safety and satisfactory performance of diaphragm wall construction.

4.1.2 Contractor's responsibility

The contractor shall ensure that the proposed temporary work to complete the work of diaphragm wall has no adverse effect on the permanent work. The contractor shall be deemed to have inspected the site and geotechnical conditions applicable to his work. The work shall be carried out on the basis of ground as found and no additional cost will be paid for handling for hard material or obstruction encountered during the installations of the contract. Any modifications and additional requirements deemed necessary by the contractor are inclusive in the rate of wall.

The contractor shall ensure that the panels of the diaphragm walls are properly interlocked to provide a watertight basement. The contractor shall be responsible for repair by pressure grouting of any joints where, on full exposure of the wall, visible water leaks resulting from faulty materials or workmanship are found. Any seepage of water shall be rectified at the contractor's expense.

All reasonable steps shall be taken to prevent spillage of bentonite slurry on the site away from the immediate vicinity of the wall. Discarded bentonite slurry which has been pumped from the trench is to be removed promptly from site in accordance with the current statutory guidelines requirements.

The contractor shall be responsible for the stability of loading for wall panels and shall take all necessary precautions for the safety of personnel in the area of

piling operations. The contractor must ensure that no damage is caused to adjoining properties and would be solely responsible for such consequences.

4.1.3 Defective works

Defective work shall be all works that, in the opinion of engineer, do not fully comply with this specification or the drawings including quality requirement. The contractor shall make or carry out such additional work as may be necessary at his own expense to the Engineer's satisfaction.

4.2.0 Materials

4.2.1 Concrete
Concrete walls shall have a minimum characteristic strength of 30Mpa at 28 days and with min cement content of 400 Kg/m3..

The slump of the concrete shall normally be 150mm to 200mm and shall flow easily in the tremie pipe.

The maximum size of aggregate shall be 20mm.

Approved Waterproofing additives are to be used in the concrete.

Work test cubes will be made on site by the contractor in accordance with provision of specification. Six (6 Nos) test cubes for each of diaphragm wall panel shall be prepared and 3 cube shall be tested at 7 days and 3 cube shall be tested at 28 days.

4.2.2 Reinforcement
All reinforcement for use of diaphragm wall shall be in accordance with IS 1786.
The steel reinforcement cage shall be clearly marked to indicate its correct orientation for proper insertion into the trench. The reinforcement shall be maintained in position during casting of each panel by approved spacers. Steel reinforcement shall be positioned as shown in the drawings and minimum cover shall be maintained. Fixing of insert plate and arrangement of projection of dowels bar shall be done before insertion of reinforcement in trench.

4.2.3 Bentonite
Bentonite, as supplied to the site and prior to mixing, shall be in accordance with specification IS 6186.

A certificate is to be obtained by the contractor from the manufacturer of bentonite powder, stating from which manufacturers consignment the material delivered to site has been taken and showing properties of the consignment as determined by the manufacturer.

The bentonite powder shall be mixed thoroughly with clean fresh water. The percentage of bentonite used to make the slurry shall be such as to maintain the stability of the trench excavation.

Density of bentonite used shall be 1.04 to 1.1 g/ml.
Viscosity may be measured by Marsh Cone method and the value shall be 30 to 90Sec.
PH value shall be 9.5 to 12.
10Min Gel strength shall be 1.4 to 10 N/m2

Prior to placing of concrete in any panel, the contractor shall ensure that heavily contaminated bentonite slurry, which could impair free flow of concrete from the tremie pipe, has not accumulated in the bottom of the trench.

Where saline or contaminated ground water occurs, special measures shall be taken as required by the Engineer to modify the bentonite slurry.

4.3.0 Tolerances

The minimum clear distance between the faces of guide walls shall be the specified diaphragm wall thickness plus 25mm and the maximum distance shall be the diaphragm wall thickness plus 50mm.

The plane of the diaphragm wall face to be exposed shall be vertical to within a tolerance of 1 in 200. Reference point for measuring verticality shall be at the top of wall on exposed face at that location.

Lump and sharp local projections in the wall face will not be acceptable by the Engineer.

Where block outs for penetrations, recesses and inserts are formed within the wall, they shall be positioned within horizontal and vertical tolerances of plus and minus 50mm.

Minimum cover to reinforcement of 75mm shall be maintained or as per drawing.

4.4.0 Records

Following records shall be maintained for inspection by Engineer in charge.

I) Panel Number and refrence drawing no.
II) Top of guide wall level
III) Bottom of guide wall level
IV) Top level of wall as cast in relation to top of guide wall.
V) Date and time of start of panel excavation
VI) Date and time of finish of panel excavation
VII) Date and time of start and completion of panel concreting.
VIII) Length of panel
IX) Thickness of wall
X) Volumn of concrete used, slump.
XI) Cubes taken, marking, date and results obtained on testing.
XII) Detail of cage type of reinforcement
XIII) Date and time of start and completion of cage placement
XIV) Detail of any obstructions encountered and time spent in dealing with obstructions.

4.5.0 Method of measurement

The actual area of the diaphragm walls, correct to two places of decimal, from design bottom level to the design cut off level as per drawing shall be measured.

Rates include cost of all inputs of labor, material and T&P, cost of handling, lifting & placing in position there in for concrete, cage in the trench, excavation in soil, Guide wall and stop ends, cost of welding the reinforcement bars, testing of concrete and bentonite, providing soil anchors at all levels and all other incidental expenditure for completing the work as directed by the Engineer-in-charge.

(Insert plate and reinforcement shall be paid separately). No payment whatsoever shall be paid for guide wall.

No payment shall be made for repair of wall against water seepage, concrete above cutoff level (however min 500mm top layer or as per drawing to be removed in view of contamination with bentonite).

5.0 MASONRY & ALLIED WORKS

5.1.1 SCOPE

This section covers furnishing, installation including handling, transporting, batching, mixing, laying scaffolding, centering, shuttering, finishing, curing, protection, maintenance and repair of common building materials till handing over of masonry and allied works for use in structures and locations covered under the scope of this package.

5.2.0 MATERIALS

a) Common Burnt Clay Bricks

Bricks for general masonry work shall be of class designation 7.5 of nominal dimensions as per standard specification under IS: 1077, well burnt, of uniform size, shape and colour, free from cracks, flaws or modules of free lime and emit clear ringing sound when struck. Fractured surface shall show uniform texture free from grits, lumps holes etc. Water absorption after 24 hours immersion shall not exceed 20% by weight for bricks. Dimensional tolerance shall not exceed 8% of the size shown in drawings for bricks. All bricks shall have rectangular faces and sharp straight edges. The bricks shall show no efflorescence after soaking in water and drying in shade.

Each brick shall have the manufacturer's identification marks clearly marked on the frog. Representative samples shall be submitted and approved samples shall be retained by the Engineer for further comparisons and reference. Any brick not found up to the specification shall be removed immediately from site at the Contractor's own cost. Bricks shall not be dumped at site. They shall be stacked in regular tiers, even as they are unloaded; to minimize breakage and defacement of bricks. Bricks selected for different situation of use in the work shall be stacked separately.

b) AUTOCLAVE AERATED CONCRETE BLOCKS (AAC BLOCKS)

Providing and constructing Autoclave Aerated cement concrete (AAC) Block masonry in cement mortar 1:5 for full wall and 1:4 with RCC bands in every fourth layer for half wall using defect less, sharp edged table molded, uniform size, approved quality blocks adequately soaked in water before use for super structure etc., including racking, scaffolding, curing etc., complete as directed. Note-MASONRY- 40% of PPC to be replaced by Fly ash for all masonry works as per GRIHA

IS-2185(III) - 1984 : Autoclaved Aerated Concrete Block.
IS-6041 - 1985 : Construction of Autoclaved Aerated Concrete Block Masonary.
IS 2572 – 2005 : Const of Hollow and Solid Concrete Block Masonry
IS-6441 - 1972 : Methods of Test for Autoclaved Cellular Concrete product.

c) Cement

Cement used shall be Portland pozzolana Cement confirming to 1489 (Part) - 1991 (Latest revision). The total flyash content shall be minimum 30% by weight

of cement. If 30% is not achieved from PPC cement, additional Fly ash conforming to grade I of IS 3812 (Part-1) only to be used. This is to meet "GRIHA-Green Building" requirement. Cement shall be fresh when delivered. The Contractor shall submit the manufacturer's certificate for each consignment of cement procured to the Engineer. If at any time, the Engineer feels that the cement being used by the Contractor is not up to specification, he may stop the work and send the samples of the cement to a testing laboratory for standard tests and all expenses incurred thus shall be borne by the Contractor. The Contractor shall also have no claim for this type of suspension of work.

The cement shall be stored above the ground level in perfectly dry and watertight sheds. The bags shall be stacked in a manner so as to facilitate removal or first in first out basis. Any material considered defective by the Engineer shall not be used by the Contractor and shall be removed from the site immediately.

d) Sand

Sand shall be hard, durable, clean, and free from adherent coatings or organic matter and shall not contain clay balls or pellets. The sand shall be free from impurities such as iron pyrites, alkalis, salts, coal, mica, shale or other laminated materials in such forms or quantities as to affect adversely the hardening, strength, durability or appearance of mortar, plaster or concrete or to cause corrosion to any metal in contact with such mortar, plaster or concrete. All sand shall be properly graded and shall be as per relevant IS Code. Sand for concrete shall conform to IS: 383.

e) Water

Water shall be clean, fresh and free from organic matters, acids or soluble salts and other deleterious substances which may cause corrosion, discoloration, efflorescence etc.

f) Reinforcement

Reinforcement steel shall be clean and free from loose mill scales, dust, loose rust, oil and grease or other coatings, which may impair proper bond. Structural steel shall conform to IS: 2062. Mild steel and medium tensile steel bars and hard-drawn steel wire shall conform to IS: 432. Cold twisted steel bars shall conform to IS: 1786. Hand drawn steel wire fabric shall conform to IS: 1566. Hexagonal wire netting shall conform to IS: 3150. All wire netting shall be galvanized.

Reinforcement bars shall be stored off the ground and under cover if so desired by the Engineer. If necessary, a coat of cement wash shall be given to the bars to guard against rusting.

5.3.0 INSTALLATION

5.3.1 Masonry

All masonry work shall be true to lines and levels as shown on drawings. All masonry shall be tightly built against structural members and bonded with dowels, inserts etc. as shown on drawings.

5.3.2 Cement Mortar

Cement mortar shall be prepared with materials specified in clause 5.2.0 Sand for masonry mortar shall conform to IS: 2116. Cement and sand in the specified proportion shall be mixed dry thoroughly and minimum water added to attain required workability.

Surplus mortar droppings from masonry, if received on surface free from dirt may be mixed with fresh mortar if permitted by the Engineer who may direct addition of additional cement without any extra payment. No mortar, which has stood for more than half an hour, shall be used.

5.3.3 Brick Masonry

Bricks shall be soaked by submergence in clean water for at least two hours in approved vats before use. Bricks shall be laid in English bond unless specified otherwise. Broken bricks shall not be used. Cut bricks shall be used if necessary to complete bond or as closers. Bricks shall be laid with frogs upwards over full mortar beds. Bricks shall be pressed into mortar and tapped into final position so as to embed fully in mortar. Inside faces shall be buttered with mortar before the next bricks is placed and pressed against it. Thus all joints between bricks shall be fully filled with mortar.
Mortar joints shall be kept uniformly 10 mm thick. All joints on face shall be raked to minimum 10 mm depth using raking tool while the mortar is still green to provide bond for plaster or pointing.

Where plaster or pointing is not provided, the joints shall be struck flush and finished immediately. Brickworks two bricks thick or more shall have both faces in true plane. Brickwork of lesser thickness shall have one selected face in true plane.

5.3.4 AAC block masonary

Installation shall be done as per the working drawings. Laying of AAC Blocks masonary shall be in accordance with the recommendations of IS:6041 of 1985 and IS:1905 of 1987. This shall hold valid for other structural requirements
like stiffening of masonary, joint reinforcements, etc. The jointing cement sand mortar in the composition as prescribed shall be used with suitable plasticizer. The horizontal & vertical joint thickness shall be approximately 10mm thick. In case of partition walls (100mm / 125 mm) the joint reinforcement i.e. 2 Nos 6 mm dia M.S. bars at every third course shall be placed to be anchored properly with the main structure. Once the masonary erected, the curing shall be minimum, with more requirements at the joints. 5-6 courses shall be erected maximum in a day.
Before plastering, cement slurry shall be applied on the walls and only leaner mix shall be applied. The thickness of the plaster shall be min. 12mm.
The openings for doors, windows, ventilators, pipes, cables, ducts, fans, ACs etc. shall be created as required. Blocks shall be cut with a saw. Wherever chasing to be done in AAC Blocks, rotary cutters shall be used. The chases shall be refilled with lean mortar and chicken mesh applied on that area.
While laying AAC blocks, safety precautions shall be taken for the safety of the requirement, structure and personnel located / working in the area.

Sampling and testing of AAC blocks shall be as per IS 2185 Part 3.

5.3.5 Curing

Masonry shall be cured by keeping it wet for seven days from the date of laying. In dry weather at the end of days work top surface of masonry shall be kept wet by ponding.

5.3.6 Embedding of fixtures

All fixtures shall generally be embedded in mortar and masonry units shall be cut as required.

5.3.7 Damp Proof Course (DPC)

Unless otherwise specified Damp-proof course shall be 40 mm thick 'artificial stone' in proportion 1:1½:3 cement sand stone-chips (10 mm down) with admixture of a waterproofing compound as approved by the Engineer. The percentage of admixture shall be as per manufacturer's specifications but not less than 2% by weight of cement. The top surface shall be double chequered and cured by ponding for seven days.

5.3.8 I.S. CODES

Some of the important relevant codes for this section are:

IS: 1127: Recommendations for dimensions and workmanship of natural building stones for masonry work.

IS: 1597: Code of Practice for Construction of stone Masonry.

IS: 1609: Code of Practice for laying Damp proof treatment using bitumen felts.

IS: 2212: Code of Practice for Brickwork.

IS: 2250: Code of Practice for preparation and use of masonry Mortar.

IS: 5134: Bitumen Impregnated Paper & Board.

5.4.0 RATES AND MEASUREMENTS

Rates

Unit rate for masonry work shall include the following:

a) Raking out joints for plastering or pointing or finishing the joint flush as the work proceeds.

b) Preparing top sand sides of existing wall for joining old with new work.

c) Providing, dismantling and removing the scaffolding.

Unit rate for DPC shall be inclusive of formwork and bitumen painting.

Measurement

a) Brickwork in wall of half brick thickness shall be measured separately in Sqm stating the wall thickness and more than half brick thickness shall be measured by volume. Plaster thickness shall not be considered for computation of volume.

b) Masonry work in sub structure and super structure shall be measured separately, unless otherwise specified in the Schedule of items.

c) No deductions shall be made and no extra payment shall be made for following:
   Opening upto 0.1 Sqm each in area. In calculating the area of the opening lintels or sills shall be included along with the size of the opening.
   Drainage holes and recesses for cement blocks to embed holdfasts for doors, windows etc.

d) Pipe and fixtures upto 300mm dia. and nothing extra shall be paid for the mortar used for fixing. Ends of dissimilar materials (i.e. joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps, etc); up to 0.1 sqm in section;

e) Chases of section not exceeding 50 cm in girth;

f) Iron fixtures, such as wall ties and hold fasts for doors and windows;

g) Cement concrete blocks as fcr hold fasts and holding down bolts; Wall plates, bed plaros, and bearing of slabs, CHAJJAS and the like, where thickness does not exceed 10 cm and bearing does not extend over the full thickness of wall;

h) Reinforcement in masonry work shall be paid separately under respective items.

i) Damp proof course shall be measured in Sqm. No deduction shall be made and no extra shall be paid for opening upto 0.1 Sqm in area.

j) Plinth protection shall be measured under respective item of works executed required for completion of the work as specified.

6.0 STRUCTURAL STEEL WORK

This specification covers fabrication, transportation to site, assembling and erection in position structural steel work consisting of beams, columns, vertical trusses, bracings, shear connections etc.

Fabrication, erection and approval of steel structures shall be in compliance with:

- These technical Specifications and IS : 800.
- Drawings and supplementary drawings provided to the contractor during execution of the work.

Providing shop primer coat for steel structures.
On structural beams: primer compatible for vermiculite cementious fire proof coating On structural columns : 01 coat of red oxide zinc-chromate primer in fabrication shop.In case of conflict between the Clauses mentioned here and the Indian Standards, those expressed in this specification shall govern.

6.1.0 Scope

The supply of fabricated structural steel (factory fabricated) and erection of the steel work consists of accomplishing of all jobs here-in enumerated including providing all labour, conveyance & transportation, loading & unloading, tools and plant, all materials and consumables such as welding electrodes, temporary assembly & erection bolts and nuts, oxygen and acetylene gases, oils for cleaning, etc. of approved quality as per relevant IS standards. Work shall include suitably marking, bundling, and packing for transport all fabricated materials from factory fabrication shop. The work shall be executed according to the drawings, specifications, relevant codes etc. in an expeditious and workman like manner, as detailed in the specifications, the relevant Indian Standard Codes & Standard Practices and to the complete satisfaction of the Engineer In-Charge. However, Structural frame work for external facade/ roof work shall be allowed for fabrication at site for which contractor shall maintain a fully equipped workshop at site for fabrication, modification and repairs of steelwork at site as may be required to complete the works in accordance with the Contract.

6.2.0 Fabrication Drawings

The contractor shall prepare all fabrication and erection drawings on the basis of design drawings supplied to him and submit the same in triplicate to the Engineer In-Charge for review, Engineer In-Charge shall review and comment, if any, on the same. Such review, if any, by the Engineer In-Charge, does not relieve the contractor of any of his required guarantee and responsibilities for successful completion of work. The contractor shall however be responsible to fabricate the structurals strictly conforming to specifications and reviewed drawings.

The fabrication drawings shall include but not limited to the following:

a) Assembly drawings giving exact sizes of the sections to be used and identification marks of the various sections.
b) Dimensional drawings of base plates, foundation bolts location etc.
c) Comparison sheets to show that the proposed alternative section, if any, is as strong as the original sections shown on the Design Drawings.
d) Complete Bill of Materials and detailed drawings of all sections as also their billing weights. (Wastages and cut pieces shall not be measured in bill of material)
e) Any other drawings or calculations that may be required for the clarification of the works or substituted parts thereof.
f) Types and dimensions of welds and bolts. Shapes and sizes of edge preparation for welding. Details of shop and field joints included in assemblies

g) Quality of structural steels, welding electrodes, bolts, nuts and washers etc. to be used.
h) Erection assemblies, identifying all transportable parts and sub-assemblies, associated with special erection instructions, if required.
i) Design Calculations where asked for approval.

Connections, splices etc. other details not specifically detailed in design drawings shall be suitably given in fabrication drawings considering normal detailing practices and developing full member strengths. Design calculations for joints and connections developed by the contractor shall also be submitted along with detailed fabrication drawings.

Any alternate design or change in section is allowed when approved in writing by the Engineer In-Charge.

However if any variation in the scheme is found necessary later, the contractor will be supplied with revised drawings. The contractor shall incorporate these changes in his fabrication detailed drawings at no extra cost and resubmit for review alongwith revised design calculations for joints and connections.

6.2.2 Engineer In-Charge review shall not absolve the contractor of his responsibility for the correctness of dimensions, adequacy of details and connections. One copy will be returned reviewed with or without comments to the contractor for necessary action. In the former case further three copies of amended drawings shall be submitted by the contractor for final review.

6.2.3 The contractor shall supply three prints each of the final reviewed drawings to the Engineer In-Charge within a week since final review, at no extra cost for reference and records.
The Engineer In-Charge will verify the correct interpretation of their requirements.

6.2.4 If any modification is made in the design drawing during the course of execution of the job, revised design drawings will be issued to the contractor. Further changes arising out of these shall be incorporated by the contractor in the fabrication drawings already prepared at no extra cost and the revised fabrication drawings shall be duly got reviewed as per the above Clauses.

6.3.0 Materials to be used

All steel materials required for the work will be supplied by the contractor unless otherwise specified elsewhere in the contract. The materials shall be free from all imperfections, mill scales, slag intrusions, laminations, fittings, rusts etc. that may impair their strength, durability, and appearance. All materials shall be of tested quality only unless otherwise permitted by the Engineer and/or Consultant. If desired by the Engineer, Test Certificates in respect of each consignment shall be submitted in triplicate. Whenever the materials are required to be used from unidentified stocks, if permitted by the Engineer, a random sample shall be tested at an approved laboratory from each lot of 50 tones or less of any particular section.
The arc welding electrodes shall be of approved reputed manufacture and conforming to the relevant Indian Standard Codes of Practice and Specifications and shall be of heavily coated type and the thickness of the coating shall be uniform and concentric. With each container of electrodes, the manufacturer shall furnish instructions giving recommended voltage and amperage (Polarity in case of D.C. supply) for which the electrodes are suitable.

6.3.1 Structural Steel

a) Rolled Sections and plates for structural steel works (factory fabricated) shall be of grade designation E350, Quality BR, Semi-killed/ killed conforming to IS 2062. However, structural frame work for external facade/ roof work shall be allowed for fabrication at site and shall be of grade designation E250, Quality BR, Semi-killed/ killed conforming to IS 2062.
b) Pipes shall conform to IS: 1161.

c) Hollow (square and rectangular) steel sections shall be hot formed conforming to IS: 4923 and shall be of minimum Grade Yst 240.

Chequered plate shall conform to IS 3502 and shall be minimum 6 mm thick excluding projection.

6.3.2 Welding Materials

All electrodes to be used under the Contract shall be of approved reputed manufacture, low hydrogen electrode and shall comply with any of the following Indian Standard Specifications as may be applicable
a) IS : 814 - Covered electrodes for metal arc welding of structural steel
b) IS : 815 - Classification and coding of covered electrodes for metal arc welding of mild steel and low alloy high tensile steel
c) IS : 1442 - Covered electrodes for the metal arc welding of high tensile structural steel
d) IS : 7280 - Bare wire electrodes for submerged arc welding of structural steels
Welding of Structural steel shall generally be done by an electric arc process and shall conform generally to relevant acceptable standards viz. IS:816, IS:9595, IS:814, IS 823, IS:2014, IS:4354 and Indian Standard Hand Book for metal arc welding, and other standards, codes of practice internationally accepted. For welding of any particular type of joint, Bidder shall give appropriate tests as described in any of the Indian Standards - IS: 817, IS: 7307 and international standards as relevant.

6.3.3 Bolts & nuts

All bolts and nuts shall conform to the requirements of Indian Standard Specification IS: 1367 - Technical Supply Conditions for Threaded Fasteners.
Materials for Bolts and nuts under the purview of this contract shall comply with any of the following Indian Standard Specifications as may be applicable.

a) Mild Steel
All mild steel for bolts and nuts when tested in accordance with the following

Indian Standard Specification shall have a tensile strength of not less than 44

Kg/mm² and a minimum elongation of 23 per cent.

i) IS: 1367: Technical supply conditions for threaded fasteners
ii) IS: 1608: Method for tensile testing of steel products other than sheet, strip, wire and tube

b) High Tensile Steel
The material used for the manufacture of high tensile steel bolts and nuts shall have the mechanical properties appropriate to the particular class of steel as set out in IS: 1367 or as approved by the Engineer.

6.3.4 Washers

Washers shall be made of steel conforming to any of the following Indian Standard Specifications as may be applicable under the provisions of the Contract:

a) IS : 2062 - Steel for general structural purposes
b) IS : 961 - Structural Steel (High Tensile Quality)
c) IS : 1977 - Structural steel (Ordinary Quality) St-42-0
d) IS : 6649 - Hardened washers

6.4.0 Receipt & Storing of Materials

Steel materials supplied by the contractor must be marked for identification and each lot should be accompanied by manufacturer's quality certificate, conforming chemical analysis and mechanical characteristics.
All steel parts furnished by supplier shall be checked, sorted out, straightened, and arranged by grades and qualities in stores.

Structurals with surface defects such as pitting, cracks, laminations etc. shall be rejected if the defects exceed the allowable tolerances specified in relevant standards or as directed by the Engineer In-Charge.

Welding wire and electrodes shall be stored separately by qualities and lots inside a dry and enclosed room, in compliance with IS: 816 - 1969 and as per instructions given by the Engineer In-Charge. Electrodes shall be perfectly dry and drawn from an electrode even, if required.

Checking of quality bolts of any kind as well as storage of same shall be made conforming to relevant standards.

Each lot of electrodes, bolts, nuts, etc. shall be accompanied by manufacturer's test certificate.

The contractor may use alternative materials as compared to design specification only with the written approval of the Engineer In-Charge.

6.5.0 Material Tests

The contractor shall be required to produce manufacturer's quality certificates for the materials supplied by the contractor. Notwithstanding the manufacturer's certificates, the Engineer In-Charge may ask for testing of materials in approved test houses. The test results shall satisfy the requirements of the relevant Indian Standards.

Whenever quality certificates are missing or incomplete or when material quality differs from standard specifications the contractor shall conduct all appropriate tests as directed by the Engineer In-Charge at no extra cost.

Materials for which test certificates are not available or for which test results do not tally with relevant standard specifications, shall not be used.

6.6.0 Fabrication

Fabrication shall be in accordance with IS: 800 in addition to the following:

Fabrication shall be done as per approved fabrication drawings adhering strictly to work points and work lines on the same. The connections shall be welded or bolted as per design drawings. Work shall include fabricating built up sections.

Any defective material used shall be replaced by the contractor at his own expense, care being taken to prevent any damage to the structure during removal.

All the fabricated and delivered items shall be suitably packed to be protected from any damage during transportation and handling. Any damage caused at any time shall be made good by the Contractor at his own cost.

Any faulty fabrication pointed out at any stage of work shall be made good by the contractor at his own cost.

6.7.0 Preparation of Materials

Prior to release for fabrication, all rolled sections warped beyond allowable limit shall be pressed or rolled straight and freed from twists, taking care that a uniform pressure is applied.

Minor warping, corrugations etc. in rolled sections shall be rectified by cold working.
The sections shall be straightened by hot working where the Engineer In-Charge so direct and shall cooled slowly after straightening.

Warped members like plates and flats may be used as such only if wave like deformation does not exceed L/1000 but limited to 10 mm (L-Length).

Surface of members that are to be jointed by lap or fillet welding or bolting shall be even so that there is no gap between overlapping surfaces.

6.7.1 Marking

Marking of members shall be made on horizontal pads, of an appropriate racks or supports in order to ensure horizontal and straight placement of such members.
Marking accuracy shall be atleast + 1 mm.

6.7.2 Cutting

Members shall be cut mechanically (by saw or shear or by oxyacetylene flame).

All sharp, rough, or broken edges, and all edges of joints which are subjected to tensile or oscillating stresses, shall be ground.

No electric metal arc cutting shall be allowed.

All edges cut by oxyacetylene process shall be cleaned of impurities prior to assembly.

Cutting tolerances shall be as follows :

a) For members connected at both ends + 1 mm.
b) Elsewhere + 3 mm.

The edge preparation for welding of members more than 12 mm thick shall be done by flame cutting and grinding. Cut faces shall not have cracks or be rough.

Edge preparation shall be as per IS : 823 - 1964.

6.7.3 Drilling

Bolts holes shall be drilled.

Drilling shall be made to the diameter specified in drawings.

No enlarging of holes filling, by mandrolling or oxyacetylene flame shall be allowed.

Allowed variations for holes (out-of-roundness, eccentricity, plumb-line deviation) shall be as per IS:800.

- Maximum deviation for spacing of two holes on the same axis shall be + 1 mm.
- Two perpendicular diameters of any oval hole shall not differ by more than 1 mm.

