HALDIA DOCK COMPLEX

KOLKATA PORT TRUST

ENGINEERING DEPARTMENT INVITE E-TENDER

[Tender No. SDM (P&E)/T/34/2018-19]

FOR

Tender Document for Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting Facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after Defect Liability period of 02 (Two) years.

Volume - 1 of 2: Commercial Part

FEBRUARY- 2019

TABLE OF CONTENTS

[Tender No. :. SDM (P&E)/T/34/2018-19 dated: 15.02.2019]

KOLKATA PORT TRUST

HALDIA DOCK COMPLEX

PART-1

SECTION-I

SHORT E-TENDER NOTICE

E-Tender No.: KoPT/Haldia Dock Complex/P&E Div/38/18-19/ET/381

Online e-tenders are invited for the work of "Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."

Date of Pre-Bid meeting: **06.03.2019,** 11:00 Hrs. onwards.

Closing date & time of online submission of e-tender: **27.03.2019**, up to 15:00 Hrs.

For details of tender and any corrigendum / addendum, please visit MSTC's e-portal http://www.mstcecommerce.com/eprochome/kopt.

General Manager
(Engineering)
Haldia Dock Complex
Kolkata Port Trust

KOLKATA PORT TRUST

HALDIA DOCK COMPLEX

PART-1

SECTION-II

NOTICE INVITING E-TENDER

(Tender No. SDM (P&E)/T/34/2018-19)

E-Tender No.: KoPT/Haldia Dock Complex/P&E Div/38/18-19/ET/381

E-Tenders, under **single stage two part system** [Part I: **Pre-qualification & Techno-commercial Bid** and Part II: **Price Bid**] are invited on behalf of Haldia Dock Complex (HDC), Kolkata Port Trust (KoPT), from the intending bidders, fulfilling the **"Minimum Eligibility Criteria** (MEC)" **and** complying with the "**Test of responsiveness**" for the work of "Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."

2.1 MINIMUM ELIGIBILITY CRITERIA (MEC):

2.1.1 The average annual financial turnover of the bidder, during the last three (3) years, ending 31st March, 2018, must be at least ₹3416.55 Lakhs. Auditor's Report of the biding firm, certified by Chartered Accountant (CA), for the years 2015-16, 2016-17 and 2017-18, including relevant Audited Balance Sheets and Profit & Loss Accounts, should be made available.

Note: The bidder upload the scanned copies of Annual Financial Turnover Statement (certified by CA) for the years 2015-16, 2016-17 and 2017-18 along with Balance Sheets and Profit & Loss Accounts.

2.1.2 The bidder must have experience of having successfully completed "Similar Work" [defined below] during last seven (7) years, ending last day of month previous to the one in which tenders are invited, and the experience must be either of the following :-

a) Three similar completed works of contract value not less than ₹ 4555.4 Lakhs each.

Or

b) Two similar completed works of contract value not less than ₹ 5694.25 Lakhs each.

Or

c) One similar completed work of contract value not less than ₹ 9110.8 Lakhs each

The term "***similar work***" means -

"Engineering, Design, construction of civil structural works including fire fighting facilities in Ports / Chemical industries/ Refineries / Power stations".

Note: The bidder will have to upload the scanned copies of work order(s) for similar works, successful completion certificates (with performance) from clients indicating the date of completion, value of work done, etc..

2.2 TEST OF RESPONSIVENESS:

The bidder should be considered responsive, only if scanned copy of the required document shall be uploaded along with bids;

a) The bidder will have to upload the scanned copies of work order(s) for similar works, successful completion certificates (with performance) from clients indicating the date of completion, value of work done, etc.

b) The bidder upload the scanned copies of Annual Financial Turnover Statement (certified by CA) for the years 2015-16, 2016-17 and 2017-18 along with Balance Sheets and Profit & Loss Accounts.

c) Goods and Services Tax (GST) Registration Certificate, issued by Government of India.

d) Valid **Profession Tax Clearance Certificate (PTCC) or** Up-to-date **Profession Tax payment challan,** if applicable. If this is not applicable, the bidder must submit [upload] a declaration in this regard.

e) Certificate for allotment of **Employees' Provident Fund (EPF) Code No.** [**Latest challan** is to be submitted (uploaded)], if applicable. If this is not applicable, the Bidder should submit [upload] a declaration (in the form of Affidavit), in this regard.

f) Registration certificate of **Employees' State Insurance** (**ESI)** authority, if applicable.

If this is not applicable, necessary document(s) [to establish Non-applicability], along with **affidavit, affirmed before a first-class Judicial Magistrate** to that effect, are to be submitted [uploaded]. Moreover, such bidder(s) shall have to submit a declaration, confirming that they will obtain registration certificate of ESI authority, if required , and they will indemnify **Kolkata Port Trust** against all damages & accident occurring to their labourer (including that of sub-contractor's labourers), in connection with the instant contract, in case they become a Successful Bidder.

g) PAN Card, issued by Income Tax Department, Government of India.

h) **Certificate of Micro & Small Enterprises** (MSEs) / **DIC** / **SSI** / **National Small Industries Corporation** (NSIC**)** to get benefit in this regard.

i) The bidder shall upload the scanned copy of **Power of Attorney, if applicable**.

j) The bidder must deposit EMD online, if applicable, and upload the scanned documentary evidence of the transaction. The EMD may be submitted in

the form of Bank Guarantee in the enclosed format. However, in case of submission of EMD through Bank guarantee the intending bidder should follow the instruction indicated in the enclosed procedure.

k) The bidder must submit the technical documents which are listed in section-XII of part-I.

In case of association, in the form of a Licensing Agreement or a Technical Collaboration & Operational Agreement or a Joint Venture Agreement or a Consortium with other bidder(s), the members of the association should nominate one of the members as "Lead Partner" for participating in the bid and for signing all the documents related therewith, up to signing of Contract Agreement and execution thereafter (in case of award of contract). All the members of the association must also be jointly and severally responsible for satisfactory performance of the contract (in case of award of contract). Agreements (in line with ITB Clause No. 5.3.5) amongst the "Lead Partner" and other members of the association are to be submitted [uploaded] by the bidder in the "Pre-qualification & Techno-commercial Bid".

The experience of each member of Licensing Agreement or Technical Collaboration & operational Agreement or Joint Venture Agreement or Consortium would be considered at par with other eligible bidders, subject to the condition that the collective experience of the members, comprising the Licensing Agreement or Technical Collaboration Agreement or Joint Venture Agreement or Consortium, must meet the criteria established in the MEC, as detailed in Clause Nos. 2.1.

2.3 The bidders are required to submit bid as per the instructions of the instant bidding documents (including Notice Inviting e-Tender). Bid will be considered rejected if any of the essential documents is not submitted by the bidder. Essential documents means papers related to "Minimum Eligibility Criteria (MEC)", "Test of responsiveness", including Bid Document fee, Earnest Money Deposit and Power of Attorney.

2.4 AVAILABILITY OF THE BIDDING DOCUMENTS:

The bidding documents (in full) would be available in the following websites:-

- **http://www.mstcecommerce.com/eprochome/kopt of MSTC Ltd.**
- **http://eprocure.gov.in/epublish/app** of **Central Public Procurement Portal.**
- **http://www.kolkataporttrust.gov.in** of **Kolkata Port Trust.**

Corrigenda, Addenda, Queries & Clarifications, if any, would also be available in the aforesaid websites.

2.5 PARTICIPATING IN THE BIDDING PROCESS:

The bidders will have to participate in the *electronic bidding process through the website of MSTC Ltd. (http://www.mstcecommerce.com/) only.*

General Manager (Engineering)
Haldia Dock Complex
Kolkata Port Trust

PART-1

SECTION-III

SCHEDULE OF TENDER (SOT)

(Tender No. SDM (P&E)/T/34/2018-19)

E-Tender No.: KoPT/Haldia Dock Complex/P&E Div/38/18-19/ET/381

3.1.	**Name of work**	::	"Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."
3.2.	**Tender Inviting Authority**	::	**General Manager (Engg.)** Haldia Dock Complex ; Kolkata Port Trust.
3.3.	**Mode of Tender**	::	**e-Procurement System** Online (**Part I:** ***Pre-qualification & Techno-commercial Bid*** *and* **Part II:** ***Price Bid)*** through http://www.mstcecommerce.com/eprochome/kopt**.** of **MSTC Ltd.** ***No physical tender is acceptable by Haldia Dock Complex, Kolkata Port Trust.***
3.4.	**Estimated Cost**	::	**₹11388.49 Lakhs (excluding GST).**
3.5.	i) **Transaction Fee**	::	The intending bidders must deposit **₹ 17700.00 (Indian Rupees Seventeen thousand seven hundred) only** [Including GST @18%] as "**Transaction Fee" (non-refundable),** in favour of **MSTC LIMITED** by **NEFT** or **Online Payment.** The intending bidders will be activated for bid submission only after receipt of aforesaid "**Transaction Fee"** by **MSTC LIMITED**.The intending bidders are advised to remit the "Transaction Fee" well in advance before the closing time of the event, so as to give themselves sufficient time to submit the bid.
	ii) **Bid Document Fee (Cost of bidding documents)**	::	The intending bidders must deposit **₹ 11,800.00 (Eleven thousand eight hundred) only [including GST @ 18%], as Bid Document Fee (non-refundable),** to Haldia Dock Complex, along with their offer. In case the said **Bid Document Fee** is not deposited by the bidder, the respective bid will be summarily rejected, treating the same as non-responsive.
	iii) **Earnest Money Deposit (EMD)**	::	The intending bidders must deposit **₹123.88 Lakhs (Indian Rupees: One hundred and twenty three lakh eighty eight thousand)** only, as **Earnest Money**, to Haldia Dock Complex, along with their

			offer. In case the said **Earnest Money** is not deposited by the bidder, the respective bid will be summarily rejected, treating the same as non-responsive.
			NOTE :: (i) For exemption of Bid Document Fee and EMD to upload the scanned copy of the certificate from National Small Industries Corporation (NSIC) with DIC is required.
			(ii) The bidders, who are not registered with MSTC, are advised to get themselves registered with MSTC, at least 72 (seventy-two) hours prior to making payment of Bid Document Fee and Earnest Money.
			(iii) The bidders are advised to deposit Bid Document Fee and EMD using the **Axis Bank Payment Gateway only**. (No other method of payment of Bid Document Fee shall be accepted.) OR
			(iv) Earnest Money Deposit (EMD) may also be deposited in the form of an irrevocable and unconditional **Bank Guarantee** [as per the form added in **Section**-XII**]**, from any Kolkata/Haldia Branch of a Nationalized/Scheduled Bank of India. In such case an amount of Rs. 10.00 lakhs (Ten Lakhs) to be deposited though Axis Bank gateway and the balance amount of EMD may be submitted in the form of BG. The Bank guarantee in original must physically reach the office of the Engineer of the Contract before the opening of the Techno-commercial bid. In case of foreign Bank Guarantee, it shall be routed through any Branch of corresponding Nationalized/Scheduled Bank in India and such corresponding Bank shall confirm the same and standby for all the commitments under the Bank Guarantee. In all cases, any dispute regarding Bank Guarantee will be adjudicated under the jurisdiction of The Calcutta High Court. Earnest Money Bank Guarantee (EMBG) submitted by bidders shall be denominated in the respective currency (ies) mentioned in the instant clause and for the respective amounts. The EMBG should be kept valid and enforceable till a date, covering **at least 3** (**three**) **months** beyond the date of expiry of the validity period of the bid. In case a bidder agrees to any extension of the bid validity period, asked by KoPT, the validity of the corresponding EMBG shall have to be extended till a date, covering at least 3 (three) months beyond the date of expiry of such extended bid validity period. Scanned copy of such EMBG must be submitted (uploaded) by the bidders, along with the Pre-qualification & Techno-commercial Bid. The **original Bank Guarantee should be sent by the issuing Branch of the Bank**, **directly to the Employer**,

			at the following address: **Senior Deputy Manager** (**Finance**), **Haldia Dock Complex** (**HDC**), **Jawahar Tower Complex**, **P.O**: **HaldiaTownship**, **Dist.**: **Purba Medinipur**, **PIN – 721 607**, **West Bengal**, **India**. **The original Bank Guarantee should reach the above address before the closing date and time of submission of bid**. Details of Earnest Money remitted must be entered by the participating bidder in the space provided in the e-Tender, as indicated hereunder: a) Name of the bidder: b) E-Tender No.: **KoPT/Haldia Dock Complex/P&E Div/38/18-19/ET/381** c) Amount of EMBG: d) EMBG Bank details: e) **Bank Guarantee No**.: f) Date of EMBG:
3.6.	**Completion Period**	::	24 months.
3.7.	**Bid Validity**	::	180 days.
3.8.	**Security Deposit**	::	i) 10 % of the Project Value excluding GST in the form of Bank Guarantee.
			ii) 10% of the O&M value excluding GST in the form of Bank Guarantee.
3.9.	**Guarantee Period**	::	24 months for complete projects.
3.10.	**Date, time and venue of Pre-Bid Meeting (off-line).**	::	**06.03.2019 at 11:00 Hrs (IST).** **Address:** Engineering Department Jawahar Tower Complex ; P.O.: Haldia Township; Dist.: Purba Medinipur ; PIN: –721607 West Bengal, India. **Telephone no. :** + 91-3224-263255 **E. mail : aganesan.hdc@nic.in**
3.11.	i) **Starting date & time of submission of e-Tender** at **http://www.mstcecommerce.com/eprochome/kopt**	::	**19.03.2019 from 11.00 hr.**
	ii) **Closing date & time of submission of e-Tender** at **http://www.mstcecommerce.com/eprochome/kopt**	::	**27.03.2019**, **up to 15: 00 Hrs. (IST).**

	iii) **Date & time of opening of Part-I (Techno-commercial Bid)**	::	**27.03.2019**, **15: 30 Hrs.** (**IST**) **onwards**.
	iv) **Date & time of opening of Part-II** (**Price Bid**)	::	**Shall be informed separately**.
3.12.	**Address of the Employer**	::	**Kolkata Port Trust (KoPT).** 15 Strand Road, Kolkata – 700 001, West Bengal, India.
3.13.	**Address of Engineer**	::	**General Manager (Engineering)** Haldia Dock Complex ; Kolkata Port Trust. **Address:** Engineering Department Jawahar Tower Complex ; P.O.: Haldia Township; Dist.: Purba Medinipur ; PIN: –721607 West Bengal, India. **Telephone no. :** + 91-3224-263255 **E. mail : aganesan.hdc@nic.in**
3.14.	**Address of the Engineer's representative**	::	Shri S. Chakraborty, Sr. Dy. Manager (P&E), Haldia Dock Complex, Operational Administrative Building (1st floor), Chiranjibpur; P.O: Haldia; Dist.: Purba Medinipur; PIN: 721 604; West Bengal; India. Phone no. + 91 9434735407 Landline: + 91-3224-252662 **E. mail :** schakraborty.hdc@nic.in

General Manager (Engineering)
Haldia Dock Complex
Kolkata Port Trust

PART-1

SECTION - IV

INSTRUCTIONS FOR ONLINE BID SUBMISSION

4.1 Introduction:

4.1.1 This is an e-procurement event of **HALDIA DOCK COMPLEX**. The e-procurement service provider is **MSTC Ltd.**, 225C, A.J.C. Bose Road, Kolkata-700 020.

4.1.2 The intending bidders are requested to go through the "**Instructions To Bidders (ITB)"** and contents of this bidding document, including all terms & conditions and Technical Specifications before submitting online tender. Bidders who do not comply with the requirements / conditions, with documentary proof (wherever required), will not qualify in the tender, for opening of Price Bid.

4.1.3 **SPECIAL NOTE**:

THE PRE-QUALIFICATION & **TECHNO-COMMERCIAL BID** AND **PRICE BID** SHALL HAVE TO BE SUBMITTED **ON-LINE** AT **www.mstcecommerce.com/ eprochome/kopt** only.

4.1.4 Possession of valid Digital Signature Certificate (DSC) [**Class III Signing Type**] and Registration of the intending bidder with **MSTC Limited** on the e-Procurement / e-Tender Portal of MSTC are pre-requisites for the instant e-Tendering.

4.1.5 The Digital Signature Certificate (DSC) [Class III Signing Type], issued by nCode/eMudra or any Certifying Authority (CA) recognized by Controller of Certifying Authorities (CCA), India, should be registered. Only the DSC that is registered should be used by the bidder and the bidder should ensure safety of the same.

4.1.6 The intending bidders are requested to read the vendor guide and see the video in the webpage www.mstcecommerce.com/eprochome to familiarize themselves with the system before bidding.

4.1.7 The online tender should be submitted strictly as per the terms and conditions and procedures laid down in the website www.mstcecommerce.com/eprochome/ of **MSTC Limited**.

4.1.8 All entries in the tender should be entered in online Technical & Commercial formats, without any ambiguity.

4.1.9 The e-Tender platform shall remain open from the pre-announced date & time and for as much duration as mentioned in the Schedule of Tender (SOT).

4.1.10 E-tender cannot be accessed after the closing date and time of e-Tender, mentioned in the Schedule of Tender (SoT) of the instant bidding documents.

4.2 Process of e-tender :

4.2.1 **Registration:**

The process involves **vendor's registration with MSTC e-procurement portal** which is **free of cost**. Only after registration, the vendor(s) can submit his / their bids electronically.

Electronic bidding for submission of Techno-Commercial Bid as well as Price Bid will be done over the internet. The **Vendor should posses Class III Signing type Digital Certificate**. Vendors are to make their own arrangement for bidding from a Personal Computer / Laptop, connected with Internet. **MSTC** is not responsible for making such arrangement. (*Bids will not be recorded without Digital Signature*).

4.2.2 **Steps for Registration:**

i) Vendors are required to register themselves online with www.mstcecommerce.com → e-Procurement → PSUs / Govt. Departments → Kolkata Port Trust → Register as Vendor → (Filling up required details and creating own user id & password) → Submit.

ii) Vendors will receive system generated mail(s), confirming their registration, in their e-mail ID(s), which has been provided during filling up the registration form.

4.2.3 **The intending bidders are requested to submit their bids, keeping sufficient time in hand.**

4.2.4 In case of any clarification regarding online submission of bids, the intending bidders are requested to contact HDC / MSTC, well in advance, keeping sufficient time in hand.

Contact person (Haldia Dock Complex):

(i) **Mr. A. Ganesan**
General Manager (Engineering)
Haldia Dock Complex ;
Kolkata Port Trust.
Telephone no. : + 91-3224-263255
E. mail : aganesan.hdc@nic.in

(ii) Mr. S. Chakrabarty
Sr. Dy. Manager (P&E.) ,HDC
Phone no. + 91 9434735407
Landline: + 91-3224-252543
email - schakraborty.hdc@nic.in

Contact persons (MSTC Ltd.):

(i) Mr. V. K. Jaiswal
Regional Manager (ERO)
Mobile No: +919903042449
Email- vikash@mstcindia.co.in

(ii) Mr. P. Biswas
Asstt.Manager (ERO)
Mobile No.- +919903248755
Email: pbiswas@mstcindia.co.in
Landline: +91 – 33 – 2290 1004

(iii) Mr. M. H. Jain
Asstt.Manager (ERO)
Mobile No: +919721277969
Email- mhjain@mstcindia.co.in

4.2.5 **System requirements and other requirements:**

i) Operating System: Windows 7 or above.

ii) Internet Browser: IE-7 or above.

iii) Class-III Signing Type Digital Certificate.

iv) Latest update JRE 8 (x86 Offline) Software to be downloaded and installed in the system.

v) To disable "Protected Mode" for DSC (Digital Signature Certificate) to appear in the signer box, the following setting may be applied:

Tools => Internet Options => Security => Disable Protected Mode (if enabled), i.e., remove the tick from the tick box mentioning "Enable Protected Mode".

vi) Other settings:

Tools => Internet Options => General => Click on Settings under "Browsing History/Delete Browsing History" => Temporary Internet Files => Activate "Every time I visit the webpage".

vii) To enable ALL Active X controls and disable 'use pop up blocker' under Tools → Internet Options → Custom Level (Please run IE settings from the webpage www.mstcecommerce.com once).

4.2.6 Bidding in e-tender:

i) The intending bidders need to submit necessary Transaction Fee, to become eligible to bid online in the e-Tender. Transaction Fee is non-refundable.

Bid Document Fee is non-refundable. Earnest Money Deposit will be refunded to the unsuccessful bidders, without any interest, within 2 (two) months from the date of opening of Price Bids or on finalization/ acceptance of tender, whichever is earlier. Earnest Money Deposit of the successful bidder will be refunded, without any interest, after submission of Security Deposit by them.

ii) The bidders must upload all the documents required as per the instant bidding documents (including Notice Inviting e-Tender). Any other document uploaded, which is not required as per the instant bidding documents (including Notice Inviting e-Tender), shall not be considered.

iii) **Certificate of MSME / Micro & Small Enterprises** (MSEs) / **DIC** / **SSI** / **National Small Industries Corporation** (NSIC**)** shall have to be submitted (uploaded) to get benefit.

iv) Unit of Measure (UOM) is indicated in the e-Tender platform. Rate to be quoted should be in Indian Rupees, as per UOM indicated in the e-Tender platform or in the bidding documents.

v) **Steps for submitting Pre-Qualification & Techno-Commercial Bid and Price Bid :**

The intending bidder(s), who have submitted the required Transaction Fee, can only submit their Pre-qualification & Techno-commercial Bid and Price Bid, through Internet, in MSTC website. The steps are given hereunder:

a) www.mstcecommerce.com → e-Procurement → PSUs/Govt. Departments → Kolkata Port Trust → Login → My Menu → Auction Floor Manager → Live Event → Selection of the Live Event → Techno-commercial Bid

b) The bidder should allow running JAVA application. This exercise has to be done immediately after opening of Bid Floor. Then the necessary steps, as would appear, would have to be followed. If this application is not run, then the bidder will not be able to save/submit their bid.

c) After filling the Techno-commercial Bid, the bidder should click on "Save" for recording their Techno-commercial Bid. Once the same is done, the Price Bid link becomes active and the same has to be filled up and then the bidder should click on "Save" to record their Price Bid. Then once both the

Techno-commercial Bid and Price Bid have been saved, the bidder can click on the "Final submission" button to register their bid.

vi) The bidders should quote their offered prices appropriately, only in the aforesaid Price Bid link. Price indicated anywhere else, in any other form or manner, will not be considered for evaluation of Price Bid.

vii) The Techno-commercial Bid and Price Bid cannot be modified/revised, once the "Final submission" button has been clicked by the bidder.

viii) After submitting online bid, the bidder cannot access the bid submitted by him/them, once the "Final submission" button has been clicked by the bidder.

4.2.7 Special Note towards Transaction Fee:

The intending bidder shall pay the Transaction Fee using "Transaction Fee Payment" link under "My Menu" in the vendor login. The intending bidder has to select the particular tender from the event dropdown box. The intending bidder shall have the facility of making the payment either through NEFT or Online Payment. On selecting NEFT, the intending bidder shall generate a challan by filling up a form. The intending bidder shall remit the Transaction Fee amount as per the details printed on the challan, without making change in the same. On selecting Online Payment, the intending bidder shall have the provision of making payment using its Credit Card/Debit Card/Net Banking. Once the payment gets credited to MSTC's designated Bank account, the Transaction Fee shall be auto authorized and the intending bidder shall be receiving a system generated mail.
Transaction Fee is non-refundable.

An intending bidder will not have access to online e-Tender without making payment towards Transaction Fee. In other words, an intending bidder will be activated for bid submission, only after receipt of the Transaction Fee by MSTC Limited.

NOTE: The intending bidders are advised to remit the "Transaction Fee" well in advance before the closing time of the event, so as to give themselves sufficient time to submit the bid.

4.2.8 Procedure of payment of Earnest Money and Bid Document Fee through Axis Bank Gateway :

i) The bidder would be able to access the payment gateway from the Vendor login page of the MSTC ecommerce site (*www.mstcecommerce.com* → *e*-Procurement → PSU/Govt. depts. → Kolkata Port Trust) under the icon "HDC EMD/Tender Fee Payment". Clicking this icon will take the bidders to the Axis Bank Gateway.

Alternatively, the bidder can also access the gateway by from Axis Bank Easy Pay website (https://easypay.axisbank.co.in → Others → Haldia Dock Complex).

ii) The bidder will be required to mention the bidder's ID (the ID used by the bidder for logging in the MSTC website) and Bid ID (E-Tender No. of the tender against which the bidder intends to submit bid) and then click 'VALIDATE'.

iii) A webpage will populate, where the bidder will be required to select "Earnest Money" OR "Bid Document Fee", then indicate his Mobile Number and the CAPTCHA displayed in the webpage.

iv) Depending on the selection, another webpage will come up.

v) In case of selection of Earnest Money (EM), the bidder will be required to select the option of With or Without Bank Guarantee. In case of the instant tender, where there is no option to pay the EM through Bank Guarantee (BG), the bidders should

select the option 'Without'.

vi) The bidder will be required to mention their Bank Account Number, IFSC of their Bank and the name of the account, insert the CAPTCHA mentioned in the webpage and then 'SUBMIT'. In case of Bid Document Fee payment, Bank Account Number would not be required.

An URN Number will be generated. Bidders should keep note of this URN Number for all future reference.

vii) Another webpage will come up and the bidder will have the option to select payment methods from – (i) Internet Banking and (ii) NEFT / RTGS, after agreeing with the terms and conditions, by clicking the dialogue box appearing in the webpage.

viii) In case of selection of Internet Banking, the bidder will be required to select any Bank of their choice and depending on the selection, the bidder will then be guided to the webpage of the respective Bank.

After validating the payment in the respective Bank, the system will return to the Axis Bank Payment Gateway.

ix) In case of selection of RTGS / NEFT, the webpage will generate a payment advice.

The Bank Account Number, IFSC of the Bank, name of the payee, i.e., Haldia Dock Complex, and the amount to be paid will be indicated in the said payment advice. The bidder will also get an SMS and e-mail detailing the same.

The bidder will be required to mention the same correctly in the Bank Challan, which is required to be filled up for payment by RTGS / NEFT in the Bank from where they intend to make the payment.

The bidders should note that Bank a/c number of HDC, mentioned in the Payment Advice, will change for each and every transaction and hence, for each and every payment, the entire process from the beginning will have to be followed for generation of a URN Number.

x) For payment of Bid Document Fee, identical process is to be followed.

xi) The bidders will be able to know the status of their payment, by using the 'Enquire URN' facility, by mentioning the URN Number in the Axis Bank login page. Until such time the payment is credited to HDC's a/c, the system will show the status as 'Pending'.

xii) The bidders should note that until such time the status remains 'Pending', the payment is not made to HDC and mere generation of URN Number will not signify payment of EM or Bid Document Fee. Hence, if the status remains 'Pending' after some time of submitting the RTGS / NEFT payment request at their Bank, then the bidders should contact their Bank to enquire about the status of RTGS / NEFT request.

xiii) In case of any problem relating to use of the payment gateway, the bidders should contact the tender inviting authority, whose phone number and e-mail address are mentioned in the e-Tender.

4.2.9 Special Note towards uploading required documents:

The intending bidders are instructed to use "**Attach Doc**" button to upload documents in

document library. Multiple documents can be uploaded.

4.3 Instructions related to Micro & Small Enterprises (MSEs):

4.3.1 For exemption of Bid Document Fee and EMD certificate from National Small Industries Corporation (NSIC) & DIC is required.

4.3.2 **Micro & Small Enterprises (MSEs)** registered with **NSIC under Single Point Registration Scheme (SPRS)** are eligible to get the benefits under new **Public Procurement policies** for **MSEs.**

4.3.3 When splitting of tender quantity is not possible purely on technical ground, Trustees reserve the right not to negotiate price with MSE if their price is within the band of L1+15% in comparison with L1 price of non-MSE for consideration of award of order for 20% of tender quantity against any item as per new public procurement policy.

4.3.4 If **Micro & Small Enterprises (MSEs)**, registered with NSIC [under single point registration scheme] intend to participate with respect to items for which they are not registered with NSIC, then they will have to deposit full amount of **Bid Document Fee** and **Earnest Money**, in accordance with the **Schedule of Tender (SoT).** Otherwise, their offer with respect to such items (for which they are not registered with NSIC) will not be considered.

4.4 Other Instructions related to e-Procurement:

4.4.1 All notices and correspondence with the bidder(s) shall be sent by e-mail only during the process till finalization of tender by HDC, KoPT. Hence, the intending bidders are required to ensure that their e-mail IDs provided are valid and updated at the stage of registration of bidders with MSTC (i.e., Service Provider). The intending bidders are also requested to ensure validity of their DSC (Digital Signature Certificate).

4.4.2 In all cases, an intending bidder should use their own ID and Password, along with Digital Signature, at the time of submission of their bid. It is mandatory that all bids are submitted with Digital Signature Certificate (DSC), otherwise the same will not be accepted by the system.

4.4.3 Addenda, Corrigenda and Queries & Clarifications (with respect to the instant e-Tender), if any, would be hosted in the e-Procurement portal of MSTC.

Since there is no provision to take out the list of intending bidders downloading the bidding documents from the websites mentioned in the Tender Notice, the intending bidders are requested to check the website of MSTC to ensure that they have not missed any Addenda, Corrigenda and Queries & Clarifications, uploaded against the instant e-Tender, after downloading the bidding documents. The responsibility of downloading such Addenda, Corrigenda and Queries & Clarifications, if any, will be that of the intending bidders.

4.4.4 No deviation/variation of the techno-commercial terms and conditions of the bidding documents will be considered by HDC, KoPT. Submission of bid in the e-Tender platform by any bidder confirms their acceptance of the techno-commercial terms and conditions of the bidding documents.

4.4.5 HDC, KoPT reserves the right to accept or reject any bid (in full or part) and to annul the bidding process and to reject all bids, at any time prior to contract award, without assigning any reason thereof and without thereby incurring any liability to the bidders.

4.4.6 Any order resulting from this open e-Tender shall be governed by the terms and conditions mentioned therein.

4.4.7 All electronic bids submitted during the e-Tender process shall be legally binding on the bidders. Any bid will be considered as the valid bid offered by that bidder and acceptance of the same by HDC, KoPT will form a binding contract, between HDC, KoPT and the bidder, for execution of the work. Such successful bidder shall be called hereafter the 'CONTRACTOR'.

4.4.8 The bids will be evaluated based on the filled-in Technical & Commercial formats and the requisite documents submitted (uploaded) by the bidders.

4.4.9 The documents uploaded by bidder(s) will be scrutinized. During scrutiny, in case any of the information furnished by the bidder is found to be false, Earnest Money Deposit of such defaulting bidder(s) will be forfeited. Punitive action, including suspension and banning of business, can also be taken against such defaulting bidder(s).

4.4.10 HDC, KoPT, at its discretion, may extend the closing date & time of e-Tender, prior to the closing date & time of e-Tender mentioned in the Schedule of Tender (SoT). However, the closing date & time of e-Tender will not be extended, under any situation, after the due date is over.

4.5 Opening of Part-I (i.e. Pre-qualification & Techno-commercial Bid) and Part-II (i.e. Price Bid) :

4.5.1 **Part I** (Pre-qualification & Techno-commercial Bid) will be opened electronically on specified date and time, as given in the Schedule of Tender (SoT). Bidder(s) can witness electronic opening of bid(s).

4.5.2 **Part II** (Price Bid) will be opened electronically of only those bidder(s), who qualify(ies) in the "Pre-qualification & Techno-commercial Bid" [Part I]. Such bidder(s) will be intimated date of opening of Part II (Price Bid), through e-mail, to valid e-mail ID(s) confirmed by them.

PART-1

SECTION - V

INSTRUCTIONS TO BIDDERS (ITB)

A. GENERAL

5.1 Definition and interpretations :

(a) the term "in writing" means communicated in written form (i.e. by mail, e-mail, fax, telex, etc.) and delivered against receipt;

(b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular;

(c) "day" means calendar day; and

(d) "procurement" means the entire work requirements, as specified in **Section VI Technical Specification**.

5.2 Fraud and corruption

5.2.1 It is the policy of **Kolkata Port Trust (KoPT)** to require that bidders, Contractors, Sub-contractors, and Consultants, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, **KoPT** :

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "**corrupt practice**" means the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence the action of a public official in the procurement process or in contract execution;

(ii) **"fraudulent practice"** means a misrepresentation or omission of facts, in order to influence a public procurement process or the execution of a contract;

(iii) "**collusive practice**" means a scheme or arrangement between two or more bidders, designed to establish Bid Prices at artificial , non competitive levels;

and

(iv) "coercive practice" means harming, or threatening to harm, directly or indirectly, persons or their property to influence their participation in procurement process or affect the execution of a contract;

(b) will reject a proposal for award, if it determines that the bidder, recommended for award, has, directly or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the contract in question;

(c) Will terminate contract, if it determines at any time that representatives of KoPT engaged in corrupt, fraudulent, collusive, or coercive practices during

the procurement or the execution of that contract ;

(d) will sanction a firm or individual, including declaring them ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that they have, directly or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for, or in executing, a contract;

and

(e) will have the right to require that a provision be included in Bidding Documents and in contracts, requiring bidders, contractors , subcontractors, and consultants to permit KoPT to inspect their accounts and records and other documents relating to the bid submission and contract performance.

5.2.2 Furthermore, bidders shall be aware of the provision stated in GCC.

5.3 Eligible bidders

5.3.1 A Bidder, and all parties constituting the Bidder, **should have the nationality of any country**. A Bidder shall be deemed to have nationality of a country if the Bidder is a citizen or is constituted, incorporated, or registered and operates in conformity with the provisions of the laws of the country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or contractors for any part of the contract, including related services

5.3.2 A Bidder shall not have a conflict of interest. Any Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this bidding process, if the Bidder and one or more parties :

(a) Submit more than one bid in this biding process.

Or

(b) are or have been associated in the past , with a firm or any of its affiliates which have been engaged by **KoPT** to provide consulting services for the preparation of the design, specifications, and other documents to be used for the procurement of the goods to be purchased under the instant Biding Documents.

5.3.3 Participating by a Bidder in more than one bid shall result in the disqualification of all bids, in which such Bidder is involved.

5.3.4 A Bidder that is under a declaration of ineligibility by **KoPT**, in accordance with **ITB Clause No.5.2**, at the date of contract award shall be disqualified.

5.3.5 If any bidder has a **Licensing Agreement** or a **Technical Collaboration Agreement** or a **Joint Venture Agreement** or a **Consortium** with other **bidder(s)**, then the bidder should comply with the following:

5.3.5.1 A copy of **Licensing Agreement/ Technical Collaboration Agreement/ Joint Venture Agreement** is to be submitted [uploaded] along with the "Pre-qualification &Techno-commercial Bid", duly attested by the bidder. Such Agreements should be in the nature of legally acceptable Agreements.

5.3.5.2 The bidder should submit an additional **Supplementary Agreement**, duly signed by all the Partners of the **Licensing Agreement**/**Technical Collaboration Agreement**/**Joint Venture Agreement**, on a Non-judicial Stamp Paper of worth not less than Rs. 50.00, duly notarised, covering the following points:

5.3.5.2.1 The **Licensing Agreement**/ **Technical Collaboration Agreement**/**Joint**

Venture Agreement, irrevocable in nature, is valid for at least a continuous period of 12 **(twelve) years** from the date of Handing over of the Fire fighting system.

5.3.5.2.2 One of the partners shall be nominated as the"**Lead Partner**".

5.3.5.2.3 The **Lead Partner** shall be authorised to incur liabilities and receive instructions for & on behalf of any & all the partners. The entire execution of the contract, including payment, shall be carried out exclusively through the **Lead Partner**.

During the entire period of the contract, the **Lead Partner** cannot be changed.

In the event of the **Lead Partner** becoming **defunct**, selection of the new Lead Partner would be made, as may be mutually agreed between the remaining partner(s) and KoPT, without any additional financial involvement. As the approval towards such new Lead Partner is the sole discretion of KoPT, it must be approved by them, in writing.

The said new Lead Partner shall also be jointly, as well as severally, liable with the remaining partner(s) for the satisfactory performance of the contract as per the scope of these bidding documents.

5.3.5.2.4 The **scope and responsibilities** of all the Partners of **Licensing Agreement/Technical Collaboration Agreement /Joint Venture Agreement**, **in terms of financial & technical commitment/contribution,** should be **explicitly** mentioned and the Partners should be **severally & jointly responsible** for the satisfactory performance of the contract as per the scope of these bidding documents.

5.3.5.2.5 In case of successful bidder, the **Contract Agreement** is to be signed by legally authorised signatories of all the Partners.

5.3.5.2.6 In the event of default of any Partner in the execution of his part of the contract, the **Lead Partner** shall have authority to assign the work to any other party acceptable to the Employer (KoPT), to ensure the execution of the part of the contract. The said party shall also be jointly [with the remaining Partner(s)] as well as severally liable so far as the unfinished part of the contract is concerned.

5.4 Authority in signing the bid / offer

5.4.1 In case the bid is submitted by a **Proprietorship Firm**, the same should be signed either by the **Proprietor** or other person(s), holding a valid **power of attorney** / **authorisation** from the proprietor, in connection with this bidding process. The signature of such power of attorney holder(s) / authorised person(s) should be attested by the proprietor. Such **power of attorney** / **authorisation** should be uploaded along with **Techno-commercial Bid** [**Part I**].

5.4.2 In case the bid is submitted by a **Partnership Firm**, the same should be signed either by the partner(s), holding valid **power of attorney** from the partners or other person(s), holding valid **authorisation** from such power of attorney holder(s) , subject to approval of the partner(s) in the matter of giving such authorization, in connection with this bid. The signature of such **power of attorney holder(s)** / **authorised person(s)** should be attested by the **partners** or **power of attorney holder**, as the case may be. Such **power of attorney** / **authorisation** should be uploaded along with **Techno-commercial Bid** [**Part I**].

5.4.3 In case the bid is submitted by a **Limited Company**, the same should be signed by the person(s) holding valid **power of attorney** / **authorisation,**

executed in his / their favour (in connection with this bid) and the signature of such **power of attorney holder(s) / authorised person(s**) should also be attested, in accordance with the constitution of the Limited Company. Such **power of attorney** / **authorisation** should be uploaded along with **Techno-commercial Bid** [**Part I**].

5.4.4 Such **power of attorney holder(s)** / **authorised person(s)** should put his / their signature identical with the attested one, in the relevant documents submitted / uploaded, in connection with the instant bidding process [including "**Techno-commercial Bid**"]. In case of putting different signatures in different documents / offers, all such signatures should be attested by the same person in line with the above.

B. CONTENTS OF BIDDING DOCUMENTS

5.5 Sections of Bidding Documents

5.5.1 The contents of the **Bidding Documents** as detailed at "TABLE OF CONTENTS" should be read in conjunction with any addendum / corrigendum issued in accordance with **ITB Clause No. 5.7.**

5.5.2 The Employer (KoPT) is not responsible for the completeness or correctness of the bidding documents and their Addenda, if they were not obtained directly from the source indicated in Notice Inviting e-Tender .

5.5.3 The bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Documents. Failure to furnish all information or documentation required by the Bidding Documents [considering all addenda / corrigenda issued] may result in the rejection of the bid.

5.6 Pre-Bid Meeting

5.6.1 A prospective bidder requiring any clarification of the instant Bidding Documents shall contact **Sr. Dy. Manager (P&E), HDC**, in writing, or raise their enquiries during the **Pre-bid meeting**.

The **prospective bidders** are requested to submit their queries / observations / suggestions / requests for clarification, in connection with the instant Bidding Documents, in advance, to enable **KoPT** to prepare response / clarifications and make pre-bid meeting meaningful.

5.6.2 As indicated in the Schedule Of Tender, pre-bid meeting will be conducted off-line on behalf of HDC, KoPT. The purpose of this pre-bid meeting will be to clarify issues and to answer questions on any matter (in connection with the instant Bidding Documents only) that may be raised at that stage.

Authorised representative(s) of the prospective bidders will be allowed to attend the **Pre-bid meeting,** which will be held on the date, time & at the venue stipulated in the **Schedule Of Tender** (**SOT)**.

The **designated representative(s)**, who will be deputed to attend the **pre-bid meeting**, should submit their authorization in this regard. The signature of such designated person(s) should be attested by the authorized signatory of the prospective bidders. Otherwise, the designated person should have to submit the proof of his identity through other means.

5.6.3 The prospective bidders are advised to attend the pre-bid meeting. However, non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

5.6.4 Unless otherwise notified, **all the queries** / **observations** / **suggestions** / **requests for clarification** (related to the instant Bidding Documents only) [including the **queries** / **observations / suggestions / requests for clarification raised during pre-bid meeting]**, received till the date of **pre-bid meeting,** will be considered. **KoPT's** response / clarifications (including description of queries / observations / suggestions / requests for clarifications, but without identifying its source), in this regard, will be communicated to all the known prospective bidders (i.e. who would **attend pre-bid meeting** or **submit queries / observations / suggestions** or **requested for clarification)**, in writing, well in advance to the last date of submission of bids. The aforesaid **queries** / **observations / suggestions / requests for clarification** and **KoPT's** response / clarifications will also be hosted in the websites, as specified in the **Notice Inviting e-Tender.**

Any modification to the Bidding Documents, which may become necessary as a result of the **KoPT's response** / **clarifications,** so issued, shall be made through the issue of an addendum / corrigendum, pursuant to **ITB.**

5.6.5 The Bidder shall be deemed to have **examined** thoroughly the instant Bidding Documents, in full, [considering all addenda / corrigenda issued (if any)], **visited the site & surroundings** and to have **obtained all necessary information in all the matters** whatsoever that might influence while carrying out the job as per the conditions of the instant **Bidding Documents** [considering all addenda / corrigenda issued (if any)] and to satisfy themselves to sufficiency of their bid, etc. If they shall have any issue to be clarified, the same should be brought to the notice of **KoPT**, in writing, as set out in **ITB.**

The bidders are advised to acquaint themselves with the job involved at the site, like availability of labour, means of transport, communication facilities, laws and bye laws in force from Government of West Bengal & Government of India and other statutory bodies from time to time. The Bidder shall be deemed to have examined and collected all necessary information as to risk, contingencies and other circumstances, which may be necessary for preparing the Bid.

Visiting the site shall be at the bidder's own expense. Failure to visit to site will no way relieve the Contractor (successful Bidder) of any of their obligation in performing the work and liabilities & responsibilities thereof, in accordance of the contract.

5.6.6 Necessary Gate Pass/Dock Entry Permit, for entering into the Dock area, will be issued to the designated representative(s) of the prospective bidders, on chargeable basis [as per the extant "Scale of Rates" of KoPT, available at **http://www.kolkataporttrust.gov.in/** of Kolkata Port Trust], to visit the site, for the purpose of inspection only, on receipt of a formal written request. The signature of such designated person(s) should be attested by the authorized signatory of the prospective bidders. Otherwise, the designated person(s) should have to submit proof of his/their identity through other means.

However, during the pre-bid meeting, if the prospective bidders are willing to enter into the dock area, they will be allowed through VIP Pass of HDC free of cost.

Such prospective bidder will be fully responsible for any injury (whether fatal or otherwise) to its designated representative(s), for any loss or damage to property, or for any other loss, damage, costs and expenses whatsoever caused,

which, but for the granting of such permission , would not have arisen.

The prospective bidder will be liable to indemnify KoPT against any loss or damage to the property of KoPT or neighbouring property which may be caused due to any act of prospective bidder or their designated representative(s).

5.7 Amendment of Bidding Documents

5.7.1 At any time, prior to the last date for submission of bids, **KoPT** may, for any reason whether at its own initiative or in response to the **queries**/ **observations/suggestions/requests for clarification,** amend and modify the bidding documents by issuing Addenda/Corrigenda. Such Addenda/Corrigenda will be hosted in the websites, as specified in the **Notice Inviting e-Tender**.

5.7.2 Any Addendum/Corrigendum, thus issued, shall be part of the bidding documents and shall be communicated, in writing, to all the known prospective bidders (i.e., who would attend Pre-bid Meeting or submit queries / observations / suggestions or request for clarification), in writing, well in advance to the last date of submission of bids.

5.7.3 To give prospective bidders reasonable time to take the Addendum / Corrigendum into account in preparing their bids, KoPT may, at their discretion, extend the last date for submission of the bids, prior to the closing date & time of e-Tendering.

C. PREPARATION OF BIDS

5.8 Cost of bidding

The Bidder shall bear all costs associated with the preparation and submission of their bid, and **KoPT** shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

5.9 Language of Bid

The Bid, as well as all correspondence and documents relating to the bid, exchanged by the Bidder and KoPT, shall be written in the **English language only**. If the supporting documents and printed literature, that are part of the bid, are in another language, they must be accompanied by an accurate translation of the relevant passages in the English language, in which case, for purposes of interpretation of the bid, such translation shall govern.

5.10 Documents comprising the Bid

5.10.1 The Bid shall comprise of the following :-

(a) Pre-qualification and Techno-commercial Bid:

The Pre-qualification & Techno-commercial Bid comprises all documents [including the Bidding Forms (provided in these bidding documents), duly filled in, signed and stamped] required to be submitted as per the Notice Inviting e-Tender, Schedule of Tender (SoT), Instructions To Bidders (ITB) and any other relevant clause(s) of these bidding documents.

(b) Price Bid:

The Price Bid comprises the prices only and the same are to be submitted electronically, through the website of MSTC Limited only.

5.11 Form of Tender

The bidder shall have to submit (upload) the "**FORM OF TENDER**". This form **must be completed without any alterations** to its format, and no **substitutes shall be accepted.** All blank spaces shall be filled in with the information requested. Such **duly filled in "FORM OF TENDER**" should be uploaded.

5.12 Price Schedule

5.12.1 The Bidder shall quote their price on-line (**through MSTC portal only**) as per the **Price Schedule** (Bill of Quantities) in the Price bid (Part-II), without any condition or deviation. Price indicated anywhere else, in any other form or manner, will not be considered for evaluation of Price Bid.

5.12.2 The Bidder should submit (upload) the **unpriced** format [Bidding Form VI : **PRICE SCHEDULE**], of the instant Bidding Documents, duly filled in the GST rates at appropriate places and signed & stamped as token of acceptance.

5.13 Bid Prices

5.13.1 The prices are to be quoted by the Bidder **through MSTC portal**, considering the work requirements, as detailed in Part-2 (**Technical Specification)** and other terms & conditions of the Bidding Documents (considering all addenda / corrigenda issued).

5.13.2 Except where otherwise expressly provided, the contractor shall have to provide all materials, labour, plant and other things necessary in connection with the contract, although everything may not be fully specified, and although there may be errors and omissions in the specifications.

5.13.3 The prices and rates entered (electronically through MSTC Portal) **as per the Price Schedule** (Bill of Quantities)**,** in the Price bid (Part-II**),** by the **Bidder,** shall include, inter alia, all costs and expenses involved in or arising out of the following:

(a) Supply, delivery, inspection, transportation (including insurance), handling, receipt and storage of all required materials [in line with Technical Specification (Part-2)] and equipment at site, erection, testing, commissioning, statutory certification, warranty obligation, O&M etc..

(b) The provision, storage, transport, handling, use, distribution & maintenance of all materials, equipment, machinery and tools, including all costs, charges, dues, demurrage or other outlays involved in transportation.

(c) The provisions & maintenance of all their staff & labour and their payment, accommodation, transport, fares and other requirements.

(d) All required first aid, welfare and safety requirements.

(e) Damage caused to the work and /or construction, plant, materials and consumable stores caused by weather.

5.13.4 Tools, Tackles, lifting machineries, scaffolding, temporary lighting, different vehicular transport etc. required for execution of the whole work will have to be arranged by the Contractor, at their own risk, cost & arrangement, which may be considered, while submitting their rates in the offer.

5.13.5 Rates & amounts quoted by the bidders in the "**PRICE SCHEDULE**", include all incidental charges [excluding Goods and Services Tax (GST)], as applicable, and charges for packing, forwarding, loading, handling, carrying to any lead, stacking, transportation, permits, overheads & profit, etc. necessary

for the complete services as described in this Bidding Document.

GST, as applicable, shall be paid extra against proper invoice submitted by the Contractor.

The contractor will be required to submit GST compliant invoice with all required details and also be required to file timely and proper return so as to enable KoPT to get due credit against GST paid.

In case of any failure on the above account, GST amount, even if paid by KoPT, shall be recoverable from the Contractor.

5.13.6 All quoted rates will remain firm during the validity period of the bid / offer, including any / all extension thereof, agreed by the bidder.

However, changes **in statutory taxes & duties [other than GST**] **will be adjusted** (within the scheduled completion period), based on documentary evidence.

5.13.7 The Bidder should clearly understand that they shall be strictly required to conform to all terms & conditions of the instant Bidding Documents [considering all addenda / corrigenda (if any) issued], as contained in each of its clauses and **plea of "Customs Prevailing"** will not be, in any case, admitted as excuse on their part, for infringing any of the terms & conditions.

No request for change or variation in rates or terms & conditions of the contract shall be entertained on the ground that the successful Bidder has not understood the work envisaged in the instant contract.

5.14 Currencies of Bid

The **Bidders** should quote the prices in **Indian Rupees (₹)** only.

5.15 Period of validity of bids

5.15.1 Bids shall remain valid for the period of **180 days** after the bid submission deadline date (considering extension thereof, if any) as prescribed in **ITB.** A bid, valid for a shorter period, shall be rejected by **KoPT**, treating the same as non-responsive.

5.15.2 In exceptional circumstances, prior to the expiration of the bid validity period, **KoPT** may request the bidders to extend the period of validity of their bids. The request and the responses shall be made in writing.

A Bidder may refuse the request, without forfeiting their **Earnest Money Deposit (EMD)**. A Bidder granting the request shall not be required or permitted to modify its bid, except when option to do the same has been specifically granted by **KoPT**, in writing.

5.16 Earnest Money Deposit (EMD)

5.16.1 The intending bidders should deposit an amount specified in the **Schedule of Tender (SoT)**, as **Earnest Money Deposit (EMD)**, in accordance with the procedure mentioned therein.

5.16.2 Failing to deposit the Earnest Money, in accordance with ITB, shall be rejected by the Employer (KoPT), treating the same as non-responsive.

For exemption of EMD the bidder is required to upload the scanned copy of the certificate from National Small Industries Corporation (NSIC) along with DIC**.**

5.16.3 Refund of Earnest Money Deposit:

Earnest Money Deposit of the successful bidder shall be retained by KoPT and Earnest Money Deposit of the unsuccessful bidders [including the bidder(s) whose Price Bid would not be opened in line with **ITB**] shall be refunded, without interest, within 2 (two) months from the date of opening of Price Bids or on finalization/acceptance of tender, whichever is earlier.

In case the bid of the **successful bidder** is found acceptable to **KoPT** and contract is awarded with them, the **Earnest Money Deposit** of the **successful bidder** (**Contractor**) shall be retained by **KoPT** and may be converted into partial performance guarantee. Submission of Remaining amount of **Performance Guarantee / Security Deposit** (in accordance with **ITB**) and signing of the **Contract Agreement** by **KoPT** and the Contractor (in accordance with **ITB**)**,** to be carried out subsequently.

In case, the successful bid is not found acceptable to KoPT, Earnest Money Deposit of the successful bidder shall be refunded after the decision, in this regard, is finalized by KoPT.

5.16.4 No interest shall be payable on the account of Earnest Money Deposit in any case.

5.16.5 Forfeiture of Earnest Money Deposit :

The EMD may be forfeited

(a) if a Bidder withdraws their offer within the validity period of the bid / offer; and / or, alters / amends any terms and / or condition and / or quoted rate(s), within the validity period of the offer (excepting when option to do the same has been specifically granted by Kolkata Port Trust, Haldia Dock Complex in writing) making it unacceptable to the Kolkata Port Trust, Haldia Dock Complex;

or,

(b) if the successful bidder,

i) fails to submit the Performance Guarantee / Security Deposit (as per SCC) for the specified sum and in the specified form, within the stipulated time;

and / or,

ii) fails to carry out the work or to perform / observe any of the conditions of the contract,

For the purpose of this provision, the validity period (of the bid / offer) shall include any / all extension thereof, agreed by the Bidder in writing. KoPT shall also be at liberty to deduct any of their dues from Earnest Money. It should be however be clearly understood that in case of any default in any terms and or condition of the contract after placement of order but before submission of Performance Guarantee / Security Deposit (as per SCC), the same shall be dealt with in accordance with the relevant provisions of contract, including forfeiture of Earnest Money.

D. SUBMISSION OF BIDS AND OPENING OF BIDS (EXCEPT PRICE BID)

5.17 Submission of bids

5.17.1 Bidders shall have to submit their bids [both **Pre-qualification & Techno-**

commercial Bid and **Price Bid]** on-line **through MSTC portal only**.

5.17.2 The Bidder should submit (upload) the scanned copies of all the relevant and required documents, statements, filled up formats, certificates, etc. [in accordance with **ITB]**, in the aforesaid portal, in support of their **Pr-qualification Criteria and Techno-commercial Bid**.

5.17.3 Before scanning the aforesaid documents, all pages are to be signed by a person duly authorised to sign on behalf of the bidder, pursuant to **ITB,** and are to be embossed with their official seal, owing responsibility for their correctness / authenticity. All pages of the aforesaid documents should be serially marked.

5.17.4 Any inter-lineation, erasures, or overwriting, in the aforesaid scanned & uploaded documents, shall be valid only if they are signed by the aforesaid authorised person.

5.17.5 The Bidder will have to produce the original documents or any additional documents, if asked for, to satisfy **Haldia Dock Complex, Kolkata Port Trust.**

5.17.6 The **Price Bid** comprised the prices only and the same are to be submitted electronically, through the website of **MSTC Ltd.** only. ***No hardcopy of priced "Price Schedule" is required to be uploaded.***

5.18 Techno-commercial offer

5.18.1 No techno-commercial deviation and variation will be considered by KoPT, except where the Techno-commercial terms and conditions, will be found as impossible and irrelevant to the bidder.

5.18.2 If the Bidder deliberately gives wrong information or conceals any information / fact in their bid, which shall be favourable for acceptance of their bid, fraudulently, then the right to reject such bid at any stage of execution, without any financial liability, is reserved by **KoPT**.

5.19 Priced offer

The Bidder should quote the offered rate appropriately in the PRICE BID, electronically, through the website of **MSTC Ltd.** only. *Price indicated anywhere else, in any other form or manner, would not be considered for evaluation of **Price Bid**.*

5.20 Deadline for submission of bids

5.20.1 Bids must be submitted within the closing date & time **indicated in the Schedule Of Tender (SOT)**.

5.20.2 **KoPT** may, at its discretion, *extend the deadline for the submission of bids, prior to the closing date & time of e-Tendering*, by amending the Bidding Documents, in accordance with **ITB**, in which case all rights and obligations of **KoPT** and bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

5.21 Late Bids

This e-Procurement System would not allow any late submission of bid, after the closing date & time, as per the **Schedule Of Tender (SOT)** or extension, if any.

5.22 Withdrawal of bids

5.22.1 A Bidder may withdraw, substitute, or modify their bid on the e-Procurement System, before the closing date and time specified, but not beyond.

5.22.2 No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity

specified by the bidder on the "**FORM OF TENDER [for Techno-commercial (un-priced) Bid].**" or any extension thereof. Modification / Withdrawal of the bid sent through any other means shall not be considered by **KoPT.**

5.22.3 Withdrawal of bid during the interval between such closing time on due date and expiring of the bid validity period, may result in forfeiture of EMD in accordance with **ITB**.

5.23 Bid opening [except Price Bid]

5.23.1 The bids **[except Price Bids]**, will be opened at the date & time, indicated in the **Schedule Of Tender (SOT)**.

5.23.2 The on-line bid-opening event may be viewed by the bidders at their remote end, by logging on to the e-Procurement System. A copy of the bid opening record shall be made available on the e-Procurement System.

E. EVALUATION OF BIDS

5.24 Confidentiality

5.24.1 Information relating to the evaluation of bids and recommendation of contract award shall not be disclosed to bidders or any other persons not officially concerned with such process until publication of the contract award.

5.24.2 Any attempt by a Bidder to influence KoPT in the examination, evaluation and comparison of the bids, or contract award decisions may result in the rejection of their bid and forfeiture of **EMD**.

5.24.3 Notwithstanding **ITB Clause No. 5.24.2**, from the time of bid opening to the time of contract award, if any Bidder wishes to contact KoPT on any matter related to the bidding process, they should do so in writing.

5.25 Clarification of bids

To assist in examination, evaluation & comparison of the bids and qualification of the bidders, the Employer (KoPT) may, at their discretion, ask any bidder for a clarification of their bid. The Employer (KoPT) may also ask any bidder to withdraw any terms/conditions mentioned by them in their offer, which are not in conformity with the terms & conditions specified in the bidding documents. In case any bidder fails to submit required clarification within the time stipulated by the Employer (KoPT), in this regard, the tender would be processed in absence of the clarifications, which may result in disqualification of the corresponding bidder for the instant tender. Any clarification submitted by a bidder, which is not in response to a request by the Employer (KoPT), shall not be considered. The Employer's (KoPT's) request for clarification and the response shall be in writing.

No change in the prices or substance of the bid shall be sought, offered or permitted, nor will the bidder be permitted to withdraw their bid before expiry of the validity period of the bid.

5.26 Deviations, reservations and omissions

During the evaluation of bids, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the bidding documents ;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the bidding documents ; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the bidding documents.

5.27 Responsiveness of bids

5.27.1 Responsiveness of a bid would be determined on the basis of the contents of the bid itself, and clarification(s) in accordance with **ITB.**

5.27.2 A substantially responsive bid is one that meets the requirements of the Bidding Documents without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would

i) affect in any substantial way the scope, quality, or performance of the work specified in the Contract; or

ii) limit in any substantial way, inconsistent with the Bidding Documents, KoPT's rights or the bidder's obligations under the proposed contract; or

(b) if rectified, would unfairly affect the competitive position of other bidders presenting substantially responsive bids.

5.27.3 Bidders shall not contain the following information / conditions to consider them responsive :

(a) Either direct or indirect reference leading to reveal the prices of the bids in the Techno-commercial offers;

(b) Adjustable prices, other than the provisions stated in **ITB.**

5.27.4 If a bid is not substantially responsive to the requirements of the bidding documents, it shall be rejected by KoPT and may not subsequently be made responsive by the bidder, by correction of the material deviation, reservation, or omission.

5.28 Nonconformities, errors and omissions

5.28.1 During examination, evaluation & comparison of the bids and qualification of the bidders, the Employer (KoPT) may, at their discretion, ask any bidder for submitting any document(s) [in case of shortfall in required documents (relating to capacity or otherwise)]. In case any bidder fails to submit required documents within the time stipulated by the Employer (KoPT), in this regard, the tender would be processed in absence of the documents, which may result in disqualification of the corresponding bidder for the instant tender.

Any document submitted by a bidder, which is not in response to a request by the Employer (KoPT), shall not be considered. The Employer's (KoPT's) request for submission of further document(s) shall be in writing.

5.28.2 **KoPT** shall examine the bids [including the further documents / clarifictions received in accordance with **ITB**] to confirm that all documents requested in **ITB** have been provided and to determine the completeness of each document submitted.

5.28.3 Provided that a bid is substantially responsive, **KoPT** may waive any nonconformities or omissions in the bid that do not constitute a material deviation.

5.29 Examination of Pre-qualification Criteria

5.29.1 At first, the contents of the documents, submitted in support of the Pre-qualification Criteria [including the further documents / clarifications received in accordance with **ITB**] will be scrutinized and evaluated.

5.29.2 KoPT may, at their discretion, seek any other detail(s)/document(s), in subsequent course, to ascertain and get confirmed about the competence of the bidder. In case any bidder fails to submit required detail(s)/document(s) within the time stipulated by the Employer (KoPT), in this regard, the tender would be processed in absence of the documents, which may result in disqualification of the corresponding bidder for the instant tender. While evaluating Pre-qualification Criteria, regard would be paid to National Defence and Security considerations of the Indian Government.

5.29.3 In case it is found that the Pre-qualification Criteria has not been fulfilled by the bidder or otherwise their participation has not been found acceptable to **KoPT**, the respective bid will be treated as non-responsive and "Price Bid" of the respective Bidder will not be considered further.

5.30 Examination of Techno-commercial offer

5.30.1 After scrutiny of the **Pre-qualification Criteria**, **Techno-commercial Bids** of the Pre-qualified bidders [as indicated above] will be scrutinized & evaluated.

5.30.2 **KoPT** shall examine the bid to confirm that all terms and conditions specified in the **Technical Specification (Part-2)**, **GCC** and **SCC** have been accepted by the bidder without any material deviation or reservation or omission.

5.30.3 If on examination of the "**Techno-commercial Bid**" of pre-qualified bidders, it is found that they have not accepted all Techno-commercial terms & conditions of the Bidding Documents [considering all addenda / corrigenda, issued], "**Price Bid**" part of such bidder(s) will not be opened. "**Price Bid**" part of other bidder(s) will be opened subsequently as per procedure. Decision of **KoPT** on this matter shall be final.

5.31 Opening of Price Bid

PRICE BIDs of the bidders, who qualifies in the "Pre-qualification & Techno-commercial Bid", will be opened on a later date, upon due intimation to the concerned bidders at their address furnished by them in their bid.

The on-line price-bid opening event may be viewed by the bidders at their remote end, by logging on to the e-Procurement System. A copy of the price-bid opening record shall be made available on the e-Procurement System

5.32 Comparison & Evaluation of Price-Bid and selection of Successful Bidder

5.32.1 While evaluating the Price Bids, the Price quoted by the Bidders against all items of the **Price Schedule** shall be taken into account and the **TOTAL PRICE**, which would be arrived at, by adding quoted prices of all items of the **Price Schedule**, will be considered for evaluation. Selection of the successful bidder will be made on the basis of the **lowest "TOTAL PRICE"** thus arrived.

5.32.2 In case it is found that the quoted "**TOTAL PRICE"** is same for two or more bidders and their bids become the lowest, the respective bidders will be given chance to submit their fresh Price Bid, subject to the condition that the fresh rate so quoted must be less than the rate quoted by the respective bidders earlier. Selection of the successful bidder will be made on the basis of the revised **lowest "TOTAL PRICE"** thus obtained.

5.33 KoPT's right to accept any bid and to reject any or all bids

5.33.1 **KoPT** reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby

incurring any liability to Bidders.

F. AWARD OF CONTRACT

5.34 Subject to **ITB Clause No. 5.33.1**, **KoPT** shall award the contract to the Bidder whose offer has been determined to be the lowest evaluated bid [as per **ITB Clause No. 5.32**] and is substantially responsive to the Bidding Documents.

5.35 Notification of award

Prior to the expiration of the period of bid validity or extended validity in accordance with **ITB**, **KoPT** shall notify the **Successful Bidder**, in writing, that their bid has been accepted. The notification letter (hereinafter called the "**Letter of Acceptance**") will be treated as **"Order Letter"** and will constitute the formation of the contract. Such order letter shall specify the **"Contract Price"** in line with **SCC.**

5.36 Signing of contract agreement

5.36.1 After placement of order, **contract agreement** [as per the form furnished in **Section- XI]** should be executed between **Kolkata Port Trust** and the **Contractor (Successful Bidder)**. In this respect, within a week of receipt of intimation regarding acceptance of their bid, the successful bidder shall have to submit, at their cost, required **Stamp Paper** [Non-judicial Stamp Paper of worth not less than **₹50.00**] & **dummy papers** (for three sets).

Immediately after receipt of the above papers & documents, **KoPT** will send three sets of **contract agreement form** [one set printed on Stamp Paper & dummy papers and two sets printed on dummy papers], photocopy of **one set of documentary transactions between them and KoPT** (till finalisation & award of the Contract) and **Contract Documents** [incorporating all accepted changes and addenda / corrigenda issued, if any], duly signed by the representative of **KoPT** at appropriate places on each pages.

Within a week, thereafter, the Contractor (Successful Bidder) shall have to return **Contract Agreement forms** (three sets) [after affixing their common seal], the set of **documentary transactions** and **Contract Documents**, duly signed by them at appropriate places on each page.

5.36.2 The **contract agreement form** & **Contract Documents** should be signed by the authorized persons of the Contractor, authorized in this respect.

5.36.3 After receipt of the **contract agreement forms** (three sets), duly signed by authorised person of **KoPT** & authorized person of the Contractor (Successful Bidder), the same shall be kept under **KoPT**'s custody, after affixing the Common Seal of **KoPT**.

One copy of such **executed contract agreement** (on dummy paper), along with one photocopy of signed **documentary transactions** and **Contract Documents** will be handed over to the Contractor for their record & future reference.

5.36.4 Total process of executing contract agreement should be completed within 28 days of issuance of "Letter of Acceptance" by KoPT. Until such contract agreement is executed, the other documents referred to the definition of the term "Contract" [**GCC Clause**], shall collectively be the contract.

5.37 Performance Guarantee / Security Deposit

5.37.1 Within **twenty-eight (28) days** of issuance of "**Letter of Acceptance**" by **KoPT**, the Successful Bidder shall provide the **Performance Bank Guarantee** in accordance with the **Special Conditions of Contract**, using the

form furnished in **Section XI.**

5.37.2 Failure of the successful bidder to submit the above-mentioned **Bank Guarantee for Performance Guarantee / Security Deposit** or sign the contract agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the **EMD** in accordance with **ITB.**

5.37.3 All costs, charges & expenses, including Stamp Duty, shall be borne by the Successful Bidder.

5.37.4 No interest / charge, of whatsoever nature, shall be paid by **KoPT** on the amount of Performance Guarantee / Security Deposit, held by them (as per **SCC**) at any stage.

PART-1

SECTION -VI

GENERAL CONDITIONS OF CONTRACT (GCC)

Table of Clauses

20)	Performance Guarantee / Security Deposit
21)	Contractor's personnel and Contractor's representative
22)	Assignment and sub-contracting
23)	Access to site
24)	Transportation of materials
25)	Contractor's equipment
26)	Supply of water and Electricity
27)	Use of ground and land / covered space for Contractor's establishment
28)	Existing services
29)	Contractor to prepare working / progress drawings
30)	Contractor's price is inclusive of all costs
31)	Contractor is responsible for all construction process, except for correctness of design and specification formulated by the Engineer
32)	Contractor to submit his programme of work
33)	Contractor to supervise the works
34)	Contractor is responsible for line, level, setting out, etc.
35)	Contractor is responsible to protect the work
36)	Contractor is responsible for all damages to other structures / persons caused by him in executing the work
37)	Fossils, Treasure troves, etc. are Trustees' property
38)	Contractor to indemnify the Trustees against all claims for loss, damage, etc.
39)	Dismantled materials Trustees' property
40)	Contractor's quoted rates / price must be all inclusive
41)	Notice to Contractor
42)	Contractor not to publish photograph or particulars of work
43)	Contractor to provide facilities to outsiders
44)	Work to cause minimum possible hindrance to traffic movement
D.	**STAFF AND LABOUR**

45)	Engagement of staff and labour
46)	Labour Laws
47)	Health and safety
48)	Labour licence
49)	Employees' Provident Fund & Employees' State Insurance
E.	**PLANT, MATERIALS AND WORKMANSHIP**
50)	Materials to be supplied by the Employer
51)	Contractor's arrangement for execution of the work
52)	Inspection and testing
53)	Contractor to replace materials/work not acceptable to the Engineer or his Representative
54)	Removal of materials on completion
55)	Workmanship and secrecy
F.	**COMMENCEMENT, EXECUTION & COMPLETION OF WORK, HANDING OVER AND TAKING OVER**
56)	Preliminary time to commence work and maintenance of steady rate of progress
57)	Contractor's site office
58)	Contractor to observe Trustees' working hours
59)	Contractor to supply all materials as per requirement of the Engineer or his Representative
60)	Materials and works
61)	Contractor to submit samples for approval
62)	Contractor to seek approval of Engineer or his Representative before covering up any portion of work
63)	Contractor to suspend work on order from Engineer or his Representative
64)	Completion Certificate
65)	Completion period
66)	Taking over of the Contract job by KoPT
67)	Defect Liability Period (DLP)
68)	Defects after taking over

General Conditions of Contract (GCC)

A. GENERAL PROVISIONS

6.1 Definitions

In the conditions of contract ("these conditions"), which includes particular conditions and these general conditions, the following words and expressions shall have the meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

6.1.1 The Contract:

a) **"Contract"** means and includes these **bidding documents** in entirety (**including** all Addenda and Corrigenda, if any), the **specification**, the **drawings**, the **PRICE SCHEDULE**, the **bid / offer**, the **Letter Of Acceptance**, the **Contract Agreement** (when Contract Agreement would be completed in all respect) and such further documents as may be expressly incorporated in the **Letter Of Acceptance** or **Contract Agreement** (when Contract Agreement would be completed in all respect).

b) "**Contract Agreement"** means the executed Contract Agreement referred to in **ITB Clause No. 5.37** [**Signing of Contract Agreement**].

c) "**Contract documents**" means the documents listed in the Contract Agreement, including any amendments thereto.

d) **"Letter Of Acceptance (LOA)"** or **"Work order"** or **"Order letter"** means the formal acceptance of the bid (and placement of order with the successful bidder), issued by or on behalf of the Employer, including any adjustments or variation to the bid agreed between the Employer and the successful bidder and includes its enclosure(s), annexure(s), etc., if any.

e) **"Specification"** means the specification of the work included in the contract and any modification thereof or addition thereto made under **GCC Clause No. 6.12** [**Additions and alterations**] or submitted by the Contractor and approved by the Engineer, in writing.

f) **"Drawings"** means **all drawings, calculations and technical information**, etc., provided by the Engineer to the Contractor under the contract and all **drawings, calculations, samples, patterns, models,** etc., including modification, if any, and other **technical information** & m**anuals** of a like nature, submitted by the Contractor and approved by the Engineer.

g) **"Tender"** or **"Bid"** means the proposal (priced offer), along with all supporting documents, submitted by the bidder to the Employer for consideration.

h) **"Price Schedule"** means the priced schedule of items, forming part of the bid.

i) "**Tenderer"** or **"Bidder**" means the individual firm, who submits the bid, duly filled up and signed, along with all the required documents and

payment instruments, in strict compliance of the conditions / requirements stipulated in these bidding documents.

j) "Contract data" means the pages completed by the Employer entitled **CONTRACT DATA**.

6.1.2 Parties and persons :

a) "**Party**" means the **Employer** or the **Contractor**, as the context requires.

b) **"Employer"** or "**Board**" or **"Trustees**" or "**Kolkata Port Trust**" or **"KoPT**" means the Board of Trustees for the Port of Kolkata (Calcutta), a body corporate under **Section 3** of the **Major Port Trusts Act, 1963** (as amended from time to time), including their successors, representatives and assigns.

c) **"Contractor"** or "**Successful bidder**" or "**Successful tenderer**" means the person or persons, firm or company, whose bid / offer has been accepted by the Employer and is named as such in the Contract Agreement or his representative(s), who is/are duly authorised to deal the contract.

d) **"Contractor's representative"** means the person(s) named by the Contractor in the contract or appointed from time to time by the Contractor, under **GCC Clause No. 6.21** [**Contractor's personnel and Contractor's representative**], who acts on behalf of the Contractor.

e) **"Sub-contractor"** shall mean a person or persons, firm or company to whom a part of the work has been sub-contracted by the Contractor, with prior consent of the Employer.

f) "Contractor's personnel" means the Contractor's representative and all personnel whom the Contractor utilises on site, who may include staff, labour and other employees of the Contractor and of each Sub-contractor, and any other personnel assisting the Contractor in the execution of the work.

g) **"Engineer"** means the person appointed by the Employer to act as the Engineer for the purposes of the contract and named in the **Contract data**, or other person appointed from time to time by the Employer and notified to the Contractor under **GCC Clause No. 6.18** [**Replacement of the Engineer**].

h) "**Engineer's Representative"** means any sub-ordinate Engineer or assistant to the Engineer or any other official appointed from time to time by the Engineer to perform the duties set forth in **GCC Clause Nos. 6.13 to 6.15** hereof.

i) "**Engineer-in-charge**" means employee of KoPT, authorised by the Engineer to look after the physical execution of the contract, at site level.

j) "**Haldia Dock Complex**" or **"HDC"** means a Dock Complex situated at Haldia, under **Kolkata Port Trust**.

k) "**Chairman**" means the Chairman of the Board of Trustees for the Port of Kolkata (Kolkata Port Trust) and includes the person appointed to act in his place under Sections 14 and 14A of the Major Port Trusts Act, 1963.

l) "**Deputy Chairman**" means the Deputy Chairman, Haldia Dock Complex and includes the person appointed to act in his place.

m) "**General Manager (Engineering)"** means the Officer appointed to take charge of Plant & Equipment Division, Infrastructure & Civic Facilities Division and Materials Management Division of HDC, under the supervision of the Deputy Chairman, HDC.

n) "**Senior Deputy Manager (P&E)"** means the Officer of Plant & Equipment Division of HDC, reporting to the General Manager (Engineering).

6.1.3 Dates and periods:

a) **"Completion period"** means the time of completion/period of execution notified under 6.65 [Completion period].

b) **"Month",** for the purpose of this contract, shall mean the period starting from the date of commencement in any month to the previous date of the following month, as per English Calendar.

c) **"Week",** for the purpose of this contract, shall mean any period of 7 (seven) consecutive English Calendar Days.

e) **"Day",** for the purpose of this contract, means English Calendar Day.

6.1.4 Money and payments:

a) "**Contract price**" or "**Contract value**" means the sum named in the "**Letter of Acceptance** (**LOA**)" [excluding GST] of the bid /offer of the Contractor, subject to such additions thereto and deductions therefrom, as may be made by the Engineer, under the provisions contained in this bidding document.

b) **"Cost"** means all expenditure reasonably incurred (or to be incurred), by the Contractor, whether on or off the site, including overhead and similar charges, but does not include profit.

c) **"Foreign Currency"** means the currency other than Indian Currency.

6.1.5 Work:

a) "**Work**" means the work to be executed in accordance with the contract and includes authorised "**Extra work**", "**Excess work**" and "**Temporary work**".

b) "**Temporary work"** means all temporary work of every kind required in or about the execution, completion or maintenance of the work and includes (without thereby limiting the foregoing definitions) all temporary erections, scaffolding, ladders, timbering soaking vats, site offices, cement and other godowns, platforms and bins for stacking building materials, gantries, temporary tracks and roads, temporary culverts and mixing platforms.

c) "**Excess work**" means the required quantities of work, in excess of the provision made in the contract, against any item of the "**Price Schedule**".

d) "**Extra work**" means those work, required by the Engineer for completion of the contract, which were not specifically and separately included in the schedule of items of the work (i.e. "**Price Schedule**") of the bidding document.

e) "**Related Services**" means the services incidental to the supply of goods / contract job, such as insurance, installation, training, initial maintenance

and other obligations of the Contractor, under the contract.

6.1.6 Other definitions

a) "**Constructional plant**" means all appliances or things, of whatsoever nature, required in or about the execution, completion or maintenance of the work or temporary work and includes (without thereby limiting the foregoing definition) all machinery and tools, but does not include materials or other things intended to form or forming part of the permanent work.

b) **"Site"** means the land and other places, on, under, in or through which the contract is to be executed or carried out and any other lands or places provided by the Employer for the purpose of the contract.

c) "**Excepted Risks**" means riot, in so far as it is uninsurable, war, invasion, act of foreign enemies, hostilities (whether war be declared or not), Civil War, rebellion, revolution, insurrection or military or usurped power or use or occupation by the Trustees of any portion of the works in respect of which a certificate of completion has been issued (all of which are herein collectively referred to as the excepted risks).

d) **"Approved / approval"** means approval in writing.

e) **"Test on Completion"** means such tests, prescribed by the applicable Design Standard, codes and described in the bidding document, to me performed by the Contractor before the equipment / items / installations are supplied, delivered and taken over by the Employer.

f) **"Defect Liability Period (DLP)" means the period defined in the GCC Clause No. 6.67.**

g) "**Force Majeure**" is defined in **GCC Clause No. 6.86** [**Definition of Force Majeure**].

6.2 Contract documents

6.2.1 The several documents forming the contract are to be taken as mutually explanatory of one another and should anything appear in one, which is not described in the other, no advantage shall be taken of any such omission.

6.2.2 In case, any discrepancies or inconsistencies however appear or should any misunderstandings arise as to the meaning and of the specifications or drawings or as to the dimensions or the quality of the materials or the due and proper execution of the work or as to the measurement or quality and valuation of the work executed under this contract or as extra thereupon, the same shall be explained by the Engineer or his authorised representative.

6.2.3 The explanation of Engineer or his authorised representative shall be final and binding upon the Contractor and the Contractor shall execute the work according to such explanations, and without extra charge or deductions and do all such work and things as may be necessary for the proper execution of the contract as implied by the specification and drawings, even though such work and things are not specifically shown and described therein.

6.3 Interpretations

6.3.1 In the contract, except where the context requires otherwise:

a) words indicating one gender include all genders;

b) words indicating the singular also include the plural and words indicating the plural also include the singular;

c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing;

d) **"written"** or **"in writing"** means hand-written (manuscript), type-written, printed or Electronically made, and resulting in a permanent record, under or over signature and seal, as the case may be;

and

e) the word "tender" is synonymous with "bid', and "tenderer" with "bidder" and the words "tender documents" with "bidding documents".

6.4 All Drawings are Trustees' property

6.4.1 The Drawings, referred to in the Special Conditions of Contract / Technical Specification / Price Schedule, if and as applicable, shall be furnished by the Engineer to the Contractor, free of cost, for his use on the work, but these shall remain the property of the Trustees and hence, the Contractor shall return them to the Engineer or his Representative on completion of the work, if not torn or mutilated on being regularly used at site.

6.5 Language

6.5.1 The contract as well as all correspondence and documents relating to the contract, exchanged between the Contractor and the Employer/Engineer, shall be written in **English Language only**. If any documents/manuals/printed literature/drawings is submitted by the Contractor in other language(s), the same should be accompanied by an accurate translation of the relevant pages in the English language. In that case, for the purposes of interpretation of the contract, such translation shall govern.

6.5.2 The Contractor shall have to bear all costs of translation to the English Language and all risk of the accuracy of such translation, for documents provided by the Contractor.

6.6 Notices

6.6.1 Any notice, given by one party to the other, pursuant to the contract, shall be in writing, to the address specified in the Contract data. The term "in writing" means communicated in written form, with proof of receipt.

6.6.2 A notice shall be effective when delivered or on the notice's effective date, whichever is later.

6.7 Governing Law

6.7.1 The contract shall be governed by and interpreted in accordance with the relevant Indian Acts [considering latest amendment thereof], as applicable, within the jurisdiction of the Honourable High Court of Kolkata [Calcutta High Court] , India, including the following Acts:

i) The Indian Contract Act, 1872.

ii) The Major Port Trust Act, 1963.

iii) The Workmen's Compensation Act, 1923.

iv) The Minimum Wages Act, 1948.

v) The Payment of Wages Act, 1936.

vi) The Payment of Bonus Act, 1965.

vii) The Payment of Gratuity Act, 1972.

viii) The Equal Remuneration Act, 1976.

ix) The Employees Provident Fund Act, 1952.

x) The Employees State Insurance Act, 1948 & The Employees State Insurance (Amendment) Act, 1989.

xi) The Contract Labour (Regulation & Abolition) Act, 1970; Rules 1971.

xii) Child Labour (Prohibition & Regulation) Act, 1986.

xiii) The Maternity Benefits Act, 1961.

xiv) Interstate Migrant Workmen (Regulation of Employment & Conditions of Service) Act, 1979.

xv) The Dock Workers (Regulation of Employment) Act, 1948.

xvi) The Dock Workers (Safety, Health & Welfare) Act, 1986.

xvii) The Indian Arbitration and Conciliation Act, 1996 [considering its latest amendment in 2015].

6.7.2 Unless otherwise specified, all the laws / rules / acts, etc., mentioned in different clauses of this bidding document, should be considered as laws / rules / acts, etc. applicable in India.

6.7.3 The Contractor shall indemnify KoPT for any proceeding taken or commenced by any authority against the Employer for any contravention of any of such laws, bye laws, rules, regulations, orders, etc., by the Contractor or their personnel / workmen / agent / supplier, etc. If, as a result of the Contractor's failure, negligence, omission, default or non-observance of any provisions of any law, bye law, rule, regulation, order, etc., the Employer is called upon by any authority to pay or reimburse or is required to pay or reimburse any amount, the Employer shall be entitled to deduct the same from any amount due or that may become due to the Contractor under this contract or any other contract or by any other means or may otherwise recover from the Contractor any sum which KoPT is required or called upon to pay or reimburse on behalf of the Contractor.

6.7.4 The Contractor shall indemnify KoPT for any proceeding taken or commenced by any authority against the Employer for any contravention of any of such laws, bye laws, rules, regulations, orders, etc., by the Contractor or their personnel/workmen/agent/supplier, etc. If, as a result of the Contractor's failure, negligence, omission, default or non-observance of any provisions of any law, bye law, rule, regulation, order, etc., the Employer is called upon by any authority to pay or reimburse or is required to pay or reimburse any amount, the Employer shall be entitled to deduct the same from any amount due or that may become due to the Contractor under this contract or any other contract or by any other means or may otherwise recover from the Contractor any sum which KoPT is required or called upon to pay or reimburse on behalf of the Contractor.

6.8 Patent Rights

6.8.1 The Contractor shall fully indemnify KoPT against any action, claim or demand, costs or expenses arising from or incurred by reason of any infringement or alleged infringements of letters, patents, design, trademark or name, copyright or other protected rights in respect of any machine, plant, work, materials or things, system or methods of using, fixing working or arrangement used for fixed or supplied by the Contractor in India, or elsewhere.

6.8.2 All payments, or otherwise shall be deemed to be included by the Contractor in the prices named in the bid and shall be paid by them to whom they may be payable.

6.8.3 In the event of any claim being made or action brought against KoPT in respect of any such matter as aforesaid, the Contractor shall be immediately notified thereof and they shall with the assistance, if they so require, of KoPT but at the sole expense of the Contractor conduct all negotiations for the settlement of the same or any litigation that may arise there from, provided that the conduct of such negotiations or litigations shall be conditional upon the Contractor giving to KoPT such security, as shall from time to time, by reasonably required by KoPT to recover the ascertained or agreed amount, as the case may be, of any compensation, damages, expenses and cost, which might be payable by the Trustees in respect of or as a result of any such negotiation or litigation.

6.9 Stamp duty & other expenses

6.9.1 All the costs, charges and expenses to be incurred in connection with **Contract Agreement, Indemnity Bond, Bank Guarantees**, **Integrity Pact**, etc., including stamp duty, shall be borne by the Contractor.

6.10 Indemnity

6.10.1 Notwithstanding that all reasonable and proper precautions may have been taken by the Contractor, at all times during the progress of the work, the Contractor shall, nevertheless, be wholly responsible for all damages, whether to the works themselves or to any other property of KoPT or to the lives, persons, property of others during the progress of the work.

6.10.2 In case any damage occurs to the existing structure due to the Contractor's operation, the same shall be made good by the Contractor, at their own risk and cost. The areas, which are likely to be unsafe for use, shall be barricaded and all necessary precautionary measures, like displaying notices, shall be taken by the Contractor, during the contract period.

6.10.3 In case any material, spare parts, components, sub-assemblies, accessories, etc., related to the work (under the scope of the Contractor), is required to be taken out of the Dock premises by the Contractor, for some specialised servicing, repairs, overhauling, etc. or for any other reason whatsoever, the Contractor shall have to obtain permission from the Employer. For this the Contractor shall have to submit an "**Indemnity Bond**" [in the form furnished in **Section-IX-B**].

6.11 Employer's lien

6.11.1 All constructional plant, temporary work and materials, when brought to the site by the Contractor, shall be deemed to be the property of the Employer, who will have lien on the same, until the satisfactory completion of the work and shall only be removed from the site, in part or in full, with the written permission of the Engineer or his Representative.

6.11.2 The Employer shall have a lien on and over all or any money that may become due and payable to the Contractor under this contract or any other contract or fro many amount lying with them or under their control and in respect of any debt or sum that may become due and payable by the Employer to the Contractor, either alone or jointly with another or other and either under this contract or under any other contracts or transaction of any nature whatsoever between the Employer and the Contractor.

6.12 Additions and alterations

6.12.1 KoPT shall have power and authority, from time to time and at all times, to make amendments or additions or alterations or changes in the **Technical Specification** and give such further instructions and directions, as may appear necessary and proper to KoPT for the guidance of the Contractor and good & efficient execution of the work.

6.12.2 The Contractor shall receive, obey and be bound by the same, according to the true intent and meaning thereof, as if the same had been mentioned or referred to in the **Technical Specification**.

6.12.3 KoPT may also vary or alter the levels or positions of any of the work contemplated by approved specification or may order any of the work contemplated thereby to be omitted, with or without substitution of any other works in lieu thereof, or may order any work or any portion of works executed or partially executed, to be removed, changed or altered, if required.

In this connection, KoPT may increase or decrease or split the quantity of work included in the contract or execute additional work of any kind necessary for good & efficient execution of the work.

6.12.4 The Engineer shall have the power to order for the above amendments (additions/alterations/changes, etc.) and any difference in the cost occasioned by any such diminution or alteration so ordered and directed shall be added to or deducted from the amount accepted under the contract based on the rate(s) available in the contract. Where the rate(s) is/are not available in the contract, such difference in the cost shall be determined by the Engineer, taking into account the market rate and labour cost at site for similar work, backed up by rate analysis, (to be submitted by the Contractor and agreed upon between the Contractor and KoPT).

In the event of disagreement, KoPT shall fix such rates or prices as shall, in their opinion, be reasonable and proper having regard to the circumstances.

B. THE ENGINEER

6.13 Instructions of the Engineer or Engineer's Representative

6.13.1 The Contractor shall execute, complete and maintain the works in terms of the contract to the entire satisfaction of the Engineer and shall comply with the Engineer's direction on any matter whatsoever. However, the Engineer shall exercise his discretion impartially, within the terms of the contract and have regard to all the circumstances.

The Contractor shall take instructions from the Engineer and subject to limitation indicated in **GCC Clause No. 6.16.1** hereof, from the Engineer's Representative.

6.14 Engineer's power and authority

6.14.1 The Engineer shall have full power and authority:

a) to supply to the Contractor, from time to time, during the progress of the works, such further drawings and instructions as shall be necessary for the purpose of proper and adequate execution and maintenance of the works and the Contractor shall carry out and be bound by the same.

b) to alter or modify the specification of any material and workmanship and to inspect the work at any time.

c) to order for any variation, alteration and modification of the work and for extra works.

d) to issue certificates as per contract.

e) to settle the claims & disputes of the Contractor.

f) to grant extension of completion time.

6.15 Power of Engineer's Representative

6.15.1 The Engineer's Representative shall:

a) watch and supervise the work.

b) test and examine any material to be used or workmanship employed in connection with the work.

c) have power to disapprove any material and workmanship not in accordance with the contract and the Contractor shall comply with his direction in this regard.

d) take measurements of work done by the Contractor for the purpose of payment or otherwise.

e) order demolition of defectively done work for its reconstruction all by the Contractor at his own expense

f) have powers to issue alteration order not implying modification of design and extension of completion time of the work.

and

g) have such other powers and authorities vested in the Engineer, which have been delegated to him, in writing, by the Engineer under intimation to the Contractor.

6.16 Limitation of Engineer's Representative's power

6.16.1 Provided always that the Engineer's Representative shall have no power:

a) to order any work involving delay or any extra payment by the Trustees,

b) to make variation of or in the work,

and

c) to relieve the Contractor of any of his duties or obligations under the contract.

6.17 Engineer's over-riding power

6.17.1 Provided also as follows:

a) Failure of Engineer's Representative to disapprove any work or materials shall not prejudice the power of the Engineer thereafter to disapprove such work or materials and to order the pulling down, removal, breaking-up thereof and re-constructing at the Contractor's cost and the Contractor shall have no claim to compensation for the loss sustained by them.

b) If the Contractor shall be dissatisfied by reason of any decision of the Engineer's Representative, they shall be entitled to refer the matter to the Engineer, who shall thereupon confirm, reverse or vary such decision which will be final, conclusive and binding on the parties.

c) Any written instructions or written approval given by the Engineer's Representative to the Contractor, within the terms of delegation of power and authority vested in the Engineer to his representative, in writing, shall bind the Contractor and the Trustees as though it had been given by the Engineer, who may, from time to time, make such delegation.

6.18 Replacement of the Engineer

6.18.1 If the Employer intends to replace the Engineer, the Employer shall give notice to the Contractor in this respect.

6.19 Determinations

6.19.1 Whenever these conditions provide that the Engineer shall proceed, in accordance with this clause, to agree or determine any matter, the Engineer shall consult with each party, in an endeavour to reach agreement. If agreement is not achieved, the Engineer shall make a fair determination, in accordance with the contract, taking due regard of all relevant circumstances.

The Engineer shall give notice to both parties of each agreement or determination, with supporting particulars **within 28** (**twenty-eight**) **days** from the receipt of the corresponding claim or request, except when otherwise specified. Each party shall give effect to each agreement or determination, unless and until revised under **GCC Clause Nos. 6.94 to 6.98** [**Claims**, **Disputes and Arbitration**].

C. THE CONTRACTOR

6.20 Performance Guarantee / Security Deposit

6.20.1 As specified in the **SCC**, the Contractor shall have to provide **Performance Guarantee / Security Deposit** towards guaranteeing the performance of the Contractor in execution of the contract.

6.20.2 The **Performance Bank Guarantee(s)** shall be denominated in the currency(ies) of payment in the contract , and shall be in the form furnished in **Section-XI**.

6.20.3 The original Bank Guarantee should be sent by the issuing Branch of the Bank, directly to the Employer, under Registered Post (A.D), at the following address:

General Manager (Finance),
Haldia Dock Complex (HDC),
Jawahar Tower Complex,
P.O: Haldia Township,
Dist.: Purba Medinipur,
PIN – 721 607,
West Bengal, India.

A photocopy of the Bank Guarantee should also be sent to the Engineer, by the Contractor, for record.

The General Manager (Finance), HDC may require Bank's confirmation for having issued the Guarantee. In that case, the issuing Branch of the Bank should send a confirmation letter, directly to the Employer, under Registered Post (A.D), at the above address.

6.20.4 Failure of the Contractor to submit the required Performance Bank Guarantee, as mentioned in **GCC Clause No. 6.20.1** and in the manner stated in the **SCC**, shall constitute sufficient grounds for termination of the contract and forfeiting the Earnest Money Deposit.

6.20.5 The proceeds of **Performance Guarantee / Security Deposit** shall be payable to the Employer, as compensation, for any loss resulting from the Contractor's failure to complete its obligations under the contract.

6.20.6 **Performance Guarantee/Security Deposit** shall be liable to be forfeited, at the option of the Employer, if the Contractor fails to carry out the work or to perform / observe any of the conditions of the contract.

6.20.7 The Employer shall be at liberty to deduct/recover any of their dues from **Security Deposit**/**Performance Guarantee**.

In that case, if **Security Deposit** / **Performance Guarantee** is reduced by reason of any such deduction or encashment, the Contractor shall have to, **within 15 (fifteen) days thereafter**, make good the amount so reduced.

6.20.8 The cost of obtaining **Performance Bank Guarantee** or any other Bank Guarantee and / or revalidation thereof, whenever required, has to be borne by the Contractor and it shall be their sole responsibility to arrange for timely revalidation of such Bank Guarantee, failing which and for non-fulfilment of any contractual obligation by the Contractor, the Engineer and/or the Employer shall be at liberty to raise claim / demand under Performance Guarantee and/or enforce the same unilaterally.

No interest/charge, of whatsoever nature, shall be paid by the Employer on the amount of **Security Deposit** / **Performance Guarantee** held by the Employer, at any stage.

6.20.9 On completion of execution of the work, the Contractor shall maintain the same during the "**Defect Liability Period**", as specified in **GCC Clause No. 7.67**, from the date mentioned in the "**Certificate of Completion of Work**" [as per the form furnished in **Section-IX-D**]. Any defect / fault, which may appear in the work during the aforesaid maintenance period, arising, in the sole opinion of the Engineer or his Representative, from materials or workmanship not in accordance with the contract or the instruction of the Engineer or his Representative, shall, upon the written notice of the Engineer or his Representative, be amended and made good by the Contractor, at his own cost, within 7 (seven) days of the date of such notice, to the satisfaction of the Engineer or his Representative, failing which, the Engineer or his Representative shall have the defects amended and made good through other agency at the Contractor's risk and cost and all expenses, consequent thereon or incidental thereto, shall be recoverable from the Contractor in any manner deemed suitable by the Engineer.

6.20.10 The contract shall not be considered completed and the work shall not be treated as finally accepted by the Trustees, until a "**Certificate of Final**

Completion" [as per the form furnished in **Section-IX-E**] shall have been signed and issued by the Engineer, after all obligations under the contract, including that in the Defect Liability Period (DLP), if any, have been fulfilled by the Contractor. Previous entry on the works or taking possession, working or using thereof by the Trustees shall not relieve the Contractor of his obligations under the contract for full and final completion of the work.

6.20.11 Refund of **Performance Guarantee / Security Deposit** would be guided by the procedure detailed in the **SCC**.

6.21 Contractor's personnel and Contractor's representative

6.21.1 The Contractor's personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the site of work, including the Contractor's representative, if applicable, who:

a) persists in any misconduct or lack of care,

b) carries out duties incompetently or negligently,

c) fails to conform with any provisions of the contract, or

d) persists in any conduct, which is prejudicial to safety, health or protection of the environment.

If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

6.21.2 The Contractor shall have to communicate the names of their officials/representatives, authorized by them through **Power of Attorney** (specimen signature of such authorized representative should be attested), to make all correspondences and sign all documents/papers in relation to this contract.

Written orders or instructions, which the Employer may issue to such authorized officials/ representatives of the Contractor, shall be deemed to have been given to the Contractor.

6.21.3 In case any of such authorised persons fails to act as Contractor's representative, the Contractor shall similarly communicate the name and particulars of another suitable person for such authorization.

The Contractor shall have to notify the Engineer, immediately after revoking the appointment of the Contractor's representative and appointment of a replacement.

6.21.4 If any of the Contractor's representatives/officials is required to be temporarily replaced during the period of contract, the name of the person temporarily authorised [by any one of the authorised officials/representatives, authorized earlier through **Power of Attorney**], shall have to be notified. Specimen signature of such temporarily authorised representative(s) should be attested [by the said authorised official/representative].

6.22 Assignment and sub-contracting

6.22.1 The Contractor shall not, directly or indirectly, transfer, assign, sublet or sub-contract the whole of the work.

Unless otherwise stated in the contract, the Contractor shall not, directly or indirectly, transfer, assign, sublet or sub-contract any part of the work without prior consent of the Engineer. Any such consent shall not relieve the Contractor

from any of their liabilities or obligations under the contract and they shall be responsible for :

a) the acts, defaults and neglect of any Sub-contractor, their agents, servants or workmen as fully as if these were the acts, defaults or neglects of the Contractor, their agents, servants or workmen,

b) their full and entire responsibility of the contract and active superintendence of the work by them despite being sublet.

Provided that the Contractor shall not be required to obtain such permission for:

i) the provision of labour engaged on piece-work basis/daily rate basis,

ii) the purchase of materials/services which are in accordance with the standards specified in the contract,

or

iii) the sub-contracting of any part of the work, for which the Sub-contractor is named in the contract.

The Contractor shall be responsible for observance, by all Sub-contractors, of labour laws applicable in India (for the portion of work that would be executed in India) and all other provisions of the contract.

6.22.2 No **participating bidder** [in connection with the instant tender] will be allowed to act as a **Sub-contractor** of the successful bidder (Contractor).

6.22.3 In the event of the Contractor contravening aforesaid condition [**GCC Clause No. 6.22.2**], the Employer shall be entitled to terminate the contract forthwith and award a fresh contract to some other parties at **risk and cost of the Contractor**, who shall be liable for any loss or damage, which KoPT may sustain in consequence to arising out of such replacement of the Contractor.

6.22.4 The Contractor shall not assign their right and interest in these presents nor assume a fresh partner or partners, dissolve the partnership existing between them in reference to this contract, without the prior written permission of the Employer.

6.23 Access to site

6.23.1 The Contractor shall have to abide by the **rules and regulations of Kolkata Port Trust (KoPT)** in respect of entry / exit and movement in the dock premises.

6.23.2 Necessary **Gate Pass / Dock Entry Permit**, for entering into the Dock area, will be issued to the personnel of the Contractor [including that of approved Sub-contractor(s)] directly connected with the work, **on chargeable basis** [as per the extant "**Scale of Rates**" of KoPT, available at **http://www.kolkataporttrust.gov.in/** of **Kolkata Port Trust**], on receipt of a formal written request.

However, for issuing such Gate Pass, the following would be required:

i) **For Indian nationals**: A photocopy of the Voter's Identity Card/any other Photo Identity Card.

ii) **For foreign nationals (excluding from Nepal and Bhutan)**: **Permission in the form of "No objection" for entering Haldia Dock**, from the office of the **Superintendent of Police**, **Purba Medinipur, West Bengal, India**,

which acts as the **District Registration Office** for **foreigners**.

Dock Entry Permits shall not be issued to the mentioned foreign nationals without the aforesaid permission.The aforesaid "No objection", along with photocopies of Passport and Visa of the foreign national, has to be submitted to the Administration Division of HDC, KoPT, with an application for obtaining Dock Entry Permit(s).

6.23.3 The Contractor will be fully responsible for any injury (whether fatal or otherwise) to their personnel [including that of approved Sub-contractor(s)], for any loss or damage to property or for any other loss, damage, costs and expenses, whatsoever caused, which, but for the granting of such permission, would not have arisen.

6.23.4 The Contractor will be liable to indemnify the Employer against any loss or damage to the property of the Employer or neighbouring property, which may be caused due to any act of the Contractor or their personnel [including that of approved Sub-contractor(s)].

6.23.5 **No photograph within the Dock Area** shall be taken by the Contractor, without prior permission of the Engineer.

6.24 Transportation of materials

6.24.1 All materials, spare parts, tools, tackles, service equipment, including consumables, required under this contract, will have to be packed, securely placed and protected by the Contractor during transportation. The Contractor will be held responsible for the inefficient packing, storing and protection of the materials.

6.25 Contractor's equipment

6.25.1 The Contractor shall be responsible for all the equipment of the Contractor. When brought on to the site, the Contractor's equipment shall be deemed to be exclusively intended for the execution of the work. The Contractor shall not remove from the site any major items or Contractor's equipment without the consent of the Engineer. However, consent shall not be required for vehicle(s) transporting goods or Contractor's personnel off site.

6.26 Supply of water and Electricity

6.26.1 **Supply of water**:

Drinking water supply at the **Contractor's site office**, **store**, **workshop**, **assembly/erection yard, etc**. will be given **on chargeable basis**. For this, the Contractor shall have to make **all arrangements**, **including installation of Water Meter** and **laying of pipelines from the source(s) identified by KoPT**, **at their cost**. The Contractor will be responsible for maintenance and calibration of such water meter also. Billing against water supply will be done in line with SCC.

KoPT do not guarantee uninterrupted supply of water and the Contractor shall not be compensated for any delay or irregularity in supplying water. The Contractor shall have to arrange for the supply of water at his own cost during such periods.

However, water supply, if required for the **actual work** (**including erection**, **commissioning & cleaning work**) **at the site only** and / or **maintenance**, **repair & cleaning work** (required to be carried out at site during the "Defect Liability Period") will be provided free of cost. The Contractor shall have to make **all**

arrangements for **laying of pipelines from the source(s) identified by KoPT**, **at their cost.**

6.26.2 **Supply of Electricity**:

Supply of Electricity at the **Contractor's site office, store, workshop, assembly / erection yard, etc**. will be on **chargeable basis**. The Contractor shall have to make all arrangements, including **installation of Energy Meter** and **laying of Cables from the source(s) identified by KoPT**, **at their cost**. The Contractor will be responsible for maintenance and calibration of such Energy Meter also. Billing against **electricity charges** will be done in line with SCC.

KoPT do not guarantee uninterrupted supply of Electricity and the Contractor shall not be compensated for any delay or irregularity in supplying Electricity. The Contractor shall have to arrange for Electricity at his own cost during such periods.

However, Power supply, required for the **actual work** (**including erection and commissioning**) **at the site only** and/or **maintenance and repair** (required to be carried out at site during the "Defect Liability Period") will be provided free of cost. The Contractor shall have to make all arrangements for **laying of Cables from the source(s) identified by KoPT**, **at their cost**.

6.27 Use of ground and land/covered space for Contractor's establishment

6.27.1 The Contractor shall be allowed to use a suitable land (open space), which in the opinion of KoPT may be absolutely necessary for the proper and efficient execution of works. For this, a token lump sum licence fee of **₹10.00 per month or part thereof** will be charged during pendency of the contract and extension thereof, if any.

6.27.2 On completion of work or termination of the contract, the Contractor shall have to clear away all their tools, plants, rubbish and other materials, **within a fortnight** and hand over vacant and peaceful possession of the same to KoPT, in a tidy and clean condition. The same license fee (₹10.00 per month or part thereof) will be applicable for this additional period (if any) for clearing the space. If the Contractor fails to clear the space and handover the same to the Employer in a clean and tidy condition, within the period mentioned above, KoPT's "Schedule of Rate" will be applicable for the period beyond that.

6.27.3 The Contractor shall be allowed to erect any temporary structures on this land [as stated in **GCC Clause No. 6.27.1**] for **office and / or store and / or workshop,** etc. and make all suitable arrangement for water supply, Electricity supply and sanitary arrangements for the same, at their own cost.

6.27.4 In case the Contractor is interested in taking **covered space**, **office room,** etc. of KoPT for the purpose of making a site office and store in the Dock area, the same may also be allotted subject to availability. The rents for such covered spaces or office room of KoPT, to be allotted to the Contractor, shall have to be paid by the Contractor, as per the 'Schedule of Rent of KoPT, prevailing at that time. In addition to the rent, **water consumption charges** [as per **GCC Clause Nos. 6.26.1**] **and Electricity consumption charges** [as per **GCC Clause No. 6.26.2**] (if Electricity / water is supplied from KoPT sources) and other applicable charges, as per the notifications of **Tariff Authority of Major Ports (TAMP),** have to be paid by the Contractor. The Contractor will be responsible for installation, maintenance and calibration of Water Meter and / or Energy Meter also.

6.28 Existing services

6.28.1 Drains, Pipes, Cables, overhead wires and similar services, whether above or below the ground, which may be encountered in the course of the work, shall be saved and kept harmless from injury and/or loss or damages by the Contractor, at their own costs and expenses, so that they continue to be in full and uninterrupted use to the Employer.

6.28.2 The Contractor shall not store any materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services. The Contractor shall, at their own costs and expenses and without any delay, repair and make good, to the satisfaction of the Employer, any injury and/or loss or damage caused by the Contractor to the same.

6.29 Contractor to prepare working/ progress drawings

6.29.1 The Contractor shall provide and make, at his own expense, any working or progress drawings, required by him or necessary for the proper execution of the works, and shall, when required, furnish copies of the same, free of cost, to the Engineer for his information and/or approval, without meaning thereby the shifting of Contractor's responsibility on the Engineer, in any way, whatsoever.

6.30 Contractor's price is inclusive of all costs

6.30.1 Unless otherwise specified, the Contractor shall be deemed to have included in his bid / offer all his cost for supplying and providing all constructional plant, temporary work, materials (both for temporary and permanent works), labour (including supervision thereof), transporting to and from the site and in and about the work, including loading, unloading, fencing, watching, lighting, payment of fees, taxes and duties to the appropriate authorities and other things of every kind required for the construction, erection, completion and maintenance of the work.

6.31 Contractor is responsible for all construction process, except for correctness of design and specification formulated by the Engineer

6.31.1 The Contractor shall be solely responsible for the adequacy, stability and safety of all site operations and methods of construction, even if any prior approval thereto has been taken from the Engineer or his Representative. The Contractor shall not be responsible for the correctness of the design or specification of the temporary and permanent works formulated by the Engineer, but the Contractor shall be fully responsible for the correct implementation thereof, as also for any design and specification prepared/proposed/used by the Contractor.

6.32 Contractor to submit his programme of work

6.32.1 Whenever required by the Engineer or his Representative, the Contractor shall submit to him the details of his

(a) programme for execution of the work,

(b) proposed procedure and methods of work,

(c) proposed deployment of plant, equipment, labour, materials and temporary works.

The submission to and/or any approval by the Engineer or his Representative to any such programme or particulars shall not relieve the Contractor of any of his obligations under the contract.

6.32.2 If, for any reason, the Contractor be unable to adhere to his earlier programme, he shall submit his revised programme for completion of work within the stipulated time, whenever asked to do so.

6.33 Contractor to supervise the works

6.33.1 Necessary and adequate supervision shall be provided by the Contractor during execution of the works and as long thereafter as the Engineer or his Representative shall consider necessary during the Defect Liability Period (DLP). The Contractor, or his competent and authorised agent or representative, shall be constantly at site and instructions given to him by the Engineer or his Representative, in writing, shall be binding upon the Contractor subject to limitation in **GCC Clause No. 6.16** hereof. The Contractor shall inform the Engineer or his Representative in writing about such representative/agent of him at site.

6.34 Contractor is responsible for line, level, setting out, etc.

6.34.1 The Contractor shall be responsible for the true and proper setting out of the works, in relation to reference points / lines / levels given by the Engineer, in writing. The checking of any setting out or of any alignment or level by the Engineer or his Representative shall not, in any way, relieve the Contractor of his responsibility for the correctness thereof and he shall fully provide, protect and preserve all stakes, templates, bench marks, sight rails, pegs, level marks, profile marks and other things used in setting out the works.

6.35 Contractor is responsible to protect the work

6.35.1 From the commencement of the works till issue of the "Certificate of Completion of Work", vide **GCC Clause No. 6.65** hereof, the Contractor shall take full responsibility for the care thereof. Save for the excepted risks, any damage, loss or injury to the work, or any part thereof, shall be made good by the Contractor, at his own cost, as per instruction and to the satisfaction of the Engineer, failing which, the Engineer or his Representative may cause the same to be made good by any other agency and the expenses, incurred and certified by the Engineer, shall be recoverable from the Contractor, in whatever manner the Engineer shall deem proper. This clause will not apply to that part of the work, which might have been taken over by the Trustees on partial completion of the work and in such case, the Contractor's obligation will be limited to repairs and replacement for manufacturing or construction defects during the Defect Liability Period, as per the directions of the Engineer, as also for defects/damages, if any, caused to the work by the Contractor during such repairs and replacement during the Defect Liability Period.

6.36 Contractor is responsible for all damages to other structures / persons caused by him in executing the work

6.31.1 The Contractor shall, at his own cost, protect, support and take all precautions in regard to the personnel or structure or services or properties belonging to the Trustees or not, which may be interfered with or affected or disturbed or endangered and shall indemnify and keep indemnified the Trustees against claim for injury, loss or damage caused by the Contractor in connection with the execution and maintenance of the work to the aforesaid properties, structures and services and / or to any person, including the Contractor's workmen. Cost of Insurance Cover, if any, taken by the Contractor, shall not be reimbursed by the Trustees, unless otherwise stipulated in the contract.

6.37 Fossils, Treasure troves, etc. are Trustees' property

6.37.1 The Contractor shall immediately inform the Engineer's Representative if any fossil, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological importance be discovered at site, which shall remain the property of the Trustees, and protect them from being damaged by his workmen and arrange for disposal of them, at the Trustees' expense, as per the instruction of the Engineer's Representative.

6.38 Contractor to indemnify the Trustees against all claims for loss, damage, etc.

6.38.1 The Contractor shall be deemed to have indemnified the Trustees against all claims, demands, actions and proceedings and all costs arising there from on account of:

(a) Infringement of any patent right, design, trademark or name or other protected right, in connection with the works or temporary work.

(b) Payment of all royalties, rent, toll charges, local taxes, other payments or compensation, if any, for getting all materials and equipment required for the work.

(c) Unauthorised obstruction or nuisance caused by the Contractor in respect of Public or Private road, railway tracks, footpaths, crane tracks, waterways, quays and other properties belonging to the Trustees or any other person.

(d) Damage/injury caused to any highway and bridge on account of the movement of Contractor's plants and materials in connection with the work.

(e) Pollution of waterway and damage caused to river, lock, sea-wall or other structure related to waterway, in transporting Contractor's plants and materials.

(f) The Contractor's default in affording all reasonable facilities and accommodation, as per the direction of the Engineer or his Representative, to the workmen of the Trustees and other agencies employed by or with the permission and/or knowledge of the Trustees on or near the site of work.

6.39 Dismantled materials Trustees' property

6.39.1 Debris and materials, if obtained by demolishing any property, building or structure, in terms of the contract, shall remain the property of the Trustees.

6.40 Contractor's quoted rates / price must be all inclusive

6.40.1 The Contractor's quoted rates shall be deemed to have been inclusive of the following:

(a) Keeping the site free of unnecessary obstruction and removal from site of constructional plant wreckage, rubbish, surplus earth or temporary works no longer required.

(b) Cleaning and removal from site all the surplus materials, of every kind, to leave the site clean and tidy after completion of the work, without which payment against final bill may be liable to be withheld.

(c) Precautionary measures to secure efficient protection of Docks, the River

Hooghly and other waterways against pollution, of whatever nature, during execution and maintenance of the works and to prevent rubbish, refuse and other materials from being thrown into the water by the Contractor's men or those of his agency.

(d) Making arrangements for deployment of all labourers and workers, local or otherwise, including payment for their wages, transport, accommodation, medical and all other statutory benefits and entry permits, wherever necessary.

(e) Making arrangements, in or around the site, as per the requirements of Calcutta Municipality Corporation or other local authority or the Engineer or his Representative, for preventing

(i) spread of any infectious disease like smallpox, cholera, plague, malaria or dengue, by taking effective actions for destruction of rats, mice, vermin, mosquitoes, etc. and by maintaining healthy and sanitary condition,

(ii) illegal storage and distribution of Drugs, Narcotics, Alcoholic liquor, Arms and Ammunitions,

(iii) unlawful, riotous or disorderly conduct of the Contractor's or his Sub-contractor's workmen,

(iv) deployment of workmen of age less than 16 (sixteen) years.

6.41 Notice to Contractor

6.41.1 Every direction or notice to be given to the Contractor shall be deemed to have been duly served on or received by the Contractor, if the same is posted or sent by hand to the address given in the bid or to the Contractor's Site Office or, in case of Trustee's enlisted Contractor, to the address as appearing in the Trustee's Register or to the Registered Office of the Contractor. The time mentioned in these conditions for doing any act after direction or notice shall be reckoned from the time of such posting or despatch.

6.42 Contractor not to publish photograph or particulars of work

6.42.1 The Contractor and his Sub-contractor or their agents and men and any firm, supplying plant, materials and equipment, shall not publish or caused to be published any photographs or description of the works, without the prior authority of the Engineer in writing.

6.43 Contractor to provide facilities to outsiders

6.43.1 The Contractor shall, at the Trustees' cost to be decided by the Engineer, render all reasonable facilities and co-operation, as per direction of the Engineer or his Representative, to any other Contractor engaged by the Trustees and their workmen, to the Trustees' own staff and to the men of other Public Body, on or near the site of work, and in default, the Contractor shall be liable to the Trustees for any delay or expense incurred by reason of such default.

6.44 Work to cause minimum possible hindrance to traffic movement

6.44.1 The work has to be carried out by the Contractor causing minimum hindrance for

any maritime traffic or surface traffic.

D. STAFF AND LABOUR

6.45 Engagement of staff and labour

6.45.1 The labour, as mentioned in the respective clauses, shall include all labourers of the approved sub-contractor(s), with respect to this contract.

6.45.2 The Contractor shall have to make their own arrangements for the engagement of all staff and labour, for doing the work at site or in respect of or in connection with the execution of work, as also for the transport, housing, feeding. They shall have to ensure making payment to the above staff and labours, to be engaged by them (including the labours, to be engaged by the approved Sub-contractor, if any).

6.45.3 KoPT's store shall mean any store of Haldia Dock Complex, situated at Haldia.

6.45.4 It is expressly made clear that both before and after the completion of the work or termination of the contract, **KoPT shall have no liability, whatsoever, for the personnel to be engaged by the Contractor [or by the approved Sub-contractor(s)] for the work under this contract.**

6.46 Labour Laws

6.46.1 The Contractor shall, at all times, during the pendency of the contract [including the period of making good/rectification of deficiencies/defects, if any], have to comply fully with all existing **Acts**, **Regulations** and **Byelaws**, including all **statutory amendments** and re-enactment of **State** or **Central Government** and other **Local Authorities** and any other enactments and acts that may be passed in future either by the **State** or the **Central Government** or **Local Authority**, including **Workmen's Compensation Act**, **Labour Laws** and **Equal Remuneration Act, Factories Act, Minimum Wages Act, Contract Labour (Regulation & Abolition) Act,** etc., if applicable and/or as applicable.

6.46.2 If, as a result of the Contractor's failure, negligence, omission, default or non-observance of any provisions of any laws, the Employer is called upon by any authority to pay or reimburse or required to pay or reimburse any amount, the Employer shall be entitled to deduct the same from any moneys due or that become due to the Contractor under this contract or any other contract or otherwise recover from the Contractor any sums, which the Employer is required or called upon to pay or reimburse on behalf of the Contractor.

All **registration** and **statutory inspection fees**, in connection with labour engagement, with respect to this contract, shall have to be paid by the Contractor, if applicable and/or as applicable.

6.46.3 The Contractor shall have to, immediately after the occurrence of any accident, at or near the site or in connection with the execution of the work under the contract, report (over phone or otherwise) to the Engineer or his representative(s) and shall make every arrangement to render all possible assistance to the victim(s) of such accident.

The Contractor shall also have to report such accident to the Engineer, in writing (giving reference to the earlier communication made). Based on such report, necessary communication with the competent authority would be made whenever such a report is required by law.

6.46.4 For any accident occurred within the entire operational area covered under the contract, the Contractor shall have to arrange prompt investigation into the matter through recording of statement of the personnel witnessing the accident. Such "Accident Report", containing the findings, along with the statements so recorded, shall have to be forwarded by the Contractor to the Engineer at the earliest.

6.46.5 The Contractor shall have to provide full medical treatment to their staff & labourers, in case of "**Accident on Duty"**, which will inter alia include their obligations under the **Workmen's Compensation Act, 1923,** including all amendments thereof.

The Employer shall in no manner be liable to the Contractor or any person engaged/employed by them [including that of Sub-contractor] or any other person, for injuries or death caused as a result of accidents occurred, either within or outside the site of work, under the contract. The Contractor shall be responsible for such contingencies and will make good all claims for compensation, claim by their personnel/workmen or the families of the sufferer(s), as the case may be, or as per the decision of the appropriate authority/tribunal or other involved persons.

6.46.6 The Contractor shall have to indemnify KoPT, in the event of KoPT being held liable to pay compensation for injury to any Contractor's servants or workmen [including that of Sub-contractor] under the **Workmen's Compensation Act, 1923**, as amended from time to time.

6.46.7 Whenever the contract comes to an end with the efflux of time or otherwise or is terminated, the Contractor shall be required to fulfil all their obligations towards their workmen in terms of applicable labour laws and submit necessary documents towards such effect, to the Employer in support of the same. Any deposit, which may be lying with KoPT to their credit, will be liable to be applied for this purpose, if the Contractor fails to comply with the same. In case such documents are not furnished by the Contractor, the Employer will not release the **Performance Guarantee/ Security Deposit** and any other amount as may remain due to the Contractor

6.47 Health and safety

6.47.1 In the event of any outbreak of illness or an epidemic nature, the Contractor shall have to comply with and carry out such regulations, orders & requirements, as may be made by the Government, or the local medical or sanitary authorities, for the purpose of dealing with and overcoming the same.

6.47.2 The Contractor shall have to ensure safety of all their working personnel to the fullest compliance of the provisions of **general safety rules/regulations,** including **Dock Workers' (Safety, Health & Welfare) Regulations, 1986**.

The Contractor shall be solely responsible for consequences arising out of non-compliance or violation of safety rules/ regulations.

6.47.3 The Contractor [including approved Sub-contractor(s)] shall have to provide (at their own expenses) all required **Personal Protection Equipment (PPE)** [such as **Helmets**, **Nose Masks**, **Hand Gloves**, etc.] & **Safety Gears** for all personnel and labourers engaged during the work and in case of their failing to do so, the Employer shall provide the same and recover the cost thereof from any amount due, or which may become due to the Contractor or from any amount lying with them or under their control.

6.48 Labour licence

6.48.1 Within 7 (seven) days from the date of issuance of the order, the Contractor shall have to apply for **labour licence** for the maximum number of workers proposed to be deployed for this work. Necessary certificate shall be issued by the Engineer against a request from the Contractor.

Photocopy of the application shall have to be furnished to the Engineer, immediately. However, payment will be released only on furnishing the copy of the **Labour Licence** to the Engineer. However, such license should be kept valid throughout the actual duration of contract.

