# Bharat Heavy Electrical Ltd
# Electronics Division
# Mysore Road, Bangalore-560026

## Tender Document (Techno-commercial) for the work of:

Air conditioning for COE Building No. 15

Opening Date: 04 –09 – 2009.

This Tender document contains 121 pages

**Issued to:**

**Bharat Heavy Electricals Limited**
**Electronics Division, Mysore Road, Bangalore – 560 026.**

**COE Building No. 15**
**Air Conditioning : NIT**

**Phone: 26998406 / 26989192**

## NOTICE INVITING TENDERS

| | | | |
|---|---|---|---|
| 01. | Tender Number | : | BHEL/EDN/FS/KCP/SA & COE/AC/01/2009-10 dtd: 12.08.2009 |
| 02. | Name of work | : | Air conditioning for COE (Centre of Excellence) Building No. 15 |
| 03. | Completion Time | : | 10 Months |
| 04. | Estimated Cost | : | Rs.35.80 Lakhs (Rupees Thirty Five Lakh and Eighty Thousand) |
| 05. | Earnest Money Deposit | : | Rs. 1.00 Lakhs (Rupees One Lakh) |
| 06. | Last Date & Time for the Receipt of Completed Tender. | : | Before 3.00 PM on 04.09.2009 |
| 07. | Date & Time for Tender Opening | : | At 3.15 PM on 04.09.2009 |
| 08. | Place of submission of Tender | : | Tender Box marked as "Factory Services" and located at Reception Area of Electronics Division, BHEL Mysore Road, Bangalore-26. |

09. Tender Contents : This tender document contains **121** Pages (Part-I) and **10** pages (Part-II) consisting of the following :

i. Technical-cum-Commercial Bid (Part-I) : Comprising the following :-
   a. NIT, Instructions to Tenderers.
   b. Scope of work (Technical Specifications / Standards / Norms including makes of equipments / material).
   c. Details of technical parameters to be furnished by tenderers.
   d. Set of Design Drawings (six drawings).
   e. Questionnaire
   f. General Conditions of Contract

ii. Schedule of Work / Price Bid (Part-II) : Comprising Bill of Quantities wherein the tenderers will submit their Price Bid furnishing the rates and amounts.

10. **Note:**
The tenderer shall read the tender documents carefully and fill all the columns neatly. Incomplete tenders may be rejected. The tenderer shall return the duly filled in tender document after affixing signature on all pages. The Tenderers shall ensure and put "Technical-cum-Commercial bid (Part - I)" & "Instructions to Tenderers" together in one cover and "Schedule of Work / Price bid (Part-II)" in a separate cover. Both these covers shall be separately sealed and then put together in a single cover and sealed. Name of work and due date for opening shall be superscribed on the envelopes and all the sealed covers shall be properly identified with necessary information such as Tender reference, type of document put inside, date of tender opening to enable to open the correct document cover only.

## PART-1
## TECHNICAL-CUM-COMMERCIAL BIDS

**Name of Work : Air conditioning for COE (Centre of Excellence) Building No. 15**

Tender Ref : BHEL/EDN/FS/KCP/SA & COE/AC/01/2009-10, dtd: 12.08.2009

Completion Period : 10 Months

### A. Information Part :

| S.N. | Particulars | To be Filled by Bidder |
|---|---|---|
| 1.0 | Name of the Contractor | |
| 2.0 | Address (Office) | |
| 3.0 | Telephone Number | |
| | Office | |
| | Fax No. | |
| | Mobile No. | |
| 4.0 | E-mail ID | |
| 5.0 | Technical Staff Details<br>(Use separate sheet if reqd.) | Furnished / Not Furnished |
| 6.0 | Working Staff Details<br>(Use separate sheet if reqd.) | Furnished / Not Furnished |
| 7.0 | Plant & Equipment details<br>(Use separate sheet if reqd.) | Furnished / Not Furnished |

## B. Essential Criteria for Techno-Commercial Acceptance of Bid:

| S.N. | Particulars | To be Filled by Bidder |
|---|---|---|
| 1.0 | Experience Certificate for having successfully completed Air-conditioning works during immediate last 7 years as mentioned below :<br><br>One work not less than 80% of the estimated cost of this NIT<br>or<br>Two works of not less than 50% of the estimated cost of this NIT<br>or<br>Three works of not less than 40% of the estimated cost of this NIT<br>Copy of completion certificates from the organization where the work is executed is to be enclosed mentioning the completed value of each single work executed and performance certificate issued by the client. (submission of work order copy is not adequate) | |
| 2.0 | Average Turn Over of the last three years (not less than 30% of the estimated cost of the NIT) | |
| 2.1 | Turn over – Previous financial year | Rs. |
| 2.2 | Turn over – 1 Year before previous financial year | Rs. |
| 2.3 | Turn over – 2 Years before previous financial year | Rs. |
| 3.0 | Solvency : (Not less than the estimated cost of the NIT, Certificate from the Bank not older than one year to be furnished) | Furnished / Not Furnished. |
| 4.0 | Whether Registered with ESI / PF Authority | Yes / No |
| 4.1 | If Yes, indicate PF Registration No.<br>(Copy of last month contribution paid receipt to beenclosed) | Enclosed / Not Enclosed. |
| 4.2 | If Yes, indicate ESI Registration No.<br>(Copy of last month contribution paid receipt to be enclosed) | Enclosed / Not Enclosed. |
| 4.3 | If No, is the tenderer willing to pay the ESI and PF contribution for the subject work under BHEL Sub code, subject to BHEL Terms and conditions. | Yes / No. |

Note: If any of the above-mentioned criteria is not met the bid will be rejected.

## C. Other Conditions :

| S.N. | Particulars | To be Filled by Bidder |
|---|---|---|
| 1.0 | Has the cost of Tender document fee been paid (if the tender document is downloaded from BHEL Website, Is the Tender Document fee enclosed with the Techno Commercial Bid in the form of **DD drawn in favour of "BHEL EDN, Bangalore"**) | Enclosed / Not Enclosed Yes / No |
| 2.0 | Form of EMD furnished<br>(Cheque is not acceptable) | DD / Pay Order / Cash<br>Document No. to be mentioned. |
| 3.0 | Has the Tenderer read General Conditions of Contract & NIT | Tender Conditions Acceptable / Not Acceptable |
| 4.0 | Completion period mentioned in NIT | Acceptable / Not Acceptable |
| 5.0 | Payment Terms defined in NIT | Acceptable / Not Acceptable |

## INSTRUCTIONS TO TENDERERS

Tender Ref: **BHEL/EDN/FS/KCP/SA & COE/AC/01/2009-10, dtd: 12.08.2009**

1. Sealed Tenders for the above noted work are hereby invited from Contractors experienced in works of similar kind and magnitude.

2. Tenders should be addressed to DGM (FS&T), Electronics Division, Bharat Heavy Electricals Limited, Mysore Road, Bangalore – 560 026. The full name and address of the tenderer, name of the work and the date of opening should be indicated on the cover.

2.1 The local address of the Contractor, the name of the person to whom all the correspondence are to be addressed should be indicated with telephone number ( both office and residence ), FAX /e-mail address, Mobile phone No. etc.

3. All entries in the tender documents should be in the same ink. Erasures and over writing are not permitted. The tenderer concerned with proper indication of the name, designation and address of the person signing should duly sign all cancellations and insertions.

4. Tenderers shall fill in all the required particulars in the blank spaces provided for this purpose in the tender documents and also sign each and every page of the tender document including the drawings (wherever applicable) attached there to before submitting tender.

5. Unit rates should be quoted in figures as well as in words in Indian Currency only i..e. Rupees and Paise with reference to each item and for all the items shown in the attached schedule. The rates shall include all taxes and duties payable on account of Service Tax, Sales Tax etc., and also expenses towards PF and ESI contributions (see clauses 8, 39 and Annexure ‘C’). Amount of each item and the total on each sheet as also the grand total amount of the whole contract shall be filled by the tenderers.

6. In case the rate quoted in figures differ from those quoted in words, the lower of the rates will be taken as the tendered rate and shall be binding on the tenderers.

7. In quoting their rates, the tenderers are advised to take into account all factors including any fluctuations in market rates. No claim for enhanced rates will be entertained on this account after acceptance of the tender or during the currency of the contract.

8. The rates to be quoted by the tenderer shall be firm and shall cover and include all statutory levies arising from Acts, passed by Parliament or by State legislature and rules framed there under. The rates shall further be deemed to include statutory levies arising from such Acts, Central or State, which may come into force, subsequent to submission of tenders. The tenderer shall note that no claim for enhancement of rates, on the ground that existing statutory levies have been increased, or that new statutory levies have come into effect after tender, or on any other ground, will be entertained on any account.

9. (a) The rates quoted in the tender shall remain valid for a period of ‘THREE MONTHS’ from the date of opening of tender.

(b) Tenderer shall not increase their quoted rates, once the tenderer has submitted his quotation and during execution of the contract in case his tender is accepted.

10. Quantities shown in the attached schedule are only approximate and are liable to variation without entitling the Contractor to any compensation, provided the total value of the contract does not vary by more than 20 % ( twenty percent ).

11. Before tendering, the tenderers are advised to inspect the site of work and its environments and be well acquainted with the actual working and other prevailing conditions, position of materials and labour. They should be well versed with BHEL General Conditions of Contract, Instructions to tenderers, drawing wherever applicable and specifications and all other documents which form part of the agreement to be entered into subsequent to award of work. The tenderers shall specially note that it is the tenderer's responsibility to provide any item which is not specially mentioned in the specification or drawing, but which is necessary to complete the work.

12. Details and quantities of each item of work shown in the "Bill of Quantities" attached here to are only approximate. They are given as a guide for the purpose of tendering only and are liable to variation and alteration at the discretion of the competent authority. The work under each item as executed shall be measured and priced at the corresponding rates to be quoted by the contractor in the Bill of Quantities attached here to.

13. Should a tenderer find discrepancies or omissions in the drawings wherever applicable / Specifications / Scope of work / Terms & Conditions attached to the tender documents or should be in doubt as to their meaning, he should at once address to the authority inviting the tender for clarifications.

    Every endeavor is made to avoid any error which can materially affect the basis of the tender but the successful tenderer shall take upon himself to provide for the risk of any error which may be subsequently discovered and shall make no subsequent claim on account thereof.

14. In the event of tender being submitted by a firm, the tender must be signed separately and legibly by each partner or member of the firm or in their absence, by the person holding the power of Attorney on behalf of the firm concerned. In the latter case, a copy of the power of attorney duly attested by a Gazetted officer must accompany the tender.

15. In case, the date of tender opening falls on Holiday, the tender will be opened on the next working day.

16. Every tender must be accompanied by deposit receipt for the amount mentioned as Earnest Money Deposit. This earnest money will be refunded to the unsuccessful tenderers after finalisation of the award of work. In the case of successful tenderer, the earnest money will be retained as part of the Security Deposit for satisfactory completion of the work in accordance with Clause – 16 of the BHEL General Conditions of the Contract. Tenders without Earnest Money Deposit receipts are liable to be rejected. No interest will be paid on the earnest money deposits.

17. The Earnest Money Deposit shall be submitted along with Technical bid and may be furnished in any of the following forms :

(a) Cash
(b) Pay Order / Demand Draft

18. Unless the Contractor whose tender is accepted signs the contract agreement within fifteen days ( 15 days ) of the date of the order directing him to do so, the amount of Earnest Money already deposited by him may be forfeited and acceptance of his tender withdrawn.

19. If, after opening of tenders, a tenderer revokes his tender or increases his earlier quoted rates or after acceptance of his tender does not commence the work in accordance with the instructions of Engineer-in-charge, the Earnest Money Deposited by him will be forfeited and acceptance of his tender withdrawn. If only a part of the work included in the tender had been awarded to the tenderer, the amount of Earnest Money to be forfeited will be based on the value of the contract so awarded.

20. BHARAT HEAVY ELECTRICALS LIMITED reserves the right to reject any or all the tenders received or accept any tender or part thereof without assigning any reason thereof. In the case of acceptance of a part of tender, the time for completion may also be reduced to the extent considered appropriate by the accepting authority.

21. Conditional and unsigned tenders, tenders containing absurd rates and amounts, tenders which are incomplete or otherwise considered defective, tenders which are not in accordance with the tender conditions laid down by the Accepting Officer and tenders not submitted in the prescribed forms are liable to be rejected.

22. The contractors who are not on the approved list of contractors of this organisation must submit the following testimonials simultaneously with their tenders. These testimonials shall be signed by the person (s) issuing the same indicating their name, designation and full address.

i) A certificate to establish that the tenderer is an independent contractor working on his own.

ii) At least 2 certificates from responsible officers of Government or firms of repute, regarding the tenderer's capacity to undertake and carryout the work tendered for / similar work satisfactorily.

iii) A certificate from a Bank of standing or magistrate regarding the tenderer's financial position.

Note: (a) Copies of testimonials unless attested by a Gazetted Officer will not be accepted.
(b) Non – submission of the above testimonials simultaneously with the tenders may result in the tenders being rejected.

23. The tenders should be accompanied by a list of contracts already held by the Contractor at the time of submitting the tender and giving the following particulars:

(a) Name of work, value and address.
(b) The balance work remaining to be done on the same.

24. Tenders submitted by post should be sent by "Registered Post with Acknowledgement due". These should be posted with due consideration for any delay in postal delivery. Tenders received after the due date of opening of tenders are liable to be rejected.

25. The Contractor's responsibility under this contract shall commence from the date of receipt of the order or acceptance of his tender.

26. If a tenderer 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 the firm expires after the submission of the Tender, after the acceptance of the Tender, BHEL may cancel such Tender at the discretion unless the firm retains its character(s).

27 BHARAT HEAVY ELECTRICALS LIMITED will not be bound by any power of Attorney granted by the tenderer or 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.

28. If the tenderer deliberately gives wrong information in his tender, BHEL reserves the right to reject such tender at any stage. Further the tenderer will be liable for any damage caused.

29 Words imparting the singular number shall be deemed to include the plural number and vice-versa where the context so requires.

30 The General and Special Conditions of Contract are complementary to each other and where they are in conflict, the special condition shall prevail.

31 The expenses for completing the stamping the agreement shall be paid by the contractor.

32 Unless and otherwise stated all tendered work includes supply, erection, testing and commissioning of equipment as agreed to in the contract.

33 After completion of the job, the contractor has to furnish actual drawings of work done in
consultation with Engineer-in-charge.

34 Any covering letter and comments of the Contractor should be submitted in duplicate along with the offer.

35 The Contractor shall provide all the materials needed for trial run, testing including chemicals, consumables etc. In quoting their rates, the Contractors are advised to take into account the cost of the above materials.

36 Should a tenderer or a contractor on the list of approved contractors have a relative or in the case of firm or Company of Contractors any of its share holder's relative is employed in a Gazetted Capacity in the Electronics Division of Bharat Heavy Electricals Limited, Bangalore-26, the authority inviting tenders shall be informed of this fact at the time of submission of the tender, failing which tender may be disqualified or if such a fact subsequently come to light, the relevant provisions of the General Conditions of Contract will apply.

37 These 'INSTRUCTIONS TO TENDERERS' & 'GENERAL CONDITIONS OF CONTRACT OF BHEL'shall be deemed to form an integral part of the contract agreement for the work to be entered into. In cases of variation between the two in any matter, the conditions in the 'THE INSTRUCTIONS TO TENDERERS' shall prevail. Extracts of some of the important clauses of BHEL GCC are enclosed (Annexure containing extracts of clauses 20, 38 and 58 of BHEL GCC). The contractor has to obtain, at his cost, a copy of the BHEL GCC, scrutinise the same, and when submitting his tender, indicate his acceptance of BHEL GCC in the proforma enclosed at Annexure B.

38 All operations to be carried out by the Contractor during the execution of the contract such as drilling, welding etc., shall be done with proper equipment brought by the tenderer. Suitable power point will be provided and tapping from the power point to equipment shall be done using proper size of cable, equipment and after getting approval of connections from our Engineer-in-charge.

39 The Contractor shall comply with the provision of Employees Provident Fund and Miscellaneous Provisions Act 1952 and rules, regulations and other orders issued thereunder. He, as an employer, shall be liable to pay employer's contribution/deductions towards PF under the PF Act in respect of all labour employed by him, for the execution of the contract in accordance with the provisions of the Employees Provident Funds and Miscellaneous Provisions Act, 1952 as amended from time to time. For this purpose he shall indicate the code number obtained from the Regional Provident Fund Commissioner or he should obtain a code number if he has not and produce the Photostat copy of the challan / receipt of monthly remittance of the contribution made by him to the PF Commissioner. Final payments due to him will be released only on production of a "No due certificate" from the Regional Provident Fund Commissioner wherever applicable. He shall also furnish such returns as are due, under the Act, to be sent to the appropriate authorities through the Principal Employer".

40 The Contractor should get himself registered with the E.S.I. Authorities as an independent Employer, obtain a separate code number and remit the dues in respect of the labour employed by him for the work and produce the Challans / Receipts of remittance of the ESI contributions due under the E.S.I. Act to the Company authorities. He shall also furnish such returns, as are due, under the Act, to be sent to the appropriate authorities through the Principal Employer.

40.1 If any action is brought in by P.F. Commissioner/ESI authorities on BHEL for the work done by the Contractor for his labourers regarding PF/ESI amount due, short remittances, non remittances etc., the Contractor shall defend the case on behalf of BHEL and/or reimburse BHEL the expenses so incurred.

40.2 If applicable, the Contractor shall apply and obtain license under Contract labour (R&A) Act 1970 and comply with the relevant provisions of this Act in respect of the labour employed by him for executing this contract. The Contractor shall furnish necessary returns to the authority through the Principal Employer.

41 If applicable, the Contractor shall insure all his labourers and materials. Any claim by his employees for the damages shall be settled by the contractor even action is against BHEL or to reimburse the legal expenses incurred by BHEL

42 Any action brought in by anybody on BHEL regarding patent, right etc., used by contractor in execution of work shall be defended by the contractor and / or reimburse to BHEL the cost of the same.

43 Contractor shall produce necessary records, documents, explanation whenever he is called upon to do, by any Government. Agencies like ESI, PF, VIGILANCE etc.

44 TERMS OF PAYMENT :

a) 56.25% of total contract value will be paid against the supply of materials at site and acceptance on prorata basis.

b) 33.75 % of the contract value will be paid on completion of erection on prorata basis.

c) Balance 10 % of the contract value will be paid after;

i) Satisfactory commissioning and handing over the entire system and

ii) On your submitting a Bank Guarantee for a value of 50 % of the Security Deposit towards performance guarantee to the extent required to cover the warrantee period.

iii) For the works which do not involve supply of materials, erection and commissioning, the terms of payment will be as per discretion of Executive in charge of BHEL.

45 SECURITY DEPOSIT

45.1 The successful tenderer shall deposit the Security deposit before start of the work. The rate of Security deposit will be as below.

| | |
|---|---|
| Upto Rs. 10 Lakhs | 10 % |
| Above Rs. 10 Lakhs upto Rs. 50 Lakhs | Rs. 1 Lakh + 7.5% of the amount exceeding Rs. 10 Lakhs |
| Above Rs. 50 Lakhs | Rs. 4 Lakhs + 5 % of the amount exceeding Rs. 50 Lakhs |

45.2 Security deposit may be furnished in any one of the following forms

i) Cash (as permissible under the Income Tax Act)
ii) Pay Order, Demand Draft in favour of BHEL
iii) Local Cheques of scheduled banks, subject to realization.
iv) Securities available from Post Offices such as National Savings Certificates, Kisan Vikas Patras etc. (Certificates should be held in the name of Contractor furnishing the security and duly pledged in favour of BHEL and discharged on the back)
v) Bank Guarantee from scheduled Banks / Public Financial Institutions as defined in the Companies Act subject to a maximum of 50% of the total security deposit value. The balance 50% has to be remitted either by cash or in the other form of security. The Bank Guarantee format should have the approval of BHEL.
vi) Fixed Deposit Receipt issued by Scheduled Banks / Public Financial Institutions as defined in the Companies Act. The FDR should be in the name of the contractor, A/C. BHEL, duly discharged on the back.
vii) Security Deposit can also be recovered at the rate of 10% from the running bills. However in such cases at least 50% of Security Deposit shall be deposited before start of the work and the balance 50% may be recovered from the running bills.
viii) EMD of the successful tenderer shall be converted and adjusted against the security deposit.
ix) The Security deposit shall not carry any interest.

**NOTE:** Acceptance of Security Deposit against Sl. No. (iv) and (vi) above will subject to hypothecation or endorsement on the document in favour of BHEL. However, BHEL will not be liable or responsible in any matter for the collection of interest or renewal of the documents or in any other matter connected therewith.

46 RUNNING ACCOUNT PAYMENTS

During execution of work, payments of all works in place will be made on the basis of measurements recorded in measurement sheet / book in respect of items executed but no claim on the account will be entertained, if for any reason payments are not so made.

47 The work shall be carried out as per detailed specifications enclosed with the tender. The items for which there is no mention in the drawings, detailed specifications to relevant IS
Specifications ( latest edition ) shall be followed.

48 CLEANING OF SITE:
After completion of the work, the contractor shall remove all debris, take away left over construction materials, machine, equipment, temporary offices, stores, work shop etc. and make the area neat and clean. The cost of this work shall be included in the quoted rate.

49 COMPLETION OF WORK AND MEASUREMENT
a) On completion of the work, the contractor must submit to the Engineer the following documents for passing of works.

b) A copy of the working drawing showing thereon all addition and alterations in the process of execution and.

c) The authorised Contractor's representative and a representative of the Employer shall jointly sign a certificate of handing over of any completed work and the date of signature of that certificate will be that the date from which the maintenance period of that unit will be reckoned.

50 MAINTENANCE OF WORKS

The contractor will be responsible for the maintenance of works during the period of execution until the various items are taken over, and for a further period of Six months, from the date of taking over.

51 EXTRA ITEMS :

No extra items of work shall be carried out by the contractor other than those authorised to do so in writing by the Engineer. For any such items of work executed as per instructions of Engineer. The rates will be fixed on the basis indicated under clause 50 of BHEL GCC.

52 SUPPLY OF MATERIALS BY CONTRACTOR :

i) The work is for a completed job including labour and supply of all except those otherwise specified in the bid document.

ii) All materials supplied by the contractor according to the contract conditions shall be subject to inspection and passing by the Engineer or his representatives from time to time, the contractor shall provide all facilities for such inspection free cost. BHEL officers connected with the contract shall have the power at any time to inspect and examine any stores or materials intended to be used in or on the work, whether on the site or at any factory or workshop or other place the same are laying and the contractor shall give necessary facilities for such inspection and examination.

iii) The contractor shall submit necessary Test Certificate / Calibration certificate for the critical items wherever necessary.

53 INTERRUPTION TO WORKS :

i) In quoting the rates / prices the contractor should take in to account the fact that due to the design or other stipulations at site, or the necessity to follow a particular sequence of overall construction operation, or non – supply of particular drawings, or the connected work or other reasons, interruptions are likely to be encountered in a work of this nature and magnitude. No claims for such interruption will be entertained on any account.

ii) Extension of time or penalty / liquidated damages as the case may be will be determined as stipulated in clause 7, 9 and 41 of BHEL General Conditions of Contract.

# SCOPE OF WORK

## 3.0 SYSTEM DESIGN DATA

3.1 **General :**

The system design, basis of design, estimated requirements and other relevant data are outlined in this section. The detailed specifications and specific requirements are outlined in the subsequent sections.

3.2 **Location :**

The proposed Air-Conditioning work is to be carried out at BHEL in Bangalore.

3.3 **Scope of Work**

3.3.1 Providing & fixing VRF system of Air Conditioning for Centre of Excellence (Building No.15).

3.3.2 Providing and fixing at site all equipments and accessories associated with A.C. system required under these Technical Specifications, BOQ and Drawings.

3.3.3 To execute all incidental work at site including materials supply at site associated with A.C. system asked in the technical specifications. Nature of such works will be, sheet metal duct/grill work, refrigerant piping and drain etc. incidental civil work, incidental electrical engineering work, cable, control panel etc. erection at site for all manufactured items at work and also items fabricated at site.

3.3.4 Routine testing, pressure testing of fabricated components, commissioning of complete plant at site.

3.3.5 Performance testing at site complete Air-Conditioning System as per various technical requirements as stipulated in performance testing clause.

3.3.6 Drainage system near the units upto the nearest available drain point.

3.3.7 Masonry work such as base for equipments shall be provided by BHEL as per approved shop dwgs.

3.3.8 BHEL would provide 3 Ph, 415 volts, 50 Hz AC supply only upto the main LT panel for HVAC outdoor units.

3.3.9 BHEL would provide 1 Ph, 220 volts, 50 Hz AC supply near each indoor units and inline/axial flow exhaust fans.

3.4 **Basis of Design :**

3.4.1 Outdoor design conditions are as given below:

| Seasons | Temp : DB | | Temp : WB | |
|---|---|---|---|---|
| | °C | °F | °C | °F |
| **Summer** | **35.6** | **96** | **25.6** | **78** |
| **Monsoon** | **27.8** | **82** | **25.6** | **78** |
| **Winter** | **14.4** | **58** | **12.2** | **54** |

3.4.2 Indoor design conditions shall be as under:

| Description | Temp : DB | | RH : % |
|---|---|---|---|
| | °C | °F | |
| **Summer & Monsoon** | **23 ± 1** | **73 ± 2** | **55±5%** |
| **Winter** | **21 ±1** | **70 ± 2** | **Not less than 40%** |

3.4.3 Fresh air : 1 a/c per hour .

3.5 **System Design :**

3.5.1 It is proposed to install air-cooled Variable Refrigerant Flow (VRF) air-conditioning system to air condition the above area.

3.5.2 The outdoor unit of VRF system shall be heat pump type to provide cooling in summer & monsoon and heating in winter and shall be located outside the building premises.

3.5.3 Each outdoor unit shall have at least 1 No. inverter compressor or minimum 50% of total capacity inverter compressors for variable speed.

3.5.4 Each outdoor unit shall be connected with multiple indoor units and refrigerant circuit along with control wiring shall be carried out up to each indoor units.

3.5.5 The indoor units of VRF system shall be low silhouette, ductable type and shall be installed above the false ceiling & at floor level. The outdoor unit shall be installed on the terrace floor.

3.5.6 Each indoor units shall have independent microprocessor based remote controllers and electronic expansion valve.

3.5.7 Conditioned air from the ductable units shall be supplied to the various spaces by using GI steel ducting with Cross Linked Closed Cell Polyethylene FR Grade insulation over it. Aluminum powder coated supply and return air grilles and diffusers shall be used for distribution of air.

3.5.8 The system shall be complete with electric panel board with cabling & earthing.

3.6. **Items to be provided by other agencies.**

The following items of work will be supplied by other agencies.

3.6.1 False ceiling to cover the duct and drop ceiling.

3.7 **Drawings :**

The drawings forming part of the specifications provide a feasible scheme for locating the equipment. The contractor may re-arrange the equipment for improving the layout and meeting the site conditions. All such changes shall however be subject to the Engineer-in-Charge / Consultants' approval. These drawings are not meant to be working drawing which shall be prepared by the contractor as required.

3.8 **Test data:**

The whole system shall be tested as per specifications given in the tender and complete test data shall be furnished on prescribed data sheet.

3.9 **Technical Data :**

The contractor shall furnish complete "technical data" on the equipment offered by him as required under the heading "Technical Data".

3.10 **Performance Guarantee:**

3.10.1 The contractor shall guarantee that the air-conditioning system shall maintain the design indoor temperature within ± 1 °C tolerance and the relative humidity shall not exceed the specified limit.

3.10.2 The contractor shall guarantee that the capacity of various components as well as the whole system shall not be less than specified.

3.10.3 The contractor shall ensure that the system shall be free of vibrations and disturbing sounds.

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## 4.0 AIR-COOLED VARIABLE REFRIGERANT FLOW (VRF) SYSTEM UNITS

### 4.1 Scope

The scope of this section comprises the supply, erection testing and commissioning of Variable Refrigerant Flow (VRF) System conforming to these specifications and in accordance with the requirements of Drawing and Schedule of Quantities.

### 4.2 Type

Units shall be air cooled, variable refrigerant flow air conditioner consisting of one outdoor unit and multiple indoor units. Each indoor units having capability to cool or heat independently for the requirement of the rooms.

The indoor units on any circuit can be of different type and also controlled individually. Any one or a combination of the following type of indoor units, as described in drawings and/or BOQ, shall be connected to the system :

- Ceiling mounted High Static Duct type
- Ceiling mounted Duct type

Compressor installed in each modular outdoor unit shall be equipped with minimum one variable speed compressor for higher reliability, improved life, better backup and duty cycling purpose. The system shall be capable of changing the rotating speed of variable speed compressor by inverter controller to follow variations in cooling and heating load and accordingly variation in power consumption to effect energy saving.

Outdoor unit shall be suitable for mix match connection of all type of indoor units.

The refrigerant piping between indoor units and outdoor unit shall be possible to extend up to 150m with maximum 50m level difference **without any oil traps.**

Both indoor units and outdoor units shall be factory assembled, tested and filled with first charge of refrigerant before delivering at site.

### 4.3 Outdoor Unit

The outdoor unit shall be factory assembled, weather proof casing, constructed from heavy gauge mild steel panels and coated with baked enamel finish. The unit shall be completely factory wired, tested with all necessary controls:

Each modular inverter outdoor shall be DC twin rotary compressor/ Scroll.

- Each modular inverter outdoor shall be DC twin rotary compressor/Scroll compressor.

