

T. N. NO. 4/2021-22

Sr. No. 1



Govt. of Maharashtra

WORKS DIVISION
Dr. P.D.K.V., AKOLA

B-1 FORM (Percentage Rate)

TENDER DOCUMENTS

NAME OF WORK

SUPPLY AND ERECTING NEW ELECTRIC CONNECTION AT DEE PRINTING
PRESS, COMMITTEE HALL AND INTERNATIONAL HOSTEL AT DR. P.D.K.V., AKOLA

NAME OF CONTRACTOR

AGREEMENT NO. B1/ /UE/2021-22

UNIVERSITY ENGINEER
WORKS DIVISION
DR. P.D.K.V., AKOLA

1) Name of Work SUPPLY AND ERECTING NEW ELECTRIC CONNECTION AT DEE PRINTING PRESS, COMMITTEE HALL AND INTERNATIONAL HOSTEL AT DR. P.D.K.V., AKOLA

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GOVERNMENT OF MAHARASHTRA

WORKS DIVISION

Original Agreement No. B-1

GENERAL INFORMATION OF CONTRACT

1) Name of Work : SUPPLY AND ERECTING NEW ELECTRIC CONNECTION AT DEE PRINTING PRESS, COMMITTEE HALL AND INTERNATIONAL HOSTEL AT DR. P.D.K.V., AKOLA

2) Name of Contractor : M/s./Shri _____

3) Date of Tender :

4) Amount of Contract : **Rs. 1,49,770/-**

5) No. & Date of work Order : _____

6) Date of Commencement : _____

7) Time stipulated for completion as per Agreement : (120) Days including monsoon period and govt. holidays.

8) Date of completion as per Agreement. : _____

9) Actual Date of Completion : _____

10) Reference to Sanction of Extension of Time limit. : 1) _____
2) _____
3) _____

Certified that this Original Agreement contains pages from 1 to _____.

Fly Leaves _____ Nos. and Drawings _____ Nos.

B - 1 TENDERS

Shri/M/s. _____ Contractor
registered in class _____ vide University Engineer, Works Division,
_____ with reference to his/their download Tender document form
www.pdkv.ac.in web site vide payment gateway dated _____ cost Rs. **200/-** +
GST received as per Pay University Engineer Office, Dr. PDKV Akola receipt.

Accounts Officer
Works Division Dr. PDKV Akola

DETAILS OF WORK

Name of Work : **SUPPLY AND ERECTING NEW ELECTRIC CONNECTION
AT DEE PRINTING PRESS, COMMITTEE HALL AND
INTERNATIONAL HOSTEL AT DR. P.D.K.V., AKOLA**

Estimated cost put to tender :- **Rs. 1,49,770 /-**

Earnest Money @ ½ or 1 percent :- **Rs. 3000 /-**
subject to minimum of Rs.

Term Deposit Receipt of Schedule Bank / State Bank Challan should be attached
with the tender at the time of submission.

Total Security Deposit @ 2% : **Rs. 6000 /-**
/-
(at the time of Agreement)

Time stipulated for completion : One (120) Days which will include
the monsoon period and govt. holidays, if any.

TO BE FILLED BY THE CONTRACTOR.

I/We have quoted my/our offer in percentage rate in words as well as in figures
specifying below/above. I/We further under take to enter into Contract in regular 'B-1' form
in WORKS DIVISION.

Name of Work : **Scope of Work**

(As per Schedule B attached)

Check List of documents to be submitted with the tender and the general information to the Contractor for Submission of tender.

The following documents should be submitted in **(Envelope No.1)** duly attested by a officer not below the rank of Ex. Engineer of Govt. of Maharashtra in service on the date fixed for the receipt of tender with the forwarding (Covering) letter along with list of all documents/forms/ statement.

Sr. No	Brief details of documents required to be attached.	Whether enclosed or not
1.	Attested copy of the valid registration certificate as a contractor with the Government of Maharashtra in appropriate class.	
2.	Earnest money in the form of Bank Gurantee / FDR Deposit receipt valid for a period of one year issued by a Schedule Bank in the name of University Engineer, Dr. P.D.K.V., Akola from the date of issue/receipt of tender.	
3	Registration certificate as per Tax deduction at source as per section 51 of Goods and Services Act-2017 as provided under section 51of MGST/CGST Act. Registration will be made available on WWW.gst.gov.in from 20.7.17	
4	Attested copy of valid professional Tax PT/E, PT/R Certificate/ /clearance certificate, PAN Card.	
5	Receipt of Tender Fee form www.pdkv.ac.in web site	
6	Bid Capacity (As per Govt. G.R. dt.17.09.2019) (* Supported Document to be attached)	
7	Affidavit (On Rs.100/- Stamp Paper)	
8	Attested Copy of Annual Turnover Certificate of previous three years up-to last audited financial year.	

Note: - Contractor has to quote his offer both in figures and in words at **Page No. 37** in this B-1 tender form.

DETAILS OF WORKS (As above)

:

Sr. No	Name of work	Estimated amount put to tender	Earnest money 1 % subject to minimum Rs. ---	Security Deposit 2%(1% at the time of acceptance of tender & 1% from current bills)	Cost of form (Non refundable)	Stipulate Period for completion	Last date and time & place of receipt of Tender	Class of Contract or.
1	2	3	4	5	6	7	10	11
1	Supply And Erecting New Electric Connection At Dee Printing Press, Committee Hall And International Hostel At Dr. P.D.K.V., Akola	Rs. 1,49,770 /-	Rs.3000/-	1) Rs. 6000/- at the time of agreement	Rs 200 + GST = 236/-	120 Days Including Monsoon period and govt. holidays.	upto 15.00 Hrs. in the office of the U.E. Dr P.D.K.V. Akola	Appropriate Class

Note : University Reserved the Right to

- To postpone/change/cancel the above mentioned date, modify the terms and conditions include new items and conditions, split and distribute the work amongst more than one agency etc. in the interest of the Projects/University, without assigning any reason whatsoever.
- To cancel the Advt./Enlistment of the Agency against the above tender , anytime without assigning any reason whatsoever for which no claim on any ground shall be entertained.
- To accept or reject any or all the applications/offers received as its own discretion, without assigning any reasons whatsoever for which no claim on any ground shall be entertained.

**GOVERNMENT OF MAHARASHTRA
WORKS DIVISION
DETAILED TENDER NOTICE FOR CONTRACTOR**

1) Sealed tenders in “B-1” (Percentage rate) form are invited from the registered contractor in Appropriate Class with the Government of Maharashtra, P.W.D. for the work of **Supply And Erecting New Electric Connection At Dee Printing Press, Committee Hall And International Hostel At Dr. P.D.K.V., Akola** up to 15.00 hours on _____ (as per tender schedule) by the University Engineer, Works Division, Dr. PDKV Akola

2) **SITUATION OF THE WORK:-** The work site is located in **Dist. Nagpur**

3) The estimated cost of work is **Rs. 1,49,770/-**

4) Time limit for completion of the work is **120 Days** Calendar from the date of work order including monsoon period and govt. holidays, if any.

5) **ISSUE OF TENDER FORMS :-** (As per Schedule)

Blank tender forms can be had from the office of the **University Engineer, Works Division, Dr. PDKV Akola** up to during office hours on payment of **Rs. 236 /-** Particulars regarding the work can also be had from the Office of the **University Engineer, Works Division Dr. PDKV Akola** during the office hours.

Completed tender in the manner specified in the following forthcoming paragraphs will be received **upto 15.00 Hours. on or before** ----- in the office of the **University Engineer, Works Division Dr. PDKV Akola**.

7) **VALIDITY :-**

Validity of the tender will be **90** days from the date of opening of the tender and there after until it is withdrawn by notice in writing duly addressed to the authority opening the tender by contractor. Such withdrawal after **90** days shall be effective from the date of receipt of notice by the **University Engineer, Works Division Dr. PDKV Akola**

8) **EARNEST MONEY :-**

i) Earnest money in the form of Bank Gurantee / FDR Deposit receipt valid for a period of one year issued by a Schedule Bank in the name of **University Engineer, Works Division Dr. PDKV Akola** from the date of issue/receipt of tender.

ii) The amount will be refunded to the unsuccessful tenderers on deciding about the acceptance or otherwise of the tender. In case of a successful tenderer, it will be refunded on paying the initial Security Deposit and completing the tender documents in Form “B-1”.

9) **SECURITY DEPOSIT :-**

9.1) The successful tenderer whose tender is accepted will have to pay **Rs.-6000/-** towards the Security Deposit. **Rs. 6000/-** is to be deposited in F.D.R. of the scheduled bank/National Saving Certificate duly pledged in the name of the **University Engineer, Works Division Dr. PDKV Akola** towards the initial Security Deposit, within the time limit prescribed in clause-1 of B-1 form agreement, failing which his earnest money will be forfeited to Government. In addition to it, an amount of **Rs. 6000/-** will be deducted from the Running Bills at 2% of the gross bill towards balance security deposit, This is a compulsory deduction.

9.2) **PERFORMANCE SECURITY :-**

ADDITIONAL PERFORMANCE SECURITY :- After opening of financial Bid (Envelope No. 2) if quoted offer of the lowest tenderer (L-1) is found below the estimated cost of the department then, L-1 tenderer should deposit submit the required **"Additional Performance Security"** within period of eight days from the date of opening of financial Bid (Envelope No. 2) in the form of **Demand Draft/FDR/Bank Guarantee**. **The L-1 tenderer should take cognizance that this time limit of 8 working days will not be relaxed/extended for any reason.**

If L-1 tenderer should not submit **Additional Performance Security** as stated above, then his offer will be considered as "Non-Responsive" and Second lowest's (L-2) tenderer will be called for negotiations. If such L-2 is agreed to execute the work below than the rates than L-1 then such L-2's revised offer will be considered for acceptance of the tender.

A) If L-1 tenderer's offer is below more than 1 % to 10 % of the estimated cost put to tender then he should submit **Demand Draft/FDR/Bank Guarantee** amounting to **1%** of the estimated cost of the department towards **Additional Performance security**.

B) If L-1 tenderer's offer is more than 10 % below upto 15% of the estimated cost put to tender then he should submit **Additional Performance security of 1 % for every percent after 10 % below percentage in addition to** the cost of **1%** performance security mentioned above clause A for quoting below offer.

(eg. If **L-1 tenderer's offer is 15 %** below the estimated cost put to tender, then he should submit $15 - 10 = 5$ % Additional Performance security + 1% Additional Performance security = 6 % amount of the cost put to tender as a total Additional Performance Security.)

C) If L-1 tenderer's offer is more than 15 % below the estimated cost put to tender then he should submit **Additional Performance security 2 % for every percent after 15 % below percentage in addition to** the cost of **6%** Additional performance security mentioned above clause A & B. (eg. If **L-1 tenderer's offer is 19 %** below the estimated cost put to tender, then he should submit [1% for below upto 10% plus 5% for below upto 15 % & two times for remaining percentage i.e. $(19-15) 4 \% \times 2 = 8 \%$] Total $(1+6+8 =) 14 \%$ amount of the cost put to tender as Additional Performance Security.)

1) Such **Demand Draft/FDR/Bank Guarantee** shall strictly issued only by the Nationalized Bank or Scheduled Bank in favour of in the **University Engineer, Works Division Dr. PDKV Akola** and shall be valid for the minimum period of three months.

2) The Demand Draft should bear the MICR and IFSC Code Number of the issuing bank.

3) The **Demand Draft/FDR/Bank Guarantee** shall be submitted in the office of the concerned **University Engineer, Works Division Dr. PDKV Akola**. In **"sealed envelope"** within **stipulated period of eight working days as mentioned above**. The tenderer shall

write the 'Name of Work,' 'E- Tender No.' and 'Tender Notice No.' on such sealed envelope addressed to the concerned University Engineer.

4) If it is found that the **Demand Draft/FDR/Bank Guarantee** as above submitted by the tenderer is False / Forged Or Tenderer treated as "**Non Responsive**" then the Earnest Money submitted by such tenderer shall be forfeited and his registration as a contractor of WORKS DIVISION **will be suspended for the period of One year**. For this concerned Superintending Engineer shall have the full rights.

5) The work order to the successful contractor shall be issued only after the encashment of his **Demand Draft/FDR/Bank Guarantee** by the concerned University Engineer.

6) The amount of Additional performance security of successful contractor shall be refunded within the period of three months after the date of completion of said work successfully.

Note: - For calculating the amount of ADDITIONAL PERFORMANCE SECURITY contractors offer will be calculated in percentage rounded upto two decimal points only.

11) **TENDER PROCEDURE :-**

A) **Blank Tender Forms :**

Blank Tender Forms can be download from **the www.pdkv.ac.in** as Stipulated in the Tender Notice.

B) **Manner of submission of tender and its accompaniments:
Tender to be submitted in two separate sealed envelopes.**

a) **Envelope No.1 :**

The first envelope clearly marked as "Envelope No. 1" shall contain the following documents.

- (i) Attested copy of the valid **Registration certificate** as a contractor with the Government of Maharashtra in appropriate class.
- (ii) **Earnest money** in the form of Bank Guarantee / FDR Deposit receipt valid for a period of one year issued by a Govt. Nationalized Authorized Bank / Schedule Bank in the name of **University Engineer, Works Division Dr. PDKV Akola** from the date of issue/receipt of tender.
- (iii) Attested copy of valid **professional Tax PT/E, PT/R** Certificate, with attested copy of **PAN Card**.
- (iv) Original valid **GST registration certificate** from Goods and Services Act-2017 under section 51 of MGST/CGST Act GST-Tax Department.
- (v) All Xerox copies submitted in connection with the tender shall be attested by a officer not below the rank of Ex. Engineer. Otherwise their tender will not be considered & Envelope No. 2 will not be opened.
- (vi) Attested Copy of **affidavit** Sworn before Executive Magistrate / Notary regarding completeness, correctness and truthfulness of documents submitted online along with Tender on **Rs.100/- Stamp paper** as per prescribed Proforma given in Annexure. A

(Pg no 23)

- (vii) Copies of all declaration regarding the work shall be self attested..
- (viii) Unemployed Enggr. Kota (SUBE) is not consider in the tender process of Dr. P.D.K.V., Akola. Hence Every Tender is consider as a regular tender & all tenderer should submit EMD and no relaxation in EMD.
- (ix) **Bid Capacity Criteria** :- The Prospective Bidder will be qualified only if their available bid capacity is more than the Cost put to the Bid of the work as per notice inviting Bid. The available bid capacity will be calculated base on the following formula:
Available Bid Capacity = 2 * (A * N) – B
Where,
A = Maximum value of Electrical Engineering works executed in any one year during the last 3 years (updated to the current year by a factor of escalation of 8% per year) which will take into account the completed and ongoing works.
B = Value of existing commitments and works (Ongoing) to be completed During the next 120(days) Period of completion of the works for which bids are invited
N = Number of years prescribed for completion of work for which bids are invited.
- (x) Copies of Completed work with work done & work in hand certificate of last 5 years duly attested by a officer not below the rank of Ex. Engineer.
- (xi) Attested Copy of **Annual Turn Over** Certificate to be required upto last audited previous **three years**.

D) Envelope No. 2: Tender

The second envelope clearly marked as “Envelope No. 2” shall contain only the main tender including the common set of conditions/stipulation issued by the department after the pre-tender conference. A tender submitted without this would be considered as invalid and non responsive.

The tenderer should quote his offer on Schedule “B” of tender as percentage of estimated rates at the appropriate place of tender documents, to be submitted only in Envelope No. 2. He should not quote this offer anywhere directly or indirectly in Envelope No. 1. The contractor shall quote for the work as per details given in the main tender..

E) Submission of Tenders :-

Download tender document from www.pdkv.ac.in website and submitted The two sealed envelopes No. 1 and No. 2 shall be again put together in one common cover and sealed. This sealed cover shall be marked on the left hand top corner. Tender for the work as stated @ Sr. No.1 on page No _____ The full name and address of the tenderer shall be written on the bottom left hand corner. If submitted by the post the sealed envelope marked as above shall be enclosed in another cover

properly addressed and shall be sent by Registered post acknowledgement due. The date and time for receipt of Envelope containing tender shall strictly apply in all cases. The tenderers should ensure that their tender is submitted before the expiry of the date and time. No delay on account of any cause will be entertained for the late receipt of the tender. Tender offered or received after the date and time is over, will either not be accepted or if inadvertently accepted, will not be opened and shall be returned to the tenderer unopened.

As Per Government Circular -2016 CR-320/Road-1 Mantralaya Mumbai Dt.01.07.2016 Self

Certification and Bituman Invoice should be submitted with each & work runnig Account bill .

(Please see the Cicular on www.maharashtra.gov.in Computer Code 201607011233411318)

1.15 Instructions given by the Govt. Vide Marathi circular No. Misc.-2016/C.No. 20/Bldg.-2/Dt. 28-

04-2016 regarding E-MB & E-Billing system is applicable to this tender.

Work measurement in Electronic measurement book and Submission of Contractors monthly bill in electronic billing system . Reference Govt. Circular Public Works Deptt. Manatralay,

Mumbai . No. Misc. 2016/ case no. 20/ Bldg.2/ Dt. 28/04/2016 , 24.06.2016 & 2.9.2016.

1. As per clause 10 of this B1 contract , it is responsibility of the contractor to submit the bill monthly to the Engineer-in-charge.

2. To discharge this responsibility the contractor shall

a) appoint system Integrator.

b) system Integrator shall be Registered at ITCC Nagpur.

c) System integrator shall provide his services to the department as and when required.

d) Data generated through E Bill Payment will be the property of the Department and access will be only to the Department .

e) No claim of what so ever nature will be entertained by the department.

f) Payment to the system Integrator will not exceed 0.02% of the contract amount which will include payment towards generating of E Bill.

h) In support of the bills, required measurements , drawings, quality control reports (field

lab and VQCC as per clause of Additional General condition), site supervision data (Scada

shall be submitted in electronic form, the data so submitted shall have a facility to Tightly

integrate it with the contract conditions , provision in the Maharashtra Public Works manual, Maharashtra Public Works Account Code (Updated to date of Submission of this

tender) and current general engineering practices (issued though various govt. resolutions,

govt. circulars Chief Engineers Circulars etc. issued up to date of submission of this tender.)

followed in WORKS DIVISION.

i) The Submission of e-bill shall be in the web based format.

j) The offer of Contractor shall be inclusive of all . He shall not be paid separately, his offer

shall be inclusive of all cost required for submitting bill in e-format mentioned as above.

k) The measurement of this work shall be recorded in Electronic Measurement Book.

l) The Unique I.D. code generated while processing of this tender shall be the E Measurement Book Number

Contractor shall submit a certificate to the effect that “All the payments to the labour/staff are made in bank accounts of staff linked to Unique Identification Number (AADHAR CARD).” The certificate shall be submitted by the contractor within 60 days from the commencement of contract. If the time period of contract is less than 60 days then such certificates shall be submitted within 15 days from the date of commencement of contract

F) Opening of tenders :-

On the date specified in Tender Notice following procedure will be adopted for opening of the tender:

Envelope No. 1

First of all, Envelope No. 1 of the tenderer will be opened to verify the documents as per requirements. If the various documents contained in this envelope do not meet the requirements of the Department, a note will be recorded accordingly by the tender opening authority and the said tenderer's envelope No. 2 will not be opened.

Envelope No. 2

The Envelope shall be opened if contents of Envelope No. 1 are found to be acceptable to the Department. The tendered rates in percentage above/below the estimated rates shall then be read out.

12) Important Points to be noted by the Tenderer :

- (A) (i) On receipt of Online downloaded blank tender form the tenderer should ensure that no correction or over writings or erasers is left out to be attested by the University Engineer.
- ii) The offer in percentage should be written both in words and in figures in the tender form. In case of deviation, the lowest percentage either in words or figures will be considered.
- iii) No alternations and additions in the form of tender and in the schedules and no additions in form of special stipulations are permitted. If any of these is found, the tender may be summarily rejected.
- iv) The offer shall be inclusive of all prevailing taxes octroi, Royalty charges etc. to be paid by the tenderer for the work and the claims for payment on any such by the tenderer for the work and the claims for payment on any such account shall not be entertained.
- v) In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof, and in the event of absence of any partner, it shall be signed on his behalf by a person holding a power of attorney authorizing him to do so.
- vi) All the pages correction/additions and pasted slips should be signed by the tenderer.

- vii) The tenderer shall be deemed to have studied all plans/specifications /terms/conditions of the tender and made himself /themselves acquainted with the site conditions and availability of labour, basic materials, water, electricity etc. before submitting the tender. A Declaration to this effect shall be signed by the tenderer in the form attached with the tender.
 - viii) The Contractor's offer shall include all Insurance Policies as stated in Additional Tender condition at Sr No 12 (A) on Page No ____ of tender Document. No claim on this account will be entertained.
- B) In case any clarification is required, the tenderer may obtain it personally or in writing well in advance from the University Engineer. In any case, the tenderer will be responsible to bind himself/themselves to the terms and conditions and specifications of the tender once submitted by him/them.
- C) The tender is liable for outright rejection if on opening, it is found that
- i) Any one or more of the mandatory documents required as per para 11 is or are missing.
 - ii) Any corrections, additions or alterations are made by the tenderer on any page of the tender.
 - iii) Any pages or pasted slips is or are missing.
 - iv) The tenderer has not signed at required places.
 - v) The contractor having three works of Dr. P.D.K.V., Akola University in hand shall not eligible for Submission of 4th Tender.
- D) Rate analysis must be given with Signature of contractor within 2 days after opening of tender if the rates quoted are more than below 15%. If the submitted rate analysis is not justifiable or found vague, tender will be rejected.
- 13) Amendment of Bidding Documents
- 13.1. Before the deadline for submission of tender, the Employer may modify the tender documents by issuing addenda / corrigendum
- 13.2. Any addendum / corrigendum thus issued shall be part of the tender documents and shall be communicated in writing or by cable to all the purchasers of the tender documents. Prospective tenderers shall acknowledge receipt of each addendum / corrigendum in writing or by cable to the Employer. The Employer will assume no responsibility for postal delays.
- 13.3 To give prospective tenderers reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at his discretion, extend as necessary the deadline for submission of tender.
- 14) Acceptance of the tender rests with the competent authority who reserves the right to reject any or all tenders without assigning any reasons thereof.
- 15) This detailed tender notice shall form part of tender documents.
- 16) The Income Tax including surcharge @2.00% or percentage in force from time to time or at the rate as intimated by the competent Income Tax authority shall be deducted from the contractor from the gross bill amount of every bill, whether for measured work or advance payment and/or secured advance.

- 17) The successful tenderer will be required to produce to the satisfaction of the specified concerned authority valid and current licence issued in his favour under the provisions of Contract Labour (Regulation and Abolition) Act 1970 before starting the work. On failure to do so the acceptance of the tender shall be liable to be withdrawn and also liable for forfeiture of the earnest money.
- 18) Any dues arising out of contract will be recovered from the contractor as arrears of Land Revenue if not paid amicably. Moreover, recovery of Government dues from the contractors will be effected from the payment due to the Contractor from any other Government works under execution with them.
- 19) Deleted
- 20) As per the Govt. Resolution No. BCA 2009/CR108/ Labour 7A Mantralalya Mumbai dated 17/06/2010, the workers welfare cess @ 1% will be deducted from the gross bill amount of every bill either for measured work for advance payment and/or secured advance.
- 21) All disputes arising out of or in any way connected with this agreement shall be deemed to have arisen @ head quarter of University Engineer Dr. PDKV Akola and only the Court @ Head Quarter of University Engineer Dr. PDKV Akola shall have jurisdiction to try and adjudication over them.
- 22) 1.22 Instructions given by the Govt. Vide Marathi circular No. Misc.-2016/C.No. 20/Bldg.-2/Dt. 28-04-2016 regarding E-MB & E-Billing system is applicable to this tender.
- 22.1) Tenderer shall quote his offer considering the fact of igst /cgst/sgst act 2017 (time to time amended by Government) No separate payment will be made on a/c of GST, TDS of GST will be made from every bill as per rate prescribed by Government time to time and as when applicable.
- 22.2) The rates quoted by the Contractor shall be deemed to be inclusive of the labour welfare cess and other taxes (other than GST) that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law
- 22.3) 1. Bidder shall quote his rate excluding GST.
2. GST shall be payable on the accepted contract value
3. GST Shall be paid to contractor on the amount of bill of work done as per prevailing rate of GST during the period of work done.

Clause for Royalty charges & Laboratory Testing Charges.

- I) Contractor will have to produce in original all Royalty passes in support of payment of Royalty to the Government. If he fails Royalty amount equivalent to the consumption of materials will be recovered from the contractor.
- II) Test Shall be Carried out in accordance with the Clause " Sample & Testing of Materials" given under Additional General Condition & Specification of this tender Document.
- III) Testing of Materials shall be Carried out as per the frequency specified by the Vigilance & Quality Control Circle Amravati & Shall be Responsibility of Contractor

- IV) The Material required for testing shall be sent by the contractor to the specified Laboratory at his own Risk & Cost.
- V) In Case the desired results are not obtained during testing or the material is rejected due to unsatisfactory results the testing charges shall not be paid to the contractor.
- VI) It shall be Obligatory on Contractor to produce & Submit original copy of the Test result along with receipt of payment made to the Laboratory for releasing any without testing payment towards testing Charges
- VII) Any short fall in the testing as per frequency, will be recovered at three times testing rates.
- VIII) Testing charges are mentioned in view of the rates finalized by the Vigilance & quality Control Circle, Pune & it shall be responsibility of contractor to pay the testing charges to the concerned laboratory in accordance with the rates finalized No difference shall be payable to the contractor in case testing charges are revised by the Laboratory.

Additional Condition :-

The lowest bidder shall deposit 1% amount of the tendered cost, in cash section of this office, at the time of agreement towards the salary payment of Project Officer handling the Project Work.

FORM B-1

**WORKS DIVISION
DR. PDKV AKOLA**

PERCENTAGE RATE TENDER AND CONTRACT FOR WORK.

General Rules And Directions For The Guidance Of Contractors.

- 1) All work proposed to be executed by contract shall be notified in a form of invitation to tender pasted on a board hung up in the office of the University Engineer and signed by the **University Engineer Dr. PDKV Akola**

The form will state the work to be carried out as well as the date for submitting and opening tenders and the time allowed for carrying out the work, also the amount of earnest money to be deposited with the tender, and the amount of security deposit to be deposited by the successful tenderer and the percentage, if any, to be deducted from bills. Copies of the specifications, designs and drawings and estimated rates, scheduled rates and any other documents required in connection with the work which will be signed by the University Engineer for the purpose of identification shall also be opened for inspection by contractors in the office of the University Engineer during office hours.

- 2) In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof, and in the event of the absence of any partner it shall be signed on his behalf by a person holding a power of attorney authorizing him to do so.

- 2 (A) (i) The Contractor shall pay along with the Tender the sum of **Rs.2000/-** as and by way of earnest money. The contractor may pay the said amount by forwarding along with the tender a FDR / Bank Guarantee for the said amount for a period of one year issued by a scheduled Bank for the said amount and duly endorsed in the name of **University Engineer Dr. PDKV Akola**. The said amount of earnest money shall not carry any interest whatsoever.

- ii) In the event of his tender being accepted, subject to the provision of sub clause (iii) below, the said amount of earnest money shall be appropriated/adjusted towards the amount of security deposit payable by him under condition of General Conditions of Contract.

- iii) If after submitting the tender, the contractor withdraws his offer or modifies the same or if after the acceptance of his Tender, the Contractor fails or neglects to furnish the balance of security deposit, without prejudice to any other rights and powers of the Government hereunder, or in law, Government shall be entitled to forfeit the full amount of the earnest money deposited by him.
 - iv) In the event of his Tender not being accepted, the amount of earnest money deposited by the contractor shall, unless, it is prior there to forfeited under the provisions of sub-clause (iii) above, be refunded to him on his passing receipt therefore.
- 3) Receipt for payments made on account of any work, when executed by a firm should also be signed by all the partners, except where the contractors are described in their tender as a firm, in which case the receipts shall be signed in the name of the firm by one of the partners, or by some other person having authority to give effectual receipts for the firm.
- 4) Any person who submits a tender shall fill up the usual printed form including the column total according to the estimated quantities stating at what rate he is willing to undertake each item of the work. Tenders which propose any alteration in the work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort, will be liable to rejection. No single tender shall include more than one work, but contractors who wish to tender for two or more works shall submit a separate tender for each. Tenders shall have the name and the number of work to which they refer written outside the envelope.
- 5) The University Engineer Dr. PDKV Akola, open tenders in the presence of any intending contractors who may be present at the time and will enter the amount of the several tenders in a comparative statement in a suitable form. In the event of a tender being accepted, the contractor shall thereupon, for the purpose of identification, sign copies of the specifications and other documents mentioned in Rule-1. In the event of a tender being rejected, the Divisional Officer shall authorize the Treasury Officer/Bank concerned to refund the amount of earnest money deposited to the contract or making the tender, on his giving a receipt for the return of the money.
- 6) The Officer competent to dispose of the tenders shall have the right of rejecting all or any of the tenders.
- 7) No receipt for any payment alleged to have been made by a contractor in regard to any matter relating to this tender or the contract shall be valid and binding on Government unless it is signed by the University Engineer.

- 8) The memorandum of the work to be tendered for and the schedule of materials to be supplied by the Works Division and their rates shall be filled in and completed by the office of the University Engineer before the tender form is issued. If a form issued to an intending tenderer has not been so filled in and completed, he shall request the said officer to have done this before he completes and delivers his tender.
- 9) All work shall be measured net by standard measure and according to the rules and customs of the Works Division without reference to any local custom.
- 10) Under no circumstances shall any contractor be entitled to claim enhanced rates for any items in this contract.
- 11) All corrections and additions or pasted slips should be initialled.
- 12) The measurement of work will be taken according to the usual method in use in the Works Division and no proposal to adopt alternative methods will be accepted. The University Engineer's decision as to what is "the usual method in use in the Works Division" will be final.
 - a) The contractor shall give a list of machinery in their possession and which they propose to use on the work.
 - b) The contractor will have to construct shed for storing materials procured by him at his own cost at the work site having double locking arrangement. The materials will be taken to use in the presence of the department person. No materials will be allowed to be removed from the site of the work.
- 13) The tenders will be liable to be rejected, if while submitting it, the tender or in the case of a firm each partner thereof does not sign or the signature/signatures is/are not attested by a witness in the space provided for the purpose.
- 14) The tendering Contractor shall furnish a declaration along with the tender showing all works for which he has already entered into contract, and the value of the work that remains to be executed in each case on the date of submitting the tender.
- 15) Every tenderer shall submit along with the tender information regarding the Income Tax circle, or ward of the district in which he is assessed to Income-Tax, the reference to number of the assessment and the assessment year.
- 16) In view of the difficult position regarding the availability of foreign exchange, no foreign exchange would be released by the department for the purchase of plant and machinery required for the execution of the work contracted for.
- 17) The contractor will have to construct shed for storing controlled and valuable materials required for the work, the materials will then be taken for use in the presence of the

departmental person. No materials also will be allowed to be removed from the site of works.

- 18) The tendering contractor should furnish a detailed statement of works in hand showing the costs of works in hand and the works completed against each with certificate from head of the office concerned.

(19) **Joint Venture:-**

19.1) In case of Joint venture the copy of registered partnership deed and certificate of Registration from Assistant Registrar of firms shall be produced at the time of purchasing of tender form and also in envelope No.1.

19.2) Two or more contractors of any class may combine and tender for a work costing to the amounts upto which each individual contractor or the higher of two limits, if they are of different categories are empowered to tender as per the original registration provided.

- (i) The combination is of the contractor as a whole and not individual partners and.
- (ii) They draw a registered partnership deed and submit a copy thereof to the authority at the time of purchase of the tender forms.

19.3) Whenever the advantage of such combination of two or more contractors is to be taken for quoting for this work where in only the individual contractor of higher category is eligible to quote, it should be ensured that the registered partnership deed should be irrevocable till the completion of this work for which they have combined and till all the liabilities there of are liquidated and the share of the contractor of the higher category should not be less than 50%. Further, the percentage share of the contractor of the lower category in such a partnership/combination, should not be more than his limit of eligibility to quote for works divided by the estimated cost of work put to tender (i.e. when such a percentage is applied to the cost of the work, his share of cost should not exceed his own eligibility limit of tendering for works.)

(19.4) Grouping of plants and machineries owned by individual Contractors executing joint Venture will be considered.

(19.5) Earnest money in form of TDR/FDR issued in the name of Joint-Venture company drawn by the Schedule Bank having branches in Maharashtra and endorsed in the name of **University Engineer, Works Division, Dr. PDKV Akola** for a period of one year only be considered.

If documents submitted by the contractor to the department during the process of tender at any stage / in Envelope No. 1 / at the time of acceptance of tender / while executing the

परिशिष्ट १-

(१) मराठी

नमुना सत्यप्रतिज्ञापत्र (रुपये -/५००च्या स्टॅम्प पेपरवर)

सत्यप्रतिज्ञापत्र (Affidavit)

मी ----- वय वर्ष या ----- राहणार -----

----- कंपनीचा मालक असून / या फर्मचा ----- मी ,सत्यप्रतिज्ञा पत्राव्दारे लिहून देतो की
१.त्या निविदेच्या लिफाफा क्र .या कामासाठी निविदा सादर करीत आहे ---मध्ये जी कागदपत्रे सादर केली आहे ती खरीबरोबर व ,
याची मी खाली केलेली असून असे शपथपूर्वक खालील अटी व शर्तीसह ,चुका नाहीत ,त्या मध्ये कोणत्याही त्रुटी .पूर्ण आहेत
मान्य करीत आहेखोटी व तसेच अपूर्ण माहिती आढळल्यास मी भारतीय ,दिशाभूल करणारी ,या कागदपत्रा मध्ये काही चुकीची .
.दंडसंहिता अंतर्गत कायदेशीर कार्यवाहीस पात्र राहीन

.१ यांनी सार्वजनिक बांधकाम विभागाला-माझ्या कार्यालयामे किंवा माझ्या कर्मचा ,मी ,जर कंत्राट कालावधी दरम्यान
कोणतीही खोटी माहिती किंवा देयका समवेत तसेच पत्रव्यवहारात खोटी बनावट साहित्य खरेदीची कागदपत्रे सादर केली /
.मी भारतीय दंडसंहिता अंतर्गत कायदेशीर कार्यवाहीस पात्र राहीन ,असल्यास

.२ अंतिम देयक देण्याच्या तारखे ,त्राट कालावधी दरम्यान आणि काम समाप्ती नंतरजर कं पर्यंत सादर केलेली कोणतेही
कागदपत्रे खोटी .मी भारतीय दंडसंहिता अंतर्गत कायदेशीर कार्यवाहीस पात्र राहीन ,बनावट किंवा फसवी आढळल्यास /

.३ कोणतीही माहिती किंवा ,किंवा त्यानंतर कोणत्याही वेळी जर काम समाप्ती नंतर दोष दायित्व कालावधी दरम्यान
ब / कागदपत्रे खोटीनावटमी भारतीय दंडसंहिता अंतर्गत कायदेशीर कार्यवाहीस ,फसवी किंवा दिशाभूल करणारी आढळल्यास ,
.पात्र राहीन

कंत्राटदाराची सही शिक्क /

Annexure -A

Affidavit (On Rs. 100/- Stamp Paper)

I ----- age ----- address -----
----- (Authorized signatory to sign in contract), hereby submit,----- vide
this affidavit in truth, that I am the owner of the contracting firm ----- / authorized
signatory and I am submitting the documents in envelope no 1 for the purpose of scrutiny of the contract.
I hereby agree to the conditions mentioned below.

1. I am liable for action under Indian Penal Code for submission of any false / fraudulent paper / information submitted in envelope no.1
2. I am liable for action under Indian Penal Code if during contract period and defect liability period, any false information, false bill of purchases supporting proof of purchase, proof of testing submitted by my staff, subletting company or by myself, I will be liable for action under Indian Penal Code.
3. I am liable for action under Indian Penal Code if any paper are found false / fraudulent during contract period and even after the completion of contract (finalization of final bill)

(Signature of contractor)

(seal of company)

INTEGRITY PACT

Between

Works Division, Maharashtra Government
having its Office at University Engineer, Work Division,
Dr. P.D.K.V., Akola.

hereinafter referred to as
"WORKS DIVISION",
and

[Insert the name of the Sale Bidder/Lead Partner of Joint Venture
having its Registered Office at _

(Insert full Address)

and

[Insert the name of the Partner(s) of Joint Venture, as applicable]

having its Registered Office at _

(Insert full Address)

hereinafter referred to as

"The Bidder/Contractor"

Preamble

WORKS DIVISION intends to award, under
laid-down organizational procedures, contract(s) for _

[Insert the name of the package]

(Signature) _ (Signature) _

(For & On behalf of WORKS DIVISION) (For & On behalf of Bidder/
Partner(s) of

[Joint Venture/ Contractor]

Integrity Pact Page 1 of 8

•

Package and Specification •

Number

[Insert Specification Number of the package]

WORKS DIVISION values full compliance with all

relevant laws and regulations, and the principles of economical use of resources, and

of fairness and transparency in its relations with its Bidders/ Contractors.

In order to achieve these goals, WORKS DIVISION and the above named

Bidder/Contractor enter into this agreement called 'Integrity Pact' which will form a
part of the bid.

It is hereby agreed by and between the parties as under:

Contractor

No of correction

University Engineer

Section I - Commitments of WORKS DIVISION

- (1) WORKS DIVISION commits itself to take all measures necessary to prevent corruption and to observe the following principles:
 - a) No employee of WORKS DIVISION, personally or through family members, will in connection with the tender, or the execution of the contract, demand, take a promise for or accept, for him/herself or third person, any material or other benefit which he/she is not legally entitled to.
 - b) WORKS DIVISION will during the tender process treat all Bidder(s) with equity and fairness. WORKS DIVISION will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.
 - c) PUBLICWORKS DEPARTMENT will exclude from evaluation of Bids its such employee(s) who has any personnel interest in the Companies/ Agencies participating in the Bidding/Tendering process
- (2) If Principle Secretary PWD, Maharashtra Government obtains information on the conduct of any employee of PUBLICWORKS DEPARTMENT which is a criminal offence under the relevant Anti- Corruption Laws of India, or if there be a substantive suspicion in this regard, he will inform its Chief Vigilance Officer and in addition can initiate disciplinary actions under its Rules.

Section II-Commitments of the Bidder/Contractor

- (1) The Bidder/Contractor commits himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles

(Signature) _____
(For & On behalf of WORKS DIVISION) (For & On behalf of Bidder/
Partner(s) of

(Signature) _____

(Joint Venture! Contractor)

Integrity Pact Page 2 of 8

using his participation in the tender process and during the contract execution:

- a) The Bidder/Contractor will not, directly or through any other person or firm, offer, promise or give to WORKS DIVISION, or to any of WORKS DIVISION's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange an advantage during the tender process or the execution of the contract.
- b) The Bidder/Contractor will not enter into any illegal agreement or understanding, whether formal or informal with other Bidders/Contractors. This applies in particular to prices, specifications,

certifications, subsidiary contracts, submission or non-submission of bids or actions to restrict competitiveness or to introduce cartelization in the bidding process.

- c) The Bidder/Contractor will not commit any criminal offence under the relevant Anti-corruption Laws of India; further, the Bidder/Contractor will not use for illegitimate purposes or for purposes of restrictive competition or personal gain, or pass on to others, any information provided by WORKS DIVISION as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
 - d) The Bidder/Contractor of foreign origin shall disclose the name and address of the Agents/ representatives in India, if any, involved directly or indirectly in the Bidding. Similarly, the Bidder/Contractor of Indian Nationality shall furnish the name and address of the foreign principals, if any, involved directly or indirectly in the Bidding.
 - e) The Bidder/Contractor will, when presenting his bid, disclose any and all payments he has made, or committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and/ or with the execution of the contract.
 - f) The Bidder/Contractor will not misrepresent facts or furnish false/forged documents/information s in order to influence the bidding process or the execution of the contract to the detriment of WORKS DIVISION.
- (2) The Bidder/Contractor will not instigate third persons to commit offences outlined above or be an accessory to such offences.

(Signature) _

(Signature) _

(For & On behalf of PUBLIC WORKS DEPARTMENT) (For & On behalf of Bidder/
Partner(s) of (Joint Venture / Contractor)

Integrity Pact Page 3 of 8

Section 111- Disqualification from tender process and exclusion from future contracts

- (1) If the Bidder, before contract award, has committed a serious transgression through a violation of Section II or in any other form such as to put his reliability or credibility as Bidder into question, PUBLIC WORKS DEPARTMENT may disqualify the Bidder from the tender process or terminate the contract, if already signed, for such reason.
- (2) If the Bidder/Contractor has committed a serious transgression through a violation of Section II such as to put his reliability or credibility into question, WORKS DIVISION may after following due procedures also

exclude the Bidder/Contractor from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of the transgression. The severity will be determined by the circumstances of the case, in particular the number of transgressions, the position of the transgressors within the company hierarchy of the Bidder/Contractor and the amount of the damage. The exclusion will be imposed for a minimum of 12 months and maximum of 3 years.

- (3) If the Bidder/Contractor can prove that he has restored/recouped the damage caused by him and has installed a suitable corruption prevention system, WORKS DIVISION may revoke the exclusion prematurely.

Section IV - Liability for violation of Integrity Pact

- (1) If WORKS DIVISION has disqualified the Bidder from the tender process prior to the award under Section III, PUBLICWORKS DEPARTMENT may forfeit the Bid Guarantee under the Bid.
- (2) If WORKS DIVISION has terminated the contract under Section III, WORKS DIVISION may forfeit the Contract Performance Guarantee of this contract besides resorting to other remedies under the contract.

Section V- Previous Transgression

- (1) The Bidder shall declare in his Bid that no previous transgressions occurred in the last 3 years with any other Public Sector Undertaking or Government Department that could justify his exclusion from the tender process.

(Signature) _

(Signature) _

(For & On behalf of WORKS DIVISION) (For & On behalf of Bidder/
Partner(s) of Joint Venture / Contractor)

Integrity Pact Page 4 of 8

- (2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section VI - Equal treatment to all Bidders/Contractors

- (1) WORKS DIVISION will enter into agreements with identical conditions as this one with all Bidders.

- (2) WORKS DIVISION will disqualify from the tender process any bidder who does not sign this Pact or violate its provisions.
Section VII - Punitive Action against violating Bidders/Contractors
If PUBLICWORKSDEPARTMENT obtains knowledge of conduct of a Bidder or a Contractor or subcontractor or of an employee or a representative or an associate of a Bidder or Contractor or his Subcontractor which constitutes corruption, or if WORKS DIVISION has substantive suspicion in this regard, WORKS DIVISION will inform the Chief Vigilance Officer (CVO).

(*) Section VIII - Independent External Monitor of Monitors

- (1) WORKS DIVISION has appointed a panel of Independent External Monitors (IEMs) for this Pact with the approval of Central Vigilance Commission (CVC), Government of India, out of which one of the IEMs has been indicated in the NIT/IFB.
- (2) The IEM is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement. He has right of access to all project documentation. The IEM may examine any complaint received by him and submit a report to Principle Secretary PWD, Maharashtra Government, WORKS DIVISION, at the earliest. He may also submit a report directly to the CVO and the CVC, in case of suspicion of serious irregularities attracting the provisions of the PC Act. However, for ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process, the matter shall be referred to the full panel of IEMs, who would examine the records, conduct the investigations and submit report to Principle Secretary PWD, Maharashtra Government, WORKS DIVISION, giving Joint findings.

(Signature) _

(Signature) _

(For & On behalf of WORKS DIVISION) (For & On behalf of Bidder/
Partner(s) of _____ Joint Venture / Contractor)
)

Integrity Pact Page 5 of 8

- (3) The IEM is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the Principle Secretary PWD, Maharashtra Government, WORKS DIVISION.
- (4) The Bidder(s)/Contractor(s) accepts that the IEM has the right to access Without restriction to all documentation of WORKS DIVISION related to this contract including that provided by the Contractor/Bidder. The Bidder/Contractor will also grant the IEM, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his documentation. The same is applicable to Subcontractors. The IEM IS under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s)/ Subcontractor(s) with confidentiality.
- (5) WORKS DIVISION will provide to the IEM information as sought by him which could have an impact on the contractual relations between WORKS DIVISION and the Bidder/Contractor related to this contract.

- (6) As soon as the IEM notices, or believes to notice, a violation of this agreement, he will so inform the Principle Secretary PWD, Maharashtra Government, WORKS DIVISION and request the Principle Secretary PWD, Maharashtra Government, WORKS DIVISION to discontinue or take corrective action, or to take other relevant action. The IEM can in this regard submit non-binding recommendations. Beyond this, the IEM has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action. However, the IEM shall give an opportunity to WORKS DIVISION and the Bidder/Contractor, as deemed fit, to present its case before making its recommendations to PUBLIC WORKS DEPARTMENT.
- (7) The IEM will submit a written report to the Principle Secretary PWD, Maharashtra Government, WORKS DIVISION within 8 to 10 weeks from the date of reference or intimation to him by PUBLIC WORKS DEPARTMENT and, should the occasion arise, submit proposals for correcting problematic situations.
- (8) If the IEM has reported to the Principle Secretary PWD, Maharashtra Government, WORKS DIVISION, a substantiated suspicion of an offence under relevant Anti- Corruption Laws of India, and the Principle Secretary PWD, Maharashtra Government, WORKS DIVISION has not, within the reasonable time taken visible action to proceed against such offence or reported it to the CVO, the Monitor may also transmit this Information directly to the CVC, Government of India.

(Signature)

(For & On behalf of WORKS DIVISION) (For & On behalf of Bidder!
Partner(s) of (Joint Venture/Contractor)

Integrity Pact Page 6 of 8

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- (9) The word 'IEM' would include both singular and plural.
(*) *Tills Section shall be applicable for only those packages to here in the IEMs have been Identified in Section - I : luation for Bids and/or Clause ITB 9.3 in Section - III: Bid Data Sheets of Conditions of Contract, Volume-I of the Bidding Documents.*

Section IX - Pact Duration

This Pact begins when both parties have legally signed it. It expires for the Contractor after the closure of the contract and for all other Bidder's six month after the contract has been awarded.

Section X- Other Provisions

- (1) This agreement is subject to Indian Law Place of performance and jurisdiction is the establishment of WORKS DIVISION. The Arbitration clause provided in the main tender document / contract shall not be applicable for any issue / dispute arising under Integrity Pact.
- (2) Changes and supplements as well as termination notices need to be made in writing.
- (3) If the Contractor is a partnership firm or a consortium or Joint Venture, this agreement must be signed by all partners, consortium members and Joint Venture partners.

Contractor

No of correction

University Engineer

- (4) Nothing in this agreement shall affect the rights of the parties available under the General Conditions of Contract (GCC) and Special Conditions of Contract (SCC)
- (5) Views expressed or suggestions/ submissions made by the parties and the recommendations of the CVO/ IEM in respect of the violation of this agreement, shall not be relied on or introduced as evidence in the arbitral or judicial proceedings (arising out of the arbitral proceedings) by the parties in connection with the disputes/ differences arising out of the subject contract.
CVO shall be applicable for packages to here in IEM are not Identified in Section IFBI BDS of Condition of Contract, Volume-I, IEM shall be applicable for packages to here in IEM are identified in Section IFB/BDS of Condition of Can tract, volume-l.

(Signature) _

(For & On behalf of WORKS DIVISION) (For & On behalf of Bidder ! Partner(s) of
Joint Venture ! Contractor)

Integrity Pact Page 7 of 8

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- (6) Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. **In** this case, the parties will strive to come to an agreement to their original intentions.

(Signature) .

(For & On behalf of WORKS DIVISION)

(Signature) .

(For & On behalf of Bidder/ Partner(s)

of Joint Venture! Contractor)

(Office Seal)

(Office Seal)

Name.,
Designation'
Witness 1:.
(Name & Address).

Name:
Designation'
Witness 1:
(Name & Address) .

Witness 2:
(Name & Address) .

Witness 2:
(Name & Address).

Integrity Pact

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Additional Conditions regarding procurement of Bitumen, Steel and Cement.

As Per Govt of Maharashtra WORKS DIVISION, Marathi Circular No. संकिर्ण-

2018/प्र.क्र.30/यं.बां.सा./ Dt. 27.3.2019

1. Instructions for purchase of Bitumen.

1.1 The bitumen shall be purchased from the Government refineries viz. Hindustan Petroleum Corporation Limited (HPCL)/ Bharat Petroleum Corporation Limited (BPCL)/ Indian Oil Corporation (IOCL), OR any Private Sector Refinery, OR any other Bitumen producing Refinery who are supplying bitumen of the required **Viscosity Grade** as per prescribed standards and Specifications of MORTH.

1.2 The Contractor/Entrepreneur, must adopt the following procedure for purchase of bulk bitumen obtained from Indian oil refineries or other Bitumen producing refineries.

(1) The Contractor/Entrepreneur appointed for bituminous road works in WORKS DIVISION Maharashtra shall be free to procure bulk bitumen from Public sector refinery / Indian refineries in private sector / local authorized suppliers / Authorized supplier - contractors of Private, Semi government and Foreign Refineries in India / Local manufacturer.

(2) Contractors/Entrepreneur and if it is required, the field officers, as per the requirement of project, has to purchase bitumen of VG-30 grade as given below.

Sr.No	Quantity of Bulk Bitumen to be procured	Source of Supply of Bulk Bitumen
1	Upto 500 MT (For the works in which requirement of bitumen is less than 500 MT)	1. Local Bitumen suppliers 2. Authorized Contractors or Suppliers of Private Sector / Public Sector Oil refineries 3. Contractor / supplier who maintain large stock of bitumen.
2	More than 500 MT (For the works in which requirement of bitumen is more than 500 MT)	1. Direct purchase from Public Sector oil refineries 2. Direct purchase from Private Sector oil refineries 3. Contractors / suppliers who procures bulk bitumen from oil refineries and maintains stock of bitumen for the purpose of sale. 4. Supplier who imports foreign bitumen to supply public refineries.
3	Only for experimental basis 1500 Km. Per Public Works Region. (If University Engineer permits)	1. Suppliers / Dealers of foreign refineries importing directly bulk bitumen of Grade VG-30 in India from foreign refineries.

Note – Permission has been granted to use VG-30 grade bulk bitumen procured from foreign refineries for the road works under P.W.D. Government of Maharashtra on experimental basis for the period from 01/04/2019 to 31/3/2020, only for the works to be carried out on experimental basis. (Prior permission of University Engineer is obligatory.)

(3) Following specifications are obligatory on the Supplier / Contractor for the Viscosity Grade Bitumen procured from private sector or any other oil refineries .

- (A) Viscosity Grade of Bulk Bitumen used in the work shall be conforming to the norms of **Indian Standard bureau I.S. 73:2013.**
- (B) The contractor/Entrepreneur shall submit CRC (Consignee receipt certificate) and Bill invoices with paid GST, in triplicate. It is binding on all the refineries to mention the name of work on consignee receipt certificate/ Bills for which the bitumen is being used.
- (C) The bitumen producer shall submit the manufacturers laboratory report of Bitumen of concerned batch. This bitumen shall be re-examined in contractors owned laboratory and report shall be submitted to the department.
- (D) All the necessary reports, certificates, purchase orders / Bills / tax invoices /Vouchers shall be submitted in originals.
- (E) For the works costing more than Rs.5.00 Crores, it is mandatory for the concerned contractor to arrange following tests carrying facilities on the work site
 - (i) Penetration test
 - (ii) Softening test
 - (iii) Seperation Test
 - (iv) Elastic Recovery test
 - (v) Adultration test.

1.3.2 Instruction Regarding recovery or payment for Price escalation due to increase or decrease in rate of bulk bitumen.

Following instructions shall be followed for payments of price escalation of bitumen used in the work procured from private sector or any other refineries.

- (i) Escalation De-escalation regarding bitumen shall be decided by considering **the lowest rate amongst rates of all Public Sector Refineries on the date of acceptance of tender** and the rate of actual purchase of bitumen from private refinery as on the date of purchase order of bitumen **will be considered as the Star Rate.**
- (ii) If due to **increase** in rate of bitumen contractor/entrepreneur is liable for the refund of escalation amount, then the escalation amount shall be calculated by considering **the lowest rate of Public Sector OR Private Sector refineries.**
- (iii) If due to **decrease** in rate of bitumen contractor/entrepreneur is liable for the recovery of excess amount, then the recovery amount shall be carried out by considering **the highest rate of Public Sector OR Private Sector refineries.**

2. Instruction regarding procurement of Cement.

2.1 The contractor can purchase the cement from any main manufacturer or manufacturer's authorized distributors.

2.2 Instructions regarding the payment of price escalation due to increase in rate and recovery due to decrease in rate of cement.

If the rate of cement hike or reduce, then the additional payment for hike rate of cement or recovery due to reduction in rate shall be calculated by considering the difference of Star Rate mentioned in the tender and the actual rate of purchase of cement on the date of purchase.

3. Instructions for purchase of Steel.

3.1 The contractor can purchase the Steel from any main manufacturer (SAIL, TATA Steel, ISPAT and other main manufacturer as directed by the Government) or their authorized distributors.

3.2 Instructions regarding the payment of price escalation due to increase in rate and recovery due to decrease in rate of Steel..

If the rate of Steel hike or reduce, then the additional payment for hike rate of Steel or recovery due to reduction in rate shall be calculated by considering the difference of Star Rate mentioned in the tender and the actual rate of purchase of Steel on the date of purchase.

Responsibility regarding the quality and quantity test check of construction materials. (Bitumen, steel, cement)

Following procedure shall be adopted for the verifications of the bills of private suppliers of the Steel, Cement, Bitumen and bitumen procured from the private sector refineries and authorized suppliers of Imported Bitumen.

It is binding on the contractor/Entrepreneur to submit Invoices / Bills / Vouchers of construction materials /Bitumen (With GST number) in originals procured from Private Sector Refineries / Public Sector Refineries or authorized Private Importers dealers.

- i) The Contractor/Entrepreneur shall be fully responsible for the authenticity of the invoices / Bills submitted by themselves regarding the purchase of steel, cement and bitumen as mentioned above.
- ii) The contractor/Entrepreneur shall assist and make all arrangements as directed for **quality and quantity check** of various building materials used for the work. (Steel, Cement, Bitumen etc.) University Engineers, Deputy Engineers , Sectional Engineers of the department will not be responsible for the authenticity / genuineness of Invoice regarding the purchase of materials submitted by the contractor along with bill. If the invoices/bills/vouchers regarding the procurement of materials submitted by the contractor/Entrepreneur is found forged / fake or bogus, then criminal offence / FIR will be registered by concerned University Engineer. Even in future against the concerned contractor/Entrepreneur. If the invoices/bills/vouchers are found forged / fake or bogus after finalization of agreement then, in such case also the Criminal offence / FIR against the contractor/Entrepreneur as per Indian Penal Code will be registered by concerned University Engineer.
- iii) University Engineer is empowered to verify the Invoices /Bill / Vouchers submitted by the contractors/Entrepreneur regarding the purchase of materials and in case of any doubt the University Engineers shall initiate field level enquiry of such documents. After due verification of Invoices regarding purchase of construction materials if these or any of these invoices /Bills/Vouchers are found forged / fake or bogus, then Criminal offence against such contractor/Entrepreneur will be registered under Indian Penal Code by concerned University Engineer..

(V) Test of steel Cement and other building materials.

The contractor /Entrepreneur shall assist and make all arrangements as directed for carrying out various quality control tests of steel/cement / other construction materials procured from main producers or their authorized distributors, as per the norms of Indian Standard Bureau for the materials procured by contractor.

The contractor/Entrepreneur shall assist and make all arrangements as directed on the basis of consumption of Steel/ Cement, to carry out required quality control tests as per frequency of Tests chart.

30% quality control tests shall be carried out in the laboratories of WORKS DIVISION and remaining 70% tests shall be carried out in field laboratory installed by the contractor at work site.

If field laboratory is not available then such tests shall be carried out from the laboratory of Engineering Colleges or any other Government laboratory.

(VI) If the contractor/Entrepreneur is found guilty in case of forged /Fake Bills /Invoices/ Vouchers regarding the purchase of materials then criminal action against such contractor/Entrepreneur will be initiated by concerned University Engineer and as per the Law Of Contract the contractor will be black listed forever for works in the WORKS DIVISION (Maharashtra) and will be debarred from participation in any tendering process of the WORKS DIVISION of state of Maharashtra.

(VII) The contractor/Entrepreneur shall assist in grade testing of bitumen at field level.

(VII) The Contractors/Entrepreneurs shall have facility of various bitumen test / quality control test and having modern machinery.

(VIII) **For the works costing Rs. 5.00 Crore and above** - The contractor/Entrepreneur must have ownership of who acquired the required tests equipments for carrying out various bitumen tests, and advanced machinery.

(IX) The Contractor/Entrepreneur shall submit Bills/ Invoices/Vouchers of the utilized Bitumen and other construction materials in quadruplicate (4 Copies) on the Fifth Day of the next month of work completed to the concerned Sub-Division. One copy out of four will be duly signed by University Engineer and returned to the contractor for their Tax and Audit purpose. If contractor fails to submit such invoices then he will be solely responsible for the delay in payment.

(X) The Contractor/Entrepreneur shall submit the abstract of utilized materials in prescribed format (Consumption Statement). The University Engineer & the Divisional Accounts Officer will verify such Consumption Statements and attest the same. Contractor/Entrepreneur shall submit invoices/bills/vouchers as per consumption statement with certificate mentioning that the submitted invoices are not forged or fake. The certificate so given by the contractor will be attested by University Engineer and Divisional Accounts Officers. If such certificate submitted by the Contractor/Entrepreneur is found forged/Fake then Criminal action will be initiated against such contractor.

5. **Instructions regarding utilization of bitumen (V.G.30 Grade Bitumen as per Indian Standard) procured directly from the foreign manufacturing refineries.**

The permission to use VG 30 grade bitumen procured from foreign refineries for the road works under WORKS DIVISION will have to be sought by the contractors/Entrepreneurs from concerned University Engineer in writing before start of work. This permission is only for works taken up on experimental basis. The works on which bitumen procured from foreign refineries is utilized will be under supervision for 2 years for the checking the Performance. the findings will be recorded carefully. The quality of such works will be Tri Party such as I.I.T, V.J.T.I., V.N.I.T etc. during defect liability period.

Following conditions shall be fulfilled for bitumen procured from foreign refineries.

- (1) Bitumen procured from foreign refineries directly shall be conforming to **Indian Standard Bureau Code IS 73:2013**

- (2) Refineries shall submit CRC/Bill Invoice in Triplicate with Test Report of Bitumen of concerned bitumen batch. Also inferences of such tests carried out by the foreign refineries in their owned laboratories as per Indian Standard shall also be submitted by the contractor/Entrepreneur to the department.
- (3) Such Foreign refineries shall have their owned laboratory in India. Contractor/Entrepreneur shall submit test reports carried out in foreign refinery owned laboratory in India after availability of bitumen in India.
- (4) For the purpose of calculating the price variation the lowest of the rate of VG-30 grade bitumen of foreign refinery and the rate of VG-30 grade bitumen of Indian Public Sector refinery on the same date in India, shall be taken. In case of Negative escalation the highest rate of above mentioned rates shall be preferred.
- (5) Foreign Refineries bitumen shall be used after obtaining satisfactory test results from Government approved laboratory. Before utilization of such foreign bitumen on the work, the contractor shall submit the undertaking that "*He will be liable for maintaining the Quality of the works as per the prescribed norms and to carry out the required tests of bitumen satisfactory as the the Indian Standards. If quality of such work is not maintained by the contractor OR required tests results of bitumen are not found satisfactory, then such works will be repaired / rectified by the contractor at his own cost. If he denies then the work will be rectified at the Risk & Cost of the contractor. Recovery of such expenses will be made from him as 'Arrears of Land Revenue'. "*

13. Insurance

- 13.1 The Contractor shall provide Contractor's All Risk Insurance (CAR), in the joint names of the Employer and the contract Insurance cover from the Start Date to the end of the Defects Liability Period in the amounts as deductible stated in the Contract Data for the following events which re due to the Contractor risk.
- a) Loss of or damage of the works, Plant and Materials
 - b) Loss of or damage of Equipment
 - c) Loss or damage of property (except the Works, Plant, Materials and Equipments in connection with the Contract; and
 - d) Personal injury or death of any personnel employed by the contract is during execution and maintenance defect Liability period, employee of PWD, any person using the facility created by the contract during the construction and defect liability period.
- 13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide is compensation to be payable in the types and proportions of currencies required to rectify the loss of damage incurred.
- 13.3 If the Contractor does not provide any of the polices and certificated required, the employee may affect the insurance which the Contractor should have provided and recover premiums the Employer has paid from payments otherwise due to the Contractor of It's payment is due, the payment of the premiums shall be a debt due shall be recoverable from the bills and deposits of the contractor of any work in Maharashtra and if no dues in work than as arrears of land revenue.
- 13.4 Alternations to the terms of Insurance shall not be made without the approval of the Engineer.
- 13.5 Both parties shall comply with any conditions of the insurance policies.

14 Mandatory Testing of Material and Penalty Clause :- It is mandatory on the part of contractor to carry out all the required tests of various construction materials as mentioned in schedule "B" of the tender. If the contractor fails to submit required test result of the various construction materials as mentioned in the items of schedule "B", he will be liable to deposit the amount at penal rate of five times of the amount of particular test which he has not carried out. Contractor will be informed by the engineer-in-charge through letter. On receipt of letter contractor will have to either deposit the said amount or to carry out the required test within ten days. If he again fails to carry out the required test in stipulated time limit, the said test will be carried out by the department and total expenditure incurred on the testing charges plus five times amount of testing charges will be recovered from the contractor's bill.

As this recovery is only due to the negligence on the part of contractor to carry out work as per Tender conditions and University Engineer's decision will be final and binding on the contractor and it can not be challenged by the contractor by way of Appeal ,Arbitration or in the Court of Law.

The Percentage shall be applied to work portion (A) only. The Part "B" of schedule "B" will be intact.

TENDER FOR WORKS.

I/We hereby tender for the execution, for the Governor of Maharashtra (herein before and hereinafter referred to as “Government”) of the work specified in the under written memorandum within the time specified in such memorandum at *()* in figure as well as in words _____

Percent below/above the estimated rates entered in Schedule ‘B’ (Memorandum showing items of work to be carried out) and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in Rule 1 hereof and in Clause 13 of the annexed conditions of contract. And agree that when materials for the work are provided by Government such materials and rates to be paid for them shall be as provided in Schedule ‘A’ hereto.

**Contractor’s Signature
and seal of contractor**

MEMORANDUM

General Description :

- a) If several sub-works are included :
they should be detailed in a separate list - **SUPPLY AND ERECTING NEW ELECTRIC CONNECTION AT DEE PRINTING PRESS, COMMITTEE HALL AND INTERNATIONAL HOSTEL AT DR. P.D.K.V., AKOLA**
- b) Estimated Cost. : **Rs. 1,49,770 /-**
- c) The amount of earnest money to be deposited shall be in accordance with the provisions of paras 206 and 207 of the M.P.W. Manual. Earnest Money **Rs.3000/-**
1 Percent subject to minimum of Rs.
- d) This deposits shall be in accordance with paras 213 and 214 of the M.P.W. manual : **Security Deposit 2% Rs. 6000/-**
(at the time of agreement)
- Total **Rs. 6000/-**
=====
- e) This percentage where no security deposit is taken will vary from 5% to 10% according to the requirement of the case. Where security deposit is taken as note to Clause 1 of conditions of contract. : Percentage, if any, to be deducted from bills so as to make up the total amount required as Security deposit by time, half the work as measured by the cost, is done, **(2 %) Two percent.**
- f) Give schedule where necessary dates by which various items are to be completed. : f) Time allowed for the work, from date of written order, to complete **120 Days** including Monsoon & govt. holiday.

Should this tender be accepted I/We hereby agree that this offer shall remain open for acceptance for a minimum period of 45 days from the day fixed for opening the same and thereafter until it is withdrawn by me/us by notice in writing duly addressed to the authority opening the tenders and sent by registered post A.D. or otherwise delivered at the office of such authority.

Treasury challan No. _____ dated _____ or Term Deposit receipt, for period of the year issued by a scheduled bank and duly endorsed in the name of **University Engineer, Dr. PDKV Akola** a sum of **Rs. 3000/-** representing the earnest money is herewith forwarded. The amount of earnest money shall not bear interest and shall be liable to be forfeited to the Government. Should I/We fail to (1) abide by the stipulation to keep the offer open for the period mentioned above or (2) sign and complete the contract documents required by the Engineer and furnish the security deposit it as specific in term (d) of memorandum contained in paragraph I above within the time limit laid down in clause (i) of the annexed general conditions of the contract. The amount of earnest money may be adjusted towards the

security deposit or refunded to me/us if so desired by me/us in writing unless the same or any part thereof has been forfeited as aforesaid

I/We have secured exemption from payment of earnest money after executing the necessary bond in favour of the Government a true copy of which is enclosed herewith, should any occasion for forfeiture of earnest money for this work arise due to failure on my/our part to (1) abide by the stipulation to keep the offer open for the period mentioned above - or (2) sign and complete the contract documents and furnish the security deposit as specified in item (d) of the memorandum contained in paragraph I above within the time limit laid down in clause (1) of the annexed General conditions of the contract, the amount payable by me/us may, at the option of the Engineer, be recovered out of the amount deposited in lump sum for securing exemption in so far as the same may extend in terms of the said bond and in the event of the deficiency out of any other money which are due or payable to me/us by the Government under any other contract or transaction of any nature whatsoever or otherwise.

Should this tender be accepted I/We hereby agree to abide by and fulfill all the terms and provision of the conditions of contract annexed hereto so far as applicable and in default to forfeit and pay to government the sum of money mentioned in the said condition. Receipt No. _____ dated _____ from the Government Treasury at in respect of sum of **Rs.3000/-** forwarded representing the earnest money (a) the full value of which is to be absolutely forfeited to Government should I/we not deposit the fully amount of security specified in the above memorandum in accordance with Clause 1 (A) of the said conditions of the contract, otherwise the said sum of **Rs.3000/-** shall be refunded.

Contractor
(Address)

+ Signature of Contractor
before submission of Tender.

Dated the _____ day of _____ 20____

(Witness)

+ Signature of Witness
to Contractors Signature.

(Address)
(Occupation)

Signature of the Officers
by whom accepted.

The above tender is hereby accepted by me on behalf of Governor of Maharashtra.

**University Engineer,
Works Division, Dr. PDKV Akola,**

Dated the _____ day of _____ 20____

CONDITIONS OF CONTRACT

Security Deposits	<p>Clause 1 :-The person/persons whose tender may be accepted (herein after called the contractor, which expression shall unless excluded by or repugnant to the context include his, heirs, executors, administrators, contractor and assigns) shall (A) within 10 days (which may be extended by the Superintending Engineer concerned, upto 15 days if the Superintending Engineer thinks fit to do so) of the receipt by him of the notification of the acceptance of his tender deposit with the University Engineer in cash or Govt. securities endorsed to the University Engineer (if deposited for more than 12 months) of sum sufficient which will made up the full security deposit specified in the tender or (B) (Permit Government at the time of making any payment to him for work done under the contract to deduct such as will amount *+ four percent of all moneys so payable such deduction to be held by Government by way of security deposit) provided always that in the event of the contractor depositing a lump sum by way of security deposit as contemplated at (A) above, then and in such case, if the sum so deposited shall not amount to Two percent, of the total estimated cost of the work, it shall be lawful for Government at the time of making any payment to the contractor for work done under the contract to make up the full amount of two percent by deducting a sufficient sum from every such payment as last aforesaid until the full amount of the security deposit is made up. All compensation or other sum of money payable by the contractor to Government under the terms of his Contract may be deducted from or paid by the sale of sufficient part of his security deposit or from the interest arising there from or from any sums which may be due or may become due by Government to the Contractor under any other contract or transaction of any nature on any account whatsoever, and in the event of his security deposit being reduced by reason of any such deduction or sale as aforesaid, the contractor shall, within ten days thereafter, make good in cash or Government securities endorsed as aforesaid any sum or sums which may have been deducted from or raised by sale of his security deposits or any part thereof. The Security Deposit referred to when paid in cash may, at the cost of depositor, be converted into interest bearing securities provided that the depositor has expressly desired this in writing.</p> <p>If the amount of the Security Deposit to be paid in lump sum within the period specified at (A) above is not paid, the Tender/Contract already accepted shall be considered as cancelled and legal step will be taken against the contractor for recovery of the amounts. The amount of</p>
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Contractor

No of correction

University Engineer

	<p>the Security Deposit lodged by a contractor shall be refunded along with the Payment of the final bill, if the date up to which the contractor has agreed to maintain the work in good order is over. If such date is not over, only 50% amount of security deposit shall be refunded along with the payment of the final bill. The amount of security deposit retained by the Government shall be released after expiry of period up to which the contractor has agreed to maintain the work in good order is over. In the event of the contractor failing or neglecting to complete rectification work within the period up to order, then, subject to provisions of clauses 17 and 20 hereof the amount of Security Deposit retained by Government shall be adjusted towards the excess cost incurred by the department on rectification work *+ This will be the same percentage as that in the tender act (e).</p>
Compensation for delay.	<p>Clause 2 :- The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor and shall be reckoned from the date on which the order to commence work is given to the contractor. The work shall throughout the stipulated period of the contract be proceeded with, all due diligence (time being deemed to be of the contractor) and the contractor shall pay as compensation an amount as the University Engineer (whose decision in writing shall be final) may decide, of the amount of the estimated cost of the whole work as shown by the tender for every day that work remains uncommenced, or unfinished, after the proper dated. And further to ensure good progress during the execution of the works, the contractor shall be bound in all cases, in which the time allowed for any work exceeds one months to complete.</p> <p>The Programme for completion of work is attached in form of bar chart on page No._____. The contractor is supposed to carry out the work and keep the progress as per bar chart on page No. _____. The contractor should complete the work as per phase period given below, which is arrived from the bar chart.</p> <p>The programme of details process laid down by the University Engineer.</p> <p>The following proportion will usually be found suitable.</p> <p>In $\frac{1}{4}$ time -25% of work $\frac{1}{2}$ time- 50% of work $\frac{3}{4}$time -75% of work</p> <p>120 Days (120 Days including Govt. Holiday & Monsoon Period) . 100% of work.,</p>

Contractor

No of correction

University Engineer

	<p>In the event of the contractor failing to comply with these conditions he shall be liable to pay as compensation an amount equal to one percent, or such smaller amounts as the University Engineer (whose decision in writing shall be final) may decide of the said estimated cost of the whole work for every day that the due quantity of work remains incomplete. Provided always that the total amount of compensation to be paid under provision of this clause shall not exceed 10 percent of the estimated cost of the work shown in the tender. University Engineer, should be the final authority in this respect irrespective of the fact that the tender is accepted by Chief Engineer, Additional Chief Engineer/ Superintending Engineer/ University Engineer of Assistant Engineer/Sub-Divisional Engineer.</p>
<p>Action when whole of Security Deposit is forfeited.</p>	<p>Clause 3 :- In any case in which under any clause or clauses of this contract the contractor shall have rendered himself liable to pay compensation amounting to the whole of his Security Deposit (whether paid in one sum or deducted by installments) or in the case of abandonment of the work owing to serious illness or death of the contractor or any other cause, the University Engineer on behalf of the Governor of Maharashtra, shall have power to adopt of the following courses as he may deem best suited to the interests of Government.</p> <p>a) To rescind the contract (of which rescission in writing to the contractor under the hand of the University Engineer shall be conclusive evidence) and in that case the security deposit of the Contractor shall stand forfeited and be absolutely at the disposal of Government.</p> <p>b) To carry out the work or any part of the work departmentally debiting the contractor which the cost of the work, expenditure incurred on tools and plant, and charges on additional supervisory staff including the cost of work charged establishment employed for getting the departmentally in all respects in the same manner and at the same rates as if it had been carried out by the contractor under the terms of the contract. The certificate of the University Engineer as to all the cost of the work and other allied expenses so included and the value of the work so done departmentally shall be final and conclusive against the contractor.</p> <p>c) To order that the work of the contractor be measured up and to take such part thereof as shall be unexecuted out of his hands and to give it to another contractor to</p>

	<p>complete, in which case all expenses incurred on advertisement for fixing a new contracting agency, additional supervisory staff including the cost of work charged establishment and cost of the work executed by the new contract agency will be debited to contractor and the value of the work done or executed through the new contractor shall be credited to the contractor in all respects and in the same manner and at the same rates as if it had been carried out by the contractor under the terms of his contract. The certificate of the University Engineer as to all the cost of the work and other expenses incurred as aforesaid for or in getting the unexecuted work done by the new contractor and as the value of the work so done shall be final and conclusive against the contractor.</p> <p>In case the contract shall be rescinded under clause (a) above, the contractor shall not be entitled to recover or be paid any sum for any work thereto for actually performed by him under this contract unless and until the University Engineer shall have certified in writing the performance of the such work and the amount payable to him in respect there of and he shall only be entitled to paid the amount so certified. In the event of either of the courses referred to in clause (b) or (c) being adopted and the cost of the work executed departmentally or through a new contractor and other allied expenses exceeding the value of such work credited to the contractor, the amount of excess value shall be deducted from any money due to the contractor by the Govt. under the contract or otherwise. Howsoever or from his security deposit or the sale proceeds thereof provided howsoever, that the contractor shall have no claim against Government even if certified value of the work done departmentally or through a new contractor except the certified cost of such work and allied expenses provided always that whichever of the three courses mentioned in clause (a), (b) or (c) is adopted by the University Engineer the contractor shall have no claim to compensation for any loss sustained by him reason of him having no claim to compensation for any materials, or entered into engagement or made any advance on account of or with a view of the execution of the work or the performance of contract.</p>
<p>Action when the progress of any particular portion of the work is unsatisfactory.</p>	<p>Clause 4 :- If the progress of any particular portion of the work is unsatisfactory the Executive Engineer shall not withstanding the general progress of the work is satisfactory in accordance with clause 2, be entitled to take action under clause 3(b) after giving the contractor 10 days notice in writing and the contractor will have no claim for compensation for any loss sustained by him owing to such action.</p>

Contractor

No of correction

University Engineer

<p>Contractor remains liable to pay compensation if action not taken under clause 3 & 4 Power to take possession of or require removal of or sell contractor's plant.</p>	<p>Clause 5 :- In any case in which any of the powers conferred upon the Executive Engineer by Clause 3 and 4 hereof shall have become exercisable and the same shall not been exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall not withstanding be exercisable in any future case of default by the contractor for which by under any clause or clauses hereof he is declared liable to pay compensation amounting to the whole of his security deposit and the liability of the contractor for past and future compensation shall remain unaffected. In the event of the Executive Engineer taking action under sub-clause (a) or (c) clause (3) he may, if he so desires, take possession of all or any tools plant, materials and stores in or upon the works or the site thereof or belonging to the Contractor, or procured by him and intended to be used for the execution of the work or any part thereof, paying or allowing, for the same in account at the contract rates, or in case of contract rates not being applicable at current market rates, to be certified by the University Engineer whose certificate thereof shall be final. In the alternative the University Engineer may after giving notice in writing to the contractor or to his clerk of the works, foreman or other authorised agent require him to remove such tools, plant, materials or stores from the premises within a time to be specified in such notice and in the event of contractor failing to comply with any such requisition the University Engineer may remove them at the contractor's expenses or sale them by auction or private sale, on account of the contractor at his risk in all respects, and the certificate of the University Engineer as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale be final and conclusive against the contractor.</p>
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<p>Extension of time</p>	<p>Clause 6 :- If the Contractor shall desire an extension of the time for completion of the work on the ground of his having unavoidably hindered init execution or on and the other ground, he shall apply in writing to the University Engineer before the expiration of the period stipulated in the tender or before the expiration of 30 days from the date to which he was hindered as aforesaid or on which the cause for asking extension occurred, whichever is earlier and the University Engineer may, if in his opinion there are reasonable ground for granting an extension, grant such extension as he thinks necessary or proper. The decision of the Chief Engineer P.W D. Region Amravati in this matter shall be final.</p> <p>Clause 6-A :- In the case of delay in handing over the land required for the work due to unforeseen cause, the contractor shall not be entitled for any compensation whatsoever from the Government on the ground that the machinery or the labour was idle for certain period. Contractor may, however apply for extension of time limit which may be granted on the merit of the case.</p>
<p>Final Certificate.</p>	<p>Clause 7 :- On completion of the work the contractor shall be furnished with a certificate by the University Engineer (Hereinafter called the Engineer-in-charge) in such completion but no certificate shall be given nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall have been executed all scaffolding surplus materials and rubbish and shall have cleaned of the dirt from all wood work, doors, windows, floors or other parts of any building, in or upon which the work has been executed, or on which he may have had possession for the purpose of executing the work nor until the work shall have been measured by the Engineer-in-charge or where the measurements have been taken by his subordinates until they have received the approval of the Engineer-in-charge or where the measurements have been taken by his subordinates until they have received the approval of the Engineer-In-Charge, the said measurements being binding and conclusive against the contractor. If the contractor shall fail to comply with the requirements of this clause as to the removal of scaffolding, surplus material and rubbish, and cleaning off dirt on or before the date fixed for the completion of the work, the Engineer-in-charge may at the expense of the contractor, remove such scaffolding, surplus materials and rubbish, and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall forthwith pay the amount of all expenses so</p>

Contractor

No of correction

University Engineer

	incurred but shall have no claim in respect of any such scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.
Payments on intermediate Certificate to be regarded as advances.	Clause 8 :- No payment shall be made for any work estimated to cost less than Rs. One thousand. After the whole of the said work shall have been completed, a certificate of completion shall be given. But in the case of the works estimated to cost more than Rs. One thousand, the contractor shall on submitting a monthly bill therefore, be entitled to receive payment proportionate to the part of the work then approved and passed by the Engineer-in-charge, whose certificate of such approval and passing of the sum payable shall be final and conclusive against the contractor. All such intermediate payment shall be regarded as payments by way of advance against the final payments only and not preclude the Engineer-in-charge from requiring any bad unsound, imperfect or unskillful work to be removed and taken away and reconstructed, or reacted, nor shall any such payment be considered as an admission of the due performance of the contract or any part thereof, in any respect or the occurring of any claim, nor shall it conclude, determine or affect in any way the powers of the Engineer-in-charge as to final settlement and adjustment of the accounts or otherwise, or in any other way vary or affect the contract. The final bill shall be submitted by the contractor within one month of the date fixed for the completion of the work otherwise the Engineer-in-charge's certificate of the measurement and of the total amount payable for the work shall be final and binding on all parties.
Payments at reduced rates on account of items of work not accepted as completed to be at the discretion of the Engineer-in-charge.	Clause 9:- The rates for several items of work estimated to cost more than Rs. One Thousand agreed to within, shall be valid only when the item concerned is accepted as having been completed fully in accordance with the sanctioned specifications. In case where the items of work are not accepted as so completed the Engineer-in-charge may make payment on account of such items at such reduced rates as he may consider reasonable in preparation of final or on account bills.