6.49 Employees' Provident Fund & Employees' State Insurance

6.49.1 The Contractor should have their establishment (with respect to this contract) registered with the concerned authorities under the provision of **Employees' Provident Fund & Miscellaneous Provision Act, 1952** and **Employees' State Insurance Act, 1948**. The Contractor shall have to submit the proof of registration as mentioned above immediately after commencement of work.

6.49.2 As per the above mentioned Act, the Contractor is liable for remittance of monthly subscription contribution in respect of **Employees' Provident Fund (EPF)** and **Employees' State Insurance (ESI)** for the workers engaged by them, wherever applicable. The Contractor shall have to submit the authenticated copy of the challans with respect to subscription / contribution of **Employees' Provident Fund** and **Employees' State Insurance** (against their respective Code Numbers issued by the **Employees' Provident Fund** and **Employees' State Insurance Authorities)** by 7th day of every English Calendar Month (during the currency of the contract) along with the list of labourers for whom such deposits have been made.

Payment will be held up if the up-to-date **Employees' Provident Fund** and **Employees' State Insurance** remittance challan is not submitted in time.

6.49.3 In case, registration with the EPF and ESI Authorities is not applicable for the employees of the Contractor [or for the employees of the Sub-contractor(s)], documentary evidence to establish non-applicability to be submitted by the Contractor.

6.49.4 In case of sub-contracting any part of the work, above requirements should also be fulfilled by the approved Sub-contractor and necessary documents shall have to be submitted in time, as indicated above.

E. PLANT, MATERIALS AND WORKMANSHIP

6.50 Materials to be supplied by the Employer

6.50.1 Regarding supply of any materials by the Trustees to the Contractor, in accordance with the contract, the following conditions shall apply:

a) The Contractor shall, at his own expense, arrange for transporting the materials from the Trustees' Store [store of Haldia Dock Complex, situated at Haldia], watching, storing and keeping them in his safe custody, furnishing of statement of consumption thereof in the manner required by the Engineer or his Representative, return of surplus and empty container to the Trustees' Stores, as per the direction of the Engineer or his Representative.

b) Being the custodian of the Trustees' materials, the Contractor shall remain solely responsible for any such materials issued to him and for any loss or damage thereof for any reason other than "Excepted Risks", the Contractor shall compensate the Trustees', in the manner decided by the Engineer, and shall, at no stage, remove or cause to be removed any such material from the site, without his permission.

c) The Trustees' materials will generally be supplied in stages and in accordance with the rate of progress of work, but, except for grant of suitable extension of completion time of work as decided by the Engineer, the Contractor shall not be entitled to any other compensation, monetary or otherwise, for any delay in the supply of Trustees' materials to him. The Contractor shall, however, communicate his requirement of such materials to the Engineer from time to time.

d) Unless stipulated otherwise in the contract, the value of the Trustees' materials issued to the Contractor shall be recovered from the Contractor's bills and/or any of his other dues, progressively, according to the consumption thereof on the work and/or in the manner decided by the Engineer or his Representative and at the rate(s) stipulated in the contract. These rates shall only be considered by the Contractor in the preparation of his bid/offer and these will form the basis of escalation/variation, if in future the Contractor is required to procure and provide any such material on the written order of the Engineer, consequent on the Trustees' failure to effect timely supply thereof.

e) If the Engineer decides that due to the Contractor's negligence, any of the Trustees' materials, issued to the Contractor, has been – (i) lost or damaged, (ii) consumed in excess of requirement and (iii) wasted by the Contractor in excess of normal wastage, then the value thereof shall be recovered from the Contractor's bills, or from any of his other dues, after adding 19.25 % extra over the higher one of the followings:

   i) The issue rate of the materials at the Trustees' Stores, and

   ii) The market price of the material on the date of issue, as would be determined by the Engineer.

6.51 Contractor's arrangement for execution of the work

6.51.1 The Contractor will have to arrange and provide all types of materials, etc. [in line with the Technical Specification] throughout the execution of the contract.

6.51.2 KoPT will not take any responsibility regarding **non-availability** of any such materials for which Contractor is responsible as per contract. The Contractor shall have to asses the requirement of such materials and keep sufficient stock.

6.51.3 The Contractor shall have to provide all equipment, including tools, tackles, lifting machineries, air compressor, scaffolding arrangement, different vehicular transport, etc., necessary to execute the work.

6.51.4 All tools & machineries to be used by the Contractor should be suitable for the particular requirement (i.e. capacity should be adequate) and the same should be checked for fitness before use. They should maintain the said equipment properly to ensure their efficient working.

6.51.5 The Contractor shall, at their own costs and expenses, have to provide all labour, plant, haulage, transportation of plant and equipment to be used for executing the

contract, all materials, stores, etc. (except the equipments & materials to be provided by KoPT, as per contract) required for efficiently carrying out the work to the satisfaction of the Employer.

6.51.6 The Contractor should use calibrated measuring & testing instruments and should also ensure revalidation of such calibration as and when required. In this regard, initially the Contractor shall have to submit a list of **measuring and testing instruments** (mentioning the period of validity of Calibration Certificates) to be used. The photocopies of the Calibration Certificates (including the revalidations) of the said measuring and testing instruments, shall have to be submitted to the Engineer.

6.52 Inspection and testing

6.52.1 The Engineer or his authorised Representative shall have, at all reasonable time, access to the Contractor's premises or work site or other premises [if a part of the work is being executed there or some **maintenance repair** work (during **Defect Liability Period**) is being done there] and shall have the power, at all reasonable time, to **inspect**, **examine and test** the **materials and workmanship**, as well as the **documents**, **equipment**, **tools**, **measuring & testing instruments**, as applicable, in connection with the instant contract (including **Defect Liability Period**).

6.52.2 The Engineer or his authorised Representative, on giving 7 (seven) days' notice, in writing, to the Contractor, setting out any ground of objections, in respect of the work, shall be at liberty to reject all or any material and/or workmanship in the subject of any of the said grounds of objection, which are not in accordance with the contract.

6.52.3 Quality of materials, to be provided by the Contractor under this contract, should be as per the satisfaction of the Engineer. Whenever asked, the Contractor shall have to provide free sample for testing.

6.52.4 If found necessary, KoPT reserves the rights to get the materials inspected from a **Government** or **Government recognized Laboratory**/**Test House**.

6.52.5 In case of sub-letting to other Contractors or manufacturers or suppliers by the Contractor, the Engineer will reserve the right as follows:

i) that inspection and / or testing will be carried at the Sub-contractor's works; or

ii) that inspection will be carried out at site; or

iii) that inspection will be waived, subject to the Contractor furnishing a certificate of compliance with specification by a competent authority recognised by national/international institutes.

6.52.6 The Employer may appoint a **Third Party Inspection Agency ,** as detailed at SCC, at the cost of the Employer, for stage-wise technical inspection and certification of **materials** & workmanship, including **painting**, **erection**, **commissioning**, etc. [in connection with the contract job, in part or as a whole]. In that case The relevant Certificates shall be produced by the **Third Party Inspection Agency** to the Engineer or his authorised Representative.

6.52.7 The stage-wise technical inspection will be carried out by the representative of the Engineer [or **Third Party Inspection Agency]** based on the approved **Quality Assurance Plan** (**QAP**) **& Field Quality Assurance Plan** (**FQAP**)

[considering the Technical Specification of the bidding documents].

6.52.8 The Contractor shall have to submit a **Quality Assurance Plan** (**QAP**) and a **Field Quality Assurance Plan** (**FQAP**), based on the Technical Specification and other terms & conditions stipulated in the bidding documents. The **QAP & FQAP** shall be approved by the "**Engineer**".

6.52.9 In all cases where tests are required, within the purview of QAP & FQAP, whether at the premises of the Contractor or any Sub-contractor or elsewhere, the Contractor, except where otherwise specified, shall provide free of charges such labour, materials, electricity, fuel, water, stores, apparatus and instruments, as may reasonably be demanded, to carry out sufficiently such tests and shall, at all times, facilitate the Engineer or his Representative [and / or the Third Party Inspection Agency] , to accomplish such testing.

6.52.10 The cost of all tests and / or analyses, within the purview of QAP & FQAP, effected at the Contractor's or Sub-contractor's works and on the site, shall be borne by the Contractor. The Contractor will be called upon to pay all expenses incurred by the Employer in respect of any work found to be defective or of inferior quality, adulterated or otherwise unacceptable.

6.52.11 If, during inspection by the **Third Party Inspection Agency [if appointed by KoPT]**, any material or test [within the purview of QAP & FQAP] fails to fulfil the contract conditions for **more than 2** (**two**) **times**, **any additional amount charged by the Third Party Inspection Agency towards inspection of the same from the 3rd time onwards shall have to be borne by the Contractor**. If the Contractor fails to make such payment to the **Third Party Inspection Agency**, the same shall be deducted from the bill(s) of the Contractor and paid to the **Third Party Inspection Agency**

6.52.12 **Tests on completion**:

On **completion of installation**, the contractor with give a **7** (**seven**) **days**' notice to the Engineer, in writing (informing the date on which they will be ready to make the tests), before carrying out such tests, in accordance with and in the manner prescribed in the specifications. The procedure specified in SCC shall be followed in this respect.

6.52.13 Notwithstanding the fact that the materials or installations have passed the inspection, the Contractor is not relieved from his obligations to conform to the quality, workmanship, guaranteeing the performance, etc., as per the contract.

6.53 Contractor to replace materials/work not acceptable to the Engineer or his Representative

6.53.1 The Engineer or his Representative shall have the power to inspect any material and work at any time and to order at any time

a) for removal from the site of any material, which, in his opinion, is not in accordance with the contract or the instruction of the Engineer or his Representative,

b) for the substitution of proper and suitable materials, or

c) the removal and proper re-execution of any work, which, in respect of material and workmanship, is not in accordance with the contract or the instructions of the Engineer.

The Contractor shall comply with such order at his own expense and within the time specified in the order. If the Contractor fails to comply, the Engineer shall be at liberty to dispose any such materials and re-do any work in the manner convenient to the Trustees by engaging any outside agency, at the risk and expense of the Contractor and after giving him a written prior notice of 7 (seven) days.

6.54 Removal of materials on completion

6.54.1 The Contractor shall, on completion of the contract or when directed by the Employer, shall have to remove all plant, equipment, tools, materials, temporary constructions, etc. and rubbish garbage, waste, which may have accumulated during the execution of the contract, other than those permanently used into the work, at Employer's site.

6.55 Workmanship and secrecy

6.55.1 The Contractor shall carry out the services in conformity with generally accepted norms and sound standards of Engineering. The Contractor shall be responsible for the technical soundness of the services rendered. In the event of any deficiency in those services, the Contractor shall promptly re-do the same, at no additional cost to the Employer.

6.55.2 The Contractor shall use all the documents, drawings and other data & information, of proprietary nature, received from the Employer, solely for the purpose of performing and carrying out the obligations on his part under the Agreement in the performance of the works for the project and maintain utmost secrecy, in this regard. The documents, drawings and other data & information, received from the Employer, shall not be used by the Contractor for any other purpose.

F. COMMENCEMENT, EXECUTION & COMPLETION OF WORK, HANDING OVER AND TAKING OVER

6.56 Preliminary time to commence work and maintenance of steady rate of progress

6.56.1 The Contractor shall commence the work within 7 (seven) days of the receipt of Engineer's letter informing acceptance of the Contractor's bid / offer by the Trustees or within such preliminary time as mentioned by the Contractor in the "Form of Tender" or the time accepted by the Trustees. The Contractor shall then proceed with the work with due expedition and without delay, except as may be expressly sanctioned or ordered by the Engineer or his Representative, time being deemed the essence of the contract on the part of the Contractor.

6.57 Contractor's site office

6.57.1 The Contractor shall provide and maintain a suitable office at or near the site to which the Engineer's Representative may send communications and instructions for use of the Contractor.

6.58 Contractor to observe Trustees' working hours

6.58.1 Unless specified otherwise in the contract or prior permission of the Engineer has been taken, the Contractor shall not execute the work beyond the working hours observed by the Engineer's Representative and on Sundays and Holidays observed in the Trustees' system, except in so far as it becomes essential on

account of tidal work or for safety of the work. If the progress of the work lags behind schedule or the work has been endangered by any act or neglect on the part of the Contractor, then the Engineer or his Representative shall order and the Contractor, at his own expense, shall work by day and by night and on Sundays and Public Holidays. Any failure of the Engineer or his Representative to pass such an order shall not relieve the Contractor from any of his obligations. The Engineer's decision, in this regard, shall be final, binding and conclusive.

6.59 Contractor to supply all materials as per requirement of the Engineer or his Representative

6.59.1 Unless stipulated otherwise in the contract, all materials required for the work shall be procured and supplied by the Contractor with the approval of the Engineer or his Representative and subject to subsequent testing, as may be required by the Engineer or his Representative. The Engineer shall exercise his sole discretion to accept any such materials

6.60 Materials and works

6.60.1 Unless stipulated otherwise in the contract, all materials, workmanship and method of measurement shall be in accordance with the relevant Codes (Latest Revision) of the Bureau of Indian Standards and the written instructions of the Engineer or his Representative. Where no specific reference is available in the contract, the material and workmanship shall be of the best of their respective kinds to the satisfaction of the Engineer.

6.61 Contractor to submit samples for approval

6.61.1 Samples shall be prepared and submitted for approval of the Engineer or his Representative, whenever required to do so, all at the Contractor's cost.

6.62 Contractor to seek approval of Engineer or his Representative before covering up any portion of work

6.62.1 No work shall be covered up and put out of view by the Contractor without approval of the Engineer or his Representative and whenever required by him, the Contractor shall uncover any part or parts of the work or make openings in or through the same as may be directed by the Engineer or his Representative from time to time and shall reinstate or make good those part of works thus affected, to the satisfaction of the Engineer, all at the cost of the Contractor.

6.62.2 The Trustees shall reimburse such cost, as determined by the Engineer, if the initial covering up was with prior written order of the Engineer or his Representative.

6.63 Contractor to suspend work on order from Engineer or his Representative

6.63.1 On a written order of the Engineer or his Representative, the Contractor shall delay or suspend the progress of the work, till such time the written order to resume the execution is received by him. During such suspension, the Contractor shall protect and secure the work to the satisfaction of the Engineer or his Representative. All extra expenses, in giving effect to such order, shall be considered by the Trustees, unless such suspension is:

a) for removal from the site of any material, which, in his opinion, is not in accordance with the contract or the instruction of the Engineer or his Representative,

b) otherwise provided for in the contract, or

c) necessary by reason of some default on the part of the Contractor, or

d) necessary by reason of climatic conditions on the site, or

e) necessary for proper execution of the works or for the safety of the works or any part thereof.

6.63.2 The Engineer shall settle and determine such extra payment and/or extension of completion time to be allowed to the Contractor, as shall, in the opinion of the Engineer, be fair and reasonable.

6.63.3 If at any time, before or after commencement of the work, the Trustees do not require the whole of the work tendered for, the Engineer shall notify the same to the Contractor in writing and the Contractor shall stop further works in compliance of the same. The Contractor shall not be entitled to any claim for compensation for underived profit or for such premature stoppage of work or on account of curtailment of the originally intended work by reason of alteration made by the Engineer in the original specifications, drawings, designs and instructions.

6.64 Completion Certificate

6.64.1 When the whole of the work [as detailed in **GCC Clause No. 6.65** (**Completion period**)] has been completed to the satisfaction of the Engineer, the Contractor shall, within 21 (twenty one) days of submission of his application to the Engineer, be entitled to receive from him a certificate for completion of work as per the form furnished in **Section – IX-D**.

6.65 Completion period

6.65.1 All the jobs, as per contract, are to be completed within the period stipulated in the SCC.

6.66 Taking over of the Contract job by KoPT

6.66.1 The **Contract job** will be taken over by HDC, KoPT after completion of the works in accordance with the contract, having passed all the tests under "Tests on completion".

6.66.2 However, the actual date of completion of the contract will be considered as per **GCC Clause No. 6.65** [**Completion period**].

6.67 Defect Liability Period (DLP)

6.67.1 "**Defect Liability Period**" shall mean the **Guarantee Period**, as specified in SCC.

6.67.2 During "**Defect Liability Period**" [as specified in SCC], the Contractor shall nominate 1 (one) competent, experienced and responsible technical person, to co-ordinate and execute all works to be attended by the Contractor, as per contractual obligations, without any extra cost to HDC, KoPT.

6.67.3 The Contractor shall be responsible for making good (including replacement of defective items, if required), with all possible speed, at their expense, any defect in or damage to any portion of the work, which may appear or occur after the Contract job has been taken over [as per GCC Clause No. 6.66 (Taking over of the Contract job by KoPT)] and before expiry of Defect Liability Period [as specified in **SCC]** and which arises either:

a) from any defective materials, workmanship or design, or

b) from any act or omission of the Contractor done or omitted during the said period.

6.68 Defects after taking over

6.68.1 If any such defects shall appear or damage occur (as detailed in **6.67.3**), the Engineer shall forthwith inform the Contractor thereof, stating in writing the nature of defect or damage.

The provision of this clause shall apply to all replacements or renewals carried out by the Contractor to remedy defects and damage as if the said replacements and renewals had been taken over on the date they were completed to the satisfaction of Engineer. After the taking over, if the Contract job cannot be used (for the purpose for which it is intended), during any period, by the reason of a defect or damage, the **Defect Liability Period** shall be extended accordingly, as specified in SCC.

6.68.2 If any such defect or damage be not remedied by the Contractor within a reasonable time, HDC, KoPT may proceed to do the work at the Contractor's risk and expense, but without prejudice to any other rights which HDC, KoPT may have against the Contractor in respect of such defects.

6.68.3 All inspection, adjustments, replacement or renewal carried out by the Contractor during the period referred in this clause shall be subject to the conditions of this contract, which shall be binding on the contractor in all respects during the **Defect Liability Period** and its extension, if any.

6.69 Extension of completion period and liquidated damage

6.69.1 Extension of completion period:

Should the quantum of extra or additional work of any kind or delayed availability of the Trustees' materials to be supplied as per contract or **Force Majeure** condition (as per **GCC Clause No. 6.86**) or other special circumstances, of any kind, beyond the control of the Contractor or any other reason not attributable to the Contractor [including hindrance at site of work, causes indicated as "**Excepted Risks**", etc.] cause delay in completing the work, the Contractor shall apply to the Engineer, in writing, for suitable extension of completion period, within **7** (**seven**) **days** from the date of occurrence of the reason and the Engineer shall thereupon consider the stated reasons in the manner deemed necessary and shall either reject the application or determine and allow, in writing, the extension period as he would deem proper for completion of the work, with or without the imposition of "**Liquidated Damage**" (**GCC Clause No. 6.69.2** hereof) on the Contractor and his decision shall be binding on the Contractor. If an extension of completion period is granted by the Engineer, "**Liquidated Damage**" (**GCC Clause No. 6.69.2** hereof) shall apply from its date of expiry, if the work be not completed within the extended time, unless stated otherwise in the decision communicated by the Engineer, as aforesaid.

6.69.2 Liquidated Damage:

If the Contractor fails to complete the work within the stipulated dates [as per **GCC Clause No. 6.65** (**Completion period**)] or such extension thereof, as communicated by the Engineer, in writing, the Contractor shall pay as compensation (**Liquidated Damage**) to the Trustees and not as a penalty, as per the following:

In case of handing over the Contract Job after the scheduled completion period, **Liquidated Damage @ ½%** of the Contract Price [excluding GST] , for every week or part thereof, beyond the scheduled date of completion, will be deducted from the Contractor's bill. Provided always the amount of such compensation shall not exceed **10 %** of the cost the Contract Price [excluding GST].

6.69.3 Without prejudice to any of their legal rights, the Trustees shall have the power to recover the said amount of compensation/damage, as per **GCC Clause No. 6.69.2** from any money due or likely to become due to the Contractor. The payment or deduction of such compensation/damage shall not relieve the Contractor from his obligation to complete the work or from any of his other obligations/liabilities under the contract and in case of the Contractor's failure and at the absolute discretion of the Engineer, the work may be ordered to be completed by some other agency, at the risk and expense of the Contractor, after a minimum **3** (**three**) **days** notice, in writing, has been given to the Contractor by the Engineer or his Representative.

G. CONTRACT PRICE , PAYMENT AND DEDUCTIONS

6.70 Contract Price

6.70.1 Price charged by the Contractor for the related services performed under the contract shall not vary from the rates accepted by the Employer, based on the bid/offer of the successful bidder and stated in the "Letter Of Acceptance", with the exception of any price adjustment, if provided for in the contract.

6.71.2 Changes **in statutory taxes & duties will be adjusted** time to time.

6.71.3 No claim whatsoever of the Contractor for their man & material resources remaining idle for any reason or for any other expenses incurred by them due to the flow of work not being continuous or for stoppage of work, will be entertained by the Employer.

6.71 Terms of payment

6.71.1 Payment of Goods & Services Tax (GST):

Amount of GST will be borne by HDC, KoPT on production of suitable document(s) by the Contractor.

6.71.2 Time of payment:

The Contractor shall have to submit **bills in triplicate** to the Engineer, in accordance with the stage-wise payments specified in **SCC**. In normal circumstances, payment of the bills, accompanied by **Inspection Certificates** & other relevant documents, duly recommended by the Engineer, will be passed within 30 (thirty) days from the date of receipt of such bills, if found in order.

6.71.3 Income Tax deduction:

Income Tax, if any, as per the relevant provision of the Income Tax Act, shall be **deducted at source** from amount payable to the Contractor.

6.71.4 No interest on account of delayed payments:

Any claim for interest will not be entertained by KoPT with respect to any delay on the part of KoPT for making payment, or for any dispute. The decision of the Engineer is final in such matters.

6.72 Extra expenses incurred by the Employer

6.72.1 Any extra expenses incurred in connection to the work by the Employer in the performance of the work owing to the neglect or omission on the part of the Contractor in any of the case mentioned in this contract shall be deducted from any sum due or which may thereafter become due to the Contractor or from any amount lying with them or under their control or they may be called upon to pay the amount of such extra expense to such person or persons as the Employer may appoint to receive the same and in the event of the Contractor failing to make such payment, the said amount shall be recoverable from them in such manner as the Employer may determine,

6.73 Recovery of deducted amount

6.73.1 Without prejudice to any of their legal rights, the Trustees shall have the power to recover the amount of **DEDUCTION**, from any money due or likely to become due to the Contractor. Such payment or deduction shall not relieve the Contractor from their obligation to complete the work or from any of their other obligations / liabilities under the contract.

6.74 Variation and its valuation

6.74.1 The Engineer shall have the power to order the Contractor, in writing, to make any variation of the quantity, quality or form of the works or any part thereof that may, in his opinion, be necessary and the Contractor upon receipt of such an order shall act as follows:

a) Increase or decrease the quantity of any work included in the contract.

b) Omit any work included in the contract.

c) Change the character or quality or kind of any work included in the contract.

d) Change the levels, lines, position and dimensions of any part of the work, and

e) Execute extra and additional work, of any kind, necessary for completion of the works.

6.74.2 No such variation shall, in any way, vitiate or invalidate the contract or be treated as revocation of the contract, but the value (if any) of all such variations, evaluated in accordance with the Engineer's sole decision, shall be taken into account and the contract price shall be varied accordingly.

6.74.3 Provided always that written order of the Engineer shall not be required for increase or decrease in the quantity of any work up to 15%, where such increase or decrease is not the result of any variation order given under this clause but is the result of the quantities exceeding or being less than those stated in the "Price Schedule". Provided also that verbal order of variation from the Engineer shall be complied with by the Contractor and the Engineer's subsequent written confirmation of such verbal order shall be deemed to be an order in writing within the meaning of this clause.

6.74.4 The Contractor shall not be entitled to any claim of extra or additional work, unless they have been carried out under the written orders of the Engineer.

6.74.5 The Engineer shall solely determine the amount (if any) to be added to or deducted from the sum named in the tender in respect of any extra work done or work omitted by his order.

6.74.6 All extra, additional or substituted work done or work omitted by order of the Engineer shall be valued on the basis of the rates and prices set out in the contract, if in the opinion of the Engineer, the same shall be applicable. If the contract does not contain any rates or prices directly applicable to the extra, additional or substituted work, then the Engineer may decide the suitable rates on the basis of "Schedule of Rates" (including surcharge in force at the time of acceptance of bid), if any, adopted by the Trustees with due regard to the accepted contractual percentage, if any thereon. In all other cases, the Engineer shall solely determine suitable rates in the manner deemed by him as fair and reasonable and his decision shall be final, binding and conclusive.

6.74.7 If the nature or amount of any omission or addition relative to the nature or amount of the whole of the contract work or to any part thereof shall be such that, in the opinion of the Engineer, the rate of prices contained in the contract for any item of the works or the rate as evaluated under **GCC Clause Nos. 6.74.5 & 6.74.6**, is by reason of such omission or addition rendered unreasonable or in-applicable, the Engineer shall fix such other rate or price as he deems proper and the Engineer's decision shall be final, binding and conclusive.

H. TERMINATION BY EMPLOYER

6.75 Notice to correct

6.75.1 If the Contractor fails to carry out any of their obligations under the contract, the Engineer may give notice to the Contractor, requiring them to make good the failure and to remedy the same within a specified reasonable time.

6.76 Termination by Employer

6.76.1 The Employer shall be entitled to terminate the contract if:

a) the Contractor fails to comply with **GCC Clause No. 6.20** [**Performance Guarantee / Security Deposit**]

or

with a notice under **GCC Clause No. 6.75** [**Notice to correct**],

b) the Contractor **abandons** the work, or **repudiates** the contract, or otherwise plainly demonstrates the intention not to continue performance of their obligations under the contract,

c) the Contractor, without reasonable or lawful excuse under this contract,

i) fails to proceed with the work, **within 14 days** from the scheduled date for commencement of work, in accordance with **GCC Clause No. 6.56** [**Preliminary time to commence work and maintenance of steady rate of progress**],

ii) keeps the work suspended for **at least 14 days**, despite receiving Engineer's written notice to proceed with the work,

or

iii) fails to comply with a notice issued regarding rejection of material(s)/work and/or remedial work, **within 28 days** after receiving it,

d) the Contractor **assigns/sub-contracts the whole of the work**

or

sub-contracts any portion of the work, without the required consent, in line with **GCC Clause No. 6.22**.

e) the Contractor becomes **bankrupt** or **insolvent**, goes into liquidation, have a receiving or administrative order made against them, compounds with their creditors, or carries on business under a receiver, trustees or manager for the benefit of their creditors, or if any act is done or event occurs which (under applicable laws) has a similar effect to any of these acts or events,

f) the Contractor gives or offers to give (directly or indirectly) to any person any bribe, gift, gratuity, commission or other thing of value, as an inducement or reward,

i) for doing or forbearing to do any action in relation to the contract, or

ii) for showing or forbearing to show favour or disfavour to any person in relation to the contract,

or, if any of the Contractor's personnel, Agents or Sub-contractors gives or offers to give (directly or in directly) to any person any such inducement or reward as is described in this **sub-paragraph (f)**. However, lawful inducement and reward to the Contractor's personnel shall not entitle termination

g) the Contractor fails to execute the work in accordance with the contract

or

persistently or flagrantly neglects to carry out their obligations under the contract.

h) the Contractor fail to make payment of wages to their personnel in relation to this contract,

i) the Contractor fails to carry out the work satisfactorily (as stated in these bidding documents or otherwise decided by the Engineer) or may not be able to complete the work within the agreed period on account of Contractor's lapses.

j) any accident occurs due to improper way of working by the Contractor's personnel, or

k) any misconduct done by Contractor's personnel (including that of Agents or Sub-contractors) to KoPT's employees.

In any of these event or circumstances, the Employer may, upon giving a **minimum 14 days' notice** [communicated by the Engineer] to the Contractor, **terminate the contract** and expel the Contractor from the site, without being liable for any compensation to the Contractor. However, in case of **sub-paragraph (e) or (f)**, the Employer may, by notice [communicated by the Engineer], terminate the contract immediately.

The Employer's election to terminate the contract shall not prejudice any other rights of the Employer, under the contract or otherwise.

6.76.2 Upon receipt of the letter of termination of work, which may be issued by the Engineer on behalf of the Employer, the Contractor shall have to leave the site of work and deliver any **required goods**, all **Contractor's documents**, and other **design documents**, made by or for them, all the **Trustees' tools**, **plant** and **materials** issued to them, at the place to be ascertained by the Engineer, **within 7 days** of receipt of such letter. However, the Contractor shall use their best efforts

to comply immediately with any reasonable instructions included in the notice

i) for the assignment of any Sub-contractor,

and

ii) for the protection of life or property or for the safety of the equipment/work.

The Contractor shall not be released from any of their obligations or liability under the contract and the rights & authorities conferred on the Employer and Engineer, by the contract, shall not be affected.

6.76.3 Upon such termination of work, the Employer shall have the power to complete the work by **themselves** and/or through **any other agency** at the **Contractor's risk & expense** and the Contractor shall be debited **any sum or sums that may be expended in completing the work beyond the amount that would have been due to the Contractor, had they duly completed the whole of the work in accordance with the contract**.

The Employer or such other agency may use, for such completion, so much of the Contractor's documents, other design documents, made by or on behalf of the Contractor, Contractor's equipment, temporary work, plant & materials, as they think proper.

Upon completion of the work, or at such earlier date, as the Engineer shall give notice that the Contractor's equipment and temporary work will be released to the Contractor at or near the site, the Contractor shall remove or arrange removal of the same from such place without delay and at their risk & cost. However, if by this time the Contractor has failed to make a payment due to the Employer, these items may be sold by the Employer in order to recover this payment. Any balance of the proceeds shall be paid to the Contractor.

6.77 Valuation at date of termination

6.77.1 As soon as practicable after a notice of termination under **GCC Clause No. 6.76** [**Termination by Employer**], has taken effect, the Engineer shall proceed in accordance with **GCC Clause No. 6.19** [**Determinations**] to agree or determine the value of the work, goods & Contractor's documents, and any other sums due to the Contractor for work executed, in accordance with the contract. The value of such work (executed in accordance to the Contract) shall be determined based on measurements of actual work done and approved rate(s), as per contract or other rates, as decided by the Engineer. The Engineer's decision, in such case, shall be final, binding and conclusive.

6.78 Payment after termination

6.78.1 After a Notice of termination, under **GCC Clause No. 6.76** [**Termination by Employer**] has taken effect, the Employer may

a) give notice to the Contractor, indicating the particulars, for which Employer is entitled to any payment under any Clause or otherwise in connection with the contract, and or any extension of the **Defect Notification Period**.

However , Notice is not required for payments due under **GCC Clause No. 6.26** [**Supply of water and Electricity**], under **GCC Clause No. 6.27** [**Use of ground and land/covered space for Contractor's establishment**], or

for other services requested by the Contractor,

b) withhold further payments to the Contractor until the cost of execution, completion and remedying of any defects, damage, and all other costs incurred by the Employer, have been established, and / or

c) recover from the Contractor any losses and damages incurred by the Employer and any extra costs of completing the work, after allowing for any sum due to the Contractor under **GCC Clause No. 6.77** [**Valuation at date of termination**]. After recovering any such losses, damages and extra costs, the Employer shall pay any balance to the Contractor.

6.79 Employer's entitlement to termination for convenience

6.79.1 The Employer, by notice [communicated by the Engineer] sent to the Contractor, may terminate the Contract, in whole or in part, at any time **for Employer's convenience**. Such termination shall take effect **28 days** after the date on which the Contractor receives this notice or the Employer returns the Performance Guarantee. The notice of such termination shall specify that termination is for **Employer's convenience**, the extent to which performance of the Contractor under the contract is terminated, and the date upon which such termination become effective.

The Employer shall not terminate the contract under this Sub-clause in order to execute the work exclusively by themselves or to arrange for work to be executed exclusively by another Contractor or to avoid a termination of the contract by the Contractor under **GCC Clause No. 6.82** [**Termination by Contractor**].

After such termination, the Contractor shall proceed in accordance with **GCC Clause No. 6.83** [**Cessation of work and removal of Contractor's equipment**] and shall be paid in accordance with **GCC Clause No. 6.90** [**Optional termination, payment and release**].

6.80 Corrupt or fraudulent practices

6.80.1 If the Employer determines that the Contractor has engaged in **corrupt**, **fraudulent**, **collusive**, **coercive**, or **obstructive** practices, in competing for or in executing the Contract, then the Employer may, after giving **14 days notice** to the Contractor, terminate the Contractor's employment under the Contract and expel them from the Site, and the provisions of **GCC Clause Nos. 6.75 to 6.78** shall apply as if such expulsion had been made under **GCC Clause No. 6.76** [**Termination by Employer**].

Should any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the execution of the work, then that employee shall be removed in accordance with **GCC Clause No. 6.21** [**Contractor's personnel and Contractor's representative**].

For the purposes of this clause:

i) "corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

ii) "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v) "obstructive practice" is deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede the Employer investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and / or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation.

I. SUSPENSION AND TERMINATION BY CONTRACTOR

6.81 Contractor's entitlement to suspend work

6.81.1 The Contractor may, if the Employer fails to pay the Contractor the amount due under any certificate of the Engineer **within 28 days** after the expiry of the time stated in **GCC Clause No. 6.71** [**Terms of payment**] within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract, after giving 28 days' prior notice to the Employer, with a copy to the Engineer, suspended work or reduce the rate of work.

6.81.2 If the Contractor subsequently receives the due payment (as described in the relevant Clause and in the above notice) before giving a notice of termination, the Contractor shall resume normal working as soon as is reasonably practicable.

6.81.3 If the Contractor suspends work or reduces the rate of work in accordance with the provisions of this Clause and thereby suffers delay, the Engineer shall, after due consultation with the Contractor, determine any extension of time or minimum criteria for satisfactory performance, to which the Contractor is entitled and shall notify the Contractor accordingly.

6.82 Termination by Contractor

6.82.1 The Contractor will be entitled to terminate the Contract if:

a) the Contractor does not receive the reasonable evidence within **42 days after** giving notice under **GCC Clause No. 6.81** [**Contractor's entitlement to suspend work**] in respect of a failure of the Employer to pay the Contractor the amount due,

b) the Employer obstruct or refuse any required approval to the issue of any such certificate, which is essentially required for further progress of the work without notifying any reason for such obstruction or refusal for a unreasonably long period of time, or

c) the Employer become bankrupt or insolvent, go into liquidation, or enter into composition with the creditors,

or

d) the Employer give notice to the Contractor that for unforeseen reasons, due to economic dislocation, it is impossible for them to continue to meet their contractual obligations.

In any of these events or circumstances, the Contractor may, upon giving **28 days' notice** to the Employer (with a copy to the Engineer), terminate the Contract.

The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.

6.83 Cessation of work and removal of Contractor's equipment

6.83.1 After a notice of termination under **GCC Clause No. 6.79** [**Employer's entitlement to termination for convenience**], **GCC Clause No. 6.82** [**Termination by Contractor**] or **GCC Clause No. 6.90** [**Optional termination, payment and release**] has taken effect, the Contractor shall promptly:

a) cease all further work, except for such work as may be necessary and instructed by the Engineer for the purpose of making safe or protecting those parts of the work already executed and any work required to leave the site in a clean and safe condition.

b) hand over all construction documents, Plant and Materials for which the Contractor has received payment.

c) hand over those other parts of the Works executed by the Contractor up to the date of termination

d) remove all Contractor's equipment, which is on the site and repatriate all their staff and labour from the site.

and

e) remove all other goods from the site, except as necessary for safety, and leave the site.

Any such termination shall be without prejudice to any other right of the Contractor under the contract.

6.84 Payment on termination

6.84.1 After a notice of termination under **GCC Clause No. 6.82** [**Termination by Contractor**] has taken effect, the Employer shall promptly:

a) return the Performance Guarantee / Security Deposit to the Contractor

b) pay the Contractor in accordance with **GCC Clause No. 6.90** [**Optional termination, payment and release**] ,

and

c) pay to the Contractor the amount of any loss or damage sustained by the Contractor as a result of this termination.

J. INSURANCE

6.85 General requirements for insurances

6.85.1 The contractor during the contract period shall provide for insurance of 110% of the contract value including manning upto the commissioning and taking over of the installation.

K. FORCE MAJEURE

6.86 Definition of Force Majeure

6.86.1 In this clause "**Force Majeure** " means an exceptional event or circumstance

a) which is beyond the control of the Employer and the Contractor,

b) which such party (Employer / Contractor) could not reasonably have provided against before entering into the contract,

c) which, having arisen, such party could not reasonably have avoided or overcome,

and

d) which is not attributable to other party.

Force Majeure may include, but not limited to, exceptional events or circumstances of the kind listed below, so long as conditions a) to d) above are satisfied:

i) **war, hostilities** (whether war be declared or not) , **invasion, act of foreign enemies**;

ii) **rebellion, terrorism, sabotage by persons other than the Contractor's personnel, revolution, insurrection** , **military or usurped power, or Civil War**;

iii) **riot**, **commotion, disorder**, **strike or lockout by persons other than the Contractor's personnel**;

iv) **munitions of war, explosive materials, ionisation radiation** or **contamination by radio-activity,** except as may be attributable to the Contractor's use of such munitions, explosives, radiations or radio-activity;

v) **natural catastrophes** such as **earthquake**, **tsunami** (caused by earthquake at the ocean bed),**fire, floods, hurricane, cyclone, typhoon or volcanic activity,**

and

vi) **pressure waves** caused by air craft or other aerial devices travelling at sonic or supersonic speed at the site of the work.

6.87 Notice of Force Majeure

6.87.1 If a party is or will be prevented from performing its obligations under the Contract by Force Majeure, then it shall give notice to the other party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given **within 48 (forty eight) hours** of the alleged beginning of the relevant event or circumstance constituting Force Majeure, giving full particulars and satisfactory evidence.

The party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

Notwithstanding any other provision of this clause, Force Majeure shall not apply to obligations of either party to make payments to the other party under the

contract.

6.88 Duty to minimise delay

6.88.1 Each party shall at all times use all reasonable endeavours to minimise any delay in the performance of the contract as a result of Force Majeure.

A Party shall give notice to the other party when it ceases to be affected by the Force Majeure, **within 48 (forty eight) hours** of such ending.

6.89 Consequences of Force Majeure

6.89.1 If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under **GCC Clause No. 6.87** [**Notice of Force Majeure**], and suffers delay and/or non-performance as per the contractual obligations, by reason of such Force Majeure, the Contractor shall be entitled, subject to **GCC Clause No. 6.91** [**Engineer's decision**], to:

a) an extension of time for any such delay, if completion is or will be delayed, under **GCC Clause No. 6.69** [**Extension of completion period and liquidated damage**],
and

b) non-imposition of penalty due to non-performance as per the contractual obligations.

After receiving this notice, the Engineer shall proceed in accordance with **GCC Clause No. 6.19** [**Determinations**] to agree or determine these matters.

6.90 Optional termination, payment and release

6.90.1 If the execution of all the work in progress is prevented for a **continuous period of 84 days** by reason of **Force Majeure** of which notice has been given under **GCC Clause No. 6.87** [**Notice of Force Majeure**], or for **multiple periods which total more than 140 days** due to the same notified Force Majeure, then either party may give to the other party a notice of termination of the contract. In this event, the **termination shall take effect 7 days after the notice is given**, and the Contractor shall proceed in accordance with **GCC Clause No. 6.83** [**Cessation of work and removal of Contractor's equipment**].

Upon such termination, the Engineer shall determine the value of the work done and issue a payment certificate which shall include:

a) The amounts payable for any work carried out for which a price is staed in the Contract;

b) the cost of plant and materials ordered for the work which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery. Such Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer and the Contractor shall place the same at the Employer's disposal;

c) any other cost or liability, which in the circumstances was reasonably incurred by the Contractor in the expectation of completing the Works;

d) the **reasonable Cost** of removal of temporary work and Contractor's equipment from the site and the return of such items to the Contractor's premises,

and

e) the reasonable cost of repatriation of the Contractor's staff and labour employed wholly in connection with the work at the date of such termination.

L. CLAIMS, DISPUTES AND ARBITRATION

6.91 Engineer's decision

6.91.1 If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with, or arising out of, the contract or the execution of the works, whether during the execution of the works or after their completion and whether before or after repudiation or other termination of the contract, including any dispute as to any opinion, instruction, determination certificate or valuation of the Engineer, the matter in dispute shall, in the first place, be referred, in writing, to the Engineer within **30** (**thirty**) **days**, with a copy to the other party. Such reference shall state that it is made pursuant to this clause. No later than the **thirtieth day** after the day on which he received such reference, the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this clause.

Unless the contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the works with all due diligence and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided, in an amicable settlement or an arbitral award.

If either the Employer or the Contractor be dissatisfied with any decision of the Engineer, or if the Engineer fails to give notice of his decision on or before the **thirtieth day** after the day on which he received the reference, then either the Employer or the Contractor may, on or before the **seventieth day** after the day on which he received notice of such decision, or on or before the seventieth day after the day on which the said period of thirty days expires, as the case may be, give notice to the other party, with a copy for information to the Engineer, of his intention to commence arbitration, as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and, subject to **GCC Clause No. 6.94** (**Failure to comply with Engineer's decision**), no arbitration in respect thereof may be commenced unless such notice is given.

If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no notice of intention to commence arbitration as to such dispute has been given by either the Employer or the Contractor on or before the **seventieth day** after the day on which the parties received notice as to such decision from the Engineer, the said decision shall become final and binding upon the Employer and the Contractor.

6.92 Amicable settlement

6.92.1 Where notice of intention to commence arbitration as to a dispute has been given in accordance with **GCC Clause No. 6.91** (**Engineer's decision**) above, both parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both parties agree otherwise, arbitration may be commenced on or **after the fifty-sixth day after the day on which a notice of intention to commence arbitration of such dispute was given**, even if no

attempt at amicable settlement thereof has been made.

6.93 Arbitration

6.93.1 Any dispute in respect of which

a) the decision, if any, of the Engineer, has not become final and binding pursuant to **GCC Clause No. 6.91 (Engineer's decision)** and

b) amicable settlement has not been reached within the period stated in **GCC Clause No. 6.92** (**Amicable settlement**),

shall be finally settled by arbitration, in accordance with the **Arbitration and Conciliation Act**, **1996** (**considering its amendment in 2015**) or any statutory modification or re-enactment thereof and rules made there under and for the time being in force. The **Arbitration Tribunal** shall be composed as per provision of the **Arbitration and Conciliation Act**, **1996** (**considering its amendment in 2015**) or any statutory modification or re-enactment thereof and rules made there under and for the time being in force.

6.93.2 In connection with the instant contract:

a) the place of arbitration shall be **Kolkata** or **Haldia**, West Bengal, India,

b) the arbitration shall be conducted in **English language**,

and

c) the fees, if any, of the Arbitrators, if required to be paid before the award of work in respect to disputes is made and published, shall be shared equally by each of the parties

6.93.3 The Arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion, valuation or decision of the Engineer, relevant to the dispute. Nothing shall disqualify representatives of the parties and the Engineer from being called as a witness and giving evidence before the Arbitrators on any matter, whatsoever, relevant to the dispute.

6.93.4 Neither party shall be limited in the proceedings before such Arbitrators to the evidence or arguments put before the Engineer for the purpose of obtaining his said decision pursuant to **GCC Clause No. 6.91** (**Engineer's decision**). No such decision shall disqualify the Engineer from being called as a witness and giving evidence before the Arbitrators on any matter whatsoever relevant to the dispute.

6.93.5 Arbitration may be commenced prior to or after completion of the works, provided that the obligations of the Employer, the Engineer and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the works.

6.94 Failure to comply with Engineer's decisions

6.94.1 Whether neither the Employer nor the Contractor has given notice of intention to commence arbitration of dispute within the period stated in **GCC Clause No. 6.91** (**Engineer's decision**) and the related decision has become final and binding, either party may, if the other party fails to comply with such decisions, and without prejudice to any other rights it may have, refer the failure to arbitration, in accordance with **GCC Clause No. 6.93** (**Arbitration**). The provision of **GCC Clause No. 6.91** (**Engineer's decision**) **and GCC Clause No. 6.92** (**Amicable settlement**) shall not apply to any such reference.

6.95 Progress of work not to be interrupted

6.95.1 The Contractor must, at all the times, fulfil their obligations under the contract and shall not slow down or stop the progress of work during the period any dispute is under settlement either through reference to the Engineer or through arbitration, pursuant to the preceding clauses. Even if the works to be carried out during such a period involve matters under dispute, the Contractor shall nevertheless proceed with the works as per direction of the Engineer, pending settlement of the dispute. Failure of the Contractor, in this respect, shall constitute default on their part and render them liable to actions under the provisions of **GCC Clause No. 6.76** [**Termination by Employer**].

PART-1

SECTION - VII

SCOPE OF WORK AND SPECIAL CONDITIONS OF CONTRACT (SCC)

The following **Special Conditions of Contract (SCC)** shall supplement the **General Conditions of Contract (GCC)**. Whenever there is a conflict, the provisions herein shall prevail over those in the **GCC**.

A. SCOPE OF WORK

1. PREAMBLE:

Haldia Dock Complex is handling LPG at 1st Oil Jetty (HOJ-I) & 2nd Oil Jetty (HOJ-II), also another jetty viz. Outer Terminal-II (OT-II) is upcoming in the same region within short period of time, for handling LPG. HDC would like to install modern Fire Fighting System as per OISD-156, in consultation with Indian Institute of Technology- Madras (IIT-M), standard in these Oil Jetties, where various POL products, LNG, LPG etc is being handled. HDC is also operating 02 (two) small Barge Jetties for handling various POL products. Fire fighting facilities are to be extended in this Barge Jetty area also.

Brief Scope of Work:

The following items to be considered for installation in the proposed Fire Fighting System. However the same is indicative only and not exhaustive. –

a) Design :

The entire Fire Fighting System to be designed by the contractor as per provision of OISD 156 standard. All drawings, layout, calculations to be submitted by them, in this regard before starting of the construction and also as build drawings to be submitted after construction. However, the consultant (IIT-M) has provided technical specification and various drawings along with the tender document for guidance of the intending bidders.

b) Pump House:

There will be one common Pump House, which will supply fire water in all three Oil Jetties and 02 (two) no. Barge Jetties through fire water pipeline. There will be six diesel driven fire pumps, three motor driven jockey pumps and two motor driven foam pumps and allied valves and pipelines inside the Pump House. Width of the Pump House should be able to accommodate movement of heavy vehicle up to the end of the Pump House. Also, sufficient space should be available for carrying out maintenance of the equipment installed therein. Considering nature of soil, adequate piling to be done for proper foundation of pump house.

c) Water Reservoir :

There will be two water reservoirs closed to Pump House. Considering nature of soil, adequate piling to be done for foundation. One sump to be constructed for initial storage of water from external service provider. First time filling of fresh water at these tanks to be done by the contractor at his cost. Pumping arrangement to be made for subsequent transfer of water from sump to the reservoirs.

d) Tower Monitor :

Three no. Tower Monitors to be installed against each of HOJ-I, HOJ-II and OT-II. In case of HOJ-I and HOJ-II, Tower Monitors to be installed in the river by piling.

e) Jumbo Nozzle :

03 (three) no. jumbo nozzles to be installed against each of HOJ-I, HOJ-II and OT-II.

f) Water Hydrant :

Sufficient number of water hydrant to be provided in the Oil Jetties and Barge Jetties.

g) Off-shore Pipeline Trestle :
Offshore pipeline trestle to be constructed for HOJ-I and HOJ-II from shore to the service platform by piling on the river.

h) On-shore Pipeline Trestle :
Fire water supply to be made in all Oil Jetties and Barge Jetties from common pump house through pipeline network, which should be supported by civil pedestal on pile foundation.

i) Ground Monitors :
Ground monitors to be provided in all Oil Jetties and Barge Jetties.

j) Fire Detection System :
Various fire detection systems as per OISD 156 standard to be provided.

k) Miscellaneous items :
Various items like universal coupling, fire extinguisher, fire hose etc. to be provided as per requirement of OISD 156 standard.

l) Control Room :
Control Room at HOJ-I to be constructed, 100 metre away from the service platform. Control Room at OT-II to be constructed 100 metre away from Service Platform. For HOJ-II, existing Pump House to be converted into Control Room.

m) Quick Release Mooring Hook (QRMH) :
Sufficient number of QRMH to be installed in HOJ-I, HOJ-II and OT-II with arrangement of automatic control from the Control Room.

n) Control System :
The entire Fire Fighting System and QRMH to be controlled from the Control Room.

o) Comprehensive Operation & Maintenance :
The contractor will have to carry out operation and maintenance during defect liability periods of 2 (two) years. There after, Comprehensive Operation & maintenance of the augmented Fire Fighting System to be carried by the contractor for the another 10 (ten) years. All spares, consumables, tools & tackles, equipments, skilled, semi-skilled & unskilled manpower, equipment operators, engineers etc. to be arranged by the contractor.

p) Soil Investigation: All soil investigations are to be done by the contractor.

q) Fire water Pipe Lines: The contractor will have to design, supply & install the entire fire water pipe line network (incl. pipe fittings, Valves, gaskets etc.) required for the subject work.

r) Statutory certification: Before commencement of construction work and after commissioning of the project, the contractor will make all arrangement for obtaining statutory clearance from PESO in connection with the subject work [Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II)] for handling of various POL products, LNG, LPG etc. in these jetties.

2.**DESIGN:**

Technical specification and drawings mentioned in the tender document is only indicative in nature. The successful bidder (contractor) will have to carryout design for all components, accessories and entire control system for successful execution of the project to achieve specified output as per OISD-156.

Design should be based on upto 40,000 DWT LPG vessels carrying different liquid cargo including Propane, Butane and LPG as per the latest OISD-156 which the same design also to be checked for handling of LNG.

The contractor will have to furnished design basis report including 'water demand analysis' showing total water required, keeping the specified equipment under the fire-fighting system in running condition and the equipment support for supply of such quantity of water. This scheme should be in line with the statutory requirement of latest OISD-156 & PESO.

3. **BAR-CHART:**

Within 30 days from the date of placement of order the contractor should submit the detailed project schedule upto level-3 by showing all activities from design to handing over and warrantee maintenance. This should be done in consultation with the progress of work related to civil construction of OT-II. Payment related milestones to be indicated also by the contractor.

4. DRAWING:

The contractor will have to submit all detailed engineering documents and drawings within 60 days from the placement of order for the approval of the Engineer, manuals and specifications of different equipment and components of the fire-fighting system to facilitate inspection and certification. During taking-over, he will have to submit the 'as build' drawings of different equipment and components of the fire-fighting system.

5. BASIC LAYOUT:

The contractor will have to submit the following technical documents a) Scheme of the system, b) Water demand analysis c) Control system planning d) Clear layout of the system, showing all major components, indicating their individual capacity, e) General Arrangement drawing of major components, f) technical literature etc.

Within 30 days from the date of placement of order, the contractor should submit detail foundation work required for installation of various fire-fighting equipments like tower monitor, base monitor, water curtain, engine, pump etc. Proper execution of all such foundation work to be carried out by the contractor.

Within 30 days from the date of placement of work order, the contractor will have to submit complete layout of the fire-fighting system showing all individual components and control system. Such layout should be prepared in consultation with the contractor engaged for construction of the jetty of OT-II, to avoid possibility of any structural obstruction during execution of the fire-fighting system.

6. SUPPLY OF MATERIALS AND MANPOWER:

For successful execution of the project, the contractor would make all arrangement for supply of material and manpower, some of which are (this is only indicative and not exhaustive) equipment, appliances & necessities for work like tools & tackles, machineries for grit-blasting & spray painting, lifting appliances, equipments for transport, welding transformers/generators, welding accessories, gas cutting sets, safety appliances, materials for scaffolding, nuts, bolts and washers, structural steel, civil, mechanical & electrical engineering materials, consumables like electrodes, gas, paints, thinners, jute, oil, grit for blasting, skilled and unskilled manpower, supervisors, engineers etc.

7. STORAGE OF SUPPLIED ITEMS:

The contractor will have to arrange for proper storage of all engineering materials, equipment, accessories, consumables etc. at Haldia site at his own cost and arrangement. All such items would remain under the custody of the contractor till handing over of the system to HDC. However HDC will provide requisite land/ site space, electricity, water for setting up temporary office, store etc. against payment to HDC as rent or charges as per the prevailing schedule of rate (SoR).

8. CO-ORDINATION RELATED TO CIVIL WORK:

The contractor engaged for fire-fighting system should maintain close co-ordination with the contractor engaged for civil construction of OT-II jetty, so that both the work can proceed simultaneously without

any dispute. However, in case any dispute between the contractor engaged for civil construction of OT-II and the contractor engaged for fire-fighting work, the decision of HDC management should be treated as final and binding to both the contractors.

9. TESTING, TRIAL RUN AND COMMISSIONING:

After installation of the fire-fighting system, testing and trial run should be carried out by the contractor in presence of representative of HDC / PMC / third party inspection agency/PESO. All equipment, pipelines, control system to be tested to verify their specified performance. Testing to be carried out in line with procedure indicated in the technical specification. Testing and trail run to be carried out continuously for at least 30 (thirty) days. In case of successful trail run, declared by representative of HDC / PMC / third party inspection agency/ PESO, the said fire-fighting system would be considered as commissioned. However, commissioning activities to be carried out in line with the procedure indicated in the technical specification. Foam to be supplied by the contractor for trail run purpose, however, the contractor is liable to handover filled foam tank to HDC.

10. **CERTIFICATION:**

Project monitoring, quality assurance, inspection of materials and installation, testing and commissioning etc. will be carried out by suitable PMC to be appointed by KoPT. The contractor should provide quality assurance plan, schedule of inspection for all materials and work. He should also arrange for stage-wise inspection and necessary certification of all materials and work including commissioning and handing over. The contractor will also have to co-ordinate with the statutory bodies and arrange for stage-wise inspection, as per requirement of the said authorities and obtain permission for construction and commission certification of the entire fire-fighting system from statutory authorities viz. OISD, PESO etc. at their own cost and arrangement.

11. HANDING OVER OF FIRE-FIGHTING SYSTEM:

After the successful commissioning and commissioning certification from PESO, the entire fire-fighting system to be handed over to HDC by the contractor in working condition along with certificates obtained from statutory authorities viz. OISD, PESO etc.

B. SPECIAL CONDITIONS OF CONTRACT

1.0 GENERAL:

These provisions though given in a separate section are part of the tender documents which must be read as a whole, the various sections being complementary to one another and are to be taken as mutually explanatory. These provisions shall be read in conjunction with the other parts of the tender documents viz. General Conditions of Contract, Notice Inviting E-Tenderers, Instructions to Bidder, Technical Specifications, Drawings, Bill of Quantities and other documents forming part of the Contract. In case of any discrepancy or ambiguity in the documents, the order of precedence of the documents as stated below will apply. In particular, these provisions will over ride those in the General Conditions provided there is discrepancy between them.

2.0 CORRELATION AND ORDER OF PRECEDENCE OF TENDER DOCUMENTS:

If the stipulations in the various tender documents be found to be at variance in any respect, one will override others (but only to the extent these are at variance) in the order of precedence as given in the list below, i.e. any particular item in the list will take precedence over all those placed lower down in the list.

Order letter.

Milestone linked schedule.

Drawings.

Technical Specifications of work.

Special Conditions of Contract.

General Conditions of Contract.

In case of any dispute, question or difference either during the execution of the work or any other time as to any matter or thing connected with or arising out of this Contract, the decision of the Sr. Dy. Manager (P&E) Haldia Dock Complex, thereon shall be final and binding upon all parties.

3.0 PRICE BASIS:

The bidder will have to quote online as per price schedule of the tender. However, this price schedule is indicative only and not exhaustive. The price would include design, supply, delivery, erection, testing, commissioning, certification, handing over, warranty obligation, Operation and Maintenance etc. considering all items related to the entire project. This price should include all taxes and duties except GST. Percentage of applicable GST should be mentioned separately. GST would be reimbursed by HDC against compliance of prevailing GST norms. Quoted price should remain firm till end of the contract.

4.0 TIME OF COMPLETION:

The Project work is to be completed within 24 (Twenty-four) months from the date of placement of work order. Execution of OT-II jetty fire fighting system to be carried out in line with the progress of civil construction. After handing over the project to HDC, there would be defect liability period of 2 (two) years, when the contractor will have to carry out the operation and warranty obligation. After defect liability period of 02 (two) years, the contractor will have to carry out comprehensive operation and maintenance for the further period of 10 (ten) years.

6.0 GUARANTEE PERIOD:

The entire fire-fighting system should be guaranteed for a period of 24 (twenty four) months from the date of commissioning. This guarantee will cover all design defects, poor materials, bad workmanship, poor performance of equipment & machineries, non-achievement of output etc. The contractor will have to repair / replace the concern item /spare parts/ components etc. immediately at free of cost within guarantee period.

7.0 GUARANTEE CERTIFICATE:

The contractor will have to submit guarantee certificate as per the guarantee clause after completion of the project.

8.0 PAYMENT TERMS:

NO ADVANCE payment will be made.

Payment will be made within **thirty (30) days** from the date of receipt of unambiguous triplicate bills/ Challan.

Payment Terms (Project work):

The payment shall be made on milestone linked schedule. The weightage will be finalised based on the bill of Quantities and value of the work/ supplied items. The milestone linked payment schedule will be finalised after successful completion of detailed design basis report and drawings.

Payment Terms (O&M):

Payment shall be made on monthly basis during Operation & Maintenance Contract (OMC) Period of 10 years after defect liability period of two (2) years. The copy of logbook, log sheet, maintenance register & facility availability report, ESI, PF Challan, wage register are to be submitted along with

the monthly bills. All bills (triplicate), logbook, log sheet, maintenance register & entire fire-fighting facility availability report, ESI Challan, PF Challan, wage register are to be jointly signed, prior to the submission, by the contractor/ contractor's representative and HDC's site official/ officials.

9.0 ACCESS TO THE SITE:

By Road:

All-weather hard top road approachable from N.H. 41 and State Highway exist right up to the area of work.

By Rail:

S. E. Railway Branch Line connects Haldia with the Panskura Railway Station.

10.0 SITE VISIT:

The Bidder shall inspect the site of work and thoroughly familiarize himself with the nature of work, site conditions, and access to the site and location before submission of the tender. He should contact the Sr. Dy. Manager (P&E), Haldia dock Complex at his office at Chiranjibpur, Haldia for collecting information about the site before submission of the tender. No excuse will be entertained afterwards on the above ground. In case any part of the site cannot be handed over to the successful Bidder in time, no compensation for loss of labour or any other cause nor any claim will be entertained by the Trustees. Suitable extension of time shall, however, be granted to the successful Bidder on that ground if applied for.

11.0 SITE FEATURES & OPERATIONS:

The off-shore work is to be carried out on the river in the estuarine region of the River Hooghly where strong tidal currents prevail and there is substantial tidal fluctuation in water level.

The work shall have to be executed by the successful bidder without hampering normal operational activities in the area and the contractor should not start any hot work without proper permits. The working hours may have to be adjusted as the situation demands. No claim for idle labour on this account shall be entertained.

During execution of the work, proper care should be taken to provide adequate protection to the existing structures, cables (electrical / telephone / computer etc), fresh water and fire pipelines etc. and other installations against any damage at the contractor's risk and expense. Careful manual excavation will have to be carried out in places where service lines have been laid to avoid any damage.

Any damage caused to the existing pavement / structures/facilities/service lines or defect arising during construction shall have to be made good / rectified forthwith as directed to the satisfaction of the Engineer. Care should be taken during transportation of materials and execution of work so as not to impede the smooth traffic flow and normal operations in adjoining areas.

Further, if so required by the Engineer in the interests of normal working of the port, it is found necessary to shift / suspend some construction activity for some duration, this shall be done in compliance with the instructions of the Engineer, without any additional cost.

The tenderers shall have to assess the impact of hindrance to the different activities of the work which may likely to occur during execution of the job due to various factors including those of shipping and other operational activities in the areas and also as stated above. They shall have to plan the work in such a way so that all the activities of the job can be continued after taking care of the above hindrances effectively round the clock even on Sundays and holidays in order to complete the job within scheduled time frame. The tenderers shall consider the above points while quoting their rates.

12.0 PARTICULARS OF EXISTING WORKS:

Such information as maybe given in the specification as to the existing features and works other than those now under construction as part of the present Haldia Dock Complex given without warranty of accuracy and neither the Trustees nor the Engineer will be liable for any discrepancies therein.

13.0 LIQUIDATE DAMAGE CLAUSE:

If the Contractor fails to complete the work within the stipulated dates or such extension thereof as communicated by the Engineer in writing, the Contractor shall pay as compensation (Liquidated Damage) to the Trustees and not as a penalty, ½% (half percent) of the total value of work (contract price) as mentioned in the letter of acceptance of the tender/offer, for every week or part thereof the work remains unfinished. Provided always that the amount of such compensation shall not exceed 10% of the said value of work. GST would be applicable extra on the amount of Liquidated damages.

14.0 PERFORMANCE GUARANTEE:

The contractor will have to submit performance guarantee for the project @ 10% of the project contract value. The contractor will also have to submit performance guarantee for O&M @10% of the O&M contract value. Earnest Money of the successful bidder (contractor) would be converted into part of the performance guarantee for the project. Within 30 (thirty) days from the placement of order, the contractor will have to submit the remaining amount of Performance guarantee of the project as per stipulation of General Conditions of Contract in the form of an irrevocable guarantee from Kolkata / Haldia Branch of any Nationalized Bank or Scheduled Bank of India in the proforma attached to the General Conditions of Contract and for a sum computed according to the General Conditions of Contract. The Bank Guarantee for the Performance Bond shall remain valid till 30 (thirty) days after successful completion of defect liability period for the project work. The separate Bank guarantee for performance of O&M contract to be submitted within 30 days from the date of the handing over of the project to HDC. The bank guarantee for O&M will be released after successful completion of Operation & Maintenance contract.

The submission of the Performance Guarantee shall be at the expense of the contractor in all respects.

In case Bank Guarantee is issued for a branch outside Haldia/ Kolkata, the same should be counter-guaranteed and payable by the Branch of the same bank situated at Haldia/ Kolkata.

Performance Guarantee will be discharged and released to the Contractor after the elapse of thirty days after the issue of certificate of final completion in terms of General Conditions of Contract. Provided always that if the Contractor has still to execute any works as provided in the GCC, and/or if some dues are recoverable from the Contractor, the Employer reserves the right to withhold discharge of the performance guarantee until thirty days after the completion of all these.

15.0 CONTRACTOR'S SITE OFFICE, STORE SHEDS ETC:

On an application from the Contractor, land near to the site of work will be allotted by the Trustees for the construction of Site Office, Store etc. For such allotment a rent as per prevailing SoR per annum or part thereof will be recovered from Contractor's bill. The Contractor shall hand over vacant possession of the land free from all encumbrances within two months from actual date of completion of work. In case the contractor does not remove the site offices, store etc. within two months from the actual date of completion, the contractor will have to pay compensation equivalent to three times the applicable license fee for the plot of land allotted to him temporarily for site offices, store etc. as per Schedule of Rent of KoPT's land and buildings at Haldia and to be recovered from his final bill / Security Deposit. The Contractor shall build office, sheds etc. on the land allotted to him as approved by the Engineer or his representative and shall maintain a clean hygienic condition throughout the period of their use.

The Contractor shall maintain a Site Order Book at his site office and all orders and instructions issued to him from time to time by the Engineer or his representative will be recorded in the Site Order Book. The Contractor shall promptly sign each entry as a token of having received such orders.

The Contractor shall maintain a Site Order Book at his site office and all orders and instructions issued to him from time to time by the Engineer or his representative will be recorded in the Site Order Book. The Contractor shall promptly sign each entry as a token of having received such orders.

Electrical power will be supplied on chargeable basis as per the prevailing rates, which may be revised from time to time. Necessary length of cable to the work place and energy meter / source and other accessories for the aforesaid purpose shall be arranged by the contractor.

Dock permit for the contractor and their staff, materials, vehicles etc. for movement inside the dock area, will be on chargeable basis.

Drinking water may be supplied on chargeable basis. However, all necessary arrangement like plumbing / installation of water meter etc. to be made by the contractor.

16.0 KEEPING THE SITE AND WORKING AREA CLEAR:

The Contractor shall at all times keep the site and working areas free from all surplus materials, rubbish and offensive matter all of which shall be disposed off in a manner to be approved by the Engineer's Representative. As the works will be carried out mainly inside of operational buildings of HDC, the Contractor has to make necessary arrangement to clear the rubbishes etc. from the buildings, at the end of day's work at his own cost & risk.

17.0 SUPPLY OF MATERIALS BY THE CONTRACTOR:

It will be the responsibility of the contractor to make timely procurement of all materials for both temporary and permanent works required in accordance with the Bill of Quantities or for any extra/additional work required as per the directions of the Engineer. The contractor shall procure materials only from manufacturers approved by the Engineer.

The contractor will be allowed to take away surplus materials on completion of the work, subject to Engineer's verification of contractor's records of entry and consumption of materials in the works.

18.0 PROGRAMME OF WORK AND PROGRESS REPORT:

The contractor shall suitably schedule various activities required for completion of the work and shall submit detailed programme of work in writing in the form of detailed project schedule upto leve-3, Bar & PERT Chart before commencement of the work.

If desired by the Engineer, the contractor, during execution of the work, shall submit on the first day of each month the progress report of the work in a manner as directed, showing therein corrective measures to be taken to make up the backlog, if there be any.

19.0 PROGRESS PHOTOGRAPHS & VIDEO RECORDS :

The contractor shall supply to the Engineer suitable negative and four prints of progress photographs, suitably inscribed, of an approximate size 165 mm x 115 mm of such portions of the work in progress as well as of completed work as the Engineer may direct. Progress photographs shall be required every month, unless otherwise directed by the Engineer. The negatives of the photographs shall become the property of the Board of Trustees and no prints from the negatives may be supplied to any person or persons without the authorization of the Engineer. Approximately 60 copies of photographs will be chosen by HDC from a minimum of 140 nos. original photographs.

The contractor shall also supply to the Engineer edited colour progress video films with sound and narration in English of various phases of such portion of the work in progress and completed work as the Engineer may direct so as to have a coherent record of the construction from start to completion. The video films will be recorded on digital video discs or compact discs which shall become the property of the Board of Trustees and no copies of the above films shall be supplied to any person or persons without the permission of the Engineer. Duration of the video film records after editing shall be minimum 30 minutes.

Cost of such photography/ video filming and ancillary works shall be borne by the contractor and no extra payment will be allowed.

20.0 SAFETY:

The contractor shall adhere to safe construction practice, guard against hazardous and unsafe working conditions and follow all safety precautions for prevention of injury or accidents and safeguarding life and property. The contractor shall comply with relevant provisions of Dock Workers (Safety, Health and Welfare) Act – 1986 and Dock Workers (Safety, Health and Welfare) Regulation – 1990 and Safety Officer of the Trustees or Safety Inspectors shall be afforded all facilities for inspection of the works, tools, plant, machineries, equipments etc. wherever so required. The contractor shall further comply with any instruction issued by the Engineer, Trustees' Safety Officer, Safety Inspector in regards to safety which may relate to temporary, enabling or permanent works, working of tools, plants, machineries, equipments, means of access or any other aspect.

The contractor shall provide all necessary first aid measures, rescue and life saving equipment to be available in proper condition.

The contractor shall provide PPE's (Personal Protective Equipments) such as, helmet, safety shoe etc. to all workers and shall also provide job specific PPE's e.g. safety belts for working at

heights; protective face and eye shield, goggles, hand gloves for welding / gas cutting works; protective foot wear and gloves for hot works; facemasks, gloves and overalls for painting works, mixing and handling materials etc, as directed by the Engineer.

All safety rules shall be strictly followed while working on live electrical systems or installations as stipulated in the relevant safety codes.

During work on the river and at the waterfront, the areas of work must be clearly marked with red flags and prominent red lamps (at night) to prevent any danger to workmen engaged at site or to ships berthing at the Jetties.

During work at night, the Contractor shall deploy halogen lamps/ other electrical lamps at the required spots to ensure there is adequate illumination for hazard-free work.

Before allowing workers in sewers, manholes, any duct or covered channel etc, the manhole covers shall have to be kept open and ventilated at least one hour in advance and necessary safety torches / lamps should be inserted first before allowing entry to the worker. Suitable hand gloves and other safety gear will be provided to the worker during handling / removing of slushes / sludge etc. without any extra cost.

The contractor shall adopt all the above safety measures at his own cost.

The successful bidder shall also ensure that –

(i) No damage is caused to plants and vegetations unless the same is required for execution of the project proper.

(ii) The work shall not pollute any source of water / land / air surrounding the work site so as to affect adversely the quality or appearance thereof or cause injury or death to animal and plant life.

(iii) His office & labour hutment etc. shall be maintained in a clean and hygienic condition throughout the period of their use and different effluents of the labour hutment shall have to be disposed off suitably.

21.0 INSURANCE OF WORKS:

The Contractor shall insure insurance coverage for men and material as per provision of the general conditions of the contract.

22.0 PROVISION TO INDEMNIFY EMPLOYER:

The terms shall include a provision whereby, in the event of any claim in respect of which the contractor would be entitled to receive indemnity under the policy being brought or made against the Employer, the insurer will indemnify the Employer against such claims and any costs, charges and expenses in respect thereof.

23. ACCIDENTS OR INJURY TO WORKMEN:

The Employer shall not be liable for any damages or compensation payable at law in respect or in consequence of any accident or injury to any workmen or other person in the employment of the Contractor or any sub-contractor. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

24.0 WATCHING OF MATERIALS:

The successful Bidder will have to arrange for proper security of all materials and tools brought by him. Although the working area is under the jurisdiction of C.I.S.F., the Contractor shall be fully responsible for any theft or damage of the materials. He may be allowed to post his own

Watchmen round –the-clock at the work-site with valid permit and prior intimation to CISF. No extra amount will, however, be paid separately for watching. The Contractor should quote his rates keeping this in view.

25.0 CONTRACT LABOUR LAWS:

The Contractor must comply with the provisions of Contract labour (Regulation & Abolition) Act 1970 and Contract Labour (Regulation & Abolition) Central Rules 1971 and the rules framed there under with all modifications/amendments being enforced from time to time.

The Contractor shall indicate maximum number of workmen to be engaged on any day for execution of the work in the appropriate place in the ABSTRACT FORM OF TENDER & he shall have to obtain a regular /permanent license as per sec12(1) of the Contract Labour Act.

Further , whenever a contract work has commenced or completed , the contractor has to intimate the same to the Assistant Labour Commissioner(Central) /labour Enforcement Officer (Central) in Form IV-A , within 15 days of such commencement or completion.

The contractor has to obtain a certificate of registration under "Building & Other Construction Workers (Regulation Of Employment & Conditions Of Service) Act-1996 and Central Rule 1998 and his rate shall include a cess payable @ 1 % of the cost of construction as applicable under "Building & Other Construction Workers Welfare Cess Act -1996 & Welfare Cess Rules 1998.

The contractor has to arrange for displaying the name of the Regional Labour Commissioner (Central), Asst. Labour Commissioner (Central) & Labour Enforcement Officer (Central) at his worksite(s).

The contractor shall inform the Principal Employer the date, time & venue of disbursement of wage to be made by him to his workers.

The successful bidder shall also be required to put up a notice at the site of work mentioning the date, time & venue of disbursement to be made by him to his workers and he or his authorized representative shall have to be present during period of disbursement.

26.0 COMPLIANCE WITH EPF & M P ACT:

The successful contractor will have to comply with provision of EPF & MP Act –1952 (along with amendments, if any), issued from time to time.

If asked for by the Employer, the contractor will be required to submit photocopy of all payment challans and produce the original for verification to the representative of the principal employer, i.e. Sr. Dy. Manager (P&E).

27.0 COMPLIANCE WITH ESI ACT:

If applicable , the successful bidder will have to comply with provisions of "Employers State Insurance Act – 1948", along with amendments (if any) issued from time to time. He shall obtain ESI registration and shall deduct employees' contribution as applicable percentage of the wages of each of the employees' and shall deposit the same together with employer's contribution as applicable percentage of such total wages payable to the employees or at such rates as fixed by the competent authority from time to time.

In case, where an employee is not covered under ESIC Scheme (or contribution not paid for him regularly) and meet an accident during and arising out of his employment, the contractor being the immediate employer, shall be liable to pay him suitable compensation.

The contractor will be required to submit Photo copies of all payment challans and produce the original for verification to the representative of the principal employer, i.e. Sr. Dy. Manager (P&E).

28.0 INDEMNIFICATIONS:

The successful bidder shall be deemed to indemnify and keep indemnified the Trustees from and against all actions, claims, demands and liabilities whatsoever under and in respect of the breach of any of the provisions of any law, rules or regulations having the force of law, including but not limited to –

a) The Minimum Wages Act, 1948.
b) The Dock Workers (Regulation Of Employment) Act, 1948
c) The Building And Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996
d) The Dock Workers' Safety, Health & Welfare Act , 1986
e) The Payment of Wages Act, 1936.
f) The Workmen's Compensation Act, 1923.
g) The Employees Provident Fund Act, 1952.
h) The Contract Labour (Regulation and Abolition) Act, 1970; Rules 1971.
i) The Payment of Bonus Act, 1965.
j) The Payment of Gratuity Act, 1972.
k) The Equal Remuneration Act, 1976.
l) The Employees State Insurance Act, 1948 & Employees State Insurance (Amendment) Act ,1989
m) Child Labour (Prohibition and Regulation) Act, 1986.
n) The Maternity Benefits Act 1961
o) Interstate Migrant Workmen (Regulation Of Employment & Conditions Of Service) Act, 1979.
p) Motor Vehicle Act, latest revision.

29.0 CUSTOMS AND SECURITY REQUIREMENTS:

The Haldia Dock area is a custom bonded area and as such the Contractor shall comply with all regulations of the Port and Customs authorities extent and those that may be imposed from time to time in respect of the transit of all Contractor's plant, vehicles, materials and staff in the area.

The contractor shall fence the area that may be allotted to him inside the "Bonded area" of the Port for stores and other requirements with closely boarded C.G.I. sheets fixed to a suitable framework, to the full satisfaction of the Port and Security authorities.

The Contractor shall abide by all the regulations and rules of Kolkata Port Trust applicable to the Haldia Dock Complex, as extant or as may be amended.

30.0 PERMIT:

Entry Permits may be necessary for the workmen and for the movement of transport vehicles for this work. In the interest of work, necessary entry Permits will be issued on chargeable basis by the Trustee's for the workmen, vehicles /lorries/trucks etc. for entering into the Dock area for execution of work / testing of materials at the departmental laboratory, against application as per prescribed proforma by the contractor, after the same is examined and approved by the Engineer. The entry permit will be issued as per requirement following latest Permit Scheme of Haldia Dock Complex. All existing rules, including any amendments thereto, in future, will have to be complied with by the contractor. The existing charges for manpower and vehicle would be as follows:

Sl. No	Description	Rate in (In INR)
1	Dock Permit per person	8.50 per daily permit (Maximum 12 hrs. validity). 229.50 per monthly permit 690.25 per quarterly permit 2295.00 per annual permit 3672.00 per biennial permit
2	Dock Permit per vehicle and circular permit for vehicle carrying ship's gear and stores (inclusive of overnight stayal).	42.53 per daily permit 1148.31 per monthly permit 2296.62 per quarterly permit 4593.24 per annual permit
3	Dock Permit for mobile crane/ Reach Stacker/ Toplifter (inclusive of overnight stayal)/ Dumper / Payloader	170.10 per daily permit 4592.70 per monthly permit 9184.40 per quarterly permit 18370.80 per annual permit
4	Dock Permit for cart (inclusive of overnight stayal).	17.00 per daily permit 459.99 per monthly permit 1239.30 per quarterly permit 4461.68 per annual permit.

31.0 SETTLEMENT OF DISPUTES:

If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with or arising out of the contract or the execution of the works, the same shall be dealt as per relevant provisions of the General Conditions of Contract and THE ARBITRATION AND CONCILIATION (AMENDMENT) ACT, 2015 and any statutory amendment thereof.

32.0 GOODS & SERVICES TAX (GST):

Any modification (addition /deletion /alteration including implementation of GST) in taxes or duties in future by the GOI after due date of submission of this tender will be addressed separately at the material time. Therefore the detailed tax break-up considered in the quoted price should also be submitted by the bidders along with their price bid in order to assess the impact of future tax levied subsequently, if any on the contract price. Any offer without the detailed tax break-up, if becomes the lowest price–bid and is accepted by KoPT with or without any negotiation of price, shall not be entitled for reimbursement of any additional amount due to subsequent modification of taxes or duties. But any recovery due on account of any subsequent modification in taxes or duties shall be assessed by HDC without any reference to the contractor and shall be made by HDC from the amount payable under the contract.

33.0 PROVISIONS FOR SITE STAFF OF ENGINEER:

After the issue of Engineer's notice to commence, the contractor shall as soon as possible make available of the following facilities for the staff of the Engineer at the Site of Work, all in accordance with the approval of the Engineer or his Representative and the Contract Price shall be deemed to be inclusive of the provision for all these facilities.

(a) Office Facilities :- Throughout the period of Contract, office accommodation at site for two rooms with electricity and water supply and adequate ventilation for the sole use of Engineer's Representative and his staff. The room shall be provided and maintained with suitable furniture, peon facility as directed by the Engineer. An independent toilet facility

shall have to be provided solely for the use of the client.

(b) Equipment Facilities: - Provide and maintain all necessary equipments in working condition for use of Engineer's staff such as survey, testing of materials and any other instruments, equipment and apparatus as they may require for carrying out the contractual obligations.

(c) Transport facilities :- The contractor Shall make available, maintain and operate one good 4 wheeler vehicle (Jeep/Maruti/Ambassador etc.) having a minimum sitting capacity for 4 persons with driver, fuel, etc for the use of the Engineer or his representative for survey, testing, inspection, measurement etc related to the work on working days from 8:00 A.M to 10:00 P.M during currency of contract. The vehicle shall not be more than 5(five) years old. Any failure in supply / sudden withdrawal / stoppage will attract deduction from bills @ HDC's similar operating transport contract. In case of exigency and work during night hours, the car shall be made available for the entire night. The supply of vehicle shall start on 15th day from the date of work order and shall finish on the date of completion of work including extension of date of completion, if any.

34.0 Inspection, Testing and Project Monitoring: The Employer shall appoint a PMC, at the cost of the Employer, for stage-wise close project monitoring, technical inspection and certification of **materials** & workmanship, including **erection**, **commissioning**, etc. [in connection with Design, manufacture, fabrication, supply, erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II)]. The relevant Certificates shall be produced by the PMC to the Engineer or his authorised Representative.
The stage-wise project evaluation, technical inspection will be carried out by the based on the approved Project Bar chart, **Quality Assurance Plan** (**QAP**) **& Field Quality Assurance Plan** (**FQAP**) [considering the Technical Specification of the bidding documents].

The Contractor shall have to submit a Phase wise project evaluation criteria, Bar chart, **Quality Assurance Plan** (**QAP**) and a **Field Quality Assurance Plan** (**FQAP**), based on the approved Technical Specification and other terms & conditions stipulated in the bidding documents. The **QAP & FQAP** shall be approved by the "**Engineer**", after the same are duly recommended by the PMC. The Project monitoring, **Technical Inspection & Certification, payment recommendations** will be carried out by the PMC, in accordance with approved Project evaluation criteria **QAP & FQAP**.

35.0 Supply of Electricity:

Electricity charges will be have to be paid (adjusted from the contractor's bill) by the contractor and the charges for the same will be determined on the basis of **Chargeable Unit (kWh)** [actual **Unit (kWh) consumed** (recorded through Energy Meter) **plus 3%** on actual Unit consumed] and applicable rate of **West Bengal State Electricity Distribution Company Limited** (**WBSEDCL**). Billing will be done on the basis of **Electricity charges** and overhead charges @ 19.25% [on the aforesaid **Electricity charges]** as per the notifications of **Tariff Authority of Major Ports (TAMP).**

The **Electricity consumption charges** [based on the prevalent rates of **WBSEDCL**, as may be amended from time to time] shall have to be paid by the Contractor immediately, on receipt of the bill from the office of Finance Division, Haldia Dock Complex. All payment on this account should be updated, otherwise the pending bill amount, along with late payment surcharge, will be recovered from the Contractor's bill(s).

36.0 **Supply of water**:

Water charges will have to be paid(adjusted from the contractor's bill) by the contractor against actual consumption recorded through water meter at the rate **INR 38.65 (including overhead charges @ 19.25%) per KL** of **Fresh Water** [As directed by **TAMP** (**Tariff Authority for Major Ports**)], **with escalation @ 5% per annum**.

The **water consumption charges** [based on the prevalent rates of KoPT, as may be amended from time to time] shall have to be paid by the Contractor immediately, on receipt of the bill from the office of the Finance Division, Haldia Dock Complex. All payment on this account should be updated, otherwise the pending bill amount, along with late payment surcharge, will be recovered from the Contractor's bill(s).

37.0 Tests on completion:

On completion of installation, the contractor shall give a 7 (seven) days' notice to the Engineer [with a copy to the PMC, appointed by KoPT], in writing (informing the date on which they will be ready to make the tests/ inspection), before carrying out such tests, in accordance with and in the manner prescribed in the specifications.

If any portion of work fails under the tests to fulfil the contract conditions, tests of the faulty portion shall, if required by the PMC (appointed by KoPT) or the Engineer or by the Contractor, be repeated within reasonable time, upon the same terms and conditions.

If such "Tests on completion" cannot be carried out successfully by the Contractor within 1 (one) month after the time fixed by the Contractor and if, in opinion of the Engineer, the tests are being unduly delayed, the Engineer may, in writing, call upon the Contractor, with 7 (seven) days' notice, to make such tests, failing which the Engineer may proceed to make such tests himself, at the Contractor's risk and expense. In the above eventuality, the Employer shall, nevertheless, have the right of using the installations at the Contractor's risk until the "Tests on completion" are successfully carried out.

It will be the obligation of the contractor to arrange for PESO, OISD-156 certification on behalf of Haldia Dock Complex, Kolkata Port Trust. PMC, appointed by KoPT, will recommend to the Engineer regarding final completion of the work (excluding O&M for 10 years).

38.0 Intellectual Property Rights: All rights over all designs, drawings, layouts, manuals etc, (as recommended by PMC who will be appointed by KoPT), regarding Design, manufacture, fabrication, supply, erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) will have to be transferred, in the time of handing over, to the HDC, KoPT and there after the contractor will have no rights over design, drawings, layouts, manuals etc (detailed list will be firmed up by the PMC who will be appointed by KoPT).

39.0 Insolvency: Will be applicable as per current provision of law.

PART-1

SECTION – VIII

BIDDING FORMS

BIDDING FORM – I

MINIMUM ELIGIBILITY CRITERIA

[To be filled up and uploaded, duly signed & stamped]

(I) ANNUAL TURNOVER STATEMENT

The annual turnover of ……..(name of the bidding firm), **for the years 2015-16, 2016-17 and 2017-18** , based on the **Balance Sheets and Profit & Loss Accounts, are given below:**

Financial years	**Turnover** (as per Auditor's Report / Balance Sheet) **[in ₹]**
2015-2016	
2016-2017	
2017-2018	
Total	
Average Annual Turnover	

NAME OF CHARTERED ACCOUNTANT ::

(COMPANY SEAL) ::

NOTE : Copy of Balance Sheets and Profit & Loss Accounts enclosed with sealed & signed.

(II) TECHNICAL EXPERIENCE

Sl. No.	Contract No. / Order No. and date	Name of the Employer and Place of work	Contract value [in ₹]	Date of completion of work	Page number(s) of reference / supporting document (s), uploaded.

BIDDING FORM-II

TEST OF RESPONSIVENESS

[To be filled up and uploaded, duly signed & stamped]

	Requirement	Submitted/Not submitted [Put √ if submitted & X if not submitted]	Validity/ For the month of
a)	scanned copies of work order(s) for similar works, successful completion certificates (with performance) from clients indicating the date of completion, value of work done, etc.	☐ If submitted, **Page Number(s)**:	
b)	scanned copies of Annual Financial Turnover Statement (certified by CA) for the years 2015-16, 2016-17 and 2017-18 along with Balance Sheets and Profit & Loss Accounts.	☐ If submitted, **Page Number(s)**:	
c)			
i)	**GST Registration Certificate**.	☐ If submitted, **Page Number(s)**:	Not applicable.
ii)	Document in support of non-applicability.	☐ If submitted, **Page Number(s)**:	Not applicable.
d)			
i)	**Profession Tax Clearance Certificate (PTCC)**	☐ If submitted, **Page Number(s)**:	
	OR **Profession Tax Payment Challan (PTPC)**	☐ If submitted, **Page Number(s)**:	
ii)	Document in support of non-applicability.	☐ If submitted, **Page Number(s)**:	Not applicable.

	Requirement	Submitted/Not submitted [Put √ if submitted & X if not submitted]	Validity/ For the month of
e)			
i)	Certificate for allotment of **EPF Code No.**	☐ If submitted, **Code No**.: **Page Number(s)**:	Not applicable.
ii)	Latest **EPF Payment Challan**.	☐ If submitted, **Page Number(s)**:	
iii)	Document in support of non-applicability.	☐ If submitted, **Page Number(s)**:	Not applicable.
f)			
i)	**Registration Certificate** of **ESI Authority**.	☐ If submitted, **Code No**.: **Page Number(s)**:	Not applicable.
ii)	Affidavit, Declaration and Indemnity Certificate.	☐ If submitted, **Page Number(s)**:	Not applicable.
g)	**PAN Card**	☐ If submitted, **PAN No**.: **Page Number(s)**:	Not applicable.
h)	**MSME / MSE / DIC / SSI / NSIC** certificate	☐ If submitted, **Page Number(s)**:	
i)	**Power of Attorney**	☐ If submitted, **Page Number(s)**:	Not applicable.
j)	**Joint Venture Agreement or a Consortium (if applicable)**	☐ If submitted, **Page Number(s)**:	

BIDDING FORM-III

GENERAL INFORMATION OF THE BIDDER

[To be filled up and uploaded, duly signed & stamped]

1.	Bidder's Legal Name (IN CAPITAL LETTERS)		
2.	a)	Country of registration.	
	b)	Year of registration.	
	c)	Legal address in country of registration.	
	d)	URL of the bidder.	
3.	Information regarding bidder's authorised representative(s) / contact person(s)		
	a)	Name(s)	
	b)	Address(es)	
	c)	Telephone number(s)	
	d)	Facsimile number(s)	
	e)	Electronic mail address	

4.	a)	Address of the branch office, if any	
	b)	Name of the contact person at branch office	
	c)	Telephone number(s)	
	d)	Facsimile number(s)	
	e)	Electronic mail address	
5.	Whether the bidder is a **Proprietorship Firm** or **Partnership Firm** or **Limited Company**.		
6.	**Details of the Banker(s)** :		
	a)	Name of the Banker(s) in full.	
	b)	Address(es) of the Banker(s)	
	c)	Telephone number(s)	
	d)	Facsimile number(s)	
	e)	Electronic mail address	
	f)	Name(s) of the contact person(s)	
7.	**Bank details for ECS payment** :		
	a)	Bank Account number.	
	b)	Name of the bank.	
	c)	Name of the branch.	
	d)	Address of the branch.	
	e)	RTGS code of the branch.	
	f)	MICR code of the branch.	
8.	**Income Tax** and **Goods & Services Tax (GST)** details (if applicable):		
	a)	**Permanent Account Number** (**PAN**)	

	b)	**GST Registration Number (GSTIN)**	
9.	**Employees' Provident Fund** (**EPF**) **Code No**.		
10.	**Employees' State Insurance** (**ESI) Code No**.		
11.	Mainlines of business		

BIDDING FORM-IV

FORMAT FOR DECLARATION

[To be printed on the bidder's Letter Head and uploaded after signing]

To,
General Manager (Engg.)
Haldia Dock Complex ;
Kolkata Port Trust.

Name of Work: "Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."

Tender No. : SDM(P&E)T/34/2018-2019

E-Tender No.: KoPT/Haldia Dock Complex/P&E Div/38/18-19/ET/381

I ……., the authorized signatory of the ……. (Name of the Company /Firm) do hereby declare / confirm that :

***** I **/** We have not been **debarred**, **banned** or **delisted** by any Government or Quasi-Government Agencies or Public Sector Undertakings in India**.**

I / we have not made any **addition / modification / alteration** in the **Bidding Documents** (including Bidding Forms & Contract Forms) hosted in the websites.

The prices have been quoted in the Price Bid, electronically, through the website of MSTC Ltd. only and no direct or indirect mention of the prices has been made by me / us anywhere else in my / our bid.

No extraneous conditions (like "Not Applicable", conditional rebate, etc.), regarding the Price Bid, have been mentioned anywhere in our bid.

Signature of authorised person of the bidder
(with office seal)

***** In case the **firm** has been debarred or banned or delisted by any Government or Quasi-Government Agencies or Public Sector Undertaking in India, then the same should be declared properly, after modifying the sentence, suitably.

BIDDING FORM-V

FORM OF TENDER

[To be printed on the bidder's Letter Head and uploaded after signing]

To,
General Manager (Engg.)
Haldia Dock Complex ;
Kolkata Port Trust.

Name of Work: *:* ***"Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."***

Tender No. : SDM(P&E)T/34/2018-2019

E-Tender No.: KoPT/Haldia Dock Complex/P&E Div/38/18-19/ET/381

I/We …..……. (Name of the bidder) …….of ……..……(Address of the bidder) ……. having **examined the site of work**, **inspected the drawings** and read the **bidding documents** [including **all addenda / corrigenda,** issued i.e. ……. {insert Addendum / Corrigendum / Extension No(s)}], hereby bid and undertake to execute & complete all the work related to **"**Design, manufacture, fabrication, supply, erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for ten years**."**, required to be performed in accordance with the **Technical Specification**, **General Conditions of Contract (GCC)**, **Special Conditions of Contract (SCC),** etc., at the **rates & prices** quoted in the **Price Bid** [*submitted electronically, through the website of **MSTC Ltd.***], within ……month from the date of order to commence the work , in the event of our bid being accepted.

I/we also undertake to enter into a **Contract Agreement** in the form hereto annexed [**Section XI**] with such alterations or additions thereto, which may be necessary to give effect to the acceptance of the bid and incorporating such **Technical Specification**, **General Conditions of Contract (GCC)**, **Special Conditions of Contract (SCC),** etc. and I/we hereby agree that until such **contract agreement** is executed, the said **Technical Specification, General Conditions of Contract (GCC)**, **Special Conditions of Contract (SCC),** etc. and the bid, together with the acceptance thereof in writing, by or on behalf of the Employer, shall be the contract.

I / We require ……..days preliminary time to arrange and procure the materials, tools & tackles, etc. required by the work, from the date of acceptance of bid, before I/we could commence the work.

I / We have deposited …….**only** using the **Axis Bank Payment Gateway**, vide **URN No.**:……. …… of ……, as **Earnest Money Deposit**.

I/We agree that the period for which the bid shall remain open for acceptance, shall not be less than **……. days**, from the last date of submission of bid.

(Signature of authorised person of the bidder)

WITNESS:
Signature:

Name : _____

Name:
(In Block Letters)

Designation : _____

Address:

Date : _____

Occupation:

(Office Seal)

Integrity Pact

Between

Kolkata Port Trust (**KoPT**) hereinafter referred to as "The Principal/Employer"

And

…… hereinafter referred to as "The Bidder/Contractor"

Preamble

The Principal intends to award, under laid down organizational procedures, contract/s for "Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years." The Principal values full compliances with all relevant laws of the land, rules, regulations, economic use of resources and of fairness / transparency in its relations with its Bidder(s) and/or Contractor(s).

In order to achieve these goals, an Independent External Monitor (IEM) appointed by the principal, will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the PRINCIPAL/EMPLOYER to get the contractual work executed and/or to obtain/dispose the desired said stores/equipment at a competitive price in conformity with the defined specifications/scope of work by avoiding the high cost and the distortionary impact of corruption on such work/procurement/disposal and Enabling BIDDERs/CONTRACTORs to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the PRINCIPAL/EMPLOYER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

Section-1 – Commitments of the Principal/Employer:

(1) The Principal commits itself to take measures necessary to prevent corruption and to observe the following principles:

a. No employee of the Principal, personally or through family members, will, in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

b. The Principal will, during the tender process, treat all Bidder(s) with equity and reason. The Principal will, in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

c. The Principal will exclude from the process all known prejudiced persons.

(2) If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal Code (IPC)/Prevention of Corruption (PC) Act, or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

Section-2 – Commitments of the Bidder(s)/Contractor(s):

(1) The Bidder(s)/Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

a. The Bidder(s)/Contractor(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

b. The Bidder(s)/Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bid or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

c. The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act; further the Bidder(s)/Contractor(s) will not use improperly, for purpose of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details including information contained or transmitted electronically.

d. The Bidder(s)/Contractor(s) of foreign origin shall disclose the name and address of the Agents/representative in India, if any. Similarly the Bidder(s)/Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principals, if any. Further details as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/Contractor(s). Further, as mentioned in the Guidelines, all the payments made to the Indian Agent/representative have to be in Indian Rupees only. Copy of the "Guidelines on Indian Agents of Foreign Suppliers" is annexed and marked as Annex-"A".

e. The Bidder(s)/Contractor(s) will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

(2) The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section-3 – Disqualification from tender process and exclusion from future contracts:

If the Bidder(s)/Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or take action as considered appropriate.

Section-4 – Compensation for damages:

(1) If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/Bid Security.

(2) If the Principal has terminated the contract according to Section 3 or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the contract value or the amount equivalent to Performance Bank Guarantee.

Section-5 – Previous transgression:

(1) The Bidder declares that no previous transgressions occurred in the last 3 years from the date of signing the Integrity pact with any other Company in any country conforming to the anti corruption approach or with any other Public Sector Undertakings/Enterprise in India, Major Ports/Govt. Departments of India that could justify his exclusion from the tender process.

(2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken as considered appropriate.

Section-6 – Equal treatment of all Bidders/Contractors/Sub-contractors:

(1) The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.

(2) The Principal will enter into agreements with identical conditions as this one with all Bidders, Contractors and Sub-contractors.

(3) The Principal will disqualify from the tender process all Bidders who do not sign this Pact or violate its provisions.

Section-7– Other Legal actions against violating Bidder(s)/Contractor(s)/Sub-contractor(s):

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with provisions of the extant law in force relating to any civil or criminal proceedings.

Section-8 –Role of Independent External Monitor (IEM):

(a) The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this pact.

(b) The Monitors shall not be subject to instructions by the representatives of the parties and shall perform their functions neutrally and independently.

(c) Both the parties accept that the Monitors have the right to access all the documents relating to the contract.

(d) As soon as the Monitor notices, or has reason to believe, a violation of this pact, he will so inform the authority designated by the Principal and the Chief Vigilance Officer of Kolkata Port Trust.

(e) THE BIDDER(s)/CONTRACTOR(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the PRINCIPAL including that provided by the BIDDER/CONTRACTOR. The BIDDER/CONTRACTOR will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation, if any. The same is applicable to subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the Bidder/Contractor/Sub-contractor(s) with confidentiality.

(f) The Principal/Employer will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor, the option to participate in such meetings.

(g) The Monitor will submit a written report to the designated Authority of Principal/Employer/Chief Vigilance Officer of Kolkata Port Trust within 8 to 10 weeks from the date of reference or intimation to him by the Principal/Employer/Bidder/Contractor and should the occasion arise, submit proposals for correcting problematic situation. BIDDER/CONTRACTOR can approach the Independent External Monitor(s) appointed for the purposes of this Pact.

(h) As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or to take corrective action, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

(i) If the Monitor has reported to the Principal substantiated suspicion of an offence under the relevant IPC/PCA, and the Principal/Employer has not, within reasonable time, taken visible action to proceed against such offence or reported to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

(j) The word 'Monitor' would include both singular and plural.

Section-9 – Facilitation of Investigation:

In case of any allegation of violation of any provisions of this Pact or payment of commission, the PRINCIPAL/EMPLOYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER/CONTRACTORS and the BIDDER/CONTRACTOR shall provide necessary information and documents **in English** and shall extend all possible help for the purpose of such examination.

Section-10 – Pact Duration:

The Pact begins with when both parties have legally signed it and will extend up to 2 years or the complete execution of the contract including warranty period whichever is later. In case bidder/contractor is unsuccessful this Integrity Pact shall expire after 6 months from the date of signing of the contract.

If any claim is made/lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/determined by Chairman of KoPT.

Section-11 – Other Provisions:

(1) This agreement is subject to Indian Law. Place of performance and jurisdiction is the Registered Office of the Principal in Kolkata.

(2) Changes and supplements as well as termination notices need to be made in writing in English.

(3) If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

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

_____ _____

(For & on behalf of the Principal) (For & on behalf of Bidder/Contractor)

(Office Seal) (Office Seal)

Place :

Date :

Witness 1: Witness 1:
(Name & address) ……. (Name & address) ……..

……..
……..

……..
……..

Witness 2:
(Name & address) ……..

……..
……..
……..
……..

Witness 2:
(Name & address) ……..

BIDDING FORM-VII

PRICE SCHEDULE

[To be filled up and uploaded, duly signed & stamped]

"Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."

Sl No	DESCRIPTION	QTY.	Applicable GST %		
			CGST	SGST	IGST
1.	"Design, fabrication/casting, supply, Erection of pre-casting elements (if any), testing, commissioning and handing over all offshore civil work required for the Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II as per scope of work detailed in the tender document..	**1 Unit**			
2.	"Design, fabrication/casting, supply, Erection of pre-casting elements (if any), testing, commissioning and handing over all onshore civil work such as firefighting pumphouse, pipe rack pedestals and fire water tank foundation and control rooms super structures required for the Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems as per scope of work detailed in the tender document..	**1 Unit**			
3.	Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over of all mechanical, pipeline works for fire fighting system as per OISD-156(2017) including electrical & instrumentation and necessary gas detection system of Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems as per scope of work detailed in the tender document..	**1 Unit**			
4. (a)	Operation & Maintenance for 1st Year, i.e. during defect liability period of EPC Contract.	12 Months			
4. (b)	Operation & Maintenance for 2nd Year, i.e. during defect liability period of EPC Contract.	12 Months			

4. (c)	Comprehensive Operation & Maintenance for 1st Year, i.e. after defect liability period.	12 Months			
4. (d)	Comprehensive Operation & Maintenance for 2nd Year.	12 Months			
4 (e).	Comprehensive Operation & Maintenance for 3rd Year.	12 Months			
4. (f)	Comprehensive Operation & Maintenance for 4th Year.	12 Months			
4. (g)	Comprehensive Operation & Maintenance for 5th Year.	12 Months			
4. (h)	Comprehensive Operation & Maintenance for 6th Year.	12 Months			
4. (i)	Comprehensive Operation & Maintenance for 7th Year.	12 Months			
4. (j)	Comprehensive Operation & Maintenance for 8th Year.	12 Months			
4. (k)	Comprehensive Operation & Maintenance for 9th Year.	12 Months			
4. (l)	Comprehensive Operation & Maintenance for 10th Year.	12 Months			

NOTE:

a. The Tenderer shall furnish the quoted amount online through MSTC only.

b. The Tenderer shall furnish applicable GST.

DATE:

TENDERER

SEAL

PART-1

SECTION – IX

CONTRACT FORMS

PART-1
SECTION – IX-A
FORM OF AGREEMENT

(To be submitted on Non- Stamp Paper of worth not less than INR 50.00)

CONTRACT NO. : GM(E)/……/ /AGMT/……./……..

TENDER REFERENCE:

Tender No**. : SDM(P&E)T/34/2018-2019**

E- Tender No. : KoPT/Haldia Dock Complex/P&E Div/38/18-19/ET/381

for : **"Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."**

ORDER REFERENCE: …… / ...../ /O-… dated ……

This agreement made this …….. day of …….. , Two thousand ……. ,

BETWEEN

The Board of Trustees for the Port of Kolkata, a body corporate -- constituted by the Major Port Trust Act, 1963 (hereinafter called the '**Trustees**', which expression shall unless excluded by or repugnant to the context be deemed to include their successors iEn office) of the one part

AND

…….. (hereinafter called the "**Contractor"**, which expression shall unless excluded by or repugnant to the context be deemed to include its heirs, executors, administrators, representatives and assignees or successors in office) of the other part

[Together hereinafter the "Parties"]

HEREAS

The Trustees are desirous that certain works should be executed by the Contractor, viz. " Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for ten years." and have accepted a Bid / offer by the Contractor for execution, completion and maintenance of such works, including remedying any defects therein, during the Defect Liability Period.

NOW THIS AGREEMENT WITNESSETH as follows :

1. In this agreement words and expression shall have the same meanings as are respectively assigned to them in **Conditions of Contract** hereinafter referred to.

2. The following documents shall be deemed to form and be read and construed as part of this agreement :

a) The said bid / offer.

b) The Letter of Acceptance of the bid /offer [vide Order No. ...../ ……/……./O-… dated …….]

c) The Conditions of Contract and **Technical Specification** [all terms and conditions of Tender No. SDM(P&E)T/34/2018-2019].

d) Addenda [Please insert Addenda Nos. ……....]

e) "Price Comparative Statement", showing the prices quoted (electronically, through the website of MSTC Ltd.) by the Successful Bidder, in the Price Bid.

f) All correspondence, by which the contract is added, amended, varied or modified, in any way, by mutual consent.

3. In Consideration of the payments to be made by the Trustees to the Contractor as hereinafter mentioned, the Contractor hereby covenant with the Trustees to execute, complete & maintain the work, including remedy any defects therein (during the Defect Liability Period"), in conformity with the provisions of the Contract, in all respects.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed the day and year first before written.

The parties hereunto affixed their respective Common Seals (or have hereunto set their respective hands and seals).

For and on behalf of	For and on behalf of
HALDIA DOCK COMPLEX KOLKATA PORT TRUST (TRUSTEES)	(CONTRACTOR)
SEAL	**SEAL**
In presence of	**In presence of**

PART-1

SECTION- IX-B

INDEMNITY BOND

[To be submitted on Non-judicial Stamp Paper of worth not less than INR .50.00, **duly notarised**]

Reference:

Order No.: ……../……./……./O-… dated ……. for **"Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."**

Senior Deputy Manager (**P&E**)**,**
Haldia Dock Complex ;
Operational Administrative Building (1st Floor) ;
Chiranjibpur, P.O.: Haldia ;
Dist. : Purba Medinipur ,
West Bengal, India
PIN : –721 604

This deed of **Indemnity Bond** made on …… by ……. having their office at …… (hereinafter called "the **Contractor**").

Whereas the General Manager (Engineering), **Haldia Dock Complex**, **Kolkata Port Trust**, Dist.: Purba Medinipur, West Bengal (hereinafter call "the **Engineer**") has placed an order, bearing no. SDM(P&E) / /……./O-… dated ……. and some materials, spare parts, components, sub-assemblies, etc. are required to be taken **outside** of **Haldia Dock Complex** premises for some specialized servicing, repairing, overhauling, etc. or **fault diagnosis** & **remedial measures** by the Contractor, as per the terms & conditions mentioned in the said order, and which have been mutually agreed upon by the parties hereto,

AND

Whereas in consideration of the said contract, the Contractor has agreed to execute an **Indemnity Bond** for the safe custody on receipt of the said materials, spare parts, components, sub-assemblies, etc., from the **Engineer** until the **completion of servicing / overhauling / repairing / remedial work** and returning back to the Engineer as hereinafter appearing.

Now this deed witnessed that in pursuance of the said agreement and in the premises, the Contractor agrees to indemnify Engineer and at all the terms, to hold themselves liable for all the **damages**, **loss** due to **pilferage** / **fire** or negligence on the part of the Contractor or their employees, agents and representatives or from whatever cause, with all losses, interest charges and expenses incurred by the said Engineer on account of the material(s) issued to the Contractor,

AND

It is in terms of the said contract and this **Deed of Indemnity,** the material(s) issued free to the Contractor for servicing / overhauling / repairing / **fault diagnosis & remedial work,** thereon shall be deemed to be the **property of the Engineer**.

It is hereby agreed that the Contractor shall be liable for all injury, losses and damages that may be caused to the ……., from whatever cause and further that the Contractor shall not part with or delivery possession of the said material(s) to any other party or person, save in compliance with and in performance & provision of contract in respect of which this **Indemnity Bond** is executed, the Contractor having undertaken to delivery the said material (s) in all respect in compliance with the terms of the contract.

This bond and the trust hereby created shall remain valid and binding on the Contractor till such time as the above said order has been fully and finally executed and Contractor has delivered the …….. complete thereon to the Engineer under the terms of the contract.

For and on behalf of (name of the Contractor), under the common seal of the company.

WITNESS

(Signature)

Name :

Designation

(Signature of the authorised person on behalf of the Contractor)

Name :

Designation

Signed in my presence and identified by me

PART-1

SECTION-IX-C

BANK GUARANTEE FOR PERFORMANCE GUARANTEE

[To be submitted on Non-judicial Stamp Paper of worth not less than INR 50.00]

To
The Board of Trustees,
for the Port of Kolkata.

BANK GUARANTEE NO..... DATE.....

Name of Issuing Bank.....

Name of Branch..... ……

Address.....

In consideration of the **Board of Trustees for the Port of Kolkata**, a body corporate – duly constituted under the Major Port Trusts Act, 1963 (Act 38 of 1963), (hereinafter referred to as "**The Trustees**") having awarded to Shri / Messrs **……..,** a Proprietary/ Partnership/Limited / Registered Company, having its Registered Office at **……** (hereinafter referred to as "**The Contractor**", which expression shall unless repugnant to the context or meaning thereof include its successors, administrators, executors and assigns), a **CONTRACT** by issue of Trustees' Work Order No. …… / ……./……./O-….. dated ……. for **"Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."** and the same having been unequivocally accepted by the Contractor resulting in a **CONTRACT** bearing No. **GM(E)/ / /AGMT/……./……..** and the Contractor having agreed to provide a **BANK GUARANTEE** from a Nationalized / Scheduled Bank of India, in prescribed format for **₹……. (Indian Rupees …….)** only, for the faithful and satisfactory performance of the entire contract .

, ... Branch, Kolkata ...../Haldia, do, on advice of the Contractor, hereby undertake to indemnify and keep indemnified the stees to the extent of the said sum of **₹……. (Indian Rupees …….)** only. We, ... ……..... .....Branch, Kolkata ... ./Haldia, her agree that if a written demand is made by the Trustees through any of its officials for ouring the Bank Guarantee constituted by these presents, we,..... ..... Branch, Kolkata ...../Haldia, shall have no right to decline to cash the same any reason whatsoever and shall cash the same and pay the sum so demanded to the stees within a week from the date of such demand by an A/c Payee Banker's Cheque wn in favour of "Kolkata Port Trust", without any demur. Even if there be any dispute ween the Contractor and the Trustees, this would be no ground for us, ... (Name of Bank), ... Branch, Kolkata ..../Haldia, to decline to honour Bank Guarantee in the manner aforesaid. The very fact that we, ...

.....Branch, Kolkata..... ...../Haldia, decline or fail or neglect to honour Bank Guarantee in the manner aforesaid, shall constitute sufficient reason for the Trustees enforce the Bank Guarantee unconditionally without any reference, whatsoever, to the ntractor.

2. We, ...' Branch, Kolkata ..../Haldia, further agree that a mere demand by the Trustees at anytime and in the manner aforesaid, is sufficient for us, ...Branch, Kolkata ....Haldia, to pay the amount covered by this Bank Guarantee in full and in the manner aforesaid and within the time aforesaid without reference to the Contractor and no protest by the Contractor, made either directly or indirectly or through court, can be valid ground for us, ... Branch, Kolkata .....Haldia, to decline or fail or neglect to make payment to the Trustees in the manner and within the time aforesaid.

3. We,... ... ... Branch, Kolkata ..../Haldia, further agree that the Bank Guarantee herein contained shall remain in full force and effect, during the period that is taken for the due performance of the said contract by the Contractor and that it shall continue to be enforceable till all the dues of the Trustees under and/or by virtue of the terms and conditions of the said contract, have been fully paid and its claim satisfied and/or discharged in full and/or till the Trustees certify that the terms and conditions of the said contract have been fully and properly observed/fulfilled by the Contractor and accordingly, the Trustees have discharged the Bank Guarantee, subject however, that this guarantee shall remain valid upto and inclusive of .....day of..... ..200.....and subject all so that the provision that the Trustees shall have no right to demand payment against this guarantee after the expiry of 6 (six) calendar months from the expiry of the aforesaid validity period upto.....or any extension thereof made by us, ...Branch, Kolkata..... .....Haldia, in further extending the said validity period of this Bank Guarantee on Non-judicial Stamp Paper of appropriate value, as required / determined by the Trustees, only on a written request by the Trustees to the Contractor for such extension of validity of this Bank Guarantee.

4. We, ...Branch, Kolakta .. ../Haldia, further agree that, without our consent and without affecting in any manner our obligations hereunder, the Trustees shall have the fullest liberty to vary from time to time any of the terms and conditions of the said contract or to extend the time for full performance of the said contract including fulfilling all obligations under the said contract by the Contractor or to postpone for any time or from time to time any of the powers exercisable by the Trustees against the Contractor and to forebear or enforce any of terms and conditions relating to the said contract and We,.. ... ...Branch, Kolkata... ..../Haldia, shall not be relieved from our liability by reason of any such variation or extension being granted to the Contractor or for any fore-bearance, act or commission on the part of the Trustees or any indulgence by the Trustees to the Contractor or by any such matter or thing of whatsoever nature, which under the law relating to sureties would, but for this provision, have effect of so relieving us, ...Branch, Kolkata ... ./Haldia.

5. We, ……. Branch, Kolkata ... ./Haldia do also agree that the Trustees at their option shall be entitled to enforce this Guarantee against us ....Branch, Kolkata ... ./Haldia as principal debtor in the first instance without producing against the Contractor and notwithstanding any

security or other guarantee that the Trustees may have in relation to the Contractor's liabilities.

6. We,..... ... .-. ... ...Branch, Kolkata... ... .../Haldia, lastly undertake not to revoke this Bank Guarantee during its currency except with the previous consent of the Trustees in writing.

SIGNATURE... .....

NAME……..

DESIGNATION.....

(Duly constituted attorney for and on behalf of)

BANK. . . .., ...

BRANCH... ……..

KOLKATA... ...../HALDIA

(OFFICIAL SEAL OF THE BANK)

PART-1
SECTION-IX-D

Kolkata Port Trust
Haldia Dock Complex
CERTIFICATE OF COMPLETION OF WORK

Contractor : _____

Address : _____

_____

Date of completion : _____

Dear Sir,

Subject : **: "Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."** at Haldia Dock Complex, Kolkata Port Trust.

Reference :

i) **Work Order No**.: ...../……../…….O-… dated ……

ii) **Contract No./ Agreement No**. : ...../……/……/ AGMT / ……./

This is to certify that the above work which was carried out by you is, in the opinion of the undersigned, complete in every respect on the _____ day of _____ 20____, in accordance with terms of the contract and you are required to maintain the work in accordance with **GCC Clause No. 7.67** of the General Conditions of Contract and under provisions of the contract.

(Signature of the Engineer/Engineer's Representative)

Name: ……..……..…..

Designation: ……

Date: ……

(OFFICIAL SEAL)

PART-1
SECTION-IX-E

Kolkata Port Trust
Haldia Dock Complex
CERTIFICATE OF FINAL COMPLETION

General Manager (**Finance**),
Haldia Dock Complex (**HDC**),
Jawahar Tower Complex,
P.O: **Haldia Township**,
Dist.: **Purba Medinipur**,
PIN – 721 607,
West Bengal, **India**.

Subject : **"Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years."**
.

Reference :
i) **Work Order No**.: ...../……../……./O-… dated ……

ii) **Contract No./ Agreement No**. : ...../……/……/ AGMT / ……./

This is to certify that the above work, which was carried out by ……. is now complete in every respect, in accordance with the terms of the contract and that all obligations under the contract have been fulfilled by the Contractor.

(Signature of the Engineer/Engineer's Representative)

Name: …….……..…..

Date: ……

Designation: ……

PART-1
SECTION-IX-F

("NO CLAIM CERTIFICATE" FROM CONTRACTOR)

[To be submitted on Bidder's Letter Head]

General Manager(Engineering)
Haldia Dock Complex ;
Kolkata Port Trust.
Engineering Department
Jawahar Tower Complex ;
P.O.: Haldia Township;
Dist.: Purba Medinipur ;
PIN: –721607
West Bengal, India.

Dear Sir,

Subject : **"Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years." at Haldia Dock Complex, Kolkata Port Trust.**

Reference :

i) **Work Order No**.: ...../……../……./O-… dated ……

ii) **Contract No./ Agreement No**. : ...../……/……/ AGMT / ……./

I/We do hereby declare that I/we have received full and final payment from Haldia Dock Complex, Kolkata Port Trust, for the execution of the subject work, and I/we have no further claim against Haldia Dock Complex, Kolkata Port Trust in respect of the above mentioned job.

Yours faithfully,

(Signature of Contractor)

Date : ……
Name of Contractor : ……
Address : ……..

(OFFICIAL SEAL OF THE CONTRACTOR)

PART-1

SECTION – X

CHECKLIST

Before scanning and upload the following required documents, all pages are to be signed by a person duly authorised to sign on behalf of the bidder, and are to be embossed with their official seal, owing responsibility for their correctness / authenticity. All pages of the aforesaid documents should be serially marked.

*The offered prices would be given in the "**Price Bid** (Part-II)" electronically, through the website of **MSTC Ltd.** only.*

Sl. No.	Particulars	Submitted/ Not submitted [Put √ if submitted and put X if not submitted]	If submitted, page numbers
1.	**Filled up checklist.**	☐	☐
2.	Proof of **Bid Document Fee**.	☐	☐
3.	Poof of **Earnest Money Deposit** (EMD).	☐	☐
4.	Certificate of getting benefit by MSME / SSI / NSIC for exemption of **Bid Document Fee** and **Earnest Money,**	☐	☐
5.	**Bidding Forms**		
	i) **Bidding Form – I**	☐	☐
	ii) **Bidding Form - II**	☐	☐
	iii) **Bidding Form – III**	☐	☐

Sl. No.	Particulars		Submitted/ Not submitted [Put √ if submitted and put X if not submitted]	If submitted, page numbers
	iv)	**Bidding Form - IV**		
	v)	**Bidding Form – V**		
	vi)	**Bidding Form - VI**		
	vii)	**Bidding Form - VII**		

***Note:** This Commercial Terms & Condition (Volume-1) should be read along with the Technical Part (volume-2) of the of the Tender document.

PART-1

SECTION- XI

Bill of Quantities

Tentative Bill of Quantities for OT-II, HOJ-I&II and BJ-I&II

Bill of Quantities for augmentation of Fire Fighting Facilities in compliance with OISD-156 standard of HOJ-1,HOJ-2 & 2 Nos. Barge Jetties, HDC Complex, Kolkata Port Trust						
	Tentative Bill of Quantities for Civil Work					
Sl.No.	**Description**	**Quantity**	**units**	**Applicable GST%**		
				CGST	**SGST**	**IGST**
(A)	**Construction**					
1	Control Room - (20M X 10M) for HOJ-1	200	Sq.M			
	a.)Sub structures	348	Cu.m			
	b.)Interiors		Lot			
2	Control Room - (20M X 10M) for HOJ-2					
	a.)Modification & Interiors		Lot			
3	Control Room - (10M X 10M) for BJ-1& BJ-2	100	Sq.M			
	a.)Sub structures & Deck Slab	222	Cu.m			
	b.)Interiors		Lot			
4	Tower monitor foundation					
	a.) Sub-Structure	1184.4	Cu.m			
	b.) Super Structure		Lot			
5	Pipe pedetals					
	a.) Delivery line from OT-II Pump House to Hoj-II - 32"	134	Nos.			
	b.)Deliver line from HOJ-II to HOJ-I-32"	105	Nos.			
	c.)Delivery line for HOJ-1 to BJ-1 & BJ-2-24"	150	Nos.			
6	**Firefighting pipeline trestle**					
7	**Connecting walkway (Tower Monitor to Jetty Head)**					

(B)	**Procurement**					
1	Pipelines					
	a.) 32" Delivery line from OT-II Pump House to HOJ-II	800	Mtrs.			
	b.)32" Delivery line for HOJ-1 & HOJ-2	1450	Mtrs.			
	c.)24" Delivery Line for BJ-1 & BJ-2	1400	Mtrs.			
	d.)4" SS line	3650	Mtrs.			
	e) 3" SS line for ROV instument air	3650	Mtrs.			
	f.)3" MS line	3650	Mtrs.			
2	Quick release mooring hook	8	Nos.			
3	Foam booster pumps - 40m3/hr at 17kg/cm2	2	Nos.			
4	Remote operated Tower Monitors - 360m3/hr	6	Nos.			
5	Jumbo nozzles -360 m3/hr	6	Nos.			
6	Monitors	8	Nos.			
7	Air comprsor with Dryer for instruments	2	Nos.			
6	Potable fire equipments		Lot			
(C)	**Fabrication and Erection**					
2	Pipelines					
	a.) 32" Delivery line from OT-II Pump house to HOJ-II	800	Mtrs.			
	b.)32" Delivery line for HOJ-1 & HOJ-2	1450	Mtrs.			
	c.)24" Delivery Line for BJ-1 & BJ-2	1400	Mtrs.			
	d.)4" SS line	3650	Mtrs.			
	e) 3" ss pipe line for	3650	Mtrs.			
	f.)3" MS line	3650	Mtrs.			
3	Equipments					
	a.)Tower Monitors	6	Nos.			
	b.)Jumbo Nozzles	6	Nos.			
	c) Form boster pumps	2	Nos.			
	d) Air compresser	2	Nos.			
	e) ss tubeing for instumentation	1	Lot			
	f.) Monitors	8	Nos.			
5	Grit blasting and Painting for pipe lines					
	a.) 32" Delivery line from OT-II to HOJ-II	2042	Sq.M			
	b.)32" Delivery line for HOJ-1 &	3702	Sq.M			

	HOJ-2					
	c.)24" Delivery Line for BJ-1 & BJ-2	2682	Sq.M			
	d.)3" MS line	1008	Sq.M			
(D)	**Electrical and Instrumentation**					
	a.) Panels	1	Lot			
	b.) Power Cables	1	Lot			
	c.) Cables Trays	1	Lot			
	e.)Control Cables		Lot			
	f.)Pressure Transmitters/Switches	20	No.			
	g.)Pressure Gauges	23	No.			
	h.)Flow Transmitters	3	No.			
	i.)Deluge Valves	6	No.			
	j.)PLC	3	No.			
	k.) Control Systems	3	No.			
	l.) Fire Detection System	3	No.			
	m.)Gas Detection System	3	No.			
	n.)Power Back Up	1	No.			
	o.)Compressor	3	No.			