- In case of modular outdoor units, the 48HP outdoor unit shall have preferably at least 50% variable speed compressors, so that the operation is not disrupted with failure of any variable speed compressor and if one variable speed compressor malfunctions, other continues to provide emergency operation smoothly till repair is effected**.**

- It should also be provided with duty cycling for multiple variable speed compressor switching starting sequence for better stability and prolonging equipment life.

- The outdoor unit shall be modular in design and should be allowed for side by side installation

- The unit shall be provided with its own microprocessor control panel.

- The outdoor units should have corrosion free base plate for easy mounting of unit.

- The machine must have a sub cool feature to use coil surface more effectively thru proper circuit/bridge so that it prevents the flushing of refrigerant from long piping due to this effect thereby achieving energy savings.

The outdoor unit should be fitted with, aero spiral design fan with aerofitting grill for spiral discharge airflow to reduce pressure loss and should be fitted with DC fan motor inverter type for better **efficiency in all fans.**

The condensing unit shall be designed to operate safely when connected to multiple fan coil units.

The Outdoor machines shall be preferably compact machines for purpose of space saving and smaller foot print shall be preferred.

### 4.3.1 **Compressor**

The compressor shall be Rotary/ Scroll type and capable of inverter control. The inverter compressor shall change the speed in accordance with the variation in cooling or heating load requirement:

- All outdoor units shall have multiple steps of capacity control to meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.

- Oil heater shall be provided in the compressor casing.

- The Inverter compressor shall preferably be Reluctance DC inverter compressor for higher efficiency and improved reliability.

### 4.3.2 Heat Exchanger

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil.

- The aluminum fins shall be covered by anti-corrosion resin film.
- The unit should be with e-pass heat exchanger to optimize the path of heat exchanger and for better efficiency of condenser.
- The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical discharge. Each fan shall have a safety guard.

### 4.3.3 Refrigerant Circuit

The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valves at condenser end.

The equipment must have in-built refrigerant stabilization control for proper refrigerant distribution.

All necessary safety devices shall be provided to ensure the safely operation of the system.

Refrigerant should be R410a Only.

### 4.3.4 Safety Devices

All necessary safety devices shall be provided to ensure safe operation of the system.

Following safety devices shall be part of outdoor unit:

- high pressure switch,
- fan drive overload protector,
- over load relay,
- fuse,
- fusible plug,
- overload protection for inverter.

### 4.3.5 Oil Recovery System

Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigeration piping lengths.

The system must be provided with oil balancing circuit to avoid poor lubrication.

## 4.4 Indoor Unit

This section deals with supply, installation, testing, commissioning of various type of indoor units conforming to general specification and suitable for the duty

selected. The type, capacity and size of indoor units shall be as specified in detailed Bill of Quantities

**General**

Indoor units shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the room.

a. The address of the indoor unit shall be set automatically in case of individual and group control.

b. In case of centralized control, it shall be set by liquid crystal remote controller

The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically
& dynamically balanced to ensure smooth operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having been supported from housing.

The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins.

Unit shall have cleanable type filter fixed to an integrally moulded plastic/aluminium frame. The filter shall be easily serviceable.

Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling or cooling and heating.

Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.

4.4.1 **Ceiling Mounted Cassette Type Unit (Multi Flow Type)**

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX-coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight and shall be able to suspend from four corners. The fan shall be aerodynamically designed diffuser turbo fan type.

Unit shall have an external panel for supply and return air. Unit shall have four way supply air grilles on sides and return air grille in center.

Each unit shall have high lift drain pump, fresh air intake provision (if specified) Low gas detection system.

All the indoor units regardless of their difference in capacity should have same decorative panel size for harmonious aesthetic point of view. It should have provision of connecting branch ducts.

### 4.4.2 Ceiling Mounted Ductable Type Unit

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for Ductable arrangement.

### 4.4.3 Ceiling Suspended Type

Unit shall be suitable for ceiling suspended arrangement below false ceiling.
The unit includes pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

Unit shall have an attractive external casing for supply and return air.

### 4.4.4 Floor Standing Type

Unit shall be suitable for floor standing arrangement. The unit includes pre filter, fan section & DX coil section. The housing of unit shall be light weight powder coated galvanized steel.

## 4.5 Centralized Type Remote Controller

A multifunctional compact centralized controller shall be provided with the system.

It shall be able to control up to 64 groups of indoor units with the following functions: -

a. Starting/stopping of Air-conditioners as a zone or group or individual unit.

b. Temperature setting for each indoor unit or zone.

c. Monitoring of operation status such as operation mode & temperature setting of individual indoor units, maintenance information, trouble shooting information.

d. Display of air conditioner operation history.

e. Daily management automation through yearly schedule function with possibility of various schedules.

The controller shall have wide screen user friendly display and can be wired by a non polar 2-wire transmission cable from the indoor unit.

## 5.0 IN - LINE FANS

5.1 **General :**
The Inline fans shall be complete in all respect and shall comply with the following specification.

5.2 **In-line Fans :** The fan shall be complete with centrifugal impeller, casing, direct driven motor, vibration isolators.

5.3 **Housing**
The housing shall be constructed of hot rolled GSS sheet metal construction. Housing metal parts shall be either spot welded or screwed or mounted together with Rivets. The housing shall indicate arrow showing rotation, make, model and duty conditions.

5.4 **Fan Wheel**
Fan wheel shall be forward/backward curved type, fan wheel shall be statically and dynamically balanced.

5.4 **Ball Bearing**
The ball bearing shall be completely maintenance free and can be used in any mounting position, at maximum indicated temperature. The bearing lubricant shall be suitable for a minimum ambient temperature of minus 15 °C. For application at maximum indicated ambient temperature life expectancy LIO is 40,000 hours minimum.

5.5 **Fan Motor**
Fan shall be supplied with built in Thermal contact (TK). At the critical high temperature point ('B' = 130 °C or 'F' = 155 °C) the Thermal contact will open and break the power supply to the fan. Fan motor shall have insulation class 'F' and protection class IP-54.

5.6 **Fan Drive**
The fan shall be direct driven type.

5.7 **Painting**
Complete fan assembly and other steel components shall either be GSS or epoxy painted.

## 6.0 AIR DISTRIBUTION : DUCT WORK AND OUTLETS

6.1 **General :**

6.1.1 The work under this part shall consist of furnishing labour materials, equipment and appliances as specified necessary and required to install all sheet metal and other allied work to make the air conditioning supply, ventilating, and exhaust system ready for operation as per drawings.

6.1.2 Except as otherwise specified all duct work and related items shall be in accordance with these specifications.

6.1.3 Duct work shall mean all ducts, casings, dampers, access doors, joints, stiffeners and hangers.

## 6.2 Duct Materials :

6.2.1 The ducts shall be fabricated from galvanized steel sheets class VIII conforming to ISS:277-1962 (revised) or Aluminium sheets conforming to ISS:737-1955 (wherever Aluminium ducts are specified).

6.2.2 All duct work, sheet metal thickness and fabrication unless otherwise directed, shall strictly meet requirements, as described in IS:655-1963 with amendment-I (1971edition)

The thickness of the sheet shall be as follows :-

| Size of Duct | Sheet Thickness | | Type of Joint | Bracing/ Rigid supports |
|---|---|---|---|---|
| | GI | Aluminium | | |
| Upto 750mm | 0.63mm | 0.80mm | GI Flange | – |
| 751mm to 1000 mm | 0.80mm | 1.00mm | 25 x 25 x 3 mm angle iron frame with 8 mm dia nuts & bolts | 25 x 25 x 3 mm angle iron frame @ 1 mtr. |
| 1001mm to 1500mm | 0.80mm | 1.00mm | 40 x 40 x 5 mm angle iron frame with 8 mm dia nuts & bolts | 40 x 40 x 3 mm angle iron frame @ 1 mtr. |
| 1501mm to 2250mm | 1.00mm | 1.50mm | 50 x 50 x 5 mm angle iron frame with 10 mm dia nuts & bolts at 125mm centre. | 40 x 40 x 3 mm angle iron frame @ 1.2 mtr to be crossed braced diagonally. |
| 2251mm and above | 1.25mm | 1.80mm | 50 x 50 x 5 mm angle iron frame with 10 mm dia nuts & bolts at 125mm centre. | 40 x 40 x 3 mm angle iron frame @ 1.2 mtr to be crossed braced diagonally. |

Ducts shall be fabricated as per detail shown on drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees and angles of ample size to keep the ducts true to shape and to prevent buckling, vibration and breathing.

6.2.3 The gauges, joints and bracings for sheet metal duct work shall further conform with the provisions as shown on the drawings.

6.2.4 Ducts larger than 450 mm shall be cross broken, duct sections upto 1200mm length may be used with bracing angles omitted.

6.2.5 Changes in section of duct work shall be affected by tapering the ducts with as long a taper as possible. All branches shall be taken off at not more than 45 Deg. Angle from the axis of the main duct unless otherwise approved by the engineer-in-charge.

6.2.6 All ducts shall be supported from the ceiling/slab by means of MS Rods of 9 mm (3/8") Dia with MS Angle at the bottom. The rods shall be anchored to RC Slab using metallic expansion fasteners.

6.3 **Installations :**

6.3.1 During the construction, the contractor shall temporarily close duct openings with sheet metal covers to prevent debris entering ducts and to maintain opening straight and square, as per direction of Engineer-In-Charge.

6.3.2 Great care should be taken to ensure that the duct work does not extend outside and beyond height limits as noted on the drawings.

6.3.3 All duct work shall be of high quality approved galvanized sheet steel guaranteed not to crack or peel on bending or fabrication of ducts. All joints shall be tight and shall be made in the direction of air flow.

The ducts shall be reinforced where necessary, and must be secured in place so as to avoid vibration of the duct on its support.

All duct work shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported in an approved manner with trapeze hangers formed of galvanized steel rods and galvanized steel angle/channel under ducts at no greater than 2 meter centre. All vertical ducts shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting. Galvanized steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods and angles/channels shall be hung through these cleats is not feasible, duct supports shall be through dash/anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods then hang through the cleats.

6.3.4 All air turns of 45 degrees or more shall include curved metal blades or vanes arranged so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration.

6.3.5 The duct work shall be varied in shape and position to fit actual conditions at building site all changes shall be subject to the approval of the Engineer-In-Charge. The contractor shall verify all measurements at site and shall notify the engineer-in-charge of any difficulty in carrying out his work before fabrication.

6.3.6 Sponge rubber or approved equal gaskets shall be installed between duct flanges as well as between all connections of sheet metal ducts to walls, floor columns, heater casings and filter casings. Sheet metals connections shall be made to walls and floors by means of wooden member anchored to the building structure with anchor bolts and with the sheet screwed to them.

6.3.7 Flanges bracings and supports are to be black, mild steel and are to be given two coat primer of red oxide and then painted with Aluminium colour paint on all surfaces before erection. Accessories such as damper blades and access panels are to be of materials of appropriate thickness and the finish similar to the adjacent ducting, as specified.

6.3.8 Joints, seams, sleeves, splitters, branches, takeoffs and supports are to be as per duct details as specified, or as decided by Engineer-In-Charge.

6.3.9 Joints requiring bolting or rivetting may be fixed by Hexagon nuts and bolts, stove bolts or buck bolts, rivets or closed centre top rivets or spot welding. Self tapping screws must not be used. All jointing material must have a finish such as cadmium plating or Galvanized as appropriate.

6.3.10 Flexible joints are to be fitted to the suction and delivery of all fans. The material is to be normally double heavy canvass or as directed by Engineer-In-Charge. On all circular spigots the flexible materials are to be screwed or clip-band with adjustable screws or toggle fitting. For rectangular ducts the material is to be flanged and bolted with a backing flat or bolted to mating flange with backing flat.

6.3.11 The flexible joints are to be not less than 75 mm and not more than 250 mm between faces.

6.3.12 The duct work should be carried out in a manner and at such time as not to hinder or delay the work of the other agencies especially the boxing or false ceiling contractors.

## 6.4 Dampers :

6.4.1 At the junction of each branch duct with main duct and split of main duct, volume dampers must be provided. Dampers shall be two gauges heavier than the gauge of the large duct and shall be rigid in construction.

6.4.2 The volume dampers shall be of an approved type, lever operated and complete with locking devices which will permit the dampers to be adjusted and locked in any positions.

6.4.3 The dampers shall be of splitter, butterfly or louver type. The damper blade shall not be less than 1.25 mm (18) gauge, reinforced with 25 mm angles 3 mm thick along any unsupported side longer than 250 mm. Angles shall not interfere with the operation of dampers, nor cause any turbulence.

6.4.4 Automatic and manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Dampers and frames shall be constructed of 1.6 mm steel sheets and blades shall not be over 225 mm wide. The dampers for fresh air inlet shall additionally be provided with fly mesh screen, on the outside, of 0.8 mm thickness with fine mesh.

6.4.5 Wherever required for system balancing, a volume balancing opposed blade damper with quadrant and thumb screw lock shall be provided.

6.4.6 After completion of the duct work, dampers are to be adjusted and set to deliver air flow as specified on the drawings.

6.4.7 Automatic fire dampers shall be provided wherever shown on the drawings. The damper shall be multiblade curtain type. The blades should out of the air stream in open position and shall be constructed with minimum 1.8 mm thick aluminium sheets. The frame shall be of 1.6 mm thickness. Other materials shall include return spring, locking device, solenoid aculator, etc.

The fire dampers shall be capable of operating automatically on receiving signal from a fire alarm panel.

6.5. **Access panel :**

6.5.1 A hinged and gasketed access panel measuring at least 450 mm x 450 mm shall be provided on duct work before each reheat coil and at each control device that may be located inside the duct work.

6.6 **Miscellaneous :**

6.6.1 All duct work joints are to be true right angle and with all sharp edges removed.

6.6.2 Sponge rubber gaskets also to be provided behind the flange of all grilles.

6.6.3 Each chute from the duct, leading to a grille, shall be provided with an air deflector to divert the air into the grille through the chute.

6.6.4 Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck.

6.6.5 Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations. Additional supports are to be provided where required for rigidity or as directed by Engineer-In-Charge.

6.6.6 The ducts should be routed directly with a minimum of directional change.

6.6.7 The duct work shall be provided with additional supports/hangers, wherever required or as directed by the Engineer-In-Charge, at no extra cost.

6.6.8 All angle iron flanges to be welded electrically and holes to be drilled.

6.6.9 All the angle iron flanges to be connected to the GSS ducts by rivets at 100 mm centres.

6.6.10 All the flanged joints, to have a sponge rubber packing stuck to the flanges with suitable adhesive.

6.6.11 The G.S.S. Ducts should be lapped 6 mm across the flanges.

6.6.12 The ducts should be supported by approved type supports at a distance not exceeding 2.4 metres.

## 6.7 Standard Grilles :

6.7.1 The supply and return air grilles shall be fabricated from extruded Aluminium sections. The supply air grilles shall have single/double louvers. The front horizontal louvers shall be of extruded section, fixed/adjustable type. The rear vertical louvers where required shall be of Aluminium extruded sections and adjustable type. The return air grille shall have single horizontal extruded section fixed louvers. The grilles may or may not be with an outer frame.

6.7.2 The damper blades shall also be of extruded Aluminium sections. The grill flange shall be fabricated out of Aluminium extruded section. Grilles longer than 450 mm shall have intermediate supports for the horizontal louvers.

## 6.8 Diffusers/Slot Diffusers :

6.8.1 The ceiling type square diffusers shall be of Aluminium extruded sections with flush or step down face, as specified with fixed pattern and neck.

6.8.2 All supply diffusers shall be provided with extruded Aluminium dampers, with arrangement for adjustment from the bottom.

6.8.3 The slot diffusers shall be of Aluminium extruded sections with diffusion plate and sliding damper.

## 6.9 Linear Diffusers/Grilles :

6.9.1 The linear diffusers/grilles shall be fabricated from Aluminium extruded sections.

6.9.2 The diffusion blades shall be extruded, flush mounted type with single or double direction air flow.

6. 9.3 The frame shall be of Aluminium extruded section and shall hold the louvers tightly in fixed position.

### 6.9.4 Metallic Frame for Grilles / Diffusers

Supply and fixing of metallic frames for grilles and diffusers will be in the scope of ducting work and included in the cost of quoted ducting rates for grilles / diffusers.

6.9.5 The dampers as described under grilles shall be provided wherever specified.

6.10 **Painting :**

All grilles, and diffusers shall be powder coated, before installation, in approved colour.

All ducts immediately behind the grilles/diffusers etc. are to be given two coats of black paint in matt finish.

6.11 **Testing :**

After completion, all duct system shall be tested for air leakage.

The entire air distribution system shall be balanced to supply the air quantity as required in various areas and the final tabulation of air quantity through each outlet shall be submitted to the engineer-in-charge for approval.

6.12 **Flexible Duct**

6.12.1 **General :**

The scope of this section comprise supply, installation, testing and commissioning of flexible ducting conforming to these specification and in accordance with requirements of drawings and schedule of quantities.

6.12.2 **Duct Materials :**

Wherever specified, uninsulated flexible duct shall be made of double lamination of metalized polyester film permanently bonded to a coated spring steel wire helix. Duct shall be in tear and puncture resistant construction.

Wherever insulated flexible duct are specified, inner core for the same should be made of double lamination of metalized polyseter film permanently bonded to a coated spring steel wire helix. Fibre glass insulation of minimum 14 kg/cu. meter density, having K-value 4.2 °F-FT$^2$-hr/Btu and 25 mm thickness shall be wrapped over the inner core & covered with strong outer jacket-cum-vapour barrier made of fibre glass reinforced metalized polyester film laminate.

Duct should conform to fire rating standards AS 4254.

6.12.3 **Installation :**

Care must be taken to install all the flexible duct in fully extruded position and bends made with adequate radius as per manufacturer recommended practices.

6.12.3.1 **Hangers and Supports**

The flexible duct must be installed fully extended to produce optimum results.

The maximum allowable sag, between any two adjacent suspension points, should not exceed 50 mm per meter.

The distance between any two adjacent suspension points may vary from 1.50 to 3.00 meter, depending upon the type of flexible duct in use.

Flexible ducts mounted above suspended ceiling should always be independently supported. Ducts mounted in these locations are susceptible to damage whenever ceiling panels need to be periodically interchanged, unless they are separately supported.

### 6.12.3.2 Bending Radius

All bends should be made as large as possible and should have a radius of not less than the diameter of the duct in use. This reduces un-favourable pressure losses and is particularly important for metal based products which are more susceptible to stress rupturing. Double bends should be avoided, however if un-avoidable, ensure that each radius is not less than R = 2 x D.

### 6.12.3.3 Straps

Ideally the hanging straps should supports the flexible duct with a minium of half the circumference surface in contact, and without reducing the effective inside diameter of the duct. It is also recommended that the minimum width of material to be used for the hanging straps should be at least 25 mm.

### 6.12.3.4 Flexible Duct to Conventional Duct Connection

Extra care should be taken when making connection to fixed conventional ducts, etc, and ensure that they do not become too stressed. An additional support is recommended to obviate this potential problem.

Metal based flexible duct products are particularly prone to fracturing due to stress caused as a result of sharp connection.

Connections to ceiling illumination “troffer boxes” should be served in the most direct manner similar to that described for conventional ducts.

Too many bends, when connecting to “troffer boxes” and/or any other type of air supplying component, may result in excessive pressure loss and the generation of noise.

### 6.12.3.5 Longer Length Installation

In the event where extreme length of flexible duct is to be installed, round duct connectors made of galvanised sheets of at least 30 cm long should be used to connect the duct at every distance of 10 meters. Use metal or galvanised hangers as recommended (point 3) to support the point where connectios are made. Light railing is a good alternative hanging support when using long length of flexible duct.

6.12.3.6 **Direct Contact**

It should be emphasized that the flexible duct must not be in direct physical contact with un-insulated heating or hot process pipes. If in the event where such situation can not be avoided, additional 1" thick insulation should be wrapped around pipes that are in contact with the duct.

## 7.0 PIPE WORK

### 7.1 General :

All piping work shall conform to quality standards and shall be carried out as per specifications and details given hereunder :-

### 7.2 Piping :

#### 7.2.1 Drain Piping :

a. **G.I. Pipes**
The drain piping shall be medium class galvanised steel.

The gate valves shall be of gun metal as described earlier.

Pipe crosses shall be provided at bends, to permit easy cleaning of drain line.

The drain line shall be provided upto the nearest drain trap and pitched towards the trap.

Drain lines shall be provided at all the lowest points in the system, as well as at equipment, where leakage of water is likely to occur, or to remove condensate and water from pump glands.

b. **PVC Piping**
The PVC drain piping shall be medium class rigid PVC as per IS 13495.

The wall thickness of the PVC pipe shall be 1.4 mm minimum for 25 mm dia pipe and 1.8 mm minimum for 32 mm and larger dia pipe.

The fittings, bends etc. shall be as per IS 7834.

#### 7.2.2 Copper Piping :

Seamless soft copper tubing, type 'L' shall be used to make connections to equipment, wherever required or specified.

Flare fittings e.g. flare nuts, tees, elbows, reducers etc. shall all be of brass.

### 7.2.3 **Refrigerant Piping :**

All refrigerant piping for the air conditioning system shall be constructed from soft seamless upto 19.1mm and hard drawn copper refrigerant pipes for above 19.1mm with copper fittings and silver-soldered joints. The refrigerant piping arrangements shall be in accordance with good practice within the air conditioning industry, and are to include charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits.

All joints in copper piping shall be sweat joints using low temperature brazing and or silver solder. Before jointing any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently, it shall be thoroughly blown out using nitrogen.

After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 20Kg per sq.cm and 10 Kg per sq.cm (lowside). Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated to minimum vacuum of 700mm hg and held for 24 hours.

The air-conditioning system supplier shall be design sizes and erect proper interconnections of the complete refrigerant circuit.

The thickness of copper piping shall not be less than mentioned below:

| S.N. | Pipe Size in mm (OD) | Wall thickness in mm |
|---|---|---|
| a. | 6.0 to 13.0 | 0.80 |
| b. | 14.0 to 30.0 | 0.99 |
| c. | 31.0 to 33.0 | 1.10 |
| d. | 34.0 to 35.0 | 1.21 |
| e. | 36.0 to 39.0 | 1.35 |
| f. | 40.0 to 43.0 | 1.43 |
| g. | 44.0 to 54.0 | 1.50 |

The suction line pipe size and the liquid line pipe size shall be selected according to the manufacturers specified outside diameter. All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

## 8.0 INSULATION

### 8.1 General :

The Insulation of refrigerant piping, drain piping, ducting etc., shall be carried out as per specifications given below :

### 8.2 Materials :

The insulating material will be as described below. Actual material to be used for insulation shall be as specified in BOQ of this tender.

### 8.2.1 Duct Insulation and Drain Pipe :

The insulation for drain piping, and duct shall be carried out from elastomeric nitril rubber having a `K' value of 0.030 W/(M.K), temperature range –40 to +115 °C and a density of not less than 60 kg/cubm. Water vapour permeability 0.09 µ g - m/N-hr. Fire rating class 1/0 as per British standard BS 476 part VII / VI 1997 building regulation. Approval of sample to be obtained in writing prior to execution.

### 8.2.2 Other Insulation :

The material for acoustic treatment of ducts, rooms, roofs etc shall be resin bonded fibre glass, as described earlier, conforming to I.S. 8183 of 1976. The density of fibre glass shall be 32 kg/cub.m and the material shall be in the form of rolls of uniform density. The `k' value at 10 °C shall not be less than 0.028 kcal/mhr/°C. Wherever insulation is to be carried out inside the duct, fibre tissue is to be installed and contractor to ensure that no fibres of insulation material get mixed up with supply/return air.

### 8.3 Drain Piping :

Insulation of drain piping shall be carried out using insulation tube of elastomeric nitril rubber having a ‘K’ value of 0.034 W/(M.K.) at mean temperature of 10 °C and a density of not less than 80 kg/cubm.

### 8.3.2 Installation

The pipe shall be thoroughly cleaned with a wire brush and rendered free from all rust and grease.

Cut insulation tube longitudinally and put on pipe and sealed the joints with adhesive and Aluminium tape (as approved by manufacturer).

### 8.4 Refrigerant Piping :

The suction line of refrigerant piping shall be insulated with 19/13 mm thick insulation as specified for refrigerant pipe lines.

8.4.1 **Pipe Insulation :**

a. **Refrigerant Pipe Insulation**

The whole of the liquid and suction refrigerant lines including all fittings, valves and strainer bodies, etc. shall be insulated with 19mm /13 mm thick elastomeric nitril rubber as specified in BOQ.

b. **Drain Pipe Insulation**

Drain pipes carrying condensate water shall be insulated with 6 mm thick elastomeric nitril rubber insulation.

For proper drainage of condensate, U Trap shall be provided in the drain piping (wherever required). All pipe supports shall be of pre fabricated & pre painted slotted angle supports, properly installed with clamps etc.

8.5 **Ducting :**

The ducts shall be insulated with the insulation sheets as follows.

Duct insulation thickness shall be as follows :

- Duct in conditioned space - 9 mm thick
- Duct in unconditioned space - 13 mm thick
- Duct with treated fresh air - 13 mm thick

8.5.1 **Installation**

Clean the surface with a wire brush and make it free from rust and oil.

The cleaned surface shall be treated with one coat of adhesive on duct surface. The coating of adhesive will, however, not be required for insulating material provided with self adhesive coating on one surface.

One coat of adhesive on one side of insulation sheet simultaneously.

Leave it to dry.

Stick the insulation on ducts and press for smoothness.

The joints shall be sealed with the same adhesive.

The Ducts in areas exposed to the weather shall be additionally covered with one layer of tar felt B.H. The tar felt shall be stuck with bitumen R 85/40 or 80/25.

8.6 **Accoustic Lining :**

8.6.1 The acoustic lining shall consist of 25mm resin bonded glass wool of density 32 KG/CuMtr (minimum) then it shall be covered by 0.5 mm perforated aluminium sheets having 3 mm perforation at 6 mm centres.

8.6.2 **Insulation**

The duct surface shall first be cleaned from inside.

Then the insulation shall be fixed inside the duct.

The insulation shall be covered with RP tissue.

The insulation shall then be covered with 0.5 mm perforated aluminium sheets. The sheet and the insulation shall be secured to the duct by means of cadmium plated bolts, nuts and washers. The ends should be completely sealed off, so that no insulation material is exposed.

## 9.0 CONTROL PANEL, MOTORS, SWITCHGEARS AND ELECTRICAL WIRING

9.1 **General :**

The motor and switchgears required for various items shall generally be as per specifications given below all electric motors shall be suitable for 3 phase, 50 cycles, 415 volts A.C. Supply ± 10%.

9.2 **Switch Panel Board :**

The main LT Panel board shall be extendible type on both sides, having in it all switches, starters and accessories and completely factory prewired. It shall be suitable for voltage systems upto 500 volts, 3 phase, 50 Hz, 4 wire supply capable of functioning satisfactorily in temperatures of 45 °C and rupturing capacity not below 35 MVA.

The boards shall be in Siemens grey, fabricated from 1.6 mm thick, cold rolled M.S. sheets. The front opening door panels shall be from 1.6 mm thick, cold rolled M.S. Sheets. Suitable stiffeners shall be used in fabricating the housing. A clear space of 450 mm shall be left at the bottom. All steel members shall first be degreased, then de-scaled using dilute sulphuric acid and a suitable phosphating process then the boards shall be powder coated. The switch board shall be dust proof and vermin proof. The panel shall generally conform to IS 8623. The front and back of the panel shall be flush type. The panel shall have front and rear access.

Cable compartment of adequate size shall be provided in the main distribution board for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate support shall be provided in cable compartment to support cables. All incoming and outgoing switch terminals shall be brought out to terminal blocks in cable compartments.

Air-break draw out type circuit breakers shall conform to IS : 2516

All switches below and upto 32 Amps shall be MCB of required rating and all switches 63 Amps and above shall be MCCB.

No MCCB/MCB, starter or accessories shall be provided in the bottom 450 mm of the panel.

The bus bars shall be of aluminium strips of 1 Amp/sq.mm ratings and as per relevant IS Codes with PVC sleeves of appropriate colour. There shall be adequate clearance between phase to phase and phase to neutral strips**.**

Items such as ammeters, switches etc shall be located close to the corresponding switchgear, and otherwise all items shall be arranged in a neat symmetrical pattern.

Every starter/contactor etc. shall be controlled by a switch of adequate rating as listed above.

A voltmeter and ammeter shall be provided to indicate incoming voltage alongwith a rotary phase selection switch.

Ammeters shall be provided for all motors of 10 HP and higher ratings. An ammeter to measure total current consumption should also be provided in such cases.

Each switch, ammeter etc shall be provided with a name plate to indicate controlled items.

The panel shall be taken up for fabrication only after getting approval of all panel shop-drawings by Engineer-in-Charge / Consultants. The panels shall be offered for inspection at works by contractor twice (in two phases), namely :

i. When the Panel frame is completely ready.
ii. When the entire Panel is complete in all respects (including switchgear, wiring, bus bars, control wiring, meters, fans etc).

All meters (including ammeters / voltmeters) wherever specified in the panel should be digital or DMM (Digital Multi-Meter) type.

LED type indicating lamps in approved colours shall be provided for the 3 phases and for on status of all controlled devices.

All the switches/breakers shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch/breaker is in off position.

Defeat arrangement shall be provided for deliberate inspection of switch/breaker without having to switch off the unit.