<p>Bill to be submitted monthly.</p>	<p>Clause 10 :- A bill shall be submitted by the contractor each month on or before the date fixed by the Engineer-in-charge for all work executed in the previous month, and the Engineer-in-charge shall take or cause to be taken the requisite measurement for the purpose of having the same verified and the claim so far as it is admissible shall be adjusted, if possible, within 10 days from the presentation of the bill. If the contractor does not submit the bill within time fixed as aforesaid, the Executive-in-charge may depute a subordinate to measure up the said work. The presence of the contractor or his duly authorised agent whose counter signature to the measurement list shall be sufficient warrant, and the Engineer-in-charge may prepare a bill from such list which shall be binding on the contractor in all respects.</p>
<p>Bill to be on printed form.</p>	<p>Clause 11 :- The Contractor shall submit all bills on the printed forms to be had on application at the office of the Engineer-in-charge. The charges to be made in the bills shall always be entered at the rates specified in the tender or in the case of any extra work ordered in pursuance of these condition and not mentioned or provided for in the tender, at the rate hereinafter provided for such work.</p>
<p>Store supplied by Government.</p>	<p>Clause 12 :- If the specification or estimate of the work provides for the use of any special description of materials to be supplied from the P.W.D. store or if it is required that the contractor shall use certain stores, and the prices to be charged therefore as hereinafter mentioned being so far as practicable for the convenience of the contractor but not so as in any way to control the meaning or effect of this contract specified in the schedule or memorandum (hereto annexed) the contractor shall be supplied with such materials and stores as may be required from time to time to be used by him for the purposes of the contract only, and the value of the full quantity of materials and stores so supplied shall be set off or reduced from any sums then due, or otherwise, or from the security deposit, or the proceeds of sale thereof, if the deposit is held in Government securities the same or a sufficient portion thereof shall in that case be sold for the purpose. All materials supplied to the contractor shall remain the absolute property of Government and shall on no account be removed from the site of the work and shall at all times be open to inspection by the Engineer-In-Charge. Any such materials unused and is perfectly in good condition at the time of completion or determination of the contract shall be returned to the WORKS DIVISIONs store, if the Engineer-In-Charge so requires by a notice in writing given under his</p>

Contractor

No of correction

University Engineer

	hand, but remaining unused by him or for any wastage in or damage thereto.
Work to be executed in accordance with specifications, drawings, orders etc.	Clause 13 :- The contractor shall execute the whole and every part of the work like manner and both as regards materials and every other respect in strict accordance with specifications. The contractor shall also confirm exactly fully and faithfully to the designs, and drawings and instructions in writing relating to the work signed by the Engineer-in-charge and lodged in his office and to which the contractor shall be entitled to have access for the purpose of inspection at such office or at the site of work during office hours. The contractor will be entitled to receive three sets of contract drawings and working drawings as well as one certified copy of the accepted tender along with the work order free of cost. Further copies of the contract drawings and working drawings if required by him, shall be supplied at the rate of Rs. 1000/- per set of contract drawing and Rs. 1000/- per working drawing except where otherwise specified.
Alterations in specifications & designs not to invalidate contract. Rate for works not entered in the estimate on schedule of rate of the district.	Clause 14 :- The Engineer-in-charge shall have power to make any alterations in, or additions to or drawing design and instructions that may the original specifications, appear to him to be necessary or advisable during the progress of the work and the contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given him in writing signed by the Engineer -in-charge and such alterations shall not invalidate the contract, and any additional work which the contractor may be directed to do in the manner above specified as a part of the work shall be carried out by the contractor in the same conditions in all respects on which he agreed to the main work and at the same rates as per specified in the tender for the main work. And if the additional or altered work, includes any class of work for which no rate is specified in this contract, then such class of work shall be carried out at the rates entered in schedule of rates of the division or at the rate mutually agreed upon rates between the Engineer-in-charge and the contractor which ever are lower. If the additional or altered work for which no rate is entered in the Schedule of rates of the Division, is ordered to be carried out before the rates are agreed upon, then the contractor shall within 7 days of the date of receipt by him of order to carry out work inform the Engineer-in-charge of the rates which if his intention to charge for such class of work, and arrange to carry it out in such manner as he may consider advisable, provided always that if the contractor shall commence work or incur any

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University Engineer

<p>Extension of time in consequence of additions or alterations.</p>	<p>expenditure in regard thereto before the rate shall have been determined as lastly here in before mentioned then in such case he shall only entitled to be paid in respect if the work carried out or expenditure incurred by him prior to the date of the determination of the rate as aforesaid according to such rate or rates as shall be fixed by the Engineer-in-charge. In the event of a dispute the decision of the Superintending Engineer of the Circle will be final.</p> <p>Where however, the work is to be executed according to the designs, drawings, and specifications recommended by the contractor and accepted by the competent authority the alterations above referred to shall be within the scope of such designs, drawings, and specifications to the tender.</p> <p>The time limit for the completion of work shall be extended in the proportion that the increase in its cost occasioned by alterations or additions bears to the cost of the original contract work, and the certificate of the Engineer-in-charge as to such proportion shall be conclusive.</p>
<p>No claim to any payment or compensation for alteration in or restriction of work</p>	<p>Clause 15 :- (1) If at any time after the execution of the contract documents, the Engineer shall for any reason whatsoever (other than default on the part of the contractor and for which Government is entitled to rescind the contract) desire that the whole or any part of the work specified in the tender should be suspended or that the whole or part of the work should not be carried out at all he shall give to the contractor a notice in writing of such desire and upon the receipt of such notice the contractor shall forthwith suspend or stop the work wholly or in part as required, after having due regard to the appropriate state at which the work should suspended so as not to cause any damage or injury to the work already done or endanger the safety thereof injury to the work already done or endanger the safety thereof provided that the decision of the Engineer as to the stage at which the work or any part of it could be or could have been safely stopped or suspended shall be final and conclusive against the contractor The contractor shall have no claim to any payment or compensation whatsoever by reason of or in pursuance of any notice as aforesaid on account of any suspension, stoppage or curtailment except to the extent specified here-in-after.</p> <p>(2) Where the total suspension if the work ordered as aforesaid continued for a continuous period exceeding 90 days, the contractor shall be at liberty to withdraw from the contractual obligations under the contract so far as it pertains to the unexecuted part of the work by giving a 10 days prior</p>

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	<p>notice in writing to the Engineer, within 30 days of the expiry or expiry of the said period of 90 days, of such intention and requiring the Engineer to record the final measurements of the work already done and to pay the final bill. Upon given such notice, the contractor shall be deemed to have been discharged from his obligation to complete the remaining unexecuted work under this contract on receipt of such notice the Engineer shall proceed to complete the measurement and make such payment as may be finally due to the contractor within a period of 90 days from the receipt of such notice in respect of the work already done by the contractor. Such payment shall not in any manner prejudice the right of the contractor to any further compensation under the remaining provision of this clause.</p> <p>(3) Where the Engineer requires the contractor to suspend the work for a period in excess of 30 days at any time or 60 days in the aggregate, the contractor shall be entitled to apply to the Engineer within 30 day of the resumption of the work after such suspension for payment of compensation to the extent of pecuniary loss suffered by him in respect of working machinery rendered idle on the site or on account of his having, have to pay the salary or wages of labour engaged by him during the said period of suspension. Provided always that the contractor shall not be entitled to any claim in respect of any such working machinery, salary or wages for the first 30 days whether consecutive or in the aggregate of such suspension or in respect of any suspension whatsoever occasioned by unsatisfactory work or any other default on his part. The decision of the Engineer in this regard shall be final and conclusive against the contractor.</p> <p>(4) In the event of</p> <p>i) Any total stoppage of work on notice from the Engineer under sub-clause (1) in that behalf.</p> <p>ii) Withdrawal by the contractor from the contractual obligation to complete the remaining unexecuted work under sub-clause (2) on account of continued suspension of work for a period exceeding 90 days.</p> <p>iii) Curtailment in the quantity of an item or items originally tendered on account of any alteration, omission or substitutions in the specifications, drawings, designs or instructions under clause 14(1) where such curtailment exceeds 25% at the rates for the items specified in the tender is more than Rs. Five thousand/-</p> <p>It shall be open to the contractor within 90 days from the service of (i) the notice of stoppage of work or (ii) the notice of withdrawal from the contractual obligation under the contract on account of the continued suspension of the work or (iii) notice under clause 14(1) resulting such curtailment or</p>
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	produce to the Engineer Satisfactory documentary evidence that he had purchased or agreed to purchase material for use in the contracted work, before receipt by him of the notice of stoppage, suspension or curtailment and require the government to take over on payment such material at the rates determined by the Engineer. Provided however such rates shall in no case exceed the rates at which the same were acquired by the contractor. The Government shall thereafter take over the material so offered, provided the quantities offered are not in excess of the requirement of the unexecuted work as specified in the accepted tender and are of quality and specification approved by the Engineer.
Time limit for unforeseen claims.	Clause 16 :- Under no circumstances whatsoever shall the contractor be entitled to any compensation from Government on any account unless the contractor shall have submitted claim in writing to the Engineer-in-charge within one month of the cause of such claim occurring.
Action, compensation payable in case of bad work.	Clause 17 :- If any time before the Security Deposit or any part thereof is refunded to the contractor it shall appear to the Engineer-in-charge or his subordinate in charge of the work, that any work has been executed with unsound, imperfect unskillful workmanship or with materials of inferior quality, or that any materials or articles provided by him for the execution of the work are unsound or of a quality inferior to that contracted for, or are otherwise not in accordance with the contractor, it shall be lawful for the Engineer-in-charge to intimate this fact in writing to the contractor and then notwithstanding the fact that work, materials or articles complained of may have been inadvertently passed, certified and paid for, the contractor shall be bound forthwith to rectify or remove and reconstruct the work so specified in whole or in part, as the case may require or if so required, shall remove the materials or articles so specified and provided other proper and suitable materials or articles at his own charge and cost and in the event of his failing to do so within a period to be specified by the Engineer-in-charge in the written intimation aforesaid, the contractor shall be liable to pay compensation at the rate of 1% on the amount of the estimate for every day not exceeding 10 days, during which the failure so continues and in the case of any such failure the Engineer-in-charge may rectify or remove and re-execute the work or remove and replace the materials or articles complained of as the case may be at the risk and expense in all respects of the contractors should the Engineer-in-charge consider that any such inferior work or materials as described above may be accepted or made use of it shall be within his discretion to accept the same at such reduced rates as he may fix therefore.

Contractor

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<p>Work to be open to Inspection. Contractor or responsible agent to be present.</p>	<p>Clause 18 :-All works under or in course of execution or executed in pursuance of the contract shall at all times be open to the inspection and supervision of the Engineer-In-Charge and his sub--ordinates, and the contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of the intention of the Engineer-in-charge or his subordinates to visit the works shall have been given to the contractor, either himself be present to receive order and instructions or have a responsible agent duly accredited in writing, present for the purpose. Orders given to the contractor's duly authorised agent shall be considered to have the same force and effect as if they had been given to the contractor himself.</p>
<p>Notice to be given before the work is covered up.</p>	<p>Clause 19 :- The Contractor shall give not less than 5 days notice in writing to the Engineer-in-charge or his subordinates in charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof taken before the same is so covered up or placed beyond the reach of measurement any work without the consent in writing of the Engineer-in-charge or his subordinate in charge of the work and if any work shall be covered up or placed beyond the reach of measurement without such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense and in default thereof no payment or allowance shall be made for such work or for the materials with which the same was executed.</p>
<p>Contractor liable for damage done and for imperfection.</p>	<p>Clause 20 :- If during the period of 24 Months from the date of completion as certified by the Engineer- in-charge pursuant to clause 7 of the contract, in the opinion of the University Engineer the said work is defective in any manner whatsoever the Contractor shall forthwith on receipt of notice in that behalf from the University Engineer, duly commence execution in every respect all the work that may be necessary for rectifying and setting right the defects specified therein including dismantling and reconstruction of unsafe portions strictly in accordance with and in the manner prescribed and under the supervision of the University Engineer. If the work or part of work is defective beyond repair, the contractor has to reconstruct the work / part of work as directed by University Engineer P.W.Division, Akola. In the event of the Contractor failing or neglecting to commence execution of the said rectification work or reconstruct work within the period prescribed (not</p>

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University Engineer

	<p>more than 3 months) therefore in the said notice and/or to complete the same as aforesaid as required by the said notice, the Executive Engineer may get the same executed and carried out departmentally or by any other agency at the risk, on account and at the cost of the Contractor. The Contractor shall forthwith on demand pay to the Government the amount of such cost, charges and expenses sustained or incurred by the Government of which the certificate of the Executive Engineer shall be final and binding on the Contractor. Such costs, charges and expenses shall be deemed to be arrears of land revenue and in the event of the Contractor failing or neglecting to pay the same on demand as aforesaid without prejudice to any other rights and remedies of the Government the same may be recovered from the Contractor as arrears of land revenue. The Government shall also be entitled to deduct the same from any amount which may then be payable or which may therefore become payable by the Government to the Contractor either in respect of the said work or any other work whatsoever or from the amount of security deposit retained by Government.</p>
<p>Contractor to supply plant, ladders, scaffolding etc.</p>	<p>Clause 21 :- The contractor shall supply at his own cost all materials (except such special materials if any) as may be supplied from the WORKS DIVISION Stores, in accordance with the contract), plant, tools, appliances, implements, ladders, cordage, tackle, scaffolding and any temporary works which may be required for the proper execution of the work, in the original, altered or substituted from, whether included in the specification or other documents forming part of the contract or referred to in these conditions or not and which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-charge as to any matter on which under these conditions he is entitled to be satisfied, or which he entitled to require together with carriage therefor, to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out work, and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or materials. Failing this the same may be provided by the Engineer-in-charge at the expenses of the contractor and the expenses may be deducted from any money due to the contractor under the contract or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof. The contractor shall provide all necessary fencing and lights required to protect the Public from accident and shall also be bound to bear the expenses of</p>

	<p>defence every suit, action or other legal proceedings at law that may be brought by any person for injury sustained owing to the neglect of the above precautions, and to pay damages and cost such person or which may with the consent of the contractor be paid in compromising any claim by any such person.</p>
Works Scaffolding	<p>Clause 21-A :- The contractor shall provide suitable scaffolds and working platforms, gangways and stairways and shall comply with the following regulations in connection therewith.</p> <ul style="list-style-type: none"> a) Suitable scaffolds shall be provided for workman for all work that cannot be safely done from a ladder or by other means. b) A scaffold shall not be constructed, taken down or substantially altered except. <ul style="list-style-type: none"> i) Under the supervision of a competent and responsible person, and ii) As far as possible by competent workers possessing adequate experience in this kind of work. c) All scaffolds and appliance connected therewith and all ladders shall <ul style="list-style-type: none"> i) be of sound material ii) be of adequate strength having regard to the loads and strains to which they will be subjected, and iii) be maintained in proper condition d) Scaffolds shall be so constructed that no part thereof can be displaced in consequence of normal use. e) Scaffolds shall not be overloaded and as far as practicable the load shall be evenly distributed. f) Before installing lifting gear on scaffolds special precaution shall be taken to ensure the strength and stability of the scaffolds. g) Scaffolds shall be periodically inspected by a competent person h) Before allowing a scaffold to be used by his workmen the contractor shall check where the scaffold has been erected by his workmen or not take steps to ensure that it complies fully with the regulations herein specified.

Contractor

No of correction

University Engineer

	<p>i) Working platforms, gangways shall</p> <p>i) be so constructed that no part thereof can sag unduly or unequally.</p> <p>ii) be so constructed and maintained having regard to the prevailing conditions as to reduce as far as practicable risks of persons tripping or slipping, and</p> <p>iii) be kept free from any unnecessary obstructions.</p> <p>j) In the case of working platforms, gangways, working places and stairways at a height exceeding 3 meters. (to be specified).</p> <p>i) every working platform and every gangways shall have to be closely boarded unless other adequate measures are taken to ensure.</p> <p>ii) every working platform and gangways, shall have adequate width and.</p> <p>iii) every working platform, gangways, working places, stairway shall be suitably fenced.</p> <p>k) Every opening in the floor of the building or in working platform shall except for the time and to the extent required to allow the access or persons or the transport or shifting of materials be provided with suitable means to prevent the fall of persons or materials.</p> <p>l) When persons are employed on a roof where there is danger of falling from a height exceeding 3 meters suitable precaution (to be prescribed) shall be taken to prevent the fall of persons or materials.</p> <p>m) Suitable precautions shall be taken to prevent persons being struck by articles which might fall from scaffolds or other working place.</p> <p>n) Safe means of access shall be provided to all working platforms and other working places.</p>
	<p>Clause 21 B :- The contractor shall comply with the following regulations as regards the hoisting appliances to be used by him.</p> <p>(a) Hoisting machines and tackle, including their attachment, anchorages and supports shall</p>

	<p>(i) be of good mechanical construction, sound material and adequate strength and free from patent defect and</p> <p>(ii) be kept in good repair and in good working order</p> <p>(b) Every rope used in hoisting or lowering material or as a means of suspension shall be of suitable quality and adequate strength and free from patent defect.</p> <p>(c) Hoisting machines and tackle shall be adequately tested after erected on the site and before and be re-examined in position at intervals to be prescribed by the government.</p> <p>(d) Every chain, ring hook shackle, swivel and pulley block used in hoisting or lowering of materials or as a means of suspension shall be periodically examined.</p> <p>(e) Every crane driver or hoisting appliances operator shall be properly qualified.</p> <p>(f) No person who is below the age of 21 years shall be in control of any hoisting machine, including any scaffolds, which give signals to the operator.</p> <p>(g) In the case of every hoisting machine and of every chain, ring, hook, shackle, swivel and pulley block used on hoisting or lowering or as a means of suspension the safe working load shall be ascertained by adequate means.</p> <p>(h) Every hoisting machine and all gear referred to in the preceding regulation shall be plainly marked with the safe working load.</p> <p>i) In the case of hoisting machine having available safe working load, each safe working load and the condition under which it is applicable shall be clearly indicated.</p> <p>j) No part of any hoisting machine or of any gear referred to in regulation of above shall be loaded beyond the safe working load except for the purpose of testing.</p> <p>k) Motors, gearing transmissions, electric wiring</p>
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University Engineer

	<p>and wiring and other dangerous part of hoisting appliances shall be provided with efficient safe guards.</p> <p>l) Hoisting appliances shall be provided with such means as will reduce to a minimum risk of the accidental descent of the load.</p> <p>m) Adequate precautions shall be taken to reduce to a minimum the risk of any part of a suspended load becoming accidentally displace.</p>
Measure for prevention of fire.	Clause 22 :- The contractor shall not set fire to any standing jungle, tree, brush wood or grass without a written permit from the University Engineer. When such permit is given and also in all cases when destroying cut or dug up trees, brush wood, grass etc. by fire, the contractor shall take necessary measures to prevent such fire spreading to or otherwise damaging surrounding property. The contractor shall make his own arrangements for drinking water for the labour employed by him.
Liability of contractors for any damage done in or outside work area.	<p>Clause 23 :- Compensation for all damage done intentionally or unintentionally by contractor's labour whether in or beyond the limits of Govt. property including any damage caused by the spreading of fire mentioned in clause 22 shall be estimated by the Engineer-in-charge or such other officer as he may appoint and the estimates of the Engineer-in-charge subject to the decision of the Superintending Engineer on appeal shall be final and the contractor shall be bound to pay the amount of the assessed compensation on demand failing which the same will be recovered from the contractor as damages in the manner prescribed in clause 1 or deducted by the Engineer -in-charge from any sums that may be due to or become due from government to the contractor under this contract or otherwise.</p> <p>The Contractor shall bear the expenses of defending any action or other legal proceedings that may be brought by any person for injury sustained by him owing to neglect of precautions to prevent the spread of fire and he shall also pay any damages and cost that may be awarded by court in consequence.</p>
Employment of female labour.	Clause 24 :- The employment of female labourers on works in the neighborhood of soldiers barracks should be avoided as far as possible.
Work on Sunday.	Clause 25 :- No work shall be done on a Sunday without the sanction in writing of the Engineer-in-charge.

Contractor

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University Engineer

<p>Work not to be sublet.</p> <p>Contract may be rescinded and Security Deposit forfeited for subletting it without approval or for bribing a Public Officer or Contractor becomes insolvent.</p>	<p>Clause 26 :-The contract shall not be assigned or sublet without the written approval of the Engineer--in-charge. And if the contractor shall assign or sublet his contract, or attempt so to do, or become insolvent or commence any proceedings to be adjudicated and insolvent or make any composition with his creditors, or attempt so to do the Engineer- in- charge may be notice in writing, rescind the contract. Also if any bribe, gratuity, gift, loan, perquisite, regard or advantage, pecuniary or otherwise, shall either directly or indirectly be given, promised, or offered by the contractor or any of his servants or agents to any public officer or person in the employment, of the Government in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Engineer-in-charge may notice in writing rescind the contract. In the event of a contract being rescinded, the Security Deposit of the contractor shall there upon stand forfeited and be absolutely at the disposal of the Government and same consequences shall ensure as if the contract had been rescinded under clause 3 hereof and in addition the contractor shall not be entitled to recover or be paid for any work therefore actually performed under the contract.</p>
<p>Sum payable by way of compensation to be considered as reasonable compensation without reference to actual loss</p>	<p>Clause 27 :- All sums payable by a contractor byway of compensation under any of these conditions shall be considered as a reasonable compensation to be applied to the use of Government without reference to the actual loss or damage sustained and whether any damage has or has not been sustained.</p>
<p>Changes in the constitution of the firm to be notified.</p>	<p>Clause 28 :- In the case of a tender by partners any change in the constitution of a firm shall be forthwith notified by the contractor to the Engineer-in-charge for his information.</p>
<p>S.E/University Engineer is the Authority of Direction and control of work</p>	<p>Clause 29 :- All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the Superintending Engineer of the Circle for the time being, who shall be entitled to direct at what point or and in what manner they are to be commenced and from time to time carried on.</p>

<p>Work to be under direction and control of Superintending Engineer.</p>	<p>Clause 30 :- Except where otherwise specified in the contract and subject to the powers delegated to him by Government under the code rules then in force, the decision of the Superintending Engineer of the Circle for the time being shall be final, conclusive and binding on all parties to the contract upon all questions relating to the meaning of the specifications, designs, drawings and instruction herein before mentioned and as to the quality of the workmanship or material used on the work, or as to any other question, claim, right, matter or things whatsoever, in any way arising out of, or relating to the contract designs, drawing, 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.</p> <p>2) The contractor may within thirty days of receipt by him of any order passed by the Superintending Engineer of the Circle as aforesaid appeal against it to the Chief Engineer concerned with the contract, work or project provided that</p> <p>a) The accepted value of the contract exceeds Rs. 10/- lakhs (Rupees Ten Lakhs).</p> <p>b) Amount of claim is not less than Rs. 1.00 Lakh (Rupees One lakhs)</p> <p>3) If the contractor is not satisfied with the order passed by the Chief Engineer as aforesaid the contractor may within thirty days of receipt by him of any such order, appeal against it to the concerned Secretary, WORKS DIVISION who, if convinced that prima-facie the contractors claim rejected by the Superintending Engineer/Chief Engineer is not frivolous and that there is some substance in the claim of the contractor as would merit a detailed examination and decision by the Standing Committee, shall put up to the Standing Committee at Government level for suitable decision.</p>
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<p>Store of European or American manufacture to be obtained from the Govt.</p>	<p>Clause 31 :- The contractor shall obtain from the P.W.D. stores all stores and articles of European or American manufacture which may be required for the work, or any part of the work or in making up any articles required therefore or in connection therewith unless he has obtained permission in writing from the Engineer-in-charge to obtain such stores and articles elsewhere. The value of such stores and articles as may be supplied to the contractor by Engineer-in-charge will be debited to the contractor in his account at the rates shown in the Schedule in form "A" attached to contract, and if they are not entered in the said Schedule, they shall be debited to him at cost price which for the purpose of this contract shall include the cost of carriage and all other expenses whatsoever, which may have to be incurred in obtaining delivery of the same as the stores aforesaid.</p>
<p>Lump sums in estimates.</p>	<p>Clause 32 :- When the estimate on which a tender is made includes lump sums in respect of parts of the work the contractor shall be entitled to payment in respect of items of work involved or the part of the work in question at the same rates as are payable under this contract for such items, or if the part of the work in question is not in the opinion of the Engineer-in-charge capable of measurement the Engineer-in-charge may at his discretion pay the lump sum amount entered in the estimate, and the certificate in writing of the Engineer-in-charge shall be final and conclusive against the contractor with regard to any sum or sums payable to him under the provisions of this clause.</p>
<p>Action where no specifications.</p>	<p>Clause 33 :-In the case of any class of work for which there is no such specification as mentioned in Rule-1 such work shall be carried out in accordance with the Divisional Specifications, and in the event of there being no Divisional Specifications, then in such case the work shall be carried out in all respects in accordance with the instruction and requirement of the Engineer-in-charge.</p>
<p>Definition of work.</p>	<p>Clause 34 :-The expression 'works' or 'work' where used in these conditions shall, unless there be something in the subject or context repugnant to such construction be construed to mean the work or the works contracted to be executed under or in virtue of the contract, whether temporary or permanent and whether original, altered, substituted or additional.</p>

Contractor's percentage whether applied to net or gross amount of bill.	Clause 35 :- The percentage referred to in the tender shall be deducted from/added to the gross amount of the bill before deducting the value of any stock issued.
Quarry fees & royalties.	Clause 36 :- All quarry fees, royalties, and ground rent for stacking materials if any, should be paid by the contractor.
Compensation under Workmen's Compensation Act.	<p>Clause 37 :- The contractor shall be responsible for and shall pay compensation to his workmen payable under the Workmen's Compensation Act. 1923 (VIII of 1923), (herein after called the said Act) for injuries caused to the workmen's. If such Compensation is payable and or paid by Government as principal under the subsection (1) of section 12 of the said Act on behalf of the contractor, this shall be recoverable by Government from the contractor under sub section (2) of the said section. Such compensation shall be recovered in the manner laid down in clause I above.</p> <p>Clause 37-A :- The contractor shall be responsible for and shall pay expenses of providing Medical aid to any workmen who may suffer a bodily injury as a result of an accident. If such expenses are incurred by Government the same shall be recoverable from the contractor forthwith and be deducted without prejudice to any other remedy of Government from any amount due or that may become due to the contractor</p> <p>Clause 37-B :- The contractor shall provide all necessary personal safety equipment and first-aid apparatus available for the use of the persons employed on the site and shall maintain the same in condition suitable for immediate use at any time and shall comply with the following regulation in connection therewith -</p> <p>a) The worker shall be required to use the equipment so provided by the contractor and the contractor shall take adequate steps to ensure proper use of the equipment by those concerned.</p> <p>b) When work is carried on in proximity to any lace where there is no risk of drawing, all necessary equipment's shall be provided and kept ready for use and all necessary steps shall be taken for the prompt rescue of any person in danger.</p> <p>c) Adequate provision shall be made for prompt first-aid treatment for all injuries likely to be sustained during the course of the work.</p> <p>Clause 37-C :- The contractor shall duly comply with the provision of 'The Apprentices Act. 1961 (III of 1961), the rules made there under and the orders that may be issued from</p>

	time to time under the said Act and the said Rules and on his failure or neglect to do so he shall be subject to all the liabilities and penalties provided by the said Act and said Rules’.
Claim for quantity of works entered in the tender or estimate.	<p>Clause 38 :- (1) Quantities in respect of the several items shown in the tender are approximate and no revision in the tendered rates shall be permitted in respect of any of the items so long as, subject to any special provision contained in the specification prescribing a different percentage of permissible variation, the quantity of the items does not exceed the tender quantity by more than 25% and so long as the value of the excess quantity beyond this limit, at the rate of the items specified in the tender, is not more than Rs. 5,000/-.</p> <p>2) The contractor shall if ordered in writing by the Engineer-in-charge so to do also carry out any quantities in excess of the limit mentioned in Sub-Clause (1) here of on the same conditions as and in accordance with the specifications in the tender and at the rates (i) derived from the rates entered in the current schedule of rates and in the absence of such rates (ii) at the rate prevailing in market, the said rates being increased or decreased as the case may be, by the percentage which the total tendered amount bears to the estimate cost of the work as put to tender, based upon the Schedule of rates applicable to the year in which the tenders where invited (for the purpose of operation of this clause, this cost shall be taken to be Rs. 1,49,770 /-</p> <p>3) Claim arising out of reduction in the tendered quantity of any item beyond 25 percent will be governed by the provisions of clause 15 only when the amount of such reduction beyond 25% at the rate of the item specified in the tender is more than Rs. <u>5,000-00.</u></p>
Employment of female or other labour.	Clause 39 :- The contractor shall employ any famine, convict or other labour of a particular kind of class if ordered in writing to do so by the Engineer-in-charge.
Claim for compensation for delay in starting work.	Clause 40 :- No compensation shall be allowed for any delay caused in the starting of the work on account of acquisition of land and in the case of the clearance work of any delay in according to sanction estimates.

Claim for compensation for delay in the execution of work.	Clause 41 :- No compensation shall be allowed for any delay in execution of the work on account of water standing in borrow pits or compartments. The rates are inclusive for hard or cracked soil excavation in mud, subsoil water or water standing in borrow pits and no claim for an extra rate shall be entertained, unless otherwise expressly specified.
Extra Payment	Clause 42 :- The Contractor shall not enter upon or commence any portion of work except with the written authority and instructions of the Engineer-in-charge or of his subordinate incharge of the work. Failing such authority the contractor shall have no claim to ask for measurements of or payment for work.
Minimum age of persons employed, the employment of donkey and/or other animals and the payment of fair wages.	<p>Clause 43 :-</p> <ul style="list-style-type: none"> (i) No contractor shall employ any person who is under the age of 18 years. (i) No contractor shall employ donkeys or other animals with breeching of string or thin rope. The breeching must be at least 3 inches wide and should be of tape (Newar). (iii) No animal suffering from sores; lameness or emaciation or which is immature shall be employed on the work. (iv) The Engineer-in-charge or his agent authorised to remove from work any person or animal found working which does not satisfy these conditions and no responsibility shall be accepted by the Government for any delay caused in the completion of the work by such removal. (v) The contractor shall pay fair and reasonable wages to the workmen employed by him in the contract undertaken by him. In the event of any dispute arising between the contractor and his workmen on the grounds that the wages paid are not fair and reasonable, the dispute shall be referred without delay to the University Engineer who shall decide the same. The decision of the University Engineer, shall be conclusive and binding on the contractor, but such decision shall not in any way affect the condition in the contract regarding the payment to be made by the Government at the sanctioned tender rates. (vi) The contractor shall provide drinking water facilities to the workers. Similar amenities shall be provided to the workers engaged on large work in urban areas.

Contractor

No of correction

University Engineer

Method of Payment.	Clause 44 :- Payment to contractors shall be made by cheques drawn on any treasury within the Division convenient to them. provided the amount exceed Rs. 10/- Amount not exceeding Rs.10/- will be paid in cash.
Acceptance of conditions compulsory before tendering the work.	Clause 45 :- Any contractor who does not accept these conditions shall not be allowed to tender for works.
Employment of scarcity labour.	Clause 46 :- If Government declare a state of scarcity or famine to exist in any village situated within 10 miles of work, the contractor shall employ upon such parts of the work as suitable for unskilled labour any person certified to him by the University Engineer or by any person to whom University Engineer may have delegated this duty in writing to be in need of relief and shall be bound to pay to such persons wages not below minimum which may arise in connection with the implementation of this clause shall be decided by the University Engineer whose decision shall be final and binding on the contractor.
GST Shall not be included in bidding offer and will be paid separately.	<p>47 (A) – “The rates quoted by the Contractor shall be deemed to be inclusive of the labour welfare cess and other taxes (other than GST) that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.</p> <ol style="list-style-type: none"> 1. Bidder shall quote his rate excluding GST. 2. GST shall be payable on the accepted contract value 3. GST Shall be paid to contractor on the amount of bill of work done as per prevailing rate of GST during the period of work done.
DELETED	<p>Clause 48 :- The rates to be quoted by the contractor must be inclusive of Sales Tax. No extra payment on this account will be made to the contractor.</p> <p>Clause 48 A:- The contractors are bound to pay to the labourers wages according to the Minimum Wages Act, 1948</p>

	applicable to the Zone in Accordance with the order issued in Government PWD/Circular No. MWA/1063, dated 7-12-1968.
	<p>Clause 49 :- In case of materials that remain surplus with the contractor for those issued for the work contracted from the date of ascertaining of the materials being surplus be taken as the date of sale for the purpose of sales tax and the sale tax will be recovered on such sale.</p> <p>Clause 49-A :- Deleted</p>
Employment of Labours	<p>Clause 50 :- The contractor shall employ the unskilled labour to be employed by him on the said work only from locally available labours and shall give preference to those persons enrolled under Maharashtra Government Employment and Self Employment Departments Scheme. Provided, however that if the required unskilled labours are not available locally, the contractor shall in the first instance employ such number of persons as is available and thereafter may with previous permission. In writing of the University Engineer-in-charge of the said work, obtain the rest of requirement of unskilled the labour from outside the above scheme.</p>
	Clause 51 :- Deleted
Land Charges	<p>Clause 52 :- All amounts whatsoever which the contractor is liable to pay to the Government in connection with the execution of the work including the amount payable in respect of</p> <p>(1) Material and or stores supplied/issued hereunder by the Government to the contractor.</p> <p>(2) Hire charges in respect of heavy plant, machinery and equipment given on hire by the Government to the Contractor, for execution by him of the work and/or on which the advance have been given by the Government to the contractor shall be deemed to be arrears of the land revenue and the Government may without prejudice to any other rights and remedies of the Government recover the same from the contractor as arrears of land revenue.</p>

Contractor

No of correction

University Engineer

<p>Labour Act</p>	<p>Clause 53 :- The contractor shall duly comply with all the provisions of the Contract Labour (Regulation and Abolition) Act 1970, (37 of 1970 and the Maharashtra Contract Labour (Regulation and Abolition) Rules, 1971 as amended from time to time and all other relevant statutes and statutory provisions concerning payment of workers employed by him on the site of the work at the rates prescribed under the Maharashtra contract Labour (Regulation and Abolition) Rules 1971. If the contractor fails or neglects to pay wages at the said rates or make short payment and the Government makes such payment of wages in full or part thereof less paid by the contractor, as the case may be the amount so paid by the Government to such workers shall be deemed to be arrears of land revenue and the government shall be entitled to recover the same as such from the contractor or deduct the same from the amount payable by the Government to the contractor hereunder or from any other amounts payable to him by the Government. (Minimum wages act as per Government Circular CAT/1284/(120)/Building Dt. 14/8/1988).</p>
<p>Price Variation</p>	<p>Clause 53-A :- Deleted</p> <p>Clause 54 :- Deleted</p>

<p>Labour Health</p>	<p>Clause 55 :-</p> <p>A) The anti-malaria and other health measures shall be as directed by the Joint Director (Malaria and Filaria) of Health Services, Pune.</p> <p>B) Contractor shall see that Mosquito genic conditions are not created so as to keep vector population for minimum level.</p> <p>C) Contractor shall carry out anti malaria measures in the area as per guidelines prescribed under National Malaria (M & F) of health Services, Pune.</p> <p>D) In case of a default in carrying out prescribed anti malaria measures resulting in increase in malaria incidence contractor shall be liable to pay to Government the amounts spent by Govt. on anti malaria measures to control the situation in addition on fine.</p> <p>E) Relations with Public Authorities : The contractor shall make sufficient arrangements for draining away the sludge water as well as water coming from the bathing and washing places and shall dispose off this water in such a way as not to cause</p>
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	any substance. He shall also keep the premise clean by employing sufficient number of sweepers. The contractor shall comply with all rules, regulations, bylaws and directions given from time to time by any local or public authority in connection with this work and shall pay fees or charges which are leviable on him without any extra cost of Government. (Vide Govt. Circular No. CST-1086/CR-243/Ka-Bldg-2/Mantralaya Mumbai 1000032 dt. 11.8.87)
Govt Act's	Clause 56 :- A contractor shall comply with all the provisions of the Apprentices Act. 1961 and the Rules and Orders issued there under from time to time. If he fails to do so, his failure will be a breach of the contract and the Superintending Engineer may, in his discretion, cancel the contract. The contractor shall also be liable for an pecuniary liability arising on account of any violation by him of the provision of the (vide Govt. Circular No. CST - 1086/CR-243 Ka-Building-2/Mantralaya, Bombay-400 032, dated 11 Sept. 1987).
Taxes	Clause 57 :- The tender rates are inclusive of all taxes, rates, and cesses and are also inclusive of s leviable tax in respect of sale by transfer of property in goods involved in the execution of a work contract under the provision of Rule 58 Maharashtra Value added Tax Act 2005, for the purpose of levy of Tax"
	Clause 58 :- In case of materials which become surplus with the contractors from those issued for the work contracted for the date of ascertainment of the materials as being surplus will be taken as the date of sale for the purpose of sales tax and sales tax will be recovered on such sale.
Quality Assurance and Maintenance	<p>Clause 59 :-<u>Quality Assurance and Maintenance Manual:-</u></p> <p>ANNEXURE "A" : (Annexure to the PWD, Circular No. CAT-1091/CR-60-Bldg-2 Dt. 14th October 1991, regarding incorporating additional condition for Quality Assurance and Maintenance Manual).</p> <p>To ensure the specified quality of work which will also include necessary survey temporary works etc. the contractor shall prepare a quality assurance plan and get, the same provided from the Engineer-In-Charge within one month from the date of work order. For this contractor shall</p>

	<p>submit an organisation chart of his technical personnel to be deployed on the work alongwith their qualification, job descriptions defining the functions of reporting supervising inspecting and approving. The contractor shall also submit a list of tools equipment and the machinery and instrumentation which he proposes to use for the construction and for testing in the field and/or in the Laboratory and monitoring. The contractor shall modify/supplement the organisation chart and the list of machinery/ equipment etc. as per the direction of the Superintending Engineer and shall deploy the persons and equipment on the fields as per the approved chart and the list respectively. The Contractor shall submit written method statements dealing his exact proposal of execution of the work in accordance with the specification. He will have to get these approved from the Engineer-In-Charge. The quality of the work shall be properly documented through certificate, records, checks list, and Log Book of results etc. such records shall be complied from the beginning of the work and be continuously updated the supplementary and this will be the responsibility of the contractor. The forms should be got approved from the University Engineer-In-Charge.</p> <p>2) Where the work is to be done on lump-sum basis on contractors designs. The contractor shall also submit a maintenance manual giving procedure. For maintenance, with the periodicity of maintenance works including inspection tools of the equipments to be used means of accessibility for all parts of the structure. He shall also include in the manual, the specification for maintenance works that would be appropriate for his design the technique of construction. This manual shall be submitted within the contract period.</p>
<p>Materials</p>	<p>Clause 60: It is obligatory on the part of agency to procure R.C.C. pipe (ISI) marked) required for the work from the M.S.S.I.D.C. only. The proof of such procurement like bill of M.S.S.I.D.C. certification of the Divisional Manager M.S.S.I.D.C. to that effect will have to be enclosed alongwith the bill pertaining to the work concerned. The payment towards the procurement of R.C.C. pipes and also items, in which the use of R.C.C. pipes is contemplated would be released only after fulfillment of the conditions, laid down as above.</p> <p><i>Note : In case, provision of this form B-1 conflicts with those in detailed cyclostyled provision and condition attached to this tender, the detailed cyclostyled provision and condition would prevail over those in this form.</i></p>

Contractor

Mo. of Construction

University Engineer

GENERAL CONDITIONS OF CONTRACT

1) Authority of the Engineer-in-charge.

- 1.1) So far as it is legally or physically impossible, the contractor shall execute, complete and maintain the works in strict accordance with the contract under the directions and to the entire satisfaction of the Engineer-In-Charge and shall comply with and adhere strictly to the Engineer-In-Charge's instructions, and directions on any matter (whether mentioned in the contract or not pertaining to this works)
- 1.2) The Engineer-In-Charge shall decide all questions which may arise as to quality and acceptability of materials furnished and work executed, manner of execution, rate of progress of the works, interpretation of the plans and specifications and acceptability of fulfillment of the contract on the part of the contractor. He shall determine the amount and quality of the work performed and materials furnished and his decision and measurements shall be final. In all such matters and in any technical questions which may arise touching the contract, his decision shall be binding on the contractor.
- 1.3) The Engineer-in-charge shall have the power to enforce such decision and orders if the contractor fails to carry them out promptly. If the contractor fails to execute the work ordered by the Engineer-in-charge may give notice to the contractor specifying a reasonable period therein and on the expiry of the period proceed to execute such work as may be deemed necessary and recover the cost thereof from the contractor.

1.4) Authorities of the Engineer-in-charge's Representative :

The duties of the representative of the Engineer-in-charge are to watch and supervise the work and to test and examine the materials to be used for workmanship employed in connection with the works.

- 1.5) The Engineer-in-charge may from time to time, in writing, delegate to his representative any of the powers and authorities vested in the Engineer-in-charge and shall furnish to the contractor a copy of all such delegations of powers and authorities.
Any written instruction of approval given by the representative of the Engineer-in-charge to the contractor within the terms of such delegations (but not otherwise) shall bind the contractor and the department as through, it had been given by the Engineer-in-charge, provided always as follows :
- a) Failure of the representative of the Engineer-in-charge to disapprove any work or materials shall not prejudice the power of the Engineer-in-charge thereafter to disapprove such work or materials and to order to pulling down, removal or breaking up thereof.
- b) If the contractor is dissatisfied with any decision of the representative of the Engineer-in-charge, he shall be entitled to refer the matter to the Engineer-in-charge, who shall there upon confirm, reverse or vary such decision.

2) Other conditions for submission of Tender.

- 2.1) The Contractor shall be deemed to have carefully examined the work and site conditions including labour, the general and the special conditions, the specifications, schedules and drawings and shall be deemed to have visited the site of the work and to have fully informed himself regarding the lead conditions including tide and water level, wind and current velocity and sub-soil conditions and carried out his own investigation to arrive at the rates quoted in the tender. In this regard he will be given necessary information to the best of knowledge of department but without any guarantee about it.

- 2.2) It is presumed that the contractor has carefully gone through the works specifications, P.W.D. Handbook, M.O.R.T. & H specifications and the schedule of rates of the division and studied the site conditions before arriving at the rates quoted by him.

3) Treasure trove :

In the event of discovery by the contractor or his employees during the progress of the works of any treasure, fossils, minerals or any other articles of value or interest, the contractor shall give immediate intimation thereof to the Engineer-in-charge and alongwith make over to the Engineer-in-charge this representative such treasure or things which shall be the property of Government.

3.1) Layout of work :

Layout of the work will be done by the Contractor in consultation with the University Engineer, of the Department or his representative. The modern equipments like Theodolite / Total station shall be deployed by the contractor at his own cost as directed by the Engineer-in-charge. Some permanent marks should however be established to indicate the demarcation of the structure or any component thereof made to this permanent marks in measurement books and drawing, signed by the contractor and the departmental officer. Responsibility regarding layout will be joint. All vegetation / bushes shall be cleared from site before start of work, so as to stack the material without hindrance to traffic.

4) Agent and work order book :

- 4.1) The contractor shall himself engage an authorised all time agent on the work capable of managing and guiding the work and understanding the specifications and contract condition. A qualified and experienced Engineer be provided by the contractor as his agent for technical matters in case the Engineer-in-charge consider this as essential for the work and so directs the contractor. Agent will take orders as will be given by the University Engineer or his representative and shall be responsible for carrying them out. The agent and/or site Engineer shall not be changed without prior intimation to the University Engineer and his representative on the work site. The Engineer-in-charge have the unquestionable right to ask for changes in the quality and strength of Contractors supervisory staff and to order removal from work of any of such staff. The contractor shall comply with such order and effect replacements of the satisfaction of the Engineer-in-charge.

- 4.2) A work order book shall be maintained on site and it shall be the property of Government and the contractor shall promptly acknowledge the order given therein by the Engineer or his authorized representative or his superior officer, and comply with them. The compliance shall be reported by contractor to the Engineer-in-charge in good time so that it can be checked. The blank work order book, with machine numbered pages in quadruplicate with perforated sheets for three copies to be detached, will be provided by the department for this purpose. Whenever any instructions are written in the work order book the contractor will be supplied with the first carbon copy.

5) Initial measurement for record :

Where for proper measurement of the work it is necessary to have an initial set of levels or other measurement taken the same as recorded in the authorized field book or M.B. of Government by the Engineer or his authorized representative will be signed by the contractor who will be entitled to have a true copy of same made at his cost. Any failure on the part of the contractor to get such level etc. recorded before starting the work will tender him liable to accept the decision of the Engineer as to the basis of taking measurements. Likewise the contractor will not cover any work which will render its subsequent measurement difficult or impossible without first getting the same jointly measured by himself and the authorized representatives of the Engineer. The record of such measurements on the Government side will be signed by the University Engineer and he will be entitled to have a true copy of the same made at his cost.

6) Custody of work:

All work and materials before being finally taken over by Government will be the entire liability of the contractor for guarding, maintaining and making good any damages of any magnitude. It is however, to be understood that before taking over such work. Government will not put it to regular use as distinct from casual or incidental use, except as specially mentioned elsewhere in this contract or as mutually agreed to.

7) Co-ordinations :

When several agencies for different sub works of the project are to work simultaneously on the project site, the contractor shall render full co-ordination for achieving proper co-ordination between different contractors to ensure timely completion of the whole project smoothly. The scheduled dates for completion specified in each contract shall, therefore, be strictly adhered to. Each contractor may make his independent arrangements for water, power, access, housing etc. but if they so desire he will be at liberty to come to mutual agreement with other contracting agencies in this behalf and make joint agreement with the approval of the Engineer-in-charge. The contractor shall not take or cause to be taken any steps or action that may cause disruption, discontent or disturbance to work, labour or other arrangements etc. of other contractors in the project localities. Any action by the Contractors which the Engineer-in-charge in his unquestioned discretion, may consider infringement of the above would be considered as a breach of the contract conditions and shall be dealt with as such.

In case of any dispute or disagreement between the various contractors, the Engineer-in-charge's decisions regarding the coordination, co-operation and facilities to be provided by any of the contractor shall be final and binding on the contractor concerned & such a decision or decisions shall not vitiate contract nor absolve the contractor of his obligations under the contract, nor form the grounds for any claim or compensation.

8) Patented Devices, Materials and Process :

Whenever the contractor desires to use any designed device, material or process covered by letter of patent copy right, the right for such use shall be secured by suitable legal arrangement and agreement with patent owners and the copy of their agreement shall be filed with Engineer-in-charge.

9) Relation with Public Authorities :-

The contractor shall comply with all rules, regulations, by law and directions, given from time-to-time by any local or public authority or body in connection with this work and shall himself pay fees or charges which are leviable on him with out any extra cost to Government.

10) Indemnity :

The contractor shall indemnify the Government against all action, suits, claims and demands brought or made against it in respect of anything done or committed to be done by the contractor in execution of or in connection with the work of this contract any against any loss or damage to the Government in consequences of anything done or committed to be done in the execution of the work of this contract. The Government may, at its discretion and entirely at the cost of contractor, defend such suit either jointly with the contractor or singly, in case the latter chooses not to defend the case.

11) Stacking, Storage and guarding of materials:

- 11.1) The stacking and storage of materials at site shall be in such a manner as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality, properties and fitness for the work. Suitable precautions shall be taken by the contractor to protect against atmospheric actions, fire and other hazard. The materials likely to be carried away by wind shall be stored in suitable stores or with suitable barricades and

where there is likelihood of subsidence of soil, heavy materials shall be stored on paved platforms. Suitable separating barricades and enclosures as directed shall be provided to separate materials brought by contractor and obtained from different sources of supply.

Contractor

No of correction

University Engineer

11.2) The contractor shall at his own expenses, engage watchmen for guarding the materials and plant and machinery and the work during day and night against any pilferage or damage and also for prohibiting trespassers.

11.3) No materials brought to the site shall be removed from the site without the prior approval of the Engineer-in-charge.

12) Inspection of work by Engineer-in-charge.

12.1) The contractor shall inform the Engineer-in-charge in writing when any portion of the work is ready for inspection giving him sufficient notice to enable him to inspect the same without affection the further progress of the work.

12.2) The contractor shall provide at his cost necessary ladders and such arrangements as are considered safe by the Engineer-in-charge for proper inspection of all parts of the work by the local representatives, M.L.A's and officers etc. No compensation shall be paid to the contractor on this account.

13) Precaution to be taken by contractor:

13.1) The work shall be carried out by the contractor without causing damage to the existing Government property and/or private property. If any such damage are caused, the contractor shall pay for restoration of the property to the original conditions, and any other consequent damages.

13.2) In the event of an occurrence of an accident, involving serious injury or death of any person, at site of work or quarry or at any place in connection with the work the same shall be reported in writing within twenty four hours of the occurrence to the Engineer-in-charge and the Commissioner of Workmen's compensation.

14) Clearance of site on completion of works:

The contractor after completion of work shall clean the site of all debris and remove all unused materials other than those supplied by the department and all plant and machinery, equipments, tools etc., belonging to him within one month from the date of completion of the work, or otherwise the same will be removed by the department at his cost or disposed off as per departmental procedure. Incase the material is disposed off by department, the sale proceeds will be credited to the 'contractor's account after deducting the cost of sale incurred. However, no claim of contractor regarding the price of amount credited will be entertained afterwards. In case of road work the vegetation on road formation and slopes shall be cleared at the time of completion by contractor at his own cost.

15) Removal of Constructional plant with prior permission:

All constructional plant, provided by the contractor shall when brought on the site be deemed to be exclusively intended for the construction and the contractor shall not remove the same or any part thereof (Save of the purpose of moving it from one part of the site to another) without the consent in writing of the Engineer-in-charge who shall record the reasons for withholding the consent.

Contractor

No of correction

University Engineer

16) Restrictions because of local traffic:

As there is Local traffic by the side of construction, the contractor will have to take proper precautions such as proper barricading, fencing, lighting, information and cautionary boards for safe and smooth flow of traffic, and keeping the concerned authorities informed about the work in progress.

17) Completion Certificate:

- 17.1) The work shall not be considered to have been completed in accordance with the terms of the contract until the Engineer-in-charge shall have certified in writing to that effect. No approval of material or workmanship or approval of part of work during the progress of execution shall bind the Engineer-in-charge or in any way prevent him from even rejecting the work which is claimed to be completed and to suspend the issue of his certificate of completion until such alteration and modification or reconstruction have been effected at the cost of the contractor as shall enable him to certify that the work has been completed to his satisfaction.
- 17.2) After the work is completed the contractor shall give notice of such completion to the Engineer-in-charge and within 30 days of receipt of such a notice the Engineer-in-charge shall inspect the work and if there is no defect in the work, shall furnish the contractor with a certificate indicating the date of completion. However, if there are any defects which in the opinion of the Engineer-in-charge are rectifiable he shall inform the contractor the defects noticed. The contractor after rectification of such defects shall then inform the Engineer-in-charge and Engineer-in charge on his part shall inspect the work and issue the necessary completion certificate within 30 days if the defects are rectified to his satisfaction, and if not, he shall inform the contractor indicating defects yet to be rectified. The time cycle as above, shall continue.
- 17.3) In case defects noticed by the Engineer-in-charge which in his opinion are not rectifiable but otherwise work is acceptable at reduced payment, work shall be treated as completed. In such cases completion certificate shall be issued by the Engineer-in-charge within 30 days indicating the un-rectifiable defects for which specified reduction in payment is being made by him.
- 17.4) The issue of completion certificate shall not be linked up with the site clearance after completion of work.
- 17.5) Should the part of construction is put to use at any stage prior to date of issue of completion certificate, the maintenance period of that part of the work shall be reckoned from the date of actual use of the facility.

18) Ancillary Works :

The contractor shall submit to Engineer-in-charge in writing the details of all ancillary works including layout and specifications to be followed for its construction. Ancillary work shall not be taken up in hand unless approved by Engineer-in-charge. The Engineer-in-charge reserves the right to suggest modifications or make complete changes in the layout and specifications proposed by the contractor at any stage to ensure the safety on the work site. The contractor shall carry out all such modification to the ancillary works at his own expenses as ordered by Engineer-in-charge.

19) Temporary Quarter :-

The contractor shall at his own expense make his own arrangement for housing his staff with all necessary amenities. General layout plan for such structures shall be got approved from the Engineer-in-charge. It will be the responsibility of the contractor to get his layout plan of temporary structure approved from the local competent authorities.

20) Safety measures and Amenities :

Safety Measures

The contractor shall take all necessary precautions for the safety of the workers and preserving their health while working on such jobs as required special protection and precaution where ever required. The contractor shall also comply with the directions issued by the Engineer-in-charge in this behalf from time to time at all times.

The following are some of the requirement

- i) Providing protective footwear to workers in situations like mixing and placing of mortar or concrete, in quarries and place where the work is to be done under too much wet conditions as also for, movements over surfaces infested with oyster growth.
- ii) Providing protective hardware to working in quarries etc. to protect them against accidental fall of materials from above.
- iii) Providing handrails at the edge of the floating platforms, barges walkways, ladder etc.
- iv) Providing workmen with safety belts, ropes etc. when working on any masts cranes, cribs, hoists, dredgers etc.
- v) Taking necessary steps towards training the workers concerned on the use of machinery before they are allowed to handle it independently and taking all necessary precautions in and around the areas where machines, hoists and similar units are working. Wherever required, the persons handling the machinery shall have requisite licenses, certificate etc.
- vi) Preventing over loading and over crowding of floating and land based machinery and equipment.
- vii) Providing life belts to all men working at such situations from where they may accidentally fall into water or on the ground, . Equipping the boats with adequate numbers of life buoys etc.
- viii) Avoiding bare live wires etc. as would cause electrocutions.
- ix) Making platforms, stagings and temporary structures sufficiently strong and not causing the workmen and supervisory staff to work under risks.
- x) Providing sufficient first-aid trained staff and equipment to be available quickly at the worksite to render immediate first-aid treatment in case of accident due to suffocation, drowning and other injuries.
- xi) Taking the all necessary precautions wherever drivers are engaged on work.
- xii) Providing full length gum boots, leather hand gloves, leather jackets with fireproof aprons to cover the chest and back reaching upto knees plain goggles for the eyes to the labour working with hot asphalt handling, vibrators in cement concrete and also where use of any or all these items is, essential in the interest of health and well-being of the labourers in the opinion of the Engineer-in-charge.

21) Medical and Sanitary Arrangements to be provided for labour employed in the construction by the Contractor :

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- a) The Contractor shall provide an adequate supply of potable water for the use of labourers on works and in camps.
 - b) The Contractor shall construct trenches or semi permanent latrines for the use of labourers. Separate latrine shall be provided for men and women.
 - c) The Contractor shall build sufficient number of huts on suitable plot of land for use of the labourers according to the following specifications.
 - (1) Huts of Bamboos and Grass may be constructed.
 - (2) There should be no over crowding. The floor space at the rate of 3 sqm. (30 Sq.ft.) per head shall be provided. Care should be taken to see that the huts are kept clean and in good order.
 - (3) The contractor must find his own land. If he wants Government land he should apply for it. Assessment for it, if demanded will be payable by contractor. However the department does not bind itself for making available the required land.
 - (4) A good site not liable to submergence shall be selected. High ground remote from jungle but well provided with trees, shall be chosen wherever it is available. The neighborhood of tank, jungles, grass or weeds should be particularly avoided. Camps should not be established close to large cutting of earth work.
 - (5) The lines of huts shall have open space of at least 10 meters between rows. When a good natural site can not be procured particular attention should be given to the drainage.
 - d) The contractor shall construct sufficient number of bathing places. Sufficient number of washing places should also be provided for the purpose of washing cloths.
 - e) The contractor shall make sufficient arrangements for draining away the surface and sullage water as well as water from the bathing and washing places and shall dispose off this waste water in such a way as not to cause any nuisance.
 - f) The contractor shall engage a medical officer with a traveling dispensary for a camp containing 3000 or more persons if there is no Govt. or other private dispensary situated within 8 kilometers from the camp. In case of an emergency, the contractor shall arrange at his cost free transport for quick medical help to his sick workers.
 - g) The contractor shall provide the necessary staff for affecting the satisfactory conservancy and cleanliness of the camp to the satisfaction of the Engineer-in-charge. At least one sweeper per 200 persons should be engaged.
 - h) The Assistant Director of Public Health shall be consulted before opening a labour camp and his instructions on matters such as water supply. Sanitary convenience, the camp site, accommodation and food supply shall be followed by the contractor.
 - i) In addition to above all provisions of the relevant labour act pertaining to basic amenities to be provided to the labourer shall be applicable which will be arranged by the contractor.
 - j) The contractor shall make arrangement for anti-malaria measure to be provided for labour employed on the work. The anti-malaria measures shall be as directed by Assistant Director of Public Health Officer.
- | | | |
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- 22) The contractor except as provided in special conditions which follow, shall, if necessary construct at his cost, temporary roads and maintain these in proper conditions till completion of the work, at his own cost.

23) The contractor except as provided in special conditions which follow shall have to at his own expenses make all preliminary arrangements for labour, water, electricity, and materials etc., immediately after getting the work order. The Government may render necessary assistance in this regard by way of letters of recommendation, if so requested by the contractor. No claim for any extra payment or application for extension of time on the grounds of any difficulty in connection with the above matters will be entertained.

24) Working methods and progress schedules :

24.1) The Contractor shall submit within the time stipulated by the Engineer in writing the details of actual methods that would be adopted by the contractor for the execution, of any items as required by Engineer at each of the location, supported by necessary detailed drawing and sketches including those of the plant and machinery that would be used their locations arrangement for conveying and handling materials etc. and obtain prior approval of the Engineer-in-charge who reserves the right to suggest modifications or make corrections in the method proposed by the contractor whether accepted previously or not at any stage of the work, to obtain the desired accuracy, quality, safety and progress of work which shall be binding on the contractor. No claim on account of such change in method of execution will be entertained by Government so long as specification of the item remains unaltered.

24.2) The Contractor shall furnish within one month of the order to start the work programme of work in quadruplicate indicating the date of actual start, the monthly progress expected to be achieved and the anticipated completion date of each major item of work to be done by him, also indicating date of procurement of materials and setting up of plants and machinery. The programme is to be such as to be practicable of achievement towards the completion of the whole work in the time limit and of the particular items, if any on the due dates specified in the contract. Planning and programme of works shall be done by the mutual discussion between the **Engineer –in-charge** and contractor's representative in charge of work. The progress of work shall be reviewed every six months and revised programme shall be drawn up, if necessary, No revised programme shall be operative without the approval of Engineer-in-charge in writing. The Engineer is further empowered to ask for more detailed schedule or schedules say weekly, for any item or items in case of urgency of work as will be directed by him and the contractor shall supply the same and when asked for. Acceptance of the programme or the revised programme, by the Engineer-in-charge shall not relieve the contractor of his responsibility to complete the whole of the work by the prescribed time or the extended time if any.

24.3) The Contractor shall furnish sufficient plant, equipment and labour as may be necessary to maintain the progress schedule. The working and shift hours restricted to one shift a day for operations to be done under the Government supervision shall be such as may be approved by the Engineer-in-charge. They shall not be varied without prior approval of the Engineer. Night work which requiring supervision shall not be permitted except when specifically allowed by Engineer-in-charge if requested by contractor. The contractor shall provide necessary lighting arrangement etc. for night work as directed by Engineer without extra cost of Government.

24.4) The contractor shall submit report on progress of work in forms and statement etc. as periodical intervals in the form of progress charts, forms, statements and/or reports as may be approved by the Engineer. Forms for sending reports about progress will be supplied by the University Engineer.

24.5) The contractor shall maintain proforma, chart, details regarding machinery equipment, labour, material, periodical returns thereof in proforma to be approved from the Engineer-in-charge.

25) Payment :

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The Tenderer must understand clearly that the rates quoted are for completed work and include all cost due to labour, all leads and lifts involved and if further necessitated scaffolding plants, supervision, service works, power etc. and to include all to cover the cost of night and round the clock work as and when required and no

claim for additional payment beyond the prices or rates quoted will be entertained and the tenderers will not be entitled subsequently to make any claim on the ground of any representation or on any promise by and person (whether tender in the employment of any Public Works Deptt. or not) or on the ground of any failure on his part to obtain all necessary information for the purpose of making his tender and fixing the several prices and rates therein relieve him from any risks or liabilities arising out of or consequence upon the submission of the tender.

Payment to the contractors will be made by cheque drawn on any treasury within the Division, provided the amount to be paid exceeds Rs. 100/- smaller amount will be paid in cash.

26) Claims of extra work

- 26.1)** Claims for extra work shall be registered within 30 days of occurrence of the event. However, bills for these claims alongwith supporting data details may be submitted subsequently.
- 26.2)** Bills for extra work or for any claim shall be paid separately apart from the interim bills for the main work. The payment of bills for the main work shall not be withheld for want of decision on the extra/claims not covered in the schedule of items for extra work.

27) Bill and Payments:

- 27.1)** Two running payments in a month are permitted. First of the bill shall be submitted by the contractor by the 10th day of the month and Second bill, if necessary, shall be submitted by the contractor by the 25th day of the month.
- 27.2)** The format of running bill on which the bills are to be submitted by the contractor shall be supplied to the contractor by the Department Printed copies of the bills forms as per this format shall be arranged by the contractor at his cost. The bills in five copies shall be submitted to the concerned Engineer's representative in the standard proforma only.
- 27.3)** The final bill shall be submitted by the contractor within one month of the date of issue of completion certificate. The final bill shall be paid within six months of initial submission.
- 27.4)** Recovery of secured advances shall be effected through bills proportionately as per consumption of materials in the work billed for.
- 27.5)** The contractor can have true copy of the bills paid to him after paying charges for photo copying the same.

27.6) Controlled concrete :

Acceptance criteria shall be as per IS: 456 -----0

27.7) Ordinary concrete :

Acceptance criteria shall be as per IS: 456 -----0

28) Assistance in procuring priorities, permits etc. :

- 28.1)** The Engineer-in-charge on written request by the contractor, will if in his opinion the request is reasonable and in the interest of work and its progress, assist the contractor in securing the police protection and the priorities for deliveries, transport, permits, for controlled materials permits for quarries and other similar permits including labour licence etc. where such are needed. All cost in this behalf shall be borne by the contractor. The department will not, however, be responsible for the non-availability of such facilities or delays in the behalf and no claims on account of such failure or delays shall be allowed by the department.

28.2) The contractor will have to make his own arrangement for machinery required for the work. However, if such machinery is conveniently available with the department it may be spared on hire as per department's rules in force if requested by the contractor in writing. For such arrangement a separate agreement in the prescribed form will have to be signed by the contractor. Such an agreement shall be independent of this contract and the supply or non-supply of machinery shall not form a ground for any claim or extension of time limit for this work.

29) Water supply :

29.1) Availability of adequate water for work and sources thereof shall be confirmed by the contractor before submitting the tender.

29.2) The Contractor shall make his own arrangements at his own cost for entering into contract with concerned authorities for obtaining the connection and carry the water upto the work site as required by him. The location of the pipe line with respect to the road shall be decided by Engineer-in-charge and shall be binding on the contractor. The department shall not bear any responsibility in respect of any problem and contractor shall not be liable for getting any compensation on any ground. The progress of work shall not hamper for the above reasons.

29.3) The contractor is advised to provide water storage tanks of adequate capacity to take care of possible shut down of water supply system.

29.4) The contractor shall have to supply water required by the department for its establishment at work site free of cost.

30) Electricity :

30.1) The contractor will have to make his own arrangement at his own cost for obtaining or providing electric supply at work site. The Department shall not bear any responsibility in respect of any problem and contractor shall not be liable for getting any compensation on any ground. The progress of work shall not hamper for the above reasons.

30.2) Electrical supply for the Departments use at work site shall be provided by the contractor at mutually agreed terms. The contractor may not abide by these conditions when power supply at the site fails.

31) Telephone facilities :

Contractor will have to make his own arrangement at his own cost for telephone connection at work site, if required.

32) Material Sources:

32.1) The tenderers shall make their own independent investigations into the availability as well as suitability of the various materials required for construction as referred to in this para.

32.2) If any quarry is in the possession of the department the contractor will be allowed to use the same on usual conditions. In other cases, the contractor will have to make his own arrangement for procuring quarries or the quarry permits, necessary assistance of which will be given by the department.

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32.3) Lime stone shall not be permitted for any concrete work.

33) Land:

- 33.1) The contractor shall make all efforts to obtain land required for the ancillary works. In case the contractor is unable to obtain land and if requested then the department may requisit land at his cost.
- 33.2) Land as available with the department or requisitioned by the department at the request of the contractor will be handed over to the contractor for such use as will be necessary for ancillary work required on payment of rent to the department. Plot development, if any, will have to be done by the contractor at his own cost. The development shall be in conformity with the regulations of the local authority.
- 33.3) If for the purpose of construction it becomes necessary of the contractor to occupy land not in possession of the department the contractor will have to make his won arrangement with the land owners and pay such compensations as mutually agreed between them.
- 33.4) On completion of work, all land mentioned in para 34.1., 34.2, 34.3 shall be handed over back to the owners, or the department, as the case may be, after clearing the land as directed by the Engineer-in-charge. Dismantling of building on Government or department land shall be done only after the approval of the Engineer-in-charge.

34) Floods or Accidents :

The contractor shall take all precautions against damages by floods or from accidents etc. No compensation will be allowed to the contractor on this account or for correction and repairing any such damages to the work during construction.

The contractor shall be liable to make good at his cost any plant or materials belonging to the Government lost or damaged by floods or from any other causes while in his charge.

- 35) Urgent Works:** If any "Urgent Works" become necessary and contractor is unable or unwilling to carry it out at once, the Engineer-in-charge may by his own or through other people have it carried out as he may consider necessary. If the "Urgent Work" shall be such as in the opinion of the Engineer-in-charge the contractor is liable under the contract to carry out at his expenses, all expenses incurred on it by the department shall be recoverable from the contractor, and be adjusted or set off against any sum payable to him.

36) Change of Cement Concrete etc.:

Theoretical consumption of Cement for the Concrete work

Sr.No.	Volumetric mix of concrete	Consumption of cement in bags/Cum
1	C.C.M-10	4.40 bags/Cum
2	C.C.M-15	6.27 bags/Cum
3	C.C.M-20	7.10 bags/Cum
4	C.C.M-25	7.50 bags/Cum
5	C.C.M-30	8.00 bags/Cum
6	C.C.M-35	8.30 bags/Cum
7	C.C. M-40	8.50 bags/Cum
8	C.C. 1:4:8	3.40 bags/Cum

Note : The weight per bag of cement is considered as 50 Kg.

The rate of consumption of cement for various grades of concrete referred above is a theoretical rate of consumption assumed for the estimate purpose. The contractor will have to obtain an economic mix design for

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various grades of concrete and get it approved from the Engineer-in-charge. The specification for controlled cement concrete shall be as per standard specification No. B-7 Page 38, and IS 456-3600

Immediately upon the receipt of the award of the contract, the contractor shall inform the Engineer the exact location of the sources of the acceptable material. The concrete mix to be used shall be got designed in all approved laboratory, by the contractor with a optimum quantity of cement to give the specified strength in the preliminary tests and the proportion got approved by the engineer in writing. These proportions shall be used so long as the materials continue to be of the same quality and from the same sources subject only to slight changes in the relative quantities of fine and course aggregate for the purpose of promoting workability provided the work tests and shows the required strength.

If such preliminary tests involve change in cement consumption upto 2% on the higher or lower side, no adjustment in the cost of the item to be paid to the contractor shall be made. If such alterations, changes, theoretical consumption of cement by more than 2% on the higher or lower side, the sources and quality of aggregate remaining the same, payment will be adjusted for or against the contractor in whatever amount the total cost of cement to the contractor has been increased or decreased by more than 2%. The amount of such increase or decrease shall be calculated on the basis of quantity of cement determined and prescribed in the special provisions. In adjusting the cost only the cost of cement shall be considered and not handling or other charges, which shall be treated as incidental to the terms. If during the progress of work the contractor wishes to change the material, the proportions shall be fixed on the basis of fresh preliminary tests to give the required strength after the Engineer is satisfied that the material satisfy the specifications. No adjustment of the cost shall be made for a change of proportions of cement fixed in the original preliminary tests.

37) Contractor to inform himself fully :

The Contractor shall be deemed to have carefully examined the work and site conditions including labour, the general and the special conditions, the specifications, schedules and drawings and shall be deemed to have visited the site of the work and to have fully informed himself regarding the local conditions including water levels, winds, current velocities and sub-soil condition and carried out his own investigation to arrive at the rates quoted in the tender. In this regard he will be given necessary information to the best of knowledge of department but without any guarantee about it.

If he shall have any doubts as to the meaning of any portion of these general conditions, or the special conditions to the scope of working of the specifications and drawing, or any other matter concerning the contract, he shall in good time before submitting his tender set forth the particulars thereof and submit them to the Engineer in writing in order that such doubt may be clarified authoritatively before tendering. Once a tender is submitted the matter will be decided in accordance to the tender conditions in absence of such authentic clarification.

38) Errors, Omissions And Discrepancies :

- a) In case of errors, omissions and/or disagreement between written and scaled dimensions in the drawing or between the drawings and specifications etc. the following order of preference shall apply :
 - i) Between actual scaled and written dimensions or description or description on a drawing the latter shall be adopted.
 - ii) Between the written or shown description or dimensions in the drawing the corresponding one in the specifications, the latter, shall apply.
 - iii) Between the quantities shown in the schedule of quantities and those arrived at from the drawing the latter shall be preferred.

- b) In all cases of omissions and/or doubts or discrepancies in the dimension or description of any item or specifications a reference shall be made to the Engineer, whose elucidation, elaboration or decision shall be considered as authentic. The contractor shall be held responsible for any errors that may occur in the work through lack of such reference and precautions.
- c) The contractor should not sublet any part of work without written permission of the Engineer-in-charge.

39) Samples and Testing of Materials :

- i) All materials to be used on work such as cement, lime, brick, aggregates, steel, stone, asphalt, wood, tiles etc. shall be got approved in advance from the Engineer-in-charge and shall pass the tests and analysis required by him which will be (a) as per specifications of the items concerned and or (b) as specified by the Indian Road Congress standard specification and code of practice for road and bridges or (c) I.S.I. specification whichever and wherever applicable (d) as per specification Ministry of Surface Transport for Roads and bridges section 900 quality control for road work or (e) such recognised specification acceptable to the Engineer-in-charge as equivalent there to or in the absence of such authorised specification (f) such representative in the order of precedence given above.
- ii) The contractor shall at his risk and cost make all arrangements and/or shall provide for all such facilities as the Engineer-in-charge may require for collecting, preparing and forward required number of samples for tests or for analysis to the nearest approved laboratory and bear all charges and cost of testing. Such samples shall also be deposited with the Engineer-in-charge till sent for testing.
- iii) The contractor shall, if and when required, submits at his cost the samples of materials to be tested or analyzed and if so directed, shall not make use or incorporate in the works any materials to be represented by the sample until the required test or analysis have been made and after this test results of the materials finally accepted by the Engineer-in-charge.
- iv) Frequency of testing of the construction material and the percentage of testing from the Government laboratory shall be as under.
 - a) Where the field laboratory certified by the concerned University Engineer is established for the work at work site 70% tests as per total frequency required shall be carried out in the said field laboratory & 30% tests shall be carried out at the Vigilance & Quality Control Laboratory for the materials mentioned in **Annexure-I** on **page ____ to ____** here under for the material not covered in Annexure- I, 50% tests shall be carried out in the field laboratory and remaining 50% tests need to be carried out in the Vigilance & Quality Control Laboratory of P.W.D. Govt. of Maharashtra. The entire responsibility of the sample testing as per required frequency including testing charges will be borne by the Contractor.
 - b) Where field laboratory is not established at works site 100% tests as per frequency shall be carried out in the Vigilance & Quality Control Laboratory.
 - c) Testing of cement and steel 100% in V.Q.C.C.Laboratory at Amravati/Akola is compulsory.
- v) For providing Electric wiring duct tubes of the required diameters and length shall be provided through walls, beams and floors, slab as when diverted without any extra cost.
- vi)
 - a) The contractor will make his own arrangement for receiving all materials, tools, etc. required for the work.
 - b) No extra charge for the carriages of work be allowed.
 - c) ~~The rates for all items are inclusive of all charges such as carting, lifting etc.~~ ^{University Engineer}
 - d) The contractor should not be sublet any part of work without written permission of the Engineer-in-charge.