Drilling faults in holes may be rectified by reaming the holes to the next upper diameter, provided that spacing of new hole centres and distance of hole centres to the edges of members are not less than allowed and that the increase of hole diameter does not impair the structural strength. Hole reaming shall be allowed if the number of faulty holes does not exceed 15% of the total number of holes for one joint.

6.7.4 Preparation of Members for Bolting

The members shall be assembled for bolting with proper jigs and fixtures to sustain the assemblies without deformation and bending.

Before assembly, all sharp edges, shavings, rust dirt, etc. shall be removed.

Before assembly, the contacting surfaces of the members shall be cleaned and given a coat of primer as per IS: 2074.

The members which are bolt assembled shall be set according to drawings and temporarily fastened with erection bolts (minimum 4 pieces) to check the coaxiality of the holes.

The members shall be finally bolted after the deviations have been corrected, after which there shall not be gaps.

Before assembly, the members shall be checked and got approved by the Engineer In-Charge.

The difference in thickness of the sections that are butt assembled shall not be more than 3% or maximum 0.8 mm whichever is less. If the difference is larger, it shall be corrected by grinding or filling.

Reaming of holes to final diameter or cleaning of these shall be done only after the parts have been check assembled.

As each hole is finished to final dimensions (reamed if necessary) it shall be set and bolted up. Erection bolts shall not be removed before other bolts are set.

6.7.5 Bolting up

Final bolting of the members shall be done after the defects have been rectified and approval of joints obtained.

The bolts shall be tightened starting from the centre of joint towards the edge.

6.7.6 Plaining of Ends

Planning of ends of members like column ends shall be done by grinding when so specified in the design.

Planning of butt welded members shall be done after these have been assembled, the spare edges shall be removed with grinding machines or files.

The following tolerances shall be permitted on member that have been planed.

- On the length of the member having both ends planed, maximum + 2 mm with respect to design.
- Level differences of planed surfaces, maximum 0.3 mm.
- Deviation between planed surface and member's axis maximum 1/1500.

6.7.7 Holes for Field Joints

Holes for field joints shall be drilled in the shop to final diameters and tested in the shop, with trial assemblies.

When three-dimensional assembly is not possible in the shop, the holes for field joints may be drilled in shop and reamed on site after erection, on approval by the Engineer In-Charge.

For bolted steel structures, trial assembly in shop is mandatory.

The tolerance for spacing of holes shall be + 1 mm.

6.8.0 Tolerances

All tolerances regarding dimensions, geometrical shapes and sections of steel structures, shall be as per Annexure B, if not specified in the drawing.

6.9.0 Preparation of Members for Welding

Assembly of structural members shall be made with proper jigs and fixtures to ensure correct positioning of members (angles, axes nodes etc.)

Sharp edges, rust of cut edges, notches, irregularities and fissures due to faulty cutting shall be chipped or ground or filled over the length of the affected area, deep enough to remove faults completely.

Edge preparation for welding shall be carefully and accurately made so as to facilitate a good joint.

Generally no special edge preparation shall be required for members under 8 mm thick.

Edge preparation (bevelling) denotes cutting of the same so as to result in V, X K or U seam shapes as per IS: 823.

The members to be assembled shall be clean and dry on the welding edges. Under no circumstances shall wet, greasy, rust or dirt covered parts be assembled. Joints shall be kept free from any foreign matter likely to get in to the gaps between members to be welded.

Before assembly the edges to be welded as well as adjacent areas extending for atleast 20 mm shall be cleaned (until metallic polish is achieved).

When assembling members, proper care shall be taken of welding shrinkage and distortions, as the drawing dimensions cover finished dimensions of the structure.

The elements shall be got checked and approved by the Engineer In-Charge or their authorised representative before assembly.

The permissible tolerances for assembly of members preparatory to welding shall be as per IS: 823-1964.

After the assemble has been checked, temporary tack welding in position shall be done by electric welding, keeping in view finished dimensions of the structure.

6.10.0 Welding procedures

Welding shall be carried out only by fully trained and experienced welders as tested and approved by the Engineer In-Charge. Any test carried out either by the Engineer In-Charge of their representative or the inspectors shall constitute a right by them for such tests and the cost involved thereon shall be borne by the contractor himself.

Qualification tests for welders as well as tests for approval of electrodes will be carried out as per IS: 823. The nature of test for performance qualification of welders shall be commensurate with the quality of welding required on this job as judged by the Engineer In-Charge.

The steel structures shall be automatically, semi-automatically or manually welded.

Welding shall begin only after all checks have been carried out.

The welder shall mark with his identification mark on each element welded by him.
When welding is carried out in open air, steps shall be taken to protect the face of welding against wind or rain. The electrodes, wire and parts being welded shall be dry.

Before beginning the welding operation, each joint shall be checked to ensure that the parts to be welded are clean and root gaps provided as per IS: 823.

For continuing the welding of seems discontinued due to some reason, the end of the discontinued seem shall be melted in order to obtain a good continuity. Before resuming the welding operation, the groove as well as the adjacent parts shall be well cleaned for a length of approx. 50 mm.

For single butt welds (in V, 1/2 V or U) and double butt welds (in K, double U etc.) the rewelding of the root is mandatory but only the metal deposit on the root has been cleaned by back gouging or chipping.

The welding seams shall be left to cool slowly. The contractor shall not be allowed to cool the welds quickly by any other method.

For multi-layer welding, before welding the following layer, the formerly welded layer shall be cleaned metal bright by light chipping and wire brushing. Backing strips shall not be allowed.

The order and method of welding shall be so that -

- No unacceptable deformation appears in the welded parts.
- Due margin is provided to compensate for contraction due to welding in order to avoid any high permanent stresses.

The defects in welds must be rectified according to IS: 823 and as per instruction of Engineer In-Charge.

6.11.0 Sequence of Welding

a) The sequence of welding shall be carefully chosen to ensure that the components assembled by welding are free from distortion and large residual stresses are not developed. The distortion should be effectively controlled either by a counter effect or by a counter distortion. The direction of welding should be away from the point of restraint and towards the point of maximum freedom.

b) Each case shall be carefully studied before finally following a particular sequence of welding.

c) Butt weld in flange plates and/or web plates shall be completed before the flanges and webs are welded together.

d) The beam and column stiffeners shall preferably be welded to the webs before the web and flanges are assembled unless the web and flanges to the beam or column are assembled by automatic welding process.

e) All welds shall be finished full and made with correct number of runs, the weld being kept free from slag and other inclusions, all adhering slag being removed.

f) Current shall be appropriate for the type of electrode used. To ensure complete fusion, the weaving procedure should go proper and rate of arc advancement should not be so rapid as to leave the edges unmelted.

g) Pudding shall be sufficient to enable the gases to escape from the molten metal before it solidifies.

h) Non-uniform heating and cooling should be avoided to ensure that excessive stresses are not locked up resulting ultimately in cracks.

i) The ends of butt welds shall have full throat thickness. This shall be obtained on all main butt welds by the use of run off and run on pieces adequately secured on either side of main plates. The width of these pieces shall not be less than the thickness of the thicker part joined. Additional metal remaining after the removal of extension pieces shall be removed by grinding or by other approval means and the ends and surface of the welds shall be smoothly finished. Where the abutting parts are thinner than 20mm the extension pieces may be omitted but the end be welded to provide the ends with the required reinforcement.

j) The fusion faces shall be carefully aligned. Angle shrinkage shall be controlled by presetting. Correct gap and alignment shall be maintained during the welding operation.

k) All main butt welds shall have complete penetration and back surface of the weld being gouged out clean before first run of the weld is given from the back. However, partial penetration butt weld shall be permitted, when specifically shown in the design drawings.

l) Intermittent welds shall be permitted only when shown in the design drawings.

m) The welding shrinkage shall be minimised by adopting the correct welding procedure and method. In long and slender member extra length should be provided at the time of fabrication for shrinkage.

6.12.0 Welding technique

All complete penetration groove welds made by manual welding, except when produced with the aid of backing material not more than 8 m thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross-section. Groove welds made with the use of the backing of the same material, as the base metal shall have the weld metal thoroughly fused with the backing material. Backing strips need not be removed. If required, they may be removed by gouging or gas cutting after welding is completed, provided no injury is done to the base metal and weld metal and the weld metal surface is left flush or slightly convex with full throat thickness.

Groove welds shall be terminated at the ends of a joint in a manner that will ensure their soundness. Where possible, this should be done by use of extension bars or run-off plates. Extension bars or run-off plates need not be removed upon completion of the weld unless otherwise specified elsewhere in the contract.

To get the best and consistent quality of welding, automatic submerged arc process shall be preferred. The technique of welding employed, the appearance and quality of welds made, and the methods of correcting defective work shall all conform to the relevant Indian Standards.

6.12.1 Temperature

No welding shall normally be done on parent material at a temperature below (-) 5°C. However, if welding is to undertaken at low temperature, adequate precautions as recommended in relevant Indian Standard shall be taken. When the parent material is less than 40 mm thick and the temperature is between (-) 5°C and 0°C, the surface around the joint to a distance of 100 mm or 4 times the thickness of the material, whichever is greater, shall be preheated till it is hand warm. When the parent material is more than 40 mm thick, the temperature of the area mentioned above shall be in no case be less than 20°C. All requirements regarding preheating of the parent material shall be in accordance with the relevant Indian Standard.

6.12.2 Peening

Where required, intermediate layers of multiple-layer welds may be peened with light blows from a power hammer, using a round-nose tool, peening shall be done after the weld has cooled to a temperature warm to the hand. Care shall be exercised to prevent scaling or flaking of weld and base metal from over peening.

6.12.3 Equipment

These shall be capable of producing proper current so that the operator may produce satisfactory welds. The welding machine shall be of a type and capacity as recommended by the manufacturers of electrodes or as may be approved by the engineer.

6.12.4 Finish

Column splices and butt joints of compression members depending on contact for stress transmission shall be accurately machined and close-butted over the whole section with a clearance not exceeding 0.1 mm locally at any place. In column caps and bases, the

ends of shafts together with the attached gussets, angles, channels etc; after welding/riveting together, should be accurately machined so that the parts connected butt over the entire surfaces of contact. Care should be taken that those connecting angles of channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 1.0 mm.

6.12.5 Inspection of Welds

a) Visual Inspection

100 percent of the welds shall be inspected visually for external defects. Dimensions of welds shall be checked. The lengths and size of weld shall be as per fabrication drawings. It may be slightly oversized but should not be undersized. The profile of weld is affected by the position of the joint but it should be uniform. The welds should have regular height and width of beads. The height and spacing of ripples shall be uniform. The joints in the welds run shall as far as possible be smooth and should not show any humps or craters in the weld surface. Welds shall be free from unfilled craters on the surface, under-cuts, stages on the surface and visible cracks.

Such inspection shall be done after cleaning the weld surface with steel wire brushes and chisel to remove the spatter metal, scales, slag, etc., If external defects mentioned above are noticed, there is every possibility of internal defects and further radiographic/ultrasonic examination shall be undertaken.

b) Production Test Plate

Test plates shall be incorporated on either side of at least one main butt welds of each flange plate and web plate of every main frame columns and crane girder. The weld shall be continuous over the test plate. The test plate extensions of the main plates and shall be fixed so that metal lies in the same direction as that of the main plate. Test plates shall be prepared and tested in accordance with the accepted Standards, in the presence of the Engineer or his authorised representative. Should any of these tests fail, further radiographic examination of the welds shall be done. These tests for test plates and radiographic examination are additional to those contemplated under inspection and testing.

c) Non-destructive and special testing

Radiographic / ultrasonic or other non-destructive examination shall be carried out. All tests of welds shall be carried out by the Bidder at his own cost. The cordoning of radiation zone, while Radiography testing is going on, shall be done. In case of failure of any of the tests, re-testing of the joints shall also be carried out after rectification is done.

d) Rectification of defective welding work

Wherever defects like improper penetration, extensive presence of blow holes, undercuts, cracking, slag inclusion, etc., are noticed by visual inspection/other tests, the welds, in such location shall be removed by gouging process. The joints shall be prepared again by cleaning the burrs and residual matters with wire brushes and grinding, if necessary, and rewelded. The gouging shall as far as possible be done using gouging electrodes.

6.13.0 Testing of welds

a) Fillet Welds

i) All fillet welds shall be checked for size and visual defects.

ii) Macroetch examination on production test coupons for main fillet weld with minimum one joint per built up beam, column and crane girder, etc.

iii) Dye-penetration test on 5% of weld length with minimum 300mm at each location shall be carried out.

b) Butt Welds

i) 100% visual examination.
ii) Dye penetration test on all butt welds after back gouging shall be carried out.
iii) Mechanical testing of production test coupons - minimum one joint/built up beam, column and crane girder. The engineer may reduce the frequency of the test, after getting consistently satisfactory results of initial 10 tests.

c) Dimensional Tolerance and Acceptance Criteria of Welds

i) Every first and further every 10th set of identical structure shall be checked for control assembly at shop erection.
ii) All structures, components/members shall be checked for dimensional tolerance during fabrication and erection as per IS:7215 and IS:12843 respectively.
iii) Dry film thickness after painting shall be checked by using elchometer.

6.14.0 Correction of Defective Welds

Correction of defective welds shall be carried out without damaging the parent metal. When a crack in the weld is removed magnetic particles inspection or any other equally positive means shall be used to ensure that the whole of the crack and material up to 25mm beyond each end of the crack has been removed.

6.15.0 Marking for Identification

All elements and members prior to despatch for erection shall be shop marked.

The members shall be visibly marked with a weather proof light coloured paint. The size and thickness of the numbers shall be chosen as to facilitate the identifications of members.

For the small members that are delivered in bundles or crates, the required marking shall be done on small metal tags securely tied to the bundle, while the crates shall be marked directly.

Each bundle or crate shall be packed with members for one and the same assembly; in the same bundle or crate, general utility members such as bolts, quests etc. may be packed.

All bill of materials showing weight, quality and dimension of contents shall be placed in the crates.

The members shall be marked with a durable paint, in a visible location, preferably at one end of the member so that these may be easily checked during storage and erection.

All members shall be marked in the shop before inspection and acceptance.

When the member is being painted, the marking area shall not be painted but bordered with white paint.

The marking and job symbol shall be registered in all shop delivery documents (transportation, for erection etc.)

6.16.0 Shop Test Pre-assembly

For steel structures that have the same type of welding the shop test pre-assembly shall be performed on one out of every 10 members minimum.

For bolted steel structures, shop test pre-assembly is mandatory for all elements as well as for the entire structure.

6.17.0 Shop Inspection and Approval

The Engineer In-Charge or their representative shall have free access at all responsible times to the contractors fabrication shop and shall be afforded all reasonable facilities for satisfying himself that the fabrication is being undertaken in accordance with drawings and specifications.

Technical approval of the steel structure in the shop by the Engineer In-Charge is mandatory.

The contractor shall not limit the number and kinds of tests, final as well as intermediate once, or extra tests required by the Engineer In-Charge.

The contractor shall furnish necessary tools, gauges, instruments etc. and technical non-technical personnel for shop tests by the Engineer In-Charge, free of cost.

6.18.0 Shop Acceptance

The Engineer In-Charge shall inspect and approve at the following stages :

The following approvals may given in shop :

- Intermediate approvals of work that cannot be inspected later.
- Partial approvals
- Final approvals

Intermediate approval of work shall be given when a part of the work is preformed later :

- Cannot be inspected later
- Inspection would be difficult to perform and results would not be satisfactory.

Partial approval in the shop is given on members and assemblies of steel structures before the primer coat is applied and includes :

- Approval of materials
- Approval of field joints
- Approval of parts with planed surfaces
- Test erection
- Approval of members
- Approval of markings
- Inspections and approvals of special features, like Rollers, loading platform mechanism etc.

During the partial approval, intermediate approvals as well as all former approvals, shall be taken in to consideration.

6.19.0 Final approval in the Shop

The final approval refers to all elements and assemblies of the steel structures, with shop primer coat, ready for delivery from shop to be loaded for transportation, or stored.

The final approval comprises of :
- Partial approvals
- Approval of shop primer coat
- Approval of mode of loading and transport
- Approval of storage (for materials stored)

6.20.0 Painting and Delivery

- Preparation of parts for shop painting

- Painting shall consist of providing one coat of red oxide zinc chromate primer or primer compatible for vermiculite coating to steel members as per drawing before despatch from shop.

- Primer coat shall not be applied unless:

  - Surface have been wire brushed, cleaned of dust, oil, rust etc.

  - Erection gaps between members, spots that cannot be painted or where moisture or other aggressive agents may penetrate, have been filled with an approved type of oil and putty.

  - The surface to be painted are completely dry.

  - The parts where water of aggressive agents may collect (during transportation, storage, erection and operation) are filled with putty and provided with holes for drainage of water.

  - Members and parts have been inspected and accepted

  - Welds have been accepted.

  The following are not to be painted or protected by any other product:

  - Surface which are in the vicinity of joints to be welded at site.
  - Surfaces bearing markings
  - Other surfaces indicated in the design.

  The following shall be given a coat of hot oil or any approved resistant lubricant only.

  - Planed surfaces
  - Holes for links

  The surfaces that are to be embedded or in contact with the concrete shall be given a coat of cement wash.

  The surfaces which are in contact with the ground, gravel or brick work and subject to moisture, shall be given bituminous coat.

  The other surfaces shall be given a primer coating.

  Special attention shall be given to locations not easily accessible, where water can collect and which after assembly and erection cannot be inspected, painted and

maintained. Holes shall be provided for water drainage and in accessible box type sections shall be hermetically sealed by welds.

If specified elsewhere, in the schedule of quantities, the contractor shall paint further coats of red-oxide after erection and placing in position of the steel structures.

6.21.0 Packing, transportation, delivery

After final shop acceptance and marking, the item shall be packed and loaded for transportation.

Packing must be adequate to protect item against warping during loading and unloading.

Proper lifting devices shall be used for loading, in order to protect items against warping.

Slender projecting parts shall be braced with additional steel bars, before loading, for protection against warping during transportation.

Loading and transportation shall be done in compliance with transportation rules.

If certain parts cannot be transported in the lengths stipulated in the design, the position and type of additional splice joints shall be approved by the Engineer In-Charge.

Items must be carefully loaded on platforms of transportation means to prevent warping, bending or falling during transportation.

The small parts such as fish-plates, quests etc. shall be securely tied with wire to their respective parts.

Bolts, nuts and washers shall be packed and transported in crates.

The parts shall be delivered in the order stipulated by the Engineer In-Charge and shall be accompanied by document showing:

- Quality and quantity of structure or members
- Position of member in the structure
- Particulars of structure
- Identification number job symbol.

6.22.0 Field Erection

While erecting a structure adequate means shall be employed for temporary fastening the members together and bracing the frame work until the joints are welded/ bolted. Such means shall consist of applying of erection bolts, tack welding or other positive devices imparting sufficient strength and stiffness to resist all temporary loads and lateral forces including wind.
The erection work shall be permitted only after the foundation or other structure over which the steel work will be erected is approved and is ready for erection.

The contractor shall satisfy himself about the levels, alignment etc. for the foundations well in advance, before starting the erection. Minor chipping etc. shall be carried out by the contractor on his expense.

Any faulty erection done by the contractor shall be made good at his own cost.

Approval by the Engineer In-Charge or their representatives at any stage of work does not relieve the contractor of any of his required guarantees of the contract.

6.23.0 Storage and preparation of parts prior to erection

The storage place for steel parts shall be prepared in advance and got approved by the Engineer In-Charge before the steel structures start arriving from the shop.

A platform shall be provided by the Contractor near the erection site for preliminary erection work.

The contractor shall make the following verifications upon receipt of material at site.

- for quality certificates regarding materials and workmanship according to these general specifications and drawings.
- Whether parts received are complete without defects due to transportation, loading and unloading and defects, if any, are well within the admissible limit.

For the above work sufficient space must be allotted in the storage area.
Steps shall be taken to prevent warping of items during unloading.
The parts shall be unloaded, stored and stored so as to be easily identified.
The parts shall be stored according to construction symbol and markings so that these may be taken out in order or erection.
The parts shall be at least 150 mm clear from ground on wooden or steel blocks for protection against direct contact with ground and to permit drainage of water.
If rectification of members like straightening etc. are required, these shall be done in a special place allotted which shall be adequately equipped.

The parts shall be clean when delivered for erection.

6.24.0 Erection & Tolerances

Erection in general shall be carried out as required and approved by the Engineer In-Charge.

Positioning and levelling of the structure, alignment and plumbing of the stanchion and fixing every member of the structure shall be in accordance with the relevant drawings and to the complete satisfaction of the Engineer In-Charge.

The following checks and inspection shall be carried out before during and after erection.

- Damage during transportation
- Accuracy of alignment of structures
- Erection according to drawings and specifications
- Progress and workmanship.

In case there be any deviations regarding positions of foundations or anchor bolts, which would lead to erection deviations, the Engineer In-Charge shall be informed immediately. Minor rectifications in foundations, orientation of bolts holes etc. shall be carried out as part of the work, at no extra cost.

The various parts of the steel structure shall be so erected so to ensure stability against inherent weight, wind and erection stresses.

The structure shall be anchored and final erection joints completed after plan and elevation positions of the structural members have been verified with corresponding drawings and approved by the Engineer In-Charge.

The bolted joints shall be tightened so that the entire surface of the bolt heads and nuts shall rest on the member. For parts with sloping surfaces tapered washers shall be used.

6.25.0 Final acceptance and handing over the structure

At acceptance, the contractor shall submit the following documents:

- Shop and erection drawings - either in tracings or reproducible.

- 4 copies of each of the following:

  (1) shop acceptance documents
  (2) quality certificate for structurals, plates, etc. (electrodes, welding wire, bolts, nuts, washers etc.)
  (3) List of certified welders who worked on erection of structures.
  (4) acceptance and intermediate control procedure of erection operations.

6.25.1 Approval by the Engineer In-Charge at any stage of work does not relieve the contractor of any of his required guarantees of the contract.

6.26.0 RATES AND MEASUREMENT

6.26.1 Rates

i. The items of work in the Schedule of items describe the work in brief. The various items of the Schedule of items shall be read in conjunction with these specifications including amendments and additions, general conditions of contract, special conditions of contracts, and other tender documents, if any. For each item of Schedule of Items, the bidder's rates shall include the activities covered in the description of the item as well as all necessary operations described in the Specifications.

ii. The bidder's rates shall include cost of all minor details which are obviously and fairly intended and which may not have been included in the description in these documents but are essential for the satisfactory completion of the work. Rates shall also include for taking all safety measures.

iii. The bidder's -rates for all items of schedule of items shall include complete cost towards plant, equipment, erection and dismantling of scaffolding, men, materials and consumables, skilled and unskilled labour, levies, taxes, royalties, duties, transport, storage, repair/rectification/maintenance until handing over, contingencies, overhead and all incidental items not specifically mentioned but reasonably implied and necessary to complete the work.

iv. No claims shall be entertained, if the details shown on the `Released for Construction' drawings differ from those shown on the bid/tender drawings.

v. Rates shall be inclusive of all leads and lifts/elevation.

vi. The bidder's rates for Structural Steel shall include for cost of steel, fabrication, surface preparation & primer painting, conveyance & transportation to site, hoisting, erection, placing in position, alignment, preparation, checking, collecting and distributing of the fabrication drawings and design calculations, erection scheme, alignment, welding, including preheating and post heating, testing of welders, inspection of welds, visual inspection, non-destructive and special testing, rectification and correction of defective welding works, production test plate, inspection and testing, erection scheme, protection against damage in transit, stability of structures, etc. The rates shall also be inclusive of providing and installing temporary structures, all other general, special, such

requirements as may be required, for the successful completion of the work.

vii. The bidder's rates for foundation bolts assembly shall include fabrication, threading, heat treatment, erection, installation, and alignment of complete bolt assembly with nuts, locknuts, anchor plates, stiffener plates, protective tape, etc. This shall also include the cost of all materials not issued by the Owner. Material issued by Owner will be specified in GCC.

viii. The bidder's rates for permanent mild steel bolts, nuts and washers shall include the supply and fixing of such bolts, nuts and washers in position, for various types of Structural Steel works, as per the technical specification.

ix. The bidder's rates for high strength structural bolts, nuts and washers shall include the supply and fixing of such bolts, nuts and washers in position, for various types, of Structural Steel works, as per the technical specification.

6.26.2 MODE OF MEASUREMENT

i) The measurement for the item of foundation bolts assembly including that of nuts; locknuts shall be based on the calculated weight of steel installed in Metric Tonne, corrected to second place of decimal. The weight of the foundation bolt shall be calculated in the same way as that done for the item of fabrication, erection, alignment of structural steel. The weight of the nut / locknut shall be taken as per actual weight supplied by the contractor and accepted by the Engineer.

ii) The measurement for the item of supply of steel, fabrication, transportation, erection, alignment, welding, etc. of structural steel work shall be based on the weight of steel as per approved bill of material (Wastages and cut pieces shall not be measured) nearest to a Kg, by applying the standard unit weight.

iii) For ISMB, ISMC, ISA, flats, round bars, square bars and pipes, length shall be taken as per distance between planes normal to the axis of the member passing through the extreme points of the section.

iv) Gussets plates in trusses, and bracings, brackets plates, stiffeners, and skew cuts if any in plates for butt welds, the area shall be assumed as the minimum circumscribed rectangle. However deduction for any notch/skew cut shall be made as mentioned in clause no-6.26.2.v.

v) For all other plates, where the area of any notch/skew cut in the plate is less than 0.05 sq.m. the area of the plate shall be assumed as that of the minimum circumscribing rectangle for the purpose of measurement and calculation of area for the purpose of payment. However, if the area of any notch/skew cuts in a plate is more than 0.05 sq.m, the area of notch/skew cut shall be deducted from assumed minimum circumscribing rectangular area for the purpose of payment.

vi) No deduction shall be made for the hole in the members, if the area of individual hole is less than 0.05 sq.m. The weight shall be calculated by deducting the area of holes, if area of individual hole is more than 0.05 sq.m.

vii) The splice plate shown in the fabrication drawing or approved by the Engineer shall only be measured for payment.

viii) The weight of permanent bolts, washers and nuts and welds shall not be included in the weights of the members. No extra payment shall be made for welding/bolting.

ix) The bolts and nuts required for erection purpose shall not be paid for and may be taken away by the Contractor after final welding/ permanent bolting for members. Erection boltholes left after removal of erection bolts shall be suitably plugged with welds.

x) The measurement for the item of permanent bolts with nuts and washers shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor and accepted by the Engineer, and as per the approved bolts and nuts schedules.

xi) The measurement for the item of High Strength Structural bolts with nuts and washers shall be based on the actual weight in Kgs, corrected to second place of decimal, as supplied by the Contractor and accepted by the Engineer, and as per the approved bolts and nuts schedules.

7.0 SPEED FLOOR SYSTEM AND METAL DECK SYSTEM

7.1.1 The speed floor system

7.1.1 The Joist

The joist is manufactured from G 350 Z 275 pre-galvanized steel conforming to AS 1397:2001. Size may be any one of the following i.e. 200mm, 250mm, 300mm, 350mm and 400mm, depending upon the design requirements. Concrete thickness may be 75mm or 90mm as required. The speed floor joist shall meet the fire rating requirement of 2 hr as per relevant standard duly confirmed by manufacturer's test certificate.

The top section of the joist is embedded in concrete. The mid-section or web of the joists has the flanged service hole and the lock-bar hole punched into it. The flanging of the service hole provides stability to the web and services can pass through without requiring protection from the sharp edges of the punched material. The bottom triangular section of the joist acts as a tension member both during construction phase and when the joist is acting compositely with the slab.

7.1.2 The Lock bar :- The lock bars support the temporary plywood formwork between the joists during construction. They shall be spaced approx. 300mm apart and engage in the slotted holes punched in the top section of the joist. They also maintain the exact spacing of the joists.