Tentative Bill of Quantities for OT-II

Augmentation of Fire Fighting Facilities in compliance with OISD-156 standard of OT-II, HDC Complex,Kolkata Port Trust						
Sl.No.	**Description**	**Quantity**	**Units**	**Applicable GST**		
				CGST	**SGST**	**IGST**
(A)	**Facilities at landfall area near OT-II jetty**					
1	**Fire Water Tanks(Each 10000 KL)-2 nos.**					
	a.) Foundation for 2 tank-nos.	5064	Cu.m			
	b.)Plates	752	Tons			
	c.)Nozzles for tanks-2 nos.		Lot			
	d.)Structural steels for tanks-2 nos.	150	MT			
	e.)Initial filling of Water for Fire Water Tanks each 10000 KL	1	Lot			
	f.)Sump (for filling water to tanks)-5 M x 3 M x 2 M	19	Cum.			
2	**Pump House**					
	a.)Pump house - (50M X 12M)	600	Sq.M			
	b.)Foundation for Pumps	70	Cu.m			
	c.)EOT Crane - 10T capacity	1	No.			

3	**Civil Pedestals for Suction Header**					
	a.)Suction Header-32"	8	Nos.			
4	**Pipe material cost for suction header**					
	a.) 32" Pipe line	42	Mtrs.			
5	**Pump equipment cost**					
	a.)Diesel driven pumps - 720 m3/hr at 16kg/cm2	6	Nos.			
	b.)Jockey pumps - 70m3/hr at 16kg/cm2	3	Nos.			
	c.)Foam pumps - 40m3/hr at 17kg/cm2	2	Nos.			
6	**Equipments erection cost in F.W.P.House**					
	a.)10 Ton Crane	1	no.			
	b.)Pumps	11	nos.			
7	**Painting,Scaffolding & Sand Blasting cost for tanks**					
	a.)Grit Blasting for tanks-2 nos.	10978	Sq.M			
	b.)Painting for tanks- 2nos.	10978	Sq.M			
	c.)Scaffoldoing for tanks - 2nos.	6531.2	Sq.M			
8	**Fabrication and Erection cost for tank & suction header**					
	a.)Tanks	1	Nos.			
	b.) 32" Suction Header Line	42	Mtrs.			
(B)	**Facilities at Jetty end**					
1	**Control Room**					
	a.)size: 20 M x 10 M	200	Sq.M			
	b.)Interiors		Lot			
2	**Pipe pedetals for F.W. Network**					
	a.)Deliver line for OT-II -24"	42	Nos.			
3	**Valves & Fittings**					
	a.)Flanges and fittings		Lot			
	b.)Valves		Lot			
4	**Pipe material cost**					
	a.) 14" Re-circulation line	60	Mtrs.			
	b.)24" Delivery line for OT-II	250	Mtrs.			
	c.)4" SS line	250	Mtrs.			
	d.)3" MS line	250	Mtrs.			
	e.) 3" Air line	250	Mtrs.			

5	**Grit blasting and Painting for pipe lines**					
	a.) 32" Suction Header Line	107	Sq.M			
	b.) 14" Re-circulation line	66	Sq.M			
	b.)24" Delivery line	480	Sq.M			
	e.)3" MS line	70	Sq.M			
	f.) 3" MS for Air line	70	Sq.M			
6	**Fabrication and Erection**					
	a.) 14" Re-circulation line	60	Mtrs.			
	b.)24" Delivery line for OT-II	250	Mtrs.			
	c.)4" SS line	250	Mtrs.			
	d.)3" MS line	250	Mtrs.			
	e.) 3" Air line	250	Mtrs.			
(C)	**Fire Fighting System**					
1	**Firefighting Equipment cost**					
	a.)Remote operated Tower Monitors - 360m3/hr	3	Nos.			
	b.)Jumbo nozzles -360 m3/hr	3	Nos.			
	c.)Monitors	4	Nos.			
	d.)Potable fire equipments		Lot			
2	**Equipments erection cost**					
	a.)Tower Monitors	3	nos.			
	b.)Jumbo Nozzles	3	nos.			
	c.) Monitors	4	nos.			
(D)	**Electrical & Instrumentation**					

PART-1

SECTION- XII

DRAWINGS/ DOCUMENTS TO BE SUBMITTED ALONG WITH THE TECHNICAL BID

The following documents (as is applicable) shall be submitted by the Contractor for the technical bid evaluation:

TABLE – 1

S No.	DESCRIPTION	REMARKS
1.	Tentative P&ID of the proposed jetties firefighting facilities	
2.	Design Basis Report in compliance with the OISD-156	
3.	List of man power to be deployed for the above said contract	
4.	Proposed organogram of the construction site	
5.	List of man power to be deployed for the O&M Contract	
6.	The proposed organogram of the O&M Contract	
7.	Project Schedule for the project	
8.	The bidder should submit all the tentative drawings of the tender has to be submitted with official seal as a token of acceptance	

PART-1

SECTION- XII

BANK GUARANTEE FOR EARNEST MONEY

[**To be submitted on Non-judicial Stamp Paper of worth not less than INR 50.00**]

Tender No. SDM(P&E) T/34/2018-2019

Name of work:
Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years, Haldia Dock Complex, Kolkata Port Trust, Dist.: Purba Medinipur, West Bengal, India.

To,
The Board of Trustees,
for the Port of Kolkata.

BANK GUARANTEE NO. …..... DATE .....

Name of issuing Bank .....

Name of Branch ……..... ……

Address .....

WHEREAS

The Board of Trustees for the Port of Kolkata, a body corporate – duly constituted under the Major Port Trust Act, 1963 (Act 38 of 1963), (hereinafter referred to as "The Trustees") have invited Tender No. **SDM(P&E) T/34/2018-2019** (hereafter referred to as "The Bid") for the work of **Design, manufacture, fabrication, supply, Erection, testing, commissioning and handing over Fire-fighting facilities at HOJ-I, HOJ-II, Barge Jetty I&II and upcoming Outer Terminal –II (OT-II) under two cover systems including Comprehensive operation and maintenance for 10 (ten) years after defect liability period of 02 (two) years, Haldia Dock Complex, Kolkata Port Trust, Dist.: Purba Medinipur, West Bengal, India.**
AND WHEREAS

Shri / Messrs ……... a Proprietary / Partnership / Limited / Registered Company, having its Registered Office at …… ……. (hereinafter referred to as " The Bidder", which expression shall mean and include their successors and assigns) have submitted their offer against the Bid.

AND WHEREAS

One of the terms of the Bid being that the Bidder may submit Earnest Money in the form of an irrevocable and unconditional Bank Guarantee as a security against the event of the Bidder withdrawing their offer on any

ground whatsoever during the period of validity of the offer and/or the Bidder fails to enter into Contract despite the Trustees select the Bidder as the successful Tenderer against the Bid,

We, ... Branch, Kolkata ...../Haldia, do hereby issue our irrevocable and unconditional Guarantee in favour of The Trustees for a sum of **……..** only.

We, ... Branch, Kolkata ...../Haldia, do, on the advice of the Bidder, hereby undertake to indemnify and keep indemnified the Trustees to the extent of the said sum of **……..** only.

We, ... …….....Branch, Kolkata ... ./Haldia, further agree that if a written demand is made by the Trustees through any of its officials for honouring the Bank Guarantee constituted by these presents, We,..... ..... Branch, Kolkata ...../Haldia, shall have no right to decline to cash the same for any reason whatsoever and shall cash the same and pay the sum so demanded to the Trustees within a week from the date of such demand by an A/c Payee Banker's Cheque drawn in favour of "Kolkata Port Trust", without any demur. Even if there be any dispute between the Bidder and the Trustees, this would be no ground for us, ... (Name of Bank), ... Branch, Kolkata ..../Haldia, to decline to honour the Bank Guarantee in the manner aforesaid. The very fact that we, ...Branch, Kolkata..... ...../Haldia, decline or fail or neglect to honour the Bank Guarantee in the manner aforesaid, shall constitute sufficient reason for the Trustees to enforce the Bank Guarantee unconditionally without any reference, whatsoever, to the Bidder.

2. We, ...' Branch, Kolkata ..../Haldia, further agree that a mere demand by the Trustees at anytime and in the manner aforesaid, is sufficient for us, ...Branch, Kolkata ..../Haldia, to pay the amount covered by this Bank Guarantee in full and in the manner aforesaid and within the time aforesaid without reference to the Bidder and no protest by the Bidder, made either directly or indirectly or through Court, can be valid ground for us, ... Branch, Kolkata ...../Haldia, to decline or fail or neglect to make payment to the Trustees in the manner and within the time aforesaid.

3. We,... ... ... Branch, Kolkata ..../Haldia, further agree that the Bank Guarantee herein contained shall remain in full force and effect, during the entire validity period of the Bid including any extension thereof until the Bidder furnishes the requisite Performance Guarantee for the amount specified in the Tender in the prescribed Form in the event of the Bidder becoming the successful Tenderer and that it shall continue to be enforceable in the Trustees' claim have been satisfied and/or discharged in full and/or till the Trustees certify that the terms and conditions of the said Bid have been fully and properly observed/fulfilled by the Bidder and accordingly, the Trustees have discharged the Bank Guarantee, subject however, that this guarantee shall remain valid upto and inclusive of .....day of..... ..201.....and subject all so that the provision that the Trustees shall have no right to demand payment against this guarantee after the expiry of 6 (six) calendar months from the expiry of the aforesaid validity period upto.....or any extension thereof made by us, ...Branch, Kolkata..... ...../Haldia, in further extending the said validity period of this Bank Guarantee on Non-Judicial Stamp Paper of appropriate value, as required / determined by the Trustees, only on a written request by the Trustees to the Bidder for such extension of validity of this Bank Guarantee.

4. We, ...Branch, Kolkata .. ../Haldia, further agree that, without our consent and without affecting in any manner our obligations hereunder, the Trustees shall have the fullest liberty to vary from time to time any of the terms and conditions of the said Bid or to extend the validity period of the Bid or to postpone for any time or from time to time any of the powers exercisable by the Trustees against the Bidder and to forebear or enforce any of terms and conditions relating to the said Bid and We,.. ... ...Branch, Kolkata... ..../Haldia, shall not be relieved from our liability by reason of any such variation or extension being granted to the Bidder or for any fore-bearance, act or commission on the part of the Trustees or any indulgence by the Trustees to the Bidder or by any such matter or thing of whatsoever nature, which under the law relating to sureties would, but for this provision, have effect of so relieving us, ...Branch, Kolkata ... ./Haldia.

5. We,..... ... .-. ... ...Branch, Kolkata... ... .../Haldia, lastly undertake not to revoke this Bank Guarantee during its currency except with the previous consent of the Trustees in writing.

SIGNATURE …….....
NAME
…….……
……..
DESIGNATION
…….....
(Duly constituted attorney for and on behalf of)

BANK
……
……
BRANCH ….....……..
KOLKATA …...../HALDIA

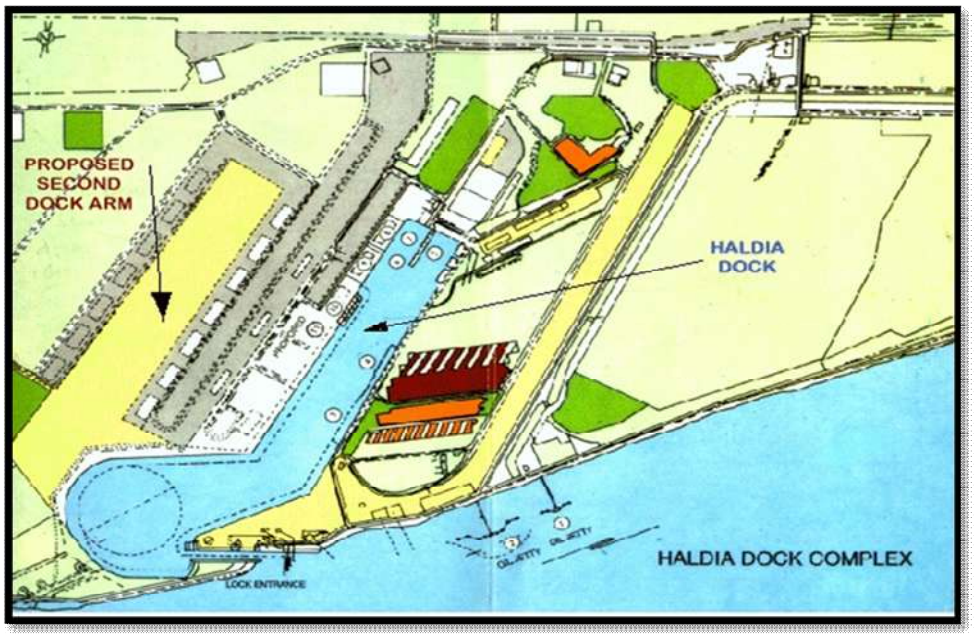
(OFFICIAL SEAL OF THE BANK)

Note:

i) In case of foreign Bank Guarantee, it shall be routed through any Branch of corresponding Nationalized/Scheduled Bank in India and such corresponding Bank shall confirm the same and standby for all the commitments under the Bank Guarantee. In all cases, any dispute regarding Bank Guarantee will be adjudicated under the jurisdiction of The Calcutta High Court.

ii) In case the Bank Guarantee is submitted from/routed through a foreign branch of a Nationalized/ Scheduled Bank of India, the Bank Guarantee submitted not on Non-judicial Stamp Paper may also be acceptable.

Volume- 2 of 2: Technical Part
[Tender No. SDM (P&E)/T/34/2018-19]
TENDER DOCUMENT
FOR AUGEMENTATION OF
FIRE FIGHTING SYSTEM
ATOT-II, HOJ-1, HOJ-2, BJ-1 AND BJ-2



Consultant
Prof. R. SUNDARAVADIVELU., FNAE

DEPARTMENT OF OCEAN ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI – 600 036

KOLKATAPORT TRUST
HALDIA DOCK COMPLEX

SECTION-1 INTRODUCTION

SECTION 2 – ENGINEERING PROCUREMENT AND CONSTRUCTION

SECTION 5 - TECHNIAL SPECIFICATIONS- FIRE FIGHTING EQUIPMENTS

5.2.33 Packaging and Indentification

5.3 Functional Specification for Centrifugal Pump

5.3.1 General
5.3.2 Codes & Standards
5.3.3 Mandatory Indian Statutory Requirements
5.3.4 Scope of Supply
5.3.5 Environmental Design Criteria
5.3.6 Basic Design
5.3.7 Pressure Casing Design
5.3.8 Impeller, Shaft and Shaft Sleeves
5.3.9 Mechanical Seal/Packing
5.3.10 Bearings
5.3.11 Base Plate
5.3.12 Pumps for fire water application
5.3.13 Materials
5.3.14 Inspection & Testing
5.3.15 Warranty
5.3.16 Spare parts & tools
5.3.17 Preparation for shipment
5.3.18 Documentation/Vendor's Data

5.4 Functional Specification for Diesel Engine

5.4.1 General
5.4.2 Codes & Standards
5.4.3 Scope of Supply
5.4.4 Environmental Design Criteria
5.4.5 Basic Design
5.4.6 Rated power output and specific fuel consumption
5.4.7 Engine Starting System
5.4.8 Engine fuel system
5.4.9 Engine jacket cooling system
5.4.10 Combustion air intake and engine exhaust system
5.4.11 Governing
5.4.12 Name Plate

14.6 Cement

14.7 Water

14.8 Admixtures In Concrete

14.9 Reinforcement Steel

14.10 Structural Steel (General Use)

14.11 Cast Iron

14.12 Fasteners

14.13 Electrodes

14.14 Quick Release Mooring Hooks and Capstans (Remote Controlled)

14.15 High Density Polyethylene Pipes

14.16 Other Materials

14.17 Equivalent Materials

14.18 Workmanship

14.18.1.1 Standards

14.18.1.2 Work to be provided for by the Contractor

14.18.1.3 No Concreting without approval

14.18.1.4 Design Mix Concrete

14.18.1.5 Minimum Cement Content and Maximum Water Cement Ratio

14.18.1.6 Proportioning of Concrete

14.18.1.7 Density of Concrete

14.18.1.8 Water-Cement Ratio of Concrete

14.18.1.9 Consistency

14.18.1.10 Slump

14.18.1.11 Batching

14.18.1.12 Exposure

14.18.1.13 Sampling And Testing For Strength

14.18.1.14 Mixing

14.18.1.15 Remixing Of Concrete

14.18.1.16 Transporting Concrete

14.18.28.4 Lifting, Handling and Placing of Pre-Cast Units

SECTION 15 - SCOPE OF WORK FOR CIVIL

15.1 General
15.2 Detailed Scope of Work
15.3 Onshore structures
- 15.3.1 Electrical/Instrument Cable road crossings
- 15.3.2 RCC Sleepers
- 15.3.3 Earthwork & Site Grading
- 15.3.4 Roads and approaches
- 15.3.5 Pipe supports/Pipe racks/Trestles/cable trays/road crossing for pipes & cables
- 15.3.6 RCC pavements
- 15.3.7 Tank Foundation
- 15.3.8 Pump House
- 15.3.9 Foundation for structures and equipments
- 15.3.10 Control Room

15.4 Offshore Structures
- 15.4.1 Tower Monitors
- 15.4.2 Hand railing
- 15.4.3 Foot paths/ Emergency walkways
- 15.4.4 Control Room

15.5 Miscellaneous
15.6 General Codes

SECTION 16 –Operations & Maintenance

17.1 Fire Protection System, Inspection and Testing
17.2 Firewater Pumps
17.3 Firewater Ring Main
17.4 Firewater Spray System
17.5 Tower Monitor Foam System
17.6 Clean Agent Fire Extinguishing System
17.7 Hoses
17.8 Communicationssystem
17.9 Fire Emergency Manual

SECTION 17 –DRAWINGS

ATTACHED AS ANNEXURES SEPARATELY

SECTION - 1

1. INTRODUCTION

1.1 About Project

Haldia Dock Complex (HDC) is proposed to do the augmentation of fire fighting system

for the existing jetties viz. (LPG-40000 DWT),HOJ-1(LPG-40000 DWT),HOJ – 2 (LPG-40000 DWT),BJ-1(POL-3000 DWT) and BJ-2 (3000 DWT) and new fire fighting facilities at OT-II as per OISD-156 for handling of vessels at their different jetties to handle of liquid cargoes including Propane, Butane, LPG and POL products. HDC would like to install fire-fighting system as per OISD -156 standards. New Fire fighting system shall be provided ,Installation and commissioning of such fire fighting system should be carried out along with the civil works without hampering the day to day operations when the work in the progress of HOJ-1, HOJ-2,BJ-1 & BJ-2 and since OT-II new jetty there is no is civil work hampering will occur in day to day operations.

1.2 Description of Project

Now HDC is planning to upgrading and augmentation of their fire fighting systems for the following jetties:

i. HOJ – 1
ii. HOJ – 2
iii. BJ – 1
iv. BJ – 2
v. OT-II (green field fire fighting system)

Fire fighting facilities for the OT-2 jetty

1. Fire Fighting control room interiors with false floor at 100 Meters away from the manifold
2. Fixed Tower monitors as per OISD 156 with foam facilities
3. Water curtain with required number of Jumbo nozzles
4. Adequate number of ground monitors with foam facilities on the jetty
5. Adequately sized hydrant lines with double hydrants of the manifold area of the jetty
6. The marine associated civil works for the fire fighting system are included in the main jetty works.
7. All structural works which are required for the fire fighting system.
8. Electrical and instrumentation system for the operations of the OT-2 terminal
9. Entire interiors and instruments like tower monitor control system, gas-detection systems, UPS and PLC systems.

Fire fighting facilities for the HOJ-2 jetty

1. Revamping of the existing Fire Fighting control room with necessary interiors with false floor
2. The fire fighting including associated marine civil works for the tower monitors and the hydrant pipeline trestle .
3. Fixed Tower monitors as per OISD 156 with form facilities
4. Water curtain with required number of Jumbo nozzles
5. Adequate number of ground monitors with form facilities on the jetty
6. Adequately sized hydrant lines with double hydrants of the manifold area of the jetty
7. All structural works which are required for the fire fighting system.
8. Electrical and instrumentation system for the operations of the HOJ-2 terminal
9. Entire interiors and instruments like tower monitor control system, gas-detection systems, UPS and PLC systems.

Fire fighting facilities for the HOJ-1 jetty

1. Construction of the Fire Fighting control room with necessary interiors with false floor at Minimum 100 Meters away from the jetty pipeline manifold including associated marine civil works.
2. The fire fighting including associated marine civil works for the tower monitors and the hydrant pipeline trestle
3. Fixed Tower monitors as per OISD 156 with form facilities
4. Water curtain with required number of Jumbo nozzles
5. Adequate number of ground monitors with form facilities on the jetty
6. Adequately sized hydrant lines with double hydrants of the manifold area of the jetty
7. All structural works which are required for the fire fighting system.
8. Electrical and instrumentation system for the operations of the HOJ-1 terminal
9. Entire interiors and instruments like tower monitor control system, gas-detection systems, UPS and PLC systems.

Fire fighting facilities for the Barge jetties.

1. Construction of the Fire Fighting control room with necessary interiors with false floor for the both barge jetties, associated the marine civil works.

2. Adequate number of ground monitors with form facilities on the barge.
3. Adequately sized hydrant lines with double hydrants of the manifold area of the barge
4. All structural work's modifications which are required for the fire fighting system.
5. Electrical and instrumentation system for the operations of the terminal
6. Entire interiors and instruments like tower monitor control system, gas-detection systems, UPS and PLC systems.

OT-II, HOJ-1, HOJ-2,BJ-1 & BJ-II : Haldia Dock Complex is proposed new fire fighting system at **OT- II, HOJ-1, HOJ-2,BJ-1 & BJ-II** as per OISD-156 for handling LPG vessels at OT-II, HOJ-1 & HOJ-2 for handling 40000 DWT Propane, Butane, LPG vessels and **BJ-1& BJ-2** for handling 3000 DWT POL and LPG barges.

The HDC would also like to install fire-fighting system as per OISD -156 standards for this jetty. As per OSID-156 for handing 40000 DWT LPG vessels and 100000 DWT POL vessels the water requirement would be 17280 KL. So we have done fire water design calculations by consider single fire contingency as per OISD-156. The details of fire water pumps and storage fire water reservoirs are as under:

Hence the no. of fire water pumps requirement would be 720 M3/hr @16 kg/cm2 - 6 nos. (4 working + 2 standby) , Jockey pumps capacity would be 70 m3/hr @ 16 kg/cm2 (2 working + 1 stand by) and foam pumps capacity would be 40 M3/hr (1 working + 1 stand by). At OT-II, HOJ-1 and HOJ-2 three independent no. of tower monitors capacity of each 6000 lpm and three independent nos. of Jumbo nozzles capacity of each 6000 lpm will be installed. These tower monitors as well as jumbo nozzle will be operated and controlled by PLC based control system which will be installed in dedicated control room and Four independent fire water monitors & Hydrants of 600 lpm shall be provided at OT-II,HOJ-I and HOJ-2 and Two independent fire water monitors and hydrants shall provided at BJ-1 & BJ-2.

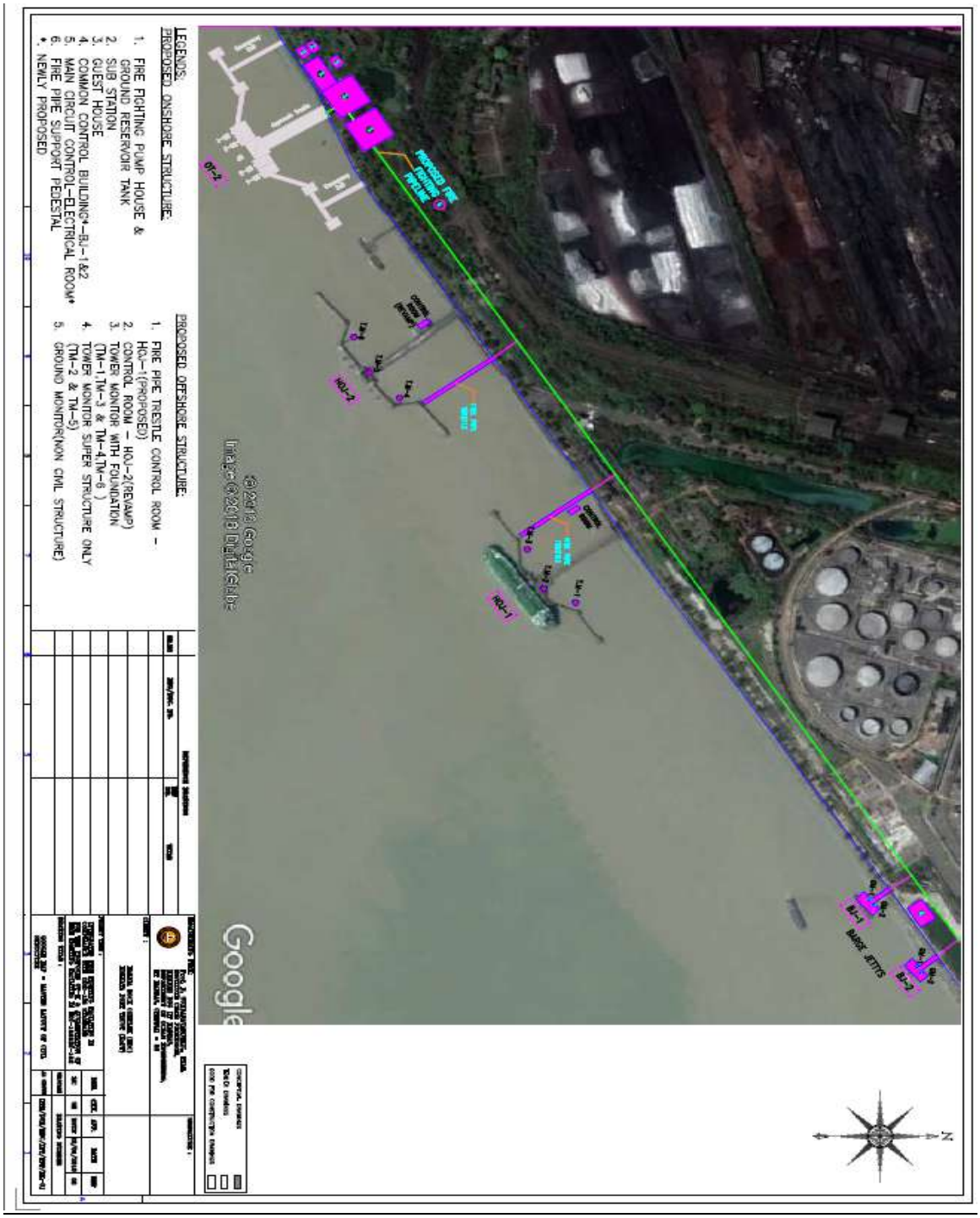
Two dedicated above grounded steel tank capacity of each tank is 10000 KL will be built in order to meet water demand calculations as per OISD-156. These tanks will be constructed as per API-650 and ASTM A 106 Gr.B pipe line will be laid from pump house to HOJ-1 to supply water for tower monitor as well as jumbo nozzles in case of any fire.

A common fire pump house will constructed in which main pumps, jockey pumps, foam pump will be accommodated in the pump house and 10 Ton EOT crane will be erected for erection and maintenance of these pumps nearer to HOJ-II jetty.

And individual control rooms will be construed for each jetty which will control the main fire pumps, jockey pumps, tower monitors, jumbo nozzles, fire detection system and gas detection will be done.

As per OISD-156 the jockey pumps should always ON and OFF in auto mode whenever line pressure drop to 7 kg/cm2 with help of pressure switch/transmitter where as the main pumps should ON in auto mode and it should OFF in manual mode.

1.3 Site Location


LEGENDS:
PROPOSED ONSHORE STRUCTURE:
1. FIRE FIGHTING PUMP HOUSE & GROUND RESERVOIR TANK
2. SUB STATION
3. GUEST HOUSE
4. COMMON CONTROL BUILDING*+BJ-1&2
5. MAIN CIRCUIT CONTROL-ELECTRICAL ROOM*
6. FIRE PIPE SUPPORT PEDESTAL
*. NEWLY PROPOSED
PROPOSED OFFSHORE STRUCTURE:
1. FIRE PIPE TRESTLE CONTROL ROOM - HOJ-1(PROPOSED)
2. CONTROL ROOM - HOJ-2(REVAMP)
3. TOWER MONITOR WITH FOUNDATION (TM-1,TM-3 & TM-4,TM-6)
4. TOWER MONITOR SUPER STRUCTURE ONLY (TM-2 & TM-5)
5. GROUND MONITOR(NON CIVIL STRUCTURE)
PROPOSED FIRE FIGHTING PIPELINE
OT-2
HOJ-2
HOJ-1
BJ-1
BJ-2
BARGE JETTY
Google
Image © 2018 DigitalGlobe
N

1.4 Project Scope:

The facility requirement at various sites is as mentioned in the following table

Sl. No.	Facilities	OT-II	HOJ-1	HOJ-2	BJ-1	BJ-2
I	**Ship Size**	Upto 100,000 DWT POL Products and for LPG-upto 40000 DWT as per table-1&2 of OISD-156	Upto 100,000 DWT POL Products and for LPG-upto 40000 DWT as per table-1&2 of OISD-156	Upto 100,000 DWT POL Products and for LPG-upto 40000 DWT as per table-1&2 of OISD-156	Max. POL barge size should not be exceed 3000DWT as per table-1&2 of OISD-156	Max. POL barge size should not be exceed 3000DWT as per table-1&2 of OISD-156
1	Fire water network with all Necessary equipment & components	Fire water system with all necessary equipments & components shall be provided as per OISD-156. The pipeline sizing has to be done as per the OISD-156 requirements by considering minimum 7kg pressure at the farthest point of the fire hydrants of OT-II,HOJ-I,HOJ-2 and BJ-I and II.				
2	Installation of new pumps & it's associated piping, electrical, instrumentation, Civil work etc	All fire water main pumps both operating & standby pump should be with diesel prime mover of capacity (approx.) 6 x 720 M3/hr @ 16 bar (4 workings + 2 Standby) and three jockey pumps of capacity(approx.) 70 M3/hr @ 16 Bar (2 working + 1 Standby) may be supplied and installed to keep network pressurized as per OISD-156 latest edition.				
3	Fire Water	Water storage requirement for fire protection facilities based on OISD 156 guidelines and it is for 6 hours of				

	Reservoir	running capacity of pumps with portable fire Water Reservoir capacity 17,280 KL(approx.). So that TWO independent fire water tanks of capacity 24 M x 20 M as per API-650 with internal and external epoxy painting shall be provided nearer to HOJ-II, OT-II to cater all five jetties				
4	Pump House	New RCC common pump house with 10 Ton EOT Crane of size 51 M x 12 M not less than this size, to accommodate all fire water pumps, jockey pumps and foam pumps and foam tanks.				
5	Panels for pumps in control room pump house	Yes, as per requirement				
6	Fire fighting equipments viz					
	a.)Tower Monitors	3 x 5678 LPM	3 x 5678 LPM	3 x 5678 LPM	Monitors : 2 x 1892 lpm	Monitors: 2x 1892 lpm
	b.)Jumbo Nozzles	3 x 6000 LPM	3 x 6000 LPM	3 x 6000 LPM		2 x 300 lpm
	c.)Under Deck Nozzle		-----	27 nos.(approx.)	---	--
	d)Water Hydrants & Water monitors		4 nos.	4 nos.	Hydrants & monitors: 2 nos.(approx.)	Hydrants & Monitors: 2 nos.(approx.)
7.	Foam pump capacity and Foam tank capacity	Foam pump = 40 M3 per hr @ 17 Bar (1 working + 1 standby) Foam Tank Capacity: 80 M3				
8	New Foam	Yes, as per requirement				

	tank with level indicator (radar type), manhole, filter capacity of 150 mm dia. With SS strainer, Breather valve, sludge trap, drain valve, lifting hooks,operating platform & ladder facility					
9	Fire fighting Control room	Control room as per requirement of size minimum of 15M x 12 M	Control room as per requirement of size minimum of 10M x 20 M	Existing HOJ-II control room will be revamped by providing necessary interiors, false flooring and painting.	Common Control room for BJ-I&II as per requirement of size minimum of 6M x 6 M.	
10	Entire remote control system including	As per design requirements of OISD-156.	As per design requirements of OISD-156.	As per design requirements of OISD-156.	As per design requirements of OISD-156.	As per design requireme

	instrumentation and electrical and electronic equipments with associated SCADA system.					nts of OISD-156.
11	EOT crane	10 TON capacity				
12	Compressor	The sizing of the compressor aas per the requirement of OISD-156 requirements.				
13	Fire Detection System	As per design requirements of OISD-156.	As per design requirements of OISD-156.	As per design requirements of OISD-156.	As per design requirements of OISD-156.	As per design requirements of OISD-156.
14	Gas Detection System	As per design requirements of OISD-156.	As per design requirements of OISD-156.	As per design requirements of OISD-156.	Not required	Not required
15	Fire Fighting equipments	As per the requirements of OISD-156 and PESO.	As per the requirements of OISD-156 and PESO.	As per the requirements of OISD-156 and PESO.	As per the requirements of OISD-156 and PESO.	As per the requirements of OISD-156 and PESO.

16	Lighting	Lux level requirements as per the relevant OISD/IS	Lux level requirements as per the relevant OISD/IS	Lux level requirements as per the relevant OISD/IS	Lux level requirements as per the relevant OISD/IS	Lux level requirements as per the relevant OISD/IS
17	Water Spray nozzles	As per design requirements of OISD-156.	As per design requirements of OISD-156.	As per design requirements of OISD-156.	Not required	Not required

1.5 Design Period:

Design life of the entire facility shall be 25 years.

1.6 Piping:

Piping MOC shall be ASTM A106 Gr B Std. Schedule.

1. 7 Civil

Detail scope of civil will be available in Table 1

1.8 Electrical systems

Power for operating various equipment like pumps and lighting shall be drawn as per single line diagrams. The requirements in SLD is minimum & indicative, Contractor shall carry out his own design and arrive at the requirements. Electrical systems as required at various locations as mentioned in PART NO.3 in Table No.2

1.9 Instrumentation

Details scope of instrumentation will be available in the subsequent chapters.

1.10 Miscellaneous

Vents, Drains, isolation valves wherever required shall be provided by Contractor during detailed engineering.

During Fabrication /erection, requirement of power, water, air, handling crane, welding equipment at site shall be in the Contractor scope.

1.11 Underground cables/Piping/ Abandoned Foundations:

During execution of work, Contractor shall identify and inform the COMPANY about underground facilities like cables, piping or abandoned foundations encountered in the current project sites and affecting the current scope of works. These facilities shall be re-routed/re-located by the Contractor with prior intimation & due approval of HDC.

1.12. Site Condition

1.12.1 Wind data

For the purpose of design of the berth, wind loads have been considered with the following wind velocities.
Basic wind speed = 50m/sec

Wind speed in operating condition = 24m/sec

1.12.2 Tidal data

As per IPA report June 2016 details received, the tidal data are tabulated in Table- 3.1.

Table 3.1.Tidal Level

Description	Level (m)
Highest High Water (HHW)	(+) 7.26 m CD
Mean High Water Spring (MHWS)	(+) 5.70 m CD
Mean High Water (MHW)	(+) 5.01 m CD
Mean High Water Neaps (MHWN)	(+) 4.26 m CD
Local Mean Water Level (LMWL)	(+) 3.23 m CD
Mean Low Water Neaps (MLWN)	(+) 2.10 m CD
Mean Low Water (MLW)	(+) 1.34 m CD
Mean Low Water Springs (MLWS)	(+) 0.80 m CD
Lowest Low Water (LLW)	(-) 0.07 m CD

1.12.3 Current Data

- The maximum flow velocity may be considered as 3.00 m/s for both way water flows as per the client recommendation.

1.12.4 Rainfall Data

- This region is mainly exposed to south-west monsoon from June to September and

an average monthly rainfall of over 250 mm is experienced (July and August are the wettest months having monthly rainfall as high as 400 mm).

- During north-west monsoon from November to February monthly average rainfall of less than 50 mm is experienced.
- The average annual rainfall is around 1500 mm and the average number of rainy days in a year with rainfall of 25mm or more is about 20.

1.12.5 Temperature

- In Haldia, there is a seasonal variation in the temperature. April and May are hotter month whereas December and January is colder months.
- The highest temperature so far recorded is 44.9°C during the month of May in 1975 and the lowest temperature is 6.9°C recorded during the month of December 1975. Design range of effective temperature is (+/-) 25°C.

1.12.6 Visibility

It is learnt that visibility at Haldia is better compared to Kolkata as the area is free from industrial smoke. At times due to heavy rain poor visibility is reported during the south-west monsoon. On an average fog is reported on 5-7 days in each month from November to February during mornings.

.1.13. Definition of Terms:

Following definitions apply to this specification:

- "Employer" means Board of Trustees of Haldi Dock Complex, Kolkata Port Trust, a body corporate under the Major Port Trust Act, 1963 by Government of India (as amended) acting through its Chairman, Deputy Chairman or the Chief Manager (Port Planning and Development Department) or any other officers so nominated by the Board.
- “Engineer” means the Project Management Consultant (PMC) appointed by the employer. The Engineer shall have a team of experienced professional and support staff headed by the Team Leader for the execution of the Consultancy Service under the Contract including liaising with headquarters of consultant as and when required.
- “Engineer’s Representative” means the Team Leader of the Project Management

Consultant and he shall be resident at the project site and act as representative of the Engineer.

- "Design Consultant" means Consultant appointed by the employer to finalise the design of fire fighting pump house & jetty fire fighting systems as per OISD 156 and issue Goods for Construction (GFC) drawings for the civil & fire fighting works and modify the same to suit site conditions as and when required.
- "Contractor" means the successful bidder for this project.
- "Vendor" Means the specialized agency supplying equipment and material.

SECTION 2

ENGINEERING, PROCURMENT AND CONSTRUCTION

2.1 Codes Standards

Installations shall be designed, engineered to the state of the art technology, supplied and constructed in conformity with the Contract after reconfirmation and carrying out residual basic engineering and detailed engineering by Contractor for which Contractor will take full responsibility. The design shall comply with technical requirements set forth in technical specifications as per applicable codes, standards and regulations and Good Industry Practices. The Contractor to note that the information provided in the technical specifications mentioned in this document may be improved / supplemented by additional information / data. The Contractor shall incorporate such information / data without time and cost impact. Design shall be in accordance with the climatic conditions of river and saline air atmosphere, marine corrosive environment, high humidity & dust.

Contractor may also suggest and submit to the approval of the Engineer:

a) Other international codes and standards no less severe in all respects than those listed and specified in the Technical Documents, and / or

b) Contractor's own design and specifications provided they are compatible and at least equal in standard with those listed and specified in the Technical Documents.

It shall be noted that requirements of Governmental Authority, Chief Controller of Explosive of e.g. Petroleum and Explosives safety Organization (PESO), Nagpur, India, Oil Industries Safety Directorate (OISD-156) shall govern when these are more stringent than requirements specified in the technical specifications mentioned in this document.

Due care shall be exercised such that the installations afford ease of construction and expansion, start-up and commissioning, repair and maintenance and shall be safe to operate under all conditions.

2.2 Deliverables

The Contractor shall prepare all drawings and design documents, design specifications and any other information in drawings and documents form, required by Engineer’s

Representative and in accordance with job requirements and site condition. Preliminary drawings shall not be used for procurement or construction purpose. Contractor shall also be responsible for providing all drawings and document for packages/ sub packages supplied by its Suppliers/JV Partners.

The contractor is responsible to get the approval from the PESO for the jetty fire fighting system upgradation and commissioning permission for all the 5 jetties after completing the fire fighting system augmentation. The necessary documentation and official letters will be issued by the Port(since all the government approvals should be in the name of KoPT). The drawings and technical write-ups shall be arranged by the contractor only.

The fire fighting facilities scope shall consists of:

1. Fire Water Reservoir
2. Fire Water Pump House
3. Electrical Substation (PCC & MCC)
4. Fire Hydrant System
5. Tower Monitors
6. Ground Monitors
7. Jumbo Water Curtains
8. Under Deck Fire Fighting System (only for Steel Piles)
9. Fixed Foam System
10. Fixed International Shore Connection
11. Gas/Flame Detection System
12. Manual Call Point System
13. Remote Control Valves
14. Remote Control Panels
15. Flame proof Electrical Fittings on the jetty
16. The entire jetty illumination has to be done as per OISD guidelines
17. PLC System & Control Cables
18. DCP protection system
19. The entire list of portable firefighting equipment's as per OISD-156
20. First Aid Fire Equipment
21. Fire Alarm/Communication System

2.3 Detailed Engineering

Contractor shall perform all detailed engineering required for the works and including, without limitation, the following. However, detailed scope of work of each discipline has been explained in the respective sections.

a) Preparation of design philosophy / basis

b) Design and preparation of "Approved for Construction" drawings,

c) Preparation of equipment data-sheets after incorporating all engineering input,

d) Inputs for preparation of P&IDs

2.3.1 Electrical Engineering

Engineering activities to be performed by Contractor shall also include, but shall not be limited to, the following:

- Electrical load list and load analysis
- Power system studies which include load flow studies, short circuit analysis, motor starting studies and harmonic analysis.
- Preparation of single line diagrams.
- Preparation of hazardous area classification schedule and layout drawings.
- Main electrical equipment sizing calculation such as transformers, bus duct, DG set, AC UPS, DC system, batteries, power factor control equipment.
- Selection of motors.
- Sizing of HV/MV/LV cables.
- Selection of HV/LV switchgear, PMCC, MCC, distribution boards.
- Detailed engineering which includes detail calculation and preparation of layouts for cabling, lighting, earthing & lighting protection systems.
- Preparation of power and control cable schedules.
- Procurement engineering
- Field / shop inspection and testing procedures,
- Preparation of the material take off,
- Preparation of installation standards,
- Soil resistivity measurement for earthing system design

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2.3.2 Mechanical / Piping / Fire Fighting Engineering

- Development of Mechanical Specifications
- Requisitions
- Technical Evaluations
- Review of Supplier Documentation to Contract Requirements
- Project Interface Documentation Review
- Technical Coordination with Suppliers

2.3.3 Instrumentation and Control Engineering

- Design Basis for I&C
- Specifications & Data Sheets for control panels for Fire Fighting, Tower monitor,
- Instruments, cables, DV, valves
- Cable Schedule
- Cable & Cable tray Route Layout
- BOQ
- Instrument list (if applicable)
- I/O list

2.4 Procurement

2.4.1 General

Contractor shall provide the control and co-ordination of all procurement activities, maintain all necessary records, issue all required reports, and take all necessary measures and required follow up action for the successful completion of the procurement function.

Contractor shall propose in detail the various records and reports to be maintained and issued, which Engineer's Representative shall review, and all requirements of PMC agency shall be taken into consideration in the finalization of such records and reports. All procurement status reports shall be issued as part of the progress reports.

The Employer's personnel will be trained at Supplier's shop or Site (as decided by Employer) by the Contractor or his Suppliers for the operation and the maintenance of various packages, equipment, etc. If applicable and technically feasible, level of training

should be such that maintenance "password" of PLCs is passed on to Employer's personnel.

Contractor shall provide warranty, performance guarantee for the systems and packages, operation guarantee of the material and equipment supplied by him as well as guarantee against defective workmanship for installation work carried out by Contractor.

2.4.2 Procurement Activities

Procurement activities shall include, but shall not be limited to:

a) Procurement planning for equipment and materials,

b) Preparation of detailed specifications related to Purchase Requisitions.

c) Purchasing and supply of permanent or provisory plant equipment and materials.

d) Subcontracts for erection/construction works,

e) Review of Supplier's documents

f) Expediting,

g) Inspection and Testing,

h) Traffic and Transportation Services,

i) All spare parts required during construction, pre-commissioning, commissioning and testing,

j) Field Purchases,

k) Materials Tracking and Control,

l) Arrangement for the importation of imported (offshore) goods: Contractor shall perform all services related to import all equipment and materials needed for the Work and for obtaining necessary licenses and documents as required,

m) Preparation of enquiry specifications, technical & commercial bid evaluation, preparation of purchase specifications, expediting and review / approval of Supplier drawings.

2.4.3 Mandatory Spare Parts

Contractor shall supply and deliver at Site before the Provisional Acceptance Date all spare parts as per a list agreed with Employer/ as per the OISD-156. A tentative list of Mandatory Spare Parts, to consider as a minimum requirement of equipment supplier recommendation.

2.4.4 Quality Management, Quality Assurance and Project Quality Plan

The Contractor shall propose to Owner a quality assurance program that shall satisfy the essential elements of latest ISO 9001, Quality Systems - Model for Quality Assurance in Design / Development, Production, Installation and Servicing - and latest ISO 9004, Quality Management and Quality System Elements – Guidelines should be followed .

The quality plan shall detail in a matrix format how the Contractor's quality system addresses the elements of ISO 9001 Section 4 with reference to responsible parties within the organization for the implementation/ control of each area, the applicable procedure used to control each area, regular reporting and verifying documents produced for each area.

2.5 Construction

2.5.1 Main Construction Activities

- Contractor shall perform all the main construction activities (including Pre-commissioning), which shall include, but shall not be limited to installation, assembly and erection of Firewater System including fire water tanks, pumps, EOT Crane, Hydrant System, Automatic Water curtain, Portable Fire Extinguishers, Tower mounted water cum foam monitors.
- Supply, fabrication and erection of firewater tanks as per API-650.
- Supply, fabrication and erection of Piping for firewater, foam and utilities
- Supply of compressed Air System including Non-lubricated, Air cooled Screw compressors, Heatless Type Air Dryer, Air receiver and associated piping.
- Supply of Electrical supply equipment’s and distribution systems including internal and external electrification and lighting for the jetty, approach trestle and fire water pump house including light masts, light poles etc.

2.5.2 Necessary Services

- During construction phase, including Pre-Commissioning, Contractor shall perform and / or provide all the necessary services, materials and works, including but not limited to:
- Reconditioning of the land at Site area on completion of Work at Site, scraps dumping out of site as well as removal of any ancillary and temporary foundation blocks which the Contractor might have had to pour,
- Supply, removal and maintenance of the erection tools and handling means including in particular engines, welding machines and air compressors (Contractor being responsible for supply of the related fuels and lubricants and consumables including supply and storage of electrodes or filler metal needed for welding)
- Supply and maintenance of hoisting means including drivers and fuels, (hoisting means shall be compatible with the soil characteristics on Site),
- Mobilization and demobilization of all the construction equipment,
- Legal and statutory certifications of structures and hoisting means and instruments,
- Necessary temporary facilities, lines and connection phases,
- Production, supply and distribution of fresh water, electric power, fuels, telecommunication for construction and other consumables from the sources of supply up to the point of consumption, along with corresponding distribution networks and safety and protection systems,
- Procurement, storage, supply and distribution of consumables, spare parts, chemicals for construction, commissioning and tests phases for the Facilities up to the Provisional Acceptance Date.
- All temporary works, housing and office spaces and services, including first aid and sanitary facilities, shelters, black room, warehouse, catering, canteen,
- Car parking and transportation facilities for all Subcontractor's personnel as well as security means, including fencing, lighting and security.
- Receipt of Contractor’s items and storage, handling, assembly, installation and Pre Commissioning of such equipment in due manner and with, if necessary, the assistance of Supplier's representative,
- Keeping Site permanently tidy and clean and, in particular, during and after the thermal insulation, tidy, clean and to template,
- Arranging locations made available by Employer for permanent and temporary works,

- Installing and maintaining all sanitary blocks, including sewage discharge, as required by the Indian rules and regulations, for Contractor's and its Suppliers' personnel,
- Compliance by all the Contractor's personnel with all Site regulations.

2.5.3 Water Supply for Construction

The Contractor will have to make his own arrangements for supply of water to his labor camps and for works. All plumbing installations, pipe network and distribution system will have to be carried out by the Contractor at his own cost.

2.5.4 Power Supply for Construction

Contractor may obtain necessary temporary power connection from nearest source of HDC, if available and permitted by Port authority, on chargeable basis. Else he may make alternative arrangements of his own. Contractor shall make his own arrangements for temporary distribution of power at various construction locations. All the works will be done as per IEA Regulations and passed by the Engineers' Representative. The temporary lines will be removed forthwith immediately after completion of the work. If there is any hindrance caused to the other work due to alignment of these lines, the Contractor will re-route or remove the temporary lines at his own cost.

2.6 Test to be performed during Completion Activities

2.6.1 Pre-Operating Tests

As defined in the Pre-operating Tests procedure to be given by Contractor and approved by Engineer's Representative, prior to the Mechanical Completion, the Contractor shall perform:

- All pre-commissioning activities and Pre-operating Tests for all the systems of the Facilities.
- All commissioning activities and run tests at maximum design capacity for all equipment under scope of this contract.

2.6.2 Commissioning

Prior to the performance tests, the Contractor shall perform commissioning of all the equipment/facilities under its scope.

2.7 Document Submission Requirements

2.7.1 General

- The following is the list of drawings and documents ("DD") that the Contractor has to submit as deliverables during execution of work as per project schedule requirements. This list is not limiting and Contractor shall submit any other deliverables that may be required for completing the Scope of Work as part of Contractor's responsibilities.

- Categorization of DD as for information and for review and approval of Engineer's Representative shall be informed at the time of kick-off meeting between Engineer's Representative and Contractor depending on criticality.

- Drawing/Document Index with schedule of submission shall be submitted by Contractor during kick-off meeting for Engineer's Representative approval.

- Review and Approval by Engineer 's Representative, of DD submitted by Contractor, in no way shall relieve the Contractor of his responsibility to comply with all Employer specifications and technical requirements specified in the contract unless Contractor receives from Engineer's representative a written authority to deviate from the specifications pertaining to the item/s in question.

- Preliminary drawings shall not be used for procurement/construction purposes.

- The details provided in the tender package shall be considered as preliminary. Contractor shall perform the complete engineering to confirm that the data provided in tender package meets the process performance requirements and update / develop the P&IDs, datasheets, specifications, drawings into "Approved for Design / Construction" (AFD/AFC) status.

2.7.2 Electrical

a) Basic engineering calculations, system studies, etc.

b) Single line diagrams

c) Electrical load list and load analysis

d) Procurement engineering, enquiry specifications, technical bid evaluation, purchase specifications, data sheets

g) Shop inspection and testing procedures

h) Various electrical layout drawings such as cabling, lighting, earthing, lightning protection, hazardous area classification, etc.

i) Installation standards

l) Field testing and commissioning procedures

n) Project Schedule

2.7.3 Instrumentation and Control Engineering

a) Design Basis for I&C

b) Specifications & Data Sheets for control panels for Fire Fighting, Tower monitor, instruments, cables, DV, valves

c) Cable Schedule

d) Cable & Cable tray Route Layout

e) BOQ

f) Instrument list (if applicable)

g) I/O List

2.7.4 Mechanical / Piping / Fire Fighting Engineering

a) Datasheet

b) Specification

c) P & ID's

d) Piping GAD etc.,

e) Requisition

f) Technical Evaluation

g) Vendor Data Book, Manufacturing Record Book, Installation & Operating Manual, As-Built documents.

2.8 List of Mandatory Spares

2.8.1 Basic principle applicable to the procurement of the mandatory spare parts:

i. Wherever the word 'SET' has been used, it means all type of the said parts and in quantity sufficient for full replacement of these parts in one machine.
ii. Minor parts like screws, washers, retaining rings etc. are to be included along with main part hence not listed separately.
iii. Spares parts shall be identical in all respects to the parts fitted on the main equipment including dimensions, material of construction and heat treatments.

Notes:

- Wherever % is identified, Contractor shall supply next rounded figure.
- Mandatory spares shall include sub-packages items also.
- The word 'TYPE' means the Make, Model number, Type, Range, Size / Length, Rating, Material as applicable.
- For consumable spares, the quantity shall be calculated based upon continuous usage of the system for the period specified.
- The terminology used under 'Part Description' is the commonly used name of the part and may vary from manufacturer to manufacturer.
- Commissioning spares are part of Contractor scope of supply. Mandatory spares as indicated above do not cover commissioning spares.
- Contractor shall not use these spares during Warranty Period. In case these spares are used during Warranty Period, same shall be replenished by the Contractor free of cost.

SECTION-3

DESIGN PHILOSOPHY OF FIRE FIGHTING SYSTEM

3.1 SCOPE OF SUPPLY:

The Scope of work for **OT-II, HOJ-1, HOJ-2, BJ-1 & BJ-2** shall include the Fire Protection facilities as per provision of OISD 156 latest edition standard and other relevant standards but not limited to the following:

Scope of work shall include design, detailed engineering, procurement , supply, fabrication, construction, installation/ erection, inspection, testing, pre-commissioning and commissioning of fire protection system for protection of ships at OT-II, HOJ-1,HOJ-2,BJ-1 and BJ-2,

The scope of work involves mainly the following:

a. Design, procure, supply, construction, install, testing, inspection, pre-commissioning and commissioning of above ground Fire water tanks in order that the effective storage capacity of the reservoirs above the low water level or above the top of the pump casing. Fire Water Reservoirs shall be provided with level instruments showing local and remote level indications, alarms etc., designing of the same shall be done during detailed engineering. All related civil, mechanical or electrical works for the same as shown in P&ID, datasheets, location/layout drawing. Design team shall carry out all design/hydraulic calculations and to check dimension of the tank/reservoir and sump accordingly as per good engineering practice as well as in line with OISD guidelines and submit same for HDC's approval.

b. Design, procure, supply, construction, install, testing, inspection, pre-commissioning and commissioning of fire water horizontal centrifugal main pumps along with suitable Diesel engines as their prime movers in combination with respective diesel day tank of capacity suitable for 6 hours continuous running of the respective pumps along with features mentioned elsewhere in the bid package. Start of the pumps and simultaneous actuation of alarms at local field panel shall be dependent upon discharge header pressure

as described in P&ID. Manual starting and stopping of pump shall be provided at the local field panel and status indications shall also be provided in control room. All related civil, mechanical, electrical, instrumentation (including cabling), piping & other works for the same as shown/ described in P&ID, drawing, standard specification is in the scope of contractor. All diesel engines shall be provided with batteries 2x200% and battery chargers of 2x100%. Pressure transmitter at each pump discharge and on common header along with all instrumentation cables (F type) shall be wired to the panel. Pressure transmitters shall be 24 volt DC operative, 2 wire microprocessor based with HART interface and indicating type suitable for field mounting and environment having 0.025% accuracy. Pressure and other switches shall be with contacts suitable for 0.5 amp, 220 volt DC and field mounted type having IP-65 degree of protection of housing. Repeatability shall be / +/- 0.5%.

c. Design, procure, supply, construction, install, testing, inspection, pre-commissioning and commissioning of one no. EOT crane of required capacity mounted on a monorail suitable for the pump house area as above and to cover the entire span as per data sheet, and any other related information mentioned elsewhere in the bid document and to be used for maintenance of pumps, motors, engines etc.

d. Design, procure, supply, construction, install, testing, inspection, pre-commissioning and commissioning of water filling line in such a manner either one or all the reservoirs or all the reservoirs can be filled up . The filling lines with suitable size flange provision to get connected to source water pipe to be laid from the existing source. Design, procure, supply, construction, laying, install , testing, inspection, pre-commissioning and commissioning of fire water_network piping shall be CS with 3.0 mm corrosion allowance as per P&ID & firefighting layout . Above ground ring main network are to be laid on RCC piping sleepers at a minimum height of 300mm above finished ground level and at regular intervals not exceeding 6 metres. The piping shall be passed underground duly coated and wrapped at road crossings and places where above ground piping is likely to cause obstruction to operation and vehicle movement. The piping shall be buried under ground at least 1.0 m deep in case of open areas and 1.5 m deep in case of roads. Further, piping shall be provided with suitable protection against soil corrosion by coating and

wrapping (refer enclosed standard specification). Fire water piping network shall be provided with isolation valves, flanges, fittings etc, as per manual, OISD standards and any other related information mentioned elsewhere in the bid document. Piping to be painted red and to be laid on independent sleepers by the side of the road.

e. Scope of work of other piping and valves, strainers, expansion bellows, eccentric reducers, pressure gauges etc. mounted on piping includes but not limited to the following. Design, procure, supply, construction, laying, erection, support structure, testing, inspection, pre-commissioning and commissioning of associated piping and piping accessories (i.e. **Piping from fire water reservoir to Pump Suction including Isolation Valves,** suction and discharge header, individual suction and discharge pipes & their isolation valves of respective pumps, check valves of respective sizes on the discharge end of pumps, strainers of respective sizes on the suction side, reducers/expanders as per requirement, expansion joints, pressure gauges, overflow pipes, drain pipes etc.) as per P&ID. Individual suction pipe (velocity head max. 2m/sec.) for main fire water pumps.

f. Design, procure, supply, construction, install, testing, inspection, pre-commissioning and commissioning of double headed fire hydrants as per OISD 156 latest edition, spaced at an interval of 30/45 metres between two consecutive hydrants each with two separate landing valves (entire facility must be approved and ISI marked) to be fitted on 4” diameter stand post with isolation valves at places along firewater network as shown in firefighting layout, to meet/ satisfy all the applicable OISD requirements and any other related information mentioned elsewhere in the bid document. All hydrant outlets shall be situated 1.5 meter above ground level. Location of hydrants etc., shown in tender documents are indicative. Same shall be finalized during detailed engineering. Hydrants shall be located along road side berms for easy accessibility. Hydrants shall be placed in such a way that it shall not only be approachable but shall be operable i.e. the surrounding shall be of the same level as that of the road without any slope so that the valves can be operated easily. The line velocity in fire water hydrant shall be below 5 m/s and shall be sized for 120% of the designed water rate.

g. Design, procure, supply, construction, install, testing, inspection, pre-commissioning and commissioning of water/foam monitors and to be flange-fitted on fire water network with isolation valves to meet/ satisfy all the OISD requirements. Location of monitors will be finalized during detailed engineering. Monitors shall be located for easy accessibility. The surrounding in case of monitors shall be prepared in such a manner that operator along with monitors can be accommodated in all 360 degree rotation without any hindrance of nearby object to enable easy swivelling and focusing of monitor on the target.

h. Design, procure, supply, construction, install, testing, inspection, pre-commissioning and commissioning of glass-fronted hose boxes, being suitable for and provided with. hoses (IS 636: Type B -15 meter long each with end couplings), jet nozzle with branch pipe and nozzle evenly distributed at hydrant locations as per layout, to meet/satisfy all the OISD requirements and any other related information mentioned elsewhere in the bid document. Each hose box shall be designed and fabricated in such a manner that it conveniently holds all the accessories as described above.

i. Design, procure, supply, construction, install, testing, inspection, pre-commissioning and commissioning of Tower Monitors & Jumbo Nozzles which shall conform/designed as per OISD 156 latest standard and as per enclosed relevant standard specification & relevant codes. Nonetheless, OISD-156 latest edition requirements shall be fulfilled in its entirety.

- ❖ All equipment and accessories connected with fire protection system shall be UL/FM approved.
- ❖ Radiography of piping joints shall be carried out as described in welding standard specification.
- ❖ All fire water piping shall be hydro-tested as per the OISD 156 latest edition.

j. Instrumentation

- ❖ Operation & control of Fire Water pumps shall be through new dual redundant PLC Based Control system.

- All field hardware for this integration of the existing pumps viz. Pressure transmitters, cables, junction boxes etc shall also be into the scope of contractor.
- Status of all fire water pumps and jockey pumps to be displayed in main Control room/SCADA room also.
- The logic should be based on Lead/Lag pump & start of pumps should be initiated based on pressure transmitters installed in the new header (based on adequacy check).
- The logic controller shall be made PLC based redundancy shall be provided as per Functional specifications.
- Auto start of tower monitor system shall also linked with hydrocarbon leak detection and alarm so that FWPs should start automatically in the pump house. Hydrocarbon Detection System will be installed and commissioned by HDC. PLC shall have sufficient spare I/Os. (**THIS SYSTEM IS AN OPTIONAL ONLY AND THE NECESSARY I/Os HAS TO BE CREATED IN THE PLC).**
- All logics as described above shall be finalized and approved by HDC

3.2 Design Criteria for fire protection

An independent firefighting system is planned for all four jetties i.e OT-II (LPG)HOJ-1 (LPG),HOJ-2 (LPG),BJ-1(POL) and BJ-2 (LPG) all the new jetties should cater the fire scenario on the facility. Following principles are to be adopted.

- OT-II designed to handle LPG
- HOJ- 1 designed to handle LPG.
- HOJ- 2 designed to handle LPG.
- BJ- 1 designed to handle POL.
- BJ- 2 designed to handle LPG.
- It is assumed that in case of fire on ship tanker, ship will be towed to open sea and that fire protection for ship tanker will be treated as first aid till towing is done.
- Fire water system shall be designed for facilities on the basis that city fire water is not available close to the installation.
- One single largest risk shall be considered for providing fire protection facilities.
- All facilities shall be covered with Hydrant System.

- Tower mounted water cum Foam monitors shall be provided for protection to loading /unloading arms/first aid to tankers.
- Water curtains shall be provided for segregation of loading/unloading arms/piping manifold and ship tanker in the event of fire on either of these facilities.
- Manual/ automatic below deck fixed water spray system or pile fire-proofing to protect berth structure and installations shall be provided.
- For ports terminals handling ships of less than 50,000 tonnes capacity one set of fire water Pumps shall be provided which will cater to both tower mounted monitors as well as hydrant service and water curtains, and for Port terminal handling ships of 50,000 tonnes or larger two sets of Fire water Pumps shall be provided for:

3.3 Fire Fighting Facility requirements:

- Fire protection facilities for this project shall comply with as per OISD 156 latest edition.
- Hydraulic study for the entire network for checking conformance to OISD 156 (latest edition) and satisfying the system requirement as:
  - Velocity of water in network Less than 5.0 m/sec.
  - Discharge pressure at the hydraulically farthest point : 7.0 Kg/cm2g
  - Pipe network sizing shall be based on 120% of pumping flow rates.
  - Fire water reservoir capacity shall be based on 6 Hours based on pump capacities.
- All related piping, electrical, civil/structural, instrumentation work shall be in contractor scope including supply of diesel tank with all necessary piping, fitting, and instrumentation as per OISD 156 Latest edition.

3.4 Fire Water Tanks:

As per design calculation the water requirement for OT-II, HOJ-1 HOJ-2 is 17280 KL and BJ-1 is 2160 KL and BJ-2 is 4320 KL. Therefore TWO tanks of size 24 M x 12 M will be constructed to cater the fire scenario in case of fire on ships at jetties. These tanks are the atmospheric pressure storage tank and is designed & constructed in accordance with API-650.

Brief Procedure of Tank Building Methodology:

- Once Foundation of tank is ready, Annular and bottom sketch laid and welded.
- Top 2 course are erected conventionally so as to accommodate Jack.
- Curb angles/compression ring installed.
- Cone Roof assembled on curb angle/Compression ring.
- Roof plates, wind girders and other supports/platform to be installed.
- Jacks arranged inside tank for lifting.
- Roof and top shell rings lifted hydraulically to height where the next course can be inserted
- Courses fit up and welded manually/ automatically.
- All the inspection (RT/MPT) are done as per API Std 650/Approved ITP before next jacking.
- Further shell rings lifted hydraulically to height where the next course can be inserted sequentially.
- Spiral stairway (with hand rail post and rail pipe) is erected bottom of the stringer to top, welded with support of bracket and stringer.
- Other supports and accessories on top course are welded and inspected before jacking up.
- Cycle repeated till completion of bottom shell course installed.
- Tank elevators are removed.
- Bottom shell course aligned properly to annular plates
- Jacks dismantled after completion of welding of 1st shell course
- In common with other construction techniques, Hydro tests done as per API & Client specification for any leaks and foundation settlement

After successful completion of hydro testing these tanks will be flushed & cleaned with water inside the tanks. Once the tank cleaning operation completes these tanks will be painted with epoxy coated painted inside the tank as well as outside the tanks. After painting operation completes these tanks will be filled with potable water then tanks are ready to use for firefighting operation. The photograph of fire water tank is as under

3.5 Fire Water Pump House

Pump house are used to facilities fire water pumps and jockey pumps for pumping water from water storage tank to tower monitors, Jumbo nozzle, water monitors and hydrants another place in case of fire.

New pump house will be constructed to accommodate all fire water pumps, Jockey pumps and foam pumps for OT-II, HOJ-I & HOJ-II and BJ-I & BJ-II. The fire water pump house will be constructed with vertical civil columns and roof will be constructed with mechanical structure and then covered with zinc coated (blue colour) corrugated roofing sheets.

In pump house all fire water pumps and Jockey pumps will erected on civil foundation with necessary piping and instrumentations which draws the water from suction header line which is connected to fire water reservoir and delivers the water with required flow rate as well as required pressure to fire water network and then double hydrants, monitors and tower monitors etc.,

The Pump House will be provided with 10 Ton electrically operated travelling bridge crane for repair and maintenance of fire water pumps inside the house.

3.6 Fire water Pumps

S.No	DESCRIPTION	FOR OT-II,HOJ-1,HOJ-2,BJ-1 & BJ-2
1	Capacity of pumps required	720 Cum/Hr.
2	No. of pumps	4+2 (4 working + 2 stand by)
3	Capacity of Jockey Pump	70 Cum/Hr.
4	No. of pumps	2+1 (2 working + 1 stand by)

3.7 Water Demand Calculations

3.7.1 Water Demand Calculations

Sl.No.	DESCRIPTION	FLOW IN M3/HR
1	Water required for Tower Monitors (3 x 6000 lpm)	1080
2	Water required for Jumbo nozzles (3 x 6000 lpm)	1080
3	Water Requirement for Double	540

	Hydrants & Ground Monitors (15 nos.x 600 lpm)	
4	**Total**	**2700**

3.8 Water Storage Requirement

- Water storage requirement for fire protection facilities based on OISD-156 guidelines and it is for 6 hours of running capacity of pumps.
- Water requirement per hour = 4 x 720 M3/hr = 2880 M3/hr
- Water requirement to run the pumps for 6 hours will be 2880 M3/hr x 6 hr = **17280 KL**
- Storage reservoir shall be two equal interconnected compartments/tanks to facilitate and repairs

3.9 Fire Fighting Facilities

The firefighting facilities are to be provided at the jetty as large quantities of inflammable products handled at the installation pose a great threat to their own safety as well as of the surroundings. The fire fighting system shall conform to statutory and technical norms such as OISD, NFPA etc.

The firefighting facilities shall consist of:

- Fire Water Reservoir (M S Tanks)
- Fire Water Pump House
- Electrical Substation (PCC & MCC)
- Control Tower
- Fire Hydrant System
- Tower Monitors
- Ground Monitors
- Jumbo Water Curtains
- Under Deck Fire Fighting System (only for Steel Piles)
- Fixed Foam System
- Fixed International Shore Connection
- Gas/Flame Detection System
- Manual Call Point System

- Remote Control Valves
- Remote Control Panels
- Flame proof Electrical Fittings
- PLC System & Control Cables
- DCP protection system
- First Aid Fire Equipment
- Mobile firefighting equipment
- Fire Alarm/Communication System

The firefighting facility at the marine terminal shall be designed on the following basis:

- One single largest risk shall be considered for providing fire protection facilities. In the present case the marine terminal is being developed to receive two vessels of size 20,000 DWT or one 40,000DWT.
- In case of fire on ship tanker, the ship will be towed to away to the jetty and the fire water protection for ship tanker will be treated as first aid till towing is done.
- Firewater facilities shall be designed on the basis that city fire water is not available close to the installation.
- All facilities shall be covered by hydrant system.
- Tower mounted water/foam monitors shall be provided for the protection of loading arm and providing first aid to tankers.
- Water curtains shall be provided for segregation of loading arms/piping manifold from ship tanker in the event of fire of either of these facilities.
- Manual/Automatic below deck fixed water spray system or pile fire-proofing to protect berth structure and installation shall be provided.
- Jetty shall be provided with Tower mounted water /foam monitors and hydrant service & Water curtains
- Dry Chemical Powder (DCP) protection shall be provided.

3.10 Tower Mounted Water cum Foam Monitors

Some of the key features of proposed Tower Mounted Water cum Foam Monitors are as follows:

- The monitors shall be remotely operated from control station at terrace level of the Fire water Pump house adjacent to the foam pump skid, from where monitors will be clearly visible.
- The monitor is tapped from firewater network system through a motorized gate valve and shall be installed at the suitable height on the tower such that it will cover the deck of the largest tanker in the lightest condition at spring tides at the jetty. At the downstream of the motorized gate valve an inline balance proportioner shall be installed.
- To feed foam to the tower mounted monitor atmospheric foam concentrate storage tank, foam pumping system is considered at the terrace level of the fire water pump house. The discharge header from foam pump shall be connected to the pressurized foam concentrate pipe, which will be laid parallel to the hydrant header throughout jetty terminal.
- Tapping shall be taken from foam concentrate header and will be connected to the foam line of inline balance proportioner of each tower mounted monitor through a manual isolation valve (normally open).
- The piping & valves handling foam concentrate shall be of Stainless Steel. Foam concentrate shall be AR-AFFF type and MOC of tower mounted water cum foam monitor shall be Stainless steel.
- Detailed Fire water pump capacity, foam pump capacity and foam concentrate storage requirement shall be shown in P&ID

3.11 Automatic Water Curtain System (Jumbo Nozzles)

It is proposed to install automatic water curtain systems to segregate loading / unloading arms / piping manifold and ship tanker of the Jetty.

Key features of the system shall be:

Automatic water curtain system shall be tapped from separate firewater network system and majorly consists of deluge valve along with isolation valves, strainers, piping network for water curtain, detection network.

- Water is tapped from the main line on the upstream side of the deluge valve. The detector line is pressurized with air and tapping for the same shall be taken from

nearest available instrument air. The detector line connected to the thermal detector sprinklers (79˚C rating). In case of fire when the surrounding temperature rises more than the rated temperature of the detector, the glass bulb of the detector shatters resulting in drop of air pressure in detector pipe network. Fall in pressure in detector pipe causes reduction of pressure in dry pilot actuator of deluge valve allowing deluge valve seat to get lifted-up thus opening the deluge valve and allow the water to flow through water curtain (jumbo) nozzles to form curtain.

- The deluge valve of water curtain system shall be provided with an isolation valve of same size as that of deluge valve both at the up-stream and downstream side. Further a Y-type strainer shall also be provided at the up-stream of deluge valve. Instruments such as pressure gauges and pressure switches shall also be provided at up-stream and downstream of deluge valve as well as in detector pipe network for interlock control.

- Strainer shall be located just upstream of the deluge valve, downstream of the isolation valve, which also facilitates periodic testing / cleaning of strainer.

- One by pass line with isolation valve shall be provided for each deluge valve.

- The material of the pipe downstream of deluge valve shall be of Galvanized Carbon Steel. Deluge valve and thermal detectors (QBDs) shall be UL listed & FM approved.

3.12 Portable Fire Extinguisher

The portable fire extinguishers are proposed to be located in all facilities / buildings and these can be used for extinguishing small fires. Portable extinguishers shall be provided as per Table -3 of OISD-156.

The extinguisher locations are decided based on following considerations:

- Travel distance of 15 meters maximum,
- Uniform distribution,
- Easy accessibility,
- Nearness to doors, windows, emergency doors and escape routes

3.13 Brief Specifications of Major Fire Fighting Components

- Piping materials shall be ASTM 106 Grade "B"
- For water curtain system, the pipes downstream of deluge valve & pipe for detector network shall be galvanized. The pipes carrying foam concentrate shall be of stainless steel.
- Isolating valves shall be gate valves of cast steel construction for hydrant system/ water curtain system. The isolation valve used in Foam concentrate line shall be of stainless steel.
- Hydrant valves shall be 63mm SS-316 ISI marked oblique pattern conforming to IS: 5290 Type A.
- Branch pipes with nozzle shall be 63mm SS-316 ISI marked short pattern (other than fog nozzles) conforming to IS: 903.
- Fire hoses for hydrants shall be 63mm, Rubber-lined, with SS-316 instantaneous couplings duly bound at either end or conforming to IS: 636 Type-A.
- Hose cabinet shall be fabricated out of SS-316, with 3mm thick glass fronted doors suitable for holding two nos. fire hoses, one branch pipe with nozzle and one no. nozzle spanner.
- First aid hose reel shall confirm to IS:884 and be provided with 36m long x 20mm dia. rubber hose pipe and gun metal shut-off nozzle.
- Deluge Valve, QBD, Tower mounted monitor shall be UL listed or FM approved.

3.14 Compressed Air System

The compressed air system is planned for all pneumatic controlled valves in the firefighting system and user requirements during the operation of the jetty. The system consists of the 2 nos. (1W+1S) of Non-lubricated, the capacity of Air cooled Screw compressors will be finalized during detail engineering. The Air compressors should have the following equipments.

- 2 nos. (1 Working + 1 Stand by) Heatless Type Air Dryer with automatic drain system
- 1 no. of Air Receiver
- Air compressor should run with PLC Control System.

The compressed air system shall be located at the fire water pump house under shelter and a compressed air piping of minimum 100 NB shall be routed from the pump house to the unloading platform of OT-II,HOJ-1,HOJ-2,

3.15 FIRE DETECTION, ALARM & COMMUNICATION SYSTEM

3.15.1 Fire Detection System

The most important component of fire protection system for Port Terminals is detection and alarm system. Timely detection of fire at an early stage, will help in early extinguishing the fire, thus prevent it to become major fire.

For the purpose, fire alarm system consisting of manual call points (break glass), automatic gas/ smoke/ heat detectors, release & inhibit switches for fire suppressment clean agent. Conventional or micro-processor based data gathering fire alarm and central fire alarm panel, mimic panels & associated equipment are provided.

Fire alarm and detection system shall conform to the latest edition of Indian & International Standards. In addition, all equipment shall conform to the provisions of Indian Electricity rules, other statutory regulations in force from time to time.

Detectors which are below false floors, above false ceiling or generally hidden should have external response indicator sited at prominent places.

Fire alarm and detection system should derive its power from either mains electricity supply (normal supply) or the standby power supply that should be immediately available in the event of failure of normal supply so as to maintain the equipment in ready condition of taking the maximum load.

A flammable gas detectors provided to give a warning of the presence of flammable gases or vapours in air, well before they reach explosive concentrations. Normally, the detector provides audio- visual alarm signals. These signals are further used to control action such as increasing ventilation or shutting off the source of gas. A flammable gas detector can also be used for tracing leaks and checking that vessels or tunnels are gas free before entering.

Following areas shall be provided with Smoke/ Flame / Heat detectors with alarm and/or system to actuate relevant fire suppression system:

- Computers/ Process control rooms
- Unmanned electric substations / MCC rooms - Cable galleries

3.15.2 FIRE ALARM SYSTEM

Electrical/hand operated fire siren shall be installed at suitable location in installation. The operating switch buttons shall be located near the Risk Area at a safe, identifiable and accessible location. In case of installations having area over 15 acres, manual call points may also be considered. The fire alarm shall be different from shift sirens.

3.15.3 COMMUNICATION SYSTEM

Adequate communication system like telephone/Public Address System/Paging System/ intrinsically safe Walkie-talkie system should be considered.

3.15.4 MANUAL CALL POINT SYSTEM

Manual call points strategic location shall be provided on Jetty at LNG for emergency response audio visual alarm at control room.

3.15.5 GAS DETECTION SYSTEM

Hydrocarbon gas detectors shall be provided along LPG jetty at locations where there is chance of gas leakage. These areas are mainly loading arms/Manifold area etc.

SECTION 4

DESIGN CRITERIA FOR ELECTRICAL SYSTEM

4.1 SCOPE OF WORK:

The Scope of Work is general in nature & forms the guidelines for detail engineering, supply installation and commissioning of the plant as per the recommendation of OISD 156 Latest Edition

This document (Electrical scope of work) shall be read in conjunction with the other sections of Tender Documents.

Where equal but conflicting requirements arise between this Scope/Specification and the reference documents, such conflict shall be brought to the attention of the HDC in writing.

Detailed Scope of work for all interfacing jobs shall be prepared and submitted along with schedules for shut-down if any as a part of the detail engineering, for HDC review and approval.

This document along with the electrical design basis, electrical scope of works, packaged equipment data sheets, electrical functional specifications, electrical installation standards and other related drawings / documents provided in this package including any clarifications issued in the form of corrigendum / addendum will form part of contractor's complete electrical scope of work.

The designed electrical system shall provide

- Safety to personnel and equipment
- Reliability of service
- Minimum fire risk
- Ease of maintenance and convenience of operation
- Adequate provision for future expansion and modification
- Maximum interchange ability of equipment
- Protection of all electrical equipment
- Fail safe features.

4.2 DETAILED ENGINEERING:

Complete design & detailed engineering consisting of all engineering documents necessary for proper procurement including sizing and selection of electrical system / equipment / cabling / earthing / lighting required at four jetties, installation, testing and commissioning of the complete system as per OISD-156. On the basis of information included in this bid package and collected by contractor from site, the contractor shall finalize all design data to carry out engineering. Contractor's scope shall include but not be limited to preparation / finalization of the following:

a) Electrical system.

- Load data and load analysis.
- Calculations for illumination and lighting system, earthing system, cable sizing, Lightening protection and cable tray sizing etc.

b) Detailed overall single line diagram (SLD) and single line diagrams for various switchboards / distribution boards etc. based on calculations and vendor's input / relevant information.

c) Development of detailed control & protection schematics and logic diagrams for switchboards, panels and other equipments.

d) Sizing and selection of all equipments including MV switchgear, distribution boards if required.

e) Developing

f) Lighting distribution system for new facilities.

g) Preparation of engineering documents such as complete equipment list. Preparation of drawings such as equipment layout, overall and area wise cabling, areawise earthing etc. including associated documents like complete cable schedule, lighting / power panel schedule, cable tray / trench sizing, equipment earthing details, installation details, block / logic diagrams etc., complete with material take-offs.

h) Preparation of all interconnection drawings.

i) Earthing system in accordance with relevant codes / specifications of Bureau of Indian Standards.

j) Preparation of all bills of materials for earthing and miscellaneous items.

k) Preparation of purchase specifications for all electrical equipments, materials etc.

l) Preparation of inspection and testing procedure, testing and commissioning schedules of various electrical equipments to be tested at site and developing test formats to keep proper records of such tests for all electrical equipments.

m) Review of sub-vendor / supplier's drawings & documents and specifying deviations (if any) along with reasons / justifications / clarifications thereof, prior to submission to owner for review / records (comments with resolution by vendor shall also be submitted along with).

m) Preparation of all other documents as listed in enclosed Vendor Data Requirement format.

n) Contractor's scope includes obtaining all relevant data from site regarding fault level, existing power transformer capacity etc. Required for the detailed engineering.

o) All equipments shall be suitable for hazardous area as per the below.

i. OISD - 113
ii. API-RP - 500
iii. IS - 5572 / 5571
iv. IEC – 79
v. BS – 5345

In case of any conflict amongst the above, the more stringent shall be followed.

The Following factors shall be considered for proper selection of equipments for use in Hazardous area classification i.e. Zone-0, 1 or 2

Gas group classification: The characteristics of the gas or vapour involved in relation to the ignition current or minimum ignition energy and safe gap data. Temperature classification: The ignition temperature of gas or vapour involved or the lowest value of ignition temperature if more than one combustible material is present.

Environmental conditions in which equipments are to be installed: The selected electrical equipments shall be suitably protected against corrosive and solvent agents, water & moisture ingress, thermal and mechanical stresses as determined by the environmental conditions.

The types of protections generally used for electrical equipments in hazardous areas are as follows:

- Zone 0 - Intrinsically Safe, Type of Protection “i”.
- Zone 1 - Intrinsically Safe, Type of Protection “i”.
- Flameproof equipment, Type of protection‘”d’.
- Pressurized enclosure, Type of protection “p”
- Sand filled equipment, Type of protection “q”.
- Other electrical apparatus specifically designed
- For zone 1, Type of protection”s”.
- Zone 2 - Protection as suitable for Zone-0 / Zone-1.

Electrical equipments to be used in hazardous area shall possess type test certificates from one of the following recognized testing and certifying authorities.

PESO: Petroleum Explosive Safety Organisation

UL: Underwriters Laboratories Inc. (USA).

FM: Factory Mutual Research Corporation (USA).

BASEEFA: British Approvals Service for Electrical Equipment in Flame proof Atmospheres.

PTB: Physikalisch Technische Boundesantalt (Germany).

While submitting material requisitions for various equipment, contractor to ensure that same shall also include filled-in data sheets, vendor qualification criteria, approved sub-vendor list, functional specifications, and electrical design criteria. Vendor data requirement, quality assurance plan, deviation list (if any) etc.

4.3 DESIGN, SUPPLY, INSTALLATION, TESTING & COMMISSIONING:

Design, supply, installation, testing and commissioning of the following equipments including all procurement activities like preparation of material requisitions, technical queries, technical bid analysis, purchase etc. for all installations under this project.

Requirement of equipments/ facilities detailed in this section given below are applicable to all four jetties as per Electrical facilities envisaged in each jetty. The scope of items/equipments for supply and their execution shall be following but not limited to:

Indicative Scope of Supply (Electrical Details)Table No.2

S No.	Location	OT-II	HOJ-1	HOJ-1	BJ-1 & BJ-II
1	Distribution Transformer	As per requirement with standby transformer			

2	Diesel Generators	As per the requirement of the total load			
3	EOT crane	10 Ton			
4	Air Compressors	As per requirement			
5	UPS system	As per requirement	As per requirement	As per requirement	As per requirement
6	Motor Panels	As per requirement			
7	Push Button Stations	As per requirement			
7	Capacitor panels	As per requirement			
8	Automatic power factor control panels	As per requirement			
9	Cable sizing	Yes	Yes	Yes	Yes
10	Earth Pits	Yes	Yes	Yes	Yes
11	Cabling	Yes	Yes	Yes	Yes
12	Lightning Protection	Yes	Yes	Yes	Yes
13	Earth Conductors	Yes	Yes	Yes	Yes
14	FLP Cable Trays	Yes	Yes	Yes	Yes
15	UG Cable buried trenches & markers	Yes	Yes	Yes	Yes
16	Battery charger with battery	Yes	Yes	Yes	Yes
17	ASB-Auxiliary power supply distribution board AC	Yes	Yes	Yes	Yes
15	Erection, commissioning, tools and accessories	Yes	Yes	Yes	Yes
16	Exhaust fan of suitable size in pump house	Yes	Yes	Yes	Yes
17	Internal illumination	Yes	Yes	Yes	Yes

	and electrification including wiring & Installation of fixture, switches, fan, conduits Brackets, junction boxes etc., in pump hose				
18	Street light poles of 10 meters height with 120 watts LED lamps on the approach from jetty to pump house and control room	Yes	Yes	Yes	Yes
19	High mast as per client requirement	Yes	Yes	Yes	Yes
20	Load details for,EOT fire water pumps, jockey pumps, foam pumps, motor operated valves,sump pumps,QRMH,High Mast lighting tower,Street lighting and internal lighting	Yes	Yes	Yes	Yes
21	Single line diagrams	Yes	Yes	Yes	Yes

4.4 AREA WISE SCOPE OF WORK DETAILS:

There are four areas in the PROJECT site namely:

1) HOJ-1 2) HOJ-2 3) BJ-1 & BJ-2 5) OT-II

With existing Substation room has to be revamped or should be equipped with the new electrical equipments for firefighting system shall be considered for entire common fire pump houses for OT-II, HOJ-1,HOJ-2,BJ-1 and BJ-2 and the electrical panel layout shall be prepared suitable for the existing panel room. Incoming Power Cable for this MCC

shall be considered with suitable feeder shall be made. The cable shall be routed on cable tray above ground (except for road crossings which will be underground with hume pipes to this new electrical substation room near fire water pump house.

From panel to motors in cable shall be in RC trench. In the PMCC/MCC & contractor shall size the cable to suit this panel electrical load. Also for lighting, lighting transformer shall be considered of suitable for 11 kva 3 phase wires With MLDB and LDB. Lighting to be carried out suitably as per design LUX level requirement. The height of MCC panel shall be designed as per standard norms. Earthling pit also to be considered as per IS-3043, New earthling grid shall be connected to existing main earth grid.1 no APFC Panel shall be considered for PF improvement. Power factor shall be improved up to 0.99 lagging. New UPS shall be considered as per design. ASB panel shall be considered. Also one battery charger with battery bank and DCDB considered for this work .battery charger shall be min. 50 AH 110 V D.C

New control rooms for each jetties shall be constructed except HOJ-II. The size of control room will be decided during the detail engineering. From the control room to remote operate tower monitors, jumbo nozzles, fire detection system, gas detection system etc.,in cables and out cables shall be laid in cable tray.

The operation and controlling of form pumps, jockey pumps, tower monitors, deluge valve, fire detection as well as gas detection will be considered in control room.

Contractor shall study the load calculation & explore the possibility for inclusion of new load. Otherwise new UPS of suitable capacity to be envisaged.

The cables up to road crossing shall be in the excavated trench, and for the road crossing suitable Hume pipe shall be considered, this shall be as per electrical standards mentioned.

4.5 Installation Lighting

For illumination of the unlighted outdoor area (e.g. open area, process area, street including bye roads, approach roads to various facilities etc.) coming under each installation and classified area FLP enclosure type Well glass / Bulk Head Luminaries suitable for T5, CFL, MH lamps shall be considered. The quantity of lamps shall be worked out as per site conditions.

a) Lighting fixtures, lamps and complete accessories / associated equipments required for lighting of jetties / Approach road/ lighting shall be energy efficient LED lamps fixtures shall be provided. The exact number of fixtures required for different

locations shall be worked out during detailed engineering and shall fulfil the minimum illumination level criteria as per the OISD guidelines.

b) Earthing Material and Accessories:
Earthing conductors, earth plates, earth electrodes / pits and other earthing accessories required for the complete earthing system, including equipment earthing. Confirmatory Soil survey shall be submitted to HDC before design of earthing system and earth grid.

c) Sun /Rain Canopies:
Sheet steel canopies made of 14 SWG MS sheet, epoxy painted for all motors, junction boxes, local control stations & other electrical equipments located outdoor.

d) Cable Trays / Cable route marker/Trenches & Accessories:
All materials and accessories of cable trays, supports, rack-risers, ducts, trenches and making of RCC lined / buried cable trenches, route markers etc as required, shall be in contractor's scope.

e) Cables and Accessories:
Required power and control cables along with its accessories i.e termination and Connections including supply of all termination kits, glands, lugs, markers, tags plates etc. Multi Cable Transit (MCT) shall be used for cable passage inside the PMCC and or Substation Room.
All cables shall be XLPE, copper.

4.6 General Requirements:

a. Contractor shall perform sizing, supply, laying, termination / connection and testing of all required cables for power, control, auxiliary and lighting circuits and any other cables as required.

b. Contractor shall perform supply, erection, testing and commissioning of all materials and accessories of hot dipped perforated GI/ FRP cable trays and making of RCC lined / buried cable trenches as required.

c. Contractor shall perform all associated civil works, as required.

d. Contractor shall perform fabrication, supply, erection and painting of steel structural supports required for various electrical equipment such as overhead cable trays etc. Execution of work if any underground or above ground existing facilities are encountered, the contractor has to ensure that the new facilities being constructed do not interfere with the existing facilities. Contractor shall inform the company of such facilities and re-routing of these facilities shall be done by the company.

e. Supply of power, welding facility at site will be in the scope of Contractor

f. Bidders are advised to visit the site well in advance (prior to bidding) so as to make Appropriate assessment of the job.

4.7 Minimum clearances on various equipment:

a. Front clearance for switchboard/ panels - 2000mm for MV Switch Boards.
b. Rear clearance for panels requiring maintenance from rear - 1000mm for MV Switch Board.
c. Rear clearance for panels having access from front only - less than 200 mm or more than 750 mm.
d. Side clearance between two switchboards or from nearest obstruction - 1500mm
e. Battery rack to rack clearance - 750 mm
f. Battery rack to wall / clearance - 750 mm
g. Front clearance for wall mounted equipments - 1000mm
h. Front clearance for operator station/ annunciation / control panel - 2500mm
i. Head room clearance for overhead equipments -2000 mm
j. Vertical clearance above the top of the highest equipment shall be minimum -1500mm from roof slab.

Contractor shall make all arrangements and mobilize equipment for the construction of complete electrical system equipment.

(i) Recommended pre-commissioning checks for switch gear, PDB and other packaged items.

(ii) Checking of electrical equipments for proper earthing, continuity, insulation resistance and secondary injection test of relays after insulation resistance test.

(iii) During the pre-commissioning /commissioning of electrical system i.e. Illumination level checking, earthing system checking, Electrical power continuation checking

Clearing of all unused materials from the premises and depositing the same at a place indicated / approved by engineer-in- charge.

Supply and installation of all other material, accessories and consumables not specifically mentioned herein but nevertheless necessary to complete the work as per good engineering practice without any extra cost and time to the Port.

4.8 PAINTING:

The painting procedure to be followed for all equipments and panels is as described below:

All metal surfaces shall be thoroughly cleaned and de-greased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any traces of acid. The under-surface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The under-surface shall be made free from all imperfections before undertaking the finished coat. After preparation of the under-surface, the panels shall be spray painted with two coats of epoxy-based final paint or shall be powder-coated. The colour shade of the final paint shall be shade 631 (light grey) as per IS-5. Spray-painted finished panels shall be dried in staving ovens in a dust-free atmosphere. All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust and corrosion. All hardware shall be corrosion resistant. All joints and connections of the panel members shall be made of galvanized, zinc passivity or cadmium plated, high tensile strength steel bolts, nuts and washers, secured against loosening.

4.9 Electrical Design

Contractor shall prepare the following drawing:

i. Single line diagram.

ii. Lighting calculations & Layouts.

iii. Power cable calculations & Layout.

iv. Earthing calculations & layout.

v. Lighting SLD

vi. SLD for light in- door and out- door lighting fixture hook-up

vii. Equipment layout drawings and equipment datasheets.

viii. Overall power cable layout.

ix. Overall hazardous area layout drawing.

x. Power, lighting and earthing layout for various rooms/sheds/areas.

xi. Over all power/earthing layouts.

xii. Cable schedule/MTO/Datasheets

xiii. Control schematics

xiv. Any other drawings/documents as desired by HDC for the scope of works.

4.10 General

The contractor shall work as per the drawings and designs described in the Tender document and the best current engineering practice. Particular attention shall be paid to internal and external access to the electrical equipment in order to facilitate inspection, cleaning and maintenance. The contractor shall comply with latest code of practice as applicable published by the Bureau of Indian Standards. Care shall be taken so that materials and equipment supplied by contractor shall be the standard catalogued products of manufacturers regularly engaged in the manufacturer of such products and shall be of the latest standard designs that conform to the specific requirements.

i. Essence of design shall be safety, simplicity and reliability in order to give long continuous service with high economy and low maintenance cost.
ii. All equipment shall be designed to minimize the risk of fire and any damage which may be caused in the event of fire.
iii. The design shall comply with relevant codes and regulations listed.
iv. All apparatus, equipment and works shall be so designed that they provide satisfactory service and without any harmful effects for prolonged and continuous periods in the worst climatic conditions, stated hereinbefore.
v. The reference design ambient temperature for all electrical equipment shall be taken as 45°C and suitable de-rating shall be applied based on published data against the most severe conditions encountered at the site, by reducing the permissible temperature rise above the ambient level for equipment as applicable.

4.11 Errors, Omissions and discrepancies

In case of errors, omissions and discrepancies between technical specification, schedules and drawings the following order shall prevail:

i) MOM with contractor in reverse chronological order.
ii) Technical specifications
iii) Tender drawings
iv) Schedule of Quantities
v) Bureau of Indian Standards
vi) International Standards
vii) In all case of doubt or omissions or discrepancies noticed in any item of work any drawing, the decision of the Engineer's Representative shall be final and binding on the contractor.

4.12 Other Technical Requirements

The contractor shall arrange all instruments, materials and labour involved in setting out the works to the satisfaction of Engineer's Representative.

4.13 Standards and Regulations

The design and manufacture of electrical equipment shall conform as a minimum to applicable codes, regulations and standards published by the following bodies:

- BIS : Bureau of Indian Standards
- IER : Indian Electricity Rules
- BSI : British Standard Institution
- ISO : International Organization for Standardization
- IEC : International Electro-Technical Commission
- IEEE : Institute of Electrical & Electronics Engineers
- NFPA : National Fire Protection Association
- NEC : National Electrical Code

Following is the list of some of the directly applicable Standards particular to the equipment. Any other relevant Indian Standard, not covered shall also be applicable.

Standards	Title
IS:5	Colors for Ready Mix Paints IS:325
IS:325-1996	Three phase moors(3amendments)
IEEE:80-2000	Guide for Safety in AC Substation Grounding
IS:694-2010	PVC Insulated Unsheathed and Sheathed Cables/Cords with rigid and Flexible Conductor for rated voltages upto and including 450/750 V
IS:900-1992	Code of practice for installation and maintenance of induction motors
IS:1231-1974	Dimensions of three phase foot mounted induction motors (4 Amendments)
IS:2026	Power Transformers
IS:3231-1986,1987	Electrical Relays for Power System Protection
IS:3452-1966	Toggle Switches (3 Amendments
IS:3528-1966	Waterproof electric lighting fittings

IS:3637-1966	Gas operated relay (1 Amendment)
IS:3646	Code of Practice for Interior Illumination
IS:3725-1966	Resistance wire, tapes and strips for heating elements (3 Amendments).
IS:3842-1966	Application guide for electrical relays for ac systems
IS:3961-1967	Recommended current ratings for cables: Part 2 PVC insulated and PVC sheathed heavy duty cables (Part II-2 Amendments)
IS:3975-1999	Mild steel wires, strips and tapes for armouring cables
IS:4029-2010	Guide for testing three phase induction motors
IS:4794-1986	Push Button Switches (Part 2)
IS:4889-1968	Methods of determination of efficiency of rotating electrical machines (2 Amendments)
IS:5082-1998	Wrought aluminium and aluminium alloy bars, rod, tubes and sections for electrical purposes (2 Amendments)
IS:5216-1986	Guide for safety procedure to practices in Electrical work
IS:5561-1970	Electrical power connectors
IS:5578-1984	Guide for marking of Insulated Conductors
IS:5831-1984	PVC insulation and sheath of electric cables (2 Amendments)
IS:6362-1995	Designation of methods of cooling for rotating electrical machines
IS:7752-1975	Guide for improvement of power factor in consumer installation: Low and medium supply voltages
IS:7816-1975	Guide for testing insulation resistance of rotating machines
IS:8130-1984	Conductors for insulated electric cables and flexible cords
IS:8789-1996	Values of performance characteristics for three phase induction motors
IS:9385-1983	High Voltage Fuse
IS:9537-1983	Conduits for electrical installations (2 Amendments)
IS:9792-1987	AC Electricity Meters
IS:11353-1985	Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals
IS:12065-1987	Permissible limits of noise level for rotating electrical machines (1 Amendment)
IS:12075-2008	Mechanical Vibration of Rotating Electrical Machines with Shaft Heights 56 mm and Higher - Measurement, Evaluation and Limits of Vibration Severity

IS:15885 (Part2/Sec13)	2012 Safety of Lamp Control Gear, Part 2 Particular Requirements Section 13 d.c. or a.c., Supplied Electronic Controlgear for LED Modules
IS:16101: 2012	General Lighting - LEDs and LED modules – Terms and Definitions
IS:16102 (Part 1) : 2012	Self- Ballasted LED Lamps for General Lighting Services Part 1 Safety Requirements
IS:16102 (Part 2) : 2012	Self- Ballasted LED Lamps for General Lighting Services Part 2 Performance Requirements
IS:16103 (Part 1) : 2012	Led Modules for General Lighting Part 1 Safety Requirements
IS:16103 (Part 2) : 2012	Led Modules for General Lighting Part 2 Performance Requirements
IS:16104	d.c. or a.c. Supplied Electronic Control Gear for LED
2012	Modules - Performance Requirements
IS:16105: 2012	Method of Measurement of Lumen Maintenance of Solid State Light (LED) Sources
IS:16106: 2012	Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products
IS:16107Part 1) : 2012	Luminaries Performance Part 1 General Requirements
IS:16107-1: 2012	Luminaries Performance Part 2 Particular Requirements Section 1 LED Luminare
IS:16108: 2012	Photobiological Safety of Lamps and Lamp Systems
IS:60034-52000	Rotating electrical machines : Part 5 Degrees of protection provided by the integral design of rotating electrical machines (IP CODE) – Classification
IS:60470-2000	High-Voltage Switchgear Alternating Current Contactors and ContactorBased Motor Starters

In addition to Codes and standards, the installation works shall also conform to the requirements of following:

a) Indian Electricity Act and Rules

b) Fire insurance regulations

c) Regulations laid down by Chief Electrical Inspector

d) Regulations laid down by the Factory Inspector

e) Regulations for the electrical equipment of Tariff Advisory committee

f) Any other regulations laid down by the authority

g) Regulation of Pollution Control Board

4.14 Standardization

Care shall be taken so that the materials and equipment are standard catalogued products of manufacturers regularly engaged in manufacture of such products and shall be of the latest standard designs conforming to specification requirements. Design shall also be based on similar types of electrical equipment supplied from one manufacturer, utilizing interchangeable parts wherever practicable. Materials and equipment incorporated shall be of a type for which spare parts and replacements are readily available in India.

4.15 Diesel Engine

The engine shall comply with the requirements of relevant BS 649/BS 5514. Engine shall be designed for maximum reliability ensuring uninterrupted operations. Engine shall be capable of delivering 10% overload for a period of one hour in any consecutive twelve (12) hour period. The values of rating, rotative speed and brake mean effective pressure (BMEP) for a specific engine design will not be accepted unless they are published as catalogue data.

Engine shall be heavy duty, industrial type four stroke delivering matching BHP at 1500 rpm, turbo charged, radiator cooled, suitable for standby duty. Engine and auxiliary system shall be designed for safe start, stop and running on high speed diesel (HSD). Engine performance shall confirm to ISO:3046/BS:5574.

Engine governor shall be electronic. The set shall be capable of accepting at least 60% of rated load in a single step from an initial start-up condition.

Filters of the replacement element type shall be provided on the engine for fuel oil, lubrication oil and air intake.

Engine starting shall be 24V DC battery system designed so that at least two separate attempts can be made, to prevent complete loss of starting capacity in one attempted engine start. Sizing of starting system shall be in accordance with the engine manufacturer's recommendations, but in no case should the storage capacity be less than 30 seconds of cranking. An automatic static battery charger which possesses characteristics of "Zero-float" and positive charging shall be used. An engine-driven battery-charging generator is not acceptable. Batteries shall be maintained in a warm (20OF to 110OF) atmosphere to assist in quick starting. The battery system shall be of lead acid automotive type.

Flywheel guards shall be provided as required (if any).

An engine control unit free from vibrations comprising of the following devices with sensors (mounted at engine) shall be provided as minimum:

- Water temperature gauges for jacket water temperature
- Water pressure gauge
- Tachometer for engine speed
- Lubricating oil, pressure and temperature gauges
- Automatic shutdown and indication for low lubricating oil pressure, over crank, low coolant level, high cooling water temperature and engine over speed.

4.15.1 Engine Auxiliaries

A. Cooling System

Cooling system shall be radiator type. Anti-freeze liquids and corrosion inhibitor as recommended by engine manufacturer shall be used to obviate the danger of damage occurring from the use of incompatible or improper liquids or inhibitors.

B. Intake and Exhaust System

- A residential type exhaust silencer of suitable size for exhaust run shall be provided complete with all support frames etc. to reduce engine exhaust noise. It should be kept as straight as possible.
- Dry type air-inlet filter, exhaust manifold, mufflers shall be used. Type of filter selected shall be to fit the environmental conditions at site.
- Combustion air shall be taken directly from outside.
- Air-intake and exhaust shall be so located as to preclude the contamination of fresh air with exhaust gases.
- To dispose of the radiant heat given off by the exhaust pipe, sheet metal ductwork shall be supplied with 50 mm of space between the ductwork and the exhaust pipe.

C. Fuel Oil System

a. Fuel-injection system shall be complete with PT fuel pump, injectors, fuel filters and self-contained piping.

b. System shall generally comprises of:

- Day tanks of capacity for 10 hour running at 75% load.
- Pumps required for conveying fuel from day tank to engine.
- Critical pumps should be provided in sets (1 working + 1 standby)
- Day tank shall also act as a relief and by-pass tank for fuel oil that is circulated to the injectors whereupon any excess fuel is by-passed back to the day tank.

D. Fuel Filtering System

Primary filtering system shall be located at day tank inlet. In addition, engine shall have secondary filtering system. Both filters shall be capable of absorbing water.

E. Lubricating Oil System

Pressure lubrication system shall be used. Filter shall be of simplex type with paper element. Full flow lubricating oil filter can be mounted on the lubricating pump or remote mounted with flexible lines.

F. Piping and other Associated Connections

All piping, flexible connections, flange valves, seals, fittings etc. shall be supplied by the Contractor for all the associated auxiliaries of equipment.

G. Alternator

The Generator shall be air cooled, brushless, 3 phase, fan ventilated, synchronous type fitted with heavy duty, long life ball or roller bearing with forced lubrication or lubricant packed for approximately 4000 hours of running without attention. The alternator shall be manufactured in accordance with BS 2613 IEE-341 or as per relevant BIS, ISO, DIN, NEMA, standard. The unit shall be horizontally mounted. Enclosure shall possess minimum IP23 degree of protection.

Insulation throughout shall be class H, temperature rise by resistance.

All windings shall be impregnated to allow operation in climatic conditions specified in this volume.

The Alternator shall be provided with following minimum accessories:

- ❖ Resistance temperature detectors
- ❖ Bearing temperature detectors
- ❖ Space heaters.

H. Basic Ratings

The basic ratings of the Alternator shall be as follows:

a. Rated voltage: 415 Volts
b. Speed: 1500 rpm
c. Rated power output: As specified (Continuous rating)
d. Frequency: 50 Hz
e. Number of phases: Three
f. Power Factor: 0.8
g. Type: Brushless, synchronous, self-excited self-regulated

h. Neutral Earthing: Solid grounding
i. Voltage regulation: +1% of rated voltage from no load to full load at any power factor between 0.8 lagging and unity
j. Type of cooling: Self cooled fan ventilated
k. Metering and AMF Control Panel

This is intended for operation of DG set in auto mode. Panel shall be of sheet steel construction, free standing, floor mounting, top entry with front and rear access. Interior wiring of the cubicle shall be looped and clipped. All wire ends shall be clearly identified. Any printed circuit boards shall be tropicalized.
Following metering and protection devices as a minimum requirement shall be included in each panel:

a. Metering Instruments

- Digital Voltmeter
- Digital Ammeter
- Frequency meter
- KW meter
- Battery voltmeter
- Power factor meter
- Hours run indicator
- KWH meter
- KVAR meter
- Excitation current ammeter
- Excitation voltmeter
- Engine Speed Indicator

b. Push Buttons

- Engine start PB.
- Engine Stop PB.
- Lamp Test PB.
- Reset PB.
- Emergency Trip PB.

c Indication Lamps

- DG set on
- Load on DG set
- Set running
- Mains available
- Mains failure
- Start failure
- Generator over current
- Generator high voltage
- Generator low voltage
- Earth fault
- High engine speed
- Low engine speed
- Low fuel level
- High fuel level
- Charge failure
- Generator winding temperature high
- High bearing temp.
- Low lubricating oil pressure
- High lubricating oil temp.
- Engine jacket water temp. high
- Engine jacket water pressure low
- Reverse power
- Low fuel oil pressure
- Rotor diode failure

d. Protective Relays

- IDMT relay (Over current and earth fault)
- Over voltage relay
- Under voltage relay
- Reverse power relay
- Field failure relay
- Differential relay
- Phase failure relay

- MFT
- Voltage – Ph-to-Ph & Ph-to-N
- Current – line to neutral
- Power – kW, kVAH, kVAR (Avg. & Ph. wise)
- Energy – kWH, kVAH, kVARH
- Power Factor – Average & Ph. wise.
- System frequency
- Import & export kWH & kVARH.
- RS 485 MOD BUS

4.15.2 General Conditions for Electrical Works

a. All electrical works shall be executed to comply with and conform to the Indian Electricity Act & rules, relevant latest IS and direction of the Engineer-in-Charge.
b. Electrical items/equipment/cable etc. shall be ordered only after the samples/ drawings/test certificates submitted are approved by the Engineer.
c. Equipment/cables etc. shall be duly inspected at manufacturer's works/premises by the approved Third Party Inspection Agency and duly stamped before dispatch.
d. The Contractor shall engage suitable qualified/experienced/licensed engineering supervisors and skilled personnel with required license for electrical works as required under IE Rules for execution of electrical works.
e. Layout of all panels/equipment, cable layout & schedule etc. shall be furnished by the Contractor for approval before starting of work.
f. Cable tags shall be made out of 2 mm aluminum sheet, each tag 1½" dia with one hole of 2.5 mm dia, 6mm below the periphery. Cable designations are to be punched with letter/number punches and the tags are to be tied to cables with piano wires of approved quality and size.
g. Tags shall be tied inside the panels beyond the glanding as well as before the gland at cable entries. Along trays tags shall be provided at every 5 metres and at all bends.
h. All tests are to be carried out as per relevant latest BIS/IEC codes and specified copies of test certificates shall be furnished.
i. Earthing work shall be done as per latest BIS and in presence of the Engineer-in-Charge or his representative.

j. Earthing layout for all equipment shall be furnished for approval before starting of work.
k. The Contractor shall be responsible to obtain necessary approval from statutory/ concerned authorities before commencement of works. All drawings / documents required for such approval shall be prepared by the Contractor.
l. Inspection / acceptance, in no way shall absolve the contractor from supplying material as per standards / codes and warranty and other obligations under the contract.
m. CCoE and CMRI approval of FLP equipment are to be done by the Contractor. The design and fabrication of LT Panels / Distribution Board shall be done as per Type Test Certificate of CPRI / ERADA.
n. FRP LT Cable tray shall be provided with cover for laying LT and control cable.
o. Power cable laying in the road shall be as per standard with Hume pipe NP-2 class.
p. HT breaker, Transformer and LT ACP capacity / reading shall be mentioned in the relevant pages.
q. High Mast Towers shall be provided for lighting arrangements along with all jetties.

4.16 GENERAL SPECIFICATION OF GENERATOR SET

4.16.1 Intent

This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, packing, transportation, receipt at site, installation and commissioning of diesel engine or gas engine driven self-excited generator set complete with all materials and accessories for efficient and trouble-free operation.

The generator set shall be supplied complete with:

a) Brushless excitation system complete with AVR.
b) Local control panel including control cubicle and associated auxiliary devices, Generator breaker.
c) AMF panel built-in the local control panel (if specified).
d) Synchronizing panel located in PMCC room (if specified).
e) Any other part/ accessories not specifically mentioned above but considered necessary for safe and reliable operation.

4.16.2 CODES & STANDARDS

The generator shall comply with the latest edition of the following and other relevant Indian standards.

IS: 5 Colours for ready mix paints & enamels

IS: 2253 Designation for type of construction and mounting arrangement of rotating electrical machines.

IS: 4691 Degree of protection provided by enclosures of rotating electrical machinery.

IS: 4722 Specification for rotating electrical machines

IS: 4728 Terminal marking and direction of rotation for rotating electrical machinery.

IS: 4889 Methods of determination of efficiency of rotating electrical machines.

IS: 6362 Methods of cooling for rotating electrical equipment.

IS: 7132 Guide for testing synchronous machines

IS: 7306 Methods of determining synchronous machines quantities from tests.

IS: 7372 Lead Acid Storage Battery for Motor Vehicle

IS: 7816 Guide for testing of insulation of rotating machines

IS:10118 Code of practice for selection, installation & maintenance of switchgear and control gear

IS:12065 Measurement & evaluation of noise in machines

IS:12075 Measurement and evaluation of vibration of rotating electrical machinery

IS:12802 Temperature rise measurement of rotating electrical machines

IS:12824 Type of duty and classes of rating assigned to rotating electrical machines

IS:13364 AC generators driven by reciprocating internal combustion engines

IS:13947 Low voltage switchgear & control gear

In case of imported equipment, standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.
The equipment shall also conform to the provisions of CEA Regulations 2010 and other statutory regulations currently in force in the country.
In case Indian standards are not available for any equipment, standards issued by IEC/BS NDE/ IEEE/ NEMA or equivalent agency shall be applicable.

4.16.3 General Requirements of Generator

Construction

- The generator set will be driven either by a diesel engine or a gas engine as specified elsewhere for the generator. The complete specification for the prime mover is provided in the mechanical section of the bid package.
- The generator set with its drive unit shall be suitable for operation in indoor area having temperature maximum up-to 5°C above, out-door ambient temperature as given elsewhere in bid package Ventilation system to maintain inside temperature rise within this limit, if required shall be provided.
- The generator shall be directly coupled to the prime mover. The generator with its prime mover and all auxiliary items shall be mounted on a steel base-frame fitted with suitable anti-vibration isolators/ pads. The generator shall be provided with necessary lifting hooks and two earth terminals on opposite sides for connection to main earth grids.
- Generator rating, if specified elsewhere, shall be the net output of the set at specified site conditions after accounting for all auxiliaries for the prime mover and the generator.
- The machine shall be rotating field stationary armature type, brush less & self-excited. Generator enclosure shall be IP-23 (minimum) with winding given suitable treatment to render it non-hygroscopic.

The generator winding shall be of class **'F'** insulation with temperature limitation for class The windings and overhangs shall be braced to withstand the short circuit forces. Machines rated above 1000 KVA and above shall have minimum six nos. RTDs, (one per phase between the coil sides to measure winding temperature and one per phase at the base of slots to measure core temperature, each placed at 120' apart).

- The stator winding shall be star connected and all windings shall be brought out to six insulated terminals in a terminal box. Generator rated 1000 KVA and above shall also be provided with neutral terminal box in addition to line terminal box. The stator neutral side connection shall be brought in neutral cubicle having protection CTs. The terminal boxes for line terminals and neutral shall have sufficient space for termination of cables of the appropriate sizes. The terminal box for control cables shall contain properly marked terminals for all internal equipment e.g. embedded temperature detectors etc all terminals shall be stud type. The terminals boxes shall be of IP-42 (minimum), if not stated otherwise in data sheet and complete with lugs and double compression nickel-plated brass cable glands.
- Generators rated 1500 KVA and above shall have differential protection and shall be equipped with suitable current transformers.
- Field winding shall have class 'F' insulation with temperature limitation for class 'B'. The field winding shall be capable of operating at a voltage of 125% of field voltage at rated load for at least one minute starting from stabilized temperatures at rated conditions.
- All parts and accessories shall be suitable to withstand stresses due to over-speed / overload / short circuit conditions specified.
- Bearings shall be anti-friction, shielded and pre-lubricated. Grease in the bearing enclosure shall provide additional lubrication to bearing as well as provide sealing against dust and moisture.
- The generator shall be air cooled unless otherwise specified.

- The direction of rotation of the machine shall be compatible with that of the prime mover. A clear indication of the direction of rotation shall be given on either end of the machine.
- Suitable space heater to operate on 240V, 11) shall be provided. Heater terminals shall be brought out to a separate terminal box. Location and maximum surface temperature of heater shall be such that no damage is caused to any insulation.

4.16.4 Excitation System

The generator shall be provided with brushless type solid state self-excitation system with automatic voltage regulator. The excitation system shall include the automatic voltage regulator, AC exciter and rotating rectifier assembly.

The field of the exciter shall be fed from the stator winding through a suitable transformer and AVR. AC voltage generated in the AC exciter shall be rectified by the rotating rectifier assembly and fed to the main field circuits. The rotor winding of the AC exciter, the rotating rectifier assembly, main field winding of the generator and other accessories on rotor parts shall be rigidly fastened to the shaft and the connection with different items shall be anti-loosening type. All components shall be mounted considering the effects of the centrifugal forces. The exciter capacity shall be at least 20% more than the maximum requirement at any time. The exciter winding shall be insulated with class 'F' insulation with temperature limitation of class **`13'** insulation.

The rotating rectifier assembly shall consist of the rectifier bridge with parallel diodes, zener diode, fuses, field discharge resistors etc. Rotor circuit shall be designed to take care of rectification of AC voltage and proper field suppression through discharge resistors. The rating of Diode Bridge and armature shall be such that the full load rated current can be supplied with one branch in operation.

Automatic solid-state voltage regulator shall be provided with the

following features as minimum:

- Short circuit protection.
- Manual voltage control.
- Voltage build up Circuitry.
- Over voltage protection.

Generator shall be capable of operation over a range of + 5 % of the rated voltage unless specified otherwise. The regulator shall be supplied complete with cross current compensation (preferably static type), voltage setting device and all required accessories

4.16.5 Other Design Parameters

Transient voltage performance

Transient voltage behaviour of machine shall conform to the VG3 grade specified in IS: 13364. The generator shall operate satisfactorily under sudden load rejection up to full load.

4.16.6 Voltage regulation

The voltage regulation of the machine shall be within ±2% of the nominal voltage under following conditions:

- Between no load and nominal load with p f of 0.8 lag to unity.
- With the machine cold or warm.
- At a speed drop of approximately 3% of the nominal speed.

4.16.7 Voltage setting range

The generator terminal voltage shall be adjustable with a continuously variable potentiometer. The adjustment range shall be ±10% of the nominal voltage. Motorized potentiometer shall be provided where remote control of voltage is envisaged.

4.16.8 Unbalanced load

The generator shall be capable of withstanding without injury the effects of a continuous current unbalance corresponding to a negative phase sequence current of 8% of the rated current for cylindrical rotor machines and 10% for salient

pole machines provided none of the phase current exceeds rated current.

4.16.9 Waveform distortion

For machines rated up to 1250 KVA, harmonic distortion factor shall not exceed the values given in the IS: 13364 - part-2. For machines rated above 1250 KVA, telephone harmonic factor as per IS: 4722 shall be applicable.

4.16.10 Frequency limits

The generator shall be suitable for continuous operation at rated load for a frequency variation of ±3% of rated value. In addition the short time under frequency operating limits shall be furnished.

4.16.11 Over current requirement

For machines rated upto 1250 KVA, generator shall be capable of withstanding momentary excess current as per IS:13364. For machines rated above 1250KVA, stipulations of I8:4722 shall be applicable.

4.16.12 Short circuit conditions

The generator shall be capable of withstanding without damage, three phase or a line to line or line to earth or two line to earth short circuit for a period of 3 seconds when operating at rated speed and rated load and with an excitation corresponding to 5% over voltage.

4.16.13 Parallel operation

When specified elsewhere in the bid, generator sets shall be suitable for parallel operation amongst themselves or with other generating sets or with other sources (Grid supply) at operating voltage and under load conditions up to rated value. Details of sources with which generator is to be made parallel is available elsewhere in bid package.

4.16.14 Excitation support system

Excitation system shall be provided with short circuit support equipment (series compounding) to maintain three times the rated current for three seconds in case of short circuit to ensure proper fault clearance in outgoing feeders.

4.6.15 Auxiliary systems

All auxiliary motors required to start and run the prime mover shall be three phase 415 V, 50 Hz squirrel cage induction motor suitable for DOL starting. Insulation shall be class 'F' with temperature rise limited to class 'B'. All motors shall have IP - 55 enclosures as minimum and shall conform to the specification for M.V. Motors given with this bid package or relevant Indian standards (if the earlier specification is not given).

4.16.16 Noise

Statutory noise control requirements as applicable and as stipulated in the Mechanical Specifications shall be adhered to.