- e) The condition in the tender notice will be binding on the contractor and tender notice will form a part of agreement.
- f) Frequency of testing shall be as per relevant specifications. In case such frequency is not specified in work specifications then the I.S. Code will be referred and for other cases where I.S. Code do not stipulate the frequency of testing it will as directed by Engineer-in-charge.

40) Weigh Batching: The following instructions shall be followed as regards to preliminary designs of mix and methods of batching of plain cement concrete and reinforced cement concrete. The preliminary mix design and batching for various grades of concrete shall be governed by the following guidelines as per IS 456-3600/ Mix Design- It will be the responsibility of the contractor to obtain the mix design for various cement concrete grades at his cost from the recognised institution.

41) Miscellaneous:

41.1) Competency of Tender:- The work will be awarded only to those contractors who are considered to be responsible bidders, capable of performing the class of work to be completed. Before passing the final award any or all bidders may have to show that he has the necessary experience, facilities, ability, and financial resources to execute the work in satisfactory manner and also within the stipulated time. The bidders may also be required to furnish to the Department a statement in respect of their experience and financial resources.

41.2) Eraser : Person tendering are informed that no erasers or any alterations by them in the text of the documents set herewith will be allowed and any such eraser or an alteration will be disregarded, if there is any error in writing no overwriting should be done but the wrong words or figures should be struck out and the correct one written above or near it in an unambiguous way. Such corrections should be initiated and dated.

41.3) Acceptance : Intimation of acceptance of tender will be given by a telegram or a letter sent by registered post to the address given below the signature of the tenderer in the tenders. The tenders which do not fulfill any of the conditions for those in the form and which are incomplete in any respect shall be liable for rejection.

41.4) Precautions to be taken by the contractor to prevent accident.

- i) No live electric lines should be allowed to run along the ground in the blasting zone and they should be at least 3 meter above ground if not more.
- ii) The wiring cable should be taken near the live electric line and it should be preferably short firing cable as supplied by the supplier of explosives. If such cable is not available a substitute cable made up of several pieces properly jointed and tapped be used.
- iii) The blasting shed from where the exploder is to finally operated should be at least 3000 Ft. away from the area to be blasted. It should have a strong roof which can withstand the impact of flying stones at his range.
- iv) Only trained hands should be allowed to handle explosives, cable detonators etc.

41.5) Police Protection:- For the special protection of the camp of the contractors work, the Deptt. will help the contractors as far as possible to arrange for such protection with the concerned authorities. The cost shall be borne by the contractor.

41.6) For providing electric wiring or water line etc. recesses shall be provided if necessary through walls, slabs beams etc. and later on refilled it with bricks or stones, chippings cement mortar without any extra cost.

- 41.7) In case it becomes necessary for the due fulfillment of contract for the contractor to occupy land outside the Department limits the contractor will have to make his own arrangements with the landowners and pay such rents, if any, which are payable as mutually as agreed between them.
- 41.8) The contractor shall duly comply with the provisions of the Apprentices Act.1961 (iii) of 1960 and the rules and orders made there under from time to time under the said Act and the said Rules and on his failure or neglect to do so he shall be subject to all the liabilities and penalties provided by the said Act and said Rules.
- 41.9) It is presumed that the contractor has gone carefully through the standard specification (vol. I & II 1981 edition) of Govt. of Maharashtra P.W.D condition/MORT & H specifications of latest edition and the schedule of rate of the Division, and studied of site conditions before arriving at rates quoted by him. The special provisions and detailed specification of wording of any item shall gain precedence over the corresponding contract. Decision of Engineer-in-charge shall be final in case of interpretation of specification.
- 41.10) If the standard specifications fall short for the items quoted in the schedule of this contract reference shall be made to the latest Indian Standard specifications, I.R.C. codes, and MORT & H specification if any of items of this contract do not fall in reference quoted above, the decision and specifications as directed shall be final.

42) Load Testing :

The Engineer-in-charge is empowered to order load testing of the building, bridges or their component whenever there is a doubt about the workmanship or the safety of the building component or whenever there is a need to confirm the workmanship and the safety of the structure by carrying out load test. The load testing shall be carried out as per the specifications B.R. 58 of the book of standard specifications published by Govt. of Maharashtra P.W.D. with such specifications as ordered by Engineer-in-charge.

- i) The load for such test shall be full dead load (excluding self load of the member under test) plus 125% maximum design live load (including impact) in cases of R.C.C. Bridges.
- ii) The load testing will be carried out by the Department through a suitable Competent Agency. Test result from such agency as will be fixed by Department will be binding on the contractor.
- iii) If the result of the load test are not found to be satisfactory, the contractor shall strengthen the already cast member or reconstruct the members at his cost and also bear the cost of load test. The decision of the Engineer-in-charge will be final in this case.

43) Special Conditions:

- 43.1) The contractor should ensure that all safety precautions are observed by their labours, working closed to the State Highway and while closing the State Highway precautions are taken including insurance etc. for their labours at the cost of the contractor etc.If any accident occurs to the labour etc, no claim in this regard on whatsoever account shall be entertained and this decision of the department will be final and conclusive.
- 43.2) During the execution if there is any change in:
- (i) Span Arrangement.
 - (ii) Height of substructure and superstructure above ground level.
 - (iii) Change in the depth of foundation, tendered rate for respective items will hold good and no extra claims shall be entertained on this account.

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- 43.3) Contractor shall observe the rules and regulations imposed by traffic police for smooth flow of traffic on the diversion road and shall not be entitled for claim any compensation arising thereof.

44) **Mix Design**

- 44.1) The following instructions shall be followed as regards preliminary design of mix methods of batching of plain cement concrete and reinforced cement concrete. These instructions should be treated as supplementary to the relevant provision in the specifications for the respective items contained in the book of standard specifications and will override the provisions contained therein wherever they are contrary to the following instructions. The preliminary mix design and batching for various grades of concrete shall be governed by the following guidelines.

	Concrete Grade	Guidelines
1	Up to M-15	This should only by ordinary concrete. No change may be prescribed for the present practice as regards preliminary design of mix permitting volume batching.
2	M-20	Preliminary mix design must be carried out for these mixes. However, weight batching shall be insisted for cement only.

- 44.2) For the grades of concrete M-20 and above the preliminary mix design shall be carried in P.W.D. Govt. laboratory.

- (i) The charges for preliminary design of concrete mix shall be entirely borne by the contractor.
- (ii) For grades of concrete M-20 and above where cement is to be used by weight, the cost of extra cement required to make up the under weight bags shall be borne by the contractor.
- (iii) For the items of concrete of grades lower than M-20 other items in the agreement where cement is not to be used by weightment. The cement bags shall contain cement of 50 Kg. net weight.

- 44.3) The admixtures such as plasticizers/super plasticizers for concrete grade M-20 and above shall be used as directed by Engineer-in-charge depending upon specific requirements. No extra payments on this account will be admissible.

45) Definitions :- Unless excluded by or repugnant to the contents-

- (a) The expression **“Government”** as used in the tender documents shall mean the WORKS DIVISION of the Government of Maharashtra.
- b) The expression **‘The Chief Engineer’** as used in the tender papers shall mean Chief Engineer, P.W.Region, Amravati.
- c) The expression **‘Superintending Engineer’** as used in the tender papers shall mean the officer of Superintending Engineers ranks (by whatever designation he may be known) under whose control the work lies for the time being.
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- d) The expression "**Engineer**" or "**Engineer-in-charge**" as used in the tender paper shall mean the University Engineer-in-charge of the work. The Engineer-in-charge for this work is University Engineer,_____.
- e) The expression '**Contractor**' as used in the tender paper shall mean the successful tenderer that is the tenderer whose tender has been accepted and who has been authorised to proceed with the work.
- f) The expression '**contract**' as used in the tender papers shall mean the deed of contract together with all its original accompaniments and those later incorporated in it by mutual consent.
- g) The expression '**plant**' as used in the tender papers shall every temporary accessory necessary or considered necessary by the Engineer to execute, construct, complete and maintain the work and all altered, modified, substituted and additional works ordered in the time and the manner herein provided and all temporary materials and special and other articles and appliance of every sort kin and description whatsoever intended or used therefore.

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ADDITIONAL TENDER CONDITIONS

1) Construction Machinery/Equipment.:

- 1.1) The methodology and equipment to be used on the project shall be furnished by the contractor to the Engineer well in advance of commencement of work and approval of the Engineer obtained prior to its adoption and use.
- 1.2) The contractor shall give a trial run of the equipment for establishing its capability to achieve the laid down specifications and tolerance to the satisfaction of the Engineer before commencement of work, if so desired by the Engineer-in-charge.
- 1.3) All equipment provided shall be proven efficiency and shall be operated and maintained at all times in manner acceptable to the Engineer-in-charge.
- 1.4) No equipment or personnel will be removed from site without permission of Engineer-in-charge.

2) Work Programme and Methodology of Construction:

The Contractor shall furnish his programme of construction for execution of the work within the stipulated time schedule together with methodology of construction of each type of work and obtain the approval of the Engineer-in-charge.

3) Revised Programme of work in case of slippage :

In case of slippage from the approved work programme at any stage, the contractor shall furnish revised programme to make up to slippage within the stipulated time schedule and obtain the approval of the Engineer-in-charge.

4) Action in Case of disproportionate progress :

In case of extremely poor progress of the work or any item at any stage of work which in the opinion of the Engineer can not be made good by the contractor considering his available resources, the Engineer will get it accelerated to make up the lost time through any other agency and recover the additional cost incurred, if any, in getting the work done from the contractor after informing him in writing about the action envisaged by him.

5) Setting Out :

Setting out the work as spelt out in clause 109 of Ministry's Specification for Road and Bridge Works (2nd Revision) will be carried out by the Contractor.

6) Public Utilities:

Action in respect of public utilities will be taken by the contractor as envisaged in clause 110 of MORT&H Specification of Road and Bridge work (2001).

7) Arrangement for traffic during construction:

Action for arrangement for traffic during construction will be taken by the contractor as envisaged in the contract documents and spelt out in clause 112 of M.O.R.T.&H. Specification of Road and Bridge work (2001)

- 8) **Quality Control :**
The responsibility of achieving quality of work will be on the contractor who will take actions as stipulated in section 900 of M.O.R.T.&H. Specification of Road and Bridge work (2001).
- 9) **MORT&H specification for Road and Bridge work (2001) Fourth Revision:**
MORT&H Specification of road and Bridge work (2001) will form part of the contract documents and the contractors will be legally bound to the various stipulation made therein unless and other wise specifically relaxed or waived wholly or partly through a special clause in the correct documents.
- 10) **Applicable in case of Road Work only:**
The details of the paver, specified in the M.O.R.T.&H. clause 504.3.5 third revision be relaxed in the case of bituminous macadam MORT&H-IVth Revision (Clause 504) where it is going to be covered by any wearing course other than semidense Bituminous macadam (Clause 507)/ Bituminous concrete (Clause 509) with the provision that it can be laid by means of self propelled mechanical paver with suitable screeds capable of spreading, temping and finishing the mixture to the specified lines grades and cross section.
- 11) **Special Condition for B.T.work:**
In respect of Black Top Work, 15% (Fifteen P.C.) payment of black Top item in a particular Km. will be retained till completion of side berms/C.D. Works etc. in that Km. After completion of other items satisfactorily, the withheld payment will be released finally..
- 12) **Insurance of Contract work.**
Contractor shall take out necessary Insurance Policy/Policies (Viz contractors all risk Insurance policy, Erection all risk, Insurance policy etc. as decided by the Directorate of Insurance) so as to provide adequate insurance cover for execution of the awarded work for total contract value and complete contract period compulsorily from the, "Directorate of Insurance, Maharashtra State, Mumbai" only. Its postal address for correspondence is "264, MHADA, First Floor, Opp. Kalanagar, Bandra (East) Mumbai-----051". (Telephone Nos. 26590403/26590690 and Fax Nos. 26592461/26590403. Similarly all workmen appointed to complete the contract work are required to insure under workmen's compensation insurance Policy. Insurance Policy/Policies taken out from any other company will not be accepted. If any Contractor has effected Insurance with any Insurance Company, the same will not be accepted and the amount of premium calculated by the Government Insurance Fund will be recovered directly from the amount payable to the Contractor for the executed contract work and paid to the Directorate of Insurance Fund Maharashtra State, Mumbai. The Director of Insurance reserves the right to distribute the risk of insurance among the other resources.

Contractor

No of correction

University Engineer

12(A) INSURANCE

The contractor shall provide in the joint names of the Employer and the contractor insurance through Director of insurance Govt. of Maharashtra from the start date to the end of the Defects Liability Period for the following events which are due to the Contractor's risks. The Contractor's all risk policy and the workmen's insurance policy shall be within the Maharashtra insurance Fund only as stated above.

- A) Loss of or damage to the work, plant and materials
- B) Loss of or damage to Equipment
- C) Loss of or damage of property (except the work, plant, materials and Equipment) in connection with the contractor and
- D) Personal injury or death

Policies and certificates for insurance shall be delivered by the contractor to the Engineer for the Engineer's approval before the start date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

If the contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the contractor or, if no payment is due, the payment of the premiums shall be a debt due.

Alteration to the terms of an insurance shall not be made without the approval of the Engineer.

Both parties shall comply with any conditions of the insurance policies.

- 13) The responsibility of achieving quality of work will be on the contractor who will take action as stipulated in standard specification as per Schedule "C".
- 14) The contractor shall provide, furnish, maintain and remove on completion of the work a suitable site **office-cum-laboratory** on the work site for use of Executive Engineer's representative. The site office cum laboratory shall be separate rooms of sufficient area. It shall preferably be 68 sqm as per drawing attached with Tender Document. It may have brick wall & asbestos or corrugated sheet roof with false ceiling, paved floor should be 0.45 mtr. above ground level, laboratory shall have working platform, necessary electrical provision and water supply arrangement. Arrangement of display of drawing should also be made. He should provide suitable latrines, urinals and keep them clean daily. This will be included in his offer. Necessary laboratory equipment, office furniture shall be provided by the contractor at his own cost. After completion of work it will be property of contractor. It should be removed from site of work at his own cost.

- 15) The contractor should produce the no objection certificate obtained from the Maharashtra Pollution Control Board before starting Crusher/Drum Mix Plant on the work site.

16) **Supply of Colour Record Photographs and Album :**

The contractor shall arrange to take colour photograph at various stages/Facts of the work including interesting and novel features of the work as desired by the Engineer-in-charge. Photographs shall be of acceptable quality. Each photograph taken shall be standard post card size, marked in albums of acceptable quality. Also the C.D. or the same shall be supplied for each photograph in the Album shall be suitably captioned.

The contractor shall arrange for taking video films of important activities of the work as directed by the Engineer-in-charge during the currency of the project and editing them to a video film of playing time not less than 60 minutes and up to 180 minutes as directed by the Engineer-in-charge. It shall contain narration of the acceptable quality and the film shall be capable of producing colour pictures.

It shall be considered as incidental to the work and no additional payment, whatsoever will be made for the same.

- 17) Notwithstanding whether it as per the rules of the traffic authorities or otherwise the agency should ensure that their vehicles, the term includes all construction machinery towards or self driven are equipped with the following to emphasize / traffic safety.

- i) Reflector 4 Nos.
- ii) Tail lamp 2 Nos.
- iii) One of the following slogan:
 - a) “ जल्दी रती ाम ाराब, होश मे आया लाट सहाब ”
 - b) “ दारुचा ए च प्याला ार ा तुमच्या नाशाला ”
 - c) “ Drink and drive, you won't survive ”
 - d) “ वाहन व्यवस्थीत, जीवन सुरा ित ”
 - e) “ ए झप ि ए ापघात ”
 - f) “ जेथे ल ा विचलित तेथे ापघात निश्चित ”
 - g) “ ाप ि भुल दुसरो ि परेशानी ”
 - h) “ ावरा वे ाला सावरा जिवाला ”
 - i) “ मनाचा ब्रे ात्तम ब्रे ”
 - j) “ न ि मर ा, न ि ापं िता, वे ात्रर ताबा बाळ ा द िता ”
 - k) “ समय मुल्यवान है ले िन जिवन ामुल्य है ”
 - l) “ धुम्रपान मद्यपान आयुष्याची धुळधा ा ”
 - m) “ Live & let Live ”
 - n) “ A cat has 10 lives you have only 1 ”
 - o) “ If married divorce speed ”

In absence of the above requirements and failure of the agency to fulfill them in a reasonable time the University Engineer in charge of the work will get it done from the Mechanical wing of the P.W.Department and would recover the cost from the amount due to the agency at the following rates.

- i) Reflector Rs.25/- Per Nos.
- ii) Tail Lamp Rs.175/- Per Nos.
- iii) Slogan Rs.75/- Per Nos.

18) The decision of the **Engineer –in-charge** will be binding and conclusive in this matter.

19) After award of contract, contractor will have to provide and fix the information boards showing name, tender cost, period of completion, Name and Telephone number of agency and University Engineer and other details as directed by Engineer-in-charge as per drawing attached. It is incidental to work & no Extra payment will made to the contractor.

20) **Laboratory Set up**

Field Laboratory:-

~~20.1) The Contractor for the purpose of testing of material shall arrange to provide and maintain fully furnished and adequately equipped field laboratory of adequate floor area as shown in drawing. The field laboratory shall preferably be located adjacent to site or as directed by the Engineer in charge. The field laboratory shall be provided with amenities like water, electric supply etc. to be arranged by Contractor.~~

~~20.2) The floor space requirement shall include office space for Engineer & Contractor's representative, storage of samples, installation of equipment, laboratory table, cup boards, working platform of size 1m x 10 m working space for carrying out various tests, curing tank, wash basin, toilet etc. and the minimum furniture such as office tables & chairs for material engineers, stools, working tables, store accessories.~~

~~20.3) The Cost of Construction of laboratory at work site or plant site as the case may be and cost of furniture, electrical equipments fittings during the currency of Contract is incidental to work and no separate payment will be made for the same to the contractor.~~

~~20.4) If the contractor fails to establish the laboratory within 60 days from the issue of work order an amount of Rs. 1.50 lacs will be recovered from forth coming bill payable to the Contractor.~~

~~20.5) After completion of work the above property will be contractor's property.~~

~~20.6) The laboratory established by the contractor shall be manned by a qualified materials Engineer/Civil Engineer assisted by experienced technicians and the setup shall be got approved from the Engineer in charge.~~

~~20.7) The Contractor shall prepare printed proforma for recording readings and results of each type of tests. Such formats shall be got approved from the Engineer in charge. The Contractor should keep a daily record of all the tests carried out by him. Two copies of the test results should be submitted to Engineer in charge within 7 days from the date of testing for examination and approval. One copy of test results will be returned to the Contractor by the Engineer in charge for keeping the record of test results in acceptable manner at site of work.~~

20.8) ~~All quality Control register/records shall be maintained by the Contractor and checked by the Engineer in-charge or his representatives regularly.~~

21) ~~Set up of equipments:~~

21.1) ~~The contractor shall have at least following equipments calibrated to the latest date in the laboratory so established. The Contractor will have to carry out the calibration of the equipments from the approved agency as and when directed by the Engineer in charge at his own cost in cases where the calibration validity stands expired.~~

General:

i)	Balance—20 Kg. Capacity (self indicating)	1 No.
ii)	Electronic balance 5 Kg. Capacity, accuracy 0.5 gm.	1 No.
iii)	Water bath—Electrically operated & thermostatically controlled, with adjustable shelves, sensitivity 1°C.	1 No.
iv)	Thermometer: (1) Mercury in glass 0° to 250° (2) Mercury in Steel with 30 cm. stem upto 300°C (Dial type)	2 Nos. 2 Nos.
v)	Kerosene or Gas stove/electric hot plate	1 No.
vi)	Set of IS sieves 45 cm. Dia. G.I. Frame, 125 mm, 100mm, 90mm, 80mm, 63mm, 53mm, 50mm, 45mm, 40mm, 37.5mm, 26.5mm, 25mm, 22.4mm, 20mm, 19mm, 13.2mm, 11.2mm, 9.50mm, 5.6mm, 4.75mm, 4.25mm, 6.3mm, 6mm, with lid and pan (coarse sieve)	1 Set of 23 Nos. sieves.
vii)	Set of IS fine sieves 20 cm. dia. brass Frame, 2.8 mm, 2.36mm, 1.18mm, 0.60mm, 0.30mm, 0.15mm, 0.75mm, 425 micron, 300 micron, 180 micron, 150 micron, 90 micron, 75 micron with lid and pan, (fine sieves)	1 Set of 13 Nos. sieves.
viii)	Glass ware, spatulas, wire gauges, steel scales, measuring tape, enameled tray, porcelain dish, requirement plastic bags, gunny bags, digging tolls etc.	As per requirement
ix)	First aid kit	1 No.
a)	Aggregate & Soil testing	
i)	Atterberg limits (liquid & plastic limit) determination apparatus No of correction	1 Set University Engineer
ii)	Density test apparatus (Sand pouring cylinder, tray, can etc.) complete.	1 Set

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iii)	Aggregate impact value test apparatus.	1 Set
iv)	Flakiness and elongation test gauge	1 Set
v)	Standard measures of 5, 3 and 1 litre	1 Set
vi)	Field density apparatus with cutting tray, chisel, hammer and standard sand	2 Set
vii)	3 meter straight edge and camber plate adjustable type	2 Set
viii)	Measuring Cylinders 3000 ml and 100 ml.	1 No. each
b)	Cement Concrete Testing	
i)	Compression testing machine of 200 tone capacity with two dial gauges.	1 No.
ii)	Cube moulds 15cmx 15cmx 15cm	18 Nos.
iii)	Slump testing apparatus	2 Nos.
iv)	Needle vibrator	2 sets
v)	Compacting factor test	2 sets
vi)	Vicat's apparatus for testing setting time	1 No.

e)	Bitumen Testing	
i)	Penetrometer with Standard needles	1 No.
ii)	Centrifuge type bitumen extractor electrically operated complete with industrial benzene	1 Set
iii)	Field density apparatus with cutting tray, chisel, hammer and standard sand	2 Set
iv)	3 meter straight edge and camber plate adjustable type	2 Set
v)	Measuring Cylinders 3000 ml and 100 ml.	1 No. each

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University Engineer

CONDITIONS FOR MATERIALS TO BE PROCURED BY THE CONTRACTOR

1) **CEMENT** :-

Cement to be used for works shall comply of the following with the prior approval of Engineer.

a) Ordinary Portland cement 43 grade Conforming to IS: 8112 used in the manufacture of exposed surface of concrete of any element of a structure shall be from the same factory. Independent testing of cement used shall be done by the contractor at site and in the laboratory approved by the Engineer before use. Any cement with lower quality than those shown in manufacture's certificate shall be debarred from use. In case of finally ground cement or imported cement, the Engineer may direct the contractor to satisfy him as to the acceptability of such cement, especially with regard to creep and shrinkage effect. Any consignment or part of a consignment of cement which has deteriorated in any way shall not used in the works and shall be removed from the site by the contractor without charge to the employer.

Cement shall be transported, handled and stored on the site in such manner as to avoid deterioration, contamination. Each consignment shall be stored separately, so that it may be readily identified and inspected and cement shall be used in the sequence in which delivered at site. The contractor shall prepare and maintain proper records on site in respect of the delivery, handling storage and use of cement and these records shall be available for inspection by the Engineer at all times.

b) Use of Portland Pozolana Cement Conforming to IS : 1489 (Part-I 1991) permissible, subject to the following conditions :-

- i) For the concrete containing PCC Cement, the curing period shall not be less than 14 days.
- ii) The stripping time for removal of form work shall be as under.

		Minimum period before striking form work .
(a)	Vertical formwork to columns, walls, beams.	48 hrs.
(b)	Soffit formwork to slabs (Props to be refixed immediately after removal of formwork)	10 days
(c)	Soffit formwork to beams (Props to be refixed immediately after removal of formwork)	14 days
(d)	Props to slabs i) Spanning up to 4.5m. ii) Spanning over 4.5m.	10 days 21 days
(e)	Props to beams and arches. i) Spanning up to 6m. ii) Spanning over 6m.	21 days 28 days

2) **Sand**

Silt content of sand shall not more than permissible limit. If it is found more than the permissible limit, it should be washed at site by contractor at his own cost.

3) **T.M.T. STEEL/HYSD STEEL**

High Yield Strength Deformed (T.M.T.) bars shall comply with IS :1786 grade Fe-415 and mild still bars shall comply I.S. 432.

All reinforcements shall be free from rust, loose mill scale or coats or oil, paints etc. placing in position for concreting. The Agency should use the Steel manufactured by the Main Producers or authorised conversion agents only. No rerolled steel shall be incorporated in the work.

4) **Bulk/Packed Bitumen**

- i) Only 60/70 grade bitumen shall be used.
- ii) Bitumen brought on site shall conform to I.S.73 of latest edition
- iii) Testing has to be arranged by contractor from recognized Govt. laboratory at his own cost for all tests mentioned in IS-73 of latest edition
- iv) The Contractor shall use Bulk Bitumen obtained from any Government Refinery only.
- v) The material brought by agency will be open to check by Executive Engineer or his representative at all time. He should submit bill from refinery itself only. No other bill than refinery's unit will be accepted by department and no claim of contractor will be admissible.
- vi) For other activities storage weighments specification No. Rd. 42 Pg.217 of Standard Specification of P.W.D. will be referred. Contractor has to arrange own static tank for storage of bulk bitumen.
- vii) If it is decided to procure bulk bitumen the contractor shall intimate Engineer-in-Charge well in advance. Consignment will not be allowed to unload until it's weight is checked on weigh bridge by Departmental persons.

5) **Rejection of Materials Not Conforming to Specification.**

Any stock or batch of materials (s) of which samples (s) does not confirm to the prescribed test and quality shall be rejected by Engineer or his representative and such material shall be removed from site by the contractor at his own cost. Such materials shall not be made acceptable by modifications.

Materials not corresponding in character and quality with approved samples will be rejected by the Engineer or his representative and shall be removed from site immediately and will not be allowed to use for any component of work.

APPENDIX – 1

Statement showing (approximately) Quantity to be brought by the Contractor

Sr. No	Name of Materials	Approximate quantity to be brought by the Contractor at his own cost	Unit	Remarks
1	2	3	4	5
1	Bulk Bitumen VG 30(60/70) Grade	M.T.	One Metric Tonne	<p>1) All required materials will have to be procured and brought by the Contractor at the site at his own risk and cost. The proof of purchase should be produced before execution of work and along with work bill</p> <p>2) Bitumen shall be procured from any Govt. Refinery by the Contractor at his own cost & risk. However proof of purchasing of 60/70 grade bitumen should be produced during the execution of work and along with bill.</p> <p>3) R.C.C. Pipe should be purchased by M.S.S.I.D.C. only.</p> <p>4) Custody of material shall be sole responsibility of the contractor.</p> <p>5) Physical properties shall be conformed with MORT&H/IS specification.</p> <p>6) Stipulated test shall be carried out by the Contractor at his own cost as per the frequency.</p> <p>7) Cement and steel shall be purchased from the manufacturers / main producers only.</p>
2.	Cement (43 grade)	M.T.	One Metric Tonne	
3.	TMT / HYSD/M.S bars	MT	One Metric Tonne	

Contractor

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University Engineer

**ADDITIONAL CONDITIONS FOR MATERIAL
BROUGHT BY THE CONTRACTOR**

- 1) All the material required for construction for work shall be arranged by the contractor at his own cost. The samples of material to be procured shall be got approved by the Engineer-In-Charge, Material as per approved samples shall only be procured.
- 2) The contractor shall submit periodically as well as on completion of work, an account of all materials brought by him in a manner as directed by Engineer-In-Charge. The contractor shall also furnish monthly account of materials. A separate register shall be maintained on site for recording daily item wise receipt and consumption of Cement, Steel and Asphalt used by him, also item wise consumption of other materials used. This register shall be signed daily by the contractor or his representative and representative of Engineer-in-Charge.
- 3) All the materials required for the work shall be brought by the contractor at his own cost. In each case, certificate for its quality and quantity shall be produced by the contractor and samples of each material shall be got tested from Government Laboratory as mentioned in condition at serial No. 39(4)(1) (General condition) by the contractor at his own cost and the test results of samples shall be supplied to the Department. The material not conforming to the required standard shall be removed at once from the site of the work by the contractor at his own cost.
- 4) Testing of all construction material shall be carried out as per required frequency and specifications. and the charges for testing shall be borne by the Contractor.
- 5) The contractor shall construct shed/sheds as per direction of the Engineer-In-Charge of the work for storing the materials brought at site. The material shall be taken out for use in the presence of the departmental representative only.
- 6) The contractor shall make his own arrangement for the safe custody of the materials which are brought for construction of work.
- 7) The contractor shall not transfer any material once brought at work site without prior written permission from Engineer-In-Charge.
- 8) In case the materials brought by the contractor become surplus owing to the change in the design of the work, the materials should be taken back by the contractor at his own cost after prior permission of the Engineer-In-charge.
- 9) The charges for conveyance of materials from the place of delivery to the site of work and the actual spot on work site shall be entirely borne by the contractor. No claim on this account shall be entertained.
- 10) The contractor shall furnish the account of asphalt brought by him at each time before placing orders for further supply. Also the same should submit on completion of the work, final account of the material used by him to the Department. This account will be scrutinized by the Engineer-In-Charge.
- 11) Contractor should bring the bitumen from Govt. refinery only
- 12) All empty asphalt drums shall be the property of contractor and the same shall be removed immediately after completion of work.

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- 13) Agency shall ensure the laying temperature of hot mix material as specified & accordingly he shall make necessary arrangement for preventing loss of temperature of hot mix material during transit from location of drum mix plant to work site.
- 14) The agency should use the steel manufactured by the main producer only.
- 15) The contractor shall procure the RCC pipes if required for this work from M.S.S.I.D.C. only. Proof of purchasing of pipe should be submitted.
- 16) The contractor should inform the schedule of arrival of Bouzers to the Engineer-in-charge time to time.
- 17) The contractor shall also arrange to provide field laboratory at plant site along with all necessary equipment & materials for testing the grade of bitumen procured by him.

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University Engineer

ADDITIONAL CONDITIONS FOR BITUMEN

- 1) The contractor shall use Bulk Bitumen, VG30(60/70) grade received from the Government Refinery only. Bitumen received as above will be entirely consumed in the respective item & work as directed by the Engineer-in-charge.
- 2) Conveyance charges of Bitumen, VG30(60/70) grade (including loading/unloading etc.) from Government Refinery to the hot mix plant site will be borne by the Contractor
- 3) The Contractor should be aware that delay may occur in getting the bulk asphalt to be supplied at the refinery. They are, therefore, advised to indent for their requirement, sufficiently in advance allow for the period usually taken for supplying Bulk Bitumen.
- 4) The contractor shall submit periodically as well as on completion of work, an account of all materials issued to him in a manner as instructed by the Engineer-In-Charge. In addition, a separate register shall be maintained on site for recording daily item wise asphalt consumption of the work (Giving details of quantities of items of executed and asphalt required for each of them) as directed and shall be signed daily by the contractor or his representative, and got signed daily from the representative of the Engineer-in-Charge.
- 5) The bitumen shall be made available on working days only during working hours. Bulk Asphalt will be delivered as per the rules of the concerned Govt. refinery. The contractors are expected to know all the rules and regulations framed by the refineries in this behalf.
- 6) The Contractor should note that the bouzars when received from Government are always unloaded at the plant in the presence of the Junior Engineer/ other representative of the Department during 8.00 A.M. to 6.00 P.M. only. He should arrange to give advance intimation in this behalf to Engineer –in-charge so that the arrangement to depute the Jr.Engineer /Representative at the plant site can be made.
- 7) Since the work lies in agricultural area the contractor shall have to make adequate arrangement for regulating the farmers and their animals by providing barricading whenever necessary and by displaying adequate number of requisite sign, and caution board etc. The work shall have to be planned properly to avoid any inconvenience to the local people.
- 8) A detailed programme of completion of work shall be enclosed with the tender.
The contractors should note that once, the work is started, he will not be allowed to operate his plant, for any work other than the work of **University Engineer, Public Works Division Akola** without the specific permission in writing from the **University Engineer, Public Works Division Akola**. Any breach of this condition will be seriously dealt with.

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University Engineer

DECLARATION OF THE CONTRACTOR

I/We hereby declare that I/We have made myself/ourself thoroughly conversant with the local conditions regarding all materials and labour on which I/We have based my/our rates for this work. The specifications, local existing condition and lead of the materials on this work have been carefully studied and understood by me/us submitting the tender. I/We undertake to use only the best materials approved by the University Engineer-in-charge of the work or his duly authorised representative before starting the work and to abide by his decision. I/we shall maintain rectify the entire works as per standard specification of P.W.D. (Red Book) and M.O.R.T. & H. Specification as soon as the damage occurs upto the expiry of defect liability period without putting forth any reason for the failure.

**Contractor's Signature
and seal of contractor**

Contractor

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University Engineer

ANNEXURE-I

QUALITY CONTROL TESTS & THEIR FREQUENCIES

Sr.No.	Material	Test	Frequency of Testing	Remarks
1	Sand	i) Fineness Modules	At the beginning & if there is change in source	
2	Metal	i) Crushing Value	One test per 200 Cum or part hereof	P.W.D. hand book I.S.2386 Part -IV
		ii) Impact Value		
		iii) Abrasion Value		
		iv) Water Absorption		
		v) Flakiness Index		
		vi) Stripping value		
		vii) Gradation		
3	Cement Concrete	Compressive Strength	Upto 5 Cum – 1 set	M.O.R.T.& H. Specification. 1716 (Fourth revision 01)
			6-15 – 2 sets	
			16-30 – 3 sets	
			31-50 – 4 sets	
			51 & Above – 4 sets + 1 additional 50 Cum or part thereof	
4	Cement	i) Compressive Strength	One test for each consignment of 50 MT (----- bags) or part thereof.	I.S. 8112 - 1989
		ii) Initial Setting Time		
		iii) Final Setting Time		
		iv) Specific Gravity		
		v) Soundness		
		vi) Fineness		
5	Steel	i) Weight per meter	One test for every 5.0 M.T. or part thereof for each diameter.	I.S. 432 IS 1786-1985
		ii) Ultimate Tensile Stress		
		iii) Yield Stress		
		iv) Elongation		
6	Granular Sub-Base	i) Gradation	One test per 200 cum	MORT&H specification Table 900-3 (Fourth Revision 2001)
		ii) Atterberg limits	One test per 200 cum	
		iii) Moisture content prior to compaction	One test per 250 cum	
		iv) Density and compacted layer	One test per 3000 Sqm	
7	Water Bound Macadam	i) Aggregate impact value	One test per 200 cum	MORT&H specification Table 900-3 (Fourth Revision 2001)
		ii) Gradation	One test per 100 cum	
		iii) Flakiness index & Elongation index.	One test per 200 cum	
		iv) Atterberg limits of binding material.	One test per 25 cum of binding material.	
		v) Atterberg limits of portion of aggregates passing 425 Micron.	One test per 100 cum of aggregate	
8	Prime coat/tack coat/ for spray Contractor	i) Quality of Binder	No. of samples per lot and tests as per I.S. 73 I.S. 217 and I.S. 8887 as applicable.	MORT&H specification Table 900.4 (Fourth Revision 2001)

		ii) Binder Temperature	At regular close intervals,	
		iii) Rate of spread of binder.	1 test per3000 sqm. and not less than two tests per day.	
9	Seal coat/ Surface Dressing	i) Quality of Binder	Same as mentioned under Sr.No.8	
		ii) Impact Value/Los Angle's Abrasion value	1 test per 50 cum of aggregate.	
		iii) Flakiness & Elongation Index	1 test per 50 cum.	
		iv) Stripping value of aggregate (Immersion tray test)	Initially 1 set of 3 representative specimen for each source of supply subsequently when warranted by change in the quality of aggregates.	
		v) Water Absorption		
		vi) Water sensitivity of mix (if required)		
		vii) Gradation.	1 test per 25 cum	
		viii) Soundness.	Initially one determination by each method for each source of supply, then as warranted by change in the quality of aggregate.	
		ix) Temp. of binder	At regular close intervals,	
		x) Rate of spread of materials	1 test per3000 Sqm. and not less than 2 tests per day.	
		xi) Percentage of fractured faces	When gravel is used. One test per 50 cum.,.	
10	Open graded premix surfacing/ Close graded premix surfacing	i) Quality of Binder	Same as per Sr.No.8	MORT&H specification Table 900.4 (Fourth Revision 2001)
		ii) Impact Value/Los Angle's Abrasion value	Same as per Sr.No.9	
		iii) Flakiness & Elongation Index	Same as per Sr.No.9	
		iv) Stripping value	Same as per Sr.No.9	
		v) Water Absorption	Same as per Sr.No.9	
		vi) Water sensitivity of mix	Same as per Sr.No.9	
		vii) Gradation.	Same as per Sr.No.9	
		viii) Soundness.	Same as per Sr.No.9	
		ix) Temp. of binder	At regular close intervals,	
	Contractor	No of correction		University Engineer

		x) Binder content	1 test per 3000 Sqm. and not less than 2 tests per day.	
		xi) Rate of spread of materials	Regular control through checks of layer thickness.	
		xi) Percentage of fractured faces	Same as per Sr.No.9	
11	Bituminous Macadam/BBM	i) Quality of Binder	Same as per Sr.No.8	MORT&H specification Table 900.4. (Fourth revision 2001) Fo BBM-Annexure-A on page 102.
		ii) Impact/ Abrasion value	Same as per Sr.No.9	
		iii) Flakiness/ Elongation Index	Same as per Sr.No.9	
		iv) Stripping value	Same as per Sr.No.9	
		v) Water sensitivity of mix	Same as per Sr.No.9	
		vi) Water absorption	Same as per Sr.No.9	
		vii) Soundness	Same as per Sr.No.9	
		viii) Percentage of fractural faces	Same as per Sr.No.9	
		ix) Gradation	2 tests per day per plant both on individual constituents and mixed aggregates from dryer.	
		x) Binder content & aggrt. Grading	Periodic subject to minimum of 2 tests per day plant.	
		xi) Control of temp of binder & aggregates for mixing & of the mix at the time of laying & rolling.	At regular close intervals.	
		xii) Density of compacted layer	Regular control through check of layer thickness. As directed by the Engineer-in-charge.	
12	Bitumen (Pure)	i) Penetration ii) Ductility iii) Softening point iv) Flash/fire point v) Specific gravity	2 test per lot as per I.S. 73	University Engineer
	Contractor	No of correction		

ANNEXURE-II

SPECIFICATION FOR BITUMINOUS BOUND MACADAM

Item: Providing and constructing 75 mm/ 50 mm thick bituminous bound macadam (BBM) road surface including all materials, preparing the existing road surface, spreading 40 mm stone metal lexicess 30% crusher broken metal + 70% hand broken (by breaking rubber obtained, by blasting) heating and spraying the bitumen 60/70@ 2 kg/sqm, spacing 12 mm size chips, compacting with static roller.

1) General :

The work consists of supply of materials and labour required for providing and laying bituminous bound macadam surface for compacted thickness of 75mm/50mm. The item includes preparing the existing road surface to receive the bituminous bound macadam course i.e. picking the existing W.B.M/ surface or application of tack coat on existing B.T. surface spreading of 40mm size metal layer in required thickness with compaction with power roller, heating and spraying bitumen with required thickness with compaction with power roller heating and spraying bitumen with sprayer etc. spreading key aggregates, 12 mm. chips, and final compaction with power roller, etc. complete and finishing in accordance with the requirement of and in close conformity with grades, lines, cross section and thickness as per approved drawings etc. complete.

2) Diversions:

Temporary diversions shall be constructed and maintained by the contractor at his own cost. Diversions shall be watered if dust is likely to blow on to the road being Bituminised.

3) Materials :

(A) Aggregates: The aggregates for providing B.B.M. surface shall comply with specification Nos. Rd.41 for 40 mm and 12 mm size metal, and shall normally comply with the following regarding to size and quality of aggregate and grade and quantities of bitumen.

Sr. No.	Description	Rate of application for 100 sqmt.			
		75 mm		50 mm	
		On asphalt surface	On WBM Surface	On asphalt surface	On WBM Surface
a)	40 mm size hand broken metal	9.00 Cum	9.00 Cum	6.00 Cum	6.00 Cum
b)	12mm size chips	1.80 Cum	1.80 Cum	1.20 Cum	1.20 Cum
c)	Bitumen for grouting I.S. penetration or S.65 with (60/70 grade) penetration	200 Kg	200 Kg	175 Kg.	175 Kg.
d)	Tack coat for existing Bitumen surface with 60/70 bitumen	50 Kg	- No of correction	50 Kg	-

University Engineer

Note : 70% Hand broken metal and 30% crusher broken metal of total quantity for 40 mm size metal shall be used.

(B) Bitumen :

The bitumen shall be paving bitumen of suitable penetration grade within the range S-35 to S-65 i.e. 60/70 as per Indian Standards Specifications for "Paving Bitumen" IS 73-1992.

4) Preparation of Base:

Any pot holes in the existing bituminous road surface and broken edges shall be patched well and the surface shall be brought to correct level and camber with additional metal and bitumen as required which will be paid separately. Before starting the work the bituminous surface shall be swept clean of all the dirt, mud cakes, animal droppings & other loose foreign material.

If so required by the Engineer, the contractor shall keep the side width & nearby diversion watered to prevent dust from blowing over the surface to be bituminous. Existing water bound macadam surface shall be picked for and surface loosened for a dept of 2.5 cm and the picked surface shall be brought approximately to the correct camber and section Edge line shall be correctly marked by dog belling the surface to form a continuous the notch.

There shall always be sufficient length of prepared surface ahead of the bituminous surfacing operations as directed by the Engineer to keep these operations continuous.

5) Tack Coat on bitumen surface:

Applying tack coat for existing B.T. surface only at the rate of 50 kg/100 m² as per specification No. Rd-47.3.3.

6) Picking of existing W.B.M. Surface :

Picking of existing W.B.M. surface for receiving bituminous bound macadam as per Rd. 33.

7) Spreading and Compaction

7.1 Spreading of 40 mm metal (70% Hand broken & 30% crusher broken):- 40 mm metal shall be spreaded evenly at the specified rate of 9 cubic metres/6 cubic metre per 100 squares of area so as to form a layer over the width of road with correct camber/super elevation as required. Any foreign matter, organic matter, dust, grass etc. shall be removed immediately. The sections shall be checked with camber board and straight edge batten etc. Any irregularities shall be made good by adding aggregates in case of depressions and removing aggregates from high spots.

7.2 Compaction of 40mm size metal :- The surface of 40 mm metal layer after bringing to necessary grades and sections shall be rolled with the use of 8 to 10 tonnes power roller. Roller shall commence from the edges and progress toward the centre longitudinally except on super elevation portion it shall progress from the lower to upper edges parallel to the centre line of pavement. Whenever the roller has passed over the whole area and high spot or depressions which become apparent shall be corrected by removing or adding aggregates. The rolling shall then continued till the entire surface has been rolled to desired compaction such that there is no crushing

of aggregates and all roller marks have been eliminated. Each pass of roller shall uniformly overlap not less than one third of the track made in the preceding pass.

8) Application of Bitumen :

Bitumen of I.S. grade supplied for the work shall be heated to temperature of 177 Celsius to 191 Celsius (350 F to 375 F) in a bitumen boiler and temperature shall be maintained at the time of actual application. The hot bitumen shall be applied through a pressure on the road surface uniformly at the rate of 200 kg. Per 100 sqm. The road surface shall be divided into suitable rectangles marked by chalk so as to ensure correct rate of application of the bitumen.

9) Key Aggregates:

On Completion of bitumen application, 12 mm size key aggregates shall be spread immediately at a uniform rate of 1.8 cubic meters/ 1.2 cubic meters per 100 sqm. of area when entire surface in hot condition Brooms shall be used to ensure even distribution of key aggregates.

10) Final Compaction:

Immediately after spraying of bitumen and spreading of key aggregates, the surface shall be rolled with a power roller to obtained full compaction and to force the blindage of key aggregates in to the interstice of the course aggregate. The rolling shall continue till the asphalt surface hardens and key aggregates stop moving under power roller.

11) Surface Finish and Quality Control:

The surface finish shall conform to requirements of clause 902 of specification for roads and bridges by Ministry of surface Transport (Copy enclosed) Quality control Test and their frequencies shall be as per table below.

Sr.No.	Test	Frequency
1	Quality of binder	Two samples per lot to be subjected to all or some test as directed by the Engineer.
2	Aggregate Impact Value	One test per 200 cubic meter of aggregate.
3	Flankiness Index and Elongation Index	One test per 200 cubic meter of aggregate.
4	Stripping value	Initially one set of three representative specimen for each source of supply subsequently when warranted by changes in the quality of aggregate.
5	Water absorption of aggregates	Initially one set of three representative specimen for each source of supply subsequently when warranted by changes in

		the quality of aggregate.
6	Aggregate grading	One test per 100 cubic meter of aggregate
7	Temperature of binder at application	At regular close intervals.
8	Rate of spreading for binder.	One test per 3000 square meter of area.

12) Item to Include:

- i) Diversions unless separately provided in the tender
- ii) Preparing the road surface.
- iii) Applying tack coat on existing B.T. or picking the existing W.B.M. surface.
- iv) Supplying spreading and compaction of 40 mm and 12 mm size aggregate.
- v) Supplying, heating and spraying of bitumen.
- vi) Supplying and spreading and compaction of 12 mm size chips (By Power roller.
- vii) All labour, materials, including bitumen and aggregates used of tools, plants and equipment for completing the item satisfactorily.

13) Mode of Measurement and Payment.

The contract rate shall be for 1.00 Sqm. The measurements shall be for the width of the road as executed, limiting it to the width specified or as ordered by the Engineer and the length measured along the centerline. The measurement dimensions shall be recorded correct upto two places of decimals of a meter and the area worked out correct upto one place of decimal of a Sqm.

Contractor

No of correction

University Engineer

ANNEXURE-III

Specifications for Traffic Safety Measures During Widening of Roads where traffic can be passed over part width

Providing Traffic Safety Measures on Road during Widening of roads Comprising of Traffic Sign Boards and devices as per detailed design, drawing, specification and as directed by Engineer-in-charge.

SPECIFICATIONS :-

The item includes providing traffic safety arrangements required for traffic control near has stretch of road where widening work is being taken up, before actual start of widening work of road. The contractor will have to provide the traffic safety arrangements as per the detailed drawing. The traffic safety arrangements will have to be got approved from the Engineer-in-charge by the Contractor before taking any construction activities for Widening of works.

The Engineer-in-charge shall get himself satisfied about the traffic safety arrangement provided on the work site before allowing contractor to dismantle the existing structure and a certificate to get effect shall be recorded in the Measurement Book.

- A) The Sign No. 1 "SPEED LIMIT (20)" shall be placed at a distance of 120 m away from the point where the transition of carriageway begins. The Sign Board shall be of size 60 cm dia. Having white background and red border and the numericals shall be in black colour as per IRC 67-1977. Distance between Sign No.2 shall be minimum 20 m.
- B) The Sign No.2: "NARROW ROAD AHEAD" shall be placed at a distance of 80 m away from the point where transition of carriageway starts. The Sign board shall be of an equilateral triangle of size 90 cm. having white background. Retro reflective border in Red colour and non reflective symbol of black colour as per IRC: 67-1977.
- C) The sign No.3: The sign board indicating "MAN AT WORK" shall be placed at a distance of 40 m. away from the point where the transition of carriageway starts.. The sign board shall be of an equilateral triangle of size 90 cm. having white backgrounds. Retro reflective border of Red colour and non reflective symbol of black colour as per IRC 67-1977.

Contractor

No of correction

University Engineer

- D) The sign No. 4: The board displaying the message "GO SLOW-WORK IN PROGRESS" shall be placed near point of transition of carriageway. The sign board shall be of size 1.0m x 1.0m having red background and message in white colour.

- F) Retro Reflective Strong Inviolable Stand Type Barrier painted black and having white Retro Reflective Strips for closer of traffic shall be placed to cover the entire width of carriageway including shoulder as per drawing. The Barricades shall not be removed unless permission is given by the responsible officer of the rank not less than Sectional Engineer. The Barricade shall have two plates of size 1.30 x 0.20m painted black and shall have white Retro Reflective Strips and mounted on angle iron stand of 1.0 m height.
- G) Yellow light flasher shall be kept lit from sunset to sunrise, 2 nos. along with white painted line and 2 Nos. at barriers on both sides as indicated in the drawing.
- H) Informatory sign board indicating name or work, estimated cost, completion period defect liability period. Name of contractor with telephone no. Name of Engineer with telephone no. shall provided between sign board no.4 and the barricade. The Sign board shall be having green back ground and white messages retro reflective as per IRC :67-1977.
- J) This is incidental to work (being Safety Measures) and no payment will be made on account of this

Contractor

No of correction

University Engineer

FINANCIAL RULE FORM NO. 2-A
(See rule 51 - 4)
GUARANTEE BOND FOR SECURITY DEPOSIT

In consideration of the **GOVERNOR OF MAHARASHTRA** (hereinafter referred to as “**THE GOVERNMENT**”) having agreed to exempt to _____ (hereinafter referred to as “**THE CONTRACTOR**”) from depositing with the Government in cash, the sum of Rs. _____ (Rs. _____ only) begging the amount of Security Deposit payable by the Contractor to the Government under the terms and conditions of the Agreements dated the _____ day of _____ and made between the Government of the one part and the Contractor of the other part (hereinafter referred to as “the said Agreement”) for _____ as security for the observance and performance by the contractor of the terms and conditions of the said agreement on the contractor furnishing to the Government a Guarantee in the prescribed form of a Scheduled Bank in India being in fact these presents in the like sum of Rs. _____ (Rs. _____ only. We _____ Bank Limited registered in India under _____ Act and having one of our local Head Office at _____ do hereby.

1) **Guarantee to the Government -**

a) Due performance and observance by the Contractor of the terms, _____ covenants and conditions on the part of the Contractor contained in _____ the said Agreement, and

b) Due and punctual payment by the contractor to the Government of all _____ sums of money, losses, damages, costs, charges, penalties and expenses payable to the Government by the Contractor under or in respect of the _____ said Agreement.

2) Undertake to pay to the Government on demand and without demur and not with standing any disputes raised by the Contractor(s) in any suit or proceeding filed in any Court or Tribunal relating thereto the said sum of Rs. _____ (Rs. _____ only) or such less sum as may be demanded by the Government from use our liability hereunder being absolute and unequivocal and agree that.

3)a) The guarantee herein contained shall remain in full force and effect during the subsistence of the said Agreement and that same will continue to be enforceable till all

the dues of the Government under or by virtue of the said Agreement have been duly paid and its claims satisfied or discharged and till the Government certified that the terms and conditions of the said Agreement have been fully properly carried out by the Contractor.

b) We shall not be discharged or released from the liability under this Government by reasons of -

i) ~~Contractor~~ any change in the constitution of the Bank or the Contractor, or

~~No of correction~~

University Engineer

- ii) any arrangement entered into between the Government and the Contractor with or without our consent,
- iii) any forbearance or indulgence shown to the Contractor.
- iv) any variation in the terms, covenants of conditions contained in the said Agreement,
- v) any time given to the Contractor, or
- vi) any other conditions or circumstances under which, in law, a surety would be discharged.
- c) Our liability hereunder shall be joint and several with that of the Contractor as if we were the principal debtors in respect of the said sum of Rs. _____ (Rs. _____ only) and
- d) We shall not revoke this guarantee during its currency except with the previous consent in writing of the Government.

IN WITNESS WHERE OF The Common Seal of _____ has been here unto affixed
this day of _____ The common seal of

Was pursuant to the resolution of the Board of Directors of the company dated the _____ day of _____
herein affixed in the presence of who, in token thereof, have hereto set their respective hands in the presence of -

- 1) _____
- 2) _____

Contractor

No of correction

University Engineer

LIST OF APPROVED MATERIAL FOR ELECTRICAL WORKS

8.1 LIST OF ELECTRICAL MATERIAL:

Sr. No.	Name of material	Company name
1	2	3
1	Fluorescent tube/LED	Philips / Wipro /Crompton
2	CFL Lamps	Philips/Wipro/HPL/Crompton /
3	Ceiling Fans	Cromptons / Orient / Havells / Usha
4	Exhaust Fans	Cromptons / Havells / Orient/ Polycab/ Panasonic/ usha
5	Modular Switches, Accerracies	Anchor /Havells/RR Electrical/Vinay/ Modular/ Cromptons/ wipro/ Polycab/ legrand/HPL/Precision/ Panasonic/ ABB/ L&T
6	MCB's - 10 KA. D,B	Legrand / Siemens /Kent/RR Electrical/ Wipro/ L&T/ C & S/Polycab/ Hager/HPL/ Anchor/In-do-asian Honeywell/ Kent/Havells
7	ELCB/RCCB - 10.0KA.D,B, ACB	Legrand / Wipro/Siemens/L&T/ C&S/polycab /HPL/Panasonic/Indo-Asian/ Honeywell/RR Electrical/ Kent/ABB
8	HRC Switch Fuse Units	L&T / GE / C&S/HPL/Indo-Asian
9	CFL Holder	Anchor /Havells/Bajaj/ wipro/ Polycab/ HPL/Precision/ Panasonic/ L&T/Modular
10	Wires: 1100V/660V Grade FRLS	Finolex /Polycab/ Anchor/ L&T / KEI /RR cable
11	PVC Conduits and Accessories	Precision /polycab/Anchor/Pressfit/ AKG/Kent
12	Distribution Boards	Legrand / Siemens /L&T/ C&S/ Polycab/Wipro/ HPL/ Panasonic/ Hager/ Honeywell
13	Load break switch	Legrand / Siemens /L&T/Hager/HPL
14	RG6 Outlets	Philips / Legrand/polycab/HPL/Panasonic
15	RG6/11 Coaxial Cable	Finolex / Polycab/Panasonic /RR cable/Kent
16	CAT 6 Cable	Finolex / L&T/ Dlink /Polycab/HPL/RR Cable/ Panasonic/ Kent
17	CAT 6 I/O Socket	Dlink / Lucent / Molex.
18	Cables Glands and Lugs	Finolex/polycab
19	LED Streetlight Fittings	Wipro / Philips /Havels/ C&S/ Polycab/

Contractor

No of correction

University Engineer

Sr. No.	Name of material	Company name
1	2	3
		Panasonic/HPL/Wipro/Crompton/Jaquaar/ Kent/Surya/RR Electric/ Halonix
20	LED Flood Light	Wipro / Philips / Havells/ C&S/ Polycab /Panasonic/HPL/Wipro/Crompton/Jaquaar /Kent/Surya/ RR Electrical/Halonix
21	LED Pathway Light	Wipro / Philips / Havells/ C&S/ Polycab / Panasonic/HPL/Wipro/Crompton/Jaquaar /Kent/Surya/ RR Electrical/Halonix
22	CFL Gate Light	Wipro / Philips / Havells/Panasonic/Polycab/Crompton
23	XLPE Cables and Accessories	Polycab / Havell's / Finolex/ KEI /Anchor/HP/RR cable/Rotoplast/Kent
24	Telephone Wires	Finolex /RR cable/Anchor/Polycab/ Epsilon/HPL
25	Aluminum Raceways	Jindal / Bentec/Honewell
26	Industrial Sockets	Legrand / L&T/HPL
27	Changeover Switch	L&T/ HPL / Havells / C&S/Siemens/Wipro
28	Capacitors	L&T / BENTEC
29	Lightning Arrestor	Siemens / Crompton.
30	BUSBAR	L&T/HPL/BENTEC
31	Main LT Panel / APFC Panel	Siemens/ L&T /Indian Electrical /Indo- Asian/HPL/AKG/Samcon
32	L.T. Feeder Pillar	Siemens/ L&T /Indian Electrical /AKG /SAMCON
33	Metering Cubicle	Siemens/ L&T /Indian Electrical
34	11KV isolator and D.O. fuse.	Topaz / Siemens
35	Distribution Transformer	Crompton, ABB,L&T, Siemens, MSEDCL/ Approved
36	Diesel Generator Set	Kirloskar /Cummins / Cromptons/Sterling Wilson/Powerica/Greaves Cotton
37	Lift	Schindler / OTIS / Thyssenkrupp
38	Water Pumps	Kirloskar / Crompton
39	Solar Water Heating Systems	Tata Solar / Jain Solar / Surya/polycab/bosch/Hawells/Panasonic/Warae
40	Video Door phone	Zicom /Legrand/Panasonic/Hikvision
41	VDP/Panic Switch/ Intercom 3in 1 system	Legrand/Panasonic/Digital Dreams
44	Audio System	Bose/Senneheiser
45	Water Heater	Bajaj/Recold/Crompton
46	MCB,MCB,DB,MCCB,ACB	Leagrand/Seimens/L&T/ABB/C&S/ESCO,Ind

Contractor

No of Correction

University Engineer

Sr. No.	Name of material	Company name
1	2	3
		oasian/-/HPL.
47	Floor Mounting MCCB Panels	ABB/Snider/Seimens/L&T/ C&S/Indoasian/HPL
48	Pumps	Kirloskar/Crompton/KSB/ CRI
49	Octagonal/Conical/Highmast Pole	Bajaj/Transrail/Surya/Volmont/Utkarsh
50	Decorative Poles	Wipro/Suncity/ K-Lite
51	Decorative Fitting	Wipro/Suncity/ K-Lite/Philips
52	Solar Power Generator	Havells/Panasonic/Waze
53	Street Light Poles	Havells/Panasonic/Waze/

APPROVED MAKES FOR FIRE FF and FAS, FA SYSTEM		
Sr. No.	Item Description	Approved Makes
1	Main & Jockey Fire Pumps	Kirloskar/Armstrong/Xylem/ ABB/Wilo(Mather+Platt)
2	Electric Lt Motors	ABB/WEG/Siemens/ Kirloskar/Crompton
3	Standby Diesel Engine Driven Pumps	Kirloskar/Mather & Platt/ Armstrong/Patterson/ Pentair/Clark
4	GI Pipes	Jindal / Tata Steel /Maharashtra Seamless
5	Fire Brigade Connections	Newage /HD Fire/Shah Bhogilal
6	Di Body Gate Valves	Viking/Victaulic/Tyco/Fivalco/Kirloskar/Hd Fire
7	Pressure Gauges	Waree, Wika, Ashcroft, Baumer/Dwyer
8	Water Flow Meters	Gerand / Siemens/Krohne Marshall / Dwyer/Any U1 Listed/Any Fm Approved Pumps
9	Fire Hose Boxes	Newage/Venus
10	Check Valves/ Nrv	Kirloskar/Audco/Tyco/C &R
11	Y Type/Pot /Bucket Strainers	Appollo Valves/Alfa Valves/Bombay Chemical Equipment Co.
12	Branch Pipes	Newage/Shah Bhogilal
13	CI Body Gate Valves	Viking/Victaulic/Tyco/Fivalco/Kirloskar/Hd Fire /Audco
14	Globe Valves	Viking/Victaulic/Tyco/Fivalco/Kirloskar/Hd Fire /Audco/Leader
15	Ball Valves	Claval/Tyco/Fivalco/Kirloskar/Hd Fire /Audco/Leader
16	Hose Reels	Newage/Minimax/Jyoti Fire
17	Alarm Valves	Hd Fire/ Tyco/Viking/Reliable
18	Sprinkler Gong	Hd Fire/ Tyco/Viking/Reliable
19	Flow Switches	System Sensor/Indfoss/Danfoss/Potter/Dwyer
20	Fire, Smoke Detectors, Manual CallPoint, Monitor & Control Modules	Honeywell / Symplex /Notifier USA (Present System At Actrec)

21	Sprinkler Heads	Tyco / Reliable/Viking/HD Fire
22	Pressure & Level Transmitter	Honeywell/Siemens/Emerson/Yokogawa
23	Pressure Switches	System Sensor/Indfoss/Danfoss/Potter/Dwyer
24	Electrical & Control Cables	Polycab/Cci/RR Cables/ Havells/ Metaplast /Associated
25	Auto Transfer Switch	Siemens/L&T/Schneider/Asco/Emerson
26	MCCB & MCB	Siemens/L&T/Schneider/Asco/Emerson/ ABB/ Legrand
27	Fire Pumps Mcc Electrical Panel	Elecmec/ Siemens/L&T/Indcon/ Havells
28	Push Button Switches	Siemens/L&T/Schneider/Connectwell/Te chnik/ ABB/ Seimmery
29	Cable Terminations	Connectwell/Wago/Elmex
30	Voltmeter, Ammeter	Kaycee/Rishabh/Meco/Me
31	Load Manager	Siemens/L&T/Schneider/Asco/Emerson/ Selec/Conzerve
32	GI Perforated Cable Trays	Elcon/Aditya Steel/Indal/Sai Cable Trays/Legrand
33	Copper Earthing Electrodes	Spa Infrastructure/Isg Global/Galaxy/ SGI/ABB/JEF
34	Fire Extinguishers	Safex/ Kanex/ Bharati Fire/ Minimax/ Intime
35	Chain Pulley System Motorized	Hercules/Crane /Titan Make Or Eqvt.
36	Led Light & Electrical Fittings	Philips/Bajaj/Crompton/Anchor/
37	Indicating Lamps On Mcc Panel	Teknic Or Eqvt.
38	Dc Relay	Oen/Pla
39	Current Transformers	Automatic Electric/Me
40	Light Fittings	Philips/Bajaj/Crompton/Anchor/
41	Electric Fittings	Anchor/Roma/Havells/Hager/Schneider
42	Cable Glands	Baliga/ Flameproof Equipment/ Fcg/ Ex Protecta
43	Pressure Relief Valve On Network	Frenger Lesser/Tyco/ Claval
44	Pressure Relief Valve In Pump House	Tyco/ Claval

LIST OF APPROVED MAKES for HVAC

Sr. No.	Item	Manufacturer/ Brand Name
1.	AC UNITS (VRF/NON VRF)	Daikin/Carrier/Mitsubishi/Ogeneral
2.	Refrigerant Pipes & Fittings	Maxflow/Mandev/Total line
3.	Centrifugal fans	Kruger/Nicrota/Systemair
4.	Cabinet/Circular Fan	Kruger/Nicrota/Systemair/VTs
5.	Anchor Fasteners	Hilti/ 3M/Canon
6.	GI Sheets	Jindal/TATA/SAIL/ Universal/ ISPAT
7.	Factory Fabricated Ducts	Roltastar/ZECO/Asawa
8.	Damper	Dynacraft/Cosmos/Ravistar/Carryaire
9.	Fire Dampers	Dynacraft/George & Sons/Carryaire/ Cosmos
10.	Aluminium Grilles/Diffuser	Dyanacraft /Cosmos/ Ravistar/Carryaire

11.	Acoustic Insulation	Armasound
12.	Disc Valve	Dyanacraft /Cosmos/ Ravistar/Carryaire
13.	Nitrile Rubber Insulation	Superloan/Total lane (9mm)
14.	Under-deck Insulation	Supreme/Owens Corning
15.	UPVC Pipe	Supreme/Prince/Airtech
16.	Drain Pipe/Refrigerant Pipe/Insulation	Superloan/Total lane (9mm)
17.	Switchgear, Push Buttons & Indicating Lamps	L&T/ABB/SIEMENS
18.	Motors	L&T/ABB/SIEMENS
19.	AC Controllers	Belimo/ABB/SEIMENS/Honeywell/Schiendler
20.	Actuators (Motorized)	Belimo/ABB/SEIMENS/Honeywell/Schiendler
21.	VFD	L&T/ABB/SIEMENS
22.	Anchor Fasteners	Hilti/3M/Canon

LIST OF IS – CODE :

Sr. No.	Item	Manufacturer/ Brand Name
1.	IS : 277-1977	Galvanized steel sheet (plain & corrugated) (Amendment - 01)
2.	IS : 655-1963	Metal Air Duct (Amendment - 02)
3.	IS : 659-1964	Safety Code for Air conditioning (Amendment - 01)
4.	IS : 660-1963	Safety Code for Mechanical refrigeration
5.	IS : 900-1992	Code of practice for Installation & Maintenance of Induction Motors
6.	IS : 2441-1984	Code of practice & measurement procedure for testing refrigerant compressors (Amendment - 01)
7.	IS : 4894-1987	Test code for Centrifugal Fans (Amendment - 01)
8.	IS : 5111-1993	Code of practice & measurement procedure for testing refrigerant compressors (Amendment - 01)
9.	IS : 7613-1975	Method of Testing panel type air filter for Air conditioning & ventilation purpose
10.	IS : 3588-1987	Specification for electrical axial flow fans
11.	SMACNA – 1995	Sheet metal – Ducting, Manufacturing & Installing (low & high pressure ducting)
12.	BS.EN 779 : 1998	Air Filters.

Contractor

No of correction

University Engineer

Notes:

- 1 The items having rating of “ Four star and above” Standardized and labeled by Bureau of Energy Efficiency shall be invariably used.
- 2 Ceiling Fans having Five star rating shall be used.
- 3 The Make other than above if required, University Engineer shall take prior approval of the office confirming that material is either approved by Chief Engineer (Electrical) P.W. Dept., Mumbai OR have ISI mark.
- 4 Samples of material during found unsatisfactory in that case the agency will have to replace the material free of cost.
- 5 The names of companies / manufacturer are given for guidance. The materials shall be used after obtaining approval from Client. Approved samples shall be preserved in sample room at site of work to ensure the quality / make for actual execution at site of work, No deviation from approved sample is allowed unless approved by Client.
- 6 No extension of time shall be granted because of delay in getting approval from Client.
- 7 The Client reserves right to ask for invoices and other details, if found necessary.
- 8 Client reserves the right to reject material if the same is not approved or substandard material used by Contractor at any stage (i.e. even during Defect Liability Period).
- 9 The contractor shall provide test certificates from the approved laboratories.
- 10 All the material shall be of first quality and ISI marked.
- 11 Certification of Client regarding presence during testing and sample approved is mandatory.
- 12 Client certification of all materials, centring materials, etc. is mandatory.
- 13 All requisite certificate shall be enclosed along with contractor's bill.
- 14 No deviation from approved sample is permissible without prior approval of client.
- 15 Client is fully responsible for quality of material brought by contractor at site of work.

Chapter 1

WIRING

1.1	Mains in Metal Conduit	WG-MA/MC
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VOLUME-II

STANDARD SPECIFICATIONS FOR ELECTRICAL WORKS

General:

All material shall be conforming to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which ISI mark is not available in market, it shall either carry valid 'Quality Control' certificate issued by the Chief Engineer (Elect), P.W. Dept. Maharashtra State Govt. as included in approved list.

Work shall be carried out as per the Method of Construction specified by BIS. If there is no reference for particular Method of Construction in IS, such work shall be carried out as per the approved Method of Construction specified in chapter 16 of P.W. Dept. Handbook.

Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of the Engineer in Charge.

Material shall be tested in approved Testing Laboratory and shall qualify the relevant tests as and when directed by Engineer In-Charge.

Recommended Standards:

The following list is showing Indian Standards, which are acceptable as good practice, and accepted standards.

IS 732: 1989	Code of Practice for Electrical Wiring Installations?
IS 4648: 1968	Guide for Electrical Layout in residential buildings
IS 9537 (Part 1): 1980	Conduits for Electrical Installations: General requirements
9537 (Part 2): 1981	IS Rigid Steel Conduits
IS 9537 (Part 3): 1983	Rigid Plain Conduits of insulating material
IS 3419: 1989	Specifications for fittings for rigid non metallic conduits
IS 694:	PVC insulated cables for working voltages up to and including 1100V
IS 1554 (Part 1): 1988	PVC insulated (heavy-duty) electric cables for working voltages up to and including 1100V
IS 3961 (Part 5): 1968	Recommended current ratings for cables: PVC insulated light duty cables.
IS 4288: 1988	PVC insulated (heavy duty) electric cables with solid aluminium conductors for voltages up to and including 1100V
IS 14772: 2000	Specifications for Accessories for household and similar fixed Electrical Installations
IS 3043: 1987	Code of practice for Earthing
SP 30: 1984	National Electrical Code
SP 7 (Group 4): 2005	National Building Code
IS 14927(Part 1): 2001	Cable Trunking and Ducting systems for electrical installations.

1.1 Conduits / Trunking (Casing Capping) (Surface type)**1.1.1 PVC Conduits****Specification No****(WG-MA/CON)****Scope:****PVC Conduits: Surface**

Providing specified PVC Conduits and erecting as per approved Method of Construction; on surface of wall / ceiling, etc. including entries through walls / slabs / flooring as per requirement, and with all necessary hardware, accessories such as Spacers, Saddles, Bends, Tees, Junction boxes, Check-nuts, etc.; making conduits erection work rigid and duly finishing, removing debris from site.

Material:**PVC Conduit:**

PVC pipe minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No. 1/2) ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe;

such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Method of Construction:

Erection PVC Conduits for Surface type wiring:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm, roundheaded screws for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers. Distance between 2 spacers shall not be more than 600mm. Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/2 for PVC conduits). Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm. or ant electrostatic partition/separate pipe should be used. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface and with colour coding conduit (For visual identification) as per Table No. 1/4. Flexible conduits shall be used at expansion joints.

Especially for PVC Conduits of surface type wiring:

In addition to general instructions above, all joints shall be made rigid with resin / adhesive. Wherever offsets are necessary, it shall be done with bending spring. Size of conduit shall be as per Table No. ½ for number of wires to be drawn through the conduit.

1.1.2 PVC Trunking (Casing capping)

Specification No (WG-MA/CON)

Scope:

PVC Trunking:

Providing specified PVC Trunking (Casing capping) and erecting as per approved Method of Construction, on surface of wall / ceiling, etc. including entries made with PVC conduit through walls / slabs / flooring as per requirement with all necessary hardware, accessories such as inner / outer Elbows, Tees, Junction boxes, etc. and duly finishing, removing debris from site.

Material:

PVC Trunking (casing capping):

PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No 1/3 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8mm thick push-fit joints/accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Method of Construction:

Erection of PVC Trunking for surface type wiring:

Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in single phase distribution and for power and light

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distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300 mm shall be maintained between the Trunking or anti electrostatic partition to be provided. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and at required locations.

Specification No (WGMA/CON)

Scope:***Rigid Steel Conduits: Surface***

Providing specified Rigid Steel Conduits and erecting as per approved Method of Construction; on surface of wall / ceiling, etc including entries through walls / slabs / floorings as per requirement along with continuous earth wire, earth-clips and all necessary hardware, accessories; such as; spacers, saddles, Bends, Tees, Junction boxes, Check- nuts, etc. and duly finishing, removing debris from site.

Material:**Rigid Steel conduit:**

Rigid steel conduit minimum 20mm dia and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint including inspection type or normal accessories such as, 5mm thick 20mm width spacers and G.I. saddles for individual pipe or GI strip for bunch of pipe, sockets, open bends, junction boxes of required ways all of the same make.

Earth continuity wire:

GI wire of 2.5 Sqmm; GI earth clips 22g, 10mm width, for fixing earth wire along the conduits.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, PVC/ rubber bushings etc.

Method of Construction:**Erection of Rigid steel Conduits:****General:**

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be duly screwed and firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm round headed for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers and saddles. Distance between 2 spacers shall not be more than 600mm. Separate pipe shall be used for each phase in single phase distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm or anti electrostatic partition to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No 1/4. Flexible conduits shall be used at expansion joints. Bushing shall be provided at open ends.

Erection of Rigid steel Conduits:**Especially for Rigid Steel Conduit of surface type wiring**

In addition to general conditions above, Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). All exposed threaded portion of Rigid Steel Conduits shall be painted with anti corrosive paint. Sharp edges at cut ends shall be made smooth by removing burr. Inspection type conduits accessories shall be used as per requirement in accessible position to facilitate drawing or withdrawing of wires. All conduits piping work shall be properly Earthed with 2.5 sq. mm G.I Earth wire fixed to conduit and made continuous with Earth clips at every 1m and at ends and joints viz. bends, junction boxes.

Testing:**Earth continuity:**

Earth continuity shall be ensured at termination points of Earth wire, and between the ends of Rigid steel conduit.

Polarity:

Polarity test and should be done including confirmation of phase entry in switch only.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter length of conduit / Trunking.

1.2 Conduits (Concealed type) Specification

No (WG-MA/CC)

1.2.1 Concealing PVC Conduits in RCC work

Scope:

Providing specified PVC conduit and laying / erecting in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with of all required material including hardware, binding wire, fish wire; accessories such as deep / long neck PVC junction boxes, PVC / MS junction / draw-in boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages.

Material: PVC Conduit:

PVC pipe of minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No.1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, deep Junction boxes of required ways and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire, steel fish wire etc.

Method of Construction:

Concealing of PVC conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in single phase distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All PVC conduit bending shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC conduits:

In RCC work:

Work shall be commenced after fixing of steel re-enforcement on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.

1.2.2 Concealing PVC Conduits in walls / flooring

Scope:

Providing specified PVC conduit and erecting¹⁴²/laying in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with of all required material including hardware such as 'U' nails, binding wire, fish wire; accessories such as PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, glands, drawing fish-wires

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and making all piping rigid, refinishing the surface with cement mortar, removing debris from site.

Material:
PVC Conduit:

PVC pipe minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No.1/2), ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, Junction boxes of required ways, type and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plate on it.

Hardware:

‘U’ nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, etc.

Other material for Surface finishing: Cement, sand, putty, and water.

Method of Construction:

Concealing of PVC conduits: (General)

Work shall be done in co-ordination with civil work to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. for which the distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No.1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC Conduits In walls / flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories, and ‘U’ nails. All joints shall be made rigid with resin. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

1.2.3 Rigid Steel Conduits in RCC work

Specification No **(WG-**

MA/CC) Scope:

Concealing of Rigid Steel Conduits:

In RCC work:

Providing specified Rigid Steel conduit and laying / erecting in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with continuous earth wire and all required material including earth clips, hardware, binding wire, fish wire; accessories such as deep junction boxes, MS draw-in / junction / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages.