The standard lockbars when installed will position the joists 1230mm, 930mm or 630mm apart. There are also special adjustable lockbars that will position the joists in increments of 50mm from 330mm to 1530mm. Other type of lockbars are provided for special situations such as cantilevers or lowered soffits.

7.1.3 Temporary plywood formwork High density paper overlaid 12mm shuttering plywood conforming to IS 4990:2011 or equivalent is used as formwork to produce a good finish to the underside of the slab. The rigid plywood sheets are used in conjunction with the lock bars and when locked in place, provide lateral stability to the entire Speed floor system during the Construction phase.

7.1.4 Reinforcing mesh : reinforcement mesh as per drawing, is laid and tied into place. No chairs are required as it is held off the plywood forms by the top section of the joist, which becomes embedded in the concrete.

7.1.5 **Concrete** (i) Minimum grade of concrete shall be M25 as per IS 456:2000. It should preferably be batched at 60mm and super plasticized to 110mm slump to provide good placement and shrinkage characteristics. Proper curing technique to be adopted to control shrinkage during the curing period.

(ii) The concrete should initially be placed evenly and continuously over the area to be formed. Special attention should be given to ensure the concrete is screened and finished to the specified thickness so that designed deflections are achieved in the Speed floor joists and the supporting structures.

7.1.6 Installation Process

Installation process is as follows:
(i) Lightweight bundles of joists is lifted into position and then individual joists are placed by hand.
(ii) Speed floor joists are generally placed at 1250 mm c/c or depends on spacing/loads as per approved drawing.
(iii) Joists are held in place using the lockbars which slip into slotted holes.
(iv) The lockbars is placed at 300mm apart to support plywood formwork. The propping is not required.
(v) Full sheets of 12.5mm plywood formwork is to be laid from above creating a working platform. Cam action of lockbars secures plywood.
(vi) Mesh is placed on top section of joist thereby embedded in the concrete poured thereafter.

7.2.0 Metal deck system

7.2.1 Metal Deck Material

Galvanized MS troughed metal decking sheets (Galvanized to Grade 275 minimum as per IS:277) with minimum 0.8mm total coated thickness (TCT), trough depth of 52mm and having yield strength of minimum 240 MPa of approved profile & sectional properties.

7.2.2 Fasteners

Decking sheets shall be fixed to the runner/purlins using self-drilling special coated shear anchor studs confirming to corrosion resistant class 3 of AS3566. Maximum spacing of Self-drilling fasteners in transverse direction (along runners/purlin) shall be 400 mm and in longitudinal direction at every runner/purlin location.

7.2.3 Miscellaneous Details

To minimize the number of joints, the length of the sheet shall preferably be not less than 4.5m, cut pieces shall not be used, unless specifically approved by the Engineer. However, the actual length shall be such so as to suit the purlin / runner spacing. Lap between the sheets shall be at least 150mm in the longitudinal direction and at least one crest wide in the transverse direction which shall be properly anchored / fixed with fasteners.

8.0 FIRE PROOFING OF STRUCTURAL STEEL BY VERMICULITE BASED CEMENTIOUS COATING

All materials to be used shall conform to the requirements of ASTM E119/UL 263. Materials shall meet the minimum acceptance criteria given under this section. Samples/test results and approval certificates for all materials shall be submitted and got approved from the Engineer-in-charge before execution of the work.

Vermiculite based light weight cementitious fire proofing system shall have following compatible components

- Primer
- suitable adhesive or wire mesh netting
- Fire proof coating
- Curing
- Water shed sealing at terminating edges/metal joints

8.1.1 Vermiculite based light weight cementitious fire proofing Material

Vermiculite based light weight cementitious fire proofing material shall be factory blended, supplied in single component, pre mixed dry form, non-flaking and non-dusting suitable for spray application, with added mould and fungi inhibitor. Material shall not contain asbestos and mineral wool and shall not contain more than 1% sulphate (expressed in SO3). The material shall be free from toxicity release when subjected to hit.

Fire proofing materials shall be stored in well ventilated, dry place away from source of heat and direct sun light. Special storage requirements such as temperature, humidity, stacking height etc. as per manufacturer's specification shall be ensured.

8.1.2 Application method

Application of fire proof material coating shall be carried out by skilled and experienced applicators.
Before start of the application, pipes and equipment in the vicinity shall be covered with polythene/tarpaulin to protect then against damage.
Open end of pipe shall be covered with wooden plugs or with other suitable shielding materials.
Steel sections shall be applied suitable adhesive or wire mesh netting if required for bonding purpose before application of fire proofing material. All outside edges of fire proofing material shall be chamfered.
The fire proofing material after application shall be cured by keeping it in moist condition for at least 7 days(or as per vendor requirements) or else the surface shall be coated with a membrane of approved curing compound. Brand, name of manufacturer, test results and method of application shall be submitted to and got approved from engineer in charge prior to procurement of curing compound.

8.1.3 Specific requirements of Vermiculite based cementitious material

The contractor responsible for fire proofing application shall be certified by fire proofing material vendor. Further the application crew shall be pre qualified through a mock application to establish their scheme to meet desired quality parameters. Application tools and machineries shall also be approved by the fire proofing material vendor. The mock up shall be demonstrated on the test surface resembling the actual application conditions to ascertain skill of the applicator. Installation surface shall be inspected within one hour of application for any shrinkage/gaps/cracks. In case defects observed, the method of application shall be adjusted for successful mock up.
Vermiculite based cementitious material shall be mixed with water on a clean platform or in a clean mixing box or in suitable mixer as per manufacturer's specification. Water cement ratio shall be adjusted so that vermiculite based cementitious based coating address properly to steel surface and does not slide upon application.
Primer compatible with vermiculite based cementitious coating shall be applied over the steel surface in fabrication shop or at site in erected position.
Mixed vermiculite based cementitious coating shall generally be applied over the steel surface with help of spray gun except for small areas and inaccessible locations where application with conventional hand toold shall be permitted.

Parameters like water quality, percentage water addition, wet density check at mixture discharge and spray head, slump test and other operating parameters like air pressure etc. shall be checked during application to ensure achievement of specified quality parameters.
All patching of damaged fire proofing work shall be done by the contractor certified by the fire proofing material vendor.

8.1.4 Scaffolding and Form work

The contractor shall arrange all approaches, scaffolding, stair ways, ladder, walking platforms etc. for carrying out the entire works safely. The working area shall be neatly maintained and all facilities required by the engineer-in-charge for proper supervision of the work shall be provided. In case any special precaution is needed for the safety of the structure till the completion of the application, the contractor shall make and provide all such arrangement to the complete satisfaction of engineer-in-charge and shall remove the same after completion of the works.
Form work shall be adequately supported and braced to protect against deformation on account of vibration during the application.

8.1.5 Testing requirements for Vermiculite based cementitious fire proofing coating

Test samples shall be taken during application of coating which shall be tested for bulk density and compressive strength as per applicable standards.

8.1.6 Method of Measurement

Payment shall be made on Square meter basis measured at the periphery of actual finished work or as calculated from construction drawings whichever is less.

The rate quoted shall be inclusive of design of vermiculite based cementious coating thickness required for minimum 02 hr fire rating, all labour, material, form work, plant and tools etc. required for successful and satisfactory completion of work including curing, curing compound, admixtures, all cleaning operations before and after the work, preparation of the surface as specified, applying the primer coat if recommended by the manufacturer compatible with the primer already applied, finishing the surface smooth, sealing the joints with sealing compounds, providing temporary working platforms, props, scaffolding and other safety measures including their removal after completion.

The rate quoted shall be inclusive of test specified and directed to establish the quality and strength of material.

9.0 Water Proofing

All water proofing work shall be carried out by approved applicators. Installation and materials shall be as per best practices for obtaining water proof work and as recommended by the manufacturer.

Water proofing work shall be commenced only after the surface is prepared, smooth rendered, cleaned free of dirt, dust and foreign matters, inspected and approved. Compressed air shall be used for effective cleaning of all surfaces.

9.1.0 INTEGRAL CEMENT BASED WATER PROOFING TREATMENT WITH BRICK BAT KOBA

a) Preparing the Surface

The surface of the slab should be roughened by scrapping when the slab concrete is still green,

however, the surface need not be hacked. In case the slab is already cast and surface fairly finished, the same shall be cleaned neatly of all mortar droppings, loose materials etc with brooms/cloth.

b) Providing and Laying of Slurry under Base Coat

The quantity of water required to prepare the slurry with 2.75 kg. of blended cement to be painted over an area of 1 sqm. shall be calculated. Depending upon the area of surface that has to be covered, the required quantity of slurry should be prepared using 2.75 kg. blended cement + water per sqm. area to be covered, taking particular care to see that only that much quantity of slurry shall be prepared which can be used within half an hour of preparation i.e. before the initial setting time of cement. The prepared slurry shall be applied over the dampened surface with brushes very carefully, including the joints between the floor slab and the parapet wall, holes on the surfaces, joints of pipes, masonry/concrete etc.

The application of the slurry should continue upto a height of 300 mm on the parapet wall and also the groove. The slurry should also be applied upto a height of 150 mm over pipe projections etc.

c) Laying Base Coat 20 mm thick

Immediately after the application of slurry and when the application is still green, 20 mm thick cement plaster as base coat with cement mortar 1:5 (1 blended cement : 5 coarse sand) shall be evenly applied over the concrete surface taking particular care to see that all the corners and joints are properly packed and the application of the base coat shall be continued upto a height of 300 mm over the parapet wall.

d) Laying Brick Bat Coba

Brick bat of size 25 mm to 115 mm out of well burnt bricks shall be used for the purpose of brick bat coba.The brick bats shall be properly dampened for six hours before laying. Brick bats shall be laid to required slope/gradient over the base coat of mortar leaving 15-25 mm gap between two bats. Cement mortar 1:5 (1 blended cement: 5 coarse sand) shall be poured over the brick bats and joints filled properly. Under no circumstances dry brick bats should be laid over the base coat. The haunches/gola at the junction of parapet wall and the roof shall be formed only with brick bat coba.

In case the brick bat coba is laid on the base coat immediately on initial set there will be no necessity of applying cement slurry over the base coat before laying the brick bat coba. However, if the brick bat coba is to be laid on the subsequent day, cement slurry prepared shall be applied over the top surface of the base coat, then only the brick bat coba shall be laid.

e) Application of Slurry over Brick Bat Coba

After two days of curing of brick bat coba, cement slurry shall be applied on the surface of brick bat coba The application of slurry shall be the same as described above which should cover the haunches/gola, and the remaining small portion of parapet wall and also inside the groove.

Laying Finishing Layer (Protective Coat)

Immediately on applying the cement slurry over the surface of the brick bat coba and when the slurry applied is still green, the fibre glass cloth shall be spread evenly on the surface without any kink & pressed to see that no air spaces exist. The fibre glass cloth shall be taken up to a height of 300 mm on parapet walls & tucked in the groove specially prepared at that height. 20 mm thick layer of cement plaster, without leaving any joints shall be applied with cement mortar 1:4 (1 blended cement: 4 coarse sand) over the entire fibre glass cloth including the haunches/gola and the small portion on the

parapet wall. The groove in the parapet wall over the haunches shall also be filled neatly packing the mortar firmly in the groove.
The surface of the finishing layer (protective coat) shall be neatly finished with cement slurry.The finished surface shall be allowed to dry for a while and then pattern of 300 mm x 300 mm groove, 8 mm deep shall be made over the entire surface.

f) Curing and Testing the Treatment
The entire surface thus treated shall be flooded with water by making kiaries with weak cement mortar, for a minimum period of two weeks.

9.1.1 Measurement
The measurement shall be taken along the finished surface of treatment including the rounded and tapered portion at junction of parapet wall. Length and breadth shall be measured correct to a cm and area shall be worked out to nearest 0.01 sqm. No deduction in measurement shall be made for openings or recesses or chimney stacks, roof lights or khurras of area upto 0.40 sqm., nor anything extra shall be paid for making such openings, recesses etc. For areas exceeding 0.40 sqm., deduction will be made in the measurements for the full openings and nothing extra shall be paid for making such openings.
The rate shall include the cost of all labour and materials involved in all the operations described above.

9.2.0 CEMENT CONCRETE GOLA

Cement Concrete
The specifications for concrete shall be the same as described in technical specification of concrete work.
Gola
A chase of 75 mm wide and 75 mm deep shall be cut in the parapet wall just above the junction of mud phuska or lime concrete with parapet wall and it shall be filled with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 stone aggregate 10 mm and down gauge) the external face finish with a slope of 1 : 0.75 and the exposed surface of the gola shall be plastered with cement mortar 1 : 3 (1 cement : 3 fine sand).
Curing
The finished surface shall be cured for at least 7 days.

9.2.1 Measurements
The length of the finished gola shall be measured at its junction with the wall face correct to a cm. No deduction shall be made in measurements for gaps for water outlets.
The rate shall include the cost of all materials and labour involved in all the operations described above. The rate includes for all turnings and roundings at all the corners and risers.

9.3.0 KHURRAS

The khurras shall be constructed before the brick masonry work in parapet wall is taken up and it shall be of size 45 cm x 45 cm unless otherwise specified in the description of the item and shall be made of cement concrete 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) or other mix as stipulated in the description of the item.
Laying
A PVC sheet of size 1 m x 1 m x 400 micron shall be laid under the khurra and then cement concrete shall be laid over it to average thickness of 50 mm with its top surface lower than the level of adjoining roof surface by not less than 50 mm.

The concrete shall be laid to a size greater than the stipulated size of the khurra in such a way that the adjoining terracing shall overlap the concrete on its three edges by not less than 7.5 cm. The concrete will slope uniformly from the edges to the outlet, the slope being as much as possible and in no case less than 20 mm cement concrete at the outlet. The concrete shall be continued at the same slope through the width of the wall into the outlet opening to ensure a water tight joint.

The khurras and the sides of the outlet shall then be rendered with 12 mm coat of cement plaster 1:3 mix (1 cement : 3 coarse sand) or other mix as stipulated in the description of the item. This shall be done when the concrete is still green and shall be finished. The sides of the khurras and sides of the outlet opening shall be well rounded. The size of the finished outlet opening shall be 10 cm wide and by 20 cm high or as directed by the Engineer-in-Charge.

9.3.1 Measurements

Khurras shall be counted in numbers.

The rate is for each completed khurra of the specified size and is inclusive of the cost of all materials and labour in forming the khurras and outlet opening as described above, except for gratings which shall be paid for separately.

9.4.0 WATER PROOFING TREATMENT WITH ATACTIC POLYPROPYLENE POLYMER (APP) MODIFIED PREFABRICATED MEMBRANE

For detailed specification, refer CPWD specifications.

10.0.0 FLOORING WORKS

10.1.1 SCOPE

This specification covers furnishing, installation, finishing, curing, testing, protection, maintenance till handing over various types of floor finishes and allied items of work as listed below:

10.2.0 VACCUM DEWATERED CONCRETE FLOORING

10.2.1 PREPARATION

1. The surface to receive flooring shall be clean, free from dirt and free from foreign material.
2. Any undulations or mortar remaining on the floor shall be trimmed.
3. Base course shall be trimmed.
4. The base shall be cleaned and watered before laying the floor.
5. Work includes at all depths and heights.
6. The finished surface shall be kept wet for a maximum period of one week.

10.2.2 CONCRETING

General

1. Concreting shall have a concrete base of M25 of specified thickness.
2. Flooring shall have hard top on the concrete base.
3. Flooring shall be laid in panels, the size of which is mentioned on the drawings.

Materials

Cement	-	Portland
Sand	-	River sand
Aggregate	-	Max. size 10 to 20mm
Water	-	Potable

Floor hardener (Optional) - @4 kG/Sqm

10.2.3 Execution

Prepared concrete (of grade as per design drawing) shall be laid immediately after mixing. The base shall be free from water and other foreign materials, dust and dirt. A coat of cement slurry of the consistency of thick cream shall be brushed on the surface of the base course. The concrete shall then be spread over this base evenly and leveled carefully. Low areas shall be filled with concrete and humps removed. De-vaccumization shall be done for removing the voids. The whole concrete surface shall be leveled, compacted by ramming and troweling. Prepared surface shall be allowed to set.

10.2.4 Floor hardner:

Hard top to be prepared as per the specifications with non-metalic mineral based concrete surface floor hardener as specified.

a) The hard top shall be provided over concrete base immediately after it is set, compacted and leveled with a steel trowel.
b) The surface shall be trowelled to bring the hardener coat to a leveled surface.
c) Excessive trowelling shall be avoided.
d) After the initial set, further compaction shall be done by steel trowelling.
e) Final brushing shall be made before the floor top becomes too hard.

10.2.5 CURING

1. Curing shall commence as soon as the surface is hard enough to receive the water.
2. The surface shall be covered with sacks or sand and shall be kept continuously wet for a period of at least one week.

11.0.0 FINISH TO MASONRY & CONCRETE

11.1.1 SCOPE

This Specification covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of finishing items for masonry and concrete. This shall also include the work to be done to make the surface suitable for receiving the finishing treatment. Before commencing finishing items the Contractor shall obtain the approval of the Engineer regarding the scheduling of work to minimise damage by other trades. He shall also undertake normal precaution to prevent damage or disfiguration to work of other trades or other installation.

11.2.0 INSTALLATION

11.2.1 Preparation of Surface

All joints in masonry walls shall be raked out to a depth of at least 10 mm with a hooked tool made for the purpose while the mortar is still green. Walls shall be brushed down with stiff wire brush to remove all loose dust from joints and thoroughly washed with water. All laitance shall be removed from concrete to be plastered.

For all types of flooring, skirting and dado work, the base cement concrete slab or masonry surface shall be roughened by chipping and cleaned of all dirt, grease or loose particles by hard brush and water. The surface shall be thoroughly moist to prevent absorption of water from the base course. Any excess of water shall be mopped up.

At any point, the level of base shall be lower than the theoretical finished floor level by the thickness of floor finish. Any chipping or filling to be done to bring the base in the required level shall be brought to the notice of the Engineer and his approval shall be taken regarding the method and extent of rectification work required.

Prior to commencement of actual finishing work, the approval or the Engineer shall be taken as to the acceptability of the base.

11.2.2 Plastering

Cement

Cement used shall be Portland pozzolana Cement confirming to 1489 (Part) - 1991 (Latest revision). The total flyash content shall be minimum 30% by weight of cement. If 30% is not achieved from PPC cement, additional Fly ash conforming to grade I of IS 3812 (Part-1) only to be used. This is to meet "GRIHA-Green Building" requirement. Cement shall be fresh when delivered. The Contractor shall submit the manufacturer's certificate for each consignment of cement procured to the Engineer. If at any time, the Engineer feels that the cement being used by the Contractor is not up to specification, he may stop the work and send the samples of the cement to a testing laboratory for standard tests and all expenses incurred thus shall be borne by the Contractor. The Contractor shall also have no claim for this type of suspension of work.

The cement shall be stored above the ground level in perfectly dry and watertight sheds. The bags shall be stacked in a manner so as to facilitate removal or first in first out basis. Any material considered defective by the Engineer shall not be used by the Contractor and shall be removed from the site immediately.

Mortar

Mortar for plastering shall be as specified in the drawings.

For sand cement plaster, sand and cement in the specified proportion shall be mixed dry on a watertight platform and minimum water added to achieve working consistency.

No plaster which has stood for more than half an hour shall be used; plaster that shows tendency to become dry before this time, shall have water added to it.

11.2.3 Application of Plaster

Plaster, when more than 12 mm thick, shall be applied in two coats - a base coat followed by the finishing coat. Thickness of the base coat shall be sufficient to fill up all unevenness in the surface; no single coat, however, shall exceed 12 mm in thickness. The lower coat shall be thicker than the upper coat, the overall thickness of the coats shall not be less than the minimum thick-ness shown on the drawings. The undercoat shall be allowed to dry and shrink before applying the second coat of plaster. The under- coat shall be scratched or roughened before it is fully hardened to form a mechanical key. The method of application shall be 'thrown on' rather than 'applied by trowel'.

To ensure even thickness and true surface, patches of plaster about 100 mm to 150 mm square or wooden screed 75 mm wide and of the thickness of the plaster, shall be fixed vertically about 2000 mm to 3000 mm apart, to act as gauges. The finished wall surface shall be true to plumb, and the Contractor shall make up any irregularity in the brickwork with plaster.

All vertical edges of brick pillars, doorjambs etc. Shall be chamfered or rounded off as directed by the Engineer. All drips, grooves, mouldings and cornices as shown on drawing or instructed by the Engineer shall be done with special care to maintain true lines, levels and profiles. After the plastering work is completed, all debris shall be removed and the area left clean. Any plastering that is damaged shall be repaired and left in good condition at the completion of the job.

11.2.4 **Finish**

Generally, the standard finish shall be used unless otherwise shown on drawing or directed by the Engineer. Wherever punning is indicated, the interior plaster shall be finished rough. Otherwise the interior plaster shall generally be finished to a smooth surface. The exterior surface shall generally be finished with a wooden float.

Neat Cement Finish

Immediately after achieving a true plastered surface with the help of a wooden straight edge, the entire area shall be uniformly treated with a paste of neat cement at the rate of one (1) kg. per Sq.M. and rubbed smooth with a trowel.

11.2.5 **Curing**

All plastered surfaces after laying, shall be watered, for a minimum period of seven days, by an approved method, and shall be protected from excessive heat and sunlight by suitable approved means. Moistening shall commence, as soon as the plaster has hardened sufficiently and not susceptible to damage. Each individual coat of plaster shall be kept damp continuously, for at least two days, and then dried thoroughly, before applying the next coat.

11.2.6 Pointing to Masonry

All joints of brickwork shall be raked out to a depth of 10 mm with a hooked tool made for the purpose while the mortar is still green. The brickwork shall then be brushed down with a stiff wire brush, so as to remove all loose dust from the joints and thoroughly washed with water. Mortar consisting of 1 part cement and 3 parts clean, sharp, well graded sand by volume shall be pressed carefully into the joints and finished with suitably tools to shape as shown on the drawings. Any surplus mortar shall be scraped off the wall face leaving the surface clean.

The pointed surface shall be kept wet for at least three days for curing.

11.2.7 Plaster of Paris Punning

Plastered surfaces, where specified shall be finished with Plaster-of-Paris punning. The material shall be from approved manufacturers and approved by the Engineer. The thickness of the punning shall be 2 mm and shall be applied by skilled workmen. The finish shall be smooth, even and free from undulation, cracks etc.

Before bulk work is taken in hand, a sample of punning shall be done on roughly 10 Sq.M. Area and approval of the Engineer taken. The work shall then be taken in hand as per approved sample.

11.2.8 ACCEPTANCE CRITERIA

Finish to masonry and concrete shall fully comply instructions of the Engineer with respect to lines, levels, thickness, colour, texture, pattern and any other special criteria as shown on drawings.

12.0.0 CEMENT CONCRETE INTERLOCKING PAVER BLOCK AND KERB STONE

12.1.0 INTERLOCKING PAVER BLOCK

12.1.2 Base

Interlocking paver block to be fixed on the bed 50 mm or specified otherwise thick of coarse sand of approved specification and filling the joints with the sand of approved type and quality or as specified and as directed by Engineer-in-charge.

12.1.3 Casting of Interlocking Paver Block

Factory made precast paver block of M-30 or otherwise specified grade to be used. Paver blocks to be of approved brand and manufacturer and of approved quality. Minimum strength as prescribed by manufacturer and as per direction of Engineer-in-Charge for the grade specified to be tested as per method mentioned in specification of subhead cement concrete of CPWD Specification 2009 Vol. I.

12.1.4 Measurement & Rates

Area provided with paver block to be measured in sqm. correct upto two places of decimal. The rate include the cost of the material, labour, tools etc. required in all the operations described above.

12.2.0 KERB STONE (PRECAST)

12.2.1 Laying

a) Trenches shall first be made along the edge of the wearing course of the road to receive the kerb stones of cement concrete of specified grade. The bed of the trenches shall be compacted manually with steel rammers to a firm and even surface and then the stones shall be set in cement mortar of specified proportion.

b) The kerb stones with top 20 cm. wide shall be laid with their length running parallel to the road edge, true in line and gradient at a distance of 30 cm. from the road edge to allow for the channel and shall project about 12.5 cm. above the latter. The channel stones with top 30 cm. wide shall be laid in position in chamber with finished road surface and with sufficient slope towards the road gully chamber. The joints of kerb and channel stones shall be staggered and shall be not more than 10 mm. Wherever specified all joints shall be filled with mortar 1:3 (1 cement : 3 coarse sand) and pointed with mortar 1:2 (1 cement: 2 fine sand) which shall be cured for 7 days.

12.2.2 The necessary drainage openings of specified sizes shall be made through the kerb as per drawings or as directed by the Engineer-in-Charge for connecting to storm water drains.

12.2.3 Finishing

Berms and road edges shall be restored and all surplus earth including rubbish etc. disposed off as directed by the Engineer-in-charge. Nothing extra shall be paid for this.

12.2.4 **Measurements:** It shall be measured in cubic meters with Length of the finished work (for specified width and height of stone) shall be measured in running metre along the edge of the road correct to a cm.
Rate: The rate shall include the cost of all the materials and labor involved in all the operations described above.

12.3. GRANITE STONE SLAB:

Base rate of granite stone slab wherever not given in price schedule should be in the range of Rs. 155 to Rs. 160 per Sqft.

FAÇADE WORK:

13. GENERAL :

13.1 General Information:

This specification covers the entire façade. The Technical Specifications shall be read along with all the relevant documents that covers the façade work contract.

The Technical Specification shall be read and understood in conjunction with the following documents:

- Bill of Quantity (BOQ).
- Façade Concept drawings/Design Intend drawings.
- Relevant or conjecture drawings related to façade.

13.2 Scope of Work:

The Scope of work includes complete in all meaning Design, Procurement, Fabrication, Proper Stacking, Supply, Third Party Site Water Testing, Installation, Cleaning and Handover of the Façade Contract work in accordance with the Technical Specification& BOQ. Term Façade or Façade Systems mentioned in the Contract documents and Technical Specification include all the items mentioned below:

- Semi unitized Structural Glazing , openable panels
- Doors in Glazing
- Aluminum composite panel cladding
- Spider Glazing & Glass doors
- Railing , Facade maintenance system and any other as specified in BOQ

The Façade Contract shall include fixings, fixtures, air-tightness, water tightness, vapor barriers, copings, sub frames, weather seals, smoke seal, spandrel panel materials, appropriate coatings as mentioned in the specifications, provision for façade lighting (if any),fire stop, maintenance manual, labor, installation equipment, flashings, openings accessories, cleaning systems provisions , insulation, protection tape during transportation/installation and all other items which comprises of the entire façade work contract.

13.3 Coordination:

The Contractor shall ensure and take responsibility that Contract work carried shall be properly interfered and coordinated with all other services& elements of the building which are related to the proper and quality work façade design and installation. Provisions shall be made as per the other services requirements and site conditions as and when required.

13.4 Tender Drawings:

The tender drawings enclosed with the tender documents are concept drawings/ indicative drawings representation of architectural intent, System requirements, performance, façade elements, other buildings restrictions/ limitations, interference / relationship with other services and elements of the buildings. The façade tender drawings should be read along with other drawings as well (Architectural & Structural drawings) which are the schematic representation of the design intent. At no point of time shall be the tender drawings considered as the **Good For Construction (GFC)** drawings by the Contractor. The Tender drawings shall be read along in conjunction with the Technical specifications and BOQ.

It's a duty and responsibility of the Contractor to comply his designs and drawings with the Tender drawings. If the Contractor is facing issue to follow the Tender drawings same shall be brought to the notice and take the acceptance of the Engineer Incharge before any change from the Tender drawings design is made.

13.5 Inspections:

The Physical Inspections of the Contractors facility shall or may be required as a part of technical evaluation prior to the award of the Façade Contract Work to know about the facility, operations, quality procedures and project handling capabilities.