All the units pertaining to a motor shall be incorporated in one cabin i.e. switch, starter, CTs, ammeter, single phasing preventer, indicating lamps, etc.

All the switchgears shall be earthed to the earth bus.

Earth shall be extended to each compartment to the door by means if a flexible, insulated copper conductor with crimped legs on either side.

Etched plastic name plates shall be provided for all the incoming, outgoing switch gears etc.

The doors of the switch compartments and cable access shall be hinged type and that of bus bars shall be fixed type.

The knobs of the hinged doors shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.

All panel doors shall have rubber gasket.

All the control and auxiliary wiring shall be carried out with PVC insulated copper conductor of proper colour code. All PVC wires and cables shall be 660/1100 volts grade.

Ammeters for all the motors upto 50 HP shall be direct reading type.

Ammeters for motors of 50 HP and above and for incoming current shall be operated with a selector switch.

Each panel shall be provided with two nos. of suitable size of earth bus at the rear of the panel and two earth terminals on either side.

Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.

The power wiring from the switches/unit breakers to the starters shall be carried out using colour coded PVC insulated copper conductors crimped with lugs.

The out going of starter shall also be PVC insulated colour coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.

A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enameled white on both sides and with inscriptions in signal red colour on front side shall be provided on the panel board.

The panel shall be BMS compatible.

## 9.3 Subsidiary Panels (With Multiple Switches) :

Subsidiary panels shall be provided for equipment located away from the plant room, such as Air Handling Units, Cooling Towers etc.

The construction of these panels should be similar to the main panel.

The sub panel shall be wall hung type and as compact as possible.

The bus bars shall be of aluminium strips of 1 Amp/sq.mm ratings with PVC sleeves of appropriate colour. There shall be adequate clearance between phase to phase and phase to neutral strips.

Every starter/contactor etc. shall be controlled by a switch of adequate rating.

A voltmeter and ammeter shall be provided to indicate incoming voltage alongwith a rotary phase selection switch.

Each switch, ammeter etc. shall be provided with a name plate to indicate controlled items.

Panel fabrication drawings shall be got approved before fabrication.

All ammeters and voltmeters where specified shall be of 96 x 96 mm size.

All the switches/breakers shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch/breaker is in off position.

Defeat arrangement shall be provided for deliberate inspection of switch/breaker without having to switch off the unit.

All the switch gear shall be earthed to the earth bus.

Etched plastic name plates shall be provided for all the incoming, outgoing switch gears etc.

The doors of the switch compartments and cable access shall be hinged type and that of bus bars shall be fixed type.

The knobs of the hinged doors shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.

The doors shall have rubber gasket.

All the control and auxiliary wiring shall be carried out with PVC insulated copper conductor of proper colour code. All PVC wires and cables shall be 660/1100 volts grade.

Each panel shall be provided with suitable size of earth bus at the rear of the panel and two earth terminals on either side.

Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.

The power wiring from the switches/unit breakers to the starters shall be carried out using colour coded PVC insulated copper conductors crimped with lugs.

The out going of starter shall also be PVC insulated colour coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.

A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enameled white on both sides and with inscriptions in signal red colour on front side shall be provided on the panel board.

Neon type indicating lamps in approved colours shall be provided for the 3 phases and for on status of all controlled devices.

## 9.4 Subsidiary Panels (With Single Switch) :

Subsidiary panels shall be provided for equipment located away from the plant room, such as air handling units, cooling towers etc.

The construction of these panels should be similar to the main panel and shall have all related accessories.

The sub panel shall be wall hung type and as compact as possible.

Every starter shall be controlled by a switch of adequate rating.

A voltmeter shall be provided to indicate incoming voltage alongwith a rotary phase selection switch.

Each switch, voltmeter etc shall be provided with a name plate to indicate controlled items.

Panel fabrication drawings shall be got approved before fabrication.

The voltmeter where specified shall be of 96 x 96 mm size.

All the switches shall be interlocked with door so that the unit cannot be closed unless the unit door is closed. The interlock shall also prevent opening the unit door unless the switch is in off position.

Defeat arrangement shall be provided for deliberate inspection of switch without having to switch off the unit.

All the switch gear shall be earthed to the earth bus.

Etched plastic name plates shall be provided for all the incoming, outgoing switch gears etc.

The doors of the switch compartments and cable access shall be hinged type and that of bus bars shall be fixed type.

The knobs of the hinged doors shall be provided with a locking arrangement to prevent them from falling down when they are unscrewed for opening the doors.

The doors shall have rubber gasket.

All the control and auxiliary wiring shall be carried out with PVC insulated copper conductor of proper colour code. All PVC wires and cables shall be 660/1100 volts grade.

Each panel shall be provided with suitable size of earth bus at the rear of the panel and two earth terminals on either side.

Suitable printed PVC ferrules shall be provided for all the conductors for easy identification.

The power wiring from the switches/unit breakers to the starters shall be carried out using colour coded PVC insulated copper conductors crimped with lugs.

The out going of starter shall also be PVC insulated colour coded copper conductor crimped with lugs and terminated on a terminal block of proper rating.

A danger notice plate of 200 mm x 150 mm of mild steel at least 2 mm thick vitreous enameled white on both sides and with inscriptions in signal red colour on front side shall be provided on the panel board.

Neon type indicating lamps in approved colours shall be provided for the 3 phases and for on status of all controlled devices.

## 9.5 Squirrel Cage Motors :

The squirrel cage motors shall be either screen protected or totally enclosed fan cooled, depending on the application and as stated in "schedule of equipment" all motors shall conform to IS 325/1978 motors shall also conform to IS=1231 for foot mounted motors and IS:2223 for flange mounted motors.

The stator windings shall be with class B insulation.

Motors shall be provided with ball/roller bearings. Bearings shall have ample capacity to deal with any axial thrust. Suitable grease nipple shall be provided for re-greasing the bearings.

Motors shall be provided with a cable box for terminating the PVC insulated, PVC sheathed armoured aluminium cables.

## 9.6 Starters :

9.6.1 The type of starters to be provided for the motors shall be as follows :

| | | |
|---|---|---|
| Squirrel cage motors upto 7.5 HP | : | direct on line |
| Squirrel cage motors above 7.5 HP | : | automatic star delta. (Except compressor motor) |

Compressor motor : automatic auto transformer starter.

All starters shall have auxiliary contacts for interlocking different machines, connecting indicating lights, controls, alarms, etc.

All starters shall be provided with separate single phasing preventers.

9.6.2 **Direct On-Line Starters**

These starters shall have heavy duty air break contactors of suitable rating.

These starters shall be complete with adjustable overload relays on all three phases, single phase preventing device and under voltage release. The starters should be "hand reset" type.

The "No Volt Coil " of these starters shall be 220 volts whenever any controls on safety devices are connected in the starters circuits, otherwise standard 415 volts coils may be used. There shall be on-off push button for each starter unless remote operation of the starter is required.

9.6.3 Motor starter shall be in accordance with IS 1882 the starter shall be totally enclosed metal clad, dust and vermin proof construction. The starter shall be of continuous rating.

9.6.4 Contactors shall have the number of poles as required for appropriate duty. The making capacity of the starters shall be as per AC 23 of ISS.

9.6.5 **Installation of Motor**

Installation of the motor shall be in accordance with IS-900.

The motor along with its driven machine or equipment shall be provided with vibration isolation arrangement motors shall generally be provided with slide rails fixed to the base unit's nuts and bolts to facilitate belt installation and subsequent belt tension.

Motors shall be wired as per the detailed specifications and drawings all the motor frame shall be earthed with 2 Nos. of earthing conductors.

Motors shall be tested at works in accordance with the relevant Indian Standard specifications and test certificates shall be furnished in triplicate.

Note :Rubber mats of 1100 volts capacity shall be laid in front of panel as per site requirement, and no extra shall be paid.

9.7 **Painting :**

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating and then sprayed with a high corrosion resistant primer.

The primer shall be baked in oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade and stoved.

## 9.8 Electric Wiring

### 9.8.1 General :

The electric wiring of motors for compressors, pumps, air handling units etc. As well as controls, heaters etc and earthing of all equipment shall be carried out as per specifications given hereunder.

### 9.8.2 Wiring for Motors, Heaters etc :

The wiring for above equipment shall be carried out in conduits or using PVC armoured cables.

The PVC armoured power cable for use on 415 volts system shall be 3 or 3.5 core with aluminium conductors and be of 1100 volts grade, as per IS 1554 part I-1964. The cross section of the cable shall be to suit the load or rating of the equipment. The cable shall be aluminium conductor PVC insulated single wire/strip armoured with overall PVC sheathing.

The cables shall be laid as per IS-1255/1967, Indian Standard Code of Practice.

The cables shall be laid, as per drawings or along a short and convenient route between switch board and the equipment, either in trenches, on wall or on hangers, supported from the slab. Cable routing shall be checked on the site to avoid interference with structure, equipment etc. Where more than one cable is running close to each other, proper spacing should be provided between them.

The radius of bends of the cable should not be less than 12 times the radius of cable to prevent undue stress and damage at the bends, the cables should be supported with wooden cleats fixed on MS supports, when running in trenches, wall or ceiling suspended hangers. When laid under ground the cables should be covered with fine soft earth and protected with cement concrete covering. Suitable GI Pipe shall be used wherever the cable comes out of the connected surface and clamped properly.

Wooden bushes shall be provided at the ends of pipes through which cables are taken in walls and floors.

All cables shall be terminated using suitable size cable glands and packing.

The wiring in conduits shall be 1100 volts grade.

The conduits used shall be of high quality, all joints shall be made with sockets. The bends and elbows shall have inspection covers fixed with grease free screws. The joints shall be water tight. Approved metal saddles shall be used to secure the exposed conduits at a space of 1 meter or less. The connection of the conduit to

switches etc shall be secured by a check nut and ebonite bushes provided at the ends of conduits.

Flush inspection covers shall be provided in case of concealed, recessed conduits. The staples for the conduits shall not be spaced more than 0.60 meters apart. Before filling up the chase with concrete the conduits should be given a coat of rust proof paint.

The wires shall be drawn only after all the conduits have been properly fixed in position.

9.8.3 **Control Wiring :**

Control cables shall be 650 volts grade as per IS 1554 made from copper conductor of 1.5/2.5 sq. mm PVC insulated single multi core unarmoured with an overall PVC sheathing. All cables and wires to be FRLS grade.

9.8.4 **Earthing :**

All equipment connected with electric supply shall also be provided with double earthing continuity conductors. The size of copper earthing conductors shall be :-

| Size of phase wire sq.mm Aluminium | Size of copper conductor tape/wire (swg) |
|---|---|
| 185 | 20 mm x 3 mm (strip) |
| 150 | 20 mm x 3 mm (strip) |
| 120 | 12 mm x 3 mm (strip) |
| 90 | 4 Swg |
| 70 | 4 Swg |
| 50 | 6 Swg |
| 35 | 8 Swg |
| 25-6 | 8 Swg |
| 4 | 10 Swg |

9.8.5 **Earthing Station (Plate Earthing)**

Earthing shall be as per relevent Indian standards.

9.8.6 **Miscellaneous :**

The final connections to the equipment shall be through flexible connections in case of conduit wiring and also where the equipment is likely to be moved back and forth, such as on slide rails.

An isolator switch shall be provided at any motor which is separated from the main switch panel by a wall or partition or other barrier or is more than 15 metres away from the main panel.

Two separate and distinct earthing conduits shall be connected from the equipment upto the main switch board panel.

The branch lines from the main panel to each equipment shall be separated and should not crisscross other lines.

The entire installation shall be tested as per electricity rules and I.S.S 732-1973 with amendments 1, 2 & 3 prior to the commissioning of the plant and a suitable test report furnished by a competent and authorised person. The test report will be obtained by contractor himself at his own expenses.

All exposed switch board panels, conduits, hangers etc. shall be given 2 coats of suitable paint of approved colour, when all work has been completed.

## 10.0 TESTING, BALANCING & COMMISSIONING

### 10.1 General :

The contractor must perform all inspection and tests of the system as a whole and of components individually as required, under the supervision of the Engineer-in-Charge / Consultants, in accordance with the provisions of the applicable ASHRAE standards or approved equal.

### 10.2 Compressors/Condensers/Evaporators etc.

Complete unit shall be factory tested for leaks. Manufacturer certificate

Complete unit shall be factory tested for performance at rated conditions.

All controls shall be tested for proper functioning and set for design value.

### 10.3 Indoor Units :

#### 10.3.1 Blowers

Dynamic/static balancing of impeller. Manufacturer Certificate

Performance test as per applicable codes.

#### 10.3.2 Coils

Pneumatic test or as per manufacturer.

#### 10.3.3 Instruments and Controls

Visual examination.

### 10.4 For Associates Works at Site :

Inspection of raw materials to be used for fabrication and assembly and inspection of manufacturer's certificates.

Pressure testing of pipe fit used for the refrigerant and water services.

Pressure testing, leak testing of complete piping network. Condenser for refrigerant/ services.

Checking of electrical circuits (power & controls) and checking functioning of controls of refrigerant systems and other circuits of air conditioning system.

Checking of calibration of controls and instrumentation

Checking of assemblies for electrical control panel, instruments panels, local panels (dimensional and functional) annunciator panels etc.

Inspection of complete electrical installation at site.

Installation of main equipments like compressor, condenser, evaporator.

Performance testing of complete A.C. system as per specifications.

10.5 **Duct Work :**

All branches and outlets shall be tested for air quantity, and the total of the air quantities shall be within plus five percent (5%) of fan capacity.

Volume dampers shall be tested for proper operation.

10.6 **Balancing and Adjustment :**

Indoor unit, duct work and outlets shall be adjusted and balanced to deliver the specified air quantities as indicated, at each outlet, on the drawings and shall be recorded and submitted to the Engineer-in-Charge. If these air quantities cannot be delivered without exceeding the speed range of the sheaves or the available horse power, the Engineer-in-Charge shall be notified before proceeding with the balancing of air distribution system.

10.7 **Electrical Equipment :**

All electrical equipment shall be cleaned and adjusted on site before application of power.

The following tests shall be carried out :

Wire and cable continuity tests.

Insulation resistance tests, phase to phase and phase to earth, on all circuits and equipment, using a 500 Volts meggar. The meggar reading shall be not less than one mega ohm.

Earth resistance between conduit system and earth must not exceed half (1/2) CMH.

Phasing out and phase rotation tests.

Operating tests on all protective relays to prove their correct operation before energising the main equipment.

Operating tests on all MCB's.

10.8 **Performance Tests :**

The installation as a whole shall be balanced and tested upon completion, and all relevant information, including the following shall be submitted to the architects.

Air volume passing through each unit, duct, grilles, apertures.

Differential pressure readings across each filter, fan and coil, and through each pump.

Static pressure in each air duct.

Electrical current readings, in amperes of full and average load running, and starting, together with name plate current of each electrical motor.

Continuous recording over a specified period, of ambient wet and dry bulb temperatures under varying degrees of internal heat loads and use and occupation, in each zone of each part of the building.

Daily records should be maintained of hourly readings, taken under varying degrees of internal heat load and use and occupation, of wet and dry bulb temperatures, upstream "on coil" of each cooling coil. Also suction temperatures and pressures for each refrigerating unit. The current and voltage drawn by each machine.

Any other readings shall be taken which may subsequently be specified by the architect.

10.9 **Miscellaneous :**

The above tests are mentioned herein for general guidance and information only but not by way of limitation to the provisions of conditions of contract and specification.

The date of commencement of all tests listed above shall be subject to the approval of the Engineer and in accordance with the requirements of this specification.

The contractor shall supply the skilled staff and all necessary instruments and carry out any test of any kind on a piece of equipment, aparatus, part of system or on a complete system if the architect requests such a test for determining specified or guaranteed data as given in the specification or on the drawings.

Any damage resulting from the tests shall be repaired And/or damaged material replaced, all the satisfaction of the Engineer.

In the event of any repair or any adjustment having to be made, other than normal running adjustment, the tests shall be void and shall be recommended after the adjustment or repairs have been completed.

The contractor must inform the Engineer when such tests are to be made, giving sufficient notice, in order that the Engineer or his nominated representative may be present.

Complete records of all tests must be kept and 3 copies of these and location drawings must be furnished to the Engineer.

The contractor may be required to repeat the test as required, should the ambient conditions at the time not given, in the opinion of the architect, sufficient and suitable indication of the effect and performance of the installation as a whole or of any part, as required.

## 11.0 MODE OF MEASUREMENTS

### 11.1 Measurement For Piping

Unless otherwise specified, measurement for piping for the project shall be on the basic of centre line measurements described herewith.

a. Piping shall be measured in units of length along the centre line of installed pipes including all pipe fittings, flanges (with gaskets, nuts, and bolts for jointing), unions, bends, elbows, tees, concentric and / or eccentric reducers, inspection pieces, expansion loops etc. The above accessories shall be measured as part of piping length along the centre line of installed pipes, and no special multiples of pipe lengths for accessories shall be permitted.

b. The quoted rates for centre line linear measurements of piping shall include all wastage allowances, pipe supports including hangers, MS channel, wooden haunches, nuts, check nuts, vibration isolator suspension where specified or required, and any other item required to complete the piping installation as per the Specifications. None of these items will be separately measured or paid for.

c. However, all valves (gate / globe / check / balancing / purge / butterfly / drain etc.), strainers, thermometers, pressure gages shall be separately counted and paid for as per their individual unit rates. Piping measurements shall be taken before application of the insulation.

### 11.2 Measurement For Ducting

Unless otherwise specified, measurements for ducting for the project shall be on the basis of centre-line measurements described herewith.

a. Duct Work shall be measured on the basis of external surface area of ducts. Duct measurements shall be taken before application of the insulation. The external surface area shall be calculated by measuring the perimeter comprising overall width and depth, including the corner joints, in the centre of each duct section, multiplying with the overall length from flange face to flange face of each duct section and adding up areas of all duct sections.

For tapered rectangular ducts, the average width and depth shall be considered for perimeter, whereas for tapered circular ducts, the diameter of the section midway between large and small diameters shall be adopted, the length of tapered duct section shall be the centre line distance between the flanges of the duct section.

For special pieces like bends, tees, reducers, branches and collars, mode of measurement shall be identical to that described above using the length along the centre line.

The quoted unit rate for external surface of ducts shall include all wastage allowances, flanges and gaskets for joints, nuts and bolts, hangers and angles and angle / flat with double nuts for supports, foam rubber between duct and support, vibration isolator suspension where specified or required, inspection chamber / access panel, splitter damper with quadrant and lever for position indication, turning vanes, straightening vanes, and all other accessories required to complete the duct installation as per the Specifications. These accessories shall NOT be separately measured nor paid for.

b. Special Items for Air Distribution shall be measured by the cross-section area perpendicular to air flow, as identified herewith :

**i. Grilles :** width multiplied by height, excluding flanges. Volume control dampers shall form part of the unit rate for grilles and shall not be separately accounted.

**ii. Diffusers :** cross section area for air flow at diffuser neck. Volume control dampers shall form part of unit rate for supply air diffusers and shall not be separately accounted.

**iii. Linear Diffusers :** shall be measured by cross-sectional areas and shall exclude flanges for mounting of linear diffusers. The supply air plenum for linear diffusers shall be measured with ducting as described earlier.

**iv. Fire Dampers :** shall be measured by their cross sectional area perpendicular to the direction of air flow. Quoted rates shall include the necessary collars and flanges for mounting, inspection pieces with access door, solenoid valves etc. No special allowances shall be payable for extension of cross section outside the air stream.

**v. Flexible Connection :** shall be measured by multiplying the periphery of duct by the straight distance between the two flanges of the ducts being jointed. Quoted rates shall include the necessary mounting arrangement, flanges, nuts and bolts and treated-for-fire requisite length of canvas cloth, and neoprene gasket.

## 11.3 MEASUREMENT OF INSULATION

Unless otherwise specified measurement for duct and pipe insulation for the project shall be on the basis of centre line measurements described herewith :

**a. Pipe Insulation :**

Pipe Insulation shall be measured in units of length along the centre line of the installed pipe, strictly on the same basis as the piping measurements described earlier. The linear measurements shall be taken before the application of the insulation. It may be noted that for piping measurement, all valves, orifice plates and strainers are separately measurable by their number and size. It is to be clearly understood that for the insulation measurements, all these accessories including cladding, valves, orifice plates and strainers shall be considered strictly by linear measurements along the centre line of pipes and no special rate shall be applicable for insulation of any accessories, fixtures or fittings whatsoever.

**b. Duct Insulation and Acoustic Lining** :

Duct Insulation and Acoustic Lining shall be measured on the basis of surface area of the duct including cladding, tapered pieces, bends, tees, branches, etc. as measured for bare ducting. However, the average of the inner and outer perimeters will be used for computing the surface area of the insulation.

For example, for a 12 ft long duct piece of size 48" x 18" provided with 2" thick insulation, the surface area of insulation will be worked out as shown below :

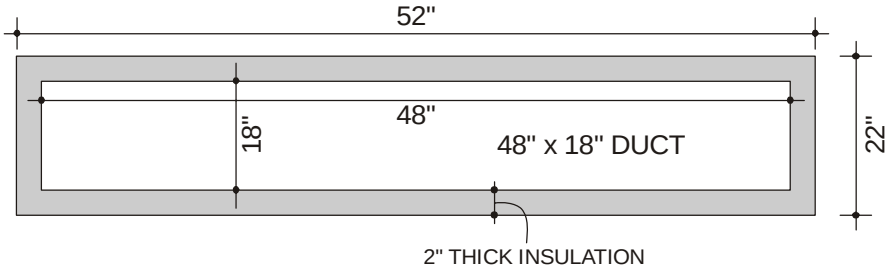



**Fig. 1 : Cross Section of an Insulated Duct**

Outer Perimeter : (52 + 22) x 2 = 148 Inches

Inner Perimeter : (48 + 18) x 2 = 132 Inches

Average Perimeter : (148 + 132) ÷ 2 = 140 Inches = (140 ÷ 12) ft.

Surface area of Insulation : Average Perimeter x Length
= (140 ÷ 12) x 12 = 140 SFT

Same procedure will be used for working out the surface area of acoustic lining within the duct where the duct will form the outer periphery and the inner surface of acoustic lining will form the inner periphery.

APPENDIX - I

## TECHNICAL DATA

Contractor shall submit catalogues of equipment + material quoted**.**

**1.0 Complete details for VRF System.**

| | | |
|---|---|---|
| i | Make | ---------- |
| ii | Capacity/Model | ---------- |
| iii | Type of indoor units(Ductable) | ---------- |
| iv | Connected load(KW) | ---------- |
| v | Electrical characteristics | --------220/415±10% volts--- |
| vi | Evaporator Coil rows | ---------- |

**2.0 Propeller / Inline Fans :**

| | | |
|---|---|---|
| a. | Manufacturer | ---------- |
| b. | Motor characteristics | ---------- |
| c. | Capacitors provided | ---------- |
| d. | Speed regulator | ---------- |
| e. | Gravity louvers | ---------- |
| f. | Single phase preventor | ---------- |
| g. | Back Draft damper | ---------- |
| h. | Bird screen | ---------- |
| i. | Wire guard. | ---------- |

**3.0 Electrical Accessories :-**

Make & Model no of The Following :

| | | |
|---|---|---|
| a. | Main Electrical Panel (Siemens gray color) | ---------- |
| -- | | |
| b. | MCCB/MCB | ---------- |
| c. | Star Delta Starter | ---------- |
| d. | Direct On Line Starter | ---------- |
| e. | Starter make | ---------- |
| f. | Current Transformers | ---------- |

| | | |
|---|---|---|
| g. | Single Phase Preventers | ---------- |
| h. | Push Buttons | ---------- |
| i. | Ammeter & Voltmeter | ---------- |
| j. | Relays | ---------- |
| k. | Indication Lamps | ---------- |
| l. | Cables-FRLS type | ---------- |
| m. | Wire | ---------- |
| n. | Switch Board(Siemens gray color) | ---------- |
| | (i) Manufacturer | ---------- |
| | (ii) Type &Dimensions | ---------- |

**4.0 Condensate Drain and Refrigerant Piping :**

| | | |
|---|---|---|
| a. | Make of pipe ( Drain Piping ) | ---------- |
| b. | Standard (IS/BS) | ---------- |
| c. | Class of pipes offered | ---------- |
| d. | Make of Refrigerant Copper Pipe | ---------- |
| e. | Standard of Copper Pipe ( IS/BS) | ---------- |

**5.0 Ducting** :-

| | | |
|---|---|---|
| a. | Material | ---------- |
| b. | Material and density & thickness | ---------- |
| c. | “K” value at 10 degree C mean temp. | ---------- |
| d. | Thickness | ---------- |

**6.0 Grilles, Diffusers & Dampers** :

| | | |
|---|---|---|
| a. | **Make, Materials and Gauge** | ---------- |
| i) | Smoke Dampers /Actuator | ---------- |
| ii) | Grilles | ---------- |
| iii) | Diffusers | ---------- |
| iv) | Louvers | ---------- |
| v) | Duct Dampers (VCD/Splitter) | ---------- |

## 7.0 Insulation :

| | | |
|---|---|---|
| a. | Manufacturer | ---------- |
| b. | Duct Acoustic Lining Material & Density | ---------- |
| c. | Duct Insulation Material & thickness | ---------- |
| d. | Pipe Insulation Material & thickness | ---------- |
| e. | Thermal Conductivity | ---------- |
| f. | Density(Duct insulation) | ---------- |
| g. | Density(Pipe insulation) | ---------- |
| h. | Metal lamination | ---------- |

Note : **Contractors shall submit manufacturers Test Certificates of all equipment + material with delivery of respective lots.**

# APPENDIX - II

## LIST OF INDIAN STANDARD

| | | | |
|---|---|---|---|
| I.S. 325 | - | - | Three phase induction Motors. |
| I.S. 1822 | - | - | Motor starters of voltage not exceeding 1000 volts |
| I.S. 3624 | - | - | Borden tube pressure and vacuum gauge. |
| I.S. 1620 | - | - | Horizontal centrifugal pumps and for clear, cold fresh water. |
| I.S. 996 | - | - | Single phase small A.C. and universal motors. |
| I.S. 277 | - | - | Galvanized steel sheets. |
| I.S. 655 | - | - | Metal Air ducts. |
| I.S. 900 | - | - | Code of practice for installation and maintenance of induction motors. |
| I.S. 2208 | - | - | HRC cartridge fuse-links upto 650 volts. |
| I.S. 1554 (I) | | - | PVC insulated (heavy duty) Electric cables for working voltage upto and including 1100 volts. |

## APPENDIX - III

## I.S. SAFETY CODES

| | | |
|---|---|---|
| I.S. 660 | - - - | Safety code for mechanical refrigeration. |
| I.S. 659 | - - - | Safety code for air conditioning |
| I.S. 3016 | - - - | Code of practice for fire precautions in welding and cutting operations. |
| I.S. 818 | - - - | Code of practice for safety and Health requirements in electrical & gas welding and cutting operations. |
| I.S.5216 | - - - | Code for safety procedures and practices in Electrical works. |
| I.S. 3696 | - - - | Safety code for scaffolds and ladders. |

## 12.0 LIST OF APPROVED MAKES FOR EQUIPMENT & MATERIALS

Only approved makes for different materials / equipments as given below shall be used for this air conditioning work. No other make shall be accepted. Any make listed below but not conforming to Technical Specifications/ Standards prescribed in the Tender shall not be accepted.

| S.No. | Details of Materials / Equipment | Manufacturer's Name / Trade Name |
|---|---|---|
| 1. | System of Air Conditioning | Variable Refrigerant Flow (VRF) |
| 2. | Make of VRF System | Daikin / LG / Hitachi / Toshiba |
| 3. | Refrigerant | R-410A |
| 4. | Inline Fan | Humidin / Krugar / Caryaire |
| 5. | Propeller Fans | Alstom (G E C) / Crompton. |
| 6. | LT Control Panels / Isolators | KEPL / Trinitron / C&S / Tricolite |
| 7. | Starters/switchgear/MCB/MCCB | Siemens / Larsen & Tubro / English Electric / Giwess |
| 8. | Control cables | Finolex / National / Skytone |
| 9. | Power cables | Finolex / Grandlay / Skytone / Anchor / CCI/Universal/Fort Gloster / Nicco / Premier |
| 10. | Timer | Siemens/L&T/Cutler Hammer/ English Electric |
| 11. | Grilles | Caryaire / Dyna Craft / Opella |
| 12. | G.I. sheets | TATA / SAIL / Nippon-Denro |
| 13. | Pipes : | |
| | a. G I | Jindal – Hissar / TATA |
| | b. Refrigerant Fittings | Totaline |
| | c. Copper Pipe | Mandev / Rajko / Totaline |
| | d. PVC Pipe | Surya / Prakash / Polypack |

| S.No. | Details of Materials / Equipment | Manufacturer's Name / Trade Name |
|---|---|---|
| 14. | Insulation : | |
| | a. Elastomeric Nytrile Rubber | A-Flex / Eurobatics / Insulflex / K-Flex / Totaline |
| | b. Expanded Polystyrene TF quality | ARKC / Beardsell |
| | c. Fibre glass / Glass wool | Owens Corning / Up-Twiga / Kim |
| | d. Hessian Fire Retarding | Navair / Pyroguard |
| | e. Expanded polyethylene | Kini Foam / Armaflex |
| 15. | Flexible duct | Caryaire/ATCO/GP Spiro |
| 16. | Vibration Isolators | Emerald / Resistoflex |
| 17. | Paint | Asian / Nerolac / ICI |

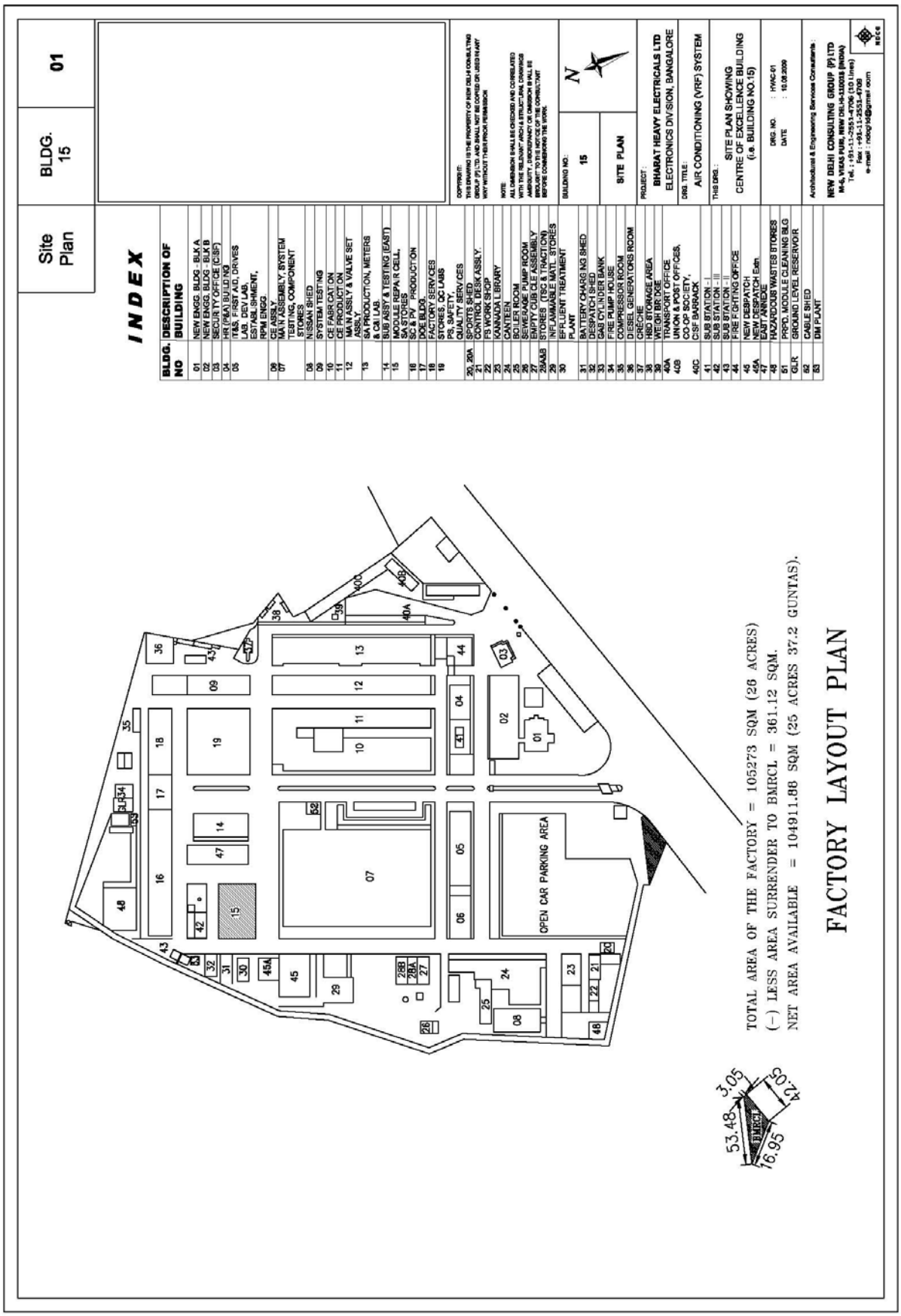
**Note :**

1. "Or Equal" appearing in specifications or BOQ with regard to makes will mean "equal make" approved in writing by the BHEL/Consultants prior to procurement of material / equipment.