Material:
Rigid Steel conduit:

Rigid HG steel screwed conduit, minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ERW grade duly processed for anti-rust treatment and painted

with black enamel paint, accessories for rigid steel conduits such as check nuts, long bends, deep junction boxes for slab, regular junction boxes for walls; of required ways, all of the same make.

Earth continuity wire:

GI wire of 2.5 sq. mm; GI earth clips 22g, 10mm width, for fixing earth wire along the conduits.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plate on it.

Hardware:

U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, fish wire, etc.

Method of Construction:

Concealing of Rigid steel Conduits:

General:

Work shall be done in co-ordination with civil work to suite final approved layout. Conduit shall be duly screwed and size of conduit shall be correct depending on number of wires to be drawn. (Table No.1/1, for Steel conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. for which distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For visual identification). Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done approved manner without changing the cross-section.

In RCC work:

Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed with steel in slab by binding wire. Fixing of conduits shall be possibly done with welding tags so that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through the conduits for drawing of wires later on.

1.2.4 Rigid steel Conduits in walls / flooring

Specification No (WG-MA/CC)

Scope:

Concealing of Rigid steel Conduits:

In walls / flooring:

Providing specified Rigid Steel Conduits and erecting in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with continuous earth wire and all required material including earth clips hardware such as 'U' nails, binding wire, fish wire; accessories such as MS junction / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, refinishing the surface with cement mortar, removing debris from site.

Material:
Rigid Steel conduit:

Rigid steel HG conduit minimum 20mm dia. and 16 gauge, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as check nuts, long bends, deep junction boxes for flooring, regular junction boxes for walls; of required ways all of the same make.

Earth continuity wire:

GI wire of 2.5 sq. mm, GI earth clips 22g, 10mm width, for fixing earth wire along the conduits.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be

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knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, GI fish wire, etc.

Other material for Surface finishing: Cement, sand, putty and water.

Method of Construction:

Concealing of Rigid Steel Conduits:

General:

Work shall be done in co-ordination with civil work to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No.1/1, for Steel conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc; for which the distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25 metre, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done approved manner without changing the cross-section.

Concealing of Rigid Steel Conduits in walls/flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories, and hardware like 'U' nails, etc. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

Testing:

Earth continuity:

Earth continuity shall be ensured at termination point of Earth wire, between the ends of metal conduit.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter length of conduit.

1.3 Bunch of wires:

Specification No (WG-

MA/BW) **Scope:**

Bunch of wires:

Providing specified wires and drawing them through provided conduits / trunking and / or as directed; with coded ferrules, harnessing the bunch of wires with necessary material when used in panel boards, duly connecting / terminating with lugs, and testing for safety and beneficial use.

Material:

Wires: in conduits / trunking / panel boards

Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5.

Wires: open

PVC insulated and PVC sheathed wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5.

Earth Continuity Wire:

PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5.

Lugs: Copper lugs of appropriate size & type

Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Bunch of wires:

Drawing of wires: General

Specified wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5, shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires: through PVC conduits

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2.

Drawing of wires: through Rigid Steel conduits

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1.

Open Wire bunch: Open wires shall be erected with due care so as to avoid chances of any mechanical injury. Harnessing shall be done with required material in an approved manner in panel boards or where ever necessary. For covering lead wires flexible conduit shall be used with gland as per necessity.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured between termination points of Earth wire.

Polarity Test:

Test shall be carried out for ensuring the correct polarity in switch and plug.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter length of single wire or bunch as specified.

1.4 Mains (surface type)

1.4.1 Mains in surface PVC conduit

Specification No (WG-MA/PC)

Scope:

Mains in surface PVC conduit:

Providing specified PVC Conduits, Wires and erecting the conduits as per approved Method of Construction; on surface of wall / ceiling, etc. including entries through walls / slabs / flooring as per requirement, and with all necessary hardware, accessories such as Spacers, Saddles, Bends, Tees, Junction boxes, Check-nuts / glands, etc.; making conduits erection work rigid; and drawing the specified wires through these conduits and duly connecting / terminating with lugs, complete finishing, removing debris from site; testing for safety and beneficial use.

Material:
PVC Conduit:

PVC pipe of minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No 1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees,

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Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires)

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PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of appropriate colour coding as per Table No 1/5

Earth Continuity Wire:

PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green or green yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate type and size.

Other material: Rubber grommet, bush, flexible PVC conduit, gland etc.

Method of Construction:

Erection PVC Conduits for Surface type wiring:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm, round headed screws for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers. Distance between 2 spacers shall not be more than 600 mm. Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/2 for PVC conduits). Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No. 1/4. Flexible conduits shall be used at expansion joints.

Especially for PVC Conduits of surface type wiring:

In addition to general instructions above, all joints shall be made rigid with resin / adhesive. Wherever offsets are necessary, it shall be done with bending spring. Size of conduit shall be as per Table No. 1/2 for number of wires to be drawn through the conduit.

Drawing of wires: General

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5, shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires: through PVC conduits for surface type wiring

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through conduit. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2. At the termination end flexible PVC conduit shall be used with gland as per required.

1.4.2 Mains in PVC Trunking (casing capping)

Specification No **(WG-MA/PC)**

Scope:

Surface type Mains in PVC Trunking (casing capping)

Providing specified PVC Trunking, Wires and erecting the Trunking as per approved Method of Construction; on surface of wall / ceiling, etc. including entries made with PVC conduit through walls / slabs / flooring as per requirement with all necessary hardware, accessories such as inner / outer Elbows, Tees, Junction boxes, etc; including erection of specified wires in PVC trunking, with coded ferrules and duly connecting with lugs, and finishing, removing debris from site; testing for safety and beneficial use.

Material:
PVC Trunking:

PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No 1/2 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8mm thick push-fit joints/

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accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires)

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5
Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green colour, ISI marked, of specified size but not less than 1.5 Sqmm as per Table No 1/5
Lugs: Copper lugs of appropriate type and size.
Other material: Flexible PVC conduit, gland coded ferrules, etc.

Method of Construction:

Erection of PVC Trunking for surface type wiring

Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of unlevelled surface number and size of screws shall be changed to higher size as per requirement and in case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300 mm shall be maintained between the Trunking or anti electrostatic partition is to be provided. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and required locations.

Erecting wires in Trunking:

Wires shall be erected within Trunking with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be erected in single Trunking. Wires shall be terminated in the terminals of accessories only, with appropriate type and size of lugs. Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be erected through Trunking. Number of wires shall not exceed with respect to size of Trunking as per Table No. 1/3. After erection of wires double locking shall be checked while fixing capping. At the termination end flexible PVC conduit shall be used with gland as per required.

1.4.3 Mains in Rigid steel conduit (Surface type)

Specification No (WG-MA/MC) **Scope:**

Surface type Mains in Rigid steel conduit:

Providing specified Rigid Steel Conduits and erecting as per approved Method of Construction; on surface of wall / ceiling, etc including entries through walls / slabs / flooring as per requirement along with continuous earth wire, earth-clips and all necessary hardware, accessories; such as; spacers, saddles, Bends, Tees, Junction boxes, Check- nuts, etc; and drawing the specified wires through these conduits in approved manner; with coded ferrules and duly connecting with lugs, and duly finishing, removing debris from site; testing the installation for safety and beneficial use.

Material: **Rigid Steel conduit:**

Rigid steel HG screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ISI mark, ERW grade duly processed for anti- rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as 5 mm thick 20mm width spacers and G.I. saddles, sockets, open bends, junction boxes of required ways all of the same make.

Earth continuity wire:

GI wire of 2.5 sq. mm GI earth clips 22g, 10mm width, for fixing earth wire along the conduits.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, PVC/ rubber bushings etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires): PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire:

PVC insulated wire minimum FR grade insulation copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate size & type

Other material: Rubber Bush, Flexible metal conduit, gland etc.

Method of Construction:

Erection of Rigid Steel Conduits:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be duly screwed and firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm round headed for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers and saddles. Distance between 2 spacers shall not be more than 600mm. Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No 1/4. Flexible conduits shall be used at expansion joints. Bushing shall be provided at open ends.

Erection of rigid steel Conduits:

Specially for Rigid Steel Conduit of surface type wiring:

In addition to general conditions above, Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). All exposed threaded portion of Rigid Steel Conduits shall be painted with anti corrosive paint. Sharp edges and burr at cut ends shall be made smooth. Inspection type conduits accessories shall be used as per requirement in accessible position to facilitate drawing or withdrawing of wires. All conduits, piping work shall be properly earthed with 2.5 Sqmm G.I Earth wire duly fixed to conduit and made continuous with Earth clips at every 1m and at ends and joints viz. bends, junction boxes.

Drawing of wires:

General:

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with correct type of and correct size of lugs.

Drawing of wires:

Through Rigid Steel conduits for surface type wiring:

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1. At the termination end flexible metal conduit shall be used with gland.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and toEarth.
IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured at all earth terminals and at earth terminals of metal enclosures.

Polarity test:

Polarity test shall be carried out for ensuring polarity in switch and plug.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter of pipe length.

1.5 Mains (Concealed type)

1.5.1 Mains in PVC Conduits in RCC work Specification No

(WG-MA/CC, WG-MA/BW)

Scope:

Concealed Mains in PVC Conduits in RCC work:

Providing specified PVC conduit, wires and laying / erecting Conduits in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with all required material including hardware, binding wire, fish wire; accessories such as deep PVC junction boxes, PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages and when directed drawing of specified wires through these conduits with fish wire, tagging with coded ferrules and duly connecting with lugs, complete testing the installation for safety and beneficial use.

Material:

PVC Conduit:

PVC pipe of minimum 20mm dia and above, depending on number of wires to be drawn (refer Table No 1/2, ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, deep Junction boxes of required ways and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, GI fish wire, etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 1.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of required size & type

Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Concealing of PVC conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual

identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All PVC conduit bending shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC conduits:

In RCC work:

Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel reinforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and at located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.

Drawing of wires:

General:

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires:

Through PVC conduits:

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2.

1.5.2 Concealed Mains in PVC Conduits in walls / flooring:

Specification No (WG-MA/CC)

Scope:

Concealed Mains in PVC Conduits in walls / flooring:

Providing specified PVC conduit, Wires and laying / erecting the conduits in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with of all required material including hardware such as 'U' nails, binding wire, fish wire; accessories such as PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, refinishing the surface with cement mortar, removing debris from site and as and when directed drawing of specified wires through these conduits with fish help of wire, tagging by coded ferrules and duly connecting / terminating with lugs, complete testing the installation for safety and beneficial use.

Material: **PVC Conduit:**

PVC pipe minimum 20mm dia and above depending No. of wires to be drawn (refer Table No 1/2, ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, Junction boxes of required ways and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plate on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, etc.

Other material for Surface finishing: Cement, sand, putty and water.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate size & type

Other material for wire drawing: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Concealing of PVC conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC Conduits In walls / flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCCwork, Conduits of adequate size shall be erected with use of appropriate accessories, and 'U' nails. All joints shall be made rigid with resin. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

Drawing of wires:

General:

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with correct type of and correct size of lugs.

Drawing of wires:

Through PVC conduits:

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2. At the termination end flexible PVC conduit shall be used with gland as per necessity.

1.5.3 Concealed Mains in Rigid Steel Conduits in RCC work

Specification No **(WG-MA/CC, WG-MA/BW)** **Scope:**

Concealed Mains in Rigid Steel Conduits in RCC work:

Providing specified PVC conduit, Wires and laying / erecting the conduits in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with continuous earth wire and all required material including earth clips, hardware, binding wire, fish wire; accessories such as deep PVC junction boxes, PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages and as and when directed drawing of wires through these conduits with fish wire, ferruling by coding tags and duly connecting with lugs, complete testing the installation for safety and beneficial use.

Material:

Rigid Steel conduit:

Rigid HG steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as check nuts, long bends, deep junction boxes for slab, regular junction boxes for walls; of required ways all of the same make.

Earth Continuity wire:

GI wire of 2.5 sq. mm 22g 10mm width, GI earth clips for fixing earth wire along with the conduits.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, rubber / PVC bushes etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of required size & type.

Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Concealed Mains in Rigid Steel Conduits in RCC work:

Concealing of conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No 1/1, for Steel conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the final approved layout, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25 m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done approved manner without changing the cross-section.

Concealing of conduits:

In RCC work:

Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed with steel in slab by binding wire. Fixing of conduits shall be possibly done with welding tags so that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers

/ sockets at ends and be flush with bottom of beam, and located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through the conduits for drawing of wires later on.

Drawing of wires:

General:

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe.

Lead wires of sufficient extra length shall be¹⁶³ provided and shall be terminated in the terminals of accessories only, with correct type of and correctsize of lugs.

<i>Drawing of wires:</i>

Through Rigid Steel conduits:

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1

1.5.4 Mains in Rigid steel Conduits in walls / flooring

Specification No (WG-MA/CC, WG-MA/BW)

Scope:

Concealed Mains in Rigid Steel Conduits in walls / flooring:

Providing specified Metal conduit, Wires and erecting in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with continuous earth wire and all required material including earth clips hardware such as 'U' nails, binding wire, fish wire; accessories such as MS junction / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, refinishing the surface with cement mortar, removing debris from site and as and when directed drawing of wires through these conduits with fish wire, ferruling by coding tags and duly connecting with lugs, complete testing the installation for safety and beneficial use.

Material:
Rigid Steel conduit:

Rigid HG steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as check nuts, long bends, deep junction boxes for flooring, regular junction boxes for walls; of required ways all of the same make.

Earth continuity wire: GI wire of 2.5 sq. mm 22g 10mm width, GI earth clips for fixing earth wire along with the conduits.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, rubber, PVC bushes etc.

Other material for Surface finishing: Cement, sand, putty and water.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5.

Lugs: Copper lugs of appropriate size & type

Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Concealed Mains in Metal Conduits in walls / flooring Concealing of conduits: General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No 1/1, for Steel conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done approved manner without changing the cross-section.

Concealing of Conduits in walls/flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories and hardware like 'U' nails, etc. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

Drawing of wires:

General:

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5, shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with correct type of and correct size of lugs.

Drawing of wires:

Through Rigid Steel conduits:

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1. At the termination end flexible metal conduit shall be used with glands as per necessity.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured at all earth terminals and at earth terminals of metal enclosures.

Polarity Test:

Polarity test shall be carried out for ensuring correct polarity in plug and switch.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter of pipe length.

1.6 Point wiring (Surface type)

Specification No **(WG-PW/SW)**

Scope:

Point wiring (Surface type):

Providing all required approved specified material including hardware and erecting wiring on surface of wall, ceiling from switch board to outlet for light / fan / bell / independent plug point, in rigid steel / PVC conduit or PVC trunking as specified; fixing one board with a 1 way switch for one way point or two boards with a 2 way switch on each board, in case of 2 way point; for controlling power supply and one board / block with accessory for outlet of light / fan / plug and terminating wires within as per approved Method of Construction; removing all debris and testing the installation for safety and beneficial use.

Material:

Point wiring (Surface)

PVC conduit:

PVC pipe of minimum 20mm dia and above depending No. of wires to be drawn (refer Table No 1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees,

Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

PVC Trunking:

PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No 1/2 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8 mm thick push-fit joints

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/ accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.

Rigid Steel conduit:

Rigid steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as 5mm thick 20mm width spacers and G.I. saddles for individual pipe or GI strip for bunch of pipes, sockets, inspection type or normal; open bends, junction boxes of required ways all of the same make.

Wires: Phase and Neutral

PVC insulated wires of specified size, 1.1 kV, & minimum FR grade insulation, electrolytic tough pitch (ETP) copper conductor, ISI marked, of required colour coding as per Table No 1/5

Earth Wire:

PVC insulated minimum FR grade copper wires of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, 2.5 Sqmm or bare copper wire of 14g

Accessories:

Switch: 1 or 2 way Piano type 6/10 A, 1 or 2 way Modular type switch 6/10A. **Outlet:** 6A angle / batten lamp holder or 3 plate ceiling-rose or Bakelite / porcelain three way connector or if plug point, 6A, 3-pin plug socket.

Boards:

Switchboards shall be double walled (back and front) of suitable size, to accommodate independent slot for each switch, socket, fan regulator. Boards shall be made up of 4mm thick marine grade plywood for back and front fixed on wooden frame with 0.8mm thick laminate pasted on exposed portion of front ply, totally varnished and with either brass hinged door or screwed top.

Or

As above with 3mm thick Bakelite/Hylam top instead of laminated front ply.

Or

Board made from Filled polypropylene.

Round/Square double wooden block or PVC board for mounting light / fan outlet accessory.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, PVC/ rubber bushings etc.

Method of Construction:

Point wiring (Surface)

Erection of conduits:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be duly screwed and firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm round headed for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers and saddles. Distance between 2 spacers shall not be more than 600mm. Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No 1/4. Flexible conduits shall be used at expansion joints. Bushing shall be provided at open ends.

Erection of conduits:

PVC pipes for surface type wiring:

In addition to General conditions above, all joints shall be made rigid with resin / adhesive. Wherever offsets are necessary, same shall be done with bending spring. Size of conduit shall be correct depending on number of wires to be drawn as per Table No. 1/2.

Or

Specially for Rigid Steel Conduit of surface type wiring:

In addition to general conditions above, Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). All exposed threaded portion of Rigid Steel Conduits shall be painted with anti corrosive paint. Sharp edges and burr at cut ends shall be made smooth. Inspection type conduits accessories shall be used as per requirement in accessible position to facilitate drawing or withdrawing of wires. All

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conduits piping work shall be properly earthed with 2.5 sq. mm G.I Earth wire fixed to conduit and made continuous with Earth clips at every 1m and at ends and joints viz. bends, junction boxes.

Or

Erection of PVC Trunking for surface type wiring:

Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of unlevelled surface number and size of screws shall be changed to higher size as per requirement and in case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300 mm shall be maintained between the Trunking. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and required locations.

Drawing of wires: General

Wires shall be drawn with adequate care. Correct colour coding as per Table No 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped within circuit. For lighting load distribution wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the terminals of accessories only. Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be erected wherever necessary. In case of 2-way point wiring additional wires of phase conductor shall be provided between the 2-way switches.

Drawing of wires: through PVC conduits for surface type wiring

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2.

Or

Drawing of wires: through Rigid Steel conduits for surface type wiring

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1.

Or

Erecting wires in Trunking:

Wires shall be erected within Trunking with adequate care. Number of wires shall not exceed with respect to size of Trunking as per Table No. 1/3. After erection of wires double locking shall be checked while fixing capping.

Fixing Switchboards and accessories:

Control switchboards shall generally be erected at 1.35m height or as specified and fixed with minimum 2 Nos. (and more as per size of board) of screws of length not less than 50mm, termination of wires shall be done with lugs on switch and other accessories only by carefully inserting all strands in lugs, terminals and proper tightening. Switches shall be provided on phase wire only. Bare wire shall not be used for looping incoming supply to switches and for earthing inside switchboards. For plug socket phase wire shall be connected in right side terminal when seen from front. Proper termination of earth wire in Earth terminal shall be ensured.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured at all earth terminals of plug outlets and at earth terminals of metal enclosures.

Polarity test:

Polarity test shall be carried out for ensuring the correct polarity in switch and plug.

Mode of Measurement:

Measurement shall be carried out on the basis per number of points, **for the point length up to 6 metre between switch and outlet**. For the length exceeding 6 metre 10% of overall rate shall be added for every 1m.

1.7 Point wiring (Concealed type)

Specification No (WG-PW/CW)

Scope:

Point wiring (Concealed type):

Providing all required approved specified material including hardware and erecting rigid steel / PVC conduits, junction boxes, provided fan boxes, along with required accessories in RCC slabs before casting and in walls, flooring by making chases, and refilling the same after erection of conduits, fixing concealed type boxes for switch boards in walls, drawing wires through conduits, from switch board to outlet for light / fan / bell / independent plug point fixing modular type switch for controlling power supply and an accessory for outlet of light / fan / bell / plug at other end, with mounting plate, and terminating wires within at both ends, as per approved Method of Construction, closing all junction boxes with plates; removing all debris and testing the installation for safety and beneficial use.

Material:

Point wiring (Concealed):

PVC conduit:

PVC pipe of minimum 20mm dia and above depending No. of wires to be drawn (refer Table No 1 / 2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, deep / normal Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Rigid Steel conduit:

Rigid steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No.1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as sockets, bends, deep / normal junction boxes of required ways all of the same make.

Sheet metal Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate, fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix surface cover plate on it. Cover plate shall be made up of fire resistant PVC material / 3mm thick laminate / Bakelite / Hylam / transparent acrylic sheet painted from inside to match colour of wall with duly tapered edges.

Wires: phase and neutral wires

PVC insulated wires of specified size, 1.1 kV, & minimum FR grade insulation, electrolytic tough pitch (ETP) copper conductor, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire:

PVC insulated minimum FR grade copper wires of electrolytic grade, having insulation of 1.1 kV grade, of green colour, ISI marked, 2.5 Sqmm or bare copper wire of 14g

Lugs: Pin type Copper lugs.

Accessories:

Switch: 1 or 2 way Modular type switch 6/10A.

Outlet:

Modular type 6A angle / batten lamp holder or 3 plate ceiling-rose or Bakelite / porcelain
3 way connector or if plug point, 6A, 3-pin plug shuttered socket.

Boards:

Switchboards shall comprise of; concealed type box of required modules made of sheet metal or Polypropylene material, mounting plate and cover plate. The required modules shall be worked out on the basis of points, plug socket/sockets, step type fan regulator, etc are to be fixed. For every blank module, 1 way blank plate shall be fixed. All the above accessories shall be of same make, as that of switch.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs / wooden gutties, 'U' nails, plumbing nails, steel binding wire, fish wire 20g, rubber / PVC bushes etc.

Other material for Surface finishing: Sand, Cement, water etc.

Method of Construction:

Point wiring (Concealed):

Concealing of conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for

Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per TableNo. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All the bends shall be done with Bending Spring.

Concealing of conduits: In RCC work

Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel reinforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and at located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.

Concealing of Conduits: In walls

Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the surface shall be done. Conduits of adequate size shall be erected with use of appropriate accessories and 'U' nails.

Drawing of wires:

Use of Steel fish wire shall be made for drawing of wires. Wires shall be drawn with adequate care. Correct colour coding shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped within circuit only. For lighting load distribution, wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the terminals of accessories only. Adequate extra length shall be left at termination points. In case of 2-way point wiring additional wires of phase conductor shall be provided between the 2-way switches.

Fixing Switchboards and accessories:

Control switchboards shall generally be erected at 1.35m height or as specified and fixed with minimum 2 Nos. of screws of length not less than 50 x 8mm, Boards shall be in line and plumb and shall be in level with wall surface so as to fix mounting plate flush with wall, Termination of wires shall be done in switch and other accessories only by carefully inserting all strands in terminals and proper tightening. Switches shall be provided on phase wire only. Bare wire shall not be used for looping incoming supply to switches. Phase wire shall be routed through switch only. For plug socket phase wire shall be connected in right side terminal when seen from front. Proper termination of earth wire in Earth terminal shall be ensured. All blank modules shall be plugged with blanking plates.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured at all earth terminals of plug outlets and at earth terminals of metal enclosures.

Polarity test:

Polarity test shall be carried out for ensuring the correct polarity in the plug.

Mode of Measurement:

Measurement shall be carried out on the basis per number of points, **for the point length up to 6 metre between switch and outlet.** For the length exceeding 6 metre 10% of overall rate shall be added for every 1metre.

2. **DISMANTLING POINT WIRING:** **(WG-PW/DM)**

Electrical installation of point wiring along with circuit mains from DBs shall be dismantled with adequate care without damaging surface of wall, ceiling, and flooring. The holes shall be refinished to match with the surrounding surface. Site shall be made clean by removing debris. Dismantled material shall be retained by the agency.

3. Mode of Measurement:

Executed quantity will be counted on the basis of number of points. (i.e. per Point)

Table No. 1/1

Maximum Number Of Single Core 1.1 kV Cables That Can Be Drawn In Rigid Steel Conduits

Size of cable mm²		Size of conduit mm													
Nominal Cross sectional area	No. and dia. of wires	16		20		25		32		40		50		63	
		S	B	S	B	S	B	S	B	S	B	S	B	S	B
1.0	1 / 1.12 Cu	5	4	7	5	13	10	20	14						
1.5	1 / 1.4	4	3	7	5	12	10	20	14						
2.5	1 / 1.8 3 / 1.06 Cu	3	2	0	5	10	8	18	12						
4.0	1 / 2.24 7 / 0.85 Cu	3	2	4	3	7	8	12	10						
6	1 / 2.80 7 / 1.06 Cu	2		3	2	6	5	10	8						
10	11 / 3.55 Al 7 / 1.40 Cu			2 2		5 4	4 3	8 6	7 5						
16	7 / 1.70					2		4	3	7	6				
25	7 / 2.24							3	2	5	4	8	6	9	7
35	7 / 2.50							2		4	3	7	5	8	6
50	7 / 3.0 Al 19 / 1.80									2		5	4	6	5

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Note 2: The table shows maximum capacity of conduits for the simultaneous drawing of cables. The columns headed 'S' apply to straight runs of conduits which have distance not exceeding 4.25m between draw in boxes and which do not deflect from straight by an angle more than 15°. The columns headed 'B' apply to bent runs of conduit, which deflect from the straight by an angle of more than 15°.

Note 3: In case of inspection type draw in box has been provided and if the cable is first drawn through one straight conduit, then through the draw in box and then through the second straight conduit such system may be considered as that of straight conduit even if the conduit deflects through the straight by more than 15°.

Table No. 1/2

Maximum Number of Single Core 1.1 kV Cables That Can Be Drawn In Rigid Non-Metallic Conduits

Size of cable mm ²		Size of conduit mm					
Nominal Cross sectional area	No. and dia. of wires	16	20	25	32	40	50
1.0	1 / 1.12 Cu	5	7	13	20		
1.5	1 / 1.4	4	6	10	14		
2.5	1 / 1.8 3 / 1.06 Cu	3	5	10	14		
4.0	1 / 2.24 7 / 0.85 Cu	2	3	6	10	14	
6	1 / 2.80 7 / 1.06 Cu		2	5	9	11	
10	11 / 3.55 Al 7 / 1.40 Cu			4	7	9	
16	7 / 1.70			2	4	5	12
25	7 / 2.24				2	2	6
35	7 / 2.50					2	5
50	7 / 3.0 Al 19 / 1.80					2 2	5 3

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Table No. 1/3

Maximum Number of Single Core 1.1 kV Cables in Cable Trunking (Casing and Capping)

Size of cable mm ²		Size of Trunking mm				
Nominal Cross sectional area	12/16 x 12 mm	20 x 12 mm	25 x 12 mm	32 x 12 mm	40 x 20 mm	50 x 20 mm
1.0						
1.5	3	5	6	8	12	18
2.5	2	4	5	6	9	15
4.0	2	3	4	5	8	12
6		2	3	4	6	9
10		1	2	3	5	8
16			1	2	4	6
25				1	3	5
35					2	4
50					1	3

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Table No. 1/4

Table No 1/5

Colour Coding For Conduits in Wall Entry**Colour Code for Wires**

<i>Conduit for</i>	<i>Colour</i>
<i>Light / Power circuit</i>	Black
<i>Security wiring</i>	Blue
<i>Fire Alarm wiring</i>	Red
<i>Low voltage circuits</i>	Brown
<i>UPS circuits</i>	Green

<i>Type</i>	<i>Colour</i>
<i>Phase</i>	Red, Yellow, Blue
<i>Neutral</i>	Black
<i>Earth</i>	Green

1.11 Telephone wiring (TW)**1. General**

All material shall conform to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which PSI mark is not available in market, it shall be approved either by ITD I DOT of Govt. of India.

Work shall be carried out as per the Method of Construction specified by BIS and as specified by DOT (Department of Telephone), Govt. of India. Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of Engineer in Charge.

2. Scope:**Specification No (WG-TW)**

To provide wiring for telephone on surface of wall or ceiling concealed in slab, wall, under flooring, etc, through existing metallic conduits, rigid PVC conduits, PVC trunking, with all necessary hardware, material, etc. as specified.

To provide, install, test & commission the instruments / equipments and accessories used in telephone system, such as; Main Distribution Frames (MDF), Krone Modules, Over Voltage Magazine, PBX / EPABX, CO-axial cable, Rosette box, Jumper wire, etc.

3. Material:

PVC Telephone cable: PVC insulated Tinned copper solid conductor with minimum 0.5mm dia. (Single & Multi pair) properly paired and colour coded, shall be terminated on KRONE module with suitable tool.

Jelly filled Armoured Telephone cable: PVC insulated, PVC sheathed with steel armouring, Tinned copper solid conductor with minimum 0.5 mm dia multi pair, with Jelly, properly paired and colour coded.

Saddles: Saddles fabricated from G I sheet of required gauge (16/18 gauge) either galvanized finish or painted with superior quality enamel black paint, with necessary shearing for mechanical strength, semi circular shaped with extended piece having suitable holes for fixing on spacer.

Hardware: Sheet Metal (SM) screws of required sizes, plugs, wooden gutties, etc.

MDF: Manufactured by reputed manufacturer of specified capacity, facility for wall mounting, with door & lock, aluminium frame for fixing of KRONE, duly enclosed in cabinet made from 18 SWG CRCA sheet with powder coating of required colour.

Junction box: Manufactured by reputed manufacturer of specified capacity, facility for + wall mounting, with door & lock, aluminium frame for fixing of Krone, duly enclosed in cabinet made from 18 SWG CRCA sheet with powder coating of required colour. The depth of the box should consider the height of KRONE module plus protection magazine.

Over Voltage protection Magazine: Manufactured by reputed manufacturer of 10 pair capacity, with 3 pole gas discharge tube should be properly fitted on KRONE module in MDF / Junction box.

Rosette box: PVC / Bakelite box with LED indicator, RJ 11 jack, facility for fixing on wall. **Jumper wire:** Twin twisted PVC insulated with Tinned copper solid conductor minimum 0.5mm dia.

KRONE Module: Disconnection type KRONE module having capacity to connect 10 pairs with silver-plated terminal contacts.

RG-11 Co-axial low voltage grade cable: PVC insulated with Tinned copper solid conductor minimum 0.5 mm dia, with connector at both ends suitable for termination in RJ type socket.

PBX (Analogue type): Manufactured by reputed manufacturer and approved by Telephone Engineering Certificate (TEC) of specified extensions, having following features:

- Direct Inward dialling (DID) with voice guidance facility.
- Caller line Identification (CLI) on Analog as well as digital extension.
- Call Billing software (CB)
- Dynamic STD locking
- Conferencing facility for specified extensions.

EPABX (Digital type): Manufactured by reputed manufacturer and approved by Telephone Engineering Certificate (TEC) of specified extensions, having following features:

- Direct Inward dialling (DID) with voice guidance facility.
- Caller line Identification (CLI) on Analog as well as digital extension.
- Call Billing software (CB)
- Dynamic STD locking
- Conferencing facility for specified extensions.
- Provision of battery back-up and power failure line transfer.

4. **Method of Construction:**

4.1 **Drawing of telephone wire through Steel conduit / PVC conduit / PVC Trunking:**

As specified in Chapter for Point Wiring.

4.2 **Erection of Jelly filled armoured Telephone cable:**

Erection shall be done as per the layout finalized, in perfect level and plum. Before fixing the cable shall be straightened as far as possible for good aesthetics look. Cable shall be fixed with saddles firmly clipped on cable. Saddles shall be fixed to wall with minimum 50x8mm SM screws with plugs/wooden gutties (Distance between two saddles shall be minimum 600 mm). Wooden gutties shall be used wherever required (Especially for stone wall). The entries made in wall, floor slab, etc for laying the cable shall be made good by filling and finishing with plastering the same.

4.3 **Erection of MDF Junction box / Rosette box / PBX / EPABX, etc:** Specified equipment shall be fixed to wall with minimum 50x8 mm SM screws, with necessary plugs, wooden gutties, etc. or may be fixed on Table Top if required.

5. **Mode of Measurement:**

Work done for telephone in Steel / PVC conduit / PVC Trunking will be measured on running meter basis, (i.e. per running meter) for each single run. For the other accessories / equipments shall be done as per unit specified. (I.e. Job / each)

A) UTP Networking Cable

General:

All material shall conform to relevant standard as per ISO/IEC11801, CENELEC EN50173& TIA/EIA 568-B2-1; CUL listed & ETL verified.

Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of Engineer in Charge.

Scope:

Specification No (WG-COC/NC)

To lay the cables for Computers on surface of wall or ceiling concealed in slab, wall, under flooring etc, through existing metallic conduits, rigid PVC conduits, PVC trunking, with all necessary hardware, material, etc. as specified. The cable shall be used only for connections between Information Outlet & Patch/ Multimax Panel. (Exception: For making MDIX patch cord)

Material:

UTP cable:

4 pairs, 100 ohms, unshielded twisted pair (UTP), each pair separated by a PE former (Star shaped) solid 23AWG tinned copper conductor rated for temperature of 75° C, PVC insulated grey colour with following types as in the table 1.12/1

Table 1.12/1

Sr. No.	Type	Class	Tested frequency
1	Cat 6	E	350MHz
2	Cat 6+	E	500MHz

- The Category 6 cable and Category 6 channel components shall be manufactured by a single manufacturer. The manufacturer shall warrant the Category 6 channel cable, components, and applications for a period of 20 years.
- The Delay Skew on the 100 meter channel shall not exceed 30 ns
- The 20 year warranty shall be a transferable warranty and has component replacement policy in case of manufacturing defect
- Category 6, 100mtr channel, **4-connection** model should guarantee 400% margin over standard NEXT specification across swept frequency
- Category 6, 100mtr channel, **6-connection** model should guarantee +4dB margin over standard NEXT Specification across swept frequency (1~250MHZ)
- The high performance Category 6 UTP cable 23AWG shall be of the traditional round design with Mylar bisector tape Non-Plenum rated.
- The cable shall support Voice, Analog Baseband Video/Audio, Fax, Modem, Switched- 56, T-1, ISDN, RS-232, RS422, RS-485, 10BASE – T Ethernet, Token Ring, 100Mbps TP-PMD, 100BASE-T Ethernet, 155 Mbps ATM, AES/EBU Digital Audio, 270 Mbps Digital Video, 622 Mbps 64-CAP ATM and emerging high-bandwidth applications, including 1 Gbps Ethernet, gigabit ATM, IEEE 1394B S100 and S400, as well as all 77 channels (550 MHz) of analog broadband video.
- The cable jacket shall comply with Article 800 NEC for use as a non-plenum cable. The 4 pair UTP cable shall be UL and c (UL) Listed Type CM.
- Performance shall be characterized to 550 MHz to support high-bandwidth video applications

Non Plenum CAT6 UTP Cable

- Weight=25.3 lb (1000 ft)
- Jacket Thickness=.022 in

- 3 Outside Diameter=0.232 in -180-
4 Conductor Diameter=.022 in
5 Insulation Type=High density Polyethylene
6 Jacket Material=PVC
7 Maximum Pulling Tension=25 lbs
8 Nom. Velocity of Propagation=0.69
9 Max DC Resistance=9.83 Ohms/100m

- 181-
- 10 Mutual Capacitance @ 1 kHz = 4.95 nF/100m
 - 11 Operating Temperature= -20 to 60° C
 - 12 The high performance Category 6 UTP cable shall be of the **traditional round design with Mylar bisector tape.**
 - 13 The 4 pair UTP cable shall be UL Type CM (non-plenum)
 - 14 Performance shall be characterized to 550 MHz to support high-bandwidth video applications

Method of Construction:

The cable shall be laid in provided separate casing n capping/ PVC conduit/ trunking 400mm away from electrical cables wherever required without sharp bends. The cable shall be spliced at both the ends for punching/ crimping at keystone jacks/ UTP connectors.

Mode of measurement: Executed quantity shall be measured on running metre basis.

B) UTP Patch cord

Scope:

Specification No

(WG-COC/PC)

Structured cabling, to make connections from switch to patch panel or information outlet to computer

Material:

UTP Patch Cord:

Assembly (conforming to EIA/TIA 568B-2-1) of Cat 6 type 4 unshielded twisted pair 24- 26AWG (0.51mm-0.40mm), each pair separated by a PE former (Star shaped) 100 ohms stranded wire PVC insulated cables with modular RJ-45 polycarbonate UL94V housing 15milliohms gold over nickel contacts (superior three piece connector) crimped on both ends with T568A & T568B wiring schemes with 8P8C connection. The cord shall be branded. The cords shall be used in structured cabling in accordance with following table 1.12/2.

Table 1.12/2

Sr. No.	Length	Use in
1	1m	from switch to patch panel
2	3m	from computer to information outlet

- 1 All patch cords shall exceed TIA/EIA and ISO/IEC Category 6/Classs Especifications.
- 2 All patch cords shall be backward compatible with Category 5 and Category 5E systems.
- 3 The patch cords shall incorporate an anti-snap feature that provides maximum protection from snagging during moves and re-arrangements.
- 4 Patch cords shall be UL listed, UL-C certified and AUSTEL approved.
- 5 Patch cords shall support network line speeds in excess of 1 gigabit per second.

Physical Specifications:

Contact Material:

Contact Plating:

Insertion Life:

Plug Material:

Operating Temperature:

Phosphor Bronze

Gold 50 micro-inch (1.27 microns) Nickel

100 micro –inch (2.54 microns)

750 minimum

Polycarbonate UL-rated 94 V-O

14°F to 140°F (-10°C to 60°C)

Method of construction:

The patch cord shall be erected for making connections from switch to patch panel or from computer to information outlet.

Mode of measurement: Executed quantity shall be counted on number basis

BACKBONE (Fibre Network)

C) PVC Armoured Optical Fibre Cable (OFC)

General:

All material shall conform to relevant standard as per IEEE, EIA/TIA 568-B.3

Scope:

Specification No (WG-COC/OFC)

Optical fibre cable is used for connecting remote places networks by means of fibre switch or fibre module without much loss of signal.

Material:

Optical Fibre Cable:

Dielectric & metallic sheath armoured multimode optical fibre cable for underground/ aerial applications, fibres separated into binder groups inside a Industry standard 3mm gel filled buffer tubes standard around a central strength member; water blocked with dry water blocking material, making access & handling individual tubes easier & craft-friendly cable core; operating temperature of 40 - 70⁰ C, crush resistance of 44N/m, as per table 1.12/3.

Table 1.12/3

Physical Specifications:

Fiber Count	Subunits	Outer	Weight	Minimum Bend		Max. Tensile Load		Max.
		Diameter	lbs/kit	Radius	In. (cm)	lbs. (Newtons)	Vertical	
		in. (mm)	kg/km					
				Loaded	Unloaded	Short Term	Long Term	Rise Feet (Meter)
4 - 48	5	0.46 (11.7)	63 (94)	9.2 (23.4)	4.6 (11.7)	607 (2700)	180 (800)	2856 (871)
72	6	0.50 (12.7)	72 (107)	10.0 (25.4)	5.0 (12.7)	607 (2700)	180 (800)	2509 765)
96	8	0.58 (14.7)	95 (141)	11.5 (29.4)	5.8 (14.7)	607 (2700)	180 (800)	1904 (580)
144	12	0.74 (18.9)	146 (217)	14.8 (37.8)	7.4 (18.9)	607 (2700)	180 (800)	1237 (377)
288	24	0.86 (21.9)	211 (315)	17.2 (43.8)	8.6 (21.9)	607 (2700)	180 (800)	852 (260)

Note* There are 12 fibres per tube

04/ 06/ 12/ 24 fibres				
Sr. No.	Grade	Core dia.	1Gbps Distance at wavelength	
			850nm	1300nm
1	FR	62.5 µm	3000m	550m
2	FR	50 µm	1100m	600m
3	FRLS	62.5 µm	3000m	550m
4	FRLS	50 µm	1100m	600m

1. The cable shall support Gigabit Ethernet and legacy applications including Ethernet, Fast Ethernet, Token Ring, ATM and FDDI.
2. The loose tube dielectric OSP cable shall be armored with a corrugated polymer

3. coated steel tape and constructed with industry standard 3mm buffer tubes, stranded around a central strength member.
4. The armor layer shall provide crush protection meeting the Telcordia requirements for Superior Armored cable.
5. The buffer tubes shall compatible with standard hardware, cable routing and fan-outkits.

6. The cable core shall be water blocked with dry water-blocking materials, making access and handling of individual tubes easier and craft-friendly.
7. The cables shall be designed for point-to point applications as well as mid-span access, and provide a high-level of protection for fiber installed in the outside plant environment.

S. No	Features
1	Support 10 Gbps up to 300 meters
2	Meets and exceeds the next generation multimode fiber (OM3) specifications in standards
3	Gigabit Ethernet is supported up to over 1.0 kilometre for 1000BASE-SX.
4	Supports very high speed data transmission by controlling DMD
5	Differential Mode Delay Exceeds TIA-492AAAC-A (IEC-60793-2-10ed2)@ 850nm
6	> 2,000 MHz-km laser bandwidth at 850 nm
7	Core Diameter should be $50.0 \pm 3.0 \mu\text{m}$
8	Cladding Diameter should be $125.0 \pm 1.0 \mu\text{m}$
9	Max. Attenuation, Loose Tube Cable 3.0 dB/km
10	Coating/Cladding Concentricity Error should be $\leq 6 \mu\text{m}$
11	Clad Non-Circularity $\leq 1\%$
12	Zero Dispersion Wavelength 1297-1316 nm
13	Water Immersion, 73.4°F (23°C) should be $\leq 0.20 \text{ dB}$

Environmental and Mechanical

	Specification	Test Method
Operating Temperature	-40°to +70°C	FOTP - 3
Installation Temperature	20°to +70°C	N/A
Storage Temperature	-40°to +70°C	N/A
Crush Resistance	44 N/mm	FOTP - 41
Impact Resistance	Exceeds	FOTP - 25
Flexing	Exceeds	FOTP - 104
Twist Bend	Exceeds	FOTP - 85

Cable Identification:

Buffer Tubes and Fibres are identified with standard color coding:

1 - Blue	5 - Slate	9 - Yellow
2 - Orange	6 - White	10 - Violet
3 - Green	7 - Red	11 - Rose
4 - Brown	8 - Black	12 - Aqua

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, clips etc.

Method of Construction:

As per the method of construction of PVC armoured cable. But these cables shall be tagged as "OFC" every metre length & can be laid in trench side by side. For underground cable laying cable indicator mentioning "Optical Fibre Cable" is a must.

Mode of measurement: Executed quantity shall be measured on running meter basis.

D) Fibre Patch Cord (FPC)

General:

All material shall conform to relevant standard as per IEEE, EIA/TIA, CENELEC

Scope:

Specification No (WG-COC/FPC)

The cord is to be used to connect fibre optic equipment to fibre optic cross-connects, interconnects & information outlets. (e.g. Remote Ethernet switch with fibre optic module can be connected to another same type of switch or Fibre Optic Switch.)

Material:

FRLS duplex fibre patch cord/ pigtails 1mtr in length with LC/ SC/ ST termination consisting of 1.6mm/ 3.0mm dia. 62.5um fibre with minimum bandwidth of 200MHz- km at 850nm & 500MHz at 1300nm with following specifications, as per table 1.12/4.

Table 1.12/4

Sr. No.	Outside dia.	Cable retention strength	Minimum Bend Radius	Maximum Cordage Tensile Load
1	1.6mm: 1.6mm x 3.3mm	50 Newton	Loaded: 5.1cm Unloaded: 3.5cm	Short Term : 3111 Newton Long Term: 93 Newton
2	3.0mm: 3.0mm x 5.9mm	50 Newton	Loaded: 5.8cm Unloaded: 3.5cm	Short Term : 400 Newton Long Term: 120 Newton

1. The fiber-optic patch cord shall be configurable with standard LC, SC, and ST terminations, and shall be available in either 1.6 mm or 3.0 mm duplex zip cord.
2. The 1.6 mm cordage shall exceed the requirements for larger diameter cordage and allows at least twice as many fibers to be installed in a cabinet.
3. The duplex cordage shall be 1.6 mm by 3.5 mm and have two single fiber cords joined together with a web.
4. The connector shall have a pull-proof design that helps prevent accidental disconnects and helps to assure optimal performance of equipment.
5. Custom hybrid patch cords shall also be available, to simplify migration to industry- leading connectors.
6. All fibers shall be Differential Mode Delay (DMD) tested by using a high-resolution test bench that exceeds the FOTP-220 standards and shall be independently certified by UL®.
7. All patch cords shall be a distinctive aqua color for positive identification.

Physical Specifications:

Minimum Bandwidth	@ 850 nm: 4700 MHz-km (laser), 3500 MHz-km (OFL) @ 1300 nm: 500 MHz-km (laser), 500 MHz-km (OFL)
Attenuation:	3.0 dB/Km @ 850 nm, 1.0dB/Km @ 1300 nm
Cable Outside Diameter:	Duplex: 1.6 x 3.7 mm
Min. Bend Radius:	2.5 cm
Operating Temperature Range:	-20 to 70 °C
Average Connection Loss:	LC = 0.1 dB
Return Loss Minimum:	-20 dB
Tip Material:	Ceramic
Mating Durability for:	500 Reconnects

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Insertion Loss Change:	<0.2 dB
Temperature Stability:	-40 to + 75 °C
<u>Insertion Loss Change:</u>	<u><0.3 dB</u>

Method of Construction:

Supplying & plugging FRLS duplex fibre patch cord/ pigtails into the LC/ SC/ ST termination of LIU & fibre module/ fibre switch port complete.

Mode of Measurement: Executed quantity shall be counted on number basis

1.13 Networking Components (NWC)

Switches/ Routers

A) Web Smart Power Over Ethernet Switch (ENS)

General:

All material shall conform to relevant standard as per IEEE802.3af PoE

Scope:

Specification No (WG-NWC/ENS)

Preferred in Wireless LAN obviating the use of external power supply for Access Points

Material:

Ethernet Switch:

Ethernet Switch with PoE: 24 ports PoE (Power Over Ethernet) with IEEE 802.3af PoE protocol, each PoE to supply up to 15.4 Watts for connecting devices such as Access Point needing additional power, 10/100Base-Tx 24 Fast Ethernet ports, 1000 Base-T 4 ports, 2 combo ports for flexible copper/fibre Gigabit connections, VLAN web manageable switch with rack mountable clips, screws, console utility software, mechanisms to detect an attack against the central processing unit of the switch and to take corrective action on attacking interface.

1. Feature-rich solution with functionality enabling by Secure Always On access to mission critical applications
2. High performance switch architecture and stacking performance delivering 320Gbps
3. High-density 10/100 ports for edge connectivity
4. Two combo 10/100/1000/SFP uplinks ports per switch for high speed gigabit or low speed connections such as 100FX
5. Simplified converged network deployments through support for Power over Ethernet (PoE), advanced Quality of Service (QoS), and auto-configuration of ports with IP Handsets & Wireless Access Points

Technical Specifications:

- 10/100 Power over Ethernet ports: 24 per switch
- 10/100/1000/SFP Gigabit ports: 2 per switch
- SFP support: SX, LX, XD, ZX, CWDM, 100FX, & T1
- Resilient Stacking: up to 8 units / 192 ports per stack
- Stacking ports: 2 built-in stacking ports per switch
- Total stacking capacity: 320 Gbps
- Individual switch packet throughput: 6.6 Mpps
- Individual switch capacity: 48.8 Gbps
- Concurrent VLANs: 256
- Jumbo Frame Support on Gigabit ports
- Maximum MAC addresses: 8,000

<u><i>Standards Compliance:</i></u>

- IEEE 802.3 10BASE-T Ethernet
- IEEE 802.3u 100BASE-TX Fast Ethernet
- IEEE (ANSI) 802.3 Auto-negotiation
- IEEE 802.3z Gigabit Ethernet
- IEEE 802.3x Flow Control
- IEEE 802.1Q VLANs

- IEEE 802.1p Priority Queues
- IEEE 802.1D Spanning Tree
- IEEE 802.1w Rapid Spanning Tree
- IEEE 802.1s Multiple Spanning Tree Groups
- IEEE 802.3ad Link Aggregation
- IEEE 802.1X Ethernet Authentication Protocol
- IEEE 802.3AB Link Layer Discovery Protocol
- RFC 783 Trivial File Transfer Protocol (TFTP)
- RFC 791/950 Internet Protocol (IP)
- RFC 792 Internet Control Message Protocol (ICMP)
- RFC 826 Address Resolution Protocol (ARP)
- RFC 854 Telnet Server and Client
- RFC 951 / 1542 BOOTP
- RFC 1112 Internet Group Management Protocol v1
- RFC 1215 SNMP Traps Definition
- RFC 1271 / 1757 / 2819 RMON
- RFC 1361 / 1769 Simple Network Time Protocol (SNTP)
- RFC 1493 Bridge MIB
- RFC 1573 / 2863 Interface MIB
- RFC 1643 / 2665 Ethernet MIB
- RFC 1905 / 3416 SNMP
- RFC 1906 / 3417 SNMP Transport Mappings
- RFC 1907 / 3418 SNMP MIB
- RFC 1945 HTTP v1.0
- RFC 2011 SNMP v2 MIB for IP
- RFC 2012 SNMP v2 MIB for TCP
- RFC 2013 SNMP v2 MIB for UDP
- RFC 2138 RADIUS
- RFC 2236 Internet Group Management Protocol v2
- RFC 2474 Differentiated Services Support
- RFC 2570 / 3410 SNMPv3
- RFC 2571 / 3411 SNMP Frameworks
- RFC 2572 / 3412 SNMP Message Processing
- RFC 2573 / 3413 SNMPv3 Applications
- RFC 2574 / 3414 SNMPv3 USM
- RFC 2575 / 3415 SNMPv3 VACM
- RFC 2576 / 3584 Co-existence of SNMP v1/v2/v3
- RFC 2660 HTTPS (Secure Web Server)
- RFC 2665 Ethernet MIB
- RFC 2863 Interfaces Group MIB
- RFC 2674 Q-Bridge MIB
- RFC 2737 Entity MIBv2
- RFC 2819 RMON MIB

<i>Additional features:</i>

- Customizable Auto-negotiation Advertisements (CANAs)
- Distributed Link Aggregation Groups
- Virtual Link Aggregation Control Protocol (VLACP)
- Single IP address for stack management
- Resilient fail-safe stacking
- Automatic Unit Replacement (Configuration and Software)
- Automatic Detection Automatic Configuration (ADAC)
- 802.1X Single Host Single Authentication
- 802.1X Single Host Multiple Authentication
- 802.1X Multiple Host Multiple Authentication
- 802.1X Guest VLAN
- 802.1X Non-EAP (NEAP) access
- DSCP-based Recognition, Marking and Recolouring
- Ingress and Egress Port Mirroring
- Broadcast and Multicast Rate limiting per port
- ASCII Configuration File
- Web, NNCLI, JDM

- SSHv2 and SNMPv3 secure management support
- Secure Network Access (NSNA) support
- BPDU Filter
- Stack Monitor
- USB software and ASCII configure upload
- New unit quick to configure

Resiliency Features:

- Should support a technology which will allow multiple physical network links between two network switches and another device (which could be another switch or a network device such as a server) to be treated as a single logical link and load balance the traffic across all available links
- Generally all the physical ports in the link aggregation group must reside on the same switch. It should also support protocols remove this limitation by allowing the physical ports to be split between two switches.
- Load balancing mechanism should not be round robin or dynamic which may not work with applications like Voice & Video, where session persistence is must.

Main Objective of above features is to achieve Active-Active Cluster Switching. And achieve sub second fail over in case of Link failure & Device Failure, which will result in 99.999% uptime.

Power over Ethernet specifications:

- 802.3af compliant with Power classification support
- Signal pair power delivery
- Maximum 15.4 watts per port
- Maximum DTE Power AC 320 watts
- Maximum DTE Power AC + RPS 740 watts

Electrical specifications:

- Power supply: AC 100-240V, 50-60Hz
- Input current at 110v: 7.1A
- Input current at 220v: 3.6A
- Max power consumption: 470W

Dimensions:

- Width: 438.2mm (17.25 in)
- Height: 1RU 43.7mm (1.72 in)
- Depth: 368.3mm (14.5 in)

Environmental specifications:

- Operating temperature: 0 to 50 degrees C
- Storage temperature: -25 to 55 degrees C
- Relative humidity: 10% - 90% non-condensing
- Peak noise level: 42.3 dB
- Thermal rating: 375 BTU/hr
- Calculated MTBF: 242,552 hrs

Safety Agency Approvals:

- IEC 60950 International CB Certification
- EN 60950 European Certification
- UL 60950 US certification
- CSA 22.2, #60950 Canadian Certification
- NOM Mexican Certification

Electromagnetic Emissions and Immunity:

- CISPR22, Class A/CISPR24 International
- EN55022, Class A/EN55024 European
- FCC, Part 15, Class A US Certification
- ICES-003, Class A Canadian Certification
- AN/NZS 3548 Australian/NZ Certification
- BSMI - Taiwan - CNS 13438, Class A

- MIC - Korea - MIC, No. 2001-116
- VCCI Class A Japanese Certification

Hardware: Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction:

The Ethernet switch fitted with rack mountable clips shall be fixed in U Rack (Networking Cabinet) with 4 nos. of chromium plated brass nuts & bolts. The switch shall be configured for TCP/IP addresses for switch IP & Gateway.

Mode of measurement: Executed quantity shall be counted on number basis

B) 24 Port Gigabit Switch (GBS)

Scope:

Specification No (WG-NWC/GBS)

To be used in wired LAN connections.

Material:

Gigabit Ethernet Switch:

24 nos. of 10/100/1000 Base-T Gigabit ports, 2 or 4 combo SFP slots for flexible fibre backbone, VLAN, manageable, 19" standard rack mountable, auto detection of MDI/MDIX, Layer 2, Safeguard Engine to protect against traffic flooding caused by virus/worm outbreaks with rack mountable clips, screws, console utility software.

1. Feature-rich solution with functionality enabling by Secure Always On access to mission critical applications
2. High performance switch architecture and stacking performance delivering 320Gbps
3. High-density 10/100/1000 ports for edge connectivity
4. Shared SFP uplinks ports per switch for gigabit fibre connectivity

Technical Specifications:

- 10/100/1000 Ethernet ports: 24 per switch
- SFP Gigabit ports: 4 per switch
- SFP support: SX, LX, XD, ZX, CWDM, 100FX & T1
- Resilient Stacking: up to 8 units
- Stacking ports: 2 built-in ports per switch
- Total stacking capacity: 320 Gbps
- Individual switch packet throughput: 36 Mpps
- Individual switch capacity: 88 Gbps
- Concurrent VLANs: 256
- Jumbo Frame Support on Gigabit ports
- Maximum MAC addresses: 8,000

Standards compliance:

- IEEE 802.3 10BASE-T Ethernet
- IEEE 802.3u 100BASE-TX Fast Ethernet
- IEEE (ANSI) 802.3 Auto-negotiation
- IEEE 802.3z Gigabit Ethernet
- IEEE 802.3x Flow Control
- IEEE 802.1Q VLANs
- IEEE 802.1p Priority Queues
- IEEE 802.1D Spanning Tree
- IEEE 802.1w Rapid Spanning Tree

- IEEE 802.1s Multiple Spanning Tree Groups⁻¹⁹⁴⁻
- IEEE 802.3ad Link Aggregation
- IEEE 802.1X Ethernet Authentication Protocol
- IEEE 802.3AB Link Layer Discovery Protocol
- RFC 783 Trivial File Transfer Protocol (TFTP)

- RFC 791/950 Internet Protocol (IP)
- RFC 792 Internet Control Message Protocol (ICMP)
- RFC 826 Address Resolution Protocol (ARP)
- RFC 854 Telnet Server and Client
- RFC 951 / 1542 BOOTP
- RFC 1112 Internet Group Management Protocol v1
- RFC 1215 SNMP Traps Definition
- RFC 1271 / 1757 / 2819 RMON
- RFC 1361 / 1769 Simple Network Time Protocol (SNTP)
- RFC 1493 Bridge MIB
- RFC 1573 / 2863 Interface MIB
- RFC 1643 / 2665 Ethernet MIB
- RFC 1905 / 3416 SNMP
- RFC 1906 / 3417 SNMP Transport Mappings
- RFC 1907 / 3418 SNMP MIB
- RFC 1945 HTTP v1.0
- RFC 2011 SNMP v2 MIB for IP
- RFC 2012 SNMP v2 MIB for TCP
- RFC 2013 SNMP v2 MIB for UDP
- RFC 2138 RADIUS
- RFC 2236 Internet Group Management Protocol v2
- RFC 2474 Differentiated Services Support
- RFC 2570 / 3410 SNMPv3
- RFC 2571 / 3411 SNMP Frameworks
- RFC 2572 / 3412 SNMP Message Processing
- RFC 2573 / 3413 SNMPv3 Applications
- RFC 2574 / 3414 SNMPv3 USM
- RFC 2575 / 3415 SNMPv3 VACM
- RFC 2576 / 3584 Co-existence of SNMP v1/v2/v3
- RFC 2660 HTTPS (Secure Web Server)
- RFC 2665 Ethernet MIB
- RFC 2863 Interfaces Group MIB
- RFC 2674 Q-Bridge MIB
- RFC 2737 Entity MIBv2
- RFC 2819 RMON MIB

Additional features:

- Customizable Auto-negotiation Advertisements (CANAs)
- Distributed Link Aggregation Groups
- Virtual Link Aggregation Control Protocol (VLACP)
- Nortel Multiple Spanning Tree groups
- Single IP address for stack management
- Resilient fail-safe stacking
- Automatic Unit Replacement (Configuration and Software)
- Automatic Detection Automatic Configuration (ADAC)
- 802.1X Single Host Single Authentication
- 802.1X Single Host Multiple Authentication
- 802.1X Multiple Host Multiple Authentication
- 802.1X Guest VLAN
- 802.1X Non-EAP (NEAP) access
- DSCP-based Recognition, Marking and Recolouring
- Ingress and Egress Port Mirroring
- Broadcast and Multicast Rate limiting per port
- ASCII Configuration File
- Web, NNCLI, JDM
- SSHv2 and SNMPv3 secure management support
- Nortel Secure Network Access (NSNA) support
- BPDU Filter
- Stack Monitor
- USB software and ASCII configure upload
- New unit quick to configure

Resiliency Features:

- Should support a technology which will allow multiple physical network links between two network switches and another device (which could be another switch or a network device such as a server) to be treated as a single logical link and load balance the traffic across all available links
- Generally all the physical ports in the link aggregation group must reside on the same switch. It should also support protocols remove this limitation by allowing the physical ports to be split between two switches.
- Load balancing mechanism should not be round robin or dynamic which may not work with applications like Voice & Video, where session persistence is must.
- Main Objective of above features is to achieve Active-Active Cluster Switching .And achieve sub second failover in case of Link failure & Device Failure which will result in 99.999% uptime

Electrical specifications:

- Power supply: AC 100-240V, 50-60Hz
- Input current at 110v: 1.3A
- Input current at 220v: 0.7A
- Max power consumption: 150W

Dimensions:

- Width: 438.2mm (17.25 in)
- Height: 1RU 43.7mm (1.72 in)
- Depth: 368.3mm (14.5 in)

□

Environmental specifications:

- Operating temperature: 0 to 50 degrees C
- Storage temperature: -25 to 55 degrees C
- Relative humidity 10% - 90% non-condensing
- Peak noise level: 42.4 dB
- Thermal rating: 290 BTU/hr
- Calculated MTBF: 312,001 hrs

Safety Agency Approvals:

- IEC 60950 International CB Certification
- EN 60950 European Certification
- UL60950 US certification
- CSA22.2, #60950 Canadian Certification
- NOM Mexican Certification

Electromagnetic Emissions and Immunity:

- CISPR22, Class A/CISPR24 International
- EN55022, Class A/EN55024 European
- FCC, Part 15, Class A US Certification
- ICES-003, Class A Canadian Certification
- AN/NZS 3548 Australian/NZ Certification
- BSMI - Taiwan - CNS 13438, Class A
- MIC - Korea - MIC, No. 2001-116
- VCCI Class A Japanese Certification

Hardware:

Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction:

The Ethernet switch fitted with rack mountable clips shall be fixed in U Rack (Networking Cabinet) with 4 nos. of chromium plated brass nuts & bolts. The switch shall be configured for TCP/IP addresses for switch IP & Gateway.

Mode of measurement: Executed quantity shall be counted on number basis

General:

All material shall conform to relevant standard as per ITU G.992.2 & RFC

Scope:

Specification No **(WG-NWC/ADSL)**

For broadband internet connections to individual computer or Wired LAN/ WirelessLAN.

Material:

Broadband ADSL Router:

ADSL2+ broadband router with PPP(Point-to-Point Protocol), DHCP support, TCP/IP, downstream up to 24Mbps, upstream up to 1Mbps, RJ-11 for ADSL line, RJ-11 for phone line with Patch cord 3 metre in length, 10/100 Base-T port, USB 1.1 & 9V adaptor with UTP(Ethernet) Patch Cord, USB 2.0 patch cord, USB driver software

- **Designed for the small to medium business** - Simpler than enterprise class routersbut more robust than consumer grade routers
- **Secure** - Good security and heavy encryption, but easy to implement; simple yet statefull firewall with simple filters
- **Simplified architecture** - Has a smaller processor that does not require a noisy fan,making it small and attractive for in-office or desk top installation

Note: *Provision of Network Interface Card (NIC) shall be made for computer withoutbuilt in NIC.*

Input/Output Requirements:

- WAN 1- 10/100 Base-T Auto-sensing - RJ-45
- LAN -4 Port Ethernet 10/100 Base-T Auto-sensing switch – RJ- 45 (fifth port for internal connection)

VPN Services:

- Minimum 10 IPSec tunnels
- IKEv1 Main Mode
- IKEv1 Aggressive Mode
- Up to 3 IP pools for Client
- 16 Split networks configured
- 64 Subnets specified for Split (inverse) network
- Diffie-Hellman Group 1, 2
- IPSec Tunnel Mode
- ESP
- Support for Dynamically addressed peers – ABOT
- NAT Traversal
- IPSec Transport Mode
- Keep Alive – For branch office and client tunnels
- VPN Router Client termination

Cryptographic Services:

- DES
- 3DES
- Data authentication SHA-1

- Data authentication MD-5
- AES -128
- AES – 192, 256 – Branch Office

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Authentication Services:

- Pre-shared secrets
- External RADIUS support
- 802.1x/EAP support

Firewall:

- Statefull Packet Inspection
- IP application Inspection (FTP, SMTP, HTTP, Telnet, SSL, DNS, etc.)
- Denial of Service (DoS) detection and prevention
- URL Filtering
- Content filtering

ALG's:

- CU-SeeME
- FTP
- SIP
- H.323
- IPSEC
- VDiLive
- RealAudio

IP Services: NAT:

- NAT, Many to One, Static, Many to Many, Many One-to-One
- Port Forwarding
- IPSec pass-through
- SIP and H.323 ALG's
- Cone NAT
- NAT support for tunnel Mode IPSec tunnels

IP Services: Routing:

- Clear text routing
- Static
- RIP v1
- RIP v2

IP Services: DHCP:

- Client
- Server
- Relay
- Static mapping – 8 IP address lease mapping

IP Services: DNS:

- DNS Proxy
- Dynamic DNS

IP Services: NTP:

- RFC-867, 868, 1305

Layer Two Protocols:

- PPPoE
- IP masquerade/ alias – Configurable MAC address

Performance and Scaling:

- 20 Mbps 3DES throughput w/ 1500 byte packets

- 10 IPSec tunnels

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<u>Management:</u>

- TFTP/FTP firmware upload
- RS232 console port
- Built-in Diagnostic tool
- SNMP
- Web GUI
- CLI (Command Line Interpreter)
- Remote management (FTP, Telnet, Web)

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- Backup and restore configuration via FTP and Web

WAN and LAN Ports:

- The WAN and LAN ports are 10/100-base T Ethernet ports, without PoE

Two-Port Router:

- The router is based on the Intel IXP-425 network processor, running at 266 MHz. It will have 64 Mbytes of FLASH, and 32 Mbytes of RAM.

5-Port Switch:

- The 5-port layer-2 switch uses the Infineon 6996i chip

Serial Port:

- The serial port provides a DCE connection that can be used for either WAN back-up or for installing software into a router that has a corrupted software load

Power Supply:

- The router will be powered by 19 volts DC. The power supply circuit block will convert this supply to the supply voltages needed by the rest of the circuitry. The Business Secure Router 222 uses a universal wall-mount power supply.

Method of construction:

The ADSL Router shall be connected directly to the incoming phone line without any parallel telephone, then to telephone to avoid breaks in Internet connection, 9V DC adaptor connected to provide power supply, UTP patch cord for connections between router Ethernet port to computer/ switch. The router shall be configured as per the requirements of Broadband Internet Service Provider. As far as possible use of USB port shall be avoided.

Mode of measurement: Executed quantity shall be counted on number basis

Wireless LAN

D) Indoor LAN Dipole Antenna (DPA)

General:

All material shall conform to relevant standard as per IEEE.

Scope:

Specification No (WG-NWC/DPA)

To enhance the signal strength of Access Point & Wireless PCI adaptor/ Router up to 500 metres.

Material:
Indoor LAN Dipole Antenna:

2.4 GHz, 5dBi gain, 50 ohms Omni-Directional Indoor Antenna outer covering made from polyurethane, polycarbonate swivel mechanism with built-in connector (RP-SMA & Reverse SMA/ TNC) for 802.11b/g wireless network

Method of Construction:

Supplying & erecting 2.4 GHz, 5dBi Omni-Directional Antenna to be screwed to Accesspoint/
wireless PCI adaptor complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

E) Omni Directional Antenna (ODA)

Scope:

Specification No (WG-NWC/ODA)

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To enhance the signal strength of Access Point & Wireless PCI adaptor/ Router at difficult to reach or far places.

Material:

Omni Directional Antenna:

2.4 GHz, 4dBi gain, Collinear, 50 ohms Omni-Directional Indoor Antenna covering horizontal 360 deg. vertical 36 deg. with 1.5m ULA-316 fixed cable, connectors (RP-SMA & Reverse SMA/ TNC), sturdy magnetic base stand to place it on flat surfaces

& can be mounted on wall for 802.11b/g wireless network

Method of Construction:

Supplying & erecting 2.4 GHz, 4dBi Omni-Directional Antenna on wall or on the desktop or suitable place which shall be at least 150mm away from electronic devices such as computers, TV, video equipment & audio/video tapes.

Mode of Measurement: Executed quantity shall be counted on number basis.

F) Aesthetic Omni Directional Antenna (AODA)

Scope:

Specification No (WG-NWC/AODA)

To enhance the signal strength of Access Point & Wireless PCI adaptor/ Router at difficult to reach or far places.

Material:

Aesthetic Omni Directional Antenna:

2.4 GHz, 20W (cw) power handling, 40 deg down tilt, 50 ohms Omni-Directional Aesthetic Indoor Ceiling Antenna with ULA-316 fixed cable, connectors (RP-SMA & Reverse SMA/ TNC) for 802.11b/g wireless network.

S No.	Type	Colour	Gain (dBi)	Coverage (deg)		Cable (mtr)	Use
				Horizontal	Vertical		
1	Globe	White	4	360	63	2.0	Places with false ceiling
2	Rod	Gray-White	5	360	32	3.0	Any other place

Hardware: Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, etc.

Method of Construction

Supplying & erecting 2.4 GHz, Omni-Directional Indoor Aesthetic Ceiling Antenna on ceiling at suitable place fixed with required size of SM screws, plugs/ gitties etc. complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

1.13 Networking Accessories (NAS) LAN
Accessories

A) UTP connector (RJ-45) (UTPC)

General:

All material shall conform to relevant standard as per TIA/EIA 568-B2-1.

Scope:

Specification No (WG-NAS/UTPC)

To make MDIX (Cross) patch cord required for cascade connections of switches & routers.

Material:

UTP connector:

Assembly of Gold over nickel contacts with 1.5A current carrying capacity, 30V with 15milli ohms contact resistance, 8P8C connection easy to crimp with crimping tool in polycarbonate UL94V housing.

Method of construction:

The UTP cable shall be spliced, untwisted not more than 12mm, inserted into the connector with sequence as shown in the **diagram** _____ as per EIA/TIA 568 B.2-1 & crimped firmly with crimping tool.

Mode of Measurement: Executed quantity shall be counted on number basis.

B) Information Outlet (Ethernet)

(IO)

)General:

All material shall conform to relevant standard as per TIA/EIA 568-B2-1.

Scope:

Specification No (WG-NAS/IO)

For connecting computers to wired LAN or external wireless Ethernet interface in WirelessLAN.

Material:

Information Outlet Flush/ Surface type:

Spring shuttered front access, high impact plastic body FR grade with high performance unshielded RJ-45 keystone jack (conforming to EIA/TIA 568-B.2-1 Cat 6), 15 milliohms contact resistance, gold over nickel spring contact, 1.5A current carrying capacity, with T568A/T568B wiring option, insulation displacement connector for cable crimping to accept 22-26AWG solid wire for connections up to Gigabit Ethernet.

1. All Category 6 outlets shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in TIA/EIA 568-B.2-1 Commercial Building Telecommunications Cabling Standard and ISO/IEC 11801:2002 Second Edition.
2. The Category 6 outlets shall be backward compatible with Category 5E, 5 and 3 cords and cables.
3. The Category 6 outlets shall be of a universal design supporting T568 A & B wiring.
4. The Category 6 outlets shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current 10BASE-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T and 1.2 Gbps ATM.
5. The Category 6 outlets shall be capable of being installed at either a 45° or a 90° angle in any M-series modular faceplate, frame, or surface-mounted box avoiding the need for special faceplates.
6. The Category 6 outlets shall have improved pair splitters and wider channel for enhanced conductor placement. The outlet shall also have a low-profile wire cap, which protects against contamination and secures the connection. Multicolored identification labels shall be available to assure accurate installation.

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, etc.

Method of construction:

The Information outlet shall be fixed on the wall with sheet metal (SM) screws, rawl plugs/wooden gitties and making due connections as per EIA/TIA 568 B.2-1 by splicing the UTP cable, untwisted up to 12mm & punching the 4 pairs in the keystone jack with the help of punching tool. Not a single wire shall be left without connections.

Mode of Measurement: Executed quantity shall be counted on number basis.

C) Keystone jack (RJ-45)

(KJ)

Scope:

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Specification No (WG-NAS/KJ)

Structured cabling, to provide connections to switch/ server from desktop computers/
Wireless devices in the patch panel.

Material:

Keystone jack:

High impact plastic body FR grade with high performance unshielded RJ-45 keystone jack (conforming to EIA/TIA 568-B.2-1 Cat 6) , 20milli ohms contact resistance, gold over nickel spring contact ,1.5A current carrying capacity, with T568A/T568B wiring option, insulation displacement connector for cable crimping to accept 22- 26AWG solid wire for connections up to Gigabit Ethernet

Method of construction:

The keystone jack shall be fixed with the help of its self-locking arrangement in provided patch panel before making due connection as per EIA/TIA 568 B.2-1 by splicing UTP cable, untwisted up to 12mm & punching the 4 pairs in the keystone jack with the help of punching tool. Not a single wire shall be left without connections.

Mode of Measurement: Executed quantity shall be counted on number basis.

D) Patch Panel (PP)

Scope:

Specification No (WG-NAS/PP)

Structured cabling for the installation of keystone jacks.

Material:

Patch Panel:

Three piece structure including front panel, cable management plate with pre-fitted B-clip to help in routing cables & metal case of 1.6mm thick Mild Steel powder coated panel of size 442.6mm X 44.5mm with the provision for 1 to 24 high density keystonejacks

1. 24 and 48 port patch panels with 110 IDC connector terminations on rear
2. The patch shall have electrical performance guaranteed to meet or exceed TIA/EIA 568-B.2-1 Category 6 and ISO/IEC Category 6/Class E specifications.
3. The panel shall have vertical and horizontal cord organizers available as to improvepatch cord management.

4. The panel shall be available in 24-port and 48-port configurations with universal A/B labeling and 110 connector terminations on rear of panel allowing for quick and easy installation of 22 to 24 AWG cable.
5. The patch panel shall have a black powder finish over high-strength steel.
6. The panel shall be equipped with a removable rear mounted cable management bar and front and rear labels.
7. The panel shall be UL listed, UL-C certified and ACA approved.
8. The panel shall support network line speeds in excess of 1 gigabit per second and be backward compatible with Category 5e, 5 and 3 cords and cables.
9. The Category 6 modular jack panels shall meet or exceed the Category 6/Class E standards requirements in ISO/IEC 11801, CENLEC EN 50173 and TIA/EIA and shall be UL Listed.
10. The panels shall be either wall or 19-inch rack mountable.
11. The panels shall meet the following specifications:

Performance Specifications:		High Performance Solution	Premium Performance Solution
Category 6 Patch Panel			
		Category 6 Channel	
	Typical Worst Pair Margin*	Guaranteed Margin**	Guaranteed Margin**
Insertion Loss	64.3%	5.0%	7.5%
NEXT	6.6 dB	6.0 dB	7.0 dB
PSNEXT	7.3 dB	7.5 dB	8.5 dB
ELFEXT	6.4 dB	6.0 dB	8.0 dB
PSELFEXT	6.1 dB	8.0 dB	10.0 dB
Return Loss	6.6 dB	4.0 dB	4.0 dB
Frequency Range	1-250 MHz	1-250 MHz	1-250 MHz

Operational Specifications:	
Operating Temperature Range:	14°F to 140°F (-10°C to 60°C) Storage
Temperature Range:	-40°F to 158°F (-40°C to 70°C)
Humidity:	95% (non-condensing)
Nominal Solid Conductor Diameter:	0.025 to 0.020 in (0.64 to 0.51 mm) (22 to 24 AWG)
Nominal Stranded Conductor Diameter:	0.025 to 0.020 in (0.64 to 0.51 mm) (22 to 24 AWG)
Insulation Size:	0.042 in (1.08 mm) (22 to 24 AWG) Maximum DOD
Insulation Types:	All plastic insulates (including PVC, irradiated PVC, Polyethylene, Polypropylene, PTF Polyurethane, Nylon, and FEP)
Insertion Life:	750 minimum insertions of an FCC 8-Position Telecommunications Plug
Front Panel:	Black powder painted steel.
Plastic:	High-impact, flame retardant, UL-rated 94V-0 thermoplastic

Hardware:
Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction

The Patch Panel shall be firmly secured in U Rack (Networking Cabinet) with 4 nos. of chromium plated brass nuts & bolts.

Mode of Measurement: Executed quantity shall be counted on number basis.

E) Lightguide Interconnect Unit

(LIU)General:

All material shall conform to relevant standard as per IEEE, EIA/TIA, CENELEC

Scope:

Specification No (WG-NAS/LIU)

To terminate the fibre backbone cables & the equipment cables.

Material:

Lightguide Interconnect Unit:

Wall mount type Lightguide Interconnect Unit with dimensions shown in the table, an interfacing unit for fibre cables coming in from field & those originating from the equipments. consisting of fibre spools to provide minimum bending radius & splice trays as splice cover for pigtail splicing, two compartment design with adaptor panel in the centre, compartmentalizing the box, complete aluminium housing, fully powder coated, two doors enclosure with lock & key, rubber grommets at the cable entry points for tightsealing; Splice trays of 140 x125 x 10mm complete aluminium body fully powder coated with provision for fibre splices fully cushioned splice holder containing grooves for fixing splice protective sleeves; FR grade high impact resistance plastic two halves design stackable sufficient room for excess cable.