Provisions shall also be made for facility visits of vendors of the Contractors for successfully carrying out the Façade Contract work.
The following facilities necessarily need to be visited and not limited after the finalization of the Façade Contractor.

- Aluminum Extrusion Facility.
- Glass Processing and Manufacturing Plant.
- Coating Plant.
- Façade Contractors Plant
- **Testing Facility**. – Site water Testing is applicable.

13.6 Site Particulars:

The Contractor shall also inspect and examine the site in all manners (i.e. loading and unloading, Stacking, installation, access, accommodation and cleaning) which are necessary for the completion of the works and shall satisfy himself before submitting his tender and in general shall himself obtain all necessary information as to risk, contingencies and other circumstances which may influence or affect his tender at its own cost. Non-familiarity with the site conditions will not be considered a reason either for extra claims or for not carrying out the work in strict conformity with the drawings and specifications. The Contractor shall also submit letter of compliance with the tender.

13.7 Site Cleaning:

The Contractor shall handover the site clean to the Client on Completion. The Site clean means cleaning of façade, removal of the protection tapes, temporary works of all kinds, rubbish, extra materials and if the Contractor fails to do so same will be done by some external agency and all the costs& risks incurred will be borne by the Contractor.

13.8 Submittals:

The Contractor shall provide all the submissions for the followings

- Technical Assessments - Concept Drawings and Shop Drawings
- To verify the System Proposed - Sample Board OR Small Prototype Mock up
- To Assess Performance Requirements as specified
- Construction Method Statements as well as Detail Project Completion schedule
- Materials Registry Record
- Site Inspections Records
- Quality Control Records - Factory and Site
- Material performance Record

13.8.1 Samples Submission:

After the finalizations of the Contract the Assigned Contractor shall and hold responsibility without fail to submit the material samples as mentioned below prior to installation and get Approvals for the same from Approving Authority and should make a same board of the approved materials and submit to for records and keep one duplicate for his own records and reference. Samples shall be properly labeled in the Particular format as per **Appendix-A**

The samples that the Contractor needs to submit prior to the start of work are as followings:

a) Aluminum :

- Alloy and Temper Certificate from the supplier
- Aluminum Profile Sample
- Finish of Aluminum Profiles
- Color of Aluminum Profiles
- Fabricated sample of the Proposed System

b) Glass :

- Performance(Thermal & Visual Characteristics) Certificates
- Glass Type-Monolithic or DGU
- Glass Color

c) Gaskets :

- Certificates from the Suppliers
- Types
- Color

d) Accessories :

- Performance Certificates from the Suppliers
- Types
- Color

e) Coatings for the Aluminum :

- Certificates from the processors

- Types
- Color

f) Fasteners and Fixtures :

- Structural performance certificates or Technical Manuals from the suppliers.

g) Miscellaneous Items :

- Waterproofing membrane
- Packing Shims
- Silicone
- Insulation
- Bracket
- Glass wool
- Hardware etc.

Samples shall be accompanied with technical specifications / manufacturer's catalogues.

13.8.2 Site Mock- Applicable& test Laboratory Mock up

The Contractor shall submit mock-up drawings with supporting calculations complying with the Technical Specifications and Façade Tender Drawings within 10 days from the awards of the Façade Contract Work for the review and comments if any. A full scale Glazing visual mock-up needs to be installed at site without any extra cost at location confirmed by the Employer in with approved material samples. The Contractor shall hold the responsibility to get the drawings approved from the Engineer In charge.

All the Submittals shall be on A-3 paper as well as a soft copy of the same to be provided. The drawings should be made to scale and the scale needs to be mandatory mentioned on the drawing sheets. No drawings without scale will be accepted.

Mock-Up drawings without the structural stability calculation of all the elements for the façade will not be accepted. The calculations should be detailed one.

13.8.3 Shop Drawing & Calculations Submission:

Submission of complete and comprehensive shop drawings showing all the aspect of the façade, detailed drawings of each and every element of the façade, fixing details, corner details, coping details, the drawings should also include the interference details with the building elements and other building services.

Shop drawings shall be up to scale with scale used for a particular drawings mentioned mandatory on the drawings sheet itself. The shop drawings shall include all the complete drawings of each and every items/elements of the Façade Work Contract.

Shop drawings shall clearly mention the sizes of members, sizes and make, finish and properties of each and every element associated with the façade work. The size shall be clearly supported and mentioned with the structural calculations as per the technical specifications and referred codes and standards.

There shall not be limitations for the submittals. The Engineer In charge holds every right to ask for any kind of extra details if and when required.

The approvals of shop drawings shall be for the member's sizes, structural stability, and performance.

All the drawings submitted for review and approvals should be on A-3 sheet there should not be any limitations for the no of copies required or asked by the Employer. All the drawings should be as per the standards and upto scale.

The drawings submitted shall be accompanied by the structural calculations, and shall not be limited to the members only but each and every element, fixtures as well. The Engineer In charge holds every right to ask for any corresponding calculations related to the Façade Work Contract if and when required and the Contractor need to provide the same at the earliest in order to avoid any kind of delay in the approvals.

All the submissions for the Façade Work Contract Shall made completely. By parts or bifurcated submissions will not be entertained. No Approvals shall be given if any required information asked by the Architect &Façade Consultant not being provided.

The Contractor holds the responsibility to execute the Façade Contract Work while adhering to the Technical Specification and getting all kind of Approvals.
The Contractor shall verify all designs as per their proposed system along with the site conditions. The variations that may occur or subjected to occur at site need to be properly coordinated. For that an initial site survey should be conducted before start of the fabrication or GFC drawings for façade work after the award of the contract. The Contractor shall bring to notice of Engineer In charge for any site variations.

All designs and documents shall be submitted for Approval prior to the start of the façade work. The Contractor holds the responsibility for the structural stability and performance of the façade for the system proposed by him and should adhere to all the clauses of the technical specification.

13.8.4 Submission of Manufacturer's Literature, Including Catalogue, Catalogue Cuts, Brochures, Charts, Test Data, and Similar Information:

Manufacturer's literature will receive consideration only when accompanied by the transmittal form, and listing each item of literature, as well as the Specification Section and paragraph numbers describing such materials. Any deviations from contract requirements shall be stated on the above form or attached to it.

Contractor shall submit six (6) copies of manufacturer's literature for Approval.

All copies of manufacturer's literature required to be resubmitted hereunder shall be original printed material. Reproductions of printed material will be received with contractor stamp with signature of the authorized person.

13.8.5 Coordination of Submittals:

Prior to submittal for review, use all means necessary to fully coordinate all material, including the following procedures:

- Determine and verify all field dimensions and conditions, materials, catalogue numbers and similar data.
- Coordinate as required with all trades and with public agencies involved.
- Clearly indicate all deviations from the Contract Documents.

Unless otherwise specifically permitted by the Engineer In charge, make all submittals in groups containing all associated items; the Engineer In charge may reject partial submittals as not complying with the provisions of the Contract Documents.

13.8.6 Request For Information (RFI):

All questions shall be originated by the specific Vendor and forwarded to the Vendor (who shall forward to the Architect &Consultant) via a Request for Information (RFI) form acceptable to the Consultant.

Develop a project numbering system, as approved, for use in coordinating and filing RFI's.

The Vendor shall log all RFI's.

Reference the specific shop drawing, construction drawing, sketch, and/or specification section that is impacted by the RFI.

Note the date of submission and requested response date.

13.9 Project Management Documents:

Project Management specified shall be in accordance with the requirements of the Contract Documents.

The duties to be performed under this Section are those of the Contractor (in coordination with its Trade Vendors, as applicable). In the event of any inconsistency between this Section and the General Conditions, and unless the Owner directs otherwise, provisions of the General Conditions shall prevail.

Work of this Section includes administrative and procedural requirements for documenting the project management during performance of the work, including but not limited to, the following:

- Preliminary Installation Schedule.
- Submittals Schedule.
- Daily Installation reports.
- Material Availability reports.
- Field condition reports.
- Special reports, including task tracking reports.

The project management includes preparation of preliminary installation schedules of the areas as mentioned or prioritized by the Client/Owner or consider key or critical by the Contractor, Which should followed by a complete bar chart showing installation period, manpower requirements and other requirements for the complete Façade Work Contract.

Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site along with copies of invoices and entry passes. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

Prepare a daily report recording the following information concerning events at Project site:

- Approximate count of personnel at Project site.
- High and low temperatures and general weather conditions.
- Accidents.
- Minutes of meeting.
- Storage and protection of materials on site.
- Stoppages, delays, shortages, and losses.
- Emergency procedures.

13.10 Quality Procedures and Requirements:

The Façade Contract Work shall comply with all the requirements of the Contract documents and specifications. This section includes the administrative and procedural requirements for quality assurance and quality control.

Prepare, submit and implementation of a detailed quality plan. Submit quality assurance documentation for all bought-in products.

Quality Control Procedures shall require the followings:

- A professional engineer who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar to those indicated for this Project in material, design, and extent.
- Qualified quality assurance representative having knowledge and experience of all the quality procedures and documentations pertaining to the kind of work indicated shall be responsible for all quality of work at site as well at the factory and preparing the report for the same.

- The Contractor shall provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements. He shall submit all specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

- An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548

- Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

- The Testing agency shall submit a certified written report of each test, inspection, and similar quality-assurance service to Consultant with copy to Owner. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- Submit a certified written report of each test, inspection, and similar quality-assurance service to Consultant with copy to Owner. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents. Unusual events (refer to special reports).

- A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

- A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

- Full-size, physical example assemblies to illustrate finishes and materials. Mock-ups shall be done before the actual work starts it is used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mock-ups establish the standard by which the Work will be judged.

- If any deviation from the quality assured by the Contractor is found, the Contractor is liable to rectify all the defects without any extra charged to the Owner.

- The factory inspections as mentioned in the above clause will be a part of quality procedure during the fabrication stage.

- Contractor shall provide the certificate of performance of the façade and its elements.

13.11 SYSTEM REQUIREMENTS :

13.11.1 General Requirements:

The Façade Contract Work Shall comply with all the codes and standards and other relevant & authorized documents.

The Façade systems under the Façade Contract Work shall comply with all the principals of the Façade design, fabrication, Installation & Maintenance as mentioned below.(including design report & structural glazing support)

Design Principals Requirements:

- Weather Tightness:

  The Façade system shall be design to withstand the air & water infiltrations. The system shall be complete water drained, pressure equalized, rain screened systems.

- Adaptability:

  The system shall be designed to adjust itself without causing any degradation of performance as per the site conditions.

- Stability:

  Structural stability of members and all associated members against all loadings subjected to the façade and its elements (i.e. wind load, seismic load, live load, dead load, impact loadings etc.)

- Life Period:

  Designed to withstand the service life without breakage and failure of individual members and components.

13.12 Design Parameters:

The Façade Contract Work Shall comply and design each type of system as per guidelines provided below.

13.12.1 Semi unitized Structural Glazing

- Semi unitized glazing will be designed considering given concept drawing as well as considering structural requirement.
- Water which enters the system, including leakage and condensation shall be drained or discharged to the exterior face of the window. Water shall not be trapped or retained in the system. Minimize risk of algae or fungus growth.
- Peripheral flashing and water proof membrane shall be provided in case of requirement.
- In no case, shall the glass touch the metal in the framing enough space shall be provided within the glass and metal edge within the location of the glass panel.
- Setting blocks shall be provided at quarter point distance from the fixing end of the Transom and not less than 30 mm.
- The aluminum members comprise of air and water seals such as gaskets to prevent the inflow of air and making the assembly completely air tight.
- Brackets shall be hot dipped galvanized with minimum coating of 65 Microns.
- All hardware must be SS 304

- Spandrel treatment as well as provision of openable vents shall be done as per BOQ specification.
- Anchoring test will be carried out before the start of the work and reports will be submitted to client for records. only after positive test result bracket work can be proceeded
- Grid fixing shall be done after line and levels checked by the quality Engineer and record for same shall be generated and submitted to client.
- Locking of panels shall be done properly and check for fixity for each installed panel.
- Glazing records must be submitted to client for verification. third party test results (Silicon Supplier) shall also submitted for records

13.12.2 Door in Glazing:

The Doors shall comply but not limited to following system requirements:

- Doors shall be outward opening Frame door.
- Complete door assembly shall be air locked thus preventing any kind of air or water infiltration.
- Glass shall be Installed as mentioned in the BOQ
- Interlocking members shall comprise of air and water seals such as gaskets to prevent the inflow of air and making the assembly completely air tight.
- In no case shall the glass touch the metal in the framing enough space shall be provided within the glass and metal edge within the location of the glass panel.
- Water which enters the system, including leakage and condensation shall be drained or discharged to the exterior face of the door. Water shall not be trapped or retained in the system. Minimize risk of algae or fungus growth.

13.12.3 Aluminium composite panel cladding:

The Cladding shall comply but not limited to following system requirements:

- In no case shall the water get infiltrated into the cladding system which may cause rusting of the fixtures of the cladding system.
- Provide for positive drainage of condensation occurring within wall Construction and water entering at joints, to exterior face of wall in Accordance with NRC “Rain Screen Principles”.
- Composite panel shall be Fire rated 4mm thickness as per BOQ specification shall be supported with test certificate by approved laboratory.
- Any visible undulations in the cladding system will not be permitted or Accepted.
- Supporting structure shall be designed for negative pressure as well as all the imposed loads.

- Supporting shall able to withstand all the imposed loads without any failure.
- Face joint to be properly sealed with gaskets or Non-stain & Non-bleed sealants.
- No stress shall directly or indirectly induce in the claddings or assembly due to the any movements.
- Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.
- intermediate aluminum support shall be provided for avoiding sag as per detailed drawing.

13.12.4 Spider Glazing:

Design calculations to withstand wind load as per IS 875 part-III for the facade to be furnished and approved, by Architect consultant/client..

The Suspended System shall have **Spider Fittings of SS-316 Grade Steel** of approved manufacturer with glass panel.

12 mm thick clear toughened glass held together with SS- 316 Grade Stainless steel Spider & bolt assembly with laminated glass fins 21.52 mm thick (approx.) shall be connected to Slab/ beams by means of SS- 316 Grade stainless steel brackets & Anchor bolts. At the bottom SS channel of 50x25x2mm using fastener & anchor bolts, non-staining weather **sealants of approved make, Teflon/ nylon bushes and separators** to prevent bi-metallic contacts shall be used,

The Articulated Routel bolts for facade glass shall be of SS 316 with all necessary accessories. The spider fittings of DORMA/Hafle make with 4,2&1 points spiders & stainless steel bolts as per design to be used.

The complete system to be designed to accommodate thermal expansion & seismic movements etc. The joints between glass panels (6 to 8 mm) and gaps at the perimeter & in U channel of the assembly to be filled with non-staining weather sealant, so as to make the entire system fully water proof & dust proof. All screws, all weather elements such as flashing, coping, **approved silicon sealants**, etc to make the system completely waterproof.
All spider fittings should be designed to support the weight of the glass by direct bearing on the bolts wherein the structure shall be designed as per the relevant codes and able to withstand the relevant thermal movements.

Rate

The rate shall include all design, Engineering and shop drawing including approval from structural designer, labour, T&P, scaffolding, statutory obligations, safety codes, other incidental charges including wastage, enabling temporary services all fitting fixers nut bolts, washer, Buffer plates, fastener, anchors, SS

channel laminated glass etc. all complete. The erection & removal of scaffolding, cleaning the façade and final handover to owner with complete satisfaction.

Measurement

For the purpose of payment, actual elevation area of Glazing including thickness of joints and the portion of Glass panel inside the SS channel shall be measured.

13.12.5 Frameless Glass Doors:

The Glass doors shall comply but not limited to following system requirements:

Patch Fitting Doors:

- Patch Fitting Doors Openable.
- Glass shall be 12mm thk. clear toughened glass as per BOQ Specification.
- Door to be provided with peripheral sub-frames to achieve the quality or performance of the opening.
- Openable doors assembly shall have heavy duty Floor Spring from Dorma make to allow a smooth opening movement.
- All Fiitings shall be of Dorma Make.
- In no case shall the glass touch the metal in the framing enough space shall be provided within the glass and metal edge.

13.12.6 Glass Balustrade & SS Railing:

Design, Fabrication, Supply, Installation, Testing, Protection, Cleaning & Handover of Stainless Steel Glass Railing system custom designed to with stand the design wind load & Live load confirming to IS -875 (The system must pass the proof test at 1.5 times design wind pressure without any failure).The Glass & SS Railing shall comply but not limited to following system requirements: SS Railing system shall be designed for 800mm Height from upstand finish with Vertical SS Tapered plate of 12mm thk. SS Railing of 50mm Dia, 2mm thk. fixed to the SS Vertical plate as shown in the design drawings. Vertical plate fixed to the RCC Slab/RCC wall with SS base plate. All SS Plate / Tube shall be SS 304 grade, all in complete required to perform as per specification and drawing in conjunction with BOQ

- All hardware and material shall be of SS316 Make.
- Glass shall be 13.52mm thk. laminated glass as per BOQ Specification and design.
- Anchoring test will be carried out before the start of the work and reports will be submitted to client for records. only after positive test result bracket work can be proceeded

13.12.7 Facade cleaning and Maintenance system :

- Provide façade cleaning system which covers all areas of façade (Glazing + Cladding) with due consideration of periodic façade cleaning & façade

maintenance. Contractor to submit complete solution of façade cleaning system for approval. Intent is to use Devit Supports with Gondola for upper floors and aluminium self-support telescopic ladder with tucker pole system for lower 2 floors.

- Contractor has to confirm & submit structural design stability for the system along with calculations.
- Manufacturer/Installer Qualifications: Firm with minimum 10 year experience in manufacturing and installing of facade maintenance equipment, with documented experience with installations of type specified.
- Coordinate Work with other operations and installation of exterior facade, roof deck, structural supports, embedded anchors and roofing materials to avoid damage to installed materials and components.
- Coordinate with other operations and installation of electrical service and locations of power panels.
- Provide a one-year equipment maintenance free contract for regular maintenance by the vender (Apple tree or equiv.) and services up to six times per annum after expiry of the direct liability period.
- Conduct full live load and operational tests, after completion of the installation. Perform tests under maximum design live loading conditions over the full range of all the building surfaces, in accord with applicable standards.
- Provide written certification that all components have been successfully operated, and will perform in accordance with the intent of this design.

NOTE - all records related to fabrication and installation for each element shall be available to client for verification.

13.13 PERFORMANCE REQUIREMENTS :

13.13.1 General:

The Contractor shall design façade &all components of the Facade Contract Work, including fixtures, anchors, structural sealants, supporting structures where ever required to maintain the structural stability, claddings, etc. and not limited, which shall be able to carry all temporary and permanent design loads, individually and in combination without causing failure, including failure which may be due to one or more over-stresses, including cracking, bowing, distortion and looseness, lack of rigidity, dislodgement by wind or seismic forces, excessive deflection or defects which would cause damage to adjacent or applied work by others or may be dangerous impact to human. The performance& structural integrity of the façade work shall not get deteriorated and shall be able to remain intact for its designed life time.

13.14 Design Life :

The structural components shall be based upon design life of 50 years.
Durability of design life of façade with routine maintenance will be around 25 years.

13.15 Structural Requirements:

The façade system and all associated components and elements shall be designed and able to resist all structural loads coming over a period of design life without any breakage or degradation in performance or visual appearance of façade system and façade components under the Façade Contract Work and not limited. The loads to be considered while designing a façade system or associated components are as followings:

13.15.1 Dead Load:

Dead load shall be computed by considering the self weight of the façade system and the associated components including the glass, Fixtures, accessories, etc.

13.15.2 Live Load:

Facade System and associated components shall be designed for a Minimum live load as followings and in combinations with other load as mentioned in load combinations.

- Point loading of 1.15 KN on all horizontal projection like canopy, sills, Sunshades, louvered profiles acting downwards.
- Uniform distributed load of 0.75 KN/m acting on any direction on at the window sill, transom levels at 1.5 m above finished floor levels.
- A minimum live load or maintenance load of 0.75 KN/m^2on horizontal surfaces.

13.15.3 Wind Load:

Facade System and associated components shall be for a minimum designed wind pressure as per the IS: 875-Part-3 and SP-64(having basic wind speed 47m/s,class of structure-A,Terrain category-2).The wind pressure shall be taken considering all the parameters associated as per the required standards and codes. The Contractor shall solely be responsible for calculating the exact wind pressure acting on a façade or components. But the wind pressure shall not be less than as defined below.

Estimated Wind Pressure:
Framing Member =1.5KPa.
Glass Panels = 2.25KPa.

Corner condition occurs from edge corner of the building to a distance of 20% of the dimension of the longest side of the building, or 25 % of the dimension of the shortest side of the building, whichever is greater.

13.15.4 Seismic Load:

Facade System and associated components shall be designed for a minimum seismic load in accordance with required standards and codes as per IS: 1893 Part-1-2002. The Façade Contractor/Sub-Contractor shall solely be responsible for calculating the exact seismic load acting on a façade or components.

Seismic Zone Considered	V

13.15.5 Load Combinations:

Facade System and associated components shall be designed to carry applied loads without causing over stressor slipping of anchors or associated members. The total dead load shall be used in combination with wind load and live loads in the design of all members as follows:

1.5 Dead Load +1.5 Wind Load	Brackets, Anchors, Cast in Channels
1.0 Dead Load + 1.0 Wind Load	All Elements of Façade
1.0 Dead Load + 1.0 Live Load + 0.75 Wind Load	All Elements of Façade

In addition to above, detail of design load combination IS 875, Part-V may be referred.

13.15.6 Other Load:

Facade System and associated components shall be designed to carry following additional loads:

- Temporary and Installation Loads: The Façade systems and associated components shall be designed to carry all the additional loads temporary and installation apart from the loads mentioned above without causing failure or overstressing of any component and member.
- BMU Loads: The Façade system and associated components shall be designed to carry loads for BMU restrain points in consultation with the BMU consultant or BMU vendor.

13.15.7 Load Sharing:

If the Facade System members are designed with composite materials the load sharing factor shall be computed by considering the relative stiffness of each material.

13.15.8 Thermal Stresses:

All the Facade System members and associated shall be designed for an ambient temperature range from 5 degrees to 50 degrees and not limited to the values. The thermal movements within the building shall not cause any critical buckling, tearing of seals, and undue stress of any fixtures or glass. No façade system or associated components or fixtures shall or subjected to undue stresses or induced loadings due to the thermal movements.

13.15.9 Building Movements:

The Contractor shall design the Façade system to accommodate all the building movements without any failure or buckling or undue induced stresses. The Façade system joints shall accommodate the worst possible load combinations and also prevent the opening of any joints that may result in failure of weather or air-tightness. Design movement joint and select sealant products to accommodate all required expansion and contraction.

All movement allowances shall be consistent and applied across all junctions and/or components for each expansion joint system or assembly.

In general the followings Building Movements shall be considered and made allowance in the Façade System Design:

Lateral Displacement of Building	+/- 8mm or H/500 or As specified by the Structural consultant.
Long term building Movements	Differential Live load & Concrete Creep
Edge beam or slab deflection	+/- 16 mm or as specified by the structural consultant
Column Shortening	1-2mm per floor
Axial Shortening of edge beam	0.4 mm per meter length
Building Expansion joints	Provision shall be provided for building understory expansion without causing an undue stress in the members, fixtures, sealants in case of stick system provision shall be made for building expansion joints by providing sleeve or splice joints at floor levels and in case of unitized system by designing a proper stack joint to take care of building expansion.

All the above-mentioned building movements shall be coordinated with the structural engineers report.

13.15.10 Deflection Limits:

The permissible deflection limits are as followings:

Vertical Deflection of Aluminum member under dead load	L/300 or 3 mm whichever is less
Horizontal Deflection of Aluminum members under wind load	L/175 or 19mm whichever is less
Glass Deflection-Monolithic	L/60
Glass Deflection-DGU	L/60
Aluminum Composite Panels	L/90 or 19 mm whichever is less
Aluminum Solid Panels	L/90 or 19 mm whichever is less
Fixing Brackets	Not more than 1mm
Steel Structure	L/325 or 19 mm whichever is less.

Above “L” refers to span

- In case of aluminum member the span is the distance between the two restrains points.
- In case of the four sides supported glass or aluminum panel will be shorter length of the panel.
- In case of two sides supported glass or aluminum panel the free edge will considered as span.

13.16 Other Requirements:

The façade system and all associated components apart from the structural requirements shall comply and satisfy the followings requirements:

13.16.1 Fire Requirements:

All the Façade Contract Work includes all labor, materials, equipment and services necessary to complete the fire stops and smoke seals as shown on the drawings and/or specified herein, including but not limited to, the following:

- Provide fire stopping systems that are produced and installed to resist the spread of fire and the passage of smoke and other gases vertically.
- Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
- Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
- Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
- Sealant joints in fire-resistance-rated construction.
- Penetrations at each floor level in shafts and/or stairwells.
- Construction joints, including those between top of fire rated walls.
- Fire stopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local building code or as tested by accepted test agencies per ASTM E 814 or UL 1479. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating, when required by code authority, shall be based on measurement of the temperature rise on the penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
- Do not proceed with installation of fire stop products when temperatures are in excess or below the manufacturer's recommendations.
- Provide components for each fire stopping system that are needed to install fill materials. Use only components specified by the fire stopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems.
- All the fire safety guidelines shall be in accordance of NBC 2016 with latest amendment.

13.16.2 Acoustical Requirements:

All the Façade Contract Work shall be designed to meet the external noise intrusion criteria contained in BS 8233.The Contractor shall provide the acoustic performance specified. Reference shall be made to the Acoustic Specification for full details of the acoustic performance criteria. The Façade work shall designed in such a way that the thermal movement noise is unnoticeable under normal condition. The Air-Movements along the façade or window or cladding shall not create any rattling sound or other attention catching sounds inside. Acoustic rating

values shall be calculated in accordance with BS EN ISO 717: Part 1.The façade shall provide following minimum laboratory sound insulation performance.

Façade Exterior Wall	Octave band centre Frequency (Hz)
25	125
27	250
31	500
35	1000
34	2000
29	4000

For project noise levels shall be check at the actual site location for proper assessment of the Acoustical Performance of façade.

13.16.3 Thermal Requirements:

The Façade System shall be designed and selected to have appropriate thermal requirements and shall not to lead to excessive heat gain through the façade which may lead to the increase in the overall HVAC load requirements. The Thermal Requirement of the façade shall be as per given in ECBC latest editions or as specified or recommended by the Façade Consultant or HVAC consultant.

As per ECBC the air leakage for doors shall not exceed 2.01/s.m^2, which may unnecessary increase the cooling costs.

The recommended values for SHGC & U-values for Climatic conditions as described in NBC 2016 &respective values provided for the two in ECBC can be considered.

13.16.4 Air & Water Tightness Requirements:

The Facade system shall be drained joint or pressure equalized system &shall be 100% water-tight and air tight allowing no water or air to penetrate into the interior of the building. The system shall be designed such that water being drained in the system shall not cause any damage to the permanent works. The system shall not be face sealed and shall not rely on wet seals.

Sealants and gaskets which are inaccessible in the installed system shall remain effective for the service life of the system.

13.16.5 Fixing Brackets Requirements:

The façade system interference with the main structure shall be through the fixing brackets only. The brackets shall be designed in such a way that the entire load occurring on to the façade shall get directly transferred to the main structure through the fixing brackets without causing any overstress or fatigue or damage of any components of the brackets.

The brackets shall be designed in such a way that the edge tolerance and installations tolerances shall be accommodated in it. The bracket fixing plan shall be submitted prior to installation the exact location of the reinforce location shall be coordinated with the structural drawings.