4.16.17 System Operation

The emergency generator set shall normally be in an unattended area. The control system shall be suitable for unattended operation. The control system shall operate in fail safe mode and shall include all controls and protection necessary for the safe operation of the package. The generator set shall function as per the following schemes:

- Auto on mains failure scheme (AMF) (if specified elsewhere).
- Manual start in service mode.
- Test mode

4.16.18 Auto mains failure scheme

This shall be effective in Auto position of Auto / Manual selector switch located in local (generator) control panel. The

generator set shall normally be at rest. Failure of normal power supply will be sensed from a remotely located panel in PMCC (whenever applicable) by the auto mains failure relay which will send signal (with a time delay) to start the generator (prime mover) automatically and rated speed and voltage shall be built up. All accessories required for starting and completion of various sequence of operation for the above purpose shall be provided as part of the generator set. Upon reaching the rated voltage and frequency, voltage monitoring relay located in control panel shall extend an impulse for closing sequentially first the generator breaker in the generator control panel and subsequently the incoming generator breaker in a remote panel in PMCC room (whenever applicable).

4.16.19 Manual start in service mode

This shall be effective in Manual position of Auto / Manual switch and service position of Service / Test selector switch located in local control panel. The scheme of operation shall be same as of auto mode as per the relevant clause above except that starting impulse shall be extended manually through the start push-button in generator control panel and the generator breaker in the generator control panel and the incoming generator breaker in a remote panel in PMCC room (whenever applicable) shall also have to be closed manually.

4.16.20 Test mode

This shall be effective in Test position of Service / Test selector switch. The scheme of operation shall be same as that of manual start in service mode as per clause above except that none of the generator breaker in the generator control panel or the incoming generator breaker in a remote panel in PMCC room (whenever applicable) can be closed in test mode run.

4.16.21 Shut down

Unless otherwise specified, stopping the generator (prime mover) in all cases (except in AMF scheme) for a normal shut down shall only be done manually by means of a stop push button in the generator control panel. In AMF scheme, the generator (prime mover) shall stop automatically upon sensing with a time delay) of return of normal power supply by the auto mains failure relay. The generator breaker in the generator control panel and the incoming generator breaker in a remote panel in PMCC room (whenever applicable), must trip in all cases (i.e. even if left in closed position by mistake of operator, during manual mode of operation), soon after the stop signal is sensed in any mode of operation with selector switches, hour-run meter, kW meter, kVAR meter, PF meter, digital frequency meter and set of CT's for metering (secondary 5A) for generator.

4.16.22 Starting time

The total time from the receipt of the starting impulse for the generator set till the set reaches rated speed and generator reaches full voltage shall not be more than 30 seconds. If this time is exceeded an annunciation in the local control panel shall be provided with a facility for repeat annunciation in a remotely located panel at the PMCC room.

4.16.23 Black start facility

The generator set shall be provided with all necessary 'Black start' facility. All D.C. supplies and chargers including batteries for start-up of prime mover shall be supplied as per Functional specifications for "Battery and Chargers For Engine Starting" attached with the bid.

4.16.24 DC control supply

Requirement for DC control supply for AMF/generator relay and control function shall be met by DC system consisting of battery and battery charger of suitable capacity to be supplied by the DG set vendor.

4.16.25 Generator Control Panel

The local generator control panel shall be floor mounted, free standing, metal enclosed fabricated with cold rolled sheet steel with thickness of 1.6 mm for doors and covers,2mm for load bearing parts and 3mm for base frame, gland plate etc, dust and vermin proof type with hinged door and having a minimum degree of protection of IP- 42.

- The panel should be rated for 50 KA short-circuit rating at 415 V, 34), 50 Hz supply.
- The control panel should have following basic components:

i) 1 no. 4-pole ACB (for incoming supply from the generator).

ii) Automatic voltage regulator (AVR), AVR CT/ PTs and metering CTs.

iii) 1 set of bus bar for phases and neutral. The bus bar should be of copper having colour coded PVC sleeves with suitable compartments/ bakelite spacers as per requirements of the panel.

iv) 1 set of metering section having ammeter and voltmeter of suitable range

v) 1 set of battery charger as specified in specification for "Battery & Battery Charger For Engine Starting"

vi) Control & protection relays required as described in section below.

vii) Control gear for generator set auxiliaries and neutral cubicle having protection CTs.

- Power and control equipment shall be segregated inside the panel as far as practicable. The maximum height of the operating handle / switches shall not exceed 1800mm and the minimum height not below 300mm. All cable entry shall be from the bottom of the panel only. Necessary removable type gland plate, double nickel plated brass cable glands and cable lugs shall be provided with the

panel.

- All auxiliary devices for control, indication, measurement and alarm such as push button, control/ selector switches, indicating lamps, metering instruments, annunciations etc. shall be mounted on the front door of the panel. Adequate number of potential free contacts shall be provided in the control panel for any remote control, monitoring of the generator set. The generator breaker rating shall be as specified in the data sheet. The breaker shall be in draw out execution. All motor starters for generator - prime mover set auxiliaries if required shall be DOL type in fixed execution with compartmentalized construction having sheet steel enclosed vertical panels along with horizontal and vertical bus bars. All bus bars shall be approachable from backside of panel. Each panel shall have a separate and approachable cable alley.

- All switches shall be load break, heavy duty type. All fuses shall be non-deteriorating HRC cartridge pressure fitted, link type. The contactors for auxiliary motor starters shall be of air-break type having AC-3 duty rating. Thermal overload relays shall be three element, positive acting, ambient temperature compensated type with adjustable setting range and built in protection feature against single phasing. All indicating instruments shall be moving iron, flush mounting type and of 72mm x 72mm square pattern. All control / selector switches rotary back connected type having a cam operated contact mechanism with knob type handle. 'Stop' push buttons shall be of stay push type.

- Wiring for power, control and signalling circuits shall be done with PVC insulated copper conductors having 660 V insulation grade. Minimum size of control wires shall be 1.5 mm2. Clamp type terminals shall be acceptable for wires up to 10 mm2 size and for conductors larger than 10 mm2 bolted type terminals with crimping lugs shall be provided. A minimum of 10% spare terminals shall be provided on each terminal

block.

- Minimum earth bus size shall be 50 x 6 mm2 electrolyte grade copper for connection to main earth grid. All non-current carrying metallic parts of the mounted equipments shall be earthed. Doors and movable parts shall be earthed using flexible copper connections. Two number terminals shall be provided in the panel for external earthing.
- AMF (Auto Mains Failure) scheme if specified elsewhere shall be provided as part of the generator control panel and the sequence of operation of the generator for starting, running and shut down under AMF shall be as described in relevant sections, as above. The DC control supply required for AMF / local control panel and for any other purpose shall be met by the DC system consisting of battery and battery charger of suitable capacity supplied along with the set of the generator and its prime-mover.
- Tripping of DG set for a normal shut down will be done manually by means of a stop push button on the control panel. There shall be a mushroom type emergency stop push button on the engine also. The trip impulse should directly go to the engine's shutdown device.

4.16.26 Control and protection system

The control panel shall have all the control and protection systems to be adopted for the normal starting, running and stopping of the prime mover, described under the "Mechanical scope of work/ Specifications" attached with the bid. Additionally, the control panel shall house the sensing devices and accessory relays for following abnormal condition, as applicable:

a) Starting battery voltage low.

b) DC control supply failure.

c) Incomplete start after a pre-set time

d) Failure to start.

e) Excitation failure/Field failure

f) Voltage out of limit (over/under voltage).

g) Over current.

h) Over/under frequency.

i) Stator earth fault.

j) Rotor earth fault.

k) Ground fault on the system

I) Unbalanced loading (Negative sequence current) protection.

m) Differential protection (rated power > 1500 KVA)

n) Reverse power (whenever generator is specified to run in parallel with others)

o) Stator winding temperature protection

Facia type annunciators shall be supplied and mounted on control panel to give visual and audible indication for the above abnormal conditions along with the specified abnormal conditions of the prime mover. Such abnormal conditions for the prime mover are specified in the specification of the prime mover in the 'Mechanical scope of work'. The panel shall have 20% spare windows also.

Tripping facility for the generator breaker (both on the generator control panel and on generator incoming breaker on remotely located PMCC panel) shall be available for conditions (f) to (o) above along with the abnormal conditions of the prime mover as specified in the specification of the prime mover in the 'Mechanical scope of work.

Specifications'. Wherever specified for remote annunciation few of these abnormal conditions of operation of the generator and the prime mover shall be simultaneously displayed through visual and audible alarms in a separate annunciation panel remotely located in the PMCC / Control room. The signals to be communicated to the remote annunciation panel are described elsewhere in the bid package.

4.16.27 Synchronizing Panel

Synchronizing panel shall be provided, if required. Sources with which the generator needs to be run on parallel is detailed out elsewhere in bid package. The synchronizing panel shall be located remotely in the PMCC room and shall be wall mounted, metal enclosed fabricated with cold rolled sheet steel with thickness of 2mm, dust and vermin proof type with hinged door and having a minimum degree of protection of IP- 42 and with proper double compression nickel plated brass glands.

- In the PMCC panel, the generator(s) incoming breaker(s) or the incoming breaker(s) from other sources of power or the bus-coupler shall be controlled through the synchronizing panel thus providing the scope of parallel operation of different sources of power in a sub-station.
- Synchronizing panel shall comprise of the synchro-check relay, synchro scope and frequency meter for the incoming machine and all other provisions for allowing manual synchronization of sources using the two-lamp method. Provision for adjustment of both speed and voltage for the incoming generator(s) shall be available in this remotely located PMCC panel. The frequency meter will show the bus frequency when the synchronization switch will be in 'OFF' position.
- All the breakers referred in section 3.6.2 and controlled through the synchronizing panel shall be capable of switching "ON" only one at a time, when permitted through the synchronizing panel and the sychro-check relay and under no other condition the breaker(s) can be switched "ON". Dead- Bus synchronization facility shall however be provided for all the incoming breakers.
- Whenever parallel operation of two or more generators is specified, there shall be suitable provision made for equal sharing of active and reactive powers between the generators and it shall be such that the ratio of sharing does not get disturbed during operation or with new loads thrown 'on' or 'off' line every time. The necessary adjustments / controls for achieving the same along with the required indications shall be made available in the remotely located PMCC panel in the PMCC room

where the synchronizing panel is located.

- Whenever synchronization panel is provided, one separate manual hand-held "Phase Sequence Meter" also needs to be provided.
- All meters, relays, lamps need to be properly rated and tested for their operating voltage levels; their load shall be calculated and taken into account while determining the capacity of their source of power. Provision of transformers, wherever required are to be made.

4.16.28 Painting & Name Plating

All metallic parts of the generator and the control panel and synchronizing panel (wherever specified) shall be painted / treated as per relevant standard. Tagging and name plating shall be done following relevant code. All panel mounted equipment (e.g. lamps, push buttons, switches, PCBs etc.) shall be provided with suitable name plates.

Labels shall be provided for every component on the cards, connecting wires as well as for the terminals in the terminal strip inside the panel. Special warning plates shall be provided on all removable covers or doors giving access to energized metallic parts above 24 volts.

4.16.29 Inspection & Testing

Inspection & testing shall be following the criteria mentioned under "Quality Assurance Plan" specified in in bid package. The generator set with all auxiliaries and control panel shall be tested to conform to the appropriate standards and the following is to be carried out as minimum:

Copies of the type test certificates for alternator as per IS-4722 shall be furnished for review.

Inspection and testing to be carried out by the vendor shall include the following as minimum:

i) Routine tests of alternator as per IS 4722.

ii) Functional tests, continuity tests and high voltage test on control panel to establish the performance called for in the specification.

iii) Power frequency voltage test on switch gear and mechanical / electrical operational check.

iv) Wave form test for alternator as per IS 4722

v) Measurement of vibration level for the generator as per IS-12075.

4.16.30 Drawings & Documents

Contractor shall submit the following as a minimum for approval / review by the company:

1. General arrangement, foundation & mounting details of drive & generator.
2. Foundation & mounting details for generator control panel, space required in front for withdrawals, power & control cable entry points etc.
3. Data sheets, technical specification, construction details of generator set.
4. Drawings for control Schematic, circuit diagram, alarm and protection schemes.
5. Performance & characteristic curves.
6. Bill of materials with makes.
7. Technical particulars of circuit breakers.
8. Copies of certificates for all type tests and routine tests for generator.
9. Copies of certificates for all type, routine and functional tests for panel with all individual components.

Manufacturer shall submit for purchaser's approval the general arrangement drawing, base frame details, and schematic and circuit diagrams. Purchaser's approval of GA drawing, schematic, logic and circuit diagram showing every device, terminal and wire number is required before the fabrication of the panel is started.

Purchaser's approval of contractor drawings and certifying test results shall not relieve the manufacturer of his responsibility for supplying

equipments conforming to relevant standards or for any mistake, omission or commission in manufacturer's drawings.

Operation & instruction manuals along with documents as mentioned above are to be handed over to purchaser at the time of handing over.

4.17 GENERAL SPECIFICATION OF DRY TYPE TRANSFORMER

4.17.1 INTENT

The intent of this standard specification is to define the general requirements for design, manufacture, assembly, testing at manufacturer's works, packing, supply, transportation, receipt at site, installation and commissioning of dry type transformers to be used as distribution or lighting transformers with all materials and accessories for efficient and trouble-free operation.

4.17.2 CODES & STANDARDS

The dry type transformer shall comply with the applicable clauses of the latest editions of the following and other relevant Indian standards.

IS: 1271 - Thermal evaluation and classification of electrical insulation insulating materials.

IS: 2026 - Power Transformers

IS: 2099 - Bushings for alternating voltages above 1000 V

IS: 2705 - Current transformers

IS: 3156 - Potential transformers

IS: 3347 - Dimensions for porcelain transformer bushing

IS: 3639 - Power transformer fittings and accessories.

IS: 4201 - Application guide for CTs

IS: 8468 - On-load tap changers

IS: 8478 - Application guide for on-load tap changers

IS: 10028 - Code of practice for selection, installation and maintenance of Transformers

IS: 10561 - Application guide for power transformers
IS: 11171 - Specification for dry type power transformers
IS: 13947 - LV switch gear and control gear
IEC 60076- Power transformers

IS/IEC 60529- Degree of Protection Provided by Enclosures (IP Code)

IEEE - Recommended practice for electrical power distribution (Std.141) for industrial plants.

- CBIP manual on transformers

In case of imported equipment, standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.

The equipment shall also conform to the provisions of CEA Regulations 2010 and other statutory regulations currently in force in the country.

In case Indian standards are not available for any equipment, standards issued by IEC/BS NDE/ IEEE/ NEMA or equivalent agency shall be applicable.

4.17.3 GENERAL REQUIREMENTS

Construction

a. The transformers shall be enclosed dry type transformers with non-encapsulated winding (vacuum resin impregnated dry type) for transformers up to 100 KVA rating and encapsulated winding (cast resin dry type) for transformers above 100 KVA rating.

b. The transformer shall be dry type, ANAN cooled suitable for indoor installation. This shall be provided with welded steel, free-standing enclosures with expanded metal screens of suitable size or louver backed by wire-mesh. Upper body of transformer tank and base shall be suitably reinforced to prevent distortion during handling. Base channels be provided with skids and pulling eyes to facilitate handling. Two numbers of earthing studs shall be provided on transformer body.

c. The complete assembly shall be mounted on suitable roller base to facilitate easy movement of the transformer.

d. The ingress protection of the enclosure shall be of minimum IP-33.

e. Different parts of transformer shall be connected by copper conductors for earth continuity purpose as described in standard specification for erection of earthing. Transformer earthing shall also be carried out following the same.

f. All fasteners bolts etc., shall be hot dip galvanized as per IS:802 or zinc passivated All surfaces to be painted shall be thoroughly cleaned, de-scaled, made free from rust and transformer shall be epoxy painted. Tagging and name plating shall be done as per relevant code,

g. The transformer shall be designed with particular regard to suppression of harmonic voltage.

4.17.4 Core and Winding:

a. The transformer shall be double wound core type with low loss, high permeability cold rolled grain oriented silicon steel laminations perfectly insulated and clamped to minimize vibrations and noise. Core fastening bolts shall be insulated to reduce losses and avoid hot spots. All parts of the magnetic circuit shall be effectively connected to earth system.

b. The winding shall be of high grade electrolytic copper and shall be designed for full load current and to withstand the thermal and electromagnetic stresses arising due to maximum fault level. The current carrying winding joints shall be electrically brazed.

c. The windings shall be provided with class "H" insulation (as applicable to dry type transformers as per IS-2026, Part-II) for transformers above 100 KVA and class "F" (as applicable to dry type transformers as per IS-2026, Part-II) for transformers up to 100 KVA. The temperature rise of windings under continuous full load shall not exceed the maximum allowable temperature for the appropriate class of insulation as per IS 2026 Part II, above the design temperature as specified elsewhere in the bid.

d. The insulation material used shall be non-hygroscopic, non-inflammable and self-extinguishing, if ignited by direct flame or arc. No

toxic or harmful gases shall form during heating and /or burning. The insulation materials shall be sufficiently resistant to ageing.

e. The transformers shall be capable of withstanding the thermal and mechanical effects of a dead short circuit on any or all winding terminals with full voltage maintained on other windings as per IS. The transformers shall sustain a symmetrical short circuit on secondary terminals for 2 seconds without damage or impairment.

4.17.5 Terminals & Marshalling Box

a. The transformers shall be provided with separate weather proof (IP-55) HV/ LV terminal boxes on the side.

b. Windings shall be brought out and terminated in cable boxes.

c. Cable boxes shall be supplied with cable lugs and double compression nickel plated brass cable glands for cable connections.

d. For MV/ LV XLPE power/ control cables, double compression glands shall be supplied. Gland plate shall be removable type. For single core cables, gland plate shall be of non-magnetic material. Cable box for the termination of high voltage XLPE cables shall be of adequate size. Such cable boxes should also have arrangements for grounding the armour of XLPE armoured cables inside the cable box. The head room available between cable gland plate and terminal lugs shall not be less than 600mm for cables up to 11KV and 900mm for 22KV and 33KV cables.

e. Cable lugs shall be tinned copper, solder-less and crimping type.

f. Primary cable box shall be able to withstand specified primary system fault level for 0.25 seconds.

g. Suitable earthing shall be provided for cable box.

h. Marshalling box shall be weather tight, having IP-55 protection. All protective devices and neutral CTs shall be wired by means of PVC/ XLPE insulated copper conductor armoured cables up to the marshalling box. Removable gland plates with double compression type nickel plated brass cable glands shall be provided.

i. Neutral of the star connected secondary winding shall be brought out to a secondary terminal chamber. A C. shall be mounted (if specified) on the neutral terminal with CT secondary wired up to the marshalling box. A separate neutral bushing shall be provided for neutral earthing of transformer. In such cases, the neutral CT shall be mounted before bifurcation of the neutral. Supporting arrangement for neutral bushing connection to earth/ NGR through GI strip/cable as applicable shall be provided.

4.17.6 TAPINGS & CONTROLS:

Tapings shall be provided on high voltage side and connected to off-circuit tap changing gear with clearly marked tap positions. Under conditions of external short circuit, the tap changing equipment must be capable of carrying the same current as the windings. The off circuit tap changing gear shall have an external operating handle mounted on the transformer side and shall meet the following requirements:

- Positive snap-action contact changing.
- The mechanism shall be such that it will be impossible for the contacts to be set in a position whereby the windings remain open circuited or partly short circuited.
- Mechanical stops at the ends shall be provided to prevent overrunning.
- The handle shall be metallic and adequately sized to allow operation without the need of any additional tools.
- The handle shall be with locking arrangement and position indicator.

4.17.7 Ventilation

For indoor type dry transformers it must be ensured that heat losses are removed from the transformer room. In order to assist natural convection, it is necessary to provide openings at the top of the room for warm to flow out and at a lower level, on the opposite side for inflow of fresh air. The minimum areas for ventilation openings are to be worked out and the required air circulation is to be achieved by putting suitable

fresh-air and exhaust-air fans in the corresponding openings.

4.17.8 Accessories

For transformers other than lighting transformers the following shall be provided:

a. Two temperature sensing devices in each limb.

b. Temperature sensing relay with one contact for alarm and one for trip.

c. Indicating platinum resistance type thermometer with alarm and trip contacts.

The trip signals to be extended to the H.V. panel for tripping the breaker on transformer trip conditions. The alarm and indication signals also to be extended to the H.V. panel/annunciation panel as required.

4.17.9 Noise

The audible sound level measured at 300 mm from the external surface of the transformer shall not exceed 74db.

4.17.10 Inspection & Testing

Inspection & testing shall be following the criteria mentioned under "Quality Assurance Plan" specified in bid package.

Copies of all type test certificates for the transformers as per IS-11171 shall be furnished for review.

All routine tests and special tests according to IS-11171 shall be carried out.

4.17.11 Drawings & Documents

Contractor shall submit the following as a minimum for approval/ review by the company:

a. General arrangement drawing showing constructional features, space required in front for removal, power & control cable entry points etc.

b. Foundation plan.

c. Installation and mounting details.

d. Control schematic and circuit diagram showing every device, terminal and wire no.

e. Bill of materials with makes.

f. Filled in data sheet.

g. Copies of certificates for all type tests.

h. Copies of certificates for all routine and special tests for transformer.

i Catalogue and brochures.

Purchaser's approval of contractor drawings and certifying test results shall not relieve the manufacturer of his responsibility for supplying equipment conforming to relevant standards or for any mistake, omission or commission in manufacturer's drawings.

Operation & instruction manuals along with documents as mentioned above are to be handed over to purchaser at the time of handing over.

4.18 HT Switchgear

4.18.1 Introduction

This specification covers the requirements of 33 kV Switchgear complete with all accessories for the firefighting facilities.

4.18.2 Codes and Standards

Equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following Indian Standards and relevant IEC standard, except where modified and/or supplemented by this specification.

- IS:375 Marking and arrangement of switchgear bus
- IS:13118 Specification for high voltage alternating current circuit breaker
- IS:12729 Switchgear and Control gear for voltages exceeding 1000V-General Requirements
- IS:2705 Current transformers
- IS:3156 Voltage Transformers

4.18.3 General Requirements

Switchgear shall comprise of one incomer cum outgoing feeder. Continuous current rating of the Switchgear shall be based on the name plate rating of the connected equipment with 20% margin, rounded off to the next higher standard rating. 33 kV Switchgear shall be rated for short circuit withstand capacity of 26.3 kA for 1 seconds.

Bus bars, breaker and other components shall be designed for continuous operation at rated current considering temperature inside the cubicle. Inside cubicle temperature shall be considered as design ambient temperature for maximum continuous operation rating of the equipment. For breaker control, 110 V DC supply shall be considered.

Each breaker module shall be provided with multifunction numerical relay for protection. Switchgear shall be provided with separate earthing trucks for cable earthing and bus earthing.

4.18.4 Switchgear Construction

Switchgear shall be indoor, single front, single tier, metal-clad, floor mounted, fully draw-out with VCB breaker. Design and construction shall be such as to allow extension at either end. Switchgear cubicle shall be so sized as to permit closing of the front access door when the breaker is pulled out to Test position. The working zone shall be restricted within 750 mm to 1800 mm as from floor level.

Circuit breakers, instrument transformers, bus-bars, cable compartment, auxiliary control devices etc., shall be housed in separate compartments within the cubicle. The design shall be such that failure of one equipment shall not affect the adjacent units. The circuit breaker and bus voltage transformers shall be mounted on withdrawable trucks. In case breaker truck rolls out on telescopic rails suitable trolley shall be provided. The breaker shall be designed for a short circuit rating of 26.3kA for 1 second. All relays, meters,

switches and lamps shall be flush mounted on the respective cubicle door or on a control cabinet built on the front of the cubicle.

The trucks shall have distinct 'Service', 'Test' and 'Isolated' positions. The switchgear assembly shall be designed to achieve IP54 degree of protection, with the truck in any position 'Service', 'Test' and 'Isolated' and all doors and covers closed. Relaying and Metering compartment shall also have degree of protection IP54.

Enclosure shall be constructed with rolled steel sections / sheets of not less than 2mm. The switchgear shall be cooled by natural airflow. Forced cooling shall not be accepted. The Breaker and the auxiliary compartments provided on the front side shall have strong hinged doors. Breaker compartment doors shall have locking facility.

4.18.5 Bus and Bus Taps

Main buses and connections shall be of high conductivity aluminium, sized for specified current ratings with maximum temperature limited to 90°C. Maximum Current density for Aluminium bus bar shall be considered as 1.0 Amps / mm2. Busbars shall be designed for a short circuit rating of 26.3kA for 1 sec. All bus connections shall be silver plated. Adequate contact pressure shall be ensured by means of two bolts connection with plain and spring washers and lock nuts. Bimetallic connectors shall be furnished for connections between dissimilar metals. Busbar insulators shall be epoxy cast resin type designed to withstand stresses due to maximum short circuit current.

Busbars and connection shall be fully insulated for working voltage with adequate phase/ground clearances. Insulating sleeves for busbars and cast-resin shrouds for joints shall be provided. Cross section of the main horizontal busbar shall be uniform throughout the switchboard and continuous in one transport unit. All buses and connection shall be supported and braced to withstand stresses due to maximum short circuit current and also to take care of any thermal expansion.

Busbars shall be colour coded for easy identification and so located that the sequence R-Y-B shall be from left to right, top to bottom or front to rear, when viewed from front of the switchgear assembly. The busbar chamber shall be provided with inter panel barrier

with epoxy case seal-off bushings which the buses shall pass through so as to prevent fire from one panel to another.

4.18.6 Circuit Breaker

Circuit breaker shall be triple pole, single throw Vacuum Circuit breaker. It shall be restrike free, trip free type. Breakers shall be suitable for switching transformers at any load. Rated operating duty shall be O-3min-CO-3min-CO. Short circuit withstand/interrupting capacity shall be 26.3 kA.

Circuit breakers shall be draw-out type, having SERVICE, TEST and DISCONNECTED positions with mechanical positive indication for each position. Operating mechanism shall be stored energy type. Circuit breakers of identical rating shall be physically and electrically interchangeable. Circuit breaker shall be microprocessor based with RS 485 communication facility.

- Each breaker feeder shall be provided with the following:
- An antipumping relay.
- Motor charged spring operating mechanism.
- Manual spring charging
- Mechanical indication of spring charge
- Mechanical position indicator (to show whether the breaker / contactor is 'ON' or 'OFF' in the service, test and disconnected positions)
- Closing coil (100% continuous rated)
- Shunt trip (100% continuous rated)
- Manual trip push button
- Operation counter,
- Locking facility to prevent breaker/contactor from being closed when it is open.
- Pressure relief device
- Safety shutters for power contacts
- Interpole insulators

For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor.

- Robust fail-safe mechanical and electrical interlocks shall be provided to prevent the following situations: Move the breaker unit from the service or disconnected position while the unit is closed.
- Move the breaker from the disconnected position to the service position while the earthing switch is closed.
- Close the earthing switch when the breaker unit is in service position or between the service and disconnected position.
- The operation of the circuit breaker while the truck is not properly installed in the service, test or disconnected position.

The closing coil and spring charging motor shall operate satisfactorily at all values of control supply voltage between 80 and 110 percent of the rated voltage. The shunt trip coil shall operate satisfactorily at all values of control supply voltage between 70 and 110 percent of the rated voltage. For breakers spring charging motor shall be provided with over current protection. Motor windings shall be provided with class B insulation or better.
Circuit breaker shall not produce any harmful over-voltage during switching off induction motors. Surge protective devices to limit over voltage shall be included in the scope of supply for all motor feeders.

4.18.7 Current Transformer (CT)

CTs shall be mounted on the switchgear stationary parts. CT secondary current shall be 1A. Core balance CT shall be provided for all the outgoing feeders. Accuracy class of the current transformer shall be:

a. Class PS/ 5P20 for differential relaying and REF protection (Based on type of relay)

b. Class 5P20 for other relaying c. Class 0.5 and ISF < 5 for metering d. Class 0.2S for Energy Accounting & Audit meters

Core balance CT and associated relay combination shall be such as to ensure a pick up sensitivity of 10 A primary ground fault current for all the outgoing feeders. Facilities for easy shorting and grounding the terminals shall be provided at the terminal block. All terminal blocks shall be of stud type with marking strip.

4.18.8 Voltage Transformer

Voltage Transformer shall be cast-resin, draw-out type and shall have an accuracy class of 0.5. Voltage Transformer mounted on breaker carriage is not acceptable. Rated secondary voltage shall be 110V. Accuracy class for metering core shall be 0.5, protection core shall be 3P and 0.2 for energy accounting & audit meters. High voltage windings of voltage transformer shall be protected by current limiting fuses. MCB shall be provided on the secondary side of all voltage transformers to trip in case of failure of fuses.

The following over voltage factor shall be considered for PT.

- 120% for continuous duty.
- 150% for 30 sec (For 415V solidly grounded system)

The voltage transformer and fuses shall be completely disconnected and visibly grounded in fully draw-out position.

Low voltage MCB's, sized to prevent overload, shall be installed in all ungrounded secondary leads. MCB's shall be suitably provided with auxiliary contacts. MCB's auxiliary contacts connected suitably through relay shall be provided on the secondary side of all voltage transformers to monitor failure or trip of MCB's. The relay shall initiate alarm and block the tripping etc. which shall operate in case of VT MCB trip or failure.

4.18.9 Relays

Numerical multifunction relays with RS485 communication port shall be provided for all feeders. Numerical relay shall have trip circuit supervision. All protective relays shall be draw-out type, suitable for flush mounting and fitted with dust tight covers. All relays shall have built-in testing facilities. Small auxiliary relays may be of non-draw-out type and mounted within the cubicle. Relays shall have lock-out facility with manual reset. Each feeder shall be complete with necessary auxiliary relays, timers, etc., to meet the circuit requirement. Under voltage relays shall be provided in the bus PT circuit.
Relays shall be rated for operation on 110V VT secondary voltage and 1A CT secondary current. The switchgear shall be provided with DC fail relay and DC fail indication lamp for each DC control supply incomer. DC isolation switch for each feeder shall be

provided with backup HRC fuse. Breaker auxiliary contacts used for interlocking purposes shall be multiplied using electrically latched relay.

- Outgoing transformer feeders shall have the following minimum protection relays.
- Numerical protection relay having Short circuit protection (50) on all the three phases, IDMT Over current protection (51) on all the three phases, Instantaneous earth fault protection (50 N).
- Instantaneous earth fault protection through CBCT (50 N).
- Backup earth fault protection connected to Transformer neutral CT (51N).
- Latched Lock out relay (86).
- Trip circuit supervision relay
- REF protection relay (For 2MVA & above)

Self-reset auxiliary relays with hand reset flag indicator shall be provided for contact multiplication of the following:

a. Transformer winding temperature indicator alarm and trip contacts.
b. Transformer pressure relief trip contacts.

Incomer and Tie feeders shall have the minimum following protection relays.

a. Numerical protection relay having IDMT Back up over current protection (51) on all the three phases, IDMT Back up Earth fault protection (51N) and Definite time delayed Back up earth fault protection residually connected (50N).
b. Latched Lock out relay (86).
c. Trip circuit supervision relay

Motor feeders shall have the minimum following protections.

a. Numerical motor protection relay
b. Instantaneous earth fault protection through CBCT (50 N).
c. Latched Lock out relay (86).
d. Under voltage protection
e. Trip circuit supervision relay

Bus PT shall have the following protections.

a. Under voltage relay

b. MCB trip or failure relay
c. No voltage relay

4.18.10 Control Switches

Breaker control switch (T-N-C) shall be 3-position spring return to `neutral' from both close and trip positions. They shall have `Pistol Grip' handle.

Ammeter selector switches shall have make before break feature on its contacts. The selector switch shall generally have four positions, three for reading three phase currents and the fourth as off position. The voltmeter selector switch shall measure phase to phase voltages.

The contacts shall be of silver plated, air break type. The continuous current and breaking capacity of the contacts shall be adequate for the duty involved.

4.18.11 Indicating Lamps

Indicating lamps shall be panel mounting, LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary. Lamps shall have translucent lamp-covers of the following colors, as warranted by the application. Bulbs and lamp covers shall be easily replaceable from the front of the cubicles. Low Voltage Glow Prevention (LVGP) feature shall be provided for indicating lamps. The colour of indication lamps shall be as follows:

- GREEN : Breaker Open
- RED : Breaker Closed
- AMBER : Auto trip & all Alarm conditions
- BLUE : Spring Charged
- WHITE : For all healthy conditions (e.g. Trip coil healthy & Control supply healthy).

For each breaker feeder, Panel indication lamps shall be provided as follows:

- Breaker Open
- Breaker Closed
- Auto trip
- Motor Spring Charged

- Trip coil healthy
  - Control supply healthy
  - Breaker in service position
  - Breaker in Test position
  - Lockout relay healthy
  - Any other indication, as required
  - For incomer & Bus, indicating lamps for R, Y, B phase shall be provided.

4.18.12 Meters

All Indicating meters shall be digital type, 96 x 96 mm size, suitable for flush mounting with constant accuracy for the entire range of respective parameters with an inbuilt provision for calibration verification. The instruments shall have an accuracy class of 1.0. All Multifunction meters shall have digital display and communication port with true rms measurement facility with minimum 1% accuracy level. All digital meters shall be with RS485 communication port. For incomers following Meters and transducers shall be provided:

- Ammeter
- Voltmeter
- Current transducer on three phases
- Voltage transducer on three phases
- Multifunction meter with digital display and communication port for kW, kVAR, kWH and power factor measurement.

For outgoing transformer feeders following Meters and transducers shall be provided:

- Ammeter
- Current transducer on one phase
- Multifunction meter with digital display and communication port for kW, kVAR, kWH measurement.

For outgoing motor feeders following Meters and transducers shall be provided:

- Ammeter on one phase
- Current transducer on one phase
- Hour run meter

For Bus VT following Meters and transducers shall be provided:

- Voltmeter
- Voltage transducer on three phase

All transducers shall have dual output of 4-20 mA range. For motor feeders, it shall be 4-20-24 mA to measure starting current also.

4.18.13 Secondary Wiring

Switchgear shall be fully wired at the factory to ensure proper functioning of control, protection, transfer and inter locking schemes. Fuse and links shall be provided to permit individual circuit isolation from bus wires without disturbing other circuits. All spare contacts of relays, switches and other devices shall be wired up to terminal blocks. Wiring shall be done with flexible, 1100V grade, PVC insulated switchboard wires with stranded copper conductors of 2.5mm² for current circuits and 1.5 mm² for voltage circuits. Each wire shall be identified, at both ends, with permanent markers bearing wire numbers as per Contractor's wiring Diagrams. Wire termination shall be made with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals. All external cable terminations shall be accessible while the breaker is in service position.

4.18.14 Terminal Blocks

Terminal blocks shall be 1100V grade box-clamp type with marking strips. CT shorting links, Drop link type terminals shall be provided for CT secondary leads. Not more than two wires shall be connected to any terminal. Spare terminals equal in number to 20% active terminals shall be furnished. Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.

4.18.15 Cable Termination

Switchgear shall be designed for cable entry from top. Sufficient space shall be provided for ease of termination and connection. All provision and accessories shall be furnished for termination and connection of cables, including removable gland plates, cables supports, crimp type tinned copper lugs, brass compression glands with tapered washer and terminal blocks. 8.4.16 Name Plates

Name plates of approved design shall be furnished at each cubicle and at each instruments & device mounted on or inside the cubicle. The material shall be lamicoid or approved equal, 3 mm thick with white letter on black back ground. The material shall be held by self-tapping screws. Nameplate size shall be minimum 20 X 75 mm for instrument device and 40 X 150 mm for panels. Caution notice on suitable metal plate shall be affixed at the back of each vertical panel.

4.18.16 Space Heaters and Plug Sockets

Each cubicle shall be provided with thermostat controlled space heaters and cubicle lamp with door switch suitable for operation from 240 V, single phase AC supply and 5A, 3 pin plug socket. Space heater shall be located at the bottom of each switchgear compartment. Cubicle heater, Motor heater, Plug/socket circuits shall have individual MCB units. In addition, motor feeder cubicle shall be wired-up for feeding the motor space heater through suitable rated breaker auxiliary NC Contact and/or contactor.

4.18.17 Testing and Inspection

Switchgear and all its components should have been type tested and proven type. Type test certificates shall be furnished for Purchaser's review. Switchgear and its components shall be subjected to routine tests as per applicable Indian Standard. In addition, any special test required shall also be performed. Test reports shall be submitted for approval.

4.18.18 Spares List

Suitable number of commissioning and successful running for 2 years spares list shall be submitted for approval.

4.19 LT SWITCHGEAR

4.19.1 Introduction

This specification covers the requirements of 415 V Power Control Centre, Lighting / Welding Distribution Boards, Starters, Local Push button stations etc. complete with all accessories for the firefighting facilities.

4.19.2 Codes and Standards

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following Indian Standards and relevant IEC standard, except where modified and/or supplemented by this specification.

- IS:3427 - Metal enclosed switchgear and control gear
- IS:8623 - Specification for low voltage switchgear and control gear assemblies
- IS:10118 - Code of Practice for Selection, Installation and Maintenance of switchgear & control gear
- IS:12021 - Specification for Control transformers for switchgear and control gear for voltages not exceeding 1000V AC.
- IS:13703 - Low Voltage fuses
- IS:13947 - Low Voltage switchgear and control gear

4.19.3 General Requirements

The switchgear and its components shall be designed for design ambient temperature of 45OC. Switchgear shall be designed for natural air cooling. No forced cooling is acceptable.

Power Control Centre (PCC) shall have two incomers and one bus coupler. Auto/Manual/Planned Changeover scheme shall be provided for PCC with interlocking of PCC I/C breaker with upstream breaker. Incomer, bus coupler & Outgoing breakers shall be controlled automatically through interlock scheme so that at a time only one type of supply (Electricity Board or DG) is available. Alternatively provision for controlling the same from PLC shall also be provided so that in future, if the same is installed, breaker can be operated through the same. Synchronizing feature shall be provided in the PCC for changeover.

Short circuit withstands rating of the switchgear shall be as given in the attached SLD. 415V normal system shall be solidly grounded.

Bus bar, breaker and other components shall be designed for continuous operation at rated current considering temperature inside the cubicle.

Close & Open control of all the motors shall be controlled automatically through interlock scheme or locally. Alternatively provision for controlling the same from PLC shall also be provided so that in future, if the same is installed, breaker can be operated through the same. Provision for remote indications / alarms in the PLC shall also be provided. Control / interlock schemes for various types of feeders shall commensurate with their application.

PMCC shall be fixed type for all the modules except for the air circuit breaker panels which shall be of fully draw out type. Distribution boards shall be of fixed type. All PCC/MCC/DB shall be single front type. 240V control supply shall be derived from 415/240V control supply transformer located in respective module. 240V AC space heater supply provision shall be provided for motors rated above 30 kW. For breaker operated feeders, control supply voltage shall be 110V DC.

Continuous current rating of bus bars, incomers, bus coupler of the PCC shall be the maximum load on the bus due to all the running auxiliaries during any operating condition plus 20% margin rounded off to the next higher standard rating.

At least 20% of feeder modules covering the range of motors used subject to minimum of one module in each bus section shall be provided as spare. Spare modules shall be completely wired up.

All motors shall have direct on line starter. 90kW and above capacity motors shall be fed from ACBs. Less than 90kW capacity motors shall be fed by MCCBs/MPCBs and contactors.

However, the duty of the drive/application, i.e. high impact loading, etc. to be considered as criteria for selecting ACB operated motors even for rating < 90kW.

Operating height of the handles/switches shall be limited to a maximum of 1800 mm and a minimum of 300 mm.

If there is an under voltage (dipped to 30-40% voltage), sensed through under voltage relays, the incomer breaker of Electricity Board shall trip automatically and the bus coupler shall open and DG switched on with simultaneous closing of the DG breaker,

thereby establishing voltage at 415V motor terminals before motor reaches standstill condition. The auto changeover shall be blocked if any of the following condition exists:

- Involved breaker is in the test or withdrawn position.
- Source voltage is not available.
- Source breaker is tripped due to bus fault.

No release is acceptable for Breaker feeders. Only CT operated relays shall be provided for protection. MCCB, Contactor and overload relay shall meet type-2 co-ordination as per applicable standard.

4.19.4 Design and Construction - Power cum Motor Control Centre (PMCC)

415V PMCC shall be metal enclosed, indoor, floor-mounted, free-standing type. Switchboard frames and load bearing members shall be fabricated using CRCA sheet steel of thickness not less than 2.0 mm. Doors and covers shall also be of CRCA sheet steel of thickness not less than 1.6 mm. Thickness of gland plates shall not be less than 3.0 mm for sheet steel & 4.0mm for nonmagnetic material. All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with IP52 degree of protection.

All switchboards shall be of uniform height not exceeding 2450 mm. Switchboards shall be easily extendable on both sides by the addition of vertical sections after removing the end covers.

Module size of switchboards shall not be less than 200mm. Cable entry for PCCs/DBs shall be from top.

Switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments:

Main busbar compartment:

- Switchgear / feeder compartment
- Cable alley
- Auxiliary busbar compartment
- Control compartment for relays for ACB feeder

The feeder compartment shall be sheet steel enclosed on all sides. The front of the compartment shall be provided with the hinged single leaf door with captive screws for positive closure and hinged or bolted covers at the rear. All circuit-breaker panels shall be of single-front type. Covers shall be provided with "DANGER" labels.

All 415 V circuit-breaker modules shall be fully draw out type having distinct `Service' and `Test' positions. Equipment pertaining to a draw out type module shall be mounted on a fully withdrawable chassis, which can be drawn out without having to unscrew any wire or cable connection. Suitable arrangement with cradle / rollers and guides shall be provided for smooth movement of the chassis.

4.19.5 Distribution Boards

Distribution boards shall be metal enclosed, fixed type, single front, and compartmentalized construction. Distribution board frame shall be fabricated using CRCA sheet steel of thickness not less than 2.0 mm. Suitable synthetic rubber gaskets shall be provided to make boards completely dust and vermin-proof with a degree of protection of IP52 for indoor installation. Handle of incoming switch shall be mounted on the door of the board, with padlocking facility in both 'ON' and 'OFF' positions. Cable entry facilities shall be provided with removable gland plates of suitable thickness. All incoming and outgoing cables shall be terminated on suitable terminal blocks.

4.19.6 Air Circuit Breakers

Air Circuit breakers shall be (three pole for motor feeders and TPN for other feeders), air break, horizontal draw out type, and shall have fault making and breaking capacities as specified. These shall be microprocessor based with RS 485 communication facility. There shall be "SERVICE", "TEST" and "ISOLATED" positions for the breakers. In "Test" position, circuit breaker shall be capable of being tested for operation without energizing the power circuits i.e. power contacts shall be disconnected, while the control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "ISOLATED" position. It shall be possible to close the door in "Test" position.

Each breaker feeder shall be provided with the following as a minimum:

- Electrical anti pumping feature
- Motor charged spring operating mechanism.

- Manual spring charging
- Mechanical indication of spring charge
- Mechanical position indicator
- Closing coil
- Shunt trip coil
- Manual trip push button
- Operation counter
- Phase barriers
- Shutter assembly
- Door interlock kit

The closing coil and spring charging motor shall operate satisfactorily at all values of control supply voltage between 80 and 110 percent of the rated voltage. The closing coil & shunt trip coil shall be rated for 100% continuous duty. One Open-Close-Open operation of the circuit breaker shall be possible after failure of power supply to motor. For breakers spring charging motor shall be provided with over current protection. Motor windings shall be provided with class B insulation or better. The shunt trip coil shall operate satisfactorily, all the values of control supply voltage between 70 and 110 percent of the rated voltage.

Circuit breaker of the same type and ampere rating shall be wired alike and shall be mechanically interchangeable.

All Air Circuit Breakers shall be provided with the following interlocks:

- Movement of a circuit breaker between “SERVICE” and “TEST” position shall not be possible unless it is in open position.
- Closing of a circuit breaker shall not be possible unless it is in “SERVICE” position, “TEST” position or in “ISOLATED” position.
- Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.

Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit-breaker module in a cubicle. The trolley shall be such that the topmost breaker module

can be withdrawn on the trolley and can be lowered for maintenance purpose. ACBs shall have CT operated relays for over current and earth fault protection.

4.19.7 Moulded Case Circuit Breaker (MCCB)

MCCB shall in general conform to IS: 13947 Part-2. MCCBs shall be provided with thermomagnetic type release for over current and short circuit protection. These shall be microprocessor based with RS 485 communication facility. The setting of the thermal release shall be adjustable from 75% to 100% of the rated current. The MCCB shall have breaking capacity not less than 50kA. MCCBs used for incomers and Bus coupler shall be equipped with stored energy mechanism for electrical closing and tripping. All other MCCBs shall be manually operated. The operating handle should give a clear trip indication.

4.19.8 Control and Selector Switches

Control and selector switches shall be of rotary type, with escutcheon plates clearly marked to show the function and positions. Circuit breaker control switches shall have three positions and shall be spring return to “NEUTRAL” from “CLOSE” and “TRIP” positions and shall have pistol grip handles. Circuit breaker selector switches shall have three stay put positions marked `Test’, `Local’ and `Remote’, respectively. They shall have black spade handles. Selector switches for starter modules shall have ‘Test’, ‘Local’, ‘Remote’ positions as specified. Ammeter and voltmeter selector switches shall have four stay put positions with adequate number of contacts for 3-phase 4-wire system. These shall have oval handles. Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondary.

4.19.9 Contactors

Motor starter contactors shall be air break, electromagnetic type rated for uninterrupted duty. Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced. Direct-on-line contactors shall be of utilization category AC3. Reversing starters shall comprise of Forward and Reverse contactors mechanically and electrically interlocked with each other. These contactors shall be of utilization category AC4. The contactor shall operate satisfactorily from 85% to 110% of the rated voltage. The contactor shall not drop out at 70% of the rated voltage but shall definitely drop out at 20% of the rated voltage.

4.19.10 Instrument Transformers

All CTs and VTs shall conform to the requirement of IS: 2705 and IS: 3156. The CTs shall be mounted on the switchgear stationary parts. For metering & protection separate CTs shall be provided. The CTs shall be of cast resin, bar primary type and of Class E or better insulation. CT secondary current shall be 1A. Accuracy class of Current Transformer shall be Class 5P20 for relaying and Class 0.5 and ISF < 5 for metering. CTs for current rating less than 50A shall be 'Wound primary' type and above 50A shall be 'bar primary' type.

Voltage Transformer shall be cast-resin, draw-out type and shall have an accuracy class of 0.5. The bus VTs shall be housed in a separate compartment. All VTs shall have readily accessible fuse and MCBs on primary and secondary sides respectively.

4.19.11 Indicating Instruments

All Indicating meters shall be digital type, 96 x 96 mm size, suitable for flush mounting with constant accuracy for the entire range of respective parameters with an inbuilt provision for calibration verification. The instruments shall have an accuracy class of 1.0. All such meters shall be fed through suitable Current transformers for motors rated 10kW & above. All Multifunction meters shall have digital display and communication port with true RMS measurement facility with minimum 1% accuracy level.

4.19.12 Push Buttons

Push-buttons shall be of spring return, push-to-actuate type. Where specified push buttons shall be stay put type. Their contacts shall be rated to make, continuously carry and break 10A at 500 V AC. All push-buttons shall have two normally open and two normally closed contact, unless specified otherwise. The contact faces shall be of silver alloy. All push-buttons shall be provided with integral escutcheon plates marked with its function. All emergency push-buttons shall be stay put/latching type. To detach, master key provision shall be provided.

The colour of the button shall be as follows:

- Green for motor START, breaker CLOSE, valve / damper OPEN /CLOSE commands.
- Red for motor TRIP, breaker OPEN.
- Black for all annunciator functions, overloads reset and miscellaneous commands.

4.19.13 Indicating Lamps

Indicating lamps shall be of the panel mounting, LED type .The lamps shall have escutcheon plates marked with its function, wherever necessary. All indicating lamps shall be rated for continuous operation at 85% to 110% of their rated voltage. Low Voltage Glow Prevention (LVGP) feature shall be provided for indication lamps. Lamps shall have translucent lamp-covers of the following colours, as warranted by the application:

- Red for motor ON, breaker CLOSE.
- Green for motor OFF, breaker OPEN.
- Blue for Service
- White for Test, Spring Charged, Spring Discharged, Lockout Relay Healthy
- Amber for auto trip

4.19.14 Control Supply and Space Heater Supply

Control supply as required for any application shall be 240V AC derived through a Control Transformer.

For space heater circuits of motor rated more than 30kW and also for panel space heater, 240V AC supply shall be provided by tapping from the incomer before the main isolating switch/breaker. Necessary switch and MCB to isolate and distribute the supply to each panel shall be provided. For motor feeders, circuit for motor space heater shall be wired through NC contact of breaker/contactor and MCB. Each panel of PCC/MCC/DB shall be equipped with the following as required:

- Thermostatically controlled space heater(s).
- Illumination lamp with door switch
- 5A 3pin socket with MCB protection

4.19.15 Wiring

All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables. All internal wiring shall be carried out with 1100 V grade, HR PVC/ XLPE insulated single core, copper conductor of minimum 2.5 sq.mm for CT circuits and 1.5 sq.mm for other circuits. All internal wiring terminations shall be made with solder less crimping type tinned copper lugs. Insulation sleeves shall be provided over the exposed parts of lugs. Engraved core identification plastic ferrules marked to correspond with panel wiring diagrams shall be fitted at both ends of each wire. Number 6 and 9 shall not be used for wire identification.

Control terminal blocks shall be of 1100 Volts grade, rated for 10 Amps and in one piece moulding. It shall be complete with insulating barriers, clip-on type terminals and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. Terminal blocks for CT & VT secondary leads shall be provided with test links & isolating facilities. CT secondary leads shall be provided with short circuiting & earthing facilities. In all the panels at least 20% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks.

4.19.16 Power Cable Termination

Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminium conductor, PVC / XLPE insulated, armoured and FRLS PVC sheathed cables. All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS:8309. All lugs shall be insulated / sleeved.

4.19.17 Nameplates and Labels

PCCs, MCCs, Distribution Boards, local push-button stations and local motor starters shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear also. All name plates shall be of non- rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Suitable stencilled paint mark shall be provided inside the panel/module for identification of all equipment, in addition to the plastic sticker labels, if provided. These labels shall be positioned so as to be clearly

visible and shall have the device number, as mentioned in the module wiring drawings. Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.

4.19.18 Busbars and Insulators

Each PCC & DB shall be provided with three phase and neutral busbars. DC distribution boards shall have two busbars. All busbars and jumper connections shall be of high conductivity aluminium alloy for PCC/MCC and Copper for DB of adequate size. Maximum Current density for Aluminium shall be 1.0A/mm2 and for Copper shall be 1.25A/mm2. The cross-section of the busbars shall be uniform throughout the length of switchboard. Interleaving of PCC busbar arrangement shall be envisaged. All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet moulded compound or equivalent type polyester fiber glass moulded insulators. All busbar joints shall be provided with high tensile steel bolts, belleville/ spring washers and nuts. All copper to aluminium joints shall be provided with suitable bi-metallic washers. All busbars shall have HRPVC sleeves and colour coded.

Contact surfaces at all joints shall be silver plated or properly cleaned and anti-oxide grease applied to ensure an efficient and trouble free connection. Suitable bimetallic connectors shall be used for dissimilar metal connections.

The continuous rating of the main busbars shall be same as that of the incomer breaker, and busbar shall carry this continuous current without exceeding the temperature of 90º C. For silver plated joints, temperature shall not exceed 105°C. All horizontal and vertical busbar joints shall be covered by insulating shrouds.

4.19.19 Earthing

A copper earthing bus of adequate size shall be provided at the bottom and shall extend throughout the length of switchgear. It shall be bolted to the framework of each panel and each breaker earthing contact bar. The earth bus shall be sized to withstand specified short circuit current. The truck and breaker frame shall get earthed while the truck is being inserted in the panel and positive earthing of the truck and breaker frame shall be maintained in all positions i.e., 'Service', 'Test' and 'Isolated' as well as throughout the intermediate travel.

All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. All hinged doors shall be earthed through flexible earthing braid. VT and CT secondary neutral point earthing shall be at one place only on the terminal block. All metallic cases of relays, instruments and other panel mounted equipment shall be effectively bonded to the earth bus by independent stranded copper wires of size not less than 2.5 sq.mm.

4.19.20 Modules Description

Following shall be provided for each breaker feeders

- Electrical anti pumping feature
- Hand reset High speed lockout relay (86)
- Trip circuit supervision relay (95)
- Aux relay for breaker contact multiplication
- Aux relays as required for contact multiplication
- Indicating lamps for ON, OFF, Auto trip, spring charged, Trip circuit healthy, DC supply fail etc.
- Breaker control switch
- Local / Remote/Test selector switch
- Test Terminal blocks

ACB incoming feeders for PCC from transformers shall be provided with the following as a minimum.

- Current transformers for metering & protection
- FP/TPN Air Circuit Breaker
- Digital Ammeter
- Fuse/MCBs for control circuits
- Multifunction meter (MFM) with communication facility
- Voltage transformers, Digital voltmeter & voltage transducer
- Under voltage relay with timer
- Numerical three phase overcurrent and earth fault relay

ACB Bus coupler for PCC from transformers shall be provided with the following as a minimum.

- TPN Air Circuit Breaker
- Current transformer for protection & metering
- Fuse/MCBs for control circuits
- Numerical three phase over current & earth fault relay

Unidirectional motor feeders rated less than 10 kW shall be provided with the following as a minimum.

- Triple pole MCCB / MPCB
- Triple pole contactor.
- Auxiliary contactors
- LOCAL/REMOTE selector switch
- Bimetallic thermal overload relay with single phasing preventer
- Push buttons.
- Indicating lamps with coloured lenses.
- MCB for control circuit
- Interposing relays

Unidirectional motor feeders rated 10kW and up to 30kW shall be provided with the following as a minimum.

- Triple pole MCCB / MPCB
- Triple pole contactor.
- Auxiliary contactors
- LOCAL/REMOTE selector switch
- Bimetallic thermal overload relay with single phasing preventer.
- Push buttons.
- Indicating lamps with coloured lenses.
- MCB for control circuit
- Current transformer for metering
- Digital Ammeter

- Interposing relays

Unidirectional motor feeders rated above 30kW and less than 125kW shall be provided with the following as a minimum.

- Triple pole MCCB
- Triple pole contactor.
- Auxiliary contactors
- LOCAL/REMOTE selector switch
- Bimetallic thermal overload relay with single phasing preventer.
- Push buttons.
- Indicating lamps with coloured lenses.
- MCB for 240V AC space heater circuit
- MCB for control circuit
- Current transformer for metering
- Current transducer
- Digital Ammeter
- Interposing relays

Unidirectional motor feeders rated 125 kW and above shall be provided with the following as a minimum.

- Triple pole Air Circuit Breaker
- Current Transformer for metering & Protection
- Numerical Motor protection relay
- Fuse/MCBs for control circuit
- Indicating lamps with coloured lenses.
- MCB for 240V AC space heater circuit
- MCB for control circuit
- Current transducer
- Digital Ammeter
- Interposing relay

Bi-directional Motor feeders shall be provided with the following as a minimum. (Not applicable for Integral Actuators)

- Triple pole MCCB.
- Triple pole mechanically interlocked, open / close contactors.
- Auxiliary contactors
- Local/Remote/Test switch
- Bimetallic thermal overload relay with single phasing preventer.
- Push buttons.
- Indicating lamps with coloured lenses.
- MCB for space heater circuit
- MCB for control circuit
- Interposing relays

4.19.21 Testing and Inspection

Switchgear and all its components should have been type tested and proven type. Type test certificates shall be furnished for Engineer's Representative review. Switchgear and its components shall be subjected to routine tests as per applicable Indian Standard. In addition, any special test required shall also be performed. Test reports shall be submitted for approval.

4.19.22 Spares List

Suitable number of commissioning and successful running for 2 years spares list shall be submitted for approval.

4.20 240 V AC UPS SYSTEM

4.20.1 Introduction

This specification covers the requirements of 240 V AC UPS System comprising of Batteries, Chargers, inverters, auto & manual bypass and Distribution Board for firefighting facilities. Function of 240 V AC Uninterruptible Power Supply System is to provide normal source of power to the Instrumentation & Control systems, package control panels, critical lighting, etc. as required.

4.20.2 Codes and Standards

Equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following Indian Standards and IEC

standard, except where modified and /or supplemented by this specification. IS 1651 Stationary cells and batteries, Lead Acid Type (with tubular positive plates) - Specification IS 266 Specification for Sulphuric acid IS 3895 Mono crystalline Semi-conductor rectifier cells and stacks IS 4540 Mono –crystalline Semi-conductor rectifier assemblies and equipment IEEE-484 Recommended Design for Installation design and installation of large lead storage batteries for generating stations and substations. IEEE-485 Sizing large lead storage batteries for generating stations and substations.

4.20.3 Design

Batteries shall be sized in accordance with IEEE-485. The battery shall be sized with a 10% design margin and an ageing factor of 1.25. 240 VAC UPS System consists of 2x100% chargers, 2x100% inverters, static switches, auto & manual bypass facility, 2x100% battery banks to provide back-up for 30 minutes and a UPS Distribution Board. End Cell Voltage of Lead Acid Plate battery shall be 1.85 V / Cell. During Normal operating condition, batteries shall be supplied from battery charger. The charger is fed power from Emergency PDB. The battery charger shall feed the loads through the inverter and, at the same time, shall continuously charge the batteries. Battery shall normally be permanently connected to the load in parallel with a charger and shall supply the load during emergency condition when AC supply is lost.

Charger shall be float cum boost type suitable for float charging the batteries and supplying load simultaneously. Chargers shall boost charge fully discharged batteries in 12 hours. Design margin of minimum 20% shall be considered in charger & inverter sizing for either mode of operation. Protections such as DC-O/V & U/V, AC U/V, E/F, S/C protection etc. shall be considered.

4.20.4 Construction of Battery

Lead Acid (Valve regulated) sealed maintenance free Plate type batteries shall be float charged at 2.15 to 2.20 Volts per cell and chargers shall also be capable of boost charging the associated DC battery up to 2.7 Volts per cell at the desired rate. Batteries shall be rated for 10 hour discharge rate (C10) as per manufacturer data. Containers shall be made of suitable glass fibre reinforced plastics or Polypropylene. Containers shall be robust, heat resistance, leak proof, non-absorbent, acid/alkaline resistant, non-bulging type and free from flaws such as wrinkles, cracks, blisters, pin holes etc.

Batteries shall have thick plates designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for continuous immersion in the electrolyte without distortion. The positive and negative terminals shall be clearly marked. Each cell shall be separately supported on porcelain insulators fixed on to the racks with adequate clearance between adjacent cells. Breathers/Vent plugs etc. shall be provided for each cell. It shall be anti-splash type and having more than one exit hole to allow the gases to escape freely but prevent the acid spray from the battery. Lead coated copper inter-cell connectors shall be used for connecting up adjacent cells and rows. Bolts, nuts and washers shall be effectively lead coated to prevent corrosion. All the terminals and cells, interconnections shall be fully insulated or have insulation shrouds/covers.

End take off connections from positive and negative poles of batteries shall be made by single core cables having stranded copper conductors and PVC/XLPE insulation. Necessary supports and lugs for termination of these cables on batteries shall also be supplied. All connectors and lugs shall be capable of continuously carrying the 60 minute discharge current of the respective batteries and through fault short circuit current which the battery can produce and withstand for the period declared. Anti-corrosive gel shall be applied at the Battery terminals.

Wooden racks shall be provided for batteries for multi-tier installation. These racks shall be made of good quality first class seasoned teak wood. They shall be free standing type mounted on porcelain insulators. Numbering tags, resistant to acid for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor.

Following accessories shall be provided with batteries.

- Syringe type Hydrometer : 2 Nos per Battery
- Thermometer with specific gravity correction scale : 2 Nos per Battery
- Cell testing voltmeter 3-0-3 volts : 2 Nos per Battery
- Acid resistant funnel : 2 Nos per Battery
- Acid resistant jug. : 2 Nos per Battery

- Rubber apron and gloves : 2 sets per Battery
- Spanners : 2 sets per Battery
- Wall mounted teak wood rack for above items : 2 Nos per Battery

Following maintenance spares shall be provided as a minimum

- Inter cell connectors : 10 Nos.
- Inter row connectors : 2 Nos.
- Battery stand insulators : 2 Nos
- Cell insulators : 2 Nos
- Nuts, bolts & washers : 10 pieces each
- Vent plugs : 10 Nos.
- Spare dry cell : 4 Nos.

Fuse box for each battery shall be provided in the battery room and shall comprise the following:

- DP Fuse Switch unit
- HRC Fuses with striker pin & aux contact for remote alarm
- FRP enclosure.

Discharge resistor made of punched stainless steel grid enclosed in sheet steel enclosure shall be provided for discharge testing of Battery.

4.20.5 Construction of UPS cum DB

During float charging, charger shall feed the Distribution board through inverters and as well as float charge its own batteries and shall maintain a DC voltage that shall pass the minimum current through the cells to keep them charged without overcharging. In case of mains failure to charger or charger failure, battery shall supply the full load. While boost charging of battery, DB shall be isolated from the Charger. Battery charger should meet the Trickle requirement of battery banks (under emergency) and boost requirement of the battery bank.

During boost charging, the battery charger shall operate on constant current mode (when automatic regulator is in service). It shall be possible to adjust the boost charging current

continuously over a range of 50 to 100 % of the rated output current for boost charging mode. During boost charging the Boost charger shall recharge the completely discharged battery to full capacity in 10 hours.

When on automatic control mode during float charging, the charger output voltage shall remain within +/-1% of the set value for AC input voltage variation of + / - 10%, frequency variation of + 3/-5%, a combined voltage and frequency (absolute sum) variation of 10 % and a continuous DC load variation from zero to full load. Uniform and step less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the charger panel covering the entire float charging output range specified. Battery charger shall have a selector switch for selecting the battery charging mode i.e. whether float or boost charging.

UPS shall be provided with facilities such as automatic voltage regulator (AVR) for both automatic and manual control of output voltage and current. The unit shall be self-regulating, natural air cooled, static type provided with suitable double wound transformer, full wave thyristor type rectifiers, filter circuits, DC & AC Switchgear. Charger shall be metal enclosed, fixed type, suitable for indoor mounting on floor. Panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Suitable synthetic rubber gaskets shall be provided to achieve a degree of protection of IP54.

Rectifier transformer shall be continuously rated, dry type, class F insulation, epoxy resin impregnated, Air Natural cooled and with adequate number of taps. The rating of rectifier transformer shall correspond to the rating of the associated rectifier assembly.

UPS panel shall be provided with an illuminating CFL lamp, a 5 Amp socket and space heaters with thermostat. Toggle switches and MCB’s shall be provided separately for each of the above fittings. Space heaters “ON” indication shall be provided. Two separate grounding pads shall be provided.

Locking facilities shall be for locking float / boost selector switch in the float position only.
Digital type Window annunciator shall be provided for alarm annunciation with acknowledge, test and reset push buttons and a buzzer for the following conditions.

- SCR fuse fail
- Battery / DC system under voltage
- DC system over voltage
- DC over load
- Output fuse blown
- AC supply fail
- AC under voltage
- Battery earth fault
- Filter fuse failure
- Battery on Float / Boost
- Charger fail / Inverter fail / Battery on discharge
- Any other annunciation, as required

Remote alarm contacts for hooking up to PLC shall be provided. For charger, current & voltage transducer shall be provided for remote monitoring of DC voltage and Current at PLC.

Protection features, indications, meters and alarms shall be provided for each charger. Protection features shall include the following as minimum.

- Overload Protection
- Phase failure protection
- Voltage unbalance protection
- Fuse failure protections for SCR and filter circuit

Suitable potential free contacts for remote indication of above abnormal conditions shall be provided. However the requirements / design shall be firmed up during the detailed engineering stage.

4.20.6 Testing and Inspection

UPS and all its components should have been type tested and proven type. Type test certificates shall be furnished for Engineer's Representative review. UPS shall be subjected to routine tests as per applicable Indian Standard. In addition, any special test required shall also be performed. Test reports shall be submitted for approval.

4.20.7 Spares List

Suitable number of commissioning and successful running for 2 years spares list shall be submitted for approval.

4.21 Power and Control Cables

4.21.1 Introduction

This specification covers the requirements Power & Control cables for Firefighting facilities.

4.21.2 Codes and Standards

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following Indian Standards, except where modified and /or supplemented by this specification.

IS: 1554	PVC insulated (heavy duty) electric cables for working voltages up to and including 1100 volts.
IS:7098-I	Cross linked polyethylene insulated PVC sheathed cables for working voltages up to and including 1100 volts.
IS:7098 -II	Cross linked polyethylene insulated PVC sheathed cables for working voltages from 3.3 kV up to and including 33 kV.
IS:10810	Methods of tests for cables.

4.21.3 Design

Power cables shall be sized to satisfy the following Criteria:

- Short circuit withstand capacity for applicable fault current and duration.
- Full load current carrying capacity under installation conditions considering Site ambient temperature & site installation (Grouping) conditions based on Manufacturer's recommendation.
- Permissible voltage drop limits under steady state/transient state as applicable.

Power cables shall withstand fault current of the circuit for the duration not less than the maximum time taken by the primary protective system to isolate the fault. Cables shall be sized for the following short circuit rating.

Outgoing cables from 33kV Switchboards	26.3 kA for 0.16 sec.
Incoming cables to 415 V PMCC (Breaker operated)	50 kA for 1 sec.
Incoming cables to 415 V MCC (Breaker operated)	50 kA for 0.5 sec.
Incoming cables to 415 V MCC/DB (MCB protected)	Fuse cut-off current for 10 millisecond
Cables from 415 V MCC to Motors	50 kA for 0.16 sec ACB
Feeders from MCC/DB (MCB protected)	Fuse cut-off current for 10 millisecond

To maintain voltage at motor terminals / equipment end within desirable limit, it is proposed to limit the voltage drop in the cables within the following limits:

- Steady state Voltage drop (Continuous running condition) : 2.5%
- Transient state voltage drop (During Motor Starting) : 10 %

All cables shall be suitable for laying on racks, in ducts, trenches with chances of flooding by water and shall also be suitable for directly buried installation. All cables shall be flame retardant low smoke (FRLS) type designed to withstand mechanical, electrical and thermal stresses developed under steady state and transient operating conditions.

Minimum size of LV power cable shall be of 2.5 Sq.mm for Copper. Power cables shall have copper conductor for sizes up to 10 sq.mm. For higher sizes, aluminium conductor shall be provided. The minimum size of control cable shall be of 1.5 Sq.mm copper. For CT circuits, minimum 2.5 sq.mm copper cable shall be provided. Conductor of Copper cables shall have plain annealed copper. All the conductors shall be multi-stranded.

Power cables shall be XLPE insulated. Control cables shall be PVC insulated. PVC insulation shall be suitable for continuous conductor temperature of 70□C and short circuit conductor temperature of 160°C. XLPE insulation shall be suitable for continuous conductor temperature of 90°C & short circuit conductor temperature of 250°C.

The cable cores shall be laid up with fillers between the cores wherever necessary. All the cables shall have distinct extruded PVC inner sheath. For single core armoured cables, armouring shall be of aluminium wire. For multicore armoured cables, armouring shall be of galvanised steel strip/wire as per applicable IS. Outer sheath shall be of PVC black in colour having following FRLS properties.

- Oxygen index of not less than 29.
- Acid gas emission of max. 20%
- Smoke density of not more than 60%

The cables shall meet flammability test as per IEEE – 383. All the cables shall be protected against rodent and termite attack. Necessary chemicals shall be added in to the PVC compound of the outer sheath.

4.21.4 HT Cables

Cables shall be XLPE insulated, PVC inner sheathed (extruded), armoured, FRLS PVC outer sheathed, stranded compacted aluminium conductor conforming to IS: 7098. 33 kV cables shall be suitable for earthed system. The conductor screen and insulation screen shall both be of extruded semi-conducting compound and shall be applied along with the XLPE insulation in a single operation of triple extrusion process. The metallic screen of each core shall consist of copper tape with minimum overlap of 20% copper screen which shall be capable of carrying the system earth fault current for 2 seconds. Outer sheath shall be FRLS PVC.

4.21.5 LV Power Cables

LV Power cables shall be of 1.1 kV grade, XLPE insulated, PVC inner sheathed (extruded), armoured, FRLS PVC outer sheathed, stranded compacted aluminium conductor conforming to IS: 7098 Part-I.

4.21.6 Control Cables

Control cables shall be of 1.1 kV grade, multicore, PVC insulated, PVC inner sheathed, armoured, FRLS PVC outer sheathed, stranded copper conductor conforming to IS:1554 Part-I. Up to 5 cores it shall be colour coded and above 5 cores shall be numbered.

4.21.7 Cable identification system

In addition to manufacturer's identification on cables as per IS, following marking shall also be embossed over outer sheath.

- Cable size and voltage grade.
- Word `FRLS' at every 5 metre.
- Sequential marking of length of the cable in meters at every one metre.

The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.

4.21.8 Cable Drums

Cables shall be supplied in wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with waterproof layer. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/rubber caps, secured by `U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative antitermite treatment shall be applied to the entire drum. Wooden drums shall comply with IS 10418.

4.21.9 Testing and Inspection

Cables offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished. Routine tests, Acceptance tests and all special tests for FRLS properties shall be carried out for all the cables as per applicable standards. The sample shall be drawn at the rate of one per type and size for every lot offered for inspection.

4.21.10 Special Tests

The following tests as applicable to FRLS sheathed cables shall be conducted as type tests on each size of each lot:

- Oxygen index test
- Temperature index test
- Acid gas generation during fire
- Smoke generation test under fire
- Swedish chimney test for class F3 as per SS : 4220 14 : 75
- Under fire conditions for bunched cables as per IEEE std. 383 / 74

4.22 Lighting System

4.22.1 Introduction

This specification covers the requirements of Illumination system for firefighting facilities.

4.22.2 Codes and Standards

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following Indian Standards, except where modified and /or supplemented by this specification.

IS 418 Tungsten filament general service electric lamps

IS 1777 Industrial luminaire with metal reflectors.

IS 1947 Flood Lights

IS 10322 Luminaires for street lighting.

IS 1944 Code of practice for design of Street lighting

IS 2206 Flame proof electric lighting fittings.

IS 2215 Starters for fluorescent lamps

IS 2418 Tubular fluorescent lamps for general lighting services

IS 4013 Dust-light electric lighting fittings

IS 8224 Electric Lighting fittings for Div. 2 areas

IS 9583 Emergency lighting units.

IS 9900 High-pressure mercury vapour lamps

IS 9974 High Pressure sodium vapour lamps

IS 2713 Specification for Tubular Steel Poles for Overhead Power Lines

4.22.3 Design and Construction

This specification covers the requirements of Illumination system.
The lighting system includes:-

- 100% Normal AC lighting alternatively fed through DG set also
- Critical lighting through battery backed LED lamps in selected areas of the plant during plant emergency conditions.

Normal AC Lighting shall be energised from 3-phase, 4-wire, 415 V Lighting Distribution Board. Single phase voltage level considered for lighting system & fixtures shall be optimally arrived to achieve energy efficiency without sacrifice in the illumination level. Lighting transformer tap range & tap step to be designed accordingly.
Emergency lighting shall be provided in specific areas such as switchgear rooms, areas near local panels, staircases and other strategic areas during AC supply failure. Emergency lighting shall normally be "off," and upon loss of normal AC supply, emergency lights shall be turned "on" in auto mode. Emergency lighting units with integral batteries shall be used. Emergency lighting unit shall provide light for four hours when the normal power source is lost. Each emergency light unit of weather & dust-proof construction shall be provided with battery (24V), battery charger and 1X5 Watt LED lamp. Each unit shall be connected to the 240 V supply system and shall automatically switch to the battery in case of power supply failure. Exit light fixtures shall be compact LED and provided in all the Building at exit doors.

LED lamps shall be used as light sources in the lighting system. Fixtures considered shall be energy efficient type with low harmonics and higher lumen / watt.

All fittings shall be weatherproof and able to withstand direct hosting.

AC lighting fixtures and accessories shall be suitable for operation on 240 VAC, 50 Hz supply with supply voltage variation of+/- 10%, frequency variation of +/-3% and combined voltage and frequency variation of absolute sum of 10%.

Lighting level design shall include a Maintenance factor as follows to account for lamp lumen depreciation, luminaries' surface dirt and room surface dirt, etc.

- Air conditioned areas : 0.8
- Non-Air conditioned areas : 0.7
- Dust prone outdoor Areas : 0.6

Suitable number of 63 Amps, 3 phase, 415 volt AC welding receptacles shall be provided. Welding receptacles shall be placed near all major equipment and at an average of 30 meters in each building or at least two numbers on each floor and type of room.

16 Amps, 240V, Single phase convenience receptacle with switch shall be provided in all the rooms. The convenience outlets shall be spaced to provide access to any point with a 15 meter extension cord. In the office area suitable numbers shall be provided taking into account the number of persons sitting, number of computers, printers, server etc., to be fed. Receptacles shall be served from an earth leakage circuit breaker (ELCB).

Welding sockets shall be fed from ACDB / PDB. Number of receptacles per circuit shall be not more than 2. Each welding receptacle unit shall have dedicated MCB installed adjacent to the receptacle with IP55 type enclosure

Light fixtures shall be circuited so that adjacent fixtures are connected to alternate phases of a 3phase circuit. The lighting for enclosed areas within the buildings shall be manually switched 'on' and 'off' at local light switches near personnel entrance doors. Auto-timed switching may also be considered with manual bypass mode for indoor lighting system. Wall mounted switches shall be provided at the entrance to battery room and equipment/office rooms.

Electric power to light street light fixtures located on the approach road to the Pump House shall be switched with photoelectric controllers and timers. Outdoor lighting shall have auto/manual mode of operation. Provision shall be made to bypass the photoelectric controller and timer.

Switches shall be sized maximum of 80 percent of the light switch ampere rating with enclosures suitable for the location in which they are installed.

Load on each lighting circuit and single phase receptacle circuit shall be limited to 2000 W.

For areas illuminated by more than one circuit, the adjacent circuit shall be fed from different phase. Load balance on all the 3 phases to be envisaged for lighting as well as 1-phase power distribution circuit.

Wiring for indoor lighting installation shall be carried with PVC insulated wire of the following sizes laid in conduit.

- Lighting Panel to lighting Fixtures : 2.5 sq.mm copper
- Switch box to lighting Fixtures : 2.5 sq.mm copper
- Lighting Panel to Sockets : 4 sq.mm copper

For Area lighting, PVC insulated, PVC inner sheathed, armoured, FRLS PVC outer sheathed Copper conductor cables shall be provided.

Wiring for Lighting fixtures and receptacle units shall be fed from different circuits and shall run in separate conduits. Two different phase circuits shall not be laid in the same conduit. All conduits shall be surface mounted in general. In Office rooms & Control rooms conduit shall be concealed type. Conduit fill criteria shall be 40%. Conduits should have the minimum number of bends in their run with pull boxes at suitable locations. Conduits shall be sloped & drained to avoid water accumulation & draining into the equipment at its end. Conduits shall be galvanized steel except in corrosive areas, where it shall be epoxy painted.

4.22.4 Lighting Distribution Board

LDB shall be provided with 415/415V, 3 phase dry type transformer of suitable capacity to obtain 3 phase, 4 wire system and to limit the fault level to 10 KA. Capacity of the transformer shall be decided such that there is at least 20% margin over the total lighting load.

LDB shall be provided with one TPN MCCB for incomer feeder and required number of 1/3 phase outgoing SPN/TPN MCB's feeders with at least 20% Spare feeders. CT operated Ammeter, Voltmeter and indicating lamps shall be provided.

4.22.5 Power Distribution Boards

For welding receptacles, Power Distribution Boards (PDBs) shall be provided.

PDBs shall be provided with TPN MCB of suitable rating for incomer and required number of 63 Amp TPN outgoing feeders with MCBs plus neutral links for each circuit distributed over three phases.

4.22.6 Receptacles

3 phase Industrial type welding receptacles shall be rated for 415V, 63 Amps with interlocked switches, scrapping earth connection, male and female units and cover. Protection class shall be IP-65.

1 phase Industrial type receptacles shall be rated for 240V, 16Amps with interlocked switches, scrapping earth connection, male and female units and cover. Protection class shall be IP-65. 1 phase receptacles with switches shall be provided at each emergency portable lamp fittings. All receptacles shall be provided with matching plug-tops. All hard wares shall be of Stainless steel type only including the mesh of well glass luminaries, nut, bolts, washers, etc.

4.22.7 Installation of Light Fittings

Mounting height of center line of various lighting equipment from FFL/Working platforms or finished grade level shall be as noted below unless otherwise specified in corresponding lighting layout drawings.

- Lighting panels/control gear boxes : 1500 mm
- Switch boxes : 1500 mm
- Receptacle boxes (Indoor) : 500 mm
- Receptacle boxes (Outdoor) : 1000 mm
- JB on poles/Masts : 750 mm

Light fixtures to be mounted on ceiling/platforms having considerable vibrations which can cause damage to the fixtures shall be suitably supported with rubber pads to limit vibrations in the fixtures. Where conduit wiring is adopted, an earth continuity conductor

of 12 SWG galvanized steel wire shall be provided for earthing of the lighting fixtures, switch boxes, etc. The earthing conductors shall run along the entire length of the conduits and shall be securely connected and terminated at the junction boxes/control gear boxes/lighting panels. Earth connection shall be properly secured with bolts, nuts and washers. For outdoor lighting installations, an earth continuity conductor of atleast 25 x 3 mm galvanized steel flat shall be used for earthing the lighting masts/poles.

While designing the lighting circuit, cables shall be sized such that the farthest loop from the supply receives no less than 95% of its nominal voltage, in addition it must be assumed that all the light fittings are energized while this design calculation is made. LED lights shall be chosen & located carefully where they illuminate rotating shafts, so as to avoid stroboscopic effect. Fittings made from Aluminium and its alloys should be avoided because the oxide that invariably forms after a time is considered as a potential source of sparks caused by mechanical impact. All fittings shall be installed at a safe height for maintenance & effective illumination. All lighting controls shall be from a non-hazardous area, using double pole, switches, the supply neutral should be switchable along with the phase.

4.22.8 Testing and Inspection

Equipment of Illumination system should be type tested and proven type. Type test certificates shall be furnished for Purchaser's review. Equipment shall be subjected to routine tests as per applicable Indian Standard. Test reports shall be submitted for approval.

4.22.9 Spares List

Suitable quantity of commissioning and successful running for 2 years spares list shall be submitted for approval.

4.23 Cabling System

4.23.1 Introduction

This specification covers the requirements of cable trays, support structures, cable laying and termination system.

4.23.2 Codes and Standards

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following Indian Standards, except where modified and/or supplemented by this specification. IS:1255 Code of practice for installation and maintenance of power cables up to and including 33 kV rating. IS:732 Electrical wiring installation (system voltage not exceeding 1100 V).

4.23.3 General Requirements

While finalizing Cable routing layouts, consideration shall be given to the requirements of Safety, Reliability and Convenience of cable laying and termination. Where duplicate drives/auxiliaries are provided for reliability, cable routing shall be segregated to the extent practically possible.

In cable trenches, distance between bottom most tier and bottom of trench shall be 150 mm and clearance from top most tray to top of trench cover shall be 400 mm. Distance between two tiers shall be minimum 250 mm. PCC flooring of built-up trenches shall be sloped in longitudinal and also in transverse direction for effective drainage system. Cables should not be laid directly in the trench floor. Cables trenches should be provided with strong & effective covers with water & fire proof sealing arrangement at trench entry & exit points.

Other than cable vault & cable trenches, Cable trays shall be laid in vertical formation to avoid dust accumulation in areas. In cable spreader room, a clear access passage of atleast 800 mm wide shall be provided along the cable ways. Wherever passage is through cable routes, a clear height of not less than 2.0 M shall be provided.

Cables of different voltages shall be laid in separate racks. Minimum distance of 250 mm shall be maintained along the routes between various types of cables. In case of horizontal formation, the highest voltage cables shall be laid in the top most position in the tray stack followed by other grades as follows in the descending order.

- 33 kV Power cables (Bottom most Tier)
- 1.1kV Power cables (Above HT Tier)
- Electrical Control Cables (Above LT Tier)

- Instrumentation/Signal cables (Top tier)

On cable trays all the multicore power cables can be laid in touching formation. Single core cables shall be laid in trefoil formation with the spacing equal to twice the diameter of the cable. Control cables shall be laid in not more than two layers. Power & Control cables shall be laid on ladder type trays. Instrumentation & Signal cables shall be laid on perforated type trays. Cable trays shall be supported at an interval of 1500 mm approximately. Vertical runs shall be supported at an interval of 1000 mm approximately. Cable tray support system suitable for FRP type cable trays shall also be included.

Cables shall be terminated using double compression cable glands suitable for the voltage grade of cables. Cable glands shall be heavy duty brass. Cable lugs for power and control cables shall be tinned copper solderless crimping type conforming to IS 8309. 33 kV cable terminations shall preferably be of heat shrinkable type kits.

Fire barriers/ Fire stops shall be provided for all fire rated wall and floor penetrations and for all direct cable entries into electrical Switchgear / Panels from Cable Vault. Fire barriers/ Fire stops shall provide a fire endurance rating of at least 2 hours. The fire sealing material shall be nonhygroscopic, mechanically steady, non-toxic and physically & chemically stable under fire conditions.

Fire barriers/ Fire stops shall be either of the following methods:

a) Panel sealing method comprising Encasing Panels, Cavity fill material & Sealant
b) Mortar Sealing method comprising Mixing Mortar curing with water.

4.23.4 Design and Construction of Cable Trays

Cable trays shall be ladder/perforated type as specified prefabricated made out of galvanized steel complete with matching fittings (like elbows, bends, reducers, tees, crosses, etc.), accessories (like side coupler plates, Tray cover etc.) and hardware (like bolts, nuts, washers, GI strap, hook etc.) as required. The size of the trays shall be selected on the basis of maximum 50% fill criteria. Cable trays shall be standard width of 150mm, 300mm, 450mm & 600mm. Thickness of side coupler plates shall be minimum 2.5mm and of tray covers shall be minimum 1.6mm. Cable Trough shall be required for branching out few cables from main cable route.

4.23.5 Design and Construction of Conduits/Pipes, Fittings & Accessories

Conduits/pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.). The size of the conduit/pipe shall be selected on the basis of maximum 40% fill criteria. Hume pipes shall be of reinforced concrete conforming to class NP3 for road crossings as per IS: 458. GI pipes shall be of medium duty as per IS: 1239.

Rigid steel conduits conforming to IS: 9537 Part-I & II shall be suitable for heavy mechanical stresses, threaded on both sides and threaded length shall be protected by zinc rich paint. Conduits shall be smooth from inside and outside. Fittings and accessories shall also be hot dip galvanized.

Flexible conduits where required, near equipment terminations, shall be made with bright, cold rolled, annealed and electro-galvanized mild steel strips. Flexible conduits shall be supplied with suitable end coupler nipple and check nut. In corrosive areas, epoxy coated conduits shall be provided.

4.23.6 Cabling Installation

Work shall be carried out in the best workman like manner in conformity with relevant specifications / code of practices of the Bureau of Indian Standards. In addition, work shall also confirm to the requirements of latest editions / amendments of the following:-

- Indian Electricity Act and rules framed thereunder.
- Fire Insurance Regulations
- Regulations laid by the office of the Chief Electrical Inspector to Government.
- Any other regulations laid down by the local authorities.

Support system shall be so designed that it is able to withstand weight of the cable trays, Weight of the cables (75 Kg/metre run of each cable tray), Concentrated load of 75 Kg between every support span without any permanent deflection. Factors of safety of at least 1.5 shall be considered. Cable tray mounting structure shall be welded / bolted to the plate inserts or to steel structure and the type of welding shall be of fillet type of at least 6mm size.

All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor. Tray covers shall be provided for overhead cable trays on top most tier. The cable risers or vertical raceways shall also be covered by cable tray covers upto 1.5 metres from respective floor for mechanical protection. The sheet cover shall be of removable type.

4.23.7 Testing and Inspection

Equipment offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished. Routine tests shall be carried out for all the equipment as per applicable standards.

4.23.8 Spares List

Suitable quantity of commissioning and successful running for 2 years spares list shall be submitted for approval.

4.24 Earthing & Lightning Protection Systems

4.24.1 General

Complete earthing system shall conform to the provision of Indian Electricity Rules, and applicable code of practice for earthing IS: 3043 & IEEE:80-2000. Working layout drawings shall be prepared by the successful Contractor. Value of earth resistivity shall be considered as per the areas indicated in IS:3043 or the actual value as obtained from the site from previous records available with the employer, if any, or through soil investigation carried out by the successful contractor.

All Non-conducting structures shall be provided with Lightning protection consisting of Air termination network at the top and down conductors as per IEC 62305. All Structures made of conducting material shall be protected by adequate earthing arrangements and air terminations at the top as per IEC 62305. Conductors shall be Galvanized Iron (GI) of suitable size as per IS:2309. Lightning grid conductors of 75mm x 8mm size shall be provided for interconnection of the Lightning earth pits around individual building. The same shall also be connected with the main plant earth grid at places through isolating link installed in Earth pits.

4.24.2 Earthing Below Ground

- Main earthing grid shall be buried below ground unless required otherwise. For crossing any trench or under-ground pipe minimum earth coverage of 500 mm shall be provided over the earthing conductor.
- Where earthing conductor passes through reinforcement or steel plate, it shall be bonded to the same.
- All building steels and columns shall be bonded directly to the earthing grid.
- Riser/pigtails from earthing grid shall project 600 mm above grade/concrete level unless shown otherwise.
- All earthing conductor connections shall be made by electric arc welding or by nuts and bolts using plain washers and spring washers.
- All arc welding shall be carried out with low hydrogen content electrode. All welded joints shall be allowed to cool down gradually to atmospheric temperature before putting any load on it. No artificial cooling should be adopted to cool welded joints.
- Welding required for earthing shall serve the following three purposes:

  i. sufficient mechanical strength between the jointing materials
  ii. sufficient electrical area for the flow of system short circuit current and
  iii. sufficient electrical area available after commissioning during the life time of the plant.
- Before welding, earth conductors shall be clamped tightly to ensure good surface contact at welding points.
- Before applying bitumen compound, two coats of red oxide primer shall be applied to risers and exposed portion of earth grid, if any. Construction joints shall be given treatment with Barium Chromate before applying red oxide paint and bitumen

- Earthing shall be mechanically robust and all joints shall be capable of retaining low resistance even after passages of many fault current.
- All connections are to be made carefully and properly. Improper/poor connections are to be remade at the cost of Contractor.
- Welded areas of risers/pigtail shall be thickly coated with bitumen compound to prevent corrosion.
- Earthing pits/conductors shall be laid in field to avoid fouling with concrete foundations and in consultation with the Employer at site.
- Trenches shall be filled up with `Free of Stones' earth after laying earth conductor. After filling up of trenches the earth shall be rammed carefully
- The successful Contractor shall submit detailed working drawings of earthing grid for approval by Employer prior to construction of the grounding system
- The rate quoted shall be inclusive of cost of all materials, labour required for excavation, backfilling, welding, cutting, bending, placing of GI strips etc. complete as per specification.
- All tests as per relevant standards shall be conducted to certify the effectiveness and other requirements of earthing grid.
- Depth of laying of earth conductor for earth grid, ring and inter-connections shall generally be minimum 500 mm from ground level and 300 mm below all foundations
- Erection of earth pits shall include making of masonry enclosure and supply of chemical and other materials.

4.24.3 Earthing Above Ground

i. Successful Contractor shall lay above ground earthing conductors inside the buildings and on various structures for connection to various equipment/ drives etc. These earthing conductors may be installed within the cable trays in the form of runway conductors. Connection to equipment shall be tapped from these runway conductors at suitable locations. One runway conductor shall be provided for each side of cable trench/tray.

ii. Neutral points of all earthed system of different voltages, all equipment frame works, other non-current carrying metallic structures and equipment such as motor frame enclosures of MCCs, panel boards, cable armour, cable trays, sheaths etc. shall be earthed by a minimum of two separate and distinct connections.

iii. Armour of all power and control cables shall be earthed at both ends through gland earth ring provided with the cable glands. d) All cable trays and supporting structure are to be earthed. All cable tray sections shall be bonded with each other for continuity.
iv. All earth leads and riser connections shall be as short as possible.
v. Metal pipes and conduits through which cables run shall be effectively bonded and earthed.
vi. Neutral connection shall not be used for equipment earthing.
vii. All connections to earth conductors shall be welded/bolted type. Earthing connections to all equipment shall be bolted type.
viii. Earthing conductor along their run on steel columns, beams etc. shall be tack welded at intervals of 1000 mm.
ix. All joints in earthing conductor shall be welded type. All joints shall be welded with an overlap of 65 mm. Joints shall be thoroughly cleaned before welding. Welding is to be done around joint completely. All joints shall be given two coats of anti-corrosive paint (Red Oxide) to a thickness of 3-5 mils, followed by a coat of bitumen paint. Joints shall be thoroughly cleaned before applying paints.
x. All nuts, bolts washers etc. shall be cadmium plated or zinc passivated. Generally, earthing studs and terminals shall be provided on all equipment. In such cases, where it is not provided the Contractor shall have to drill and tap the equipment for deriving earth terminals.
xi. Connections of earthing conductors to the main earthing loops or to equipment shall generally be made by means of cable lugs in case of round conductors, solid or stranded and directly in case of strips. Devices like spring washers and lock washers must be used to ensure that the connections are vibration proof.
xii. Laying of earthing conductor shall include fabrication and fixing of clamps, cleats and supply fixing device i.e. nuts, bolts, washers as also civil work such as preparation of floor surface and finishing them to the finished floor level after installation of earthing strips,

4.24.4 Earth Pits for Earthing and Lightning Protection Systems

Earth pits shall be based on High Conductivity Technology. In this technology of chemical earthing, a compound of high electrical conductivity shall be filled up in the space around the ground electrode, so that the earth resistance value would decrease

appreciably. The high Conductive Compound shall be able to perform in any weather and soil Conditions and shall have following properties;

- It shall have high electrical conductivity, which should remain constant and unaffected by changes in temperature & moisture.
- It shall permanently remain embedded and should neither dissolve in and swept away by water. 3. It shall have an ability to absorb large amount of water and retain the same over a long periods of time.
- It shall decreases earth pit resistance with passage of time.
- Solubility: Shall be partly miscible; so that it does not dissolve fully like common salt and thus increasing the Earth Pit Life.
- The pH value shall be near neutral so that it does not pollute soil or water and also does not corrode earth electrode.
- It shall be maintenance free Compound so that there shall be no need of extra water pouring at regular interval as in conventional earthing material, because it should retain the moisture.
- Chemical Compound shall be thermally conductive, in order to maintain a constant Earth resistance in temperature range of -50 to +60 degree Celsius.
- The Compound shall have relatively High conductivity so that it can create very low resistance even in rocky areas.
- It shall have low earth resistance, carries high peak current repeatedly.
- It shall have a Long and reliable life.
- It shall be easily installed in any soil conditions.

Minimum Electrode size shall be as per the latest amendments of IS:3043. Earth electrodes / plates for body earth, DG & transformer neutral, Instrumentation earthing and Lightning earth pits shall be selected as per the latest amendments / requirements of IS:3043.

All earth electrodes comprising an earth system shall be connected together with a continuous ring of earth tape. After installation, test shall be made to ascertain that the earthing resistance hereinafter specified is obtained. If the required resistance value cannot be obtained, a sufficient number of additional pipes shall be installed, until the resultant resistance not exceeding the specified value can be obtained.

In all cases the pipes shall be driven such that their zones of earthing do not overlap. Each earth electrode shall be connected to its associated earth tape through a linked connection. The link shall be installed as close to the earth electrode as possible. Each earth electrode shall be enclosed together with the link in a reinforced concrete hand-hole with cast iron cover, which shall be set flush with the ground.

4.24.5 Earthing Connections

For Earthing and Lightning protection of the Pump House building and its equipment, it is proposed that at least two numbers of rods / angles shall be brought out from each of the column/pile including those of the approach from berth to Pump house and connected to form earth grid. Also at least two numbers of Earth pits shall be made in the nearest land area and connected to this grid. New Earth system shall also be connected to the existing earth grid of the Plant wherever possible.

The Contractor shall furnish and install a 75 x 8 mm GI strip as the main grid. The resistance between any point on each earthing system and the earth electrode shall not exceed 0.1 ohm. The overall resistance between the earthing installation and the general mass of earth shall be less than 1 ohm.

The main earthing bars shall be so placed that earthing terminals of major equipment and where required cable sheaths to be earthed, can be readily connected to them. Branch connections from the main earth bars shall be provided to all switchboards, power transformers, capacitors, Control Consoles, distribution boards, etc. The bonds shall be made to the cable glands on which the lead sheath shall be plumed and the armour clamped. All steelwork supporting electrical equipment shall be bounded to the main earthing bars.

The Sizes of GI earth bus and earth wires shall be as follows:

For Neutral Earthing of the Transformer and DG set, earthing shall be done through two separate piles/columns (which are not connected with the main grid) and through strip immersed in the sea water up to the Sea bed. Similar arrangement shall be done for Lightning protection also.

Main earthing grid	75 x 8 mm GI strips

Riser upto ground level	75x8 mm GI Strip
HT & LT switchboards, MCC panels, cable trays	40 x 6 mm GI strip
Street Pole Earthing	25 x 3 mm GI strip
Lighting panels, Distribution Boards etc	25 x 6 mm GI strips
Junction boxes, field instruments, gland earthing Lighting fixtures, 15A switch sockets	12/8 SWG GI Strip

Joints, termination, fixing of the earth bars and their protection from corrosion shall be in accordance with the recommendation given in the aforementioned code of practice subject to the additional requirements specified herein. GI tapes shall be secured at intervals not exceeding 1m by means of single-screw fixing purpose made gunmetal saddle of a pattern approved by the Employer. The tapes shall run in square and symmetrical lines. Links shall be provided in the system adjacent to all junctions to enable tests to be carried out from time to time. All links shall have high tensile steel bolts and the nuts shall be tightened by means of a torsion spanner. All joints in exposed sections shall be protected against moisture and corrosion by the application of two coats of anticorrosive paint and shall be taped with self-adhesive PVC tape.

SECTIOIN 5

TECHNICAL SPECIFICATION – FIRE FIGHTING EQUIPMENTS

5.1 Scope of Work

The scope of work includes design, engineering and procurement, delivery to site, erection, testing, commissioning and handing over of fire-fighting System for HOJ-1, HOJ-2, BJ-1 & BJ-2 and OT-II at HDC. The pump house building is supported over the pile foundation near approach road of HOJ-2. The detailed design of the building will be prepared by the contractor.

These shall include but not be limited to the following:

a) Supply & installation of Horizontal split casing pumps - 6 nos. capacity of each 720 m3/hr (approx.) for Water Hydrant, jumbo nozzles, ground monitors and Tower monitor system including diesel drive with propeller shaft coupling, control panels, including diesel tanks, associated piping, valves and pressure gauges, battery banks & battery chargers, cables, etc.

b) Supply & installation of Jockey pumps - 3 nos. capacity of each 70 m3/hr (approx.) including all accessories, DOL starters, cables, piping, valves pressure gauges, pressure sensors etc. complete for operation from control panel for maintaining the required pressure in water hydrant and tower monitor lines.

c) Supply and installation of long range electrically remote controlled foam/water monitors, Tower monitors- 9nos, Jumbo nozzles- 9 nos. each 5678 lpm capacity at 7kg/cm2(approx.) along with control panels and associated piping, valves, deluge valves pressure gauges, cables, etc.

d) The fire-fighting system shall include foam pumps -2nos.capacityof each-40 m3/hr (approx.), foam tanks and foam supply pipe line from pup house to the tower monitor. The Foam system shall consist of two numbers of foam compound pumps (1 Main + 1 Standby). Both pumps shall be positive displacement rotary gear type complete with engine / motor drives control panels, cables along with associated piping, valves, pressure gauges, strainer, orifice plates etc. complete for operation from remote control panel.

e) Supply and installation of 2nos. of horizontal foam tank of stainless steel make (SS 316) of 40 cum. each capacity with associated piping valves and controls, level indicators support, ladders, sight glass, air vent etc.

f) Supply and installation of fire extinguishers as per OISD 156.

g) Supply and installation of double headed fire hydrant of 63 mm size of SS 316 with necessary piping, controls etc. along with hose cabinets each with 2 nos. of 15 meters length reinforced rubber lined hose pipes with end couplings, nozzles, etc.

h) Supply and installation of CS pipes & fittings for firefighting system including motorised valves, fittings, pipe supports, accessories, etc. Pipe lengths to be 12 meter with welded joints. All nuts, bolts, washers etc. used in the pipelines shall be SS 316. The flanges shall be forged steel type of suitable rating.

i) Supply and installation of International shore connections at unloading platform.

j) All Electrical and C & I for the complete fire-fighting system are under the scope of these works.

All the fire-fighting pumps shall be suitably installed inside the pump house building and keeping in mind the proper and efficient space utilization but without compromising the safety.

Notwithstanding the details furnished in this document, it shall be the responsibility of the Contractor to complete the work in all respects, commission and complete the final trials & performance tests to the satisfaction of Engineer's Representative / 3rd Party Inspection Agency.

This specification together with enclosed drawings outlines the functional requirements and the operating characteristics which the equipment must fulfil. Alternative technical features other than those specified may be acceptable subject to the approval of the Employer / Engineer. In any case, the performance of the system/ equipment delivered shall be guaranteed in every detail by the Contractor. Overall dimensions (boundary dimensions) and functional requirements as shown on drawings and/ or as specified shall be strictly adhered to.

All the power and control cables (including supply and laying) for entire fire fighting system shall be under the contractor scope of work. Cables on approach trestle, fire

pump room and control room shall be FRLS type. Fire Survival type cables shall be used on the unloading platform. All power & control cables shall be of approved makes. Flameproof / Explosion proof Junction boxes, Motors and cable glands shall be used at the unloading platform.

Following documents shall be submitted by contractor for approval.

i) GA drawing of drawings of complete systems as well as for sub systems.

ii) GA drawing of diesel engine driven main pumps & Jockey Pumps.

iii) Design Calculation(s), Data sheet(s), Performance curves of the Pump, etc.

iv) P&I diagram of Fire Fighting system.

v) GA & Layout of Fire pump house, Control room, etc.

vi) Foundation Details of Pumps, Diesel Engines, Motors, Pipe Trestle Line.

vii) Pipe line layout diagram.

The contractor shall prepare and submit a comprehensive scheme of training for a period of 3 months, covering all the systems such as fire protection system, foam system, Remote Control System etc. for operation, maintenance, troubleshooting etc. The programme prepared by the contractor shall be reflective and appreciative of the long term interest in the sustained operation of the systems, equipment provided.

Brief technical write up of the system being offered and their design considerations shall be submitted. Technical schedules of all Pumps, Motors, and Diesel Engines, Jockey pumps, motorized valves, Foam Proportioned system, Foam Tank and Tower Monitors shall be furnished by the contractor for approval of Engineer's Representative.

5.2 General Specification of EOT Crane

5.2.1 General

This specification along with data sheets, other specifications & attachments to inquiry / order describes and constitutes the minimum requirement for EOT and their accessories / auxiliaries for general industrial purposes. The intent of these requirements is to

supplement the requirements as given in data sheets, other specifications and other applicable standards / codes referred to in data sheets / specifications.

Contractor and vendor shall make all possible efforts to comply strictly with the requirements of this specification and other aforesaid specifications / attachments to inquiry / order. In case any deviations are considered essential by vendor, same shall be separately listed (with cross reference to Page No. / Section / Clause No. / Para etc. of the respective document) in vendor's offer under section titled as "List of deviations / exceptions to the inquiry document", duly supported with proper reasons for the deviation for Company's considerations. No cognizance shall be given to any deviation indicated elsewhere, but not listed in the deviation list. All such issues should be conveyed to Company in writing by the perspective Contractor / vendor prior / during the pre-bid conference, if any, before submitting the final offer. No deviation and exception from this specification shall be permitted without written approval of Company.

Except as specified herein, the EOT cranes shall be designed, manufactured, tested and supplied in accordance with data sheets / specifications / applicable codes / standards (latest edition).

In the event of any conflict / contradiction / discrepancy / dispute between this specification, other specifications, codes and standards and other technical documents, Contractor shall refer the matter to Company for clarification.

The following order of precedence shall govern.

1. Scope of Work & Design Basis / Criteria
2. P&ID / SLD
3. Data Sheets
4. Job / Equipment Specifications
5. Standard Specifications.
6. Codes & Standards.

In case any issue still remains unresolved, the most stringent requirement shall apply.

Contractor / vendor shall seek Company's approval regarding such features which are not specified by Company but job requirements call for purchaser decision on these matters. Compliance with this specification shall not relieve Contractor / vendor of the responsibilities of furnishing equipment and accessories / auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions. In case Contractor / vendor considers requirement of additional instrumentation, controls, safety devices and any other accessories / auxiliaries essential for safe and satisfactory operation of the equipment, he shall recommend the same along with reasons in a separate section along with his offer and include the same in his scope of supply.
All the definitions as indicated in IS: 3177 shall apply.

EOT crane vendor / manufacturer shall have adequate engineering, manufacturing and testing facilities conforming to national / international standards / codes.
The EOT crane model offered shall be from a regular and established manufacturer of electric cranes.
The EOT crane model offered shall be from the existing regular manufacturing range of electric crane vendor / manufacturer and already type tested at either manufacturer's works or outside. Vendor's / manufacturer's catalogue and general reference list shall be furnished along with the offer.
The offered EOT crane shall be of a proven design in similar service. At least two (2) units of comparable type, rating and design identical to the offered EOT crane should have been designed, manufactured from the proposed manufacturing plant, tested and supplied by vendor during last three years from the date of submission of offer and at least one unit must have successfully completed 8000 hours of operation without any problem. Contractor / vendor shall have to furnish references from users, if called for. Since this reference list will be used for establishing proven-ness of proposed model for operating under specified operating conditions, it is in vendor's own interest to select such reference, where the proposed model is supplied and operating at conditions similar to those specified for item against which the proposed model is offered. In addition, manufacturer's catalogue and general reference list for the EOT crane shall also be furnished.
EOT crane vendor / manufacturer shall assume responsibility for satisfactory performance of the equipment for the specified service.
EOT crane and all auxiliaries shall be suitable for the specified area classification.
EOT crane vendor / manufacturer shall not offer any alternative designs.

Two sets of special tools and tackles required either for installation / erection or operation and maintenance of the EOT crane shall be included in vendor's scope of supply.

5.2.2 CODES AND STANDARDS

- IS:3177 : Code of Practice for Electric Overhead Travelling Cranes and Gantry Cranes other than Steel Works Cranes.
- IS:807 : Code of Practice for Design, Manufacturing, Erection and Testing (Structural Portion) of cranes and hoists.
- IS:816 : Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
- IS : 1181 : Qualifying Tests for Metal Arc Welders (Engaged in Welding Structures other than Pipes)
- IS : 1823 : Code of Practice for Oxy-acetylene Welding for structural Work in Mild Steel.
- IS : 2266 : Steel Wire Ropes for general engineering purpose.
- IS : 3443 : Specification for Crane Rail Sections.
- IS : 3815 : Point Hook with Shanks for General Engineering Purpose.
- IS : 5749 : Forged Ramshorn hooks.
- IS : 226 : Specification for structural steel (Standard quality)
- IS : 2062 : Specification for structural steel (fusion welding quality)
- IS : 1030 : Specification for carbon steel castings for General Engineering Purpose.
- IS : 1570 : Schedules for wrought steels (Part-II – Carbon Steel).

5.2.3 BASIC DESIGN

In the design of components on the basis of strength factor of safety based on ultimate strength shall be as per IS: 3177. Impact, fatigue, wear and stress concentration factors shall be taken into account, wherever applicable.

Drive shall be designed with adequate margin to give the best performance and efficiency. Safety arrangement shall be incorporated to prevent damage to motors, gearing, shafts etc.

All materials shall be of tested quality conforming to specified standards and shall be new, unused and first class in all respects. Combustible fabrication material shall not be used. No cast iron part shall be used on the crane except for electrical equipment.

Where any portion of the structure is not free to expand or contract under variations of temperature, allowance shall be made for the resulting stresses. The co-efficient of expansion for each degree centigrade in variation of temperature above or below normal being taken as 0.000011 for mild steel. The maximum variation of temperature may be taken as 30°C unless specified otherwise in the data sheets. Besides, clause-8, section-II of IS:800 - "Code of Practice for use of structural steel in General Building Construction" shall also apply.

The crane shall be designed for minimum head room and for closest approach of the hooks to each end stop.

Breathing holes shall be provided in completely enclosed welded box type girders. Drain holes shall be provided in all places where water or oil is likely to collect. Where practicable, means of access shall be provided for inside inspection of completely enclosed box girders. Diaphragm support plates at suitable interval may be used to avoid deformation / deflection of the box girder.

5.2.4 Bridge

Bridge girder shall be of vendor's / manufacturer's standard design box type welded construction. The material for the girder shall be of structural steel as per IS:226 / IS:2062. Plates above 12mm thick shall be IS: 2062 materials. The cranes shall be single or double girder type, as specified in the data sheets.

The ratio of the effective length of the compression flange of the girder to the breadth of flange of the girder shall not exceed 60.

The deflection of member of the structure as a whole shall not impair the strength or efficiency of structure or lead to damage to finishing. Girder shall be designed so that the vertical deflection caused by the safe working load including dead load and the weight of crab in central position (without taking into consideration impact factor) shall not exceed 1/1000 of the span.

Bridge girder shall be cambered by an amount equal to the deflection caused by dead load plus half the rated live load.

To enable handling of crane girder without any damage during erection handling points shall be marked clearly on girders.

Each girder shall be marked so as to facilitate end carriage connection & squareness.

5.2.5 End Carriage

End carriage shall be made from rolled steel sections or plates to IS:226 / IS : 2062 welded together to form a box. The design shall be such that the load is uniformly distributed.

The end carriage shall be fitted with safety stops to prevent crane from falling more than one inch in the event of breakage of a truck wheel bogie or axle.

The ratio between the wheel base and span shall not be less than 1/5.

In the attachment of end carriages to the main girders, gusset plates or diagonal bracings shall be employed to provide lateral strength.

The ends of the main girder shall extend over the full width of the end carriage and the extension shall have sufficient shear section to take the maximum reaction from girders. The reaction from main girders shall be distributed over the width of end carriage.

End carriage shall be designed so as to enable the track wheels to be withdrawn readily. Jacking pads shall be provided for jacking up the crane for changing crane wheels.

Each carriage shall be provided with spring buffers at each end to enable smooth stopping of the crane at end of runway.

Repair cages shall be provided below the end carriage for maintenance of DSL and current collectors. The approach to repair cage will be provided from bridge platform by a ladder.

5.2.6 Lubrication

Grouped grease lubrication shall be provided for each mechanism (CT, LT, Hoist). Each mechanism shall have hand grease pump for lubricating all parts of the mechanism simultaneously. All grease piping shall be securely fixed for LT motion, two groups (one at each end) shall be provided.

5.2.7 Crab Construction

Crab frames shall be fabricated from IS: 226 rolled steel sections. Frames carrying mechanical or electrical driving equipment shall be fitted with doubling plates of adequate thickness welded on and machined to true surface.

End stops shall be fitted to prevent the crab from over running.

Crab structure shall be provided with suitable buffers to enable smooth stopping of the crab at runway end.

Crab structure shall be provided with safety stops to prevent it's jumping off the rails in the event of breakage of truck wheel bogie or axle.

The floor or crab shall be covered with chequered plates except for opening required for ropes and other parts. Hand-railing shall be provided on the two open sides of the crab.

Crab shall be provided with jacking pads for lifting crab for removal of wheels and other repairs.

5.2.8 Platform & Ladders

Safe means of access shall be provided to the drivers and to every place where any person engaged on the examination or maintenance of the crane has to work. Adequate hand holds and foot holds shall be provided, where necessary.

All the platforms should be connected to main girder by bolted joints, to enable transportation of girders and platforms as separate units.

Platform should be of chequered / non-slip surface steel plate of minimum 6 mm thickness.

All platforms shall be have 32 NB pipe hard-rail all round with ISA 50 post at maximum 1500 mm spacing, 100x5 mm toe plate and 50x6 mm flat runner.

5.2.9 Operator's Cab

The operator's cab shall be open / closed type and suitable for indoor service.

The cab shall be provided with adequate lighting arrangements and a fan.

Cab shall be provided be provided with a foot operated warning gong.

All crane controls shall be provided in the cabin.

5.2.10 Pendant Push Button

A pendant push button station movable along the complete span of the crane (on a separate track) independent of trolley movement shall be provided.

The pendant shall have buttons / controls for all the movement of the crane. It shall have a mushroom head type emergency stop button.

5.2.11 Guarding

All rotating parts, revolving shafts shall be adequately guarded as per safety requirements according to relevant clauses of IS specifications.

5.2.12 Runway Rails

The crane rails as per IS: 3443 along with fixtures such as shims, anchor bolts, inserts, fish plates and sole plates shall be supplied and erected at site well in advance before the delivery of crane to site.

Adequate provision for end stops and buffers shall be made on the long travel rail ends.

5.2.13 Crane Wheels

Wheels for Bridge & Trolley shall be double flange type with tread and flange, machined accurately to size and flanges tapered and reduced.

The wheels shall be mounted in such a manner as to facilitate removal and replacement.

Material for wheels shall be forged steel to IS: 1570 with minimum hardness of 250 BHN. The wheels shall be single piece type (no tyre).

The width of the wheel tread shall be greater than the rail head width by an amount which shall suitably allow for known variations in the gantry rail alignment and gantry track

span dimensions. As a minimum, the tread width of LT & CT wheel shall be 40 mm & 20 mm more than rail head width respectively.

The dimension of flanges of track wheels shall be as per IS: 3177.

5.2.14 Wire Ropes

The wire ropes shall be of suitable diameter as per vendor's / manufacturer's design of crane. The rope shall conform to IS: 2266. The rope should have 6 x 37 construction with hemp core. However, this should be in relation with drum diameter as per IS: 3177. The tensile designation of the wires shall be minimum 1770 as per IS: 2266.

5.2.15 Rope Drums

The drum shall be fabricated from mild steel plates (fusion welding quality) to IS: 2062. Circumferential welded joint shall not be permitted. All butt welds shall be subjected to 100% radiography. The plate material for the drum shall be accepted only after this plate has been successfully passed in ultrasonic testing. The fabricated rope drum shall be stress relieved.

The drum shall be sufficiently wide to accommodate in one layer the length of rope required for specified lift and, in addition, not fewer than two dead turns at each anchored end and one spare groove at opposite end.

The drum shall be flanged at both ends and flanges shall project a distance not less than two rope diameters above the rope. A spur or other wheel secured to the drum may be regarded as forming one of the flanges.

Rope anchorage shall be readily accessible.

Drum strength, drum diameter and drum grooving shall comply to the requirements given in IS: 3177.

The lead angle or rope shall not exceed 5º (1 in 12) on either side of helix angle of the grooving in the drum.

5.2.16 Sheaves

The sheaves (Pulleys) shall be carbon steel casting having chemical and mechanical properties as per IS: 1030 (Class-I I).
Sheaves diameter, sheaves grooving, its lead angle and equalizing sheaves shall comply to the requirement specified in IS: 3177.
Sheaves shall be provided with guards to retain the ropes in the grooves if necessary.

5.2.17 Bearings

The type of bearings recommended for various parts shall be as per IS: 3177 and shall be of standard make.

Provision shall be made for service lubrication of all bearings. Bearing enclosures shall be designed as far as practicable to exclude dirt and prevent leakage of oil or grease.

Suitable drip pans shall be provided as required to collect oil and grease which may drop from operating parts. All drip pans shall be accessible for draining and cleaning.

All bearings of gearing shall be antifriction type. Angular contact ball for taper roller bearings shall be used wherever necessary. The bearings shall correctly locate the shafts allowing for internal expansion of the shafts. Bearings shall be enclosed in suitable housing with proper plugs to prevent any ingress of dirt and holes to permit easy lubrication.

Lubricating chart shall be provided.

5.2.18 Couplings

Couplings shall be geared type on all power output shafts. On power input shaft pin and bush coupling may be provided.

All couplings shall be of forged steel and shall be designed to suit the maximum torque that may be developed.

Flexible couplings shall be fitted between motor shafts and gear box extension shafts.

5.2.19 Shafts

Shafts shall be made from rolled / forged steel bars of C-40 to IS: 1570.

The material for axles shall be C-45 to IS: 1570. Shafts and axles shall have ample strength and rigidity and adequate bearing surface.

Keys, keyways, spliners and serrations shall conform to IS: 2048.

5.2.20 Gears, Pinions and Gear Box

Gearing shall be straight or helical type. All gearing shall be totally enclosed in gear boxes. No open gearing shall be allowed to be used in any motion.

All gears shall be made of Rolled / Forged steel (C-45 of IS: 1570) and all pinions shall be made of C-50 of IS: 1570. The rating of the gear shall be as per IS: 4460.

The gears shall have tooth form and modules as recommended in IS: 3681 and they shall be adequately designed to stand shock load and vibration. They shall not be excessively noisy in operation. Gears and pinions teeth shall be suitably heat treated for resistance to wear. However, case carburizing of gear teeth shall not be done.

Gear box shall be designed and manufactured according to the requirements given in IS: 3177. Gear box casing fabricated out of steel plates shall be stress relieved.

5.2.21 Hook Blocks and Hooks

The hook block shall be designed to lift without twisting. The hook shall be of forged steel as per IS: 1875 Gr. 2. It shall be of swivelling type and shall be mounted on thrust bearings. The hook shall be provided with locking device to prevent the rotation of hook when desired.

The hooks of the crane shall be ramshorn type as per IS: 5749 for S.W.L. 40 tonnes and above.

The Auxiliary hook of the crane shall be point hook with shank as per IS: 3815.

The hooks shall be magnetic particle tested before and after proof load test.

The hooks shall be proof load tested, marked and duly certified by competent authority.

The material for the hook shall be supplied with chemical & physical test reports.

A safety latch shall be provided on hooks to prevent coming out of the slings.

5.2.22 Trunnion

The trunnion shall be of Forged steel as per IS: 1875 Gr. 2.

The material for the trunnion shall be tested ultrasonically. Chemical & physical tests shall also be conducted.

5.2.23 Drive Unit

Equal driving efforts shall be applied at each drive wheel of bridge and trolley to prevent one end traveling faster than other.

For bridge, the torsional deflection in cross shaft shall be limited to safe value and in no case shall this exceed 0.08 degree per foot.

For bridge drive individual wheel drive shall be provided for spans of 16 m. For span of 16m a central drive may be provided when motor shall be located at mid-span. In case of central drive the shaft shall be supported at intermediate points at 3 metres distance. It twin motors are used for drive they shall be synchronized. Motor shall be located equidistantly from both wheel ends.

Trolley drive shall be achieved by single motor in which the motor shall drive a common output shaft through gearbox.

All machineries for the drive unit shall be properly aligned. Self-aligning type gear coupling shall be used between connecting shafts to take care of transverse as well as axial movement wherever necessary. Wherever components of considerable amount of inertia is directly mounted on the high speed shaft (e.g. brake drum, couplings, etc) they shall be balanced dynamically to minimize vibrations.

5.2.24 Buffers

Spring loaded buffers shall be fitted on all four corners of the end carriage for smooth stopping of crane and also on the four ends of the trolley.

5.2.25 Brakes

i) Bridge and Trolley Travel Brakes

2 Nos. (for twin drive) or 1 No. for centre drive) brakes shall be provided for Bridge Travel (i.e. LT) suitable for operations at 415 V, 3 phase, 50 Hz power supply. These brakes shall be Electro-hydraulic thruster brakes. For Trolley Travel (i.e. CT), 1 No. Electro Hydraulic thruster brake shall be provided.

The braking torque for LT & CT shall be at least 130% of motor torque.

ii) Main and Auxiliary Hoist Brake

Main Hoist and auxiliary Hoist shall be provided with 1 No. of DC Electromagnetic / Electrohydraulic thruster brake each. The braking torque shall not be less than 200% of motor torque.

In case thruster brake is used for hoisting, anti-drop feature shall be provided to prevent lowering of load during application of brake, by suitably connecting the hoist motor in reverse direction with the help of suitable control scheme.

- ❖ All the brakes shall be fail safe type and shall be applied automatically when power to drive motor is out or fails.
- ❖ The brake shall be applied directly to the motor shaft and equally effective in both directions of rotation.
- ❖ The brake shoes shall be self-aligning type and shall have large cooling surface for low temperature rise.
- ❖ The thruster motor shall be 3 phase, totally enclosed, class B insulated, continuously rated motor. The thruster motor shall be designed for frequent switching operation in the range of 720 switching per hour.
- ❖ Thrustors shall have reserve of at least 30% stroke length available for necessary adjustment as well as provision for adjustment of time for upward and downward travels of the piston.
- ❖ Emergency Braking: All brakes shall irrespective of control or position be applied immediately on operating the emergency stop push button or switches.
- ❖ Design and rating of Brakes shall be as per IS: 3177 (Clause 27).