Sr. No.	Ports	Dimensions	Fibre splices
1	12	300 x 300 x 80mm	6
2	24	370 x 350 x 80mm	12

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, etc.

Method of Construction:

Supplying & erecting Lightguide Interconnect Unit (LIU) on wall with cable termination complete with sheet metal screws of required size, plugs/ wooden gitties.

Mode of Measurement: Executed quantity shall be counted on number basis.

Fibre Accessories

F) ST "D" type Multimode Adaptor (MMA)

General:

All material shall conform to relevant standard as per IEEE, EIA/TIA 568-B.3

<u><i>Scope:</i></u>

Specification No **(WG-NAS/MMA)**

To couple two connectors together i.e. to provide optical connectivity between fibre cable & fibre switch/ fibre module.

Material:

ST "D" type multimode adaptor consists of Die cast zinc alloy housing Nickel plated, thread type mounting, washer, nut, 2 nos. of rubber plugs, high precision mechanical design Zirconium/ Phosphor Bronze sleeve having insertion loss < 0.3dB max, return loss < -40dB.

Method of Construction:

Supplying & fixing ST " D" type with threads in provided Lightguide Interconnect Uniton adaptor panel with nut & washer. The adaptor which is not in use shall be plugged with rubber plugs on both the sides to avoid dust accumulation in the adaptor.

Mode of Measurement: Executed quantity shall be counted on number basis.

G) ST "D" type Multimode Connector for LIU (MMA-LIU1)General

All material shall conform to relevant standard as per IEEE, EIA/TIA 568-B.3

Scope:

Specification No (WG-NAS/MMA-LIU1)

To terminate the optical fibre cables in Lightguide Interconnect Unit (LIU)

Material:

1. **ST "D" type Multimode connector** consists of bayonet coupling, 2.5mm Zirconium Ferrule, wide range of Ferrule selection, pre-radiused ferrule to provide fast physical contact polishing, insertion loss < 0.5dB.
2. Distilled water (as lubricant & flushing agent between each polishing process).
3. Epoxy or Anaerobic adhesive (to bond the fibre inside the ferrule).

Tools to be used:

- Carbide cleaving tool with 30 deg tip (to cut off the fibre to the desired height above the ferrule)
- Portable Microscope (200X minimum)
- Polishing kit (includes a polishing puck, pads & an assortment of diamond, aluminium oxide & silica films)

Method of Construction:

The fibre shall be stripped & cleaved. Epoxy and polish connectors field-installed to terminate backbone and distribution cables. Epoxy and polish fibre termination include the following steps: injecting the connector ferrule with epoxy, curing, scribing the protruding fibre(s) from the ferrule, and polishing the ferrule end-face. The correct amount of epoxy must be injected into the ferrule and cured for the specified time and temperature before the ferrule end-face is scribed and polished. Air bubbles shall be avoided in the epoxy to avoid micro-bending and increased loss. The cured epoxy securely bonds the fibre to the ferrule over the operating temperature minimizing relative fibre movement. The connectors with fibre cable shall be tested for loss test with Optical Time Domain Reflectometer (OTDR) & recording the results.

Mode of Measurement: Executed quantity shall be counted on number basis.

H) No Epoxy No polish ST "D" type Multimode Connector (MMA-

LIU2)Scope:

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Specification No **(WG-NAS/MMA-LIU2)**

To terminate the optical fibre cables in Lightguide Interconnect Unit (LIU)

Material:

ST "D" type Multimode connector with Factory pre-polished fibre stub end face consists of bayonet coupling, 2.5mm Zirconium Ferrule, insertion loss < 0.5dB

Tools to be used:

Carbide cleaving tool with 30 deg tip (to cut off the fibre to the desired height above the ferrule)

Method of Construction:

The no Epoxy no polish connectors field-installed to terminate backbone and distribution cables. The fibre shall be striped, cleaved, inserted into the connector & mechanically secured. The connectors with fibre cable shall be tested for loss test with Optical Time Domain Reflectometer (OTDR) & recording the results.

Mode of Measurement: Executed quantity shall be counted on number basis.

I) Power over Ethernet Adaptor (PoEA)

General:

All material shall conform to relevant standard as per IEEE, TIA/EIA.

Scope:

Specification No (WG-NAS/PoEA)

To provide DC power supply to Ethernet devices, which do not have external/ built-in power supply.

Material:

Power over Ethernet Adaptor with output voltage of 5V DC or 12V DC (selectable) with input of 48V DC consists of Power over Ethernet base unit, Power over terminal unit, AC to DC power adaptor, DC power cable & Ethernet cable.

Method of Construction:

Supplying & connecting Power over Ethernet Adaptor with all its connections of base unit, terminal unit & AC to DC power adaptor for supplying power to Access Point, Router or Wireless Ethernet Transceiver complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

J) Tri-Mode Dual band Wireless PCI LAN Card (LANC1)

General:

All material shall conform to relevant standard as per IEEE 802.11 xs.

Scope:

Specification No (WG-NAS/LANC1)

Making provision of Wireless LAN connectivity for desktop PCs in difficult places where signal strength is low.

Material:

Wireless PCI 32 bit interface LAN card covering 100 metres (indoor) transmission speed of 108Mbps to connect 802.11b, 802.11g & 802.11a networks operating in two non-interfering bands 2.4 GHz & 5GHz with 4dBi to 5dBi gain Omni directional dipole antenna & driver.

Method of Construction:

Supplying & fixing Tri-mode dual band wireless PCI LAN card in desktop computer with installation of driver & configuration for TCP/IP address complete.

- K) **Mode of Measurement:** Executed quantity shall be counted on number basis.
Wireless PC LAN Card (LANC2)

General:

All material shall conform to relevant standard as per IEEE 802.11g.

Scope:

Specification No (WG-NAS/LANC2)

Making provision of Wireless LAN connectivity for desktop PCs.

Material:

Wireless PCI 32 bit interface LAN card to connect 802.11g networks operating in 2.4 GHz band covering 100 metres range (indoor), transmission speed of 54Mbps with external dipole antenna, detachable reverse SMA connector & driver.

Method of Construction:

Supplying & fixing Wireless PCI LAN card in desktop computer with installation of driver & configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

- L) **Manageable Wireless LAN Access Point** (LAP1)

General:

All material shall conform to relevant standard as per IEEE 802.11b/g & IEEE 802.3/u

Scope:

Specification No (WG-NAS/LAP1)

To provide wireless access to the WLAN network.

Material:

Wireless Access Point consists of 108Mbps turbo mode handling heavy data payloads, 2dBi gain detachable dipole antenna with reverse SMA connector, external AC to DC 5V adaptor.

Method of Construction:

Supplying & connecting Wireless Access Point with AC to DC adaptor to Ethernet switch with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

- M) **High Performance Manageable Wireless LAN Access Point with PoE (Power over Ethernet)** (LAP2)

General:

All material shall conform to relevant standard as per IEEE 802.11b/g, IEEE 802.3/u

& IEEE 802.3af

Scope:

Specification No **(WG-NAS/LAP2)**

To provide high performance wireless access to the WLAN network.

Material:

Wireless Access Point consists of 108Mbps turbo mode handling heavy data payloads, dual 5dBi gain detachable dipole antenna with reverse SMA connectors, Power over Ethernet 10/100 Base-Tx port.

Note: To connect the Access Point, availability of PoE Ethernet Switch or PoEadaptor is essential.

Method of Construction:

Supplying & connecting Wireless Access Point to PoE Ethernet switch or Ethernet Switch through PoE Adaptor with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

N) Dual Band High Performance Manageable Wireless LAN Access Point with PoE(Power over Ethernet) (LAN3)

Scope:

Specification No

(WG-NAS/LAP3)

To provide high performance wireless access to the WLAN network.

Material:

Wireless Access Point consists of 108Mbps turbo mode handling heavy data payloads operating in 2.4 GHz & 5 GHz bands, dual 5dBi gain detachable dipole antenna with reverse SMA connectors, Power over Ethernet 10/100 Base-Tx port.

Note: To connect the Access Point, availability of PoE Ethernet Switch or PoEadaptor is essential.

Method of Construction:

Supplying & connecting Wireless Access Point to PoE Ethernet switch or EthernetSwitch through PoE Adaptor with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

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Chapter 2

FITTINGS

2.1	Lamps	FG-LP
2.2	Indoor fittings	FG-IF
2.3	Outdoor fittings	FG-OF
2.4	Accessories for fittings	FG-AS
2.5	Brackets for Outdoor fittings	FG/BKT
2.6	Fans	FG-FN
2.7	Accessories for Fans	No Specs
2.8	Drawings	

2.1 Lamps (FG-LP)**A) GLS/MF Lamps (GLS)****Specification No (FG-LP/GLS)****Scope:**

Supplying and fixing of GLS/MF lamps suitable for 230 volts, and of specified wattage, conforming to IS: 418-1978. The lamp shall meet with the requirements mentioned in Table No. 2.1/1

Material:

Lamp: Made of blown molten glass, and shall comply with IS: 418-1978.

Filament: Made from Tungsten.

Cap: Made from high grade Aluminium sheet either Bi pin/Edison screwed.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e each)

Table No. 2.1/1 Lamp**Data for GLS lamps**

Watts (W)	Filling	Filament	Finish	Luminous flux (lm) at 230 V
25	Vacuum	Single Coil	Clear	220
40				425
60				700
100	Gas filled	Coiled coil		1380
150				2080
200				2920
300				4700
500				8300
1000				18600
1500				29500

B) Fluorescent tubes (FT)**Specification No****(FG-LP/FT)****Scope:**

Supplying and fixing of fluorescent tube suitable for 230 volts, and of specified wattage, conforming to IS: 2418 (Part 1 to 4) - 1977. The lamp shall meet with the requirements mentioned in Table No. 2.1/2

Material:

Lamp: Based on Tri-phosphor fluorescent powder, with triple coil electrode & anode ring.

Cap: Bipin cap made from high grade Aluminium sheet.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/2

Lamp Data for Fluorescent tubes

Lamp Type	Colour Rendering Index	Colour Temp. (°K)	Lamp watt (W)	Lamp volt (V)	Operating lamp current (A)	Nominal luminous flux (lm)	Life (hrs)
Tri-band phosphor 36 W	82 %	6500	36	103	0.44	3250	15000
	84 %	4000	36	103	0.44	3250	15000
	86 %	2700	36	103	0.44	3250	15000
24 W	85 %	3000	24	-	-	1350	-
	85 %	3400	24	-	-	1350	-
Normal 18 W	54 %	6500	18	58	0.37	1015	-
Normal 36 W	54 %	6500	36	103	0.44	2450	-

C) High Pressure Mercury Vapour Lamps

(MV)Specification No (FG-LP/MV)

Scope:

Supplying and fixing of High pressure Mercury vapour lamps suitable for 230 volts, and of specified wattage, conforming to IS: 9900 (Part 1 to 4) - 1981. The lamp shall meet with therequirements mentioned in Table No. 2.1/3

Material:

Lamp: Hard glass lamp made from high pressure mercury vapour with quartz dischargetube in an ovoid shaped, internally phosphor coated outer shell, with average colour temperature 3800 °K

Cap: 3 Pin BC/Screwed cap made from high grade Aluminium sheet.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/3

Lamp Data for High Pressure Mercury Vapour lamps

Lamp Type	Colour Temp. (°K)	Lamp watt (W)	Lamp volt (V)	Operating lamp current (A)	Nominal luminous flux (lm)	Starting Time (min.)
HPL-N	3800	80	115	0.80	3500	3.5
HPL-N	3800	125	125	1.15	6250	3.5
HPL-N	3800	250	135	2.0	13500	4.0
HPL-N	3800	400	140	3.2	23000	4.0

D) ML Blended Lamp/Self Ballasted Lamp

(MLL)Specification No (FG-LP/MLL)

Scope:

Supplying and fixing of ML Blended lamps suitable for 230 volts, and of specified wattage, conforming to IS: 9900 (Part 1 to 4) - 1981. The lamp shall meet with the requirements mentioned in Table No. 2.1/4

Material:

Lamp: Hard glass lamp made from high pressure mercury vapour self ballasted with quartz discharge tube in an ovoid shaped, with average colour temperature 3600 °K

Cap: 3 Pin BC cap made from high grade Aluminium sheet.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/4

Lamp Data for High Pressure Mercury Vapour lamps

Lamp Type	Colour Temp. (°K)	Lamp watt (W)	Min. mains Voltage (V)	Lamp current (A)	Nominal luminous flux (lm)	Average life (hrs)
MLL	3600	160	190	0.72	2900	5000

E) High Pressure Sodium Vapour Lamps (SV)

Specification No (FG-LP/SV)

Scope:

Supplying and fixing of High pressure Sodium vapour lamps suitable for 230 volts, and of specified wattage, conforming to IS: 9974 (Part 1 & 2) - 1981. The lamp shall meet with therequirements mentioned in Table No. 2.1/5

Material:

Lamp: High pressure sodium vapour lamps with a polycrystalline translucent Aluminium discharge tube enclosed in an ovoid or tubular outer glass envelope. The ovoid shell shallhave internally coated with uniform layer of diffusing powder applied electro statically. Thedischarge tube shall contain an amalgam of mercury and sodium along with Xenon gas asstarting aid.
Cap: Screwed cap made from high grade Aluminium sheet.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/5

Lamp Data for High Pressure Sodium Vapour lamps

Lamp Type	Lamp watt (W)	Average Lamp volt (V)	Average lamp current (A)	Nominal luminous flux (lm)
SON	70	90	1.0	5800
SON	150	100	1.8	13500
SON-T	150	100	1.8	14000
SON	250	100	3.0	25000
SON-T	250	100	3.0	27000
SON	400	105	4.4	47000
SON-T	400	105	4.4	47500

F) Metal Halide Lamps (MHL)

Specification No (FG-

LP/MHL)Scope:

Supplying and fixing of Metal Halide lamps single/Double ended, suitable for 230 volts, andof specified wattage. The lamp shall meet with the requirements mentioned in Table No. 2.1/6

Material:

Lamp: High pressure metal halide gas discharged lamps with iodide additives indium, thallium and sodium in the mercury discharge. The discharge tube shall be enclosed in an

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ovoid, hard glass outer bulb with fluorescent coating (HPI-BU) or clear tubular outer hardglass envelope, (HPI-T).

- Colour Temperature : HPI-BU -> 4300 °K
- : HPI-T -> 4300 °K to 4900 °K

Cap: Pin type/Screwed cap made from high grade Aluminium sheet.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/6

Lamp Data for Metal Halide lamps

Lamp Type	Lamp watt (W)	Minimum Voltage for Ignition (V)	Average lamp voltage after 100 burning hours (V)	Average lamp current after 100 burning hours (A)	Lamp starting current (A)	CRI (Ra)	Average luminous flux after 100 burning hours (lm)
HPI-BU	250	200	128	2.2	3.2	69	17000
HPI-BU	400	200	125	3.4	6.0	69	30600
HPI-T	70	200	90	1.0	1.4	80	5500
HPI-T	150	200	98	1.8	2.4	85	12100
HPI-T	250	200	128	2.2	3.9	65	17000
HPI-T	400	200	125	3.4	6.0	65	30500

G) Compact Fluorescent Lamps (CFL)

Specification No (FG-LP/CFL)

Scope:

Supplying and fixing of Compact Fluorescent lamps either with adapter (Retrofit – Instant Start type) or without (Pin type-PL tube to be used with ballast), suitable for 230 volts, and of specified wattage. The lamp shall have life of 10000 burning hours and shall meet with the requirements mentioned in Table No. 2.1/7. All lamps shall have pf above 0.9.

Material:

Lamp: Based on fluorescent powder, with electrode.

Cap: Pin type/Screwed cap made from high grade Aluminium sheet.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/7

Lamp Data for Compact Fluorescent lamps

Mounting type	Lamp watt (W)	Colour Temp. (°K)	Luminous flux (lm)	Efficacy (lm/W)	Average life in (hrs)
Retrofit	13	5000	575	44	10000
Retrofit	13	6000	575	44	10000
Retrofit	13	2700	550	42	10000
Retrofit	18	5000	850	47	10000
Retrofit	18	6000	850	47	10000
Retrofit	18	2700	800	45	10000
Retrofit	25	5000	1100	44	10000
Retrofit	25	6000	1100	44	10000
Retrofit	25	2700	1050	42	10000
PL	9	2700	400	44	10000
PL	11	2700	600	55	10000
PL	15	2700	900	60	10000
PL	15	5000	800	53	10000
PL	20	2700	1200	60	10000
PL	20	5000	1100	55	10000
PL	23	2700	1500	65	10000
PL	23	5000	1350	59	10000
PL	5	2700	250	50	8000
PL	5	4000	250	50	8000
PL	7	2700	400	57	8000
PL	7	4000	400	57	8000
PL	11	4000	900	91	8000

2.2 Indoor fittings (FG/IDF)A) Bulkhead FittingScope:Specification No

(FG-IDF/BHF)

Supplying and erecting bulkhead fitting with fine finished cast Aluminium enamel painted body with 20 mm conduit entry and clear glass / prismatic glass with guard and complete water tight hinged with locking screw porcelain holder to house CFL up to 5/9/11 Watt erected in position on polished double wooden block.

Material:Bulkhead fitting:

Bulk Head Fitting shall be made from pressure die-cast aluminium LM6 body in stove enamel finish and fitted with a heat resistant elegant glass cover through a gasket. A two pin BC porcelain holder for GLS or a CFL holder shall be fitted inside the housing. An electro-galvanized MS wire guard for protection against pilferage. Glass and wire guard assembly shall be hinged to the body for ease of maintenance. The bulkhead shall be suitable for Integral type CFL, with cable entry through one no. 3/4" B.S. threaded inlet. Incoming wires shall be terminated on the lamp holder terminals in case of GLS and in the terminal block in case of CFL. Two lugs with slots for facilitating wall/ceiling mounting. The fitting shall be I.P. 54 protected.

Wooden board: As per (WG-PW/PW) 1.6 specified in chapter for Point wiring.

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Method of Construction:

The Bulkhead shall be mounted on polished double wooden block with required size of SM screws, duly wired.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

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B) Mirror Light Fitting Suitable for CFL 9/13/18 watts (ML1)

Scope:

Specification No (FG-IDF/ML1)

Supplying and erecting luminaries suitable for 9/13/18 watt CFL lamp made of engineering Plastic in approved colour finish and an elegantly designed milky white acrylic front diffuser, and bright anodized Aluminium reflector, with VPIT ballast, lamp holder, and connector.

Material:

Fitting:

The Luminaries Comprises housing made of engineering plastic in approved colour finish and an elegantly designed milky white acrylic front diffuser enclosing a bright anodized Aluminium reflector. Pre-wired with vacuum pressure impregnated copper ballast, lamp holder and mains connector with two holes on rear side facilitates wall/ceiling mountings, the grommet should be provided at rear side.

Wooden board: As per 1.6 specified in chapter for Point wiring. (WG-PW/PW)

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Connection Wire: Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Method of Construction:

The fitting shall be mounted on polished Wooden / Laminated 4mm plywood top / block by required size of screws with necessary flexible wire for connection.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

C) Mirror Light Fitting Suitable for CFL 9 watts (ML2)

Scope:

Specification No (FG-IDF/ML2)

Supplying and erecting Mirror light fitting with 1 x 9 Watts CFL, with necessary Choke & accessories complete erected on polished wooden / sunmica block.

Material:

Fitting:

Channel fabricated from CRCA MS sheet and finished in reflector white inside and outside. Pre-wired with vacuum pressure impregnated copper ballast, lamp holder and mains connector, and an aesthetically appealing serrated / reeded opal diffuser held in position by decorative end covers white (W) / deep blue (B) / orange (O) / H.C.grey (G), post office red (R)/ Black (BK) or approved colour, 12mm dia grommet. Two

6.5 mm dia holes on the rear side of the channel to facilitate wall / ceiling mounting.

Wooden board: As per 1.6 specified in chapter for Point wiring. (WG-PW/PW)

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc. **Connection wire:**

Two core flexible stranded copper wire cord 24/0.2mm ISI marked. **Terminal connector:** As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The fitting shall be mounted on polished Wooden / Laminated 4mm plywood top / block by required size of screws with necessary flexible wire for connection.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

D) Mirror Optic Recessed down Lighter suitable for 2 x 18 watts CFL (DL1)

Scope:

Specification No (FG-IDF/DL1)

Supplying and erecting circular type recessed down lighter suitable for 2x18 watts CFL, including gear box. The luminaire comprises a ceiling ring spun from Aluminium attached to mounting unit made of mild steel. The mounting unit has a pair of sliding brackets for fixing the luminaire to the ceiling.

Material:**Fitting:**

Scientifically designed highly polished & anodized Aluminum reflector ensures precise light control with optimum light utilization, leading to substantial savings in energy cost and excellent ambient conditions. Reflector is fitted into the frame with decorative screw

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arrangement. Frame is fabricated from CRCA MS sheet and epoxy powder coated white. Precoated frame ensure corrosion free life. Fitting shall have a prismatic acrylic diffuser resting on upper part of reflector to reduce glare. Retaining clips facilitate mounting in false ceilings.

Ballast: As per (FG-FG/AS1) specified in chapter 2.4.

Bi-pin lamp holder: Conforming to IS: 3323/80 with amendment No.1 to the extent possible /applicable.

Capacitor / Condenser: As per (FG-FG/AS7) specified in chapter 2.4.

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mmISI marked.

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The fitting shall be fixed firmly in the designated place (False ceiling / unspecified ceiling) with the help of swinging bracket, and making the connection.

In case where fittings are to be installed flush with /on false ceiling; layout shall be given to civil wing and work shall be done in co-ordination with civil wing e.g. making recesses in false ceiling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

E) Mirror Optic CFL fitting

(MOF)

Scope:

Specification No (FG-IDF/MOF)

Supplying & erecting recessed / surface down lighter with mirror optics suitable for specified wattage of CFL.

Material: **Fitting:**

Housing fabricated from CRCA sheet, epoxy powder coated, white enamelled, with mirror assembly comprising of significantly designed high purity aluminium reflector for high optical performance back wing light and with improved vertical illumination. **Ballast:** As per (FG-FG/AS1) specified in chapter 2.4.

Bi-pin lamp holder: Conforming to IS: 3323/80 with amendment No.1 to the extent possible /applicable.

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mmISI marked.

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Chain: Heavy duty lacquered MS chain with hooks.

Block: As per 1.6 specified in chapter for Point wiring. (WG-PW/PW)

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

Mirror optic fitting suitable for specified wattage of CFL complete erected on wooden block/PVC block /on ceiling directly in case of surface mounting fitting, as directed by site engineer, with necessary screws of suitable size, with rawl plugs, gutties, etc. In case of recesses mounting, the fitting shall be secured and erected by fixing the hook at ceiling, and the chain shall be fixed to the fitting, in such a manner that the fitting shall be in level with the designated place (false / unspecified ceiling)

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

F) Box type Fluorescent fitting

(BFF)

Scope:

Specification No (FG-IDF/BFF)

Supplying & erecting white stove enamelled / powder coated box type fluorescent fitting suitable for T 8 tube/ tubes, with specified ballast, and necessary accessories, duly

wired up for use on 250 V AC, supply and ²²⁹erected if required on varnished wooden / PVC block with flexible wire, twin core 24/0.20 mm. and with necessary materials complete and marking Sr. No. and date of erection.

Material:

Fitting:

White stove enameled / powder coated box type fluorescent fitting suitable for T 8 tube, made of CRCA sheet not less than 0.5 mm thick, painted white on the reflector side and gray/any other colour (specified by the Engineer in-charge) on other surface. Wire ways shall be smooth & free from sharp edges, burrs, flashes & like which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wire ways. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.IDF-1 (Fig.1))

Ballast: As per (FG-FG/AS2) / (FG-FG/AS3) / (FG-FG/AS4) specified in chapter 2.4.

Tube holders: As per (FG-FG/AS8) specified in chapter 2.4

Starter: As per (FG-FG/AS11) specified in chapter 2.4 **Condenser:**

As per (FG-FG/AS7) specified in chapter 2.4 **Starter holder:** As

per (FG-FG/AS9) specified in chapter 2.4

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Paint: Superior quality enamel paint of specified colour.

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Chain: Heavy duty lacquered MS chain with hooks.

Down Rod: Steel conduit as per (WG-MA/CON) specified in chapter for Point wiring.

Block: As per 1.6 specified in chapter for Point wiring. (WG-PW/PW)

Method of Construction:

The complete fitting with all the above accessories shall be fixed on wooden / PVC block with SM screws (minimum size shall be 25x8 mm). The wooden/PVC block shall be fixed on wall/ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. S. No and date of erection shall be painted/marked by enamel paint. The fitting shall be connected with PVC insulated copper wire leads, to the point and testing shall be carried out.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

G) Chalk Board type Fluorescent fitting

(CBF)

Scope:

Specification No (FG-IDF/CBF)

Supplying & erecting white stove enameled / powder coated Chalk board type fluorescent fitting with enameled reflector of 0.8 mm thick, white on the reflector side and gray on other surface suitable for T 8 tube/ tubes, with specified ballast, and necessary accessories, duly wired up for use on 250 V AC, supply including material required for erection and erecting as per requirement complete and marking Sr. No. and date of erection.

Material:

Fitting:

White stove enameled / powder coated Chalk board type fluorescent fitting suitable for T 8 tube, made of CRCA sheet not less than 0.5 mm thick, with enameled reflector of 0.8 mm thick, painted white on the reflector side and gray on other surface. Wire ways shall be smooth & free from sharp edges, burrs, flashes & like which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wire ways. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.IDF-1 (Fig.2))

Ballast: As per (FG-FG/AS2) / (FG-FG/AS3) / (FG-FG/AS4) specified in chapter 2.4.

Tube holders: As per (FG-FG/AS8) specified in chapter 2.4

Starter: As per (FG-FG/AS11) specified in chapter 2.4 **Condenser:**

As per (FG-FG/AS7) specified in chapter 2.4 **Starter holder:** As

per (FG-FG/AS9) specified in chapter 2.4

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Paint: Superior quality enamel paint of specified colour.

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Block/ Board: As per 1.6 specified in chapter for Point wiring. (WG-PW/PW)

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Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be fixed on wooden / PVC block with SM screws (minimum size shall be 25x8 mm). The wooden/PVC block shall be fixed on wall/ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. S. No and date of erection shall be marked/painted by enamel paint. The fitting shall be connected PVC copper wire leads, to the point and testing shall be carried out.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

H) Industrial type Fluorescent fitting

(INF) Scope:

Specification No (FG-IDF/INF)

Supplying & erecting white stove enameled / powder coated Industrial type fluorescent fitting with enameled reflector of 0.8 mm thick, white on the reflector side and gray on other surface suitable for T 8 tube/ tubes, with specified ballast, and necessary accessories, duly wired up for use on 250 V AC, supply including material required for erection and erecting as per requirement complete and marking Sr. No. and date of erection.

Material:

Fitting:

White stove enameled / powder coated Industrial type fluorescent fitting suitable for T-8 tube, made of CRCA sheet not less than 0.5 mm thick, with enameled reflector of 0.8 mm thick, painted white on the reflector side and gray on other surface. Wire ways shall be smooth & free from sharp edges, burrs, flashes & like which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wire ways. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.IDF-1 (Fig.3))

Ballast: As per (FG-FG/AS2) / (FG-FG/AS3) / (FG-FG/AS4) specified in chapter 2.4.

Tube holders: As per (FG-FG/AS8) specified in chapter 2.4

Starter: As per (FG-FG/AS11) specified in chapter 2.4 **Condenser:**

As per (FG-FG/AS7) specified in chapter 2.4 **Starter holder:** As per (FG-FG/AS9) specified in chapter 2.4

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Paint: Superior quality enamel paint of specified colour for marking. **Hardware:**

Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc. **Block:** As per 1.6 specified in chapter for Point wiring. (WG-PW/PW) **Terminal connector:** As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories duly wired up shall be fixed on block with SM screws (minimum size shall be 25x8 mm). The block shall be fixed on wall/ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. The fitting if, to be ceiling suspended, it shall be fixed to the provided 16 SWG 20 mm dia., HG conduit duly threaded in ball suspension plate. The provided ball suspension plate shall be fixed on block with SM screws (minimum size shall be 25x8 mm) and the block shall be fixed at ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. S. No and date of erection shall be marked/painted by enamel paint. The fitting shall be connected with PVC insulated copper wire leads, to the point and testing shall be carried out.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

I) Recess /Surface mounting Mirror Optic Fluorescent Fitting (MOP)

Scope:

Specification No (FG-IDF/MOP)

Supplying & erecting white stove enameled / powder coated Mirror Optic type fluorescent fitting with enameled reflector of 0.8 mm thick, white on the reflector side and gray on other

surface suitable for T 8 tube/ tubes, with specified ballast, and necessary accessories, duly wired up for use on 250 V AC, supply including material required for erection and erecting as per requirement complete and marking Sr. No. and date of erection.

Material:

Fitting:

White stove enameled / powder coated recess /surface mounting mirror optic type fluorescent fitting suitable for T 8 tube, made of CRCA sheet not less than 0.5 mm thick, painted white on the reflector side and gray on other surface, and with Mirror assembly comprising of significantly designed high purity aluminium reflector for high optical performance. Wire ways shall be smooth & free from sharp edges, burrs, flashes & like which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wire ways. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.IDF-2 (Fig.4 & Fig.5))

Ballast: As per (FG-FG/AS2) / (FG-FG/AS3) / (FG-FG/AS4) specified in chapter 2.4.

Tube holders: As per (FG-FG/AS8) specified in chapter 2.4

Starter: As per (FG-FG/AS11) specified in chapter 2.4

Condenser: As per (FG-FG/AS7) specified in chapter 2.4 **Starter**

holder: As per (FG-FG/AS9) specified in chapter 2.4

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISImarked.

Paint: Superior quality enamel paint of specified colour.

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Chain: Heavy duty lacquered MS chain with hooks.

Down Rod: As per (WG-MA/CON) specified in chapter for Point wiring.

Block: As per 1.6 specified in chapter for Point wiring. (WG-PW/PW)

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be fixed on wooden / PVC block / on provided chain / down rod with ball suspension plate with SM screws (minimum size shall be 25x8 mm). The wooden/PVC block shall be fixed on wall/ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. The fitting if, to be ceiling suspended, it shall be fixed to the provided 16 SWG 20 mm dia., HG conduit duly threaded in ball suspension plate. The provided ball suspension plate shall be fixed in wooden /PVC block with SM screws (minimum size shall be 25x8 mm).The wooden/PVC block shall be fixed at ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. In case of recesses mounting, the fitting shall be secured and erected by fixing the hook at ceiling, and the chain shall be fixed to the fitting, in such a manner that the fitting shall be in level with the false / unspecified ceiling. Sr. No and date of erection shall be marked or painted by enamel paint. The fitting shall be connected PVC copper wire leads, to the point and testing shall be carried out.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

2.3 Outdoor fittings

(FG/ODF)

A) Street Light fitting suitable for CFL

(CSL)

Scope:

Specification No

(FG-ODF/CSL)

Supplying & erecting Street Light suitable for specified wattage of CFL complete with serrated acrylic diffuser & gasket, with necessary control gear and erected on provided bracket.

Material:

Fitting:

The fitting canopy shall be made of deep drawn of CRCA Sheet, powder coated / epoxy powder coated CRCA sheet housing with epoxy white powder coated CRCA sheet steel gray tray covered with anodized Aluminium reflector wired with a provision for housing open construction ballast required for specified wattage of CFL with clear acrylic cover with rubber gasket fixed by 4 Nos. toggles of suitable OD entry for direct mounting pipe bracket. Fitting shall be with degree of

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protection IP 54 electrical Safety Class-I. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.ODF-1 (Fig.1 & Fig.2)

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Ballast: As per (FG-FG/AS1) specified in chapter 2.4.
Bi-pin lamp holder: Conforming to IS: 3323/80 with amendment No.1 to the extent possible /applicable.
Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.
Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Street Light fitting suitable for HPMV/HPSV/MH Lamps (GSL)

Scope:

Specification No (FG-ODF/GSL)

Supplying & erecting Street Light fitting suitable for specified wattage of HPSV/HPMV/MH lamps, with all accessories, erected with provided bracket on wall/street light pole or at any place as directed by Site engineer with necessary materials.

Material:

Fitting:

The fitting comprises deep drawn one piece Aluminium body. Lamp compartment has stove enamel white finish from inside & gray finish from outside. nickel chrome plated reflector / Aluminium reflector is mounted inside the lamp compartment for high optical efficiency control gear compartment houses a detachable gear tray & is wired with provided copper wound ballast, power factor improvement capacitor, electronic ignitor & with mains connector. The cable entry is through mounting pipe & terminated on mains connector inside the control gear housing with felt gasket which ensures weather proofness & also prevents entry of insects inside the housing. The fittings lamp compartment shall have IP

43 protection & IP 23 protection for control gear compartment. The fitting shall be ISI marked to IS: 10322 part -5: 1987 with Amendment No.1&2 and comply with requirements of IS: 10322: part-5/Sec-1:1985 with Amendment No.1&2 IS: 13383: part 2: 1992 with Amendment No.1. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.ODF-2 (Fig.3))

Ballast: As per (FG-FG/AS5) specified in chapter 2.4 **Ignitor:**

As per (FG-FG/AS6) specified in chapter 2.4 **Condenser:** As

per (FG-FG/AS7) specified in chapter 2.4

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

C) Street Light fitting suitable for T 8 Fluorescent tubes (FSL1)

Scope:

Specification No (FG-ODF/FSL1)

Supplying & erecting Street Light suitable for specified wattage complete with serrated acrylic diffuser & gasket, with necessary control gear and erected on provided bracket.

Material:

Fitting:

ISI marked Fluorescent Street light fittings complete with electronic ballast, transparent cover made out of 3mm thick acrylic sheet, gear cum reflector tray, canopy and lamp holder duly wired for use on 240 volt AC single phase 50 Hz without fluorescent lamp. Canopy shall be made of Aluminium

sheet 1.25 mm thick minimum. Gear cum reflector²³⁵ tray (GCRT) shall be made of either CRCA sheet of 0.8 mm thick or Aluminium sheet of 1.25 mm thick.

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- Fitting shall be suitable for mounting up to a height of 15 meters and shall be able to withstand wind load test. It shall conform to class-1 of IS: 10322 (part 5/sec 3)/87 with amendment 1 and IP-53 protection with photometric test requirement with luminous efficiency not less than 65%.
- i) Various components of fittings shall conform to IS specification as noted below.
 - a) Electronic ballast (EB) to IS: 13021: Part-1:1991 with Amendment No.1, IS: 13021: Part-2:1991 with Amendment Nos.1 and 2 and additional requirement as per the
 - b) Bi-pin lamp holders to IS: 3323/80 with amendment No.1/
 - c) PVC cables to IS: 694/90 with amdt.No.1 & 2.
 - ii) Surface of CRCA Steel and Aluminium sheets used shall be properly phosphatized and stove enamelled white on the reflector side, tray side and other surface stove enamelled grey.
 - iii) The street light fittings shall be required with socket bore of 30mm or 40 mm or 50mm for side entry/top entry type fittings. The socket bore, however, will be specified by the indenters at the time of placement of supply order.
 - iv) All wire leads to be adequately covered with sleeves for protection against accidental contracts.
 - v) All hardware parts used should be zinc coated or nickel/chromium plated so as to be corrosion resistant.
 - vi) Fitting shall be wired with multi-stranded copper wire terminating on suitable connectors. The wiring shall be properly clamped.
- Ballast:** As per (FG-FG/AS1) specified in chapter 2.4.
- Bi-pin lamp holder:** Conforming to IS: 3323/80 with amendment No.1 to the extent possible /applicable.
- Connection wire:** Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.
- Terminal connector:** As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

D) Energy efficient T-5 2X14 & 2X24 Street Light fitting (FSL2)

Scope:

Specification No (FG-ODF/FSL2)
Supplying & erecting Energy efficient T-5 2X14 & 2X24 Street Light fitting suitable for specified wattage of T-5 lamp complete with serrated acrylic diffuser & gasket, with necessary control gear and erected on provided bracket.

Material:

Fitting:

ISI marked Energy efficient T-5 2X14 & 2X24 Street Light fitting complete with electronic ballast, transparent cover made out of 3mm thick acrylic sheet, gear cum reflector tray, canopy and lamp holder duly wired for use on 240 volt AC single phase 50 Hz without T-5 lamp. Canopy shall be made of Aluminium sheet of width 3" minimum per lamp. Gear cum reflector tray (GCRT) shall be made of either CRCA sheet of 0.8 mm thick or Aluminium sheet of 1.25 mm thick. Fitting shall be suitable for mounting up to a height of 15 meters and shall be able to withstand wind load test. It shall conform to class-1 of IS: 10322 (part 5/sec 3)/87 with amendment 1 and IP-65 protection

- i) Various components of fittings shall conform to IS specification as noted below.
- a) Electronic ballast (EB) to IS: 13021: Part-1:1991 with Amendment No.1, IS: 13021: Part-2:1991 with Amendment Nos.1 and 2 and additional requirement as per the
- b) Bi-pin lamp holders to IS: 3323/80 with amendment No.1/
- c) PVC cables to IS: 694/90 with amdt.No.1 & 2.
- ii) Surface of CRCA Steel and Aluminium sheets used shall be properly phosphatized and stove enamelled white on the reflector side, tray side and other surface stove enamelled grey.

- iii) The street light fittings shall be required with socket bore of 30mm or 40 mm or 50mm for side entry/top entry type fittings. The socket bore, however, will be specified by the indenter at the time of placement of supply order.
- iv) All wire leads to be adequately covered with sleeves for protection against accidental contacts.
- v) All hardware parts used should be zinc coated or nickel/chromium plated so as to be corrosion resistant.
- vi) Fitting shall be wired with multi-stranded copper wire terminating on suitable connectors. The wiring shall be properly clamped.

Method of Construction:

The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

E) Flood Light fitting suitable for HPMV/HPSV/MH Lamps (GFL)

Scope:

Specification No (FG-ODF/GFL)

Supplying & erecting Flood Light fitting suitable for specified wattage of HPSV/HPMV/MH lamps, with all accessories, erected with provided bracket on wall/street light pole or at any place as directed by Site engineer with necessary materials.

Material:

Fitting:

Luminaries comprising of a die cast aluminium housing with store enamel finish. A flat toughened heat resistance glass is firmly fixed with a synthetic rubber gasket to the housing by stainless steel toggles. Control gear comprises of provided copper wound ballast, power factor improvement capacitor, and electronic ignitor & with mains connector. Luminaire shall be mounted on a MS cradle for rotating in horizontal & vertical planes for facilitating positioning of the luminaire to effectively illuminate the target area. Brightened & anodized aluminium reflector for high optical efficiency. Cable entry shall be through suitable cable glands/ nipple provided for cable entry.

(Refer drawing no. ODF-2 (Fig.4))

Ballast: As per (FG-FG/AS5) specified in chapter 2.4 **Ignitor:**

As per (FG-FG/AS6) specified in chapter 2.4 **Condenser:** As

per (FG-FG/AS7) specified in chapter 2.4

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

F) Gate Light fitting (PTL) suitable for HPMV/HPSV/MH Lamps (PTL)

Scope:

Specification No (FG-ODF/PTL)

Supplying and erecting Gate light fitting suitable for specified wattage of HPMV/SV/MH lamp/lamps, complete with control gear, duly wire and erected on provided pipe/pole or at any other place, as directed by site engineer.

Material:

Fitting:

The fitting comprising of a control gear capsule made of die cast aluminium alloy and shall have provision for fixing of control gear. Fitting shall have acrylic bowl with ushroom/round shape bowl of specified diameter, and shall be fixed on the top of the capsule. The bowl shall be adequately

gasketed for weather proofness. The inner diameter of control gear capsule base shall be suitable for pipe of 50 mm to 77 mm O.D. Fitting shall have entry for

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termination of cable. The control gear capsule shall have IP 43 protection class. (Refer drawing no. ODF-2 (Fig.5))

Ballast: As per (FG-FG/AS5) specified in chapter 2.4 **Ignitor:** As per (FG-FG/AS6) specified in chapter 2.4 **Condenser:** As per (FG-FG/AS7) specified in chapter 2.4

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be erected with provided pole/pipe or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

G) Gate / Garden Light fitting suitable for CFL (GLT)

Scope:

Specification No (FG-ODF/GLT)

Supplying and erecting Gate / Garden light fitting suitable for specified wattage of CFL (One or Two), complete with control gear, duly wire and erected on provided pipe/pole or at any other place, as directed by site engineer.

Material:

Fitting:

The fitting comprising of a control gear capsule made of die cast aluminium alloy and shall have provision for fixing of control gear. Fitting shall have acrylic bowl with mushroom/round shape bowl of specified diameter, and shall be fixed on the top of the capsule. The bowl shall be adequately gasketed for weather proofness. The inner diameter of control gear capsule base shall be suitable for pipe of 50 mm to 77 mm O.D. Fitting shall have entry for termination of cable. The control gear capsule shall have IP 43 protection class.

Ballast: As per (FG-FG/AS5) specified in chapter 2.4 **Ignitor:**

As per (FG-FG/AS6) specified in chapter 2.4 **Condenser:** As

per (FG-FG/AS7) specified in chapter 2.4

Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be erected with provided pole/pipe or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

2.4 Accessories for fittings (FG/AS)

Specifications for Ballasts / Ignitor / Condenser

Scope:

This chapter deals with supply, erection and connecting the accessories required in arioustypes of fittings suitable for fluorescent tubes, HPMV/SV/MH lamps, etc., and giving necessary testing of the fittings after erecting the accessory.

Specification No

(FG-FG/AS1)

1. CFL Ballast:

Ballast shall be copper wire wound, polyester filled or vacuum impregnated type suitable for Compact fluorescent lamp (CFL) conforming to I.S. 1534 with amendment No. 1 to 4 suitable for use on 230 V, 50 Hz, Single phase AC Supply, Temperature rise for ballast shall be 50 degree C, above the ambient temperature under normal conditions, minimum preheating current shall be 153 milliamp at 90 % of rated voltage and maximum 240 milliamp at 110 % of the rated voltage.

Specification No

(FG-FG/AS2)

2. Electromagnetic Ballast for T 8 fluorescent tubes:

The ballast shall be of self Inductive coil of super enamelled copper low loss silicon steel lamination inductive coil with or without as additional resistor, designed to give operational characteristics for 40 W, at rated voltage of 220 V to 240V with calibration current 0.43 A., conforming to IS: 1534. Air temperature of the ballast winding shall not exceed 25°C above ambient, with appropriate IP protection class.

Specification No

(FG-FG/AS3)

3. Electronic Ballast for T 8 fluorescent tubes:

The High frequency electronic ballast suitable for T 8 tube shall have circuit P.F of 0.95 / protected against mains disturbances, automatic cut off protection for a deactivated tube, glass fuse in main input circuitry, short circuit protection for a limited duration for both PCB terminals and components. Should withstand 1.5 KV AC high voltage for insulation as per IS 1302/ Part I. Terminal block should be provided for mains and lamp connections, separate earthing terminal & tamper proof warrantee seal, the losses should not be more than 4 watts & without humming noise.

Specification No

(FG-FG/AS4)

4. VPIT Ballast T 8 fluorescent tubes:

Vacuum impregnated low loss copper ballast made of low loss silicon steel lamination with super enamelled copper wire, vacuum impregnated with white resin, two way terminal block and winding temperature limited to 120°C, conforming to IS 1534 (Part -1 of 1977) and suitable for 240 Volt 50 Hz, AC supply.

Specification No

(FG-FG/AS5)

5. Ballast for HPMV/SV and Metal Halide Lamps:

Ballast shall confirm to IS: 6616/82 with the following variations. The ballast shall be marked with watt loss and at rated voltage power delivered shall be between 92.5% and 107.5% of the power delivered by the reference ballast.

Ballast used in the fittings shall be energy efficient where watt loss will not exceed the following limits:-

Ballast for 70 Watts Lamp	:	15 Watts max.
Ballast for 150 Watts Lamp	:	19 Watts max.
Ballast for 250 Watts Lamp	:	26 Watts max.
Ballast for 400 Watts Lamp	:	38 Watts max.

Winding Resistance shall be within a Tolerance of +5% & 10 % on values declared by the manufacturer.

<i>Specification No</i>	<i>(FG-FG/AS6)</i>
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6. **Ignitor:**
Ignitor shall be suitable for HPSV/MV and Metal Halide lamps. It shall not pulsate after the lamp has been fully ignited. Ignitor improper connection shall not cause any deleterious effects on the luminaries. The components shall be fitted inside the polypropylene, insulating container. Necessary wires with standard colour coding (Red, yellow & Black), shall be drawn outside the container for facilitating the connections.

<i>Specification No</i>	<i>(FG-FG/AS7)</i>
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7. **Condenser / Capacitor:**
Made of Metallized Polypropylene (MPP) housed in a polypropylene container, hermetically sealed designed for tropical conditions, of appropriate capacity conforming to IS: 1569 of 1976 used for P.F improvement not less than 0.9 for all types of luminaries or other appliances. Condenser shall be connected across the mains or in series with one ballast for lead / lag circuit.

<i>Specification No</i>	<i>(FG-FG/AS8)</i>
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8. **Tube holders:**
Lamp holder should be designed for tubular fluorescent T 8 lamps for all wattages, for end to end mounting, rotary locking type. The holder shall conform to IS: 3323 of 1980.

<i>Specification No</i>	<i>(FG-FG/AS9)</i>
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9. **Starter holder:**
Starter holder made from PVC with copper contacts, and groove for securely holding the starter. The starter holder shall conform to IS: 2215/1984.

<i>Specification No</i>	<i>(FG-FG/AS10)</i>
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10. **Terminal connector:**
Connector shall be made of Porcelain / Bakelite / PVC, with necessary brass / copper contacts, screws for connections. The nominal cross sectional area of the connector shall be suitable for leads of 2.5 mm².

<i>Specification No</i>	<i>(FG-FG/AS11)</i>
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11. **Starter:**
Starter made of bi-metallic glow switch housed in polypropylene can with plastic cover and brass pins, with radio interference suppression capacitors and heavy gauge nickel plated brass contact, conforming to IS 2215 of 1983. Starter shall be suitable for fixing in all types of starter holders.

<i>Method of Construction:</i>

The above accessories shall be fixed in the fitting, duly wired and necessary testing shall be carried out in presence of site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

2.5 Brackets for Outdoor fittings (BKT)

- A) **Bracket welded to Pole Cap** (BKT/BPC)

Scope:

<i>Specification No</i>	<i>(FG-BKT/BPC)</i>
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Fabrication of Street light bracket of specified diameter 'B' class G.I. Pipe, of specified length welded to pole cap erected on top of the pole for erection of either single /

-244-

double, side entry WP fluorescent/CFL/MV/MH/SV fitting(s), duly painted with one coat of red oxide & one coat of Aluminium paint, and erecting the same with provided leads.

Material:

GI Pipe: GI Pipe of specified diameter as per (CW-PLB/GP) mentioned in chapter 17.5
Pole Cap: Pole cap fabricated from 4 mm thick MS Sheet, of 30 cm in length.
Corner support: 3 mm thick MS flat / sheet
Set screws: MS bolts, nuts of 6 mm dia.
Paint: Red oxide & Aluminium paint.

Method of Construction:

The bracket shall be fabricated as per drawing No(s) BKT-1 (Fig.1 Fig.3), BKT-2 (Fig.4, Fig.5) and shall be placed on the pole cap. Inner diameter of pole cap shall be as per the outer diameter of pole with sufficient clearance, so as to facilitate easy placing of the cap on top of pole. Two holes of minimum 6 mm diameter shall be drilled to pole cap. The nuts shall be placed on the pole cap duly aligned with the hole, and shall be butt welded. Bolts shall then be tightened through the nut so as to hold the bracket in vertical position.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

B) Wall Bracket (BKT/WB)

Scope:

Specification No

(FG-BKT/WB)

Fabrication of Street light bracket of specified diameter 'B' class G.I. Pipe, 1.2 m in length erected on wall for erection of side entry WP fluorescent/CFL/MV/MH/SV fitting(s), duly painted with one coat of red oxide & one coat of Aluminium paint, and duly connected to supply with PVC wire leads.

Material:

GI Pipe: GI Pipe of specified diameter as per (CW-PLB/GP) mentioned in chapter 17.5
Hardware: Grouting MS bolts, nuts of 10 mm dia. & 100 mm length. 'U' shaped clamps of suitable diameter made of GI.
MS Flat: MS flat 3 mm thick 50 mm wide
Paint: Red oxide & Aluminium paint.
Wire leads: 1.5 mm², as per (WG-MA/BW) mentioned in chapter 1.3
Miscellaneous: Cement, Sand, Water, etc.

Method of Construction:

The bracket fabricated as per drawing No BKT- 1 (Fig.2) shall be erected on wall as explained below:

- MS flat of length 15 cm with 10 mm diameter hole shall be welded to the pipe as shown in drawing.
- Grouting bolts shall be grouted in wall and finished with cement plaster.
- Bracket shall be placed on the grouted bolts with clamps and nut shall be tightened.
- Fitting shall then be inserted onto the bracket and connections shall be made.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

C) Street Light Bracket (BKT/SLB)

Scope:

Specification No

(FG-BKT/WB)

Fabrication of Street light bracket of specified diameter 'B' class G.I. Pipe, of required length erected on pole for erection of side entry WP fluorescent/CFL/MV/MH/SV fitting(s), duly painted with one coat of red oxide & one coat of Aluminium paint, and duly connected to supply with PVC wire leads.

Material:

GI Pipe: GI Pipe of specified diameter as per (CW-PLB/GP) mentioned in chapter 17.5

Hardware: MS nuts & bolts, Rubber Grommet.

MS Flat: MS sheet 5 mm thick 40 mm wide.

Paint: Red oxide & Aluminium paint.

Wire leads: 1.5 mm², as per (WG-MA/BW) mentioned in chapter 1.3

Method of Construction:

The bracket fabricated as per drawing no BKT-2 (Fig.6) , shall be erected on pole as explained below:

- Clamps of required length shall be fabricated as per outer diameter of pole and the pipe used for bracket.
- Bracket shall be clamped with the pole and the nuts bolts shall be tightened so as to keep bracket in plum.
- Hole for drawing the mains wire shall be drilled just below the bracket. The grommet shall be placed and the wires shall then be drawn.
- Fitting shall then be inserted onto the bracket and connections shall be made.

Mode of Measurement: Executed quantity shall be measured on running metre basis of the pipe used. (i.e. each)

2.6 Fans (FG/FN)

A) Ceiling Fans

Scope:

Specification No (FG-FN/CF)
Supplying and erecting Ceiling fan of specified sweep with all accessories and necessary materials, erected in provided hook/clamp.

Material:

Ceiling Fan:

Electric Ceiling fan capacitor type with double ball bearing complete with capacitor, 300 mm down rod, canopies, shackles, reel insulator, half threaded bolts of 9.53 mm (3/8") dia 62.5 mm (2-1/2") to 88 mm (3-1/2") long and 7.94 mm (5/16") dia 44.5 mm (1-3/4") to 57 mm (2-1/4") long with nuts, with lock type split pin, spring & plate washers, etc.; three number blade made of Aluminium alloy, suitable for single phase, AC 210 volts, 50 Hz supply and conforming to class I of IS : 374/1979 with amendment no 1 to 6 except for performance parameters to the extent modified as details in general requirements. The down rod shall be capable to withstand a tensile load of 1000 kg without breakdown and a torsion load of 500 kg.cm without breakage as per Clause 10.14.1 of IS: 374/1979 with amendment no. 1 to 6. Electrical motor should be single phase permanent capacitor type with no. of poles 12/14/16/18 (As per sweep), Class-I with basic insulation. Class of insulation shall be B class. The winding wire used for fan should be synthetic enamelled of 30 to 38 SWG. **Connection wire:** Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Paint: Superior quality enamel paint of specified colour for marking Sr. No and date of erection.

Table 2.6/1

Performance Parameters for Fans suitable for Rated Voltage

S.No.	Sweep	Maximum Input Power in watts	Air delivery in m ³ /minute	Minimum Service Value
			at Rated Voltage	at 180 V
1	900 mm	42	140	3.4

2	1200 mm	50	215	4.3
3	1400 mm	60	270	4.5

Method of Construction:

Blades of ceiling fan shall be properly fixed. Down rod, clamp shall be carefully fixed with nut bolt and split pin. Canopies shall be tightened on down rod keeping sufficient clearance. Wiring connections shall be made with required wire leads. Regulator of fan shall be erected on provided switchboard with required wire leads.

Testing:

After erection fan shall be tested by connecting to supply at all positions of regulator. Also steadiness of fan shall be checked at full speed, so that there is no wobbling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Exhaust Fans

Scope:

Specification No

(FG-FN/EXF)

Supplying and erecting Exhaust fan of specified sweep and speed, with all accessories and necessary materials, suitable to work on 230 V / 415 V, AC Supply 50 Hz, erected in position.

Material:
Exhaust Fan:

ISI marked Exhaust fan suitable for Single/Three phase AC 230/415 Volts 50 Hz, capacitor run with mounting ring, four numbers of fixing hole without regulator and louvers. The sweep and speed shall be as per table below. Fan motor with moisture proof treatment and E class insulation, ISI marked, conforming to IS: 2312/67 with amendments 1 to 8. The fan mounting rings shall be proper pre-treatment followed with at least two coats of primer; final finish shall be with two coats of grey colour paint duly baked. The connecting leads shall be brought out for making connections.

Paint: Superior quality enamel paint of specified colour.

**Table 2.6/2 Corresponding
Speed with Sweep**

S.No.	Sweep	Speed in RPM	Voltage level	CFM in m ³ /hr
1	375 mm	900	230 V	2460
2	375 mm	1400	230 V	4000
3	450 mm	1400	230 V	6800
4	450 mm	900	230 V	4350
5	375 mm	900	415 V	2460

Method of Construction:

The Exhaust fan complete with all above accessories and duly wired shall be erected at specified position, connected to the supply and tested.

Testing:

After erection fan shall be tested by connecting to supply. Also steadiness and vibrations if any, of fan shall be checked at full speed, so that there is no wobbling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

2.7 Accessories for Fans (FG-FAS)

Metal Sheet Cawl (MSC)

A) Metal Sheet Cawl

Scope:

Specification No (FG-FAS/MSC)

Supplying & erecting metal sheet cawl made from GI sheet of specified shape and with radius more than the size of exhaust fan. The cawl mounted on angle iron frame to be fixed to wall with grouting nut & bolts, duly painted.

Material:

GI Sheet: 20/22 SWG

Angle iron: 25x5x3 mm, 40x40x4 mm

MS Flat: 25 x 3 mm

Metal mesh: Expanded metal mesh

GI Wire: 8 SWG

Paint: Red Oxide, Superior quality enamel paint

Grouting bolts: 6 x 100 mm, 10 x 100 mm MS nut, bolts.

Finishing material: Cement, Sand, Putty, and Water.

Method of Construction:

Sector shaped Cawl:

Fabrication of Cawl shall be made from 22 SWG GI Sheet. The cawl shall be of round with sector shape, having radius more than the radius of exhaust fan. Cawl shall be fixed to the angle iron frame made from 40x40x4 mm angle, duly welded and the edges made smooth by removing burrs, etc. At the open end expanded metal mesh shall be fixed with 25x3 mm MS flat. Spray painting shall be done by applying 1 coat of red oxide and 2 coats of superior quality enamel paint of colour directed by site engineer. Cawl than shall be fixed on wall by grouting the foundation bolts. The damaged portion of wall shall be finished properly with cement mortar, with necessary colour washing. (Refer drawing no FG-FAS-3 (Fig. 5) for fabrication details.)

Rectangular/Round shaped Cawl:

Fabrication of Cawl shall be made from 20 SWG GI Sheet with slanting flaps at 45 degree. The cawl shall be of rectangular/round shape, having 10 cms radius more than the radius of exhaust fan. Cawl shall be fixed to the angle iron frame made from 25x25x3 mm angle, duly welded and the edges made smooth by removing burrs, etc. At the fan end expanded metal mesh shall be fixed. The flaps shall be rigidly fixed by GI wire of 8 SWG on the width wise. Spray painting shall be done by applying 1 coat of red oxide and 2 coats of superior quality enamel paint of colour directed by site engineer. Cawl than shall be fixed on wall by grouting the foundation bolts. The damaged portion of wall shall be finished properly with cement mortar, with necessary colour washing. (Refer drawing no FG-FAS-3 (Fig. 6 & Fig.7) for fabrication details.)

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

DRAWINGS

Fan clamp for round pipe with hook (Refer drawing no. FG-FAS-1 (Fig.1)
Fan clamp for I-beam with hook (Refer drawing no. FG-FAS-1 (Fig.2)
Fan box with hook (Refer drawing no. FG-FAS-2 (Fig.3)
Fan hook grouted in RCC slab (Refer drawing no. FG-FAS-2 (Fig.4)

Chapter 3

APPLIANCES

3.1	Water-heaters	AP-WH
3.2	Air-conditioners	AP-AC
3.3	Water-coolers, Refrigerators	AP-WC
3.4	Air Cooler	AP-ACR
3.5	Water Purifier	AP-WPF
3.6	Inverter,	AP-INV
3.7	On line UPS	AP-UPS
3.8	Batteries for Inverter & UPS	No Specs
3.9	Voltage Stabilizers	AP-VS

3.1 Water Heaters**(AP-WH)****A)****Storage / Pressure type Water Heaters****(STWH)****Scope:****Specification No****(AP-WH/STWH)**

Supplying, erecting and testing of horizontal/ vertical, stove enameled, storage/pressure type water heater, suitable for wall / floor mounting, of specified capacity, one inlet with nonreturn valve, one outlet with dead weight, pressure reducing valve, stop cock; suitable to work on 230/250-V single phase AC Supply, heating element of specified wattage, thermostat, control fusible plug, pilot lamp etc. ISI mark only and marking of S No. and date of erection. (IS 2082)

Material:

Outer Casing: Corrosion proof stove enameled/ powder coated, mild steel / engineering plastic body. Colour of the casing shall be as directed by Engineer in-charge.

Inner tank: It should be of electrolytic copper (99% pure) properly fabricated so as to be leak proof and of specified capacity.

Heating Element: Mineral filled / tubular / copper cord & nickel plated, and conforming to IS: 4159, of specified wattage.

Pilot Lamp: A neon gas field indicating lamp shows functioning of heating elements along with thermostat & thermal cut-out.

Thermal Insulation: Resin bonded glass wool slab insulation & should be filled between two casings of storage water heater.

Thermostat: A Stem type snap action thermostat, which should cut off the electric supply automatically as per setting of temperature & should be ISI mark.

Thermal Cut-out: In case of thermostat failure this cutout should cut off the electric supply automatically and should restart only on pressing the reset knob.

Pressure Release Valve: If pressure exceeds above 50 psi, it should release the pressure & should be fitted on the inlet pipe.

Dead weight: It will operate when pressure in inside tank increase beyond specified limit.

Fusible plug: Cast aluminium body with threading, and hole for plug with fusible metal. The metal shall be fused, only all the other safeties fails & at high pressure

Hardware: 100x10 mm grouting bolts, MS washers, nuts, etc.

Wall Fasteners: 100x10 mm with vertical cuts, and pin at the centre, washer and nut, etc., made of MS. (Similar to Anchor bolt fastener)

Grouting material: Cement, Sand, water, etc.

Paint: Superior quality enamel paint of specified colour.

Method of Construction:

The water heater shall be erected in required position with necessary hardware's and base is grouted, as per the site situation. The water heater is to be connected to water supply on inlet side by valve, mountings and connected to outlet tap.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

3.2 Air Conditioners**(AC)****A)****Window Model Air Conditioners****(WAC)****Scope:****Specification No****(AP-AC/WAC)**

Supplying, erecting, and testing Window model room air conditioner of specified tonnage, conforming to I.S.1391 suitable for operation on single phase, AC supply, 230/250 Volts 50 Hz, using best quality compressor, dehumidifier in provided air circulating, ventilators and

fitting in position in recess or in window to required size, and connected to supply, and marking of S No. and date of erection.

The AC unit shall be capable of performing following functions:

- Cooling
- Dehumidifying
- Air Circulating
- Air Filtering
- Ventilation

The Window AC should be of minimum 3 Star rating as directed by B.E.E.

Material:

Compressor:

The room air conditioners shall be fitted with hermetically sealed type suction cooled (Reciprocating) or discharge cooled (Rotary) compressor with suitable rated capacitor start electric motor. It should start unloaded and shall be equipped with overload protection. The compressor shall be mounted on resilient mountings for quiet operation. The compressor shall conform to IS.10617 (part-1): 1983 with amendment 1 & 2.

Cooling capacity for Compressors shall be as under:

For 1.5 Ton -	Minimum 4750 kcal/hour
For 2.0 Ton -	Minimum 6250 kcal/hour

Energy efficiency ratio for Compressor shall be minimum 2.625 kcal/hour/watt.

Cabinet:

The cabinet of the air conditioner be made from either galvanized MS sheet of 1mm thickness or aluminium alloy sheet of 1.2mm thickness. The sheets shall be suitably stiffened by embossing the fabrication work and shall be of suitable workmanship. The sheets shall be suitably phosphate and protected by powder coated paint. The galvanized steel sheets shall conform to IS: 277:2003 and have a coating grade of 120 gm/m².

Air Filter: The air filters provided shall be of cleanable type and made of synthetic material.

Thermostat:

The air-conditioner shall be fitted with thermostat suitable for a working range from 16 degree Centigrade to 35 degree Centigrade with a differential of +/-1 degree Centigrade, with operational voltage as 240V and current rating not exceeding 25 amps. The thermostat shall conform to IS: 11338:1985.

Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4Paint:

Superior quality enamel paint of specified colour.

Method of Construction:

The AC unit shall be fixed in the recess/window with necessary materials. The outer frameshall be fitted to recess or cutout made in window making the recess/window air tight, duly connecting the unit to power supply by means of metal clad switch & plug and giving satisfactory trials.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

B) Split type Air Conditioners (SAC)

Scope:

Specification No **(AP-AC/SAC)**

Supplying, erecting, and testing Split type room air- conditioner of specified tonnage, conforming to I.S.1391, having one/two air handling units Hi-wall / ceiling (suitable for false ceiling) mounting type having cooling unit and the outdoor condensing unit connected with 12/9 mm copper piping up to 6 meter duly insulated and 3 core copper flexible cord of required length etc. with stand for condensing unit, complete with testing etc. (Conforming to IS: 1391 Part-I & Part-II with all amendments & as per BEE) suitable for operation on single phase, AC supply, 230/250 Volts 50 Hz, using best quality compressor, and fitting in position as per site situation and as directed by site engineer, duly connected to supply, and marking of S No. and date of erection.

The AC unit shall be capable of performing following functions:

- Cooling

- Dehumidifying
- Air Circulating
- Air Filtering
- Ventilation

The Split type AC should be minimum 3 Star rating as directed by B.E.E.

Material:
Compressor:

The air conditioners shall be fitted with hermetically sealed type suction cooled reciprocation or discharge cooled rotary compressor (as applicable), compressor unit operating on Refrigerant R-22 with suitable rated capacitor start electric motor. It shall be equipped with overload protection. These shall be mounted on resilient mountings for quiet operation. The compressor shall conform to IS: 10617 part (1) -1983 (amendment 1 & 2)
The air conditioners shall be complete with automatic temperature control and cut-in and cut-out etc. for temperature range 16 degrees to 35 deg. C. The differential of the thermostat for cut-in and cut-out shall not be greater than +/- 1 degree Centigrade.

Outdoor Cabinet:

The cabinet of the evaporator unit and condensing unit shall be made from galvanized steel sheet of 1.0mm thick with stiffness for robust construction and shall have rounded corners, steel parts/front panel etc. shall have stove-enameled finish preceded by undercoat of anti corrosive primer paint phosphate and through cleaning of the surface. Alternate method of corrosion protection like plastic powder coating, electrostatic paintings are also acceptable in lieu of stove enameled finish. Galvanized sheet shall conform to IS: 277/ 2003.

Indoor Unit:

The indoor units made of ABS/HIPS shall be of flame retardant and impact resistant life. ABS/HIPS indoor unit cabinet shall pass in flammability test requirement for Grade V-O as per UL -94. For impact resistance the unit duly packed, when dropped from a height of 1 metre shall show no damage.

Air Filter: The air filters provided shall be of cleanable type and made of synthetic material.

Thermostat: Thermostat or electronic thermostat as per IS 11338: 1985.

Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4

Piping:

Suction line -Copper pipe of min 0.70mm thickness and of suitable diameter as per manufacturers design.

Liquid line -Copper pipe of min 0.70mm thickness and of suitable diameter as per manufacturers design.

Drain pipe -15mm dia flexible PVC pipe.

Connection Cable: Suitable capacity 3 Core PVC insulated FRLS copper wire to be electrically connected to both the units.

Paint: Superior quality enamel paint of specified colour.

Remote Control: Remote control (Cordless) shall be provided with one On/Off timer, selecting Fan speed (Three speeds) and setting up of temperature.

Drain Pipe: Drain pipe (15mm dia flexible PVC pipe).

Method of Construction:

The installation shall comprise the following work:

- Mounting/Fitting indoor & outdoor units at the respective locations on provided MS stands with necessary hardware's.
- Laying refrigerant piping of 6m length and connecting both the units after drilling hole/holes in the wall, if required. The thickness of the copper tubing shall not be less than 0.70mm and diameter of required size by flaring, threading, etc.
- Insulating the suction pipe with expanded polyethylene of foam 5mm tubing.
- Laying 15mm drain pipe to throw out the condensate water formed in the Indoor unit.
- Leak testing of the entire system.
- Charging Refrigerant gas in the unit.
- Suitable electric wiring between indoor and outdoor units up to 6 m length & up to switch within 3 metre of location of indoor unit.
- Testing and giving satisfactory trials.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

A) Water Coolers

(WC

Scope:

<i>Specification No</i>	<i>(AP-WCR/WC)</i>
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Supplying, erecting, testing and commissioning self contained water cooler with specified storage capacity & cooling capacity, and marking S No and date of erection.

<u>Material:</u>

Water Cooler:

The water cooler shall be suitable for operation on 230 V +/- 10% , 50 Hz, single phase AC supply with hermetically sealed type suction cooled compressor with overload protection conforming to IS :-10617(part I) : 1983 with amendment no 1&2.

Tank:

Tank shall be fabricated from SS sheet of 0.8 mm min. thickness as per ISI 304 and shall be made by electrically seam welded lap joints or alternatively from 0.63 mm thickness stainless steel sheet with PUF insulation, with required number of Taps. However tank fabricated by double seam jointing is also acceptable if the same is reinforced and sealed by lead free solder material. Use of lead soldering material for sealing the joints of water tank is not permitted. Water tank cover and lid bottom shall be made of 1.25 mm aluminum sheet duly anodized / epoxy painted / high impact polystyrene (HIP) of 1.5 mm thickness. Positive locking of the lead is to be provided (lock with two keys). A drain valve at the bottom of the storage tank to be provided to draw out water while cleaning.

Cabinet (Body):

The cabinet of the water cooler shall be made of GS or SS sheet of 1.0 mm. The front panel, below the water outlets in the storage type water coolers shall be made of stainless steel of 0.8 mm. The drain pan for storage type water coolers shall be made of stainless steel sheet of 0.63 mm upto size 40 liters/hour and beyond 40 liters/hour of 0.8 mm thickness. The bottom pedestal shall be made of 2.65 mm minimum thick stainless steel sheet. Pedestal shall have a minimum ground clearance of 100 mm for ease of cleaning. Pedestal shall be strong enough to withstand weight with storage tank full and shall be reinforced to prevent skewing. The body shall be held securely with the pedestal with stainless steel nuts and bolts. The drain size should be 25 mm or above. In case water outlets are provided on three sides then all the three lower panels should be made of aluminium sheet or stainless steel sheet. The mild steel components used in the manufacture of the cabinet shall be individually degreased, pickled, scrubbed and rinsed to remove grease, rust, scale or any other foreign elements. Immediately after pickling the MS parts shall be given phosphate treatment. The components along with the front panels shall then be given a primer coat with a finish coat of stove with a finish coat of stove enamel paint. The finish shall be smooth and uniform with hard tough film of the enamel adhering to the surface. The finish shall be free from all the visible defects and shall not chip when tapped lightly with a dull pointed instrument. Alternatively method of corrosion protection like plastic powder coating, electrostatic painting shall be permitted.

Refrigeration coils to be fully soldered to the outside of the tank for good thermal contact and not merely tack welded.

There shall not be any gap between water tank cover (mask) and water tank to prevent rodent/ insect/ dust entry.

Water tank overflow should be adequately covered with strainer such as wire mesh etc to avoid rodent/ insect/ dust entry.

Condenser Fan Motor: The condenser fan motor shall be capacitor start and capacitor run (CSR) or permanently split capacitor (PSC) or alternatively permanently lubricated motor may be provided.

Thermostat: The thermostat shall conform to IS: 11338-1985. The position of the thermostat shall be adjustable through a rotary switch mounted on the front or side panels. Min and max of the thermostat setting shall be from 0 degree Celsius and 25 degree Celsius which shall be marked.

Method of Construction:

The water cooler shall be fixed at designated place or as directed by the site engineer, duly connected with inlet and drain by leak proof joints. The water cooler is to be erected on stand and tested.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

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3.4 Air Coolers (ACR)

A) Desert type Air Coolers (DAC)

Scope:

Specification No

(AP-ACR/DAC)

Supplying and erecting and testing evaporative air cooler (desert Cooler) with fibre body, 230/250 Volts, 50 cycles, comprising of fan, pump,, drip proof motor , filter pads, confirming to IS: 3315 and having specified cooling capacity, complete with 5 metre long 3 core cable and 5A hand shield type three pin top and marking S No. and date of erection.

Material:

Exhaust fan for Inlet air:

Exhaust fan shall be complete with motor and ISI marked to IS: 2312:1967 with amendment No 1 to 8. Fan shall be complete with motor and fan, motor shall be ISI marked to IS: 996:1979 with amendment No 1, 2 &3. Cooler pump shall be ISI marked, and confirming to IS: 11951:1987 with amendment No 1 to 4. Exhaust fan shall be of 900mm (6 pole motor) and shall have single speed

Cooler:

Cooler shall be suitable for operation on 230 volts +/- 10%, single phase, 50 Hz AC supply. Pump set shall conform to IS: 11951-1987 with amendment no.1 to 4. The coolers shall be complete with fan, motor, filter pads, water pump, etc. Fan motor will be of 1400 rpm (4 poles) and shall have three speeds. Filter panel, front grill, and top of the cooler body shall be made of 0.8 mm galvanized steel sheet. The sump tank and rest of the body shall be made of 1.2 mm thick galvanized steel sheet. The galvanized steel sheet shall be ISI marked and shall have zinc coating not less than 120 gm/m² and shall conform to IS: 277- 2003. All internal surfaces including inside of the tank, fan blades, motor body, pump, pump body and frame shall be painted with water resistant paint conforming to IS: 9862-1981 with amendment No 1.

Water pump shall be provided with proper clamping arrangement. The shaft of the pump shall be stainless steel. Impeller, housing, and fan shall be of polypropylene. The pump shall conform to IS: 11951-1987 with amendment No 1 to 4 and shall be ISI marked.

Suitable nylon bushes shall be provided in the grill for easy and smooth movement of louvers.

The filter pads shall contain wood wool. The filter pads shall be fixed over the panel and secured by clamping guard of galvanized wire of 2 mm dia approx and net size 50 to 75 mm approx, square/ rectangular. The wire guard shall be fixed in the clamps to avoid any sagging.

15 mm size punched hole shall be provided to fix the float valve where required. The drain plug of brass shall be fitted in such a way so as to be able to completely drain the water from the tank.

The inside wiring connection shall be through suitable non- ferrous thimbles and the live contacts of rotary switch shall be protected by suitable enclosure of insulating material.

Rotary switches:

The cooler shall be provided rotary/ piano type On-Off and speed selection switch for three speed cooler fan motor.

Method of Construction:

The air cooler shall be fixed at designated place or as directed by the site engineer, duly connected to electric supply by means of 3 core copper wire and tested.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

3.6 Inverter (AP-INV)

General

This part of the specifications covers the technical aspects of the Digital pure Sine wave Inverter.

Scope:

Supplying, erecting, testing & commissioning of Digital pure sine wave Inverter with necessary safeties, etc.

Specification No (AP-INV)**Material:**

Equipment manufactured as per standard manufacturer's specification. The unit housed in powder coated CRCA sheet enclosure with following fault protection on mains / inverter mode:

- Under voltage on mains mode
- Over voltage on mains mode
- Charger protection on mains mode
- Overload on inverter mode
- Short circuit on inverter mode
- Low battery on inverter mode
- Battery reverse on inverter mode
- Under voltage on inverter mode
- Over voltage on inverter mode
- LED display for above fault protection
- Alarm for above fault protection
- Arrangement to cut of neutral of supplier when supply from invertors is on.

In addition to above the inverter shall comply with the specifications mentioned in Table No. 3.6/1

Table No. 3.6/1**Additional Specifications for Inverter**

S.No.	Specifications / Features		Standard Parameters
1	Input AC range	Under Voltage Under Voltage restoration Over Voltage Over Voltage restoration	180 +/- 5 V 185 +/- 5 V 260 +/- 5 V 255 +/- 5 V
2	Output on Inverter Mode	Maximum power Minimum Efficiency Voltage (Inverter mode) Frequency (Inverter mode) Overload Transfer time	As specified 85 % (As per Clause 7.9.3 of ISS) 230 V Nominal +/- 12% 50 Hz +/- 2% > 110% for 10 minutes 30 ms
3	Conversion	Switching device Harmonic distortion	MOSFET or IGBT. < 5 %
4	Inverter mode protection	Low battery Battery reverse Over load Short Circuit	Electronic trip Through fuse Electronic trip Electronic trip
5	Mains mode protection	Over load / Short Circuit Charger	Through MCB Through MCB
6	Battery	Charging time	10 – 12 hours
7	Battery charger	Constant voltage with current limit	10 amp with boost voltage & float voltage as per manufacturer's specification High power factor boost charger
8	LED Display	Switch On, Inverter ON, Low battery Pre-alarm, Battery low, Mains ON, Smart charge, Overload, Short Circuit, Batteryfuse fail, Battery reverse, MCB Trip.	As per manufacturer's standard specification

9	Alarms	Low battery Pre-Alarm Overload Pre-alarm Short Circuit MCB Trip	Continuous beeping Continuous beeping Continuous beeping Continuous beeping
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10	Environmental	Operating temperature Storage temperature Humidity	0 - 40 ⁰ C 0 - 40 ⁰ C 0 -95 % RH non-condensing
11	Enclosure	CRCA/MS sheet minimum 1.2 mmthick	Aesthetically finished, duly pre treated and powder coated.

Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each)

3.7 On Line UPS (UPS)

General

This part of the specifications covers the technical aspects of the Online UPS system for 1 to 10 kVA capacity.

Scope:

Specification No (AP-UPS)

Supplying, erecting, testing & commissioning of Online UPS with necessary safeties,etc.