13.17 TOLERANCES :

The façade system and all associated components designed and allowance shall be made for the followings tolerances:

13.17.1 BUILDING TOLERANCES:

The Façade System shall be designed to accommodate the primary structural tolerances in consultation with the project engineer. The maximum construction tolerances shall be following unless otherwise noted:

Façade system from the building edge	+/- 25 mm
Soffit and Slab Surface	+/- 25 mm
Vertical deviation of slab edge	< 50 mm

All these values shall be verified during the initial survey of the building before design, installation if the values are found are higher than the given, shall be bring to the notice of the Engineer In charge.

13.17.2 FABRICATION TOLERANCES:

The tolerance at joints and critical junction details shall be followings:

Misalignment of surfaces	+/- 0.5 mm
Diagonals of major components	+/- 2 mm
Joint width	+/- 1 mm
Cut length of major components	+/- 0.5 mm

13.17.3 INSTALLATION TOLERANCES:

All the Façade Contract Work shall be within the following tolerances during and after the complete installation any deviation apart from the tolerances mentioned shall be considered as under quality work.

Misalignment of Levels	+/- 1 mm
Deviation in alignment	+/- 1 mm
Deviation in plumb	+/- 1 mm

13.18 PRODUCTS :

13.18.1 Aluminium:

Design, supply & Installation of aluminum sheet, extrusion of alloy of suitable grade and structural performance. The alloy and temper designation shall be as per the relevant standards and codes. The finish, durability and strength shall be as per the specification in accordance with the standards and codes. Also submit the vendor's certificate mentioning the grade, temper designation, mechanical properties specific to project for Approval

The Contractor shall provide the quality certificate from the Aluminum manufacturer and ensure that the quality of aluminum is maintained through the project execution stage and get Approvals prior to the start of project. All the aluminum products shall comply with the technical specifications laid for the product & as per standard IS specification.

13.18.2 Aluminium Extrusions:

Design & provide aluminum extrusions of alloy of suitable grade and structural performance. The alloy and temper designation shall be as per the relevant standards and codes. The finish, durability and strength shall be as per the specification in accordance with the standards and codes. Also submit the vendors certificate mentioning the grade and temper designation for Approval. The manufacturer of Aluminum Extrusions shall be approved by Engineer In charge.

In no case shall the use of recyclable aluminum alloys be used unless tested for the structural performance under lab conditions.

All the structural member aluminum extrusion alloys shall be of 6063 grade and temper designation shall beT6 and all non-structural member Aluminum extrusion alloys shall be of 6063 grade and temper designation shall be T5 unless specified by the Façade Consultant. The surface of the extrusions shall be suitable for PVDF, Powder Coatings, or Anodizing and same surface shall provide the uniformity of the same. No extrusion marks or undulated surface of the extrusions shall be accepted by the Engineer In charge.

Local thickness shall be provided in extrusion equal of twice the diameter of the screw where required to have a proper engagement of the screw in the extruded profiles and bearing of screw in the profiles and screw flutes wherever required.

The minimum wall thickness shall not be less than 2 mm and sharp radius in the profiles shall be avoided. (All profile as per structural calculation report)

13.18.3 Coatings for Aluminium:

All the coatings shall comply with the specifications and not limited and shall be as per the relevant codes and standards. Coating samples needs to be approved from Approved.

a) Powder Coating:

Powder coatings shall be sourced from India form an Approved Manufacturer and Coatings shall be done at the Approved Coating plant approved by the Powder Manufacturer.

- Color& Finish:

  Approved samples for Color, By Architect.

  There shall be two sets of samples 600mm in each set. Approved shade color will be Accepted for use on the project.

  Surfaces to be finished shall be free from imperfections, scratches, scrapes and dents. When the finish is applied, all coatings when cured shall be visibly free of spots, stains and streaks.

- Grade and Thickness:

External: Super durable powder coating of 60-80 microns conforming to AAMA 2604

b) Anodizing Coating : If Applicable

Anodizing Coatings shall be done at the Approved Coating plants.

- Color& Finish:

  Approved samples for Color, By Architect.

  There shall be two sets of samples 600mm in each set. Approved shade color will be accepted for use on the project.

  Surfaces to be finished shall be free from imperfections, scratches, scrapes and dents. When the finish is applied, all coatings when cured shall be visibly free of spots, stains and streaks.

- Grade and Thickness:

  External: 20 to 25 microns

All non-exposed Aluminum shall be achromatized.

13.19 Glass:

Design, supply &Installation of glass. The designed thickness of glass shall be as per the relevant standards and codes. The type of glass shall be based upon the thermal performance of the building or as Specified in the **Appendix-B**.The color or tint shall be approved by the Architect/Engineer Incharge based on the visual checking of the samples. Provide the glass samples of 300 x 300 with all the visual and thermal performances for Approvals.

The Contractor shall provide the quality certificate from the glass manufacturer mentioning the Thermal and visual performance of the glass. The Contractor shall be responsible to have a same tint and flatness of the glass in the respective façade any variation in the tint or flatness of the glass will be rejected. Also any visible distortion shall be under acceptable limits. The Contractor shall provide necessary glass thickness to prevent the visible distortion from occurring.

The Contractor shall be responsible to determine the structural stability of the glass as per the relevant codes under the designed loading conditions. The structural stability limitations of glass shall be as per the specifications.

The glass thickness shall not be less than as mentioned in the **Appendix-B** of the technical specifications.

Submit the FEA (Finite Element Analysis) computational reports suggesting the stress induced in the plane and edges of glass under full loading conditions. In any case shall not be the difference in the surface temperature of the glass surface more than 19 degrees.

The façade system shall be designed in such a way that there is minimum disturbance to the existing or local area under damaged glass replacement. A certain quantity of glass shall be always available cut to the size on size under

immediate replacement of damaged glass. The quantity shall be decided by the Client and Contractor under the Façade Contract Work.

13.19.1 Heat Strength and Fully Tempered Glass:

Heat strengthened glass and fully tempered glass, shall be manufactured using the process in accordance with AS 2208, ASTM 1048.

All toughened glass shall have belt ariseedges. All heat strengthened glass shall have clean cut edges. Cutting and marking of glass post process is not permitted.

Surface compression stress of toughened glass shall be not less than 96.8 MPa.Roller wave distortions shall not exceed requirements for annealed glass, refer to relevant section of this specification.

100% heat soak testing will be required for all glass with edge stress exceeding 7500 psi. If same is being asked by the Consultant.

13.19.2 Laminated Glass:

Laminated glass shall be in accordance with ASTM C1172and GANA Glazing Manual. Submit details for review and Acceptance. The Interlayer Manufacturer shall be Approved by the Façade Consultant.

All laminated glass shall have clean cut edges, or polished edges if required to eliminate thermal stress breakage risk. During and after installation there shall be no delaminations and discolorations of interlayer. The open edges shall be protected by EPDM or Silicon gasket.

13.19.3 Double Glass Units:

Double Glass Units (DGUs) in accordance with ASTM E774, AS 2208, ETAG

DGUs shall incorporate Approved polyisobutylene primary (vapour) seals continuously bonded to glass, and two-part silicone secondary (structural) seals. Primary seal shall be not less than 3 mm deep. Secondary seal shall completely cover spacer with no gaps or voids, continuously bonded to glass.

Spacer bar shall be an proprietary aluminum type, desiccant filled, anodized in a color compatible with seals. Conceal spacer bar within the depth of the glazing gasket line to ensure smooth sight line.

The structural seal bite for the DGU unit shall be calculated and submitted for review and Approval prior to manufacturing.

All edges shall have an edge protection and clean cut edges.

The structural seal shall be protected in the façade system to directly coming in contact with the weathering condition in order to prevent detonation of the seal.

13.19.4 Glass Coatings:

Glass coatings shall conform to ASTM C1376 & BS EN 1096 but not limited.

Inspection shall be made at a distance of three meters from the glass for scratches and chips, viewing perpendicular to the glass plane, with any natural light for which flaws are clearly visible. All other imperfections will be viewed at a distance of 300mm.

The central area is a square or rectangle concentric with the daylight opening and having width and height respectively equal to 80 percent of the daylight opening width and height.

Scratches, rub marks or other gaps in the coating are not permitted where any portion thereof could include a circle with diameter exceeding 0.8mm. Where the included circle is 0.8mm or less, length of the scratch, rub marks or other gap shall not exceed 25mm in the central area and 75mm in the outer area.

Streaks or splotches resulting from non-uniformity of the coating that appears visible from the building interior or exterior are not permitted.

Color range must fall within the limits established by Accepted samples.

13.19.5 Glass Glazing Products:

Design ,supply& Installation of non-cellular elastomeric profiles including gaskets, silicones, seals and other accessories required for complete installation and completion .Compatibility tests of the glazing products with the adjacent components shall be carried out prior to installations and the report submitted to the Engineer Incharge. Location grade, type, thickness, makes, size shall be clearly mentioned in the drawings but not limited.

Glazing accessories, including spacers, setting blocks, wedges, and the like, shall comply with AS 1288& BS 6262.

Extruded profiles or glazing materials shall not cause bleeding or staining of the adjacent components and shall remain intact under the UV radiations. They shall be able to with stand temperature variations without cracking or breakage in seals.

Products may be manufactured from EPDM (ethylene-propylene-diene monomer), Neoprene, or Accepted equivalent.

13.19.6 Gaskets:

The elastomeric materials shall be made from high quality ozone resistance material and properly cured.

The cured compound shall be suitable for use where resistance to sunlight, weathering, oxidation & permanent deformation are of prime importance.

The performance gaskets shall be free from porosity, surface Defects, dimensional irregularities that may affect the serviceability.

- Hard profiles:

  Where required or indicated, provide dense profiles including flashings, wiper seals and the like, complying with ASTM C864& BS 4255, as follows:

Class	Hardness	Type of Profile

Shore-A	80	Solid
Shore-A	60	Hollow

Tested in accordance with ASTM D2240.

Compression set 100% (168 hrs): Not greater than 40% when tested in accordance with ASTM D395.

- Soft profiles:

  Where required or indicated, provide soft profiles including bulb seals, sponge seals and the like, complying with ASTM C509, as follows:

Class	Hardness	Type of Profile
Shore-A	45	Bulb

Tested in accordance with ASTM D2240.

Compression set (168 hrs): 30% +/- 5% when tested in accordance with ASTM D395.

13.19.7 Setting Blocks and Side Blocks:

The Setting blocks and side blocks shall be provided at the locations indicated in the drawings and not limited to. The blocks are used to prevent the direct contact of the glass edge and the metal component. The thickness, grade, length shall comply as specified.

- Setting Blocks:

  Where required or indicated, provide the type of setting blocks as mentioned below.

Class	Hardness	Type of Profile
Shore-A	85	Flat

Compression set (168 hrs): Not greater than 25% when tested in ` for Approvals.

Location of setting blocks shall quarter to distance from the support or unless otherwise mentioned but not less than 150 mm.Shims used shall be of same material as that of the setting blocks. The setting blocks shall be secured to the prevent dislodgement.

Setting block length shall not be less than 80 mm and shall be designed as per BS 6262.

- Side Blocks:

  Where required or indicated, provide the type of side blocks as mentioned below.

Class	Hardness	Type of Profile
Shore-A	60	Flat

Compression set (168 hrs): Not greater than 25% when tested in accordance with ASTM D395.

Install side block with 3 mm clearance between block and bearing surface. Block shall be of sufficient length to prevent point loading on the glass.
Side blocks are not required where glass is supported along the vertical edges with structural silicone.

Side blocks of extruded silicone may be Accepted for DGUs with silicone edge seals. Neoprene or EPDM side blocks may be Accepted only if recommended by the IGU manufacturer.

13.19.8 Shims:

Provide shims where necessary up to but not exceeding the limits specified on the drawings and designed for in the engineering calculations.

Shims which transfer shear forces shall be steel plates, set in a staggered pattern and fillet welded to each other and adjacent steel surfaces. Design shims and welds to support the applied loads.

Polypropylene shims may be Accepted at static connections where shims transfer only compressive loads.

13.19.9 Structural Silicone:

Design and provide structural sealant glazing systems where indicated on the Drawings.

All glazing shall be done as per the manufacturer's standards and manuals. And be tested at a regular intervals. Comply with minimum dimensional requirements for edge clearance, edge cover, front clearance, back clearance, and as required by AS 1288/BS6262 and as recommended by the sealant manufacturer.

- Structural Requirements:
  Structural sealant shall be designed to resist not more than 138 kPa of tensile loads.

  Structural sealant shall be designed to resist not more than 7kPa of shear loads.

  The minimum bite shall be calculated for the imposed loads and get verified by the Engineer In charge.

- Quality:
  The glazing shall be done under the supervision of an experienced glaze

  The areas of glazing shall be under proper glazing conditions as required and recommended by the manufacturer and quality check.

  All the surfaces shall be properly cleaned prior to glazing.

  The compatibility check of the silicon with the other materials shall be done prior to glazing.

The structural silicon shall be free from any Volatile organic compound & Contractor needs to submit the certificate of amount of VOC levels from the manufacturer.

13.19.10 Weather Silicon:

Design, supply & Install elastomeric sealant joints as required. The sealant shall be from the Manufacture as Approved. All required accessories recommended by sealant manufacturer, including backing rods, bond breaker tape shall be adapted during the installation wherever required.
Sealant type and installation method shall be in accordance with manufacturer's recommendations suitable to the location, function, substrates and performance requirements including movement, air infiltration, fire and acoustic requirements.

All sealants shall be of Non-satin and Non-bleeding grade and shall be compatible with the adjacent materials.

Where sealants are used to seal movement joints, movement capability of sealant shall be appropriate to expected maximum deflection or movement.

Fire-rated sealant and joint filers where indicated or required. All fire rated products shall comply with the Relevant Indian Standards.

Fire rated fillers may include elastomeric sealants and rigid dry foam fillers.

Colored or in accordance with Accepted samples. Sealants shall be resistant to staining due to dirt or pollution, and shall be capable of cleaning.

13.19.11 Backer Rods:

Backer rods shall be silicone compatible &non-staining. The material used for backer rods shall be Polyurethane Foam. They are to be compressed to limits specified by the Manufacturer and shall be located in a manner which prevents them from dislodging from the rebate that is being sealed. The backer rods shall be supplied by Manufacturer as Approved by the Façade Consultant.

13.19.12 Tapes

Tapes shall be from Manufacturer as Approved by the Façade Consultant. They are to be silicone compatible &non-staining.

Where tapes are exposed in glazing rebates they shall be continuous and of uniform color. They shall align with the glass edge to within +/- 1mm. They shall be held by sealant or a captive edge so as to be prevented from dislodging in the event of a breakdown to the adhesive surfaces.

Tapes (including double-sided adhesive tapes) shall not be used to permanently hold any building envelope components in position.

Tapes are not accepted to form as a part of the permanent weather seals.

13.19.13 Aluminium Composite panel

Structural analysis, design and preparation of shop drawings of aluminum composite panel shall be done for all possible load such as wind load as per IS 875 part-III. Pressure equalization or rain screen principle is required, for proper drainage of water to make it watertight including checking of structural and functional design.

Providing, fabricating, supplying and installations of aluminium composite panel cladding in pan shape in solid or metallic colour of approved shades made out of 4mm thick aluminium composite panel (weight of panel should be 7.5 kg/Sqmt) material consisting of 3mm thick FR grade Class B as per EN 13501,mineral core sandwiched between two Aluminium sheets (each 0.5mm thick).

The aluminium composite panel cladding sheet shall be coil coated, with Kynar 500 based PVDF conforming to AAMA 2605 or Lumiflon based fluoropolymer resin coating of approved colour and shade on face # 1 and polymer (Service) coating on face # 2 as specified using stainless steel screws, nuts, bolts, washers, cleats, weather silicone sealant, backer rods etc.
The top coated surface of ACP shall comply with the “specification for coated coil for the exterior building application” issued by ECCA (European Coil Coating Association).The aluminium composite panel top and bottom skin should confirm to Aluminium Alloy 5005 (AlMg 1) marine grade series and H 22/24 temper with mechanical properties confirming to EN 485-2 standard. The ACP product must confirm to either BS 476 part 6 & 7 or ASTM E 84 standards along with EN-13501-1.

The contractor must furnish Class 1A manufacturer certificate for this ACP produced in the plant from which it is going to be supplied. The panel shall be designed for 12mm groove in horizontal & in verticals with close joint system. Vertical & Horizontal groove shall be filled by non-staining high performance weather sealant. ACP panel shall have sub frame all around panel and aluminum stiffener profile as per structural requirements.

The finished surface of ACP shall be protected with a self-adhesive (Rubber based) peel off foil with 70 microns thickness white or black, tested to withstand upto 6 months exposure to local weather condition without losing the original peel off characteristic or causing stain or other damages on the coated surface of the aluminium composite panel.Installation of ACP Coping/facia at terrace level sealing the top gap of the parapet wall and ACP Panel shall have GI stiffeners below with required aluminum grid work with necessary MS HDG / aluminum alloy brackets & SS fasteners.2nd barrier of 1mm thk GI sheet laid continuously below the copping to seal the parapet wall.Overlap of GI sheet shall be properly sealed with weather sealant All shade approval shall be as per Architect's Approval.as per approved sample from Alucobond Plus, Alpolic fr, Reynobond or equivalent.
The fastening brackets of Aluminium alloy 6005 T5 / MS with Hot Dip Galvanised with serrations and serrated washers to arrest the wind load movement, fasteners, SS 316 Pins and anchor bolts of approved make in SS 316, Nylon separators to prevent bi-metallic contacts all complete required to perform as per specification and drawing The item includes cost of all material & labour component, the cost of all mock ups at site, cost of all samples of the individual components for testing in an approved laboratory, field tests on the assembled working curtain wall with aluminium composite panel cladding, cleaning and protection of the curtain wall with aluminium composite panel cladding till the handing over of the building for occupation.The Contractor shall provide curtain wall with aluminium composite panel cladding, having all the performance characteristics all complete , as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by the Engineer-in-Charge.

Measurement
Base frame (aluminum) work for ACP cladding is payable separately. However, for the purpose of payment, only the actual area on the external face of the curtain wall with Aluminum Composite Panel Cladding (including width of groove) shall be measured in sqm.up to two decimal places."

Composition.
Skin Material: - 0.5 mm thick aluminum sheet of alloy 3105 – H14 or 3003-H14 and manufacture by adopting direct casting method.
Core Material: - 3mm thick mineral core material having fire retardant property.

Physical properties
Specific Gravity :- 1.38
Weight :- 7.5 to 7.6 kg/sqmt.
Thermal Expansion (ASTM D-976) :- 24* 10^{-60} C (-20 to 60'C) or 1.2 mm / M/50'C
Thermal Conductivity (ASTM D-976) :- 0.39 Kcal/m.h.'C
Thermal Resistance (ASTM D-976) :- 0.19 m2 Ci Kcal.
Deflection Temperature (AST D-648) :- 115'C

Mechanical properties
Tensile Strength (ASTM E-8) :- 4.9 $Kg.mm^2$
Yield Strength (ASTM E-8) :- 4.5 $Kg.mm^2$
Elongation (ASTM E-8) :- 14%
Flexural elasticity (ASTM C-393) :- $14*10^5$ $Kg.mm^2$

Mechanical properties of skin aluminum
Yield Strength (ASTM E8) :- 15.5 $kg.mm^2$ (3105 H14)
Modules of elasticity (ASTM C939) :- 7000 $Kg.mm^2$
Bond integrity 9Vertical pull, ASTM C297) :- 120 $Kg.mm^2$ (12.2 N/cm^2)
Deflection temperature (ASTM D648) :- 115*C
Sound transmission loss in accordance with ASTM E413 (STC) :- 26
Aluminium coil for coating: - Manufactured by direct casting method to ensure the compressive strength and other characteristics of the coil as per standard.

Finish and test properties
The panels shall be finished in a manufacturer 's continuous coating line with Lumiflon-based fluorocarbon coating or kynar-500 based PVDF based PVDF thet should be tested by the manufacturer to meet the criteria published as per the product.

13.20 Building interface:

13.20.1 Support Brackets:

Design, Supply& Install interfacing brackets supporting façade of material and locations as provided in concept drawings and not limited, for the structural integrity of façade system. The supporting bracket shall include all fixing assemble like anchors, bolts and install work in a neat, secure manner, including bolts, washers, screws, rivets, welds, proprietary fasteners, and the like, templates and other accessories of Accepted types for a complete installation.

Brackets shall be of the type and size appropriate for the purpose and location as per the design requirements. The brackets shall be of sufficient stiffness to transfer all the imposed loads to the main structure without the failure and any undue increase of stresses.

Brackets shall be corrosion resistant, to adjacent work.

Details of bracket fixings shall comply with the Façade Tender Drawings as well shall be properly concealed otherwise mentioned.

Detailed Calculations with shop drawings mentioning clearly the load path, load estimation, size, thickness, material, grade and spacing's shall be submitted to Façade Consultant for review & Approval.

Co-ordinate with the Main Contractor to ensure that anchorage is provided and accurately built into base-structure without delay or disruption to the Civil works. Provide set-out drawings, templates and installation instructions as required.

Ensure that all bolts and similar fixings are tight at completion of installation.

All bolts, nuts, washers in any given assembly shall be of the same material.

Apply an Accepted nut locking compound or device to all nuts.

13.20.2 Nut & Bolts:

- Bolts, Nuts and Washers:

  All bolts, nuts and washers shall be galvanized High Strength Grade 8.8 to BS 3692, unless specified.
- Stainless Steel Bolts, Nuts and Washers:

  Stainless steel bolts and nuts shall comply with BS 6105, strength A4, class 80. Stainless steel washers shall comply with BS1449:Pt2, Grade 316 S 31.Unless specified.

13.20.3 Anchors:

- Masonry Anchors:

  All anchors shall be installed in accordance design requirements and Manufacturers manual. The Contractor shall be responsible for confirming that all edge distance, spacing and embedment requirements, design are satisfied.

- Expansion anchors:

  Expansion anchor shall be designed to carry all the imposed loads without failure by the Contractor/Sub-Contractor and the computation to be provided for Acceptance. All the Parameters of the anchor (e.g. edge distances, spacing, etc.) shall be considered while designing. Expansion anchors shall be of the make as approved by the Façade Contractor. Stainless steel bolts and nuts shall comply with BS 6105, strength A4, class 80. Stainless steel washers shall comply with BS1449: Part-2 or relevant Indian codes, Grade 316 S 301or hot dip galvanized or unless specified. Holes drillings for expansion anchors are not permitted for PT structures unless the location of the tendons are verified from the Structural Consultant/Civil Contractor and written permission be taken onto the layout plan of the brackets from them.

  Normally the expansion anchors not recommended for PT slabs due to the threat of damage to the tendons if any mistake in coordination happens.

13.21 Other Products:

13.21.1 Flashing:

Provide all required thickness of flashings, baffles, trims, copings and the like to prevent the entry of water and weather tightness, and make neat and clean junctions with the base-structure and adjoining work. Where visible, provide matching materials and finishes. Include all fixings and sealing.

All flashings shall be cut and folded to Accepted profiles out of non-corrosive materials, with protective coatings as required. Flashing shall be factory fabricated in long lengths where practical, and pre-painted on visible surfaces.

Flashing shall be of adequate stiffness to retain shape and to resist lifting by the wind. Make provision for differential movements and for separation of dissimilar materials.

Continuous flashings shall be welded or mechanically fixed to form continuous uninterrupted lengths. Corners shall be accurately scribed and mitered. If the flashing is concealed, flashing joints shall be lapped at least 100mm and sealed.

Where flashings are fitted to pre-formed rebates, co-ordinate cast-in grooves or reglet as required.

Construct weep-holes as required to enable the passage of moisture to the outside of the building. Lap and seal all flashings by Accepted methods.

Flashing thickness shall not be less than 1.0 mm.

13.22 Openable Panel Hardware:

13.22.1 Openable Vents:

All window hardware shall be of a proprietary type stainless steel, grade 316, which has been fully designed and tested. Load capacity tables provided by the Supplier shall be submitted, together with test results, if required. Operable vents, formed of extruded aluminum with a profiled handle, shall be constructed with end pieces which have been cut to match the end profile of the vent extrusion. The profile of the handle shall be designed in coordination with the Contractor to ensure its operability in terms of depth and access for recoverability of the vent when it is in open position.

13.22.2 Locking System:

Locking System for operable vents shall be Multi-Point Locking System or Accepted Equivalent. Handle shall be located at mid-point of operable vent on the vertical face. The handle in the open position should not obstruct the action of the outward opening vent.

Locking Points shall be calculated based on acceptable vent deflection and stress limits, with a minimum of locking points as specified.

The locking system shall be fully concealed within the body of the vent frame and shall lock into a concealed location.

Keys shall be submitted with one master key opening all locks in addition to individual keys

13.22.3 Hinges & Limiting Devices:

The vents shall be manually opened to a point of full extension (minimum of 30 degrees) allowing the full cross-sectional area of the vent opening to be vented. At full extension there shall be a stainless steel 'keeper' which shall be adequate to restrain the open vent in full wind loading conditions. The restraint shall be designed so that the vent may be manually closed without compromising the future functioning of the 'keeper'.

Stainless steel piano hinges or similar proposals may be considered. The hinges shall be free-moving but shall be designed to a 'snug' fit so as to prevent any vibration of the vent in either closed or open positions.

13.23 Steel Works:

13.23.1 General:

Design, supply, fabrication, surface treatment, storage, delivery and erection of all the steelwork required to support the Façade System as show in the tender drawings as part of the Contractors works. This also includes the supply and installation of trims used to support the steelwork, the grouting of base plates, the provision of cleats and drilling of holes for the attachment of the cladding system, and repairs to damage surfaces during construction.

Structural steelwork shall comprise wieldable structural steel to mild Steel or high yield steel, unless otherwise indicated.

Dimensions, mass, tolerances and rolling margins are to comply with the relevant Indian Standards for the followings:
Hot Rolled Sections

- Universal beams, columns, tee sections and channels
- Hollow sections
- Angles
- Flats, plates, round bars and square bars

The rolling or manufacturing tolerances shall be such that the actual weight of sections does not differ from the theoretical weight by more than - 2.5% or + 2.5%. Sections of sizes or thickness outside of these specifications shall be subject to the tolerance clauses of an equivalent nominal size.

Members shall be free from twists and localized deviations from true line

- Cold Formed Sections

  Dimensions, mass, tolerance of cold rolled sections to be in accordance with Indian standards. Cold rolled sections are not permitted unless specifically nominated on the Engineer's drawings.

13.23.2 Storage:

The storage of the steel members (tubular sections) shall be such that so as to prevent the way-in of water into the tube which may cause initiate rusting of members. The steel members shall be placed in dry conditions as far as possible and the stacking shall be such that it shall not cause twisting or damage to the profile of the members.

13.23.3 Fabrication:

Fabrication of the steel work shall be done as per the relevant standards.
All the members shall be factory cut & fabricated to size with tolerance for site installations no gas cutting is permitted. All the end plates shall be designed to the loadings. The edges of the profiles shall be cleaned and grinded after cut so as to have a smooth surface for joinery. The joinery shall be as smooth as possible for perfect joinery of the members filler weld is recommended. Members shall be market mentioning their length and locations as per the bar chart drawings for installation.

No variation of the number, type or position of the joints or connections shown on the approved drawings shall be made.

Contractor shall make sure to do accurate site survey prior to installation and incorporate all the site variations in the drawings.

Members shall be cut accurate to the dimensions mentioned in drawings to achieve proper connections.

Holes in plates shall be as per the drawings no adjustment in the hole will be permitted on site. The holes shall be twice the diameter of the designed anchor and bolts. Where site adjustment is required for alignment of the steel work oblong holes shall be used which need to tack welded to plate to the desired locations. No gas cuttings for holes are permitted it needs and shall be drilled only.

13.23.4 Welding:

All welding of structural steel shall comply with Indian standards as mentioned in the **Appendix D**. welding consumables used in fusion welding. Welding consumables used in metal arc welding of austenitic stainless steel.