5.2.26 Limit Switches

- Each of main and auxiliary hoists shall be provided with two limit switches for over hoisting and these shall be following type.
- The first limit switch to act in case of over hoisting shall be screw type with self-resetting feature and included in the respective motor control circuit.
- The second shall be gravity operated hand reset type connection in the main contractor control.
- The backup limit switches shall be provided for switching off the power supply whereas main limit switch is for stopping the movement of individual motion.

Bridge travel and trolley travel shall be provided with limit switches to prevent over traveling and over traversing respectively. The limit switches shall operate the respective motor control circuits.

The limit switches shall be totally enclosed type with properly designed actuators and shall be readily accessible for adjustment and repair.

5.2.27 Crane Controls

- **Hoist Motions (Applicable for both main and auxiliary hoist)**

a) For hoist control in hoisting and lowering directions, vendor / manufacturer shall offer suitable schemes and complete equipment to meet functional requirement.

b) The hoist control shall be designed to achieve inching speed of approximately 10% of rated speed in both hoisting and lowering direction with loads (from no load to full load) on hooks, if specified in the data sheets. To achieve inching speed one of the following methods shall be used.
   - ❖ Planetary gear box.
   - ❖ Pole changing motor.
   - ❖ Separate motor with clutch and gearbox.
   - ❖ Thyristor control

c) Minimum five nos. speed steps shall be provided for each direction of hoist motion. Conventional rotor resistance shall be used in both hoisting and lowering direction to achieve the above speed steps.

- **Bridge and Trolley Travel Motions**

Minimum four (4) nos. of speed steps shall be provided for each direction of motion. Conventional rotor resistance controls shall be used to achieve the above speed steps. Step-less speed variation shall be provided wherever specified.

The control system shall be designed for 110 ± 10% single phase 50 Hz power supply. Necessary transformers and all other equipment shall be furnished by vendor / manufacturer.

5.2.28 Hazardous Area Requirement

All wheels shall be provided with phosphor bronze tyres.

Any other mechanism where two non-lubricated parts mate, one of them shall be of non-ferrous materials like phosphor bronze / aluminium bronze.

All electricals components / equipment shall be the requirements of respective area classification.

Coupling guards shall be non-ferrous / non-metallic type.

5.2.29 Inspection & Testing

In addition to the requirements of inspection mentioned in the mechanical scope, followings are also required.

Testing at vendors works and site shall be carried out in accordance with IS: 807 & IS: 3177 and shall include following tests as minimum.

- Testing of electrical and mechanical equipment in accordance with appropriate standards.
- Full load and 125% overload test for hoist & cross travel motions at works.
- Hoist speed verification test at works.
- Deflection Test at works.
- Testing of effectiveness of brakes, safety device, electric insulation etc. at works.

The tolerance in speeds shall not exceed the following limits:

- CT / LT: + 10%, - 5%

- Hoisting: + 10%, - 5%
- Traversing: + 20%, - 5%

A certified record of test figures / results shall be submitted along with the equipment. Test certificates of all bought-out components shall be provided.

After assembling and erection at site, the crane shall be subjected to commissioning tests as laid down in IS: 807 and IS: 3177. Contractor / vendor shall be fully responsible for carrying out all the tests required by these standards including the overload testing of the crane.

The lifting tackle, slings, test gauges and instruments shall be furnished by Contractor / vendor.

The reports on these tests shall be submitted to Company by Contractor's / vendor's authorized representative at site.

The equipment shall meet the performance requirements specified in the data sheets and this specification.

Operability tests and overload tests at site to demonstrate satisfactory operation of crane without undue friction or display of any other unfavourable characteristics.

5.2.30 Protection & Painting

All exposed carbon steel parts to be painted shall be thoroughly cleaned from inside and outside to remove scale, rust, dirt and other foreign materials by wire brushing and sand blasting, as applicable. Minimum acceptable standard in case of power tool cleaning shall be St. 3 and in case of blast cleaning shall be Sa 2 1/2 as per Swedish Standard SIS: 055900 (latest edition).

Non-ferrous materials, austenitic stainless steels, plastic or plastic coated materials and insulated surfaces of equipment not be painted.

Stainless steel surfaces both inside and outside shall be pickled and passivated.

Machined and bearing surface shall be protected with rust preventive agent like varnish or thick coat of grease.

Depending on the environment, following primer and finish coats shall be applied.

Environment	Description
1. Normal Industrial	Primer: 2 coats of Red oxide zinc chromate, each 25 microns (min.) Finish: 2 coats of Synthetic enamel, each 25 microns (min) thick.
2. Corrosion Industrial	Primer: 2 coats of Epoxy zinc chromate each 35 microns (min) thick. Finish: 2 coats of Epoxy high build paint, each 100 microns (min) thick.
3. Coastal and Marine	Primer: 2 coats of High build chlorinated rubber zinc phosphate each 50 microns (min) thick. Finish: 2 coats of Chlorinated rubber paint each 35 microns (min) thick.
4. All environments (Temp. 80-250ºC)	Finish: 2 coats of Heat resistant Aluminium paint suitable for 250ºC each of thickness 20 microns.
5. All environment (Temp. 250-400ºC)	Finish: 2 coats of Heat resistant Aluminium paint suitable for 400ºC each of thickness 20 microns.

(All values refer to dry film thickness)

The colour of finish coat shall be intimated to vendor after placement of order.

5.2.31 Warranty

Vendor shall have final and total responsibility for the design and mechanical performance of all equipment supplied under this specification. Vendor shall warrant the equipment furnished by him and the performance of the said equipment in accordance with this specification and with warranty requirements given elsewhere in bid package.

5.2.32 Spare Parts & Tools:

Spare Parts:

Vendor shall provide spare parts needed for start-up and commissioning. Vendor shall furnish a separate itemized priced list of recommended spares for one as well as two (2) years normal operation and maintenance. Lists shall include part number, part description, serial number and normal delivery lead time. Contractor shall ensure listed parts are available for shipment at the time of equipment shipment. Recommended spares should take into account related factors of equipment reliability, effect of equipment downtime upon production or safety, cost of parts and availability of equipment service facilities. All spare parts furnished by Vendor should be wrapped and packaged so that they will be preserved in original as new condition under the normal conditions of storage to be anticipated in India. Spare parts shall be properly tagged and coded so that later identification as to intended equipment usage will be facilitated. They shall be packaged separately, clearly marked as "Spare parts" and shipped at the same time as the equipment. Packing lists shall be furnished so that the parts can be handled without uncarting, if required. Start-up spares shall be packed and identified separately.

Tools Vendor shall provide two sets of special tools or fixtures as required, for installation / erection, operation & maintenance and disassembly of the furnished equipment. All such tools shall be permanently tagged with information pertaining to their use. Any special drawings or instructions pertaining to the use of such tools shall be included in the instruction manual.

5.2.33 Packaging & Identification

All packaging shall be done in such manner as to reduce the volume. The equipment shall be dismantled into major components suitable for shipment and shall be properly packed to provide adequate protection during shipment. All assemblies shall be properly match marked for site erection.

Attachments, spare parts of the equipment and small items shall be packed separately in wooden-cases. Each item shall be appropriately tagged with identification of main equipment, item denomination and reference number of the respective assembly drawings.

Detailed packing list in water-proof envelope shall be inserted in the package together with equipment.

Each equipment shall have an identification plate giving salient equipment detail / data, name of manufacturer, make / model, equipment number, year of manufacture etc.

5.3 FUNCTIONAL SPECIFICATION FOR CENTRIFUGAL FIRE PUMP

5.3.1 General

This specification along with data sheets, other specifications & attachments to inquiry / order describes and constitutes the minimum requirement for horizontal centrifugal pumps and their accessories / auxiliaries for use in the process & pipeline applications. The intent of these requirements is to supplement the requirements as given in data sheets, other specifications and other applicable codes / standards referred to in data sheets / specifications.

Contractor and vendor shall make all possible efforts to comply strictly with the requirements of this specification and other aforesaid specifications / attachments to inquiry / order. In case any deviations are considered essential by vendor, same shall be separately listed (with cross reference to Page No. / Section / Clause No. / Para etc. of the respective document) in vendor's offer under section titled as "List of deviations / exceptions to the inquiry document", duly supported with proper reasons for the deviation for Company's considerations. No cognizance shall be given to any deviation indicated elsewhere, but not listed in the deviation list. All such issues should be conveyed to Company in writing by the perspective Contractor / vendor prior / during the pre-bid conference, if any, before submitting the final offer. No deviation and exception from this specification shall be permitted without written approval of Company.

Except as specified herein, the pumps shall be designed, manufactured, tested and supplied in accordance with data sheets, specifications and applicable codes / standards (latest edition).

In the event of any conflict / contradiction / discrepancy / dispute between this specification, other specifications, codes and standards and other technical documents, Contractor shall refer the matter to Company for clarification. The following order of precedence shall govern.

- Scope of Work & Design Basis / Criteria
- P&ID / SLD
- Data Sheets
- Job / Equipment Specifications
- Standard Specifications.
- Codes & Standards.

In case any issue still remains unresolved, the most stringent requirement shall apply.

Contractor / vendor shall seek Company's approval regarding such features, which are not specified by Company, but requirements call for purchaser decision on these matters.

It will be the responsibility of Contractor / vendor to furnish a safe operating unit. Compliance with this specification shall not relieve Contractor / vendor of the responsibilities of furnishing equipment and accessories / auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions. In case Contractor / vendor considers requirement of additional instrumentation, controls, safety devices and any other accessories / auxiliaries essential for safe and satisfactory operation of the equipment, he shall recommend the same along with reasons in a separate section along with his offer and include the same in his scope of supply.

Pump vendor shall be a regular and established manufacturer of centrifugal pumps.

Pump vendor shall have adequate engineering, manufacturing and testing facilities for centrifugal pumps for water service confirming to relevant codes / standards.

Pump model offered shall be from the existing regular manufacturing range of the pump vendor. Vendor’s / manufacturer' catalogue and general reference list shall be furnished along with the offer.

The offered pump shall be a proven design in similar service. At least 2 units of comparable type, rating and design should have been designed, manufactured from the proposed manufacturing unit, tested and supplied by vendor during last three years from the date of submission of offer and at least one unit must have successfully completed 8000 hours of operation at site without any problems. Contractor / vendor shall have to furnish references from users, if called for.

Since this reference list will be used for establishing provenances of proposed model for operating under specified operating conditions, it is in vendor's own interest to select such reference, where the proposed model is supplied and operating at conditions similar to those specified for item against which the proposed model is offered. In addition, manufacturer's catalogue and general reference list for the pump shall also be furnished.

Pump vendor shall assume responsibility for satisfactory hydraulic and mechanical performance of the equipment for the specified service.
Pump and all auxiliaries shall be suitable for the specified area classification.
Pump vendor shall not offer any alternative designs.
Two sets of special tools and tackles required either for installation / erection or operation and maintenance of the pump units shall be included in vendor's scope of supply.

5.3.2 Codes & Standards

Codes, Standards and Regulations The centrifugal pump covered by this specification shall be designed, manufactured and tested in accordance with the requirements of this Project Specifications, Company approved data sheets and the latest editions of applicable National / International codes and standards (not limited to those listed hereunder) and Statutory Regulations (where applicable). IS 5120: Technical requirements for Roto dynamic Special Purpose Pumps.

OISD: 113 Standard on classification of area for electrical installations at hydrocarbon and handling facilities.

Project Specifications: The pump(s) covered by this specification shall be designed, manufactured and tested in accordance with the requirements of the following Project Specifications:

- Design Basis
- Electrical Specifications.
- Instrumentation Specifications.
- Piping Specifications.
- Insulation Specifications.
- Painting Specifications.

5.3.3 Mandatory Indian Statutory Requirements

This document has been prepared to the National / International Standards detailed within. Contractor shall ensure that the scope of work is executed in accordance with all mandatory Indian statutory requirements.

5.3.4 Scope of Supply

General

Contractor shall furnish completely filled in data sheets for each centrifugal pump for water service as per IS: 5120 and Project Specifications for Company's review and approval.

Contractor shall supply all necessary equipments specified for the package / unit and auxiliary systems and all other requirements in accordance with this specifications. Any equipment that is necessary to make a complete, operable, safe and dependable package / unit but not specifically identified herein shall also be in Contractor's scope of supply. The scope of supply for each pump unit shall include, but not necessarily be limited to the following:

Pump & Driver

- Common Base Plate (drain rim type)
- Seals and Seal systems
- Flexible couplings, complete with suitable non-sparking guard
- Power transmission gear unit (if required)
- All necessary interconnecting pipework, fittings and valves, including drain connections, terminating at the edge of the baseplate / skid.
- All necessary electricals, controls and instrumentation (as applicable).

- Any additional piping, instrumentation or accessories necessitated by this specification or as shown within the package limits on nominated P&ID drawings.
- All necessary spare parts for start-up and commissioning.
- A list of spare parts recommended for one year and for two years of operation
- Two (2) sets of any tools required for maintenance of the pump unit
- Inspection and testing as called for in this specification and its attachments
- All documentation as specified in this specification and as listed in the Company‟s procurement documentation
- Preparation for Shipment

All the above components shall be mounted on a common structural skid fully assembled, piped with inlet and outlet piping terminated at the skid edge with appropriately rated flanges, wired, tested and painted for corrosive environment.

Contractor shall be responsible for the complete design, engineering, coordination, testing, delivery and proper functioning of the equipment, notwithstanding any omissions from this specification.

5.3.5 Environmental Design Criteria

Climatic Conditions

The climatic and other conditions under which the equipment will operate are detailed in the process package (design criteria) of the bidding document. Conditions specific to the Equipment Package shall be detailed on individual equipment data sheets.

Contractor is responsible for ensuring that all equipment and components provided are suitable for the utility and environmental conditions as specified during the entire design life.

Area Classification Electrical and Instrumentation will be rated for the applicable Hazardous Area classification according to OISD standard 113

5.3.6 Basic Design

General Contractor's standard design shall be capable of meeting the performance requirements when operating in the environment as mentioned the process package or elsewhere for a period of total design life of the installation of 20 years with minimum uninterrupted service period of 3 years. Contractor / vendor shall identify any aspects of the standard components of packages that don't meet this specification and submit descriptions to Company during the tendering process. Except where amended by the data sheets or this specification or unless otherwise approved by Company, the design of centrifugal pumps shall be in accordance with the requirements of the Project Specifications and current edition of Standard IS - 5120 „ Technical requirements for Roto dynamic Special Purpose Pumps ".
Units used in all documentations, drawings and name plates shall be metric SI units except for pressure units that shall be kg/cm2.

Pump rated capacity shall be at least equal to the maximum capacity specified in the data sheet.

The pump unit and auxiliary shall be designed and constructed for continuous full load duty.

Unless otherwise specified, equipment (pump-driver train) shall be designed to be suitable for outdoor installation without a roof.

Pumps where difference between NPSHA and NPSHR is 0.6 meter or less are not acceptable. The said NPSHR value shall correspond to the maximum value of NPSHR from rated flow down to the recommended minimum stable flow specified by vendor.

The best efficiency point for the furnished impeller is preferred between the rated point and the normal point. However in no case the rated point shall be beyond 110 percent of the best efficiency point of the rated impeller.

Pumps with constant speed drivers shall be capable of at least 5 percent head increase at rated condition and pump rated speed by replacing with a new impeller or impellers. Offered impeller shall in no case be less than the minimum diameter impeller.

Pumps that have stable head / capacity curves (continuous head rise to shut-off) are preferred for all applications and are required when parallel operation is specified. When

parallel operation is specified, the head rise shall be at least 10 percent of the head at rated capacity.

The pump for parallel operation shall have characteristics suitable for capacity sharing by ensuring that shut off head is not less than 110 % of rated head and not more than 120 % of the rated head.

Pumps with variable speed drivers shall be capable of operating continuously upto 105 percent of rated speed as well as operating briefly upto driver trip speed.

Horizontal pumps of the close-coupled, the two stage overhung, or the single stage double suction overhung, type shall not be furnished.

The guaranteed parameters shall be demonstrated during shop test without any coating on impellers or casings.

Lifting lugs / eye hooks shall be provided for ease of lifting of complete pump as well as the heavy maintenance components of the pump (e.g. top half cover of axially split pump).

5.3.7 Pressure Casing Design

Maximum allowable working pressure of casing / flanges and associated parts shall in no case be less than the maximum discharge pressure produced by the pump at shut-off (including tolerances), at the maximum suction pressure, for the maximum impeller diameter and the rated speed. These casing / flanges shall be suitable for hydrostatic test pressure of not less than 1 ½ times the maximum allowable pressure.

Pumps shall have suction and discharge flanges designed for same rating. Unless otherwise stated, flanges shall be machined and drilled conforming to ANSI B16.5 standard.

Weld Neck type carbon steel companion flanges with rating conforming to applicable specification of ANSI, drilled and faced in accordance with pump suction and discharge flanges shall be supplied along with gaskets and fasteners for all pumps.

5.3.8 Impeller, Shaft and Shaft Sleeves

Impeller shall be cast as one piece.

Shaft shall be provided with sleeves under the packing / seal and shall be locked to the shaft. The material of sleeve shall be 12 percent chrome steel (hardened). Where the size of pump makes the use of shaft sleeve impracticable, the shaft shall be constructed of 12 percent chrome steel (hardened).

5.3.9 Mechanical Seal/Packing

Unless otherwise specified, the pump shall be supplied with packing. Stuffing box shall have minimum five packing rings plus lantern ring. Packing ring size shall be 3/8" or larger.

Mechanical seals when specified shall be either SEALOL or DURAMETALLIC or of a make approved by Company.

Seal manufacturers specific recommendation shall be obtained and submitted to Company.

All auxiliaries for flushing of mechanical seal shall be in vendor's scope of supply.

5.3.10 Bearings

Antifriction bearings shall be of standard type and shall meet minimum L-10 rating life of either 25000 hours with continuous operation at rated conditions or 16000 hours at maximum axial and radial loads and rated speed.

The rise in bearing grease / oil temperature with continuous running of the pump shall be within the allowable limits which shall not exceed 300C for grease and 390C for oil lubricated bearings above ambient. Cooling arrangement shall be provided if required. Bearings shall be equipped with constant level oilers, vent breather & drain point for oil lubricated arrangements.

Sleeve bearing pumps shall be arranged so as to permit measurement of shaft vibration adjacent to at least one bearing.

Vibrations: The following vibration limits shall be applied at rated speed and at flow + 10 percent of rated flow.

Horizontal pumps: Unfiltered vibration velocity for horizontal pumps upto 3000 rpm with antifriction bearings or sleeve bearings when measured at the bearing housing in horizontal or vertical direction shall not exceed 7.6 mm / sec (0.3 inch / sec).

The maximum permissible sound level shall not exceed 88 dBA measured at 1m from pump surface for the recommended range of operation.

For carbon steel construction pumps in caustic service, the pressure containing components as well as any welding performed on there shall be stress relieved.

Pump and driver shall be connected through a flexible coupling or reputed make.

All exposed rotating / moving parts shall be provided with removable non-sparking type guards and shall be open at the bottom to permit manual shaft rotation. The guard shall be sufficiently rigid to withstand deflections as a result of 100 kgs of load.

Flanged nozzles shall be provided for all sizes.

Unless otherwise specified, pump shall be supplied with companion flanges, gaskets and fasteners.

5.3.11 Base Plate

A common base plate with anchor bolts shall be provided for pump and driver.

For driver trains over 75 kW, alignment positioning screws shall be provided for each drive element to facilitate longitudinal and transverse horizontal adjustments. The lugs holding these positioning screws shall be attached to the base plate so that they do not interfere with the installation or removal of the drive element.

Vertical levelling screws, spaced for stability shall be provided on the outside perimeter of the base plate. These shall be numerous enough to carry the weight of the base plate, pump, gear-box (if any) and driver without excessive deflection.

The base plate shall be provided with lifting lugs for at least a four point lift. Lifting the base plate with all equipments mounted shall not permanently distort or otherwise damage the base plate or the equipments mounted on it.

Electric motor drivers shall have a kW rating (excluding service factor) at least 125% of rated BkW or end of curve operation whichever is higher.

Unless otherwise specified the driver motor shall be in the scope of pump vendor.

The electric motor shall be suitable for the electrical area classification specified in the pump data sheets.

5.3.12 Pumps for Fire Water Application

Pumps for Fire Water Application shall also meet the following additional requirements:

Pumps shall meet the requirement stipulated by OISD & vendor shall be responsible for obtaining the necessary approvals.

Pumps shall be direct coupled except in the case of engine driven vertical turbine pumps wherein gear drives shall be used. Belt driven pumps are not acceptable.

Parts of pumps like impeller, shaft sleeve, wearing ring etc. shall be of noncorrosive metal preferably brass or bronze unless the quality of water requires the use of special metals / alloys which shall be insisted upon.

Pumps shall be capable of furnishing not less than 150 percent of rated capacity at a head not less than 65 percent of the rated head. Shut-off head shall not exceed 120 percent of rated head in horizontal pumps and 140 percent in the case of vertical turbine pumps.

Difference between NPSHA and NPSHR at 150 percent of the duty point shall not be less than 0.5 meters.

The electrical motor shall be of continuous rating type and the rating shall be 110 percent of the power at rated point or equal to maximum BKW rated impeller whichever is higher.

For diesel engine drivers, the net continuous site power available after considering the deration due to site condition and power losses due to other parasitic loads and engine driver auxiliaries shall be higher of the following two values:

- 20 percent in excess of the maximum BkW required to drive the pump at rated condition.
- Maximum BkW rated impeller as indicated by the manufacturer in the pump data sheets.

5.3.13 MATERIALS

Material of construction shall be as per datasheets and equivalent as per ASTM. Contractor and vendor shall however assume responsibility for suitability of selected material for specified service. If necessary, vendor should furnish superior materials than specified. For impellers in bronze construction, the tip speed shall be limited to 40 meters/sec. For tip speeds exceeding 40 meters/sec, the material of impellers shall be stainless steel

The repair of pressure castings by peening, plugging, impregnating or by the use of cement or plastic compounds is not acceptable. Company's prior approval shall be obtained for the repair of castings. When authorized, repair shall be carried out with applicable ASTM specifications. Weld repair of pressure containing parts of CI is not permitted.

5.3.14 Inspection & Testing

In addition to the requirements of inspection mentioned in the mechanical scope of work, followings are also required.

Jackets for bearing, stuffing box, coolers etc., shall be tested at 8 kg / cm2 or 1½ times the maximum allowable jacket working pressure whichever is higher.

The mechanical as well as the hydraulic performance (including NPSHR) for the complete range of operation of the offered model shall have been established in the shop test.

Performance testing of complete pump unit shall be in vendor's scope. Unless otherwise specified, pump shall be tested at the rated speed specified in the data sheet with calibrated motors, atleast for four hours. During the four hour run test, complete data including pressure, capacity, power, bearing temperatures, vibration levels, noise levels etc. shall be recorded and guaranteed parameters verified. Unless otherwise specified, NPSH test shall be carried out whenever the margin between (NPSH) available and (NPSH) required is less than 1.5 meter.

During performance test, vibrations shall be measured on the bearing housing for the capacity range of + 10 % of rated capacity.

After the performance test, 4 hrs running test and NPSH test (if any), the pump shall be dismantled to check for wear. Parts having close clearances and mechanical seal faces

shall be checked for any abnormal rubbing and wear. Wear ring clearances shall be measured and recorded.

The basic reference standard shall be the latest edition of Hydraulic Institute Standard or IS: 5120.

For fire water application all engine driven horizontal pumps shall be subjected to a 6 hour complete unit string test at the pump vendor's works during which mechanical performance of the train shall be verified, in terms of vibration, bearing / oil temperature, engine parameters and controls.

5.3.15 Warranty

Vendor shall have final and total responsibility for the design and mechanical performance of all equipment supplied under this specification. Vendor shall warrant the equipment furnished by him and the performance of the said equipment in accordance with this specification and with warranty requirements given elsewhere in bid package.

5.3.16 Spare Parts & Tools

Spare Parts: Vendor shall provide spare parts needed for start-up and commissioning. Vendor shall furnish a separate itemized priced list of recommended spares for one as well as two (2) years normal operation and maintenance. Lists shall include part number, part description, serial number and normal delivery lead time.

Contractor shall ensure listed parts are available for shipment at the time of equipment shipment. Recommended spares should take into account related factors of equipment reliability, effect of equipment downtime upon production or safety, cost of parts and availability of equipment service facilities. All spare parts furnished by Vendor should be wrapped and packaged so that they will be preserved in original as new condition under the normal conditions of storage to be anticipated in India. Spare parts shall be properly tagged and coded so that later identification as to intended equipment usage will be facilitated. They shall be packaged separately, clearly marked as "Spare parts" and shipped at the same time as the equipment. Packing lists shall be furnished so that the

parts can be handled without uncrating, if required. Start-up spares shall be packed and identified separately.

Tools Vendor shall provide two sets of special tools or fixtures as required, for installation / erection, operation & maintenance and disassembly of the furnished equipment. All such tools shall be permanently tagged with information pertaining to their use. Any special drawings or instructions pertaining to the use of such tools shall be included in the instruction manual.

5.3.17 Preparation for Shipment

After final Testing and approval, the assembly shall be drained of water and dried. All items shall be properly packed and protected against damage during shipment. Each crate, bag or package shall be clearly identified with the purchase order number and identification symbol, and shall be securely fastened to the package. Exposed surfaces shall be coated with an easily removable rust preventative. All flanged opening shall be protected with steel plate covers attached by proper bolting and sealed with plastic compound. All electrical control enclosures shall be properly plugged at entries and loaded with silica gel bags where necessary. The contractor shall state in their proposal their recommendations for long term storage (up to 12 months) for both indoor and outdoor storage in a corrosive environment.

5.3.18 Documentation/Vendor's Data

With Proposal Contractor shall submit the total documents on equipment specifications, catalogues, data sheets, deviation schedule and other relevant data as per attached „Vendor Data Requirement" sheet, to facilitate Company in evaluating the equipment selection.

After Order Placement Drawings and data to be furnished for Company" s review / approval, as outlined in the attached „Vendor Data Requirement" sheet and shall be submitted as a part of Equipment Data Book. This shall include, as a minimum the followings: Any additional document / data required by Company for engineering & construction shall also be furnished by vendor.

5.4 FUNCTIONAL SPECIFICATION FOR DIESEL ENGINE

5.4.1 General

This specification along with data sheets, other specifications & attachments to inquiry / order describes and constitutes the minimum requirement for engines and their accessories / auxiliaries for general industrial purposes. The intent of these requirements is to supplement the requirements as given in data sheets, other specifications and other applicable codes / standards referred to in data sheets / specifications.

Contractor and vendor shall make all possible efforts to comply strictly with the requirements of this specification and other aforesaid specifications / attachments to inquiry / order. In case any deviations are considered essential by vendor, same shall be separately listed (with cross reference to Page No. / Section / Clause No. / Para etc. of the respective document) in vendor's offer under section titled as "List of deviations / exceptions to the inquiry document", duly supported with proper reasons for the deviation for Company's considerations. No cognizance shall be given to any deviation indicated elsewhere, but not listed in the deviation list. All such issues should be conveyed to Company in writing by the perspective Contractor / vendor prior / during the pre-bid conference, if any, before submitting the final offer. No deviation and exception from this specification shall be permitted without written approval of Company.

Except as specified herein, the engines shall be designed, manufactured, tested and supplied in accordance with data sheets / specifications / applicable codes & standards (latest edition).

In the event of any conflict / contradiction / discrepancy / dispute between this specification, other specifications, codes and standards and other technical documents, Contractor shall refer the matter to Company for clarification. The following order of precedence shall govern.

- Scope of Work & Design Basis / Criteria
- P&ID / SLD
- Data Sheets
- Job / Equipment Specifications
- Standard Specifications.
- Codes & Standards

In case any issue still remains unresolved, the most stringent requirement shall apply.

Contractor / vendor shall seek Company's approval regarding such features which are not specified by Company but job requirements call for purchaser decision on these matters.

It will be the responsibility of Contractor / vendor to furnish a safe operating unit. Compliance with this specification shall not relieve Contractor / vendor of the responsibilities of furnishing equipment and accessories / auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions. In case Contractor / vendor considers requirement of additional instrumentation, controls, safety devices and any other accessories / auxiliaries essential for safe and satisfactory operation of the equipment, he shall recommend the same along with reasons in a separate section along with his offer and include the same in his scope of supply.

Engine vendor shall be a regular and established manufacturer of reciprocating I.C. Engines.

Engine vendor / manufacturer shall have adequate engineering, manufacturing and testing facilities conforming to national / international codes / standards.

The engine model offered shall be from the existing regular manufacturing range of engine vendor / manufacturer for industrial applications and already type tested at either manufacturer’s works or outside. Vendors / manufacturer’s catalogue and general reference list shall be furnished along with the offer.

The offered engine shall be of a proven design in similar service. At least two (2) units of comparable type, rating and design should have been designed, manufactured from the proposed manufacturing unit, tested and supplied by vendor during last three years from the date of submission of offer and at least one unit must have successfully completed 8000 hours of operation without any problem. Contractor / vendor shall have to furnish references from users, if called for.

Since this reference list will be used for establishing provenances of proposed model for operating under specified operating conditions, it is in vendor’s own interest to select such reference, where the proposed model is supplied and operating at conditions similar to those specified for item against which the proposed model is offered. In addition, manufacturer’s catalogue and general reference list for the engine shall also be furnished.

Engine vendor / manufacturer shall assume responsibility for satisfactory performance of the equipment for the specified service.

Engine and all auxiliaries shall be suitable for the specified area classification.

Engine vendor / manufacturer shall not offer any alternative designs.

Two sets of special tools and tackles required either for installation / erection, operation and maintenance of the diesel engine shall be included in vendor's scope of supply.

5.4.2 Codes & Standards

Codes, Standards and Regulations The diesel engine covered by this specification shall be designed, manufactured and tested in accordance with the requirements of this Project Specifications, Company approved data sheets and the latest editions of applicable National / International codes and standards (not limited to those listed hereunder) and Statutory Regulations (where applicable).

All the definitions as indicated in ISO 3046 shall apply.

ISO:3046-1	Reciprocating Internal Combustion Engine – Performance Part-1: Standard ref. conditions & declaration of power, fuel & lubricating oil consumptions and test methods.
ISO:3046-3	Reciprocating Internal Combustion Engine – Performance Part-3 : Test measurements
ISO:3046-4	Reciprocating Internal Combustion Engine – Performance Part-IV : Speed governing
ISO:3046-5	Reciprocating Internal Combustion Engine – Performance Part-V : Torsional vibrations
ISO:3046-6	Reciprocating Internal Combustion Engine – Performance Part-6 : Over-speed protection
ISO:3046-7	Reciprocating Internal Combustion Engine – Performance Part-7 : Codes for engine power
ASME	The American Society of Mechanical Engineering: Boiler and Pressure vessel code. Section VIII - Rules for Construction of Pressure vessels. Section IX - Welding and Brazing Qualifications.
EEMUA	Engineering Equipment and Material User's Association Pub. No. 107 Recommendations for the protection of Diesel Engines for use in Zone 2 Hazardous area.
NFPA 20	National Fire Protection Association Centrifugal Fire Pumps

UL	Underwriters Laboratories Inc.

Project Specifications: The diesel engine(s) covered by this specification shall be designed, manufactured and tested in accordance with the requirements of the following Project Specifications:

- Design Basis.
- Electrical Equipment Specifications.
- Instrumentation Specifications.
- Piping Specifications
- Insulation Specification.
- Painting Specifications

Mandatory Indian Statutory Requirements: This document has been prepared to the National / International Standards detailed within. Contractor shall ensure that the scope of work is executed in accordance with all mandatory Indian statutory requirements.

5.4.3 Scope of Supply

General Contractor shall furnish completely filled in data sheets for each diesel engine as per the Project Specifications for Company's review and approval. Contractor shall supply all necessary equipments specified for the package / unit and auxiliary systems and all other requirements in accordance with this specifications. Any equipment that is necessary to make a complete, operable, safe and dependable package / unit but not specifically identified herein shall also be in Contractor's scope of supply.

The scope of supply for each diesel engine unit shall include, but not necessarily be limited to the following:

- Diesel engine along with all accessories and auxiliary systems
- Common Base Plate (drain rim type)
- Cooling Systems (if required)
- Flexible couplings, complete with suitable non-sparking guard
- All necessary interconnecting pipework and valves etc.
- All necessary electricals, controls and instrumentation (as applicable).
- Any additional piping, instrumentation or accessories necessitated by this specification.

- All necessary spare parts for start-up and commissioning.
- A list of spare parts recommended for one year and for two years of operation
- Two (2) sets of any tools required for maintenance of the diesel engine.
- Inspection and testing as called for in this specification and its attachments
- All documentation as specified in this specification and as listed in the Company's procurement documentation
- Preparation for Shipment

All the above components shall be mounted on a common structural skid fully assembled, piped with inlet and outlet piping terminated at the skid edge with appropriately rated flanges, wired, tested and painted for corrosive environment.

Contractor shall be responsible for the complete design, engineering, coordination, testing, delivery and proper functioning of the equipment, notwithstanding any omissions from this specification.

5.4.4 ENVIRONMENTAL DESIGN CRITERIA

Climatic Conditions

The climatic and other conditions under which the equipment will operate are detailed in the process package (design criteria) of the bidding document. Conditions specific to the Equipment Package shall be detailed on individual equipment data sheets. Contractor is responsible for ensuring that all equipment and components provided are suitable for the utility and environmental conditions as specified during the entire design life. 4.3 Area Classification Electrical and Instrumentation will be rated for the applicable Hazardous Area classification according to OISD standard 113 and latest DGMS notifications.

5.4.5 Basic Design

General Contractor's standard design shall be capable of meeting the performance requirements when operating in the environment as mentioned the process package or elsewhere for a period of total design life of the installation of 20 years with minimum uninterrupted service period of 3 years. Contractor / vendor shall identify any aspects of the standard components of packages that don't meet this specification and submit descriptions to Company during the tendering process. Except where amended by the data sheets or this specification or unless otherwise approved by Company, the design

of diesel engine shall be in accordance with the requirements of the Project Specifications and current edition of Standard ISO – 3046 Part I – VII.

The engine selected shall be vendor's standard model after taking into consideration the requirement of the driven equipment, transmission losses, site deration and power requirements of auxiliaries and other parasitic loads.

Engine vendor's / manufacturer's deration calculation for the specified site conditions shall be furnished along with the offer. In case there is no deration for the specified site conditions, engine vendor / manufacturer statement along with justification shall be furnished along with the offer. As a minimum, vendor shall consider the deration due to altitude, ambient temperature, cooling water temperature, inlet and exhaust losses, relative humidity etc. Deration factor shall be worked out as per ISO: 3046.

Standard reference conditions shall be as defined in ISO: 3046-1.

5.4.6 RATED POWER OUTPUT AND SPECIFIC FUEL CONSUMPTION

The engine rating is the net output in kilowatts which the engine is capable of delivering continuously, between the normal maintenance intervals stated by manufacturer at the stated crankshaft speed and under the stated ambient conditions assuming that the maintenance prescribed by manufacturer being carried out. Diesel engine rating specified by the manufacturer in equipment data sheet shall be with no negative tolerance.

The engine shall be capable of providing an overload power of 110% of the continuous rating defined in clause 5.4.1 above, at the same stated crankshaft speed for one hour, with or without interruption, within a period of 12 hours of operation and for 2 hours in every 24 hrs period.

Specific fuel consumption shall be indicated at 100% continuous rating as defined in clause 5.4.1 above. Specific fuel consumption shall also be indicated at other loads as specified by Company in the engine data sheet. The tolerance shall be as per ISO: 3046.

5.4.7 ENGINE STARTING SYSTEM

Unless otherwise specified, the type of starting arrangement shall be battery starting.

Engine shall be capable of starting without the use of cold starting aids for ambient temperatures of 40C and above.

Vendor shall provide suitable cold starting aids with engines for quick starting below 40C ambient and such aids shall be clearly detailed out in the offer. Lubricating oil heaters shall not be used as a cold starting aid.

Where the engine is specified / offered with battery starting arrangement, the starter motor shall be suitable for the specified electrical area classification. Where the engine is equipped with a dual starter, the synchronizing switch and the corresponding wiring / connection with the starter motor shall be provided by vendor.

Where the engine is specified / offered with compressed air starting, vendor shall specify the starting air pressure required for cranking. Unless otherwise specified, vendor shall also provide two air compressors (one driven by a diesel engine and the other by electric motor) and air receiver(s). The system shall be provided with necessary instruments, controls and safety devices.

Starting air compressors and its diesel engine driver shall be as per manufacturer's standard and shall be proven with adequate running experience. Vendor shall however furnish with the offer full technical details of air compressor unit and its instruments / controls.

The air receiver supplied by vendor shall be sized for at least six consecutive starts without recharging. Air receivers shall meet ASME Section VIII & IX specifications and be equipped with a safety valve, gauge and drain valve.

Where the engine is specified / required to start and / or stop automatically, vendor shall provide the necessary controls (automatic-cum-manual) in the engine panel, the inter-connecting wiring, piping / tubing from panel to the engine and the starting / stopping equipment. A pilot lamp shall be provided in the starting equipment / control panel to indicate that the controller is in automatic position. In the event the engine does not start after three attempts the controller shall stop further cranking and operate the audio-visual alarm.

For engines requiring pre-lubrication immediately before start up, electric motor driven pre-lubrication pump connected to emergency power source with timer, suitably interlocked with the starting system shall be provided by vendor. Unless otherwise specified the emergency power source shall be furnished by vendor. Where emergency power source is not available, a manual pre-lubrication system shall be provided.

For engines which do not require pre-lubrication immediately before start but require periodic pre-lubrication to keep engine lubricated for automatic start, an AC motor driven pre-lubrication pump with automatic start-stop and timers, set for specific running time to provide pre-lubrication after preset periods of intervals shall be provided by vendor.

For engines, which have only manual starting / stopping, a vendor's standard manual pre-lube pump shall be provided, unless vendor does not recommend the same and proposes other means to be adopted for any pre-lubrication after prolonged shut down periods. Such means shall be explained in the offer.

5.4.8 ENGINE FUEL SYSTEM

A fuel float (surge) tank shall be provided along with its interconnecting piping / hoses, in case fuel day tank is mounted above engine fuel connection level so as to ensure that the system does not permit gravity flow to the engine through fuel supply line during engine shutdown.

- The system is to have NRV to prevent air locking the fuel lines.
- Fuel priming system is to be provided where positive suction is not available.

The fuel day tank shall be equipped with vent piping with flame arrester, shielded level gauge, strainer and a hand hole of not less than 150 mm diameter, beside the required fuel connections and a drain valve.

The fuel day tanks for diesel engine driving generator and diesel engine driving fire water pump and other equipments shall be located outside the DG room or Fire Water pump house etc. irrespective of the capacity / size of the fuel day tank.

For fire water pump application, the capacity of the fuel tank (day tank) shall be suitable for running of the engine at full load for six hours.

For all other applications, unless otherwise specified, the size of the fuel tank (day tank) shall be for six hours of engine operation at full load, limited to 990 liters.

5.4.9 ENGINE JACKET COOLING SYSTEM

Engine jacket cooling system (primary circuit) shall be closed circuit liquid cooled type including circulating pump, heat exchanger, temperature regulating device and make up tank. Selection of heat exchanger shall be done as under:

- For firewater pumps the heat exchanger shall be water-cooled shell and tube type and the secondary cooling water shall be taken from the discharge of the firewater pump.
- Unless otherwise specified for all other applications the heat exchanger shall be engine driven fan cooled radiator type. Vendor may propose any other type of exchanger consistent with the utility available at site for Company's approval.

For radiator cooled engines, the engine shall be provided with a radiator mounted on the common base plate with engine driven radiator fan, temperature control valve, expansion tank, radiator guard and other necessary piping and valves. The radiator fan shall be non - metallic. The engine vendor / manufacturer depending on the service, size of engine, noise limitation and his experience may offer subject to Company's approval, remote mounted radiator system with separately driven radiator fan and additional cooling water booster pump located in the engine return line. Height of the expansion tank in the closed circuit cooling shall be at the highest level in the complete circuit. Piping connections from cooling water outlet from the top of the engine to the portion of the radiator shall be continuously sloping towards the engine without any pockets.

Shell & tube heat exchanger shall be of single pass type with secondary raw water passing through the tubes. Heat exchanger shall be of vendor's standard design and sized for heat rejection of at least 15% greater than engine full load rejection.

5.4.10 COMBUSTION AIR INTAKE & ENGINE EXHAUST SYSTEM

Vendor shall prepare a layout drawing showing the layout and routing of air intake and engine exhaust piping / ducting, and include in his scope complete piping / ducting, nozzle, expansion joints and supports as required as per his layout and routing.

The type and location of air intake filter shall be vendor's standard and shall be suitable for the climatic / environment conditions applicable to the site of installation of the engine.

In case the filter is located outside the engine-building, vendor shall provide the following for the filter.

- Inspect screen
- Rain hood
- Supporting structure with approach for maintenance.

The filter shall be suitable located to prevent exhaust gases getting into the intake air. Air intake and exhaust shall not be on the same side of the engine.

Exhaust gas discharge shall be located away from ventilation air intakes to prevent re-entry of offensive fumes and also should not cause discomfort to personnel or hazards to building or equipment.

Engine air intake and exhaust system shall be jacketed and water cooled to ensure that the skin temperature meets the requirements of EEMUA – PUB 107 with engine operating at full load.

Unless otherwise specified statutory emission regulations as applicable to the place of installation shall be fully complied with. In the event such regulations are not enclosed with the enquiry document, regulations of the state and country of origin of the engine shall be applied.

Unless otherwise specified, the height of the engine stack from the base of engine room shall be as under.

H = h + 0.2 * square root of kW

Where H = Minimum height of the exhaust from base, meter.

h = Height of engine room eves level from the base, meter.

kW = kilowatt site rating of the engine, kW.

5.4.11 GOVERNING

Unless otherwise specified in the equipment data sheets, the engine shall be provided with Class A2 governing as per ISO: 3046.

In case engines are required to drive generators in parallel, the governor - fuel injection pumps provided shall have identical characteristics.

5.4.12 NAME PLATE

A nameplate of 18Cr-8Ni stainless steel or Monel shall be attached by pins of a similar material to the engine and to any other piece of major auxiliary equipment, in a location permitting easy visibility. Company’s item number, vendor’s name, serial number, rating and testing data appropriate to the unit shall appear on all name plates.

5.4.13 SPECIAL REQUIREMENTS

Diesel Engine for Fire Water Application

Diesel Engine supplied from India shall meet all TAC requirements and vendor shall be responsible for obtaining TAC approval for the offered engine. Diesel engine supplied from outside India shall be FM / UL listed.

Engine shall be provided with an adjustable governor to control the engine speed within 10 percent of its rated speed under any condition of load upto the full load rating. The governor shall be set to maintain rated firewater pump speed at maximum firewater pump load.

The means of charging the batteries shall be by a 2-rate trickle charger with manual selection of boost charge and the batteries shall be charged in position. Where separate batteries are provided for automatic and manual starting, the charging equipment shall be capable of trickle charging both the batteries simultaneously. Equipment shall be provided to enable the state of charge of the batteries to be determined.

Where the engine is specified / offered with pneumatic (air / gas) or hydraulic starting or both systems, the engine starting system shall be as per Clause 5.5. Diesel Engine for Generating Set Application

Diesel Engine rating whether required for continuous duty or for intermittent / emergency service shall be as defined in clause No. 5.4.1 of this specification after having accounted for generator efficiency and all transmission losses.

Unless otherwise specified, diesel engine and generator shall be mounted on a common fabricated skid / steel base plate designed to support the engine and the alternator.

The complete unit along with job accessories and auxiliaries shall be tested at shop for 4 hours at full load and 1 hour at 10 percent overload.
Diesel engine for Hazardous Area Application
Engines required to be installed in Zone 2 Hazardous area shall comply with the requirement stipulated in EEMUA Pub. No. 107.
Flame arresters (Flame Trap), inlet air shutoff valve, exhaust spark arrester etc. shall be provided by engine vendor in accordance with EEMUA Pub. No. 107.

In case EEMUA Pub. No. 107 safety requirement is not applicable, following as minimum to be provided.

i) Over speed protection (fuel cut off as well as air cut off)

ii) All belts shall be anti-static fire resistance type.

iii) Air intake and exhaust system shall be protected against explosion.

iv) Fuel injection pumps and governor shall be designed so that reverse running of engine is not possible.

v) Silencer and flame arrestor / flame trap shall be provided on intake and exhaust system.

vi) Flame arrester for vent pipe and overflow pipe for fuel tank.

vii) Crank case breather.

viii) Alarm / shutdown system

ix) Exhaust manifold shall be water cooled and skin temperature shall be maintained as per EEMUA Pub. No. 107.

x) Maximum skin temperature of engine shall be as per EEMUA Pub. No. 107.

5.4.14 COUPLING AND GUARDS

Couplings shall be sized for maximum continuous torque, which is based on the potential maximum power of the diesel engine.

Couplings for generator drive application and for horizontal pumps shall be flexible type. For vertical pumps right angle gear drive with suitable universal joint shall be used. The coupling used shall be successfully proven for the service being used. The service factor used shall be conservatively selected for the maximum horsepower rating of the engine with a factor of not less than 1.7.

Non sparking guards are required over all moving parts and shall be constructed either from aluminium alloys (other than A1-Magnesium alloy) or sheet metal lined with non-sparking material. The guards shall be securely attached to the base plate on

foundation by means of bolts. The guard shall be sufficiently rigid to withstand deflections as a result of bodily contact of nominally 100 kgs.

5.4.15 BASE PLATE

Unless otherwise specified, a common base-plate for the complete unit (engine and the driven equipment) shall be supplied by vendor. A base plate shall be a single fabricated steel unit, unless Company and Contractor / vendor mutually agree that it may be fabricated in multiple sections.

When specified, the base plate shall be suitable for column mounting i.e of sufficient rigidity to be supported at specified points without continuous grouting under structural members.

The base plate shall be provided with lifting lugs for a four-point lift. Lifting the baseplate complete with all equipment mounted shall not permanently distort or otherwise damage the base plate or the machinery mounted on it.

The bottom of the base plate between structural members shall be open. When installed on a concrete foundation, accessibility for grouting under all load carrying structural members shall be provided.

5.4.16 MATERIALS

Material of construction shall be as per data sheet. Contractor and vendor shall however assume responsibility for suitability of selected material for specified service. If necessary, vendor should furnish superior materials than specified.

Inspection and Testing In addition to the requirements of inspection mentioned in the mechanical scope of work, followings are also required.

Engines of nominal rating up to 1000 kW shall be subjected to engine manufacturer's routine shop test and the test certificates shall be submitted for review, provided engine manufacturer is an ISO: 9000 certified vendor. These shall be observed tests. For all other cases, engines shall be tested in accordance with the latest edition of ISO: 3046 unless otherwise specified. The routine load and fuel consumption test shall be of the following duration:

a) Part Loads (50% & 75%) - ½ hours each

b) Full Loads - 4 hours

c) 10% Overload - 1 hour

After the specified tests have been completed satisfactorily, the fuel stop on the fuel injection pump shall be set and sealed at the specified site rating including provision for 10 percent overload

The hydrostatic test certificates for the heat exchanger / intercooler, fuel tanks and other pressure vessels shall be furnished for review at the time of load testing of the diesel engine.

The engine control panel after assembly and wiring shall be functionally tested at sub-vendor's works in the presence of third party inspection agency (at Contractor's cost) and / or of Company's authorized inspector.

If the diesel engine is required for the firewater service, it shall be the responsibility of vendor to arrange for its inspection and approval by the concerned statutory inspection authorities.

5.4.17 WARRANTY

Vendor shall have final and total responsibility for the design and mechanical performance of all equipment supplied under this specification. Vendor shall warrant the equipment furnished by him and the performance of the said equipment in accordance with this specification and with warranty requirements given elsewhere in bid package.

5.4.18 SPARE PARTS AND TOOLS:

Spare Parts Vendor shall provide spare parts needed for start-up and commissioning. Vendor shall furnish a separate itemized priced list of recommended spares for one as well as two (2) years normal operation and maintenance. Lists shall include part number, part description, serial number and normal delivery lead time.

Contractor shall ensure listed parts are available for shipment at the time of equipment shipment. Recommended spares should take into account related factors of equipment reliability, effect of equipment downtime upon production or safety, cost of parts and availability of equipment service facilities. All spare parts furnished by Vendor should be wrapped and packaged so that they will be preserved in original as new condition under the normal conditions of storage to be anticipated in India. Spare parts shall be properly tagged and coded so that later identification as to intended equipment usage will be facilitated. They shall be packaged separately, clearly marked as "Spare parts" and shipped at the same time as the equipment. Packing lists shall be furnished so that the parts can be handled without uncarting, if required. Start-up spares shall be packed and identified separately.

Tools Vendor shall provide two sets of special tools or fixtures as required, for installation / erection, operation & maintenance and disassembly of the furnished equipment as part of the initial supply of the machine. All such tools shall be permanently tagged with information pertaining to their use. Any special drawings or instructions pertaining to the use of such tools shall be included in the instruction manual.

5.4.19 PREPARATION FOR SHIPMENT

Immediately upon completion of all inspections and tests, all exposed machined surfaces shall be cleaned and coated with suitable rust preventive by vendor and the un-machined surfaces shall be painted by at least two coats of zinc rich red oxide primer.

Diesel engine along with its auxiliaries / accessories shall be transported in assembled condition as far as possible.
All untapped openings shall be provided with 4 mm thick metal closures with full rubber gaskets and bolted with not less than 4 bolts. All connections including those for instruments, instrument leads, lubricating oil and the like shall be identified with securely attached tag indicating the type of connection, the instrument or the line description, as applicable.

The equipment shall be suitably packed, fastened to avoid damage during transit and crated for shipment as specified in the data sheets for outside storage at job site in a corrosive environment for atleast 12 months. Each crate, bag or package shall be clearly

identified with the purchase order number and identification symbol, and shall be securely fastened to the package.

If any extra precaution is to be taken by Contractor / Company for storage beyond 12 months the same shall be explicitly indicated in the operation and maintenance manuals. Lifting, load cut / unpacking and handling instructions shall be securely attached to the exterior of the largest packing in a well-marked weather proof container. The upright position, lifting points, gross weight (including packing) and dimensions shall be clearly marked on each package. Each package shall properly identify the equipment contained therein.

All electrical control enclosures shall be properly plugged at entries and loaded with silica gel bags where necessary.
Two copies of the manufacturer's installation and instruction manual shall be packed and shipped with the equipment.

5.4.20 DOCUMENTATION / VENDOR'S DATA

All vendor data and drawings shall be English language and use metric (MKS) system of units

5.4.21 VENDOR'S PROPOSAL

- Vendor's offer / proposal shall as a minimum include the following:
- All data sheets, drawings and documents listed in Mechanical Data Requirement (MDR).
- References of offered engine as required by this specification.
- List of recommended start-up and commissioning spares included in the offer.
- List of mandatory spares (where specified by Company) included in the offer.
- List of vendor's recommended spare parts for one year as well as first two years normal operation of equipment including auxiliaries and drivers along with itemized price list for all parts & shall show part number, description, quantity installed in one unit and recommended quantity per unit and for total number of unit.
- An itemized list of special tools included in the offer.
- Any start-up, shutdown or operating restrictions required to protect the integrity of the equipment.

- Any limitations of vendor's test facilities to carry out the specified tests.
- Vendor's specific statement that the proposal is in strict accordance with data sheets / this specification / inquiry documents, except for specific deviations (if any) listed in the separate deviation section of the offer.

5.4.22 AFTER ORDER PLACEMENT

Drawings and data as required after purchase order is specified in the MDR. Vendor is to note that the drawings / documents descriptions / titles as given in the MDR are generic in nature. It is possible that against one drawing / document specified, there are several drawings to be furnished by vendor or vice versa.

All vendor data / drawings / documents shall be in English language and in Metric Systems.

Data specified in the MDR is the minimum requirements of Company. Any additional document / data required by Company for engineering or construction shall also be made available by vendor.

Drawings / documents with following titles shall contain as a minimum the following information:

a) General Arrangement Drawing: A general arrangement drawing shall indicate:

- Outline dimensions (minimum three views) (all principal dimensions).
- Location (in all three planes), size, type, rating and identification of all hook-up / interface connections including those of vents, drains, fuel, cooling water & electrical / instrumentation.
- Direction of rotation viewing from the driving end.
- Weight of each assembly / component.
- The weight & location of centre of gravity of the heaviest assembly / components that must be handled for erection.
- Identification and weight, dimensions of the heaviest assembly / subassembly / component required to be handled for maintenance.
- Maintenance clearance and dismantling clearances.
- Speed
- Layout of auxiliary equipment and operating platform.
- Make, Type and Size of couplings and the location of guards.

- A list of reference drawings, if any.
- A list of any special weather - protection and climatic features.

b) Foundation Drawings

A foundation drawing shall indicate complete information required for foundation design including the following:

i) Foundation bolt sizes, pocket sizes and locations.
ii) Grouting thickness and other necessary technical details.
iii) Static weight of each skid / independently grouted item and location of center of gravity of each of such skid / items in all three planes.
iv) Weight distribution for each bolt / sub-sole plate location and total static weight.
v) Dynamic loading caused due to various items grouted independently.
vi) Maximum permissible amplitude of vibration of the foundation at base level.
vii) Suggested dynamic factor and ratio of foundation weight to weight of skid / equipment as per vendor experience.

c) Field Alignment Diagram

The diagram shall indicate the relative displacement to be kept between the centreline of various equipments at the time of installation, so that under normal running conditions the equipment gets fully aligned. This relative displacement should be decided on the basis of centerline, temperature rise data of driver, gear box / transmission system, driven equipment.

d) Vendor shall provide completely filled in data sheets for Company's approval.

Mechanical catalogue is a compilation of "As Built" drawings and data, manufacturing, inspection and test records, installation, operation and maintenance instructions, etc. All drawings, calculations and data sheets will require review and approval by Company and will require the issue of "as-built" documents should final product differ from those shown on previously issued construction documents. Shop details shall be completed with all dimensions, thickness and details of construction including all nozzle locations and orientations. All material thickness shall be shown. All welds shall be detailed for fully described by notes or weld symbols and annotated to the relevant weld procedure

specification. Review of the drawings by Company does not relieve Contractor of his responsibility for the correctness of the design to suit the stated condition.

Jockey Pump

Electrical operated Jockey pumps shall be used in the pump house to maintain a required pressure in the fire water line. This pump will have auto cut in and cut out depending upon the pressure losses in the main pipeline due to any leakage and maintain the line in constant pressure. Since the proposed main pumps are designed to start automatically due to loss of pressure, the same will help to prevent the main fire water pumps from starting in case of NO FIRE conditions. Jockey pumps shall be capable to start automatically as well as manually.

Stopping of jockey pumps shall occur automatically due to restoration of system pressure sensed by pressure switches. The general information of the jockey pump shall be as per Technical Data sheet of Jockey Pump.

Fire Water Distribution Network

Fire Water Pipes shall be ASTM A 106 GRADE “B” STD, SCHEDULE . The diameter of the pipeline shall be established after the completion of pipeline hydraulic and network analysis during detailed engineering. Within the pump house, there shall be a 600 NB (24”)(approx.) header pumping water from Water storage reservoir to fire water network of OT-II,HOJ-1,HOJ-2,BJ-1 and BJ-2 . Two sets of branch out connections from header shall be used for the following for OT-II, HOJ-1 and HOJ-2.

- Tower Monitor Line
- Hydrant Line

The Contractor shall provide the required pipe support, specials reducers, expanders, puddle pipe, fittings, flanges, gaskets, nuts and bolts etc. Fabrication and inspection of pipelines shall be in accordance with following codes: B1S-9595, 814, 822, 4853, 3703 and as per TAC guidelines.

10% of field weld joints shall be x-ray tested and if the results are unsatisfactory, the same has to be removed, re-welded and radio graphed to ensure sound weld. Doubler plates for piping supports shall be provided by contractor for running the main firefighting pipelines on approach trestle. The Contractor as required at his cost shall provide necessary steel clamps, saddles and support for duct foot bends etc. Suitable support pads

to be provided to the pipelines wherever it rests on the pedestals. The vertical pipeline to water / foam monitor shall also be properly supported / fixed by providing suitable steel brackets/clamps and stays etc.

All pipelines to be laid on unloading platform, approach trestle and pump house are to be supported by providing steel saddle with clamps fittings and fixtures.

All pipelines shall be hydrostatically tested to 1.5 times of their respective operating pressure.

All pipes should be supplied in complete conformity to all requirements specified in the standards. Suitable pressure gauges to be provided in the fire water network / foam injection lines at strategic locations. Hydraulic pressure drop calculations shall be provided for each of the 3 pipelines namely Monitor System, Hydrant System and Foam System. The calculations must ensure that the pipe sizing being considered is adequate to ensure that the required pressure is being achieved at the base flange of each of the outlet equipment such as tower monitors, base monitors, hydrants, water curtain system etc.

The maximum allowable flow/velocity in the system should be not more than 2.5 m/s. The contractor shall calculate and confirm the pipe dia. and thickness prior to procurement and obtain approval from the Engineer's Representative.

Pipes shall be kept thoroughly clean during the course of installation. The ends of pipes shall be blocked with wooden plugs wedged home, at the end of each day's work to prevent dirt, rodents and insects etc., entering the pipe. The general information of the fire water header / pipeline network shall be as per technical data sheet

5.5 Tower Monitors

For the protection of tankers and the unloading arms, it is proposed to provide nine nos. of long range, high pressure water cum foam monitors for OT-II, HOJ-1 and HOJ-2 each 6000 LPM flow which shall be located at available suitable tower position. The specification covers the minimum requirements regarding design, materials, fabrication, performance, testing and supply for remote operated electric motor operated UL / FM approved long range high volume foam cum water monitor, non-aspirating type to be used for fire-fighting.

Common Requirements for the Monitors are given below:

i. These monitors shall be mounted on 20m high towers.

ii. The material of construction (MOC) for the Towers shall be MS steel bolted pre-engineered sections with epoxy based suitable colour finish paint coat as per the requirement.

iii. The monitors shall deliver 5678 LPM of portable water at 7 kg/cm2 pressure from 20m high tower with a horizontal throw of 100 M of expanded Foam solution at 7 kg/cm2 with a throw range of 100 m (approx. as per the maximum vessel size) and vertical range will be 45m.

iv. It is the responsibility of the Contractor to select a suitable monitor to ensure throw of 100 m from tower using the main pump specified. All the monitors shall be capable of discharging foam solution of 3% AFFF foam concentrate.

v. The Monitor shall be capable of 340°rotation in either direction in horizontal plane and 60° (elevation) and 70° (depression) in vertical plane. Suitable electrical motors shall be mounted on the monitor so that rotation of the monitor can be achieved by remote control.

vi. Swivel joints enclosed type with inbuilt worm and worm gear shall be provided both for horizontal and vertical rotation. Swivel joints to have SS ball bearings and efficient sealing.

vii. A pressure gauge to indicate the inlet pressure shall be fitted in the monitor body near inlet of nozzle. .

viii. The monitors shall also be fitted with fog / jet nozzles remotely controlled from the terminal control room located on top of the pump house building. Remote control with joystick is required to be provided for rotation of foam/water monitors in horizontal and vertical planes. The remote control system shall be operated electrically and should be compatible with the monitor offered.

ix. The equipment's used for remote control system shall be explosion proof and the wiring shall be by fire survival cables. The essence of the working of the monitors depends upon the reliability of this system. Therefore, the latest practices to increase its reliability must be adopted. The remote control system should also control the electrically operated valves & the tower monitor lines and the hydrant/water curtains. A mimic diagram shall be provided on the control desk.

x. The foam injection system also should be controlled by this system. The interconnecting cables between the control panel and motorised valves at the berth area shall be FRLS / fire survival type as specified. The electric remote control panel in the control room shall have all the necessary controls.

xi. A drain connection with valve shall be provided near the base/ mating flange of Monitor.

xii. Contractor shall provide details and schematic sketch of the system along with the technical submission. No rubber / plastic parts to be provided in the monitor.

xiii. The monitor assembly shall be designed to resist the nozzle reaction force experienced during the operation of the monitor. The monitors shall be provided with a changeover valve of suitable design for instantaneous switch over from foam to water or vice Versa.

xiv. The entire assembly shall be tested to an internal hydraulic pressure of 16 Kg/ cm2. A suitable pressure gauge shall be provided to the inlet connection of the monitors at the top of tower and on platform.

xv. There shall not be any flanged joint on the monitor body, except base flange. Joint between monitor body and nozzle shall be threaded joint.

xvi. All the parts shall have workmanship and finish. All burrs and sharp edges shall be removed. Passages for foam/water and nozzle shall have smooth finish.

xvii. Nonferrous components subject to direct foam/water contact to be coated on inside with tin-lead alloy. External surface of such components to be given good polish.

xviii. The manufacturer shall guarantee the material, workmanship and the performance unit for a period of two years from the date of commissioning which shall not be later than six months from the date of receipt at site of the items accepted. The vendor without any extra cost shall rectify any mechanical defect, faulty workmanship or operational defects found during this period.

xix. The materials used for different parts of the monitor shall be as per shown in DATA SHEET which is attached in ANNUXURE

xx. Other accessories / Equipment's required are: -

- ❖ Pressure Gauges are to be provided at the bottom of the monitor and further at the remotest point from the jetty.
- ❖ Electric motors for direction control Ex-proof / flameproof type along with limit switches and potentiometers for position indications etc
- ❖ Inline balance pressure Proportionator of adequate capacity.

xxi. The controls provided on the remote control desk shall-be as follows:

- ❖ Auto/Manual selection of monitor, hydrant & jockey pumps
- ❖ Manual start/stop of all pump sets including Foam pumps
- ❖ Manual open/close of all electrical operated valves
- ❖ Joystick control of Tower/base water monitors
- ❖ Fog to Jet control of all monitors
- ❖ Master selector switch for local or remote start for all pumps

xxii. The indications shall be provided on the remote control desk as follows:

- ❖ ON/OFF for all pump sets
- ❖ OPEN/CLOSE for all electrical operated valves
- ❖ POSITION of all monitors
- ❖ PRESSURE in Monitor & Hydrant mains.

The remote control desk type panel is located in the safe zone and components shall be selected accordingly

5.5.1 Scope of Inspection & Testing

Prior to dispatch from vendor's shop, the following acceptance tests shall be carried out by the vendor.

Manufacturers test certificates shall be provided including hydraulic test of monitor at 16kg/cm2 and electrical operation tests etc.

5.5.2 Information / Documents required from Vendor

i. Details and drawing/s of the offered foam cum water tower monitor with bill of material of monitor & accessories. Details & Drawings shall be in line with UL/FM/VdS approval document of the vendor.

ii. ii. Reference lists of vendor showing his experience in design, manufacturing & supply of offered foam cum water monitors.

iii. Valid certificates of UL Listing/FM/Vds approval and marking of offered foam cum water monitor

iv. General arrangement Plan (GAP) incorporating the stipulated inspection and testing requirements.

5.6 Jumbo Curtain and Nozzles

i. Six numbers of jumbo water curtain nozzles for OT-2, HOJ-1 and HOJ-2 each 6000 LPM flow with vertical curtain nozzles shall be provided between manifold and ship for protection of critical equipment from heat radiation due to fire on the tankers and to facilitate fire-fighting personnel to operate during fire.

ii. A pipe line shall be laid in the unloading platform periphery to connect the jumbo water curtains.

iii. In case of fire in the unloading platform the water curtain system is operated first to form water barrier between the tanker and the berth which enables to protect the oil unloading arms and also the towers from heat developed due to fire in and around the tanker and vice-versa.

iv. Each Jumbo curtain nozzles shall be able to produce dense water curtain in the vertical plane. v. Jumbo Curtains shall be of capacity 6000 lpm and with a range of 18m radius provided for protection of Unloading arms.

v. Water supply to these jumbo curtain nozzles will be from the Hydrant line controlled by either motor operated valves from control room or locally. Water is delivered to the curtains at a pressure of 7 to 8 kg/cm2. The angle of spray is approximately 180°.

vi. The jumbo curtain nozzle shall be of SS 316 with 100 NB flange connection. The Jumbo curtain header mounted with nozzles shall be laid above ground with supporting and provision of flanged joints in order to facilitate maintenance of jumbo curtain header nozzles as and when required.

vii. System components and equipment shall have materials of construction compatible with raw water.

viii. The pressure switch shall be provided downstream of the last isolation valve on the water curtain system header in order to give a visual indication on the control desk "Water Curtain System ON". The general information of the jumbo curtain & nozzles shall be as per shown in DATA SHEET which is attached in ANNUXURE.

5.7 Hydrant System

i. Double headed hydrant shall be provided on berth area, along approach trestles, pump house / substation. Single headed hydrant shall be provided at each floor of control room building.
ii. The hydrant system is designed to cater to the single largest fire demand likely to be posed at any of the various areas as referred earlier at seaside berth and landside berth.
iii. All the hydrants are 63 mm size, 900 lpm of SS316 construction with instantaneous male couplings. Hydrant posts shall be spaced as per OISD 156.
iv. Each double headed hydrant stand-post shall comprises of a vertical flanged tap-off of 100 NB from the main pipeline with an isolation gate valve, orifice plate flange as per standard practices. Each hydrant shall be numbered.
v. The water will be supplied to hydrants from the common pump and pipe line provided for the ground monitor system.
vi. Each equipment used in the system shall comply with TAC requirements in all respects.
vii. Fire hydrant shall generally conform to IS: 5290 Type A.
viii. This shall be tested as per relevant BIS code. The ends shall be fixed with male couplings. Material of construction of hydrant valve branch pipes and coupling shall be SS: 316 of approved make. All hydrant outlets shall be situated 1.4 metre above floor level.
ix. Orifice Plate (Optional) Suitable size of orifice plates of SS 316 construction shall be provided at all hydrants. The general information of the hydrant system shall be shown in ANNUXURE

5.7.1 The key features of the firewater systems proposed are as under:

i. The proposed firewater system mainly consists of Fire Water Pumps, jockey pump, firewater network pipe & fittings, isolation valves, external hydrants, fire escape hydrants, hose cabinets hydrant accessories, Water monitors at ground.
ii. ii. The firewater network shall be laid aboveground on pedestals or taking supports from proposed pipe rack.
iii. The external hydrants shall be provided at a spacing of not exceeding 30 m. throughout the jetty terminal. Every alternate hydrant shall be replaced by water monitors. Hydrant / monitors shall be placed alongside the berth for easy accessibility.

iv. Hydrants shall be located at a minimum distance of 15 meters from the periphery of the tanker or equipment under protection, so that the hydrants/ monitors are approachable & workable even in case of a serious fire.

v. One hose cabinet, consisting of 2 Nos. 15 m long hoses with couplings and one branch pipe with nozzle, will be suitably mounted on the wall or over ground near hydrant. Fog type nozzles shall be installed wherever live electrical equipment are likely to be involved in the fire (e.g. transformers)

vi. Fire escape hydrant valve will be located at or near floor landing of staircases at first floor of Fire water pump house /control room building. One first aid hose reel with shut-off nozzle shall be provided near fire escape hydrant to be used in case of small fires. Riser pipe feeding the fire escape hydrants is provided with isolation valve.

vii. The fire water network piping layout is designed to supply water from two or more routes to each area. Adequate numbers of isolation valves shall be provided to ensure that when a particular section of piping to be isolated for maintenance work, the rest of the system remains in working condition all the time.

5.7.2 Hose Pipes and Hose Cabinet

The pipes shall be of fabric reinforced rubber lined woven jacketed for firefighting purposes of approved make Hose pipes dia. 63 mm and length of 15m and tested to a bursting pressure of 42 kg/cm2 and Proof Pressure 22Kg/cm2 as per IS: 636/1988 Type B with IS mark fitted with SS 316 size 63mm. Both ends shall be provided with female hose couplings as per BIS: 903. Hose cabinet shall be suitable for housing 2 nos. hose pipes of above length, branch pipe and nozzle as required. Minimum 3mm SS 316 sheet to be used for fabrication of hose cabinet. The cabinet shall be located near to hydrant with suitable supporting / base.

The box shall be provided with double door and shall have locking arrangements. Provision for break glass recess for key shall be given in the box. The front doors shall be provided with transparent acrylic sheet fitted with rubber beading for transparency. The box shall be capable to resist the weight of hose with couplings. Suitable wall mounting bracket shall be provided in the cabinet.

5.7.3 First Aid Fire Fighting Equipment

The first aid equipment shall consist of portable fire extinguishers. For extinguishing small fires and for first aid use, it is proposed to have portable fire extinguishers and wheel mounted extinguishers. These portable extinguishers shall be of a pressure type using dry chemical powder. They shall be located on the unloading platform and breasting dolphins and at other strategic points. Carbon dioxide portable fire extinguishers (6.8 kg) shall be installed in the control and electrical room.

5.7.4 75 kg DCP Fire Extinguisher (ISI Mark)

i. Made of 6 mm thick M.S. Sheet (B.Q. Plate & design of vessel as per IS:2825) with radiography quality welding. The Extinguisher shall be conforming to IS:10658 (Latest) with ISI Mark duly embossed / punched. The Extinguisher shall be treated with anticorrosive treatment. Nonferrous parts shall be gunmetal. Design calculation of the extinguisher shall be submitted along with the offer.

ii. ii. The hose shall be of minimum 15 metres length and the bursting pressure shall not be less than 50 Kg/cm2.

iii. Drain plug of not less than 25 mm diameter to be provided on the body.

iv. The nozzle shall be of Trigger Controlled and capable of discharging powder as per ISI Specification.

v. Automatically and manually operated Safety Relief Valve to be provided as per IS:10658 (Latest) specification.

vi. Pressure gauge having minimum 50 mm dia. and range from 0 to 42 Kg/cm2 to be provided on the body.

vii. The extinguisher to be mounted on robust trolley having two heavy duty bearing fitted rubberised wheels and strong handles for easy mobility.

viii. ISI Marked CO2 gas cylinder shall be of suitable capacity and shall be approved by Department of Explosives with protector and thermal insulation and to be fitted with ISI Marked wheel type Valve.

ix. Dry Powder with ISI Mark IS:4308 (Latest). The powder shall be packed in plastic rigidex material type bags with heavy duly LD lines duly hermetically sealed. The materials of packing and sealing is to be made in such a way that if the pack is kept inside the water bucket for 24 hours, not a single drop of water will penetrate inside the bag & the characteristics of the powder shall remain unaffected against moisture.

x. Painting: The paint system offered shall be suitable for marine sea water location. The colour of finish coat shall be of approved shade.

xi. As per IS: 2825, Dye penetrated test of the fillet weld of all nozzles and attachment – No discontinuities in the welding.

xii. As per IS: 2825 Radiography (10% covering 50% of "T" Joints) - No discontinuities allowed.

xiii. The extinguisher shall be hydro tested at 30 Kg/cm2 and shall not develop any leaks at this pressure.

xiv. In addition to markings stipulated in IS:10658 (latest) the following permanent punching at the bottom ring is required:

- Manufacturer's name.
- Year of manufacturing.
- Manufacturer's serial number.
- Purchase Order No. and date.
- Inspector Stamp.
- The date of hydraulic test shall also be marked. Space shall be left for writing the dates of subsequent hydraulic test.
- Dry Chemical Powder filling height shall be marked on the extinguisher.

xv. Following checks to be carried out:

- Extinguisher is as per IS: 10658 (Latest) with ISI Mark.
- Design calculation of extinguisher is correct.
- Design of vessel as per IS: 2825.
- ISI Marked CO2 gas cylinder approved by department of explosives.
- Dry Powder is with ISI Mark. The packaging material to be tested as per clause 4.1.1. of IS: 4308/1982. Also the material of the packing should be as per the specification only. Extinguisher vessel to be hydro tested at 30 kg/sqcm.

5.7.5 5kg DCP Fire Extinguisher (ISI Mark)

With ISI Mark-2171 (Latest) complete with initial charge of CO2 cartridge (200 gms) with ISI Mark-4947 (Latest) and dry chemical powder with ISI Mark-4308 (Latest).
The Fire Extinguisher shall consist of the followings:

- Size of filler opening (inner dia.) shall be 63 mm.
- ii. Cap shall be of gunmetal / forged brass with chromium plating / black colour.
- Hose shall be of braided plastic high pressure with one-meter length with nozzle of ABS Plastic.
- All other components, design and performance, anticorrosive treatment shall be as per IS: 2171 (latest).

- Certification that every extinguisher shall be radiography quality welding and fabrication and design of vessel as per IS: 2825, 10% radiography of weld joints to be done. Design calculation of the extinguisher shall be submitted along with the offer.
- In addition to markings stipulated in IS:2171 (latest) the following permanent punching at the bottom ring is required:
  - Manufacturer's name.
  - Year of manufacturing.
  - Manufacturer's serial number.
  - Purchase Order No. and date.
  - Inspector Stamp.
  - The date of hydraulic test shall also be marked. Space shall be left for writing the dates of subsequent hydraulic test.
  - Dry Chemical Powder filling height shall be marked on the extinguisher.

5.7.6 6.8 kg CO2 Fire Extinguisher (ISI Mark)

CO2 type 6.8 Kg. capacity fire extinguisher assembled out of seamless steel cylinder having Explosive (CCE) Approval and ISI Mark (manufactured to IS:2878) complete with ISI marked wheel type valve, one metre length high pressure wire braided discharge hose with horn, mounted on two wheeled rubber tyre trolley and handle. The cylinder shall be fully charged with CO2 Gas. All other components, design and performance, anticorrosive treatment shall be as per IS:2878 latest. In addition to markings stipulated in IS:2878 (latest) the following permanent punching to be provided:

a) Manufacturer's name.

b) Year of manufacturing.

c) Manufacturer's serial number.

d) Purchase Order No. and date.

e) Inspector Stamp

5.7.7 Foam System

Fixed balanced pressure proportioning systems, using foam concentrate pumps for pressurization of concentrate, shall be provided for the protection of the berths. The general information of the foam system shall be as per shown in ANNUXURE

The foam system consists of foam compound storage tanks, pumps (one working and one standby) and stainless steel piping (SS316) for supplying foam compound to the foam monitors.

The foam compound requirement shall be calculated based on the assumption that three tower monitors (3 x 6000lpm) operating simultaneously for 60 minutes.

5.7.8 Jetty Foam System

i. Pressurized foam shall be pumped by foam concentrate pumps installed at Pump house roof.

ii. There shall be two foam concentrate pump sets - one main and the other stand-by.

iii. The pumps shall obtain foam under positive suction from the foam concentrate tank located on the pump house roof. The foam tank shall have suitable vent connection.

iv. It shall have all the relevant instruments such as level gauge, high and low level alarms level switch, provision for inlet, outlet, re-circulation and drain connections, as per requirements.

v. The foam tank must be erected in a dyke enclosure of suitable capacity.

vi. The foam concentrate discharge header shall be normally charged but not pressurized, except when system is on demand. Flow indicators must be installed in the discharge header.

vii. The water supply header for the foam system shall, however, be normally pressurized up to the main motor operated valves located near the foam discharge equipment located at unloading platform. The pressure is maintained automatically by jockey pumps.

viii. For injecting foam solution into the fire water line at individual monitors, Two (2) nos. rotary gear/pumps (both diesel engine driven) shall be provided which will pump foam compound into the foam line. The design, material, construction, Manufacture, inspection, testing and performance of rotary gear/ pump shall comply with all currently applicable standards. The pump and the diesel engine shall be factory assembled on welded steel base frame with suitable dowels etc.

ix. Anyone of these two pumps can be kept as main foam pump and the other one as stand-by.

x. Manual starting of foam pumps should be able to be initiated by operation of push button systems located next to the pumps / control room.

5.7.9 Foam Pump and FoamTank

5.7.9.1 Foam Pump Capacity

	Requirement as per OISD-156	To be provided
Foam Feed Pumps for 3% concrete	3 x 5678 lpm Tower Monitors + 4 x 600 lpm Ground Monitors 3% of above for 60 minutes operation =36720 litres = 40 M3/hr	2 nos. (1 working + 1 stand by) of capacity 40 M3/hr at pressure 17 kg/cm2 i.e 40 M3/hr (working) and 40 M3/hr (stand by)

5.7.9.2 Foam Tank Capacity

Tanker Berth at a warf or jetty handling ship of 20000 tonnes & above less than 50000 tonnes dead weight	Requirement as per OISD-156	To be provided
	3 x 5678 lpm Tower Monitors + 4 x 600 lpm Ground Monitors 3% of above for 60 minutes operation =36720 litres = 40 M3/hr	2 nos. of 36720 lts.=73440 lts.=80 M3

- The tank(s) shall be mounted in the pump house and provided with an inlet, outlet, drain, vent, manhole for cleaning and a level indicator.
- Both foam pumps will be used to pump foam compound to the Proportioner system near the base of tower monitors for injecting 3% foam in main water lines. The running light indication of the pumps must be available at the Control Room.
- The foam compound received through the barrels will be pumped by foam filling pump into the Stainless Steel (SS 316) storage tank located suitably position inside the pump house to be used at the time of firefighting.

- The pumps shall obtain foam under positive suction from the foam concentrate tank located as per design criteria. At each tower monitors/ ground monitors there shall be a dedicated Inline balance pressure proportioning system which shall mix the foam compound with water suitably as required. The Contractor should design a suitable effective system to supply the correct proportion of foam and water at any given time of the operation.
- **Stopping of the foam pump sets shall be done manually.**

5.7.10 Foam Supply Tank

Foam supply tank of suitable capacity fabricated out of minimum 6mm thick stainless steel (SS316) materials shall be supplied and mounted on suitable supports. To give sufficient strength to the tank suitable baffles / reinforcement of stainless steel shall be provided. The tank shall have 450 mm dia. inspection manhole with cover, dished end and air vent. An Overflow vent with isolation ball valve and suitable fixtures shall be provided to the tank. Dished end of tanks shall be without welding joint. The tank shall have filler pipe of 150mm dia. with SS 316 strainer. A breather valve and a sludge trap shall, be fitted to the tank. The sludge trap shall have cleaning hole and 25mm dia. drain pipe with an SS316 ball valve. The bottom of the tank shall have a slight slope towards the sludge trap. All the fittings, other components connected with tank shall be SS 316.

Necessary lifting hooks shall be provided on the tank. The tank shall be fitted with level indicator with transparent graduated scale.

The design, fabrication and testing of tank shall confirm to BIS 2825. The dished end welding of the tank shall be 100% radiographed. The foam supply tank shall be calibrated. The calibration chart shall be supplied. The foam supply tank should have fill connection, concentrate supply connection to the pump, reverse flow connection to the tank from the pump, sump expansion dome, level indicator, air vent, drain valve and ladder. The fill connection shall have the strainer. Dip Sounding Flange to be provided for alternate sounding method. Tank shall be provided with High level and low level switches / alarms.

5.7.11 Foam Filling Pump

Foam filling pump of capacity 50 LPM electrical driven shall be provided for pumping foam from drums/barrels/containers to foam supply tank. The contractor shall carry out necessary piping along with valves etc. from this pump to the tank.

- Material of Construction : SS-316L
- Capacity : 50 LPM

5.7.12 Foam Proportioner System

Foam concentrate to be used shall be of tested and approved quality AFFF concentrate of low expansion foam (3%). In line balance proportioning system to be provided that consist of Proportioner spool valve, foam concentrate valve, duplex gauge check valves, water and foam sensing line, concentrate valves, Foam Proportioned indicator etc. complete in all respect and suitable for outdoor installation. The Proportioner shall be inserted in to each fire water line for both tower monitors near base of monitors. Motor operated ball valve shall be provided in foam lines so that either foam water mixture or only water can be thrown from the two monitors for remote operations.

Correct foam liquid proportioning is necessary to produce optimum quantity and quality of foam for extinguishing flammable liquid fire. 3% foam concentrate is envisaged in the system for producing foam water mixture.

The pump capacities have to be designed so as to discharge foam liquid suitable for maximum quality of foam solution requirement. However depending upon the exigencies of operation such as either two or one monitor is working, the flow requirement will vary. The excess quantity of the foam liquid shall return to the foam supply tank through the high pressure release valve bypass line. Arrangement shall also be provided to prevent water entering the foam concentrate inlet through the foam Proportioner.

5.7.13 Valves

General

a. All valves selected shall be strictly in accordance with the relevant fire-fighting codes & must be capable to withstand the requirements of the system under all conditions without getting failure.
b. ii. All the equipment shall be designed manufactured and tested as per the Indian Standards/ British Standards given in the relevant paragraphs.

c. All valves shall be so designed that the effort! Torque required to operate the valve is minimum.
d. All valves shall be suitable for the service conditions i.e. flow, temperature and pressure, at which they are required to operate. Each control valve shall be sized and selected to provide reliable operation and control at the specified operating and design conditions.
e. All valves shall be designed for 100% tight shut off condition.
f. All the valves more than 10" shall be provided with geared hand wheel. The face of the wheel shall be clearly marked with the words i.e. Open / Close and an arrow to indicate the direction for opening/closing.
g. For all the Ni-resist cast iron valves body shall be so designed that at all point, wall thickness is greater than the minimum specified in the various standards. Particular attention should be given to the distribution of material to limit the stresses within permissible range and to prevent stress concentration anywhere in the valve design.
h. The valves as well as all accessories shall be designed for easy disassembly and maintenance.
i.The design, material, construction, manufacture, inspection, testing and performance of valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the valves will be installed. Nothing in this specification shall be construed to relieve the Contractor of his responsibility. Compliance to this specification shall not relieve the Contractor of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions
j.The Valves shall be of numerically actuated valve confirming to IS:13114, ISO:15407 or equivalent. The electrical signal from the control panel shall actuate the valve.
k. Non return valve (NRV) shall be used to stop backflow & to ensure the flow on water in required direction only.
l.All valves shall be designed considering 100 Cycles of On-Off operation in a day.
m. Valves to be installed outside shall be required to have the stem properly protected against atmospheric corrosion.
n. The direction of flow shall be clearly stamped on the body of the valve. Riveted tags are acceptable
o. All gate and globe valves shall have bonnet-back seating arrangement.
p. All rising stem valves shall be provided with back seat to permit repacking (of glands) with valves in operation. All valves shall preferably be suitable flanged.
q. The valves shall be designed on the basis of the following :

- ❖ The internal parts shall be suitable to support the pressure caused by the actuators;
- ❖ The valve-actuator unit shall be suitably stiff so as not to cause vibrations, misalignments, etc.
- ❖ All valves shall be provided with hand operated gearing provision for manual override so that they can also be operated manually when needed.

r. All valves shall be capable of being closed against the design pressure. Where globe valve has been specified for regulation purpose, the disc shall be tapered plug type and suitable for controlling throughout its lift.

s. All valves shall open/ close fully within time required by the process but not later than 30 seconds after actuators starts with feedback. All valves shall be capable of sealing with design pressure applied from either end of the valve.

t.All valves shall have electrical feedback for positions. All valves shall have a mechanical manual operating facility.

u. All operating spindles and gears shall be provided with adequate points for lubrication.

v. Head loss curves through the valves for throttled flow conditions shall be provided for all valve sizes.

w. The contractor shall submit the following:
- ❖ Assembly drawings.
- ❖ Manufacturer Valid quality certifications ISO or equivalent.
- ❖ Certified copies of Manufacturer quality control Test results and reports.
- ❖ Assembly shop drawings.
- ❖ Instruction & training manuals.
- ❖ Catalogues.

5.7.14 Gate Valves

a. The Gate valves used shall be capable in accordance with the site's atmospheric condition.

b. ii. All the gate valves shall have mechanical position indicator with adjustable position stopper and lock to prevent over travel. Gate valves shall conform to IS: 780-1984 RA 1990 or IS: 2906 - 1984 RA 1990.
c. Gate valves of adequate size be provided with by pass and drain arrangement. All the isolation valves, of size above manufacture from forgings.
d. All gate valves should comply with ISO 6002, IS:14846, IS:11323, IS:11335 or equivalent.
e. The test pressure shall be min. 1.5 times nominal pressure rating of the valves.
f. The valves shall be suitable for motorised actuated as well as hand wheel operation at least against the pressure differentials preferably geared type to reduce the operating tensions.
g. Bodies of valves shall be double-flanged ends and shall be fitted with seat rings securely fixed in machined recesses. The strength characteristics of the metal selected, appropriate to the standard flange thickness shall be according to IS 210:1978. Stem shall be of stainless steel and forged or machined from forged/rolled bar. No casting is permitted.
h. Hand wheels shall preferably be of the marine pattern conforming to IS 11218:1984.
i.The valve shall have internal parts made up of copper alloy or stainless steel; resilient seats shall not be used.
j.Valve shall have seals and gasket made up of material suitable for the proposed application.
k. Where shafts enter castings they shall be provided with corrosion resistant bushes to prevent galvanic corrosion
l.Hydraulic testing of valves shall he in accordance with the requirements of IS 6157
m. Valves shall be marked in accordance with the requirements of IS 9866
n. All valves ordered shall be supplied with their body ends suitably sealed to exclude foreign matter during transit and storage.
o. Unless otherwise indicated in the Tender Documents for an alternative coating system, the internal and external surfaces of valves shall be prepared and coated with epoxy paint. The final coat shall be applied to external surfaces after installing the valves. All valves shall be painted externally before despatch.
p. Main bearings shall be external. Valves with bearings that are accessible without emptying or removal of the valve body from the line shall be given preference. Bearings shall offer a long life and retain a low coefficient of friction.
q. The gate valve shall have electrical feedback for position.
r. The Gate valves shall be as per DATA SHEET which is furnished in ANNUXURE

5.7.15 Non Return Valve (NRV)

a. The swing check valves (non-return) provided in the piping system shall conform to IS:5312 or BS 5153 : 1974 (1991).
b. ii. Non-return valves shall be double flanged for horizontal and vertical installation.
c. The valves shall offer minimum hydraulic resistance, shall not be subject to disc flutter and shall give a quick non-slam closure on reversal of flow.
d. The design of the body and body seals shall be such that they are free from pockets which may cause eddies or accumulate debris. Special care shall be taken that foreign objects, like bolts, cannot lodge in pockets on the downstream side of body seats and thereby prevent doors from closing fully.
e. Access openings and covers shall be well designed and the creation of stress risers shall be prevented.
f. Where shafts protrude through the valve at the non-drive end (NDE) they shall have flanged and bolted stainless steel, grade 316, bearing cover plates.
g. Sealing faces shall be securely fixed with a corrosion resistant material or shall be deposit welded with stainless steel. Corrosion protection of the contact area between mild steel and stainless steel shall be in accordance with Standard Specification.
h. Bearings shall be substantial and shall be designed to take the unbalanced thrust on doors or discs in the structural test.
i.Valve components shall be constructed of the material specified in the relevant latest standards.
j.The data sheets for the Valves is attached as ANNUXURE

5.7.16 Training Scheme

The Contractor shall prepare and submit a scheme of training for a period of 3 months, covering all the system Fire Protection system, foam system, gas detection system etc. operation, maintenance, troubleshooting etc. The programme prepared by the Contractor shall be reflective and appreciative of the long term interest in the sustained operation of the systems, equipment provided.

5.7.17 International Shore Connection

Two numbers of International shore connection on each jetty shall be provided with isolation valve on unloading platform wherever required.

5.7.18 Testing At Manufacturer's Works

The following of tests shall be conducted at the Manufacturer's works) Tower Monitors LED RIGHT / LEFT & UP / DOWN

5.7.19 Foam Pumps/ Main Fire Pumps/Jockey Pumps

In addition to various routine tests, the pumps shall be subjected to the following tests.

a. Pump assembly etc., shall be tested hydraulically up to twice the working pressure or 1.5 times the shut-off head of the foam pump.
b. ii. The test pressure shall be maintained for minimum half an hour.
c. Foam pumps shall be operated at constant speed to establish full head capacity characteristics using water as the medium. A minimum of 5 points shall be covered to plot the curve.
d. Dynamic balancing test for rotating assembly
e. The Foam pumps & Engine shall be tested for vibration at the guarantee points. Vibrations in excess of 75 microns at each bearing housing and shaft shall not be accepted.

5.7.20 Diesel Engine

At manufacture's works, tests shall be carried out during and after completion of manufacture of different component parts and the assembly.

Following tests shall be conducted.

- Performance test of the diesel engine to determine its torque, power and specific fuel consumption as function of shaft speed. Performance test of the engine shall be carried for 12 hours out of which 11 hours at full load and one hour at 110% overload.
- ii. Functional checks and adjustment of speed governor iii. Over all mechanical and electrical inspection.

5.7.221 Valves / Nautical Valves

The following tests shall be conducted at Manufacturer's works:

- Body test: All valves when completely assembled shall be subject to the hydrostatic test at the appropriate test pressure as per relevant standards.

- ii. Seat test: After being subjected to the body test, valves shall show no leakage at the valve seat when subjected to the hydrostatic test at the appropriate test pressure as per relevant standards.
- Performance test for electrically operated with respective actuators mounted in position to show valve opening and closing and observation of leakage.

5.7.22 Motors

The following tests shall be carried out for the motors as detailed below.

i. No Load test.

ii. Reduced Voltage running test.

iii. Locked rotor test.

iv. Noise & Vibration test.

v. Over Speed test at 155% for 15min.

5.7.23 Painting

a. The painting scheme specified in this clause is applicable to all firefighting equipment and piping.
b. Painting shall provide a continuous adherent film of adequate thickness on the surface being treated and protected from attack due to continuous exposure in industrial atmosphere prevailing at the site of erection of the equipment,
c. ii. Paint shall be applied in accordance with manufacturer's recommendations as supplemented by this specification. The work shall generally follow IS: 1477 (Part II) - 1990.
d. Paint shall generally be applied by brushing, except the spraying may be used for finish coats only when brushing may damage the prime coats. Roller coats or any .other method of paint application shall not be used unless specifically authorized. Spraying shall not be adopted on red lead or zinc rich paints. Daubers may be ' used only when no other method is practicable for proper application in difficult accessible areas.
e. Paint shall generally not be applied when the ambient temperature is 5°C and below. For paints which dry by chemical reaction, the, temperature requirements specified by the manufacturer shall be met with also paint shall not be applied in rain, wind, fog, or at relative humidity of 80% and above or when the surface temperature is below

dew point resulting in condensation of moisture. Any wet paint exposed to damaging weather condition shall be inspected after drying and the damaged area repainted after removal of the paint.

f. Each coat of paint shall be continuous, free of pores and of even film thickness without thin spots. The film thickness shall not be so great as to affect detrimentally either the appearance or the service of the paint.

g. Each coat of paint shall be allowed to dry sufficiently before application of the next coat to avoid damage such as filling or loss of adhesion. Undercoats having glossy surface shall be roughened by mild sand papering to improve adhesion of subsequent coats. Successive coats of same colour shall be tinted, whenever practical, to produce contrast and help identify the progress of work.

h. The contractor shall furnish paint manufacturer's test reports, technical data sheet pertaining to the paint selected. The data sheet shall indicate among other things, the relevant standards, if any, composition in weight per unit of pigment vehicles, additives, drying time, viscosity, spreading rate, flash point, method of application, quality of surface preparation required, corrosion resistance properties and colour.

i.Painting at works - Equipment like pumps, motors, diesel engine, diesel Oil storage tank, valves and fire hydrants shall be painted at works before dispatch but after the testing by proper surface preparation, primer coats and finish coats as specified below.

j.Surface preparation - All surfaces shall be cleaned of loose substances and foreign materials, such as dirt, dust, scale, oil, grease, welding flux etc. irrespective of whether the same has been spelt out in the standards in order that the prime coat is rigidly anchored to the virgin metal surface. The surface cleaning shall conform to pictorial representation of surface quality, grade Sa 2 1/2 of Swedish Standards Institution SIS 055900 or equivalent standards such as SSPC-VIS-1.67 or DIN 55928 (Part 4) or IS: 1477(Part-I) -1990.

k. Paint - The sand blasted surface should be painted with two coats of Zinc-rich primer and two coats of epoxy paint of fire red colour. The thickness of the Zinc-rich primer shall not be less than 30 microns per coat and the thickness of each coat of epoxy paint of fire red colour shall be not less than 100 microns. The total dry film | thickness of the total painting shall be not less than 260 microns.

l.The zinc rich primer paint shall have 92% zinc content. Both the zinc-rich primer and the epoxy paint shall be compatible and the paint shall be of reputed and approved makes. All over ground lines shall be sand blasted and epoxy painted whereas the underground lines shall be double coated and double wrapped.

m. For electrical panels necessary metal treatment like hot alkaline degreasing. Cold water rinsing followed by pickling cold water rinsing, phosphate and passivation shall be carried out. The complete panel board shall then be dried out by the compressed air in dust free atmosphere. The boards shall then be epoxy powder coated to shade 623 of IS-5 over priming coats and finally baked.

n. Pipes and pipe fittings shall be given one coat of zinc rich primer as mentioned in after testing and before dispatch to the site.

o. The complete pipe work after erection and testing shall be given two coats of zinc rich primer and two coats of final epoxy paint as per relevant standards..

p. Colour Code
   - ❖ The colour code of the paint for Foam Pumps, Diesel engine and motors shall be fire red.
   - ❖ Pipelines & pipefitting and hydrants shall be fire red.
   - ❖ Water monitor shall be fire red

5.7.24 Accessories

i. Junction box for welding generator in pump house - 1 No.

ii. Blowers, exhaust fans in pump house as may be required on site considerations.

iii. Wind socks - 2 Nos.

iv. Portable explosive meter- 1 no.

v. Safety showers / Eye wash fountains to be installed at Strategic Locations – 2 Sets

Further accessories as required in OISD 156 shall be provided.

5.7.25 Erection

General

i. The erection of all plant and equipment shall be carried out according to the latest engineering practice and according to the drawings, specification, instructions etc. duly approved by the Engineer's representative. The contractor shall carry out the work in presence and/or as per the instructions of site engineer/supervisory personnel deputed by the Engineer's Representative. The erection shall be carried out with highly skilled workmen.

ii. The contractor shall take care of positioning, levelling and plumbing of all pipelines and equipment as well as supporting structures within the required accuracy and tolerance limits. It shall be deemed as a contractual obligation that the lines are not thrown out of alignment or lifted off during commissioning and subsequent operation.

iii. There may be more than one contractor working in the area at the same time. As such, the, work has to be carried out in proper co-ordination and consultation with the Engineer's Representative and all other parties concerned with the work. The Tenderer shall take due notice of the working condition, practices and agreements current in the area of the plant site and satisfy himself before quoting.

iv. It will be contractor's responsibility to take required precautions, actions to adequately safeguard the personnel carrying out the work and to ensure that the work is carried out in such a manner that maximum safety of men, machine material and environment is ensured.

v. The contractor shall comply with relevant rules and regulations on Safety, Health and environment, ILO regulations, Dock Safety requirements etc. The contractor shall provide all personal protective equipment to workmen such as Helmet, Shoes, Suitable Gloves, masks, goggles, Safety Belts etc. as applicable.

vi. The contractor shall be responsible for SHE (safety, Health, Environment) requirements.

vii. The contractor shall be responsible for paying strict attention to statutory regulations for prevention of accidents and to other- safety rules. The regulations for prevention of accidents shall be displayed visible to all appropriate places and should be distinctly visible to all working personnel in area. Notices of warning sign and symbols shall draw attention to all possible sources of danger.

viii. In case of any accidents, shall inform to CISF, Safety Officer and Police. All Welding may be carried out with proper safety precautions and with the Prior approval of Fire officer.

ix. Housekeeping should also be given priority and it must be on a day to day basis.

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

xi. Throughout the performance of work the contractor shall at his own cost keep structures, materials or equipment adequately braced by guys, struts, or other

approved means which shall be supplied and installed by the contractor as required till the installation work is satisfactorily completed. Such guys, shorting, branching, strutting, planking, supports etc. Shall not interfere with the works under execution/executed by other agencies.

xii. The Tenderer shall be responsible for successfully erecting and commissioning of the plant and equipment supplied by him. xiii. The scope of work shall cover storage at site transportation, fabrication/assembly, laying/erection, testing, painting and commissioning of the Fire Fighting water system and the connected piping system as a whole (inclusive of valves and other auxiliary equipment) with necessary supports and supporting structures. The erection work shall be carried out as per the working drawings prepared by the contractor and duly approved by the Engineer's Representative.

5.7.26 Site Testing & Painting

After erection at site the plant and equipment shall be subjected to tests to prove satisfactory performance as individual equipment and also as a system on the whole. The Tenderer shall include and conduct field tests for all pumps and piping systems. These tests shall be made after installation is completed and before the systems are placed in service. Field tests covered by BIS and Government and local codes shall govern in so far as they exceed corresponding requirements of this specification or cover omissions therein. All tests shall be performed as specified in the presence of the Engineer's Representative and must be accepted by him. The Tenderer shall conduct a preliminary test and repair or correct all faulty work before calling the Engineer's Representative to the test for acceptance of the systems materials, tools, consumables, fuel, stores, apparatus and instruments as may be necessary to carry out such tests efficiently. Disposal of testing media must be done with full consideration to flooding or damage to the piping, other installations or property of the Engineer's Representative and safety of the personnel. The method of disposal shall be approved by the Engineer's Representative. The contractor shall be liable for any damages resulting from field tests.

5.7.27 Pipelines

i. Erected pipelines together with fittings shall be tested by hydraulic pressure. The value of test pressure shall be equal to 1.5 times the working pressure or 20 kg/cm2 whichever is higher for duration of 4 hrs.

ii. The Foam Pumps and monitors shall be disconnected before the test Combined tests of equipment with the pipeline is not allowed.

iii. Hydrostatic tests shall be conducted for each system of piping separately.

iv. Air vents shall be provided at all high points of the piping where the test shall be conducted in order to purge air pockets while the piping system is being filled up. Hydraulic test pressure shall be maintained for duration of 4 hrs. At this pressure the pipelines shall be inspected and all welded joints shall be tapped by a hand hammer.

v. Hydraulic test will be considered satisfactory if during the tests, pressure does not decrease and no leakage or mist is found in the joints fittings etc.

vi. The contractor shall arrange at his own expenses all equipment, material, instruments and consumables to conduct the various site tests to demonstrate specified performance of all plant and equipment offered by the contractor.

vii. Representatives of the Engineer's Representative and Contractor shall make a statement regarding the acceptance of the erected pipelines mentioning defects found during the tests, characteristics of the defects and the method of their elimination.

5.7.28 Commissioning

a. Before start of preparation for commissioning, all the equipment and pipelines shall be certified by the Engineer's Representative for commissioning.

b. ii. The site shall be thoroughly cleaned of all sorts of foreign materials such as welding rod ends, welding beads, metal chips etc. by the contractor from the site before commencement of commissioning activities.

c. Before commissioning all the pipelines shall be blown with compressed air until the air discharged is free from dust particles etc.

d. All lubricants, oils and other consumables required for commissioning the system shall be supplied by the Tenderer.

e. Commissioning of the various equipment and system shall be carried out by the Tenderer as per the accepted procedure and as per the instructions of the Suppliers of the equipment.

f. On completion of the installation but before powering of the electrical system, all installation shall be physically checked and properly tested. These checks and tests shall be conducted by the Tenderer under the supervision of the Engineer's Representative. Any defect observed during such checks and tests shall be made good by the Contractor before commencement of commissioning.

5.7.29 Test Certificates and Documents

For each of the items being manufactured, following test certificates and documents as applicable for each of the equipment, in requisite copies including original shall be submitted to purchaser / their representative. All test certificate must be endorsed by the Manufacturer and Contractor with linkage to project, purchase order and acceptance criteria.

a. Raw materials identification and physical and chemical test certificates for all materials used in manufacture of the equipment (except IS 2062 - 1992 Gr. A & IS 210 - 1993, FG -150)
b. Welding procedures and welders qualification test certificates as per applicable code.
c. Details of stage wise inspection and certification record for fabricated items, castings, forgings and machined articles.
d. Control dimension chart with records of alignments, scariness etc.
e. Manufactures material and performance / relevant test certificates for all bought-out items,
f. Details of heat-treatment and stress relieving charts as per specification.
g. Non-Destructive Test reports as per respective code
h. Static / dynamic balancing certificate for rotating components /machines.
i. Hardness test certificate, x. Pressure Test Certificate.
j. Performance Test Certificate for all characteristics.
k. Geometric accuracy and repeatability test reports of machine tools.
l. Routine / type / calibration / acceptance / special test certificates for electrical items.
m. Diagnostic features of NC/CNC system and test for electrical items.
n. Surface preparation and painting certificates.
o. Certificates from competent authority for the items coming under statutory regulations.

Where physical and chemical test certificates of material are not available, the contractor / Subcontractor shall arrange to have specimens and test samples of the materials, tested in its own laboratory at his cost and submit the copies of test results in requisite numbers to purchasers / their representative for scrutiny & approval. Number to test samples against each heat / cast / lot or batch of materials shall be as per relevant Indian or international standards.

Where facilities for testing do not exists in the contractor / subcontractors laboratories or in case of any dispute, sample & test piece shall be drawn by the Contractor / subcontractor in presence of purchaser their representative & sealed sample shall be sent to any approved laboratory for necessary tests at contractor / subcontractors cost.

The purchaser / their representative shall have the right to be present & witness all tests being carried out by the contractor / subcontractor at their own approved laboratories. Also, the purchaser / their representative shall preserve the right to call for confirmatory test on samples, at his discretion. Valid calibration certificate of all measuring instruments & gauges used during inspection & testing with tractability to national, standard of NPL / NPL accredited testing laboratories shall be furnished along with "inspection call" prior to undertaking inspection' by purchaser / their representative.

5.7.30 Guidelines for QA requirements

The offer of the firm should include details of quality control plans during various stages of manufacture/fabrication. The availability of in house quality control procedures and plans are essential pre requisite for tendering. Therefore the firm should have all essential Quality control facilities including testing of end product. The critical bought out items, like pumps, motors, diesel engine, monitors, valves, control system and components may be at the Engineers representative discretion permitted for testing at sub - contractor's / vendors works. All bought out critical items shall be procured from suppliers approved by the Engineers representative.

All bought out critical items shall be inspected by Trust approved Inspection agency. This inspection shall cover all aspects of material, workmanship, process and performance keeping in view Quality Control parameters. This inspection will be at all stages, starting from raw material, fabrication, assembly and performance testing.
The equipment / material will be accepted after the same is tested by the inspection Agency & duly stamped before dispatch. All costs towards the charges for the inspection agency during the manufacture and testing at the sub-contractor's / vendor works shall be borne by the Contractor. The offer will be evaluated for Quality control plan procedures, which would be rated in conjunction with final bid. The information Submitted shall be

liable to verification prior to placement of order and a firm submitting factually inaccurate data, shall render itself for appropriate penal action.

SECTION 6

TECHNICAL DATA SHEETS

ATTACHED AS ANNEXURES

SECTION 7

SCOPE OF WORK FOR PIPING

7.1 Scope

This scope of work is general in nature & forms the guidelines for the detailed engineering, supply installation and commissioning of the plant as per recommendation of OISD-156

The scope of work includes but not limited to the following

- Complete piping design and detailed engineering.
- Contractor to note that the drawings enclosed with the contract is conceptualized piping layout drawing. Detailed engineering on the same including supporting arrangement is to be carried out by the contractor.
- Procurement and supply of all required piping materials including all materials required for pipe supports and clamping of pipelines and supporting and clamping of other piping materials.
- Supply, procurement & storage of all materials and consumables.
- Execute piping fabrications, laying and erection including prefabrication, preheating, welding, NDT including radiography, site fabrication, post weld heat treatment.
- Erection, supporting, water/steam flushing, air drying, testing, cleaning, painting, etc. as per specifications
- Perform Flexibility Analysis, Dynamic Analysis, Digital/ Analog Study of piping as required, support selection, support schedule and its markings in drawings and prepare engineering data for springs etc.
- To execute the field engineering jobs which become necessary due to problems during prefabrication, shop fabrication, field fabrication or erection at site. Necessary sketches shall be prepared by the contractor which shall be reviewed by owner/consultant before execution.
- Any discrepancy of line fouling or shifting due to underground/existing system during installation of new equipment/piping. The necessary modification shall be done by contractor with due approval of owner/consultant.

- Providing equipment drain collection system. This shall include routing of all process equipment drains to drain pit(s) through above ground/underground C.S. piping. All buried pipes should be suitably wrapped & coated. In this U/G drainage system suitable RCC manholes should be provided.
- Supply of painting material and execute painting of all piping and piping structural like platforms, supports, cross over etc. as per specification.
- Scope also includes insulation of piping (if specified), wrapping coating for underground pipe (as applicable).
- Wherever required, dismantling and replacement/rerouting of all piping including all pipe items supporting, testing and completion in all respects wherever required during execution and detailed engineering.
- Positive isolation/purging of piping, tank, valve, etc including providing requirement items for this work, shall be in the scope of contractor. HDC scope will be limited to closing of the required valve prior to isolation. Handling/removal of sludge, oily sludge (from tanks & piping) shall be in the scope of contractor, as per directions of HDC.
- The scope of contractor shall also include all other such activities and supply of such materials which are necessary to complete the job in all respects as per the directions and instruction of owner/consultant.
- Execute all mechanical jobs identified during owner checklist, Technical audits, pre-commissioning and commissioning, including additional supports required to restrain pipes movements avoiding interface with nearby structural/piping.
- All piping materials required for testing and pre-commissioning e.g. piping spools , bolting and gaskets , flanges , blinds or any other piping materials for carrying out these activities is included in contractor's scope of supply.
- Preparation of as built drawings
- The above list of activities is not exhaustive and therefore not limited to the above. The scope includes all such activities as required , supply of all materials and components as required , for successful commissioning of the plant as per the requirements of the P & Ids , line lists , piping design basis and engineering specifications etc. enclosed in the bid document so as to result in a total operable and maintainable plant.
- Design and engineering as per the respective codes and specification Preparation of drawings and documents, Sizing, Selection and Procurement of mechanical equipment Fabrication of vessels/ tanks at shop/ site NDT of equipment, vessels and tanks as required. Construction of civil foundation for equipment Inspection

and Testing at shop and at site as required Transportation and supply of all material and equipment, tools and tackles, Cleaning and Painting at site, as required. Installation, commissioning, testing handing over of mechanical facilities in all respect at site. As built drawings, specifications, operation and maintenance manuals, vendor data books etc.

- The description and requirements contained in the specifications are concise by necessity and cannot include all details. However, it is the responsibility of the Contractor to execute the job in accordance with specifications and good engineer operation of all the facilities at site.

7.2 DETAILED ENGINEERING:

Contractor's scope of work shall include but not limited to the following:

Design and engineering of all piping works including equipment layout drawings, piping key plan, preparation of piping GAD's including platform layout etc.
Contractor shall review all engineering drawings/standard specifications enclosed in the bid and shall bring discrepancies/contradiction if any, to the notice of the owner/consultant. Contractor's scope shall also include review of piping and valve material specifications and preparing/updating specification, standards etc. required to complete the scope of work in all respect with reference to the line sizes/thickness/material of construction/rating/codes and also any required modifications in conceptual piping layout drawing without any additional time and cost implication.

Preparation of isometrics, bill of material, pipe support, support index and other related engineering.
As built piping GAD's, isometrics, equipment layout etc.
Stress analysis and flexibility analysis including support selection and engineering data for springs expansion bellows etc.
Use of expansion joints/bellows shall be avoided to the extent feasible.
Preparation of nozzle/platform orientation for all vessels showing all platform and staircase tank/vessel cleats documents.
While preparation of bill of materials contractor should consider the wastage and the spares for construction/commissioning.

7.3 PROCUREMENT:

Procurement of all piping materials such as pipes , flanges , pipe fitting Valves, gaskets, strainers, fasteners and other misc. items as per attached specifications / standards / datasheets and drawings based on the bill of material prepared by contractor.
Contractor shall follow exact specifications /data sheets /standards/drawings and vendor list, attached along with bid documents. Any deviation from above shall be brought to owner/consultant notice before finalization of order. Contractor shall not proceed ahead for placing order without obtaining prior approval.

7.4 INSPECTION:

All equipments under the scope of supply of contractor shall be subjected to stage wise and final inspection by owner/consultant/third party as per approved QAP, at manufacturer's workshop/site.

7.5 BASIS OF WORK:

The following documents forms the basis of work for the contractor

- P & ID
- Line List
- Process description
- Process / Equipment data sheets
- Conceptual piping layout drawings
- Codes and Standards
- Piping and Valve material specifications and standards
- Various documents forming part of the contract document
- Piping Design Basis

7.6 DOCUMENTS

The Contractor shall submit the following documents to the owner/consultant for approval/review/information.

- P&ID , Plot Plan, firefighting layout
- ii. Equipment layout plans, elevations and sections with all vendor data incorporated for approaches, roads around the units, drop out area and maintenance area clearly marked
- Piping GAD's showing nozzle orientation for all vessels
- Purchase Requisitions
- Bill of Material (Final MTO)
- Isometric Drawings
- Support Marking Drawings and Support Index
- Stress & Flexibility analysis reports
- As built Drawings /documents viz. piping GAD, isometrics, equipment layout etc.
- Quality plan for piping activities
- Piping material and valve material specifications.
- Hook up drawings.

7.7 PAINTING:

Scope of painting as a minimum shall include all Pipes , Fittings , Valves , Columns , Vessels , Drums , Storage Tanks , Heat Exchangers , All Structural steel works , Supports , Walkways , Handrails , Platforms etc.

7.8 GENERAL NOTES FOR PIPING MATERIAL SPECIFICATION

SCOPE

This specification (PMS) covers the various piping classes for Process and utility Piping.

Deviations from this specification may be necessary to conform to specific job requirements.

7.9 REFERRED CODES & STANDARDS

All Piping shall be designed in accordance with the Process Piping Code, ASME B31.3.

Editions and addenda (if any) of referred Codes and Standards shall be as per the Job Engineering Design Basis (Piping).

For the sake of brevity, the initials of the society to which the codes are referred to may be omitted in the specification. For example; B16.5 is a code referring to ASME; A106 is a standard referring to ASTM.

7.10 MATERIAL SPECIFICATIONS

Individual piping Class has been generally designed to cover a set of services operating within pressure-temperature combination as per ASME B16.5 / B16.34 or part of it.

The PMS shall be strictly adhered to in the design, requisitioning, purchasing, fabrication and testing of the piping system. However, deviations of material may occur due to design conditions and/or availability. All substitutions must be duly approved.

Unless mentioned otherwise, pipe thicknesses in the specs are for above ground piping.

7.11 CLASS DESIGNATION CODE

The class designation shall consist of not more than three components made up of a letter, number & letter; e.g.B1A.

The first letter indicates pressure rating.

A 150 Class	D 600 Class	G 2500 Class
B 300 Class	E 900 Class	J 125/150 Class
C 400 Class	F 1500 Class	K UNCLASSIFIED

The middle number indicates difference in the specifications due to service change within the same rating.

The third letter indicates type of material.

A Carbon

B Carbon Moly.

C 1.0 % Cr., 0.5 % Moly.

D	1.25 % Cr., 0.5 % Moly.
E	2.25 % Cr., 1.0 % Moly.
F	5.0 % Cr., 0.5 % Moly.
G	9.0 % Cr., 1.0 % Moly.
H	3.5 % Ni.
J	Nickel / Titanium
K	Stainless steel type 304, 304H, 304L.
L	Aluminium
M	Stabilized stainless steel type 316, 316H, 321, 347.
N	316L
P	Monel / Alloy 20
Q	Hastalloy / Inconel / Incoloy
R	Lead
S	PVC & FRP, PP / FRP, PVDF / FRP
T	Cast Iron / Silicon Iron
V	Duplex Stainless Steel
W	Cupro-Nickel
Y	Lined steel (Rubber Lined, Teflon Lined etc).
Z	HDPE / PDVF / Teflon / PVC

7.12 PIPES

Pipe dimension shall be in accordance with ASME B36.10, IS:1239 & IS:3589 for wrought steel and wrought iron pipe; to B36.10 / B36.19 for stainless steel pipe and respective ASTM Standard for non-ferrous and non-metallic pipes.

Pipe made by acid-Bessemer process shall not be acceptable, steel pipe shall be made by open hearth, electric furnace or basic Oxygen process.

All pipe threads shall conform to ASME B1.20.1 except where otherwise noted.

Pipe thicknesses not covered in different classes of this specification shall be calculated to meet specific job requirement based on actual max. design condition to economize on thickness. However, in such cases the thickness shall be calculated at not less than 80% of class rating unless defined otherwise in the Job Engineering Design Basis (Piping).

Maximum of 10% of Corrosion Allowance may be adjusted to optimize on pipe schedule. However, if CA is suffixed by 'minimum', this downward adjustment shall not be used. Non-Standard pipe sizes 1¼", 2½", 3½", 5" and 22" shall not be treated as a part of this specification unless these sizes are separately called out.

7.13 FLANGES

Flanges shall be in accordance with the following codes, except where otherwise noted:

Up to 24" (150# -1500#)	ASME B16.5
Up to 12" , 2500#	ASME B16.5
Above 24"	ASME B16.47 SERIES 'B' / AWWA / RPE' STD.

Flanges to ASME B16.47 SERIES 'A' or any other standard (e.g. DIN, GOST, JIS etc.) may be specified to mate with equipment or valve flanges with the corresponding bolting.

Finish of steel flange faces shall be as follows:

Stock Finish	: 1000 µin AARH max.
Serrated Finish/ 125 AARH/	: Serrations with 125-250µin AARH
Smooth finish 63 AARH	: 32 TO 63 µin AARH

Brinnel hardness for RTJ groove shall be at least 20 BHN more than that of corresponding gasket as specified.

7.14 FITTINGS

Forged steel SW and threaded fittings shall be in accordance with ASME B16.11, unless otherwise specified. For items not covered under B16.11, reference may be made to BS 3799 or appropriate MSS-SP-Std.
BW Fittings shall be in accordance with ASME B16.9, unless otherwise specified.
Dimensions of steel BW fittings for sizes not covered in ASME B16.9 shall conform to MSS-SP48.
Usage of unions shall be restricted to utilities only.

7.15 BENDS, MITRES AND REDUCERS FABRICATED FROM PIPE

Mitres and Reducers fabricated from Pipe may be used if specified in particular Piping Class. 90 degree mitre shall be minimum 4-piece construction up to 24" and minimum 5-piece construction for 26" & above. 45 degree mitre shall be minimum 3-piece construction. Mitres require higher thickness than corresponding Pipe / Elbow to hold the same pressure (Refer ASME B31.3). All bends less than 24” shall be of readymade bends, mightier bends are not acceptable.

7.16 GASKETS

Non-metallic gaskets shall conform to B16.21 (corresponding to B16.5) up to 24", and B16.21 (corresponding to B16.47B) beyond 24", unless otherwise specified.
Spiral wound gaskets (SP.WND or SPWD) and Ring Joint gaskets shall conform to B16.20

7.17 BOLTING

All bolts shall conform to B18.2.1, nuts to be B18.2.2. Reference shall also be made to B16.5 for studs.
Threads shall be to coarse Thread Series, B1.1, having Class 2A allowances for bolts and studs, and Class 2B tolerance for nuts.
Nuts for Bolts and Studs shall be the American Standard Hexagon Heavy Series.

7.18 THREADS

Threads for threaded Pipes, Fittings, Flanges and Valves shall be in accordance with B1.20.1 taper threads, unless otherwise specified.

Up to 204 deg.C, threaded joints shall be made with 1" width PTFE joining tape.

Above 204 deg.C, threaded joints shall be seal welded with a full strength fillet weld.

All threaded joints irrespective of pressure and temperature on lines carrying toxic fluid shall be seal welded with a full strength fillet weld.

7.19 VALVES

Face to Face / End to End dimension of valves shall conform to B16.10 to the extent covered. For valves not covered in B16.10, reference shall be made to BS 2080 and/or the manufacturer's drawings.
Flange / weld ends of the valve shall be as per the corresponding Flange / Fitting ends of the piping class, unless otherwise specified.
Pressure-temperature rating for flanged and butt welding end valves shall be as per ASME B16.34 except for ball, plug & butterfly valves. For these valves refer TABLE FOR PRESSURETEMP RATING FOR BALL, PLUG AND BUTTERFLY VALVES.
Wall thickness of valve body at different locations should not be less than as calculated as per
Unless called-out specifically, valves shall be as per the following Standards:

Valve	Size	Rating	Design. Std	Testing Std.
Gate	½" to 1 ½"	800 / 1500	API-602	API-598
Globe / Check	-do-	800 / 1500	BS-5352	BS-6755 Pt-I
Gate	2"-24"	150 / 300 / 600	API-600	API-598
Gate	26"-42"	150 / 300	BS-1414	BS-6755 Pt-I
Globe	2"-8"	150 / 300/ 600	BS-1873	-do-
Check	2"-24"	-do-	BS-1868	-do-
Gate/ Globe/Check		900 / 1500 / 2500	B-16.34 (Refer 12.6 also)	API 598 / BS-6755 Pt.I
Ball	1/2"-16"	150 / 300 / 600	BS-5351/API6D	BS-6755 Pt.1/API

		900 / 1500	API 6D	598
Plug	½" – 12"	All	API-599/BS5353/	API-598/BS 6755 Pt.1/AWWA
Butterfly	3" & above	All	API-609/BS5155 AWWAC504	API-598/BS 6755 Pt.1/AWWA
Diaphragm Bronze Cast Iron	All	All	BS-5156 RELEVANT IS STD RELEVANT IS STD	BS-6755 Pt.1 RELEVANT IS STD RELEVANT IS STD

If not covered in 12.3, the valve shall be as per B16.34 / relevant MSS-SP Standard.