Material:

Equipment manufactured as per standard manufacturer's specification and as tabulated in Table No. 3.7/2. The unit housed in powder coated CRCA sheet enclosure with following fault protection on mains / UPS mode:

- Under voltage on mains mode
- Over voltage on mains mode
- Charger protection on mains mode
- Overload on UPS mode
- Short circuit on UPS mode
- Low battery on UPS mode
- Battery reverse on UPS mode
- Under voltage on UPS mode
- Over voltage on UPS mode
- LED & LCD display for above fault protection
- Alarm for above fault protection
- Batteries shall be of Sealed Maintenance Free type (Tubular). The selection of number of batteries required shall be as per Table No 3.7/1

Table No. 3.7/1

Details of Batteries required for the UPS in respect to the Backup Period.

kVA rating	DC Voltage	Output pf	No of SMF Batteries	Back Up Period				
				15 mins.	30 mins.	1Hr	2Hrs	3Hrs
1kVA	36V	0.7	3	17AH	2 X 17AH	42AH	65AH	100AH
2kVA	96V	0.7	8	17AH	26AH	42AH	65AH	100AH
3kVA	192V	0.8	16	17AH	17AH	26AH	42AH	65AH
5/6 kVA	192V	0.8	16	17AH	26AH	42AH	65AH	100AH
8kVA	240V	0.8	20	17AH	26AH	42AH	100AH	2X 65AH
10kVA	240V	0.8	20	26AH	42AH	65AH	2X 65AH	2X 100AH
A) The Batteries considered are Sealed Maintenance Free Batteries (SMF)								

B)	The Batteries need to be placed in Ambient Temperature of 20Deg C -25Deg C	
C)	The UPS is considered to be working @ 90% Load of its capacity	

Specifications & Standard Parameters of On Line UPS

The UPS shall comply with specifications as indicated in the following table:

S.No.	Specifications / Features	Standard Parameters
1	Technology	True online Double Conversion design (DSP / Microprocessor based)
2	Input voltage range	160 V to 270 V for 1 Phase Input 335 V to 477 V for 3 Phase Input
3	Input power factor	Near unity Power factor > 0.93 for 1 Phase input
4	Generator compatibility	Yes (1.2 times the UPS rating)
5	Nominal input frequency	50 Hz +/- 6 %
6	Rectifier type	Advance Rectifier with inbuilt APFC (Advance Power Factor Compensated) for 1 Phase . IGBT charger Advance Rectifier with inbuilt APFC (Advance Power Factor Compensated) for 3 Phase .
7	Output Voltage	230 V AC +/- 1 % for 1 Phase Output . 400 V AC (380/415 selectable) for 3 Phase & Neutral .
8	Total Harmonic distortion	1 Phase Output < 3 % for Linear load < 5 % for Non-linear load 3 Phase Output < 2 % for Linear load < 5 % for Non-linear load
9	Overload Capacity	110 % for 10 Seconds & 130 % for 2 Seconds for 1 & 2 kVA UPS . 125 % for 10 Minutes & 150 % for 60 Seconds for 3 to 10 kVA UPS .
10	Inverter	IGBT based PWM with Digital control (Microprocessor based)
11	Crest Factor	3: 1 for 1 & 2 kVA UPS . 5: 1 for 3 to 10 kVA UPS .
12	Static Bypass	Automatic bypass switch facility
13	Display	Should be User friendly with LED & LCD display with showing important parameters.
14	Output Power factor	0.7 lag to Unity within kVA & kW rating.
15	Load in terms of PC per kVA. (PC with 15" CRT Monitor)	3 PC's per kVA (for 1 & 2 kVA UPS) 5 PC's per kVA (for 3 to 10 kVA UPS)
16	Battery type	SMF / Thick plate / Tubular
17	DC Voltage	1 kVA – 36 V, 2 kVA – 96 V, 3 & 5 kVA – 192 V, 8 to 10 kVA – 240 V
18	Battery charger current limit	1 & 2 kVA – 6 A, 3 & 5 kVA – 4 & 6 A, 8 & 10 kVA – 8 & 15 A.
19	Ambient temperature	45° C
20	Noise level	< 50 db @ 3 metres
21	Testing standards	IEC 62040 Part III
22	Isolation Galvanic	Isolation transformer from 3 to 10 kVA

Mode of Measurement: Executed quantity will be measured on number basis. (i.e. each.

3.9 *Voltage Stabilizer (VS)*

A) Servo Motor controlled Voltage Stabilizer (SVS)

Scope:

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Providing single phase auto/manual line voltage servo motor operated voltage stabilizer
confirming to IS 9815-1981 of specified KVA capacity duly tested with guarantee for one
year marking S. No. & date of erection.

Material:

- Single Phase auto/manual line voltage stabilizer confirming to IS 9815-1981 with following components:
- Motorized variable voltage auto transformer.
- Double wound Buck boost/series transformer
- Servo control sensing card (PCB)
- Suitable for input 160 to 250 volts & output voltage $230 \pm 1\%$
- Zero wave distortion losses should be negligible with 95% efficiency
- No phase shift.
- No effect of load power factor.
- Natural air-cooled.
- Correction rate 20 to 30 volts per second.
- Audio alarm for over voltage & under voltage.
- Volt meter 0-300 volts with selectors switch to monitor input & output voltage, overload & short circuit protection.

Method of Construction:

The stabilizer shall be installed at designated place as directed by engineer in-charge,
with both input & output connected, with necessary testing.

Mode of Measurement: Executed quantity will be measured on number basis. (i.e.Each)

ENERGY SAVING DEVICES

4.1	Solar Hot water system	ESD-SHWS
4.2	Pipes for Solar Hot Water System	ESD-HWP
4.3	Solar Lighting	ESD-SOL
4.4	Energy Devices (Harmonic Active Filter, APFC Panel with Harmonic filters)	ESD-ESD/DAHF ESD-ESD/APFC
4.5	Miscellaneous	No Specs
4.6	Drawings	

Scope:**Specification No (ESD-SHWS)**

Supplying, erecting, testing and commissioning of Solar Water Heating System with & without heat exchanger for cold & warm regions respectively with Solar flat plate collector conforming to IS: 12933 (part 1) with amdt.no.1 and IS: 12933 (Part 2)/2003 suitable for inletwater with chlorine and fluorine content up to 100 ppm and supply hot water at the outlet.
(Refer drawing no.ESD-SHWS-1)

Material:**1. Solar water heating system:**

Comprising of solar flat plate collector, collectors stand assembly, stainless steel insulated hot water storage tank with heat exchanger and various other components.

Solar flat plate collector component shall have:

- Solar flat plate collector cover plate made of toughened glass
- Sheet for absorber made of copper
- Absorber made of copper sheet and copper tube.

2. Solar Flat Plate Collector:

Solar flat plate collector shall conforming to IS: 12933 (Part 1) with amdt.no.1 and IS:12933 (Part 2)/2003 and various components shall be as under:

Cover plate: Cover plate shall be toughened glass and thickness of 4.0 mm (min.) conforming to section-1 of IS: 12933(Part-2)/2003. The solar transmittance of the cover plate shall be minimum 82 percent at near normal incidence.

Collector Box: Collector box shall be made of Aluminium sections only. Type, grade, size, workmanship and finish of the material used shall be as per section-2 of IS: 12933 (pt2/2003). The minimum thickness of Aluminium shall be as under:

- a) Channel section for sides 1.6 mm
- b) Sheet for bottom 0.7 mm
- c) Support for glass retaining 1.2 mm
- d) Sheet for entire body 1.0 mm

3. Absorber:

Absorber shall consist of riser, header, and sheet for absorber. The Diameter of header shall be 25.4 +/-0.5mm and thickness 0.71mm. The Diameter of riser shall be 12.7

+/- 0.5mm and thickness 0.56mm and made of copper only. The distance between the risers from center to center shall be 120mm. Type grade, size, workmanship and finish of the material used shall be as per section-3 of IS:12933 (Part 2)/2003.

Riser and header assembly designed for working pressure up to 24.5 K Pa (2.5

kg/cm² shall be tested for leakage at a minimum hydraulic pressure of 490 K Pa (5 kg/cm²).

Sheet for absorber:

Sheet for absorber shall be made of copper only. Type, grade, size, workmanship and finish of the material used shall be as per section-3 of IS: 12933 (pt2)/2003. A sample piece of the absorber for having minimum area of 400 square cm. shall be heated in an oven at temperature of 175 degree C for 2 hours. After heating, the sample shall be taken out from the oven and cooled at room temperature. The cooled sample shall be inspected visually for damages, if any. There shall not be any appearance of blistering/rupture/peeling off of the coated/painted surface and of weakening of the bonding between absorber sheet and risers/headers.

Collector box insulation: Insulation shall be provided at back and sides. Thermal Resistance @ of insulation material shall be minimum 0.96 m square degree C/W for back insulation and minimum 0.48 m square degree C/W for side insulation. This shall be derived after determining thermal conductivity (K) value at 100 degree C mean temperature in accordance with IS:3346. Collector box insulation shall conform to sec.4 of IS: 12933(Part-2)/2003

Gaskets and Grommets: Gaskets and Grommets shall conform to sec.5 of IS: 12933 (Part-2)/2003.

4. Insulated hot water storage tank: The thickness of the water storage tank shall be uniform.

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Material: Insulated hot water storage tank shall be non-pressure type and made of stainless steel grade (X04Cr19Ni9 or X07Cr18Ni9 of IS: 1570(part 5) /1985), TIG welded.

Insulation: Solar water heating system (SWHS) up to and including 500 LPD shall be insulated with 40mm thermal grade PUF insulation of 32 Kg/ meter cube or higher density. PUF insulation could be pre extruded type fitted with FRP exterior cladding or alternatively injection moulded in a twin walled steel tank and PPE end cap. Other systems shall be insulated with 100 mm thick Rock wool of 48Kg/m3 density with 22swg Aluminium cladding. Systems up to 500 LPD may also alternatively be installed with 100 mm thick Rock wool of same specifications with aluminium or GI powder coated cladding.

Tank stand: Tank stand assembly shall be made of MS angle of size (min) 38x38x4 mm duly pre-treated and stove enamelled with black Colour paint. Alternatively tubular structure with Powder coating could also be provided.

5. **Heat Exchanger:** Heat Exchanger shall be cage type and made of copper/stainless steel tubes of grade X04Cr19Ni9 or X07Cr18Ni9 of IS: 1570(part 5)/1985 .Heat exchangers shall have a minimum of 0.24 sq. meters heat transfer area per 100 LPD capacities.
6. **System inter connecting piping:** ISI marked G.I. pipes, medium class of IS: 1239 duly insulated with 50mm thick rock wool of 48 Kg/m3 density and 26swg Al cladding. EPDM hose pipes can also be used for systems up to and including 500LPD.
7. **Collector stand:** Collector stand assembly shall be made of MS angle of size 38x38x4 mm duly pre-treated and stove enamelled with black Colour paint. Alternatively tubular structure with Powder coating could also be provided.
8. **Make up water tank:** The capacity of make up tank shall be 5 litres up to 500 LPD and 10 litres for 1000 LPD and above.
9. **Electrical heaters:** Electrical heater shall be ISI marked. Electrical heater backup shall be two nos. each of rating 3 KW for 500 LPD, 3 nos. each of rating 3 KW for 1000 LPD, 4 nos. each of rating 3 KW for 2000 LPD and 2 nos. of 3 KW rating in each of the three phase for 3000 LPD.
10. **Temperature Gauge:** Dial type, duly calibrated and suitable for temperature range from 0 degree C to 120 degree C and shall be provided for capacity above 500 LPD.
11. **Valves:** 3 valves, one for inlet, outlet, and make up tank each.

Method of Construction:

The entire Solar Hot water system with all accessories shall be installed at designated place, with necessary plumbing, wiring and testing.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

4.2 Pipes for Solar Hot Water System

(ESD-HWP)

A) **Thermal insulated GI pipes:** (TIP)

Scope:

Specification No

(ESD-HWP/TGP)

Supplying and erecting ISI mark GI Pipe with accessories, as piping for solar hot water system of specified diameter with resin bonded flap rock wool/glass wool insulation with aluminium cladding to withstand the temperature of 100 degree C maximum, complete as directed by the site engineer.

Material:

GI Pipe: As per (CW-PLB/GP) specified in chapter 17.5 for Plumbing

Glass Wool: Superior quality with thermal conductivity value 1.67 per cm² per watt.

Rock wool: Superior quality with density of 30 – 32 kg/ cm²

Bonding material: Resin or adhesive.

Cladding material: Aluminum sheet of 26 SWG or Plastic sheet, Chicken mesh.

MS Clamps: Clamps fabricated of required length and shape, of 3 mm thick mild steel having 25 mm width.

Hardware: Sheet Metal (SM) screws of required sizes, plugs/wooden gutties, etc.

Method of Construction:

Before preparing the piping, exact measurements shall be taken. The pipes shall be insulated either by rock wool or with glass wool as explained below:

Glass wool insulation: Firstly the outer surface shall be cleaned so as to make it free from oily substance, if any. Then the glass wool shall be pasted with resin or adhesive uniformly for a thickness of 50 mm. The glass wool shall then be covered with plastic sheet so as to hold it in position, this will form the insulation. Then the aluminium sheet shall be fixed to the insulation and the ends shall be securely fixed with SM screws. The insulation at fixing ends of pipe (i.e. at coupling, bend, elbows, Tee's, valves, etc) shall be done after the piping is fixed to the system. The entire insulated piping shall be tested for leakages, temperature.

Rock wool insulation: As mentioned above, but with rock wool bonded to the pipe and covered with chicken mesh to hold in its place.

The insulated piping shall be fixed on wall or at any other location directed by the site engineer, with MS clamps fixed with SM screws, with plugs, wooden gutties (for erection on stone wall) complete. In addition to above the erection shall meet the requirements mentioned in para 4.2.1 of chapter 17.5 for Plumbing.

Mode of Measurement:

Executed quantity shall be measured on running meter basis, including the entire accessory. The lengths shall be measured net on the straight and bends along the center line of the pipes and fittings correct up to a cm. (i.e. per meter)

B) Polyethylene Composite Pipes: (PCP)

Scope:

Specification No (ESD-HWP/PCP)

Supplying and erecting Polyethylene Composite Pipe with accessories, as piping for solar hot water system of specified diameter, suitable for continuous operating temp. of 95 degree C. and rated pressure of 6.9 Kg / sq. cm at 82 degree C complete as directed by the site engineer. The pipe shall have chemical composition prepared as per ASTM F1282-02 specifications (pressure rating of 13.8 kg per sq cm and 11 kg per sq. cm at 60 degree, short term excursions to 95 degree C) and shall not affect the overall performance

Material:

Composite Pipes & accessories:

Pipes shall be made from aluminum and polyethylene composite by combining the two materials along with adhesive layers. The pipe shall have the following properties:

Properties of Pipe:

- a) No thermal expansion and deformation.
- b) High flexibility, frost resistant, ready to use with plastic.
- c) Malleable. Easy to form curves, bends.
- d) Corrosion free.
- e) No scaling build up, to avoid reduction in flow of water.
- f) Non-toxic, rust free and shall not allow growth of micro-organisms to make it contamination free.
- g) Fire retardant with Low smoke.
- h) UV resistant and shall be Opaque.
- i) Pipe walls shall not allow Permeation. (No entry of foreign material inside the pipe through the pipe walls)
- j) Low coefficient of linear expansion.
- k) Thermal expansion of 25×10^{-6} degree Kelvin (Expansion/Contraction rate shall be less than 10% of Plastic pipe). Anti-freezing, with thermal conductivity of 0.43 watt /m degree Kelvin.

MS Clamps: Clamps fabricated of required length and shape, of 3 mm thick mild steel having 25 mm width.

Hardware: Sheet Metal (SM) screws of required sizes, plugs/wooden gutties, etc.

Method of Construction:

Before preparing the piping, exact measurements shall be taken. The pipe shall be joined by compression/crimp fitted with internal as well as external end with necessary sealing arrangement, to make it leak proof.

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The piping shall be fixed on wall or at any other location directed by the site engineer, with MS clamps fixed with SM screws, with plugs, wooden gutties (for erection on stone wall) complete. In addition to above the erection shall meet the requirements mentioned in para 4.2.1 of chapter 17.5 for Plumbing.

Mode of Measurement:

Executed quantity shall be measured on running meter basis, including the entire accessory. The lengths shall be measured net on the straight and bends along the center line of the pipes and fittings correct up to a cm. (i.e. per meter)

4.3 Solar Lighting (ESD-SOL)

A) Solar Street Light (SOL)

Scope:

***Specification No* (ESD-SOL/STL)**

Supplying & erecting Solar Street Light Fittings suitable for specified wattage of CFL, along with GI/MS Pipe Pole. The system should be designed to automatically switch ON at dusk, operate throughout the night, and automatically switch OFF at the dawn, under average daily, solar radiation conditions of 5 kWh/m² on a horizontal surface. (Refer drawing no. ESD-SOL-1 (Fig.1))

Material:

1. PV Module(s):

- The PV module(s) shall contain crystalline silicon solar cells.
- The power output of the module(s) under STC should be a minimum of 74 W, either two modules of minimum 37W output each or one module of 74W output should be used.
- The operating voltage corresponding to the power output mentioned above should be 16.4V.
- The open circuit voltage of the PV modules under STC should be at least 21.0 Volts.
- The terminal box on the module should have a provision of opening for replacing the cable, if required.

2. Inverter:

- The inverter should be of quasi sine wave or full sine wave type with frequency in the range of 20-35 KHz.
- The total electronic efficiency should be at least 80%.
- No blackening or reduction in the lumen output by more than 10% should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle).
- The idle current consumption should not be more than 10 mA.
- Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery through out the year.
- Necessary length of wires, cables, and fuses should be provided.
- The PV module will be used to sense the ambient light level for switching ON and OFF the lamp.

3. Electronic Protections:

- Adequate protection is to be incorporated under no load conditions e.g. when the lamp is removed and the system is switched ON.
- The system should have protection against battery overcharge and deep discharge conditions.
- Fuses should be provided to protect against battery overcharge and deep discharge conditions.
- A blocking diode should be provided as a part of the electronics to prevent reverse flow of current throughout the PV module(s), in case such diode is not provided with the solar module(s).
- Full protection against open circuit accidental short circuit and reverse polarity should be provided.

4. Mechanical Hardware:

- A metallic frame structure (with corrosion resistance paint) to be fixed on the pole to hold the SPV module(s). The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45 degrees so that the module(s) can be oriented at the specified tilt angle.

- The pole should be made of mild steel pipe with a height of 4 meters above the ground level, after grouting and final installation. The pole should have the provision to hold the weather proof lamp housing. It should be painted with a corrosion resistant paint.
- A vented acid proof and corrosion resistant painted metallic box for outdoor use should be provided for housing the battery.

Method of Construction:

The entire solar light with all accessories shall be installed at designated place, duly wired and giving necessary testing.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

B) Solar Home Lighting System (SHL)

General:

A solar home system aims at providing solar electricity for operating lights and/or fan or energizing a DC operated portable TV set for specified hours of operation per day.

Scope:

Specification No (ESD-SOL/SHL)

Supplying & erecting Solar Home Light Fittings suitable for specified wattage of CFL/DC Fan, along with required accessories.

Material:

1. Models:

The model shall be as mentioned in the Table No. 4.3/1 given below:

Table No. 4.3/1

Model wise details of Solar Home Lights

S.No .	Model Configuration	Details of PV Module	No. of 9/11 Watts CFL	No. of DC Fan (Wattage < 20 Watts)	Battery
1	Model 1 (1 Light)	1x18 Wp under STC	1	0	1x12 V, 20 AH, Tubular/Plate, low maintenance
2	Model 2 (2 Lights)	1x37Wp under STC	2	0	1x12 V, 40 AH, Tubular/Plate, low maintenance
3	Model 3 (1 Light and 1 Fan)	1x37Wp under STC	1	1	1x12 V, 40 AH, Tubular/Plate, low maintenance

2. Lamps:

- The lamps shall be of compact fluorescent (CFL) type, either 4-Pin or 2 Pin types, with rating of 9/11W. For the 4-Pin type CFL a suitable preheating circuit must be provided.
- (b) The light output from the lamps should be around 600 +/- 5% lumens (9W CFL) and 900 +/- 5% lumens (11W CFL).
- (c) The lamps should be housed in an assembly suitable for indoor use, with a reflector on its back. While fixing the assembly, the lamp should be held in a base up configuration.

3. Battery:

- The battery will be of flooded electrolyte type, positive tubular plate, low, maintenance lead acid battery.

- (b) The battery will have a minimum rating of 12V, 20 or 40 or 75 Ah, the discharge rate of 1/10th of the AH capacity of the battery.

- 75% of the rated capacity of the battery should be between fully charged & load cut off conditions.

4. Electronics:

- The inverter should be of quasi sine or full sine wave type with frequency in the range of 20-35 KHz. Half wave operation is not acceptable.
- (b) The total electronic efficiency should be at least 80%.
- © No blackening or reduction in the lumen output by more than 10% should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle.)
- (d) The idle current consumption should not be more than 10 mA.
- (e) Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery throughout the year.
- Necessary lengths of wires/cables, switches suitable for DC use and fuses should be provided.

5. PV Module(s):

- The PV module(s) shall contain crystalline silicon solar cells.
- The power output of the module(s) under STC should be a minimum of 18W or 37W or 74W. In case of Model 4 & 5 either two modules of 37 W each or one module of 74W should be used.
- The operating voltage corresponding to the power output mentioned above should be 16.4V
- The open circuit voltage of the PV modules under STC should be at least 21.0 Volts
- The terminal box on the module should have a provision for opening for replacing the cable, if required.
- A strip containing the following details should be laminated inside the module so as to be clearly visible from the front side:

6. DC Fan:

- The wattage of the fan should not be more than 20 Watts and it should operate at 12V DC.

7. Electronic Protections:

- Adequate protection is to be incorporated under no load conditions e.g. when the lamps are removed and the system is switched ON.
- The system should have protection against battery overcharge and deep discharge conditions.
- Fuses should be provided to protect against short circuit conditions.

8. Mechanical Components:

- Metallic frame structure (with corrosion resistance paint) to be fixed on the roof of the house to hold the SPV module(s). The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45, so that it can be installed at the specified tilt angle.
- A vented metallic box with acid proof and corrosion resistance paint, for housing the storage battery indoors should be provided. The box can be of injection Moulded plastic or wooden for home lighting models 1, 2 and 3 only.

Method of Construction:

The entire Solar Home light with all accessories shall be installed at designated place, duly wired and giving necessary testing.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

4.4 Energy Devices (ESD-ED)

A) Digital Active Harmonic Filter (DAHF)

Scope:

Specification No

(ESD-ED/DAHF)

Designing, supplying, erecting, testing, and commissioning of Digital Active Harmonic filter cum Power conditioner, with high speed IGBT device for specified filtering current.

Material:

The unit shall comprise of following features and meet the following parameters:

Topology	4 wire (3Ph + N) Active Power Filter			
Technology	Digital Closed Loop Active Filter with Source Current Sensing 32 bit, Digital Signal processing, High speed IGBT's in power circuitwith necessary CT for current sensing.			
Working Principle	Synchronous rotating reference frame.			
Application	Selectable for Harmonic Filtration & or PF Correction.			
Compensation Filter current	30 AMP	60 AMP		
Heat dissipation	< 1500 W	< 1700 W		
Input Voltage	Nominal 400 Volt Phase to Phase Accepted Phase to Phase voltage range: +10%, -15%			
Input Frequency	Nominal: 50Hz +/-10%, (60Hz Optional)			
Interrupting capacity	100 KA, Fused	100 KA, Fused		
Over load capacity	Limiting to nominal current continuous limiting operation possible			
Harmonics Filtering	3 rd to 31 st Harmonic compensation attenuation ratio up to 96%.Programmable for Selective Harmonic Elimination.			
Power Factor correction	Adjustable up to unity from 0.6 lag or 0.6 lead without Over compensation OR Under compensation			
Audible noise level	< 65 db (A)	< 65 db (A)		
Operating temperature range	-5°C To 40°C			
Storage temperature range	-25°C To + 55°C			
Relative Humidity	Max. 90%, Non-condensing			
Standards	IEEE 519 for compensated harmonicsIEC / EN62040-2: 2006- Category C3. EN 50178: 1997. CE approved.			
Protection degree	IP32			
Electrostatic discharge immunity	4 KV contact / 8 KVA air discharge			
Cooling	Forced air cooling with axial flow fan			
Color	Havells grey or as specified by Engineer in-charge			
Access	Front access			
External cable connections	Bottom / Top Entry (Front Side)			
Configuration	Standalone/ with facility of Paralleling up to 8 Machines.			
Switches for <input type="checkbox"/>	1. ON 2. OFF 3. Reset 4. Up		5. Down 6. Acknowledge 7. Soft Key 1 8. Soft Key 2	
Remote Signals for <input type="checkbox"/>	1. Filter Running – 1 Amp – 125 V AC 2. Fault			
Indications for <input type="checkbox"/>	1. OK (Filter Running) 2. Alarm 3. Warning			
Display Faults for <input type="checkbox"/>	1. Wrong Phase sequence 2. External Inhibit 3. Fast DCOV 4. Rph CTFB Wrong 5. Yph CTFB Wrong 6. Bph CTFB Wrong 7. DC Over voltage		8. Over Load 9. Over Temp. 10. Over current 11. No Sync 12. Mains Abnormal 13. DC Under Volt 14. Filter Trip	
Display Parametersfor <input type="checkbox"/>	1. Status 2. ID 3. Input Voltage 4. Input Voltage Waveform 5. Input Voltage FFT 6. Input Current 7. Input Current Waveform 8. Input Current FFT 9. Input Current (KW) 10. Input Power (KVA)		11. No. of mains failures 12. Total Filter ON Time 13. Alarm Log 14. Power Factor 15. DC BUS Voltage 16. Filter Load % 17. Mains Frequency 18. Heat Sink Temp. 19. Date & Time	

Method of Construction:

The entire equipment shall be installed at designated place, duly wired with provided cable/leads and giving necessary testing.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

B) APFC Panel with Harmonic suppressor (APFC)

Scope:

Specification No

(ESD-ED/APFC)

Supplying, Installing Testing & commissioning manual / Auto power load correction panel of required capacity in kVAR, 440 Volts, 3 phase 50 Hz, Thyristor switch consisting of minimum 4 steps suitable design to take care of 5% of load variation at any time. Steps configuration shall be by the Engineer in charge as per site conditions.

Material:

Capacitors: App Type IS: 13585 part-I 1994 any type gas filled 525 Volts. **Thyristor switches:** Thyristor switches should be designed for zero crossing with snubber circuit forced cooling & min 1600 PIV rating.

Series reactor: Copper wound dry type, iron core suitable as per requirement.

Harmonic filter circuit: Circuit suitable to filter Harmonics up to 17th Harmonics.

CRCA sheet: CRCA sheet 14/16 SWG with 7 tank process & powder coating suitable to site condition of required colour shade.

MS angles & channels: Size as per site condition.

Bus bar: Electrolytic copper bus bar of suitable capacity.

Exhaust fan: Tube axial exhaust fan of adequate capacity.

Fabrication materials: MS Jali, Hinges, nut bolts washers, screws etc. of suitable size.

Switchgear: SFU, MCB, MCCB, HRC Din type fuse base as specified in chapter switchgear.

Power factor Controller Relay: Minimum four steps, microprocessor based programmable intelligent relay / dynamic correction Intelligent relay with switches time from selected 1sec. to 1200 sec. having display of system v/s, current, frequency, target PF, THD, short fall KVAR, active power KW, KVAR, Harmonic display up to 17th order.

Accessories: Digital ammeter, digital Voltmeter, Bar primary CTS Class 1, 15VA and ratio, selector switch indicating pilot Lamps all Bakelite with colour glass, buttons. of require push

Method of construction:

APFC panel shall be designed to cater required KVAR capacity with 20% expandable additional load requirement.

Fabrication of panel shall be in such away to accommodate additional extra capacitors.

Panel shall be delivered after testing in presence of the engineer in charge.

Method of Construction:

The entire equipment shall be installed at designated place, duly wired with provided cable/leads and giving necessary testing.

Mode of Measurement: Executed quantity will be measured according to the sum of capacitor banks installed on kVAR basis. (i.e. per kVAR)

SWITCHGEARS

5.1	LT --I/C M/C Switches, ATS, Bus Bar, Feeder Pillar	SW-SWR
5.2	I/C M/C Distribution boards	SW-DB
5.3	LT -- MCB	SW-MCB
5.4	LT -- MCBDB	SW-MCBDB
5.5	LT -- MCCB	SW-MCCB
5.6	LT -- RCCB	SW-RCCB
5.7	LT – Oil Circuit Breakers	SW-OCB
5.8	LT – Air Circuit Breakers	SW-ACB
5.9	HT – SFU, LBS	SW-HTS
5.10	HT – Breakers (VCB)	SW-VCB
5.11	Drawings	

5.1 LT—I/C M/C Switches, ATS, Feeder Pillar**(SWR)****General**

All material shall confirm to relevant standard as per BIS and shall carry ISI mark.

Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W. Dept. Handbook/NEC.

Refer IS; 13947/1993, For Switch gears, IS: 13703/1993 for HRC fuses.

Incoming contacts for all switchgears shall be shrouded for avoiding accidental contact.

A) Indicator DP (BDP)**Scope:**

Specification No (SW-SWR/BDP)

Supplying surface/flush mounting Bakelite D.P switch and erecting on filled polypropylene ISI marked board or on screwed board with top of plywood pasted with laminate.

Material:

DP Switch: Bakelite double pole switch 32A 250V, with copper contacts for make & break, and fuse, indicator lamp with shrouded incoming contacts.

Boards: As per **(WG-PW/SW)** in chapter of Wiring para No. 1.6

Hardware: SM screws, rawl plug, wooden gutties etc.

Method of Construction:

The DP switch shall be erected on specified board or flush in provided enclosure.

Mode of Measurement:

Executed quantity will be counted on number basis. (i.e. Each)

B) IC/Metal clad DP (MDP)**Scope:**

Specification No (SW-SWR/MDP)

Supplying and erecting IC/Metal clad DP switches of specified rating on angle iron frame of suitable size.

Material:

DP Switch: Single phase Double pole metal / iron clad weatherproof air break switch fuse unit, confirming to IS: 13947 (part- 1 & 3)/ 1993 with facility to de-link neutral, suitable for single phase 240 volts, 50 Hz AC supply, having positive make break arrangement with shrouded incoming contacts, cable entry holes, sealing arrangement and mounting arrangements.

Fabrication: Required size of angle iron / MS Flat.

Paint: Superior quality enamel paint of specified shade & colour, Red Oxide paint.

Hardware: SM screws, MS Nuts & bolts, rawl plug, wooden gutties etc.

Grouting Material: Cement, Sand, Putty, water, etc.

Method of Construction:

The switch shall be erected at designated place duly mounted on suitable size of angle iron frame as per Table no. 5.1/1 with the help of required nut bolt washer etc. The angle frame to be erected on wall with the help of screws, or to be grouted in wall with the help of cement concrete etc. Frame shall be painted prior to erection.

Mode of Measurement:

Executed quantity will be counted on number basis. (i.e. Each)

C) IC/Metal clad TP/TPN switches

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(MTP)

Scope:

Specification No

(SW-SWR/MTP)

Supplying and erecting IC/Metal clad TP/TPN /on load/off load changeover switches of specified rating on angle iron frame of suitable size.

Material:

TP/TPN Switches: Three phase Triple pole / Three phase Triple pole with neutral link weatherproof metal clad air break switch fuse unit of specified rating, confirming to IS:13947 (part- 1 &3)/ 1993 with positive make and break arrangement with shrouded incoming contacts, facility suitable for Three phase 415 volts, 50 Hz AC supply, It shall be fitted with interlock-able cover and re-wire able type porcelain fuse and having cable entry holes, sealing arrangement and mounting arrangements.

Fabrication: Required size of angle iron / MS Flat.

Paint: Superior quality enamel paint of specified shade & colour, Red Oxide paint.

Hardware: SM screws, MS Nuts & bolts, rawl plug, wooden gutties etc.

Grouting Material: Cement, Sand, Putty, water, etc.

Method of Construction:

The switch shall be erected at designated place duly mounted on suitable size of angle iron frame as per Table No. 5.1/1 with the help of required nut bolt, washer, etc; on frame/wall. The angle frame to be erected on wall with the help of screws, or to be grouted in wall with the help of cement plaster, and finished as original. The Frame shall be painted prior to erection.

Mode of Measurement:

Executed quantity will be counted on number basis. (i.e. Each)

D) Metal clad TP/TPN Switches with HRC fuse

(TPHRC)

Scope

Specification No.: (SW-SWR/TPHRC)

Supplying and erecting Metal clad TP/TPN switches with HRC Fuses of specified rating on angle iron frame of suitable size.

Material:

TP/TPN Switches: Combination fuse switch unit, Metal clad, Triple pole with Neutral link, Degree of Protection IP-2L3 as per IS: 13947 (pt.3) 1993. Quick make and break, Inter-lockable cover, uninterrupted duty, Utilization category AC-23A and confirming to IS: 13947 (Part.3) 1993. It shall be suitable for three high rupturing capacity equal to 80 KA (HRC) cartridge fuses confirming to IS: 13703 (Part.1) 1993 and IS: 13703 (Part.2/Section & 2) 1993 having rupturing capacity 80 KA minimum, with rated voltage 415 Volts, 50 Hz. AC with shrouded incoming contacts.

Enclosure: Made of CRCA sheet of thickness not less than 1.2mm.

Fuses: 80 kA High rupturing capacity fuses with ISI mark.

Mounting: Required size of angle iron / MS Flat.

Paint: Superior quality enamel paint of specified shade & colour, Red Oxide paint.

Hardware: SM screws, MS Nuts & bolts, rawl plug, wooden gutties etc.

Grouting material: Cement, Sand, Putty, Water, etc.

Method of Construction

The switch shall be erected at designated place duly mounted on suitable size of angle iron frame as per table no. 5.1/1 with the help of required nut bolt, washer, etc on frame/wall. The angle frame to be erected on wall with the help of screws, or to be grouted in wall with the help of cement plaster, and finished as original. The Frame shall be painted prior to erection.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e.each)

Table No.5.1/1**Minimum size of angle to be used for Mounting frames of Switchgear**

S No.	Capacity	Minimum Size of angle iron
1	16A,32 A, DP/TP/TPN/ changeover switch	25x25x3 mm
2	63A to 200 A DP/TP/TPN/ changeover switch	40x40x5 mm
3	300 A and above TPN/changeover switch	50x50x6 mm

E) Mini Feeder Pillar**(MFP****)Scope:****Specification No****(SW-SWR/MFP)**

Fabrication of feeder pillar with CRCA sheet, fixing of aluminium strips/bars, with necessary painting and complete erection on provided cement concrete foundation.

Material:**Incoming Isolator:** 200 A Four Pole MCCB with 35 kA SC rating**CRCA Sheet: 14 gauge****Fabrication:** Angle iron of required size.**Bus bar strip:** Aluminium strips with colour coding heat shrinkable sleeves**Insulators:** Bus bar insulators (Porcelain/Epoxy)**Gasket:** Rubber / Neoprene gasket **Red****Oxide:** Red oxide paint /Primer**Paint:**

Superior quality Enamel paint

Hardware: MS nut bolts of required size and length. MS Hinges, Self locks for door.**Danger Board:** Danger notice in Marathi & English

Foundation material: Cement, Sand, water.

Method of Construction

The mini feeder pillar shall be fabricated from 14 SWG CRCA sheet. The size of the chamber shall be 75 cm in height, 50 cm in width and 35 cm in depth. The top cover(50 cm in width and 30 cm in depth) shall be fabricated in such a manner so as to have slope on all four sides. The slope shall start at the centre of the chamber. Front door of the feeder pillar shall have self locking arrangement (minimum two) and shall be fixed as directed by the site engineer. The door shall be made water proof by fixing the rubber / neoprene gasket on the inner side. Necessary provision for ventilation shall be made on both side of feeder pillar chamber. These shall be complete with welded non ferrous metallic mesh so as to make it vermin proof. The entire fabricated chamber shall be fixed frame made from 50x50x5 mm angle iron. Dimensions of the frame shall be as per the size of the frame and the depth of the legs shall be 50 cm. The extended portion of the leg of frame shall be covered on all four sides with 14 SWG CRCA sheet duly fixed with suitable size of MS bolts & nuts. The chamber shall have removable bottom plate at the end of the frame, with holes of suitable diameter for incoming and outgoing cables.

Four numbers of aluminium bars of 40 x 5 mm cross section with 35 cm in length for three phases & neutral duly covered with colour coded PVC heat shrunk sleeves or covered with PVC insulation tapes with colour coding, shall be fixed inside the chamber on porcelain / epoxy insulators in staggered manner so as to facilitate the connections of cable leads. (Minimum two insulators shall be provided), with main cable socket to each bar. The provided Four Pole MCCB of 500 V 200 A rating, shall be fixed on mounting made from CRCA sheet at the bottom for terminating the incoming cable.

The feeder pillar chamber door shall be fixed with enamel iron G.I. Sheet 18 gauge caution board of size 200 mm x 150 mm or have sticker pasted, as per I.S.2551 of 1982.

The entire feeder pillar thus fabricated shall be erected in cement concrete foundation (with excavation of soil) with 4 numbers of suitable size foundation bolts. The minimum dimensions of the cement concrete foundation shall be 60 cm in width, 50 cm in depth and 30 cm height.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

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5.2 I/C M/C Distribution boards (MDB)

Metal clad DB (MDB)

Scope:

Specification No (SW-SWR/MDB)

Supplying, erecting Metal clad distribution board of specified ways and rating, suitable 250 V/440 V 50 Hz, AC supply, erected on iron frame/board.

Material:

Distribution board: Fabricated from 18 gauge C.R.C.A. sheet steel of required ways, 250/440 V having kitkat pattern H.C. type fuse bridges 16 A/32 A and Neutral bar connector with earth terminal.

Mounting: Required size of angle iron / MS Flat.

Paint: Superior quality enamel paint of specified shade & colour, Red Oxide paint.

Hardware: SM screws, MS Nuts & bolts, rawl plug, wooden gutties etc.

Boards: As per (WG-PW/SW) in chapter of Wiring Para. No. 1.6

Method of Construction:

The switch shall be erected at designated place duly mounted on suitable size of angle iron frame as per Table no. 5.2/3 with the help of required nut bolt, washer, etc on frame/wall. The angle frame to be erected on wall with the help of screws, or to be grouted in wall with the help of cement plaster, and finished as original. The Frame shall be painted prior to erection.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Table No. 5.2/3

Minimum size of angle to be used for fabrication of frames for DB's

Sr. No	Rating of Distribution Boxes	Minimum size of angle iron in mm
1	DB 16 A, 250 V.	25x25x3
2	DB 16 A, 415 V	40x40x3
3	DB 32 A, 415 V	40x40x5

5.3 Miniature Circuit Breakers (MCB) (MCB)

SP/SPN/DP/TP/FP MCB'S

Scope:

Specification No (SW-SWR/MCB)

Supplying MCB of specified poles, current rating, and either of B or C series with required wiring connections & lugs etc. and erecting in provided enclosure / distribution board.

General Specifications for MCB's

- MCB's shall be of current limiting type, ISI marked confirms to IS 8828 – 1996.
- The power loss per pole shall be low and shall be in accordance with IS 8828 1996.
- All cable entries shall be either from bottom or top.
- MCB's shall be of C- curve characteristic & shall have quick make & break non-welding self wiping silver alloy contacts for 10 kA short circuit both on the manual & automatic operation.

- All the active, live parts of MCB's should be out of human reach, ensuring safety & confirms to IP: 55 degree of protection.
- The MCB's must house transparent label holder to ensure circuit identification.
- The MCB's must have fully insulated safety shutters.

- The MCB's shall have lockable switching lever.
- The Minimum electrical endurance shall be 20,000 operations.
- The housing of the MCB shall be mounted self-extinguishing DMC (Dough Moulding Compound).
- The short circuit Current shall be brought to zero within 4 to 5 milliseconds from the time they are established.
- All MCB's shall have a minimum short circuit Capacity of 10kA RMS.

Material:

Single Pole / Single pole with Neutral / Double Pole / Triple pole / Four pole: MCB, ISI marked as per IS 8828 : 1996 (IEC 60898) with hammer trip and watch mechanism 15 arc plates, 10 KA capacity with nominal rating of 240/415V.

Lugs: Copper lugs of suitable size as per (CB-CL/CU) in chapter 7.10 for Cable

Method of Construction:

MCB shall be erected in provided enclosure / distribution board and terminating the provided wires by copper lugs (crimping type) and connecting the same.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.4 Distribution Board suitable for MCB's (MCBDB)

Horizontal / Vertical type DB's

Scope:

Specification No (SW-SWR/MCBDB)

Supplying of MCBDB suitable for 230 V / 415 V, horizontal/vertical, with/without door of specified ways (poles), surface / flush mounting to house incoming and outgoing MCB's, and erected on iron frame.

General Specifications for MCBDB's

- DB's shall be prewired and shall be fabricated as per IS: 8623.
- Suitable for flush mounting & surface mounting, with 100 A copper bus bar (For Horizontal type DB), neutral bar, earth bar & cable ties for cable management.
- In case of Vertical DB the bus bar shall be of 200 A rating.
- DB's shall be of IP – 43 degree of protection.
- All the MCB distribution boards shall be fabricated out of 18 SWG thick sheet steel duly rust inhibited through a process of degreasing, pickling, phosphating & powder coating to an approved colour over primer & shall be of the totally enclosed dust proof type suitable for wall mounting.
- All components shall be mounted on DIN rails & covered totally with a sheet steel cover rendering it finger-safe. Access to the internal connections shall be only through removing the cover sheet.
- All DB's shall be internally prewired using copper insulated high temperature PVC wires.
- Bus bars & neutral bar shall be fully insulated with standard colour code.
- Bus bar withstanding capacity shall be 10kA.
- DB's must have facility of reversing door without modification, pan assembly for ease of installation & convertible locking.

Material:

Horizontal/Vertical type MCBDB: ISI marked as per IS 8623, of specified ways (poles), surface/flush mounting, with/without door, suitable for 230 V / 415 V.

Lugs – Copper lugs of suitable size as per (CB-CL/CU) in chapter 7.10 for Cable

Iron work: Suitable size of angle/flat.

Hardware: SM screws, rawl plug, gutties, etc.

Method of Construction:

MCBDB shall be erected at designated location and directed by site engineer and terminating the provided wires by copper lugs (crimping type) and connecting the same.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.5 Moulded Case Circuit Breaker (MCCB) (MCCB)

Scope:

Specification No

(SW-SWR/MCCB)

Providing & erecting 3 Pole/4 Pole MCCB of specified rating and with specified short circuit rupturing capacity in KA, complete erecting in provided enclosure & connected with provided leads on incoming and out going side, complete.

General Specifications for MCCB's

- MCCB's should comply with IS 13947 part -2, IEC (6094) and IEC 60947-3 & IEC 60947 part – 2.
- The MCCB shall be suitable for universal mounting i.e. the load/line shall be interchangeable with shrouded incoming contacts.
- The MCCB shall be suitable for minimum operating voltage of 415V.
- The thermal setting shall be adjustable from 64 % to 100% of its normal current.
- The magnetic setting shall be adjustable from 3.5 to 10 In (normal current).
- Trip reset should be available Manual / Automatic.
- Isolator switches for electronic circuits to open the MCCB automatically.
- The MCCB's must have transparent label holder to ensure circuit identification.
- The MCCB's must have fully insulated safety shutters.
- Overload Zone adjustable from 0.4 to 1 in with line (For 630 amp & above MCCB)
- Short circuit Zone adjustable from 1.5 to 10 In with time.

Material:

3 pole or 4 Pole MCCB Moulded case circuit breaker. Fixed version– front Terminals with current rating & breaking capacity as below:

i.	63 A to 125 A	-	15 KA
ii.	160 A to 250 A	-	35 KA
iii.	300/400 A	-	35 KA
iv.	630 A	-	70 KA

Method of Construction:

3 pole /4 pole MCCB shall be erected in provided enclosure & connected with provided leads/strip on incoming & out going side complete

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.6 Residual Current Circuit Breaker (RCCB)

A) Residual Current Circuit Breaker (RCCB)

Scope:

Specification No	(SW-RCCB/RCCB)
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Supplying, erecting, and commissioning of 2/4 Pole RCCB of specified rating, conforming to IS: 12640, duly connected with copper leads, copper lugs, etc., in provided enclosure.

<u>General Specifications for RCCB</u>

- RCCBs shall be ISI marked as per IS 12640 (part 1) – 2000 and Confirming to IEC 61008-1.
- It shall work on residual current energy, having 30 milliamp sensitivity and shall protect against earth leakage.
- Tripping time shall be maximum 30 milliseconds.
- Breaking capacity shall be 20 kA.
- RCCB shall operate for rated leakage at nominal Ten volts AC, and also in both, Neutral Open & Snapping condition.
- RCCBs shall have trip free mechanism with quick make & break non-welding self wiping silver alloy contacts for 20 KA short circuit current both on the manual & automatic operation. Test knob facility shall be provided.
- All the active, live parts of RCCBs should be out of human reach, ensuring safety & confirms to IP20 degree of protection.
- The RCCBs must house transparent label holder to ensure circuit identification.
- The RCCBs must have fully insulated safety shutters.
- The Minimum electrical endurance shall be 20,000 operations.

<u>Material:</u>

2 Pole / 4 pole, RCCB, ISI marked as per IS: 12640-2000 (IEC 61008-1) with hammer trip and watch mechanism 15 arc plates, 20 KA breaking capacity of specified rating suitable for 240/415V.

Lugs – Copper lugs of suitable size as per (CB-CL/CU) in chapter 7.10 for Cable PVC

Copper leads: As per WG-MA/BW specified in chapter of Wiring in para. no.1.3

<u>Method of Construction:</u>

2 / 4 Pole RCCB shall be erected in provided enclosure & connected with leads, with necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

B) Residual Current Circuit Breaker with over voltage cut Off (RCBO)

Scope:

Specification No	(SW-RCCB/RCBO)
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Supplying, erecting, and commissioning of 2 Pole RCBO (RCCB+MCB) of specified rating, conforming to IS: 12640 duly connected with copper leads, copper lugs, etc., in provided enclosure.

<u>General Specifications for RCBO</u>

- RCBO's with integral combination of RCCB+MCB, shall be ISI marked as per IS 12640 (part 1) – 2000 and Confirming to IEC 61008-1.
- It shall work on residual current energy, having 30 milliamp sensitivity with

protection against earth leakage and over voltage upto 290 Volts.

- Tripping time shall be maximum 30 milliseconds.

- Breaking capacity shall be 10 kA.
- RCCB shall operate for rated leakage at nominal Ten volts AC, and also in both, Neutral Open & Snapping condition.
- RCBO's shall have trip free mechanism with quick make & break non-welding self wiping silver alloy contacts for 10 kA short circuit both on the manual & automatic operation. Test knob facility shall be provided.
- All the active, live parts of RCBO's should be out of human reach, ensuring safety & conforms to IP20 degree of protection.
- The RCBO's must have transparent label holder to ensure circuit identification.
- The RCBO's must have fully insulated safety shutters.
- The Minimum electrical endurance shall be 20,000 operations.

Material:

2 Pole / 4 pole, RCBO with integral combination of RCCB+MCB, ISI marked as per IS: 12640-2000 (IEC 61008-1) with hammer trip and watch mechanism 15 arc plates, 10 kA breaking capacity of specified rating suitable for 240/415V.

Lugs – Copper lugs of suitable size as per **(CB-CL/CU)** in chapter 7.10 for Cable **PVC Copper leads:** Copper leads of suitable size, as per **(WG-MA/BW)** specified in chapter of Wiring in para. No. 1.3

Method of Construction:

2 / 4 Pole RCBO shall be erected in provided enclosure & connected with leads, with necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.7 LT – Oil Circuit Breakers (OCB)

Scope:

Specification No

(SW-SWR/OCB)

Supply, erection of panel mounting, non-draw out type Oil Circuit Breaker of specified rating and rupturing capacity, triple pole 440 V, 50 Hz, neutral link, oil filled, totally enclosed. (Conforming to BSS 936/1960 & IS 2516/1965)

Material:

Enclosure:

Compact, all-welded robustly constructed steel enclosure, suitable for wall mounting/pedestal mounting with standard finish of dark admiral grey paint, making perfect for industrial use under the most severe operating conditions. The unit should also be suitable to mount on the switchboard directly.

Protection:

Overload protection:

Overload protection is through a triple pole series, operated upto 200 Amps and above CT operated electromagnetic overload coils suitably time lagged with oil dash pots operated directly on the mechanism tripping the breaker on sustained overloads. These overload devices are instantaneous self resetting type with an inverse time-lag characteristic protecting the circuitry faster than any other type of protection. Suitable range of calibration is also provided for, thus ensuring more accurate fool proof overload protection.

Under Voltage protection:

Electro-magnetic under voltage protection by an under voltage coil fitted separately and acts directly on the mechanism. Normal coil voltage is 415 Volts 50 cycles AC, A special arrangement shall be made to make it impossible to close the breaker as long as there is no supply.

Short Circuit Protection:

Short Circuit Protection is ensured through Electromagnetic series/CT operated overload devices.

Contacts:

Contacts should be substantial size cross section made of Electrolytic 99.9% purely copper contacts that have durable silver plating on contacts. The fixed contacts are spring finger type, fitted with easily removable arcing contacts. The moving contacts for lower range are made of flat copper bars made into specific shapes and for higher ranges are made from copper 'V' bars. Moving arcing contacts are made of hard bronze Metal and are self-aligning type fitted to 'V' bars. Rupturing capacity shall be 15MVA up to 400A and 25 MVA for capacity above 400A up to 800A.

Oil:

First filling of oil shall be done in the oil tank & in dashpot with specific gravity 0.96, and dielectric strength 30kV at 2.5mm gap.

Termination:

Cable end box & glands on incoming side & out going sides should be provided.

Method of Construction:

The O.C.B. should be erected on provided panel board complete with first filling of oil in oil tank & in dash pot with connecting to bus bar by means of provided insulated copper strip of suitable rating as per the rating, complete.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.8 LT – Air Circuit Breakers (ACB)

Scope:

Specification No

(SW-SWR/ACB)

Supplying, erecting, and commissioning of Air Circuit breaker of specified rating, conforming to IS 2516/IES157 manually operated non draw out type/draw out type erected at position in provided panel board in approved manner.

Material:

Air Circuit Breaker:

Draw out type/non draw out type manually quick make quick break type front operated mechanical indication for ON/OFF position with 50 kA short circuit rating. Trip free mechanism with high performance characteristic based on modular construction and should be compact.

The breaker shall have following accessories:

- **Auxiliary Switch:** Auxiliary switch shall consist of 2 NO & 2 NC contacts. The total Auxiliary switch block shall have minimum six auxiliary. In case of draw out breakers two sliding contacts should be provided.
- **Alarm Switch:** For breaker with thermal and magnetic trip units the indications should be direct from trip unit through micro switch with necessary wiring.
- **Shunt Release:** Shunt trips are used for remote control. Shunt trip coil should operate through an auxiliary switch. The operating ranges should be normally 50-110 % of the rated voltage.
- **Under voltage Release:** Under voltage release must be energized before closing breaker. This should be provided for remote control.
- **Over current release:** Over current release shall consist of Current Transformer with slides on each current carrying path of a bi-metal relay common to all transformers. The transformer shall have a fix ratio suited to particular setting range. Overload releases shall be thermal time lagged. Overload relay range shall be 50 % to 100 % of CT ratio. Frame shall facilitate site adjustment from 25-100% of ACB rating to match the load requirement.
- **RA unit** - given for 0-110% operating range of SHT-ensures supply available to shunt trip from same AC source in short circuit condition.
- **RC unit** – for up to 3secs. Time delay with U/V trip. Ideal for protection against transient voltage dips and nuisance tripping continuously adjustable time delay range of 40-500 ms with S/c trip ideal for selective interruption coordination of ACB's.
- Contacts made of electrolytic copper of 99.9 % purity, of ACB shall be totally

- shrouded, for eliminating access to live parts.
Short Circuit release pick up shall be adjustable for closer protection.

- Breaker shall be compact in size, for saving space in the cubicle and as far as possible shall be lightweight for easy handling.
- Thermal over load and magnetic short circuit protection shall be provided.

Method of Construction:

The breaker should be erected on provided panel board or cubicle as the case may be, complete with connecting to bus bar by means of provided insulated copper strip of suitable cross section as per the rating, complete.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.9 HT -- SFU's, Load Break Switch (HTS)

A) HT Switch Fuse Unit/ Load Break Switch (LBS)

Scope:

Specification No **(SW-HTS/LBS)**

Supplying and erecting extendable/ non extendable type load break switch with fuses of required rating and with IP 55 protection class, on provided MS channels/ trench/ foundation in an approved manner.

Recommended Standards:

IS 9920 (Latest Revision):- Rating, performance, testing of load break switch
IS 9921 :- Standards for temperature of electrical parts exposed to air

Load Break Switch should normally comply with the following parameters:

S. No	Specifications	11 KV	22 KV
1	Rated Voltage	12 KV	24 KV
2	Rated Current	630A	630A
3	Rated short time current	25 KA	25 KA
4	Rated making current	62.5 KA	62.5 KA
5	Rated breaking current	630A	630A
6	Impulse withstand voltage		
	Earth and between poles	75 KV	125 KV
	Across the isolation distance	85 KV	145 KV
7	Power frequency test voltage		
	Earth and between poles	28 KV	50KV
	Across the isolation distance	32 KV	60KV

Material:

- Steel Sheet
- **Electrolytic Aluminium Bus bar of 400A**
- Arc Chutes
- **Epoxy Resin Cast Type Insulators**
- H.T. Fuses of adequate capacity
- **Shunt Trip Coil**
- Manual trip push button
- **Auxiliary contacts**
- Earth switch
- **Earth Bus bar copper (25x3)**

Method of Construction:

Load break switch should be erected on provided MS channels/ trench/ foundation as per approved drawing by site in charge.
Manufacturer's certificate for type test should be obtained. Routine
Type test should be carried out at site.
An earth switch having separate operating handle should be interlocked with main switch should be checked.
An operating handle with correct sequence device having ON and OFF position and arrangement for pad locking provided should be checked.

Application:

Load break switch is suitable mainly for underground H.T. distribution system. It can be used for switching of transformers, overhead lines, capacitors, ring mains and cables.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

B) Ring Main Unit: (RMU)

Scope:

Specification No (SW-HTS/RMU)

Supplying and erecting Indoor type ring main unit with 2 incoming and 1 outgoing with HRC fuses and with IP 55 protection class, complete erected on provided CC foundation/ MS channels/ trench in an approved manner. (Refer drawing no. SW-HTS-1)

Recommended Standards:

IS 9920 (Latest Revision):- Rating, performance, testing of Ring Main Unit IS
9921 :- Standards for temperature of electrical parts exposed to air

Material:

- Steel Sheet
- **Electrolytic copper Bus bar of 400 A**
- Arc Chutes
- **Epoxy Resin Cast Type Insulators**
- H.T. Fuses of adequate capacity
- **Shunt Trip Coil**
- **Manual trip push button**
- **Auxiliary contacts**
- Earth switch
- **Earth Bus bar copper (25x3)**

Method of Construction:

Ring main unit should be erected on provided MS channels/ trench/ foundation as per approved drawing by site in charge.
Manufacturer's certificate for type test should be obtained. Routine
Type test should be carried out at site.
An earth switch having separate operating handle should be interlocked with main switch should be checked.
An operating handle with correct sequence device having ON and OFF position and arrangement for pad locking provided should be checked.

Application:

Ring Main Unit is suitable mainly for underground distribution system. It can be used for switching of transformers, overhead lines, capacitors, ring mains and cables

Mode of Measurement: - Per RMU

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Chapter 6

CONTROL PANEL

6.1	Sheets	No Specs
6.2	Bus-bars	CP-BB/
6.3	Measuring Instruments	No Specs
6.4	Accessories	No Specs

Chapter 6

Control Panel (CP)

6.2 Bus bar (BB)

Scope:

Specification No (CP-BB)

Fabrication of bus bar chamber, fixing of bus bar of specified metal, complete erection of the bus bar chamber on provided angle iron or as instructed.

Material:

Sheet: 16 gauge CRCA sheet

Fabrication material: Angle iron of required size, Hinges made from MS.

Bus bar strip: Aluminum/Copper strips covered with colour coded PVC heat shrunk sleeves or wrapped with PVC insulation tape with colour coding.

Bus bar support: Bus bar insulators (Porcelain/Epoxy)

Earth stud: MS Nut & Bolt minimum 10 mm diameter.

Packing material: Rubber / Neoprene gasket

Paint: Red oxide paint /Primer, Enamel paint

Hardware: Nuts, bolts, washers, etc of required size & length.

Danger Board: GI Sheet danger board in Marathi & English or Screen printed sticker.

Method of Construction:

The bus bar chamber shall be fabricated from 16 SWG CRCA sheet with necessary clearance on all side as mentioned in Table No 5/1 duly painted with one coat of red oxide/primer and with 2 coats of Superior quality enamel paint of required shade. The earth stud shall be welded to the chamber. The bus bar shall be fixed on fabricated bracket (to be fixed on inner rear surface of the box), with minimum three porcelain / epoxy bus bar insulator minimum at both ends & at the centre of the bar (with distance of 45cms.between insulators), with minimum 40x8 mm MS nut bolt, spring washers, etc. The above method shall be adopted for all the 4 bars. The bar shall be vertically fixed in staggered manner so as to maintain clearance in between the bars as per Table No. 6.2/2. All the bars shall either be covered with colour coded PVC heat shrunk sleeves or wrapped with PVC insulation tape with colour coding. (i.e. R, Y, B, N). The chamber shall be fixed on 25x25x4 mm angle iron frame to make it sturdy. The chamber shall have minimum one hole per bus bar for fixing incoming cable, and required holes for the out going cables. The size of the bar either aluminium / copper for the required rating shall be as per Table No 6.2/1

Mode of Measurement:

Measurement will be on running metre basis of the length of the bus bar provided in the chamber. (i.e. per meter length of bus bar)

Table No 6.2/1

Dimensions of Bus bar chamber & Size & Number of Strips required for the corresponding current rating.

S.No	Dimensions of Bus bar chamber Length, Height, Depth in mm	Aluminum/ Copper bus bar length per phase in mm	Current rating in amperes	No. of Insulators (Epoxy /Porcelain) per bus	Recommended rectangular cross section			
					Aluminium		Copper	
					No. of strips per phase	Size in mm	No. of strip per phase	Size in mm
1	1150x400x150	1000	100	3	1	25x5	1	20x5
2	1150x400x150	1000	200	3	1	40x5	1	30x5
3	1150x400x150	1000	300	3	1	50x5	1	40x5
4	1150x500x300	1000	400	3	1	50x10	1	50x5
5	1150x500x300	1000	630	3	2	40x10	-	-
6	1150x500x300	1000	800	3	2	50x10	-	-

Table No 6.2/2

Minimum Clearance between Bus Bars in Bus Bar Chamber / Control Panel(IS: 4237-1967)

S.No.	Voltage level (kV)	Clearance in mm	
		Between Phases	Between Phase & Earth
1.	0.416	19	16
2.	0.6	25	19
3.	3.3	51	35
4.	11	127	77
5.	22	242	140
6.	33	356	223

CABLES

7.1	LT Cables (Aluminium)	CB-LT/AL/
7.2	LT Cables (Copper)	CB-LT/CU
7.3	HT Cables	CB-HT/
7.4	Cable Joints, Termination Kit (LT)	CB-JT/LT
7.5	Cable Joints, Termination Kit (HT)	CB-JT/HT
7.6	Cable Enclosure (Pipes)	CB-CE/
7.7	Cable Glands	CB-GL/
7.8	Street Light Boxes & Cable Indicators	CB-SB/ CB-CIP
7.9	Cable Lugs (Copper)	CB-CL/CU
7.10	Cable Lugs (Aluminium)	CB-CL/AL
7.11	Drawings	

7.1, 7.2, & 7.3 **Armoured Cables (HT & LT)****1. General**

All material shall conform to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which ISI mark is not available in market, it shall be included in approved list.

Work shall be carried out as per the method of construction specified by BIS. If there is no reference for particular method of construction in IS, such work shall be carried out as per the approved method of construction specified in chapter 16 of P.W. Dept. Handbook.

Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of the Engineer in Charge.

2. Cables: (Armoured)

The following list records those Indian Standards in force, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code
IS 1255: 1983	:	Code of practice of Installation & Maintenance of armoured cables up to 33 kV.
IS 3961: Part 2: 1967	:	Recommended current ratings of PVC cables.
IS 1554: Part 1; 1988	:	PVC Insulated (Heavy duty) Electric Cables; Part 1 for working voltages up to and including 1100 Volts.
IS 1554: Part 2; 1988	:	PVC Insulated (Heavy duty) Electric Cables; Part 1 for working voltages up to and including 3.3 kV to 11 kV.
IS 10810: Part 63; 1993	:	Method for Test of cables, Part 63 Smoke density of electric cables under fire condition.

3. Scope: (Armoured cables)

Specification No. (CB-LT/AL, CB-LT/CU, CB-HT)

Providing armoured cable of specified voltage level, size & specified conducting material (Aluminum / Copper) as per **Table no. 7/3** including required material, hardware's for erection and erecting on wall, ceiling, RCC slab or drawing the same through pole, pipe, laying in provided conduit, trench, ducts, trays as per approved method of construction including glands, lugs, etc.

**4. Material:
Cables:**

Cables shall be PVC for LT/MP and XLPE for HT as per Table no. 7/3 and of required construction, colour, shall carry ISI mark, IS No, manufacturer's name, size, duly embossed / screen printed at every metre and having the total count of progressive length in meter at each mark.

Earth wire: Galvanized Iron (G I) wire of appropriate gauge as per Table No 7/1.

Glands: As per specification **(CB-GL)**

Lugs: As per specification **(CB-CL/AL, CB-CL/CU)**

Saddles: Saddles fabricated from GI sheet of required gauge and size depending on dia of cable either galvanized or painted with superior quality enamel black paint with necessary shearing mechanical strength, semi circular shaped with extended piece having suitable holes for fixing.

G I Strip: 22 g x 25 mm width G I Strip.

Clamps: MS Clamps fabricated of required length and shape, having the size of 3/6 mm thick mild steel having 25/50 mm width (as per size of cable), rounded ends with wooden / resin cast grip for holding the cable.

Identification tags: For identifying root, connection position GI strip with identification mark / name embossed / painted with arrangement to tie should be fix on cable or arrangement of ferrules to be done.

Hardware: Sheet Metal (SM) screws of required sizes, plugs / wooden gutties, etc.

4. Method of Construction:General:

- a) Irrespective of method of construction the cable ends shall be terminated with appropriate size & type of glands with lugs duly crimped, as directed by Site engineer.
- b) Wherever the cable has to be bent, the turning radius shall be as mentioned in Table No 7/2. Grouping of cables shall be done with adequate distance between cables as mentioned in IS so as to minimize de-rating. Cables shall be tagged/ferruled with identification name / mark at the point from where distribution starts and at ends. Bare earth wire of appropriate size as per Table no. 7/1 shall run along with the cable. Earth wire running with the cable shall be terminated at the earth terminal nearest to cable termination.

5.1 Erection of Cable on Surface:

Erection shall be done as per the routes and layout finalized, in perfect level and in plumb. Before fixing the cable shall be straightened as far as possible for good aesthetics look, continuous bare GI earth wire of required gauge as per Table No 7/1 shall be run. Cable with G I wire shall be fixed by saddles firmly clipped on cable and shall be fixed to wall with minimum 50 x 8 mm SM screws with plugs/wooden gutties, etc. (Distance between two supports / saddles shall be maximum 450 mm). Wooden gutties shall be used wherever required (Especially for stone wall). The entries made in wall, floor slab, etc for laying the cable shall be made good by filling and finishing with plastering the same.

5.2 Erection of Cable on Trusses:

Cable along with bare GI earth wire, while erecting on trusses, shall be firmly clamped by wrapping GI strip of 22 g, 25 mm width of required length fixed to truss with nuts and bolts.

5.3 Erection of Cable on Pole:

Cable along with bare GI earth wire, while erecting on pole, shall be firmly clipped by suitable wooden / epoxy resin cast grips, clamped with 25 x 3 mm or 50x6 mm MS strip of required length and fixed to pole with nuts and bolts.

5.4 Laying of Cable in provided Trench/Pole:

While laying Cable along with bare GI earth wire, utmost care shall be taken to prevent damage to the insulation of the cable and to the open end. Cable shall be brought out from trench vertically straight (minimum 1.0 metre above G L). Care shall be taken to inspect the trench so that depth of cable shall not be less than as shown in Table No 7/4. Suitable size of cable loops shall be provided near termination point at adequate depth.

5.5 Erecting cable in constructed Trench / duct:

Erection of cable/s in constructed trench / duct, shall be as per guide lines of IS 1255.

5.6 Erection of cable/s on trays:

Cable/s shall be tied with PVC tags on GI trays. At bending point care shall be taken so that sharp edges of sheet will not damage insulation of cable.

5.7 Mode of Measurement: Executed quantity shall be measured on the basis of running metre per run of cable.

6. Dismantling

Cable laid underground, or fixed on any surface shall be dismantled carefully without damaging complete with all its accessories, making coil and stored as directed. The surface of the dismantled cable shall be made clear by removing of unwanted material, cement mortar, etc. When cable is dismantled from trench refill back the trench and making the surface proper.

7. Mode of Measurement: Executed quantity shall be measured on the basis of running metre per run of cable.

Table No 7/1

Size of Bare GI Earth wire to be used with LT Cables upto 1.1 kV

S.No.	Size of cable	Size of bare GI Earth wire to be used with cable
1	2.5 Sqmm to 50 Sqmm of all cores.	12 SWG
2	70 Sqmm to 95 Sqmm of all cores.	10 SWG
3	120 Sqmm and above of all cores.	8 SWG

Table No 7/2

Minimum bending Radius for Cables

S.No.	Voltage level of cables	Single core	Multi core Unarmoured	Multi core Armoured
1	Up to 11 kV	20 D	15 D	12 D
2	Up to 22 kV	25 D	20 D	15 D
3	Up to 33 kV	30 D	25 D	20 D

Note: D diameter of cable.

Wherever possible, 25 percent larger radii than the specified above should be used.

Table No 7/3

Current Rating (In Ground) for PVC/ XLPE Insulated 1.1 kV Grade Cables

Nominal area of conductor	Aluminum Conductor				Copper Conductor			
	Single Core		Multi Core		Single Core		Multi Core	
	PVC	XLPE	PVC	XLPE	PVC	XLPE	PVC	XLPE
Sqmm								
10	51	55	46	50	65	71	60	65
16	66	74	60	68	85	95	77	87
25	86	98	76	90	110	125	99	115
35	100	118	92	108	130	150	120	138
50	120	137	110	126	155	175	145	161
70	140	172	135	158	190	220	175	202
95	175	204	165	187	220	260	210	239
120	195	234	185	215	250	301	240	276
150	220	262	210	240	280	336	270	308
185	240	298	235	273	305	381	300	350
240	270	344	275	316	345	441	345	405
300	295	387	305	355	375	496	385	455
400	325	458	335	420	400	586	425	538
500	345	495	-	-	425	635	-	-
630	390	555	-	-	470	710	-	-
800	440	625	-	-	-	-	-	-
1000	490	685	-	-	-	-	-	-

Rating Factors for Variation in Ambient Air Temperature

Air Temperature (°C)	40	45	50
Rating Factor (XLPE)	1.00	0.94	0.88
Rating Factor (PVC)	1.00	0.90	0.81

Table No 7/4

Minimum laying Depth of cables (IS: 1255)

S.No.	Voltage level of cables	Minimum depth from top of the cable
1	Up to 1.1 kV	750 mm
2	3.3 kV to 11 kV	900 mm
3	22 kV to 33 kV	1050 mm
4	At road crossing	1000 mm
5	At railway crossing (from Bottom of sleepers to Top of pipe)	1000 mm

Notes below Table No 7/4:

1.	PVC Insulated electrical cable for voltage grade up to 1.1 kV is based on 8 voltsdrop.			
2.	The distances are given in meters and after rounding.			
3.	The distances are given in meters and after rounding.			
For Temperature Correction please see as detailed below:				
Ground temp.	20 degree C	25 degree C	30 degree C	35 degree C
Rating factors:	0.95	0.90	0.85	0.80

Distance up to which different sizes of UG Aluminum Conductor Cables 1.1 kV grade, can be used for different current ratings of 8 Volts drop. (PVC insulated, PVC Sheathed, 3 cores or 4 cores)

Maximum Conductor temperature – 70 degree C														
S. No	Current	Distance in meters for the following cable sizes in Sqmm												
	Amp	6	10	16	25	35	50	70	95	120	150	185	240	300
1	5	165	260	415	725	895	1300	1925	2360	3065	3555	4300	5770	6460
2	10	80	130	205	360	450	650	960	1180	1530	1775	2150	2885	3230
3	15	55	85	140	240	300	430	640	785	1020	1185	1430	1920	2155
4	20	40	65	100	180	225	325	480	590	765	890	1075	1440	1615
5	25	30	50	80	145	180	260	385	470	610	710	860	1150	1290
6	30	25	40	70	120	150	215	320	390	570	590	715	960	1075
7	40	20	30	50	90	110	160	240	295	380	445	535	720	805
8	50	-	25	40	70	90	130	190	235	305	355	430	575	645
9	60	-	-	35	60	75	110	160	195	255	295	355	480	535
10	70	-	-	30	50	65	90	135	165	215	255	305	410	460
11	80	-	-	-	45	55	80	120	145	190	220	265	360	405
12	90	-	-	-	40	50	70	105	130	170	195	235	320	360
13	100	-	-	-	35	45	65	95	115	150	175	215	290	320
14	110	-	-	-	-	40	60	85	105	140	160	195	260	290
15	120	-	-	-	-	35	55	80	95	125	145	180	240	270
16	130	-	-	-	-	-	50	75	90	115	135	165	220	250
17	140	-	-	-	-	-	45	70	80	110	125	150	205	230
18	150	-	-	-	-	-	-	65	75	100	115	140	190	215
19	160	-	-	-	-	-	-	60	70	95	110	130	180	200
20	170	-	-	-	-	-	-	55	70	90	105	125	170	190
21	180	-	-	-	-	-	-	50	65	85	100	120	160	180
22	190	-	-	-	-	-	-	-	60	80	90	110	150	170
23	200	-	-	-	-	-	-	-	60	75	90	105	145	160
24	225	-	-	-	-	-	-	-	-	65	80	95	125	145
25	250	-	-	-	-	-	-	-	-	-	70	85	115	130
26	275	-	-	-	-	-	-	-	-	-	-	80	105	115
27	300	-	-	-	-	-	-	-	-	-	-	70	95	105

*(LT/HT Cables) (JT/LT/HT)***1. Scope:***Specification No**(CB-JT/LT/HT)*

Providing straight through cable jointing kit of approved make and jointing cable as per the manufacturer's instructions and duly marking name of jointer and date.

2. Material:

Joint kit: Kit manufactured by reputed manufacturer with PVC moulds made in two parts, with epoxy compound, earth continuity lead of appropriate cross section having lugs at both ends, aluminum ferrules of the size of the cable, cross shaped epoxy spacer, MS clips for holding the moulds, adhesive for pasting the moulds.

3. Method of Construction:**3.1 Straight through joint Kit: LT/HT Cables**

Before providing joint to the cable, the cable ends of the equivalent length of the joint moulds, shall be prepared by removing the outer PVC insulation along with the steel armouring. The ferrule shall then be inserted over the bare core of the cable, and shall be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimped portion shall be wrapped first with the PVC insulation tape and then with the insulation tape used for wrapping HT conductor. The above method shall be carried out for all the cores strictly following the colour code. The leads of the both the cables now shall be placed into the mould by using the epoxy spacer, for having sufficient gap in-between the leads. The earth continuity lead shall be clamped to the both ends of the cable. After covering the cable leads with the PVC moulds, the edges shall be clipped after applying the adhesive on the inside face of the moulds. The pasting of moulds shall be rigid and as far as possible leak proof, so that the epoxy compound shall not spill out. Now the duly stirred epoxy compound shall be poured and fill till the compound rises through the risers provided on the moulds.

After completing the above procedure, the joint shall be allowed to dry out for at least 8 to 10 hours (for epoxy compound to get hardened) depending upon the size of cable. Before connecting to supply, the dry and hardened joint shall be tested for its insulation level with 1000 V/ 5000 V Meggar.

The cable should be fixed or laid in such manner that there should not be pressure on end of moulds or on jointing position of cables. (Refer drawing No. CB-JT-1)

3.2 Outdoor/Indoor end termination Kit: LT/HT Cables

Before providing end termination kit to the cable, the cable end of the equivalent length of the moulds, shall be prepared by removing the outer PVC insulation along with the steel armouring. The ferrule shall then be inserted over the bare core of the cable, and shall be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimping shall be done in such a manner that there shall be no air gap. Then the crimped portion shall be wrapped first with the PVC insulation tape and then with the insulation tape used for wrapping HT conductor. The above method shall be carried out for all the cores strictly following the colour code. The leads of the cable now shall be placed into the mould by using the epoxy spacer, for having sufficient gap in-between the leads. The earth continuity lead shall be clamped to the ends of the cable. After covering the cable leads with the PVC moulds, the edges shall be clipped after applying the adhesive on the inside face of the moulds. The pasting of moulds shall be rigid and as far as possible leak proof, so that the epoxy compound shall not spill out. Now the duly stirred epoxy compound shall be poured and fill till the compound rises through the risers provided on the moulds. (Refer drawing No. CB-JT-2)

After completing the above procedure, the joint shall be allowed to dry out for at least 8 to 10 hours (for epoxy compound to get hardened) depending upon the size of cable. Before connecting to supply, the dry and hardened joint shall be tested for its insulation level with 1000 V/ 5000 V Meggar.

4	<u>Mode of Measurement:</u>
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Executed quantity will be measured on number basis. (i.e. each).

7.7 Cable Glands (GL)

Scope:

Specification Nos (CB-GL)

Termination of cable ends with cable glands for preparing and fixing the cable leads for connection. Cable glands shall be of Flange type.

Material:

Cable glands: Flange type heavy duty. Made of high purity brass metal, with brass washers, rubber rings, threaded stud with washers and nuts.

Method of Construction

Before erection of gland, the cable end shall be prepared by removing the outer PVC insulation up to the point where gland to be fixed, by assessing the length of leads required. Bottom portion of gland shall be inserted over the steel armoring, and then armour strips shall be bent for the length of collar of gland, remaining length of armoring shall be cut. The cable end shall then be inserted through the entry of plate where the cable is to be terminated. The top portion of gland with washer shall be then inserted in such a manner that the bent armour strip should be touching the surface of the entry. The nuts shall be tightened with spring washers over the projected stud portion. Fixing of gland shall be at right angle to the gland plate. Tightening shall assure continuity of earth. Hole to the gland plate shall be punched / knocked out, of correct diameter with respect to gland size.

Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each).