2. If make of any equipment / material required for the work is not available in this list, the same should be brought to the notice of BHEL/Consultants by the tenderer in writing before submitting his offer.

# List of Drawings

| S.No. | Drawing No. | Description |
|---|---|---|
| 1. | HVAC-01 | Site Plan Showing Centre of Excellence Building (Bldg No.15) |
| 2. | HVAC-02 | Ground Floor Plan Showing Air Conditioning Layout |
| 3. | HVAC-03 | First Floor Plan Showing Air Conditioning Layout |
| 4. | HVAC-04 | Second Floor Plan Showing Air Conditioning Layout |
| 5. | HVAC-05 | Third Floor Plan Showing Air Conditioning Layout |
| 6. | HVAC-06 | Cross-Section of Building No. 15 |


Site Plan
BLDG. 15
01
INDEX
BLDG. NO
DESCRIPTION OF BUILDING
01 NEW ENGG. BLDG - BLK A
02 NEW ENGG. BLDG - BLK B
03 SECURITY OFFICE (CISF)
04 HRD(R&A) BUILDING
05 ITAS, DEVT.LAB, DRIVES LAB, ESTABLISHMENT, RPM ENGG
06 CE ASSLY.
07 MAIN ASSEMBLY, SYSTEM TESTING, COMPONENT STORES
08 NISSAN SHED
09 SYSTEM TESTING
10 CE FABRICATION
11 CE PRODUCTION
12 MAIN ASSLY & VALVE SET ASSLY.
13 SA PRODUCTION, METERS & CAL LAB.
14 SUB ASSY & TESTING (EAST)
15 MODULE REPAIR CELL, SA STORES
16 SA & PV PRODUCTION
17 DOE BLDG.
18 FACTORY SERVICES
19 STORES, QC LABS
20, 20A PS, SAFETY, QUALITY SERVICES
21 SPORTS SHED
22 CONTROL DESK ASSLY.
23 FOUNDRY SHOP
24 KANNADA LIBRARY
25 CANTEEN
26 BOILER ROOM
28 SEWERAGE PUMP ROOM
27 EMPTY CUB CLE ASSEMBLY
28AB STORES (TBG & TRACTION)
29 INFLAMMABLE MATL. STORES
30 EFFLUENT TREATMENT PLANT
31 BATTERY CHARG NG SHED
32 DESPATCH SHED
33 GAS CYLINDER BANK
34 FIRE PUMP HOUSE
35 COMPRESSOR ROOM
36 DIESEL GENERATORS ROOM
37 CRECHE
38 HRD STORAGE AREA
40 WEIGH BRIDGE
40A UNION OFFICE,
40B UNION & POST OFFICES,
40C CO-OP SOCIETY, CSF BARRACK
41 SUB STATION - I
42 SUB STATION - III
43 SUB STATION - II
44 FIRE FIGHTING OFFICE
45 NEW DESPATCH
45A NEW DESPATCH Extn.
47 EAST ANNEXE
48 HAZARDOUS WASTES STORES
51 PRPD. MODULE CLEANING BLG
GLR GROUND LEVEL RESERVOIR
52 CABLE SHED
53 DM PLANT
COPYRIGHT:
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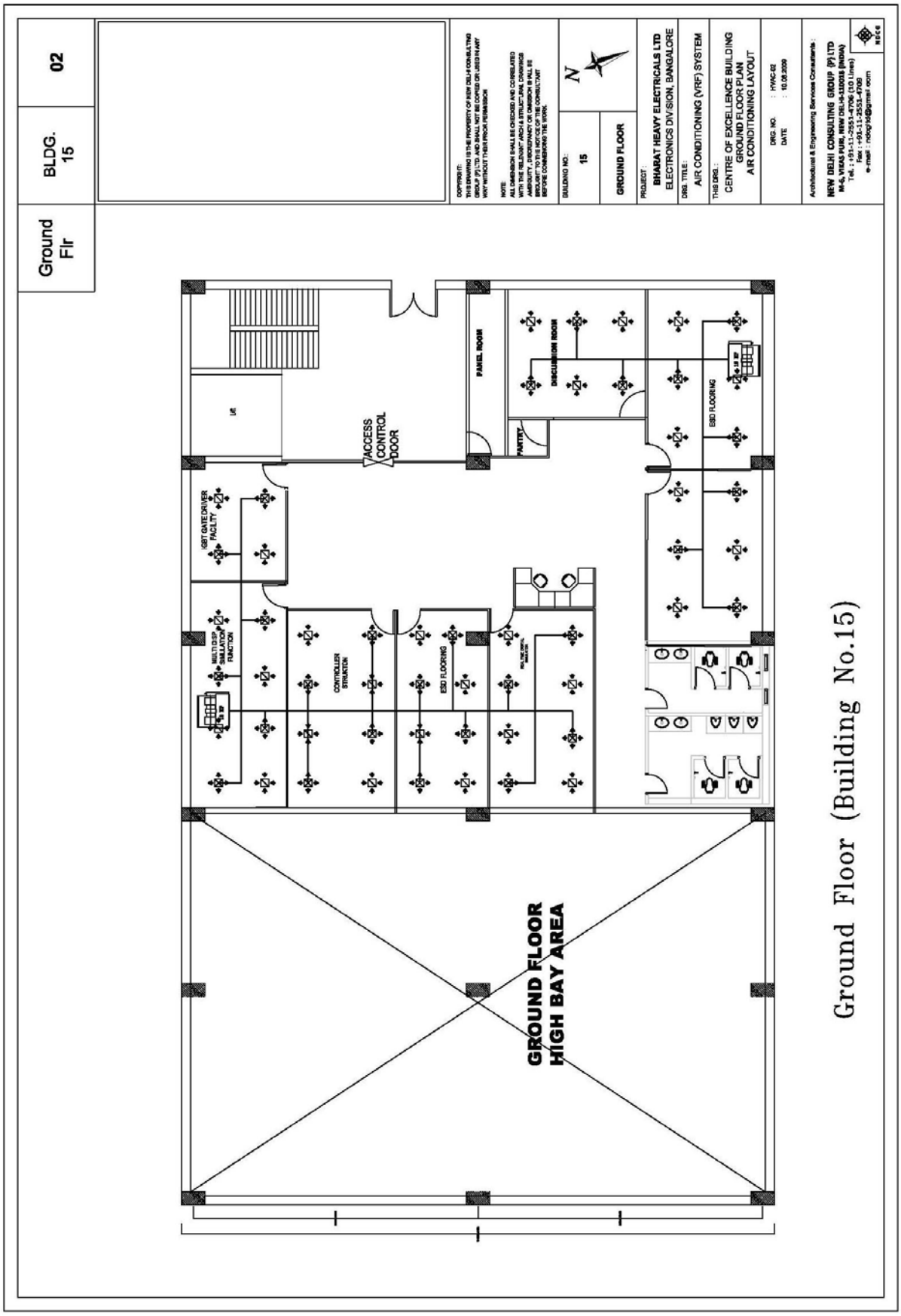
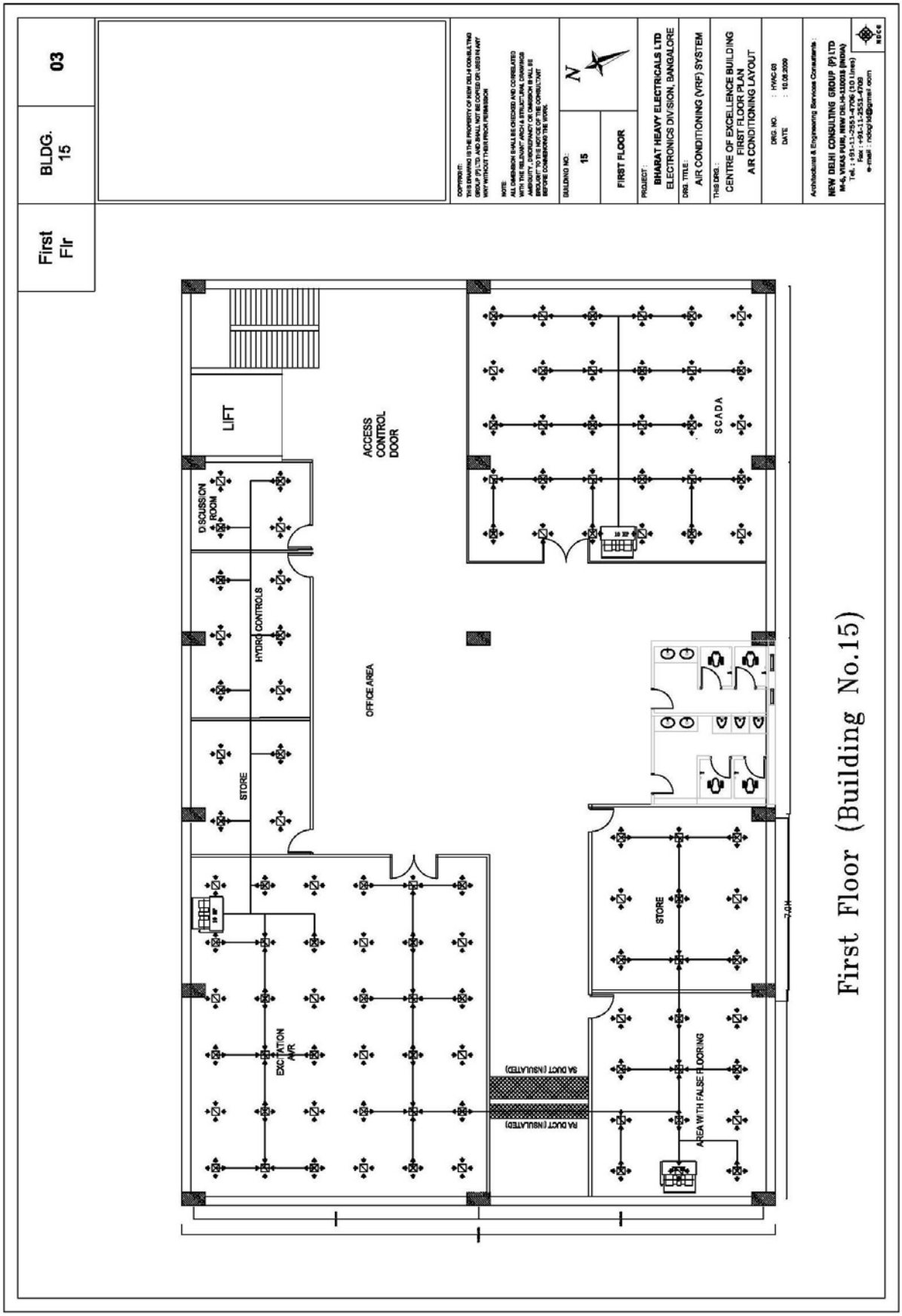
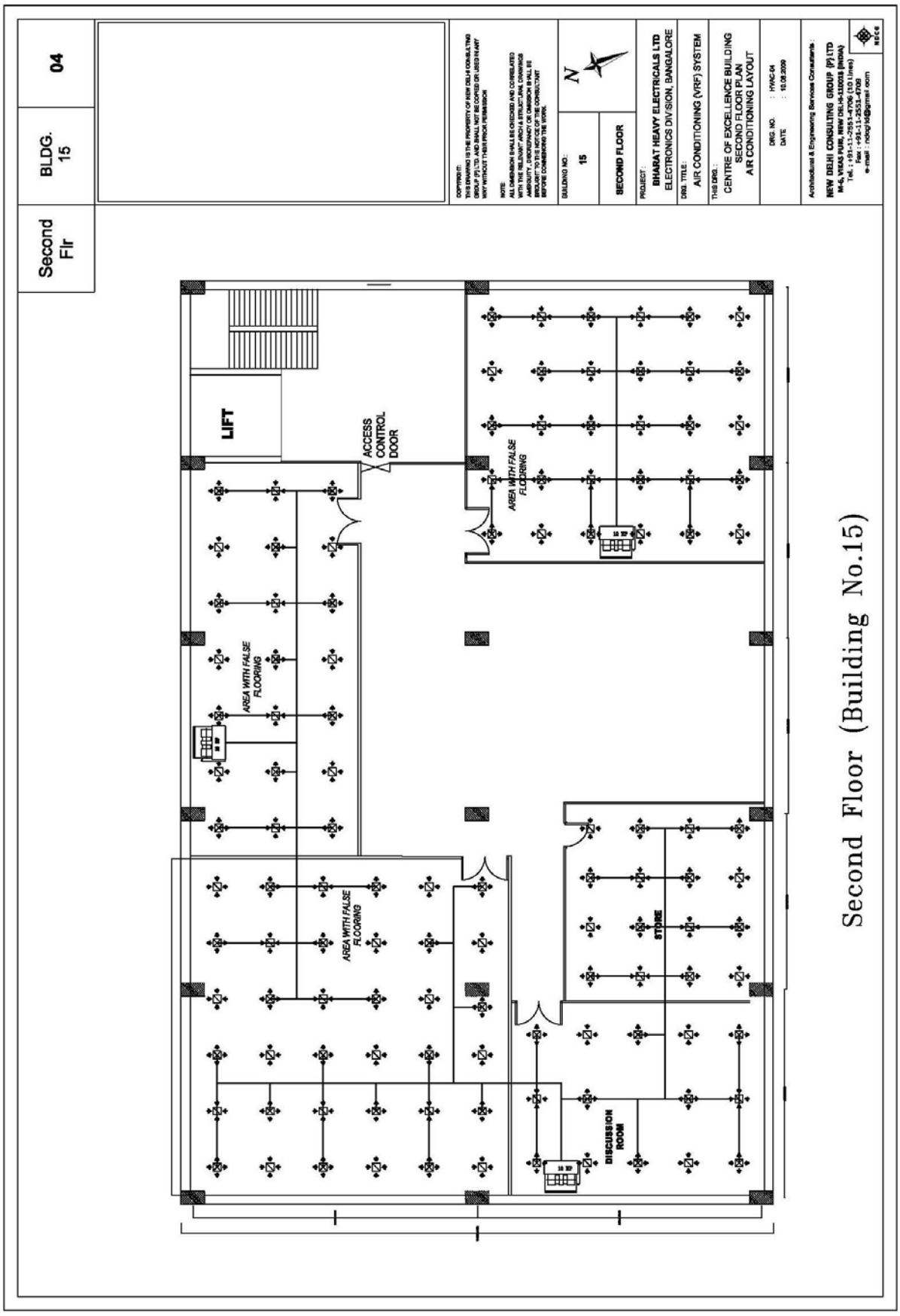
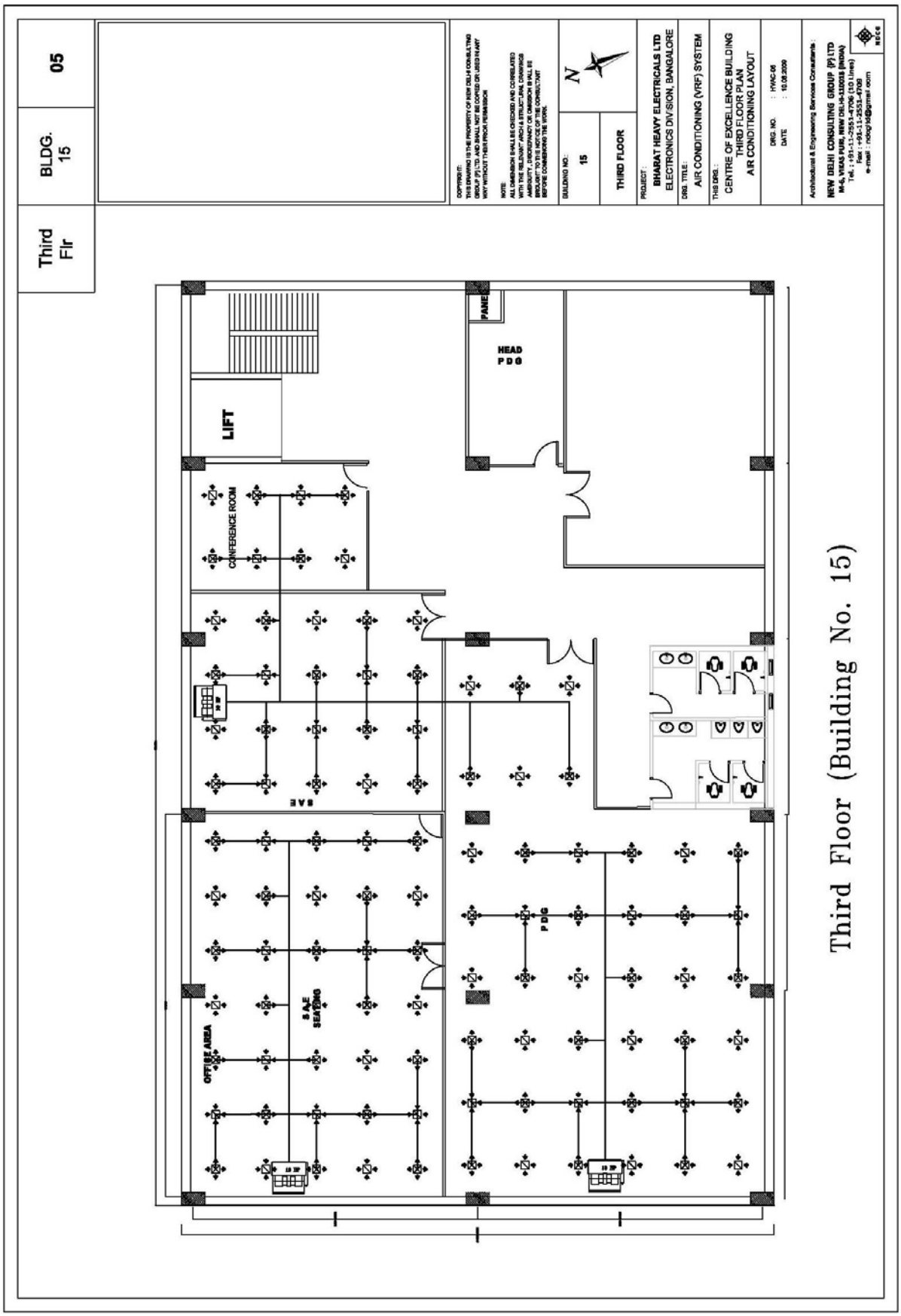
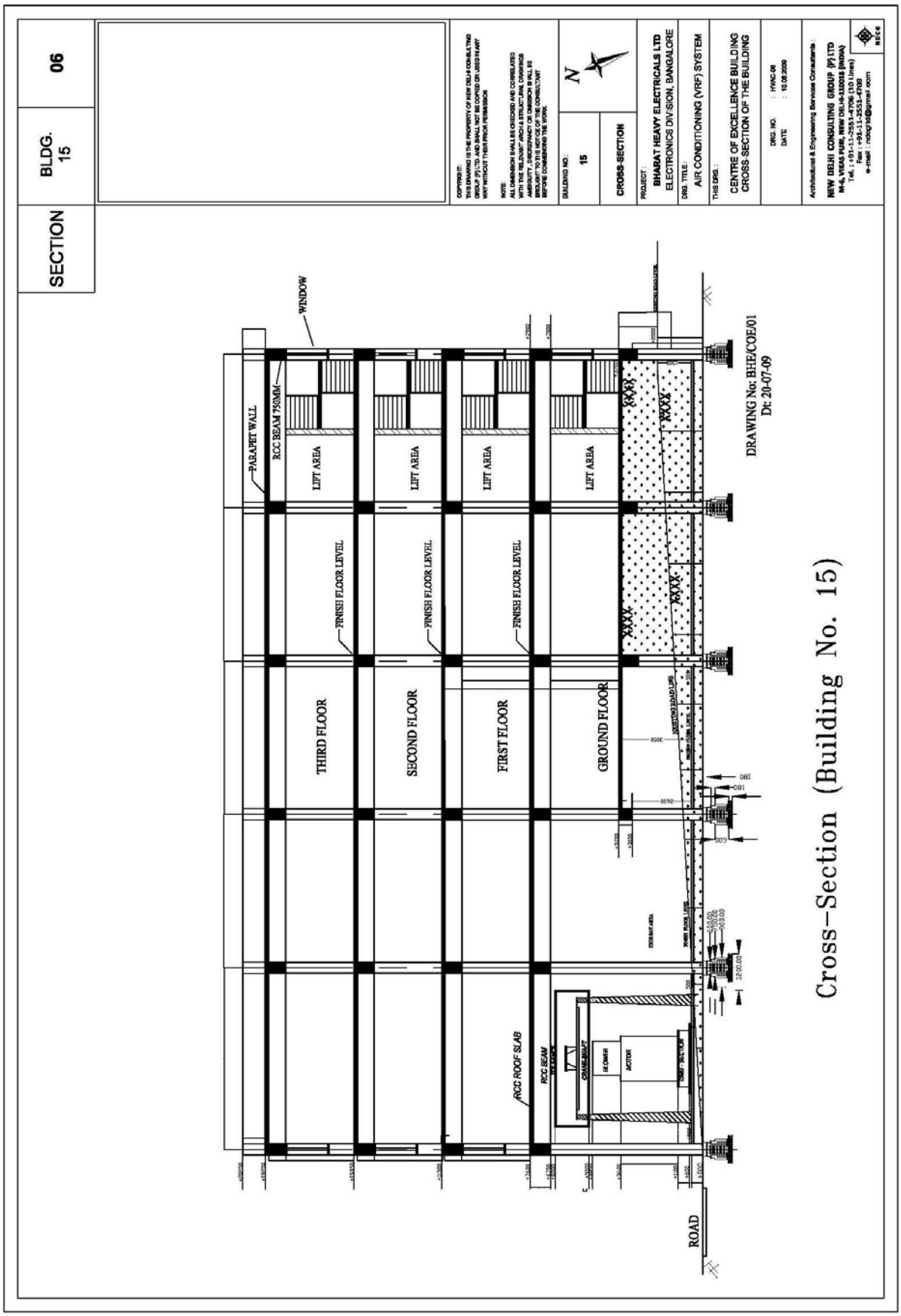
NOTE:
ALL DIMENSION SHALL BE CHECKED AND CORRELATED WITH THE RELEVANT ARCH & STRUCTURAL DRAWINGS AND ANY DISCREPANCY SHALL BE BROUGHT TO THE NOTICE OF THE CONSULTANT BEFORE COMMENCING THE WORK.
BUILDING NO.: 15
SITE PLAN
PROJECT:
BHARAT HEAVY ELECTRICALS LTD
ELECTRONICS DIVISION, BANGALORE
DRG. TITLE:
AIR CONDITIONING (VRF) SYSTEM
THIS DRG.:
SITE PLAN SHOWING
CENTRE OF EXCELLENCE BUILDING
(i.e. BUILDING NO.15)
DRG. NO. : HVAC-01
DATE : 10.08.2009
Architectural & Engineering Services Consultants:
NEW DELHI CONSULTING GROUP (P) LTD
M-6, VIKAS PURI, NEW DELHI-110018 (INDIA)
Tel. : +91-11-2553-4706 (10 Lines)
Fax : +91-11-2553-4708
e-mail : ndcg1@gmail.com
OPEN CAR PARKING AREA
TOTAL AREA OF THE FACTORY = 105273 SQM (26 ACRES)
(–) LESS AREA SURRENDER TO BMRCL = 361.12 SQM.
NET AREA AVAILABLE = 104911.88 SQM (25 ACRES 37.2 GUNTAS).
FACTORY LAYOUT PLAN
53.48
3.05
30.42
16.95
BMRCL


Ground Flr
BLDG. 15
02
BUILDING NO.: 15
GROUND FLOOR
PROJECT: BHARAT HEAVY ELECTRICALS LTD ELECTRONICS DIVISION, BANGALORE
DRG. TITLE: AIR CONDITIONING (VRF) SYSTEM
THIS DRG.: CENTRE OF EXCELLENCE BUILDING GROUND FLOOR PLAN AIR CONDITIONING LAYOUT
DRG. NO. : HVAC-02
DATE : 10.08.2009
ACCESS CONTROL DOOR
PANEL ROOM
DISCUSSION ROOM
PANTRY
ESD FLOORING
CONTROLLER STRATION
GBT GATE DRIVER FACILITY
MULTI DISP SIMULATION FUNCTION
GROUND FLOOR HIGH BAY AREA
Ground Floor (Building No.15)


First Flr
BLDG. 15
03
LIFT
ACCESS CONTROL DOOR
SCADA
D.SCUSSION ROOM
HYDRO CONTROLS
OFFICE AREA
STORE
STORE
EXCITATION AVR
SA DUCT (INSULATED)
RA DUCT (INSULATED)
AREA WITH FALSE FLOORING
7.0 M
First Floor (Building No.15)


Second Flr
BLDG. 15
04
SECOND FLOOR
BUILDING NO.: 15
PROJECT: BHARAT HEAVY ELECTRICALS LTD ELECTRONICS DIVISION, BANGALORE
DRG. TITLE: AIR CONDITIONING (VRF) SYSTEM
THIS DRG.: CENTRE OF EXCELLENCE BUILDING SECOND FLOOR PLAN AIR CONDITIONING LAYOUT
DRG. NO. : HVAC-04
DATE : 10.08.2009
LIFT
ACCESS CONTROL DOOR
AREA WITH FALSE FLOORING
AREA WITH FALSE FLOORING
AREA WITH FALSE FLOORING
STORE
DISCUSSION ROOM
Second Floor (Building No.15)