For details of the valves specifications, refer specifications 04-SP-08. Features not covered by 04-SP-08 and the relevant code shall be to the manufacturer's standard.

Unless otherwise specifically called for, up to 600# rating, 2" and larger size steel Gate, Globe & Check valves in Hydrocarbon and utility service shall have bolted bonnets. Pressure-seal bonnets or covers shall be used for Classes 900# and above to minimize bonnet leakage. However, valves with Pr-seal Bonnet shall have wall thickness & stem diameter as per API-600, (if required). Welded bonnets or screwed & seal welded bonnets are acceptable for sizes lower than 2" for Classes 900# & above.

For Welding Specifications and Non-Destructive Testing (NDT) specification, refer RPE' STD 04-SP-04.

SECTION 8

SCOPE OF WELDING & NDT

8.1 SCOPE

This specification modifies and/or supplements the referenced codes that apply to all piping, pressure vessels, structural and pipeline welding. These requirements cover welding done at supplier's fabrication plant, Contractor's Yard, or field installation, either onshore or offshore.

8.2 CODE & STANDARDS

The following Codes shall be the minimum acceptable standards for welding and inspection. The latest edition, addenda, and supplement available at the time of bidding will be used. Any part of any other non-listed code referred to in these listed codes as augmentation is to be considered applicable.

PIPING & PRESSURE VESSELS

ASME Sec.IX

ANSI B 31.3

ANSI B31.4

ANSI B31.8

ASME Sec. VIII

ASME Sec. V

ASME Sec. II Part C

NACE-MR-01-75 / ISO 15156

SNT-TC-1A

8.3 GENERAL TECHNICAL NOTES

a. Low hydrogen electrodes shall be used for piping welding.

b. Consumables for material confirming to NACE requirements shall have physical, chemical, fatigue and corrosion resistance properties comparable to base metal.
c. Manufacturer's batch test certificate shall be submitted for each batch of consumables used. Test results shall include chemical, physical (including impact), corrosion resistance (if welding material with NACE Requirement) & fatigue resistance (if welding material or WPS with CTOD Requirements).

d. Company shall approve all consumables including brands.

e. Welding shall be carried out as per approved WPS. For carbon steel piping, previously qualified WPS are acceptable subject to the PQR's have been qualified in the presence of reputed IIIrd party inspection agency, as mentioned in Contract. All certificates shall be submitted to company for review & approval. For piping welding involving Corrosion Resistant Alloys (CRA) including CS-NACE, Cu-Ni, SS and DSS etc, previously qualified procedures are not acceptable. The contractor shall qualify new procedures for piping welding involving CRA materials.

8.4 PIPING: CS

Random radiography (10%) shall be performed covering on one weld in each 10 welds for each welder on the following:

a) Water (in case of carbon steel)

b) Air

c) Chemical

d) Diesel

e) Closed drain

f) Relief

g) Hydraulic Oil

h) Oily water

i) Sloop

j) Glycol & Thermoil

k) Vent gas

l) Lube oil & Seal oil

50% Radiography shall be performed on size 2" and above and 10% on below 2" for the following:

a) Crude oil

b) Jet fuel

c) Fuel gas / instrument gas

d) Process gas

e) Production flow lines (well fluid)

f) Injection water

g) Hydrocarbon (process)

h) Water (in case of 90/10 Cu-Ni)

i) H.P. and L.P. Flare lines.

For fillet welds and brazed joints where carrying out radiography is not possible , magnetic particle test or dye penetrant test shall be carried out. The extent of inspection shall remain same as for radiography.

All the lines which are stress relieved or have design pressure more than 50 Kg/cm2 shall be radiographed for 50% of weld joints even if not required as per 9.1 to 9.3.
Radiographic Procedure shall be as per ANSI B 31.3.

Acceptance criteria based on visual radiography and other types of examination shall be as per ANSI B 31.3 with the following modifications:

a) The internal weld protrusion on 'pigged lines" shall not exceed 1.6 mm (1/16 Inch)

b) Orifice flange butt-weld shall be internally ground smooth and flush.

c) For 90/10 Cu-Ni piping, radiograph examination of welds shall be as per ASME section VIII, UW 51

Those field welded joints, which cannot be leak tested due to unavoidable reason shall always be 100% radio graphed.

PIPING CS NACE: Butt welds: 100% RT & Hardness testing

Fillet weld: 100 % MPI / DP & hardness testing.

8.5 NDT PROCEDURES:

a) Piping: ANSI B 31.3 / ASME Sec. V.

8.6 ACCEPTANCE CRITERIA FOR NDT

a) Piping RT CS: ANSI B 31.3

b) CS (NACE) & CuNi: ASME Sec VIII Div I, UW – 51.

c) UT / MPI / DP: ANSI B 31.3

8.7 NDT Personnel

All NDT personnel shall be currently qualified under ASNT Level II (as per SNT-TC-1A) or client approved equivalent certification scheme (like PCN, CSWIP) for the category of non- destructive examination being undertaken.

- Only two times repairs are allowed on any joint.
- Welding shall not be performed when the ambient temperature is lower than zero degree C, when surfaces are wet or exposed to rain, snow or high wind velocities, when welders are exposed to inclement conditions, or when conditions prevent required inspections.

- Only welding equipment that is in good working condition and that is properly grounded shall be used. All welding machines shall be calibrated prior to commencement of fabrication and calibration certificates shall be available for audits. Certification shall be valid for 6 month periods, or as per manufacturer's recommendation.

8.8 Grounding of Equipment

- Each welding machine shall be individually grounded to the platform or portion of the platform being welded.
- No machine shall be grounded to floating equipment during welding on the structure.
- Arc strikes should be made in weld groove. Arc strikes on the surface of base metal shall be removed by grinding, including any hardened zone beneath the strike. Any such repair shall be visually and magnetic particle inspected.

8.9 CTOD Testing

- Material subjected for CTOD Testing shall be tested and shall meet or exceed CTOD value of 0.35mm.
- Welding consumable subjected to CTOD Testing shall be tested and shall meet or exceed CTOD value of 0.25mm.
- WPS subjected for CTOD testing shall be tested and shall meet or exceed CTOD value of 0.20 mm.

8.10 TECHNICAL NOTES FOR PIPING WELDING

- The quality of welding shall be such that a weld efficiency factor as defined in ASME B 31.3 of 1.0 is achieved.
- The deposited filler metal shall match the chemistry, corrosion resistance (if required) and minimum physical properties of the parent metal when similar metals are welded.
- Circumferential welds on pipes shall be staggered at least four times the pipe wall thickness or 25 mm, whichever is greater, apart.
- Branch connections shall be joined to their headers with full penetration welds.
- Backing rings, back-up rings or chill rings shall not be used.

- Back or seal welding of screwed fittings is prohibited unless specified in the drawing or is part of the approved welding procedure.
- Oxy-acetylene torches shall not be used for pre-heating.
- Pipes of dissimilar materials shall not be welded to each other but shall be flanged unless otherwise approved.
- Compressor and turbine piping, including lube and seal oil piping, and other piping requiring special cleaning as shown in the drawings provided by the supplier shall have the root pass deposited by the gas tungsten arc process. The backside of the root pass shall be purged with inert gas.
- If the bore of the pipe is different from the bore of fittings or flanges, to which it is welded, by more than 3mm (total bore diameter), the thicker member shall be bored, taper bored or ground smooth to match the specified bore. Figure 328.4.3 of ASME B 31.3 will governs the geometry of all taper boring and beveling.
- Coupling or other weld-on type branch connection shall be located at least 80 mm away from any weld joint.
- When socket weld fittings or valves are used, pipe shall be spaced approximately 1/16 inch to avoid “bottoming” which could result in excessive welds stress.
- The inside of the brazed fitting and outside of the tube shall be cleaned with sand Paper. Flux paste to be evenly applied to the joint.
- Reinforcing pads shall be added only after external and internal visual inspection the attachment. Reinforcing pads shall be provided with ¼” tapped weep hole. Weep holes should be plugged after welding of pads is over.
- Exposed machined and threaded surfaces shall be protected from oxidation during heat treatment.
- Flange bolt holes shall straddle the established horizontal and vertical centerlines of the pipe except where connection to equipment dictates otherwise.
- Cleaning of the piping after fabrication and heat treatment shall be performed externally and internally to remove all loose scale, weld spatter, sand and other foreign materials.
- Welding shall not be done when quality of completed weld would be impaired by prevailing weather conditions, air borne moisture, blowing sand or high winds. Windshields may be used when practical.
- All welders working on the project shall wear identification cards made at contractor’s cost which shall contains photograph, welders name, welder no. Procedure qualified and Company’s/Engineer’s representative’s signature.

- Welder shall be supplied with tempil stick – thermal crayons or pendox gauges so that welders and inspector can check and control the temperature of weldment.
- No weld shall be coated, painted, hydrotested before it has been inspected and accepted. 22. No weld is to be cooled by quenching or by any means other than air.
- SOUR SERVICE WELDING: Welding procedures to be used in sour service shall be qualified with Vickers Hardness Testing. The maximum Vickers Hardness Number shall be 248 Hv10.

8.11 FIELD WELDING:

- a). Where field welds are designated, the prefabricated pipe shall be cut off 150 mm longer than the dimensions shown on the pipe fabrication drawings to allow for modification then precise fit-up in place.
- Additional field fit welds may be included in a spool by the Contractor for those spots which may have restricted site access or which may be cumbersome for transportation.
- The location of field welds, where not indicated on the drawings, will be the responsibility of the Contractor.

8.12 WELDING PROCEDURES & DOCUMENTATION:

- Weld procedures shall be qualified as per ASME B31.3 (except 90-10 Cu-Ni) or ASME Code Section IX (for Cu-Ni piping). NDT shall be performed as per ASME B31.3/ ASME BPV Code Section-V.
- Mechanical testing of WPQT coupons for CS piping shall confirm to the requirements of ASME Sec.IX / ANSI B31.3. In addition to the above requirement, hardness testing shall be performed on each test coupon. Maximum hardness value shall be 325 HV10 for normal service piping. For piping in Sour Service, a maximum permitted hardness of 22 HRC (248 HV10) shall apply. Charpy Impact Testing of Carbon Steel Pipe work shall be performed in accordance with ASME B31.3 Table 323.2.2.
- The Contractor shall not commence welding until appropriately qualified welding procedures have been accepted by the Company representative.
- For each welding process, the welding procedures shall specify all equipment settings. The Contractor’s Welding Supervisor shall check daily and record machine

settings for each weld procedure used during welding activities. This record shall be available for audit by the Company representative.

- A welding procedures record shall be prepared by the Contractor prior to start of welding and shall be available or review by the Company representative. A welding summary recording progress of all welding shall be prepared by the Contractor daily.

8.13 WELDERS' QUALIFICATION:

- Welders and welding procedures shall be qualified as ASME Boiler and Pressure Vessel Code, Section IX.
- Qualification on production welds is not permitted.
- A welder shall not be permitted to weld on pipe work or attachments to pipe work unless they are qualified to the procedure in use and the documentary evidence has been sighted by the Company representative.
- Tack welds shall be made by a qualified welder using the same type of electrode as is used for the root pass.
- The Company representative shall be advised in advance that the Contractor's conducting welder qualification to enable auditing of test facilities. Qualification test welds shall be made on test coupons prepared in accordance with the relevant standard. A test certified amp/volt tong tester shall be available at the Contractor's establishment at all times.
- The Contractor shall be responsible for all costs, including labor and laboratory testing, associated with welder qualification tests and retests.
- The Company may request a retest of any welder at any time and from time to time during the work. If a welder fails to qualify, then at the discretion of the company representative, all non-installed welds completed by that welder shall be examined by additional radiographic tests, over and above that which would normally be required or specified in the drawings for that pipe work and the same shall be charged to the Contractor's account.
- Welds not identified and recorded, or welded by unqualified welders, shall automatically be rejected. It will be the Contractor's responsibility to prove that the welds conform to the applicable Specification. This may require 100% radiography.

8.14 REPAIRS

- If the company representative considers a weld to be grossly defective, it shall be cut out and the joint re-welded and all costs associated therewith shall be the Contractor's responsibility.
- Repair of weld defects shall be made using the approved welding procedure.
- Mechanical defects such as scratches and gouges may be ground smooth provided the depth of the defect does not exceed 10% of the nominal wall thickness of the pipe.
- Dents or grooves who's depth is greater than 10% of the nominal pipe wall thickness shall be removed by cutting out and replacing that length of pipe in which the defect occurs. The minimum length of a cut out shall be four times the nominal diameter or 150 mm, whichever is the lesser.
- Internal weld metal projecting into the pipe on weld neck orifice flanges shall be removed and ground smooth with the pipe.

8.15 HEAT TREATMENT (During winter work only):

- Preheat and post-weld heat treatment (PWHT) shall be in accordance with ASME B 31.3. ASME B31.4 or ASME B31.8 as applicable.
- The method and equipment used in heat treatment shall be acceptable to the Engineering In charge and their Inspector.
- All threaded connections shall be protected from oxidation during heat treatment and be chased or gauge checked after heat treatment.
- Exposed machined and threaded surfaces shall be protected from oxidation during heat treatment.
- Cleaning of pipe work after fabrication and heat treatment shall be performed, externally and internally to remove all loose scale, weld spatter, sand and other foreign materials.
- For all welds requiring PWHT, the specified inspection and NDT shall be performed after completion of PWHT process but not before the welds have cooled to ambient temperature. NDT prior to PWHT, performed in addition to mandatory NDT following PWHT, shall be at the discretion of the Contractor. However, where defects requiring repair are located by this inspection, it shall be brought to the notice of Company.
- Machined surfaces shall be protected by a suitable paint or compound to prevent damage from scaling during PWHT.

- After final heat treatment, the Contractor shall identify the piping as having received PWHT. The method of identification shall be recorded on the as-built isometric and P&ID together with the other recorded information.
- A legible heat treatment chart shall be provided to the Company. This chart must show the rate of increase of temperature, the holding temperature and time and the rate of decrease of temperature.

8.16 INSPECTION, EXAMINATION & TESTING

- Destructive tests required by this Specification shall be performed by an accepted third-party laboratory Radiographic Examination:
- Radiography will be performed for every pipe thickness and material grouping and for each welding process and procedure, progressively throughout entire job. At least one of each type and position of weld made by each welder will be examined. A record shall be kept by the Contractor of the quality and extent of each welder's work.
- Because of the limited sensitivity of gamma radiography when used with heavy wall pipe, all welds in material over 19 mm thick shall, in addition to radiographic requirements, be 100% ultrasonically tested. If a single wall single image radiography technique is used the material thickness limit of 19 mm can be extended to 30mm.
- Welds, which cannot be radiographed because of their location, will be examined by ultrasonic, liquid penetrant or magnetic particle method as applicable. The extent of inspection shall be the same as for radiography.
- Radiography is not required for the welds on slip-on flanges or socket welds or seal welds.
- Fluorescent intensifying screens such as calcium tungsten shall not be used.
- For each weld found to be defective two additional welds made by the same welder who produced the defective weld will be subjected to radiographic examination. These additional examinations will be made immediately after the defective welds is found and are in addition to the minimum examination requirements for the line class as specified in the drawings or specifications.
- Weld repairs shall be re-examined by the same method used to detect the original defect.

8.17 Ultrasonic Examination

Ultrasonic examination may be employed where the material thickness and degree of defect are such that determination is not possible by any of the other methods. The procedure used and criteria of acceptance shall be based on the recommendations of ASME Boiler and Pressure Vessel Code Section V.

8.18 QUALITY CONTROL, MATERIALS AND STORAGE

Quality Control Quality Control Procedures for welding operations shall include the following -

- Storage of Welding Electrodes: Electrodes shall be stored and handled in accordance with the recommendations of the electrode manufacturer, AWS D1.1 and the following. Electrodes that have been removed from their sealed containers, and exposed to atmospheric conditions, shall be returned to heating ovens for drying in accordance with the electrode manufacturer recommendations, and AWS D1.1 requirements. A positive means of identification of the electrodes held in the drying ovens, the drying cycle, temperature and time held, shall be established.
- The flux conditioning procedure shall detail methods of assuring dryness before use, recovery of flux after use, screening of foreign materials and flux, and the storage of flux to prevent contamination.

Welder Identification

a) Each welder shall be issued with an identification card or badge after qualifying the welding test, which will be carried on his person and be visible at all times during working hours. The COMPANY shall have the right to inspect welder identification at any time to insure that all welders as qualified.

b) The CONTRACTOR shall assign identifying letters or numbers to each welder employed, shall require each welder to stamp all welds he makes with his identification mark. The stamping of welds shall be done with a low stress stamp and shall be made adjacent to the weld. Alternatively, a resilient paint stamp may be used.

- **Materials and Storage**

  Welding materials (electrodes, fluxes, shielding) and storage of welding supplies shall meet the provisions of AWS D1.1, and the following provisions:

  ❖ Coated welding electrodes shall be of the low hydrogen type.

- ❖ SAW flux shall be supplied in clearly identified moisture-proof containers.
- ❖ SAW flux, not fused in welding, may be recycled, but shall be free from fused flux, mill scale, dirt and other foreign matter.
- ❖ All welding wires shall be clearly identified by manufacturer, grade and batch number.
- ❖ Manufacturer's batch test certificates.

➢ **Storage of Welding Supplies**

- ❖ All welding materials shall be stored in a clean dry area until used, as described in AWS D1.1.
- ❖ Wet or damaged electrodes, contaminated flux and rusted filler wire shall be rejected and removed from the fabrication site.
- ❖ Welding wire and SAW flux shall be stored in a dry location at a minimum temperature of 21ºC.

➢ **Protection from Weather**

The welder and weld area shall be provided with protection during periods of inclement weather and/or excessive wind conditions. The procedures shall include means of protecting electrodes, wires, fluxes, etc. Suitable windshields must be provided when the wind velocity exceeds 32 km/h or 8 km/h in case of GMAW and gas shields FCAW.

8.19 DOCUMENTATION

The CONTRACTOR shall establish and maintain procedures for identifying full details of welding, welding procedures, records of inspection, non destructive testing and compliance with the Specification for each welded joint and repair in the completed works. The following documents shall also be generated:

- ➢ NDT Plan
- ➢ NDT Drawings
- ➢ Certification Package for each NDT drawing.

The weld number shall be marked against all welds on the works. The weld number shall be in accordance with a scheme of numbers shown on the shop drawings. Welds shall mark their welds with their identifying number. Tractability records shall correlate weld number with:-

a) Welder Identity Number

b) Date Welded

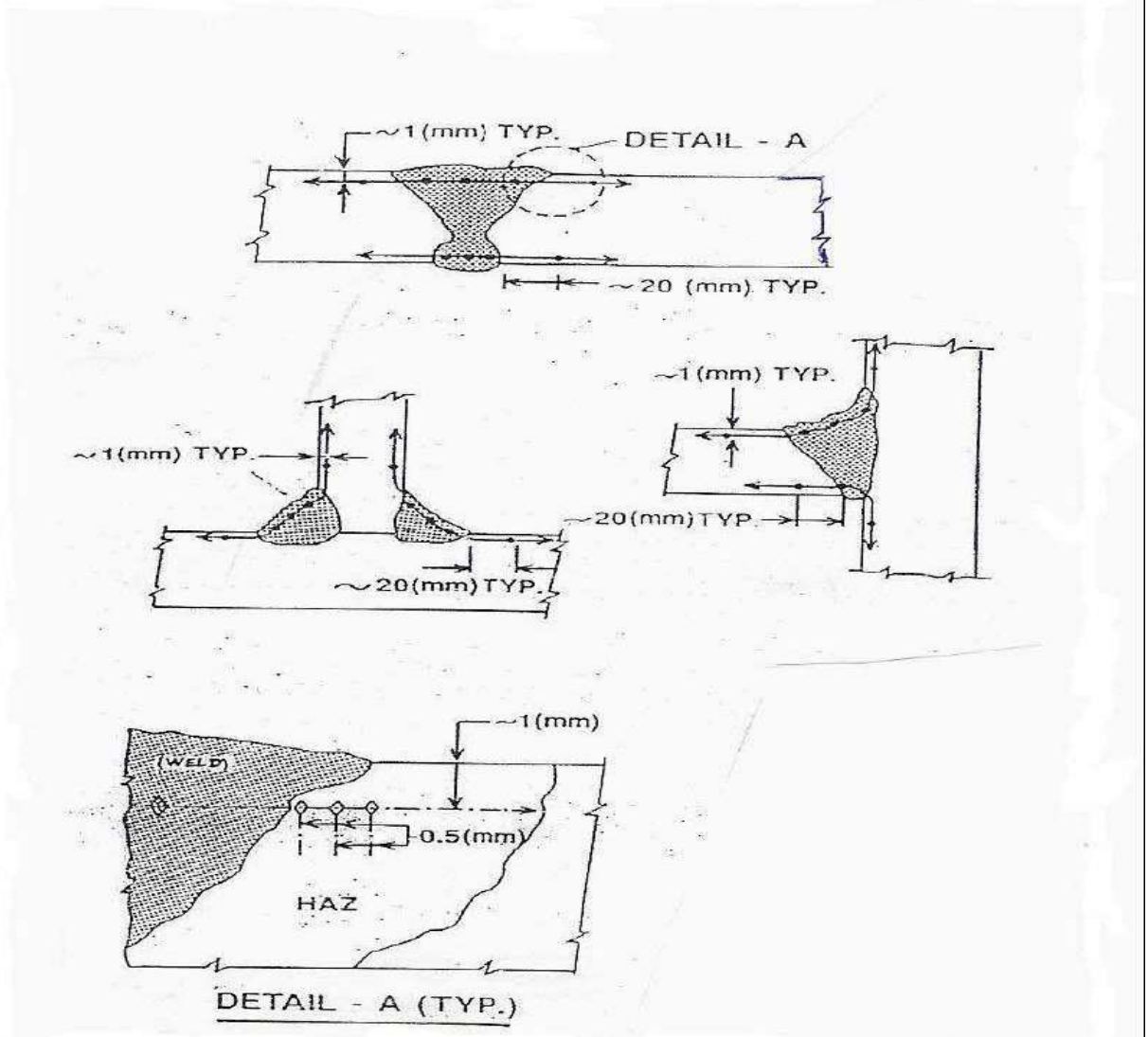
c) Material Piece and Heat Numbers

d) Qualified Welding Procedure Specification Identity
e) Non-Destructive Test Records
f) Fit Up Inspection Record
g) Repair Records where applicable

APPENDIX-A HARDNESS TESTING

1. Hardness testing shall be performed along the transverse shown in Fig. 1.
2. The required hardness survey shall be tested on a suitable macro section machined from the same welded test assembly made to determine other weld joint properties. However, an additional bead-on-plate weld pass shall be made on the original weld test assembly for the purpose of determining maximum hardness at the toe of the weld. This pass shall be made wit the lowest permissible heat input and lowest interpass temperature applicable to the cap passes of that procedure.
3. The hardness surveys shall be prepared and tested in accordance with ASTM E 92, Standard Test Method for Vickers Hardness (Hv) of Metallic Materials, using an applied load of 10 kgf.
4. Indentations shall be made along all of the transverses shown for each type of weld tested, approximately 1 mm below the surface of the base metal. In the weld metal, a minimum of three equally spaced indentations along the traverse shall be made. In the heat-affected zone, the indentations shall start as close to the fusion line as practicable. A minimum of three readings shall be taken at each weld toe. One additional reading shall be taken at least 20 mm from the fusion line at each traverse to represent unaffected base metal.
5. The maximum hardness value obtained from any indentation shall not exceed 350 Hv. If any single value exceeds 350 Hv and a retest adjacent to the failed test also produces one or more values exceeding 350 Hv, the procedure qualification test has failed these requirements and a new test weld shall be made with some planned modifications of essential variables or techniques (change heat input, increase preheat, later bead sequence, etc.) and retest.

6. A photo macrograph of the hardness test section shall be included in the PQR clearly showing the hardness impressions.
   Fig.1


~1 (mm) TYP.
DETAIL - A
~20 (mm) TYP.
~1(mm) TYP.
~20(mm) TYP.
~1(mm) TYP.
~20(mm) TYP.
~1(mm)
(WELD)
0.5(mm)
HAZ

DETAIL - A (TYP.)

SECTION 9

SCOPE OF WORK FOR PAINTING

9.1 General

This specification shall be applicable for all the work covered by the contract, and without prejudice to the various standards & codes of practice etc. Contractor shall complete the work in all respects with the best quality of materials and workmanship and in accordance with best engineering practice and instructions of the Engineer-In-Charge.

9.2 Scope

This specification covers as a minimum, the requirements for supply of all primers, paints, epoxy and all other material required for surface preparation, epoxy coating / painting, selection and shop / field painting on compressors, columns, drums, ducts, electrical panels, equipments, fittings, handrails, heat exchangers, ladders, machinery, motors, platforms, pipes / piping, pumps, stacks, staircases, steel structures including structural works, supports, external and internal protection of storage tanks for all services, valves, vessels, walkways, painting of identification marks, painting under insulation for carbon steel and stainless steel as specified, over insulation surface of equipments and pipes wherever specified, etc. Contractor is required to prepare painting/coating procedures in consultation with the paint / coating manufacturers based on the requirements of this specification as a minimum. The same is to be submitted to Company for review and approval. Contractor shall provide paint formulation for a design life of 5 years for various painting / coating systems, considering the requirement of this specification as a minimum. Contractor shall take up painting / coating jobs under the supervision of the paint / coating manufacturer for all or for critical applications as specified in the contract document. Contractor shall arrange the same at no extra cost and time to Company. Uninsulated austenitic stainless steel, plastic and/or plastic coated material, non-ferrous materials like aluminium, galvanized piping, gratings shall not be painted unless otherwise specified. All abrasive material, brushes, rollers, spray guns, equipments / tools required for cleaning and blasting, scaffolding materials shall be suitable, in good order and in sufficient quantity and shall be arranged by Contractor at site.

9.3 APPLICABLE CODES

The following codes and standards shall be followed for the work covered under this specification.

SIS-05-5900 / ISO- 8501-1	Swedish Standards for surface preparation (ST.2, ST.3, SA1/2/3, SA2½.
BS-4232	Surfaces finish or blast cleaning for painting
SSPC-SP2/3/5/6/7/10	American standards equivalent to Swiss standards for surface preparation.
IS: 5	Color coding
IS: 101	Methods of test for ready mixed paints and enamels.
IS: 161	Heat resisting paints
IS: 2074	Specifications for ready mixed red oxide zinc chrome primer
IS: 2339	Aluminum paint for general purposes in dual container.
IS: 2379	Color code for identification of pipelines
IS: 2932	Specification for manual, synthetic, exterior (a) undercoating (b) finishing
ASA A 13.1	Scheme for identification of piping systems.

9.4 SURFACE PREPARATION

To achieve the maximum durability, one or more of following methods of surface preparation shall be followed, depending on condition of steel surface and as instructed by the Engineer-In-Charge.

- Manual or hand tool cleaning.
- Mechanical or power tool cleaning.

Blast cleaning to Swedish Standard SIS 055900 / ISO – 8501 - 1.All tank bottoms (both sides) and inside tanks shall be blast cleaned to SA 2½ of Swedish Standard. Mill scale, rust and foreign matter shall be removed by suitable means to ensure that a clean and dry surface is obtained. Blast cleaning shall be done wherever specified or recommended by the paint manufacturer. The minimum acceptable standard in case of hand tool cleaning shall be St.2 and power tool cleaning shall be St.3 as per Swedish Standard SIS55900-1967 and in case of blast cleaning it shall be SA 2½ as per Swedish Standard SIS 055900 / ISO-8501-1. Irrespective of the method of surface preparation, the first coat of primer must be applied on dry surface immediately and in any case within four hours of cleaning of surface. However, during unfavourable weather conditions, blasting and painting shall be avoided as far as practicable.

9.5 PAINTS

Paint System Paint system shall be generally in line with tables 1 to 5 attached to these specifications. For the environments not specified in these tables, the paint system shall be decided with approval of Company which shall be based on suitability of paint system with the application / environment.

Paint Manufacturer: The paint manufacturer's instructions shall be followed as far as practicable at all times.

The paints shall conform to the specifications given in table 1, 2.1 and 2.2 and shall be of first quality in their products range of any of the following recommended manufacturers:

i) Asian Paints (India) Ltd.
ii) Berger Paints Ltd.
iii) Bombay Paints.
iv) Godless Nerolac Paints Ltd.
v) Jenson & Nicholson paints Ltd.
vi) Shalimar Paints
vii) Sigma coatings

Storage All paints and painting material shall be stored only in rooms to be provided by Contractor. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separate from adjacent building. A signboard bearing the words "PAINT STORAGE – NO NAKED LIGHT- HIGHLY INFLAMMABLE" shall be clearly displayed outside.

Colour code: Colour code scheme intended for identification of the individual group of pipeline, equipment, tanks shall be decided with the approval of Company. The system of color-coding shall consist of a ground color and color bands superimposed on it. OISD and TAC requirements shall be complied with.

General Requirements for Paint Application;

a) All primers and finish coats should be cold cured and air-dried unless otherwise specified.

b) Selected chlorinated rubber paint should have resistance to corrosive atmosphere and suitable for marine / saline environment.

c) All paints shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, application, curing and weather conditions. The surface preparation, quality and workmanship should be ensured.

d) Technical data sheets for all paints shall be provided.

e) After surface preparation, the primer should be applied to cover the crevices, corners, sharp edges etc.

f) The shades of successive coats should be slightly different in colour in order to ensure application of individual coats, the thickness of each coat and complete coverage should be checked as per provision of this specification.

g) No coat shall be applied until the preceding coat has dried. No coat shall be forced dried under conditions, which will cause blistering, cracking, formation of pores, wrinkling, or detrimentally affect the condition of the paint.

h) Paint shall be protected from rain, condensation, contamination, snow and freezing until dry to the fullest extent practicable.

i) Where paint has been damaged in handling and in transportation, the repair of coating prior to pre-erection shall be done.

9.6 IDENTIFICATION OF VESSELS, PIPING etc.

a. Equipment number shall be stencilled in black or white on each column, equipment, machinery (insulated or uninsulated) and vessel after painting. Line number in black or white shall be stencilled on all the pipelines at more than one location and as directed by the Engineer-in-Charge.

Size of letters printed shall be as below;

Column & Vessels – 150 mm (high)

Compressor, pump and other machinery - 50 mm (high)

Piping - 40-150 mm

b. An arrow shall indicate flow direction as directed by the Engineer-In Charge.

c. Colours of arrows shall be black or white and in contrast to the colour on which they are superimposed.

d. Following items shall be painted for camouflaging if required by Company by two coats of selected finishing paint as per defence requirements and as per instruction by the Engineer-In-Charge.
   - ❖ All columns
   - ❖ All tanks in off sites
   - ❖ Large vessels
   - ❖ Spheres
   - ❖ Painting & Numbering of Oil Storage Tanks

e. Painting of oil storage tanks shall include without being limited to, painting of outside surface of tank shell, roof & attachments, inside of roof, roof supporting structure, ladder and platform, walkway, handrail, inside of shell above the liquid level or as specified in engineering datasheets, camouflaging wherever specified, etc. the underside of all tank bottom (soil side) shall be blast cleaned to remove mill scale etc. to the entire satisfaction of the Engineer-in Charge.

f. The quality of surface preparation of steel parts of outside shell and roof, floating roof top shall be as per standard Swedish norm SIS-05-5900 SA 2½ finish or equivalent and other steel surfaces such as inside of roof, roof structure, ladder, platform, inside of floating roof tank above maximum liquid level as per Swedish norm SIS-05-5900 SA 2 finish or equivalent.

g. Inside surface treatment of tanks, which are to be painted with epoxy paint shall have a finish as per Swedish norm SIS-05-5900 SA 3.

h. Tank number, safe filling height, over filling height, reference height, etc. shall be painted on the tank to avoid operating errors.

i. Numbers shall be painted at three positions, 1200 apart, below roof level and should be clearly visible from outside the dyke / roadside. The size of the letters shall be half meter high and 50 mm thick.

j. Additionally at the foot of the staircase of each tank, tank number, safe filling height, reference height and name of the product being handled, capacity of the tank should be painted clearly. The size of the letters shall be 150 mm and 12 mm thick. Luminous paint shall be preferred.

9.7 INSPECTION AND TESTING

All painting materials including primers and thinners brought to site by Contractor shall be accompanied by manufacturer's test certificates.

The Engineer-in-Charge at his discretion may call for tests for paint formulations. Contractor shall arrange to have such tests performed at his cost.

The painting work shall be subject to inspection by the Engineer-in-Charge at all times. In particular, following stage wise inspection will be performed.

a) Surface Preparation

b) Primer Application

c) Each Coat of Paint

Contractor shall provide facilitate for the above inspection / tests by providing manpower and relevant instruments such as standard thickness measurement instrument with appropriate range(s) for measuring dry film thickness of each coat, surface profile gauge for checking of surface profile in case of blast cleaning, holiday and pinhole detectors and positector whenever required for checking in case of immersion conditions.

Whenever required by Company, Contractor shall provide the paint manufacturer's expert technical services at site. This service should be free of cost and without any obligation to Company.

Final inspection shall include measurement of paint dry film thickness, check of finish and workmanship. The thickness should be measured at as many points / locations as decided by the Engineer-in-Charge and shall be within + 10% of the dry film thickness.

Contractor shall rectify any defect noticed during the various stages of inspection to the entire satisfaction of the Engineer-In-Charge before proceeding further.

Irrespective of the inspection, repair and approval at intermediate stages of work, Contractor shall be responsible for making good any defects found during final inspection

Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint shall be applied to make-up the DFT specified without any extra cost to Company.

Surface preparation & application should start only after availability of paint / coating manufacturer's inspectors and supervisors at site, wherever asked by Company.

Strict quality control shall be observed and implemented by the contractor and all record shall be maintained.

All work performed under the specification shall be inspected to:

a. Confirm environmental and surface temperature requirement are met (including compliance with all the manufacturers recommendations).
b. Verify all surface preparation and cleanliness prior to coating and adjacent surface are properly protected.
c. Confirm the field adhesion test requirement and the adequacy of each coat prior to application of the next coat.
d. Confirm areas found to contain runs, over spray, holidays, roughness or signs of improper application are being repaired or recoated in accordance with the manufactures recommendations. e) Confirm all work, including repairs, complies with the requirement of this specification. The finish coat shall be inspected over its entire surface for adequate total dry film thickness as specified. Defective areas shall be marked with greaseless, contrasting coloured chalk for further repairs.

9.8 WARRANTY / GUARANTEE

Contractor shall guarantee that the chemical and physical properties of paint materials used are in accordance with the specification contained herein / to be provided during execution of work and the paint / coating system so provided shall meet their specified design life.

TABLE NO. : 1 PRIMERS

SNO	DESCRIPTION	P-2	P-4	P-6
1	Technical Name	Chlorinated rubber Zinc Phosphate primer	Etch Primer / wash primer	Epoxy Zinc phosphate primer
2	Type and composition	Single pack, air drying chlorinated rubber based medium plasticised with unsaponifiable plasticizer, pigmented with Zinc phosphate.	Two pack polyvinyl butyral resin medium cured with phosphoric acid solution pigmented with Zinc tetroxy chromate.	Two-component polyamide cured epoxy resin medium, pigmented with Zinc phosphate.
3	Volume Solids (approx.)	40%	7-8%	40%
4	DFT (Dry film thickness) per coat (approx.)	40-50 µ	8-10 µ	40-50 µ
5	Theoretical covering capacity in m2 per coat per litre (approx.)	8-10	8-10	8-10
6	Weight per litre in kgs/litre(approx.)	1.3	1.2	1.4
7	Touch dry at 30°C (approx.)	30 minutes	2 hrs.	After 30 mins.
8	Hard dry at 30°C (approx.)	Min : 8 hrs. Max : 24 hrs.	Min : 2 hrs. Max : 24 hrs.	Min : 8 hrs. Max : 3-6 months
9	Over coating interval (approx.)	Min : 8 hrs. Max : No limitations	Min : 4-6 hrs. Max : 24 hrs.	Min : 8 hrs. Max : 3-6 months
10	Pot life at 30°C for two component paints (approx.)	Not applicable	Not applicable	8 hrs.

TABLE NO. : 2.1 FINISH PAINTS

SL.NO	DESCRIPTION	F-2	F-3	F-6	F-7
1	Technical Name	Acrylic polyurethane finish paint	Chlorinated rubber based finish paint.	finish paint. Epoxy-High build finish paint	High build coaltar epoxy coating.
2	Type and composition	Two pack alipathatic isocynate cured acrylic finish paint	Single pack plasticised chlorinated rubber based medium with chemical and weather resistant pigments.	Two pack polyamide/ polyamine cured epoxy resin medium suitably pigmented	Two pack polyamide cured epoxy resin blended with coaltar medium, suitably pigmented.
3	Volume Solids (approx.)	40%	40%	62%	65%
4	DFT (Dry film thickness) per coat (approx.)	30-40 µ	40 - 50 µ	100-125 µ	100-125 µ
5	Theoretical covering capacity in m2 per coat per litre (approx.)	10-13	8-10	5-6	5.2 – 6.5
6	Weight per litre in kgs/litre(approx.)	1.3	1.2	1.4	1.5
7	Touch dry at 30°C (approx.)	1 hr.	30 minutes	3 hrs.	4 hrs.
8	Hard dry at 30°C (approx.)	Overnight	8 hrs.	Overnight	48 hrs.
9	Over coating interval (approx.)	Min : Overnight (12hrs.) Max : unlimited	Min : Overnight Max : unlimited	Min : Overnight Max : 5 days	Min : 24 hrs. Max : 5 days
10	Pot life at 30°C for two component paints (approx.)	6-8 hrs	Not applicable	4-6 hrs.	4-6 hrs.

TABLE NO. : 2. FINISH PAINTS

SL.NO	DESCRIPTION	F-8	F-9	F-11	F-12
1	Technical Name	Self priming type surface tolerant High Build Epoxy coating (complete rust control coating)	Inorganic Zinc Silicate coating	Heat resistant synthetic medium based two packs Aluminium paint suitable up to 250°C dry temperature.	Heat resistant silicone Aluminium paint suitable up to 500°C dry temperature
2	Type and composition	Two pack epoxy resin based suitably pigmented and capable of adhering to manually prepared surface and old coating	Two pack air drying self-curing solvent based Inorganic Zinc silicate coating	Heat resistant synthetic medium based two pack Aluminium paint suitable up to 250°C.	Single pack silicone resin based medium with Aluminium flakes.
3	Volume Solids (approx.)	72%	60%	25%	20%
4	DFT (Dry film thickness) per coat (approx.)	100-125 µ	65 – 75 µ	20 – 25 µ	20 – 25 µ
5	Theoretical covering capacity in m2 per coat per litre (approx.)	6.0-7.2	8-9	10-12	8-10
6	Weight per litre in kgs/litre(approx.)	1.4	2.3	1.2	1.1
7	Touch dry at 30°C	3 hrs.	30 minutes	3 hrs.	30 minutes

	(approx.)				
8	Hard dry at 30°C (approx.)	24 hrs.	.12 hrs.	12 hrs.	24 hrs.
9	Over coating interval (approx.)	Min : 10 hrs. Max : 6 months	Min : 8 hrs. at 20°C and 50% RH. Max : Unlimited	Min : 16 hrs. Max : Unlimited	Min : 16 hrs. Max : Unlimited
10	Pot life at 30°C for two component paints (approx.)	90 minutes	4-6 hrs.	Not applicable	Not applicable
11	Temperature Resistance	--	--	250°C	500°C

F-14 Specially formulated polyamide cured coal tar epoxy suitable for -45°C to 125°C for application under insulation.
F-15 Two pack cold cured epoxy phenolic coating suitable for -45°C to 125°C for application under insulation.
F-16 Epoxy siloxane Amercoat 738.

TABLE 3: FIELD PAINT SYSTEM FOR NORMAL CORROSIVE ENVIRONMENT (FOR CARON STEEL, LOW TEMPERATURE CARBON STEEL & LOW ALLOY STEEL)

ALL NORMAL CORROSIVE AREAS SUCH AS OFFSITES, EXTERNAL SURFACES OF UNINSULATED COLUMNS, VESSELS, HEAT EXCHANGERS, BLOWERS, PIPING, PUMPS, TOWERS, COMPRESSORS, STRUCTURAL STEEL WORKS, RCC CHIMNEY WITH OR WITHOUT REFRACTORY LINING INSIDE CHIMNEY (ALL ENVIRONMENTS), EXCLUDING TANK TOPS, FLARE LINES, D.M. PLANTS, INTERIOR OF TANKS ETC. FLARE LINES FOR NORMAL CORROSIVE ENVIRONMENT ALSO TO BE PAINTED AS PER TABLE 4.

SL.NO	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM			REMARKS
			FIELD PRIMER	FINISH PAINT	TOTAL DFT IN MICRONS (MIN.)	
3.1	-90 TO –15	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT	NONE	65-75	No over coating to be done. Follow rear procedure only on damaged areas of preerection/pre-fabrication primer / coating F-9
3.2	-14 TO 60	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT + 2 COATS OF P-2 @ 40µ DFT/COAT 2 X 40 = 80	2 COATS OF F-3 @40µ DFT/COAT 2 X 40 = 80	225	
3.3	61 TO 80	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER	1 COAT OF F-6 @100µ	245	

			1 COAT OF F-9 @ 65-75µ DFT/COAT + 2 COATS OF P-6 @ 40µ DFT/COAT 2 X 40 = 80	DFT/COAT		
3.4	81 TO 250	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT 3	3 COATS OF F-11 @20µ DFT/COAT 3 X 20 = 6	125	
3.5	251 TO 400	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT.	2 COATS OF F-12 @20µ DFT/COAT 2 X 20 = 40	105	
3.6	401 TO 500	SSPC-SP-10	REPAIR AS PER 7.2.2	2 COATS OF F-12 @20µ DFT/COAT 2 X 20 = 40	80	

NOTE 1 : FOR MS CHIMNEY WITH OR WITHOUT REFRACTORY LINING 3.3, 3.4 AND 3.5 SHALL BE FOLLOWED.

NOTE 2 : FOR EXTERNAL SURFACES OF RCC CHIMNEY : 2 COATS OF F-6 @ 100µ DFT/COAT TO OBATIN 2 X 100 - 200µ DFT SHALL BE APPLIED AFTER MAKING SURFACE PREPARATION AS PER GUIDELINES .

NOTE 3 : WHEREVER REQUIRED S.NO. 3.3 SHALL BE USED FOR –14°C TP 80°C AND S.NO. 3.2 WILL BE DELETED.

TABLE 4: FIELD PAINT SYSTEM FOR CORROSIVE ENVIRONMENT (FOR CARON STEEL, LOW TEMPERATURE CARBON STEEL & LOW ALLOY STEEL)

FOR ALL CORROSIVE AREAS ABOVE GROUND WHERE H2S, SO2 FUMES OT SPILLAGES OF ACID/ALKALI/SALT ARE LIKELY TO COME IN CONTACT WITH SURFACES SUCH AS EXTERNAL SURFACES OF UNINSULATED COLUMNS, VESSELS, HEAT EXCHANGERS, BLOWERS, PIPING, PUMPS, TOWERS, COMPRESSORS, FLARE LINES, STRUCTURAL STEEL ETC.

SL.NO	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM			REMARKS
			FIELD PRIMER	FINISH PAINT	TOTAL DFT IN MICRONS (MIN.)	
4.1	-90 TO –15	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT	NONE	65-75	Repair of pre-erection / prefabrication primer shall be done wherever damage is observed. Surface
4.2	-14 TO 80	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT + 1 COAT OF P-6 @ 40µ	1 COAT OF F-6 @100µ DFT/COAT + 1 COAT OF F-2 @ 40µ	245	

			DFT/COAT	DFT/COAT		required only for repairing of damaged preerection / fabrication primer.
4.3	81 TO 400	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT	2 COATS OF F-12 @20µ DFT/COAT 2 X 20 = 40	105	
4.4	401 TO 500	SSPC-SP-10	REPAIR AS PER 7.2.2	2 COATS OF F-12 @20µ DFT/COAT 2 X 20 = 40	80	

TABLE 5: TABLE 5: FIELD PAINT SYSTEM FOR NORMAL CORROSIVE ENVIRONMENT (FOR CARBON STEEL, LOW TEMPERATURE CARBON STEEL & LOW ALLOY STEEL) EXTERNAL SURFACES OF UNINSULATED COLUMNS, VESSELS, HEAT EXCHANGERS, BLOWERS, PIPING, PUMPS, TOWERS, COMPRESSORS, FLARE LINES, STRUCTURAL STEEL ETC.

EXPOSED TO SPILLAGE OR FUMES OF HCL, H2SO4, SALTY WATER, WATER IMPINGEMENT, AND CHLORIDE ETC.

SL.NO	DESIGN TEMPERATURE IN °C	SURFACE PREPARATION	PAINT SYSTEM			REMARKS
			FIELD PRIMER	FINISH PAINT	TOTAL DFT IN MICRONS (MIN.)	
5.1	-90 TO –15	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT	NONE	65-75	Repair procedure of pre-erection/ fabrication primer shall be followed. No overcoating is allowed. Surface preparation is required only for repairing of damaged preerection/fabrication primer.
5.2	-14 TO 60	SSPC-SP-10	REPAIR OF PRE-FABRICATION PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT + 1 COAT OF P-6 @ 40µ DFT/COAT 2 X 40 = 80	2 COATS OF F-3 @40µ DFT/COAT: 2 X 100 = 200 + 1 COAT OF F2 @ 40µ DFT/COAT	345	
5.3	81 TO 400	SSPC-SP-10	REPAIR OF PRE-FABRICATION	2 COATS OF F-12 @20µ	105	

			PRIMER 1 COAT OF F-9 @ 65-75µ DFT/COAT.	DFT/COAT 2 X 20 = 40		
5.4	401 TO 500	SSPC-SP-10	REPAIR AS PER 7.2.2	2 COATS OF F-12 @20µ DFT/COAT 2 X 20 = 40	80	

SECTION 10

SCOPE OF WORK FOR MECHANICAL

10.1 SCOPE OF WORK:

This scope of work is general in nature & forms the guidelines for the detailed engineering, supply installation and commissioning of the plant as per OISD 156- Latest Edition .

Contractor shall also ensure that the equipment/packages are complete with base plate/supports, foundation bolts, companion/blind flanges, local instruments along with pre-fabricated inter-piping, tubes, cablings etc. in all respects as per drawings including PID's, functional specifications, and codes and standards etc.

The scope of Contractor shall also include any item including activities and supply of all such materials, not listed, but considered necessary for the desired performance, safe operation of the complete system and successful completion of the job in all respects in safe manner.

Equipment and facilities shall be designed in accordance with Mechanical design basis and relevant Data Sheet, functional/ standard specifications, codes and standards

Contractor's scope of work shall include but not limited to:

- Preparation of drawings and documents,
- Design and engineering as per the respective codes and specification
- Sizing, Selection and Procurement of mechanical equipment
- Fabrication of vessels/ tanks at shop/ site NDT of equipment, vessels and tanks as required.
- Construction of civil foundation for equipment
- Inspection and Testing at shop and at site as required
- Transportation and supply of all material and equipment, tools and tackles,
- Cleaning and Painting at site, as required.
- Installation, commissioning, testing handing over of mechanical facilities in all respect at site.
- As built drawings, specifications, operation and maintenance manuals, vendor data books etc.
- The description and requirements contained in the specifications are concise by necessity and cannot include all details. However, it is the responsibility of the Contractor to execute the job in accordance with specifications and good engineer operation of all the facilities at site.

10.2 DESIGN & DETAILED ENGINEERING, PROCURREMENT:

All design, detail engineering, procurement and other related activities etc shall be performed by Contractor.

Contractor shall carry out all mechanical design, detailed engineering including design calculations, preparation of technical data sheet, drawings including fabrication drawings for all static and rotary equipment and various packaged items based on the input enclosed in this document and shall update all the documents based on equipment vendor's/ manufacturer's inputs and Company's comments. Any material required due to the above, shall be in Contractor's scope without any cost and time implication to Company.

Contractor shall perform the work as per this document, and other engineering documents prepared by Contractor and duly approved by Company during execution of the works, and shall ensure to meet in to, the requirements stipulated in the documents concerning design and detailed engineering, fabrication, construction, manufacturing, assembly, testing, supply, erection, pre-commissioning trials, commissioning and performance guaranty test of all the mechanical equipment as per the scope of work.

Elevation of equipment/ tanks/ vessels etc. shall be finalized during detailed engineering based on NPSH calculation of the pumps, line sizes and final pipe routings after obtaining Company's approval. However, minimum elevation shall be 300 mm from FFL. Contractor shall also ensure that NPSH available for pumps is at least one meter over

Effective capacities wherever indicated in the tank data sheets shall be considered between overflow nozzle and outlet nozzle.

Design and construction of the foundations, if required, shall be as per manufacturer data and drawings approved by Company.

All welds on equipment shall be stress relieved.

Company's review shall not relieve Contractor from the responsibilities of design and

Erection and installation of equipment including accessories on the foundations, alignment and grouting shall be the responsibility of the contractor..

Contractor shall prepare the bill of materials based on Company's approved documents for all the equipment under Contractor's scope of supply.

Contractor shall submit the technical portion of all purchase orders being released on vendors/ manufacturers (including sub-vendors) for Company's approval prior to placement of order. Contractor shall carry out the following activities for procurement of Equipment/ Packages:

- Contractor shall prepare the enquiry specifications/ documents for each Equipment/ Packages and materials to be purchased including spare parts for erection and commissioning, special tools and tackles and also provide list of spare parts for one year normal operation (or as required by Company).
- Equipment data sheets as indicated in relevant API codes and as specified in functional specifications shall be submitted for company's review.
- Contractor shall prepare the detailed Purchase Requisition/ Specification for each Equipment/ Packages. Contractor shall obtain the approval of Purchase Specification of all Equipment/ Packages and items from Company/ Company's representative before placement of order on vendors selected by them.
- Contractor shall carry out the detailed review, checking and approval of equipment engineering and all drawing and technical data from Vendors for equipment and materials, to ensure adequacy and consistency with the design, safety and operability requirements.
- Contractor shall ensure that, Inspection and tests are conducted for all equipment at Vendor's shops as specified in bid document, Functional Specifications, Codes and Standards etc.
- Contractor shall include all the Commissioning spares as required in the equipment vendor's scope. Contractor shall procure the same from the equipment vendors and make it available well before commissioning of Equipment. In case, any additional spares are consumed during commissioning the same to be provided by the contractor at no additional cost to the Company/ Company's representative.
- For all Equipment/ Package, vendor shall furnish the list of special tools/ tackles required for assembly and maintenance. Such tools/ tackles shall be supplied by the vendor and shall form part of firm supply of Contractor. Unless otherwise specified, for multiple identical Equipment/ Packages (2 or more), at least Two (2) sets of special tools and tackles shall be supplied else one set shall be supplied if the number of equipment/ package is one.

- Contractor's scope shall include complete supply, transportation of equipment package from vendor's shop to site, Receipt of material at site, Handling at site and arrange for storage at site as per Bid Document.

Contractor shall submit copy(s) of filled in datasheets, etc. for Company's approval and post order manufacturer drawings (as per the MDR/ VDR as applicable) to Company for information/ review. Vendor/ manufacturer documents requiring Company's approval shall be identified later by mutual agreement.

All the material being procured by Contractor shall be inspected and witness tested at the respective vendor's/ manufacturer's works by third party inspection agency as per approved QAP. However, Company reserves the right to depute its authorized representative in addition to third party inspection agency.

10.3 SCOPE OF SUPPLY:

Further to Contractor's scope of supply mentioned in General Project details, followings are also to be noted.

All statutory approvals required for design, supply, and installation and commissioning of individual equipment and for system as a whole are included in contractors' scope of work.

Painting on all the fabricated equipment shall be done at shop prior to dispatch as per the requirement given in the attached specifications. Final painting shall be done at site as per painting specification. All other bought out items already painted as per manufacturer's standard practice shall be repainted at site as per painting specification enclosed elsewhere in this document.

10.4 MATERIAL HANDLING FACILITIES:

A material handling study encompassing all site activities shall be performed to determine the requirements for lifting devices such as davits, lift points, monorails, trolleys and hoists (including dedicated lifting facilities that may be required for major items of equipment). Suitable arrangements shall be provided for lifting and movement of

equipment components housed inside the shed/room. The study shall determine the most appropriate method to transfer material in and around the site. The study shall also consider the requirements for operation and maintenance of the equipment. The material handling philosophy as indicated in design criteria shall be considered for the study. In addition to the requirements of the materials handling study the material handling facilities shall also be able to access the various areas of the site and provide the appropriate means for operations and maintenance in those areas.

Various material handling facilities (minimum) envisaged at site are:
Installation of EOT\crane in Fire Water Pump House. Electrically operated overhead traveling crane of capacity of min 10 Ton capacity with arrangements for longitudinal travel, cross travel and hoisting of the load of approved make and as per relevant Indian standard shall be provided at Fire water pump house. Minimum indicative capacity and location of EOT required to be installed has been minimum indicated above. The capacity shall be at least 110% of material weight to be lifted. EOT shall be designed in accordance with Mechanical design Basis.

10.5 PUMPS: Pumps shall be designed in accordance with Mechanical design Basis.

10.6 DIESEL ENGINE:

Diesel Engine shall be designed in accordance with Mechanical design Basis.

10.7 ERECTION

All the equipment, materials and items covered in Contractor's scope of supply shall be erected on the respective equipment foundation indicated in the relevant to the foundation drawings as per sound engineering practice. All power, control and signal cables shall be safely and suitably terminated. Hook-up shall include all Mechanical, Piping, Fire Fighting, Electrical and Instrumentation systems including supply of material.
Any damage of equipment during the erection shall be rectified/ replaced by Contractor without any additional cost and time.

The erection procedure of Contractor shall have facilities for consecutive hydro testing, painting etc., without affecting any other construction activities.

All the equipment shall be painted as per painting specification after completion of erection

On completion of successful erection and painting of all the equipments and on getting Company's approval, Contractor shall carry out pre-commissioning of the equipments installed by him to the entire satisfaction of Company.

All necessary precautions as required for the safety of the plant and personnel during erection works like gas cutting, welding etc., shall be taken by Contractor.

SECTION 11 SCOPE OF WORK FOR INSTRUMENTATION

11.1 SCOPE OF WORK

Table No.3

Sl.No.	Item/Description	OT-II	HOJ-1	HOJ-2	BJ-1	BJ-2

1	Control system for Main pumps, Jockey Pumps, Foam pumps, level transmitter for foam tank as well as water storage tanks	Yes, As per requirement				
1	Control systems for electrical operated Tower Monitor, Foam Monitors, Deluge valve of Jumbo Nozzles monitors	Hard wired relay based control panel				
2	Control systems for Fire Fighting system	Redundent PC-PLC Based control Panel	Redundent PC-PLC Based control Panel.	Redundent PC-PLC Based control Panel.	Redundent PC-PLC Based control Panel.	Redundent PC-PLC Based control Panel.
3	Power Source for PANEL	UPS	UPS	UPS	UPS	UPS
2	Cable tray	Yes	Yes	Yes	Yes	Yes
3	Control system for gas detection	Yes	Yes	Yes	Yes	Yes
4	Control system for fire detection	Yes	Yes	Yes	Yes	Yes

6	Instrument Data sheets	Yes required
7	Instrumentation & automation design specification	Yes required
8	System Architectural drawing	Yes required
9	System I/O sizing	Yes required
10	Instrument list	Yes required
11	Material Take-off	Yes required
12	Cable Schedule	Yes required
13	Loop Drawings	Yes required
14	Control and technical & building arrangement drawing	Yes required
15	Cable routing drawings	Yes required

This scope of work is general in nature & forms the guidelines for the detailed engineering, supply installation and commissioning of the plant as per OISD-156

The purpose of instrumentation is to provide a system for monitoring, controlling and operation of the firefighting system with safety and environmental consideration.

Detailed Scope of work for all interfacing jobs shall be prepared and submitted along with schedules for all shutdowns if any, as a part of the detailed engineering, for HDCs review and approval. P&ID for all systems and sub-systems, layout drawings, Purchase

Specifications, Data sheets, Logic Diagrams, SAFE Chart, etc. shall be a part of the detailed engineering scope of the Contractor.

Broadly, the Contractor's scope of work shall be as listed below regarding instrumentation and control system on a Contractor basis.

- Design and Engineering.
- Procurement, Inspection, FAT, Shop testing, Integration Testing,
- Erection, Installation, Field Calibration/ testing, pre-commissioning and Commissioning
- Certifications, Warranty certificate, O&M manual, test/inspection report, calibration report

And shall be inclusive of all the necessary hardware & software requirements for the effective hook-up & interfacing between systems and sub-systems to make the systems complete and safe for operation and maintenance. All the necessary hardware & installation materials like junction boxes, tubing/piping, tube trays, Instrumentation fittings/ (miniature) valves/ (miniature) manifolds, interconnecting cables, cable glands, plugs, cable trays, supports, MCTs, stanchions, supports, connectors, terminals and termination accessories, etc., shall be the part of scope of work and supply of the LSTK Contractor.

The description and requirements contained in this specification are indicated in brief is project related and may not include all details. However, it is the responsibility of the Contractor to develop approval procedure and execute the job on a package basis in accordance with the job specifications, relevant codes, and good engineering practices for smooth and successful operation of the plant.
Any activity required for satisfactory completion is deemed to be contractor's scope.

11.2 DESIGN AND ENGINEERING:

Contractor shall carryout design and engineering of instrumentation and controls as per OISD-156. Documents and drawings listed in Table - 1 & 2 shall be prepared by Contractor and furnish to HDC (Design Engineering Consultant) for approval as a minimum. Any other document/ drawing not listed but required to carry out the

engineering and for integration of other equipment packages sub-ordered by Contractor shall also be prepared and furnished to HDC for approval.

The control panel related documents such as functional schematics, ladder diagram, instrument details summary, general arrangement and layout of control panel cable schedule etc. for various sub-package items shall be prepared by the Contractor.

The design and engineering work shall also include review of post-order vendor drawings and documents for all instruments. The Contractor shall thoroughly review and approve vendor drawings for all instruments including sub-package items, before forwarding to HDC. Only the approved drawings duly stamped and signed by a competent engineer of Contractor shall be sent to HDC for review.

11.3 PROCUREMENT, SHOP TESTING, SUPPLY:

Engineering for procurement shall include

a) Preparation of purchase requisitions.
b) Evaluation of offers received from different vendors
c) Review/ approval of vendor drawings

All equipment supplied shall be of field proven quality, both with respect to design and materials. No prototype instrument or instrument of an experimental nature shall be offered or supplied. No instrument requiring special maintenance of operating facilities shall be offered or supplied, as far as possible.

The Purchase Requisition (PR) for each item shall be prepared by using instrument datasheet/ standard formats and shall contain all information including the make and model No. of each instrument, in addition to the material specification. Where the datasheet/ standard format is not available for any of the instruments. Contractor shall use ISA format for the same. In case, the Contractor intends to follow his own format for those instruments for which the data sheet/ standard format are not included in the bid document, it shall necessarily contain all information as in ISA format, as a minimum.

11.4 INSTALLATION, FIELD TESTING/ CALIBRATION & COMMISSIONING:

Contractor shall carry out installation of all instruments as described in “Specification for material installation, testing and commissioning” enclosed in the bid specification.

This activity shall include but not limited to installation of all field instruments, installation of junction boxes, interconnection between instruments and junction boxes, laying of single pair, multi pair cables from field to control room, laying of power supply cables from control room / switchgear room to the field, tagging and pair/core identification of all field cables including cables to and from MCC. The cables shall be ferruled and terminated in the cabinet inside the control room and further cabling/ wiring between the various cabinets as per the requirement.

11.4.1 Testing & Calibration

Testing of impulse lines, instrument air lines, pneumatic signal tubes and instrument cables including special instruments/ items if any, and calibration of all instruments shall be carried out as per the requirements in as specified in doc. “Specification for material, installation, testing and commissioning,” enclosed in the bid specification.

All arrangement for shop testing and calibration of all instruments shall be carried out by the Contractor. HDC or its authorized representative may carry out stage/ final inspection of any or all items of work/ supply before shipment/ installation.

11.5 SCOPE OF SUPPLY & OPERATION PHILOSOPHY:

- Engineering, Supply, Installation commissioning of Tower Monitors and Jumbo nozzles.
- Engineering, Supply, Installation commissioning Control Panel for Gas detection system, Fire detection system & Status Indication.
- All additional instruments and controls necessary for safe, efficient operation and safety which are not listed specifically in the document but which are required as per vendor’s experience/ recommendation and for safety of the plant operation, shall be in the scope of Contractor.

11.6 CONTROL ROOM

11.6.1 Hardwired relay based Control Panel

- The operation, monitoring & data acquisition shall be based on hardwired relay based control panel.

- Control panel shall have OPEN/CLOSE/STOP Status Indication Lamps and push buttons for OPEN/CLOSE/STOP Operation.
- Supply and distribution of 230V UPS Power, DC Power, etc. for Control panel.

11.6.2 SCADA

SCADA System for remote monitoring.

11.6.3 FIELD

- Supply, installation, testing and commissioning All Tower monitors, Jubmo Nozzles at all site.
- All installation and erection materials such as impulse tubing/ piping, pipe fittings and valves, tubing, tube fittings, cable tray/duct and tray supports, all types of consumable and accessories or mounting all instruments and instrument supports etc.
- All type of cables such as signal, alarm, control and power between:
  - ✓ Individual instrument to field junction box
  - ✓ Equipment/ instrument to panel
- Panel to field junction box
- Field junction boxes to main control room
- Supply and laying of Main cable duct/ perforated tray/ angle tray/ structural supports, consumable for cable laying and routing within the plant and up to control room. Preparation of duct/trench (RCC/ Buried) from main control room to plant battery limit as applicable.
- Junction boxes and cable glands for different types of signals such as intrinsically safe 4-20 mA DC, switch contacts, alarm, power etc.
- GI earthing strip for earthing of all instrumentation items like junction boxes, instruments, etc. to electrical earthing strip in the plant.

- ❖ Earth pit for system earth & general earthing for instruments, equipments, junction boxes etc. as required as per Control system Vendor's recommendation and Code of Practice.
- ❖ Any other erection material necessary for installation and commissioning of instruments and special instrument items.

11.6.4 Instrumentation Scope of Work for Fire Fighting system for all four jetties.

i) Sequential auto start of fire water pumps shall be based on set pressure signals derived from fire water header pressure instruments. 3 nos. of pressure transmitters shall be mounted on fire water header and connected to main fire alarm fire alarm control panel. 2oo3 voting logic shall be considered for reliability of signals. The logic shall be performed in main fire alarm panel. Main fire alarm control panel shall be PC-PLC based located in main control room. Pressure transmitters shall be provided on fire water header for auto start of jockey pumps, diesel engine pump. Diesel storage tanks for individual fire water pumps shall be provided with level transmitter & indicators. Tripping of diesel engine fire water pumps on low diesel tank level to be provided. Level transmitter shall be provided for fire water tanks. Electromagnetic Flow transmitter with local indication shall be provided to measure water flow of single & multiple pumps during various performance trails.

ii) Local fire alarm control panel shall be provided in pump house. Local fire alarm control panel shall consist of start/stop push buttons, Status indication, local remote switches, selector switches for fire water pumps. Annunciator & hooter shall be considered for audio & visual alarms of reservoir/tanks levels, low pressure alarms etc. Digital indicator for header pressure, reservoir level.

iii) Main fire alarm control panel shall be provided for automated starting of Fire water pumps based on lead lag logic in control room. This shall be fail safe, Dual redundant PC-PLC based as per standard spec. enclosed elsewhere in bid documents.

Main fire alarm control in control room shall be with monitor to multiple display graphics. Separate annunciator (hard wired) shall be provided on operator console for audio Visual alarms. Start stop Push buttons, selector switches, Auto manual switches for pumps shall be provided on operator console.

Graphic screens shall display fire water pump house P&ID, diesel tank levels & alarms, reservoir levels & alarms, pumps status & alarms, pressure indication alarms, fire detection, gas detection, foam monitors, tower monitor, jumbo nozzles (open/close) system graphics. Area wise graphic displays for manual call point's status with pop-ups etc.

All pump running indication to be displayed in SCADA system.

DRAWINGS/ DOCUMENTS REQUIRED FROM CONTRACTOR

The following documents (as is applicable) shall be submitted by the Contractor for Owner's information/ review/ records:

TABLE – 1

S No.	DESCRIPTION	REMARKS
1.	Material Requisition and Purchase Requisition for all instruments	MR=I, PR= A
2.	Documents/ drawings list and schedule	A
3.	Logic/ Ladder diagrams (with write-up)	A
4.	Functional schematics	A
5.	GAD and layout of Control Panel/ Gas Panel	A
6.	Instrument details summary	I
7.	Cable/ Tubing schedule	A
8.	Instrument duct/ tray/ trench layout	I
9.	Instrument location, JB location	I
10.	Instrument Index	I
11.	Sub-vendor list	A
13.	Instrument/ Detector/ MCP mounting details	I
14.	Certificates (statutory/ test calibration/ inspection)	I
15.	Installation, operation and maintenance manuals	I

16.	As-built drawings/ documents	A
17.	Instrument power consumption	I
18.	Sub vendor drawings/ documents	A
19.	Power supply distribution/ feeder requirement	A
20.	Instrumentation/ Electrical interface details	I
21	MCT layout	I

A = For Approval,

I = For Information

TABLE – 2

SNo.	DESCRIPTION	REMARKS
1.	Fire Control panel front layout	
2.	Gas detection panel front layout	
3.	Power consumption list & UPS requirement.	
4.	Control room equipment/ panel foundation details	
5.	Input / Output list	
6.	Loop wiring diagram	
7.	Power supply distribution	
8.	System grounding details	

9.	Bill of Material	
10.	Acceptance procedures for Testing, Installation & Commissioning	
11.	Test certificates of system from engg. / operating / testing Agency.	
	Certificates from statutory authorities.	
12.	Catalogues including Technical information / literature.	
13.	Installation details.	
14.	Operation and maintenance manuals.	

Any other drawings / document not mentioned in the above list but required during erection, commissioning, or for reconfiguration of system, shall also be supplied by the vendor.

A = For Approval, **I** = For Information

SECTION-12

Technical specification for Mandatory Spares

12.1 GENERAL

This section defines the philosophy for mandatory spares to be supplied by the bidder as part of the contract.

Bidder shall supply mandatory spares for applicable equipment & instrument.

The list below indicates the minimum requirement for mandatory spares for all discipline. However additional mandatory spares if and as recommended by all systems shall be supplied by bidder without any cost and time implication.

Bidder shall also refer notes given at the end of this section for working out mandatory spares requirement.

Mandatory spares for all discipline) shall be quoted and included in by bidder in base lump sum price as per the following table:

A. MECHANICAL & PIPING:

Contractor shall supply minimum mandatory spares as follows:

Item Description	Qty. Required
1.CENTRIFUGAL PUMPS	
Set of Shaft sleeves	1 for each pump (each tag no.)
Set of case wear rings	1 for each pump (each tag no.)
Set of impeller wear rings	1 for each pump (each tag no.)
Set of bearings (drive end)	1 for each pump (each tag no.)
Set of bearings (non drive end)	1 for each pump (each tag no.)
Set of throat bushing	1 for each pump (each tag no.)
Set of throttle bushing	1 for each pump (each tag no.)
Set of gaskets	6 for each pump (each tag no.)

Set of labyrinths –as applicable	1 for each pump (each tag no.)
Set of oil seals-as applicable	2 for each pump (each tag no.)
Set of deflectors	1 for each pump (each tag no.)
Set of impeller nut	1 for each pump (each tag no.)
Set of coupling spares fixable elements, bushes,1 for each pump (each tag no.) pins, packing etc.	1 for each pump (each tag no.)
Set of mechanical seals complete assembly	1 for each pump (each tag no.)
2.PIPING	
Non Metallic Pipes	5% of total installed quantity
Fittings and Valves for Non Metallic Pipes	10% of total installed quantity
Gaskets	10% of total installed quantity
Fasteners	10% of total installed quantity
3.DIESEL ENGINE	
Air filter element	2 sets of each engine
Fuel oil filter	2 sets of each engine
Lube oil filter	2 sets of each engine
4. TANKS/ PRESSURE VESSEL	
Gaskets	100% of total installed quantity
Fasteners	10% of total installed quantity

B. ELECTRICAL

Contractor shall supply minimum mandatory spares as follows:

Contractor : 1 no. of each rating
MV fuse : 10% of each rating..
Overload relay with single
Phasing preventer : 10% of each rating.
Indication lamps : 10% of total installed quantity
MCBs &ELCB : 10% of each rating for each item.
MCCBs : l no. of each rating.
Timers : One number of each rating.
1000 V Electronic/digital (push button type) driven megger : 01 no.

Earth tester kit, complete with electrodes, connecting cable: 01 no.
Digital Multimeter : 04 no.
Digital tong tester for A.C Measurement: 01no.
Electrical drill machine (portable): 01no.
Hand drill machine : 01no.
Electrician tool kit which consist of screw driver set, electrician pliers, nose pliers, wire cutter & stripper, Fuse Puller, pipe Wrench, Insulated screw driver with line tester, spanners box, ring and open end type, battery voltmeter, hydrometer etc. : 02 set

500 V Motor Tester : 01no.

Manual crimping tool with accessories for cable size upto185 MM2 : 01no.

Hydraulic crimping tool with accessories for cable up to 500 MM2 : 01no.

Working bench with vice : 01no.

C. INSTRUMENTATION

SL.NO.	PART DESCRIPTION	QUANTITY REQUIRED
1.0	**Field instruments**	
1.1	Field indicators	10% subject to minimum 1 No. of each type
1.2	Burn back thermocouple sets	100% of each type
1.3	Transmitters (smart) for temperature	10% subject to minimum 1 No. of each type
1.4	Smart positioned	10% subject to minimum 1 No. of each type
2.0	**Line mounted instruments**	
2.1	Control valves	
2.2	i. Proximity type limit switches ii. Air filter regulator iii. Diaphragm actuators	10% subject to minimum 1 No. of each typ
2.3	Self-actuated regulators	
	• Bonnet gaskets/ Special gaskets • Gland packing	10% subject to minimum 1 No. of each type
3.0	**Installation material**	
3.1	Cables	100% of the length of each type
3.2	Cable glands	10% subject to minimum one number,

		whichever is higher, of each type
4.0	Local panel (Note-5	
4.1	Items like all items like push buttons, indicators, hand switches, lamps, holders, fore panel alarm etc. mounted in the local panel	Loose supply of 10% subject to minimum two numbers, whichever is higher, of each type
4.2	Hardwired micro-processor based receiver instruments including indicators, totalizer, recorder etc	Loose supply of 10% subject to minimum one number, whichever is higher, of each type
4.3	Fuses	100% of each type

a. Bidder shall provide consumable spares for six months operation.

b. Start up and commissioning spares as required shall be provided

NOTES:

a. The word 'TYPE' means the Make, Model no., Type, Range, Size/ Length, Rating, Material as applicable.
b. Wherever % age is identified, Bidder shall supply next rounded figure.
c. The terminology used under 'Part description' is the commonly used name of the part and may vary from manufacturer to manufacturer.
d. The above list indicates predefined mandatory spares excluding the commissioning spares, Consumables and installed engineering spares for system-oriented items. The commissioning spares and consumables shall also be part of bidder scope of supply. The installed engineering spares for system oriented items like sub-package control system, Local control panels etc. shall be as per specification given elsewhere.
e. For S.No.4, items specified are predefined mandatory spares supplied loose over and above installed engineering spares specified in job standard specification. 6. Mandatory spares shall also be applicable for instrumentation items of sub packages as per mandatory spares philosophy.

SECTION 13

Hot Work Permits

13.1 Hot Work Permits

To take up hot work for carrying out the required modification at site on existing operating jetties, the contractor shall be fully responsible to design, engineer, procure, supply fabricate, coat wrap (in case of pipeline), erect, lay piping, pre-commission, test, commission (wherever applicable) making the related area of jetties/ plants/ worksite gas free, clean and flushing with water of the complete system and whatever is necessary. The modification works shall be completed in shortest possible time and in a safe manner. The Company shall issue hot work permits only between dawn to dusk on Contractor's request keeping in view company’s production programmes, safety requirements and the Contract with the provision that the Company reserves the right to divert the Contractor's activities involved in his work programme.

It is an essential requirement that there shall be no shutdown of the operating jetty unless the situation so demands subject to approval of Company

The Contractor shall be responsible for devising methods and developing detailed procedure to realize this objective and carry out the modifications in orderly manner. The details and procedures shall be subject to Company's approval.

Contractor shall strictly comply with all safety requirements of Hot work permit during permit duration failing which Company's representative will have the right to stop Hot work and all Cost and time effect thereof shall be to Contractor's account.

Company shall not issue hot work permit at Site when critical activities or any other operation during which Contractor's working may be detrimental to the safety of the facilities are being carried out.

Any delay, rescheduling or interruption of already approved Work programme for modification works, attributable to Company on account of delay in issuing the Hot Work Permit, after the contractor having met the requirement of the hot work permit save for safety reasons of company’s facilities and personnel, shall be to Company's

account in respect of cost and time effect (if it affects the critical path) as per the provision of the Contract. Company shall be responsible for the shutdown of operating jetties and depressurization of hydrocarbon systems related to the approved shutdown.

All hot works job shall be carried out in presence of the contractor's safety officer, who shall be directly responsible for carrying out the hot work job in a safe and orderly manner.

13.2 SAFETY AUDIT BY HDC

Port may conduct safety Audits at any stage of project execution and before taking over the facilities. The audit shall be based on a protocol that covers elements which can affect the safety during execution or the safe operation of the facilities in the contractor's scope of work. The protocol shall cover documentation, process hazard analysis, fire detection and suppression system, lifesaving appliances and escape routes, operating procedures, pre-start up safety review, safe work practices, safety and shut down devices, management of change, assurances of quality and mechanical integrity, emergency response control investigation of accidents, personnel protective equipments, audit team which could be conducted by the company's personnel or any agency appointed by the Company for the purpose, accord full access to site and provide all relevant information, comply with the observations and recommendations of the audit. An indicative description of the information which may be required to be submitted by the contractor for / during the safety audit as per company norms.

- The Contractor should be required to:
  - Have in place a Safety Management System, approved by a recognized, approved authority. - Prepare a project-specific Safety Plan for each Site.
  - Implement the Safety Plans.
  - Ditto the above for Environmental Management

- Contractor should submit the above for the approval of the Company considering the requirements for the Safety and Environmental plans for execution of the Work.

SECTION 14

TECHNICAL SPECIFICATION OF CIVIL WORK

14.1 GENERAL: -

- All materials to be used in the permanent works shall be of the best quality of the kind and to the approval of the Engineer. They shall comply with the Specifications laid out in the BIS codes (referred to as IS) as revised or modified up to the date one month prior to the Tender Date unless otherwise specifically mentioned in the Tender Documents.
- Samples of materials to be supplied and used by the Contractor in the works shall be subject to the prior approval of the Engineer. For this purpose, the contractor shall furnish in advance, representative samples in quantities and in the manner as directed by the Engineer for his approval.
- Materials brought to the site, which in the opinion of the Engineer do not conform to the approved sample, shall, and if so directed by him, be removed by the contractor within 24 hours at his own cost from the site and replaced by materials of approved quality at no extra cost.
- The contractor shall produce manufacturer's test certificates for the materials procured by him. The Engineer may carry out or order any test on any of the materials as he may decide. The contractor shall, at his cost and expense, supply requisite materials for this purpose and render such assistance to the Engineer as he may require. The cost of testing will be borne by the Contractor. Further, if and as required by the Engineer, the contractor shall get the materials tested from approved laboratories at his expense and produce the test certificates for the inspection of the Engineer.
- If the Engineer is of the opinion that the materials are not suitable for use on the works; he may reject the consignment, notwithstanding the Manufacturer's certificates. The Engineer's decision regarding the suitability

of materials brought to site for use in the works shall be final and binding on the contractor, who shall remove the rejected materials from site and replace them with materials of required quality.

- In spite of approval of the Engineer of any material brought to the site, he may subsequently reject the same if in his opinion the materials have since deteriorated due to long or defective storage or for any reason whatsoever and is thereby considered unfit for use in the permanent works. Any material thus rejected shall be immediately removed from the site at contractor's cost and expense.
- All materials bought to the site shall be properly stored and preserved to ensure their quality and fitness during the course of their use in work. If the storage arrangements are not to the Engineer's satisfaction, he may direct the contractor for arranging proper storage to which the contractor shall have to comply. The materials shall be stored in adequate quantities well in advance to meet the construction schedule and shall be guarded in the manner directed by the Engineer and to his satisfaction.
- All materials used in the works shall be of the best kind and to the approval of the Engineer's Representative. The materials supplied and the workmanship shall satisfy the relevant clauses as given below and in the Bill of Quantities of the tender.

14.2 CONFORMANCE TO INDIAN STANDARDS

Except where otherwise specified all materials shall conform to the latest editions of the relevant Indian Standards published by the Bureau of Indian Standards. For manufactured or proprietary items, the manufacturers' specifications as approved by the Engineer shall be applicable.

14.3 SAMPLES

In addition to the requirements of sampling and testing of materials as specified in the Indian Standards and in these specifications, samples of the following materials shall be taken and submitted by the Contractor to the Engineer for approval in advance of the commencement of Works. The cost of all sampling and testing shall be deemed to have been included in the rates and prices in the contract.

i) Cement
ii) Aggregates

iii) Reinforcement Bars
iv) Concrete
v) Rock
vi) Admixture
vii) Water
viii) Mild steel

14.4 MATERIAL STORAGE

All materials brought to the Site for use in the Works shall be properly stored and preserved as per IS:4082 to ensure their quality and fitness during the course of their use in Works. Cement and Steel shall not be allowed to be stored in the open areas. If the storage arrangements are not to the Engineer's satisfaction he may direct the Contractor for arranging proper storage facilities, failing which the Engineer will reserve the right to reject such materials as he deems it necessary. All materials shall be stored in adequate quantities well in advance to meet the Construction Schedule.

14.5 AGGREGATES

14.5.1 General

The aggregates (coarse/fine) used for concrete work shall conform to IS: 383. The aggregates shall not contain any harmful material such as iron pyrites, coal, mica, shale, or similar laminated materials, clay, alkali, soft fragments, sea shells organic impurities in such quantity which affect strength or durability of concrete. Aggregates reactive with alkalies of cement are strictly prohibited. The maximum quantity of deleterious materials in the aggregates shall be determined in accordance with IS:2386 (Part II) and shall not exceed the limits given in the Table 1, IS:383, unless otherwise directed by the Engineer.

14.5.2 Storage of Aggregates

Aggregates shall be stored at site in suitable bins or on clean hard durable surface well drained and maintained free from all contaminations. Different aggregates shall be stored in separate compartments or heaps without intermingling.

14.5.3 Coarse Aggregates

The size, shape, quality, specific gravity, grading, soundness, crushing strength, abrasion resistance of coarse aggregate for all concreting works shall comply in all respects with IS 383.

14.5.4 Fine Aggregate

Fine aggregate for all concrete works shall be sharp and clean dry river sand free from all debris organic matter clay or other foreign material which affect the durability of concrete, and shall be subject to the Engineer's approval. Suitable allowance shall be made for bulking when measuring sand as directed by the Engineer or his Representative. Sand shall be screened and washed properly to the Engineer's satisfaction.

The size of fine aggregate shall be such that most of it passes through 4.75 mm IS sieve and not more than 10% passes through 150 micron IS sieve. It shall, when tested as per IS: 2386, conform to Zone-II for concrete works or Zone-III for road/ hardstand filling works as per Table-III, IS:383. Fineness Modulus of sand used in the work shall not be less than 2.0.

14.6 CEMENT

14.6.1 Quality, Make & Testing

Unless specifically mentioned otherwise the cement to be used in the Works shall be Ordinary Portland Cement Grade **53/43/33** conforming to **IS: 12269/IS:8172/IS:269** or Portland Slag cement confirming to **IS:455** or Portland Pozzolona Cement conforming to **IS:1489. The brand/ manufacturer of the cement shall be subjected to prior approval of the Engineer.**

The Contractor shall get approval for at least 3 brands/ manufacturers in advance so as to have an alternative brand/ manufacturer in hand in case of disruption of supply from other brand/ manufacturer.

Once the quality and brand/ manufacturer of cement to be used in the works is approved after necessary testing of the samples of each brand/ manufacturer, the Contractor shall obtain further supplies of cement from the same brand/ manufacturer. The Contractor shall furnish manufacturer's test certificate along with challan for each batch of cement to be supplied for construction purpose.

For each delivery of cement to the Site the Contractor shall forward to the Engineer a certificate to the effect that such cement was tested and analysed at the Factory and the results of such tests and analysis satisfactorily meet the specifications stipulated in the relevant Indian Standards. The supplier should also furnish the date of manufacture of the lot from which the consignment has been drawn by the Contractor. In addition, the Engineer shall be authorized to draw samples of cement from the site and reject any consignment which do not pass necessary tests and/or specifications.

During the progress of work, the following quality assurance method shall be adhered to:

14.6.1.1 Contractor shall submit the **test certificate** of each **batch** of cement received at site for construction purpose.

14.6.1.2 The Contractor shall conduct physical and chemical tests on samples from each batch of cement drawn jointly with the representative of Engineer as per relevant IS Code at the laboratory approved by the Engineer. The costs of all such tests shall be borne by the Contractor.

14.6.2 Delivery and Storage of Cement

Cement shall be transported handled and stored on the Site in such a manner as to avoid contamination or deterioration. 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 it is delivered at Site.

From the time that a consignment of cement is brought on the Site and tested and approved by the Engineer and until such time as cement is used in the Works, the Contractor shall be responsible for keeping the same in sound and acceptable condition.

If cement is to be stored in bulk containers these shall be subject to the prior approval of the Engineer and shall be large enough to contain such quantities as may be required with sufficient reserve to allow for the likely frequency of supply.

Cement stored in bulk containers shall be, in the opinion of the Engineer, adequately protected against rain, humidity, dewfall and dust, and all charging and discharging points shall be properly sealed. Aeration equipment for the bulk containers, if available, shall incorporate dehumidifiers.

If packaged cement is stored in bulk containers it shall be charged into the containers through a 5 mm mesh screen which is welded or bolted to and covers the entire feed area of the charging hopper.

Cement other than that stored in bulk shall be kept in the bags or containers in which it was delivered until use and shall be stored in a Dry Store large enough to contain such quantities as may be required with sufficient reserve to allow for the likely frequency of supply. Cement in bags or containers shall be unloaded under cover. This store shall be dry, well-ventilated, perfectly weatherproof and waterproof and shall be so situated as not to be liable to flooding and shall have a floor raised not less than 60 cm from the ground in order to protect the cement from moisture. An air space shall be left between the floor and the bottom layer of the bags. Cement bags shall be stored well away from outer walls of the store and not more than 12 bags shall be stacked in any tier. Each consignment shall be stacked separately therein to permit easy access for inspection and a record shall be kept so that each consignment may be identified by a serial number and date of delivery and used in the sequence in which it was delivered at site.

Cement shall be adequately protected at all times from rain and spray. Cement which has set or partially set and become lumpy shall not be used in the Works.

Notwithstanding the above provision, any cement which the Engineer considers has become stale or unsuitable through absorption of moisture from the atmosphere or for other reasons shall be rejected and removed from the Site at the Contractor's expense. Any cement in containers damaged so as to allow the contents to spill or to be affected by atmospheric moisture prior to opening at the time of concrete mixing shall be rejected and removed from the Site at the Contractor's expense.

14.6.3 Rejection of Cement

Any consignment or part of a consignment of cement which has deteriorated in any way or which does not otherwise comply with the specifications shall not be used in the Works and shall be removed from the Site by the Contractor at no extra cost to the Employer.

14.6.4 Identification and Records for Cement

Cement shall be stored in such a way as to permit easy identification of the

different consignments stored. Records must be maintained by the Contractor showing the date-wise receipts with consignment numbers, amounts used, and the balance.

14.6.5 Removal of Cement for use

Removal of cement from storage sheds for use in the works shall be on "First in, First out" basis.

14.6.6 Material Testing Laboratory

The Contractor shall maintain at site a material testing Laboratory with equipment and staff for testing of cement, aggregates, concrete etc. The Contractor shall furnish full details of all equipment and apparatus for such testing along with the tender.

14.7 WATER

a) Water used for mixing concrete, curing, cooling or washing of aggregate shall be clean and free from injurious amounts of oils, acids, alkalis, salt, sugar, organic material or any other substance that may be deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing concrete.

b) pH value shall not be less than 6 nor more than 7.5.

c) River water shall not be permitted.

14.8 ADMIXTURES IN CONCRETE

Admixtures may be used in concrete at contractors cost only with the approval of the Engineer and shall conform to IS:9103 and IS:2645. The Contractor shall produce test certificates from recognized laboratories before use of admixtures. The proportion of admixture to be used in concrete shall be determined by tests as directed by the Engineer.

14.9 REINFORCEMENT STEEL

14.9.1 Reinforcement Steel

Steel reinforcement bars for concrete shall be round bars complying with Grade 1 Mild Steel as per IS:432 and high yield strength deformed bars conforming with IS:1786. **The Contractor shall get approval of at least 3 brands/ manufacturers of reinforcement/ structural steel in advance so as to have alternative in hand in case of disruption of supply from the other brand/ manufacturer.**

14.9.2 Test Certificates and Tests

Test certificates must be produced by the Contractor for all steel procured by him. However, the Engineer may order specimens from each consignment to all tests, (particularly tensile, bend, re-bend tests with results) required under Indian Standards, which tests shall be carried out by the Contractor at his own cost. Notwithstanding certificates produced by the Contractor, the Engineer may reject the consignments, test results of which do not conform to the specifications, and the Contractor shall forthwith remove such material from one site.

All test pieces for such tests shall only be selected by the Engineer or his representative, and shall be removed from the parent stock/material only in the presence of the Engineer or his representative.

14.9.3 Mild Steel Binding Wire

The mild steel binding wire shall be of 1.63 mm. or 1.22 mm. (16 or 18 gauge) diameter and shall conform to IS 280 (latest revision) and shall be as approved by the Engineer.

14.9.4 Stamping or Marking

The steel shall be marked or stamped with a private mark for the purpose of identification as may be directed by the Engineer.

14.10 STRUCTURAL STEEL (GENERAL USE)

- All structural steel shall be mild steel confirming to IS:2062. The finished materials shall be free from cracks, surface flows laminations, rough and imperfect edges and any other defects. Steel shall be free from rust, scaling and pitting.
- All structural steel tubes shall confirm to IS:1161.
- All fixtures permanently embedded in concrete structure shall comply with relevant IS codes for stainless steel of marine grade.

- Hexagon head bolts, screws and nuts of product grade-C (Part I) shall conform to IS:1363.
- All electrodes required for metal are welding shall be covered electrodes and comply with the requirement of IS:816 and IS:814 unless otherwise specified.
- In addition to any mechanical tests required under previous clauses herein above, the Engineer may require the contractor to carry out independent tests of the material. The cost of such testing shall be borne by the contractor.

14.11 CAST IRON

Cast iron shall generally comply with IS:210 'Gray Iron Castings'. Trench covers and gratings, if specified shall comply with the requirement of IS:1726 and shall be of heavy duty type unless otherwise indicated.

14.11.1 Cast Steel

All steel castings shall be in accordance with IS: 1030-Steel Castings for General Engineering Purposes. The steel unless otherwise specified conform to Grade-I of this Code and shall satisfy all tests as specified in IS: 1030.

14.11.2 Stainless Steel

All stainless steel materials shall conform to AISI:316 grade quality and fasteners shall be manufactured to IS:1367 (Part 14).

14.12 FASTENERS

Bolts and nuts of all types shall conform to IS: 1367. Black bolts and nuts shall conform to IS:1363.

High strength Structural Bolts and Nuts shall conform to IS:3757 and IS: 1367 (Part-III) of Property Class 8.8 (Low Carbon Steel with additives).

Plain washers shall conform to IS: 2016 and taper washers for I beams shall conform to IS: 5374.

Countersunk head screws shall be in accordance with IS: 1365 and shall conform to product Grade-A as specified in the revision IS: 1367- Part II (Second Revision).

14.13 ELECTRODES

Electrodes for metal arc welding shall conform to the requirements of IS: 816 and IS:814 and shall be of best heavy coated type and of approved make.

14.14 QUICK RELEASE MOORING HOOKS AND CAPSTANS (REMOTE CONTROLLED)

The mooring system shall comprise remote controlled mooring hooks fitted with electrically operated capstan and vendor has to approve, it will be located at HOJ-1&2 as detailed below :

a) Mooring Dolphins

- Hooks assembly with S.W.L. per hook of not less than 80 T with flame proof electrical control for remote as well as local push button operation and with facility for local manual release.
- Integral mounting base for total load of 240 T

b) Berthing Dolphins

- Hooks assembly with S.W.L. per hook of not less than 80 T with flame proof electrical control for remote as well as local push button operation, and with facility for local manual release.
- Integral mounting base for total load of 160 T

Both power and control cables are to be supplied, laid and connected up from the point of QRMH and control room. Cables shall be laid on FRP cable trays suitably fixed on hand rails. All fittings and fixtures shall be of stainless steel. The hook release control panel is to be erected in the control room of the control building and connected up. The control cables from the hooks are to be terminated at this control box. The power cables for capstans are to be terminated in the switch room of substation. Provision for control cables have been made for 8 core and 12 core cables. If different, the tenderer is to indicate the type of cables, detailed drawings, schematic and catalogue of all equipment and to be made available.

14.14.1 Quick release hooks

The hooks shall be released with an electrically operated solenoid and a back

indication to the control box that the hooks have been released. The hooks shall also be provided with a local manual release trip lever. All electrical Equipment shall be flameproof type, and also weatherproofed.

The assembly shall be provided with necessary shock absorbing mechanism and also a means of returning the hook to normally working locked position, once the hook is released.

The assembly shall be complete with mounting bolts and template with necessary drawings to provide the inserts in the foundation.

Detailed catalogue/ drawings shall be submitted along with the tender.

After award of work, erection drawings, wiring drawings and necessary test certificate shall be made available. After completion of work, documentation shall be made available. Documentation shall cover GA drawings, foundation drawings, wiring and schematic drawings.

Satisfactory working of the system shall be guaranteed for a period of 12 months from date of handing over.

14.15 HIGH DENSITY POLYETHYLENE PIPES

HDPE pipes where specified shall conform to IS: 4984.

14.16 OTHER MATERIALS :

All materials not herein fully specified and which may be offered for use in the Works shall be of first class quality and of such kind as is generally used in first class work. The Engineer shall have the right to determine whether all or any of the materials offered or delivered for use in the Works are suitable for the purpose and his decision shall be final and binding on the Contractor.

14.17 EQUIVALENT MATERIALS :

The materials specified with brand/proprietary name shall only be used and the

Contractors shall take procurement action well in advance so that the specified materials are available in time. However, if the specified material is not available as confirmed by the supplier or his agent to complete relevant work within the stipulated time, alternative material to the approval of the Engineer would be allowed with price adjustment as applicable. Engineer's decision shall be final and binding in this regard.

14.18 WORKMANSHIP

The following specifications shall cover the general workmanship requirements for earthwork in excavation and filling, concreting and formwork etc. These specifications will supplement other specifications provided in the sections for Particular Applications.

14.18.1 CONCRETE

The following specifications cover the general workmanship requirement for concrete and concreting.

14.18.1.1 Standards

All concreting work shall be done in accordance to the provisions of IS: 456, and other allied standards mentioned in IS:456, unless otherwise specified or directed by the Engineer.

14.18.1.2 Work to be Provided for by the Contractor

The work to be provided for by the Contractor under this specification, unless otherwise specified shall include but not be limited to the following :

Furnish all labour, supervision, services including facilities as may be required under statutory labour regulations, materials, forms, templates, supports, scaffolds, approaches, aids, construction equipment, tools and plants, transportations, etc. required for the Works.

Except where it is excluded from the Scope of Contract, Contractor shall prepare progressively and submit for approval detailed drawings and Bar Bending Schedules for reinforcement bars showing the positions and details of spacers, supports, chairs, hangers etc.

Design and prepare working drawings of formwork, scaffolds, supports, etc. and submit for approval.

Submit for approval detailed drawings of supports, templates, hangers, etc. required

for installation of various embedments like inserts, anchor bolts, pipe sleeves, frames, joint seals, openings etc.

Submit for approval detailed schemes of all operations required for executing the work, e.g. Material handling, Concrete mixing. Placement of concrete, Compaction, curing, services, Approaches etc.

Design and submit for approval, concrete mix designs required to be adopted on the job.

Furnish samples and submit for approval results of tests of various propertie of the following : (Cost of Samples and testing to be borne by the Contractor)

The various ingredients of concrete Embedment's Joint seals

For supply of certain materials normally manufactured by specialist firms, the Contractor may have to produce, if directed by the Engineer, a guarantee in approved proforma for satisfactory performance for a reasonable period as may be specified, binding both the manufacturers and the Contractor, jointly and separately.

14.18.1.3 No Concreting without Approval

The Contractor shall inform the Engineer, sufficiently in advance, whenever any section of the Work is ready for concreting. He shall accord all necessary help and assistance to the Engineer Representative for all checking required. No section of the Works shall be concreted without the approval of the Engineer.

14.18.1.4 Design Mix Concrete

Where Designed Concrete mix is specified, the Contractor shall calculate the proportions of the ingredients as per IS:10262 and IS 456 and carry out several trial mix batches to determine the final proportions by weight of cement, aggregate and water necessary to produce the concrete having the desired characteristics. The Contractor shall submit to the Engineer the following data for his approval:

1. The proportion of cement, coarse aggregate, fine aggregate and water so determined.
2. The sieve analysis of aggregates, which he proposes to use in the works.
3. Full details of preliminary tests on each class of concrete, and on the ingredients of each class ofconcrete.
4. For each trial mix, the mix strength - determined as the average of 10 test specimens - shall exceed the specified target strength specified below.
5. All calculations relevant to the design of each grade of concrete mix.

The proportions may also be determined by experiments at an approved laboratory so as to give the greatest possible strength and density for the mix. The density of concrete shall not be less than 2.40 t/cum.

The proportions adopted shall be subject to the approval of the Engineer and they must be determined for each different type of aggregate the Contractor proposes to use and whenever the Contractor proposes to change to a different type of aggregates during the course of the work. Proportions of a particular grade of concrete, once established by mix design and exhaustive trial mixes, shall not be altered on any account without the express approval of the Engineer.

The concrete mix shall be designed for values of target mean strength not lower than those indicated in Table below.

Grade of Concrete	Target mean strength(N/sq.mm.) after 28 days
M 40	**48.25**

14.18.1.5 Minimum Cement Content and Maximum Water Cement Ratio

The concrete mix shall comply with the minimum cement content and maximum water cement ratio as given in the Table below.

Grade of Concrete	Minimum Cement Content (Kg/Cu.M.)	Maximum Water Cement Ratio
M 40	**430**	**0.45**

The minimum cement content specified above are from considerations of durability of the structure and do not necessarily represent the contents of cement to be actually used for the design of the mix.

14.18.1.6 Proportioning of Concrete

Proportioning shall mean the determination of proportion of various ingredients to be used to produce concrete of required strength, workability, durability and other desired properties.

Preliminary mix design shall be established well ahead of the start of the Concreting

working work. The Engineer shall verify the strength of the concrete mix before sanctioning its use. Any such verification and/or sanction by the Engineer shall not absolve the Contractor of his responsibility to achieve the prescribed strength and other requirements of the mix.

If, during the execution of the work, cube tests show less than the desired strength, the Engineer shall order fresh trial mixes to be made by the Contractor and these shall be at the Contractor's cost. No claim shall be entertained for such changes in concrete mix.

Variations in cement consumptions shall be taken into consideration for material reconciliation.

14.18.1.7 Density of Concrete

For each grade of concrete, suitable proportions of sand and sizes of coarse aggregate shall be selected to obtain the maximum density as practicable. This is to be determined by mathematical means, laboratory tests, field trials and changes in gradation of aggregate.

14.18.1.8 Water-Cement Ratio of Concrete

Water-cement ratio of a mix which is specified and approved by Engineer shall be maintained. The water content of the aggregates shall be determined frequently during the progress of the Work, and the amount of mixing water entered at the mixer adjusted as directed by the Engineer so as to maintain the specified water-cement ratio. Maximum water-cement ratio of the concrete shall be governed by figures given in IS: 456 latest revision.

14.18.1.9 Consistency

The concrete shall have a consistency such that the workability of the fresh concrete is suitable for the conditions of handling and placing, so that after compaction it surrounds all reinforcements and completely fills the formwork.

14.18.1.10 Slump

The slump as determined according to IS: 1199 shall be within the following limits:

Degree of Workability	Slump in mm.		Type of Construction
	Min.	Max	

		.	
Medium	40	80	Reinforced Foundations, walls and footings.
Medium	25	75	Plain footings, substructure walls, etc.
Medium	50	100	Reinforced beams, columns, walls, etc.
High	150	180	Bored Piles.

14.18.1.11 Batching

In proportioning concrete, the quality of both cement and aggregate should be determined by weight. Where the weight of cement is determined on the basis of weight of cement per bag, a reasonable number of bags should be weighed separately from the aggregates. Water should be either measured by volume in calibrated tanks, or weighed. Any solid admixture that may be added, may be measured by weight; liquid and paste admixtures by volume or weight.

All measuring equipment should be maintained in a clean, serviceable condition, and their accuracy periodically checked. Batching plant when used shall conform to IS:4925 and shall be accurately calibrated.

Except where it can be shown to the satisfaction of the Engineer that supply of properly graded aggregate of uniform quality can be maintained over the period of the work, the grading of aggregate should be controlled by obtaining the coarse aggregate in different sizes, blending them in the right proportions when required, the different sizes being stocked in separate stock piles.

The grading of coarse and fine aggregate should be checked frequently as specified by the Engineer to ensure that the specified grading is maintained.

The Water-cement ratio for any particular mix shall be maintained constant at its specified and approved value. Depending upon weather conditions, the moisture content in fine and coarse aggregate shall be determined (in accordance with IS: 2386) at intervals specified by the Engineer and the amount of water added shall be adjusted to compensate for any variations in the moisture content of the aggregates. Suitable adjustments in the weight of aggregates shall be made to allow for variation in weight due to variation in moisture content. For nominal mixes only, the amount of surface water may be estimated from the values given in IS: 456 in the absence of exact data.

No substitutions in materials used on the work or alterations in the established proportions, except as permitted in the above paragraph shall be made without additional tests to show that the quality and strength of concrete are satisfactory.

14.18.1.12 Exposure

Exposure condition for concrete in this work shall be considered as "severe".

14.18.1.13 Sampling and Testing for Strength

Sampling, testing and acceptance of concrete shall be in accordance with IS:456.

14.18.1.14 Mixing

The concrete shall be mixed in approved type of automatic weigh batching plant of suitable capacity (to IS: 4925) or tilting or non-tilting type stationary mixers (to IS: 1791) or truck mixers of approved make and design. Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer, the concrete shall be remixed. Workability of the concrete shall be controlled and checked at frequent intervals by testing as per IS:1199. **Calibration of the Batching Plant shall have to be done prior to commencement of the work, and subsequently, not less than two times during production of concrete. The frequency of calibrations to be carried out during the work shall be decided by the Engineer.**

The mixing time shall be about 2 minutes or as decided by the Engineer.

All records and charts for mixing operations shall be prepared as directed by the Engineer and shall be submitted to him.

14.18.1.15 Remixing of Concrete

Concrete or mortar which has commenced to set shall not be remixed with additional cement or water and in no circumstances shall such concrete or mortar be used in the Works.

14.18.1.16 Transporting Concrete

Concrete shall be transported as rapidly as possible from the place of mixing to the place of final deposit. Concrete shall be transported by methods which prevent adulteration, segregation or loss of cement content and which ensure that the concrete is of the required workability at the point and time of placing.

14.18.1.17 Preparation of Concreting

Before concreting commences forms shall be carefully examined for any damage due to accident or repeated use. Any such damage is to be thoroughly repaired to the

satisfaction of the Engineer.

The surfaces of the forms in contact with concrete shall be thoroughly cleaned. The insides of the forms shall be treated with a coating of an approved substance (oil for instance) to obviate adhesion, and where further necessary to prevent absorption from the concrete, the forms shall be thoroughly wetted shortly before concreting is commenced.

For concreting work on the ground, the ground shall first be excavated. The excavated ground shall be compacted thoroughly by mechanical means. A binding layer of 75 mm thick M-15 concrete shall be provided over the compacted ground, to the approval of the Engineer.

14.18.1.18 Depositing Concrete

a) Concreting for Piles : Specifications for concreting for piles are as given in the specifications for piles.

b) For other works : As soon as possible the concrete shall be deposited directly in the forms. Concrete shall not be allowed to fall through a height greater than 2 m.

14.18.1.19 Vibrating Concrete

Concrete used in the Works except for the concrete laid in piles shall be vibrated by means of approved form/immersion type vibrators.

Immersion Vibrators designed to operate with vibratory element submerged in concrete and having a frequency of at least 8000 cycles per minute (when submerged in concrete) shall be used. The number of vibrators used shall be sufficient to consolidate the concrete properly within ten minutes after it is deposited in the forms. Vibration shall be stopped immediately after the concrete has been compacted thoroughly and ceases to decrease in volume.

The use of mechanical vibrators complying with IS: 2505, IS: 4656 for compacting concrete is recommended. Wherever vibration has to be applied externally, the design of the formwork and the disposition of vibrators shall receive special consideration to ensure efficient compaction and to avoid surface blemishes. Care shall be taken to avoid segregation and excessive vibration.

14.18.1.20 Surface Treatment

All concrete surfaces shall be free from blemishes and shall be reasonably smooth and true. Any fins occurring at form work joints shall be removed and air holes filled with mortar after obtaining approval from the Engineer.

14.18.1.21 Curing

Concrete shall be protected during hardening from the direct sun rays and drying winds.

Immediately, after pouring concrete all exposed surfaces shall be protected by screens of thick matting or other suitable material which are to be kept wet throughout for a minimum period of seven days after depositing concrete.

14.18.1.22 Work in Extreme Weather Condition

During extreme weather conditions the concreting shall be done as per procedure set out in IS: 7861.

14.18.1.23 Commencement of Concreting

No concreting shall be commenced in any portion of the Works until the programme and preparation have been approved and permission given by the Engineer that the concreting in such portion of the Works may commence.

14.18.1.24 Intervals During Concreting

The schedule for depositing of concrete is to be so arranged that no face of concrete shall be left more than 20 minutes before concrete is deposited against it. Pauses for meals, changes of shifts etc. and the distribution of the concrete among the positions where work may be proceeding simultaneously must therefore be carefully organized to ensure that the above –mentioned interval is not exceeded.

14.18.1.25 Construction Joints

In-situ concreting shall be carried out continuously up to vertical construction joints, the position and arrangement of which shall be predetermined by the Engineer, other specifications of IRC 21-1987 shall be followed.

14.18.1.26 Concrete not to be Disturbed

Care shall be taken not to disturb the concrete by direct or indirect loading, striking of shutters or otherwise, until it has hardened sufficiently. In this regard Engineer's decision shall be final and binding.

14.18.1.27 Records of Concreting

An accurate and up-to-date record showing dates, times, weather and temperature conditions when various positions of the works were concrete will be kept by the Engineer and shall be counter-signed by the Contractor or his representative. If the Contractor fails to sign the Engineer's record it shall be regarded as correct and binding on the Contractor.

14.18.2 FORMWORK

14.18.2.1 General

The Contractor shall prepare, before commencement of actual work, designs and working drawings for formwork and centering and get them approved by the Engineer. The form work shall conform to the shape, grade, lines levels and dimension as shown on the drawings.

Materials used for the formwork inclusive of the supports and centering shall be capable of withstanding the working load and remain undistorted throughout the period it is left in service. All supports and scaffolds should be manufactured from structural or tubular steel except when specifically permitted otherwise by the Engineer.

The centering shall be true to vertical, rigid and thoroughly braced both horizontally and diagonally. Rakers are to be used where forms are to support inclined members. The forms shall be sufficiently strong to carry without undue deformation, the dead weight of the concrete as a liquid as well as the working load. In case the Contractor wishes to adopt any other4 design criteria, he has to convince the Engineer about its acceptability before adopting it. Where the concrete is vibrated, the formwork shall be strong enough to withstand the effect of vibration without appreciable deflection, bulging, distortion or loosening of its components. The joints in the formwork shall be sufficiently tight to prevent any leakage of slurry or mortar.

To achieve the desired rigidity, the bolts, spacer blocks, tie wires and clamps as approved by the Engineer shall be used but they must in no way impair the strength of concrete or cause stains or marks on the finished surface. Where there are chances of these fixtures being embedded, only mild steel or concrete of adequate strength shall be used. Bolts passing completely through liquid retaining walls/slabs for the purpose of securing and aligning the formwork shall not be used.

The formwork shall be such as to ensure a smooth uniform surface free from honeycombs, air bubbles, bulges, fins and other blemishes. Any blemish or defect found on the surface of the concrete must be brought to the notice of the Engineer immediately and rectified free of charge as directed by him. For exposed interior and exterior concrete surfaces of beams, columns and wall, plywood or other approved from shall be thoroughly cleaned and tied together with approved corrosion-resistant devices.

Rigid care shall be exercised in ensuring that all column forms are plumb and true and thoroughly cross braced to keep them so. All floor and beam centering shall be crowned not less than 8 mm in all directions for every 5 metres span. Unless specifically described on the drawings or elsewhere to the contrary, beveled forms 25 mm by 25 mm shall be fixed in the formwork at all corners to provide chamfering of the finished concrete and be secured sufficiently at lift joints to prevent bulges and offsets.

Temporary opening for cleaning, inspection and for pouring concrete shall be provided at the base of vertical forms and at other places, where they are necessary and as may be directed by the Engineer. The temporary openings shall be so formed that they can be conveniently closed when required, during pouring operations without leaving any mark on the concrete.

All parts of the forms shall be thoroughly cleaned of old concrete, wood shavings, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish, loose concrete, chippings, shavings, saw dust, etc. shall be scrupulously removed from the interior of the forms before concrete is poured Compressed air jet and/or water jet along with wire brushes, brooms, etc. shall be used for cleaning.

The inside surface of the formwork shall be taken that oil or other compound does not come in contact with reinforcing steel or construction joint surfaces. The formwork will be inspected just prior to placement of concrete and re-done wherever necessary.

14.18.2.2 Formwork: Design

The formwork shall be so designed and erected that the forms for slabs and the sides of beams, columns and walls are independent of the soffits of beams and can be removed without any strain to the concrete already placed or affecting the remaining formwork. Removing any props or re-propping shall not be done except with the specific approval of the Engineer. If formwork for column is open and built up in section, as placing of concrete progress wedges, spacer bolts, clamps or other suitable means shall be provided to allow accurate adjustment and alignment of the formwork and to allow it to be removed gradually without jarring the concrete.

14.18.2.3 Inspection of Forms

Casting of concrete shall start only after the formwork has been inspected and approved by the engineer. The concreting shall start as early as possible within 3

(three) days after the approval of the formwork and the same shall be kept under constant vigilance against any interference. In case of delay being three days, a fresh approval from the Engineer shall be obtained.

14.18.2.4 Removal of Forms

Before removing any formwork the Contractor must notify the Engineer in advance to enable him to inspect the concrete if he so desires.

The Contractor shall record on the drawing or in any other approved manner, the date on which concrete is placed in each part of the work and the date of which formwork is removed there from and have this record checked and countersigned by the Engineer regularly. The Contractor shall be responsible for the safe removal of the formwork and any work showing signs of damage through premature removal of formwork or loading shall be rejected and entirely constructed by him without any extra cost to the Employer. The Engineer may however instruct to postpone the removal of formwork if he considers it necessary.

14.18.2.5 Tolerance

The formwork shall be so made as to produce a finished concrete, true to shape, lines, levels, plumb and dimensions as shown on the drawings subject to the following tolerances unless otherwise specified in this Specification or drawings or directed by the Engineer:

a) Sectional dimension + 5 mm, - nil

b) Plumb 1 in 1000 of height + 3 mm before any deflection has taken place.

The tolerance given above are specified for local aberrations in finished concrete surface and should not be taken as tolerance for the entire structure taken as a whole or for the setting and alignment of formwork, which should be as accurate as possible to the entire satisfaction of the Engineer. Any error, within the above tolerance limits or any other as may be specially set up by the Engineer, if noticed in any lift of the structure after stripping of forms, shall be corrected in the subsequent work to bring back the surface of the structure to its true alignment.

14.18.3 REINFORCEMENT

14.18.3.1 Storage

All reinforcing bars shall be stored on the site on timber or concrete supports suitably

spaced and of sufficient height to keep the steel clear of the ground.

14.18.3.2 Bar Bending Schedules

All bar bending schedules will be prepared by the Contractor as per IS:2502.

The Contractor shall be responsible for the correctness of the numbers, lengths and bending details of reinforcing bars shown on the schedules must in all cases be verified by the Engineer-in-Charge. The bar bending schedules shall be submitted to the Engineer-in-Charge by the Contractor sufficiently in advance for approval.

14.18.3.3 Placing

The number, size, form and position of all the reinforcement shall, unless otherwise directed or authorized by the Engineer-in-Charge be strictly in accordance with the drawings, except that bars may be displaced locally as approved by the Engineer-in-Charge to clear bolts, pockets and the like which may not necessarily be shown on the reinforcement drawings. Nothing is otherwise to be allowed to interfere with the disposition of the reinforcing bars, and the Contractor is to make a particular point of seeking that they are placed correctly in every respect.

The longitudinal bars in piles, columns, ties etc., are to be straight, and fixed in correct relation to each other and to the sides of the moulds.

14.18.3.4 Reinforcement: Maintaining in Position

The steel reinforcement shall be so connected as to form a rigid cage. To prevent displacement before or during concreting the bars shall be secured one to the other with approved wire. Ends shall point inwards, to preserve the full specified amount of cover. Soft steel 18 gauge binding wire conforming to IS: 280 shall be used throughout the work. Where necessary steel spacers of approved diameter and spacing are to be provided between layers of reinforcement as shown on the drawings or as instructed by the Engineer-in-Charge.

Dense concrete (not mortar) spacer blocks shall, unless otherwise directed, be used between the reinforcement and the bottom and sides of the forms to ensure correct cover of concrete over the bars. The shapes and size and procedure for concreting the spacer blocks shall be to the approval of the Engineer-in-Charge and they shall be of a mix not leaner than the concrete in which they are to be embedded. After their removal from the moulds in which they are cast they shall be cured for 10 days in water.

The cost of providing tying wire, and concrete spacer blocks shall be deemed to be

covered in the rates for reinforcing steel.

Care is to be taken to prevent any displacement or bending of the members of the reinforcement when adjusted and temporarily fixed in position before the commencement of concreting. In cases where bars project they are to be adequately protected against displacement both during concreting and subsequently.

14.18.3.5 Bending Reinforcement

Reinforcement bars shall be bent by machine or other approved means producing a gradual and even motion. All bars shall be bent cold.

Bars incorrectly bent shall be used only if the means used for straightening and re-bending have been approved by the Engineer-in-Charge.

No reinforcing bar shall be bent when in position in the work without the Engineer-in-Charge's approval whether or not it is partly embedded in hard concrete.

Bars shall comply with the dimensions given in the bar bending schedule. Links, hoops & stirrups are generally to be bent round pins of the same diameter as the bars they enclose, but the minimum diameter of the pin shall be twice the diameter of the link etc. The internal radius of bends and hooks of main reinforcing bars shall be not less than twice the size of the bar unless specified otherwise.

14.18.3.6 Reinforcement to be Clean

All reinforcing steel shall be free from rust, loose scale, oil, grease or other deleterious material.

14.18.3.7 Approval of Reinforcement

The Contractor must obtain the approval of the Engineer-in-Charge as to the reinforcement when placed, before any concrete is deposited in the shutters.

14.18.4 MOORING RINGS

Mooring rings shall be fixed at the locations shown by the Engineer-in-charge.

14.18.5 HIGH DENSITY POLYETHYLENE PIPES

High density polyethylene pipes to IS: 4984 of the diameters and the lengths shall be fixed at the locations shown by the Engineering-in-charge.

14.18.6 MISCELLANEOUS STEEL FIXTURES AND EMBEDMENTS

The work under this item involves fixing of miscellaneous steel at locations indicated in the drawing or as directed by the Engineer, Inserts, embedment's or other items

shall be fixed to proper lines, levels and orientation to the Engineer's satisfaction.

Payment will be made on the basis of weight of materials fixed or embedded. The rate shall include the cost of all such materials, galvanizing or painting as required, means of fixing, making and filling of pockets, all filling concrete, and all related work.

14.18.7 PAINTING

All dust, rust and other foreign matter shall be removed from the surface of to be painted and the material thoroughly cleaned to the Engineer's satisfaction. Where blast cleaning is specified it shall be done to Swedish standard Sa 2-1/2 and painting done within specified times.

In general the manufacturer's instruction shall be followed in application of paints.

The number of coats to be applies shall be as specified under the various items of work. The primer or first coat shall be applied to the Engineer's satisfaction and only after his approval shall subsequent coats of paints applied.

14.18.8 PILE FOUNDATION

This work shall consist of construction of RCC bored cast-in-situ piles for the liquid Cargo handling Jetty at different locations in accordance with the details shown on the drawings and to the requirements of the specifications.

The number of piles mentioned in the schedule of quantities in this contract is based on required capacities of bored cast in situ pile of and the basic length of pile and its dimensions are shown in the drawings. The final length shall be decided by the Engineer on the basis of the actual boring data observed on site for individual piles.

14.18.9 SPECIFICATIONS

The execution of pile foundation shall conform to IS: 2911 (Sec-I / Part-2) with latest amendments.

The specifications for safe allowable load, test load, total settlement, total deformations, net settlements, would be as per IS: 2911 (Sec-I / Part-2) provisions.

14.18.10 CONTRACTOR TO PROVIDE DETAILS

The drawings and specifications are enumerated for the general guidance of the Contractor. Complete details of proprietary or other system of piling proposed to be adopted for the work along with details of equipment proposed to be deployed with detailed and step by step methodology shall be submitted in four copies along with Tender.

14.18.11 FOUNDING OF PILES

The founding levels of piles have been tentatively shown on the drawings. However depending on the results of geo-technical investigations and actual conditions met at site during pile boring operations, the Engineer will decide the exact founding levels, which shall be final and binding on the Contractor.

14.18.12 BORING

The ground level shall be taken at the location of each pile before commencement of boring operations.

Boring may be done by either rotary or percussion equipment or grabbing equipment using reverse or direct mud circulation method. In case of unstable soils, the boring tools used should be such that suction efforts are minimized. Stabilization of the sides of the borehole, shall be done by the use of bentonite slurry or casing. The size of cutting tool/ trenching equipment Conform to the dimensions of the pile and is to be approved by the Engineer.

During boring, it shall always be ensured that the bottom of the lower-most liner shall be driven enough in advance of the boring tool to prevent the entry of soil into the casing, thus preventing the formation of cavities and settlements in the adjoining ground. The joints of the casing shall be made as tight as possible to minimize inflow of water or leakage of slurry during concreting.

Removal of obstruction if any met with during pile driving or boring shall also be done by the Contractor. No extra payment will be made for this work.

The spoils arising out or boring shall be disposed of as directed by the Engineer within the quoted rates.

14.18.13 DRILLING MUD (BENTONITE)

The level of drilling mud shall always be maintained above the level of sea high water. Care shall be taken that during boring and removal of the spoil the hole shall remain almost full with the fluid which should preferably be kept in motion. The density and composition of the bentonite fluid shall be such as will suit the ground conditions and maintain the fine materials from the borings in suspension and shall conform to IS:2911 (Part I/Sec-2).

14.18.14 CLEANING OF BOREHOLE BOTTOM

The bottom of the hole shall be cleaned very carefully before concreting work is taken up. The cleaning of the hole shall be ensured by careful operation either by

flushing with the fresh drilling mud through the bottom of the hole or by airlifting process. To lift the spoil at founding level before concreting, borehole shall be agitated by jetting with fresh drilling mud with relatively higher pressure than that used during boring or air through tremie pipe. While boring by use of drilling mud, the specific gravity of the mud suspension in the vicinity of the bottom of borehole shall be monitored. Consistency of the drilling mud suspension shall be controlled throughout the boring as well as concreting operation in order to keep the hole stabilized as well as to avoid suspension of the mud.