7.8 Street Light Boxes & Cable Indicators

A) Cable Indicator Plate (CIP)

Scope:

Specification No (CB-CIP)

Providing and fixing of cable indicator plate along the route of under ground cable.

Material:

Cable indicator plate: Circular plate made of cast iron having 100 mm dia. and 6mm thick.
Iron rod for fixing of cable indicator plate: 700 mm long galvanized iron rod of 12 mm dia., and 150 mm long cross bar welded at bottom or hook to be made with same continuous bar.

Method of Construction:

Cable indicator plate fixed/welded to the 700 mm long iron rod or angle, with 150 mm cross bars welded at bottom as fasteners or bent in 'J' shape to hook the cable in the bent portion, shall be buried along the route of cable in the trench made for laying the cable. For clear visibility, the Cable indicator plate shall be buried in such a manner that the plate should be minimum 200 mm above the ground level and shall be provided at every 15-25 metre in straight run, at both ends of road crossing and immediate before and after turning point of cable.

Mode of Measurement:

Executed quantity will be measured on number basis. (I.e. each).

B) Street Light Boxes (SB)

Scope:

Providing and fixing of CRCA sheet metal / FRP boxes on pole with MS Clamps fixing topoles and terminating the cable.

Material:

CRCA sheet metal box: 16 gauge CRCA sheet with mounting arrangement for kitkat / MCB

Bakelite connectors: Bakelite connector of 2/4 ways, 32A, 250 V.

MS Clamps: Clamps fabricated of required length and shape, of 3 mm thick mild steel having 40 mm width.

Hardware: 10 mm mild steel nuts and bolts.

Paint for CRCA box: Superior quality aluminum / silver paint or required shade enameled paint as per the requirement of site engineer.

Primer / Red oxide: Superior quality primer / red oxide for use on sheet metal.

Method of Construction:

CRCA Sheet metal boxes:

Box shall be fabricated from 16 gauge CRCA sheet as per dimensions specified in item, with minimum 3 mm fold on front side of the box so as to make it water proof (Rubber beading / gasket shall be pasted on the edges / asbestos rope beading). Edges of front cover shall be folded in such a manner so that it shall cover the front opening of the box. The front cover shall be fixed either by screws or be hinged (as per requirement), with self-locking arrangement. There shall be provision of fixing connector / porcelain kitkat fuse / single pole MCB, inside the box. Provision of two holes of minimum 10 mm dia. for fixing bolt of clamp and one hole of required dia. for PVC wire leads, shall be made at the rear side of the box and provision for holes of required dia. at bottom for fixing the cable gland of incoming and outgoing cables. Box shall have earth terminal. Box shall have anti rust treatment and be painted with two coats of red oxide and finally two coats aluminum / silver paint. Rubber gasket shall be provided for making the box watertight. Unless and otherwise specified, the mounting height of the box shall be minimum 1750 mm from the finished ground level for facilitating easy maintenance.

FRP boxes:

FRP boxes manufactured with minimum wall thickness of 2.7 mm either gray or blue in colour, having provision for fixing either porcelain kitkat fuse or Single pole MCB, 4 way bakelite connector, and with provision of two holes of minimum 10 mm dia. for fixing bolt of clamp and one hole of required dia. for PVC wire leads, shall be made at the rear side of the box and one hole of required dia. at bottom for fixing the cable gland of incoming and outgoing cables. The front cover shall be hinged, with locking arrangement and lock and key. The mounting height of the box shall be minimum 1750 mm from the finished ground level for facilitating easy maintenance. Wherever required fixing of box shall be done with MS clamps of required length, so as to hold pipe pole / RSJ pole and shall be duly painted in approved manner.

Mode of Measurement:

Executed quantity will be measured on number basis. (I.e. each).

2. **Scope:**

<i>Specification Nos</i>	<i>(CB-CL/AL, CB-CL/CU)</i>
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Crimping of lugs, and fixing to the terminals with nuts and bolts, etc.

3. **Material:**

Lug: Lug shall be of high purity aluminum / copper / bimetallic of required type, with required size of hole and smooth finished both from inside and outside.

Hardware: Brass or Cadmium plated mild steel nuts and bolts, bimetallic washers.

Anti-Oxide paste: Paste of superior quality manufactured by reputed manufacturer.

4. **Method of Construction:**

Before fixing of lugs to the cable end, the cable end to the equivalent length of the lug shall be prepared by removing the outer PVC insulation along with the steel armouring and then, the inner PVC insulation. The paste shall be applied to the cable lead and inside the lug prior to the inserting of lug on the cable lead. The lug shall then be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimping shall be done in such a manner that there shall be no air gap. Then the crimped portion shall be wrapped with the PVC insulation tape. (Colour of tape shall be of that of cable lead) The above method shall be carried out for all the cores. The cable end with lug shall then be terminated into the terminal and then be tightened with either brass nuts or Cadmium plated nuts as directed by Engineer in-charge.

5. **Mode of Measurement:**

Executed quantity will be measured on number basis. (i.e. each).

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Chapter 8

OVERHEAD SYSTEMS

8.1	Steel Poles	OH-PL
8.2	Spun Poles	OH-SPP
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Chapter 8

Overhead Systems

(OH)

8.1 Steel Poles

(OH-PL)

A) *Steel Tubular Poles* (OH-PL/STP)

Scope:

Specification No (OH-PL/STP)

Supply of steel tubular swaged pole (Swan type or other wise) as per IS 2713: Part 21980, fabricated with earthing stud, pole base plate with required numbers of holes as per drawing and erecting the pole, including painting in provided foundation as per method of construction.

Material:

Pole: Steel tubular swaged pole (Swan type or other wise) as per Table No 8/1

Base plate: MS Base plate of 30x30x0.6 cms.

Pole Cap: Pole cap 4 mm thick with inside diameter equal to outside Dia. of the pole and minimum height shall be 100 mm and welded or fixed with set screws.

Earth Stud: Earth stud 5/8"mm Dia. bolt welded to pole with required size nut and double G.I. /M.S. washers

Paint: Red oxide paint as primer, bituminous paint, Aluminium paint/ any other paint as per the instructions of engineer-in-charge.

Method of construction:

Before erection of pole base plate of size 30x30x0.6 cm shall be full length welded or fixed with 4 set screws at the bottom of the pole, a suitable hole of required diameter and at specified height shall be drilled and welded with knock out nipple for laying wires for street light poles at required height. The pole shall be then painted by 2 coats of red oxide paint and one coat of bituminous paint before erection for min 1/6 length which is to be buried in ground & after erection remaining portion to be painted by two coats of aluminium paint. The pole shall be erected in provided pit with cement

Concrete foundation and muffing in perfect plumb.

Mode of Measurement:

Executed quantity will be measured on number basis. (I.e. each)

Table 8.1/1

Swaged Poles Made From Steel of Ultimate as per IS: 2713 (Part-II) 1980

Designation	Overall Length in mtr	Planting Depth in mtr	Height above Ground in mtr	Length of Sections in mtr			Outside Diameter / Thickness of Sections			Approx Weight of Pole. Kg
				Bottom h3	Middle h2	Top h1	Bottom	Middle	Top	
410 SP-28	9.00	1.50	7.50	5.00	2.00	2.00	139.7 x 4.50	114.3 x 3.65	88.9 x 3.25	113
410 SP-31	9.00	1.50	7.50	5.00	2.00	2.00	165.1 x 4.50	139.7 x 4.50	114.3 x 3.65	147
410 SP-52	11.00	1.80	9.20	5.60	2.70	2.70	165.1 x 4.50	139.7 x 4.50	114.3 x 3.65	175
410 SP-60	12.00	2.00	0.60	5.80	3.10	3.10	165.1 x 5.40	139.7 x 4.50	114.3 x 3.65	208

B) Rolled Steel Joist (RSJ) Poles (OH-PL/RSJ)

Scope:

<i>Specification No</i> (OH-PL/RSJ)

Supply and erection of Rolled Steel Joist (Girder) pole as per IS 2713, including painting in provided foundation as per method of construction.

Material:

Pole: Rolled Steel Joist (Girder) As per Table No 8.1/2

Base plate: MS Base plate of 30x30x0.6 cms.

Hardware: Nut and bolts for fixing earth wire

Paint: Bituminous paint, Aluminium paint, Red oxide paint.

Method of construction:

Before erection of pole base plate of size 30x30x0.6 cm shall be full length welded at the bottom of pole, a suitable hole of required diameter and at specified height shall be drilled for earth stud. The pole shall be then painted by 2 coats of red oxide paint as primer for full length and then by one coat of bituminous paint before erection for min. 1/6 length which is to be buried in ground & after erection remaining portion to be painted by two coats of aluminium paint. The pole shall be erected in provided pit with cement concrete foundation and muffing in perfect plumb.

Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each)

Table No. 8.1/2

Weight of various sizes of RSJ Poles with 8.5 meter length

RSJ POLE	Size	Weight per Meter
Rolled steel Joist	150x80 / 150x75mm	14.9 Kg/meter
Rolled steel Joist	200x100 mm	25.4 Kg/meter
Rolled steel Joist	175x90 mm	19.3 Kg/meter
Rolled steel Joist	100x116 mm	23.0 Kg/meter
Rolled steel Joist	125x75 mm	12.42 Kg/meter
Rolled steel Joist	152x152 mm	37.0 Kg/meter

C) Rail Poles (OH-PL/RLP)

Scope:

Specification No (OH-PL/RLP)

Supply and erection of Rail Pole including painting in provided foundation as per method of construction.

Material:

Pole: Rail Pole 29.76 Kg/ metre, as per IS 2713 (Part II)

Base plate: MS Base plate of 30x30x0.6 cms.

Hardware: Nut and bolts for fixing earth wire

Paint: Bituminous paint, Aluminium paint, Red oxide paint.

Method of construction:

Before erection of pole, base plate of size 30x30x0.6 cm shall be full length welded or fixed with 4 set screws at the bottom of pole, a suitable hole of required diameter and at specified height shall be drilled for earth stud. The pole shall be then painted by 2 coats of red oxide paint as primer for full length and then by one coat of bituminous paint before erection for 1/6 length which is to be buried in ground & after erection remaining portion is to be painted by two coats of aluminium paint. The pole shall be erected in provided pit with cement concrete foundation and muffing in perfect plumb.

Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each)

Scope:**Specification No****(OH-PL/GIP)**

Supply and erection of ISI mark G.I. Pipe Pole 'B' Grade 75/80 mm dia. 6 m long including painting in provided foundation as per method of construction.

Material:

Pole: ISI mark G.I. Pipe Pole 'B' Grade 75/80mm dia. of total length 6 meter

Base plate: CI/MS Base plate of 30x30x0.6 cms.

Pole Cap: Pole cap 4 mm thick with inside diameter equal to outside Dia. of the pole and minimum height shall be 75 mm shall be welded or fixed with set screws.

Earth Stud: Earth stud 5/8"mm Dia. size bolt welded to pole with required size nut and double G.I. /M.S. washers

Paint: Bituminous paint, Aluminium paint/ any other paint as per the instructions of engineer-in-charge, Red oxide paint.

Method of construction:

Before erection of pole base plate of size 30x30x0.6 cm shall be full length welded or fixed with 4 set screws at the bottom of pole, a suitable hole of required diameter and at specified height shall be drilled and welded with knock out nipple for laying wires of street light. The pole shall be then painted by 2 coats of red oxide paint as primer and one coat of bituminous paint before erection for 1/6 length which is to be buried in ground & after erection remaining portion to be painted by two coats of aluminium paint.

The pole shall be erected in provided pit with cement concrete foundation and mugging in perfect plum.

Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each)

8.2 PSC Poles**(PSC)****PSC Poles****(OH-PL/PSC)****Scope:****Specification No****(OH-PL/PSC)**

Supply and erection of PSC Rectangular pole in provided foundation as per IS 13158 1991, and as per method of construction mentioned below.

Material:

PSC Rectangular Poles as per Specifications in Table 8/3 and as per satisfactory tests minimum required as per IS.

Table 8.2/3**Specifications for PSC Poles**

Top Cross section in mm	Bottom Cross section in mm	Length in metre	Weight in kg
90x102	90x275	8	140
105x115	105x315	9	200

Method of construction:

The pole shall be erected in provided pit with cement concrete foundation and muffing or as instructed by site-in-charge in perfect plum. 1/6th of the total length of pole shall be buried in ground. The poles shall not to be used for end pole, large angle

pole (angle more than 30⁰), cut point or span length more than 65 mtr length, where heavy vehicular traffic exists and to be used for straight poles or small angle pole.

Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each)

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8.3 Hot dipped Galvanized poles & High Mast (HM)

A) High Mast (OH-PL/HM)

<u>Scope:</u>

below. **Specification No (OH-PL/HM)**
Supplying and erecting 12.5 m /16 m / 24 m high-mast and its accessories as specified

<u>Material:</u>

Hot dipped galvanised pole with details as given in the Table below;(Refer
drawing no. OH-PL-1 & OH-PL-2)

The design life of high mast shall be minimum 25 years.

Height	12.5 m without Power Tool	12.5 m with Power Tool	16 m Power Tool	20 m Power Tool	Remarks
1. Material	Hot dipped galvanised as per specification BSEN ISO 1461	Hot dipped galvanised as per specification BSEN ISO 1461	Hot dipped galvanised as per specification BSEN ISO 1461	Hot dipped galvanised as per specification BSEN ISO 1461	Each section shall be fabricated out of individual plates duly folded and welded. There shall be only one longitudinal seam weld per section. Hot deep internally and externally having uniform thickness of 85 microns for bottom section and 65 microns for top and middle section
Top and bottom Dia. Thickness	110 mm and 242 mm thickness 3 / 3 mm	150 mm and 360 mm thickness 3/3 mm	150 mm (thickness 3mm) and 460 mm (thickness 4mm)	150 mm (thickness 3mm) and 460 mm (thickness 4mm)	
Overlap	1.5 times the Dia	1.5 times the Dia	1.5 times the Dia	1.5 times the Dia	At site sections shall be joined together by slip-stressed- fit method. No site welding or bolted joints shall be done to the mast.
Max. Dynamic loading to withstand Max. Wind pressure	As per IS 875 part 3	As per IS 875 part 3	As per IS 875 part 3	As per IS 875 part 3	Max. Dynamic loading to withstand Max. wind pressure
Opening of base door	175 X 500 mm	225x1050 mm	1200 X 250 mm	1200 X 250 mm	
Double internal lock	Yes	Yes	Yes	Yes	
Base plate	20 mm thick 320 X 320 mm	25 mm thick 520 mm Dia	25mm thick 670mm Dia	30 mm thick 670mm Dia	The welding connection of the base flange shall be fully developed to the strength of the entire section. The base flange shall be provided with supplementary gussets between the bolt- holes to ensure elimination of helical stress concentration.
Anchor plate	3 mm	5 mm	8 mm	8 mm	

2. Accessories	12.5 m	12.5 m	16 m	20 m	Remarks
Lantern Carriage arrangement	Hexagonal Lantern Carriage for 6 fittings symmetrically	Lantern carriage of 50 NB ERW Class-B M.S pipe covered with PVC sleeve suitable to carry 250 Kg load upto 6 fittings	Lantern carriage of 50 NB ERW Class-BM.S pipe covered with PVC sleeve suitable to carry 250 Kg load upto 8 fittings	Lantern carriage of 50 NB ERW Class-BM.S pipe covered with PVC sleeve suitable to carry 250 Kg load upto 8 fittings	Hot deep, in two halves with stainless steel bolts and lock type stainless steel nuts to ensure easy installation, lining with protective PVC arrangement. junction box of cast aluminium-weather proof
Raising and lowering mechanism	----	Yes	Yes	Yes	Completely self sustaining Winch fixed at the base without the need of brake shoe, spring or clutches. Gravity activated pawls. Gear ratio 53:1, with self lubricating oil bath
Head frame	Yes	Yes	Yes	Yes	Galvanised
MCB erected on PVC board	Yes	Yes	Yes	Yes	OF suitable rating.

3. Lighting protection

- By G.I. single spike 1200mm at top

4. Trailing

- PVC sheathed 5 X 2.5 Sq. mm copper cable

5. Winch

- Double drum, oil bath (SAE 90/140) with lubrication arrangement

6. Wire rope- 2 Nos stainless steel wire rope 7/19, 6mmdia.
Breaking load capacity 2400 Kgx2**7. Integral power tool**

- 3 Ph 1 HP 2m/ min single speed,

8. Torque limiter

- Upto 500Kg adjustable

9. Aviation obstruction light

- Twin dome with 2 Nos 100W GLS/LED lamp

Standards applicable:

a) I.S. 875 (part- III) 1987

- Code and practice for design for

structures

b) BSEN10-025/DIN17100

- Grades of M.S plates

c) B.S 5135/AWS

- Welding

d) B.S. ISO1461

- Galvanising

e) TR. No.7 2000 of ILE UK

- Specification for Mast and foundation

Manufacturer of the Mast must have conducted wind tunnel test on their Mast sample.**Mode of Measurement:**

Executed quantity will be measured on number basis (i.e. each)

B) Octagonal Poles (OPL)

Scope:

Specification No (OH-PL/OPL)

Supplying and erecting 9 m high galvanised octagonal pole details are as specified below.

Material:

9 m high galvanised Octagonal pole with details of given below.

Particulars	CSR Item No 8-3-3	CSR Item No 8-3-4
Material	Galvanised as per specification	Hot dipped galvanised as per specification BSEN ISO 1461
Top and bottom Dia. Thickness	100 mm A/F and 200 mm A/F thickness 3mm HT plate	70 mm A/F and 155 mm A/F thickness 3mm HT plate
Bracket	1500 mm long decorative sword type single arm bracket	1500 mm long decorative sword type double arm bracket

Method of construction:

The pole shall be erected in provided cement concrete foundation specially designed. Erection shall be in plum.

Mode of Measurement:

Executed quantity will be measured on number basis (i.e. each)

8.4 Brackets (BKT)

A) Pole Bracket (Cross arm) (OH-PL/BKT)

Scope:

Specification No (OH-PL/BKT)

Supply and erection of MS Pole Bracket for erection of L T insulators on provided pole.

Material:

Pole Bracket: MS pole bracket fabricated as per specifications in Table 8.4/1. Thickness and size of channel is to be checked from the steel table.

**Table No 8.4/1
Details of Pole Brackets**

Item No	Material of bracket	Length	No of insulator	No of insulat or	Guarding Extension piece	Remark
8-4-1	Angle iron 50x50x6 mm	550 mm	2	2		For LT guarding for vertical formation

8-4-2	Angle iron 50x50x6 mm	750 mm	2	2		For LT guarding for horizontal formation
8-4-3	ISMC Channel 75x40x 6.8 mm	550 mm	4	4		For LT 3 phase 4 wire vertical formation

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8-4-4	ISMC Channel 75x40x 6.8 mm	750 mm	5	5		For LT 3 phase 5 wire vertical formation
8-4-5	ISMC Channel 75x40x 6.8 mm	550 mm	2	2		
8-4-6	ISMC Channel 75x40x 6.8 mm	1100 mm	4	4		
8-4-7	ISMC Channel 75 x40x 6.8 mm	550 mm	2	2	300mm of same channel	
8-4-8	ISMC Channel 75 x40x 6.8 mm	1100 mm	4	4	300mm of same channel	

D' type Clamps: MS Flat of 50x6mm, 15 mm MS nut bolts

Paint: Silver paint, Red oxide paint

Method of construction:

The cross arm shall be made up of size of channel mentioned in above table. The length shall be as stated above table. The cross arm shall be complete with pole clamp of size 50X6 mm MS flat and holes required for pin / shackle insulator. For MS pole bracket with guarding extension, an extension piece of same size of length 300 mm shall be welded to bracket as per drawing attached herewith. The cross arm and pole clamp shall be painted with one coat of red oxide and two coat silver enamel paint any other colour paint (as per the instructions of engineer in-charge).

Cross arm shall be fabricated as per drawing no. OH-PL/BKT-1 (Fig.2 & Fig.3)

Mode of Measurement: Executed quantity will be measured on number basis. (i.e.Each)

B) Vee Cross Arm (OH-PL/VCA)

Scope:

Specification No (OH-PL/VCA1)

Supplying Vee cross arm, suitable for 11 kV and necessary ancillary materials complete erection on provided pole with necessary painting as per specification and as per instructions from the site engineer.

Material:

Cross arm: Channel Iron cross arm

Hardware: G.I. nut bolts

Flat: MS flat 80 x 10 mm thick

Clamp: Two clamps made from MS flat of size 80 x 10 mm.

Paint: Red oxide, Silver paint.

Method of construction:

Fabricating the Vee cross arm for erecting Insulators with channel 75 x 40 mm with 4.4 mm thick web and 7.3 mm thick flange, length of 45 mm for base of insulator, vertical member of suitable length to maintain the clearance of 1220 mm, with angle of 60 degrees to horizontal and M.S. flat of 80 x 10 mm at centre of cross arm fixed to the pole by means of two M.S. clamps of 80 x 10 mm. M.S. flat with 15mm. dia bolts and nuts duly painted with one coat of red oxide paint and two coats of aluminium paint. Cross arm shall be fabricated as per drawing no. OH-PL/BKT-1 (Fig.1)

Detailed specifications of material of the items included in CSR are given in Table No 8.4/2.

Mode of Measurement: Executed quantity will be measured on number basis (i.e.each)

C) Vee Cross Arm (OH-PL/VCA)

Scope:

Specification No

(OH-PL/VCA2)

Supplying Vee cross arm, suitable for 22 kV and necessary ancillary materials complete erection on provided pole with necessary painting as per specification and as per instructions from the site engineer.

Material:

Cross arm: Channel Iron cross arm

Hardware: G.I. nut bolts

Flat: MS flat 80 x 10 mm thick

Clamp: Two clamps made from MS flat of size 80 x 10 mm.

Paint: Red oxide, Silver paint.

Method of construction:

Fabricating the Vee cross arm for erecting Insulators with channel 75 x 40 mm with 4.4 mm thick web and 7.3 mm thick flange, length of 45 mm for base of insulator, vertical member of suitable length to maintain the clearance of 1530 mm, with angle of 60 degrees to horizontal and M.S. flat of 80 x 10 mm at centre of cross arm fixed to the pole by means of two M.S. clamps of 80 x 10 mm. M.S. flat with 15mm. dia bolts and nuts duly painted with one coat of red oxide paint and two coats of aluminium paint. Cross arm shall be fabricated as per drawing no. OH-PL/BKT-1 (Fig.1)

Detailed specifications of material of the items included in CSR are given in Table No 8.4/2.

Mode of Measurement: Executed quantity will be measured on number basis (i.e.each)

Table No 8.4/2

Details of Iron Cross Arm / Bracket as Per Item in CSR

Item No.	Item description	Size of channel	Clamps	Nut bolts
8-4-11	100X50 channel cross arm	100 x 50 mm. with 4.7 mm thick web and 7.5 mm thick flange channel X 2.7 m length	Two clamps of 50x6mm. M.S. flat	15mm. nuts and bolts
8-4-12	Vee-cross arm	made out of channel 75 x 40 mm with 4.4 mm thick web and 7.3 mm thick flange with clearance of 1220 mm. between the insulators as per drawing attached here with	Clamps of 75x10 mm of MS Flat	15mm. dia bolts and nuts
8-4-13	Vee-cross arm	100x50 mm with 4.7 mm thick web and 7.5 mm thick flange size suitable with clearance of 1530 mm. between the insulators	Clamps of 75x10 mm of MS Flat	15mm. dia. bolts and nuts
8-4-14	Channel with clamp for erection of 11/22 KV pin insulators	75x40 mm with 4.4 mm thick web and 7.3 mm thick flange channel	Clamps of 80x10 mm of MS Flat	with 3 sets screws
8-4-15	Channel bracket for guarding	channel iron 1600 mm. in length and 75x40 mm. with 4.4 mm. thick web and 7.3 mm thick flange	Clamps of 50x6 mm of MS Flat	15mm. dia nuts and bolts with 2 earthing clips, made from 25x3 mm

8-4-16	Angle iron bracket for guarding	Angle iron bracket 65 x 65 x 6mm. Angle 1600 mm. in length and 75x40 mm. with 4.4 mm. thick web and 7.3 mm thick flange	Clamps of 50x6 mm of MS Flat	15mm. dia nuts and bolts with 2 earthing clips, made from 25x3 mm
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8.5 Conductors

(CON)

A) All Aluminium Conductors (AAC)

(OH-CON/AAC)

Scope:

Specification No (OH-CON/AAC)

Supply and erection of All Aluminium Conductors for overhead line.

Material:

Conductor: All aluminium stranded conductor (As per table 8.5/1)

Binding wire: 12 SWG aluminium binding wire

Clamps: PG clamps as per requirement

Method of construction:

At first the conductor is removed from bundle/drum straighten without knots, bends, etc. Stringing of conductor shall be done with draw vice. Conductor shall not be twisted while stringing. Shackle insulators shall be used if the line deviates by 30 degrees or more, at terminal pole and at junction/ cut pole.

Parallel double groove clamp having two nut bolts designated to carry full line current shall be used for making Jumper wire connections.

On straight line the conductor shall be bounded on top groove of insulator and at angular position binding shall be done in side groove. Binding wire of 12 SWG shall be of the same metal as that of conductor.

Mode of Measurement:

For measurement purpose, sum of the total conductor including jumper connection shall be considered. (i.e. per km)

B) Aluminium Conductor Steel Reinforced (ACSR)

(OH-CON/ACSR)

Scope:

Specification No (OH-CON/ACSR)

Supply and erection of aluminium conductor steel reinforced for overhead line.

Material:

Conductor: All aluminium conductor steel reinforced (As per table 8.5/1)

Binding wire: 12 SWG aluminium binding wire

Clamps: PG clamps as per requirement

Method of construction:

At first the conductor is removed from bundle/drum straighten without knots, bends, etc. Stringing of conductor shall be done with drawing vice. Conductor shall not be twisted while stringing. Disc insulators shall be used if the line deviates by 30 degrees or more, terminal pole and tri-pole or four pole structure at terminal pole and at junction/ cut pole.

Parallel double groove clamp having two nut bolts designated to carry full line current shall be used for making Jumper wire connections. Universal parallel double groove clamp having two nut bolts shall be used for Tap Off point.

On straight line the conductor shall be bounded on top groove of insulator and at angular position binding shall be done in side groove. Binding wire of 12 SWG shall be of the same metal as that of conductor.

Mode of Measurement:

For measurement purpose, sum of the total conductor including jumper connection shall be considered. (i.e. per km)

Table No. 8.5/1**Conductor Specifications As Per I.S. 398/1961**

Code Name of Conductor	Resistance at 20 ⁰ ohm /km.	Approx. Current Carrying Capacity in Amperes.		Number of Strands / Diameter of each Strand in mm	Overall Diameter of Conductor in mm	Weight of Conductor(kg/km)
		At 40 ⁰ C	At 45 ⁰ C			
All Aluminium Conductor						
Rose	1.361	116	108	7/1.96	5.88	58
Gnat	1.071	133	123	7/2.21	6.63	73
Irish	0.850	150	138	7/2.48	7.44	92
Pansy	0.677	178	165	7/2.78	8.34	116
Ant	0.544	204	189	7/3.10	9.30	144
ACSR Conductor						
Squirrel	1.374	115	107	6+1/2.11	6.33	85
Weasel	0.911	150	139	6+1/2.59	7.77	128
Ferret 4.04	0.679	181	618	6+1/3.0	9.00	171
Mink 0.06	0.456	234	217	6+3.66	10.98	255
Raccoon	0.365	270	250	6+1/4.09	12.27	318
Dog 0.1	1.137	520	482	30+7/3.0	21.00	976

Table No 8.5/2**Minimum Clearance between Conductors(IS: 4237-1967)**

S.No.	Voltage level (kV)	Clearance in mm	
		Between Phases	Between Phase & Earth
7.	11	460	305
8.	22	610	460
9.	33	915	610
10.	110	1675	1000
11.	230	3350	1675
12.	400	4000	3500

8.6 Insulators (INS)**A) Porcelain Disc Type Insulator 11/22/33 kV (OH-****INS/DI)Scope:****Specification No (OH-INS/DI)**

Supplying porcelain disc type insulator, suitable for 11/22/33KV and necessary ancillary materials and complete erection on provided cross arm / bracket and connected to the over-head line as per instructions from the site engineer

Material:

Insulator: Distribution class Disc type insulator made from porcelain, suitable for specified voltage level, having ISI mark, with necessary hardware.

Hardware: Nuts, washers, etc.

Binding wire: Bare Copper wire or conductor.

Clamps: MS clamps.

Method of construction:

Distribution class porcelain disc type insulator, suitable for specified voltage level, erected on provided cross arm or bracket with clamps, ancillary materials, and connected to the over-head line. Connection shall be made with bare copper wire of specified gauge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e.each)

B) Pin Type Insulator 11/22/33 kV (OH-INS/PN)

Scope:

<i>Specification No</i>	<i>(OH-INS/PN)</i>
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Supplying porcelain Pin type insulator, suitable for 11/22/33KV and necessary ancillary materials and complete erection on provided cross arm / bracket and connected to the over-head line as per instructions from the site engineer

Material:

Insulator: Distribution class Pin type insulator made from porcelain, suitable for specified voltage level, having ISI mark, with necessary hardware.

Hardware: Nuts, washers, etc.

Binding wire: Bare Copper wire or conductor.

Clamps: MS clamps.

Method of construction:

Distribution class porcelain pin type insulator, suitable for specified voltage level, erected on provided cross arm or bracket with clamps, ancillary materials, and connected to the over-head line. Connection shall be made with bare copper wire of specified gauge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e.each)

C) Post Type Insulator 11/22/33 kV (OH-INS/PST)

Scope:

Specification No **(OH-INS/PST)**

Supplying porcelain Post type insulator, suitable for 11/22/33KV and necessary ancillary materials and complete erection on provided cross arm / bracket and connected to the over-head line as per instructions from the site engineer

Material:

Insulator: Distribution class Post type insulator made from porcelain, suitable for specified voltage level, having ISI mark, with necessary hardware.

Hardware: Nuts, washers, etc.

Binding wire: Bare Copper wire or conductor.

Clamps: MS clamps.

Method of construction:

Distribution class porcelain post type insulator, suitable for specified voltage level, erected on provided cross arm or bracket with clamps, ancillary materials, and connected to the over-head line. Connection shall be made with bare copper wire of specified gauge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e.each)

D) Thyrite type Lightning Arrestor 11/22 kV (OH-INS/LA)

Scope:

Specification No **(OH-INS/LA)**

Supplying porcelain Thyrite type lightning arrestor, suitable for specified voltage level and necessary ancillary materials and complete erection on provided cross arm / bracket and connected to the over-head line as per instructions from the site engineer.

Material:

Arrestor: Distribution class Thyrite type lightening arrestor made from porcelain, suitable for specified voltage level, having ISI mark.

Hardware: Nuts, washers, etc.

Binding wire: Bare Copper wire or conductor.

Clamps: MS clamps.

Method of construction:

Distribution class porcelain Thyrite type lightening arrestor, suitable for specified voltage level, erected on provided cross arm or bracket with clamps, ancillary materials, and connected to the overhead line. Connection shall be made with bare copper wire of specified gauge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

DRAWINGS

OH-1 : Overhead Line Distribution System

OH-2 : Overhead Line Distribution System

Chapter 9 ⁻³³¹⁻

EARTHING

9.1	Plate, Pipe	EA-EP/
9.2	Accessories	No Specs
9.3	Drawings	

9.1 Plate / Pipe type Earthing

A) Plate type Earthing (With or Without C.I Cover, Funnel, etc) (EA-EP)Scope:

Specification No (EA-EP)

Supplying and erecting galvanised cast iron / copper earth plate type / G.I. pipe type earthing with / without C.I. cover as per instructions from the site engineer.

Material:

Earth Plate: Galvanised cast iron / Copper earth plate or G.I. pipe as per specifications given in Table No 9.1/1.

CI Cover: As per specifications given in Table No 9.1/1.

Earthing Conductor: Copper/G.I strip/Annealed bare copper wire/G.I. earth wire of size as per specifications given in Table No 9.1/1.

GI Pipe: As per specification (CW-PLB/GP) mentioned chapter no. 17.5 for watering, and as enclosure for Earth wire, refer specifications given in Table No 9.1/1.

Hardware: Screw / nut bolts with required washer of dimensions, Rawl plug / clip/ 'U' nails and material as per specifications given in Table No 9.1/1.

Filling material: Coal /Charcoal/ salt as per specifications given in Table No 9.1/1. as per specifications given in Table No 9.1/1.

Lugs: As per specification (CB-LG/AL, CB-LG/CU) mentioned chapter 7.9 & 7.10 Copper/ Aluminium lugs as per specifications given in Table No 9.1/1.

Method of construction:

Pit is to be dug of required dimension and depth for the earthing at site, and laying of Galvanised cast iron / Copper earth plate or G.I. pipe shall be as per Table No 9.1/1. The earth connection to equipment/ switch gear and earthing electrode shall be connected as shown in the diagram and as per IS 3043 amended up to-date. The connections shall be made either by strip or double run of earth wire with drilling, welding, riveting, brazing and nut bolting to plate or pipe, where ever required in an approved manner. As far as possible continuous strip shall be used, but where ever jointing of strip is unavoidable, the overlap portion must not be less than $2^{1/2}$ times the width of the strip either welded/brazed/soldered by all sides or 6 inches overlap with two nut bolts/ riveting of adequate size with required washer and covered by anti-corrosive paint as per approved

jointing practice in the industry and as per directives from site engineer in charge.

Pit shall then be filled with screened soil with alternate layer of coal and salt, and if, necessary brick masonry work (Where ever applicable) shall be done as specified in IS: 3043, with laying wires in PVC/ G.I. pipe and watering arrangement as per drawing no EA-1 and covered with C.I. Cover (Where ever applicable).

Where ever requires or as specified by Site Engineer, a Test link shall be provided for facilitating the testing of resistance of earth electrode.

Testing:

The value of each earth electrode shall be measured by earth tester in presence of site Engineer and record to be submitted.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

Table No 9.1/1

Detailed Specifications of various types of Earthing

Type of earthing----- >		Galvanised cast iron earth plate type without C.I cover	Copper earth plate type with C.I cover	Galvanised cast iron earth plate type with C.I cover	Pipe type earthing with out C.I cover
S.No.	Particulars				
1)	Depth from top of plate Up to Ground level	1.5 m	1.5 m	1.5 m	1.5 m
2)	Size & type of material for pipe / Plate type earthing.	Cast iron earth plate size 60x60x0.6 cms	Copper earth platesize 60x60x0.6 cms	cast iron earth plate size 60x60x0.6 cms	'B' grade G.I. pipe 40mm. dia. 2.5 mtr. Long or 20 mm dia. G.I. Rod
3)	Salt/charcoal	30 Kg. charcoal and salt each	30 Kg. charcoal and salt each	40 Kg. charcoal and salt each	N A
4)	Type of Wire	Double G.I. wire 8 SWG	Double G.I.8 SWG	Double G.I. 6 SWG	double G.I.8 SWG
5)	Wire enclosure	12mm. dia. G. l. pipe 2 mtr. Long	12mm. dia. G. l. pipe 2 mtr. Long	12mm. dia. G. l. pipe 2.5 mtr. Long	N A
6)	Nut bolts	12 mm dia. Cadmium / GI	12 mm dia. Cadmium / GI	12 mm dia. Cadmium / GI	N A
7)	Washers	GI	GI	GI	N A
8)	Watering pipe	19mm. dia. G.I. pipe	19mm. dia. G.I. pipe	19mm. dia. G.I. pipe	N A
9)	Lugs	Yes	Yes	Yes	Yes
10)	funnel	No	yes	yes	N A
11)	Brick Masonry	No	yes	yes	N A

B) Low Impedance Earthing (Pipe in pipe technology) (EA-EPP)

Scope:

Specification No **(EA-EPP)**

Supplying and erecting approved type earthing system with **Pipe in pipe technology** with necessary ancillary materials and complete erection as per instructions from the site engineer

Material:

GI Pipe: As per specification no. **(CW-PLB/GP)** mentioned chapter 17.5;

1. 50 mm dia x 3 meter long (In place of traditional GI pipe Earthing), for LV / MV applications.

Or

2. 80 mm x 3 meter long (In place of traditional copper plate Earthing), for HV/EHV applications.

Earthing Conductor: G.I strip/GI earth wire of size as per specifications given in Table No 9.1/1.

GI Pipe: As per specification no. **(CW-PLB/GP)** mentioned chapter 17.5 for watering and enclosure for Earth wire, as per specifications given in Table No 9.1/1.

Hardware: Screw / nut bolts with required washer of dimensions, Rawl plug / clip/ 'U' Nails and material as per specifications given in Table No 9.1/1.

Filling material: Coal /Charcoal/ salt as per specifications given in Table No 9.1/1. as per specifications given in Table No 9.1/1.

Lugs: As per specification no. **(CB-LG/AL, CB-LG/CU)** mentioned in chapter 7.9 & 7.10 for Copper/ Aluminium lugs and as per specifications given in Table No 9.1/1.

Method of construction:

Earthing Pipe in pipe technology with ancillary materials shall be done by digging an 8" / 10" dia hand bore 10.5' deep sufficient to install the electrode in normal soil conditions. The space between the soil and the electrode is filled up with electrolyte material mixed with the dug out mother soil, along with water and tightly packed up to the base of the terminal. In rocky areas and under hard soil and sandy soil conditions the method of installation will be as specified by manufacturer. Installation shall include drilling, welding, reventing, brazing and nut bolting pipe when ever required in an approved manner with required material such as nut bolts and washer etc. and with necessary brick masonry work as per the specification. (As per IS 3043 amended up to-date). As far as possible continuous GI strip shall be used but when ever jointing of strip is unavoidable, the jointing over lap portion must not be less than $2^{1/2}$ times the width of the strip either welded/ brazed/soldered by all sides or overlap of 6 inch with two nut bolts/ riveting of adequate size with required washer and covered by anti corrosive paint as per approved jointing practice in the industry and as per directives from site engineer in-charge.

Testing:

The value of each earth electrode shall be measured by earth tester and record to be submitted. **(Also refer drawing No. EA-2)**

Mode of Measurement: Executed quantity will be measured on number basis i.e. each

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Chapter 10

SUB STATION

10.1	Transformer	SS-TR
10.2	Accessories	No Specs
10.3	Drawings	

Chapter 10

Sub Station

(SS)

10.1

Transformer

(TR)

Scope:

Specification No

(SS-TR)

Supplying and erecting AC three phase 11 or 22 kV/0.44 kV, 50 Hz, oil immersed and naturally cooled indoor/outdoor type copper wound distribution transformer of specified capacity, connected delta on HV side and star on LV side with additional neutral brought out on load side.

Recommended standards:

The following list shows Indian Standards which are acceptable as good practice and accepted standards.

IS 335: 1963

Dielectric Strength

IS 2026 part I 1977

Specification for Transformer

IS 2026 part II 1977

Specification for type of cooling and

permissible temp. rise of transformer

IS 2026 part III 1981

Specification for insulation level and

dielectric strength of transformer

IS 2026 part IV 1977

Specification for terminal marking tapping

and connections

IS 1180 part I 1989

Specification for outdoor type three phase

distribution transformer

IS 10028 Part I 1985

Code of practice for selection installation and

maintenance of transformers

CBIP/TAC Manuals

Material:

1. Copper wound Transformer with Delta connection on HV side and star connection on LV side complete with Manufacturer's test certificates
2. Standard mountings required for transformer are shown below. The mountings are to be selected from them and any additional if required.

- Off load tap changing
- Oil conservator with fitting holes and cap and plain oil level gauge
- Silica gel dehydrating breather
- Oil drain valve
- Thermometer pockets
- Oil filter valve
- Lifting arrangement
- Two earthing terminals
- Diagram and rating plate
- Four bi directional plain rollers
- Air vent
- Explosion vent
- Terminal arrangement
- Bushing with lugs and/or cable end box on LV side
- HV cable end box and/or HV bushing

The transformer losses shall be as mentioned in Table No 10.1/1

Method of Construction:

The contractor should intimate name of manufacturer and make of the Transformer and location of the manufacturer factory to engineer in charge prior to delivery of the transformer. After manufacturing of the transformer, the agency/contractor shall intimate the engineer-in-charge for carrying out the inspection.

After receipt of intimation engineer-in-charge or his representative should inspect the Transformer at manufacturer factory and shall carry out the following tests jointly in presence of concern contractor.

- 1) Open Circuit test
- 2) Short Circuit test

- 3) Specific Resistance Test
- 4) Insulation Resistance of HV, LV, in between HV and LV, Winding and Body.
- 5) Dielectric Strength and acidity test of Transformer oil.

The test results of joint inspection shall be recorded on the test report of Transformer with its Sr. No. prior to delivery of the Transformer to site.

Necessary work of plinth and or for D.P. structure with D.O. set, L.A., A.B. switch should be completed before dispatch of the transformer. The channel arrangement on plinth is to be done. Earthing arrangement should be completed. The Transformer should be installed on plinths / double pole structure/floor by arranging chains pulley block, crane etc as per IS Norms.

After installation of Transformer the stopper/lock should be provided to rollers of the Transformer.

The connection of H.T/L.T. side should be completed by provided Copper wire/ cable with necessary lugs to avoid loose connection. The earthing (2 Nos for Neutral & 2 Nos for Body) should be connected from distinct electrodes. The earthing should be connected by lugs/proper size of strip.

The Engineer in charge or his representative should check all connections on H.T. side, L.T. side and earths and insulation and earth resistance test should be carried out and results obtained shall be recorded.

Statutory Permissions to be obtained by the Agency/Contractor:

Before commencement of work, the drawings of installation shall be got approved from the Electrical Inspector, I E & L Department.

The installation should be got inspected from Electrical Inspector and obtain written permission to charge the Transformers.

Commissioning:

After above formalities the Transformer, should be charged/commissioned in presence of Engineer in charge or his representative along with load trials and shall be handed over to the department for beneficial use.

After charging the Transformer, line, phase voltages and line current shall be measured, and the same shall be submitted.

Following test certificates shall be submitted:

1. Manufacturer's original certificate of Transformer as stipulated in IS.
2. Test certificate for dielectric strength of oil as per IS.
3. Test results of IR values.
4. Test results of all earth electrodes.
5. Readings of Voltages & currents at the time of commissioning.

Table No 10.1/1**Capacity wise maximum losses of Transformers**

Sr. No.	Transformer Rating kVA	Voltage Ratio in kV	Winding	(At 75°C) Losses at No Load (Watts)	(At 75°C) Losses at 50 % Load (Watts)	(At 75°C) Losses at 100 % Load (Watts)	Short Circuit Current Amp
1	63	11/0.433	Cu	155	380	1250	
2	63	22/0.433	Cu		362	1193	
3	63	11/0.433	Al	180		1235	84
4	63	22/0.433	Al				
5	100	11/0.433	Cu	220	520	1800	
6	100	22/0.433	Cu		495	1717	
7	100	11/0.433	Al	260		1765	133.34
8	100	22/0.433	Al				
9	160	11/0.433	Cu	400		2400	
10	160	22/0.433	Cu				
11	160	11/0.433	Al				
12	160	22/0.433	Al				
13	200	11/0.433	Cu	500		3000	
14	200	22/0.433	Cu				
15	200	11/0.433	Al	500		3000	266.67
16	200	22/0.433	Al				
17	250	11/0.433	Cu	550		3600	
18	250	22/0.433	Cu				
19	315	11/0.433	Cu	580		4200	420.02
20	315	22/0.433	Cu				
21	500	11/0.433	Cu				
22	500	22/0.433	Cu				
23	630	11/0.433	Cu	1000		7000	840.04
24	630	22/0.433	Cu				

10.2 Accessories**(AS)****A) Fencing for Sub Station (FSG)****Scope:****Specification No****(SS-AS/FSG)**

Supplying and erecting fencing of section having size **2450 mm** in height from ground level and **1200 mm** width with angle iron frame work, erected in foundation, and painted.

Material:

Fabrication material: ISI mark 50x50x6 mm angle iron, Iron studs/Spikes 10 mmthick with arrow head, 25x6 mm MS flat iron.

Chain link Jali: Jali made from hard GI wire 10 SWG/3.26 mm dia.

Foundation material: Cement, Sand, Water.

Paint: Aluminium paint, Red oxide.

Method of Construction:

The fencing shall be fabricated **as per drawing no** The fencing section shall be **2450 mm in height from finished ground level and 1200 mm** in width. The square jali shall be welded from inside of the angle iron frame measuring 2200mm (1800 mm for fencing frame + 400 mm for embedding in cement concrete foundation) in height and 1200 mm in width. On top the frame iron studs of minimum 150 mm in height with arrow head shall be welded with spacing of minimum 300 mm. Supports made from MS flat iron shall be welded width wise on the top the jali from inside the frame at top, middle and at the bottom. The entire structure shall be erected in plumb. After the entire fabrication, fencing shall be painted with one coat of red oxide and two coats of aluminium paint. (Overall size of doors shall be 1800mm height x 3000 mm wide)

Mode of Measurement: Executed quantity will be measured on number basis. (i.eeach)

B) Double leaf door for Sub Station (DLD)**Scope:****Specification No****(SS-AS/DLD)**

Supplying and erecting double leaf hinged door each 1500 mm in width x 1800 mm in height using B Class GI pipe with angle iron supports, chain link jali, complete supported onchannel iron, erected in foundation, and painted.

Material:

GI Pipe: ISI mark, 25 mm diameter as per **(CW-PLB/GP)** for chapter 17.5 **Fabrication material:** ISI mark 45x45x5 mm angle iron, Iron studs/Spikes 10 mmthick with arrow head.

Channel iron: ISI mark 100x 50mmx 5mm.

Chain link Jali: Jali made from hard GI wire 10 SWG/3.26 mm dia.

Foundation material: Cement, Sand, Water.

Paint: Aluminium paint, Red oxide.

Method of Construction:

The door shall be fabricated **as per drawing no** The door section shall be **1800 mm in height from finished ground level and 1500 mm** in width. The door frame shall be fabricated from B class GI pipe 25 mm in diameter, with chain link jali welded into the frame. The jali shall be supported with cross bracing the 45x45x5 mm angle. The door shall be supported to the channel with hinges welded to door frame and the channel. On top the frame iron studs of minimum 150 mm in height with arrow head shall be welded with spacing of minimum 300 mm. The total length of the channel shall be minimum 2200 mm. The channel shall be embedded in cement concrete foundation.

The doors shall have locking arrangement for restricting unauthorized entry and the lock shall be with minimum 6 levers with duplicate keys. The entire structure shall be erected in plumb. After the entire

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fabrication, fencing shall be painted with one coat of red oxide and two coats of aluminium paint.

Mode of Measurement: Executed quantity will be measured on number basis. (i.e. each)

<i>DRAWINGS</i>

SS-1 : 22kv Plinth mounted substation
SS-2 : 22kV Pole mounted substation
SS-3 : Layout of Plinth mounted substation with feeder pillar
SS-4 : Layout of Plinth mounted substation with LT panel room
SS-5 : Layout of Plinth mounted substation with 4 pole structure for 2 transformers
SS-6 : Layout of Partial outdoor substation
SS-7 : Layout of Indoor substation for one transformer
SS-8 : Layout of Indoor substation for two transformers
SS-9 : 22kV Metering cum isolator panel
SS-10 : 11kV Earth pits & connections

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Chapter 11

GENERATORS

11.1	Generators	GEN-GEN
11.2	AMF Panel	GEN-AMF
11.3	Acoustic Enclosure	GEN-ACS
11.3	Drawings	

11.1 Generators**A) Portable Generator (PG)****Scope:****Specification No****(GEN-PG)**

The work includes supplying, erecting, final testing, putting in to operation and handing over of the complete system of portable generator set with petrol start & Kerosene run suitable to give specified output at 220 V +/-13 volts A. C. with accessories like tool kit and comprehensive maintenance of the installation up to 1 year from date of commissioning.

Material:

Portable generator suitable to give output 1400 VA/ 2000 VA output Generator with built in voltmeter, non fuse circuit breaker, along with one set of tool kit comprising of one spanner, screw driver spark plug opener & Oil, fuel etc.

Portable Generator shall be of standard design and of original manufacturer with petrol start and kerosene run engine of 4 stroke, single cylinder, TCI ignition system, centrifugal governor, air cooled, semi dry type air cleaner and recoil starter, noise suppressor, oil alert system, with brushless, self exciting, two pole, rotating field type and with "E" class insulation alternator suitable to give specified output, duly tested at full load for continuous 2 hours with first filling of oil and fuel.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

B) Diesel Generator (DG)**Scope:****Specification No****(GEN-DG)**

Providing D.G. Set at site, carrying out all preparatory works, assembling, installing, making adjustments, confirming all pre-commissioning requirement as per manufacturer's instructions, commissioning, final testing, putting in to operation and handing over of the complete system of D.G. set including inspection from inspectorate office. The work includes necessary minor Civil works including opening on wall/Slab/floor and making good as it was etc. & comprehensive maintenance of the DG set for 1 year from date of commissioning.

Material:

Diesel Generator set with continuous rating, 3 Phase, 415 V., 50 Cycles A.C. supply of specified capacity, comprising of totally enclosed air/water cooled diesel engine with standard control panel & tool kit. (Refer drawing no. GEN-DG-1 & GEN-DG-2)

Diesel Engine:

The engine shall be of standard design of original manufacturers. It should be a totally enclosed air/water cooled Diesel engine with 4 stroke multi cylinders developing suitable BHP (As per Table 11/3) for giving power rating of (As per table 11/3) at the load terminal of alternator at 1500 R.P.M., at armature temperature of 40° C for height at 1000 Meter above M.S.L. at 50% R.H. The engine shall be capable of delivering specified power at variable loads for P.F. of 0.8 (lag) with 10% over load available in excess of specified output for one hour in every 12 hours. The average load factor of the engine over period of 24 hours shall be 0.85 for power output. The engine shall confirm to IS: 10000 and Amended up to date.

The engine shall be fitted with following accessories:-

- 1) Dynamically balanced fly wheel.
- 2) Necessary flexible coupling and guard for alternator and engine applicable
- 3) Lubricating oil cooler
- 4) Air cleaner Dry/Bath type
- 5) Lubricating oil pressure gauge

6) Lubricating oil filter with replicable element³⁴⁵

7) Dry exhaust manifold with suitable exhausts heavy duty residential type exhaust silencer and vertical hot air duct both lagged with asbestos rope exhaust piping of required length to reduce noise level.

8) 12/24 V. Electric starting equipment complete with standard batteries, dynamo, cut-out, ammeter, necessary wiring, self starter etc. The system shall be capable of starting D.G. set within 20 to 30 second even in winter condition with an ambient temperature down to 0° C.

9) Mechanical Governor of Class A2 for up to and including 200 KVA capacity and electronic governor of Class A1 for capacity above 200 KVA shall be provided as per standard design of manufacturer. Governor shall be a self contained unit capable of monitoring speed.

10) Radiator

11) Daily fuel Tank

Daily fuel service tank of minimum capacity as per Table 11/1, below, fabricated from M.S. sheet with inlet, outlet connections air vent tap, drain plug and level indicator (gauge) M.S. fuel piping from tank to engine with valves, unions, reducers, flexible hose connection and floor mounting pedestals, twin fuel filter. The location of the tank shall depend on standard manufactures design.

Table 11/1

Minimum capacity of Daily fuel tank for Generators

Sr. No	Capacity of D.G. set	Minimum Fuel Tank Capacity
1.	Up to 25 KVA	100 Liters
2.	Above 25 KVA to 62.5 kVA	120 Liters
3.	Above 62.5 KVA to 125 KVA	225 Liters
4.	Above 125 KVA to 200 KVA	285 Liters
5.	Above 200 KVA to 380 KVA	520 Liters

Engine Control Panel:

Engine control panel should be fitted with following accessories/indicators and shall have display:-

- Start/stop key switch
- Lube oil pressure indication
- Water temperature indication
- RPM indication
- Engine Hours indications
- Battery charging indication
- Low lube oil trip indication
- High water temperature indication
- Over speed indication

Battery Charger:

The battery charger shall be of Trickle & Boost type, and suitable to charge required numbers of batteries at 12V/ 24 Volts complete with, transformer, rectifier, charge rate selector switch, indicating ammeter, voltmeter, battery over charging protection with audible alarm. Connections between the battery charger & batteries shall be provided

with suitable copper leads with lugs.

Battery:

Battery capacity and copper cable sizes for various engine capacities shall be as per the details given in Table No 11/2. Cable sizes shown are for maximum length of 2m length, if higher size of cable is required, it shall be selected in such a way that voltage drop does not exceed 2 V.

Table 11/2

Battery Capacity and Copper Cable Sizes for Various Engine Capacities

S.No.	D G Set Capacity	Battery Capacity (AH)	Copper Cable size in mm ²	Electrical System (Voltage)
1.	Upto 25 kVA	88	35	12
2.	Above 25 kVA upto 62.5 kVA	120	50	12
3.	Above 62.5 kVA upto 82.5 kVA	150	50	12
4.	Above 82.5 kVA upto 125 kVA	180	50	24
5.	Above 125 kVA upto 500 kVA	180	70	24

For AMF applications, a static battery charger working on mains supply recommended to keep the batteries charged at all times.

Alternator:

Alternator of specified rating, 415 Volts, 1500 RPM, 3 Ph, 50 HZ, A/c Supply with P.F 0.8 lagging at 40⁰ C armature temperature for height 1000 mtr. Above MSL at 50 % R.H.alternator shall be brush less type self regulated having static excitation system having capacity of desired output confirming to IS: 4722-1968 with automatic voltage Regulation + 5% operated voltage from no load to full load, two numbers of earth terminal on opposite sides. Terminal box shall be suitable for underground cables and same shall be with stand mechanical and thermal stresses developed due to any short circuit at the terminals. The alternator shall be in accordance with following standards:-

IS: 4722 The performance of rotating electrical machines
 IS: 4889 Rules for method of declaring efficiency of electrical machines
 IS: 13364 Part I 1992 Alternator-voltage Regulation up to 20 KVA
 IS: 13364 Part II 1992 Alternator Voltage regulation above 20 KVA to 80 KVA

Performance:

Voltage dip shall not exceed 20 % of the rated voltage for any step load or transient load as per IS: 8528 (Part I). The winding shall not develop hot spots exceeding safe limits due to unbalance of 20% between any two phases from no load to full load.

The performance characteristics of the alternator shall be as below:-

- (a) Efficiency at full load 0.8 P.F.
 - (i) Up to 25 KVA- not less than 82 %
 - (ii) Above 25 KVA and up to 62.5 KVA- not less than 86 %
 - (iii) Above 62.5 KVA/upto 250 KVA- not less than 90 %
 - (iv) Above 250 KVA- not less than 93 %
- (b) Total Distortion factor
 - (i) 10 % Overload One Hour in every 12 hrs of continuous operation
 - (ii) 50% overload 15 seconds.

Common Base Plate:

Engine and alternator shall be coupled by means of flex plate/flexible coupling as per manufacturer standard design and both units shall be mounted on a common base plate together with all auxiliaries to ensure perfect alignment of engine and alternator with minimum vibrations. The base plate shall be suitable for installation on suitable anti-vibration mounting system comprising of 6 anti-vibration pads duly provided.

Control Panel:

Floor/wall mounted control panel Box comprising of voltmeter, ammeter, selector switches MCCB/MCB of adequate capacity, indicator lamp duly wired with HRC fuses. Alternator &

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control panel shall be connected with provided suitable capacity armored cable with necessary cable glands & lugs etc.

Exhaust system:

It shall comprise of following parameters:-
Exhaust system should create minimum back Pressure. Smooth bends shall be used for minimizing the back pressure.
Minimum number of bends shall be used for minimizing the back pressure.
Pipe sleeve of larger diameter should be used while passing the pipe through concrete wall & gap shall be filled with felt lining.
Exhaust piping inside the Acoustic enclosure / Generating set room should be lagged with asbestos rope and covered with aluminum sheet cladding to avoid heating of the area.
Class 'B' MS pipes and long bend/elbows should be used.
The exhaust outlet should be in the direction of prevailing winds and should not allow exhaust gases to enter air inlet / windows, etc.

Factory Testing:

- DG set shall be tested in presence of Engineer in charge or his authorized representative in the factory for following before dispatch;
- Full load trial for 12 hour. Fuel, lubricating oil, etc shall be arranged by the agency.
 - 10% overload trial for one hour within 12 hrs test.

Certificates:

- Manufacturer's test certificates for Engine, Alternator and of the set.
- Necessary certificate for the engine model so selected along with compliance of noise and emission norms as per latest CPCB guidelines for D.G. set should be furnished from the manufacturer along with manufacturer's technical details.
- Permission from Electrical Inspector.

Method of Construction:

The DG Set with canopy shall be erected with due care and ensuring the perfect level with the help of Spirit level, on provided cement concrete foundation and connecting the provided earthing connections. The exhaust system shall be connected to the exhaust manifold. After ensuring the filling of fuel, lubricating oil and medium of coolant, the set shall be commissioned, with giving necessary full load trials or with the available load at site. The set shall then be handed over to the department along with the installation report given by the manufacturer and with all the necessary certificates and permissions obtained.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Table No 11/3

Rating of Alternator and minimum BHP of Engine

S No.	KVA Capacity of Alternator	Minimum BHP of Diesel Engine	Average Fuel consumption litre per hour at 100 % Load
1	10	12	3.0
2	15	19	4.1
3	20	26	6.0
4	25	32	6.4
5	30	42	8.3
6	40	50.5	10.3
7	50	65.8	13.0
8	62.5	76	15.6
9	75	91	16.0
10	82.5	102	18.6
11	100	127	22.8
12	125	154	28.0
13	140	166	30.0
14	160	198	34.3
15	180	235	40.0
16	200	254	44.0
17	250	313	54.0

11.2 Automatic Mains Failure Panel (AMF)

Scope:

Specification No

(GEN-AMF)

The work includes supplying, installing, Testing & commissioning of automatic mains failure control panel including auto by-pass, suitable for specified rating of DG Set complete with accessories **and comprehensive maintenance of the panel up to 1 year from date of commissioning.**

AMF Panel shall comply following IS specification:

IS: 2147 1962

Degree of protection.

IS: 4722

H.V. testing for panel

Material:

Panel shall consist of following:

Power module a pair of electromechanically interlocked contactors for all the phase /phases & neutral. (For mains & generator)

Overload relay for generator contactor, neutral contactor for mains and generator.

Control and Metering module: Line voltage monitor. Generator voltage monitor, Ammeter, 3times attempt to start facility.

MCB/MCCB of suitable rating for auto/manual operation. Auto/manual switch.

Emergency stop push buttons.

Manual start push button.

Frequency meter.

Engine hour and RPM meter. (Taco meter)Two earthing studs.

Protection module: The engine shutdown in the unlikely event of low lube oil pressure, high cylinder head temperature, high water temperature (For water cooled engine)

Indicators with alarm for Full/ Maximum Load on generator.

Indicators for Load on mains, Load on D.G. set, Engine fails to start, Emergency stop. Battery charger complete with transformer/ rectifier, D.C Voltmeter and Ammeter, selector switch for trickle, off, and boost charging and current adjustment.

Main supply failure monitor.

Timers.

Fault reset push button.

Method of Construction:

AMF Panel complete with relays, timers, set of CT's for metering & protection and energy analyzer to indicate currents, phase and line voltages, frequency, power factor, KWH, KVARH & provision for overload, short circuit, fault, under frequency, control cabling from AMF panel to diesel engine and elsewhere if required, complete with metering as per material list.

System Operation:

The above-mentioned facilities provided shall be functional for following operational requirements:

1. Auto Mode

- A line voltage monitor shall monitor supply voltage on each phase when the mains supply voltage fails completely or falls below set value (variable between 80 to 95 % of the normal value) on any phase, the monitor module shall initiate start-up of diesel engine. To avoid initiation due to momentary disturbance, a time delay adjustment between 0 to 5 second shall be incorporated in start-up intimation.
- A three attempt starting facility shall be provided 6 seconds ON, 5 seconds OFF, 6 seconds ON, 5 Seconds OFF, 6 seconds ON. If at the end of the third attempt, the engine does not start it shall be locked out of start and a master timer shall be provided for this function, suitable adjustment timers are to be incorporated which will make it feasible to vary independently ON-OFF setting periods from 1-10 seconds, if alternator does not build up voltage after the first or second start as may be the case, further starting attempt will not be made until the starting facility is reset.
- Once the alternator has built up voltage, the alternator circuit breaker shall close connecting the load to the alternator. The load is now supplied by the alternator. When the main supply is restored and is healthy as sensed by the line voltage monitor setting, both for under voltage or unbalance, the system shall be monitored by a suitable timer which can be set between 1 minute to 10 minutes for the load to be transferred automatically to main supply.
- The panel shall start the set in the event of fault condition of under voltage, over voltage, phase reversal, high frequency, neutral snapping, short circuit, etc., on the mains side. If the above fault condition arises if the load is being fed from the DG Set, then the panel start cut off the load from the set with an audible alarm, and the set shall run on no load.

2. Manual Mode:

- In a manual mode, it shall be feasible to start-up the generator set by the operator on pressing the start push button.
- Three attempts starting facility shall be operative for the start-up function.
- Alternator circuit breakers closing and trip operations shall also be through operator only by pressing the appropriate button on the panel and closed shall be feasible only after alternator has built up full voltage.

3. Test Mode:

- When under test mode, pressing of test button should complete the start up sequence simulation, and engine shall be started.
- Engine shall build up voltage but the set shall not take load by closing alternator circuit breaker when the load is on the mains, monitoring performance for voltage/ frequency etc. shall be feasible without supply to load
- If during test mode, the power supply has failed, the load shall automatically get transferred on DG Set.
- Bringing the mode selector to auto position shall shut down the set provided main supply is ON if the mains supply is not available at that time, the alternator shall take load.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Scope:

Specification No

(GEN-AEC)

The Work includes supplying & erecting the Acoustic Enclosure (Canopy) fabricated from CRCA sheet of specified gauge, suitable for indoor / outdoor installation exposed to weather conditions & to limit overall noise level to 75 dB at distance 1 meter from the enclosure as per CPCB / MPCB norms under free field condition.

Material:

Acoustic enclosure (canopy) shall be fabricated out of the CRCA sheet of thickness not less than 1.6 mm on the outside cover with inside cover having not less than 0.6 mm thick perforated power coated CRCA sheet.

Method of Construction:

The construction of Acoustic enclosure (canopy) should be such that, it shall prevent entry of rain water splashing into the enclosure, and shall allow free & quick flow of rain water to the ground in the event of heavy rain.

The detailed construction shall confirm to the details as under:-

The hinged doors shall be made from not less than 16 SWG (1.6 mm) thick CRCA sheet and will be made air tight with neoprene rubber gasket and heavy duty locks.

All sheet metal parts should be processed through 7-tank process. The enclosure should be powder coated.

The enclosure should accommodate the daily service fuel tank of the D.G. set to make the system compact.

There should be provision of fuel gauge, which should show the level of the fuel even when the DG set is not running. The gauge should be calibrated. The fuel tank should be filled from the outside as in automobiles and should be with a lockable cap.

The batteries should be accommodated in the enclosure in battery rack.

The canopy should be provided with high enclosure temperature safety device.

The acoustics lining should be made up of high quality insulation material/ glass / mineral or rock wool of minimum 50 mm thickness and shall be of 75 kg/m³ to 100 kg/m³ density for sound absorption as per standard design of manufacturers to reduce the sound level as per CPCB norms. The insulation material shall be covered with fine glass fiber cloth and would be supported by perforated MS sheet duly powder coated.

The enclosure shall be provided with suitable size and No. of hinged type doors along the length of the enclosure on each side for easy access inside the acoustic enclosure for inspection, operation, and maintenance purpose. Sufficient space will be provided inside the enclosure on all sides of the D.G. set for inspection, easy maintenance, and repairs.

The canopy should be as compact as possible with good aesthetic look. The complete enclosure shall be of modular construction.

The forced ventilation shall be as per manufacturer design using either engine radiator fan or additional blower fans. If the acoustic enclosure is to be provided with forced ventilation then suitable size of axial flow fan with motor (Auto-start arrangement) and suitable size of axial flow exhaust fan to take the hot air from the enclosure complete with necessary motors and auto start arrangement should be provided. The forced ventilation arrangement should be provided with auto stop arrangement to stop after 5 minutes of the stopping of D.G. sets.

The acoustic enclosure should be suitable for cable connection through bus-trucking. Such arrangements on acoustic enclosure should be water proof and dust-proof conforming to IP-65 protection.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

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Chapter 12

WATER PUMPS

12.1	Centrifugal	WP-CGP/
12.2	Ejecto type Water Pump	WP-EJP/
12.3	Submersible Pumps for Bore wells	WP-SMP/
12.4	Submersible pumps for Open well	WP-OSP
12.5	Accessories	No Specs
12.6	Drawings	

12.1 Centrifugal Pump (CGP)**General:**

This part of the specifications deals with providing, installing, testing & commissioning of Centrifugal pump.

All material shall conform to relevant standard as per BIS and shall carry ISI mark.

Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W. Dept. Handbook/NEC.

Scope:**Specification No (WP-CGP)**

Providing, installing, testing & commissioning of ISI mark Centrifugal water pump (Monobloc), of required HP with specified discharge and head with required size of suction & delivery, foundation bolts grouted in provided cement concrete. (As Per IS: 9079 specifications)

The following list records those Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code

Material:

Pump Body: Cast iron Grade FG 200 of IS 210 -1978

Impeller: Cast iron Grade FG 200 of IS 210 -1978 **Shaft:**

High grade carbon steel Grade C-40 of IS 2073 **Bearings:**

Stainless Steel

Motor: Squirrel cage induction.

Protection class: IP 55 TEFC with Class "F" insulation, with copper windings operated on Single phase, 250 V / Three phase 415 V, 50 Hz, AC, Supply, with 2900 RPM. IS: 325 **Base plate:** Mild steel

Foundation Nut Bolts: Mild steel

Shaft seal: Fitted with high quality mechanical seal ensuring zero leakage

Method of Construction:

Pump mounted with motor on base plate, shall be placed on provided foundation with perfect alignment, proper leveling. The pump should be connected to suction & delivery in an approved manner, with provided MS / CI flange. (Refer drawing no. WP-1 (Fig.1))

After the completing the erection of pump, it shall be run continuously for minimum 2 hours, and following tests shall be carried out for its performance:

a) Alignment, b) Bearing noise, c) Discharge, d) Current

Mode of Measurement: Executed quantity will be counted on number basis. (Each)

Dismantling:

Dismantling of pump along with/without pipeline shall be done with utmost care with required tools / shackles, machinery, if any. The dismantled pump and the pipeline shall be stored in a safe place or shall be transported to the place as per the direction of Engineer-in-charge.

Mode of Measurement: Executed quantity will be counted on number basis. (Each)

12.2 Ejecto Type Jet Water Pump (EJP)**General:**

This part of the specifications deals with providing, installing, testing & commissioning of Ejecto type Jet pump.

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All material shall conform to relevant standard³⁵⁶ as per BIS and shall carry ISI mark.
Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W.
Dept. Handbook/NEC.

Scope:

Specification No (WP-EJP)

Providing, installing, testing & commissioning of ISI mark Ejecto type Jet water pump of required HP with specified discharge and head with required size of suction, delivery & pressure pipe, with “H” type MS clamps to hold the suction & pressure pipe and duly grouted with foundation nuts & bolts on provided cement concrete, spring washers of requisite size or on provided angle iron frame. (As Per IS 9079 specifications)

The following list records those Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984 : National Electrical Code
SP 7 (Group 4): 2005 : National Building Code

Material:

Pump Body: Cast iron Grade FG 200 of IS 210 -1978

Impeller: Cast iron Grade FG 200 of IS 210 -1978 **Shaft:** High grade carbon steel Grade C-40 of IS 2073 **Bearings:** Stainless Steel

Motor: Squirrel cage induction. TEFC fan cooled with Class “F” insulation, with copper windings operated on Single phase, 250 V / Three phase 415 V, 50 Hz, AC Supply, with 2900 RPM. IS: 325

Venturi & nozzle: High tensile bronze.

H type clamps with nut bolts: Made from Mild steel.

Foundation Nut Bolts: Mild steel.

Method of Construction:

First inspect the jet pump for any foreign particles in nozzle as well as in venturi with the help of screw for freeness of plunger of foot valve to ensure no damage has taken place in transit. Plunger should be free for up & down movements. While connecting Suction & pressure pipe to jet pump, do not over tighten as this may damage the threads on jet pump and also do not move away the two pipes. A good practice is to hold two pipes together by tying with steel wire keeping the pipes in vertical position & filling the same with water & checking the leakage of venturi, as well as of joints. Ensure that the pipes are independently supported so as to avoid the transmitting of load of pump.

After the completing the erection of pump, it shall run continuously for minimum 2 hours, and following tests shall be carried out for its performance:

a) Alignment, b) Bearing noise, c) Discharge, d) Current

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

Dismantling:

Dismantling of pump along with the pipeline shall be done with utmost care with required tools / shackles, machinery, if any. The dismantled pump and the pipeline shall be store in a safe place or shall be transported to the place as per the direction of Engineer-in-charge. **Mode of Measurement:** Executed quantity will be counted on number basis. (i.e. each).

12.3 Submersible Pump for Bore Well (SMP)

General:

This part of the specifications deals with providing, installing, testing & commissioning of Submersible pump.

All material shall conform to relevant standard as per BIS and shall carry ISI mark.

Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W.

Dept. Handbook/NEC.

Scope:

Specification No (WP-SMP)

Supplying and erecting ISI mark submersible pump set suitable for bore well, with high quality wear resistance and dynamically balanced bronze impeller with stainless steel shaft sleeves, pump-coupling and pivot with squirrel cage induction motor of 415 V/230 V, 50 cycles A.C. supply winding with waterproof PVC insulated copper wire of high precision strength, not to be affected by chemically aggressive water and suitable bronze

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bearings with nut & bolts etc. of required stage, specified H.P, discharge, head and delivery pipe with necessary H. type clamp of suitable size and strength.

The following list records those Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code
IS 8034	:	Submersible Pumps

Material:

Pump Body: Cast iron Grade FG 200 of IS 210 -1978.

Impeller: Made of Gun metal.

Shaft: High carbon steel Grade C-40 of IS 2073.

Bearings: Mitchell type thrust bearing unit with tilting pad assembly.

Motor & Pump: Windings with weather proof class, PVC insulated copper wire, Rotor with stainless steel shaft & spine coupling, Stage casing high grade engineering polymer & intermediate plate with stainless steel protection ring, Re-woundable stator with stainless steel casing, Diffuser with stainless steel protection ring, etc.

H type clamps with nut, bolts: Made from Mild steel.

Foundation Nut Bolts: Mild steel.

Method of Construction:

Before installing the pump, the bore shall be checked thoroughly for its trueness and presence of any protruding material (stones, tree roots, etc). After ascertaining the trueness, the pump along with pipe line shall be lowered in to the bore with the help of Tripod. While connecting delivery pipe to Submersible pump do not over tighten as this may damage the threads on Submersible pump, Keep the pipes in vertical position & fill the same with water & check the leakage at joints. The delivery pipes shall be clamped with 2 Nos of 'H' type clamps and shall be rested on the top of the bore casing. (Refer drawing no. WP-1 (Fig.2))

After the completing the erection of pump, it shall be run continuously for minimum 2 hours, and following tests shall be carried out for its performance:

a) Alignment, b) Bearing noise, c) Discharge, d) Current

Mode of measurement: - Executed quantity will be counted on number basis. (i.e. each).

Dismantling:

Dismantling of pump along with the pipeline shall be done with utmost care with required tools / shackles, machinery, if any. The dismantled pump and the pipeline shall be store in a safe place or shall be transported to the place as per the direction of Engineer-in-charge.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

General:

This part of the specifications deals with providing, installing, testing & commissioning of Submersible pump.

All material shall conform to relevant standard as per BIS and shall carry ISI mark.

Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W. Dept. Handbook/NEC.

Scope:

Specification No (WP-OSP)

Supplying and erecting ISI mark submersible pump set suitable for bore well, with high quality wear resistance and dynamically balanced bronze impeller with stainless steel shaft sleeves, pump-coupling and pivot with squirrel cage induction motor of 415 V/230 V, 50 cycles A.C. supply winding with waterproof PVC insulated copper wire of high precision strength, not to be affected by chemically aggressive water and suitable bronze bearings with nut & bolts etc. of required stage, specified H.P, discharge, head and delivery pipe with necessary H. type clamp of suitable size and strength.

The following list records those Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984 : National Electrical Code
 SP 7 (Group 4): 2005 : National Building Code

Material:

Pump Body: Cast iron Grade FG 200 of IS 210 -1978.

Impeller: Made of high quality and purity Bronze metal.

Shaft: High grade carbon steel Grade C-40 of IS 2073.

Bearings: Stainless steel.

Motor & Pump: Windings with weather proof class, PVC insulated copper wire, Rotor with stainless steel shaft & spine coupling, Stage casing high grade engineering polymer & intermediate plate with stainless steel protection ring, Re-woundable stator with stainless steel casing, Diffuser with stainless steel protection ring, etc.

H type clamps with nut bolts: Made from Mild steel.

Foundation Nut Bolts: Mild steel.

Method of Construction

While connecting delivery pipe to Submersible pump do not over tighten as this may damage the threads on Submersible pump, Keep the pipes in vertical position & fill the same with water & check the leakage at joints. The delivery pipe shall be clamped with 2Nos of 'H' type clamps and shall be rested on the top of the well.

After the completing the erection of pump, it shall be run continuously for minimum 2 hours, and following tests shall be carried out for its performance:

a) Alignment, b) Bearing noise, c) Discharge, d) Current

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

Dismantling:

Dismantling of pump along with the pipeline shall be done with utmost care with required tools / shackles, machinery, if any. The dismantled pump and the pipeline shall be store in a safe place or shall be transported to the place as per the direction of Engineer-in-charge.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

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Chapter 13

FIRE FIGHTING & FIRE ALARM

13.1	Main Fire Pumps (Single Stage Centrifugal)	FF-MFP/SSC
13.2	Main Fire Pumps (Multi Stage Centrifugal)	FF-MFP/MSC
13.3	Main Fire Pumps (Submersible)	FF-MFP/SBM
13.4	Jockey Pumps	FF- MFP/JP
13.5	Booster Pump	FF- MFP/BP
13.6	Pipes	FF-PP
13.7	Valves	FF-VL
13.8	Fire Fighting Accessories	FF-FFA
13.9	Fire Alarm System	FF-FAS
13.1	Fire Alarm accessories	FF-FAAS
13.1	P. A. System	FF-PAS
13.1	Sprinklers	FF-SPR

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| 13.1 Main Fire Pumps (Single Stage Centrifugal) | (FF-MFP/SSC) |
| 13.2 Main Fire Pumps (Multi Stage Centrifugal) | (FF-MFP/MSC) |
| 13.4 Jockey Pumps | (FF-MFP/JP) |
| 13.5 Booster Pumps | (FF-MFP/BP) |

General:

Fire safety in building has become very important consideration in construction and maintenance. A normal office building has fire load in the form of large quantity of papers and furnishing. Buildings like Hospitals, Laboratories, Auditorium, Libraries, and Museum etc. require fire safety provisions by virtue of their type of occupancy and importance irrespective of their height.