Third Flr
BLDG. 15
05
THIRD FLOOR
BUILDING NO: 15
PROJECT: BHARAT HEAVY ELECTRICALS LTD ELECTRONICS DIVISION, BANGALORE
DRG. TITLE: AIR CONDITIONING (VRF) SYSTEM
THIS DRG.: CENTRE OF EXCELLENCE BUILDING THIRD FLOOR PLAN AIR CONDITIONING LAYOUT
DRG. NO. : HVAC-06
DATE : 10.08.2009
Architectural & Engineering Services Consultants:
NEW DELHI CONSULTING GROUP (P) LTD
M-6, VIKAS PURI, NEW DELHI-110018 (INDIA)
Tel. : +91-11-2553-4706 (10 Lines)
Fax : +91-11-2553-4708
e-mail : ndcg@gmail.com
LIFT
HEAD PDG
CONFERENCE ROOM
PANEL
SAE
OFFICE AREA
SAE SEATING
PDG
Third Floor (Building No. 15)


SECTION
BLDG. 15
06
BUILDING NO: 15
CROSS-SECTION
PROJECT: BHARAT HEAVY ELECTRICALS LTD ELECTRONICS DIVISION, BANGALORE
DRG. TITLE: AIR CONDITIONING (VRF) SYSTEM
THIS DRG.: CENTRE OF EXCELLENCE BUILDING CROSS SECTION OF THE BUILDING
DRG. NO. : HVAC-06
DATE : 10.08.2009
Architectural & Engineering Services Consultants:
NEW DELHI CONSULTING GROUP (P) LTD
M-6, VIKAS PURI, NEW DELHI-110018 (INDIA)
Tel. : +91-11-2553-4706 (10 Lines)
Fax : +91-11-2553-4708
e-mail : ndcg1@gmail.com
DRAWING No: BHE/COE/01
Dt: 20-07-09
WINDOW
PARAPET WALL
RCC BEAM 750MM
LIFT AREA
FINISH FLOOR LEVEL
THIRD FLOOR
SECOND FLOOR
FIRST FLOOR
GROUND FLOOR
RCC ROOF SLAB
RCC BEAM
ROAD
Cross-Section (Building No. 15)

## Annexure-II

## Questionnaire

**Questionnaire to be answered by the tenderer by ticking the suitable boxes**

| S.No. | Description | Yes | No |
|---|---|---|---|
| 01 | Whether the tenderer has understood the scope of work as indicated in the tender. (If there is any clarification required, the same may be got cleared from the Executive in charge, before submitting the offer.) | | |
| 02 | Whether the tenderer has agreed to all terms and Conditions given in the tender. (If there is any deviation, the same may be mentioned in separate sheet. | | |
| 03 | Whether the tenderer agrees for the payment terms mentioned in the tender. | | |
| 04 | Whether the tenderer has their own code for ESI and PF. (If the tenderer does not possess their own code their offer will not be considered. Paying the PF and ESI on another agency's name / sister concern is not acceptable.) | | |
| 05 | Whether the tenderer agrees to comply with all statutory regulation. | | |
| 06 | Whether the tenderer agrees to give validity of offer for 3 months from the date of opening of technical bid. | | |
| 07 | Whether the tenderer agrees to company with all safety Standards as mentioned in the tender specification. | | |
| 08 | Whether the tenderer has agreed to submit EMD of Rs. 100,000/- (Rs One Lakh) and has submitted the same along with technical bid. (If not enclosed, the tender will not be considered.) | | |
| 09 | Whether the tenderer has enclosed the DD for Rs. 1,000/- towards the cost of Tender Document, along with the Technical bid. (In case of tender documents are down loaded from BHEL web site.) | | |
| 10 | Whether the tenderer has service Tax registration No. (If they do not have the same, the offer will not be considered.) | | |
| | | | |

| S.No. | Description | Yes | No |
|---|---|---|---|
| 11 | Whether the tenderer has agreed to submit Security Deposit immediately after receipt of the work order as mentioned in the tender. | | |
| 12 | Whether the tenderer has enclosed the list of clients with addresses and contact person. | | |
| 13 | Whether the tenderer has enclosed the list of similar works already done / being done with the addresses and contact person. | | |
| 14 | Whether the tenderer has enclosed the certificates received from Government / Reputed organization for the similar work done. | | |
| 15 | Whether the tenderer has enclosed the list of technical personnel their qualification and experience who will be in charge for this work. | | |
| 16 | Whether the tenderer has indicated the address of their local offer in Banglore along with the phone no. & fax no. etc. | | |
| 17 | Whether the tenderer has enclosed the solvency certificate obtained from a bank for a value not less than the estimated cost of the work. | | |
| 18 | Whether the tenderer has enclosed the copy of Power of Attorney (if applicable) | | |
| 19 | Whether the tenderer has enclosed the certificate to establish that the tenderer is an independent contractor working on his own. | | |
| 20 | Whether the tenderer has agreed to supply materials as per the Approved makes as mentioned in the tender. | | |
| 21 | Whether tenderer has agreed to insure all supplying materials and his labours. | | |

**Note :** If any of the question is not applicable, please mention as “Not Applicable”

## ANEXURE: 'B'

## GENERAL CONDITIONS OF CONTRACT

It is hereby agreed by me/us that the BHEL General Conditions of Contract including subsequent amendments/ additions/ deletions to clauses if any, and conditions pertaining to the settlement of disputes by Arbitration form an integral part of the tender documents and that the tender submitted by me / us is subject to the aforesaid BHEL General Conditions of Contract which has been read and accepted by me/us.

## ANNEXURE 'C'

## CLAUSE 20 OF GENERAL CONDITIONS OF CONTRACT

### LABOUR

The Contractor shall employ labour in sufficient numbers either directly or through sub-contractors to maintain the required date of progress and of quality to ensure workmanship to the degree specified in the contract and to the satisfaction of the Engineer-in-charge. The contractor shall not employ, in connection with the works, any person who has not completed eighteen years of age.

The Contractor shall furnish to the Engineer-in-charge, at the intervals specified by him, a distribution return of the number and description by trades of the work people employed on the works. The Contractor shall also submit on the 4th and 19th of every month to the Engineer-in-charge a true statement showing in respect of the second half of the preceding month and the first half of the current month ( i ) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them and ( ii ) the number of female workers who have been allowed maternity benefits as provided in the Maternity Benefit Act, 1961 or Rules made there under and the amount paid to them.

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 Contractor's Labour Regulations.

The Contractor shall in respect of labour employed by him, either directly or through sub-contractors, comply with or cause to be complied with contractor's labour Regulations in regard to all matters provided therein.

The Contractor shall comply with the provisions of the payment of Wages Act, 1936, Minimum Wages Act, 1948, Workmen's Compensation Act 1923, Industrial Disputes Act, 1947, Maternity Benefit Act 1961, or any modifications thereof or any other law relating there to and rules made thereunder from time to time.

The Contractor shall be liable to pay his contribution and the employees' contribution of the State Insurance Scheme in respect of all labour employed by him for the execution of the contract, in accordance with the provision of "The Employees' State Insurance Act, 1948," as amended from time to time. The Contractor shall apply to the ESI Authorities, get himself registered with them and obtain a code Number. He shall pay the remittances under his Code Number only.

The Contractor shall be liable to his contribution and the employees contribution towards PF as per Provident Fund Rules and Regulations, in respect of all labour employed by him for the execution of the contract. The Contractor shall apply to the PF Authorities, get himself registered and obtain a code number from them. He shall pay the remittances towards PF under his code number only.

The Engineer-in-charge shall, on a report having been made by an Inspecting Officer as defined in the Contractor's Labour Regulations, have the power to deduct from the moneys due to the contractor any sum required or estimated to be required, for making good the loss suffered by a worker or workers by reason of non fulfillment of the conditions of the contract for the benefit of workers, non-payment of wages or of deductions made from his or their wages which are not justified by the terms of the Contract of non observance of the said Contractor's Labour Regulations.

The Contractor shall indemnify BHEL against any payment to be made under and for observance of the Regulations aforesaid without prejudice to his right to claim indemnity from his sub-contractors.

In the event of the Contractor committing a default or breach of any of the provisions of the aforesaid contractor's Labour Regulations, as amended from time to time or furnishing any information or submitting or filling any form / Register / Slip under the provisions of these Regulations which is materially incorrect, then, on the report of the Inspecting Officers as defined in the Contractors Labour Regulations, the Contractor shall without prejudice to any other liability pay to BHEL a sum not exceeding Rs. 50/- as liquidated damages for every default, breach, or furnishing, making, submitting, filling materially incorrect statements as may be fixed by the Engineer – In – Charge and in the event of the contractor's default continuing in this respect, the liquidated damages may be enhanced to Rs. 50/- per day for each day of default subject to a maximum percent of the estimated cost of works put to tender. The Contractor shall defend the case by himself any action brought in by such Government Agencies for non-compliance of any Labour Regulations and / or reimburse the expenses incurred by BHEL in this regard.

The Engineer-in-charge shall deduct such amount from bills or security deposit of the Contractor and credit the same to the welfare fund constituted under Regulations. The decisions of the Engineer-in-charge in this respect shall be final and binding.

## MODEL RULES FOR LABOUR WELFARE

The Contractor shall, at his own expense, comply with or cause to be complied with Model Rules for Labour Welfare as appended to these conditions or rules framed by Government from time to time, for the protection of health and for making sanitary arrangements for workers employed directly or indirectly on the works. In case the Contractor fails to make arrangements as aforesaid, the Engineer-in-charge shall be entitled to do so and recover the cost thereof from the contractor.

# SAFETY CODE

## RESPOSIBILITIES OF THE CONTRACTOR IN RESPECT OF SAFETY OF MEN, EQUIPMENT, MATERIAL AND ENVIRONMENT

1. Before commencing the work, the contractor is required to submit a "SAFETY PLAN" to the authorised BHEL Official. The 'Safety Plan' shall indicate, in detail, the measure that would be taken by the contractor to ensure safety of men, equipment, material and environment during execution of the work. The plan shall take care to satisfy all requirements specified hereunder. The contractor shall submit safety plan along with his offer. During negotiations before placing of work order and during execution of the contract, BHEL shall have right to review and suggest modification in the Safety Plan. The contractor shall abide by BHEL's decision in this respect.

2. The contractor shall take all necessary safety precautions and arrange for appropriate appliances as per direction of BHEL, or its authorised officials, to prevent loss of human lives, injuries to personnel engaged, and damage to property and environment.

3. The contractor shall provide to its work force and ensure the use of the following personal protective equipment as found necessary and as directed by the authorised BHEL officials:-

   ( i ) Safety Helmets conforming to IS – 2925: 1984.
   ( ii ) Safety Belts conforming to IS – 3521: 1983.
   ( iii ) Safety Shoes conforming to IS – 1989: 1978.
   ( iv ) Eye and Face Protection devices conforming to IS – 8520: 1977 and IS – 8940: 1978.
   ( V ) Hand and body protection devices conforming to:
   IS – 2573: 1975
   IS – 6994: 1973
   IS – 8807: 1978
   IS – 8519: 1977.

   All tools, tackles, lifting appliances, material handling equipment, scaffolds, cradles, safety nets, ladders, equipment etc. used by the contractor shall be of safe design and construction. These shall be tested and certificate of fitness obtained, before putting them to use and from time to time as instructed by authorised BHEL official who shall have the right to ban the use of any item.

   All electrical equipment, connections and wiring for constructions, power, its Distribution and use shall conform to the requirement of Indian Electricity Act and Rules. Only electricians licensed by the appropriate statutory authority shall be employed by the contractor to carry out all types of electrical works. All electrical appliances including portable electric tools used by the contractor shall have safe plugging system to source of power and be appropriately earthed.

   The Contractor shall not use any hand – lamp energised by electric power with supply voltage of more than 24 Volts. For work in confined spaces, lighting shall be arranged with power source of not more than 24 Volts.

The contractor shall adopt all fire safety measures as laid down in the "Code for Fire Safety at Construction sites" issued by the Safety Department of the Construction management

( HQ ) of BHEL and as per the directions of the authorised BHEL official. A copy of the above referred

"Code of Fire Safety at Construction Sites" shall be made available by BHEL to the contractor for reference, on demand by the contractor, during tendering stage itself.

Where it becomes necessary to provide and/or store Petroleum Products, explosives, chemicals and liquid or gaseous fuel or any other substance that may cause fire or explosion, the contractor shall be responsible for carrying out such provisions and/or storage in accordance with the rules and regulations laid down in the relevant government acts, such as Petroleum Act, Petroleum and Carbides of Calcium Manual of the Chief Controller of Explosives, Govt. of India etc., Prior approval of the authorised BHEL official at the site shall also be taken by the contractor in all such matters.

The contractor shall arrange at his cost ( wherever not specified ), appropriate illumination at all work spots for safe working when natural daylight may not be adequate for clear visibility.

The contractor shall be held responsible for any violation of statutory regulations local, state or central and BHEL instructions, that may endanger safety of men, equipment, material and environment in his scope of work or another contractor's or agency's. Cost of damages if any, to life and property arising out of such violation of statutory regulations and BHEL instructions, shall be borne by the contractor.

In case of a fatal or disabling injury / accident to any person at construction sites due to lapses by the contractor, the victim and/or his/her dependents shall be compensated by the contractor as per statutory requirements. However, if considered necessary, BHEL have the right to impose appropriate financial penalty on the contractor and recover the same from payments due to the contractor for suitably compensating the victim and/or his/her dependents. Before imposing any such penalty, appropriate enquiry shall be held by BHEL giving opportunity to the contractor to present his case.

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

In case of any delay in the completion of a job due to mishaps attributable to lapses by the contractor, BHEL shall have right to recover cost of such delay from payments due to the contractor, after notifying the contractor suitably and giving him opportunity to present his case.

If the contractor fails to improve the standards of safety in its operation, to the satisfaction of BHEL, after being given a reasonable opportunity to do so and / or / if the contractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions regarding safety issued by the authorised BHEL official, BHEL shall have the right to take corrective steps at the risk and cost of the

contractor, after giving a notice of not less than seven days, indicating the steps that would be taken by BHEL.

The contractor shall submit report of all accidents, fires and property damage, dangerous occurrence to the authorised BHEL official immediately after such occurrence, but in any case not later than twelve hours of the occurrence. Such reports shall be furnished in the manner prescribed by the contractor to the authorised BHEL official from time to time as prescribed.

Before commencing the work, the contractor shall appoint/nominate a responsible officer to supervise implementation of all safety measures and liaison with his counterpart of BHEL.

If the Safety record of the contractor is to the satisfaction of Safety Department of BHEL, issue of an appropriate certificate to recognise the safety performance of the contractor may be considered by BHEL after completion of the job.

## ANNEXURE: 'D'

## CLAUSE 38 OF BHEL GENERAL CONDITIONS OF CONTRACT

INSURANCE OF WORKS AGAINST DAMAGE AND LOSS DUE TO FIRE, STRIKE, TEMPEST, FLOODS, EARTHQUAKE, RIOT AND AGAINST DAMAGE BY AIRCRAFT

The contractor shall, within one month after the date of acceptance of the contract, insure the work against loss and damage by fire, tempest, floods, earthquake, riots, strike and against damage by aircraft with an insurance office approved by the accepting officer, from the date of acceptance of work or actual commencement of work whichever is earlier. Such insurance shall be effected in the name of BHEL and shall be for the full value of the contract sum. The contractor shall lodge with BHEL the policies and receipts of the premiums for such insurance and shall maintain such policies in force until the entire completion of the work as certified by the Engineer – In - Charge.

If the contractor fails to comply with the terms of this condition, the accepting officer may insure the work and may deduct the amount of premiums from any money that may become payable to the contractor or may at his discretion refuse payment of any advance/payment to the contractor until the contractor shall have complied with the terms of this condition.

Such insurance whether effected by the Accepting officer or the Contractor shall not be a limit or bar to the liability and obligation of the contractor to complete the entire work in all respects as certified by the Engineer – In – Charge.

In case of such a loss or damage as aforesaid, the money payable under any such insurance shall be received and may be retained by BHEL until the work is finally completed and shall then be credited to the contractor in the final statement of accounts in the event of the contract not having been previously cancelled under these conditions, after taking into account the delay in completion, settlement to his workers for damages, damage to BHEL's Property etc.

## ANNEXURE 'E'

## CLAUSE 58 OF GENERAL CONDITIONS OF CONTRACT

**ARBITRATION:**

Except where otherwise provided for in the contract, all questions and disputes relating to the meaning of the specifications, designs, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works, or the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the sole arbitration of the Executive Director/General Manager of BHEL and if the Executive Director/General Manager is unable or unwilling to act to the sole arbitration, some other person appointed by the Executive Director/General Manager, willing to act as such Arbitrator. There will be no objection if the arbitrator so appointed is an employee of BHEL-EDN or an employee of any other unit of BHEL and that he had to deal with the matters to which the contract relates and that in the course of his duties as such he had expressed views on all or any of the matters in dispute or difference. The Arbitration to whom the matter is originally referred being transferred or vacating his office or being unable to act for any reason, such Executive Director/General Manager as aforesaid at the time of such transfer, vacation of office or inability to act, shall appoint another person to act as Arbitrator in accordance with the terms of the contract. Such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor. It is also a term of this contract that no person other than a person appointed by such Executive Director/General Manager or an employee appointed as Arbitrator as aforesaid should act as Arbitrator and the Arbitrator shall give reasons for the award.

Subject as aforesaid the provision of the Arbitration Act, 1940 or any statutory modification or re-enactment thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceeding under this clause.

It is a term of the contract that the party invoking arbitration shall specify the dispute or disputes to be referred to arbitration under this clause, together with the amount or amounts claimed in respect of each such dispute.

The arbitrator ( s ) may from time to time with consent of the parties extend the time, for making and publishing the award.

The work under the contract shall, if reasonably possible, continue during the arbitration proceedings and no payment due or payable to the contractor shall be withheld on account of such proceedings.

The arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties fixing the date of the first hearing. The arbitrator shall give a separate speaking award in respect of each dispute or difference referred to him.

The venue of arbitration shall be such place as may be fixed by the arbitrator in his sole discretion. The award of the arbitrator shall be final, conclusive and binding on all parties to this contract.

## ANNEXURE 'F'

BHARAT HEAVY ELECTRICALS LIMITED
ELECTRONICS DIVISION
&
ELECTRONICS SYSTEMS DIVISION
BANGALORE

### HEALTH, SAFETY & ENVIRONMENTAL POLICY

**T**he Management is committed to be an environmentally sound company in its activities, products, services and to provide safe and healthy working environment covering its employees, products & services as an integral part of business performance through :

- **C**ompliance with applicable Legislation and Regulations
- **S**etting objectives and targets to eliminate / control / minimise environmental pollution, risks due to Occupational Health and Safety Hazards
- **P**romotion of activities for conservation of resources by environmental management with focus on oil, electrical energy and chemicals
- **E**nhancement of Environmental, Safety and Occupational Health awareness amongst employees, customers, suppliers, contractors by pro-active communication
- **R**egular evaluation and pro-active measures for prevention & control of environmental pollution/accidents / occupational diseases
- **A**ppropriate training of employees and interested parties on Health, Safety & Environmental ( HSE ) aspects
- **F**ormulation and maintenance of HSE Management Programs for continual improvement
- **P**eriodic review & audit of HSE Management System to ensure its continuing suitability, adequacy and effectiveness
- **C**ommunication of HSE Policy to all employees and interested parties
- **C**o-operation with concerned agencies / regulatory bodies engaged in HSE activities.

**EXECUTIVE DIRECTOR**
BHEL ( EDN ) BANGALORE

**BHARAT HEAVY ELECTRICALS LIMITED**

**ELECTRONICS DIVISION**

**BANGALORE – 560026**

# GENERAL CONDITIONS OF CONTRACT

# FOR

# LUMP-SUM, ITEM-RATE AND PERCENTAGE

# CONTRACT

# REVISED GENERAL CONDITIONS OF CONTRACT w.e. f. 1-4-1975

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Condition
Number Description

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## DEFINITIONS

In these general conditions of contract, the following terms shall have the meaning hereby assigned to them except where the context otherwise requires:

a) The "CONTRACT" means the documents forming the tender and acceptance thereof , together with all the document referred to therein including general and Special Conditions of Contract, Schedules 'A', 'B', 'C', 'D', 'E' and/or General Summary attached to the form of tender, the Karnataka P.W.D. Schedule of Rates as amended up to 1979-80 the specifications and the Drawings. All these documents as applicable taken together shall be deemed to form one contract and shall be complementary to one another.

b) The ''TENDER DOCUMENTS'' means the form of tender, the applicable schedules 'A', 'B', ' C', 'D', 'E' and / or General summary, General and Special conditions of contract and the specifications and / or drawings as given to contractors on payment for the purpose of preparing their tenders

c) The 'WORK' means the work described in the tender documents, in individual work orders and/ or accompanying drawings and specifications as may be issued from time to time to the Contractor by the senior Engineer (Civil) deputy manager (projects) or the Engineer- in-charge within the powers conferred upon them, including all modified or additional works and obligations to be carried out either at the site or at any Factory workshop or other place as required for the performance of the contract.

d) The ''SITE'' means the land and /or other places on, in, into or through which the work is to be executed under the contract or any adjacent land , path or street which may be allotted to or used for the purpose of carrying out the contract.

e) The ''CONTRACTOR'' means the individual, firm or company, whether incorporated or not, undertaking the work and shall include the legal personal representatives of such individuals or the persons composing the firm or company, or the successors of the firm or Company and the permitted assigns of such individual or firm or company.

f) The abbreviations DGM/P, Sr. M/P, S.E/C means Dy. General Manager /Projects, Senior Manager / Projects, and Senior Engineer / Civil respectively, who direct the contract and the letters E/C means Engineer / Civil in-charge of the particular work pertaining to the contract.

g) The "Engineer – in – charge" means the Engineer / Civil deputed by Senior Engineer / Civil to supervise the work, or part of the work.

h) "APPROVED" and "DIRECTED" means the approval or direction of the DGM/P. Sr. M/P, or S.E/C. or person deputed by them for the particular purpose.

i) "BHARAT HEAVY ELECTRICALS LIMITED" hereinafter referred to as BHEL Shall mean the board of directors, Resident Director, General Manager/ Project Administrator or other Administrative Officers, of the said company including the project officer, Sr, Manager / Projects, or Senior Engineer / Civil, Engineer/ Civil authorised to invite tenders and enter

into the contracts for works on behalf of "Bharat Heavy Electrical Limited", unit : Electronics Division, Mysore Road, Bangalore – 26.

j) In the case of lumpsum contracts, CONTRACTOR'S PERCENTAGE" means the percentage offered by the contractor as addition to or deduction from the cost of buildings, or other works listed in schedule, 'A' to provide a lump sum quotation for performance of the contract inclusive of all extra costs, profit, establishment charges, carriage, insurance etc., complete.

1. In the case of percentage rate contracts, " Contractor's percentage" shall, if the context so permits, mean the uniform percentage tendered by the contractor and accepted by the Accepting Officer, and the expression " CONTRACT RATE" shall like wise mean the rates in the K.P.W.D. schedule of rate as amended up to 1979-80 as adjusted by the said Contractor's percentage, if any.

k) The " CONTRACTOR SUM" means the sum accepted, or the sum calculated in accordance with the
prices accepted in the tender and / or the contract rates as payable to the Contractor for the entire execution and full completion of the work.

l) the "FINAL SUM" means the actual amount payable under the contract by BHEL, to the Contractor for the entire execution and full completion of the work.

m) The " DATE OF COMPLETION" is the date or dates for completion of the whole or any part of the work as set out in or ascertained in accordance with the individual work orders or the tender documents ,or any subsequent agreed amendments thereto.

n) A "WEEK" means seven days without regard to the number of hours worked or not worked in any day in that week.

o) A"DAY" means a day of 24 (Twenty four) hours irrespective of number of hours worked or not in that day.

p) A "WORKING DAY" means any day other than that prescribed by the Negotiable instruments ACT as being a holiday , consists of the number of hours of labour as commonly recognised by good employers in the trade in the District where the work is carried out or as laid down in the BHEL Regulations.

q) "DEVIATION ORDER" means an order given by the Senior Engineer/Civil or Engineer-in-charge to effect an alteration ,addition or deduction, which dose not radically affect the scope of nature of the contract.

r) "EMERGNCY WORK" means any urgent measures which , in the opinion of the Engineer-in-charge , become necessary during the progress of the work to obviate any risk of accident or failure or which become necessary for security.

s) "PROVISIONAL SUM" or "PROVISIONAL LUMPSUM" means a lump-sum included by the BHEL in the tender documents and represents the estimated value of work for which details are not available at the time of inviting the tender.

t) "PROVISIONAL ITEMS" means items for which approximate quantities have been included in the tender documents.

u) "DAY WORK" means on item of work requiring the employment of labour with or without materials as the case may be , which, in the opinion of the Senior Engineer /Civil-in-charge, is not capable of being evaluated by the accepted methods of measurement or assessment and is paid for on the basis of the actual labour and materials utilised on the particular item of work referred to.

## Chapter-II

## SCOPE OF CONTRACT

### 1. HEADING TO THE CONTRACT

The heading to these conditions shall not affect the interpretation thereof

### 2. CONTRACT DOCUMENTS:

The accepting officers shall furnish to the Contractor on demand "FREE OF COST" three copies of signed Drawings and one copy of the signed agreement comprising of preamble to Agreement , General and Special Specifications , Schedules 'A' 'B' 'C' 'D' and 'E' etc. ,(but excluding General Conditions of Contract and Drawings) and three copies of all further drawings issued during the progress of work.

However , for any additional copies of the agreement or drawings required by the Contractor , the same will be supplied on payment of the Specified Cost.

The contractor shall keep one copy of all the drawings and of the specifications on the site and the Engineer-in-charge or his representative shall at all reasonable times have access to them.

### 3. WORK TO BE CARRIED OUT :

The Contract shall, expect as provided under Schedules 'B' and 'C' include all labour , materials, tools, plant , equipment and transport which may be required in preparation for , and in the entire execution and full completion of the work. Schedule 'A' shall be deemed to have been prepared in accordance with good practice and recognised principles and unless otherwise stated, the descriptions given therein shall be held to include waste on materials, carriage and cartage, lead, return of empties, hoisting, setting, fitting in position and all other labour necessary in and for the entire execution and full completion aforesaid. Any error in description or quantity in Schedule 'A' or any omission therefrom shall not vitiate the Contract or release the Contractor from the execution of the whole or any part of the work comprised therein according to the drawings and specifications, or from any of his obligations under the contract. The insertion of the name of any firm of suppliers in the Tender Documents is for the purpose of obtaining a particular class or quality of materials or workmanship but the articles or materials specified may be obtained from any other firm subject to the prior written approval of the Senior Engineer / Civil / Engineer/Civil.

In the case of a discrepancy between Schedule 'A' the Specifications and/or the Drawings, the accepting officer shall be the sole deciding authority as to which shall prevail and his decision shall be final and conclusive. If neither drawings nor specifications contain any mention of minor details of construction, which in the opinion of the Accepting Officer whose decision shall be final and conclusive, are reasonable and obvious and fairly intended for the satisfactory completion of the work, such details shall be provided by the Contractor without any extra cost as if they were specially mentioned and shall be deemed to be included in the contract.

The Contractor will be deemed to have satisfied himself as to the nature of the site , local facilities of access and all matters affecting the execution and completion of the work. **No extra** charges consequent on any misunderstanding in these respects or otherwise will be allowed.

## 4. PROVISIONAL ITEMS:

The full amount of provisional lump-sum and the value annexed to each provisional item inserted in the Tender documents shall be deducted from the contract sum and the value of work ordered and executed there under shall be ascertained by measurement or valuation as for deviations.

No work under these items is to be begun without instructions in writing from the Engineer-in –charge.

The extent of quantities or items described as " provisional " shall not be held to guarantee or limit the amount and description of the work to be executed by the Contractor either in respect of the item concerned or the work as a whole.

No addition or deduction shall be made by the Contractor to the amount of the provisional lump-sums as included in the tender documents.

## 5. DIVIATIONS:

The contractor shall not make any alteration in addition to or omission from the work as described in the tender documents except in pursuance of the written instruction of the Engineer –in charge. No such deviation from the work described in the tender documents shall be valid unless the same has been specifically confirmed and accepted by the Accepting Officer in writing and incorporated in the contract.

The accepting Officer may deviate, either by way of addition or deduction, from the work so described, provided that the contractor sum be not thereby varied on the whole by more than the percentage set out in the tender documents. The value of all additions and deductions will be added to , or deducted from the contract sum. Whenever the Accepting Officer intends to exercise such a right, his intention shall specify the deviation which are to be made, the lump sum assessment or the proposed basis of payment, the extra time allowed, if, any and the date for completion of the entire contract.

Any objection by the Contractor to any matter concerning the order shall be notified by him in writing to the Senior Engineer (Civil) / Engineer-in-charge within SEVEN DAYS from the date of such order, but under no circumstances shall the work be stopped (unless so ordered by the Senior Engineer/Civil /E/C) owing to differences or controversy that may arise from such an objection. In the absence of such a notification of objection, by the contractor, he will be deemed to have accepted the order and the conditions stated therein. In the event of the contractor, failing to agree with the Senior Engineer/ Civil /E/C regarding the terms of the proposed deviation, the objections shall be referred to the DGM/P/Sr.M/P, whose decision shall be final, conclusive and binding on the Contractor.

## 6. TIME:

Time is the essence of the contract and is specified in the tender document or in each individual work order.

As soon as possible after the contract is let or any substantial work order is placed and before work under it is begun, the Senior Engineer/Civil or Engineer-in-charge and the contractor shall ( if so required by the Sr. E/C) agree to a time and Progress chart. The chart shall be prepared in direct relation to the time stated in the tender documents or the Work Order for the completion of the individual items thereof, and/or the contract or Orders as a whole. It shall indicate the forecast of the dates for the commencement and completion of the various trade processes or sequences of the work, and shall be amended as may be required by agreement between the Sr. E/C or Engineer-in-charge, and the contractor within the limitation of the time imposed in the tender documents or ORDER.