Welding consumables and the procedures used shall ensure that the mechanical properties of the deposited weld metal shall not be less than the parent metals.

Surfaces must be dry. Warm the surfaces if required to remove condensation.
Remove welding slag by chipping before depositing subsequent runs. Tack welding may only be used with express approval. Tack welds to be minimum 50mm long.

Butt welds shall be full penetration welds between prepared fusion faces, unless otherwise specified. Carry out back chipping, grinding or gouging of the deposited weld as required to obviate imperfections in the root run. Grind butt welds flush without loss of parent metal.

Deposit fillet welds to the required length, throat thickness and with partial or full penetration as specified.

The type & thickness of weld shall be designed as per the loading conditions as submitted for review and Approval

13.23.5 Protective Coatings:

All steelwork is to be provided with a protective coating system. The coatings shall be provided over the full surface area of steelwork. Exposed edges and site weld areas are to be coated with an Accepted coating system for site applications .Protective coatings are to be as outlined below for normal internal and external

applications. For more aggressive environments, higher performance paint systems shall be used.

- Exposed Steelwork:

  - Primer Coat:
    2-coats of epoxy zinc phosphate primer, minimum thickness 70 microns.
  - Finish Coat:
    2-coats of high build polyurethane, minimum thickness 100 microns. To be applied in two 50 micron layers.

  Paint samples, technical catalogues and Manufacturer's Application Procedures shall be submitted for Acceptance before commencement of paint application. The application of coat shall be done as per the recommendations of the Manufacturer.

- Concealed Steelwork:

  Internal steelwork shall be Hot Dip Galvanized with a minimum dry film thickness of 70 microns.

  The steelwork shall be chemically descaled and cleaned, so that rust, mill scale, oil, grease and other foreign matter are removed immediately prior to galvanizing. Tubular sections are to have bleed holes as necessary. The size and location of bleed holes is to be shown on shop drawings.

  The contractor shall ensure the steelwork does not distort as a result of galvanizing. The size of components, preheating requirements, and dipping method are to be reviewed to achieve minimal distortion and maintain steelwork Tolerances.

  Hot dip galvanizing shall be carried out in accordance relevant Indian standards

  Following galvanizing, the steelwork is to be left to cure for 48 hours before transportation to site.

  All abrasions site welds etc are to be repaired by grinding (wire brushing) the surface back to a sound substrate and batch coating with an inorganic zinc silicate primer equivalent in quality to 110 micrometers dry film thickness of Dimetcote 6.

13.23.6 Safety Considerations:

The Contractor/Subcontractor shall take full responsibility for the Safety and Stability of the steelwork during erection and until such time as it is finally completed and handed over, must take all precautions including temporary bracings necessary to ensure stability of the partially assembled structure against wind forces, and those stresses exerted due to erection equipment and its operation tending to distort or deform the framework.

The Contractor/Subcontractor shall adopt an erection procedure such that all members can be placed and fixed in position without distortion

The Contractor/Subcontractor shall allow for the cost of temporary erection bracing required and any professional advice required in connection with such bracing.

As each section of steel is erected, all members shall be line, levelled and plumbed before final bolting up or welding commences. The ties, jacks braces, etc, used in lining, levelling and plumbing the steelwork shall be left in position until all bolts have been finally tightened.

13.23.7 Stainless Steel: If Applicable

Provide all stainless steel in the required profiles, finishes, sizes and grades.

Stainless steel shall be of Grade 304 or 316. Grade 302 shall not be used. Structural applications and all exposed stainless steel works shall be Grade 316.

Unless otherwise indicated on Drawings, exposed stainless steel shall be finished to match Accepted samples.

Grain shall be vertical in all locations, unless otherwise indicated on the Drawings.

Flatness of Architectural stainless steel shall be not less than "stretcher level" grade. Submit manufacturer's specifications.

Where indicated on the Drawings to be colour finished, stainless steel be colour treated by an Accepted permanent process to match Accepted colour samples. Submit details.

Submit certificate of compliance or test report and properly identify each batch of stainless steel in accordance with the relevant Standard.

13.23.8 Installation:

The site installations shall be done as per the installation drawings. All the members shall be lined, levelled & positioned to the designed location prior to bolting or welding. In case of bolt connections temporary bolt positioning bolts shall be used prior to the final adjustment and fixing of desired no of bolts. Tack weld shall be used for positioning of members prior to final welding.

Site fabrication of members shall not be permitted. All members shall be cut to size from factory only.

13.24 FABRICATION :

The fabrication shall be in accordance with the technical specifications and relevant codes and standards and not limited. The fabrication of the façade components shall be done under the strict quality control. The fabricated components shall be marked, packed and transported to the site. The fabrication drawings shall be done after approval of the shop drawings.

13.24.1 Aluminium fabrication:

Tolerances at joints and junctions shall take precedence over tolerances for components or assemblies.

Submit a schedule of fabrication tolerances for all major cladding system components for review and Acceptance. Indicate extremes of allowable base-structure tolerances on shop drawings.

Provide holes and connections for site assembly and to accommodate work of others as required. Holes shall be drilled, or punched and reamed, perpendicular to the surface.
Provide suitable clear marking to enable correct setting out, and installation. Marking shall be of a type that can be removed with water or solvents after assembly. Marking should be positioned on unexposed surfaces where possible.

Where two or more sections of aluminum are used in built-up members, contact surfaces shall be smooth, true and even, and secured so that the joints are tight without the use of filling materials.

Steel reinforcement of aluminum members shall be completely enclosed and separated from aluminum. Steel reinforcement to be hot dip galvanized. Submit details for review and Acceptance.

Glazing rebates shall be of adequate size to hold the weight and size of glass required, with necessary clearances and tolerances, and to withstand the specified loading.

Where required, provide snap-on cover-strips to secure glass. Meeting corners of cover-strips shall be mitered. Cover-strips shall exclude water in driving rain conditions.

Moving parts shall operate freely and smoothly, without binding or sticking, at correct tensions or operating forces, lubricated where appropriate.

Protect finished aluminum surfaces to prevent damage during transportation, storage, installation, and until the completion of the subcontract works.

Provide factory applied protective film, tape or coatings which will not bond to the aluminum surfaces when exposed to sunlight or weather.

13.24.2 Aluminium Frame Assembly:

Fabricate aluminum in accordance with Accepted shop drawings and prototypes.

Cut edges, drilled holes, riveted joints and flat sheets shall be clean, neat, free from burrs and indentations. Remove sharp edges without excessive rounding off or chamfering.

13.24.3 Joints and junctions:

All visible joints shall be fixed by concealed means, unless otherwise indicated on the shop drawings or Approved in writing.

Fit exposed joints accurately to provide close continuous contact to a fine hairline. Ensure continuity of finish colour and texture without surface variations at joints.

Make junctions with concealed mechanical connectors so that no fixings, pins, screws, pressure indentations and the like are visible on exposed faces.

Sections shall be sized to eliminate edge projection or misalignment at joints.

Where required, joints shall be watertight and weather tight.

Joints between fabricated assemblies may be concealed with suitable aluminium extruded covers or clip-ons.

13.25 EXECUTION:

No excuse pertaining to the site conditions and interface with agencies (like civil, mechanical electrical etc) shall be considered as a cause of delay in the project.

Detailed site inspection during design period shall be done and any site variation shall be communicated to the Engineer In charge/Architect.

13.26 Installation Tolerances:

Comply with manufacturer's recommendations and install work within the tolerances given in Section 4

13.27 Sealant Installation:

Prepare joints and install all sealants strictly in accordance with sealant manufacturer's recommendations and Accepted shop drawings.

Comply with the sealant manufacturer's recommendations regarding surface preparation, priming, pot-life, sealant bead application, and the acceptable range in surface temperature at time of application and for a period at least eight hours following sealant application.

Joints shall be prepared and sealed on the same working day.

13.27.1 Cleaning:

Clean joint surfaces immediately before installation of backing rod and again before applying the sealant as recommended by sealant manufacturer. Remove all foreign matter such as dust, oil, grease, dirt, laitance, insecure coatings, moisture and other substances which could interfere with bond of sealant.

Remove protective tape or removable films and ensure that no residue remains.

Joint areas to be protected with masking shall be cleaned before application of tape or film.

13.27.2 Glass and aluminium:

Cleaning compounds shall be applied with clean lint-free cloths. A two-wipe method of application shall be employed, where one cloth is used to wipe the surface dry and clean, and the second is used to apply the cleaning compound. The cleaning compound shall not be allowed to air-dry on the substrate.

13.27.3 Priming, etching and sealing:

Prime or seal joint surfaces where recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces. Areas adjacent to joints to be sealed shall be protected where there is a likelihood that contamination by cleaning compound, primer or sealant could occur.

If recommended by the sealant manufacturer, roughen surfaces to remove protective coatings or imperfections which may prohibit provision of clean, sound base surface for sealant adhesion.

13.28 Installation of sealant accessories:

13.28.1 Backer rod:

Install sealant backer rod for sealants, except where otherwise indicated, or not recommended by sealant manufacturer, at a proper depth to provide sealant bead profiles indicated on Approved shop drawings. Backer rods shall be an accepted non gassing type.

13.28.2 Sealant proportions:

Install sealant to depths as recommended by the sealant manufacturer and indicated on the Accepted shop drawings.

Provide elastomeric sealant of depth not greater than the joint width and not less than half the joint width or 6 mm, whichever is the greater.

13.28.3 Installation of sealants:

Install sealants during ambient temperature and humidity conditions recommended by the manufacturer.

Employ only proven installation techniques which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, and with complete "wetting" of joint surfaces equally on opposite sides.

Unless otherwise indicated on the Accepted shop drawings, fill vertical joints to a slightly concave surface, slightly below adjoining surfaces, and fill horizontal joints to slightly convex profile, so that joint will not trap moisture and dirt.

Apply sealant under pressure using a hand or power actuated gun or other appropriate means. The application tools shall have nozzles or size and shape as necessary to ensure that sealant beads are formed to the designed profiles. The surface of each joint shall be tooled so as to ensure the formation of a compacted bead, free from cavities and flow irregularities. A lubricant (tooling aid) shall not be used unless the use of such a compound is expressly Approved by the relevant manufacturer.

Remove excess sealant and leave surfaces neat, smooth and clean, without smears on surrounding work. Tool joints where recommended by manufacturer or required. Remove all cartons and debris from site as the work progresses.

Remove any masking material immediately application of sealant bead is complete and "clean-down" adjacent surfaces as work progresses. All finished work shall be left in a neat clean condition.
Provide weep holes where indicated or required.

13.28.4 Façade Installation:

Install the façade system in accordance with shop drawings and prototypes to comply with all performance requirements, Codes and Standards and the requirements of the relevant Regulatory Authorities.

Install the facade system plumb, level and true to line within required tolerances, and suitably anchored to the base-structure.

13.28.5 Loads:

Ensure that no loads from, due to or generated by the base-structure are transferred to the cladding system, including loads resulting from short or long term structural deflection or shortening of slabs or beams.

13.28.6 Trim:

Install all required flashings, trim and seals to ensure the finished work are weatherproof and waterproof.

13.28.7 Site modifications:

Finished work which contains unauthorized site modifications, or work not in accordance with the Accepted shop drawings, may be required to be removed and replaced.

Unauthorized work may be Approved subject to additional computations and testing at the Consultants sole discretion. If requested, carry out and pay for all such testing, and submit all computations, test results and any other information required.

13.28.8 Staged completion:

Façade shall be installed in an orderly sequence. Where practical, facade shall be completed and closed off on a floor-by-floor basis.

Provide temporary flashings at completion of each stage to waterproof and weatherproof the enclosed work. Remove temporary flashing before proceeding with subsequent work.

Sections of façade which are left open for any reason shall be designed in accordance with the design wind serviceability load with an allowance for wind funneling through the base-structure.

13.28.9 Hardware:

Install all hardware and accessories including but not limited to latches, locks, openers and remote controllers.

Fit insect screens where supplied.

Opening units shall be checked to ensure that operation is full, free and smooth, and that all operable hardware, locks and controllers are operating properly and smoothly.

13.28.10 Exposed sealants:

Exposed sealants will not be Accepted, except where indicated on Accepted shop drawings.

13.28.11 Temporary marking:

Provide temporary marking of glass (if necessary). Use a soluble marking compound and remove all traces on completion. Do not use lime or advertising stickers.

13.29 Protection& Cleaning:

13.29.1 Progressive cleaning:

Clean the work area and progressively remove debris, waste, excess materials and the like from the work area on a daily basis and maintain the works areas allocated for this contract in a state of cleanliness at all times.

13.29.2 Field Testing:

Field testing needs to be carried out by the Contractor in presence of representative from Architect/Owner/engineer in charge, in accordance with AAMA 501.2 prior to handover to check any defects incurred during installation and as per other terms and conditions of the contract.

13.29.3 Final cleaning:

At completion of installation, clean the work area thoroughly and clean the interior and exterior of the finished work to remove all marks, soiling, stains and the like. Exterior final clean should include a pre-rinse water spray to remove any abrasive particles prior to the use of T-bars for cleaning with mild detergent solution.

Finished work shall be free from defects and mechanical imperfections such as scratches, scrapes, dents, and abrasion.

13.29.4 Adjacent work by others:

At the completion of all adjacent work by others, including services work, attend the Site, inspect the work areas generally, and repair all damage, complete or make good finishing, trimming and sealing, and replace any damaged or dislodged work.

13.29.5 Handover:

At completion of installation, commission, test and adjust as required, all manual and mechanical operating components in all functional modes.

13.29.6 Architectural finishes:

At completion of installation, wrap or cover Architectural finishes to avoid soiling, damage, or wear and tear during subsequent building activities. Otherwise, clean and maintain finished work as frequently as necessary through-out remainder of construction period. Protection shall be designed for removal without damage to finished surfaces.

13.29.7 Glass:

Remove and replace glass which is broken, cracked, abraded, chipped, scratched, etched, stained, or damaged in other ways before or during installation.

13.30 Testing

The contractor shall submit a testing Plan and carry out all testing and commissioning of the Façade systems.

The Contractor shall prepare and submit for approval the overall test schedule, prior to the commencement of any tests. The Test Plan shall include, but is not limited to the following items:

(1) Description of the tests to be performed.

(2) Detailed description of the conditions under which the test shall be conducted and accepted.

(3) Schedule of actions to be taken in the testing of the various parts of the building envelope and the forms of documentation of the test results.

The purpose of the tests shall be to demonstrate compliance with all of the performance and technical specifications set out in the Specifications.

Testing shall be carried out in a number of phases, including, but not limited, to:

- Tests during manufacture and Project site Tests
- Pre-Commissioning
- Commissioning
- Performance Tests
- Integration Tests

All tests shall be conducted within the technical and operational environment as it will exist after the installation of the Façade System at the project site.

The Architect/Engineer in-charge, Representative may choose to visit the Subcontractor's manufacturing site(s) to observe, assess, first hand, all "Tests during Manufacturing " and Quality Assurance procedures that they may elect to attend

The Engineer incharge/Architect shall both reserve the right to be present at any or all the tests for the purposes of observation, result verification, obtaining technical information or operator training.

The Testing Plan shall include, without limitation, the following and submitted as per the **Appendix-E**:

13.35.1 Performance Prototype Testing:

Design & Supply and erect off-site full-scale facade Test Performance Prototypes for façade testing in accordance with the Specifications, including a suitable simulated building frame, and incorporating at least one example of each repetitive design element and construction method in the system, as indicated on the Drawings.

Testing shall include structural performance, air infiltration, water penetration, seismic raking, proof-load testing and visual assessment. The test shall be carried out at testing facility.

The test prototypes will be Approved subject to the successfully carrying out of the test program and the submission of all specified requirements, and the satisfactory passing of all structural performance, seismic raking, air infiltration, water penetration and proof criteria by the testing laboratory. When Accepted, the test prototype shall be the accepted control standard for the subcontract works. Test panels and components shall not be re-used in the subcontract works.

Submit details of the proposed laboratory, the detailed and sequential outline of the proposed test procedure with schematic diagrams describing the type and location of all data collection instruments. The proposed testing program and procedure shall be Approved prior to the commencement of testing.

The following performance test are to be conducted on structural glazing system from the certified laboratories accredited by NABL(National Accreditation Board for Testing and Calibration Laboratories), Department of Science & Technologies, India.

Performance Testing of Structural glazing system Tests to be conducted in the NABL Certified laboratories.

I) Performance Laboratory Test for Air Leakage Test (-50pa to - 300pa) (+50pa to +300pa) as per ASTM E-283-04 testing method for a range of testing limit 1 to 200 mVhr.
II) Static Water Penetration Test. (50pa to 1500pa) as per ASTME- 331-09 testing method for a range up to 2000 ml.
III) Dynamic Water Penetration (50pa to 1500pa) as perAAMA 501.01- 05 testing method for a range upto 2000 ml.
IV) Structural Performance Deflection and deformation by static air pressure test (1.5 times design wind pressure without any failure) as per ASTME-330-10 testing method for a range upto 50 mm.
V) Seismic Movement Test (upto 30 mm) as per AAMA 501.4-09 testing method for Qualitative test. Tests to be conducted on site.
VI) Onsite Test for Water Leakage for a pressure range 50 kpa to 240 kpa (35psi) upto 2000 ml

Prototypes:

Test prototypes shall typically be 2-storey high, 3 bays wide, with corner returns. They shall incorporate the largest size of panel found on the façade. Deviations from the above may be considered, depending on actual façade configuration.

Testing:

Submit notice in writing of proposed commencement of the Performance Testing, complete with Program, before commencement. The testing shall include all actual job-site components, including all glazing configurations, sealants, adhesives and gaskets. Instruments and gauges shall be selected, tested and located in consultation with Architect/Engineer in-charge

Prototype Testing Sequence:

 Pre-Load:
Positive pressure 50% of design loading held for 10 seconds.

 Open/Close Cycle:
Vents to be unlocked, opened and closed, and locked fifty (50) times.

 Air Infiltration Test to ASTM E283-91:

 Static Water Penetration Test to ASTM E331-93:

 Dynamic Water Penetration Test to AAMA 501.1-94:

Structural Performance Test:

 Test at Design Load as per ASTM E330-90:

Structural Safety Test:

 Test at Proof Load as per ASTM E330-90:

13.35.2 Degradation Testing:

On completion of the water penetration testing, a further series of water penetration tests shall be undertaken with portions of various gaskets and sealant beads removed on each test assembly. The purpose of such testing is to simulate the effects of degradation and failure of such seals, and is carried out for information only. At this time secondary covers to structural silicone edges will be checked.

13.35.3 Performance Testing:

The contractor shall be responsible for pay for all the performance testing associated with the supply, fabrication, assembly, erection, maintenance, modification, dismantling and the removal of the Testing Prototypes from the test site etc. If any as per site requirement.

In the event of re-testing, the costs shall be borne by the contractor. This applies to all re-testing, whether outside or inside of India.

13.35.4 Performance Prototype Submissions:

Submissions shall include the following:
 Program for testing including the following:
 Material delivery.
 Performance Prototype fabrication.
 Test chamber construction.
 Curtain wall installation.
 Pre-testing.
 Testing.
 Report submission.

Performance Mock-Up Shop Drawings, complete detail documentation and Calculations:

Drawings shall include all relevant panel interfaces and shall indicate all vision panels, sashes and other materials as required.

Detail Prototype Trial Assemblies of Curtain Wall Interfaces (see relevant section of this specification):

 Trial Assemblies should be accompanied by relevant detail drawings.

 All Trial Assemblies must be Accepted prior to commencing Performance Prototype installation.

Complete Testing Proposal, with tests as outlined above in this specification. The Test Proposal shall include the following:

 Itemised list of Tests and Governing Standards.
 Method statement for Testing Procedures.
 Test chamber details.
 Explanation of all testing equipment.
 Performance Mock-Up elevation drawings, showing transducer locations, etc.

This proposal shall be submitted for review and Approval.

All Test Results including preliminary and interim Test Results. All Test Results shall include the following:

 The original report issued by the Testing Laboratory, signed by the officer in charge. The report shall include the certificate issued by the Testing Laboratory verifying that the test prototype has been tested in accordance with Specifications, and complies with the other Specified Tests.

 The Test Report shall be presented in a manner suitable for submission to the relevant Regulatory Authorities and shall be endorsed by the India Registered Structural Engineer representing the Façade contractor.

 Detailed “Performance Prototype as Tested" drawings. Actual dimensions and thickness of all component parts including actual measured sizes of tested glass panes shall be recorded. Particularly note all remedial work carried out since previous tests. Make available copies of the "As-Tested Drawings” for reference during the Testing Programme.

 The Testing laboratory is responsible for marking up all changes to the Performance Prototype which occur during testing together with any changes observed during dismantling of the Performance Prototype.

 Approval of Layout Drawings, Details and Calculations must be granted before commencing Performance Prototype fabrication. On Acceptance of shop drawings, submit Accepted shop drawings to the testing laboratory prior to the installation of the test specimen.

 Approval of Detail Prototype Trial Assemblies must be granted before commencing any Performance Prototype installations.

 All Performance Prototype Test Reports shall indicate specifically pass/fail results for:

- Structural performance.
- Air infiltration.
- Water penetration (static and dynamic).

13.35.5 Erection:

The prototype shall be identical to samples previously Accepted for the quality of materials and workmanship.

The prototype shall be set square and plumb, complete with all weather seals, fixings, trims and flashings for testing.

The prototype assembly shall comply with the Accepted Drawings, and be installed to simulate the worst case structural tolerance and movement.

Ensure that the prototype for each test assembly is supported from a structure which simulates in all important respects the on-site structure.

Ensure to the satisfaction of the Consultant that the prototype construction and installation shall, as nearly as possible, simulate the actual installation in the completed structure, including reasonable representations of the profiles of adjacent building elements.

Finishes shall be identical in every respect to those proposed for on-site use. Interior finishes are not required.

Submit shop drawings defining the proposed scope and extent of the prototype assembly. Do not proceed with fabrication of prototype until the shop drawings are Approved.

On Approval, provide Approved shop drawings to the testing laboratory prior to the installation of the test specimen.

Submit a copy of all documentation provided to the testing laboratory.

13.35.6 Field Testing:

General Field Water Testing per AAMA-501.2:

a) Field water testing shall be carried out periodically during the facade installation.
This is to ensure that leaks are identified and repaired prior to installation of internal linings and finishes.

b) Initially, 30sqm shall be tested following the installation of the first 3 floors of building envelope.

c) Further testing of 30 m2 shall be carried out every 5 floors.(Minimum of 5 locations each.)

d) Each test shall cover an area of not less than 30sqm and not less than 5 linear m of work.

e) The tests shall be included in the Testing program by the Façade Subcontractor, with specific locations as selected by the Consultant.

f) Should problems arise during any of the above testing, the Consultant may instruct that further testing be carried out at no additional costs. Locations and times shall be nominated by the Consultant.

g) Water Testing of Flashings, EPDM Closures, and Other Interfaces: Field water testing shall be carried out periodically during the facade installation. This is to ensure that leaks are identified and repaired prior to installation of internal linings and finishes.

Initially, 100% of linear interfaces shall be tested, following the installation of the first 3 floors.

a) Further testing of 50% shall be carried out thereafter. Successful testing may allow for decreased quantity of further testing.
b) Each test shall cover an area of not less than 5 linear m of work.

c) The tests shall be included in the Testing program by the Façade contractor, with specific locations as selected by the Façade Consultant.

d) Should problems arise, the Consultant may instruct that further testing be carried out, at no extra cost. Locations, extents, and times shall be nominated by the Consultant.

13.35.7 Material Testing:

Material Testing:

Brackets, Aluminium Studs and Screw Fixings:

Arrange and pay for testing at the Approved laboratory and submit test results for components as follows:

Fixing brackets:

Test a minimum of 5 brackets and anchors fixed to the base structure for each fixing condition. The brackets shall be fixed to prefabricated concrete blocks which exactly represent the base structure in relation to edge distances, reinforcement and concrete strength. Prepare and submit shop drawings prior to fabrication of the concrete blocks. Be responsible for making and transporting the concrete blocks to the testing laboratory.

a) Install test fixings in accordance with Approved shop drawings, but locate with most adverse tolerances and application of loads.

b) Approval of the fixing system is dependent on each test failure load being at least 2 x the design working load for concrete failure, 2 x for metal failure and the absence of permanent deformation at 1.5x the design load.

c) The test report shall be submitted and Accepted prior to casting-in any embedment or fixings into the structure.

Screws secured in extrusion flutes:

Demonstrate the strength of each connection by testing 18 screws in accordance with AS 1664. or an equivalent Standard. Stagger tests in groups of 6.

The test report shall be submitted and Accepted prior to fabrication.

Silicone compatibility testing:

Test procedures and minimum acceptance criteria shall comply with AAMACW 13.

- **Sealant - Adhesion and compatibility testing:**

Carry out and submit results for initial adhesion and compatibility testing by the Accepted laboratory including "peel" tests to ASTM C794 and ASTM C510. Verify unconditional acceptance of all materials in contact with structural adhesives, and that no material in contact with the structural adhesives will cause deterioration of structural adhesives, and the structural adhesives will not cause intrusion into laminated glass interlayers or DGU seals.

- **Sealant - Direct tension tests:**

Carry out and submit results for direct tension tests by the Accepted laboratory on samples of vision glass and spandrel glass adhered to finished aluminium. Use an Instron Tensile Tester, or Accepted alternative. Test ten samples of each joint type without weatherseals and using actual materials and joint configuration identical to that proposed and complete testing prior to manufacture, as follows:

- Five samples shall be air-cured 21 days then water immersed 7 days before testing.

- Repeat procedure on completion of manufacture of 30% of the materials.

- Apply a 5x safety factor to the mean of the ultimate strength results to determine joint dimension. Complete initial tests prior to commencement of manufacture.

- **Sealant - Adhesion tests:**

  Carry out and submit results for factory adhesion (de-glazing) tests to fully cured glazed panels selected randomly. Cut joint at midpoint to leave half the sealant attached to the glass and half to the substrate. Carry out visual examination of joint fill, voiding and structural bite adhesion. After testing fully remove silicone tape and spacers, thoroughly clean and reapply sealant in accordance with Accepted procedures in the factory.
  Any unsatisfactory occurrence including lack of joint fill, lack of adhesion, excessive voiding or other defect be apparent, may be grounds for all units represented by that testing to be rejected. Carry out additional testing of units manufactured on the same day and one day either side (a further five units). Such units may be accepted on the condition that a satisfactory explanation of such occurrence is submitted and that no additional unsatisfactory occurrences occur.

- **Sealant - Peel tests during glazing:**

  Carry out periodic "hand pull" peel tests in the factory on finished metal samples out at a rate of one per day. A silicone bead shall be applied to an area not exposed to view in the final location, on a random basis. After curing, a peel test shall be performed to demonstrate adhesion

- **Prototype de-glaze:**

  At completion of testing, de-glaze and replace one vision and one spandrel glass pane in accordance with proposed reglazing procedure to demonstrate the procedure to the Consultant and Employer’s Representative.

- **Structural glazing restraint testing:**

  Samples of the secondary cover mould restraints shall be tested to demonstrate structural integrity in the event of structural glazing adhesion failure. Structural silicone shall be cut to simulate total adhesion failure and cover mould restraints fitted and tested.

- **Structural Glazing Testing:**

  Test procedures and minimum acceptance criteria shall comply with AAMA CW 13.

13.36 WARRANTY :

The Contractor/Sub-Contractor shall be responsible for the warranty period of 10 years all functional and performance design requirements for all complete building envelope systems, including all relevant testing.

Provide a warranty for materials and workmanship of the building envelope from Date of Completion of the subcontract works for a period of 10 years. Provide all manufacturers' product warranties. Also provide a warranty to cover all the costs of materials, labour and equipment to remove any defective components of the building envelope and replace them. This warranty shall also cover the costs associated with removing and replacing internal finishes trims and services so that remedial works can be carried out. The content of each warranty shall be Accepted and Endorsed.