The design and installation of a fire fighting system is of utmost importance. The fire fighting installation on completion will have to be got cleared from the local fire fighting authorities (Fire Service) for its efficacy, suitability and usability by the Fire Service in the event of a fire.

Following types of water based fixed fire fighting installations are normally provided in buildings:

Wet Riser.

Down Comer.

Automatic Sprinkler.

The design of fire fighting system for a building shall be as per the provisions in National Building Code of India (Part IV) (Amended up to date) and also considering the provisions in the Development Control Rules of local body/authority.

The operating pressure of individual hydrant shall be between 5.5 kg/cm² to 3.5 kg/cm² and the operating pressure of the furthest level hydrant from main pump shall be minimum 3.5 kg/cm².

The pipeline will be designed in such a way that it should be possible to get discharge at any location.

Specifications:

This part deals with the specifications of following pumps:

Specification No(s)

- | | |
|--|---------------------|
| 1. Main Fire Pumps (Single Stage) | (FF-MFP/SSC) |
| 2. Main Fire Pumps (Multi Stage) | (FF-MFP/MSC) |
| 3. Jockey Pumps | (FF-MFP/JP) |
| 4. Booster Pumps | (FF-MFP/BP) |

Scope:

Supplying, installing, testing, perfect aligning, proper levelling and commissioning of Fire service main/jockey/booster pump single/multi stage having specified discharge and head with required HP or similar to with minimum parameters, confirming to IS: 1520 with specified size of suction and delivery pipes, coupled with squirrel cage A.C. induction motor. The pump set shall be erected in alignment on cement concrete foundation.

The Main Fire pumps should be able to deliver minimum operating pressure of 3.5 kg/cm² at highest and farthest hydrant.

Selection of Main Fire Pumps (Single & Multi Stage Centrifugal type) shall be as per Table No. 13.1/1, & 13.1/2 and, whereas the selection of Jockey Pump (Centrifugal type) & Booster Pump (Centrifugal type) shall be as per Table No. 13.1/3 & 13.1/4 respectively.

Material:**Pump Body:**

The centrifugal pumps shall conform to IS 1520. The pump casing shall be of heavy section close grained cast iron and designed to withstand 1.5 times the working pressure. The casing shall be provided with shaft seal arrangement as well as flanges for suction and delivery pipe connections as required.

Impeller:

The impeller shall be bronze. This shall be shrouded type with machined collars. Wear rings, where fitted to the impeller, shall be of the same material as the impeller. The impeller surface shall be smooth finished for minimum frictional loss. The impeller shall be secured to the shaft by a key.

Shaft:

The shaft shall be of stainless steel EN-8/ C – 40 and shall be accurately machined. The shaft shall be balanced to avoid vibration at any speed within the operating range of the pump.

Shaft Sleeve:

The shaft sleeve shall be of bronze.

Bearing:

The bearing shall be of stainless steel and of ball or roller type suitable for duty involved. These shall be grease lubricated and shall be provided with grease nipples / cups. The bearings shall be effectively sealed against leakage of lubricant or entry of dust or water.

Shaft seal:

The shaft seal shall be mechanical type so as to allow minimum leakage. A drip well shall be provided beneath the seal.

Motor:

Suitable HP squirrel cage induction motor, TEFC (totally enclosed fan cooled) synchronous speed 2900 RPM, suitable for operation on 415 volts, 3 phase 50 Hz. AC with IP 55 protection for enclosure, horizontal foot mounted type with Class-‘F’ insulation, conforming to IS-325.

Body: Cast iron

Rotor Shaft: Stainless steel

Bearing: Refer specification for bearing under Pump above.

Winding: Class ‘F’ insulated copper winding.

Base plate: Fabricated from Mild Steel, foundation bolts etc.

Cement Concrete Foundation: Cement, Sand, and Water, in 1:2:4 ratio. **Anti**

Vibrating Pads: Made from high quality rubber of specified grade and strength.

Hardware: Mild Steel

Method of Construction:

The surface of the pump foundation should be chipped with pneumatic hammer or sharp pointed chisel. The teak wood box of appropriate size shall be placed and filled with cement concrete in 1:2:4 ratio with 20 to 25 mm stone metal and required size and strength of foundation nut & bolts. The necessary curing & finishing shall be done in approved manner. The M.S. fabricated base plate of suitable size & strength should be fixed with anti-vibration rubber pads. Proper levelling and alignment shall be observed before tightening of foundation bolts. Both the pump and motor shall be placed on common base plate frame with perfect alignment, proper levelling. The pump should be connected to pipe line with M.S. flanges, gaskets, nut bolt etc and shall be checked for the leakages. The coupling guard shall be provided with nut bolts of required size. The pump shall be tested for 3.5 kg/cm² pressure at highest and farthest point of the building for minimum 2 hours. The necessary test certificate from manufacturer of pump and motor shall be produced. The motor should have efficiency more than 90% and power factor above 0.80.

Mode of Measurement:

Executed quantity shall be measured on number basis.

Table No. 13.1/1

Fire Fighting pump (Single Stage Centrifugal)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
30	2900	1400	56	80/65
50	2900	1800	76	80/65
75	2900	2400	76	100/80

Table No. 13.1/2

Fire Fighting pump (Multi Stage Centrifugal)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
30	1450	1400	56	80/65
50	1450	1800	76	100/80
75	1450	2400	88	125/100
75	1450	2800	76	125/100
120	1450	2800	105	150/125

Table No. 13.1/3

Jockey Pump (Centrifugal type)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
15	2900	240	56	50/32
20	2900	240	105	50/32

Table No.13.1/4

Booster Pump (Centrifugal type)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
7.5	2900	450	35	50/32
10	2900	468	40	50/32

13.3 Main Fire Pumps (Submersible) (FF- MFP/SBM)

13.4 Jockey Pumps (FF-MPF/JP)

Specification No

1. Main Fire Pumps (FF- MFP/SBM)
2. Jockey Pumps (FF- MFP/JP)

Scope:

Supply, installation, testing & commissioning of fire pump (submersible) of required stages having specified discharge and head with min. HP or equivalent for design parameters. Submersible pump sets shall be manufactured in accordance with IS: 8034 specifications. Selection of Main Fire Pumps (Submersible type) shall be as per Table No. 13.1/5

Material:

Pump bowls & casings: Closed grained C.I. coated with special Epoxy resin paint or high corrosion resistance.

Impeller: Made from Gun metal & dynamically balanced for smooth and silent operations.

Strainer: Stainless steel

Bearing Bushes: Lead bronze

Bearing sleeves: High quality stainless steel

Pump shaft: High quality stainless steel & dynamically balanced for smooth and silent operations.

Motor body: Cast iron

Rotor shaft: High quality stainless steel & dynamically balanced for smooth and silent operations.

Stator Housing: MS Seamless tube.

Thrust bearing: Bronze

Thrust bearing plate: High quality fiber sheet

Windings: PVC insulated copper

Method of Construction:

The provided M.S. frame shall be erected at inclined level at bottom of sump in rigid manner. The submersible pump shall be erected on this frame & shall be clamped properly & shall be connected to delivery pipe line with M.S. flanges, gaskets, nut-bolts, water level guard connections, etc. The pump shall be checked for the leakages. The proper electrical connection shall be made. The pump shall be tested for 3.5 Kg/ cm². Pressure at highest & furthest point building for minimum 2 hours. The test certificate from manufacturer of pump and motor shall be submitted. The motor should have efficiency more than 90% and power factor above 0.80.

Mode of Measurement: Executed quantity shall be measured on number basis.

Table No-13.1/5

Fire Fighting pump (Submersible pump)

Capacity in HP/ No. Of stages	Speed in RPM	Discharge in LPM	Head in metre	Delivery/Size in mm
30/2	2900	1400	56	130
45/3	2900	1800	76	130
75/5	2900	2400	88	
30/2	2900	1800	56	
105/7	2900	2800	105	
60/4	2900	2800	76	

13.6 Pipes (FF-PP)

Pipes

Specification No

(FF-PP)

Scope:

Supplying erecting C class (Heavy Duty) galvanized iron pipe, ISI mark of specified diameter with screwed sockets, Joints & necessary G.I. fittings such as sockets, check nuts, elbows, bends, tees, reducers, enlarger, plugs, etc. including electric resistance welding (ERW), fixing with clamps & all connected works such as excavation, drilling holes in wall, slabs, backfilling & making good the damages.

Material:

The galvanized iron pipes shall be of type and diameter as specified and shall comply with I.S. 1239--1973 and 1969 for the specified type. The specified diameter of the pipes shall refer to the inside diameter of the borepipes. The fittings of which the galvanizing has been damaged shall not be used. For the firefighting works, the C Class pipes and accessories shall be used.

Anti-Corrosive Protection On Under Ground Pipe:

Corrosion protection tape shall be wrapped on M.S. Pipes to be buried in ground. This corrosion protection tape shall comprise of coat tar/asphalt component supported on fabric of organic or inorganic fiber and minimum 4mm. thick and conform to requirement of IS: 10221-Code of practice for

coating and wrapping of under ground mild steel pipe line. Before application of corrosion protection tape all foreign matter on pipe shall be removed with the help of wire brush and suitable primer shall be applied over the pipe thereafter. The primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Both primer and tape shall be furnished by the same manufacturer. Corrosion protection tape shall then be wound around the pipe in spiral fashion and bounded completely to the pipe. There shall be

no air pocket or bubble beneath the tape. The overlaps shall be 15 mm. and 250 mm. shall be left uncoated on either end of pipe to permit installation and welding. This area shall be coated and wrapped after the pipe line is installed.

The tapes shall be wrapped in accordance with the manufacturer's recommendations. If application is done in cold weather, the surface of the pipe shall be pre-heated until it is warm to touch and traces of moisture are removed and then primer shall be applied and allowed to dry.

No joint shall be located in the thickness of the walls.

If the pipe is required to be cut and the end threaded, the burns of the cut end shall be filled smooth and any obstruction in the bore shall be entirely eliminated. The rate includes wastage in cutting etc.

When the pipe is to be fixed to walls it shall be fixed with standard bracket, clips or holder bates keeping the pipe about 12mm clear of the wall. The pipe shall be fixed to the wall horizontally and vertically and parallel to one another when more than one pipe is laid unless unavoidable. The supporting clips, etc., for the pipe shall be spaced at about two meters or so as necessary.

When holes are not left during construction they shall be cut into the walls or slabs, etc., to pass the pipe through or to fix clamps. etc., after fixing of the pipes, clamps etc., these shall be neatly made good.

Pressure Testing:

All piping shall be tested to hydrostatic test pressure of at least one and a half times the maximum operating pressure, but not less than 10 kg/cm² for a period not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-Charge.

Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.

System may be tested in sections and such sections shall be securely capped.

Pressure gauges may be capped off during pressure testing of the installation.

Method of Construction:

Galvanized iron pipes of specified diameter and type and galvanized iron fittings with ERW shall be erected on MS angle support with one coat of red oxide primer and two coats of Post Office fire red enamel paint duly tested to

1.5 times of working pressure.

Excavating and back filling trenches including dewatering, cutting through walls, floor, etc., and making site good.

Laying, jointing, and fixing the pipe with the fittings including cutting pipes, wastage and threading the ends.

At all the road crossings the pipes shall be laid lower than the crust of the road.

During excavation if, any other service pipes (Water, electric, telephone, etc) come across, these shall be carefully protected and supported. Any damage done shall be made good.

The pipe shall be laid on a well compacted bed in the trench. The trench after laying the pipe shall be refilled except at the joints in layers and manually rammed. Care shall be taken to see that no earth, etc., gets inside the pipes. The filling shall be kept raised by about 5 cm. for subsequent settlement.

Bedding and cushioning of murum, good earth, or sand shall be provided for the pipe in case of trench through rock. The trench at the joints shall be filled similarly after satisfactory testing of the pipe. Any surplus excavated stuff shall be disposed of satisfactorily without causing nuisance.

Mode of Measurement:

Measurement shall be for one metre of each type and diameter of pipe laid complete with fittings, clamps etc., as specified.

The lengths shall be measured net on the straight and bends along the center line of the pipes and fittings correct up to a cm.

13.7 Valves (FF-VL)

A) Foot Valve with Strainer (-ve suction)

Scope:

Specification No (FF- VL/FV)

Supplying and installing cast iron foot valve of specified diameter with strainer conforming to IS: 4038 with Gun metal seat (flapper), nut bolts, gasket, washers etc. for negative suction.

Material:

Housing, seat discs and disc plates: Grey cast iron

Hinge pins and disc guide: High tensile Stainless Steel bars

Strainers: a) Grey cast iron, b) Galvanized steel

Disc faces: a) Vegetable tanned leather (Min. 3 mm. thick), b) Leaded tin bronze, c) Natural rubber (with reinforcement of cotton canvas), d) Synthetic rubber (with reinforcement of cotton canvas)

Flange jointing nature: a) Compressed fibre board or rubber minimum 1.5 mm thick. The fibre board shall be impregnated with chemically neutral oil and shall have a smooth and hard surface. b) Compressed asbestos fibre.

Method of Construction:

The footwall with strainer shall be fitted with provided flange, gaskets, nut bolts to be erected at required position and fitted firmly to pipe with proper alignment so as the joints should be leak proof with shellac and other material required including necessary labour and required tools and plants

Mode of Measurement:

Executed quantity shall be measured on number basis.

B) End line strainer (+ ve suction)

Specification No (FF-VL/ELS)
Scope:

Supplying and installing end liner strainer of specified diameter as per IS: 907, fabricated out of brass perforated sheet of 14 SWG (2.0 mm. thick) duly with brazing to flange or pipe with nut bolts, gaskets, washers etc, in position for only suction in an approved manner.

Material:

Body: Cast Iron

Strainer screen: Stainless steel/Brass screen of 1mm thick perforated sheet with 3mm diameter holes.

Flange: Cast iron / M.S. sheet

Method of Construction:

End line strainer with strainer shall be fitted with provided flange, gaskets, nut bolts etc, and to be erected at the end of suction pipe, including labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

C) Sluice valve

Specification No (FF-

VL/SV) Scope:

Supplying and installing cast iron double flange sluice valve of specified diameter conforming to IS: 780, ISI mark, having cast iron body and gun metal working parts with nut bolts, gaskets etc. and tested to 1.5 times of working pressure, in an approved manner.

Material:

Body: a) Brass, b) Lead tin bronze
Bonnet or cover: a) Lead tin bronze, b) Forged brass, c) Brass
Stuffing box, disc hinge, check nut, stem nut, disc retaining nut, gland, gland nut, gland flange, body seat rings and disc or wedge facing rings (where renewable): a) Lead tin bronze, b) Extruded brass rod, c) Forged brass, d) Brass
Stem, hinge pin and plug: a) Extruded brass rod, b) High-tensile brass, c) Forged Brass
Ball (for ball type check valves): Chromium steel
Nut bolts: Mild steel
Hand wheel: Cast iron
Gasket: Compressed asbestos fibre
Gland packing: a) Hemp and jute, b) Asbestos
Spring: Phosphor bronze wire
Seating ring: Synthetic rubber

Method of Construction:

The double flange sluice valve shall be fitted with provided flange, gaskets, Nut bolts, etc. to be fitted to pipe, accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

D) Butterfly valves

Specification No (FF-
VL/BFV) Scope:

Supplying & installing cast iron double flange butterfly valve of size 75/80mm.dia confirming to IS: 13095 having cast iron body, FG 220 Nitrite rubber replaceable seat with Moulded 'O' ring, C.I. powder coated disc flow control complete & tested to 1.5 times of working pressure in an approved manner.

Material:

Body: Cast iron Spheroid graphite iron Carbon steel
Disc: a) Cast iron Spheroid graphite iron carbon steel, b) Stainless steel Gun metal c) Aluminum bronze
Shaft: a) Stainless steel, b) Carbon steel Aluminum bronze Nickel copper alloy
Seating ring/Seal retaining ring: a) Stainless steel, b) Gun metal aluminum bronzedeposited metal suitable for duty or resilient material
Seat: Elastomers
Shaft bearing seals: Manufacturer's standards suitable for duty
Internal fastenings: Stainless steel
External bolting: Carbon steel: tensile strength 390 n/mm or MPa

Method of Construction:

The double flange butterfly valve shall be fitted with provided flange, gaskets, Nut bolts etc. to be fitted to pipe, accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

E) Non Return Valves

Specification No (FF-
VL/NRV) Scope:

Supplying and installing double flange NRV of specified diameter conforming to IS:5312 (Part-I), ISI mark, having cast iron body and gun metal working parts with nutbolts, gaskets, etc. and tested to 1.5 times of working pressure in an approved manner.

Material:

Body, cover, door, bearing holder: Grey cast iron

Hinge pin, door pin and door suspension pin: Stainless steel

Body seat rings: Leaded tin bronze
Door face ring: Leaded tin bronze
Bearing bushes/ Bearing block: Leaded tin bronze **Plugs for hinged pin/Air release plug:** Leaded tin bronze
Bolts: Carbon steel
Nuts: Carbon steel
Gaskets: Rubber
Hinges: Grey cast iron

P N Rating and Test Pressure:

S No.	PN Rating	Test for	Test Pressure (Gauge) MPa	Test Duration in minutes
1	PN 1.0	Body Seat	1.5 1.0	5 2
2	PN 1.6	Body Seat	2.4 1.6	5 2

Method of Construction:

The double flange NRV shall be fitted to pipe with provided flange, gaskets, and Nutbolts etc, accessories with washers, spring washers, and check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

F) Gate Valves

Specification No (FF-
VL/GV) Scope:

Supplying & installing gun metal gate valve of specified diameter having threaded ends, conforming to IS: 778, ISI mark, along with G.I. threaded nipple.

Material:

Body: a) Brass, b) Leaded tin bronze
Bonnet or cover: a) Leaded tin bronze, b) Forged brass, c) Brass
Stuffing box, disc hinge, check nut, stem nut, disc retaining nut, gland, glandnut, gland flange, body seat rings and disc or wedge facing rings (where renewable): a) Leaded tin bronze, b) Extruded brass rod, c) Forged brass, d) Brass
Stem, hinge pin and plug: a) Extruded brass rod, b) High-tensile brass, c) Forged Brass
Ball (for ball type check valves): Chromium steel
Nut bolts: Mild steel
Hand wheel: Cast iron
Gasket: Compressed asbestos fibre
Gland packing: a) Hemp and jute, b) Asbestos
Spring: Phosphor bronze wire
Seating ring: Synthetic rubber

Method of Construction:

The Gate Valve shall be fitted to pipe with provided flange, gaskets, and Nut bolts etc, accessories with washers, spring washers, and check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis.

G) Hydrant Valves (Landing Valves)

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Specification No **(FF- VL/HV)**

Scope:

Supplying and installing gun metal single outlet hydrant valve Morris pattern, oblique type, conforming to IS:5290, ISI mark, with G.M. blanks cap and M.S. or G.I. chain in an approved manner.

Material:

Valve Body, bonnet, stop valve, Check nut, female outlet: Bronze/ Aluminium alloy or Stainless Steel

Valve spindle: Bronze/ Aluminum alloy or Stainless Steel

Hand Wheel: M.S. or C.I. (Black painted)

Spring: Made of phosphor wire.

Washer, Gasket: Rubber **Blank**

Cap: ABS plastic.

Method of Construction:

The hydrant valve shall be connected with provided flange, gaskets, Nut bolts etc. with use of required tools and plants.

The water discharge shall be not less than 900 lpm for single head and 1800 lpm for double head valves at 7 kg / cm²

Mode of Measurement:

Executed quantity shall be measured on number basis.

13.8 Fire Fighting Accessories (FF-FFA)

A) Priming Tank

Specification No (FF-
FFA/PT) Scope:

Supplying & Installing One piece Moulded HDP / Fibre water tank of required capacity with necessary plumbing material on provided M.S. structural supports in an approved manner.

Material:

Priming Tank: HDPE/ Fiber of good quality material

Gate Valves: As per (FF- VL/GV) above.

Method of Construction:

The Priming tank shall be installed on provided M.S. structural supports with 20/25 mm dia. inlet valve and 50 mm dia. outlet valve with provided necessary G.I. piping up to delivery of main fire pump before non-return valve.

Mode of Measurement:

Tank capacity will be measured on litre basis. (i.e. per litre)

B) Hose Reel

Specification No (FF-FFA/HRD)

Scope:

Supplying and installing wall mounting swinging Hose reel drum as per IS: 884 and fitted with 19 mm dia 22.5 meter long high pressure polypropylene (Polyhose) pipe as per IS: 444 (type III) G.M. chrome plated nozzle and 19 mm dia and G.M. gate valve on the inlet pipe with

necessary M.S. Bracket for holding Hose reel³⁷⁷ drum fitted in position with wall fasteners, in an approved manner.

<u>Material:</u>

Hub and sides: Aluminum Alloy/Mild steel/ Aluminum sheet

Wall Bracket: Cast iron / Mild steel.

Hose tube (20 mm): Thermoplastic (Textile Reinforced) Type-2, (Nominal internal dia) as per IS- 12585

Nozzle with branch Pipe: Brass as per IS 8090

Stop Valve (Ball Valve): Gun metal.

Method of Construction:

The Wall Mounting swinging Hose reel drum with Gun Metal Nozzle, gate valve, shall be connected on M.S. bracket with provided flange, gaskets, Nut bolts etc. with use of required tools and plants. The water flow rate shall be not less than 24 LPM and the range of jet shall be not less than 6 metre.

Mode of Measurement:

Executed quantity shall be measured on number basis.

C) Hose pipe for Hose reel

Specification No (FF-FFA/HOP)

Scope:

Supplying & erecting high pressure polypropylene hose pipe 20 mm. dia as per IS 444- type III & IS 446-1980 type I fabricated from polyester core braided with high tensile textile yarn suitable for erection of 19 mm Gun Metal Chrome plated nozzle.

Material:

Hose pipe material: Polypropylene, the lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity and splits. The tensile strength shall be minimum 5.00 MPa and shall withstand for 10.2 kg/cm²
Nozzle: Chrome plated gun metal

Method of Construction:

The hose pipe shall be connected with provided couplings.

Mode of Measurement:

Executed quantity shall be measured on per meter basis.

D) Rubber Hose Pipe

Specification No (FF-FFA/RHP)

Scope:

Supplying & erecting high pressure rubber hose pipe 20 mm. Dia as per IS 446- 1978(type I) & IS 444- 1978 (type II) fabricated lead moulded with high tensile yarn braided rubber hose pipe suitable for erection of 19 mm gun metal Chrome plated nozzle.

Material:

Hose pipe material: Rubber. The lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity, and splits. The tensile shall be minimum 5.00 MPa and shall withstand pressure of 10.2 kg/cm²
Nozzle: Chrome plated gun metal

Method of Construction:

The hose pipe shall be connected with provided couplings.

Mode of Measurement:

Executed quantity shall be measured on per meter basis.

E) Controlled Percolation Hose Pipe

Specification No (FF-FFA/CPH)

Scope:

Supplying fire fighting C P (Controlled Percolation)³⁷⁹ Hose pipe of 63 mm in diameter, conforming to IS: 8423, and 15 metre in length, fitted with male and female G.M. coupling confirming to IS: 903, ISI mark.

<u>Material:</u>

Hose pipe material: Synthetic cotton yarn confirming to IS 8423 and shall be made of jacket or cotton or synthetic material or their combination. It shall be tested as specified in IS and shall withstand for pressure 10.2 kgf/cm² and should not burst before a pressure of 35.7 kg/ cm² is reached.

Coupling: Gun metal confirming to IS 903

Method of Construction:

Hose pipe of 15 metre length with male and female Gun metal coupling shall be connected as per direction.

Mode of Measurement:

Executed quantity shall be measured on number basis.

F) R.R.L Hose Pipe

Specification No (FF-FFA/RRL)

Scope:

Supplying fire fighting R.R.L. Hose pipe, conforming to IS: 636 (Type-A) 15 metre length, fitted with male and female G.M. coupling conforming to IS: 903, with ISI mark.

Material:

Hose pipe material: Rubber lined woven jacketed & 63mm in dia., the lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity and splits. The tensile shall be minimum 5.00 MPa and shall withstand pressure of 10.2 kg/cm²

Coupling: Gun metal

Method of Construction:

Hose pipe of 15 metre length with male and female Gun metal coupling shall be connected as per direction.

Mode of Measurement:

Executed quantity shall be measured on number basis

G) Canvas Hose Pipe

Specification No (FF-FFA/CHP)

Scope:

Supplying fire fighting canvas Hose pipe, conforming to IS: 4927 and 15 metre length, fitted with male and female G.M. coupling conforming to IS: 903, with ISI mark.

Material:

Hose pipe material: Canvas

Coupling: Gun metal

Method of Construction:

Canvas hose pipe 15 metre in length with male and female Gun metal coupling including necessary labour, material and use of required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis

H) Nozzles

Specification No (FF-FFA/NZ)

Scope:

Supplying G.M. branch pipe of 63 mm diameter with specified length fitted with 20mm diameter detachable hexagonal nozzle conforming to Is: 903, ISI mark.

Material:

Nozzle: Chrome plated Gun metal

Method of Construction:

Gun metal hexagonal nozzle fitted with required tools and plants including necessary labour, material, etc.

Mode of Measurement:

Executed quantity shall be measured on number basis.

l) Fire Brigade connection

Specification No (FF-FFA/FBC) -382-

Scope:

Supplying and installing fire brigade Header of 150 mm Ø, G.I. 'C' class pipe having 2Nos. of 100 mm 'T' outlet with 100 mm Ø flange, fitted with 2 Nos. of G.M. fire branchinginlet connection, each consisting of 2 Nos. 63 mm dia. G.M. male inlet for supplyingwater in fire tank.

Material:

Pipe material: G.I. 'C' class (Heavy duty)

Branching Inlet: Gun metal

Male Inlet: Gun metal

Method of Construction:

In case under ground storage tank is not approachable by fire tenders, a 4 way 63 mm diameter instantaneous male inlet connection is provided at street level and connected to UG tank with 1 meter length of 150mm. diameter under ground pipe.

The whole unit shall be placed in provided MS box made of 2 mm thick MS sheet with openable glass cover.

Mode of Measurement:

Executed quantity shall be measured on number basis

J) Siamese connection (Fire service Inlet)

Specification No (FF-FFA/SMC)

Scope:

Supplying and installing fire brigade Header (Siamese Connection) of 150 mm Ø, G.I. 'C' class pipe having 2 Nos. of 100 mm 'T' outlet with 100 mm Ø flange, fitted with 2Nos. of G.M. male inlets with spring type NRV for supplying water to Wet riser.

Material:

Pipe material: G.I. 'C' class

Branching Inlet: Gun metal

Male Inlet: Gun metal

Non Return Valve: As per (FF- VL/NRV) above.

Method of Construction:

In order to facilitate feeding of water in the system by fire service, a 4 way 63 mm diameter collecting head shall be provided and connected with each riser/down comer and the ring main with non return valve and with provided butterfly/slucice valve. This should belocated at a place where fire brigade tender can reach.

The whole unit is placed in provided MS box made of 2 mm thick MS sheet with open-ableglass cover.

Mode of Measurement:

Executed quantity shall be measured on number basis

K) Air Cushion Tank (Air Vessel)

Specification No (FF-FFA/ACT)

Scope:

Supplying and installing Air Vessel of 300 mm Ø 1.5 mtr. in height M.S. Tank fabricated from M.S. black ERW pipe, conforming to I.S.: 3589, having 6mm thickness, dish end at both ends, duly welded with 300 mm Ø pipe, having inlet of 100 mm Ø, duly fitted with 100 mm Ø sluice valve and 20/25 mm Ø draw in with G.M. gate valve, to be installed inside pump house along with provided M.S. angle tripod.

Material:

Air Vessel: MS ERW pipe confirming to IS 3589

Tripod: MS angle of size 75 x 75 x 5mm

Method of Construction:

300mm dia, 1.5 metre height air vessel, Gate Valve, flanges, MS angle Tripod including
necessary labour, material and use of required tools and plants.

Mode of Measurement:

Executed quantity shall be measured on number basis

L) Air Release Valve

Specification No (FF-
FFA/ARV)
Scope:

Supplying and erecting Air release cock of 20/25 mm Ø made from G.M. with necessary G.I. coupling for fixing on top of Air vessel or on wet riser.

Material:

Air release Valve: Gun metal

Coupling: G.I.

Method of Construction:

Air release Valve with necessary GI Coupling shall be fixed on top of wet riser with required labour, tools, etc.

Mode of Measurement:

Executed quantity shall be measured on number basis

M) Pressure Gauge

Specification No (FF-FFA/PG)
Scope:

Supplying and installing pressure gauge of 100 mm Ø. 0-300 PSI or 0-21 kg/cm² square fitted with 12/15 mm Ø. pad cock valve, and G.I. pipe, elbow etc. as per requirement in an approved manner.

Material:

Pressure Gauge: 100 mm diameter made from Brass metal.

Cock valve, elbow, and pipe: G.I

Method of Construction:

The 100 mm dia pressure gauge with G I cock valve, erected with GI Pipe including accessories, with required labour, tools, etc, as directed by the Engineer-in-charge.

Mode of Measurement:

Executed quantity shall be measured on number basis

N) Pressure Switch

Specification No (FF-FFA/PS)
Scope:

Supplying and installing pressure switch with 12/15 mm Ø isolation valve, G.I. nipple, elbow etc. in an approved manner.

Material:

Pressure switch: Brass metal

Isolation valve, elbow, Nipple: G.I

Method of Construction:

The Pressure switch with G I isolation valve, and necessary GI fittings (elbow, Nipple)fitted with required labour, tools, etc.

Mode of Measurement:

Executed quantity shall be measured on number basis

O) Orifice plate

Specification No (FF-FFA/OP)

Scope:

Supplying and erecting one no. Brass orifice plate having 6 mm. thick with specified outer diameter and suitable inner diameter to reduce the pressure between 3.2 kg/cm² to 5.5 kg/cm²

Material:

Body: Stainless steel 6 mm thick

Method of Construction:

The Orifice plate shall be placed before the hydrant valve.

Mode of Measurement:

Executed quantity shall be measured on number basis

13.9 Fire Alarm System (FF-FAS)

A) Heat detector

Specification No

(FF-FAS-HD)

Scope:

Supplying, erecting, and testing heat detector with base erected on 16 gauges M.S. sheet box of 100 x 100 x 75 mm size duly painted.

Material:

Heat detector: UL listed / LPCB marked with 360° blinking LED & having 68° C/78° C fixed temperature.

Box: CRCA/MS sheet of 16 gauges

Red oxide paint: Superior quality

Enamel paint: Superior quality of specified colour

Hardware: Sheet metal screws

Plugs: Plastic

Method of Construction:

The Heat Detector shall be fixed on the CRCA/MS sheet box duly painted with one coat of red oxide & 2 coats of enamel paint of specified shade with necessary SM screws, plugs, etc on ceiling, duly terminating the provided cable with provided glands and making the connection.

Mode of measurement:

Executed quantity shall be measured on number basis

B) Optical type Photo electric smoke detector

Specification No

(FF-FAS/SD)

Scope:

Supplying, erecting and testing optical type smoke detector complete with base erected on 16 gauge CRCA/MS sheet box of 100 x 100 x 75 mm duly painted.

Material:

Smoke detector: UL listed / LPCB marked

Box: CRCA/MS sheet of 16 gauge

Red oxide paint: Superior quality

Enamel paint: Superior quality of specified colour

Hardware: Sheet metal screws

Plugs: Plastic

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Method of Construction:

The Smoke Detector shall be fixed on the CRCA/MS sheet box duly painted with one coat of red oxide & 2 coats of enamel paint of specified shade with necessary SM screws, plugs, etc on ceiling, duly terminating the provided cable with provided glands and making the connection.

Mode of Measurement:

Executed quantity shall be measured on number basis.

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C) **Beam type Photo-Thermal/Thermal Smoke detector (Optical Beam Detector)**

Specification No

(FF-FAS/OBSD)

Scope:

Supplying, erecting and testing Optical Beam Detector (Beam type Photo-Thermal Smoke detector) complete with Transmitter and receiver unit erected on wall/ceiling with base.

Material:

Detector: Comprising Transmitter & Receiver unit, UL listed / LPCB marked, with BS5839 part 1 2002, compliance and duly tested & certified as per EN54-12: 2002.

The detector shall have following features:

- Automatic drift compensation
- Dust tolerance chamber to provide optimum detection performance and minimal nuisance alarms to minimize maintenance
- Digital addressing capability
- Photoelectric and Photo-thermal multi criteria
- Operating voltage range 8 to 30 V DC
- Operating temperature range -30 to +70° C
- Multi-function Alarm- Normal bi-colour LED indicator.

Hardware: Sheet metal screws

Plugs: Plastic

Applications:

- Photo-Thermal detector to be used in General purpose halls, auditoriums, and at spaces where the ceiling **height is more than 4.0 metre**.
- Thermal detector with combination of fixed and rate of rise heat shall be used in kitchens, pantry and bars and at similar spaces where the ceiling **height is more than 4.0 metre**.

Method of Construction:

The Detector consisting of Transmitter (Detector) and receiver shall be mounted /fixed at designated place duly connected with provided cable/wires and tested.

Mode of Measurement:

Executed quantity shall be measured on number basis.

13.10 Fire Alarm Accessories

(FF-FAAS)

A) **Pill Box (Manual Call Point [MCP])**

Specification No

(FF-FAAS/MCP)

Scope:

Supplying, erecting, testing, and commissioning pill box with break glass, push button. MCP is manually operated device used to initiate an alarm signal

Material:

Push Button: Plastic

Enclosure: CRCA/MS with 100/150 mm round/square with Glass cover

Hammer with chain: Brass

Enamel paint: Superior quality Post Office red colour

Hardware: S.M. Screw

Plugs: Plastic

Method of Construction:

The pill box with break glass cover, push button in circular/ square enclosure with push button kept inside per set with a glass outside marked "IN CASE OF FIRE BREAK GLASS" provided with a small hammer and chain fixed to the pill box shall be mounted on wall or any other place as directed and provided with cable entry with suitable terminal inside and painted with two coats of red oxide and two coats of post office red enamel paint.

Mode of Measurement:

Executed quantity shall be measured on number basis

B) Hooter

Specification No (FF-FAAS/HTR)

Scope:

Supply and erecting hooters with CRCA enclosure duly connected to main amplifier to radiate two tone sounds for public.

Material:

Hooter: Electronic type with 6W output, Line matching transformer

Enclosure: CRCA sheet of 14 SWG with perforation **Enamel**

paint: Superior quality Post Office red colour **Hardware:** S.M.

Screw

Plugs: Plastic

Gitties: Wooden

Method of Construction:

The electronics hooter with Line matching transformer shall be enclosed in suitable size perforated CRCA enclosure and installed as per instructions and shall be connected and fixed at suitable site to ensure that the alarm is heard anywhere in the protected area. The minimum sound level shall be 80 dB.

Mode of Measurement:

Executed quantity shall be measured on number basis

C) Remote Response Indicators

Specification No (FF-FAAS/RR1)

Scope:

Supplying, erecting, and testing of remote response indicators.

Application: Remote Response Indicators shall be fixed for closed rooms, cabins, or for inaccessible rooms, etc.

Material:

Indicator: 5 mm LED (2 Nos) / 10 mm LED (1 No) in Red colour

Enclosure: CRCA sheet of 14 SWG with perforation

Enamel paint: Superior quality of specified colour

Hardware: S.M. Screws

Plugs: Plastic

Gitties: Wooden

Method of Construction:

Remote response indicator housed in enclosure shall be fitted out side the rooms, cabins at accessible height and shall be clearly visible.

Mode of Measurement:

Executed quantity shall be measured on number basis

**D) Fire Alarm Control Panel
Local Control Panel**

Specification Nos

<i>Fire Alarm Control Panel</i>	<i>(FF-FAAS/FACP)</i>
<i>Local Control Panel</i>	<i>(FF-FAS/LCP)</i>

Scope:

Supplying, erecting, testing, & commissioning of Fire Alarm Control Panel with all accessories.

Material:

Panel: Microprocessor based Conventional Main Fire Alarm Control Panel (FACP) with necessary Test Certificate from ERTL as per IS 2189-1999 provided with SMPS (Switch Mode Power Supply) of suitable battery (2x12V) 24V, 24 AH capacity maintenance free battery as standby supply to switch over automatically for a period of 8 hours in case of A.C. supply failure to panel with 7 AH capacity battery charger, panel shall have following features.

- a) Visual zone indication in which fire has emerged.
- b) Audio alarm devices.
- c) Acknowledge reset and test devices.
- d) Visual indication (2x20 character LCD display) incorporating following indications:
 - (i) Fire condition
 - (ii) Fault condition
 - (iii) A.C. Pilot indication
 - (iv) Low battery indication
 - (v) Blown fuse indication A.C. as well as D.C.
 - (vi) Built in electronic hooters of 2 tone round for fire condition and single tone for fault condition.
 - (vii) Open and short circuit fault.
 - (viii) Push button switch for checking each zone.
 - (ix) Push button to disable audio alarm.
 - (x) Reset push button.
- e) Fire protection and alarm circuit shall have modular design using electronic plug in type printed circuit boards (PCB) with spare cards.

Method of installation:

The microprocessor based main fire Alarm control panel designed as per IS 2189- 1999 with ERTL Test certificate shall be fixed at accessible place so that security or fire personal can attend to the fault immediately.

Testing:

The control shall be tested for following features:

- 1) Alarm cancel Test
- 2) Reset 1 lamp
- 3) Fire Test
- 4) Open Test (for detector & hooter)
- 5) Short circuit Test (for detector & hooter)
- 6) Walk Test (one man test)
- 7) Sounder Test

Mode of Measurement:

Executed quantity shall be measured on number basis

13.11 P.A. System (FF-PA/AFR)

A) Amplifier for P A System

Specification No

(FF-PA/AFR)

Scope:

Supplying, erecting, testing, and commissioning amplifier 120 W / 250W for Public address system.

Material:

Amplifier: Amplifier unit with wall mounted closed cabinet having rated output wattage
120 W / 250W with 4 Nos input channels (2 Nos for Microphone & 2 Nos Auxiliary), 4/8/16 Outputlines,
suitable to work on 230 V AC supply / 12 V DC supply, and necessary protection circuit.

Method of Construction:

Amplifier unit shall be installed as per guide lines of manufacture and shall be tested for
rated output.

Mode of Measurement:

Executed quantity shall be measured on number basis

B) Sound Column

Specification No (FF-PA/SOC)

Scope:

Supplying, erecting, testing, and commissioning 15 watts Sound Column.

Material:

Sound Column: Wall mounted Sound column shall give 15 watts output, with necessary fixing arrangement.

Method of Construction:

Sound column shall be installed as per guide lines of and connected to the amplifier duly tested.

Mode of Measurement:

Executed quantity shall be measured on number basis

C) Microphone

Specification No (FF-

PA/MIC) Scope:

Supplying, erecting, testing, and commissioning hand shield microphone

Material:

Microphone: Microphone unit as per manufacturer's standard specifications.

Method of Construction:

Microphone unit shall be connected with cord to amplifier unit as per guide lines of manufacture and shall be tested.

Mode of Measurement:

Executed quantity shall be measured on number basis

D) Microphone Cable

Specification No (FF-PA/MCC)

Scope:

Supplying erecting, testing to 2 core shielded Microphone cable.

Material:

Microphone cable: 2 core microphone cable, PVC insulated with copper conductor.

Method of Construction:

Microphone cable shall be connected to microphone and tested.

Mode of Measurement:

Executed quantity shall be measured on meter basis

A) Sprinklers

Specification No (FF-SPR)

Scope:

Supplying and erecting 15 mm (1/2") dia. NBCM Body chrome finished, pendent type quartzoid bulb sprinkler.

Material:

Chrome plated sprinkler bulb having 68° / 78°C fixed temperature rating UL listed.

Method of Construction:

The sprinklers bulb shall be fitted to sprinklers pipe line and tested for required pressure.

Mode of Measurement:

Executed quantity shall be measured on number basis.

Chapter 14

LIFTS

14.1 Lifts

LFT-LFT

14.2 Drawings

Chapter 14

Lift

14.1 Lifts

Scope:

Specification No (LFT)

Supplying erecting and commissioning passenger lift, hospital lifts and goods lift with technical requirements of lift installation, its components, safety devices various type of controls and methods of operation. The selection of a particular type of control and method of operation will be guided by the requirements in individual case such as nature of building, usage, occupancy, traffic pattern, etc. and has to be decided in individual case considering quality and quantity analysis of service.

(Refer drawing no. LFT-1)

Recommended Standards:

The following list is for Indian Standards which are acceptable as good practice and accepted standards;

IS 14665 part I	:	Guidelines for outline dimensions of passenger, goods, service and hospital lifts.
IS 14665 part II	:	Code of practice for installation, operation and maintenance of lifts.
IS 14665 part III	:	Safety rules
IS 14665 part IV	:	Components

Development Control Rules	:	Of concerned Corporation or Local Authority
National Building Code 2005		
Bombay Lift Act 1939		
Bombay Lift Rules 1958		
I. E. Rules 1956	:	Reprint as per 2005

Material:

- **Electric Supply:**
Three phase, 50 c/s, 415 V electric supply shall be made available by owner. The entire lift equipments should be suitable for operation at +10% to - 20% of the rated supply voltage.
- **Gearless machine:**
The gearless machine shall consist of a motor, traction sheave and break-drum or brake disc completely aligned on a single shaft. Gearless machine shall be AC. gearless with VVVF drive.
- **Geared machine;**
The lift machine shall be of worm gear reduction type with motor, brake, worm gearing and driving sheave and suitable for type of control specified.
- **Electric motor:**
Energy efficient Electric motor of suitable HP with class F insulation and S-4 duty cycle
- **Car:**
As per IS 14665 part IV with MS Girders, bracings of adequate size and strength at the bottom and top with angle iron frame and side panels of CRCA/MS of 16 gauge duly powder coated paint or SS sheet of 18 gauge with mirror or hairline finish with safety factor more than 5.
- **Signals:**
FPI in car and CPI at all landings are to be provided with up / down direction indicators with call registration facility.
- **Variable Voltage Variable Frequency:**
Incoming mains AC power is first rectified to DC and then inverted to provide controlled AC current to the elevator drive. Precision monitoring is required for motor speed, car direction,

position and load to enable the pulse width³⁹⁸ of the AC power supplied to the motor and to be adjusted to ensure that elevator speed is maintained very accurately to an ideal profile. Energy saving through reduced power consumption should be achieved.

- **Controls:**

Microprocessor based Control panel duly wired with proper size and strength of copper wire.

- **Control panel box:**
Control panel box of MS sheet of 16 gauge with duly power coated of MS sheet of 16 gauge.
- **Driving / traction pulley:**
Sheaves and pulleys shall be of hard alloy, cast iron, SG iron or steel and free from cracks, sand holes and others defects. They shall have machined rope grooves. The traction sheave shall be grooved to produce proper traction and shall be of sufficient dimension to provide for wear in the groove. The deflector sheave shall be grooved so as to provide a smooth bed for the rope.
- **Over speed governor:**
The car safety shall be operated by speed governor located overhead and driven by governor rope suitably connected to the car and mounted on its own pulleys. Governor shall be provided for lifts with a travel of more than 5.5 meters. The governor rope shall be not less than 6mm in dia and shall be made of steel or phosphor bronze. These shall be in accordance with IS 14665 (part 4/sec-4): 2001.
- **Electromagnetic breaks:**
The lift drive machinery shall be provided with an electro-magnetic brake or motor operated brake normally applied by means of springs in compression when the operating device is in off position. The brake shall be suitably curved over the brake drum or brake disc and provided with fire proof friction lining. The operation of brake shall be smooth, gradual and noiseless. The brake shall be designed to be of sufficient size and strength to stop and hold the car at rest with rated load. The brake should be capable of operation automatically by the various safety devices.
- **Suspension wire rope:**
Round strand steel wires ropes made from steel wire ropes having a tensile strength not less than 12.5 tones / cm² and of good flexibility shall be used for lift. Lubrications between the strands shall be achieved by providing impregnated hemp core.
- **Guide rails:**
The guide rails shall be continuous throughout the entire travel and shall withstand without any deformation by the action of safety gear with a fully loaded car. Generally the guide rails shall be supported by brackets secured to the hoist way frame at each floor. The rails shall be securely fastened to the brackets or other supports by approved heavy rail clamps. Guide rails shall extend from pit floor to the underside of concrete slabs or grafting at top of the lift well. They shall be erected in plumb and parallel with a maximum deviation of 3mm.
- **Buffers:**
Buffers shall be suitable for installation in the space available. Buffer anchorage at pit floors shall be installed avoiding puncturing of water proofing. Oil buffers of the car and counter weight shall be of the spring return type or of gravity type. The contractor must indicate the name of buffer manufacturers, buffer stroke & certified maximum loads.

Method of Construction:

- Bar chart shall be prepared as per tender condition and requirement. Lift hoist way measurement shall be done before finalizing the material quantity.
- Drawing should be prepared according to tender specification considering hoist way size and permission from Lift Inspector for erection of lift should be taken prior to commencement of erection.
- White wash in lift well shall be carried out by the client.
- Site in full readiness shall be handed over to the agency.
- Minor civil work pertaining to front wall architraves internal / external plastering etc. shall be done by the lift agency.
- Prepare and install scaffolding and template by adjustment required.
- List of components / finished items those are not manufactured by lift manufacturer shall be informed by the agency.
- Brackets are to be erected and fixed in to plum line.
- Put the fasteners (16 mm dia x 100 mm) if the brackets are to be fixed on RCC wall / beam / lintel or fix rig bolts if brick work found in RCC.
- After fixing brackets and guides with adjustment fix the car and counterweight
- Fix the landing door frame / door bottom with sill and suitable brackets to withstand the load of passenger / freight as per specification
- Fix metal trunking / PVC pipe as per IS requirement

- Complete civil work such as fixing up hoist way, push button, buffers, machine room I beams for resting machine, foundation for control panel, minor civil work, making holes in bottom slab of machine room to pass traction rope, speed governor rope / wiring and complete finishing according to sizes and specification.
- Electrical wiring in lift shaft and supply cable shall be carried out from electrical agency as per requirement of lift rules.
- Fix machine with complete gear box unit, suitable rubber pad / anti vibrating pad, diverter if required with alignment as per norms.
- Fix the control panel at accessible height from floor level to inspect, connect, and operate easily.
- Put wires in accordance with the control panel connection diagram according to colour code in metal trunking with insulating paper on all bends, corners. Metal trunking shall be duly earthed from top to bottom according to IS specifications.
- Mid way junction boxes are to be fixed according to size but it should be marked by every wire with nos. (Ferrules) Traveling cables should be fixed with suitable hanger to take load of travelling cable and put extra wire of 20 % approximately
- Fix the car and counterweight frame according to sizes, adjustment of safety blockwedges shoes as per requirement.
- **Toe Guard Aprons:**
 - The toe guard apron of gauge not less than 1.6mm sheet steel may be provided extending at least 15mm beyond entrance jams at each side. The guards shall have a straight vertical face extending below the level of the finished car floor and not less than the depth of the levelling zone plus 7.5mm. It shall be seamed to car platform construction and be reinforced and braced.
- **Car Apron, Landing Thresholds and Sills:**

An apron shall be fitted to the car platform such that no dangerous gap exist at anytime when the landing door is opened, Thresholds and sill plates shall be provided at the landings also. The distance between landing sill and the sill on car platform shall not be more than 30mm.
- **Emergency Power Supply for lift car, fan and intercom system:**

This shall include suitable secondary battery with trickle/Boost charge arrangement and inverter power pack with necessary contactors for supply to light fixtures in the lift car, fresh air fan in lift car. The same battery shall also feed the alarm bell and communication equipment.
- **Inter-communication system:**

Intercom system shall be provided in car to have communication in case of an emergency and shall be connected to re-chargeable battery supply.
- **Ratings and Instructions:**

Inside the lift car, the lift supplier shall also provide a stainless steel metallic plate indicating the rated load and detailed instructions for the passengers. This shall be mounted at a suitable place.
- **General:**
 - a) Put main traction ropes from car to counterweight with rope tension adjustment.
 - b) Put counterweight i.e. of CI blocks in counter weight frame for suitable equilibrium.
 - c) Put car platform and car with adjustment.
 - d) Fix car door and panels / car push button/ fall ceiling light, fan.
 - e) Fix landing panels and put in lock in circuit.
 - f) Fix hoist way accessories like drum reels terminators, final limits, levelling
 - g) Removing the scaffolding.
 - h) Connect three phase supply from main switch along with earthing to controller as per instruction given.
 - i) Wiring from controller to motor along with earth wire is to be completed.
 - j) Check motor / gear oil.
 - k) Start lift in maintenance mode.
 - l) Check adjustment of hoist way switch/ safety doors and check all parameters of shaft.
 - m) Put controller on normal mode.
 - n) Test run to be taken and service inspection of lift with all safeties shall be done in presence of site in charge.
 - o) Pre commissioning work such as cleaning of shaft, pit etc shall be done.
 - p) After completion of work, NOC shall be obtained from lift inspector

q) by the agency before putting LIFT in to operational use.

Testing of Lift Installation:

Tests at site:

(a) Levelling Test:

Accuracy of the floor levelling shall be tested with the lift empty, fully loaded. The lift shall be run to each floor while travelling both in upward and downward directions and the actual distance of car floor above, below landing floor shall be measured. In each case there shall not be any appreciable difference in these measurements for levelling at the floors when the car is empty and when it is fully loaded. The tolerances for levelling shall be as specified in para 8 of chapter IV, section I.

(b) Safety Gear Tests:

Instantaneous safety gear controlled by a governor should be tested with contract load and a contract speed, the governor being operated by hand. Two tests should be made, however, with wedge clamp or flexible clamp safeties, one with contract load in the car and the other with 68 kg (equivalent to one person) in the car. The stopping distance obtained should be compared with the specified figures and the guides, car platform, and safety gear should be carefully examined afterwards for signs of permanent distortion.

Counterweight safety gear should be tripped by the counter weight governor and the stopping distance noted. In this case, however the governor tripping speed may exceed that of the car safety governor but by not more than 10 percent.

During the safety gear tests, car speed (from the governor or the main sheave) should be determined at the instant or tripping speed with that stated in IS. The governor jaws and rope should be examined for any undue wear.

(c) Contract speed:

This should be measured with contract load in the car, with half load, with no load, and should not vary from the contract speed by more than 10 percent. The convenient method is by counting the number of revolutions, made by the sheave or drum in a known time, Chalk mark on the sheave or drum and a stop switch will facilitate timing but care must be exercised to ensure that no acceleration or retardation periods are included. If the roping is 2 to 1 the sheave speed is twice the car speed. Alternatively, the speed can be measured by a tachometer applied directly to shaft immediately below the sheave.

(d) Lift balance:

After the above test, some of the weight shall be removed until the remaining weights represent the figures specified. With this condition at half way travel the effort required to move the lift car in either direction with the help of winding wheel shall be as nearly as can be judged by the same.

(e) Car and landing doors interlock:

The lift shall not move with any door open. The car door relay contact and the retiring release cam must be tested. The workings of the door operation and the safety edges and light equipment if any provided shall also be examined.

(f) Controllers:

The operation of the contactors and interlocks shall be examined and it shall be ascertained whether all the requirements laid down in the specifications have been met.

(g) Normal terminal stopping switches:

These shall be tested by letting the car run to each terminal landing in turn, first with no load and then with contract load and by taking measurements, top and bottom over travels can be ascertained.

(h) Final terminal stopping switches:

The normal terminal stopping switches shall be disconnected for this test. It shall be ensured that these switches operate before the buffers are engaged.

(i) Insulation Resistance:

This shall be measured (after removing the electronic PCB's and their connection) between power and control lines and earth and shall not be less than 5 mega-ohms when measured with D.C. voltage of 500 volts. The test shall be carried out with contactors so connected together as to ensure that all parts of every circuit are simultaneously tested.

(j) Earthing:

Earthing continuity of all conduits, switches, casing and similar metal work shall be tested.

(k) Ropes:

The size, number construction and fastenings of the ropes should be carefully examined and recorded.

(l) Buffers:

The car should be run on to its buffers at contract speed and with contract load in the car to test whether there is any permanent distortion of the car or buffers. The counter weight buffers should be tested similarly. Test report shall be intimated after testing at works.

<u>Service Temperature Test:</u>

A continuous run of one hour should be made with number of starts and stops to reproduce as nearly as practical the anticipate duty in service. (The standard duty cycle is for 180 starts per hour). It is very difficult in practice to carry out this test with alternate starts at full load and no load and it is necessary therefore to simulate these cycles. A suitable test for all motors except squirrel cage motors is to run the car up from the bottom landing with contract load and stop at each floor. From the top floor a non stop run is made to the lowest floor and the upward journey with stop is then repeated. The time intervals between stops and starts at the floors should be uniform and such as to give about 150 starts in one hour. At the end of this run the temperatures of the armatures and fields of the motor and generator are recorded. The temperature rise should, not exceed 55 deg C or 75 deg C for class A or B insulation respectively.

Method of Construction: Executed quantity will be counted on number basis. (i.e. each)

Chapter 15

TEMPORARY ILLUMINATION

15.1 Temporary Illumination	TE-IL
15.2 Hiring of DG Set	TE-DG

Chapter 15

Temporary Illumination

(TE)

15.1 Temporary Illumination (TE/IL)

Scope:

Specification No (TE/IL)

This work is to be carried out within municipal premises or as instructed by Engineer- in-charge.

Method of Construction:

Wires shall be used of copper conductor with one continuous length and with minimum joints and of good insulation quality.

All switchgears and panels must be checked, tested with earth test, IR test Polarity, continuity prior to commencement or charging of installation. The results for the same shall be maintained in the logbook at site.

Termination shall be done with copper lugs at an important place such as in main switchgears and in panel.

Necessary ancillary works such as making holes in brick wall or concrete wall, scaffolding or wood work, mechanical work, civil work etc. to be done and again have to make good as original with no extra cost if required.

Maintenance personnel shall be made available for the entire period of function.

Safety Code:

All the safety codes under different statutory authorities shall be observed strictly while doing the work.

Full load testing shall be given prior to trial day with all necessary latest testing equipment.

15.2 Hiring of DG Sets (TE/HDG)

Scope:

Specification No (TE/HDG)

This work is to be carried out within municipal premises or as instructed by Engineer- in-charge and for temporary functional programs.

Method of Construction:

The DG Set on hire basis shall be fully equipped with all accessories, four pole changeover, etc and shall be filled with fuel. The connections of the changeover shall be made in presence of site engineer. Necessary testing on full load or on available load shall be taken in presence of site engineer. As far as possible load balancing shall be done. In case of switches with interlocking neutral isolation should be confirmed.

The set shall be properly earthed and earth connection are to be connected to body & neutral as per IE rules.

Termination shall be done with copper lugs at an important place such as in main switchgears and in panel.

Agency must have sufficient quantity of fuel and oil to be stored at site with tools for necessary maintenance, arrangement of first aid and fire extinguishing system.

Maintenance personnel along with Operator of DG Set shall be made available for the entire period of function.

Safety Code:

All the safety codes under different statutory authority shall be observed strictly while doing the work.

Full load testing shall be given prior to function day with all necessary latest testing equipment.

<u><i>Certificate:</i></u>

Commencement certificate shall be obtained by the agency from concerned Electrical Inspector of I.E. & L. Department.

Chapter 16

SIREN

16.1 Siren & Accessories

SRN-SRN

Chapter 16

Siren (SRN)

16.1 Siren & Accessories (SRN-AS)

A) Weather Shade (WS)Scope:

Specification No (SRN-AS/WS)

Supplying and erecting weather shade for protection of Siren motor, with louvers from all sides for ventilation and clear sounding of siren, duly painted with one coat of red oxide paint and two coat of approved enamel paint.

Material:*MS Sheet:* 18 SWG.*Fabrication:* MS angle iron*Paint:* Primer & Enamel paint*Anti vibrating Pads:* High density, heavy duty class rubber pads, with nut, bolts.Method of Construction:

Weather shade for covering Siren motor shall be fabricated from 18 SWG MS sheet with necessary cutting, bending & welding. Shade shall have louvers from all sides for ventilation & clear sounding of Siren. Shade of size 91 cm height x 91 cm length x 60 cm width, top having hollow trapezium of size 91 cm x 35 cm x 35 cm with angle iron frame work of size 25 x 25 x 3 mm shall be fabricated and painted with one coat of red oxide & two coats of approved enamel paint from both sides i.e., from inside & outside. The weather shade shall be firmly erected on anti vibrating pads.

Mode of Measurement: Executed quantity will be measured on number basis (i.e., each)

B) Scrapping & Painting of Shade (PTG)Scope:

Specification No (SRN-AS/PTG)

Scrapping the existing paint and repainting the weather shade of Siren motor to withstand all weather conditions.

Material:*Surface cleaning material:* Iron brush and emery paper.*Paint & Red Oxide:* Epoxy red oxide, Epoxy Enamel paint, and Special thinner for painting.Method of Construction:

Scrapping the existing paint of outer and inner surface of the weather shade with cleaning powder (Shade having an area of 3.5 Sq. mtr approx. on one side) and applying one coat of special primer red oxide mixed in special type thinner (844) in 1:3 proportion. After curing time of 6 hours, apply two coats of epoxy air dry paint (anticorrosive) of approved colour mixed in special type thinner complete (the job is to be carried out on site).

Mode of Measurement: Executed quantity will be measured on number basis (i.e., each)

C) Siren Motor (SM)

Scope:

Specification No

(SRN-AS/SM)

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Supplying & erecting Siren Motor of specified HP 1 ph / 3 ph AC, 50 Hz. 230/415 Volt type and as per IS 1941 (Part I) 1976, at the rated speed of 2800 RPM within 10 seconds of start for the range up to 3.25/8 Km.

Material:

Motor:

The stator & rotor shall be of aluminium alloy or similar material. The siren motor shall be compact in design and reliable in operation and stable for installation in open as well as in exposed position any where in the country. The electric motor with Class 'F' insulation shall be totally enclosed with greased sealed ball bearing and shall conform to IS 325 of 1970. If housing is provided for protection against rains, it shall not affect the sound output at the specified distance. The siren motor shall be fitted with two blowers (double mounted) horizontally properly balanced and mounted on opposite side of motor shaft and having unequal numbers of slots on the stators capable of producing a basic note from 400 to 1000 Hz.

Anti vibrating Pads: High density, heavy duty class rubber pads, with nut, bolts.

Method of Construction:

The Siren motor complete assembly shall be erected on designated plate on provided cement concrete foundation with anti-vibration pads nut-bolts etc. as directed by the engineer in-charge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e., each)

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Chapter 17

CIVIL WORK

17.1	Excavation	CW-EXN
17.2	Masonry work	No Specs
17.3	C.C. Foundation	No Specs
17.4	Painting	CW-PTG
17.5	Plumbing	CW-PLB
17.6	Plumbing Accessories	No Specs

17.1 **Excavation** (EXN)A) **Cable Trench (CTR)**1. **General**

This part of specification deals with the preparation of trenches in soft soil, hard murum, BT road, and laying of cables inside the trench, etc as per IS: 1255.

2. **Scope:****Specification No (CW-EXN/CTR)**

Excavating in all types of soil strata and making trench for laying cable/cables, providing sand bed for laying the cable, covering cable with specified material as per requirement, and finishing the same by making the surface proper with crown on top of the trench.

The following list shows Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code
IS 1255: 1967	:	Code of practice of Installation & Maintenance of armoured cables up to 33 kV.

3. **Material:**

Bricks: Solid Clay bricks of minimum size 225x110x62.5 mm (L x B x H), burnt in the kiln, of good quality.

Sand: Screened sand of good quality.

4. **Method of Construction:****Trench in Soft soil / Hard Murum / Tar road: Single run of cable**

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum 300 mm width shall be excavated up to minimum depth below the ground surface as per Table No 17.1/1 Bottom of the trench should be carefully levelled and freed from stones. Cable duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand at the bottom of the trench. Bricks shall be laid all over the run of cable as specified below:

Lengthwise for cable up to and including 10 Sqmm of all cores.

Width wise for cable above 10 Sqmm of all cores.

Remaining portion of the trench shall be back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150 mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

Trench in Soft soil / Hard Murum / Tar road: Two or more cables run of cable

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum required width more than 300mm. shall be excavated up to minimum depth as per Table No 5, below the ground surface. Bottom of the trench should be carefully levelled and freed from stones. Cables duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand. The inter-axial distance between two cables shall be between 230 and 400 mm. at the bottom of the trench. Bricks shall be laid all over the run of cable as specified below:

Lengthwise for cable up to and including 10 Sqmm of all cores.

Width wise for cable above 10 Sqmm of all cores.

Remaining portion of the trench shall be ⁴¹²back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150

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mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

Trench in Soft soil/Hard Murum/Tar road with half round Hume pipe:

(For cables of size 25 Sqmm. and above shall be covered by min. 150 mm. dia. of RCC Hume pipe)

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum required width more than 300mm. shall be excavated up to minimum depth as per Table No 5, below the ground surface. Bottom of the trench should be carefully levelled and freed from stones. Cables duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand. The inter-axial distance between two cables shall be between 230 and 400 mm. at the bottom of the trench. Inverted 150mm. dia. Half round RCC Hume pipe shall be laid above full length of cable. For more than one cable higher size or more number of Hume pipes are to be provided.

Remaining portion of the trench shall be back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150 mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

As per 3.1 above, in place of bricks, the cable of size 25 sq.mm and above shall be covered with 150 mm dia. half round Hume pipe.

4.4 Mode of Measurement:

Executed quantity shall be measured on the basis of running meter per run of cable.

Table No 17.1/1

Minimum laying Depth of cables (IS: 1255)

S.No	Voltage level of cables	Minimum depth from top of the cable
1	Up to 1.1 kV	750 mm
2	3.3 kV to 11 kV	900 mm
3	22 kV to 33 kV	1050 mm
4	At road crossing	1000 mm
5	At railway crossing (from Bottom of sleepers to Top of pipe)	1000 mm

17.4 Painting (PTG)

General:

This part of specification deals with the painting of all types of Fans, Poles, Fluorescent fittings, Panel type lift doors, Collapsible gates of lift, Transformer, Fencing & Gate of transformer sub station, Feeder pillar, etc.

A) Painting of Fans (PTF)

Specification No (CW-PTG/PTF)

Scope:

Spray painting of table fan / pedestal fan / cabin fan / ceiling fan / exhaust fan including guards etc., shall be carried out in the workshop by adopting following method:

Method of construction:

- a) Existing paint on the surface of the fan body and its accessories shall first be scrapped off with the help of Emery paper of required grade or by heating the surface with blowlamp. One coat of primer shall then be uniformly applied with spraying gun and same shall be allowed to dry out. The body of fan then shall be spray painted with 2 coats of enamel paint of specified colour. When the colour is completely dried, rubbing Wax compound shall be applied. With a smooth cloth, the surface shall then be vigorously rubbed, until the painted parts starts shining. Same method shall be adopted for fan blades, base & stand of pedestal fan, mounting frame of exhaust fan. After complete drying, fan shall be covered in paper, to avoid abrasion.
- b) Grills of the fan shall be soaked and then cleaned with solvent and pressure dried. Paint shall be applied either by brush or with by spraying. After complete drying, it shall be covered in paper, to avoid abrasion.
- c) The agency shall have to make arrangement of transportation of fans from site to workshop & back to site, after completion of painting job.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Painting of Poles/Channels (PTP)

Specification No (CW-PTG/PTP) **Scope:**

Painting of channel / steel tubular / Rail / RSJ / pipe pole along with street light / pole brackets / clamps completely & providing one coat of red oxide paint and two coats of aluminum paint (Black paint up to 1.5 m from plinth is recommended)

Method of construction:

- a) Existing paint of the pole/channel shall be scrapped completely by emery paper/wire brush. Then one coat of red oxide shall be applied on cleaned surface. After drying out of the red oxide two coats of aluminium paint shall be uniformly applied to the pole/channel. In case of pole, it is recommended to apply black paint for the portion, which shall get embedded in soil/foundation. Remaining portion of the pole shall then be painted with two coats of aluminium paint as per instruction.
- b) The agency shall make arrangement of ladders, tools, spares, etc. required for carrying out painting at site.

Mode of Measurement: Executed quantity shall be measured on running meter basis. (i.e. per meter)

C) Painting of Fluorescent fittings (PFT)

Specification No (CW-PTG/PFT)

Scope:

Spray painting of fluorescent fitting with flat reflector for ½ - 4' FTL completely from inside and outside after dismantling inside wiring / accessories and providing one coat of red oxide and two coats of best quality enamel paint of required colour and duly wired with accessories complete with re-erection as original.

Method of construction:

- a) Fitting shall be dismantled from its location. All wiring shall then be dismantled and stored in safe place, so as to reuse it after the painting.
- b) Existing paint of the metal surface of both the surfaces (inside & outside) shall be scrapped completely by using emery paper. After cleaning the scrapped surface, one coat of red oxide shall be applied by spraying gun. When the red oxide is completely dried out, two coats of white or any other specified colour shall be uniformly applied with spraying gun.
- c) The fitting duly painted then shall be erected at its location with necessary required hardware.
- d) The agency shall make necessary arrangements of tools/ladders required for executing the above job.

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Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

D) Painting of Panel type doors of Lift (PLD1)

Specification No (CW-PTG/PLD1)

Scope:

Spray Painting of Panel type lift doors of MS, complete with scrapping the existing paint preparing the surface, painting the door with one coat of red oxide paint, white primer and finally with two coats of best quality paint of colour specified by engineer in-charge & polishing with rubbing compound & final polish of surface painting of doors etc.

Method of construction:

- a) Existing paint on the surface of the door and its accessories shall first be scrapped off with the help of Emery paper of required grade or by heating the surface with blowlamp.
- b) One coat of primer shall then be uniformly applied with spraying gun and same shall be allowed to dry out. Then all parts shall be spray painted with 2 coats of enamel paint of specified colour. When the colour is completely dried, rubbing Wax compound shall be applied. With a smooth cloth, the surface shall then be vigorously rubbed, until the painted parts starts shining.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

E) Painting of lift door of Collapsible type (PLD2)

Specification No (CW-PTG/PLD2)

Scope:

Painting lift door of collapsible type complete by scrapping the existing paint & preparing the surface, applying one coat of red oxide, white primer & two coats of approved quality enamel paint of required colour.

Method of construction:

Existing paint collapsible door of lift shall be scrapped completely by emery paper/wire brush. Then one coat of red oxide shall be applied on cleaned surface. After drying out of the red oxide, two coats of best quality paint of colour specified by engineer in-charge shall be uniformly applied to the door.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e.each)

F) Spray painting of Distribution Transformer (PDT)

Specification No (CW-PTG/PDT)

Scope:

Spray painting of distribution transformer of specified capacity with one coat of red oxide & two coats of approved quality enamel paint after scrapping the existing paint without any damages, in an approved manner as per direction.

Method of construction:

Existing paint of the transformer body, radiator fins, conservator tank, along with cable end boxes if any, shall be scrapped with emery paper of required grade. Sufficient care shall be taken while scrapping the paint at joints, so as to avoid leakage of oil. All the oil stains shall be removed. After preparing the surface, one coat of red oxide shall be applied with spray gun. After drying out of red oxide two coats of superior quality paint shall then be uniformly applied as instructed by site in charge.

Mode of Measurement: Executed quantity shall be measured on job basis. (i.e. job)

17.5 Plumbing (PLB)

A) Galvanized Iron Pipes (GP)

1. General

This part of specification deals with the Galvanized Iron pipes of different Class (Heavy, Medium & Light) used for water supply, or for any other purpose.

The guidelines for the use of pipes are as under:

- Heavy gauge pipes shall be used for delivery line of Submersible pumps/Ejecto Jet pumps/Open well submersible pumps.
- Medium gauge shall be used for suction pipe of Centrifugal pumps, (Except for Centrifugal pumps meant for Fire fighting purpose.) and shall be used enclosure forcables while meant for laying underground at road crossing, or any other location as directed by engineer in-charge, etc.
- Light gauge shall be used as enclosure for cables on wall, pole, or for other purpose wherever specified.

2. Scope:

Specification No (CW-PLB/GP)

Supplying and erecting GI Pipes of specified class, with necessary accessories, (such as: bends, tees, couplings, unions, sockets, enlargers, reducers, check nuts, plugs, etc.) at designated place, having relevant ISI mark, complete to the satisfaction of the department.

3. Material:

Pipe: The galvanized iron pipes shall comply with IS: 1239--1973 and 1969 for the specified class. The specified diameter of the pipes shall refer to inside diameter.

Fittings & Accessories: Bends, Tees, Couplings, Unions, sockets, bends, tees, enlargers, reducers, back nuts, plugs, unions, etc shall made of galvanized iron and shall comply IS: 1239-1973 and 1969.

Plumbing material: Hemp, Linseed oil.

MS Clamps: Clamps fabricated of required length and shape, of 3/6 mm thick mild steel having 25/50 mm width.

Hardware: MS nuts & bolts of required size and strength, Sheet Metal (SM) screws of required sizes, plugs/wooden gitties, etc.

4. Method of Construction:

4.1 Pipes to be used as Enclosure:

4.1.1 Erection of Pipe on wall:

The required length of pipe shall be machine cut, without any sharp edges, burrs, etc. The pipe duly enclosing the specified material, shall be erected on wall in plum, and fixed with required size of MS clamps on wall with plugs, gitties, etc.

When the pipe is to be fixed to walls it shall be fixed with standard bracket, clips or holder by keeping the pipe about 12mm clear of the wall. The pipe shall be fixed to the wall horizontally and vertically and parallel to one another, when more than one pipe is to be laid, unless unavoidable. The supporting clips, etc. for the pipe shall bespaced at about two meters or so as necessary. Holes cut during construction shallnot be left out; they shall be filled and finished after passing of the pipe through it.

4.1.2 Erection of Pipe on pole:

The required length of pipe shall be machine cut, without any sharp edges, burrs, etc. The pipe duly enclosing the specified material, shall be erected on pole in plum, and fixed with required size of MS clamps with MS nuts & bolts of required size and strength. When the pipe is to be used as cable enclosure and is to be terminated on street light pole(s), the pipe at the trench level should be placed at least 30 cm above the cable level for avoiding damage to the insulation of cable.

4.1.3 Laying the Pipe underground:

The excavation for laying the pipe underground shall be done as required, and in advance of laying, so as to cause least damage to the trench and least inconvenience to traffic and in other respects.

The trench for laying the pipe shall be excavated to the lines and levels as directed by the site engineer. The bed shall be made even. Unless otherwise

specified in the special provisions, the excavation shall be about 30 cm. wide and not less than 45 cm. deep. The trench shall be excavated through all strata met with. Where necessary, sides may be shored or sloped. In case rock is met with the section of the trench, the depth may be slightly reduced but shall be sufficient to receive the pipe and the cushioning with a safe margin. Dewatering shall be done where necessary. During excavation, if any, pipes, water mains, cables. etc. are met, these shall be carefully protected and supported; any damage done shall be made good by the contractor at his own cost.

4.3 *Pipe used for Plumbing purpose:*

The required length of pipe shall be machine cut and threaded (threading shall be done by machine only), without any sharp edges, burrs, etc. The pipe shall then be properly aligned with the accessory and tightening by applying hemp, linseed oil, so as to make it leak proof. During the erection, wherever required, correct accessory shall be used. When holes are not left during construction they shall be cut into the walls or slabs, etc., to pass the pipe through. The necessary clamps, supports shall be provided wherever required.

5. *Mode of Measurement:*

Executed quantity shall be measured on running meter basis, including the entire accessory. The lengths shall be measured net including the straight and bends along the center line of the pipes and fittings correct up to a cm. (i.e. per meter)

SCHEDULE – “B”
&
DRAWINGS

Schedule B

Name of Work:- Supply and erecting new electric connection at DEE printing press, Committee hall & International hostel, Dr. P.D.K.V., Akola

Sr. No.	Quantity	Description of Item.	Rate		Unit.	Amount.
			In Figure	In Words		
1	2	3	4	5	6	7
1	12	Supplying & erecting fuse bridges with base HC type fuse links 415V 200A erected on polished wooden block complete.	808.00	Rupees eight hundred eight and paise nil only	Each	9696.00
2	4	Supplying & erecting 415V 100A porcelain base neutral link complete erected in provided MS box complete.	196.00	Rupees one hundred ninety-six and paise nil only	Each	784.00
3	180	Supplying and erecting metal work in CRCA sheet with fabrication of boxes, panel boards, etc. including cutting, bending, drilling, welding, riveting, treated with anti-rust treatment and duly powder coated or painted with one coat of red lead paint and 2 coats of enamel paint complete.	232.00	Rupees two hundred thirty-two and paise nil only	Kg	41760.00
4	4	Supplying and erecting plywood 12 mm thick fixed to wall or on provided panel board with necessary materials such as screws, wall fasteners supports, nuts bolts etc. complete.	678.00	Rupees six hundred seventy-eight and paise nil only	m2	2712.00
5	120	Supplying and erecting iron, sheet metal work consisting of CRCA sheets, various sections of iron, plates, chequered plates, rods, bars, MS pipes, etc. for panel board or any other purpose with bending, cutting, drilling and welding complete erected at the position with necessary materials duly painted with one coat of red oxide and two coats of enamel paint to match the switchgears or as per directions by the authority.	134.00	Rupees one hundred thirty-four and paise nil only	Kg	16080.00
6	35	Supplying, erecting & terminating XLPE armoured cable 4 core 35 sq. mm. aluminium conductor with continuous 5.48 sq. mm. (12 SWG) G.I. earth wire complete erected with glands & lugs, on wall/ trusses/pole or laid in provided trench/ pipe as per specification no. CB-LT/AL	279.00	Rupees two hundred seventy-nine and paise nil only	Mtr	9765.00

7	70	Supplying, erecting & terminating XLPE armoured cable 4 core 70 sq. mm. aluminium conductor with continuous 8.35 sq. mm. (10 SWG) G.I. earth wire complete erected with glands & lugs, on wall/ trusses/pole or laid in provided trench/ pipe as per specification no. CB-LT/AL	462.00	Rupees four hundred sixty-two and paise nil only	Mtr	32340.00
8	35	Supplying, erecting & terminating XLPE armoured cable 4 core 95 sq. mm. aluminium conductor with continuous 8.35 sq. mm. (10 SWG) G.I. earth wire complete erected with glands & lugs, on wall/ trusses/pole or laid in provided trench/ pipe as per specification no. CB-LT/AL	569.00	Rupees five hundred sixty-nine and paise nil only	Mtr	19915.00
9	8	Providing pipe type earthing with 40mm. dia. G.I. pipe or 20 mm dia. G.I. Rod complete with all materials as per specification no. EA-EP	1300.00	Rupees one thousand three hundred and paise nil only	Each	10400.00
10	2	Making cement concrete foundation in 1:3:6 cement concrete, (20 to 25) mm. stone metal duly plastered with necessary curing for complete. (pole muffing or any other purpose).	3156.00	Rupees three thousand one hundred fifty-six and paise nil only	m ³	6312.00
				Total		149764.00

Sd/-
Deputy Engineer
Construction Sub Div. No. 2
Dr. P.D.K.V. Akola

Sd/-
University Engineer
Dr. P.D.K.V. Akola