In the absence of any specific Time and Progress Chart to be agreed to between the Contractor and the Sr. E/C. or Engineer –in-charge, the contractor shall ensure and maintain uninterrupted progress of the work such that the entire work shall be completed within the time imposed in the tender document or order and that the proportion of work completed up to any time in relation to the entire work to be done under the Contract or Order shall not be less than the proportion that the time elapsed bears to total time of completion provided in the Tender Documents or Order.

The Contractor shall suspend the execution of the work, or any part or parts there of whenever called upon in writing by the Engineer –in –charge to do so, and shall not resume work thereon until so directed in writing by the Engineer –in –charge. The Contractor will be allowed an extension of time for completion not less than the period of suspension but no other claim in this respect for compensation or otherwise how so ever will be admitted. This may also be extended to allow for alteration of work made by the deviation order.

## 7. STORES AND MATERIALS:

The contractor shall, at his own expense , supply all stores and materials required for the contract, other than those listed in Schedule ‘B’ which may be provided by Bharath Heavy Electricals Limited at the rates detailed therein subject to their availability at the place of issue indicated therein. All stores and materials to be supplied by the Contractor shall be of the best kind as described in the Specifications and the Contractor shall, if required by the Engineer –in- charge furnish him with proof to his satisfaction that the stores and materials so comply with the specifications.

The contractor shall, at his expense and without delay, supply samples of stores and materials proposed to be used in the execution of the work for the approval of the Engineer-in charge, who may reject all stores and materials not corresponding either in quality or character to the approved samples.

In the case of stores provided under Schedule ‘B’ the Contractor shall bear the cost of loading, transporting to site, unloading, storing under cover as required, assembling & jointing the several parts together as necessary and incorporating & fixing these stores & materials in the work, including all preparatory work of whatever description that may be

required, and closing, preparing, loading and returning empty cases or containers to the place of issue without any extra charges.

## 8. DELAY AND EXTENSION OF TIME:

If, in the opinion of senior Engineer/Civil/engineer/Civil the work is delayed:

i) by reason of abnormally bad weather, or

ii) by reason of serious loss or damage by fire, or

iii) by reason of civil commotion, local combination of workmen, strike or lockout, affecting any of the trades employed on the work, or

iv) by delay on the part of the agency or tradesman engaged by BHEL in executing work not forming part of this contract, or

v) by reason of any other cause which in the absolute discretion of the Sr. M/P. Sr. E/C. or E/C is (when he is the Accepting Officer of the Contract) beyond the contractors control, then in any such case, the Accepting Officer, on the recommendation of the Sr. E/C., E/C (or higher authority) may make fair and reasonable extension in the completion dates of the individual items of work or the contract as a whole. Such extension which will be communicated to the contractor by the Sr. E/C./E/C. in writing shall be final and binding on the contractor. No other claim in this respect for compensation or other wise howsoever is admissible. Upon the happening of any such event causing delay, the contractor shall immediately give notice thereof in writing to the Sr. E/C/E/C but shall nevertheless use constantly his best endeavour to prevent or make good the delay and shall do all that may reasonably be required to the satisfaction of the Sr. E/C/E/C to proceed with the work.

## 9. PATENT RIGHTS:

The contractor shall fully indemnify BHEL, or the agent, servant, or employee of BHEL, against any action, claim or proceeding relating to infringement or the use of any patent or design or any alleged patent or design rights, and shall pay any royalties which may be payable in respect of any article/ or part thereof included in the contract.

In the event of any claims being made or action brought against BHEL, or any agent, or servant or employee of BHEL., in respect of any of the matters aforesaid, the contractor shall immediately be notified thereof for taking necessary action provided that payment of indemnity shall not apply when such infringement has taken place in complying with the specific directions issued by the BHEL….but the contractor shall pay any royalties payable in respect of any such use.

## 10. **OCTROI AND OTHER DUTIES**:

All charges on account of octroi, Terminal or Sales Tax and / or other duties on materials obtained for the work (excluding materials provided by BHEL, on payment) shall be borne by the contractor.

## 11. ROYALTIES:

Royalties fixed from time to time as per prevalent local rules will be recovered for materials, which the contractor may be allowed to remove from quarries situated on land which is in charge of the BHEL ., authorities.

## 12. PLANT AND EQUIPMENT:

The contractor, shall at his own expenses, supply all tools, plant and equipment (herein-after referred to as T & P) required for the execution of the contract, as specified in the tender documents.

## 13. ASSIGNMENT OR TRANSFER OF CONTRACT:

The contractor shall not, without the prior written approval of the Accepting Officer, assign or transfer the contract or any part thereof , or any share, or interest therein to any other person. No sum of money which may become payable under the contract shall be payable to any person other than the contractor unless the prior written approval of the Accepting Officer to the assignment or transfer of such money is given.

a) SUB-CONTRACT:

The contractor shall not sub-let any portion of the contract without the prior written approval of the Accepting Officer

## 14. COMPLIANCE TO REGULATION AND BYE-LAWS :

The contractor shall conform to the provisions of any statute relating to the work and regulations and bye-law of any local authority and of any water and lighting Companies or Undertakings with those system the works is proposed to be connected. He shall before making any variation from the drawings or the specification that may be necessiated for such connection give the Senior Engineer /civil /E/C notice, specifying the variation proposed to be made and the reason therefore and shall not vary out any such variation until he has received instructions from the Senior Engineer/ Civil /E/C in respect thereof. The contractor shall be bound to give all notices required by statute regulations or bye-laws as aforesaid and to pay all fees and taxes payable to any authority in respect thereof.

## CHAPTER-III

## PERFORMANCE OF THE CONTRACT

**16. SECURITY DEPOSIT**:

i) The amount of security money to be deposited for proper fulfillment of the contract will be as follows:

| | | | |
|---|---|---|---|
| a) | For contract valued upto Rs. 1.00 lakh. | ……. | 10% of the contract value. |
| b) | For contract valued above Rs. 1.00 lakh but not exceeding Rs. 2.00 lakhs. | ……. | 10% on the 1st Rs. 1.00 lakh Plus 7 ½ % on the balance of the contract Value. |
| c) | For contracts valued above Rs. 2.00 lakhs. | ……. | 10% on the 1st Rs. 1.00 lakh Plus 7 ½ on the next Rs.1.00 lakh Plus 5% on the balance of the contract value. |

ii) The contractor whose tender may be accepted shall within seven days of receipt by him of the notification of acceptance of his tender, deposit with the BHEL, Unit: Bangalore the prescribed sum as per Clause 16 (i) above towards security deposit.

The Earnest Money Deposited at the time of tender will be treated as part of the Security Deposit and the balance amount to make up the full Security Deposit as refereed to in Clause 16(i) above may be furnished in Cash or in any of the following forms duly pledged to the BHEL Limited.

a) Call Deposit Receipt, Pay Order or Demand Draft.
b) Post Office cash certificates, National Savings Certificates, Treasury Saving Deposit Certificates, National Plan Saving Certificates, 12 year National Defence Certificates and 10 year Deposit Certificates.
c) Fixed Deposit Receipt issued by State Bank of India/ Nationalised Bank/ Scheduled Bank.
d) Bank Guarantee from Nationalised /Scheduled Bank valid for a period inclusive of the maintenance period also after the date of completion of the work, wherever warranted.
e) Insurance Guarantee issued by L.I.C. or any of the four General Insurance Corporations valid for a period inclusive of the maintenance period also after the date of completion of work, where warranted.

Alternatively the requisite amount to make up the full Security Deposit may also be deducted, from each Running bill in respect of the particular contract concerned at 10% (ten percent) of the value of the work done by the Contractor as billed till such deductions along with the Earnest money already deposited by him shall make up the full Security Deposit as per para 16 (i) above.

No interest shall be allowed on Security Deposits.

BHEL, shall not be responsible for any loss of Securities due to liquidation or any other reason whatsoever or any depreciation in the value of the Securities while in their charge or for any loss of interest thereon.

iii) All compensation or other sums of money payable by the Contractor to BHEL under the terms of this contract or under any other contract with BHEL, may be deducted from the Security Deposit or realised by the Sale of Securities or from the Interest arising there-from or from any sums which may be due or may become due to the Contractor payable by BHEL, on any account whatsoever against this contract or any other contract with BHEL, and in the event of his Security Deposit being reduced by reason of such deduction or sale as aforesaid, the contractor shall, within seven days thereafter, make good in cash or in securities endorsed as aforesaid , any sums by which the Security Deposit has been so reduced.

iv) 50% of the Security Deposit may be refunded on completion of the work after payment of the final bill and the balance 50% of the Security Deposit is refunded only after the expiry of the maintenance period of six (6) months from date of completion of work or as stipulated in the contract concerned.

## 17. ORDERS UNDER THE CONTRACT:

All orders, notices etc. to be given under the contract shall be in writing, type script of printed and if sent by registered post to the address given in the tender of the contractor, shall be deemed to have been served on the date when in the ordinary course they would have been delivered to him.

The contractor shall carry out without delay all orders given to him.

## 18. ADMISSION TO SITE:

The contractor shall not enter on ( other than for inspection purposes) or take possession of the site unless permitted to do so by the Senior Engineer/Civil/E/C. The portions of the site to be occupied by the Contractor will be clearly defined and marked on the site plan, and the contractor will on no account be allowed to extend his operations beyond these areas. The Contractor shall provide, if necessary, or required at the site, temporary access thereto and shall alter, modify and maintain the same as required from time to time. He shall take out and clear away the access route when no longer required restoring the area to its original conditions.

The Senior Engineer/Civil/E/C shall have power to execute other works (whether or not connected with the work in the contract agreement) in the site contemporaneously with the execution of the original work and contractor shall give reasonable facilities for this purpose.

BHEL, reserves the right of taking over, at any time, and portion of the site which they may require and the contractor shall at his own expense clear such portion forthwith. No photographs of the site or of the work or any part thereof shall be taken, published or otherwise circulated, without the prior approval of the Senior Engineer/Civil/E/C.

No such approval shall however exempt the contractor from complying with any statutory provisions in regard to the taking and publication of such photographs.

BHEL officials connected with the contract shall have the right of entry to the site at all times.

Senior Engineer/Civil/E/C shall have the power to exclude from the site any person whose admission thereto may, in his opinion, be undesirable for any reason whatsoever.

## 19. CONTRACTORS SUPERVISION:

The Contractor shall either himself supervise the execution of the Contract or shall appoint a competent Agent approved by the senior Engineer/Civil/E/C to act in his stead.

The contractor shall employ an Engineer/Agent having atleast a 'Degree of Bachelor of Civil Engineering' from a recognised University/on any work with a Contract value exceeding rupees two lakhs and having atleast a 'Diploma in Civil Engineering' from a recognised college on work with a contract value exceeding Rs. 50,000/- but not exceeding rupees two lakhs.

The employment of an Engineer/Agent as aforesaid, shall not be necessary if the contractor is in possession of a recognised technical qualification and is in opinion of the Senior Engineer/Civil/E/C capable of receiving instructions of the Engineer-in-charge and of executing the work to the satisfaction of the Engineer-in-charge.

If the contractor fails to appoint a suitable Engineer/Agent as aforesaid, the Senior Engineer/Civil/E/C shall have full powers to suspend the execution of work and stop payment of any advances that may have become due until such date as a suitable Engineer/Agent is appointed and the contractor shall be held responsible for the delay caused to the work and no extension of time on this account shall be given to him as stipulated in condition (9) above.

Orders given to the contractors Agent/Engineer shall be considered to have the same force as if they had been given to the contractor himself.

The contractor or his agent shall be in attendance at the site during all working hours and shall superintendent the execution of work with such additional assistance in each trade as the Senior Engineer/Civil/E/C may consider necessary.

The contractor or his accredited agent shall attend, when required and without making any claim for doing so, either the Office of the Engineer-in-charge or the work-site to receive instructions.

The Senior Engineer/Civil/E/C shall have full powers, and without assigning any reason, to require the contractor immediately to cease to employ in connection with this contract any agent, servant or employee whose continued employment is, in his opinion, undesirable.

The contractor shall not be allowed any compensation on this account.

## 20. LABOUR:

The contractor shall employ labour in sufficient numbers either directly or through sub-contractors to maintain the required date of progress and of quality to ensure workmanship of the degree specified in the contract and to the satisfaction of the Engineer-in-charge. The contractor shall not employ in connection with the works any person who has not completed his fifteen years of age.

The contractor shall furnish to the Engineer-in-charge at the intervals specified by him, a distribution return of the number and description by trades of the work people employed on the works. The contractor shall also submit on the 4th and 19th of every month to the Engineer-in charge a true statement showing in respect of the second half of the preceding month and the first half of the current month (i) the accident that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them and (ii) the number of female workers who have been allowed maternity benefit as provided in the maternity benefit Act, 1961 or Rules made there under and the amount paid to them.

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 contractors labour regulations.

The contractor shall in respect of labour employed by him either directly or through sub-contractors comply with or cause to be complied with contractors Labour Regulations in regard to all matters provided therein.

The contractor shall comply with the provisions of the payment of Wages Act, 1936, Minimum Wages Act, 1948, Employers Liability Act 1938. Workman's Compensation Act, 1923, industrial Disputes Act, 1947, Maternity Benefit Act, 1961 and Mines Act 1952 or any modifications therof or any other law relating there to and rules and there under from time to time.

The contractor shall be liable to pay his contribution and the employees contribution to the State Insurance Scheme in respect of all labour employed by him for the execution of the contract, in accordance with the provision "The Employees" State Insurance Act, 1948" as amended from time to time. In case the contractor fails to submit full details of his account of labour employed and the contribution payable, the Engineer-in-charge shall recover from the running bills of contractor an amount of contribution as assessed by him. The amount so recovered shall be adjusted against the actual contribution payable for employees' State Insurance.

The Engineer-in-charge shall on a report having been made by an inspecting Officer as defined in the contractors labour regulations have the power to deduct from the moneys due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfillment of the conditions of the contract for the benefit of workers, non-payment of wages or of deductions made from his or their wages which are not justified by the terms of the contract or non-observance of the said contractors labour Regulations.

The contractor shall indemnify the BHEL against any payments to be made under for observances of the Regulations aforesaid without prejudice to his right to claim indemnify from his sub-contractors.

In the event of the Contractor committing a default or breach of any of the provisions of the aforesaid Contractors Labour Regulations, as amended from time to time or furnishing any information or submitting or filling any form/Register/Slip under the provisions of these regulations which is materially incorrect, then on the report of the Inspecting Officers as defined in the Contractors Labour Regulation, the contractor shall without prejudice to any other liability pay to the BHEL a sum not exceeding to Rs.50/- as liquidated damages for every default breach or furnishing, making, submitting, filling materially incorrect statement as may be fixed by the Engineer-in-charge and in the event of the contractors default continuing in this respect, the liquidated damages may be enhanced to Rs. 50/- per day for each day of default subject to a maximum percent of the estimated cost of woks put to tender.

The Engineer-in-charge, shall deduct such amount from bills or security deposit of the contractor and credit the same to the Welfare fund constituted under Regulations. The decision of the Engineer-in-charge in this respect shall be final and binding.

**MODEL RULES FOR LABOUR WELFARE:**

The contractor shall at his own expense comply with or cause to be complied with model Rules for Labour Welfare as appended to these conditions as rules framed by Government from time to time for the protection of health and for making sanitary arrangements for workers employed directly or indirectly on the works. In case the contractor fails to make arrangements as aforesaid, the Engineer-in-charge shall be entitled to do so and recover the cost thereof from the Contractor.

**SAFETY CODE:**

The contractor shall at his own expense arrange for the safety provisions as appended to these conditions or as required by the Engineer-in-charge, in respect of all labour directly or indirectly employed for performance of the works and shall provide all facilities in connection therewith. In case the contractor fails to make arrangements and provide necessary facilities as aforesaid, the Engineer-in-charge shall be entitled to do so and recover the cost thereof from the contractor.

Failure to comply with model Rules for Labour Welfare, Safety Code, or of the provisions relating to report on accidents and to grant of maternity benefits to female workers shall make the Contractor liable to pay to the BHEL as liquidated damages an amount not exceeding Rs 50/- for each default or materially incorrect statement. The decision of the Engineer-in-charge in such matters based on reports from the Inspecting Officers as defined in the contractors Labour Regulation as appended to these conditions shall be final and binding and deductions for recovery of such liquidated damages may be made from any amount payable to the Contractor.

## 21. WATER :

The contractor shall allow in his tender and provide at his cost all water required for the work or his employees on the work, together with all pipes and fittings or other means that may be necessary or required to ensure a proper and ample supply of water for all purposes connected with the work.

In the event of a provision existing in the Tender documents for supply of water on payment by Bharat Heavy Electricals Limited, water will be supplied from the BHEL supply System, or other sources at any points fixed by the Senior Engineer/Civil on the site of work. The contractor shall make necessary arrangement for lifting, pumping, carrying or conveying the water as required at his own cost. The levy of water charges to be borne by the Contractor in such case shall be specifically mentioned in the Tender documents.

## 22. TEMPORARY WORKSHOPS, STORES ETC :

The Contractor shall, during the progress of the work provide, erect and maintain at his own expenses all necessary temporary workshops, stores, offices etc., required for the proper and efficient execution of the work. The planning, sitting and erection of these bldgs. Shall have the approval of the Engineer-in-charge and the Contractor shall at all times keep them tidy and in a clean and sanitary condition to the entire satisfaction of the Engineer-in-charge.

On completion of the work all such temporary buildings shall be cleared away and the site restored and left in a clean and tidy condition to the entire satisfaction of the Engineer-in-charge.

## 23. STORES AND MATERIALS ON SITE :

All stores and materials required for the work are to be deposited by the Contractor only in places to be indicated by the Engineer-in-charge.

Where in accordance with the contract stipulations certain Stores and Materials (for incorporation in the work) are to be issued to the Contractor by the BHEL as detailed under Schedule 'E' such times will be so issued only to the extent required for the actual completion of the work as stipulated in the Contract. The decision of the Senior Engineer/Civil/E/C regarding the quantities to be issued as above shall be final and binding on the Contractor. For any excess quantities consumed on the work their cost will be recovered from the Contractor at punitive rates which will be 100%(hundred percent) more than the issue rates of the BHEL.

In regard to the materials and stores which may be issued to the contractor by BHEL the Contractor shall give the Engineer-in-charge reasonable notice in writing of his requirements of such stores and materials and on the approval of his demand being notified to him, he shall make immediate arrangements for drawing the same. Such stores and materials shall be transported by Contractor at his own expenses direct from the place of issue to the site of the work, unless prior written approval is obtained from the Engineer-in-charge to take them to a store or workshop elsewhere.

The Contractor shall have to build a weather-proof shed for the storage of cement required for 15 days consumption of the work.

BHEL officers connected with the Contract shall have the power at any time to inspect and examine any stores or materials indented to be used in or on the work, whether on the site or at any factory or workshop or other place where such stores or materials are being fabricated or manufactured or at any place where the same are lying and the contractor shall give necessary facilities for such inspection and examination.

The Engineer-in-charge shall be entitled to have tests made of any stores or materials supplied by the Contractor who shall provide at his own expense all facilities which the Engineer-in-charge may require for this purpose. If at the discretion of the Engineer-in-charge an independent expert is employed to make any such tests his charges shall be borne by the contractor only if the test discloses that the said stores or materials are not in accordance with the provisions of the contract.

Should the Senior Engineer/Civil/E/C consider at any time during the construction or re-construction, on prior to the expiry of the 'MAINTENANCE PERIOD', that the stores or materials provided by the Contractor are unsound or of a quality inferior to that contracted for, or otherwise not in-accordance with the Contract, (in respect whereof the decision of the Senior Engineer/Civil/E/C shall be final and conclusive) the contractor shall on demand, in writing from the Sr. E/C. E/C specifying the stores or materials complained of, not withstanding that the same may have been inadvertently passed, certified and paid for, forthwith remove the stores or materials so specified and provide other proper and suitable store or materials at his own expense; to the entire satisfaction of the Sr. E/C. E/C and in the event of his failing to do so within a period to be specified by the Sr. E/C. E/C in his demand aforesaid, the Sr. E/C.E/C may replace within others the stores or materials complained of at the risk and expense in all respects of the Contractor. The liability of the contractor under this condition shall not extend beyond the maintenance period aforesaid except as regards stores or materials, which the Sr. E/C.E/C shall have previously given notice of to the contractor to replace. (Maintenance period for any work under this organisation will be six months from the date of actual completion of the particular work and handing over to BHEL).

All stores and materials brought to the site shall become and remain the property of BHEL and shall not be removed from the site without the prior written approval of the Senior Engineer/Civil/E/C. However, when the work is finally completed the Contractor shall at his own expense forthwith remove from the site all surplus stores and materials originally supplied by him and upon such removal, the same shall re-vest in and become the property of contractor. All BHEL stores and materials issued to Contractor for incorporation or fixing in the work and which, making due allowance for reasonable wear and tear/or waste, have not on completion of the work been so incorporated of fixed, shall be returned by the Contractor at his own expense to the place of issue.

Credit for surplus and/or materials returned by the contractor to BHEL will be given to him at a price based on the prevailing market rate but not exceeding that at which the said stores and materials were originally issued to him but due consideration shall be given to the allowance claimed by BHEL in respect of any depreciation or damages suffered by the stores and/or materials whilst in the custody of the contractor regarding which the decision of Sr. E/C/E/C shall be final and conclusive.

If , in the opinion of the Sr. E/C/E/C (which shall be final and conclusive) any stores supplied by BHEL have either during currency of the work or after completion of the work whilst under the custody of the contractor, become damaged to such an extent that they cannot be usefully utilised, either in the same work or in other works, the Sr. E/C.E/C shall not accept the stores and in the extent of his rejecting , the Contractor shall be charged for the said stores at a rate fixed by the Accepting Officer. The Contractor shall not be entitled to any claim what-so-ever on this account.

## 23(a).DEFECTS LIABILYTY PERIOD :

The contractor shall be responsible to make good and remedy at his own expenses within such period as may be stipulated by the Engineer-in-charge, any defect which may develop or may be noticed before the expiry of the maintenance period of six months hereto from the certified date of completion and intimation of which has been sent to the contractor within seven days of the expiry of the said period by a letter sent by hand delivery or by registered post.

## 24. TOOLS AND PLANT ON SITE :

All tools, plant and equipment brought to the site shall become the property of BHEL and shall not be removed from the site without the prior written approval of the Senior Engineer/Civil/E/C. When the work is finally completed or the Contractor is determined for reasons other than the defaults of the contract, he shall forthwith remove from the site all tools, plants, equipment etc., (other than those as may have been provided by BHEL) and upon such removal, the same shall re-vest in, and become the property of the contractor.

## 25. STATEMENT OF HIRE CHARGES :

A monthly detailed statement of the hire charges incurred in respect of BHEL tools, plants, equipment etc., shall be given to the contractor by the Engineer-in-charge.

## 26. PRECAUTIONS AGAINST RISK :

The contractor shall be responsible for providing at his own expense, for all precautions to prevent loss or damage from any and all risks and to minimise the amount of any such loss or damage and for the necessary steps to be taken for the said purpose until the works have been handed over complete in all respects to the Engineer-in-charge.

The contractor shall provide all watchmen necessary, for the protection of the site, the work, the materials, tools, plant, equipment and anything else lying on the site during the progress of the work. He shall solely be responsible for and shall take all reasonable and proper steps for protecting, securing, lighting and watching all places on or about the work and the site which may be dangerous to any person whom so ever.

## 27. NOTICES AND FEES :

The contractor shall give all notices required by any statutory provision or by the regulations and/ or bye-laws of any local authority and / or of any Public Service, Company or Authority affected by the work or with whose system the same are or will be connected. The contractor shall pay and indemnify BHEL against any fees and charges, demandable by law under such

Acts, Regulations and/ or bye-laws in respect of the work and shall make and supply all drawings and plans required in connection with any such notice.

## 28. SETTING OUT OF THE WORKS AND PROTECTIVE AND MAINTAINING SIGNALS AND WORKS :

The engineer-in-charge shall supply dimensioned drawing, levels and other information necessary to enable the contractor to set out the work. The contractor shall at his own expense set out accurately according to the drawing and figured dimension thereon, all the work comprised in the contract and any extras or additions thereto and shall be solely responsible for their being so set out and executed.

All bench marks, pegs, signals, on the surface, alignment stones, milestones and all similar marks whether put in by BHEL Authority for the purpose of checking the contractors work or in the nature of permanent survey marks will during the tenure of the contract, be under the care of the contractor who shall , at his own expense , take all proper and reasonable precautions and care to preserve and maintain them in their true position. In the event of these marks being disturbed or obliterated by accident or due to any other cause whatsoever, the same may, if deemed necessary to replaced by the Sr.E/C/. E/C at the contractors expense and the cost thereof deducted from any money than or thereafter becoming due to the contractor.

Where requested by the contractor, the level marks center line and chainage pegs corresponding to those shown on the drawing will be pointed out to the contractor on the ground but all bench marks or chainage pegs additional to those shown on the drawing will be set out by BHEL authorities.

## 29. SITE DRAINAGE :

All water that may accumulate on the site during the process of the work, or in trenches and excavations shall be removed to the entire satisfaction of the Engineer-in-charge and at Contractors expense.

## 30. EXCAVATIONS, RELICS, ETC :

Material of any kind obtained from excavation on the site shall remain the property of BHEL and shall be disposed off as the Engineer-in-charge directs.

All gold, silver, oil and other minerals of any description and all precious stones, coins, treasured, relics, antiquities and other similar items which may be found in or upon the site shall be the property of Bharat Heavy Electricals Limited and Contractor shall duly preserve the same to the satisfaction of the BHEL and shall from time to time deliver the same to such person or persons as the Bharat Heavy Electricals Limited, may appoint to receive the same.

## 31. FOUNDATIONS :

The contractor shall not lay any foundations until the excavations for the same have been examined and approved in writing by the Engineer-in-charge.

## 32. COVERING-IN WORK :

The contractor shall give reasonable notice in writing to the Engineer-in-charge whenever any work is to be permanently covered up or concealed, whether by earth or other means so that it can finally be inspected or measured, if necessary. In default of so doing, the contractor shall, if required by the Engineer-in-charge uncover such work at his own expense.

## 33. APPROVAL OF WORKS BY STAGES :

All work embracing more than one process shall be subject to examination and approval at each stage thereof and the contractor shall give due notice in writing to the Engineer-in-charge when each stage is ready. In default of such notice being received, the Engineer-in-charge shall be entitled to approve the quality and extent thereof at any time he may choose and in the event of any dispute, the decision of the Senior Engineer/Civil thereon shall be final and conclusive.

## 34. EXECUTION OF THE WORK :

The work shall be executed in a workman-like manner and to the satisfaction in all respects of the Engineer-in-charge.

The Engineer-in-charge will communicate or confirm his instructions to the Contractor in respect to the execution of the work in a " work Site Order Book " maintained at his office and contractor shall visit this office daily and shall confirm receipt of such instructions by signing the relevant entries in this book. Such entries will rank as order or notices in writing within the intent and meaning of these conditions.

## 35. DAY WORK :

No day-work shall be performed without the prior written instructions of the Accepting Officer.

The Contractor shall give to the Engineer-in-charge reasonable notice of the start of any work ordered to be executed by day-work and shall deliver to the Senior Engineer/Civil-in-charge/E/C within two days of end of each pay-week return in duplicate giving full detailed accounts of labour and materials for that pay week. One copy of each of these returns, if found correct, will be certified by the Engineer-in-charge and returned to the contractor and must be produced at the time of adjustment of accounts.

An invoice in duplicate signed by the Contractor or his agent shall be sent with each delivery of materials for day-work and the contractor will be furnished with a receipt signed by the Engineer-in-charge specifying the description, quantities weight or measurement (as the case may be) of the articles approved, reference will be made in this receipt in the return aforesaid and the receipt itself is to be produced in support of the Contractors bill.

In the case of Lump-sum contracts, the rates to be changed and the percentage addition for profit and establishment charges, etc, will be agreed upon between the Accepting Officer and the Contractor prior to the execution of the work.

36. **INSPECTION OF THE WORK** :

BHEL Officers concerned with the Contractor shall have power at any time to inspect and examine any part of the work and the contractor shall give such facilities as may be required to be given for such inspection and examination.

Should Sr.E/C/E/C consider at any time during the expiry of maintenance period, that any work has been executed with unsound, imperfect or unskilled workmanship or of quality inferior to that contracted for or not otherwise in accordance with contract (in respect whereof the decision of the sr. E/C. shall be final and conclusive) the contractor shall, on demand in writing from the Sr. E/C.E/C specifying the fault notwithstanding that the same may have been inadvertently passed, certified and paid for, forthwith rectify or remove and reconstruct the work so specified, in whole or in part as the case may be require at his own expense to the entire satisfaction of the Sr. E/C. & E/C in the event of his failing to do so within a period to be specified by the Sr.E/C. E/C in his demand aforesaid, the Sr. E/C. may carry out the work by other means at the risk and expense in all respect of the contractor. However, the liability of the contractor under this condition shall not extend beyond the maintenance period except as regard workmanship which the Sr. E/C .E/C shall have previously given notice of to the contractor to rectify.