Concreting shall **on no account** be taken up if the specific gravity of bottom slurry is more than 1.2.

14.18.15 **PILE CONCRETING**

The pile shall be RCC bored cast in situ type with design mix concrete of specified grade. Under-water concreting shall be done as per IS 456 (latest revision). For Piling Concrete, provision mentioned in IS 2911 regarding extra cement content in the mix shall be adhered to.

Concreting of pile shaft shall start as soon as possible after the procedure for cleaning the borehole bottom specified hereinabove have been completed and approval of Engineer-in-Charge obtained. Concrete shall be placed by means of a tremie pipe. Should a borehole be left un-concreted for more than two hours, it shall be cleaned thoroughly as directed by the Engineer-in-Charge before placing concrete. A vermiculite plug should be introduced in the tremie before pouring concrete.

For the first pour a plug shall be introduced at the junction of funnel and tremie pipe and concrete filled in the funnel. This plug is then removed and funnel lifted by about 150 mm to allow the concrete to fall and flush out the bottom.

During concreting, the concrete levels in the pile shaft shall be checked every two metres intervals in order to note the difference, if any, between the theoretical quantity that should have been placed and actual quantity that has gone in. This is to locate the position of over cut during boring, and/or under-filling of concrete.

14.18.16 Tremie Concrete in Piles

The following procedures shall be used for tremie concrete in piles :

a) The concreting of a pile shall be completed in one continuous operation.

b) The hopper and tremie shall be closed system embedded in the placed concrete, through which water cannot pass.

c) The hopper shall be large enough to hold a complete batch of concrete mix or content of the concrete bucket, if any. The diameter of the tremie pipe shall not be less than 200 mm.

d) The first charge of concrete shall be placed with a sliding plug pushed down the tube ahead of it or with a steel plate of adequate charge to prevent mixing of concrete and water. However, the plug shall not be left in the concrete as a lump.

e) The tremie pipe shall always penetrate well into the concrete with adequate margin of safety against withdrawal of the pipe.

f) All tremie pipes should be scrupulously cleaned after use.

Normally, concreting of the piles shall be uninterrupted till completion of pile. In the exceptional case of interruption of concreting which shall not be more than 1 hour under any circumstances, the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered slowly, from time to time to prevent the concrete around the tremie from setting. Concreting should be resumed by introducing a little richer concrete with a higher slump for easy displacement of the partly set concrete.

If the concreting cannot be resumed before final setting up of concrete already placed, the pile so cast may be rejected or accepted with modifications at the sole discretion of the Engineer-in-Charge.

In case of withdrawal of tremie out of the concrete, either accidentally or to remove a choke in the tremie, the tremie may be reintroduced in the following manner to prevent impregnation of laitance or scum lying on the top of the concrete already deposited in the bore.

The tremie shall be gently lowered on to the old concrete with very little penetration initially. A vermiculite plug shall be introduced in the tremie. Fresh Concrete of slump between 150 mm and 175 mm shall be filled in the tremie which will push the plug forward and will emerge out of the tremie displacing laitance/scum. The tremie will be pushed further in steps making fresh concrete sweep away laitance/scum in its way. When tremie is buried by about 60 to 100 cm. concreting may be resumed.

When concrete is placed by tremie method, concrete shall be cast to a minimum of 200.0 mm above the cut-off level to permit removal of all laitance and weak concrete before capping and to ensure good concrete of the specified grade at the cut-off level for proper embedment into the superstructure elements.

In exceptional cases, if the concreting operation is interrupted for some reason, and

the borehole is left un-concreted for a period exceeding four hours, the Engineer may reject the pile and instruct the contractor to re- bore and construct a substitute pile at an alternate location decided by the Engineer. The cost of such additional pile, if required, shall be borne entirely by the Contractor.

In the circumstances where cut-off level is below ground water level, the need to maintain a pressure on the concrete equal to or greater than water pressure shall be observed and accordingly length of extra concrete above cut-off level shall be determined and allowed in works.

14.18.17 SEQUENCE OF PILING

During installation of piles, the sequence of construction shall be as directed by the Engineer.

When the piles are to be provided near the existing service lines and structures etc. care shall be taken to avoid damage to existing structures.

14.18.18 DEFECTIVE PILES

In case, defective piles are formed, they shall be removed or left in place as directed by the Engineer depending on how they affect the performance of the adjacent piles or the group as a whole. Additional piles shall be provided without any cost whatsoever to the employer and in this regard Engineer's decision shall be binding on the Contractor.

Any deviation from the designed location, alignment or load capacity of any pile shall be noted and adequate measures shall be taken well before the concreting of the pile cap if the deviations are beyond the permissible limits.

After concreting the actual quantity of concrete shall be compared with the average obtained from field observations made in the case of a few piles initially cast. If the actual quantity is found to be considerably less, special investigations shall be conducted and appropriate measures taken.

14.18.19 TOLERANCE

Piles shall be installed as accurately as possible as per the designs and drawings. For the vertical piles, a deviation of 0.5 percent from the vertical line shall not be exceeded, subject, however, the piles shall not deviate more than 75 mm or one-tenth of diameter whichever is more from their designed positions at the cut-off level. In case of single pile in a pile cap, positional tolerance shall not be more than 50 mm.

In case of piles deviating beyond these limits, and to such an extent that the resulting

eccentricity cannot be taken care of by a redesign of the pile cap or pile ties, the piles shall be replaced or supplemented by one or more additional piles by the contractor at his own cost along with any additional cost for pile cap being over size. The decision taken in this regard by the Engineer-in-Charge shall be final and binding on the Contractor. Further the redesign of the pile sub-structure and superstructure associated with the supplemental or additional piles(s) shall be carried out by the Contractor.

14.18.20 CHIPPING OF PILEHEAD

Manual chipping shall be permitted after three days of pile casting. Pneumatic chipping shall not be started before 7 days.

14.18.21 PROVIDING M.S. LINERS

This item is for supply and fixing permanent M.S. Liners for the piles from cut off level up to the design scour depth.

Indicative table of Records to be kept

25)	All information regarding obstruction delays and other interruptions to the sequence of work	**Bored Cast *in situ* pile installation data**
1)	Work Order no.	
2)	Pile reference number and location	
3)	Pile type	
4)	Nominal cross-sectional dimensions	
5)	Original Ground Level / River bed level	
6)	Stipulated Pile Cut-Off Level	
7)	Boring Start Date & Time	
8)	Boring Completion Date & Time	
9)	Time taken for penetration of every 15 cm during last 1 m depth before founding level.	
10)	Pile Bottom Level (Founding Level)	
11)	Bottom Level of MS Liner	
12)	Top Level of Liner	
13)	Depth from Ground/ River bed level at pile position to Pile Bottom Level (Founding Level)	
14)	Steel Reinforcement details	
15)	Level of top of reinforcement cage as constructed	
16)	Method of cleaning bottom of hole at founding level before concreting	
17)	Date & time of Commencement of Concreting	
18)	Date & time of Completion of Concreting	
19)	Concrete Mix	
20)	Theoretical Concrete Quantity	
21)	Theoretical Cement Consumption (in 50 Kg bags)	
22)	Actual Cement Consumption at end of concreting (in 50 Kg bags)	
23)	Pile Head Level as constructed	
24)	Soil samples taken during pile formation	

The Contractor shall fabricate the liners from M.S. Sheets to suit the diameter of the pile

As directed the required length of the M.S. Liners will be made up by welding each unit at site by the Contractor. M.S. sheets required for manufacture of the liners shall be supplied by the Contractor.

The length of the liner above the cut-off level shall be cut to facilitate chipping the top portion of the pile and for interlacing its reinforcement bars into the capping slab.

The payable depth of the liner shall be measured from the cut-off level to the depth up to which the liner is actually provided, though the liner has been provided right from the level of the working platform from practical considerations.

14.18.22 REINFORCEMENT FOR PILES

The reinforcement cage shall be fabricated as per drawings and lowered carefully into position inside the cleaned trenches. It shall be ensured that the orientation of cage is as indicated in the drawings. Proper cover for reinforcement, as shown in the drawings shall be provided.

In positioning of reinforcement, longitudinal tolerance of cage head at the top of the guide wall measured along trench wall measured along the trench shall be 75 mm. and vertical tolerance at case head in relation to top of guide wall shall be 50 mm.

14.18.23 RECORDING OF DATA

During installation of piles, a complete site record shall be made by the contractor, as per IS: 2911 along with any other data as directed by the Engineer. The record shall be submitted to the Engineer in triplicate on completion of installation of each pile. An indicative record sheet is shown below:

14.18.24 CONCRETE STRENGTH TEST

Concrete strength test for piling concrete mix shall be carried out at regular intervals during concreting of each pile or as directed by the Engineer. Sampling, testing and interpretation of results shall be done as per relevant I.S. Codes. The cost of these tests shall be borne by the Contractor.

14.18.25 Load Tests and Acceptance Criteria

14.18.25.1 Static Load Test

In order to determine the load carrying capacity of the piles, static load test shall be carried

out by the Contractor as per IS: 2911 (Part IV)-1985 on isolated piles selected by the Engineer-in-Charge. Piles to be tested should be cast-in-place at least 28 days before loading, unless otherwise directed by the Engineer-in-Charge.

The pile head shall be chipped off carefully till sound concrete is met. The projecting dowels should be bent suitably and the top finished smooth and level. A bearing plate shall preferably by placed on the head of the pile for the jacks to rest.

The test load shall be applied in a series of increments by means of a hydraulic jack, with pressure gauge, reacting against a suitable load frame obtaining reaction from anchor piles or other suitable anchors. The reaction to be made available for the test should be 25 percent more than final test load to be applied.

Elastic shortening and settlement shall be recorded with dial gauges of 0.01 mm sensitivity preferably with three gauges.

Before any load test is made, the proposed arrangement of the test set up shall have to be approved by the Engineer-in-Charge. All responsibilities for conducting the test safely and properly shall lie with the contractor.

The axial load test on piles shall be done to confirm that the soil strata into which the piles are funded have the required bearing capacity.

The test loads shall be applied in increments of about 20 per cent of the pile load value. Reading of elastic shortening and, if any, the settlement of pile in rock and rebounds shall be referred to a constant elevation bench marks and shall be recorded to 0.01 mm for each increment or decrement of load. Each state of loading shall remain in place for a maximum of 2 hours. The final test load shall remain in place for 24 hours and settlements, if any, should be observed every hour during this period. The test load on pile may be removed in one stage by releasing the jack steadily after completion of the test and rebound observations made for 2 hours. The loads and readings obtained shall be duly verified and countersigned by the Engineer-in-Charge.

14.18.25.2 Pile integirity Test

The test may be carried out on at least 50% of total number of piles as directed by engineer in charge.

14.18.25.3 Recording of data and presentation

All pile test data i.e. load, displacement and time shall be recorded in a suitable form along with the information about the pile as approved by the Engineer.

The data shall also be presented by curves drawn between load displacements and displacement time and safe load shall be indicated on the graphs.

14.18.26 VARIATION TO THE ANTICIPATED DEPTH

Any additional length of pile over the approximate length shown in the drawings or mentioned elsewhere shall be carried out at the rate quoted against the items of work for piles.

The Contractor shall carry out the work at the accepted rate without variation in case of any increase of decrease in the number of piles.

14.18.27 SPECIFICATION FOR PRECAST CONCRETE WORKS

The work consists of providing controlled cement concrete for precast concrete units of required sizes and dimensions. The work included formwork, mixing, laying, curing, conveying and placing to the correct profiles.

14.18.28 PRE-CASTING BEDS

All pre-cast units shall be cast on horizontal rigid beds of such design and character as the Engineer-in-Charge may approve.

All units shall be suitably marked with a reference number of the date of casting, which information shall be clearly visible when units are stacked. No payment will be made for preparation of casting yard. The contractor may provide casting beds at no extra cast as direct by engineer.

14.18.28.1 FORMWORK FOR PRE-CAST CONCRETE UNITS

Formwork for pre-cast concrete units shall be of robust steel construction the design of formwork for blocks shall be submitted to the Engineer-in-Charge for his approval before they are fabricated. The formwork shall be capable of being dismantled without jarring or damage to the units.

14.18.28.2 PRE-CASTING RECORDS

Complete records are to be maintained by the Contractor of all precast works. Every units shall have a reference number, date of casting, date of removal of formwork, date of placing and location, all of which shall be recorded together with test results in a suitable Register.

14.18.28.3 CASTING TOLERANCE

Precast units shall be cast to within a tolerance of 5 mm on any dimension.

14.18.28.4 LIFTING, HANDLING AND PLACING OF PRE-CAST UNITS

Lifting and placing (and removal, if any) of precast units shall be undertaken without causing shock vibration or undue stress to or in the units. The units shall not be lifted, transported or used in the works until they are sufficiently matured. The crushing strength of test cubes which are to be kept with the precast units will be used to assess the maturity of the units.

The methods proposed for lifting, transporting and setting precast units should not overstress or damage the units in any way. In the event of overstress or damage due to whatever cause, the unit or units concerned will be liable for rejection and if so rejected shall be immediately broken up and removed from the site. The contractor shall replace such rejected units at his own cost. The contractor shall furnish detailed method for lifting and placing the units in final position for the approval of Engineer.

14.18.29 LADDERS

Steel Ladders shall be fabricated and **fixed with hot dip including G.I coating 80 micron** of size (2.80m x 0.44m) using 75 x 20 mm .M.S Flat (2Nos. 2.80m) and 25mm dia M.S bar 44cm long at 30cm centre as cross bars and to be welded with 2 nos. M.S flat (75 x 20mm) to a length of 35cm with 7cm length 25mm dia M.S bar (cross wire) to hold the ladder, drilling holes at M.S flat for holding M.S bar and welded and painting the steel ladder with one coat of red oxide primer and two coats of anti-corrosive black paint and fixing the ladder in the sea side wharf as per standard specifications and as directed by the EIC. The cost inclusive of all materials and fabrication charges, labour for fixing in position etc. complete complying with AISS and as directed by the EIC.

SECTION 15

SCOPE OF WORK FOR CIVIL

15.1 General:

This scope of work is general in nature & forms the guidelines for the detailed engineering, supply installation and commissioning of the plant as per OISD-156 latest edition:

The work to be performed by the Contractor under the scope of this bid shall include, but not limited to the responsibilities for design, detailed engineering, procurement, fabrication, construction, assembly/packaging, inspection & shop testing at manufacturer's works, supply, transportation, site installation, pre- commissioning trials, testing, commissioning, etc. Scope of work also includes transportation of materials labour, tools and tackles, consumables etc. Intending bidders are advised to visit the site and assess the quantum of work, before submitting their offer. Contractor shall carry out all detailing considering the requirement given in this document as a minimum. Any upward change necessitated during detailed engineering due to the site conditions, soil parameters and process or operational requirements shall be incorporated in the works by the contractor without any extra time and / or cost implication to the Company.

The work shall be carried out as per detailed scope of work, design criteria, attached specifications, standards codes and drawings for the facilities but not limited to the following:

a. Tree cuttings, dewatering of water-logged areas including de-sludging, disposal of water sludge and other waste material to Company designated site.
b. Developing of area by earth filling, rolling and compacting to raise the finish ground level (FGL) as per requirement.
c. The contractor shall be required to fully dismantle and level the area to create levelled ground for ease of operational accessibility, maintenance & aesthetic appearance.
d. RCC walkway, footpath, RCC pipe culverts including entry to sheds etc
e. Pipe way bridges, pipe racks, pipe sleepers, pipe support, cable trenches/racks, cable trays etc as per process requirement

15.2 DETAILED SCOPE OF WORK:

Table-1

S No	Item/Description	OT-II	HOJ-1	HOJ-2	BJ-1	BJ-2
Onshore Structures						
1	Tank Foundations	RCC pile foundations with Raft for TWO tank foundations				
2	Pump House	RCC/Structural Steel for New Pump House with 10 Ton EOT Crane facility				
3	Sleepers	RCC	RCC	RCC	RCC	RCC
4	PMCC Room	Existing room				
5	Control Room (Onshore)	RCC	Not required	Not required	RCC	
6	Equipments Foundations	RCC				
7	25KL Sump for makeup water	RCC				
8	Pavements	RCC paving around pump area				
Offshore Structures						
1	Control Room (Offshore)	Not required	RCC	Existing control room	Not required	
2	Pipe Trestle/Emergency walkway	Not required	RCC with steel hand rails	RCC with steel hand rails	Not required	
3	Emergency exits foundations.	Not required	RCC pile foundations	RCC pile foundations	Not required	
4	Tower Monitor Structure	Only concrete structure for tower monitor	RCC pile foundations with Concrete structure	RCC pile foundations with Concrete structure	Not required	

15.3 Onshore Civil Structures

15.3.1 Electrical/Instrument cable road crossings (ERC/IRC):

a. Design and construction of roads crossings for electrical / instruments cables including finalization of cable routing.

b. Electrical/instrumentation road crossings (ERCs / IRCs) and cable trenches shall be provided as per electrical and instrumentation requirements.

15.3.2 RCC sleepers:

- Design and construction of RCC sleepers and pipe way bridges for laying all piping and road crossings. Firewater sleeper shall be independent and shall not carry any process piping. The contactor shall decide pipe sleeper's type.
- RCC sleepers and structural pipe way bridges shall be provided as per piping / electrical / instrumentation requirements - Pipe support/Cable trays/Road crossings for pipes and cables etc.
- The sleepers for process piping and fire water lines shall be designed based on the soil bearing capacity (to be ascertained by the bidder during site survey) and the horizontal / vertical loads of the pipes running full. Before laying of sleepers, black cotton soil if any shall be replace by sand up to minimum 500 mm depth below the foundation for a width 500 mm more than the width of foundation. The compaction criteria of sand shall be as per relevant specifications of BIS and this tender. Sleepers shall be minimum 300 mm above FGL / HPP. Crossovers shall be provided wherever required.

15.3.3 Earthwork & Site Grading:

- Only new / proposed facilities area to be developed and raised up till FGL.
- Bidder shall assess, earth work quantity based on the survey carried out by himself, extent of number of trees to be cut, shrubs, bushes, vegetation etc. himself before bidding, by visiting the site. The complete work shall be carried out as per standards, specification and drawings etc
- The contractor shall carry out earthwork in filling (and cutting, if any) to make up levels in general site grading to bring the tripped areas upto the required finished ground levels (FGL) with approved good quality earth. Only non-expansive (yellow) earth shall be used, (expansive black cotton soil shall not be used). The earth for filling shall be free of clods, grass, vegetation etc. The earth and borrow pits shall be arranged by the contractor on his own for all leads / lifts from a location approved by the Engineer In-Charge.

- Disposal of surplus / excavated earth & debris outside COMPANY campus as per directions of Engineer In-Charge for all leads and lifts keeping COMPANY indemnified from any claim from any person/ authority/ agency etc. whatsoever.
- After demolition of existing facilities, all the depressions shall be filled with good quality earth & compacted up to FGL.
- All unpaved areas shall be suitably graded and sloped towards the drains in the battery limit area or drains outside battery limit area.
- The FGL shall be frozen during detailed engineering based on the report of contour survey to be done by the HDC and matched wherever required with existing levels.

15.3.4 Roads and approaches:

Roads/approaches shall be constructed as per operational requirements, specifications, standards and drawings for smooth maintenance and operation of the plant.

15.3.5 Pipe Supports / Pipe racks / Trestles / cable trays / Road crossing for pipes & cables:

- Design and construction of overhead and underground road and other crossings for various pipes and cables etc.
- All overhead and underground crossings such as pipe way bridge and cable tray crossings (CTCs), RCC culverts / Hume pipes / trenches shall be provided as per piping / electrical / instrumentation requirements. Specifications, design basis / job specifications attached with this document.
- Proper arrangement for taking cables, pipes and all other interconnections shall be provided by the contractor. The schematic arrangements and details shall be prepared by the contractor and got approved from the Company.
- The ground pipes shall be laid on pipe sleepers with a bottom clearance of 300 to 500 mm from finished grade level. Pipe way crossing of suitable design shall be provided for crossover wherever required.
- Structural steel trestles shall be provided wherever required.
- The overhead pipes shall be laid on steel support of adequate design. The minimum clearance between pipe bottom and finished grade level shall be as per piping specifications.
- Cable trays shall run along on pipe rack or pipe sleepers with adequate spacing. Where it is not possible to run it on pipe rack / sleepers, overhead cable trays shall be used with proper structural supports. Road crossing shall be through culverts or ERC / IRC. Cable trench shall be made in plant area where it is not possible to run on pipe

sleepers / racks. Approved electrical / instrumentation cable layout shall be referred to for routing the cables.

- Pre-cast RCC trench / earth pit cover shall have 3mm MS strip around the block to give it rugged shape.
- When it is required to lay electrical / instrumentation cable below ground they shall be laid in RCC trenches or buried as per details given in Electrical / Standard structural specifications. The contractor shall submit design details of cable trench for approval during detailed engineering.

15.3.6 RCC pavements:

- Heavy duty RCC pavement shall be provided in areas where maintenance and crane movement is envisaged as per design criteria and rest of the areas shall be provided with Type-II RCC pavement as per standards and drawings attached to the tender.
- Type-II RCC pavement shall be provided for flare paving as standard and drawings attached to tender.
- Type-III RCC pavement for pump station, air compressor shed, tank farm areas etc., as required.
- The contractor shall design the pavement as per CBR value to be obtained by the contractor through Survey.
- Paving shall be 100 mm above the F.G.L. and shall have camber of 1:20. Around equipment foundations / structural columns 20 mm wide joint shall be provided upto full depth of the pavement. The joint shall be filled with sand except in top 25 mm which shall be filled with sealing compound.
- Expansion joints shall be provided at a maximum spacing of 15 meters. Expansion joints shall be 20 mm wide and shall be filled with impregnated fiber board except in top 25 mm portion which shall be filled with sealing compound. For heavy duty pavement, 1 meter long 25 mm diameter dowel bars shall be provided at 300 mm c/c at expansion joints.
- The joining sealing compound shall conform to BIS: 1834.
- Top surface of the pavement shall be provided with adequate slopes as required for the surface drainage.

15.3.7 Tank Foundation:

The selection of the tank site and the design and construction of the foundation shall be given careful consideration. The adequacy of the foundation is the responsibility of the Contractor. Foundation loading data shall be provided by the Design consultant to HDC,

15.3.8 Pump house

- Civil structural fire water pumps shall be in contractor's scope. The finished floor level (FFL) of the sheds shall be minimum 300mm above FGL The actual sizes shall be decided and finalized during detailed engineering. All round brick work of 1M height from FFL shall be provided, with suitable openings for entry and exit. The shed shall be side opened and roof sheeting to be color coated galvanized steel or the shed shall be side opened and roof covered with RCC slab, it will be decided during detail engineering. Suitable ramp to be provided at the entrance of the shed.1 m wide pavement shall be provided all around sheds. The fire water pump house shall taking care of any additional loads due to EOT or any changes due to additional new items

- The height of the sheds shall be provided as per the statutory requirements and equipments and crane/ monorail requirement.

15.3.9 Foundations for structures, equipment's etc.

- Foundation for equipment such as vessels, Pumps, pipe, tanks and other relevant auxiliary foundations including package items shall be designed and constructed for safe bearing capacity of soil and designed load and as per recommendations of approved soil investigation report.
- Any soil treatment necessary (as per soil investigation report/geotechnical recommendation) shall be provided by the contractor

15.3.10 Control Room:

a. RCC framed structure building for Control room, UPS room and MCC panel room shall be constructed as per specification and latest design codes detailed in the electrical scope of work and civil design criteria. The actual size shall be decided and finalized during detailed engineering. Building shall be provided with brick walls, internal & external plaster and painting, Aluminium doors and windows for adequate ventilation with rolling shutter as per requirement, cement concrete, flooring with RCC trenches or cables with ramp at entrance with required fittings and fixtures.

b. Acid / Alkali proof tiling shall be provided to surface likely to come in contact with acid / alkali.

c. Design Basis (Architectural) For Buildings & Sheds: Architectural design of the buildings / sheds shall be in conformity with the following:
   - ❖ Codes and Standards
   - ❖ National building Code of India
   - ❖ Local Municipal or other authority's bye-laws
   - ❖ Relevant state Govt. Factory Acts
   - ❖ TAC (Tariff Advisory Committee) regulations
   - ❖ Any other rules/regulations/recommendations as applications

d. Space Requirement: Space requirement shall be based on one or combination of the following depending upon the specific situation
   i. Occupancy
   ii. Equipment layout and clearances
   iii. Maintenance and safety requirements
   iv. Storage requirement

d. The height of the buildings / sheds shall be provided as per the statutory requirements and equipments and crane/ monorail requirement.

e. Minimum required clear height of buildings is to be 3 meters.

15.4 Offshore Structures

15.4.1 Tower Monitor

RCC structure with civil columns shall be provided for tower monitor as per specification and latest codes details in civil design criteria. The actual size and location for the same shall be decided and finalized during detailed engineering.

15.4.2 Hand Railings

a. The height of railing shall be 1.0 meter minimum and it shall be of Galvanized Iron (GI) pipe rail of 40 mm OD and 1.0 meter height (Clear) shall be provided around platforms, fire water tanks, and emergency stairway, etc. and along with stair cases for accessing platform, in double rows with 40 mm dia. GI pipe uprights at a spacing of not more than 1.5 meter interval. In addition knee rails and TOE board shall also be

provided. At ladder points a safety chain / drop bar is to be provided. Knee rails and TOE boards shall have one coat of red oxide zinc chromate primer and two coats of approved enamel paint.

b. A suitable arrangement for grouting of hand railing supports has to be provided wherever it is coming on RCC structure and suitable welding specifications are to be adhered to wherever it is on steel structure.
c. The exact length / perimeter of new railings to be installed shall be decided during detailed engineering based on process and operational requirements.
d. Operating platforms jump over, including stairs, ladders, railings etc. if any.

15.4.3 Footpaths / Emergency walkways:

Footpaths / Emergency walkways shall be constructed as per operational requirements, specifications, standards and drawings for smooth maintenance and operation of the plant.

15.4.4 Control Room:

a. RCC framed structure building for Control room, UPS room and MCC panel room shall be constructed as per specification and latest design codes detailed in the electrical scope of work and civil design criteria. The actual size shall be decided and finalized during detailed engineering. Building shall be provided with RCC walls, internal & external plaster and painting, Aluminium doors and windows for adequate ventilation with rolling shutter as per requirement, cement concrete, flooring with RCC trenches or cables with ramp at entrance with required fittings and fixtures.

e. Acid / Alkali proof tiling shall be provided to surface likely to come in contact with acid / alkali.
f. Design Basis (Architectural) For Buildings & Sheds: Architectural design of the buildings / sheds shall be in conformity with the following:
   - ❖ Codes and Standards
   - ❖ National building Code of India
   - ❖ Local Municipal or other authority's bye-laws
   - ❖ Relevant state Govt. Factory Acts
   - ❖ TAC (Tariff Advisory Committee) regulations
   - ❖ Any other rules/regulations/recommendations as applications

g. Space Requirement: Space requirement shall be based on one or combination of the following depending upon the specific situation
   v. Occupancy
   vi. Equipment layout and clearances
   vii. Maintenance and safety requirements
   viii. Storage requirement

d. The height of the buildings / sheds shall be provided as per the statutory requirements and equipments and crane/ monorail requirement.

e. Minimum required clear height of buildings is to be 3 meters.

15,5 Miscellaneous

a. Fire proofing of structural steel members and equipment supports, wherever required, as per specifications and OISD standards.
b. Water proofing and damp proofing wherever required
c. Anti-termite treatment works, plinth protection works, soil treatment for foundations, dewatering, and providing framing inserts in concrete /brick work as required. Providing sand traps, oil traps, manholes, oil catch pits etc.
d. Protective lining/ coating wherever required as per the specifications and plastering and painting of reinforced cement concrete work, cement concrete work, brickwork and steel members.
e. Miscellaneous civil works like turfing/ pitching with bricks to protect the slopes of all earthen embankments including side slopes of the filled-up areas and roads, compound wall/boundary wall
f. Providing walk ways wherever required, writing name boards for all the structures, signs/markings, providing cranes, monorails, chain pulley and other
g. Any other civil/ structural works that may emerge during detailed engineering/ construction phase of work for satisfactory and successful completion of the project.
h. Platforms for maintenance, operations, dyke cross overs shall be provided wherever required as per engineering practices and with ease for operations.
i. All furniture, fixtures required in MCC room, Substation shall have to be planned, provided and set properly.

14.17 GENERAL CODES

- Material Grade: Refer Civil Design criteria for Concrete grade, Reinforcement grade, PCC grade etc.
- Design a. Refer Civil Design criteria for designing of various structures, loading, minimum cover and thickness of members, codes to be followed etc.
- All structures shall be constructed as per specifications.

INDIAN STANDARDS AND CODES

- IS:456 – 2000 Code of Practice for plain and reinforced Concrete IS:800 – 2007 Code of Practice for general construction of steel
- IS:1893 – 2002 Part 1 – Criteria for Earthquake resistant design of struc- tures
- IS:875 - 1987 Part 1 to 3 – Code of Practice for design loads for Building and Structures
- IS:4651 – 1974 Part 1 – Code of Practice for Planning and Design of Ports and Harbours – Site Investigation
- IS:4651 – 1989 Part 2 – Code of Practice for Planning and Design of Ports and Harbours – Earth Pressure
- IS:4651 – 1974 Part 3 – Code of Practice for Planning and Design of Ports and Harbours – Loadings
- IS:4651 – 1989 Part 4 – Code of Practice for Planning and Design of Ports and Harbours – General Design Considerations
- IS:4651 – 1980 Part 5 – Code of Practice for Planning and Design Ports and Harbours – Layout and Functional Requirements
- IS:2911 – 1975 Part I & IV – Code of Practice for Design and
- Construction of Pile Foundations – Bored Cast In situ Concrete Piles, Lateral Load Capacity of Piles.
- NBC-2005 National building code of India
- IS :9103-1999 Concrete Admixtures – Specification
- IS 2502-1963 Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement
- IS:5525-1969 Recommendation for detailing of reinforced concrete works
- IS:1786-2008 Specification for high strength deformed steel bars and wires for concrete reinforcement
- IS:10262-2009 Recommended guidelines for concrete mix proportioning IS:808-1989 Dimensions for hot rolled steel beam, column channel and angle section

- IS:813-1986 Scheme of symbols for welding
- IS:816-1969 Code of Practice for use of metal arc welding for general construction in mild steel
- IS:7215-1974 Tolerances for fabrication of steel structures
- IS:9595-1996 Recommendation for Metal arc welding of carbon and carbon manganese steel
- IS:12843-1989 Tolerances for erection of steel structures.
- IS:11447-1985 Code of practice for construction with large panel prefa- bricates
- IS:1343-2012 Code of practice for prestressed concrete
- IS:14268-1997 Uncoated stress relieved low relaxation seven-ply strand for prestressed concrete- specification.
- IRC6 -2010 Standard specification and code of practice for Bridges
- IRC58-2011 Guideline for design of rigid pavement for Highways IRC37-2001 Guideline for design of flexible pavement
- SP16 - 1996 Design aids to IS: 456
- SP24 1983 Explanatory Handbook on Indian Standard code for plain and Reinforced concrete.
- SP34 1987 Handbook on Concrete reinforcement and Detailing

BRITISH STANDARDS AND CODES

- BS 6349 British standard code of Practice for Maritime structures
- Part 1 – 2000 General Criteria
- Part 2 – 1998 Design of quay walls, jetties and Dolphins
- Part 3 - 1988 Design of Dry docks, Locks, Slip- ways and ship Building Berths, Ship lifts and Dock and Lock Gates
- Part 4 - 1994 Design of Fendering and Mooring system
- Part 5 - 1991 Code of Practice for Dredging and Land reclamation.
- Part 6 - 1989 Design of Inshore Mooring and Floating structures.
- Part 7 - 1991 Guide to the Design and Construction of Breakwaters.
- Construction Industry Research and Information Association (CIRIA) – C683- Rock Manual 2007
- OTHER INTERNATIONAL CODES AND REFERENCES
- Permanent International Association of Navigational Congresses (PIANC), Approach

Channels, a guide for Design, Report of Working Group 11-30, 1997.

- Permanent International Association of Navigational Congresses (PIANC), Criteria for Movements of Moored Ships in Harbours, Reports of Working Group No. 24, 1995.
- Permanent International Association of Navigational Congresses (PIANC), Guidelines for the Design of Fenders Systems, Reports of Working Group No.33, 2002.
- Permanent International Association of Navigational Congresses (PIANC), seismic design guidelines for port structures, Reports of Working Group 34, 2001.
- Det Norske Veritas (DNV) - Recommended Practice B401- Cathodic Protection Design, 2010
- BPA Heavy duty pavements design manual, 3rd Edition
- PIANC RWG 22 , Scour protection, Supplement to Bulletin no. 96
- Shore Protection Manual – US Army Corps of Engineers 1984.

SECTION 17

OPERATION & MAINENANCE OF FIRE FIGHTING SYSTEM AS PER TENDER DOCUMENT

17.1 FIRE PROTECTION SYSTEM, INSPECTION AND TESTING

The fire protection equipment should be kept in good operating conditions at all the time and the fire fighting system should be periodically tested for proper functioning and logged for record and corrective actions.

- Inspection of firefighting equipment should be done in accordance with OISD-STD-142 on 'Inspection of Fire Fighting Equipment and System'.
- Regular inspection shall be carried out to check the corrosion on pipelines, equipment etc.
- Maintenance and inspection of all facilities equipment shall be in line with manufacturer's recommendations.
- Internal audit of facilities shall be carried out by multi-disciplinary team with a structured checklist.

In addition to routine daily checks/maintenance, the following periodic inspection/testing shall be ensured:

17.2 FIREWATER PUMPS

i) Every pump should be in test run for at least half an hour minimum two times a week.
ii) Once a month each pump should be checked and tested and the shut off pressure observed and logged.

iii) Once in six months each pump should be checked for performance. This may be done by opening required number of hydrants/monitors depending on the capacity of the pump and by verifying that the discharge pressure and the motor load are in conformance with the design parameters.

17.3 FIREWATER RING MAIN

The ring main should be checked once a year for leaks etc. by operating one or more pumps with the hydrant points kept closed as required to get the maximum operating pressure.

The ring main, hydrants, valves should be visually inspected every month for any pilferage, defects and damage.
All fire main valves should be checked for operation and lubricated once in 3 months.

17.4 FIREWATER SPRAY SYSTEM

Fixed Water cooling spray systems or nozzles should be tested at least once in a quarter.

17.5 TOWER MONITOR FOAM SYSTEM

Tower Monitor foam system should be tested once in a year. This shall include the testing of all foam making equipment.
After testing foam system, piping should be flushed with water.

17.6 CLEAN AGENT FIRE EXTINGUISHING SYSTEM

The system should be checked once in 6 months for agent quality and pressure of refillable containers. Detection system should be checked once in 3 months after putting gas release on manual mode to avoid discharge of gas. Smoke detectors should be cleaned once in three months.

17.7 HOSES

Fire hoses shall be hydraulically tested once in 6 months to a minimum water pressure of 10.5 kg/cm2g.

17.8 COMMUNICATIONSSYSTEM

Fire sirens should be tested once a week.

17.9 FIRE EMERGENCY MANUAL

Each oil installation shall prepare a detailed fire emergency manual containing all the actions to be taken in the event of the fire emergency. The key points of this manual shall be displayed at strategic locations in the oil installation to ensure prompt.

NOTE; SYPPLY OF MANPOWER, TOOL AND TACKLES AND O & M SPARES ARE IN THE SCOPE OF CONTRACTOR

Following minimum quantities of fire fighting nozzles shall also be stored in the central hose stations.

Sl.No.	**A.HOSES**	Qty.
1	The hoses shall be of 15 mtrs. Standard length and shall be provided with gun metal /stainless steel male and female couplings of instantaneous pattern.	Shall not be less than 10.
	B.NOZZLES	
1	Jet nozzles with branch pipe as per IS:903	4 nos.
2	Fog nozzles pipe as per IS:952	4 nos.
3	Universal nozzles as per IS: 2171	4 nos.
4	Foam branch pipe as per IS:952(optional)	4 nos.
5	In addition, HAZCHEM nozzle and high flow long range multipurpose nozzles may also be considered.	
	C. ACCESSORIES	
1	Sand Scoops	4 nos.
2	Safety Helmets	10 nos.
3	Water Curtain Nozzles	2 nos.
4	Stretcher	2 nos.
5	First Aid Box	2 nos. (min.)
6	11 KVA Rubber hand gloves	2 pairs
7	Explosive meter	1 no.
8	Fire Proximity suit	2 nos.

9	Resuscitator	2nos.
10	Electrical siren (3 KM range)	1 no.
11	Hand Operated Siren	1 no. (min.)
12	Water jet blanket	2nos.
13	Red/Green flags	1 set
14	Positive Pressure Type self contained breathing apparatus with spare cylinder	2 nos.
15	Low temperature Gloves for handling LPG liquid/gases	4 nos.
16	H2S Gas Detector	As per need
17	The DCP power shall be 25% of the total required for the portable DCP fire extinguishers and also 2000 kg in case of DCP tender	

PORTABLE & WHEELED FIRE EXTINGUISHER

Sl.No.	Description	Norms/Criteria to determine the quantity needed
1	Tanker berth at a jetty handling ships of 20000 to 40000 tonnes deadweight	8 X 9kg DCP Extinguishers 10 x 75 kg wheeled DCP Extinguishers

First Aid Fire Fighting Equipments to be maintained at different locations.

Sl.No	Locations	Name of Firefighting equipment

1	Hydrocarbon Pumping area, Manifold area, Loading areas, Substations, worshops, laboratory, power station building etc., The number to be determined based on the travelling distance of 15 M in above areas (at least one fire extinguisher for every 250 m2 area)	Dry Chemical power Fire Extinguishers 9 kg capacity
2	Loading arms areas The number to be determined based on the max. travelling distance of 50M in above areas (at least one fire extinguisher for every 750 m2 area)	Dry Chemical power Fire Extinguishers 75 kg capacity
3	Sub stations and power stations. The number to be determined basedon the max travelling distance of 15M (at least one fire extinguisher for every 250 m2 area)	CO2 extinguishers of 4.5 kg capacity or 6.8 kg on wheels

SECTION 17

DRAWINGS

ATTACHED AS ANNEXURES

[Tender No. SDM (P&E)/T/34/2018-19]
PART 6 - TECHNICAL DATA SHEETS -ANNUXURE

Data sheet No.	Name of Equipments	Remarks
01	EOT Crane	
02	Main fire water pump	
03	Diesel Engine	
04	Jockey Pump	
05	Tower Monitor	
06	Fire Water Pipelines	
07	Foam Pipelines	
08	Hydrant valves	
09	Hose Box & Accessories	
10	Gate valve	
11	Non return valve	
12	Motor Operated gate valve	
13	Ball Valve	
14	Non Return Valve (Foam System)	
15	Motorized Ball Valve (Foam System)	
16	In-Line Balance Pressure Foam Proportioner	
17	Pressure gauge	
18	Pressure Switch	
19	Pressure Transmitter	
20	Orifice Plate	
21	Foam Tank Level Indicator	
22	Foam Tank Level Switch	
23	Control Cable - Fire Survival	
24	Foam Tank	
25	Y- Type Strainer	
26	Y- Type Strainer	
27	Jumbo Water Curtain Nozzles	
28	Double Hydrants	
29	Remote operated Water cum Foam Monitors	
30	3% AFFF Concentrate	
31	Foam Concentrate Pump	
32	Vendor list for Mechanical Equipments	
33	Vendor list for Electrical Equipments	

1.DATA SHEET FOR EOT CRANE

PROJECT : Augmentation of fire fighting system at HDC **OWNER : HDC,KOLKATA PORT**	**TAG NO. : -** **LOCATION : FIRE WATER PUMP HOUSE**

		1.0 OPERATING CONDITIONS			
1.1	QUANTITY (NOS.)	**01 (ONE)**			
1.2	SAFE WORKING LOAD (TONS)	**10 TONS**			
1.3	TEST LOAD	**125% OF SWL**			
1.4	SPAN (M)	**AS PER FIRE PUMP HOUSE DIMENSION**			
1.5	LIFT OF HOIST (M)	**AS PER FIRE PUMP HOUSE DIMENSION ****			
1.6	BAY LENGTH (M)	**AS PER FIRE PUMP HOUSE DIMENSION ****			
1.7	BRIDGE DEFLECTION	**SPAN / 1200 (max)**			
1.8	CLEARNACE DIAGRAM	**REQUIRED**			
1.9	TYPE OF GIRDER	**SINGLE / DOUBLE**			
1.1	DUTY	**CLASS II**			
1.11	TYPE OF POWER SUPPLY	**DSL**			
1.12	POWER SOURCE	**415 V, 3 PHASE, 50Hz**			
1.13	TYPE OF CONTROL	**PENDANT PUSH BUTTON**			
1.14	LOCATION	**INDOOR**			
1.15	AREA CLASSIFICATION	**SAFE**			
1.16	APPLICABLE CODE	**IS 807, IS 3177 AND OTHER REFERRED CODES / STANDARDS**			
		2.0 VENDOR DATA			
2.1	MAKE	*			
2.2	MODEL	*			
2.3	BRIDGE CONSTRUCTION	*			
2.4	CLEARNACE DIAGRAM	*			
2.5	UNLADEN WEIGHT (Kg)	**Complete**	**Trolley**	**End (Carriage (each)**	**Girder (each)**
		*	*	*	*
2.6	ROPE	**Dia (mm)**	**Strength**	**# of falls**	**Factor of Safety**
		*	*	*	*
2.7	ROPE DRUM	**Dia (mm)**	**LENGTH(MM)**	**STRENGTH**	**HARDNESS**
		*	*	*	*
2.8	HOOK	**Type**	**Material**	**Safety Latch**	**Hardness**
		*	*	**Yes**	*
		HOIST	**CROSS TRAVEL**	**LONG TRAVEL**	
2.9	OPERATING SPEED	**2.0 (M/MIN)**	**10.0 (M/MIN)**	**20.0 (M/MIN)**	
2.1	WHEEL BASE		*	*	
2.11	**WHEEL**		*	*	
	# OF TOTAL WHEELS		*	*	

	# OF DRIVEN WHEELS DIA. (mm) WIDTH (mm) RAIL SIZE LOAD (Kg) MATERIAL HARDNESS (BHN)		*	*
			*	*
			*	*
			*	**CR – 80**
			*	*
			*	*
			250 (Min)	**250 (Min)**
2.12	**BRAKE DRUM(if any)** MATERIAL WIDTH	**Yes/no**	**Yes/no**	**Yes/no**
		*	*	*
		*	*	*
2.13	**GEAR BOX(if any)** MAKE TYPE	Yes/no	**Yes/no**	**Yes/no**
		*	*	*
		*	*	*

		HOIST	**CROSS TRAVEL**	**LONG TRAVEL**
2.14	**MOTOR** MAKE TYPE KW / RPM INSULATION CDF	**Yes/no**	**Yes/no**	**Yes/no**
		*	*	*
		*	*	*
		*	*	*
		F	**F**	**F**
		*	*	*
2.15	**BRAKES** MAKE TYPE SIZE TORQUE	**Yes/no**	**Yes/no**	**Yes/no**
		*	*	*
		DC ELECTRO-MAGNETIC	**ELECTRO-HYDRAULIC-THRUSTOR**	**ELECTRO-HYDRAULIC - THRUSTOR**
		*	*	*
		*	*	*
2.16	**LIMIT SWITCHES** MAKE TYPE QUANTITY	**Yes/no**	**Yes/no**	**Yes/no**
		*	*	*
		*	*	*
		*	*	*
2.17	DSL CABLE SIZE	*	*	*
2.18				
2.19				
2.2				

3.0 MISCELLANEOUS REQUIREMENTS	
3.1	Ratio between wheel base and span shall not be less than 1/5.
3.2	Grouped lubrication shall be provider for each mechanism.
3.3	Safe means of access shall be provided for all the area requiring maintenance. On all walkways, railings and chequered plates of minimum 6 mm thickness shall be provided.
3.4	All rotating shafts etc. shall be suitably guarded. The crane should be operable manually in case of power failure.

3.5	All gears shall be helical or straight and shall be enclosed in gear box.
3.6	**Control :** All motions of crane shall be controlled by hand operated pendant. Main off push button should be lockable type. Emergency push button of mushroom head type shall be latchable type. Movement of pendant switch shall be independent of trolley movement.
3.7	**Brakes** : All brakes should be fail safe and shall be applied automatically when power to driver motor is out or fails. The Thrustor motor shall be 3 phase, totally enclosed, class B insulated, continuous duty motor. The Thrustor shall be designed for 720 switching per hour. Power shall be taken directly from motor terminal box. Brakes can be released manually.
3.8	Power Rails : Power rails shall be mild steel and supported by brackets at the building columns. Power connection to collector shoe assembly shall from under side.
3.9	Flexible Trailing Cables : Shall have metallic braiding and shall be supported with hangers having rollers moving on I-beams.
3.10	DSL : A cage shall be provided below end carriage for maintenance of DSL current collector.
3.11	Control Panel : Control Panel shall be made of minimum 16 Gauge steel with removable doors and degree of protection IP-51. The doors should not open when incoming supply is on. However, for testing purpose, interlock defect feature shall be provided. All components shall be marked as per circuit diagram. Cable entry shall be from bottom. The panel shall include TPN load break switch and contractor on incoming line. Contractor rating shall be at least 1.5 times the full load current of motor.
3.12	Resistors : Resistors shall be stainless steel grid type only.
3.13	Wiring : For power circuit, wiring shall be minimum 6 sq. mm. aluminum conductor, PVC insulated sheathed and armored cables as per IS-1554 Part-I. For control circuit, wiring shall be 2.5 sq. mm. copper conductor. Cable glands shall be double compression type. All un-armoured cable shall be protected using a flexible metallic conduit.
3.14	Motor : All motors shall be heavy duty reversible, crane service type with duty factor of 40% and shall be suitable for 300 starts per hour. All motors shall have TEFC enclosure with IP-55 protection with class F insulation.
3.15	Limit Switches : Minimum rating shall be 5A, 240 VAC.
3.16	Lighting : Bulk head type fittings with dust proof enclosure shall be provided for areas where control panel, resistors, transformers, walkways etc.. are installed.
3.17	Earthing, Painting etc… : All works shall be carried out as per best engg. Practices.
3.18	Referring drawings of the crane shall be submitted by Vendor for approval.

4.0 REMARKS	
4.1	* VENDOR TO SPECIFY
4.2	Items marked '**' shall be finalized during detailed Engg.
4.3	EOT CRANE CAN BE OPERABLE MANUALLY ALSO.
4.4	The data sheet is to be submitted to OWNER for approval after completing technical discussion between contractor and the EOT crane manufacturer based on design calculations for durability of the equipment and reliable operation of the crane. Any additional requirement ,whatsoever, based on Vendor's recommendation for safe, efficient and smooth operation of the system is in contractor scope without any time and cost implications to OWNER.

2.DATA SHEETS FOR MAIN FIRE WATER PUMP

PROJECT : **Augmentation of fire fighting system at HDC**					CUSTOMOR : **HDC, Kolkata Port**
LOCATION : **HDC, Kolkata Port**					SERVICE : **FIRE WATER PUMP – DIESEL DRIVEN**
ITEM NO.. :					DRIVER : **WORKING DIESEL ENGINE DRIVEN**
QUANTITY : 6 WORKING : 4 STAND BY : 2					
OPERATING CONDITION OF EACH PUMP					
LIQUID HANDLED : **TUBEWELL WATER/FRESH WATER**					CAPACITY (M3/Hr) : MIN - NOR **720 M3/HR**
PUMPING TEM 0C : **AMBIENT**					DISCHARGE PRESSURE (Kg/Cm2g) : **16**
SPECIFIC GRAVITY AT P.T. : **1.01**					SUCTION PRESSURE (Kg/Cm2g) : **FLOODED**
VAPOUR PRESSURE AT P.T.(Kg/cm2g) : **0.032**					DIFF.PRESSURE (Kg/Cm2) : *****
VISCOSITY AT P.T. CST : **1.0**					DIFF. HEAD (m) : *****
CORROSIVE/ERROSIVE CAUSED BY :					NPSH AVAILABLE (m) : **FLOODED**
MANUFACTURE 'S SPECIFICATION					
PUMP MANUFACTURE : *					SIZE & TYPE : **HORIZONTAL CENTRIFUGAL**
CONSTRUCTION					**PERFORMANCE**
CASING MOUNTING : FOOT RADIAL					PROPOSAL CURVE NO. : *****
CETERLINE (BETWEEN BEARINGS) BRACKET					NPSH REQUIRED (WATER) m : *****
TYPE : **HORIZONTAL MULTISTAGE SPLIT: AXIAL RADIAL**					NO OF STAGES : ***** RPM : *****
TYPE: SINGLE VOLUTE DOUBLE VOLUTE DIFFUSER					EFF. % : ***** BKW : *****
CASING CONN. : - **VENT ~~DRAIN~~ GAUGE**					MAX. BKW RATED IMP: ***** RECO DRIVER KW : *****
NOZZLE	SIZE	RATING	FACING	POSITION	MAX. HEAD RATED IMPELLER (m) : *****
SUCTION	*	150 #	RF	*	MIN CONTINOUS FLOW (M3/Hr) : *****
DISCHARGE	*	150 #	RF	*	MAX. ALLOWABLE WP AT PT : *
IMP DIA(mm) : * RATED * MAX. * MIN. * TYPE *					HYDROSTATIC TEST PRESSURE (KG/CM2g): *****
BRGS TYPE /NO * RADIAL * THRUST * LUBE *					ROTATION FACING COUPLING END : * CW/CCW
COUPLING MAKE/TYPE : **FLEXIBLE ELEMENT SPACER TYPE**					FLUSHING: * SELF/EXTERNAL
GUARD NON SPARKING : **YES/N/NO**					PACKING LANTERN RING CONN.: YES/NO
DRIVER HALF MOUNTED BY PUMP MANUFACTURER : **YES OTHERS : NO**					SEAL FLUSH PIPINHG PLAN : *****
PACKING TYPE : **GRAPHITE ASBESTOS ROPE WITH LATERN RING**					MATERIAL : *
SIZE OF PACKING * NO OF RING. *					EXT. SEAL FLUSH FLUID LPM : * (Kg/cm2g)
MECH. SEAL MAKE : **NA MODEL**					CW PIPING PLAN : * MATERIAL: *

API CLASS CODE : **NFPA 20**				CW REQD. LPM : 0C		(Kg/Cm2g)	
BASE PALTE DRAIN RIM TYPE : YES/NO				**AUXILIARY PIPING CONNECTION (NA)**			
FOUNDATION BOLTS : YES/NO						FLUID REQMT	
THROAT BUSHING : YES/NO					SIZE	LPM	Kg/Cm2g
BALANCE DEVICE : YES /NO				LANTERN	-	-	-
MATERIAL (I-CAST IRON, B-BRONZE)				SEAL FLUSH	-	-	-
MATERAIL CLASS	**I-2 (AS PER TABLE H-1 OF API 610)**			CASING DRAIN	-	-	-
CASING	**I(IS 210 GR FG260)**			CASING VENT	-	-	-
IMPELLER	**B(IS318 GR LT B2)**			STUFFING BOX	-	-	-
INNER CASE PARTS	**B(IS 318 GR LT B2)**			BEARINGS	-	-	-
SLEEVE SHAFT	**SS-410**			PEDSTAL	-	-	-
CASING RING	**B(IS 318 GR LT B2)**			BASE PLATE	-	-	-
IMPELLER RING	**B(IS 318 GR LT B2)**			**INSPECTION AND TESTS**			
SHAFT	**SS-316**			SHOP TESTING/INSP.		REQD.	WITNESS
THROTTLE BUSH	**MFR .STD**			MATL. CERTIFICATES		YES	-
MOUNTING PLATE	**MILD STEEL**			HYDROSTATIC		YES	YES
DRIVER BY : **VENDOR/OTHERS (REFER STANDARD SPECIFICATION)**				RUNNING PERFORMNACE		YES	YES
ITEM NO. : * MOUNTED BY : *				NPSH		YES	-
KW: * RPM : * FRAME : *				DISMANTLING		YES	YES
MFR. : CGL /KEC/ABB/SIEMEN /NGEF							
TYPE : * INSULATION : B				**WEIGHTS AND DIMENSIONS**			
ENCLOSURE : * TEMP. RISE : * 0C				**WEIGHT**			
VOLTS/PHASE/CYCLES :				PUMP +BASE+COUPLING : ***** Kg			
BRG BALL : * LUB GREASE : *				DRIVER : ***** Kg			
FULL LOAD AMPS : *				FLOOR SPACE LENGTH : ***** m			
VHS : * VSS: *				WIDTH : ***** m , HEIGHT : ***** m			
VERT THURST CAP Kg :				TOTAL SHIPPING VOLUME : ***** m3			
APPLICABLE STANDARD /CODE : NFPA-20.							

1)IN CASE OF NON STANDARDPUMP FLANGES, MATING FLANGES SHALL BE SUPPLIED BY VENDOR.
2) VENDOR TO FURNISH DATA MARKED AS THUS *.
3) PUMPS SHALL BE CAPABLE OF FURNISHING NOT LESS THAN 150 % OF RATED CAPACITY AT A HEAD NOT LESS THAN 65% OF THE RATED HEAD.
4) SHUT OFF HEAD SHALL NOT EXCEED 120 PERCENT OF RATED HEAD .
5) PUMPS MUST BE CAPABLE OF STARTING AGAINST AN OPEN DISCHARGE.
6) UNITISATION OF PUMP AND DRIVER SHALL BE DONE IN PUMP MANUFACTURER'S SHOP.
7) THE PUMP SHALL CONFORM TO TARIFF ADVISORY COMMITTEE (TAC) REQUIREMENTS AS PER FIRE PROTECTION MANUAL (PART-II) LATEST EDITION AND SHALL BE TAC APPROVED OR APPROVED BY AGENCIES ACCEPTABLE TO TAC.
8) DIESEL ENGINE FOR FIRE WATER PUMP SHALL BE UL LISTED / FM CERTIFIED.

3.DATA SHEET FOR DIESEL ENGINE

1	**GENERAL**	
2	Project: Augmentation of Fire Fighting System at HDC	Tag No.:
3	Site :HDC,KOLKATA PORT	Service: **Prime mover Suitable for FW main pump**
4	Quantity: 15 working:10 Standby: 5	Driven Equipment Item No:
5	Applicable to: Proposals Purchase As built	
6	Note: scope option / information specified Information required from / options left to vendor, vendor to cross the selected option.	
7	**SITE / INSTALLATION DATA**	
8	**Site conditions**	**Location:**
9	Barometric Pressure (mbar A) : Highest Lowest	Indoor Outdoor
10	Mean sea level (m) :	Heated Unheated
11	Ambient Air Temp. (C^0): Max. **50** Min. **4**	Under-roof Partial Sides
12	Ambt. Air Temp. around the Engine (C) : Highest Lowest	Closed Room With Air Ventilation System.
13	Relative Air Humidity at the Max. Ambient Air Temp. (Kg/cm^2A) :	Electrical Area classification (Refer Electrical Specifications)
14	Water Vapour Pressure at the Max. Ambient Air Temp. (kg/cm^2A) :	Class Group Division
15	Wet Bulb Temp. (C^0): Dry Bulb Temp. (C^0) :	
16	**UTILITY DATA**	
17	**Cooling Water**	
18	Cooling Water Temp.(C^0) Supply (Max/Nor/Min): Return(Max):	
19	Cooling Water Press(Kg/cm^2 g) Supply (Max/Nor/Min): Return(Min):	
20	Cooling Water Characteristics : Raw water	
21	**Instrument Air :**	
22	Supply Pressure (Max/Nor/Min) (Kg/cm^2 g) : **8.5./7.0/6.5**	
23	Supply Temp. (Max/Nor/Min) (C^0) : **--/50/---** Dew pt.(C^0)	
24	**Electric Power (Refer Electrical Specifications attached elsewhere in the bid package:**	
25	Electric Supply: Volts Hz	
26	Available during Engine starting operations shut-down (Engine not operating)	
27	**Fuel Oil :**	
28	Type of Fuel Oil: **HSD as per IS 1460(1999) Lower Calorific Value (kj/kg)**	
29	Fuel Oil Characteristics:	
30	**APPLICABLE CODES , STANDARDS & STATUTORY GUIDELINES**	
31	ISO 3046/ BS 5514/Relevant MOEF notification/CPCB guidelines	
32	Acoustic Housing/Enclosure & Noise specification: As per latest Environment (Protection) Rules issued through MOEF Notification	
33	P&ID for Fire water system	
34	Exhaust Gas Emission – Statutory requirements. (if any) : As per latest CPCB guidelines to meet ISO-14001 requirements	
35	Listing/Approval of Engine Required From: √ UL/FM MOEF/Authorized agencies of MOEF TAC ,EEMUA	
36	Air Receiver for Starting Air System ASME SEC-VIII Div.1 Air Compressor for starting Air System Manufacturer's Std.	
37	Shell and Tube type Exchangers Manufacturer's Std. Auxiliary Pumps Manufacturer's Std.	
38	Air Cooled Heat Exchangers/Radiator Manufacturer's Std. Other Tanks and Vessels Manufacturer's Std.	
39	Site :	

40	Driven Equipment : Elect. Generator Pump	
41	Duty : Continuous Intermittent (Except at the time of PGTR)	
42	Probable Period For Continuous Running :	
43	Duration of Max. Load. : Duration of Min. Load:	
44	Minimum BKW of the driven eqpt. kW: @RPM:	
45	Rated BKW of the driven eqpt. kW: @RPM:	
46	Ambient Air Temp. (C^0): Max. **50** Min. **4**	
47	Relative Air Humidity at the Max. Ambient Air Temp. (Kg/cm^2A) :	
48	Water Vapour Pressure at the Max. Ambient Air Temp. (kg/cm^2A) :	
49	Wet Bulb Temp. (C^0): Dry Bulb Temp. (C^0) :	
50	Direction of Rotation of driven equipment viewed from coupling End CW CCW	
51	Method of Drive : Thru universal joint Direct thru Flexible Coupling V-Belts Gear Drive	
52	Cooling Water Temp.(C^0) Supply (Max/Nor/Min): Return(Max):	
53	Cooling Water Press(Kg/cm^2 g) Supply (Max/Nor/Min): Return(Min):	Engine Model:
54	Type of Engine: Two-Stroke Four-Stroke	Engine Cooling: Air Cooled Water Cooled
55	Mech. Pressure-charged Turbo-Charged: With Charge Air Cooler Normally Aspirated	
56	Supply Pressure (Max/Nor/Min) (Kg/cm^2 g) : **8.5./7.0/6.5**	
57	Supply Temp. (Max/Nor/Min) (C^0) : **--/50/---** Dew pt.(C^0)	
58	Speed (rpm) : Mean Piston Speed (m/sec.):	
59	**PERFORMANCE**	
60	Rated Engine Power at Standard operating conditions as per ISO 3046/ BS 5514 (**ISO Std. Power)**: kW @ RPM	
61	(Using only the essential dependent Auxiliaries and with 10% Overload provision for one Hour within a period of 12 house of operation).	
62	Rate engine Power at Site conditions **(Service Std. Power)**(Guaranteed, No Negative Tolerance): kW @ RPM	
63	(Using only the essential dependent Auxiliaries and with 10% Overload provision for one Hour within a period of 12 house of operation).	
64	Min. Engine site power at which Engine can be Operated Continuously. KW @ RPM	
65	ISO 3046/ BS 5514/Relevant MOEF notification/CPCB guidelines	
66	Acoustic Housing/Enclosure & Noise specification: As per latest Environment (Protection) Rules issued through MOEF Notification	
67	P&ID for Fire water system	
68	Air Flow Required for Operation of the Engine for : Combustion & Scavenging Cooling & Ventilation	

69	Essential dependent Auxiliaries are :				
70	Engine Shaft Driven Radiator Fan kW Engine Shaft Main LO Pump kW				
71	Engine Shaft Driven CW Pump kW Engine Shaft Driven Fuel Oil Pump kW				
72	Independent Auxiliaries are:				
73	Electric Motor Driven Auxiliary LO Pump kW Electric Motor Driven Fuel Oil Transfer Pump kW				
74	Electric Motor Driven CW Pump. KW Electric Motor Driven Starting Air Compressor kW				
75	Electric Motor Driven Radiator Fan kW				
76	**Specific Fuel Consumption:**				
77	**Fuel Consumption, gm/kW-hr @ reference conditions ***				
78		**ISO 3046 ***	**Manufr's Std.***	**Site ***	**Manfr's. shop**
79	(a) Guaranteed Engine Rated Power (100% Continuous Rating)				
80					
79	Relative Air Humidity at the Max. Ambient Air Temp. (Kg/cm^2A) :				
80					
81	Wet Bulb Temp. (C^0): Dry Bulb Temp. (C^0) :				
82	(c) 52% of (a)				
83	(d) 110% of (a)				
84	Cooling Water Temp.(C^0) Supply (Max/Nor/Min): Return(Max):				
85	Cooling Water Press(Kg/cm^2 g) Supply (Max/Nor/Min): Return(Min):	**100kpa**			
86	Atmospheric Temp., t , C^0_{r1}	**25 (298^0 k)**			
87	Relative Humidity, $\varnothing_{r1}$ %	**30**			
88	Charge Air Coolant Temp. t C^0_{cr1}	**25 ($298\ ^0$k)**			
89	**SPEED GOVERNING SYSTEM**				
90	Type: Single Speed Multiple Speed All Speed (Variable Speed)				
91	Class of Accuracy: A_0 A_1 A B B $_2$ $_1$ $_2$				
92	Governor Type: Electronic Hydraulic Mechanical				
93	Make: Model:				
94	ONGC stand. Spec. no. M-021 ISO 3046/ BS 5514/Relevant MOEF notification/CPCB guidelines				
95	Acoustic Housing/Enclosure & Noise specification: As per latest Environment (Protection) Rules issued through MOEF Notification				
	STARTING SYSTEM				
96	Method of Starting Manual Automatic				
97	Method of Stopping Manual Automatic				
98	Type of Cold Starting Aid:				
99	Type of Starting System:				
100	Hand Starting with Starting Handle ı Battery Starting ı Air Starting through Pneumatic Motor				

101	Air Starting through Air Injection into Cylinders Hydraulic Motor
102	Battery Starting System:
103	Battery Bank: Number Two Voltage AH Capacity Make:
104	Cells per Bank ı Number Voltage AH Capacity
105	Starter Make / Rating: Dynamo Make / Rating:
106	Regulator and Cut-out:
107	Battery charging equipment including transformer, static Rectifier, D.C. Ammeter, D.C. Voltmeter, charge
108	Rate selector Switch and charging Meter.
109	Inter connecting cable leads between battery charger & battery
110	Inter connecting cable leads between battery & engine starter
111	Note: Each Battery Bank shall be sized to provide minimum 6 consecutive starts.
112	Remarks:
113	Starting Air System:
114	Air Compressor ı Type : ı Reciprocating I
115	Rated Capacity (Am2/hr at Inlet Conditions): Discharge Pressure (Kg/cm2g): BKW: RPM:
116	Air Compressor Driven by: ı Working by Electric Motor ı Standby by Diesel Engine
117	Driver Rating kW: RPM: Volts/⌀HZ:
118	Air Receiver with Pressure Gauge, Relief Valve & Manual Drain Valve:
119	Start-Stop Switch for Compressor ı Manual ı Automatic
120	No. of Air Receiver : ı One ı Two Capacity of Each Air Receiver (M3)
121	Note: Total Air Receiver Capacity shall be suitable for at-least Six (6) consecutive starts.
122	Other starting systems:
123	**COOLING SYSTEM**
124	Type: ı open Circuit Cooling with Engine driven water-circulating Pump.
125	Closed circuit cooling including:
126	Water Pump driven by: Driver Rating / Speed (KW/RPM):
127	Primary (Soft) circuit Piping with Temp. Control & Make-up tank.
128	Heat Exchanger with Anchor / Foundation Bolts
129	Secondary (FW from pump's discharge) circuit Piping with Strainers PR. Regulating Valve
130	By-pass Valve: Check Valve :
131	Heat Exchanger Temp. (0C) (Primary Ckt) Inlet: Outlet:
132	Heat Exchanger Temp. (0C) (Secondary Ckt) Inlet:: Outlet:
133	Water Pressure (Secondary circuit) Kg/cm2(g) : Heat Exchanger Testing Pressure Kg/cm2(g):
134	Radiator Cooling including Interconnecting Piping &:
135	Radiator with Temp. Control Valve Expansion / Make-Up water tank
136	Fan Driven By Engine itself Driver Rating / Speed (KW/RPM):
137	Water circulating Pump ı Driven By: Engine itself ı Driver Rating / Speed (KW/RPM):
138	Engine Water Inlet/Outlet Temp. (0C):
139	**FRAME LUBRICATION SYSTEM**
140	Type:
141	Splash Lubrication

142	Force Feed Lubrication Including Valves, Oil Pump, piping &:
143	Oil Cooler Type: **Shell & Tube**
144	Oil Filters Self Cleaning Duplex Paper Cartridge
145	Pre-lube Oil Pump driven by:
146	Pre-lubrication Manual Automatic at Intervals of hours.
147	Type/Grade of Lub. Oil: Auto pre-lubrication pump shall be powered from mains.
148	Oil Sump capacity (litres): Oil consumption (lph):
149	^{2} Oil Cooler testing Pressure (Kg/cm g):
150	Explosion Relief Valve for Crankcase
151	**FUEL SYSTEM**
152	Type: Gravity Feed System Fuel Lift Pump including
153	Fuel Filters Paper cartridge Duplex
154	Fuel Injection Pump Make: Model:
155	Daily Service Fuel Tank Engine Mounted Wall Mounted Ground Mounted
156	Capacity of Daily Service Tank (liters): For 6 hrs continuous operation @ full load For 24 hrs @ full load
157	For_____ hrs continuous operation @ full load
158	Fuel Float Tank Ground Mounting with Base Plate
159	Motor Driven Fuel Transfer Pump
160	Fuel Piping and Fittings:
161	Fuel Piping from Transfer Pumps to Daily Tank Fuel Piping from Daily Tank to Engine
162	Overflow Pipes Vent Connection for Fuel Tank with Flame Arrester
163	Drain Valve for Fuel Tank Inspection and cleaning Hole for Fuel Tank (min 150mm dia.)
164	Fill connection for Fuel Tank Level Switch (Level Low Alarm)
165	Shielded Level Gauge for Fuel tank Float valve in fill connection Strainers
166	**AIR INLET SYSTEM**
167	Suction Air Fitter (Dry Type) Air Inlet Ducting / Piping / Manifolds Inlet Silencer
168	Expansion Bellows All supports / Hangers
169	**ENGINE EXHAUST SYSTEM**
170	Exhaust Manifolds / Ducting / Piping terminated at safe height outside Engine room Exhaust Silencer (Residential Type)
171	Expansion Bellows Exhaust stack / Chimney All supports / Hangers Thermal Insulation for complete Exhaust Flame Arrestor
172	**CONTROLS & INSTRUMENTATION**
173	Hazardous Electrical Area Classification NEC: Class Div. Group
174	ISO: Zone Gas Group
175	**Electric Supply:**
176	Lamps: + V; AC/DC; ∅; + Hz.
177	Alarm Circuit: + V; AC/DC; ∅; + Hz.
178	Trip circuit: + V; AC/DC; ∅; + Hz.
179	Control Circuit: + V; AC/DC; ∅; + Hz.
180	Solenoid Valves: + V; AC/DC; ∅; + Hz.
181	Notes:
182	1. Pre-Alarms to precede Trips.
183	2. Instruments to be connected to junction boxes on skid and consoles.
184	3. All Tubing, piping, wiring between instruments and junction boxes, local gauge boards and local panels to be supplied by

	vendor.
185	4. Instruments, safety and control devices specified herein are minimum required by customer. In case, in the opinion of vendor, additional devices are required, vendor shall specifically state so and include the same in his scope of supply.
186	5. Vendor shall also refer to P&ID's enclosed and any additional instruments required as per P&ID's shall be included by vendor in his scope supply.
187	6. All switching devices (hardware/software) for pre-alarms, trips, trip alarm, and interlocking shall be in the vendor's scope.

	Loose Supply	**Locally Mtd.**	**LGB Mtd.**	**LCP Mtd.**	**UCP**	**DCS**
194	AC Power On/Off Switch With Indication Lamp					
195	Control Power On/Off Switch with Indication Lamp					
196	Selector Switch A/M Station For L/O Pump Motor		-			
197	Start/Stop Push Button For Fuel transfer Pump motor					
198	Start/Stop Push Button For Aux. Drive Motor					
199	Stop Push Button					
200	Lamp Test Push Button					
201	Alarm/Trip Acknowledge / Reset Push Button					
202	Lubricating Oil Heater 'ON' Indicating lamp					
203	Emergency Stop Push Button					
204	Note:					
205	Legend: LM: Local Mounted : By Vendor Others					
206	LGB: Local Gage Board: By Vendor Others					
207	*LCP*: Local Control Panel : By Vendor Others					
208	UCP: Unit Control Panel : By Vendor Others					
209	PLC: Programmable Logic Control: By Vendor Others					
210	DCS: Distributed Control System: By Vendor Others					
211	Items under LGB to be housed in the Engine Mounted Gauge Board					
212	Items under LCP to be housed in free standing type Local Engine Control Panel					
213	Electric Switches for Alarm and shutdowns to have Weather Proof IP-65 Enclosures					
214	Temp. gauges shall be Bimetallic Dial Type					
215	All Wiring piping between Engine – Gauge Board – Control Panel in Vendor's Scope					
216						
217						
218						

Sl. No.	Description	Req	Indication	A/V Annun. & Pre-Alarm	Trip & A/V Alarm Annun.

		uired	Gauge - Local Mount.	Gauge - LGB	Indicator-*LCP*	Indicator-UCP	Repeat signal to DDCS/MP	Low - *LCP*	Low - UCP	High - *LCP*	High - UCP	Repeat contact for PLC / DCS /MP	Low - *LCP*	Low - UCP	High - *LCP*	High - UCP	Repeat contact for PLC/ DCS/ MP
219	**LUBRICATION SYSTEM**															
220	- Reservoir Oil Level															
221	- Reservoir Temp.															
222	- Main/Std by L/O Pump Disch. Pr.															
223	- Lub Oil Filter Diff. Pr.															
224	- L/O Supply Header Pressure															
225	- L/O Supply Header temp.															
226	- Oil Cooler Oil Outlet Temp.															
227	- *Stand by Pump Start*															
228		**COOLING SYSTEM**														
229	- Oil Cooler coolant outlet temp.															
230	- Coolant supply header flow															
231	- Sight flow coolant return															
232	- Local mount TSV on each isolatable circuit															
233	- Coolant level in make up coolant tank of Radiator															
234	- Engine Jacket coolant supply (outlet of Radiator) temp.															
235	- Engine Jacket coolant return (Inlet of Radiator after TSV) temp.															
236	- For Closed Circuit Cooling (as applicable):															
237	- Coolant main/standby pump disch. Pr.															
238	- Coolant stand by pump start															
239	- Coolant supply header Pr.															
240	- Coolant supply header temp															
241	- Coolant cooler Outlet Temp.															
242	- Coolant reservoir Level															

243	**STARTING SYSTEM**		
244		-	
245		-	
246	**FUEL SYSTEM**		
247	- Fuel Oil level in fuel tank		
248		**INLET AIR SYSTEM**	
249	- Inlet Air filter – differential pressure		
250	- Supercharge Air (Turbo Charger)- Discharge Pressure (if reqd.)		
251	- After-cooler Outlet-Air Temp. (If required)		
252		**MISCELLANEOUS**	
253	- Engine Vibrations		
254	- Engine Speed		
255	- Key Switch - Start & Push Button Stop		
256	- Engine Over speed		
257	- Engine fails to start		
258	- Tacho-hour Meter		
259	- Engine Running		
260			
261	**Legend : V : By Vendor; P : Purchaser**		
262	**MATERIAL**		
263	Charge Air Cooler Shell: Tubes:		
264	Water Cooler Shell: Tubes:		
265	Air Cooler Shell: Tubes:		
266	Air Receiver		
267	Fuel Tank: **MS**		
268	**INSPECTION AND TESTING**		
269	Observe Witness		
270	Stage Inspection during Manufacture		
271	Full Load Test at Engine Manufacturer's Shop		
272	Fuel consumption & Governing Test at Engine Manufacturer's Shop		
273	Control Panel Functional Test at *LCP* vendor's shop.		
274	Mechanical String Test of Pump and Engine at Pump Manufacturer's Shop		
275	No load Mechanical Run test at Packager's/Driven Eqpt. Mfr. Shop		
276	Inspection /Testing Witnessed By: Other Purchaser/Representative Third party		
277	**WEIGHTS**		
278	Net Weight of Engine with Mounted Ancillaries (kg):		
279	Heaviest part to be handled during erection and its weight (kg):		
280	Heaviest part to be handled during normal maintenance and its weight (kg):		
281	Recommended Crane capacity (Tons): Crane Hook Height (m):		
282	**MAINTENANCE DATA**		
283	Expected Period of Running Between Top Overhauls: Hours		
284	Expected Period of Running Between Main Overhauls: Hours		
285	The Type and Grade of Lubricating Oil Recommended		

286	Lube Oil Consumption (kg/hr) / (Litres/hr)
287	Change of Lubrication Oil After: Hours
288	**ACCESSORIES**
289	Flywheel with Barring Device
290	Guards for Moving Parts
291	Coupling for Engine – Pump
292	Common Base Plate for Engine – Pump
293	Foundation / Anchor Bolts
294	Anti Vibration Pads
295	First Fill of Lubricating Oil and fuel.
296	**REMARKS**
297	1. The Engine shall be suitable for starting the pump against open discharge valve conditions.
298	2. The Engine shall be provided with an adjustable governor to control engine speed within 10% of its rated speed.
299	3. The Engine shall be equipped with feature for three automatic start attempts coupled with battery charger circuit for recharging of engine battery.
300	4. The Engine shall be provided with safety interlocking shut-off features with alarm against low lube oil pressure, high water temperature and over speed.
301	5. The Engine exhaust shall have spark arrestor and residential silencer.
302	6. LSTK to provide suitable unloading arrangement for transferring diesel to fuel day tank from barrels/tankers with the help of motor(electrical) driven pump . Fuel day tank shall be suitably protected to prevent ingress of water /dust etc. from the outside environment.
303	7. The datasheet is to be submitted to OWNER for approval after completing both by the LSTK and the engine manufacturer/vendor based on design calculations for reliable operation of the engine. Any additional requirement, whatsoever, based on vendor's recommendation for safe , efficient and smooth operation of the system is in LSTK's scope without any time and cost implications to OWNER.
304	8. Each engine shall be equipped with the facilities mentioned above. Requirement is for one numbers of engines.

DATA SHEETS FOR JOCKEY PUMP (ELECTRICAL OPERATED)

LOCATION : **Haldia Dock Complex,Kolkata Port**					SERVICE : **FIRE WATER JOCKEY PUMP**
ITEM NO. :					DRIVER : **MOTOR**
QUANTITY : **3** **WORKING : 2** **STAND BY : 1**					
OPERATING CONDITION OF EACH PUMP					
LIQUID HANDLED : **TUBE WELL WATER/FRESH WATER**					CAPACITY (M3/Hr) : MIN - NOR **70** **MAX. -**
PUMPING TEM 0C : **AMBIENT**					DISCHARGE PRESSURE (Kg/Cm2 g) : **16**
SPECIFIC GRAVITY AT P.T. : **1.01**					SUCTION PRESSURE (Kg/Cm2 g) : **FLOODED**
VAPOUR PRESSURE AT P.T.(Kg/cm2g) : **0.032**					DIFF.PRESSURE (Kg/Cm2) : *
VISCOSITY AT P.T. CST : **1.0**					DIFF. HEAD (m) : *
CORROSIVE/ERROSIVE CAUSED BY :					NPSH AVAILABLE (m) : **FLOODED**
MANUFACTURE 'S SPECIFICATION					
PUMP MANUFACTURE : *					SIZE & TYPE : **HORIZONTAL CENTRIFUGAL**
CONSTRUCTION					**PERFORMANCE**
CASING MOUNTING : FOOT / RADIAL					PROPOSAL CURVE NO. : *
CETERLINE (BETWEEN BEARINGS) BARCKET					
					NPSH REQUIRED (WATER) m : *
TYPE : **HORIZONTAL SPLIT: AXIAL RADIAL**					NO OF STAGES : * RPM : *
TYPE: SINGLE VOLUTE DOUBLE VOLUTE DIFFUSER					EFF. % : * BKW : *
CASING CONN. : VENT DRAIN GAUGE					MAX. BKW RATED IMP: * RECO DRIVER KW : *
NOZZLE	SIZE	RATING	FACING	POSITION	MAX. HEAD RATED IMPELLER (m) : *
SUCTION	*	150 #	RF	*	MIN CONTINOUS FLOW (M3/Hr) : *
DISCHARGE	*	150 #	RF	*	MAX. ALLOWABLE WP AT PT : *
IMP DIA(mm) : * RATED * MAX. * MIN. * TYPE *					HYDROSTATIC TEST PRESSURE (KG/CM2g): *
BRGS TYPE /NO * RADIAL * THRUST * LUBE *					ROTATION FACING COUPLING END : * CW/CCW
COUPLING MAKE/TYPE : **FLEXIBLE ELEMENT SPACER TYPE**					FLUSHING: * SELF/EXTERNAL
GUARD NON SPARKING : YES /NO					PACKING LANTERN RING CONN.: YES/NO
DRIVER HALF MOUNTED BY PUMP MANUFACTURER : **YES ,OTHERS : NO.**					SEAL FLUSH PIPINHG PLAN : *
PACKING TYPE : **GRAPHITE ASBESTOS ROPE WITH LATERN RING**					MATERIAL : *
SIZE OF PACKING * NO OF RING. *					EXT. SEAL FLUSH FLUID LPM : * (Kg/cm2g)
MECH. SEAL MAKE : **NA MODEL**					CW PIPING PLAN : * MATERIAL: *
API CLASS CODE : **NFPA 20**					CW REQD. LPM : (Kg/Cm2g) 0C
BASE PLATE DRAIN RIM TYPE					**AUXILIARY PIPING CONNECTION (NA)**

: YES/NO							
FOUNDATION BOLTS : YES/NO						FLUID REQMT	
THROAT BUSHING : YES/NO					SIZE	LPM	Kg/Cm2g
BALANCE DEVICE : YES /NO				LANTERN	-	-	-
MATERIAL (I-CAST IRON, B-BRONZE)				SEAL FLUSH	-	-	-
MATERAIL CLASS	**I-2 (AS PER TABLE H-1 OF API 610)**			CASING DRAIN	-	-	-
CASING	**I(IS 210 GR FG260)**			CASING VENT	-	-	-
IMPELLER	**B(IS318 GR LT B2)**			STUFFING BOX	-	-	-
INNER CASE PARTS	**B(IS 318 GR LT B2)**			BEARINGS	-	-	-
SLEEVE SHAFT	**SS-410**			PEDSTAL	-	-	-
CASING RING	**B(IS 318 GR LT B2)**			BASE PLATE	-	-	-
IMPELLER RING	**B(IS 318 GR LT B2)**			**INSPECTION AND TESTS**			
SHAFT	**SS-316**			SHOP TESTING/INSP.		REQD.	WITNESS
THROTTLE BUSH	**MFR .STD**			MATL. CERTIFICATES		YES	-
MOUNTING PLATE	**MILD STEEL**			HYDROSTATIC		YES	YES
DRIVER BY : **VENDOR/OTHERS (REFER STANDARD SPECIFICATION)**				RUNNING PERFORMNACE		YES	YES
ITEM NO. : * MOUNTED BY : *				NPSH		YES	YES
KW: * RPM : * FRAME : *				DISMANTLING		YES	YES
MFR. : **CGL /KEC/ABB/SIEMEN /NGEF**							
TYPE : : * INSULATION : *****				**WEIGHTS AND DIMENSIONS**			
ENCLOSURE : * TEMP. RISE : * 0C				**WEIGHT**			
VOLTS/PHASE/CYCLES : **415 / 3 / 50**				PUMP +BASE+COUPLING : ***** Kg			
BRG BALL : * LUB GREASE : *				DRIVER : ***** Kg			
FULL LOAD AMPS : *				FLOOR SPACE LENGTH : ***** m			
VHS : * VSS: *				WIDTH : ***** m , HEIGHT : ***** m			
VERT THURST CAP Kg :				TOTAL SHIPPING VOLUME : ***** m3			

1)IN CASE OF NON STANDARDPUMP FLANGES, MATING FLANGES SHALL BE SUPPLIED BY VENDOR.
2) VENDOR TO FURNISH DATA MARKED AS THUS *.
3) PUMPS SHALL BE CAPABLE OF FURNISHING NOT LESS THAN 150 % OF RATED CAPACITY AT A HEAD NOT LESS THAN 65% OF THE RATED HEAD.
4) SHUT OFF HEAD SHALL NOT EXCEED 120 PERCENT OF RATED HEAD .
5) PUMPS MUST BE CAPABLE OF STARTING AGAINST AN OPEN DISCHARGE.
6)UNITISATION OF PUMP AND DRIVER SHALL BE DONE IN PUMP MANUFACTURER'S SHOP.
7) THE PUMP SHALL CONFORM TO TARFF ADVISORY COMMITTEE (TAC) REQUIREMENTS AS PER FIRE

PROTECTION MANUAL (PART-II) LATEST EDITION AND SHALL BE TAC APPROVED OR APPROVED BY AGENCIES ACCEPTABLE TO TAC.

NOTE: Applicable Standard/code-NFPA-20

5. DATA SHEET FOR TOWER MONITOR		
1.0	**General**	
1.1	Make	Approved make
1.2	Model	Manufacturer to state
1.3	Size	200 NB
1.4	Water Capacity	6000 LPM
1.5	Type	Electric Remote Operated
1.6	Mounting Height of Monitor	Will be finalized during detail engineering
1.7	Pressure available at base flange of the monitor	7 bar (Min.) & 12.5 bar (Max.)
1.8	Standard/Approval	FM/UL
2.0	**Guaranteed Performance Data**	
2.1	Horizontal Water Range In Still Wind	100 Meters (Min.)
2.2	Vertical Water Range	45 Meters (Min.)
2.3	Operating Pressure (Max.)	16 bar
2.4	Horizontal Rotation Range	+/- 180 deg.
2.5	Vertical Rotation Range	+/- 70 deg.
2.6	Rotation Speed Horizontal	10 (Deg./Sec)
2.7	Rotation Speed Vertical	06 (Deg./Sec)
3.0	**Constructional Features**	
3.1	Nozzle Capacity	Adjustable Disc Type
3.2	Fog/Jet Changeover	Remote operation to be provided
3.3	Operation	Electric Remote Control With Manual Override
3.4	Remote Position Indicator	1 Turn 10k Potentiometer provided for both Horizontal & Vertical Movements
3.5	Safety Limit Switches (Variable Settings)	Provided for both Horizontal & Vertical Movements
3.6	Electric Drive Motor Rating	415 V, 3 Phase,50 HZ, power supply
3.7	Electric Control Supply Rating	All control supply shall be 220 V, Single Phase,50Hz
3.8	Type of Enclosure/IP rating for all Electrical Item such as Terminal Boxes, Limit Switches, Motors etc., mounted on the Monitor	Flameproof Ex (d) suitable for installation in (Zone 1/ Gas Group II A/IIB,T3) & IP 55 (minimum)
3.9	Flange Mounting Details	Size 150 NB, Rating 150#,Dimensions AS PER ANSI B 16.5
4.0	**Materials of Construction**	
4.1	Body / Turret	SS 316
4.2	Barrel/Branch Pipe	SS 316
4.3	Nozzle	SS 316
4.4	Worm & Worm Wheel	Bronze
4.5	Swivels/Bearings	SS 316
4.6	Base Flange	SS 316
4.7	Bolts/Nuts/Fasteners	SS 316
4.8	Motor Fan Cover / Manual Operation	SS 316

	Handle arrangement	
5.0	**Performance Curves/Documents**	
5.1	Terminal Pressure V/s Horizontal Throw	Manufacture to submit
5.2	Terminal Pressure V/s Vertical Throw	
5.3	Terminal Pressure V/s reaction Force	
5.4	Nozzle Adjustment Drawing	
5.5	General Arrangement Drawing	
5.6	Electrical Control Schematic Drawing	
5.7	Product Catalogue	
5.8	Manufacture Quality Assurance Plan	
5.9	Experience Record	
6.0	**Other Details**	
6.1	Rated Working Pressure of Monitor	16 kg/cm2
6.2	Rated Hydraulic Test Pressure of Monitor	24 kg/cm2
6.3	Weight of Total Monitor assembly	Manufacture to state
6.4	Reaction Force of the monitor (Maximum)	Manufacture to state
6.5	Location of Equipment	At unloading platform - Risk Area (Outdoor)

6.DATA SHEET FOR CS PIPE LINE & FLANGES & FITTING		
A	**PIPES**	Welded Joints at every 12 Meter.
1.0	Diameter Range	As required
1.1	Makes	Approved make
1.2	Type	Seamless
1.3	Materials Standard	ASTM A 106 GRADE ‘’B’’
1.4	Dimensional Standard	ASME B 36.10
1.5	Schedule	Upto 80 MM sch.80 & above std. Sch.
1.6	Pipe Ends	Bevelled
1.7	Size/Qty.	As required
1.8	Testing	As per ASTM B 31.3
B	**FITTINGS**	Flanged Joints
1.0	ELBOWS 90 Deg.	R = 1.5 D, Butt Weld Bevel Ends
1.1	Materials Standard	ASTM A 234 Gr. WPB
1.2	Dimensional Standard	ANSI B-16.9
1.3	Size/Qty.	As Required
2.0	**ELBOWS 45 Deg.**	R=1.5D,Butt Weld Bevel Ends
2.1	Material Standard	ASTM A 234 Gr. WPB
2.2	Dimensional standard	ANSI B – 16.9
2.3	Size/Qty.	As required
C	**REDUCER TEE**	Butt Weld Bevel Ends
3.1	Materials Standards	ASTM A234 Gr.WPB
3.2	Dimensional Standards	ANSI B-16.9
3.3	Size/Qty.	As required
D	**EQUAL TEE**	Butt Weld Bevel Ends
4.1	Materials Standards	ASTM A234 Gr.WPB
4.2	Dimensional Standards	ANSI B-16.9
4.3	Size/Qty.	As required
E	**FLANGES**	
1.1	Type	SW RF/SORF
1.2	Material standard	ASTM A 105
1.3	Class	150 Lbs
1.4	Dimensional Std.	ANSI B 16.5
1.5	Size/Qty.	As required
F	**BLIND FLANGE**	ASTM A 105,RF,150 CL,ASME B 16.5
G	**BOLTS WITH NUTS**	
1.1	Type	M/C BOLT
1.2	Materials Standard	CS
1.3	Dimensional Standard	ASTM A 193 GR.B7.ASME B 18.2.1 WITH NUT
1.4	Full Thread	Yes
1.5	NUT/BOLT	SA 193 GR.B7 & SA 194 GR.2H
1.5	Size/Qty.	As required
H	**GASKETS (ALL SIZES)**	
1.1	Type	Spiral Wound (Suitable for above

		Flanges)
1.2	Materials Standards	Spiral Wound SS 316 + CA Fill
1.3	Dimensional Standards	ASME B 16.21
1.4	Thickness	4.4 mm
1.5	Size / Qty.	As required
I	**GATE VALVE**	
1.1	Class	150#
1.2	Design	ANSI B 16.34 & API 600
1.3	Test	API 598
1.4	Face to Face Dimensions	ANSI B 16.10
1.5	End Flange	ANSI B 16.5 (2" TO 24")
		ANSI B 16.47 (30" TO 48")
2.0	MOC	
2.1	Body	Cast Carbon steel ASTM A 216 Gr.WCB, ASTM A 105
2.2	Bonnet	Cast Carbon steel ASTM A 216 Gr.WCB
2.3	Stem	A 182 GR.F6a
2.4	Seat Ring	A 105 N + HF
2.5	Disc	A 105 N + HF
2.6	Gasket	graphite
2.7	Bolts/Nuts	A 193 GR.B7/A194 GR.2H
2.8	Hand Wheel	Cast Iron
J	**BALLVALVE**	
1.1	Class	150#
1.2	TYPE	FULL BORE
1.3	Design	ANSI B 16.34 & BS5351
1.4	Body	ASTM A 216 Gr.WCB
1.5	Face to Face Dimensions	ANSI B 16.10
1.6	End Flange	ANSI B 16.5
1.7	Ball	ASTM A 351 Gr.CF8M/ASTM A 182 Gr. F 316
1.8	Stem	ASTM A 479 Type 316
1.9	Size / Qty.	As required
K	**NRV(SWING CHECK VALVE)**	ASME B 16.34/API 594,ASTM A 216 GR.WCB
L	**CONC. REDUCER**	ASTM A 234,WPB,BW,ASME B 16.9
M	**ECCENTRIC REDUCER**	ASTM A 234,WPB,BW,ASME B 16.9
N	**HALF COUPLING**	ASTM A 105,SW,3000 CL,ASME B 16.11
O	**COUPLING**	ASTM A 105,SW,3000 CL, ASME B 16.11

7.DATA SHEET FOR SS PIPE LINE & FLANGES & FITTINGS FOR FOAM LINES		
A	**PIPES**	
1.0	Diameter Range	1 inch to 8 inches (25 NB to 200 NB)
1.1	Makes	Approved make
1.2	Type	Seamless
1.3	Materials Standard	ASTM A 312 GR.TP-316
1.4	Dimensional Standard	ANSI B – 36.19
1.5	Schedule	10 S
1.6	Pipe Ends	Bevelled
1.7	Size/Qty.	As required
B	**FITTINGS**	Flanged Joints
1.0	ELBOWS 90 Deg.	R = 1.5 D, Butt Weld Bevel Ends
1.1	Materials Standard	ASTM A 403 Gr. WP 316 SS
1.2	Dimensional Standard	ANSI B-16.9
1.3	Size/Qty.	As Required
C	**ELBOWS 45 Deg.**	R=1.5D,Butt Weld Bevel Ends
2.1	Material Standard	ASTM A 403 Gr. WP 316
2.2	Dimensional standard	ANSI B – 16.9
2.3	Size/Qty.	As required
2.4	Schedule/Grade	10 S
D	**TEE JOINTS**	
3.1	Type	Equal-Butt Weld Bevel Ends
3.2	Materials Standard	ASTM A403 Gr.WP 316SS
3.3	Dimensional Standard	ANSI B 16.9
3.4	Size/Qty.	As required
3.5	Schedule/Grade	10 S
E	**TEE JOINTS**	
4.1	Type	Un Equal-Butt Weld Bevel Ends
4.2	Materials Standard	ASTM A403 Gr.WP 316SS
4.3	Dimensional Standard	ANSI B 16.9
4.4	Size/Qty.	As required
4.5	Schedule/Grade	10 S
F	**REDUCER**	
5.1	Type	Concentric – Butt Weld Bevel Ends
5.2	Materials Standard	ASTM A403 Gr.WP 316SS
5.3	Dimensional Standard	ANSI B 16.9
5.4	Size/Qty.	As required
5.5	Schedule/Grade	10 S
G	**FLANGES**	
6.1	Type	SW RF/SORF
6.2	Material standard	ASTM A 182 F 316 SS
6.3	Class	150 Lbs
6.4	Dimensional Std.	ANSI B 16.5
6.5	Size/Qty.	As required

H	**BLIND FLANGE**	ASTM A 182 F GR.F 316
I	**BOLTS WITH NUTS**	
7.1	Type	BOLTS with 2 nuts
7.2	Materials Standard	SS 316
7.3	Dimensional Standard	ANSI B – 18.2
7.4	Full Thread	Yes
7.5	Size/Qty.	As required
7.6	Bolts & Nuts	SA -320-B8 WITH SA 194-8
K	**GASKETS (ALL SIZES)**	
8.1	Type	Spiral Wound (Suitable for above Flanges)
8.2	Material Standards	Spiral Wound SS 316 + CA Fill
8.3	Dimensional Standards	ASME B 16.20
8.4	Thickness	4.4 mm
8.5	Size / Qty.	As required
8.6	Dimensional Standards	ASME B 16.20
8.7	Thickness	4.4 mm
L	**GATE VALVE**	
1.1	Class	150#
1.2	Design	ANSI B 16.34 & API 600
1.3	Test	API 598
1.4	Face to Face Dimensions	ANSI B 16.10
1.5	End Flange	ANSI B 16.5 (2” TO 24”)
		ANSI B 16.47 (30” TO 48”)
1.6	Body:	ASTM A 182 GRADE F 316/ASTM –A 351 GRADE CF8M SS 316
1.7	TRIM	ASTM A 182 GRADE F 316
1.8	Size / Qty.	As required
M	**BALLVALVE**	
1.1	Class	150#
1.2	TYPE	FULL BORE/TWO PIECE
1.3	Design	ANSI B 16.34 & BS5351
2.0	MOC	
2.1	Body	ASTM A 182 GRADE F 316
2.2	Face to Face Dimensions	ANSI B 16.10
2.3	End Flange	ANSI B 16.5
2.4	Body	Cast SS ASTM A 351 Gr.CF 8M
2.5	Stem	SS AISI 316
2.6	Ball	Cast SS ASTM A 351 Gr. CF 8M
2.7	Seat	RPTEE
2.8	Stem Seal	RPTEE
2.9	Bolts/Nuts	AISI 316
3.0	Qty.	As required
N	**NRV(SWING CHECK VALVE)**	ASME B 16.34/API 594, ASTM A 182

		GRADE F 316
O	**CONC. REDUCER**	ASTM A 403,GR.WP 316 ,BW,ASME B 16.9
P	**ECCENTRIC REDUCER**	ASTM A 403,GR.WP 316 ,BW,ASME B 16.9
Q	**HALF COUPLING**	ASTM A 182 F 316,SW,3000 CL,ASME B 16.11
R	**COUPLING**	ASTM A 182 F 316,SW,3000 CL,ASME B 16.11

8. HYDRANT VALVE SS-316		
1.0	Quantity	As required
1.1	Make	Approved make
1.2	Standard of Manufacture	As per IS:5290 Type A /FM 1521
1.3	Size of valve	63mm Male Instantaneous TYPE
1.4	Capacity	600 lpm at 7 kg/cm2
1.5	Flange Size/Drilling	Flanged-80/75 NB,IS:1538/ANSI B 16.5,150 class
1.6	Hydrostatic Test Pressure	21 kg/cm2 for 2.5 minutes
	Water Tightness Seat Test	14 kg/cm2 for 2.5 minutes
1.7	Operation	Manual
1.8	Recommended service condition	Raw water
2.0	Materials of construction	SS-316
2.1	Body, Bonnet, Female outlet and parts	SS-316
2.2	Spindle	SS-316
2.3	Spring,	Stainless Steel Wire IS:6258
2.4	Hand Wheel	C.I.IS:210 FG 200
2.5	Dimensions check	Dimensions as per IS:5250 Type A
2.6	Finish	Polish finish

Hydrant valves (also called Landing valves) provide the means to draw water for firefighting from the Fire water piping network. They are normally mounted onto stand posts, fitted on the fire water network.

Brief Description : Hydrant Valve, as per IS:5290 Type A, made of Stainless Steel (SS316), having 75 mm flanged inlet, and 63 mm Female Instantaneous outlet, provided with C.I. hand wheel for operation, and PVC blank cap with chain. Body duly painted with 2 coats of superior quality paint. H.P. tested to 21 kgf/cm² (body) and 14 kgf/cm² (seat). Flow 600 lpm (min) at 7 kgf/cm²

9.DATA SHEET FOR HOSE BOX & ACCESSORIES		
1.0	Quantity	As required
2.0	Scope of supply	Hose Box – 1

		Hose 15 M Long – 2nos. Branch pipe + Nozzle - 2nos.
3.0	Hose Box	
3.1	Make	Approved
3.2	Standard Manufacture	Fabricated
3.3	Type/Size of Hose Box	Weather Proof/To store 2 nos. of 15 meter long 63mm size fire hose + 2 Nos. Branch pipe + Nozzle + One no. Nozzle spanner
3.4	MOC	SS 316
3.5	Finish	Polished finish
3.6	General Arrangement	Suitable for storage of 2 nos. 15 meter long,63mm fire hose and 2 nos. branch pipe nozzle/Two glass panel doors with hinges/Handle type lock/MS Hammer with GI chain/Break-glass recess for keys. The Hose shall be self-supporting type suitable for outdoor installation on suitable pedestal
4.0	Fire Hose	
4.1	Make/Brand	Approved make
4.2	Standard manufacture	As per ISI
4.3	Type/Size of Hose	A/63 MM
4.4	Size/Type of end couplings	63 MM Female at both ends Instantaneous Type SS with Copper binding
4.5	Length of Hose	15 meters
4.6	Hydrostatic Test Burst Pressure Proof Pressure	 38 kg/cm2 22 kg/cm2
4.7	Working pressure	14 kg/cm2
4.8	MOC	Cotton synthetic fiber, circular woven, jacketed rubberized fabric reinforced rubber lined (RRL),MYSTOX Treated
5.0	Branch pipe & Nozzle	
5.1	Make	Approved make
5.2	Standard of Manufacture	As per IS
5.3	Type/Size of Branch Pipe	Short / 63 mm Male InstantaneousType
5.4	Size/Type of Nozzle	20 mm Threaded
5.5	Working pressure	14 kg/cm2
5.6	MOC	SS

10. DATA SHEET FOR GATE VALVE		
1.0	Make	Approved Make

2.0	Size/Type	As required
3.0		
4.0	Operation	Manual Hand Wheel / Gear operation for size 300 NB & above
5.0	Standard	API/BS
6.0	Rating	150 Class
7.0	End Connections	Flanged to ANSI B 16.5 RF / 125 AARH
8.0	Face to Face dimensions	ANSI B 16.10
9.0	Hydrostatic Test Pressure	Body : 450 PSIG Seat : 325 PSIG
10.0	Test Pressure with AIR	Body : 80 PSIG
11.0	Materials of Construction (suitable for Raw Water)	
11.1	Body	Cast Carbon steel ASTM A 216 Gr.WCC, ASTM A 105
11.2	Bonnet	Cast Carbon steel ASTM A 216 Gr.WCC
11.3	Stem	A 182 GR.F6a
11.4	Seat Ring	A 105 N + HF
11.5	Disc	A 105 N + HF
11.6	Gasket	graphite
11.7	Bolts/Nuts	A 193 GR.B7/A194 GR.2H
11.8	Hand Wheel	Cast Iron

11.DATA SHEET FOR NON-RETURN VALVE		
1.0	Make	Approved Make
2.0	Size/Type	As required
3.0	Check Valve Type	Body - Cast Cover – Bolted Disc - Solid Body Seat Ring – Renewable
4.0	Balancing	Counter Weight for 300 NB size and above
5.0	Standard	BS 1868/API 594/ASME B 16.34
6.0	Rating	150 Class
7.0	End connection	Flanged to ANSI B 16.5 RF/125 AARH
8.0	Hydrostatic Test Pressure	Body: 450 PSIG Seat : 325 PSIG
9.0	Test Pressure with AIR	Body : 80 PSIG
10.0	MOC (Suitable for Raw Water)	Specified
10.1	Body	CS ASTM A 216 Gr. WCC
10.2	Cover	CS ASTM A 216 Gr. WCC

10.3	Disc	A 216 GR.WCC
10.4	Seat Ring	A 105N + HF
10.5	Disc Washer, Disc Nut, Disc Pin	SS-316
10.6	Disc Hinge	A 216 GR.WCC
10.7	Hinge/Bracket	A 216 GR.WCC/A 516 GR.70
10.8	Gasket	Graphite with Braided end rings
10.9	Cover Nut	A 194 Gr.2H
10.10	Cover Stud	A 193 gr. B7

12.DATA SHEET FOR MOTOR OPERATED GATE VALVE (OPTIONAL)		
1.0	Make	Approved Make
2.0	Size/Qty.	As required
3.0	Gate Valve Type	Body - Cast Bonnet - Bolted Stem – Rising Wedge Disc – Solid Body Seat Ring – Renewable Stem Packing – Renewable with valve OPEN on stream Hand Wheel – Non-Rising
4.0	Operation	Electric Actuator / Manual
5.0	Standard	API / BS
6.0	Rating	150 Class
7.0	End Connections	Flanged to ANSI B 16.5 RF/125 AARH
8.0	Hydrostatic Test Pressure	Body – 450 PSIG Seat – 325 PSIG
9.0	Test Pressure with AIR	Body : 80 PSIG
10.0	MOC	
10.1	Body	Cast Carbon steel ASTM A 216 Gr.WCC, ASTM A 105
10.2	Bonnet	Cast Carbon steel ASTM A 216 Gr.WCC
10.3	Stem	A 182 GR.F6a
10.4	Seat Ring	A 105 N + HF
10.5	Disc	A 105 N + HF
10.6	Gasket	graphite
10.7	Bolts/Nuts	A 193 GR.B7/A194 GR.2H
10.8	Hand Wheel	Cast Iron
11.0	Electric Actuator Details	
11.1	Make	Approved make
11.2	Model	As per manufacture
11.3	Type	Electric Motor
11.4	Enclosure	Ex (d) suitable for ZONE 1 Gas group IIA/IIB,T3

11.5	IP Rating	IP 55 (Minimum)
11.6	Power Supply	415 V,3 Ph,50Hz
11.7	Torque	Manufacture to state
11.8	Speed	Manufacture to state
11.9	Travel Time	60 Sec.
11.10	Stem Acceptance	As per size of valve
11.11	Insulation Class	F
11.12	Finish	Epoxy paint
11.13	Features	Integral Reversing DOL Starter Operating Push Buttons Torque Switch – 2nos. Limit Switches (1 NO + 1 NC)-4nos. Space Heater Ex (d) Cable Glands Mechanical Position Indicator
11.14	Wiring Diagram	To be submitted by vendor
11.15	Approx. Weight	To be indicated by Vendor
12.0	Location of Equipment	At unloading platform- Hazardous Area (Outdoor)
13.0	Drawing	To be submitted by vendor
14.0	Product catalogue	To be indicated by Vendor

13.DATA SHEET FOR BALL VALVE		
1.0	Make	Approved make
2.0	Type / Model No.	Full Bore
3.0	Standard of Manufacture	BS:5351
4.0	Class of Valve	150 class
5.0	Size / Qty	As per required
6.0	Mounting Flange Details	Dimensions / Drilling ANSI B 16.5 Raised Face / 125 AARH
7.0	Test Pressure	BS:6755
7.1	Body - (Hydrostatic)	30 kg/cm2
7.2	Seat – (AIR)	5.6 kg/cm2
	Seat – (WATER)	22 kg/cm2
8.0	Mode of Operation	Manual Lever
9.0	Recommended service condition	3% AFFF Concentrate
10.0	Material Of Construction. (suitable for 3% AFFF Concentrate)	Specified
10.1	Body	Cast SS ASTM A 351 Gr.CF 8M
10.2	Stem	SS AISI 316
10.3	Ball	Cast SS ASTM A 351 Gr. CF 8M
10.4	Seat	RPTEE
10.5	Stem Seal	RPTEE
10.6	Bolts/Nuts	AISI 316

10.7	Lever	SG Iron
11.0	Drawing	To be submitted by vendor
11.1	Product Catalogue	To be submitted by vendor

14.DATA SHEET FOR NON-RETURN VALVE (SS-316) FOR FOAM LINES		
1.0	Make	Approved make
2.0	Type / Model No.	Swing Check
3.0	Standard of Manufacture	BS:1868
4.0	Class of Valve	150 class
5.0	Size / Qty	As per required
6.0	Mounting Flange Details	Dimensions / Drilling ANSI B 16.5 Raised Face / 125 AARH
7.0	Test Pressure	BS:6755
7.1	Body - (Hydrostatic)	30 kg/cm2
7.2	Body	30 kg/cm2
	Seat	22 kg/cm2
8.0	Mode of Operation	Manual Lever
9.0	Recommended service condition	3% AFFF Concentrate
10.0	Material Of Construction. (suitable for 3% AFFF Concentrate)	Specified
10.1	Body/Bonnet	ASTM A 351 Gr. CF 8 M SS-316
10.2	Disc	SS-304/316
10.3	Seat Ring	ASTM A 351 Gr.CF8M SS-316
10.4	Bolts/Nuts	SS 304/316
10.5	Gasket	SW 316 CAF filler
11.0	Drawing	To be submitted by vendor
12.0	Product Catalogue	To be submitted by vendor

15. DATA SHEET FOR MOTOR OPERATED (SS-316) BALL VALVE		
1.0	Make	Approved make
2.0	Type / Model No.	Full Bore
3.0	Standard of Manufacture	BS:5351
4.0	Class of Valve	150 class
5.0	Size / Qty	As per required
6.0	Mounting Flange Details	Dimensions / Drilling ANSI B 16.5

		Raised Face / 125 AARH
7.0	Test Pressure	BS:6755
7.1	Body - (Hydrostatic)	30 kg/cm2
7.2	Seat – (AIR)	5.6 kg/cm2
	Seat – (WATER)	22 kg/cm2
8.0	Mode of Operation	Electric Actuator
9.0	Recommended service condition	3% AFFF Concentrate
10.0	Material Of Construction. (suitable for 3% AFFF Concentrate)	Specified
10.1	Body	Cast SS ASTM A 351 Gr.CF 8M SS-316
10.2	Stem	SS AISI 316
10.3	Ball	Cast SS ASTM A 351 Gr. CF 8M
10.4	Seat	RPTEE
10.5	Stem Seal	RPTEE
10.6	Bolts/Nuts	AISI 316
10.7	Lever	SG Iron
11.0	Drawing	To be submitted by vendor
11.1	Make	Approved make
11.2	Model	As per manufacture
11.3	Type	Electric Motor
11.4	Enclosure	Ex (d) suitable for ZONE 1 Gas group IIA/IIB,T3
11.5	IP Rating	IP 55 (Minimum)
11.6	Power Supply	415 V,3 Ph,50Hz
11.7	Torque	Manufacture to state
11.8	Speed	Manufacture to state
11.9	Travel Time	60 Sec.
11.10	Stem Acceptance	As per size of valve
11.11	Insulation Class	F
11.12	Finish	Epoxy paint
11.13	Features	Integral Reversing DOL Starter Operating Push Buttons Torque Switch – 2nos. Limit Switches (1 NO + 1 NC)-4nos. Space Heater Ex (d) Cable Glands Mechanical Position Indicator
11.14	Wiring Diagram	To be submitted by vendor
11.15	Approx. Weight	To be indicated by Vendor
12.0	Location of Equipment	At unloading platform- Hazardous Area (Outdoor)
13.0	Drawing	To be submitted by vendor
14.0	Product Catalogue	To be submitted by vendor

16.DATA SHEET FOR IN-LINE BALANCE PRESSURE FOAM PROPORTIONER		
1.0	General	
1.1	Make	Approved make
1.2	Model	Manufacture to state
1.3	Size/Qty.	As required
1.4	Water Capacity	
1.5	Foam Capacity	
1.6	Type	In-Line Wafer Type
1.7	Design Pressure	17 Bar
1.8	Standard / Approval	Manufacture to state
2.0	Constructional features	
2.1	Proportioner	In-Line Wafer Type mounted between two flanges of monitor water line
2.2	Water Inlet	Flanged, ANSI B 16.5,150#
2.3	Foam Inlet	Flanged, ANSI B 16.5,150#
2.4	Ratio Adjustment	1% to 6%
3.0	MOC	Must be suitable for Raw water + Foam
3.1	All parts of the proportioner	Bronze or SS 316
4.0	Drawings/Documents	
4.1	General Arrangement & Dimensional Drawing	
4.2	FM/UL Approval Certificates	
4.3	Product Catalogue	
4.4	Manufactures Quality Assurance Plan	
4.5	Experience Record	

17.DATA SHEET FOR PRESSURE GAUGE		
1.0	Make	Approved make
2.0	Model No.	Manufacture to state
3.0	Type	Bourden
4.0	Tag No.	
5.0	Service	water
5.1	Operating pressure	16 kg/cm2
5.2	Design Pressure	20 kg/cm2
6.0	Operating Temperature	40°C
6.1	Design Temperature	52 °C
7.0	Application	Raw Water
8.0	Location	Pump discharge & Main Header
9.0	Fill Fluid	Glycerin
10.0	Mounting	½" Flanged End ANSI B 16.5
11.0	Dial size	150 MM
12.0	Case Material	
13.0	Bezel Ring	
14.0	Window material	

15.0	Enclosure Class	
16.0	Pressure element	
17.0	Element material	
18.0	Socket material	
19.0	Accuracy	
20.0	Zero Adjustment	
21.0	Movement	
22.0	Diaphragm Seal (Wherever required)	
	a.)Type	
	b.)Wetted Parts	
	c)Other Materials	
	d.)Process Connections	
	e.)Facing & Finish	
	f).Capillary Materials	
	g.)Armour Type	
	h.)Armour Materials	
	i.)Capillary Length	
	j.)Flushing Filling Conn.	
23	Over Range protection	
24	Blow out Protection	
25	Options	
	a.)Snubbet	
	b.)Siphon	
	c.) Gauge Saver	
	d.)Liqued filled casing	
	e.)Vacuum protection	
26.0	MOC	SS 316

18.DATA SHEET FOR PRESSURE SWITCH		
1.0	Make	Approved make
2.0	Model No.	Manufacture to state
3.0	Type	Diaphragm Sealed Piston Actuator
4.0	Tag No.	
5.0	Service	Raw water
5.1	Operating pressure	16 kg/cm2
5.2	Design Pressure	20 kg/cm2
6.0	Operating Temperature	40°C
6.1	Design Temperature	52 °C
7.0	Location	Pump Discharge & Main Header
8.0	Mounting	Direct - Bottom entry ½" NPT
9.0	Enclosure Protection	IP 66
10.0	MOC	
11.0	Enclosure	Die Cast Aluminium

12.0	Diaphragm	SS 316
13.0	Wetted Parts	SS 316
14.0	Electrical Rating	
15.0	Switch	SPDT-1no.Snap action micro switch
16.0	Contacts	1 No + 1 NC
17.0	Rating	15A 250V AC / 1A 30 C DC
18.0	Standard Features	1/setting-Full range adjustable 2/Over range protection-130%
19.0	Location of Equipment	Fire water Pump House-Safe Area (Indoor)
20.0	Drawing/Catalogue	To be submitted by Vendor

19.DATA SHEET FOR PRESSURE TRANSMITTERS		
1.0	Make	Approved make
2.0	Model No.	Manufacture to state
3.0	Type	Transmitter
4.0	Tag No.	
5.0	Service	Rawwater
5.1	Operating pressure	16 kg/cm2
5.2	Design Pressure	20 kg/cm2
6.0	Operating Temperature	40°C
6.1	Design Temperature	52 °C
7.0	Application	Raw Water
8.0	Location	Pump discharge & Main Header
9.0	Sensor Element	
10.0	Element type	
11.0	Process connection	½" Flanged End ANSI B 16.5
12.0	Flange Material	SS 316
13.0	Transmitter	
14.0	Measuring Range	20 bar
15.0	Calibrated span	
16.0	Reference accuracy (% of span)	
17.0	Repeatability	
18.0	Long term Stability	
19.0	Power Supply	
20.0	Output signal/communication	
21.0	Hazardous area class + Protect	
22.0	Accessories	
23.0	Mounting Bracket	
24.0	Manifold type/Manifold material	
25.0	Manifold process connection	
26.0	Enclosure	
27.0	Enclosure material	
28.0	Ingress protection	

29.0	Cable Glad entry	
30.0	Chemical Seal	
31.0	L-Pressure type	
31.1	Seal type	
31.2	Seal mounting	
31.3	Diaphragm extent length	
31.4	Seal wetted parts material.	
31.5	Seal model no.	
32.0	H-Pressure type	
32.1	Seal type	
32.2	Seal mounting	
32.3	Diaphragm extent length	
32.4	Seal wetted parts material.	
32.5	Seal model no.	

20.DATA SHEET FOR ORIFICE PLATE (OPTIONAL)		
1.0	Make	Approved make
2.0	Model No.	Manufacture to state
3.0	Type	Square Edge Concentric
4.0	Tag No.	
5.0	Service	Raw water
6.0	Qty.:	As required
7.0	Location	Hydrant Stand Posts
8.0	Mounting	Between 2nos. 4” 150 class, RF,ANSI B-16.5 Flanges
9.0	Materials of Construction	SS 316
10.0	Drawing /Catalogue	To be submitted by Vendor

21.DATA SHEETFOR FOR LEVEL INDICATOR OF FOAM TANK		
1.0	Make	Approved make
2.0	Model No.	Manufacture to state
3.0	Type	Tubular
4.0	Tag No.	
5.0	Service	AFFF Compound
6.0	Qty.:	As required
7.0	Location	AFFF Storage Tank
8.0	Range	Between Top & Bottom Tank Nozzle
9.0	Mounting	Local direct mounting on tank nozzles
10.0	Process Connection Size	1” 150 class Flange as per ANSI B 16.5
11.0	Operating Pressure/Temperature	Atmosphere/Ambient
12.0	Viewing Element	Transparent Tube
13.0	MOC	

13.1	View Tube	Acrylic
13.2	Body & Tie Rod	SS 316
13.3	Auto Shut-off Ball valve	SS 316
13.4	Flange	SS 316
13.5	Packing/Gasket	Gr.Asbestos
13.6	Drain Plug	SS 316
13.7	Vent Plug	SS 316

22.DATA SHEET FOR FOAM TANK LEVEL SWITCH OF FOAM TANK		
1.0	Make	Approved make
2.0	Model No.	Manufacture to state
3.0	Type	Side Mounting Magnetic Coupling
4.0	Tag No.	
5.0	Service	AFFF Compound
6.0	Qty.:	As required
7.0	Location	AFFF Storage Tank
8.0	Mounting	Foam Tank (Low Level)
9.0	Process Connection/Mounting	Direct-Nozzle flange on the tank side
10.0	Enclosure Type/Ingress Protection	Explosion proof as per Zpne 1 Gas Gr.IIA/IIB and IP 66
11.0	MOC	
11.1	Electrical Enclosure	Die Cast Aluminum
11.2	Float	SS 316
11.3	Flange	SS 316
11.4	Electrical Rating	
11.5	Switch	SPDT-2Nos. Snap action micro-switch
11.6	Contacts	1 NO + 1 NC

23.DATA SHEET FOR CONTROL CABLE- FIRE SURVIVAL		
1.0	Make	Approved make
2.0	Model No.	Manufacture to state
3.0	Type	Fie Performance / Fire Survival
4.0	Tag No.	
5.0	Performance Standards	BS 7846/IEC 331 or Higher Rating
6.0	Conductor	Stranded Copper
7.0	Rated Voltage	1100 V
8.0	Armored	Yes – GI Round Wire
9.0	Cable Construction	
9.1	Conductor Core	Copper
9.2	Core Fire Resistant Sheath	Mica/Glass Tape
9.3	Core Insulation	Cross linked Polyethylene Insulation (XLPE)

9.4	Inner Sheath	Zero Halogen,Low Smoke and Fume
9.5	Armour	GI round wire
9.6	Outer Sheath	Zero Halogen,Low Smoke and Fume
9.7	Markings	Yes on Outer Sheath
9.8	Color of Outer Sheath	Red
9.9	Color/Number Coding for cores	All core to be clearly identified by color or number code as per applicable standard
10.0	Application	To connect between the Main Junction boxes to each of the equipment on unloading platform
11.0	Certification/Drawing	To be submitted by vendor

24.DATA SHEET FOR FOAM TANK		
1.0	Make	Approved make
2.0	Model No.	Manufacture to state
3.0	Type	Horizontal Cylindrical Dish Ends
4.0	Manufacture Standard	BIS:2825
5.0	Application	AFFF Storage Non Pressure Vessel
6.0	Overall Capacity & Qty.	75 Cu.M – 3nos.
7.0	Hydrostatic Testing Pressure	Water Fill Tank only
8.0	MOC	
8.1	Horizontal Tank	SS 316 Plate 6 mm Thick (min.)
8.2	Nozzles welded to the tank	SS 316 Pipe
8.3	Manhole & Sludge Trap	SS 316 Plate 6 mm Thick (Min.)
8.4	Filling Lines, Vents & Drains welded to tank	SS 316
8.5	Bolts/Nuts	SS 316
8.6	Isolation ball valves	SS 316
9.0	Features on the Tank	
9.1	Dish Ends	2 Nos.
9.2	Manhole 600 MM diameter	1 No.
9.3	Air vent 80NB Goose neck	1 No.
9.4	Overflow line & valve	1 No.
9.5	Sludge Trap & Drain Valve	1 No.
9.6	Lifting Hooks	2 Nos.
9.7	External Ladder to Manhole	1 No.
9.8	Filler line & Strainer (150 NB)	1 No.
10.0	Accessories on the Tank	
10.1	Breather Valve	1 No.
10.2	Level Indicator	1 Set
10.3	Level Switch	1 No.