13.37 Accessories:

All products shall be warranted for the warranty period. The warranty shall include specific provisions and terms for failure of, or due to, the following:

- Cracking due to any reason.
- Sustaining growth of mildew, mould, fungi and the like.
- Excessive discolouration due to exposure to sunlight and weathering.
- Excessive deformation under load.
- Excessive ageing, detrimental increase in hardness or change in tensile strength and elongation more than allowable under ASTM C864.

13.38 Sealants:

All sealants shall be warranted for the warranty period for failure of, or due to, the following:

- Cohesion and adhesion.
- Change in hardness by more than +/- 5 points on the Shore A durometer scale.
- Fade or change in colour by more than five Hunter Colour Difference Units as measured by any spectrometer or colorimeter in accordance with ASTM D 2244 on an exposed coated surface which has been cleaned of external deposits with clear water and a soft cloth.
- Stain due to corrosion or bleeding of sealant.

13.39 Coatings

All preparation and coating work shall be warranted for the warranty period. Works shall be warranted against fading or colour change in excess of 5 NBS units when calculated from measurements on spectrophotometer or colorimeter capable of colour measurement by reflectance readings in accordance with ASTM D3344-90.

Works shall also been warranted against chalking in excess of #8 chalk rating when measured in accordance with ASTM D659-74.

13.40 APPENDIX-A :SAMPLE SUBMISSION FORMAT :

The Contractor shall submit the samples in the format as mentioned below:
For Glass Sample:

Name of the Vendor:		Date of Submission:			
Product:		Manufacturer:			
Item Code:		Type of glass			
Tint of Glass		Coating if any	Y		N
Glass thickness		Refractive	Y		N
Strengthening Process:		Type of Coating			
Thermal Properties		Visual Properties			

CONTRACTOR
(Sign with name, designation and date)

For Coating:

Name of the Vendor:		Date of Submission:	
Product:		Manufacturer:	
Item Code:		Type of Coating	
Coating Thickness			

For Extrusions:

Name of the Vendor:		Date of Submission:	
Product:		Extruder:	
Item Code:			
Alloy Type:			

For Hardware:

Name of the Vendor:		Date of Submission:	
Product:		List of items:	
Item Code:			
Type:			

13.40.1 APPENDIX-B:GLASS PROPERTIES

General Requirements:	
Façade system	
Glass Type	
Glass Thickness	
Glass Make	

Thermal Performanace		**Visual Performanace**		
Solar Factor (SF)	U-Value (W/m²/ºK)	Internal Reflection	External Reflection	Visible Light Transmission

13.40.2 APPENDIX-C:APPROVED VENDORS LIST

1 Cement -ACC, JK, L&T, Ultra Tech, Ambuja

2 Chlorpyriphos -DE-NOCIL, Cynamide, Bayer India Ltd, Bhagiradha Chemicals Ltd.

3 Structural Steel -SAIL, TATA, RINL, JSW, JSPL

4 Reinforcement steel -TISCO, SAIL, RINL, JSW

5 M.S. Pipe, Tubes, Bar,

Flats, Angle, Tee Sections -SAIL, TATA, TISCO, JINDAL

6. Concrete admixture -Fosroc, MC-Bauchemie, BASF, Sika; CHOKSEY CHEMICAL

7. Ready Mix cement concrete -ACC Concrete, ultratech concrete, L&T concrete or equivalent

8.	Polysulphide sealant	-Pidilite, Chemetall-Rai, Thioflex 600 FOSROC, CHOKSEY CHEMICAL; DOW CORNING
9.	Bitumen Impregnated Board	-Shalitex, Sika or approved equivalent
10.	Polyethylene back up rod	-Supreme Ind. Ltd. or approved equivalent
11.	PVC water stops	-Fixopan, Sintex or equivalent
12.	White Cement	-Birla, J.K
13.	Water proofing compound	-Fosroc, MC-Bauchemie, BASF, Sika, CICO Technologies Limited;
14.	White washing lime	-Dehradun (Source) or equivalent
15.	Paints	-Asian Paints, Nerolac, luxture, akzonobel, Berger
16.	Fire Retardant paint	-Viper or approved equivalent
17.	Epoxy	-Fosroc, BASF, SIKA, MC-Bauchemie
18.	Waterproof Ply	-Green, Century, Duro, Marino
19.	AAC Blocks.	-BILT, JK, KJS
20.	APP Polymeric Polyethylene	Felt-BITUMAT, Techno Nicol, or equivalent
21.	Expanded Polystyrene (Thermocole)	-Beardshell, BASFor approved equivalent
22.	Extruded Polystyrene	-Iso board ND, BASF or approved equivalent
23.	Commercial Quality White Glazed Ceramic Tiles	-Kajaria, Somany, Jhonson
24.	PVC strips	-Fixopan, Fair Polymers or approved equivalent
25.	Welding rod	-ADVANI or approved equivalent
26.	Micro Concrete	-FOSROC, SIKA, BUILTECH
27.	R.C.C. pipes	-Indian Hume Pipe, Pragati, Paradise, Vikas pipes
28.	Water proofing cement paint	-Super Snowcem paint, J.K, Birla, Acrocem
29.	Chemical Grout	-Endure Bal-grout, Leticrete, Fosroc, star coating
30.	Dash Fasteners	-Fischer, hilti or equivalent
31.	Granite Stone	-as per approved sample
32.	METAL DECK	-Pennar, TATA, JSWSMD or any other equivalent make
33.	Hydraulic door closers	-DORMA, HAFLE, or equivalent.
34.	Aluminium Sections	-Hindalco, Jindal/approved equivalent
35.	GLAZING	-Modi glass, AIS glass, Saint Gobain
36.	Silicon sealants	-Dow corning
37.	Wall putty	-Birla putty, JK putty, Asian putty
38.	Spider fittings	-Dorma, Nexus, Hafle

39. Floor springs -Dorma, Hafle
40. LOW VOC paints -Asian Paints, Nerolac paints, Alconoble (ICI)
41. Alluminium Powder coating -Akzonobel, Jotun.
42. Vermiculite Cementious fire coating- Carboline, Newkem, other brand if meeting specification
43. Reinforcement coupler -Spplicetek, JB Engineering, Mascon infratech or any other equivalent make

5.40.1 APPENDIX-D:LIST OF STANDARDS

(a) Indian Standards

- NBC – 2016: Bureau of Indian Standards, the National Building Code of India,
- IS: 875(Part 1) -1987: Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Unit Weights
- IS: 875(Part 2) -1987: Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures – Imposed Loads
- IS: 875(Part 3) -1987: Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Wind Loads
- IS: 875(Part 5) -1987: Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures – Special Loads and Load Combinations
- IS: 800 – 1984: Code of Practice for General Building in Steel
- IS: 1893(Part-1) – 2002: Indian standard criteria for Earthquake Resistant Design of Structures (Part-1 General provisions and Buildings) Fifth Revision.
- IS: 808 – 1989: Dimensions for hot rolled steel beams, columns, channels and angle sections.
- IS: 801 – 1975: Code of practice for use of cold formed section light gauge steel structural member's in general building construction.
- IS: 2062: Hot Rolled Low, Medium and High Tensile Structural Steel
- IS: 816: Code of practice for use of metal arc welding for general construction in mild steel
- IS: 3757: Specification for High Strength Structural Bolts
- IS: 3139: Dimensions for screw threads for bolts and nuts (dia range M42 to M150) [covered in IS 4218: Part 5]
- IS: 2016: Specification for Plain Washers
- IS: 4000: Code of practice for high strength bolts in steel structures
- IS: 1477: Code of Practice for Painting of Ferrous Metals in Buildings and Allied Finishes
- IS: 806: Code of Practice for Use of Steel Tubes in General Building Construction.
- IS: 7215: Tolerances for Fabrication of Steel Structures.
- IS: 1161: Steel Tubes for Structural Purposes – Specification
- IS: 811: Cold formed light gauge structural steel sections
- IS: 6610: Specification for Heavy Washers for Steel Structures
- IS: 12843: Tolerances for erection of steel structures
- IS: 8147: Code of Practice for Use of aluminium alloys in structures.

(b) American Standards:

- ASTM A743 Stainless Steel Castings

• ASTM A744	Stainless Steel Castings
• ASTM C509	Specification for Cellular Elastomeric Pre-Formed Gasket and Sealing Material
• ASTM C794	Test Methods for Adhesion – in Peel of Elastomeric Joint Sealants
• TT-S-0227E	Sealing Compound Elastomeric Type, Multi-Component (US Federal Interim Specification Board).
• ASTM D523	Test Method for Specular Gloss
• ASTM D4214	Test Method for Evaluating Degree of Chalking of Exterior Paint Films
• ASTM D714	Test Method for Evaluating Degree of Blistering of Paints
• ASTM D968	Test Method for Abrasion Resistance of Organic Coatings by the Falling Abrasive Tester
• ASTM D1654	Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
• ASTM D2244	Method for Instrumental Evaluation of Colour Differences of Opaque Materials
• ASTM D2247	Method for Testing Coated Metal Specimens at 100% Relative Humidity
• ASTM D3363	Test Method for Film Hardness by Pencil
• ASTM G23	Recommended Practice for Operating Light and Water Resistant Exposure Apparatus (Carbon Arc Type) for Exposure of Non-Metallic Materials.
• AAMA 2604	Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminium Extrusions and Panels.
• AAMA 2605	Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminium Extrusions and Panels.
• ASTM E283	Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.
• ASTM E330	Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
• ASTM E331	Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
• ASTM E547	Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
• AAMA 501.1	Standard Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration using Dynamic Pressure.
• AAMA 501.2	Specification for Field Testing of Metal Curtain Walls: Field Check of Water Penetration Through Installed Exterior Windows, Curtain Walls and Doors by Uniform Air Pressure Difference.
• AAMA 2604-02	Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on aluminium Extrusions and Panels.

• AAMA 2605-02	Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on aluminium Extrusions and Panels.

(c) British Standards:

• BS 6399.1	Code of Practice for Dead and Imposed Loads
• BS 6399.2	Code of Practice for Wind Loads
• BS 5588	Fire Precautions in Design, Construction and Use of Building
• BS 5588	Part 3: 1983 Code of Practice for Office Buildings
• BS 5750	Quality Systems
• BS 7543	Guide to the Durability of Buildings and Building Elements, Products and Components
• BSEN 288	Specification and Approval of Welding Procedures for Metallic Materials
• BS 4870	Specification for Automatic Fusion Welding of Materials, Including Welding Operator Approval
• BS 4871	Specification for Testing of Welders Working to Accepted Welding Procedures
• BS 3019	TIG Welding
• BS 3571	MIG Welding
• BSEN 287	Approval Testing of Welders for Fusion Welding
• BS 7475	Specification for Fusion Welding of Austenitic Stainless Steel
• BS 8118	Structural Use of Aluminium (British Standard)
• BS 5950	Structural Use of Steel in Buildings
• BS 7613	Specification for Hot Rolled Quenched and Tempered Wieldable Structural Steel Plates
• BS 7668	Specification for Wieldable Structural Steels. Hot Finished Structural Hollow Sections in Weather Resistant Steel
• BSEN 10029	Specification for Tolerance on Dimensions, Shape and Mass for Hot Rolled Steel Plates 3mm Thick and Above
• BSEN 10113	Hot-Rolled Products in Wieldable Fine Grain Structural Steel
• BS 2994	Specification for Cold Rolled Steel Sections
• BS 4848	Hot Rolled Structural Steel Sections
• BS 5950.5	Code of Practice for Design of Cold-Formed Steel Sections
• BS 729	Specification for Hot-Dip Galvanised Coatings on Iron and Steel Articles
• BS 1449.2	Specification for Stainless and Heat-Resisting Steel Plate, Sheet. Strip
• BS 6105	Specification for Corrosion Resistant Stainless Steel Fasteners
• BSEN 485	Aluminium and Aluminium Alloys. Sheet Strip and Plate.
• BSEN 515	Aluminium and Aluminium Alloys. Wrought Products. Temper Designations.
• BSEN 573	Aluminium and Alum. Alloys. Chemical Composition and Form of Wrought Products.
• BS 1474	Specification for Wrought Aluminium and Aluminium Alloys for General Engineering purposes: Bars, Extruded Round Tubes and

	Sections.
• BS 1706	Method for Specifying Electroplated Coatings of Zinc and Cadmium on Iron and Steel AMD 6731,May 1991 (Gr O).
• BS 2569	Specifications for Sprayed Metal Coatings
• BSEN 22063	Metallic and Other Inorganic Coatings. Thermal Spraying. Zinc, Aluminium and Other Alloys.
• BSEN 10143	Continuously Hot Dip Metal Coated Steel Sheet and Strip. Tolerances on Dimension and Shape.
• BS 4190	Specification for ISO Metric Black Hexagon Bolts, Screws and Nuts.
• BS 6338	Specifications for Chromate Conversion Coatings on Electroplated Zinc and Cadmium Coatings.
• BS 3100	Steel Castings for General Engineering Purposes
• BS 952	Glass for Glazing
• BS 5889	One-Part Gun Grade Silicone-Based Seals
• BS 6206	Specification for Impact Performance Requirements for Flat Safety Glass and Safety Plastics for Use in Building
• BS 6262	Code of Practice for Glazing for Buildings
• BS 6375	Performance of Windows
• CP 153	Code of Practice for Windows and Roof-Lights (British Standard)
• BS 4254	Specification for Two-Part Polysulphide Based Sealants
• BS 4255	Rubber Used in Pre-Formed Gaskets for Weather Exclusion From Buildings.
• BS 4255	Part 1: Specification for Non-Cellular Gaskets
• BS 5215	Specification for One-Part Gun Grade Polysulphide Based Sealants.
• BS 476	Fire tests on Building Materials and Structures.
• CP 3012	Code of Practice for Cleaning and Preparation of Metal Surfaces
• BS EN 12373-1	Specification for Anodised Aluminium
• BS 6161	Methods for Testing Anodised Aluminium Finishes
• BS 5493	Code of Practice for Protective Coating of Iron and Steel Structures against Corrosion
• BS 6496	Specification for Powder Organic Coatings for Application to Aluminium
• BS 4842	Specification for Liquid Organic Coatings for Application to Aluminium Alloy Extrusions, Sheet, and Pre-Formed Sections for External Architectural Purposes, and for the Finish on Aluminium Alloy Extrusions, Sheet and Pre-Formed Sections Coated With Liquid Organic Coatings.
• BS 5411	Method of Test for Metallic and Related Coatings.
• BS 6161	Part 8: Determination of the Fastness to Ultraviolet Light of Coloured Anodic Oxide Coatings
• BS 6497	Specification for Powder Organic Coatings for Application and Stoving to Hot-Dip Galvanised Hot-Rolled Steel Sections and Pre-Formed Steel Sheet for Windows and Associated External

	Architectural Purposes and for the Finish on Galvanised Steel Sections and Pre-Formed Sheet Coated with Powder Organic Coatings.
• BS 6651	Code of Practice for the Protection of Structures Against Lightning

(d) Australian Standard

• AS/NZS 1288	Glass in Buildings – Selection and Installation.
• AS/NZS 4284	Testing of Building Facades

Civil & Structural work for construction of BHEL Tower
(Package-1)
at
Plot no. 25, Sec-16A, Noida(UP)

VOLUME-1F
FORM AND PROCEDURES

ISMG & Corporate Administration
BHARAT HEAVY ELECTRICALS LTD.
AGVC, Siri Fort, New Delhi-110 049

CONTRACTOR
(Sign with name, designation and date)

OFFER FORWARDING LETTER / TENDER SUBMISSION LETTER

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

Offer Reference No:……. Date:……

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : Submission of Offer against Tender Specification No: ……

I/We hereby offer to carry out the work detailed in the Tender Specification issued by Bharat Heavy Electricals Limited Corporate Office in accordance with the terms and conditions thereof.

I/We have carefully perused the following listed documents connected with the above work and agree to abide by the same.

1. Amendments/Clarifications/Corrigenda/Errata/etc issued in respect of the Tender documents by BHEL
2. Notice Inviting Tender (NIT)
3. General Conditions of Contract
4. Special Conditions of Contract
5. Specific conditions for GRIHA & LEED Certification
6. Technical Conditions of Contract
7. Tender Drawings
8. Forms and Procedures
9. Price Bid

Should our Offer be accepted by BHEL for Award, I/we further agree to furnish 'Security Deposit' for the work as provided for in the Tender Conditions within the stipulated time as may be indicated by BHEL.

I/We further agree to execute all the works referred to in the said Tender documents upon the terms and conditions contained or referred to therein and as detailed in the appendices annexed thereto.

I/We have deposited/depositing herewith the requisite Earnest Money Deposit (EMD) as per details furnished in the Check List.

Authorised Representative of Bidder
Signature :
Name :
Address :

Place:
Date:

CONTRACTOR
(Sign with name, designation and date)

BHARAT HEAVY ELECTRICALS LIMITED

(A Government of India Undertaking)

……..

……

CONTRACT AGREEMENT

AGREEMENT NO._____ _____

NAME OF WORK	
NAME OF THE CONTRACTOR WITH FULL ADDRESS	
VALUE OF WORK AWARDED	
LETTER OF INTENT NO.	
TIME ALLOTTED FOR COMPLETING THE WORK (DATE OF COMPLETION)	

SIGNATURE OF CONTRACTOR (SIGNATURE OF BHEL OFFICER)

CONTRACTOR
(Sign with name, designation and date)

CONTRACT AGREEMENT

THIS AGREEMENT MADE THIS _____DAY OF_____ between BHARAT HEAVY ELECTRICALS LIMITED (A Government of India Enterprise) a Company incorporated under the Companies Act, 1956, having its Registered Office at BHEL House, Siri Fort New Delhi- 110049 (herein after called BHEL) of the ONE PART.

AND

M/S _____
_____ (hereinafter called the `Contractor') of the SECOND PART.

WHEREAS M/s ----------state that they have acquired and possess extensive experience in the field of ----------
And Whereas in response to an Invitation to Tender No. ---------- issued by BHEL for execution of ---------- the contractor submitted their offer No.----------dated ----------And whereas BHEL has accepted the offer of the Contractor on terms and conditions specified in the Letter of Intent No.---------- dated ----------read with the references cited therein.

THIS AGREEMENT WITNESSES AND it is hereby agreed by and between the parties as follows:

1. That the contractor shall execute the work of ----------and more particularly described in Tender Specification No ----------including Drawings and Specifications (hereinafter called the said works) in accordance with and subject to terms and conditions contained in these presents, instructions to Tenderers, General Conditions of Contract, Special Conditions, Annexures, Letter of Intent dated ----------and such other instructions, Drawings, Specifications given to him from time to time by BHEL.

2. The Contractor is required to furnish to BHEL Security deposit in the form of cash/ approved securities/ Bank Guarantee valid upto ---------- for a sum of Rs.---------- towards satisfactory performance and completion of the Contract.

3. The Contractor has furnished a Bank Guarantee bearing no.----------dated ----------for a sum of Rs.----------executed by ---------- in favour of BHEL towards Security Deposit valid upto ---------

OR

The Contractor has furnished to BHEL an initial Security Deposit of Rs.----------in the form of cash / approved Securities/ B.G No.---------- dated ---------- for Rs.---------- executed by ---------- in favour of BHEL valid upto ---------- and has agreed for recovery of the balance security deposit by BHEL @ 10% of the value of work done from each running bill till the entire Security Deposit is recovered.

OR

The contractor has furnished to BHEL an initial Security Deposit of Rs.-----(Rs.---------- vide Bank draft No.----------dated ----------and by adjusting EMD of Rs.---------- submitted vide Bank draft No.---------- dt.---------) and has agreed for recovery of balance Security Deposit by BHEL @ 10% of the value of work done from each running bill till the entire security deposit is recovered.

CONTRACTOR
(Sign with name, designation and date)

4. The Contractor hereby agrees to extend the validity of the Bank Guarantee for such further period or periods as may be required by BHEL and if the Contractor fails to obtain such extension(s) from the Bank, the Contractor, shall pay forthwith or accept recovery of Rs.---------- from the bills in one installment and the contractor further agrees that failure to extend the validity of the Bank Guarantee or failure to pay the aforesaid amount in the manner specified above shall constitute breach of contract. In addition to above, BHEL shall be entitled to take such action as deemed fit and proper for recovering the said sum of Rs.----------

OR

In case the contractor furnishes the bank guarantee at a later date the contractor hereby agrees to extend the validity of bank guarantee for such further period or periods as may be required by BHEL and if the contractor fails to obtain such extension(s) from the bank, the contractor shall pay forthwith or accept recovery of the amount of bank guarantee given in lieu of security deposit from the bills in one installment and the contractor further agrees that failure to extend the validity of bank guarantee or failure to pay the aforesaid amount in the manner specified above shall constitute breach of contract. In addition to above, BHEL shall be entitled to take such action as deemed fit and proper for recovering the said sum.

5. That in consideration of the payments to be made to the Contractor by BHEL in accordance with this Agreement the Contractor hereby covenants and undertakes with BHEL that they shall execute, construct, complete the works in conformity, in all respects, with the terms and conditions specified in this Agreement and the documents governing the same.

6. That the Contractor shall be deemed to have carefully examined this Agreement and the documents governing the same and also to have satisfied himself as to the nature and character of the Works to be executed by him.

7. That the Contractor shall carry out and complete the execution of the said works to the entire satisfaction of the Engineer or such other officer authorised by BHEL, within the agreed time schedule, the time of completion being the essence of the Contract.

8. That BHEL shall, after proper scrutiny of the bills submitted by the Contractor, pay to him during the progress of the said works such sum as determined by BHEL in accordance with this Agreement.

9. That this Agreement shall be deemed to have come into force from -------- the date on which the letter of intent has been issued to the Contractor.

10. That whenever under this contract or otherwise, any sum of money shall be recoverable from or payable by the Contractor, the same may be deducted in the manner as set out in the General Conditions of Contract or other conditions governing this Agreement.

11. That all charges on account of Octroi, Terminal and other taxes including sales tax or other duties on material obtained for execution of the said works shall be borne and paid by the Contractor.

12. That BHEL shall be entitled to deduct from the Contractor's running bills or otherwise Income Tax under Section 194 (C) of the Income Tax Act, 1961.

13. That BHEL shall be further entitled to recover from the running bills of the Contractor or otherwise such sum as may be determined by BHEL from time to time in respect of

consumables supplied by BHEL, hire charges for tools and plants issued (Where applicable) and any other dues owed by the Contractor.

14. That it is hereby agreed by and between the parties that non- exercise, forbearance or omission of any of the powers conferred on BHEL and /or any of its authorities will not in any manner constitute waiver of the conditions hereto contained in these presents and the liability of the Contractor with respect to compensation payable to BHEL or Contractor's obligations shall remain unaffected.

15. It is clearly understood by and between the parties that in the event of any conflict between the Letter of Intent and other documents governing this Agreement, the provisions in the Letter of Intent shall prevail.

16. The following documents

1. Invitation to Tender No----------
   and the documents specified therein.
2. Contractor's Offer No----------
   dated----------.
3. _____
4. _____
5. _____
6. Letter of Intent No_____ dated_____.
7. _____

shall also form part of and govern this Agreement.

IN WITNESS HEREOF, the parties hereto have respectively set their signatures in the presence of

WITNESS (CONTRACTOR)
(to be signed by a person holding
1. a valid Power of Attorney)

2.

WITNESS (For and on behalf of BHEL)

1.

2.

(Format for BG)

B.G. NO. **Date**

This deed of Guarantee made this ---------- day of ----------two thousand ----- by <Name and Address of Bank> hereinafter called the "The Guarantor" (which expression shall unless repugnant to the context or meaning thereof be deemed to include its successors and assigns) in favour of M/s Bharat Heavy Electrical Limited (A Govt. of India Undertaking) a company incorporated under the Companies Act, 1956, having its registered office at BHEL House, Siri Fort, Asiad, New Delhi – 110049 through its unit at Bharat Heavy Electricals Limited, Power Sector Western Region, Shree Mohini Complex, 345 Kingsway, Nagpur 440 001 hereinafter called "The Company" (which expression shall unless repugnant to the context or meaning thereof be deemed to include its successors and assigns)

WHEREAS < Contractor's Name and Address> (hereinafter referred to as the Contractor) have entered into a contract arising out of Letter of Intent no. < LOI REF & Date > (hereinafter referred to as "the contract") for < Name of Work > with the company.

AND WHEREAS the contract inter-alia provides that the contractor shall furnish to the company a sum of Rs.---------- (Rupees----------) towards security deposit for due and faithful performance of the contract in the form and manner specified therein.

AND WHEREAS the contractor has approached the Guarantor and in consideration of the arrangement arrived at between the contractor and the Guarantor, the Guarantor has agreed to give the Guarantee as hereinafter mentioned in favour of the company.

The Guarantor do hereby guarantee to the company the due and faithful performance, observance or discharge of the Contract by the contractor and further unconditionally and irrevocably undertake to pay to the Company without demur and merely on a demand, to the extent of Rs.----------(Rupees----------) against any claim by the company on them for any loss, damage, costs, charges and expenses caused to or suffered by the company by reasons of the contractor making any default in the performance, observance or discharge of the terms, conditions, stipulations or undertakings or any of them as contained in the contract.

CONTRACTOR
(Sign with name, designation and date)

The decision of the company whether any default has occurred or has been committed by the contractor in the performance, observance or discharge of any of the terms, conditions, stipulations or undertakings or any one of them as contained in the contract and / or as to the extent of loss, damage, costs, charges and expenses caused to or suffered by the company by reason of the contractor making any default in the performance, observance or discharge of any of the terms, conditions, stipulations or undertakings or any one of them shall be conclusive and binding on the Guarantor irrespective of the fact whether the contractor admits or denies the default or questions the correctness of any demand made by the company in any Court, Tribunal or Arbitration proceedings or before any other Authority.

The company shall have the fullest liberty without affecting in any way the liability of the Guarantor under this Guarantee, from time to time to vary any of the terms and conditions of the contract or extend time of performance by the contractor or to postpone for any time and from time to time any of the powers exercisable by it against the contractor and either enforce or forebear from enforcing any of the terms and conditions governing the contract or securities available to the company and the Guarantor shall not be released from its liability under these presents by any exercise by the company of the liberty with reference to the matters aforesaid or by reasons of time being given to the contractor or any other forbearance, act or commission on the part of the company or any indulgence by the company to the contractor or any other matter or thing whatsoever which under the law relating to sureties would, but for this provision have the effect of so releasing the Guarantor from its liability under this guarantee.

The Guarantor further agrees that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the contract and its claim satisfied or discharged and till the company certifies that the terms and conditions of the contract have been fully and properly carried out by the contractor and accordingly discharges this Guarantee, subject however, that the company shall have no claim under this Guarantee after ---------- i.e. (the present date of validity of Bank Guarantee unless the date of validity of this Bank Guarantee is further extended from time to time, as the case may be)

unless a notice of the claim under this Guarantee has been served on the Guarantor before the expiry of the said period in which case the same shall be enforceable against the Guarantor not withstanding the fact that the same is enforced after the expiry of the said period.

The Guarantor undertakes not to revoke this Guarantee during the period it is in force except with the previous consent of the Company in writing and agrees that any liquidation or winding up or insolvency or dissolution or any change in the constitution of the contractor or the Guarantor shall not discharge the Guarantor's liability hereunder.

It shall not be necessary for the company to proceed against the contractor before proceeding against the Guarantor and the Guarantee herein contained shall be enforceable against them notwithstanding any security which the Company may have obtained or obtain from the Contractor shall at the time when proceedings are taken against the Guarantor hereunder be outstanding or unrealized.