**37. RESPONSIBILITY FOR BUILDING :**

In the event of any building, or part of any building being handed over to the Contractor for the execution of work thereto under the provisions of the Contract, he shall give a written receipt for all fixtures, glass etc., and he shall be required to make good at his own expense all damages resulting from any cause whatsoever while in his charge and on completion of the work to deliver up the said building or part thereof a clean state complete in every particular to the entire satisfaction of the Engineer-in-charge.

## 38. INSURANCE OF WORKS AGAINST DAMAGE AND LOSS DUE TO FIRE, TEMPEST, FLOODS, EARTHQUAKE, RIOT AND AGAINST DAMAGE BY AIR-CRAFT.

The contractor shall, within one month after the date of acceptance of the contract, insure the work against loss and damage by fire, tempest, floods, earthquake, riots and against damage by air-craft with an insurance office approved by the Accepting Officer. Such insurance shall be affected in the name of BHEL and shall be for the full value of the contract sum. The Contractor shall lodge with the BHEL policies and receipt of the premiums for such insurance and shall maintain such policies in force until the entire completion of the work as certified by the Senior Engineer/Civil/E/C.

If the contractor fails to comply with the terms of this condition that the Accepting Officer may insure the work and may deduct the amount of premiums from any money become payable to the contractor or may at his discretion refuse payment of any advances to the Contractor until the contractor shall have complied with the terms of the condition.

Such insurance whether effected by the Accepting Officer or the Contractor shall not be a limit or bar to the liability and obligation of the contractor to complete the entire work in all respects as certified by the Senior Engineer/Civil/E/C.

In case of such a loss or damage as aforesaid, the money payable under any such insurance shall be received and may be retained by the BHEL until the work is finally completed and shall then be credited to the contractor in the final statement of accounts in the event of his contract not having been previously cancelled under these conditions.

## 39. DAMAGE AND LOSS TO PRIVATE PROPERTY & INJURY TO WORKMAN :

The contractor shall at his own expense reinstate and make good to the satisfaction of the Sr. E/C/E/C and pay compensation for any injury, loss or damage occasioned to any property or rights whatever including property and rights of BHEL, (or Agents, servants or employees of BHEL) the injury loss or damage arising out of or in any way in-connection with the execution of purported execution of the contract and further the contractor shall indemnify BHEL against all claims enforceable against BHEL (or any agent, servant or employee of BHEL or which would be so enforceable against BHEL) where a private person , in respect of any such injury (including injury resulting in death loss or damage to any person) whosoever or property, including all claims which may arise under the workman's Compensation Act or otherwise.

## 40. COMPLETION:

The works shall be completed to the entire satisfaction of the Engineer-in-charge and in accordance with the Contractors forecast of Time and Progress where operative, and all unused stores and materials, tools plant, equipment, temporary buildings, and things shall be removed and the site and work cleared of rubbish and all waste materials and delivered up clean and tidy to the satisfaction of the Engineer-in-charge at the Contractors expense on/or before the Scheduled date of completion.

The BHEL shall have power to take over from the Contractor from time to time such sections of the work as have been completed to the satisfaction of the Engineer-in-charge.

The Senior Engineer /Civil/E/C shall certify to the Contractor the date on which the work is completed and the state thereof.

The Senior Engineer/Civil/E/C shall also certify, to the Contractor the state of the work at the end of the maintenance period, where applicable.

41. **COMPENSATION FOR DELAY:**

If the contractor fails to maintain the required progress in terms of condition 7 or to complete the work and clear the site on or before the contracted or extended date period of completion, he shall, without prejudice to any other right or remedy of the BHEL on account of such breach, pay as agreed compensation an amount calculated as stipulated below or such smaller amount as may be fixed by the BHEL on the contract value of the work for every week that the progress remains below that specified in condition 7 or that the work remains incomplete.

This will also apply to items or a group of items for which separate period of completion has been specified.

For this purpose the term 'contract value' shall be the value at contract rates of the work as ordered.

a) Completion period (as originally stipulated) not exceeding 6 months. …… @ 1 percent per week

b) Completion period (as originally stipulated) Exceeding 6 months and not exceeding 2 years …… @ 1/2 percent per week

c) Completion period (as originally stipulated) exceeding 2 years …..…… @ 1 /4 percent per week

Provided always that the total amount of compensation for delay to be paid under condition shall not exceed the under noted percentage of the contract value or of the contract value of the item of group of items of work for which a separate period of completion is given :

a) Completion period (as originally stipulated) not exceeding 6 months. …… 10 percent

b) Completion period (as originally stipulated) Exceeding 6 months and not exceeding 2 years …….. 7 ½ percent

c) Completion period (as originally stipulated) Exceeding 2 years …..……. 5 percent

The amount of compensation may be adjusted or set off against any sum payable to the Contractor under this or any other contract with the BHEL.

## 42 LAWS GOVERNING THE CONTRACT :

This contract shall be governed by the Indian Laws for the time being in force.

## 43 CANCELLATION OF CONTRACT FOR CORRUPT ACTS :

The Accepting Officer, whose decision shall be final and conclusive, shall, without prejudice to any other right or remedy which shall have accrued or shall accrue thereafter to Bharat Heavy Electricals Limited, cancel the contract in any of the following cases and the contractor shall be liable to make payment to BHEL for any loss or damage resulting from any such cancellation to the same extent as provided in the case of cancellation for default.

If the contract shall :

a) Offer or give or agree to give to any person in BHEL, service any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract for BHEL service,
OR

b) Enter into a contract with BHEL in connection with which commission has been paid or agreed to be paid by him or with his knowledge, unless the particulars of any such commission and the terms of payment thereof have previously been disclosed in writing to the Accepting Officer,
OR

c) Obtain a contract with BHEL as a result of RING tendering or by non-bonefide methods of competitive tendering without first disclosing the fact in writing to the Accepting Officer.

## 44. CANCELLATION OF CONTRACT FOR INSOLVENCY, ASSIGNMENT OR TRANSFER OR SUB LETTING OF CONTRACT :

The Accepting Officer, without prejudice to any other right or remedy which shall have accrued or shall accrue thereafter to BHEL shall cancel the contract in any of the following cases:-

If the contractor:

a) Being an individual, or if a firm any partner thereof, shall at any time be adjusted bankrupt or have a receiving order or orders for administration of his Estate made against him of shall take any preceedings, for liquidation or composition under Bankruptcy Act for the time being in force or make any conveyance or assignment of his effects of composition or arrangements for the benefit of his creditor or purport to do so, or if any application be made under any Bankruptcy Act for the time being in force for the sequestration of his estate or if a trust deed be granted by him on behalf of his creditors;

OR

b) Being a company, shall pass a resolution or the court shall make an order for the liquidation of its affairs, or a Receiver or a Manager on behalf of the debentures holders

shall be appointed or circumstances shall arise which entitle the court or debentures holders to appoint a Receiver or Manager;

OR

c) Assigns, transfers, sub-let or attempt to assign transfer or sub-let any portion of the work without the prior return approval of the Accepting Officer.

Whenever the Accepting Officer exercise his authority to cancel the contract under this condition he may complete the work by any means at the contractor risk and expense provided always that in the event of the cost of completion (as certified by Sr. E/C/E/C which is the final and conclusive ) being less than the contract cost, the advantage shall accrue to the BHEL and that if the cost of completion exceeds the moneys due to the contractor under the contract, the contractor shall either pay the excess amount ordered by Sr. E/C/E/C or the same shall be recovered from the contractor by other means.

In case of BHEL completes the work under the provisions of this condition the cost of such completion to be taken into account in determining the excess cost to be charged to the contractor under this condition shall consist of the cost of material purchased and /or labour provided by the BHEL with an addition of such percentage to cover superintendence and establishment charges as may be decided by the Sr. Manager (P) Sr. E/C/E/C whose decision shall be final and conclusive.

## 45 CANCELLATION OF CONTRACT IN PART OR IN FULL FOR CONTRACTOR'S DEFAULT :

If the contractor;

a) Makes default in commencing the work within a reasonable time form date of handing over of the site and continues in that state after a reasonable notice from senior/Engineer /Civil E/C;

OR

b) In the opinion of the Sr. E/C/E/C at any time, whether before or after the date or extended date for completion, make default in proceeding with the work , with due diligence and continues in that state after a reasonable notice from Sr.E/C/E/C.

OR

c) Fails of comply with any of terms and conditions of the contract or after reasonable notice in writing with orders properly issued thereunder :

OR

d) Fails to complete the work, work order and items of work with individual dates for completion and clear the site on or before the date of completion, or fails to achieve the progress as set out under clause 7 of these General Conditions of Contract.

The Accepting Officer may, without prejudice to any other rights or remedies which shall have accrued or shall accrue thereafter to BHEL cancel the contract as a whole or in part thereof or only such work order or items of work in default from the contract. Whenever the Accepting Officer exercises his authority to cancel the contract as a whole or in part under this condition he may complete the work at the contractor risk and cost, provided always that in the event of the cost of completion (as certified by Sr,. E/C/E/C which is final and conclusive) being less than the contract cost, the advantage shall accrue to the BHEL if the cost of the excess amount ordered by Sr. M.P./Sr. E/C/E/C or the same shall be received from the contractor by other means.

In case the BHEL completes the work or any part thereof under the provisions of this condition the cost of such completion to be taken into account in determining the excess cost to be charged to the contractor under this condition shall consist of the cost of the materials purchased and /or labour provided by the BHEL with an addition of such percentage to cover superintendence and establishment charges as may be decided by the Sr. M.P./Sr.E/C/E/C. whose decision shall be final and conclusive.

46 **TERMINATION OF CONTRACT FOR DEATH** :

Without prejudice to any of the rights or remedies under this contract, if the contractor dies, Accepting Officer shall have the opinion of terminating the contract without compensation to the contractor.

47. **SPECIAL POWER OF DETERMINATION:**

If at any time after the Acceptance of the tender, BHEL shall for any reason whatsoever not require the whole or any part of the work, to be carried out, the Sr. M.P./Sr. E/C/E/C shall give notice in writing of the fact to the contractor who shall have no claim to any payment of compensation or otherwise how-so-ever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not derive in consequence of the force-closing of the work.

He shall be paid at Contact rate, for the full amount of the work executed including such additional works, e.g. clearing of site, etc., as may be rendered necessary by the said force-closing. He shall also be allowed reasonable payment (as decided by the Accepting Officer) for any expenses sustained on account of labour and materials collected but which could not be utilised on the work, as verified the Sr. E/C Neither shall the contractor has any claim for compensation on account of any alterations having been made in the original specifications, drawings, designs and instructions, involving any curtailment of the work as originally contemplated.

**48. FAIR WAGE :**

a) The Contractor shall pay not less than the 'Fair Wage' to labourers engaged by him on the work.
'Fair Wage' means wage whether for time or piece work notified at the time of inviting tenders for the work and where such wages have not been notified, the wages prescribed by the Sr. Manager/Projects/Sr.E/C/E/C for the stations at which the work is done.

b) The contractor shall, not withstanding the provision of any contract to the contrary, cause to be paid a 'Fair Wage' to labourers indirectly engaged on the work, including any labour engaged by his sub-contractors in connection with the said wok, as if the labourers had been directly employed by him.

c) In respect of all labours directly or indirectly employed on the work for the performance of the contractor's part of this Agreement, the contractor shall comply with or cause to be complied with the BHEL contractor's labour Regulations (appended hereto as Annexure 'A' to these conditions) in regard to payment of wages, wage period, deductions from wages, recovery of wages, not paid and deductions, unauthorisedly made, maintenance of wage book, wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of a like nature.

d) The Senior Engineer /Civil/E/C concerned shall have the right to deduct from the moneys due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfillment of the conditions of the contract for the benefit of the workers, non-payment of wags or of deductions made from this or their wages which are not justified by the terms of the contract or non-observance of the regulations.

e) Vis-à-vis BHEL, the Contractor shall be liable primarily for all payments to be made under the contract and for the observances of the Regulations aforesaid without prejudice to his right to claim indemnity from his sub-contractors.

f) The regulations aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.

# CHAPTER-IV

# VALUATION AND PAYMENT

## 49. RECORDS AND MEASUREMENTS :

All items having a financial value shall be entered in the BHEL Measurement Book so that a complete record is obtained of all works performed under the contract.

Building etc. priced in schedule 'A' as a unit lump-sum will be entered by number at the unit lump-sum. Work carried out for agreed lump-sums will be described and similarly recorded.

Lump-sum omissions will be entered for deduction. Measurement shall be restricted to that required to ascertain the financial liability of BHEL under the contract.

Work which fails to be measured in detail shall be measured physically, without reference to any local custom that may obtain excepting where it may otherwise be directed in the tender documents. The measurements shall be taken jointly by any person duly authorised on the part of the BHEL and by the contractor.

The Engineer-in-charge shall give reasonable notice in writing to the Contractor of appointment for measurement.

The contractor shall, without extra charge, provide assistance with appliances and other things necessary for measurement.

The Contractor shall bear all the cost of measurement of his work.

Measurement shall be entered in the BHEL Measurement book and signed and dated by both parties each day at the site on completion of measurement. If the contractor objects to any of the measurement recorded on behalf of the BHEL a note to that effect will be made in the BHEL measurement book or against the item or items objected to; and such note shall be signed and dated by both the parties engaged in taking the measurement.

If, as a result of such objection, it becomes necessary to re-measure the work wholly or in part, the expense of such re-measurement shall be borne by the party requiring the ,measurement to be re-taken provided that a net error is found by this re-measurement to amount to less than 5% (five percent) of the value as recorded by the first measurement. But, where the net errors amount to 5% and over of the said value, then the cost is to be borne by the other party. In any case, if the net value of errors found exceeds Rs. 500/- the expense of re-measurement is to be borne by the other party.

If the Contractors representative fails to attend when required, the Engineer-in-charge shall have power to proceed by himself to take measurements and in that case these measurements shall be accepted by the Contractor as final.

The contractor shall, once every month submit to the Senior Engineer/Civil/E/C with a copy to the Sr. M/P/details of his claims for the work done by him upto and including the previous months which are not covered by his contract Agreement in any of the following respects.

a) Deviation from the items and Specifications provided in the contract documents.

b) Extra items/New items of work.

c) Quantities in excess of those provided in the contract schedule.

d) Items in respect of which rates have not been settled. He should, in addition, furnish a clear certificate to the effect that the claims submitted by him as aforesaid cover all his claims and that no further claims shall be raised by him in respect of the work done upto and including the period under report.

## 50. VALUATION OF DEVIATIONS :

Rates for deviated items of work will be fixed as follows:

I. For any item of wok required to be carried out after the contract has been awarded and which is not covered by Contractors Schedule but is covered by K.P.W.D. schedule of rates the rate payable for such a fresh item will be derived from K.P.W.D. Schedule by the method of proportion as follows:

a) In the same proportion to the rate in K.P.W.D. Schedule of Rates as the tendered rate for the nearest analogous items of work in Contractors Schedule bears to the rate for the particular analogous item or work in K.P.W.D. schedule of Rates.

b) If a single appropriate analogous item of work is not available in both Contractor's Schedule and K.P.W.D. Schedule, then the method of proportion will be applied to the nearest analogous group of items available in both the Schedules referred i.e. in the same proportion as the total tendered cost of that particular group of items (the sum of the products of the tendered rates and the quantities for which orders are placed) bears to the total cost of the same items and quantities at the K.P.W.D.Schedule of Rates.

c) If even an appropriate analogous group of items is not available in Contractor's Schedule and K.P.W.D. Schedule, then the methods of proportion will be applied to all those items of the whole work, which are available in both the Schedules and for which orders have been placed on the Contractor, i.e., In the same proportion as the total cost of all these items of work (the sum of the products of the tendered rates and the quantities for which orders are placed) bears to the total cost of the same items and quantities at the K.P.W.D. Schedule of Rates.

II. If any work not covered by any of the foregoing is ordered on the Contractor, the basis of payment shall be decided by the Accepting Officer whose decision shall be final and conclusive and binding on the parties.

The selection of analogous item or analogue group of items referred to above shall be done by the Sr. E/C./E/C. Where the rates for deviated items or new items of work can be derived by the selection of different analogous items or analogous group of items, the lowest of all such derived rates shall be taken as the correct rate.

In the case of the contracts for which the Sr. E/C.,E/C is the Accepting Officer, all disputes regarding the settlement of rates of deviated or new items of work shall be referred to the Sr. M/P. whose decision shall be final and conclusive.

## 51. **REIMBURSEMENT/REFUND ON VARIATION IN PRICE, MATERIALS** :

In after submission of the tender and/or during the progress of the works, the price of any materials (not being a material supplied from the BHEL, stores in accordance with the Conditions of the Contract) is increased or decreased by an Act of Legislature (Central or state) and /or any notification thereunder or on account of new duties or levies such as octroi or on account of increase or decrease in such duties affecting the price of materials required for incorporation in the works or the price of any item to be incorporated in the works and made from materials of which the price has increased or decreased as aforesaid and the Contractor has thereupon to pay in respect of such material or item a price which is higher or lower than the price of that material or item as prevailing immediately before the passing of such Act or levying, increasing/decreasing of such duty, the BHEL., shall in case of increase in price or the duty reimburse the Contractor the increase in price or additional increased duty paid by the Contractor and in case of decrease in price, the BHEL shall be entitled to a refund of the reduction in duty. Provided however no reimbursement or refund shall be made if the increase /decrease is not more than plus 10% of the said price, and if so, the reimbursement or refund shall be made only on the excess over 10% provided always that any such increase shall not be payable if, in the opinion of the Sr. M/P whose decision shall be final and conclusive the increase is attributable to the delay in the execution of the contract within the control of the Contract, or that any such increase has become operative after the contracted/or extended date completion of the work or items of works in question.

The Contractor shall , for the propose of this condition, keep such books of account and other document as are necessary to show the amount of any increase claimed or any reduction available and shall allow inspection of the same by any duly authorised representative of the BHEL and further shall at the request of the Sr, E/C/E/C. furnish for verification such other information as the Sr. E/C/E/C may require.

The contractor shall within a reasonable time of his becoming aware of any alteration in the prices of any such materials, give notice thereof in writing to the Sr. E/C.E/C stating that the rate is submitted in pursuance to this condition together with all information relating there to which he may be in a position to supply.

## 52. **ADVANCES ON ACCOUNT** :

No payment shall be made for work estimated to cost less than Rupees One Thousand till after the whole of the work shall have been completed and a certificate of completion given by the Competent authority.

In the case of work estimated to cost more than Rupees One Thousand the contractor may at intervals of not less than one month or as otherwise provided for in the Contract documents, counting from the date on which order to commence work given by Sr. E/C.E/C submit claims on BHEL forms for payment of advance on account of work done and of materials delivered in connection with the Contract.

The Contractor shall be paid in respect of such claims to the extent approved and passed by the Sr. E/C.E/C subject to a maximum of 90% of the value of the work actually executed in site provided the work has been executed to the satisfaction of the Engineer-in-charge. The certificate of the Sr. E/C. E/C regarding such approval and passing of the sums so payable shall be final and conclusive against the Contractor.

"After the full amount of Security Deposit is made up through the 10% deductions from 'On Account' bills, 100% of all subsequent bills may be made to the Contractor".

The Contractor may also be paid during the progress of the work 75% of the value of any materials which are in the opinion of the Engineer-in-charge in accordance with contract, and are actually required for incorporation in the work and which have reasonably been brought to the site in-connection therewith and are adequately stored and/or protected against damage by weather or other causes, but which have not at the time of payment of the advance been incorporated in the work. Payment of such advances however shall be purely at the discretion of the Sr. M/P/Sr.E/C.,/E/C provided always that payments shall not be made under these periodical certificates in respect of perishable materials like lime, cement, timber,sand kankar etc.

Any sums/due from the Contractor on account of tools and plant, stores or any other items provided by BHEL shall be deducted from the respective advances.

The Senior Engineer/Civil/E/C shall from time to time certify the sums payable to the Contractor after retaining the reserves.

Any certificate relating to work done or materials delivered may be modified or corrected by any subsequent interim certificate or by the final certificate and no certificate of the Sr. E/C/E/C supporting an advance payment shall itself be conclusive evidence that any work or materials to which it relates are in accordance with the contract. All such intermediate payments shall be regarded as advances against the final payment only and shall not be considered as an admission of the due performance of the contract or any part thereof in respect or the accruing of any claim whatsoever. Such intermediate payments shall not conclude, determine or effect in any way the powers of the Sr. E/C/E/C as to the final settlement and adjustment of the account or otherwise, or in any way vary or affect the Contract.

**53. FINAL BILL :**

As soon as possible after the completion of the work to the satisfaction of the Engineer-in-charge, the contractor shall forward a certified final account on BHEL forms, in duplicate. It shall be accompanied by all abstracts, vouchers etc., in support thereof and shall be prepared in the manner prescribed by the Senior Engineer /Civil/E/C. No claim will be entertained after the receipt of the final bill.

The contractor shall be entitled to be paid the final sum less the value of payments already made on account, subject to certification of the final bill by the Sr. E/C/E/C any sums due from the contractor on account of Tools and plant, Stores or any other items provided by BHEL not yet recovered from the contractor shall be deducted from the final sum aforesaid.

No charge shall be allowed to the contractor on account of the preparation of the final bill.

**54. PAYMENT OF BILLS :**

All payments to be made to the Contractor under this contract shall be by "Crossed Cheque" marked
"A/C payee only" (within a reasonable time after the certification by the Sr. E/C/E/C at the……
……..located in the station where either the work is executed or service rendered or at their branch nearest to the station where the Office of the Senior Engineer/Civil/E/C is located.)

55. **RECOVERY FROM CONTRACTOR** :

Whenever under the contract any sum of money shall be recoverable from or payable by the contractor the same may be deducted from any sum then due or which at any time thereafter may become due to the contractor under the contract or under any other contract with BHEL or from his Security Deposit or he shall pay the claim on demand.

**56. POST TECHNICAL AUDIT OF WORK AND BILLS :**

BHEL reserves the right to carry out a post-payment audit and technical examination of the work and final bill including all supporting vouchers, abstract etc., and to enforce recovery of any sums becoming due as a result thereof in the manner provided in the preceeding sub-paragraph's provided however that no such recovery shall be enforced after three years of passing the final bill.

**57. REFUND OF SECURITY DEPOSIT :**

50% of the Security Deposit mentioned in condition 16 above, may be refunded to the contractor in respect of all contracts on completion of work and after payment of final bill and the balance 50% on expiry of the maintenance period, (Described under clause 23) provided the contractor shall have rendered a " No Demand Certificate." In case of works where maintenance period is not involved 100% of the security deposit may be refunded after payment of final bill provided that the contractor shall have rendered a " No Demand Certificate."

## 58. ARBITRATION :

Except where otherwise provided for in the contract all question and disputes relating to the meaning of the specifications, design, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or as been other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the contract, design, drawing, specification, estimates, instructions, orders or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the program of the work or after the completion or abandonment thereof shall be refereed to the sole arbitration of the Managing Director/Chief Engineer of BHEL and if the Managing Director/Chief Engineer is unable or unwilling to Act, to the sole arbitration of some other person appointed by the Managing Director/General Manager/Chief Engineer, willing to Act as such arbitrator. The cases referred to arbitration shall be other than those for which the decision of the Sr. M/P./D.C.E/Sr.E/C. is expressed in the contract to be final and conclusive. There will be no objection if the arbitrator so appointed is an employee of BHEL and that he had to deal with the matters to which the contract relates and that in the course of his duties as such he had expressed views on all or any of the matters in dispute or difference. The arbitrator to whom the matter is originally referred being transferred by vacating his office or being unable to act for any reason, such Managing Director/ General Manager/Chief Engineer as aforesaid at the time of such transfer, vacation of office or inability to act, shall appoint another person to act as arbitrator in accordance with the terms of the contract, such person shall be entitled to proceed with the reference from the state at which it was left by his predecessor.

Subject as aforesaid the provision of the Arbitration Act, 1940 or any statutory modification or re-enactment thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause.

It is a term of contract that the party involving arbitration shall specify the dispute or disputes to be referred to arbitration under this clause together with the amount or amounts claimed in respect of each such dispute.

The arbitrator (s) may from time to time with consent of the parties enlarge the time, for making and publishing the awards.

The work under the contract shall, if reasonably possible, continue during the arbitration proceedings and no payment due to payable to the contractor shall be withheld on account of such proceedings.

The Arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties fixing the date of the first hearing.

The Arbitrator shall give a separate award in respect of each dispute or difference referred to him.

The venue of arbitration shall be such place as may be fixed by the arbitrator in his sole discretion.

The award of the arbitrator shall be final, conclusive and binding all parties to this contract.

ANNEXURE- 'A'

BHEL CONTRACTOR'S LABOUR REGULATIONS.
(See condition 20)

1. **DEFINITION:**
   In these regulations, unless otherwise expressed or indicated, the following words and expressions shall have the meaning hereby assigned to them.

   a) "Labour" means workers employed by a contractor directly or indirectly through a sub-contractor, or by an agent on his behalf on a payment not exceeding Rs. 500/- per month.
   b) "Fair Wage" means wages, which shall include wages for weekly day of rest and other allowances, whether for time or piece work, after taking into consideration prevailing market rates for similar employment in the neighborhood but shall not be less than the minimum rates of wages fixed under the Minimum wages Act.
   c) "Contractor" for the purpose of these Regulations shall include an agent or sub-contractor employing labour on the wok taken on contract.
   d) "Inspecting Officer" means any Labour Enforcement Officer or Assistant Labour Commissioner of the Chief Labour Commissioner's organisation.
   e) "Form" means a form appended to these Regulations.

2. **NOTICE OF COMMENCEMENT:**
   The contractor shall, within seven days of commencement of the work, furnish in writing to the Inspecting Officer of the area concerned the following information, with copy to the Engineer- in-charge.
   a) Name and situation of the work.
   b) Contractor's name and address.
   c) Particulars of the Department for which the work is undertaken.
   d) Name and address of the sub-contractors as and when they are appointed.
   e) Commencement and probable duration of the work.
   f) Number of workers employed and likely to be employed.
   g) 'Fair Wages' for different categories of workers.

3. I ) Number of hours, which shall constitute a normal working day. The number of hours which shall constitute a normal working day for an adult shall be NINE hours. The working day of an adult worker shall be so arranged that of intervals, if any for rest it shall not spread over more than 12 hours on any day, when an adult worker is made to work for more than NINE hours on any day or for more than 48 hours in any week he shall in respect of over time work, be paid wages at double the ordinary rate of wages.

   II ) Weekly day of rest: Every worker shall be given a weekly day of rest, which shall be fixed and notified at least 10 days in advance. A worker shall not be required or allowed to work on the weekly rest day unless he has or will have a substitution rest day, on one of the five days immediately before or after the rest day, provided that no substitution shall be made which will result in the worker working for more than 10 days consecutively without a rest day for a whole day.
   Where in accordance with the foregoing provisions a worker works on the rest day and has been given a substituted rest day he shall be paid wages for the work done on the weekly rest day at the overtime rate of wages.

NOTE: The expression ' Ordinary rate of wages ' means the fair wage the worker is entitled to.

4. **DISPLAY OF NOTICE REGARDING WAGES, WEEKLY DAY OF REST ETC**.

The Contractor shall before he commences his work on contract display and correctly maintain and continue to display and correctly maintain in a clean legible condition in conspicuous places on the works, notice in English and in the local Indian languages, spoken by majority of workers, giving the rate of fair wages, the hours of work for which such wages are payable, the weekly rest days workers are entitled to and name and address of the Inspecting Officer. The Contractor shall send a copy of each of such notice to the Inspecting Officers and the Engineer- in- charge.

5**. FIXATION OF WAGE PEIODS:**

The contractor shall fix wage periods in respect of which wages shall be payable. No wage period shall normally exceed one work.

6**. PAYMENT OF WAGES:**

i) Wages due to every worker shall be paid to him direct. All wages shall be paid in current coins or currency or in both.

ii) Wages of every worker employed on the contract shall be paid where the wage period is one week ,within three days from the end of the wage period, and in any other case before the expiry of the $7^{th}$ day or $10^{th}$ day from the end of the wage period according as the number of workers does not exceeds 1000.

iii) When employment of any worker is terminated by or on behalf of the contractor, the wages earned by him shall be paid before expiry of the day succeeding the one on which his employment is terminated.

iv) Payment of wages shall be made at the work site on a working day except when the work is completed before expiry of the wage period, in which case final payment shall be made at the work site with in 48 hours of the last working day and during normal working time.

Note:

The term "working day" means a day on which the work, on which labour is employed, is in progress .

**7. REGISTER OF WORKMEN:**

A register of workmen shall be maintained in the form appended to these regulations and kept at the work site or as near to it as possible, and the relevant particulars of every workmen shall be entered therein within 3 days of his employment.

8. **EMPLOYMENT CARD:**

The contractor shall issue an employment card in the form appended to these regulations to each worker on the day of work or entry into his employment. If a worker has already any such card with him issued by the previous employer the contractor shall merely endorse that employment card with relevant entries. On termination of employment the employment card shall again be endorsed by the contractor and returned to the worker.

9**. REGISTER OF WAGES ETC :**

i) A register of wages- cum-muster roll in the form appended to these regulations shall be maintained and kept at the work site or as near to it as possible.

ii) A wage slip in the form appended to these regulations shall be issued to every worker employed by the contractor atleast a day prior to disbursement of wages.

10. **FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES:**

i) Wages of worker shall be paid to him without any deductions of any kind except the following:

a) Fines.
b) Deductions for absence from duty, i.e. from the place or the places where by the terms office employment is required to work. The amount of deduction shall be in proportion to the period for which he was absent.
c) Deduction for damage to or loss of goods expressly entrusted to the employed person for custody, or for less of money which he is required to account for, where such damage or loss is directly attributable to his neglect or default ;
d) Deductions for recovery of advances or for adjustment of over payment of wages. Advances granted shall be entered in a register ; and
e) Any other deduction which the BHEL may from time to time allow.

ii) No fines shall be imposed on a worker save in respect of such acts and omissions on his part as have been approved by the chief Labour Commissioner.

iii) No fines shall be imposed on a worker and no deductions for damage for loss shall be made from his wages until the worker has been given an opportunity of showing – cause against such fines or deductions.

iv) The total amount of fines which may be imposed in any one wage period on a worker shall not exceed an amount equal to three paise in a rupee of the wages payable to him in respect of that wage period.

v) No fine imposed on a worker shall be recovered from him in instalments, or after expiry of sixty days from the date on which it was imposed. Every fine shall be deemed to have been imposed on the day of the act or omission in respect which it was imposed.

vi) The contractor shall maintain both in English and the local Indian language a list, approved by the Chief Labour Commissioner, clearly stating the acts and omissions for which penalty or fine may be imposed on a workman and display it in good condition in a conspicuous place on the work site.

vii) The contractor shall maintain a register of fines and the register of deductions for damage or loss in the forms appended to these regulations which should be kept at the place of work.

**11. REGISTER OF ACCIDENTS:**

The contractor shall maintain a register of accidents in such form as may be convenient at the work place but the same shall include the following particulars :-

a) Full particulars of the labourers who met with the accident.
b) Rates of wages
c) Sex.
d) Age.
e) Nature of accident and cause of accident.
f) Time and date of accident.

g) Date and time when admitted in hospital.
h) Date of discharge from the hospital.
i) Period of treatment and result of treatment.
j) Percentage of loss of earning capacity and disability as assessed by Medical officer.
k) Claim required to be paid under workmen's composition Act.
l) Date of payment of compensation.
m) Amount paid with details of the person to whom the same was paid.
n) Authority by whom the compensation was assessed.
o) Remarks.

12. **PRESERVATION OF REGISTERS**:
The register of workmen and the Register of wages-Cum-Muster Roll required to be maintained under these Regulations shall be preserved for 3 years after the date on which the last entry is made therein.

13. **ENFORCEMENT:**
The Inspecting Officer shall either on his own motion or on a complaint received by him carry out investigations and send a report to the Engineer-in-charge specifying the amount representing / workers dues and amount of penalty to be imposed on the contractor for breach of these regulations, that have to be recovered from the contractor, indicating full details of the recoveries proposed and the reasons, therefor. It shall be obligatory on the part of the Engineer-in-charge on receipt of such a report to deduct such amounts from payments due to the contractor.

14. **DISPOSAL OF AMOUNTS RECOVERED FROM THE CONTRACTORS**:
The engineer- in -charge shall arrange payment to workers concerned within 45 days from receipt of a report from the Inspecting Officer except in cases where the contractor had made an appeal under regulation. 16. Of these regulations. In cases where there is an appeal, payment of worker dues would be arranged by the Engineer -in -charge, wherever such payments arise, with in 30 days from the date of receipt of the decision of the Regional Labour Commissioner (RLC).

15. **WELFARE FUND :**
All moneys that are recovered by the Engineer-in-charge by way of workers due which could not be disbursed to workers with in the time-limit prescribed above, due to reasons such as where about or workers not being known, death of a worker, etc., and also amounts recovered as penalty, shall be credited to a fund to be kept under the custody or BHEL for such benefits and welfare of workmen employed by the contractors.

16. **APPEAL AGAINST DECISION OF INSPECTING OFFICER**:
Any person aggrieved by a decision of the Inspecting Officer may appeal against such decision to the Regional Labour Commissioner concerned within 30 days from the date of decision, forwarding simultaneously a copy of his appeal to the Engineer-in-charge. The decision of the Regional Labour Commissioner Shall be final and binding upon the contractor and the work men.

17. **REPRESENTATION OF PARTIES :**
i) A workman shall be entitled to be represented in any investigation or enquiry under these Regulations by an officer of a registered trade union of which the said trade union is affiliated or where the work man is not a member of any registered trade union, by an

officer of a registered trade union, connected with, or any other workmen employed in, the industry in which the worker is employed.

ii) A contractor shall be entitled to be represented in any investigation or enquiry under these Regulations by an officer of an association of contractors of which he is member or by an officer of a Federation of associations of contractors to which the said association is affiliated or where the contractor is not a member of any association of employers, connected with, or by any other employer engaged in the industry in which the contractor is engaged.

iii) No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under these Regulations.

18. **INSPECTION OF BOOKS AND OTHER DOCUMENTS:**

The contractor shall allow Inspection of the registers and other documents prescribed under these regulations by inspecting officers and the Engineer-in-charge or his authorised representative at any time and by the worker or his agent on receipt of due notice at a convenient time.

19. **INTERPRETATION ETC. :**

On any question as to the application, interpretation or effect of these Regulations, the decision of the Chief Labour Commissioner or Deputy Chief Labour Commissioner (Central) shall be final and binding.

20. **AMENDMENTS :**

Central Government may, from time to time, add to or amend the Contractors Labour Regulations and issue such directions as it may consider necessary for the proper implementation of the Contractors Labour Regulations for the purpose of removing any difficulty which may arise in the administration thereof, based on which the BHEL Contractors Labour Regulation here in contained shall be subject to revision.

# BHEL SAFETY CODE

(See condition 20)

1. Suitable scaffolds shall be provided for workmen for all work that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used one extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than ¼ to 1 (1/4 horizontal and 1 vertical).
2. Scaffolding or staging more than 3.25 meters above the ground or floor, swing or suspended from an overhead support or erected with stationery support, shall have a guard rail properly attached, bolted, braced and otherwise secured atleast 1 meter high above the floor or platform of such scaffolding or staging and extending along with the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery or materials, such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
3. Working platform, gangways and stairways shall be so constructed that they do not sag unduly or unequally, and if height of a platform or gangway or stairway is more than 3.25 meters above ground level or floor level it shall be closely boarded, have adequate width and be suitably fenced, as described in 2 above.
4. Every opening in floor of a building or in a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or failing with a minimum height of 1 meter.
5. Safe means of access shall be provided to all working platform and other working places, Every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length. Width between side rails in a rung ladder shall in no case be less than 30cm. For ladders upto and including 3 meters in length. For longer ladders this width shall be increased by atleast 6mm for each additional 30 cms of length. Uniform step spacing shall not exceed 30 cm.

   Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect public from accidents and shall be bound to bear expenses of defence of every suit action or other proceedings at law that may be brought by any person for injury sustaining owing to neglect of the above precautions, and pay any damages and costs which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person.

6. **EXCAVATION AND TRENCHING :**

   All trenches, 1.5 meters or more in depth, shall at all times be supplied with atleast one ladder for each 30 m length or fraction thereof. Ladder shall to be extended from bottom of trench to atleast, 1 meter above surface of the ground. Sides of a trench 1.5 meters or more in depth shall be stepped back to give suitable slope, or securely held by timber bracing, so as to avoid the danger of sides collapsing. Excavated materials shall not be placed within 1.5 meters of the edge of trench or half the depth of trench, whichever is more. Cutting shall be done from top to bottom. Under no circumstances shall undermining or undercutting be done.

7. **DEMOLITION :**
Before any demolition work is commenced and also during the process of the work.

a) All roads and open areas adjacent to the work site shall either be enclosed or suitably protected;
b) No electric cable or apparatus which is liable to be source of danger over a cable or apparatus used by operator shall remain electrically charged.
c) All present steps shall be taken to prevent danger to persons employed, from risk or fire or explosion or No floor, roof or other part of a building shall be so overloaded with debris or materials as to render it unsafe.

8. All necessary personal safety equipment as considered adequate by the Engineer-in-charge shall be available for use of persons employed on the site and maintained in a condition suitable for immediate use and the contractor shall take adequate steps to ensure proper use of equipment by those concerned.

a) Workers employed on mixing asphaltic materials cement and lime mortars/concrete shall be provided with protective footwear and protective goggles.
b) Those engaged in handling any materials which is injurious to the eye shall be provided with protective goggles.
c) Those engaged in welding works shall be provided with welder's protective eye shelds.
d) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.
e) When workers are employed in sewer and manholes which are in use, the contractor shall ensure that manholes covers are opened and manholes are ventilated atleast for an hour before workers are allowed to get in to them. Manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to public.
f) The contractor shall not employ men below the age of 18 and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting the following precautions shall be taken.
i) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.
ii) Suitable face masks shall be supplied by the contractor for use by workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scrapped.
iii) Overalls shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable working painters to wash during and cessation of work.

9. When work is done near any where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

10. Use of hoisting machine and tackles including their attachments, anchorage and supports shall conform to the following:

a) i) These shall be of good mechanical construction, sound material and adequate strength and free from defects.
ii) Every rope used in hoisting or lowering materials or as a means of suspension shall be durable quality and adequate strength, and free from defects.

b) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in-charge of any hoisting machine including any scaffolding winch or give signals to operator.

c) In case of every hoisting machine and of every chain, ring, hook, shackle, swivel and pulley block used in hoisting, or lowering or as means of suspension safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall have the safe working load plainly marked thereon. In case of a hoisting machine having a variable safe working load, each safe working load, and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

10.d) In case of departmental machine, safe working load shall be notified by the Engineer-in-charge. As regards contractor's machines the contractor shall notify safe working load of each machine to the Engineer-in-charge whenever he brings it to site of work and get it verified by the Engineer-in-charge.

11. Motors gearing, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards, hoisting appliances shall be provided with such means as will reduce to the minimum risk of accidental descent of load. Adequate precautions shall be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energised, insulating mats, working apparel such as gloves, sleeves, and boots, as may be necessary shall be provided. Workers shall not wear any rings, watches carry keys or other materials which are good conductors of electricity.

12. All scaffolding, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities shall be provided at or near the places of work.

13. These safety provisions shall be brought to the notice of all concerned by display on a notice board at a prominent place at the work spot. Persons responsible for ensuring compliance with the safety code shall be named there on by the contractor.

14. To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the contractor shall be open to inspection by the Engineer-in-charge or his representative and the inspection officers as defined in the contractor's Labour Regulations.

15. Notwithstanding the above conditions 1 to 14, the Contractor is not exempted from the operation of any other Act or Rule in force.

# FROM OF REGISTER OF WORKMEN
## (Regulation 7)

**(i) Name and address of the contractor :**…….
**(ii) Number and date of the contract agreement/work order :**…….
**(iii) Name and address of the department awarding the contract:**……
**(iv) Nature of the contract and location of the work:**……
(v) **Duration of the contract :**……..

| **Sl.No** | **Name and Surname of the workers** | **Age & Sex** | **Father's Husband' s Name** | **Nature of employment designation.** | **Permanent/ home address of employee (village) Dist. Tana)** | **Present address.** | **Date of commence ment of employmen t** | **Date of ter- mination or leaving of emp loyment** | **Signature or thumb impression of the employee** | **Remarks.** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** |
| | | | | | | | | | | |

**Bharat Heavy Electri**
**Electronics Division, Mysore Roa** **0 026.**

COE Building No. 15
Air Conditioning : NIT

# FORM OF EMPLOYMENT CARD
## (Regulation 8)

**(i) Name and sex of the worker :……**
**(ii) Father's/Husband's Name :……**
**(iii) Address :……**
**(iv) Age or date of birth :…….**
**(v) Identification marks :……**

**Particulars of next of kin (wife/husband and children, if any, or/dependant next of kin in case the worker has no wife/husband or child) :**
**Name :…….**
**Full address of dependants :……**
**( Specify village, Dist., and State) :……**

| Sl.No | Name and address of Employer (specify whether a contractor or a sub- contractor). | Particulars of location of work site and description of work done. | Total period for which the worker is employed (from- to) | Actual Number of days worked | Leave taken (No. of days should be specified | Nature of work done by the worker | Wage rate with particulars of unit in case piece-work | Total wages earned by the worker during the period shown under col.5. | Remarks | Signature of the emplo-yer. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | | | | | | | | |

**N.B. for a worker employed at one time one piece-work basis and at another on daily wages, relevant entries in respect of each type of employment should be made separately.**

# FORM OF WAGE SLIP
# (REGULATION 9)

**(i) Name of the contractor…….**
**(ii) Place…….**

---

**1. Name of the workers with father's/husband's Name :**
**2. Nature of employment :**
**3. Wage period :**
**4. Rate of wages payable :**

**5. Total attendance/unit of work done :**

**6. Dates on which overtime Worked. :**

**7. Overtime wages. :**

**8. Gross Wages payable :**

**9. Total deductions (indicating nature of deduction).**

**10. Net Wages Payable :**

---

**CONTRACTOR'S SIGNATURE/ THUMB IMPRESSION.**

**EMPLOYEES SIGNATURE/ THUMB IMPRESSION.**

# FORM OF RESISTER OF WAGES-CUM-MUSTER ROLL

## (Regulation 9)

(i) Name and address of the contractor:……

(ii) No. & Date of the contract agreement/work order :……..

(iii) Name and address of the dept. awarding the contract :…….

(iv) Nature of the contract and location of the work :…….

(v) Duration of the contract :…….

(vi) Wage period :…….

| | | | | | | | Fair wages payable. | | Wages paid . | | Overtime worked. | | | | Deduction from wages. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number | No. and Surname of the worker. | Father's/husband's Name | Sex | Designation nature of work. | Daily attendance (No. of units worked) | Total attendance units. | Basic | D.A.and other allowances | Basic | D.A.and other allowances | Date | No. of hours. | Over time wages earned . | Total wages paid | Fine | Deduction for damage or loss | House rent. | Revenue of advances. | Other deductions | Net wages payable. | Date of payment | Signature or thumb impression | Remarks. |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| | | | | | | | | | | | | | | | | | | | | | | | |

# FORM OF REGISTER OF
## DEDUCTIONS FOR DAMAGE OR LOSS CAUSED TO THE BHEL BY THE NEGLECT OR DEFAULT OF THE EMPLOYED PERSONS.
## (Regulation No. 10 (vii).

| Sl.No. | Name | Father's/ Husband's Name. | Sex. | Dept. | Damage or loss caused with date. | Whether worker showed cause against deduction if so, enter date. | Date and amount of deduction imposed. | Number of instalment if any. | Date on which total amount realised | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | | | | | | | | |

# FROM OF REGISTER OF FINES (REGULATIONS No. 10 (VII)

| Sl.No. | Name | Father's/ Husband's Name. | Sex. | Dept. | Nature and date of the offence for which fine imposed | Whether workman showed cause against fine or not, enter date. | Rate of wages . | Date and amount of fine imposed. | Date on which fine realised. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | | | | | | | | | | |

# Bharat Heavy Electrical Ltd
# Electronics Division
# Mysore Road, Bangalore-560026

# Price Bid
# for the work of:

Air conditioning for COE Building No. 15

Issued to: M/s

# Bill of Quantities

**Notes :**

1 All items of work under this Contract shall be executed strictly to fulfill the requirements laid down under "Basis of Design" in the specifications. Type of equipment, material specifications, methods of installation, testing, and type of controls shall be in accordance with the Specifications, the relevant BIS codes and other Standards and approved shop Drawings i.e. detailed fabrication drawings of various sizes of ducts / pipes and all associated accessories keeping in view the final commissioning and air / water balancing of the installation to give specified performance. However, capacity of each component and their quantities shall be such as to fulfill the above-mentioned requirement.

2 The rate for each item of work included in the Schedule of Quantities shall, unless expressly stated otherwise, include cost of :

a. All materials, fixing materials, accessories, appliances, tools, plants, equipment, transport, labour and incidentals required in preparation for and in the full and entire execution, testing, balancing, commissioning and completion of the work called for in the item and as per specifications and Drawings.

b. Wastage on materials and labour.

c. Customs clearance, loading, transporting, unloading, handling / double handling, hoisting to all levels, setting, fitting and fixing in position, protecting, disposal of debris and all other labour necessary in and for the full and entire execution and to fully complete the work in accordance with the contract documents, good practice and recognized principles.

d. Liabilities, obligations and risks arising out of Conditions of Contract.

e. All requirements of Specifications, whether such requirements are mentioned in the item or not. The Specifications and Drawings where available, are to be read as complimentary to and part of the Schedule of Quantities and any work called for in one shall be taken as required for all.

3 In the event of conflict between Schedule of Quantities and other documents including the Specifications, the most stringent shall apply and the interpretation of BHEL & Consultant jointly shall be final and binding.

4 All equipment, quantities and technical data indicated in this Schedule are for the Contractor's guidance only; This Schedule must be read in conjunction with these documents. The Contractor shall be paid for the actual quantity of work executed by him in accordance with the approved Shop Drawings at the contract rates and the actual measurement. All measurements for ducts & insulation, pipes and insulated pipes, fittings, bends and valves etc. shall be taken along the center line.

5 The quantities given in this schedule are provisional, BHEL reserves the right to increase or decrease the quantities of work or to totally omit any items of work and the Contractor shall not be entitled to claim any extras or damages on these grounds. These variations shall be permitted until such time Contractor's shop drawings are approved. For items with variable quantities, the payment will be made on the basis of actual quantity executed at site.

6 This Schedule of Price Bid shall be fully priced and the extensions and totals duly checked. The rates for all items shall be filled in same ink.

7 No alteration whatsoever is to be made to the text or quantities of this Schedule unless such alteration is authorized in writing by BHEL. Any such alterations, notes or additions shall, unless authorized in writing, be disregarded when tender documents are considered.

8 In the event of an error occurring in the amount column of the Schedule, as a result of wrong extension of the unit rate and quantity, the unit rate quoted by the Tenderer shall be regarded as firm and the extensions shall be amended on the basis of the rates.

9 Any errors in totaling in the amount column and in carrying forward totals shall be corrected. Any error, in description or in quantity or omission of items from this schedule shall not vitiate this Contract but shall be corrected and deemed to be a variation required by Owners.

10 Some 'NIL' (QR) quantity items are also contained in this section. Tenderer shall fully price the unit rates for all items, including those for which quantities indicated are nil.

11 Rates quoted for all items in BOQ shall be on indivisible works contract basis and shall include excise duty, customs duty, sales tax, octroi, transportation, works contract tax or any other taxes.

12 Generally, no foreign exchange or assistance for import of any equipment / component shall be provided by BHEL. It shall be Contractor's responsibility.

13 The HVAC drawings accompanying the tender shall be read in conjunction with Architectural / Structural drawings.

14 All Ceiling Suspended AHUs / FCUs and indoor units shall be provided with suitable hinged type inspection doors in the false ceiling creating adequate access (trapdoor) to the unit for repair/ maintenance/ inspection.

15 Owners reserve the right to get any equipment / material tested / checked, before accepting its delivery at site or at original manufacturers works or at any approved Govt. laboratory at Contractor’s cost to establish conformity of quality / rating with tender specifications and the entire cost in this regard will be borne by the Contractor.

16 Samples of material / equipments / controls etc as required by the Engineer-in-Charge will be submitted for approval before delivering the equipment / material at site. No material / equipment will be delivered without approval of the sample.

17 Actual execution of work will start only after approval of Contractor's shop drawings.

18 Buried pipes crossing roads / hard /finished floorings will be provided with adequate retaining brick walls on side and RCC slab on the top to protect the pipes from any damage due to movements of heavy vehicles etc.

19 The prices are to be quoted in the BOQ format given herewith and shall include, as also mentioned above, the supply, installation, testing and commissioning at site, of all the equipments, ancillary materials as specified and shall be inclusive of all taxes, duties etc at the prevailing rates and all such items whatsoever which may be required to fulfil the intent and purpose as laid down in the specification and/or the drawings.

20 The scope of work is inclusive of Centralized Controller for the system and also power / control wiring for indoor units. The rates quoted should, therefore, be inclusive of the same.

# Bill of Quantities

| Sl no. | Description. | Unit | QTY | Per Unit Rate (Rs) | Amount (Rs) |
|---|---|---|---|---|---|
| | Supply of AIR COOLED & INVERTER BASED VARIABLE REFRIGERANT FLOW (VRF) TYPE AIR CONDITIONING SYSTEM with R410A refrigerant suitable for 415 ± 10%, 50 cycles as per details given below. | | | | |
| | | | | | |
| **A.** | **SUPPLY : Supply of equipments / components as described below :** | | | | |
| i. | 48HP VRF Outdoor Unit | Nos | 2 | | |
| ii. | 16HP VRF Outdoor Unit | No | 1 | | |
| | | | | | |
| **ii.** | **VRF indoor unit** | | | | |
| a | 10 HP High Static ductable type unit | Nos | 11 | | |
| | | | | | |
| **iii.** | **'Y' Joints** | | | | |
| a. | Y-branch (IDU) | Nos | 10 | | |
| b. | Y-branch (ODU) | Nos | 2 | | |
| | | | | | |
| **iv.** | **Remote controller** | | | | |
| a | Wired | Nos | 11 | | |
| | | | | **Sub Total (A)** | |
| | | | | | |
| | | | | | |

| S.N. | Description | Unit | Qty | Per Unit Rate (Rs) | Amount (Rs) |
|---|---|---|---|---|---|
| **B.** | **INSTALLATION, TESTING & COMMISSIONING** | | | | |
| **1** | **Installation of Outdoor Units of Following Configuration with Pressure Testing, Nitrogen flushing, gas charging, testing & commissioning of the air-conditioning system.** | | | | |
| a | 48HP Outdoor unit | Nos | 2 | | |
| b | 16HP Outdoor unit | Nos | 1 | | |
| | | | | | |
| **2** | **Installation of Indoor Units** | | | | |
| a. | High Static Ductable type indoor unit | Nos | 11 | | |
| | | | | | |
| **3 a** | **Interconnecting control cabling between IDU's & ODU's** | RMT | 225 | | |
| 3 b | PVC Conduit for above cabling | RMT | 200 | | |
| | | | | | |
| | **Supply, installation, testing and commissioning of following items :** | | | | |
| **4** | **Supply and installation of Refrigerant copper Piping (liquid/gas set). Interconnecting refrigerant pipe work suitable for R410A refrigerant with 13 mm thick Liquid line insulation and 19mm thick suction line insulation between each set of indoor & outdoor units as per specifications & with sizing as per piping layout finalization. All piping inside the room shall be properly supported with MS hanger & clamps.** | | | | |
| | | | | | |
| a | 41.3 mm O.D. pipe : 19 mm insulation | RMT | 30 | | |
| b | 34.9 mm O.D. pipe : 19 mm insulation | RMT | 22 | | |
| c | 31.8 mm O.D. pipe : 19 mm insulation | RMT | 15 | | |
| d | 28.6 mm O.D. pipe : 19 mm insulation | RMT | 40 | | |
| e | 25.4 mm O.D. pipe : 19 mm insulation | RMT | 10 | | |
| f | 22.2 mm O.D. pipe : 19 mm insulation | RMT | 105 | | |
| g | 19.1 mm O.D. pipe : 19 mm insulation | RMT | 5 | | |

| S.N. | Description | Unit | Qty | Per Unit Rate (Rs) | Amount (Rs) |
|---|---|---|---|---|---|
| h | 15.9 mm O.D. pipe : 19 mm insulation | RMT | 15 | | |
| i | 12.7 mm O.D. pipe : 19 mm insulation | RMT | 5 | | |
| j | 19.1 mm O.D. pipe : 13 mm insulation | RMT | 20 | | |
| k | 15.9 mm O.D. pipe : 13 mm insulation | RMT | 10 | | |
| l | 12.7 mm O.D. pipe : 13 mm insulation | RMT | 10 | | |
| m | 9.5 mm O.D. pipe : 13 mm insulation | RMT | 10 | | |
| n | 6.4 mm O.D. pipe : 13 mm insulation | RMT | 2 | | |
| | | | | | |
| **5** | **Electrical cabling** | | | | |
| a | Power Cabling from ODU to electrical board (3.5cx35mmsq aluminium armoured) | RMT | 60 | | |
| b | Power Cabling from 1 Phase Termination to IDU (Lot - 11 Nos) | LOT | 1 | | |
| | | | | | |
| **6** | **LT Control Panels** | | | | |
| **i.** | **LT Control Panel for Outdoor Units** | | | | |
| | Supply, Erection, Testing and Commissioning of 415 Volts LT Panels fabricated out of 16G sheet steel. The panel shall be compartmentalised, treated for anti rust and powder coated, complete with DMC insulators, Internal wiring as required, suitably sized Aluminum Bus Bar Links from Switch gear to cable alley and earth bus throughout the length of the panel, etc. The panel shall be mounted on the trench/floor using necessary MS "C" Channels. (The drawings shall be got approved by BHEL before the start of fabrication). | | | | |
| | The scope of work will also include termination of cables into these isolators. | | | | |
| | | | | | |
| | **Bus Bar Section:** TPN Aluminium bus bars suitable for 250 A continuous current rating for main Header Bus and suitably rated Bus for distribution and connecting Links. | | | | |
| | **Metering Compartment with:** 1 No - | | | | |

| S.N. | Description | Unit | Qty | Per Unit Rate (Rs) | Amount (Rs) |
|---|---|---|---|---|---|
| | Digital Multifunction Meter to read Current, Voltage, Frequency Power Factor Power and Energy. and 3 Nos.-200/5 Amp, 15 VA, Cl.-1 CTs. R,Y,B indicating LED lamps with fuse protection. | | | | |
| | | | | | |
| | **Incoming feeder compartment with:** 1 compartment with 1 No. 200 A TP MCCB. | | | | |
| | | | | | |
| | **Outgoing feeder as described below:** | | | | |
| | a. 125 A MCCB : 3 Nos. (Including one Standby) | | | | |
| | b. 63 A MCCB : 2 Nos. (Including one standby) | | | | |
| | | | | | |
| | LT Control Panel described above for Outdoor Units, as per specifications and complete in all respects. | No. | 1 | | |
| | | | | | |
| **ii.** | **LT Control Panel for Indoor Units** | | | | |
| | Supply and fixing of following control panels each with one incomer and outgoings as shown below, suitably enclosed in a tailored 1.6mm thick metallic case having adequate provision for receiving incoming and outgoing cables/wires to be connected including necessary indications. The scope of work will also include termination of cables into these panels. | | | | |
| | | | | | |
| **a.** | **For 2 units : 1 incomer + 2 outgoings** | | | | |
| | 1 No. 32A SP MCB as incomer, 63A Cu bus bar and 2 Nos. 16A SP MCBs as outgoings each with standard accessories and complete in all respects. | Nos | 1 | | |
| | | | | | |
| **b.** | **For 3 units : 1 incomer + 3 outgoings** | | | | |
| | 1 No. 63A SP MCB as incomer, 100A Cu bus bar and 3 Nos. 16A SP MCB as | Nos | 3 | | |

| S.N. | Description | Unit | Qty | Per Unit Rate (Rs) | Amount (Rs) |
|---|---|---|---|---|---|
| | outgoings each with standard accessories and complete in all respects. | | | | |
| **c.** | **For 4 units : 1 incomer + 4 outgoings** | | | | |
| | 1 No. 63A SP MCB as incomer, 100A Cu bus bar and 4 Nos. 16A SP MCBs as outgoings each with standard accessories and complete in all respects. | Nos | QR | | |
| | | | | | |
| **7** | **MS stands as per design of manufacturer of units for the following sizes of Outdoor units :** | | | | |
| a | 48HP Outdoor unit | Nos | 2 | | |
| b | 16HP Outdoor unit | No | 1 | | |
| | | | | | |
| **8** | **Hard PVC plumbing grade Drain piping as per specification with Nitrile insulation 10mm thick** | | | | |
| a | 25 mm inside Diameter | RMT | 60 | | |
| b | 32 mm inside Diameter | RMT | 20 | | |
| | | | | | |
| **9** | **GSS Ducting (For supply air)** | | | | |
| a | 0.63 mm | Sq.M. | 80 | | |
| b | 0.80 mm | Sq.M. | 50 | | |
| | | | | | |
| **10** | **Thermal Insulation (nitril rubber or equal) 13mm for supply air duct** | Sq.M. | 5 | | |
| | | | | | |
| **11** | **Supplying and fixing of 25 mm thick acoustic lining of duct as per specifications for supply air duct** | Sq.M. | 5 | | |
| | | | | | |
| **12** | **Fire retardant double layer canvas for ducted unit mouth** | Nos | 11 | | |
| | | | | | |
| **13** | **Grilles / Diffusers** | | | | |
| **a** | **Powder Coated Aluminium Grilles / Diffusers for VRF Duct System with Control Damper.** | Sq.M. | 15 | | |

| S.N. | Description | Unit | Qty | Per Unit Rate (Rs) | Amount (Rs) |
|---|---|---|---|---|---|
| **b** | **Powder Coated Aluminium Grilles / Diffusers for VRF Duct System without Control Damper** | Sq.M. | 18 | | |
| | | | | | |
| **14** | **GSS Ducting (For Fresh Air)** | | | | |
| | 0.63 mm | Sq.M. | 5 | | |
| | | | | | |
| **15** | **Thermal Insulation (nitril rubber or equal) 13mm for return air duct** | Sq.M. | 5 | | |
| | | | | | |
| **16** | **Inline Fan** | | | | |
| | **400 CFM, 20mm SP, Circular, 115 watt, single phase** | Nos. | 11 | | |
| | | | | | |
| **17** | **300 Ø, Single phase, Propeller Fan to work as exhaust fan.** | Nos. | QR | | |
| | | | | **Sub Total (B)** | |
| | | | | | |
| | | | | | |
| | | | | **Total (A+B)** | |

Total in Words (Rupees…….

……..)