Notwithstanding anything contained herein before, our liability under the Guarantee is restricted to Rs.---------- (Rupees----------). Our guarantee shall remain inforce until ----------, i.e. (the present date of validity of Bank Guarantee unless the date of validity of this Bank Guarantee is further extended from time to time) unless a claim or demand under this guarantee is made against us on or before ---------- we shall be discharged from our liabilities under this Guarantee thereafter.

Any claim or dispute arising under the terms of this documents shall only be enforced or settled in the courts of at Nagpur

only.

The Guarantor hereby declares that it has power to execute this guarantee and the executant has full powers to do so on behalf of the Guarantor.

IN WITNESS whereof the ---------- (Bank) has hereunto set and subscribed its hand the day, month and year first, above written.

CONTRACTOR
(Sign with name, designation and date)

(Name of the Bank)

Signed for and on behalf of the Bank

(Designation of the Authorized Person Signing the Guarantee)

(Signatory No.----------)

DATED:

SEAL

==========

Notes :

1. The BG shall be executed on non-judicial stamp papers of adequate value procured in the name of the Bank in the State where the Bank is located.

2. The BG is required to be sent by the executing Bank directly to BHEL at the address where tender is submitted / accepted under sealed cover.

FORM for EXTENSION OF VALIDITY OF BANK GUARANTEE

1. **To be typed on non judicial Stamp Papers of value as applicable in the State of India from where the BG has been issued or the State of India where the BG shall be operated**
2. **The non judicial stamp papers shall be purchased in the name of the Party on whose behalf the BG is being issued or the BG issuing Bank**

BANK GUARANTEE No:
Date:……..

To

(Write Designation and Address of Officer of BHEL inviting the Tender)

Dear Sir

Sub : Validity of Bank Guarantee No:……. Dated ……. for ……. Rs …… in favour of yourself, expiry date ……., on account of M/s …… in respect of Contract Number..……., (herein after called the Original bank Guarantee)

At the request of M/s…….., we …….. Bank, having its branch Office at …….. and having Head office at ……, do hereby extend our liability under the above mentioned Bank Guarantee number…….. dated …… for a further period of ……..Months/years from …… to expire on ……..

Except as provided above, all other terms and conditions of the Original Bank Guarantee No ……. Dated…… shall remain unaltered and binding on us.

Kindly treat this extension as an integral part of the original Bank Guarantee to which it would be attached.

Yours faithfully

Signature…….
Name & Designation……..
Power of Attorney/Signing Power No
Seal of Bank

CONTRACTOR
(Sign with name, designation and date)

MONTHLY CONSTRUCTION SCHEDULE

Name of Site		Contract No.	
		Name of Contractor	
Review for the month of		Brief Scope of work	
Date of Review			

PART- A PHYSICAL REVIEW

Sl.No.	Description of work	Unit of Measurement	Original Plan (QTY Planned for the month as per joint review of previous month)	Last months shortfall (attributable to Contractor)	Total Planned for the month (including previous month backlog attributable to Contractor)	Achieved	Shortfall attributable to (in Qty)		REMARKS
			(a)	(b)	C=(a)+(b)		BHEL	Contractor	
		UOM	Phy.	Phy	Phy	Phy.	Phy.	Phy.	

Use separate sheets if necessary
CONTRACT NO:

CONTRACTOR
(Sign with name, designation and date)

CONTRACTOR:
PART – B-1 REVIEW OF DEPLOYMENT OF MAJOR T&Ps

SUPPLIER SCOPE:-

SN.	MAJOR T&P TO BE DEPLOYED AS PER WORK PLANNED FOR THE MONTH	QTY.	DEPLOYMENT STATUS (ACTUAL DEPLOYED)	REMARKS (WORKS EFFECTED DUE TO NON-DEPLOYMENT OF T&Ps

CONTRACT NO:
CONTRACTOR:
PART – B-2 REVIEW OF DEPLOYMENT OF MANPOWER

SUPPLIER SCOPE:-

SNO.	AREA OF WORK	CATEGORY OF LABOUR	NO. OF LABOUR REQUIRED AS PER CATEGORY	DEPLOYED FOR THE PERIOD	REMARKS (WORKS AFFECTED DUE TO NON-AVAILABILITY OF LABOUR)

CONTRACT No.:
Date of Report:

PART C1 : PLAN FOR THE NEXT MONTH (PHYSICAL)

CONTRACTOR
(Sign with name, designation and date)

SL NO.	DESCRIPTION OF WORK (Area Wise)	PLANNED MT/ % / QTY (EXCLUDING SHORTFALLS ATTRIBUTABLE TO CONTRACTOR TILL DATE)	T&Ps REQUIRED	MANPOWER REQUIRED	REMARKS

NOTE: USE SEPARATE SHEETS, IF REQUIRED

PART C2: PLAN FOR THE NEXT MONTH (OTHERS)

SL NO.	DESCRIPTION OF WORK (Area Wise)	PLANNED MT/ % / QTY	T&Ps REQUIRED	MANPOWER REQUIRED	REMARKS

NOTE: USE SEPARATE SHEETS, IF REQUIRED

CONTRACTOR
(Sign with name, designation and date)

DECLARATION BY AUTHORISED SIGNATORY OF BIDDER

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : **Declaration by Authorised Signatory**
Ref : 1) NIT/Tender Specification No: ……,
2) All other pertinent issues till date

I/We, hereby certify that all the information and data furnished by me with regard to the above Tender Specification are true and complete to the best of my knowledge. I have gone through the specifications, conditions, stipulations and all other pertinent issues till date, and agree to comply with the requirements and Intent of the specification.

I further certify that I am authorised to represent on behalf of my Company/Firm for the above mentioned tender and a valid Power of Attorney to this effect is also enclosed.

Yours faithfully,

(Signature, Date & Seal of Authorized Signatory of the Bidder)

Date:

Enclosed : Power of Attorney

INDEMNITY BOND

(To be executed on a Non Judicial Stamp Paper of the requisite value as per Stamp Duty prevalent in the respective State)

This Indemnity Bond executed by <name of company> having their Registered Office at <xxxxxxxxxxx> in favour of M/s Bharat Heavy Electricals Limited, a Company incorporated under the Companies Act, 1956, having its Registered Office at BHEL House, Siri Fort, Asiad, New Delhi - 110049 through its Unit at Power Sector-_____ Region, _____, _____ State. (Hereinafter referred to as the Company)

And whereas the Company has entered into a Contract with M/s xxxxxxxxx, the executants of this Deed (hereinafter referred to as the Contractor) as its contractor in respect of the work of "xxxxxxxxxxxxxxxxxxxxxxxxxx".

AND WHEREAS under the provisions of GCC further stipulates that the Contractor shall indemnify the Company against all claims of whatever nature arising during the course of execution of Contract including defects liability period of <xx Months > i.e till <xx xx xxxx>

Now this deed witness that in case the Company is made liable by any Authority including Court to pay any claim or compensation etc. in respect of all labourers or other matters at any stage under or relating to the Contract with the Contractor , the Contractor hereby covenants and agrees with the Company that they shall indemnify and reimburse the Company to the extent of such payments and for any fee, including litigation charges, lawyers' fees, etc, penalty or damages claimed against the Company by reason of the Contractor falling to comply with Central/States Laws, Rules etc, or his failure to comply with Contract (including all expenses and charges incurred by the Company).

The Contractor further indemnifies the Company for the amount which the Company may be liable to pay by way of penalty for not making deductions from the Bills of the Contractor towards such amount and depositing the same in the Government Treasury.

The Contractor further agree that the Company shall be entitled to with hold and adjust the Security Deposit and/or with hold and adjust payment of Bills of Contractor pertaining to this Contract against any payment which the Company has made or is required to make for which the Contractor is liable under the Contract and that such amount can be withheld, adjusted by the Company till satisfactory and final settlement of all pending matters and the Contractor hereby gives his consent for the same.

The Contractor further agrees that the terms of indemnity shall survive the termination or completion of this contract.

The contractor further agrees that the liability of the contractor shall be extended on actual basis notwithstanding the limitations of liability clause, in respect of :

CONTRACTOR
(Sign with name, designation and date)

1. breach of terms of contract by the contractor
2. breach of laws by the contractor
3. breach of Intellectual property rights by the contractor
4. breach of confidentiality by the contractor

Nothing contained in this deed, shall be construed as absolving or limiting the liability of the Contractor under said Contract between the Company and the Contractor. That this Indemnity Bond is irrevocable and the condition of the bond is that the Contractor shall duly and punctually comply with the terms and the conditions of this deed and contractual provisions to the satisfaction of the Company.

In witness where of M/s xxxxxxxxxxxxx these presents on the day, month and year first, above written at xxxxxxxx by the hand of its signatory Mr. xxxxxxxxxxx.

Signed for and on behalf of
M/s xxxxxxxxxxxxxxx

Witness:
1
2

REFUND OF SECURITY DEPOSIT

To,

The Construction Manager
BHEL Site Office

Dear Sir,

Sub : **Refund of Security Deposit**
Ref : Contract No: ……,
Work:……..

I/We have submitted Final Bill in respect of the above Contract/Work vide our letter no:…… dated …….. . In line with Tender conditions (GCC clause no 1.11), kindly arrange to release/refund the Security Deposit along with Final Bill payments.

The details of Security Deposit are as below:

1. Cash Portion :
2. BG Portion :

Thanking You

Date: _____ Authorised representative of Contractor

==========

To be filled up by BHEL

1. Security Deposit to be refunded:
    a. Cash Portion:
    b. BG Portion :
2. Less
    a. Amount spent by BHEL on behalf of Contractor:
    b. Payments made by BHEL on behalf of Contractor:
    c. Other recoveries for Services etc
    d. Any other recoveries
    e. Total of 'a' to 'd':
3. Net Amount to be released (1-2) :
4. Certified that
    a. The payment recommended for release is in order and there are no demands other than those included in the claim outstanding from the Contractor
    b. Contract Guarantee period of …… Months commenced wef :_____
    c. All objections raised so far have been settled
    d. A note for refund of Security Deposit has been made in the Measurement Book

Signature of BHEL Engineer

Construction Manager

Date:----------

CONTRACTOR
(Sign with name, designation and date)

REFUND OF GUARANTEE MONEY

BHARAT HEAVY ELECTRICALS LIMITED

Ref No: Date:

1. Name and Address of Contractor :
2. Contract Agreement/LOI No :
3. Date of Contract Agreement/LOI :
4. Name of the Work undertaken :
5. Date of commencement of the Work :
6. Date of Completion of the Work :
7. Period of Maintenance (Guarantee Period) :
8. Date on which the Final Bill was paid :
9. Last date of making good the defect during Maintenance Period :
10. Expenditure incurred by BHEL during Maintenance Period, if any, recoverable :
11. Date on which Guarantee Money refund: falls due as per Contract
12. Amount of Guarantee Money to be refunded:
13. Less Amounts recoverable (with details)
    a. Amount spent by BHEL on maintenance :
    b. Payments made by BHEL on behalf of Contractor:
    c. Court dues/penalties/compensation :
    d. Other recoveries for Services, etc :
    e. Total of 'a' to 'd' :
14. Net Amount recommended for release (12-13) :

Signature of BHEL Engineer

Date: _____

CONTRACTOR
(Sign with name, designation and date)

CERTIFICATE TO BE FURNISHED BY THE CONTRACTOR

I/We have no claim or demand outstanding against BHEL_____, for the work done or for labour or material supplied or any other account arising out of or connected with the Contract Agreement/LOI (No_____ dated _____) and the payment of this bill shall be in full and final settlement of all my/our claims and demands including the 'Deposits' of the Contract Agreement/LOI referred to.

Signature of Contractor

Date:

CERTIFICATE TO BE FURNISHED BY SENIOR ENGINEER/CONSTRUCTION MANAGER

1. Certified that
    a. The payment recommended for release is in order and there are no demands other than those included in the claim outstanding from the Contractor
    b. Maintenance period (Contract Guarantee period) is over and the Contractor has carried out the works required to be carried out by him during the period of maintenance (Guarantee) to our satisfaction, and all expenses incurred by the Company on carrying out such works have been included for adjustment
    c. All objections raised so far have been settled
    d. A note for refund of Guarantee Amount has been made in the Measurement Book and Contract Agreement/Work Order

Signature of BHEL Engineer

Construction Manager

Date:----------

---**FOR**

USE IN ACCOUNTS DEPARTMENT

Passed for Rs_____ (Rupees _____ only)

Accountant Accounts Officer

ACKNOWLEDGE BY THE CONTRACTOR

Received Rs _____ in full and final settlement of my/our claim

Signature of Contractor

Date:

POWER OF ATTORNEY for SUBMISSION OF TENDER/SIGNING CONTRACT AGREEMENT

(To be typed on non judicial Stamp Papers of appropriate value as applicable and Notarised)

KNOW ALL MEN BY THESE PRESENTS, that I/We do hereby make, nominate, constitute and appoint Mr …….. , whose signature given below herewith to be true and lawful Attorney of M/s…… hereinafter called 'Company', for submitting Tender/entering into Contract and inter alia, sign, execute all papers and to do necessary lawful acts on behalf of Company with M/s Bharat Heavy Electricals Ltd, Power Sector _____ Region, _____, in connection with …….
…….
…… vide Tender Specification No : _____, dated _____.

And the Company do hereby agree to ratify and confirm all acts, deeds, things or proceedings as may be lawfully done by the said attorney and by or on behalf of the company and in the name of the company, by virtue of the powers conferred herein and the same shall be binding on the company and shall have full force and effect.

IN WITNESS WHEREOF the common seal of the company has been hereunto affixed in the manner hereinafter appearing on the document.

Dated at _____, this _____ day of _____

Director/CMD/Partner/Proprietor

Signature of Mr……(Attorney)

Attested by: Director/CMD/Partner/Proprietor

Witness

Notary Public

NO DEVIATION CERTIFICATE

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : **No Deviation Certificate**
Ref : 1) NIT/Tender Specification No: ……,
2) All other pertinent issues till date

We hereby confirm that we have not changed/ modified/materially altered any of the tender documents as downloaded from the website/ issued by BHEL and in case of such observance at any stage, it shall be treated as null and void.

We also hereby confirm that we have neither set any Terms and Conditions and nor have we taken any deviation from the Tender conditions together with other references applicable for the above referred NIT/Tender Specification.

We further confirm our unqualified acceptance to all Terms and Conditions, unqualified compliance to Tender Conditions, Integrity Pact (if applicable) and acceptance to Reverse Auctioning process.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

CONTRACTOR
(Sign with name, designation and date)

DECLARATION CONFIRMING KNOWLEDGE ABOUT SITE CONDITIONS

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : **Declaration confirming knowledge about Site conditions**
Ref : 1) NIT/Tender Specification No: ……,
2) All other pertinent issues till date

I/We, _____ hereby declare and confirm that we have visited the Project Site as referred in BHEL Tender Specifications and acquired full knowledge and information about the Site conditions including Wage structure, Industrial Climate, the Law & Order and other conditions prevalent at and around the Site. We further confirm that the above information is true and correct and we shall not raise any claim of any nature due to lack of knowledge of Site conditions.

I/We, hereby offer to carry out work as detailed in above mentioned Tender Specification, in accordance with Terms & Conditions thereof.

Yours faithfully,

(Signature, Date & Seal of Authorized Representative of the Bidder)

Date :
Place:

DECLARATION FOR RELATION IN BHEL

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder failing which the offer of Bidder is liable to be summarily rejected)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : **Declaration for relation in BHEL**
Ref : 1) NIT/Tender Specification No: ……,

I/We hereby submit the following information pertaining to relation/relatives of Proprieter/Partner(s)/Director(s) employed in BHEL

Tick(√) any one as applicable:

1. The Proprieter, Partner(s), Director(s) of our Company/Firm DO NOT have any relation or relatives employed in BHEL

OR

2. The Proprieter, Partner(s), or Director(s) of our Company/Firm HAVE relation/relatives employed in BHEL and their particulars are as below:

   (i)

   (ii)

Signature of the Authorised Signatory

Note:

1. Attach separate sheet, if necessary.
2. If BHEL Management comes to know at a later date that the information furnished by the Bidder is false, BHEL reserves the right to take suitable against the Bidder/Contractor.

CONTRACTOR
(Sign with name, designation and date)

NON DISCLOSURE CERTIFICATE
(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

NON DISCLOSURE CERTIFICATE

I/We understand that BHEL is committed to Information Security Management System as per their Information Security Policy.

Hence, I/We M/s…….. who are submitting offer for providing services to BHEL against Tender Specification No:_____, hereby undertake to comply with the following in line with Information Security Policy of BHEL, _____

- To maintain confidentiality of documents & information which shall be used during the execution of the Contract.
- The documents & information shall not be revealed to or shared with third party which shall not be in the business interest of BHEL.

(Signature, date & seal of Authorized Signatory of the bidder)

Date:

BANK ACCOUNT DETAILS FOR E-PAYMENT

(To be given on Letter head of the Company /Firm of Bidder, and **ENDORSED (SIGNED & STAMPED) BY THE BANK** to enable BHEL release payments through Electronic Fund Transfer (EFT/RTGS)

---

1. Beneficiary Name :
2. Beneficiary Account No. :
3. Bank Name & Branch :
4. City/Place :
5. 9 digit M ICR Code of Bank Branch :
6. IFSC Code of Bank Branch :
7. Beneficiary E-mail ID :
   (for payment confirmation)

CONTRACTOR
(Sign with name, designation and date)

FORMAT FOR SEEKING CLARIFICATION

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

(Write Name & Address of Officer of BHEL inviting the Tender)

Dear Sir,

Sub : **Request for Clarification**
Ref : 1) NIT/Tender Specification No: ……,
2) All other pertinent issues till date

Sl no	Reference clause of Tender Document	Existing provision	Bidder's query	BHEL's clarification
1				
2				
3				
4				
5				
6				

Yours faithfully,

(Signature, date & seal of Authorized Representative of the Bidder)

CONTRACTOR
(Sign with name, designation and date)

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Sir' Fort, New Delhi - 110049 (India) hereinafter referred to as The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

……. (description of the party along with address), hereinafter referred to as The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART'

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for……
……
……. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

1.1. The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

1.1.1. No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2. The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular. before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3. The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

1.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

1.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

1.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

1.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor (s) will not instigate third persons to commit offences outlined

above or be an accessory to such offences.

Section 3 - Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors". framed by the Principal.

Section 4 - Compensation for Damages

4.1 If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent Earnest Money Deposit/Bid Security.

4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor, penalty equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

Section 5 - Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 - Equal treatment of all Bidders/ Contractors / Sub-contractors

6.1 The Bidder(s)/ Contractor(s) undertake(s) to obtain from all subcontractors a commitment consistent with this Integrity Pact and report Compliance to the Principal. This commitment shall

be taken only from those sub-contractors whose contract value is more than 20 % of Bidder's/ Contractor's contract value with the Principal. The Bidder(s)/ Contractor(s) shall continue to remain responsible for any default by his Sub-contractor(s).

6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 -Independent External Monitor(s)

8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)! Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor. upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality,

8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.

8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD. BHEL.

8.10 The word `Monitor' would include both singular and plural.

CONTRACTOR
(Sign with name, designation and date)

Section 9 - Pact Duration

9.1 This Pact begins and shall be binding on and from the submission of bid(s) by bidder(s). It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months alter the contract has been awarded.

9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders / contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

----------	----------
For & On behalf of the Principal	On behalf of' the Bidder/ Contractor
(Office Seal)	(Office Seal)

Place----------

Date----------

Witness: …….	Witness: ……
(Name & Address) ……	(Name & Address) ……..
…….	……

PROFORMA OF BANK GUARANTEE FOR EARNEST MONEY

(On non-Judicial paper of appropriate value)

Bank Guarantee No.:……

Date:……

To
(Employer's name and address)
……

Dear Sirs,

In accordance with the terms and conditions of your Invitation for Bids/Notice Inviting Tender No. ……[1](Tender Conditions) M/s. ……having its registered office at ……[2] (hereinafter referred to as the 'Tenderer'), is submitting its bid for the work of ……for ……[3].(name of the Employer) at …… [4](The Tender Conditions provide that the Tenderer shall pay a sum of Rs…… as Earnest Money Deposit in the form therein mentioned. The form of payment of Earnest Money Deposit includes Bank Guarantee executed by a Scheduled Bank.

In lieu of the stipulations contained in the aforesaid Tender Conditions that an irrevocable and unconditional Bank Guarantee against Earnest Money Deposit for an amount of .....[5] ..... is required to be submitted by the Tenderer as a condition precedent for participation in the said Tender and the Tenderer having approached us for giving the said Guarantee,,

we, the .....[Name & address of the Bank] ..... having our Head Office at ……(hereinafter referred to as the Bank) being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer without any demur, merely on your first demand any sum or sums of Rs. [5] .....(*).....without any reservation, protest, and recourse and without the beneficiary needing to prove or demonstrate reasons for its such demand. Any such demand made by the 'Employer' shall be conclusive and binding on us irrespective of any dispute or difference raised by the Tenderer.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Tenderer shall have no claim against us for making such payment.

We ……bank further agree that the employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Tender or to extend the time of submission of bids from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Tenderer and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Tendered or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Tenderer or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Tenderer and notwithstanding any security or other guarantee that the Employer may have in relation to the Tenderer's liabilities.

CONTRACTOR
(Sign with name, designation and date)

This Guarantee shall be irrevocable and shall remain in force upto and including …… [6] and shall be extended from time to time for such period as may be desired by the Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Tenderer but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms hereof. However, unless a demand or claim under this Guarantee is made on us in writing on or before the ……..[7] we shall be discharged from all liabilities under this Guarantee.

We, …….. Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceed…… [5]

b) This guarantee shall be valid upto …… [6]

c) Unless the Bank is served a written claim or demand on or before _____[7] all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

Date:……
Place of Issue:……..

[1] Details of the Invitation to Bid/Notice Inviting Tender
[2] Name and Address of the Tenderer
[3] Details of the Work
[4] Name and Address of BHEL Unit/Division/Region
[5] BG Amount in words and Figures
[6] Validity Date
[7] Date of Expiry of Claim Period

Details of similar works successfully completed in support of Qualifying requirements

S.N	Name of Work/Project	Client	CA/WO Ref with Date	WO Value (Rs.)	Executed Value (Rs)	Date of Start	Date of Completion	Performance (Satisfactory/ Unsatisfactory)	Supporting documents

CONTRACTOR
(Sign with name, designation and date)

Proforma for Hindrance Register

S.N	Nature of hindrance	Items of work that could not be executed due to this hindrance	Date of start of hindrance	Date of removal of hindrance	Over-lapping period, If any	Net hindrance in days	Weightage of this hindrance	Net effective days of hindrance	References	Sign of Engineer-in-charge(s)	Contractor/ contractor's representative signature with Name & date	Remarks of Project Manager
1	2	3	4	5	6	7	9	10	11	12	13	

*the format can be modified based on the requirement

CONTRACTOR
(Sign with name, designation and date)

Proforma for Site Order Book

S N.	Date	Instructions issued on the Inspection of work with signature and designation	Contractor/ contractor's representative acknowledgement with signature, Name & Date	Compliance report by contractor/ contractor's representative with Signature, Name & date	Final remarks of engineer-in-charge with signature, designation & date
1	2	3	4	5	6

*the format can be modified based on the requirement

CONTRACTOR
(Sign with name, designation and date)

PROJECT IMPLEMENTATION SCHEDULE (15 months)

S.N.	ACTIVITY	Duration (in days)	Duration (in months)															
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Mobilisation of T&P	15																
2	Milestone-1: Completion of structure work upto Ground level	180																
3	Milestone-2: Completion of structure work upto 4th floor	55																
4	Milestone-3: Completion of structure upto 9th floor	43																
5	Milestone-4: Completion of structure upto 14th floor	43																
6	Milestone-5: Completion of structure upto terrace level	43																
7	Milestone-6: Completion of façade work	92																
TOTAL		471																

Note:
1. Letter of Award - within 10 days from Letter of Intent
2. Work shall commence after 15 days from Letter of Award

CONTRACTOR
(Sign with name, designation and date)

Civil & Structural work for construction of BHEL Tower
(Package-1)
at
Plot no. 25, Sec-16A, Noida(UP)

VOLUME-1G
TENDER DRAWINGS

ISMG & Corporate Administration
BHARAT HEAVY ELECTRICALS LTD.
AGVC, Siri Fort, New Delhi-110 049

CONTRACTOR
(Sign with name, designation and date)

S. NO.	DRAWING TITLE	DRAWING NOS.
A.	**ARCHITECTURAL DRAWINGS**	
1	LAYOUT PLAN	SC/BH/A/01
2	1ST/UPPER BASEMENT	SC/BH/A/03
3	2ND/LOWER BASEMENT	SC/BH/A/02
4	G.FLOOR	SC/BH/A/101
5	1 ST.FLOOR	SC/BH/A/102
6	2 ND.FLOOR	SC/BH/A/103
7	3 RD.FLOOR	SC/BH/A/104
8	4 TH.FLOOR	SC/BH/A/105
9	5 TH.FLOOR	SC/BH/A/105
10	6 TH.FLOOR	SC/BH/A/106
11	7 TH.FLOOR	SC/BH/A/106
12	8 TH.FLOOR	SC/BH/A/107
13	9 TH.FLOOR	SC/BH/A/108
14	10 TH.FLOOR	SC/BH/A/109
15	11 TH.FLOOR	SC/BH/A/110
16	12 TH.FLOOR	SC/BH/A/111
17	13 TH.FLOOR	SC/BH/A/112
18	14 TH.FLOOR	SC/BH/A/113
19	15 TH.FLOOR	SC/BH/A/114
20	16 TH.FLOOR	SC/BH/A/115
21	17 TH.FLOOR	SC/BH/A/116
22	18 TH.FLOOR	SC/BH/A/117
23	TERRACE FLOOR PLAN & OH TANK	SC/BH/A/118
24	ELEVATION - A	SC/BH/A/119
25	ELEVATION - B	SC/BH/A/120
26	SECTION - 1-1	SC/BH/A/121
27	SECTION - 2	SC/BH/A/122
28	SURVEY PLAN	SC/BH/SUR/-01
B.	**CIVIL STRUCTURAL WORKS**	
29	FOUNDATION PLAN	SC/BH/A/01
30	FOUNDATION DETAILS	SC/BH/A/01-A
31	GROUND FLOOR PLAN	
32	1ST FLOOR PLAN	SC/BH/A/102
33	2ND FLOOR PLAN	SC/BH/A/103
34	3RD FLOOR PLAN	SC/BH/A/104
35	4TH FLOOR PLAN	SC/BH/A/105
36	5TH FLOOR PLAN	SC/BH/A/105
37	6TH FLOOR PLAN	SC/BH/A/106
38	7TH FLOOR PLAN	SC/BH/A/106
39	8TH FLOOR PLAN	SC/BH/A/107
40	9TH FLOOR PLAN	SC/BH/A/108
41	10TH FLOOR PLAN	SC/BH/A/109
42	11TH FLOOR PLAN	SC/BH/A/110
43	12TH FLOOR PLAN	SC/BH/A/111
44	13TH FLOOR PLAN	SC/BH/A/112
45	14TH FLOOR PLAN	SC/BH/A/113
46	15TH FLOOR PLAN	SC/BH/A/114
47	16TH FLOOR PLAN	SC/BH/A/115

48	17TH FLOOR PLAN	SC/BH/A/116
49	18TH FLOOR PLAN	SC/BH/A/117
C.	**FAÇADE WORK**	
50	FAÇADE- 1	AL-BH-EL-01
51	FAÇADE – 2	AL-BH-EL-01
D.	**LANDSCAPING WORK & BARRICADING PLAN**	
52	LANDSCAPING LAYOUT PLAN	L-001
53	BARRICADING PLAN	BP/01
54	EXISTING ROUTE OF UNDERGROUND SERVICES	-
55	TRAFFIC MOVEMENT	L-001