25.DATA SHEET FOR Y-TYPE STRAINER (FOAM PUMP)		
1.0	Make	Approved make
2.0	Type	Y-Type Having open strainer area 3 times the pipe inlet area
3.0	Standard of Manufacture	Manufacture's Std.
4.0	Mesh size	40
5.0	Size of Strainer	80 NB
6.0	Flow	75 Cu.M
7.0	Flange Details	Dimensions/Drilling ANSI B 16.5;150 Class
8.0	Hydrostatic Test Pressure	6 kg/cm2
9.0	Recommended service condition	On Suction side of foam pump for 3% AFFF Concentrate
9.1	MOC	
9.2	Body	SS316
9.3	Mesh	SS 316
9.4	Bolts/Nuts	SS 316
9.5	Gasket	CAF
9.6	Flange	SS316

26.DATA SHEET FOR T-TYPE STRAINER FOR WATER SERVICE		
1.0	Make	Approved make
2.0	Type	T-Type
3.0	Standard of Manufacture	Manufacture's Std.
4.0	Mesh size	40
5.0	Flow	720 M3/hr
6.0	Size of Strainer	350 NB
7.0	Flange Details	Dimensions/Drilling ANSI B 16.5;150 Class
8.0	Hydrostatic Test Pressure	6 kg/cm2
9.0	Recommended service condition	Water
10.0	MOC	
10.1	Body	ASTM A 216 Gr.WCB
10.2	Mesh	SS 316
10.3	Bolts/Nuts	ASTM A 193 B7/ ASME B 18.2.1 With nut
10.4	Gasket	SS Spiral wound graphite
10.5	Flange	ASTM A 105;150 Class; ASME B 16.5

27.DATA SHEET FOR JUMBO WATER CURTAIN		
0.0	Size	200 MM
1.0	Nos. of water curtain	As required

2.0	Flow	6000 LPM
3.0	Angle of Spray	180°
4.0	Flow Pressure	7 kg/cm2
5.0	End Connection	ANSI B 16.5; Class:150
6.0	Finish	Natural finish or Epoxy painted
7.0	MOC	SS 316
	a.)Body	SS-316
	b.)Nozzle	SS-316
	c.)Diffuse Valve	SS-316
	d.)Deflector	SS-316
	e.)Working Pressure	5 to 12 kg/cm2
	f.)Discharge Pattern	Semi-Circular spray, Approx 18 Mtrs.., 6 Meters Height

28.DATA SHEET FOR DOUBLE HYDRANTS		
1.0	Flow	600 LPM/900 LPM
2.0	Inlet	100 NB
3.0	Out let	2 x 80 NB Flange (ANSI 16.5, 150 #) Should match 65 mm Hydrant valve
4.0	MOC	CARBON STEEL
	a.)PIPE	M.S. ERW IS:1239 Part 2
	b.)Inlet/outlet Flanges	Carbon Steeel,IS:2062/IS:2004,ASTM A 105
	c.)Operational Test	H.P Teste to 23 kg/cm2 for 5 minutes
5.0	Working pressure	7 to 14 kg/cm2
6.0	Height	600 MM
7.0	Shade	Fire Red IS:5 Shade no. 536, inside with zinc chromate paint

NOTE: 1. CS Make Hydrants shall be used at Land fall area of F.W.Net work
2. SS-316 Make Hydrants shall be used at Jetty area of F.W. Net work

29.DATA SHEET FOR ELECTRICAL OPERATED WATER CUM FOAM MONITORS		
1.0	Nos.	As required
2.0	Flow	900 LPM
3.0	Type	Stand Post Type (Fixed), Single Barrel, Manual & electrical operated(Flame proof)
4.0	In let	100 NB
5.0	Flow Pressure	7 kg/cm2 to 14 kg/cm2
6.0	Fluid Handled	Water / Foam Solution
7.0	Temperature	Ambient
8.0	Movement	Horizontally- 340 Deg Vertically-105 Deg (+90 Deg, -15Deg)

9.0	Foam Expansion Ratio	1.3 : 1.7
10.0	Foam Induction Mechanism	1.Self Inducting , Aqua Powered Able to induct 3% foam
		2.Capable of Feeding Foam concentrate to the monitor from a horizontal distance of up to 60 meters from monitor nozzle / Centralized Foam System
		4.Min Kinematic Performance with 7Kg/cm2 pressure at Inlet Flange(Water / Foam
11.0	Horizontal	50m
12.0	Vertical	25m
13.0	Scope of Supply	Scope of Supply - Monitor (UL Listed / FM Approved)Nozzle (UL Listed / FM Approved)Foam Induction Mechanism (UL Listed / FM Approved)
14.0	End Connection	ANSI B 16.5; Class:150
15.0	Finish	Epoxy painted
16.0	MOC	
16.1	Nozzle	SS316 / SS-316 L
16.2	Monitor Body	SS316 / SS-316 L
16.3	Flange	SS316 / SS-316 L
16.4	Worm	SS316 / SS-316 L / Brass
16.5	Gear	SS316 / SS-316 L / Brass
16.6	Spindle for worm	SS316 / SS-316 L / Brass
16.7	Hand-wheel for Nozzle, horizontal/vertical movement	SS316 / SS-316 L / Brass / SS-304
16.8	Pick up tube	PVC tube reinforced with high tensile steel wire helix as per ASTM D1785 sch.80 (3-4 meter length)
16.9	Drain connection	SS316 / SS-316 L
16.10	Drain valve	SS316 / SS-316 L
17.0	Foam strainer	(removable type) - SS316 / SS-316 L /
18.0	Foam Induction device / system / mechanism	SS316 / SS-316 L / Brass
19.0	Foam Induction Couplings	SS316 / SS-316 L / Brass
20.0	Nuts/bolts/studs at Monitor -	SS316 / SS-316 L

30. DATA SHEET FOR 3% AFFF CONCENTRATE		
1.0	Make	Approved make
2.0	Reference standard	IS 4989 Part 2-1984
3.0	PH at 25°C+/-1°C	7.0+/-0.5
4.0	Specific Gravity at 27 °C +/- 1°C	0.8 to 1.15
5.0	Miscibility with Distilled Water, Raw Water	Miscible

6.0	Viscosity (cST) at 27°C +/- °C	7 to 10
7.0	Spreading (Co-efficient)	More than 3
8.0	Sludge Content (% v/v)	Less than 0.1%
9.0	Surface Tension (dyn/cm)	Less than 17
10.0	Pour Point	(-) 5°C
11.0	Foam Expansion Ratio at 27 °C +/-1°C	More than 6
12.0	Drainage Time (25%) at 27 °C +/- 1°C	More than 120 secs.
13.0	Film Formation	Forms Aqueous Film
14.0	Resistance to burn back	More the 10 mins.
15.0	Fire Extinguishing Time	Less than 60 secs.
16.0	Packing	200 ltrs. Barrels

31.DATA SHEET FOR GEAR PUMP FOR FOAM APPLICATION		
Sl.No.	Description	Foam Concentrate Pump
A	General	
1	Type	Gear Pump
2	Service	Foam Concentrate
3	Standard	Shall be confirmed to NFPA-20 as per API 676
4	Capacity	40 M3/hr
5	Discharge Pressure	17 bar
B	MOC	
1	Casing (pump body)	CF8M
2	Rotor gears	SS 316
3	Rotor gears	SS 431
4	End covers	SS 316
5	Wearing Plates	Ph Bronze
6	Stuffing Box packing	Mechanical Seal
7	Gland / Bearing Cover	SS 316
8	Coupling guard	Aluminium
9	Base Plate	MS Fabricated
C	Prime Mover	Electric motor
1	R.P.M	1500

32.PREFERRED VENDOR LIST FOR MECHANICAL EQUIPMENTS		
Sl.No	**Item**	**Name of Manufacture**
	Plares	TISCO, SAIL, JINDAL STEEL, ESSAR STEEL
	STRAINER (FAB/ CAST/ FORGED)	J.N. MARSHAL & CO, OTOKLIN FILTERS OF INDIA LTD., GREAVES COTTON & CO., MAZDA POWER ENGINEERS, VIRAL ENGINEERS
1	Main Pump/Jockey Pump	KIRLOSKAR,MATHER & PLATT,FAIR Banks VOLTAS or any imported make with external bearing provided with certificate from any

		classification society
2.a	Main Foam Pump	EMI or Equivalent UL/FM approved make/model
2.b	Foam Filling Pump	KSB,ROTOPUMP,TUSHACO,KISHOR
3	Diesel Engine	CUMMIMS.MAN,CATERPILLER,KIRLOSKAR OIL ENGINE
4	Foam/water monitor remote operated and foam proportionator	ANGUS/ANSUL/SKUM/ACRON BRASS (U.S.A)
5	Hydrant Valve	NEWAGE,VENUS,SHAH BOGILAI,SUKAN
6	Hose Pipe	CRL,JAYASREE,NEWAGE
7	Pipe	TATA,INDUS,SAW,SAIL,WELSPUN,ROSHINI, GSL,MUKUND,ZINDAL,ISMT,MAHARASHTRA, SEAMLESS LTD.,
8	SS Pipe	CHOKSHI,SWASTICK
9	Butterfly Valve	INTERVALVE,L&T, FOURESS VALVES, KEYSTONE
10	Ball Valve	L & T,CRESCENT,KEYSTONE,STEEL STRONG VALVES
11	Globe/Gate Valve	TYVO,SANMER,BDK,AUDCO-INDIA
12	Motorized Valve	TYCO,SANMAR,BDK,AUDCO-INDIA,ROTORK
13	Non Return Valve	L&T,CRESCENT,UPADHYA,KEYSTONE
14	Fire Extinguisher	MINIMAX,VIJAY,ZENITH FIRE SERVICES
15	Pressure gauge manometer	AN, H-GURU,FIBEG,GENERAL INSTRUMENTAL
16	Jumbo Curtain nozzle	HD FIRE/FIRE TECH
18	AFFF	UL/FM APPROVED 9FOAM CONCENTRATE)
19	Foam & water monitor (ground monitor)	ANGUS/ANSUL/SKUM/ACRON BRASS (U.S.A)
20	FIRE FIGHTING SYSTEM	MATHER & PLATT FIRE SYSTEMS LTD., VIJAY FIRE PROTECTION SYSTEM LTD., VIMAL FIRE CONTROL PVT. LTD. NITIN FIRE PROTECTION INDUSTRIES LTD. STEELAGE INDUSTRIES LTD, New Age Fire Fighting Co. Ltd, Surendranagar

33. APPROVED MAKES FOR ELECTICAL EQUIPEMRNTS		
S. No.	Equipment / Component	Preferred Makes
1	HT Switchgear	Adlec (Schneider) / SPC Electrotech (L&T) / RISHA (L&T) / NITYA (Siemens)
2	LT Switchgear & Distribution Boards (CRCA)	Adlec (Schneider) / RISHA (L&T, ABB) / SPC Electrotech (L&T) / Vidhyut Control (L&T) / NITYA (Siemens)
3	Distribution Boards (FRP	Sumip Composite (Pushtron)
4	Distribution Transformer	Areva / Emco / Crompton / BHEL / Voltamp

		/ Bharat Bijlee / PETE Hammond
5	HT Cables	Havells / Ravin / Gemscab / Gloster / Paramount
6	LT Power Cables	Havells /Ravin / Gemscab / Gloster / Grandlay / Paramount
7	Control Cables, Wires & Flexible cables	Havells / Gemscab / Ravin / Gloster / Grandlay / Paramount
8	Cable Glands/Lugs	Jainsons / Dowells / Gripwell / SMF
9	Cable Trays (FRP)	Ercon / Indiana / Sumip Composites / Sintex
10	LT Capacitor Bank	L&T / Epcos / Schneider / ABB / Asian / Madhav / Havells
11	Battery	Exide / Amco / Amara Raja / Chloride / HBL
12	Battery Charger with DCDB	Chhabi Electricals / Caldyne / Mastek / DB Electronics / HBL
13	Diesel Generator Set	Powerica / Jakson / Kohler / Greaves / Sudhir / Cummins / Caterpillar
14	Lighting fixture (LED) /	Bajaj / Philips / GE Lighting / Havells / Pharox / Surya
15	Street light fixtures with poles	Bajaj / Philips / GE Lighting / Surya
16	Aviation Light	AVAIDS Technovators
17	Plate-Switches & Sockets, Boxes	MK / Crabtree (Havells) / Anchor
18	GI Conduit with accessories	BEC / AKG / SENCO / Jindal 19
19	VCB	Siemens / L&T / ABB / Schneider
20	ACB	Siemens / L&T / ABB / Schneider
21	MCCB	Siemens / L&T / ABB / Schneider
22	MCB / ELCB / RCB / MPCB	Siemens / L&T / MDS / Schneider / Havells
23	Fuse/Link	Siemens / L&T / Alstom / Schneider / C&S / Areva
24	Switch Fuse Units	Siemens / L&T / Havell's
25	Contactors	Siemens / L&T / ABB / Schneider
26	Indicating Lamps / Push buttons	Siemens / Schneider / Teknic / Kaycee / L&T / Essen / Vaishnav / BCH / C&S
27	Push button stations	Siemens / Schneider / Teknic / L&T / BCH / Sumip Composits (Pushtron - FRP)
28	Meters (digital) MFM	Schneider (Conzerv) / L&T / Secure
29	Voltmeter / Ammeter / PF Meter / Frequency Meter/ KWH Meter	AEI / IMP / MECO / INDCOIL / Enercon / L&T / Rishabh / Siemens
30	Selector Switch	L&T / Siemens / Schneider / Kaycee / Salzer / C&S / Vaishnav
31	Auxiliary Contactors/ Relays	L&T / Siemens / BCH
32	Overload Relays (Hand Reset Type)	L&T / Siemens / BCH / Telemachanique
33	Protective / Auxiliary Relays	Alstom / Schneider / Siemens / EasunReyroll / ABB / Telemechanique / L&T
34	Time Delay Relays	BCH / Siemens / L&T / English Electric
35	Power Contactor with 2NO+2NC	L&T / Siemens / Telemechanique
36	Timer	Siemens / L&T / BCH / Schneider

37	Terminal Blocks	Elmex / Connect Well
38	Current Transformer/ Potential Transformer	AE / Kappa / L&T / Siemens / Pragati / C&S / Jyoti
39	Plugs & Sockets	Havells / Legrand / Hensel
40	Welding Sockets	B&C / BCH
41	PVC Conduit and accessories	BEC / Polypack / Precision /AKG
42	Cable Termination Kits & Straight Through Joints	Reychem,M-seal(M)
43	Motors	BHEL / Kirloskar / Crompton / Siemens / Havells
44	CCTV	CP PLUS / Dahua / Bosch / Honeywell
45	Chemical Earthing	Ampere Protection / JK Earthing / JMV
46	Axial Flow / Exhaust Fans	Almonard / Dynamic Engineerings
47	Air Conditioners	O'General / Samsung / Blue Star / LG / Hitachi

DEPARTMENT OF OCEAN ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY MADRAS
CHENNAI 600036

Job Title : INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD-156 STANDARD FOR THE PROPOSED OT-II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ-1&2&BJ-1&2

Package : Drawings

Project No - IC/18-19/OEC/102/KoPT/RSUN

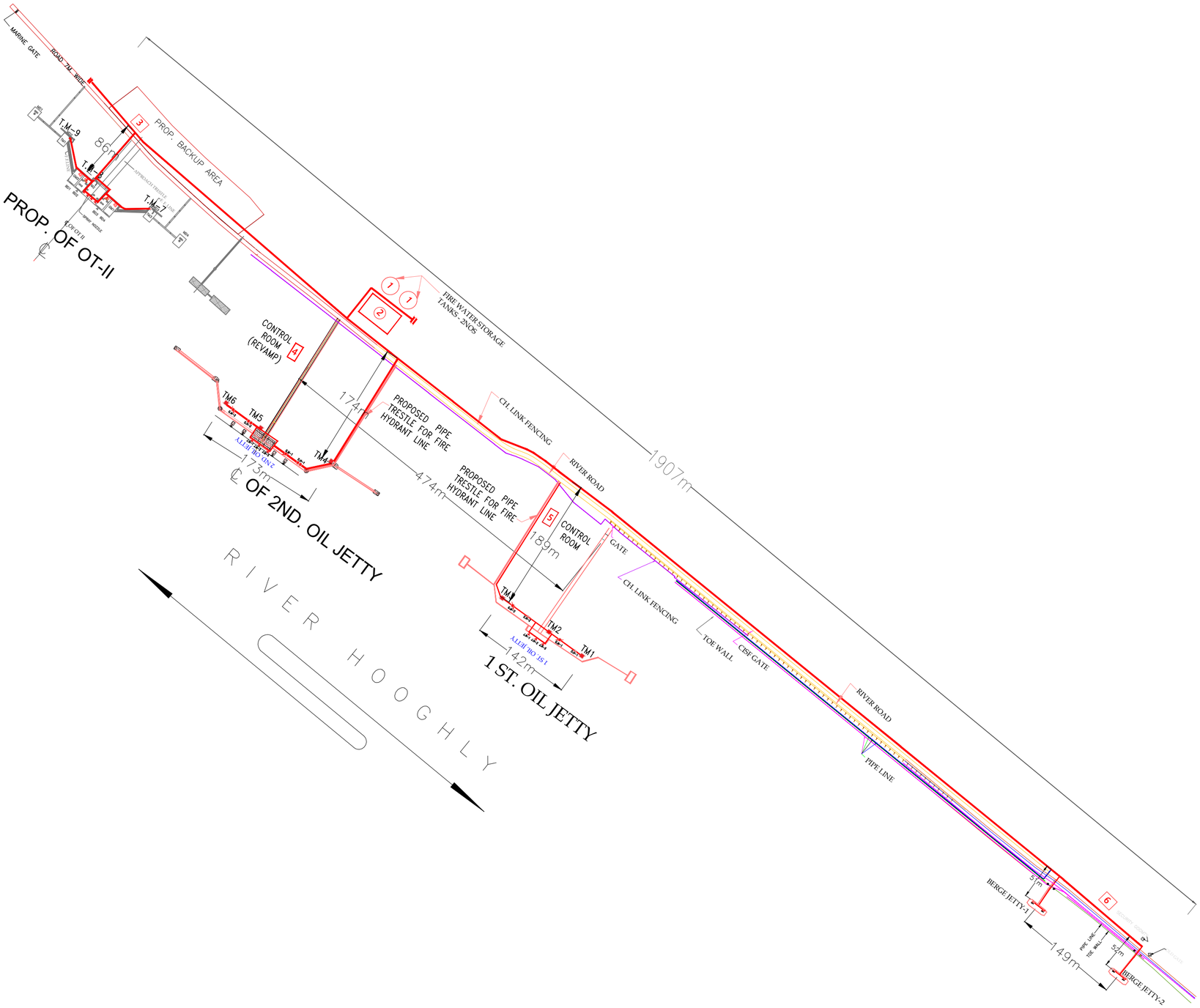
Register of Drawings and Document Issues

Tansmittal No.
1

Day	01
Month	02
Year	19

SL.NO	Title	Doc. No./ Drawing No.	
	Tentative drawings for tender purpose		
	Fire Fighting Facilities		
1	Overall Master Layout	IITM/DOE/HDC/INT/FFF/ML-01	P-00
	Onshore Bore Hole Drawings		
2	Borehole Drawings (BH-1 to 5)	IITM/DOE/KoPT/OT-II/BH - 01	P-00
3	Borehole Drawings (BH-6 to 11)	IITM/DOE/KoPT/OT-II/BH - 02	P-00
	Proposed offshore Civil structure borehole Drawings		
4	Borehole location layout for HOJ-I&II	IITM/DOE/HDC/INT/FFF/BH-03	P-00
	Pump House		
5	Ground Floor Plan (Pump Details)	IITM/DOE/KoPT/OT-II/PH/2001A	P-00
6	Ground Floor Plan	'IITM/DOE/KoPT/OT-II/PH/2001B	P-00
7	Longitudinal Section AA	IITM/DOE/KoPT/OT-II/PH/2002	P-00
8	Crosss Section BB	IITM/DOE/KoPT/OT-II/PH/2003	P-00
9	Elevation	IITM/DOE/KoPT/OT-II/PH/2004	P-00
10	Pile and Pile muff Layout	IITM/DOE/KoPT/OT-II/PH/2005	P-00
11	Column Layout	IITM/DOE/KoPT/OT-II/PH/2006	P-00
	Common Control Room		
12	Ground Floor Plan	IITM/DOE/KoPT/OT-II/CR/5001	P-00
13	Longitudinal Section AA	IITM/DOE/KoPT/OT-II/CR/5002	P-00
14	Crosss Section BB	IITM/DOE/KoPT/OT-II/CR/5003	P-00
15	Elevation	IITM/DOE/KoPT/OT-II/CR/5004	P-00
16	Column,Pile and Pile muff Layout	IITM/DOE/KoPT/OT-II/CR/5005	P-00
	Offshore Structures		
17	Fire pipe Trestle - GA Drawing - 150m length	IITM/DOE/HDC/INT/HOJ-1&2/6001	P-00
18	Fire pipe Trestle - GA Drawing - 150m length	IITM/DOE/HDC/INT/HOJ-1&2/6002	P-00
19	Fire pipe Trestle - GA Drawing - 190m length	IITM/DOE/HDC/INT/HOJ-1&2/6003	P-00
20	Fire pipe Trestle - GA Drawing - 190m length	IITM/DOE/HDC/INT/HOJ-1&2/6004	P-00
21	Fire pipe Trestle - Cross section Detail	IITM/DOE/HDC/INT/HOJ-1&2/6005	P-00
22	Control Room for HOJ-1	IITM/DOE/HDC/INT/HOJ-1/7001	P-00
23	Tower Monitor 1,3,4&6	IITM/DOE/HDC/INT/HOJ-1/8001	P-00
24	Tower Monitor 2&5	IITM/DOE/HDC/INT/HOJ-1/8002	P-00
25	Plan & Elevation of connecting platform	IITM/DOE/HDC/INT/HOJ-1/9001	P-00
26	Elevation of conneting platform 10M length and gusset plate connection details	IITM/DOE/HDC/INT/HOJ-1/9002	P-01
27	Plan & cross section of base plate and boller arrangements	IITM/DOE/HDC/INT/HOJ-1/9003	P-02
28	Elevation of conneting platform and connecting plate details	IITM/DOE/HDC/INT/HOJ-1/9004	P-03
Record Copy			1

B - As Built, D - Definitive drawing, G - Good for Construction, P - Preliminary drawing, W - Working drawing	Purpose of Issue	G
FR - Final Report, PR-Preliminary Report,		-
H-Hand Submission, E-Email, P-Post, F-FTP, C-Courier	Method of Issue	E/P
Construction issues to be countersigned by Project Manager.		



N

HOJ - I FIRE FIGHTING SCHEME

SYMBOL	DESCRIPTION	CAPACITY	QTY
■	TOWER MONITOR	5678 IPM	3
●■	GROUND MONITOR	600/900 IPM	2
●●	DOUBLE HYDRANT	600/900 IPM	2
Y	JUMBO NOZZLE	6000 IPM OR 360M³/HR	3

HOJ - II FIRE FIGHTING SCHEME

SYMBOL	DESCRIPTION	CAPACITY	QTY
■	TOWER MONITOR	5678 IPM	3
●■	GROUND MONITOR	600/900 IPM	2
●●	FIRE HYDRANT	600/900 IPM	2
Y	JUMBO NOZZLE	6000 IPM OR 360M³/HR	3

OT - II FIRE FIGHTING SCHEME

SYMBOL	DESCRIPTION	CAPACITY	QTY
■	TOWER MONITOR	5678 IPM	3
●■	GROUND MONITOR	600/900 IPM	2
●●	FIRE HYDRANT	600/900 IPM	9
Y	JUMBO NOZZLE	6000 IPM OR 360M³/HR	3

BJ-I FIRE FIGHTING SCHEME

SYMBOL	DESCRIPTION	CAPACITY	QTY
●■	GROUND MONITOR	3000 IPM	1
●■	GROUND MONITOR	600/900 IPM	2
●●	FIRE HYDRANT	600/900 IPM	2

BJ-II FIRE FIGHTING SCHEME

SYMBOL	DESCRIPTION	CAPACITY	QTY
●■	GROUND MONITOR	3000 IPM	2
●■	GROUND MONITOR	600/900 IPM	2
●●	FIRE HYDRANT	600/900 IPM	2

FIRE FIGHTING EQUIPMENTS

SL.NO	DESCRIPTION	CAPACITY	QTY
1	FIRE PUMP	720M³/HR @ 16KG/CM²	6
2	JOCKEY PUMP	70M³/HR @ 16KG/CM²	3
3	FOAM PUMP	14M³/HR @ 17KG/CM²	2

CONCEPTUAL DRAWINGS	☐
TENDER DRAWINGS	■
GOOD FOR CONSTRUCTION DRAWINGS	☐

NOTES

1. FIRE WATER HYDRANT LINE WILL BE CHANGED AS PER SITE CONDITION
2. FIRE WATER EQIPEMENTS SHOWN IN THIS DRAWING TENTATIVE ONLY

PROPOSED FACILITIES :

1. FIRE WATER TANKS
2. FIRE WATER PUMP HOUSE
3. CONTROL ROOM FOR OT–II
4. CONTROL ROOM – HOJ–2(REVAMP)
5. CONTROL ROOM – HOJ–1
6. COMMON CONTROL ROOM FOR–BJ–1&BJ–2

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

CLIENT :
HALDIA DOCK COMPLEX (HDC)
KOLKATA PORT TRUST (KoPT)

PROJECT TITLE :
PROPOSED FIRE FIGHITING SYSTEM FOR OT–II, HOJ–I, HOJ–II, BJ–I & BJ–II IN COMPLIANCE WITH OISD–156 AT HDC

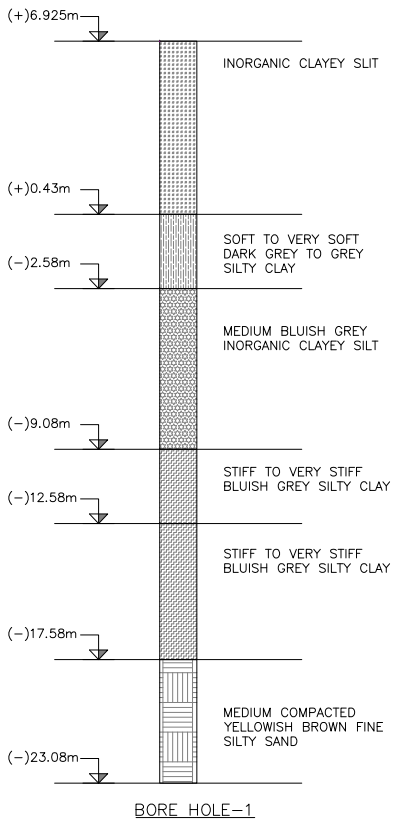
DRN.	CHK.	APP.	DATE	REV
AN	SH	RSUN	18/02/2019	00

DRAWING TITLE :
MASTER LAYOUT OF PROPOSED FIRE FIGHITING SYSTEM

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/INT/FFF/ML–01

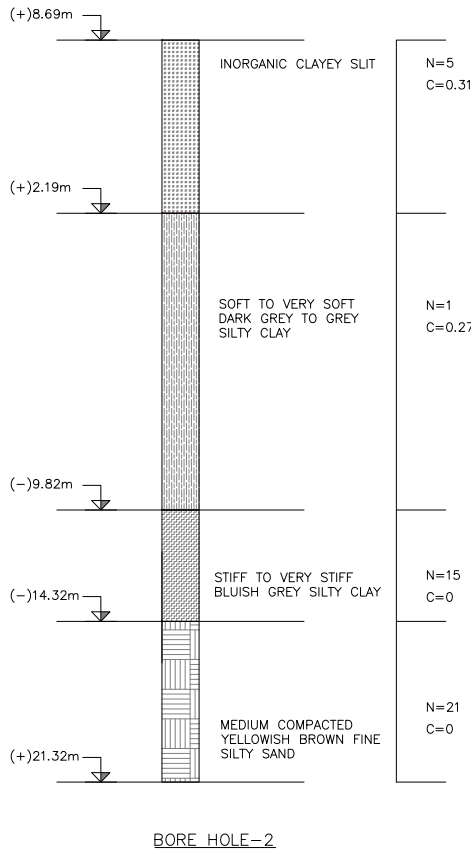
A

10 9 8 7 6 5 3 2 1



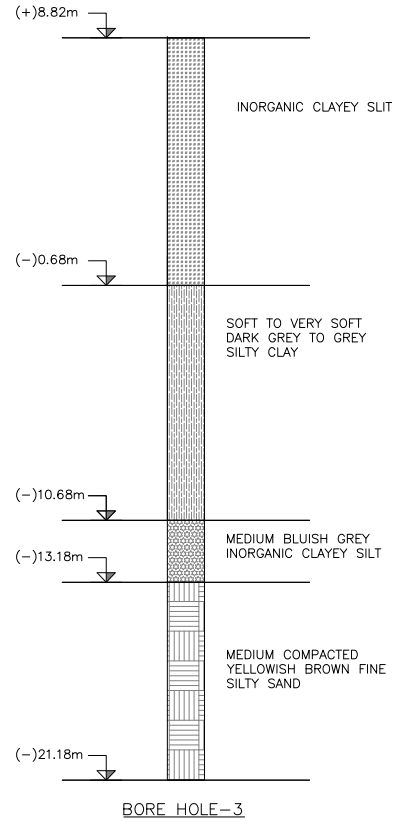
BORE HOLE−1

N=2	γ=18.10kN/m
C=0.30	Φ=2°
N=2	γ=15.70kN/m
C=0.24	Φ=1°
N=4	γ=19.50kN/m
C=0	Φ=0°
N=13	γ=0kN/m
C=0	Φ=0°
N=17	γ=0kN/m
C=0	Φ=0°
N=23	γ=17.90kN/m
C=0	Φ=31°



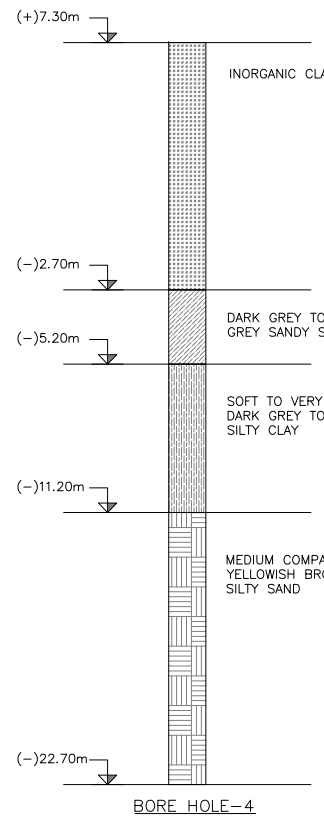
BORE HOLE−2

N=5	γ=18.10kN/m
C=0.31	Φ=2°
N=1	γ=15.80kN/m
C=0.27	Φ=1°
N=15	γ=0kN/m
C=0	Φ=0°
N=21	γ=17.80kN/m
C=0	Φ=32°



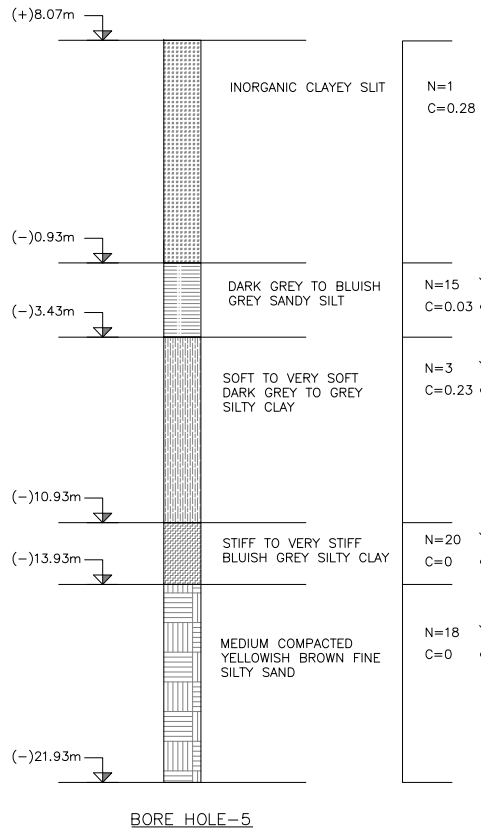
BORE HOLE−3

N=2	γ=17.80kN/m
C=0.28	Φ=1°
N=4	γ=15.90kN/m
C=0.20	Φ=0°
N=7	γ=0kN/m
C=0	Φ=0°
N=13	γ=17.79kN/m
C=0	Φ=31°



BORE HOLE−4

N=1	γ=17.90kN/m
C=0.22	Φ=4°
N=12	γ=0kN/m
C=0	Φ=0°
N=5	γ=15.70kN/m
C=0	Φ=0°
N=1	γ=18.20kN/m
C=0	Φ=32°



BORE HOLE−5

N=1	γ=18.20kN/m
C=0.28	Φ=1°
N=15	γ=17.70kN/m
C=0.03	Φ=20°
N=3	γ=15.80kN/m
C=0.23	Φ=0°
N=20	γ=0kN/m
C=0	Φ=0°
N=18	γ=18.20kN/m
C=0	Φ=32°

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE IN "mm"
2. ALL LEVELS ARE IN "m"

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI − 36

SIGNATURE :

CLIENT :
KOLKATA PORT TRUST

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

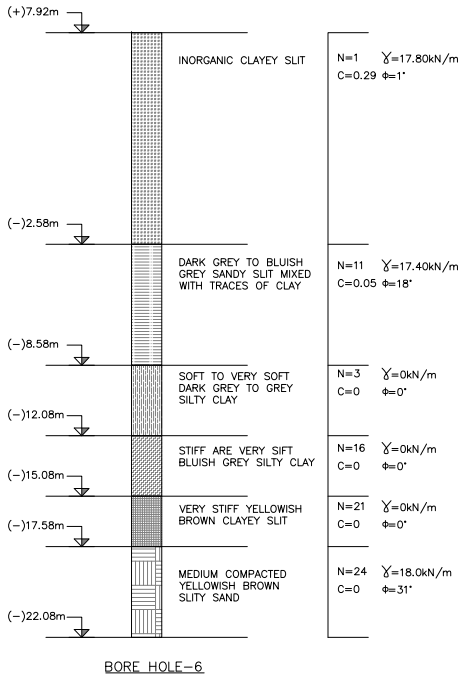
DRN.	CHK.	APP.	DATE	REV
SS	HN	RSUN	01/02/2019	00

DRAWING TITLE :
BORE HOLE DETAILS−(1to5)

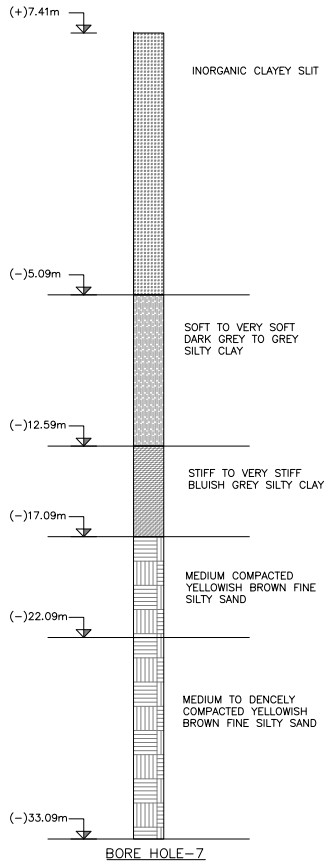
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT−II/BH−01

A

11 10 9 8 7 6 5 3 2 1



BORE HOLE−6



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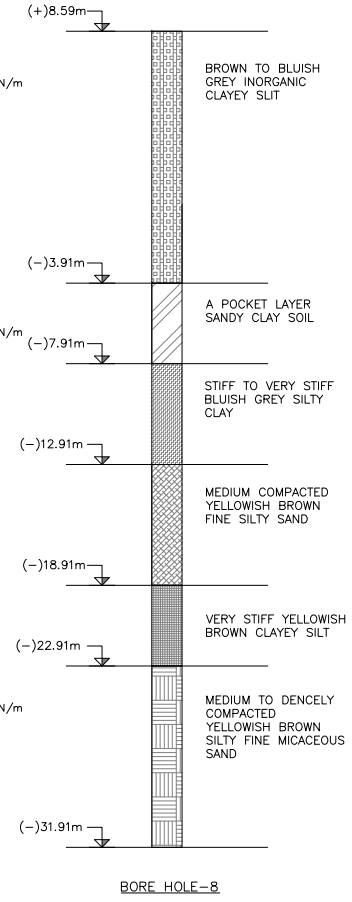
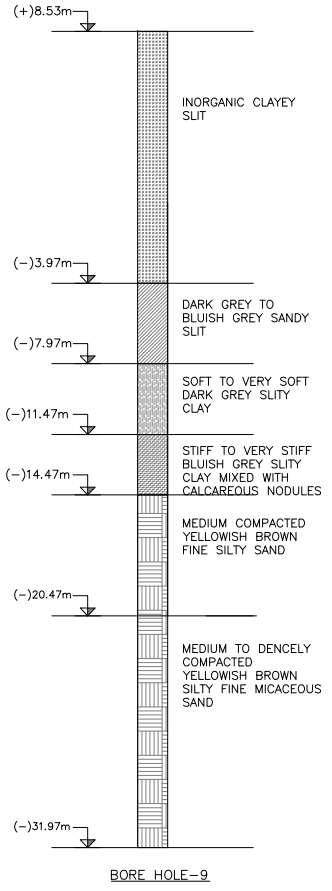
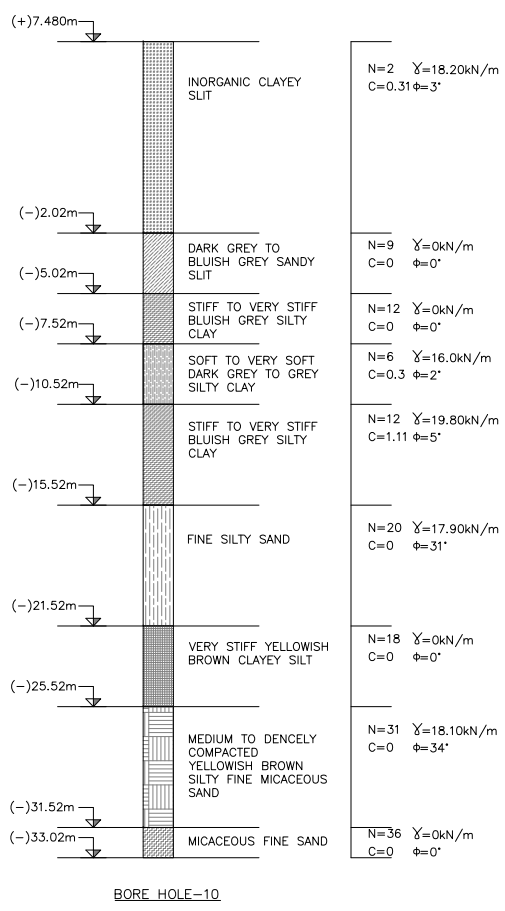


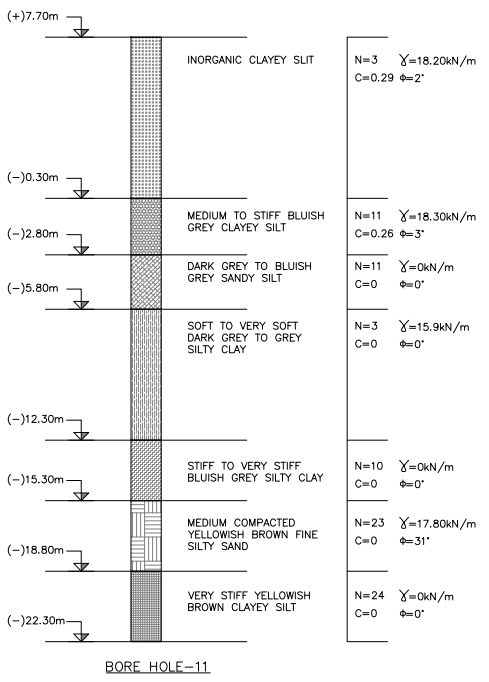
BORE HOLE−8



BORE HOLE−9



BORE HOLE−10



BORE HOLE−11

CONCEPTUAL DRAWINGS	
TENDER DRAWINGS	■
GOOD FOR CONSTRUCTION DRAWINGS	

NOTES:

1. ALL DIMENSIONS ARE IN "mm"
2. ALL LEVELS ARE IN "m"

SR.NO	REFERENCE DRAWINGS: DRG/DOC. NO.	REV NO.	TITLE
			A

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI − 36

SIGNATURE :

CLIENT :
KOLKATA PORT TRUST

PROJECT TITLE :
CONSTRUCTION OF A LIQUID CARGO TERMINAL (OUTER TERMINAL-II)NORTH OF LOCK ENTRANCE AT HALDIA DOCK COMPLEX-SUB STATION

DRN.	CHK.	APP.	DATE	REV
SS	HN	RSUN	01/02/2019	00

DRAWING TITLE :
BORE HOLE DETAILS−(6to11)

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT−II/BH−02

A

11 10 9 8 7 6 5 3 2 1

BORE HOLE NO.S	LATITUDE AND LONGITUDE
BH–07	22° 1'50.81"N 88° 5'54.17"E
BH–08	22° 1'52.09"N 88° 5'53.10"E
BH–11	22° 1'45.20"N 88° 5'45.70"E
BH–12	22° 1'46.39"N 88° 5'44.50"E
TM–01 BH–01	22° 1'52.65"N 88° 5'59.39"E
TM–03 BH–03	22° 1'49.81"N 88° 5'55.66"E
TM–04 BH–04	22° 1'43.62"N 88° 5'46.65"E
TM–06 BH–06	22° 1'40.08"N 88° 5'42.40"E

NOTES:

1. ALL DIMENSION ARE IN MM (OTHERWISE NOTED)
2. TOWER MONITOR(TM) 2 & 5 IS ON THE JETTY
3. GROUND MONITORS(GM) IS ON THE BARGE(PANTOON)

CONCEPTUAL DRAWING
TENDER DRAWING
GOOD FOR CONSTRUCTION DRAWINGS

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

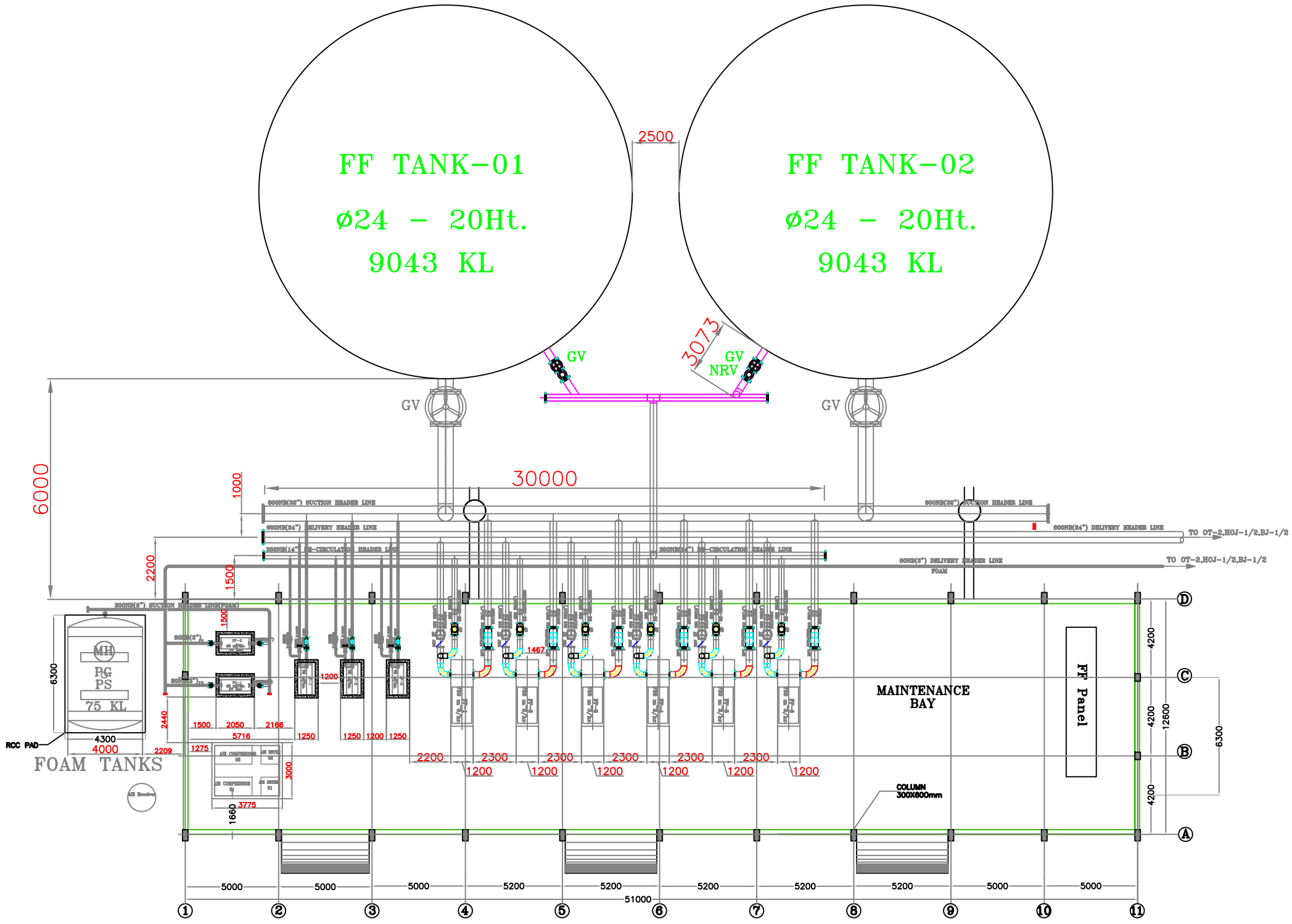
CLIENT :
HALDIA DOCK COMPLEX (HDC), KOLKATA PORT TRUST (KoPT), HALDIA.

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD–156 STANDARD FOR THE PROPOSED OT–II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ–1&2&BJ–1&2

DRAWING TITLE :
BOREHOLE LOCATION LAYOUT FOR HOJ–1&2

DRN.	CHK.	APP.	DATE	REV
KK	HA	RSUN	01/02/2019	00

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOR/HDC/INT/FFF/BH–03



GROUND FLOOR PLAN

CONCEPTUAL DRAWINGS	☐
TENDER DRAWINGS	■
GOOD FOR CONSTRUCTION DRAWINGS	☐

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE –M35 FOR SUB STRUCTURE –M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL –Fe500D
8. PILE –1000 mmø
9. PILE MUFF –1300X1300X900mm
10. COLUMN 1 –300X600mm
11. COLUMN 2 –300X400mm
12. PLINTH BEAM –500X700mm
13. LINTEL BEAM –300X400mm
14. ROOF BEAM –300X400mm
15. WALL THICKNESS –250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	RS–ROLLING SHUTTER–1	5000X6200mm
2	RS–ROLLING SHUTTER–2	5200X6200mm
3	D–DOOR	1200X2600mm
4	W–WINDOW	1200X1500mm
5	V –VENTILATOR	1200X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

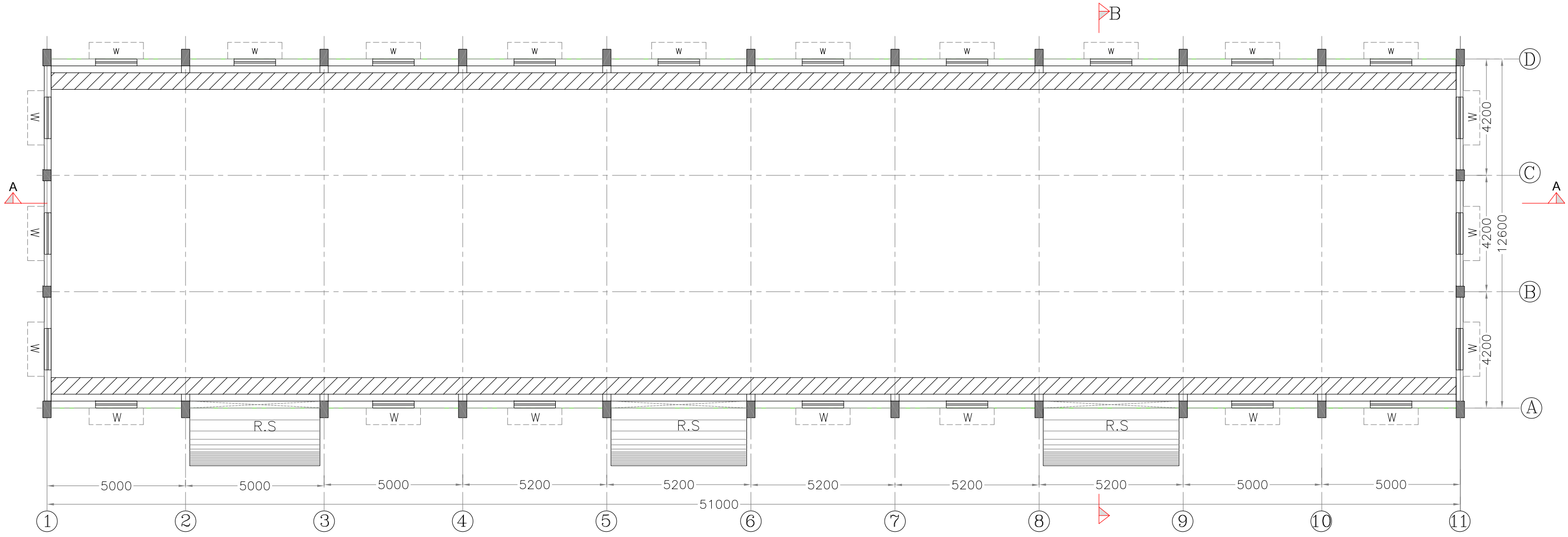
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	22/01/2019	00

DRAWING TITLE :
PLINTH BEAM LAYOUT

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT-II/PH/2001A



GROUND FLOOR PLAN AT (+)10.80m LVL

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE –M35 FOR SUB STRUCTURE
   –M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL –Fe500D
8. PILE –1000 mmø
9. PILE MUFF –1300X1300X900mm
10. COLUMN 1 –300X600mm
11. COLUMN 2 –300X400mm
12. PLINTH BEAM –500X700mm
13. LINTEL BEAM –300X400mm
14. ROOF BEAM –300X400mm
15. WALL THICKNESS –250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	RS–ROLLING SHUTTER–1	5000X6200mm
2	RS–ROLLING SHUTTER–2	5200X6200mm
3	D–DOOR	1200X2600mm
4	W–WINDOW	1200X1500mm
5	V –VENTILATOR	1200X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
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INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

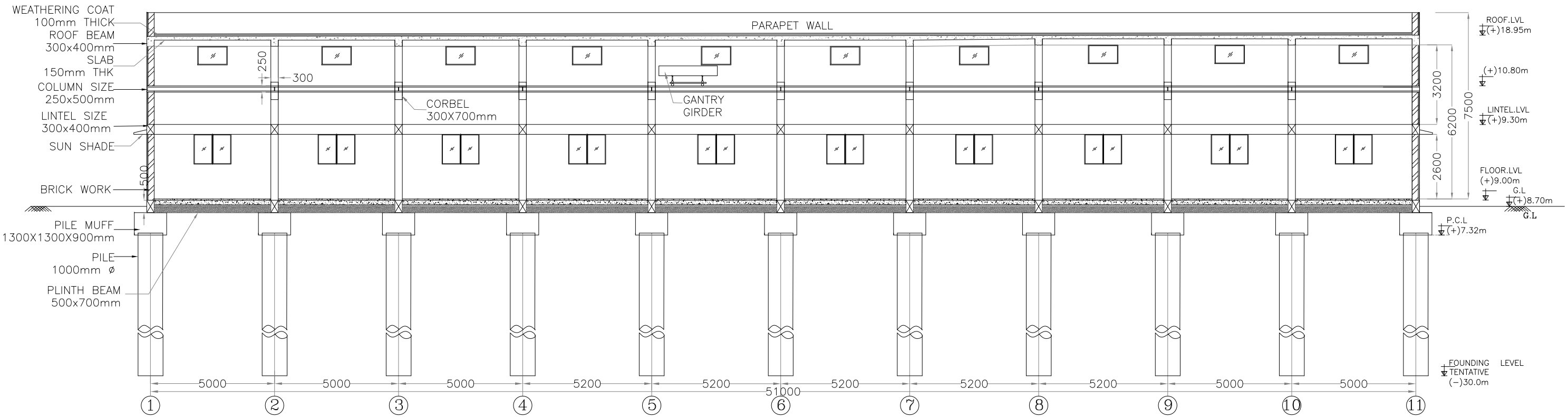
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	22/01/2019	00

DRAWING TITLE :
GROUND FLOOR PLAN

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT–II/PH/2001B



SECTION - AA

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE −M35 FOR SUB STRUCTURE
   −M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL −Fe500D
8. PILE −1000 mmø
9. PILE MUFF −1300X1300X900mm
10. COLUMN 1 −300X600mm
11. COLUMN 2 −300X400mm
12. PLINTH BEAM −500X700mm
13. LINTEL BEAM −300X400mm
14. ROOF BEAM −300X400mm
15. WALL THICKNESS −250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	RS−ROLLING SHUTTER−1	5000X6200mm
2	RS−ROLLING SHUTTER−2	5200X6200mm
3	D−DOOR	1200X2600mm
4	W−WINDOW	1200X1500mm
5	V −VENTILATOR	1200X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
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IIT MADRAS, CHENNAI − 36

SIGNATURE :

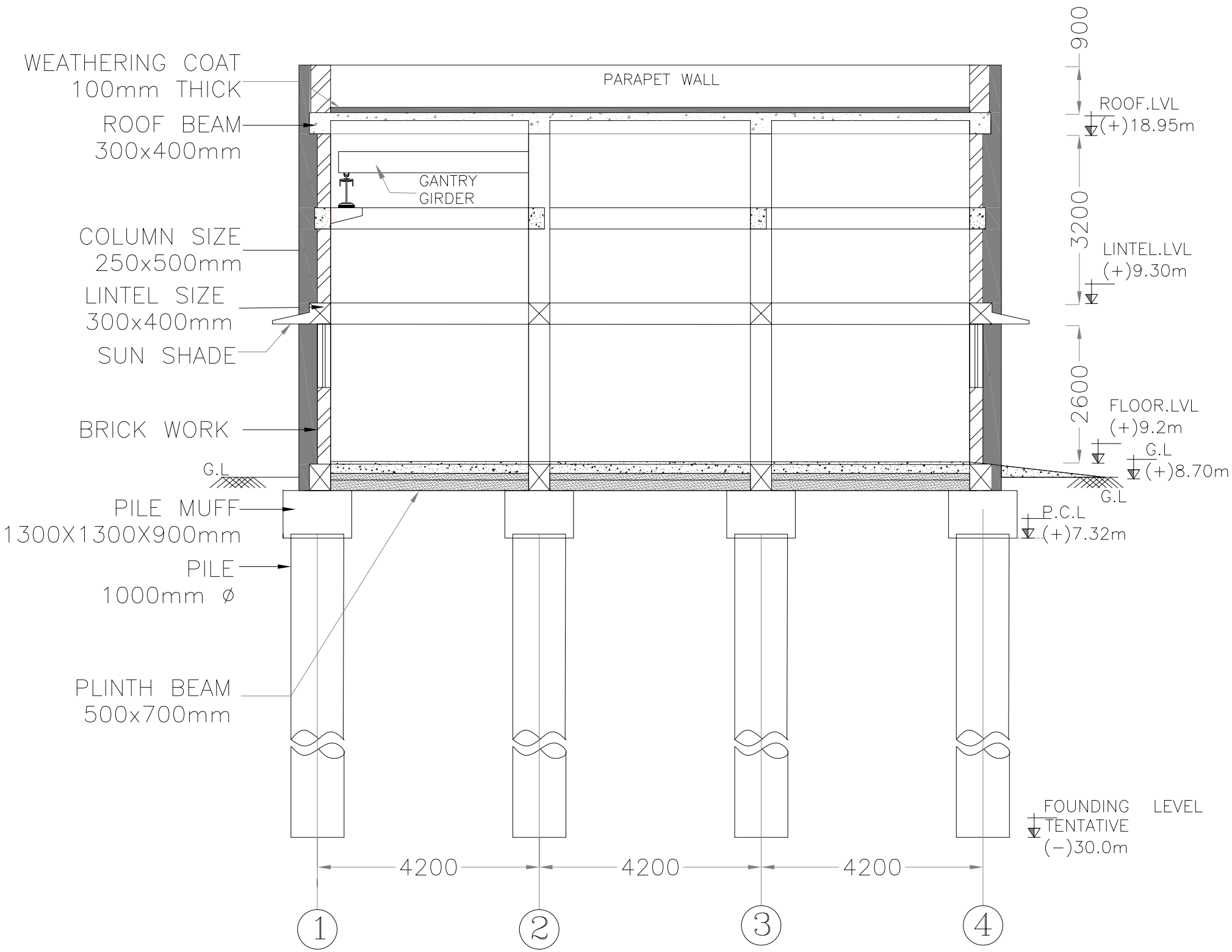
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	22/01/2019	00

DRAWING TITLE :
LONGITUDINAL SECTION AA

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT−II/PH/2002



SECTION ON ''BB''

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE −M35 FOR SUB STRUCTURE
   −M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL −Fe500D
8. PILE −1000 mmø
9. PILE MUFF −1300X1300X900mm
10. COLUMN 1 −300X600mm
11. COLUMN 2 −300X400mm
12. PLINTH BEAM −500X700mm
13. LINTEL BEAM −300X400mm
14. ROOF BEAM −300X400mm
15. WALL THICKNESS −250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	RS−ROLLING SHUTTER−1	5000X6200mm
2	RS−ROLLING SHUTTER−2	5200X6200mm
3	D−DOOR	1200X2600mm
4	W−WINDOW	1200X1500mm
5	V −VENTILATOR	1200X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
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INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
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IIT MADRAS, CHENNAI − 36

SIGNATURE :

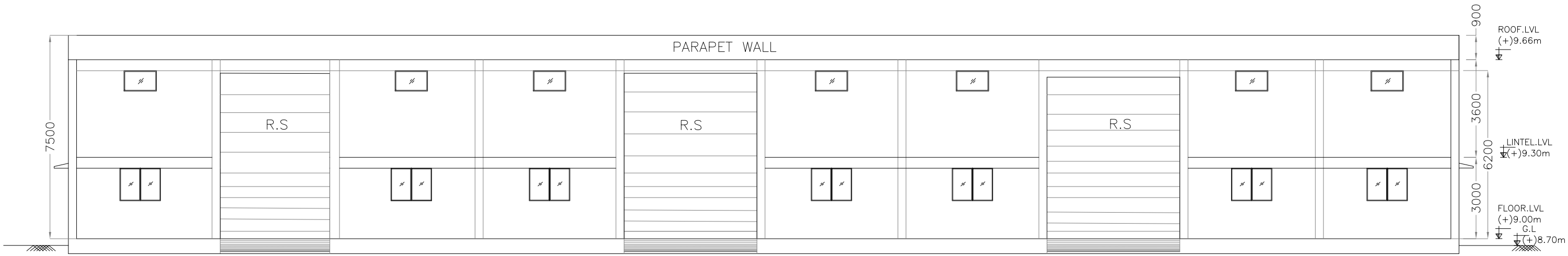
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	22/01/2019	00

DRAWING TITLE :
CROSS SECTION BB

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT−II/PH/2003



ELEVATION

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1.ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2.ALL LEVELS ARE IN "m" W.R.T CD
3.CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4.FIGURED DIMENSIONS SHALL BE FOLLOWED.
5.EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6.GRADE OF CONCRETE –M35 FOR SUB STRUCTURE
–M20 FOR SUPER STRUCTURE
7.GRADE OF STEEL –Fe500D
8.PILE –1000 mmø
9.PILE MUFF –1300X1300X900mm
10.COLUMN 1 –300X600mm
11.COLUMN 2 –300X400mm
12.PLINTH BEAM –500X700mm
13.LINTEL BEAM –300X400mm
14.ROOF BEAM –300X400mm
15.WALL THICKNESS –250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	RS–ROLLING SHUTTER–1	5000X6200mm
2	RS–ROLLING SHUTTER–2	5200X6200mm
3	D–DOOR	1200X2600mm
4	W–WINDOW	1200X1500mm
5	V –VENTILATOR	1200X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
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IIT MADRAS, CHENNAI – 36

SIGNATURE :

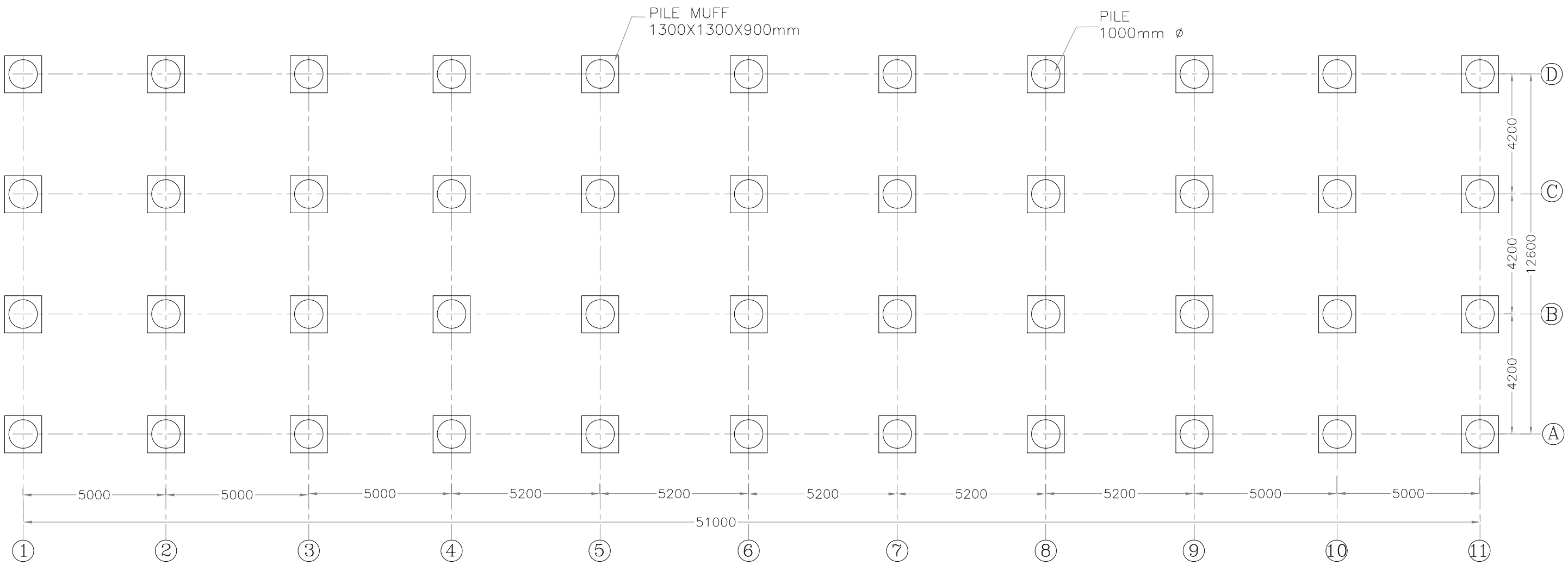
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	22/01/2019	00

DRAWING TITLE :
ELEVATION

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT–II/PH/2004



PILE AND PILE MUFF LAYOUT

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE –M35 FOR SUB STRUCTURE
   –M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL –Fe500D
8. PILE –1000 mmø
9. PILE MUFF –1300X1300X900mm
10. COLUMN 1 –300X600mm
11. COLUMN 2 –300X400mm
12. PLINTH BEAM –500X700mm
13. LINTEL BEAM –300X400mm
14. ROOF BEAM –300X400mm
15. WALL THICKNESS –250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	RS–ROLLING SHUTTER–1	5000X6200mm
2	RS–ROLLING SHUTTER–2	5200X6200mm
3	D–DOOR	1200X2600mm
4	W–WINDOW	1200X1500mm
5	V –VENTILATOR	1200X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
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MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

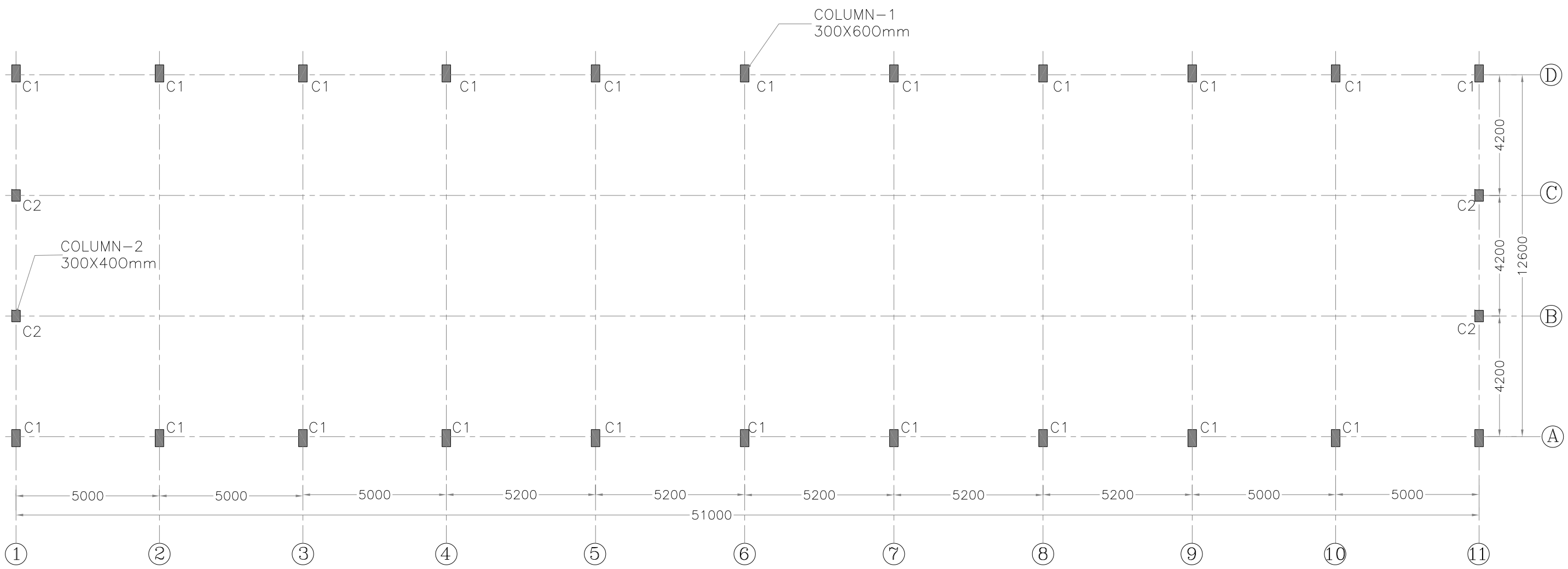
PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	22/01/2019	00

DRAWING TITLE :
PILE AND PILE MUFF LAYOUT

SH.SCALE: AS SHOWN

DRAWING NUMBER: IITM/DOE/KoPT/OT–II/PH/2005



COLUMN LAYOUT

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE – M35 FOR SUB STRUCTURE, M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL – Fe500D
8. PILE – 1000 mmø
9. PILE MUFF – 1300X1300X900mm
10. COLUMN 1 – 300X600mm
11. COLUMN 2 – 300X400mm
12. PLINTH BEAM – 500X700mm
13. LINTEL BEAM – 300X400mm
14. ROOF BEAM – 300X400mm
15. WALL THICKNESS – 250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	RS–ROLLING SHUTTER–1	5000X6200mm
2	RS–ROLLING SHUTTER–2	5200X6200mm
3	D–DOOR	1200X2600mm
4	W–WINDOW	1200X1500mm
5	V –VENTILATOR	1200X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
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MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

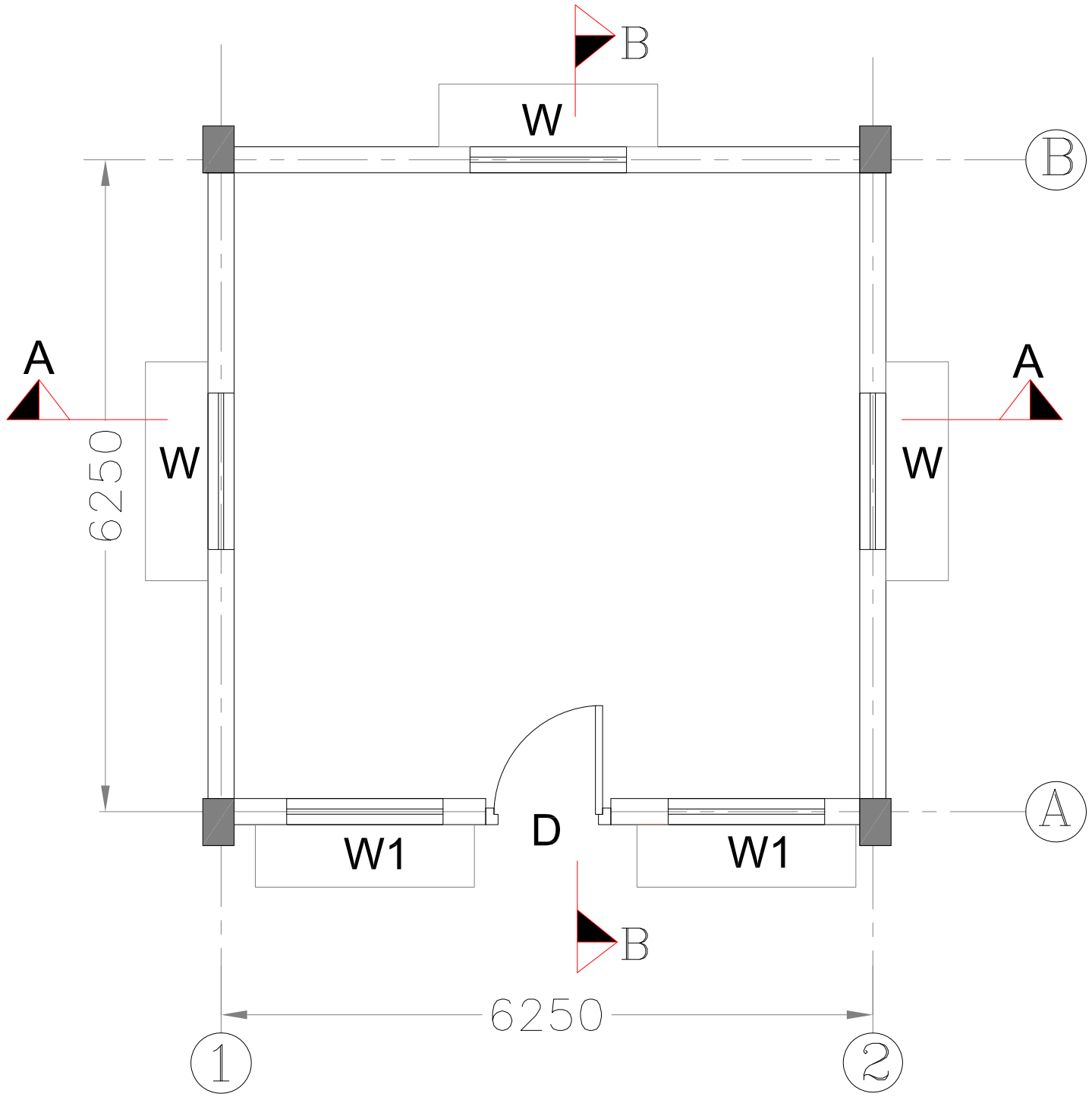
PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	22/01/2019	00

DRAWING TITLE :
COLUMN LAYOUT

SH.SCALE: AS SHOWN

DRAWING NUMBER: IITM/DOE/KoPT/OT–II/PH/2006



GROUND FLOOR PLAN

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
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4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE –M35 FOR SUB STRUCTURE
   –M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL –Fe500D
8. PILE –600 mmø
9. PILE MUFF –1000X1000X450mm
10. COLUMN –300X450mm
11. PLINTH BEAM –500X700mm
12. LINTEL BEAM –300X300mm
14. ROOF BEAM –300X350mm
15. WALL THICKNESS –250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	D–DOOR	1200X2100mm
2	W–WINDOW	1500X1500mm
3	W1–WINDOW	1500X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

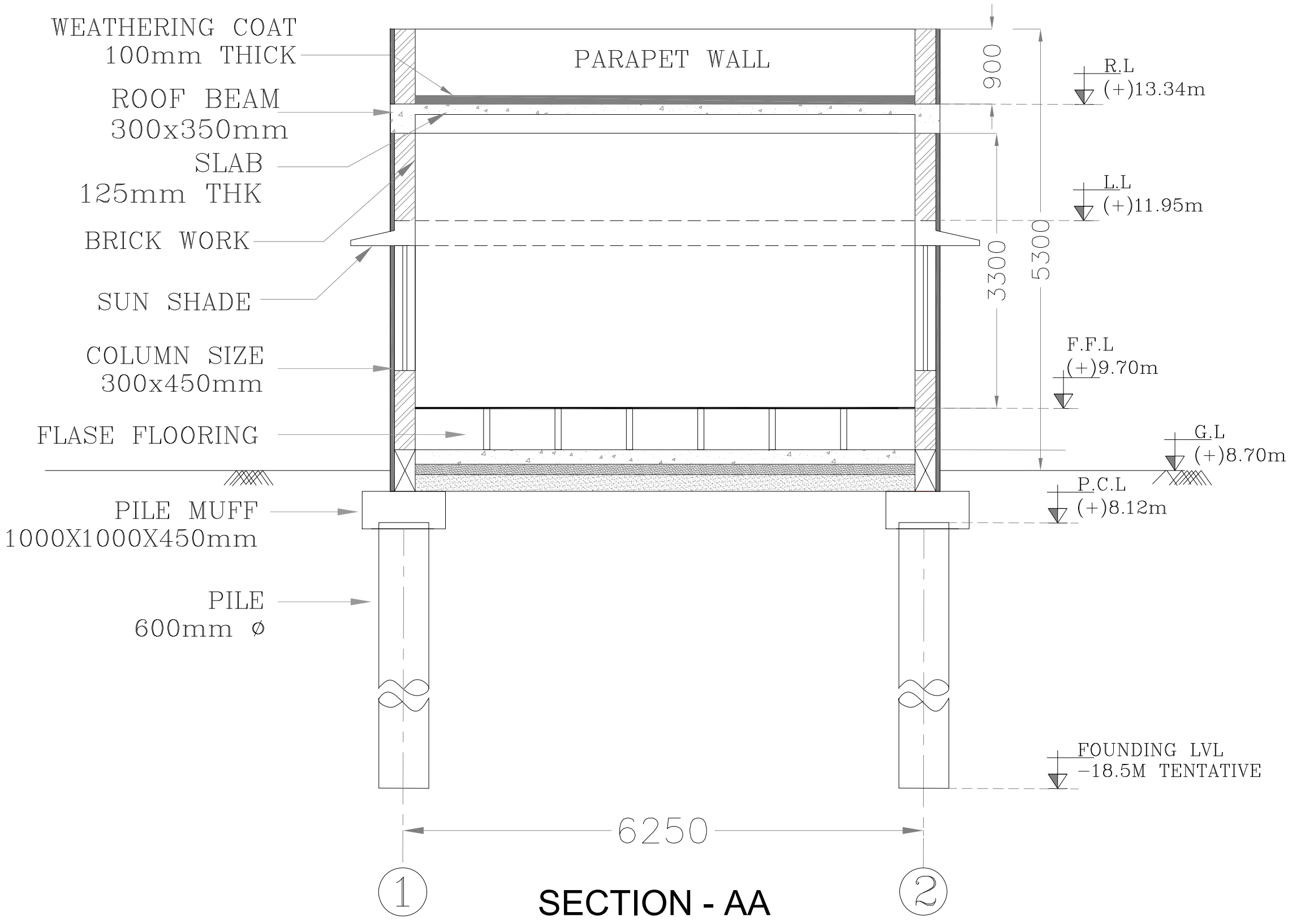
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	24/01/2019	00

DRAWING TITLE :
GROUND FLOOR PLAN

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT-II/CR/5001



SECTION - AA

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE —M35 FOR SUB STRUCTURE
   —M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL —Fe500D
8. PILE —600 mmø
9. PILE MUFF —1000X1000X450mm
10. COLUMN —300X450mm
11. PLINTH BEAM —500X700mm
12. LINTEL BEAM —300X300mm
14. ROOF BEAM —300X350mm
15. WALL THICKNESS —250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	D—DOOR	1200X2100mm
2	W—WINDOW	1500X1500mm
3	W1—WINDOW	1500X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

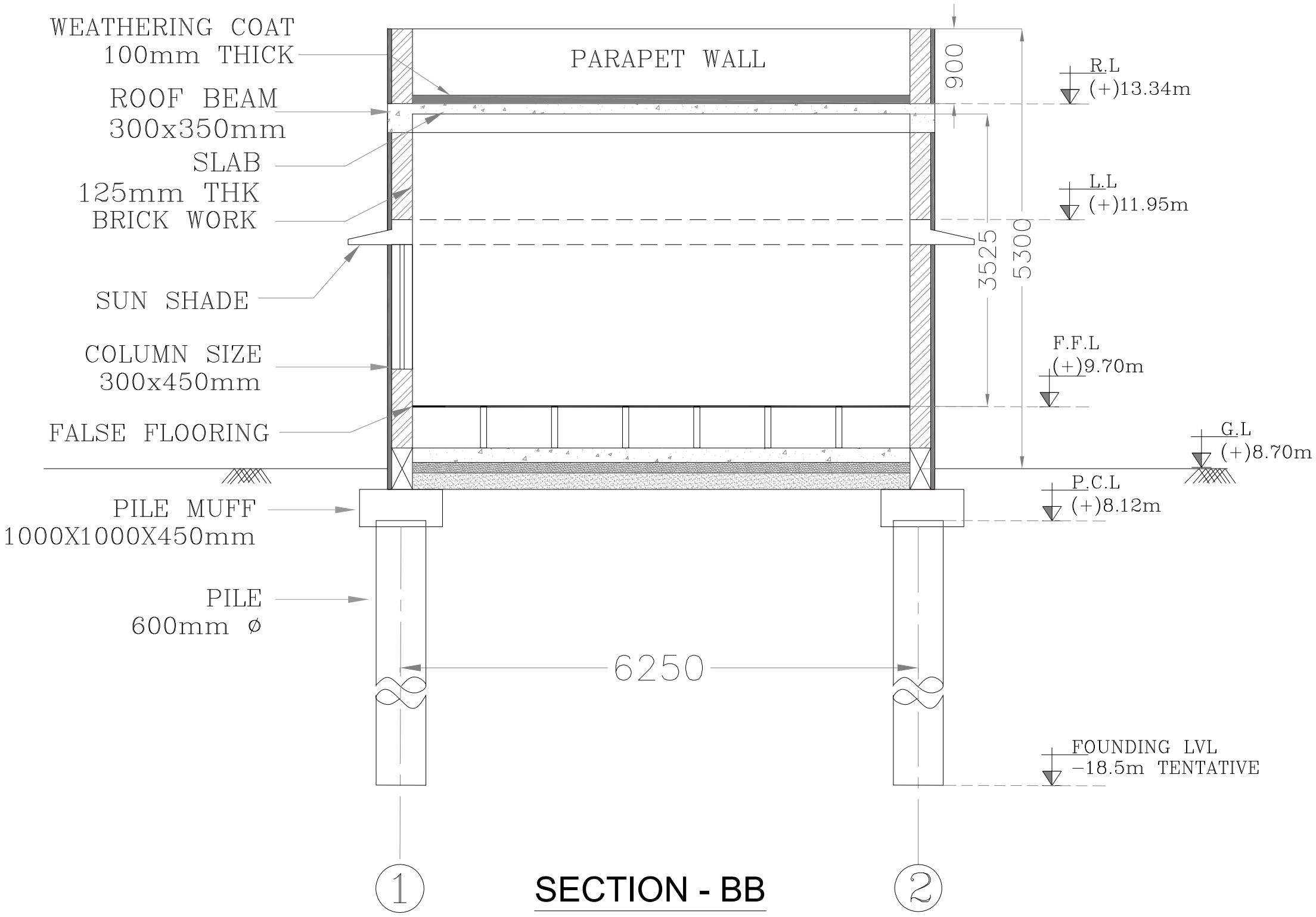
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	24/01/2019	00

DRAWING TITLE :
LONGITUDINAL SECTION AA

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT-II/CR/5002



SECTION - BB

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE -M35 FOR SUB STRUCTURE
   -M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL -Fe500D
8. PILE -600 mmø
9. PILE MUFF -1000X1000X450mm
10. COLUMN -300X450mm
11. PLINTH BEAM -500X700mm
12. LINTEL BEAM -300X300mm
14. ROOF BEAM -300X350mm
15. WALL THICKNESS -250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	D-DOOR	1200X2100mm
2	W-WINDOW	1500X1500mm
3	W1-WINDOW	1500X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI - 36

SIGNATURE :

CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

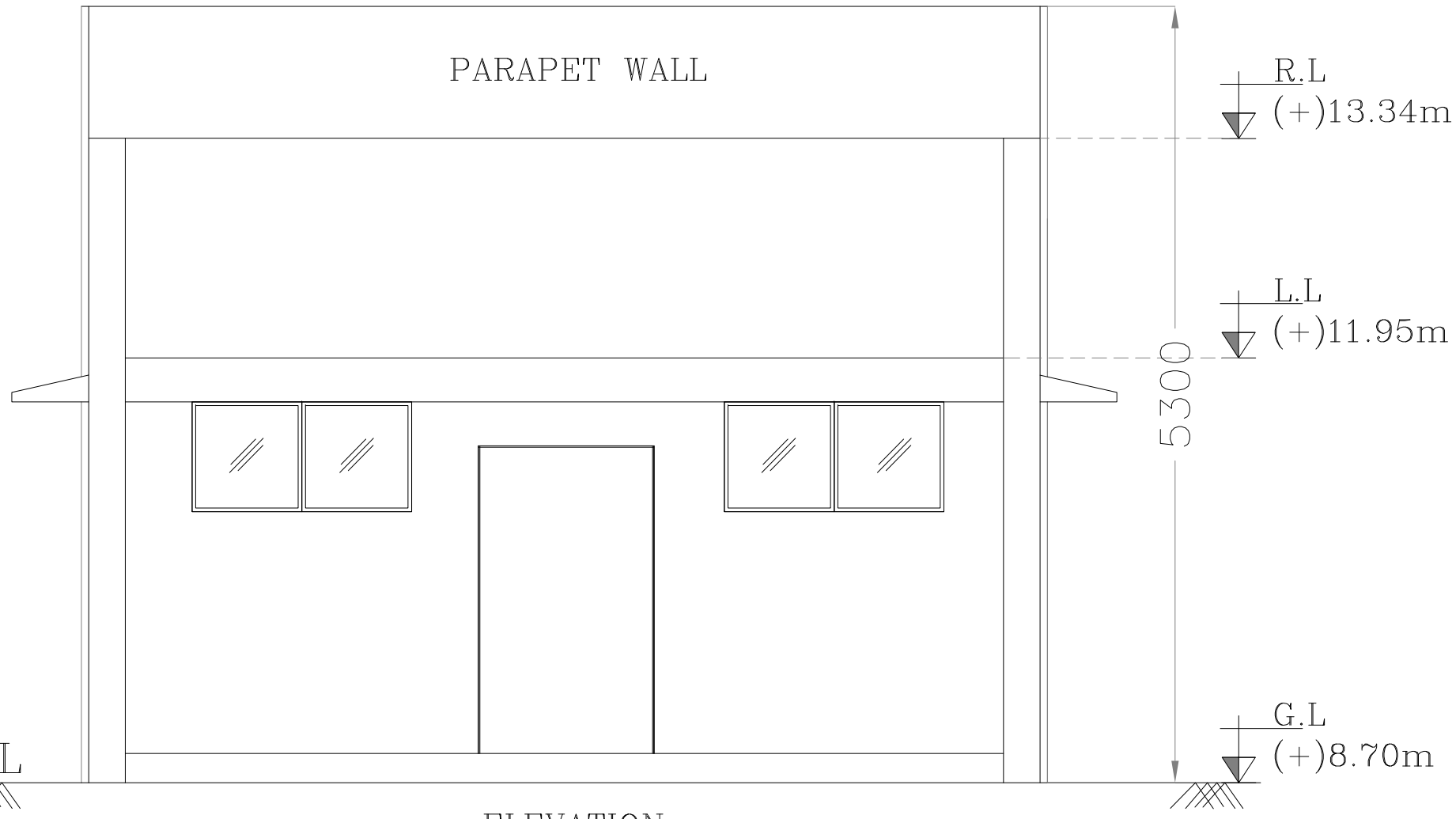
PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	23/01/2019	00

DRAWING TITLE :
CROSS SECTION BB

SH.SCALE: AS SHOWN

DRAWING NUMBER: IITM/DOE/KoPT/OT-II/CR/5003



ELEVATION

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE —M35 FOR SUB STRUCTURE
   —M20 FOR SUPER STRUCTURE
7. GRADE OF STEEL —Fe500D
8. PILE —600 mmØ
9. PILE MUFF —1000X1000X450mm
10. COLUMN —300X450mm
11. PLINTH BEAM —500X700mm
12. LINTEL BEAM —300X300mm
14. ROOF BEAM —300X350mm
15. WALL THICKNESS —250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	D—DOOR	1200X2100mm
2	W—WINDOW	1500X1500mm
3	W1—WINDOW	1500X750mm

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

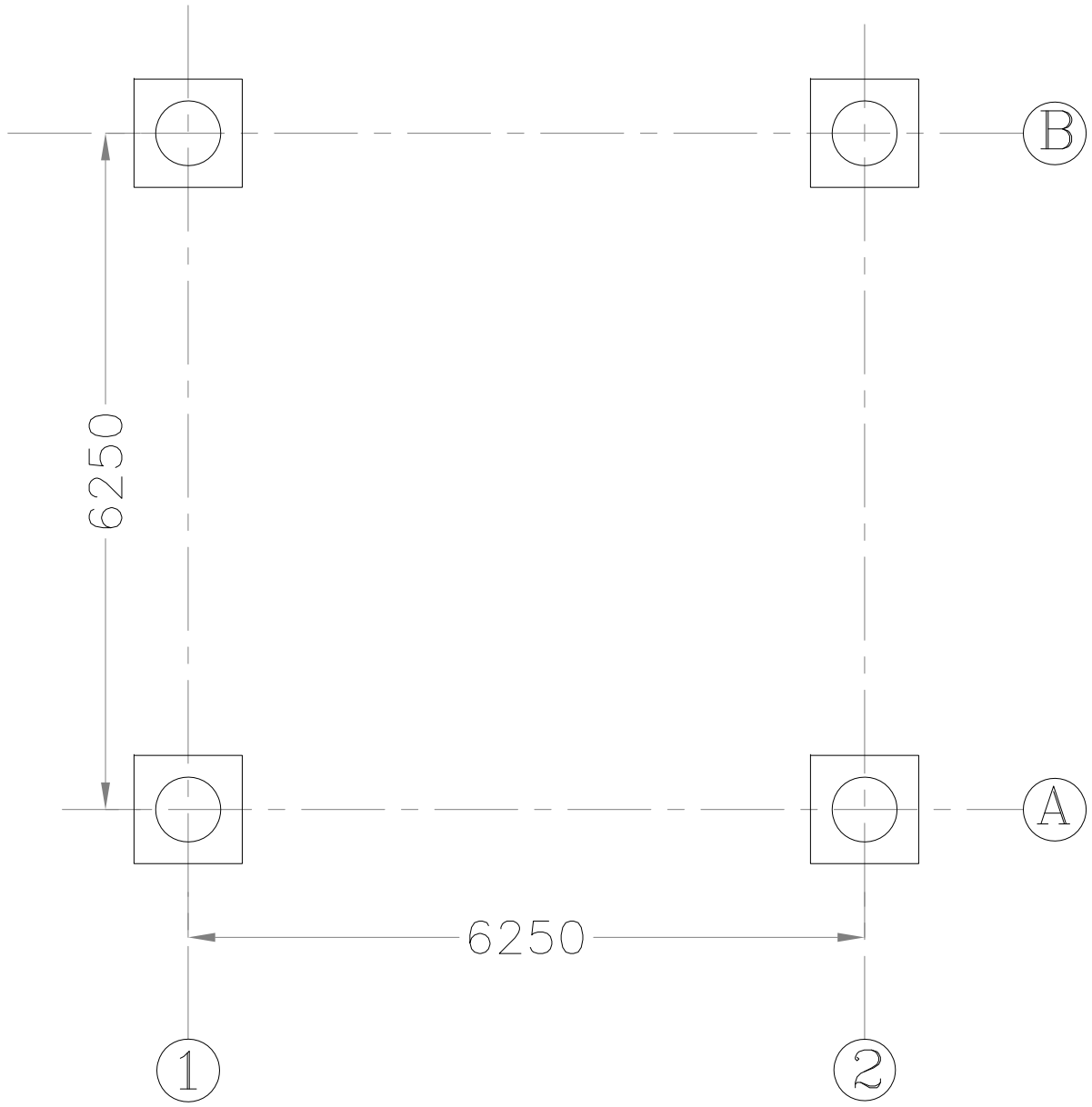
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

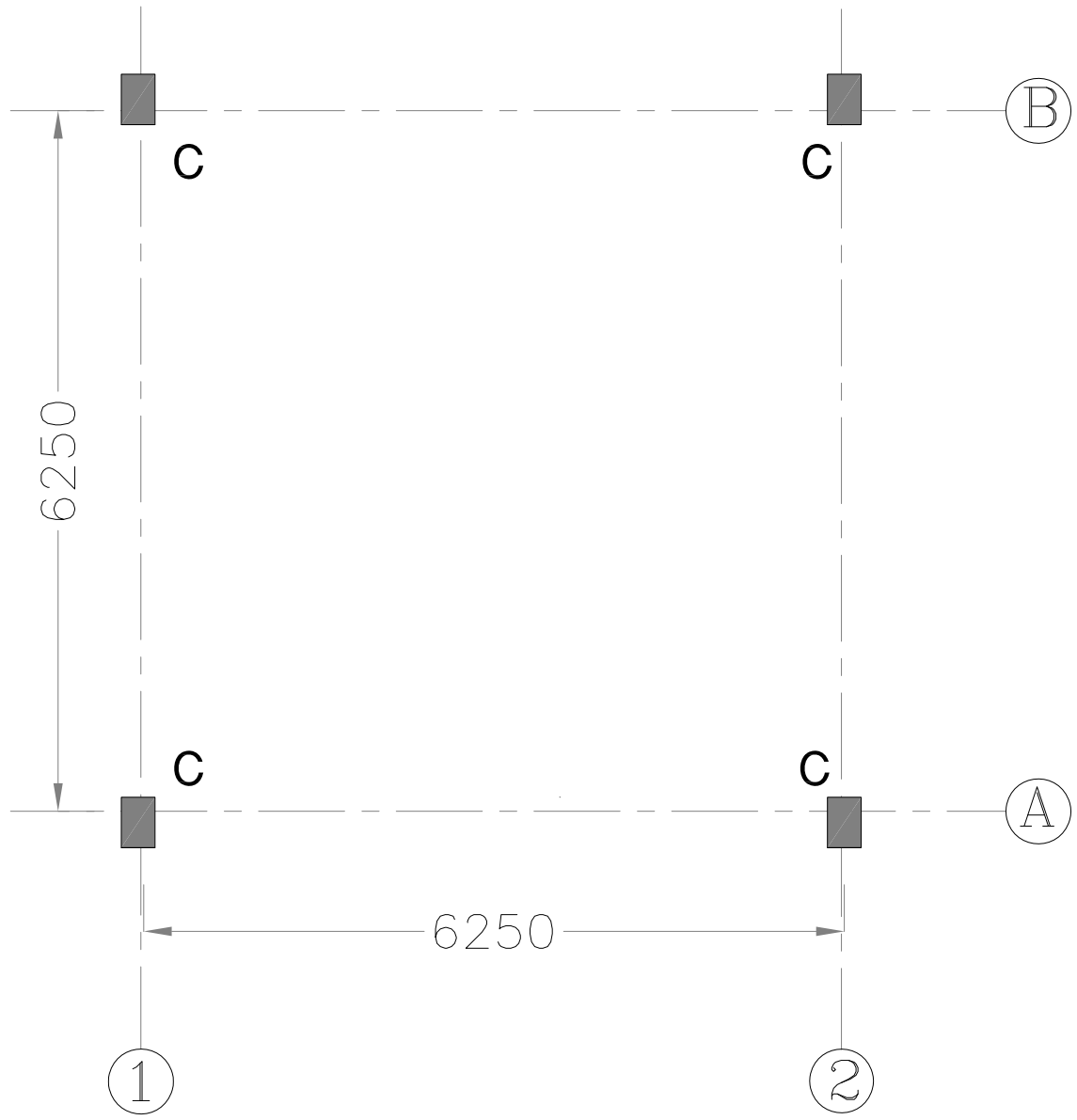
DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	23/01/2019	00

DRAWING TITLE :
ELEVATION

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT-II/CR/5004



PILE &PILE MUFF LAYOUT



COLUMN LAYOUT

CONCEPTUAL DRAWINGS
TENDER DRAWINGS
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1.ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2.ALL LEVELS ARE IN "m" W.R.T CD
3.CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4.FIGURED DIMENSIONS SHALL BE FOLLOWED.
5.EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6.GRADE OF CONCRETE —M35 FOR SUB STRUCTURE
—M20 FOR SUPER STRUCTURE
7.GRADE OF STEEL —Fe500D
8.PILE —600 mmø
9.PILE MUFF —1000X1000X450mm
10.COLUMN —300X450mm
11.PLINTH BEAM —500X700mm
12.LINTEL BEAM —300X300mm
14.ROOF BEAM —300X350mm
15.WALL THICKNESS —250mm

REFERENCE

SL.NO	DESCRIPTION	DIMENSION
1	D—DOOR	1200X2100mm
2	W—WINDOW	1500X1500mm
3	W1—WINDOW	1500X750mm

SR.NO	REFERENCE DRAWINGS DRG/DOC. NO.	REV NO.	TITLE
1			

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

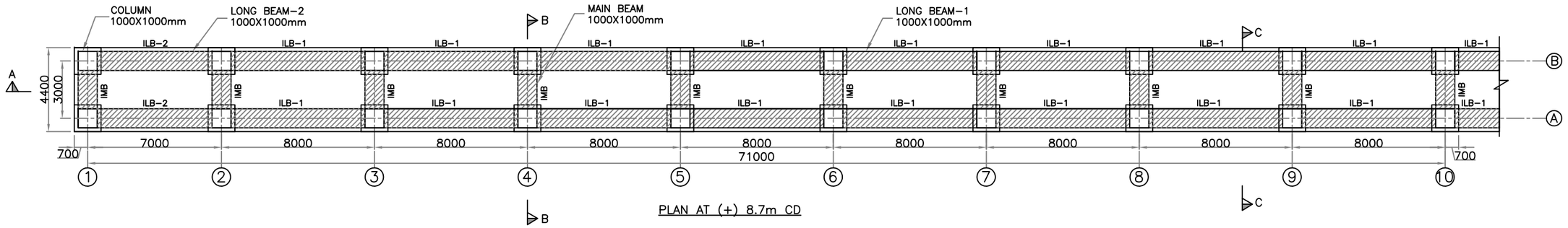
CLIENT :
KOLKATA PORT TRUST
HALDIA DOCK COMPLEX

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD 156 STANDARD FOR THE PROPOSED OT II & AUGMENTATION OF FIRE FIGHTING FACILITIES OF HOJ 1&2,BJ 1&2

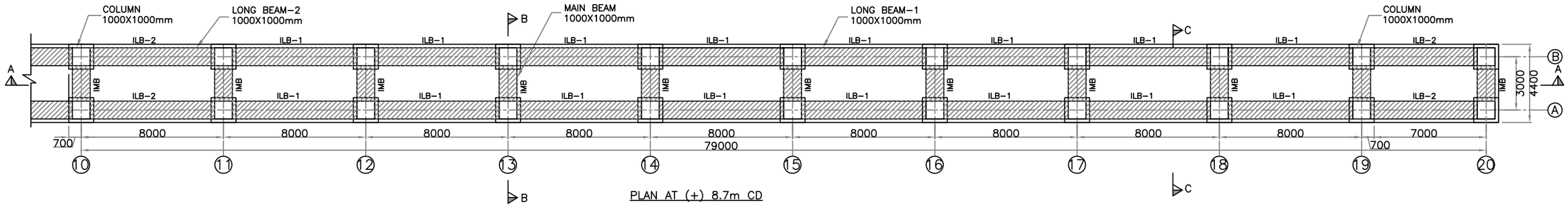
DRN.	CHK.	APP.	DATE	REV
S.S	HN	RSUN	23/01/2019	00

DRAWING TITLE :
PILE & PILE MUFF & COLUMN LAYOUT

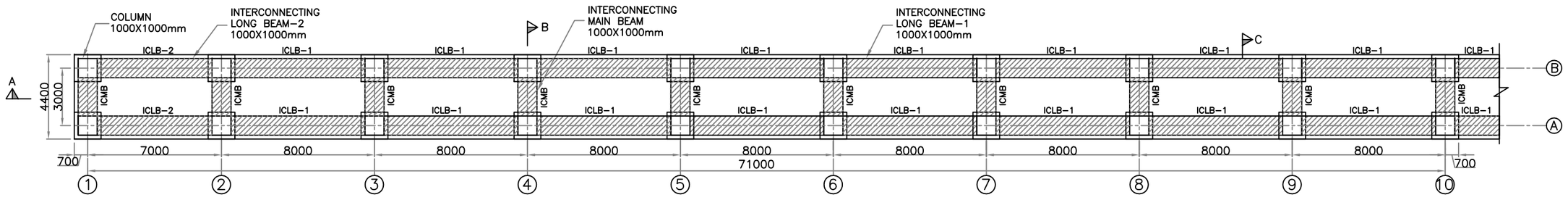
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/KoPT/OT-II/CR/5005



PLAN AT (+) 8.7m CD



PLAN AT (+) 8.7m CD



PLAN AT (+) 4.23m CD

CONCEPTUAL DRAWING

TENDER DRAWING

GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE : M40
   GRADE OF STEEL : Fe 500D
7. DREDGE LEVEL IS (–) 12m CD

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE

ENGINEERING FIRM:

Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

CLIENT :

HALDIA DOCK COMPLEX (HDC),
KOLKATA PORT TRUST (KoPT),
HALDIA.

PROJECT TITLE :

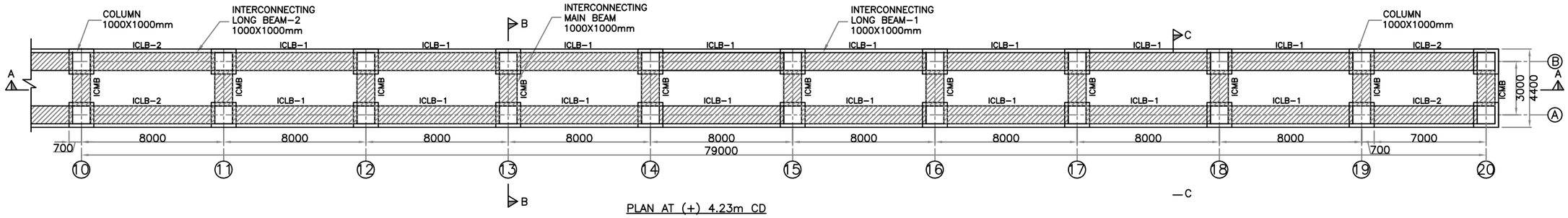
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD–156 STANDARD FOR THE PROPOSED OT–II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ–1&2&BJ–1&2

DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

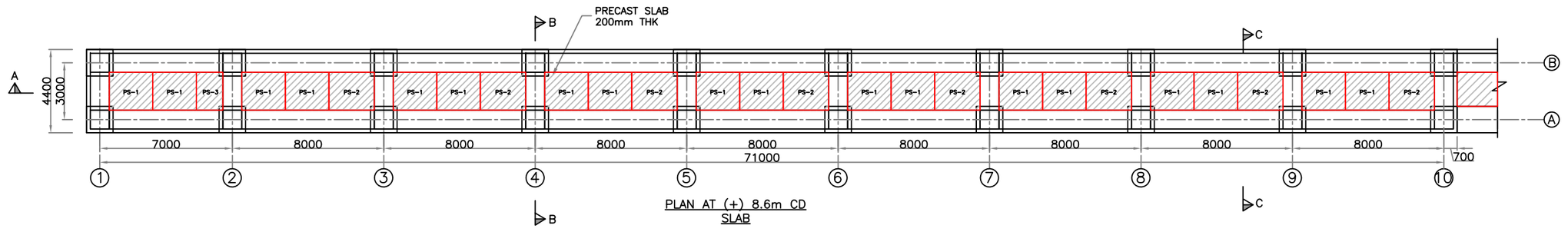
DRAWING TITLE :

FIRE PIPE TRESTLE – GENERAL ARRANGEMENT
150M LENGTH

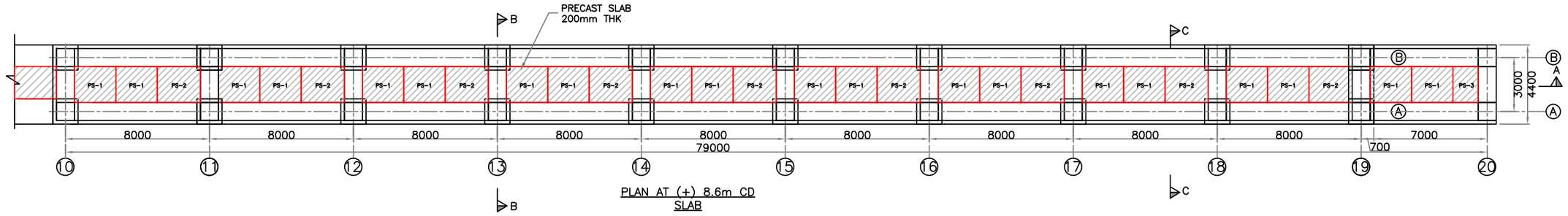
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/INT/HOJ–1&2/6001 (SHEET 01 OF 05)



PLAN AT (+) 4.23m CD



PLAN AT (+) 8.6m CD
SLAB



PLAN AT (+) 8.6m CD
SLAB

CONCEPTUAL DRAWING

TENDER DRAWING

GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE : M40
   GRADE OF STEEL : Fe 500D
7. DREDGE LEVEL IS (-) 12m CD

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI - 36

SIGNATURE :

CLIENT :
HALDIA DOCK COMPLEX (HDC),
KOLKATA PORT TRUST (KoPT),
HALDIA.

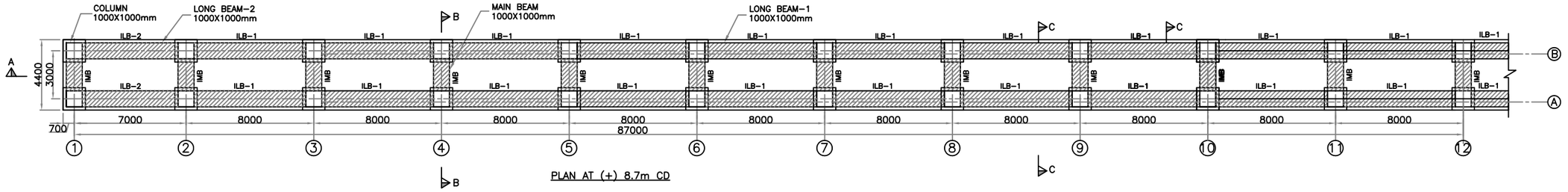
PROJECT TITLE :
AUGMENTATION OF FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD-156 STANDARD OF 1ST & 2ND OIL JETTIES & 2 NOs. BARGE JETTIES OF HDC, KoPT, HALDIA.

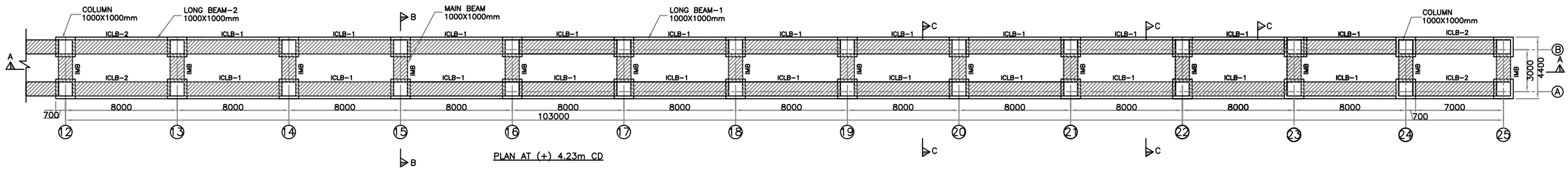
DRAWING TITLE :
FIRE PIPE TRESTLE - GENERAL ARRANGEMENT
150M LENGTH

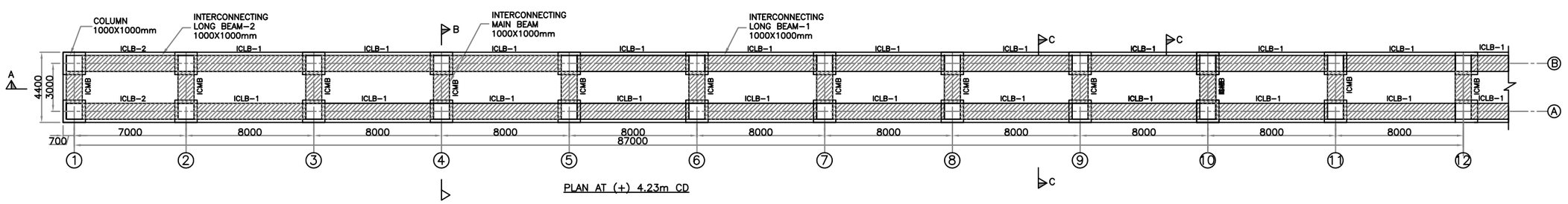
DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

SH.SCALE: AS SHOWN

DRAWING NUMBER: IITM/DOE/HDC/INT/HOJ-1&2/6002
(SHEET 02 OF 05)







CONCEPTUAL DRAWING

TENDER DRAWING

GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE : M40
   GRADE OF STEEL : Fe 500D
7. DREDGE LEVEL IS (–) 12m CD

SR.NO	REFERENCE DRAWINGS DRG/DOC. NO.	REV NO.	TITLE

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

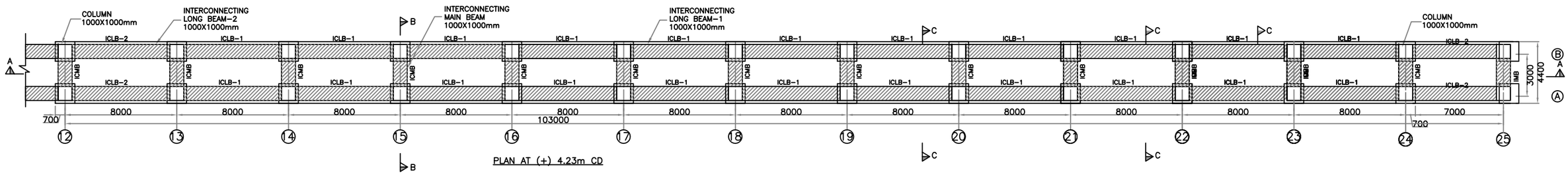
CLIENT :
HALDIA DOCK COMPLEX (HDC),
KOLKATA PORT TRUST (KoPT),
HALDIA.

PROJECT TITLE :
AUGMENTATION OF FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD-156 STANDARD OF 1ST & 2ND OIL JETTIES & 2 NOs. BARGE JETTIES OF HDC, KoPT, HALDIA.

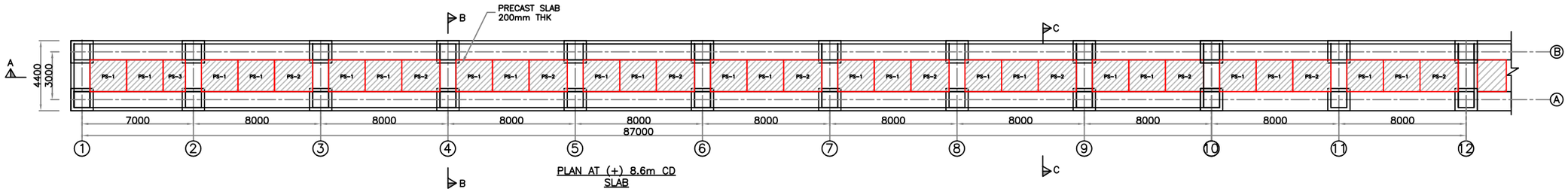
DRAWING TITLE :
FIRE PIPE TRESTLE – GENERAL ARRANGEMENT
190M LENGTH

DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

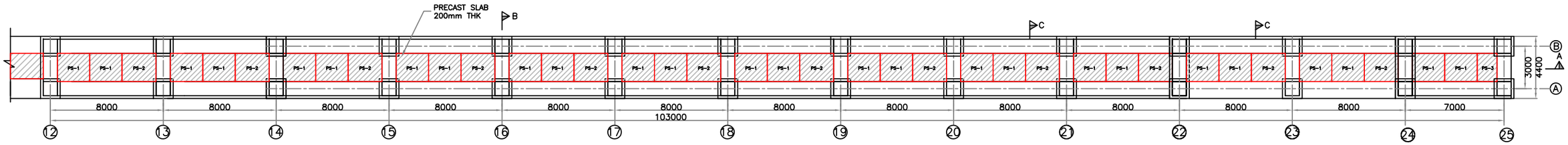
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/INT/HOJ-1&2/6003 (SHEET 03 OF 05)



PLAN AT (+) 4.23m CD



PLAN AT (+) 8.6m CD
SLAB



PLAN AT (+) 8.6m CD
SLAB

CONCEPTUAL DRAWING

TENDER DRAWING

GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE : M40
   GRADE OF STEEL : Fe 500D
7. DREDGE LEVEL IS (-) 12m CD

REFERENCE DRAWINGS			
SR.NO	DRG/DOC. NO.	REV NO.	TITLE

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI - 36

SIGNATURE :

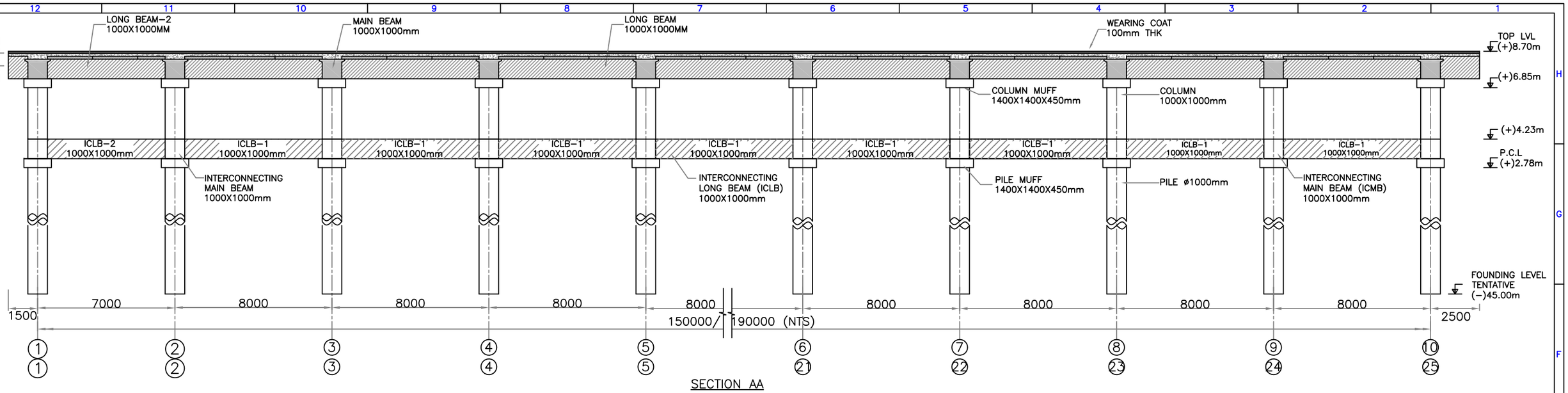
CLIENT :
HALDIA DOCK COMPLEX (HDC),
KOLKATA PORT TRUST (KoPT),
HALDIA.

PROJECT TITLE :
AUGMENTATION OF FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD-156 STANDARD OF 1ST & 2ND OIL JETTIES & 2 NOs. BARGE JETTIES OF HDC, KoPT, HALDIA.

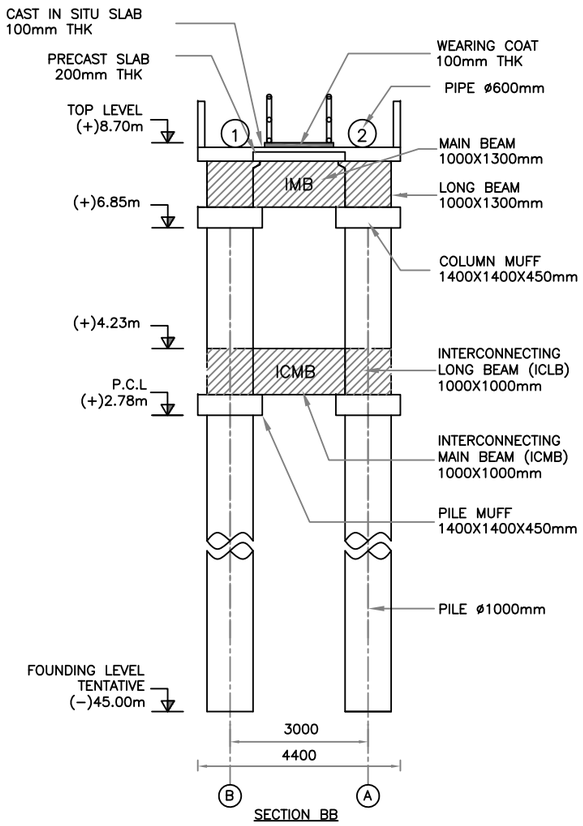
DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

DRAWING TITLE :
FIRE PIPE TRESTLE - GENERAL ARRANGEMENT
190M LENGTH

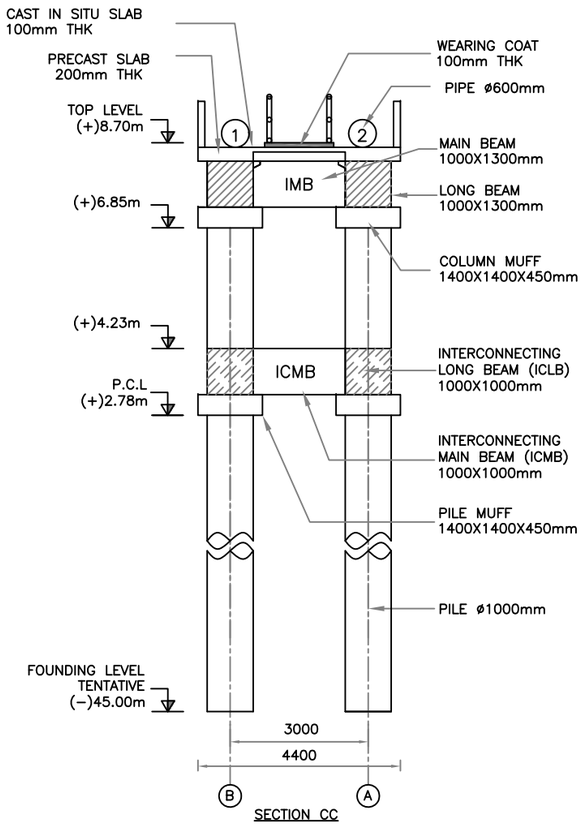
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/INT/HOJ-1&2/6004 (SHEET 04 OF 05)



SECTION AA



SECTION BB



SECTION CC

SI.NO	DETAILS		SHAPE
1	LONG BEAM	7000x1000X1300mm (PRECAST+INSITU)	1300 / 1000
2	LONG BEAM–2	6000x1000X1300mm (PRECAST+INSITU)	1300 / 1000
3	INTERCONNECTING LONG BEAM–1 (ICLB–1)	7000x1000X1000mm (PRECAST)	1000 / 1000
4	INTERCONNECTING LONG BEAM–2 (ICLB–2)	6000x1000X1000mm (PRECAST)	1000 / 1000
5	MAIN BEAM	1000X1000X1300mm (INSITU+PRECAST)	1300 / 1000
6	INTERCONNECTING MAIN BEAM (ICMB)	1000X1000mm (PRECAST)	1000 / 1000

CONCEPTUAL DRAWING

TENDER DRAWING

GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN "m" W.R.T CD
3. CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE : M40
   GRADE OF STEEL : Fe 500D
7. DREDGE LEVEL IS (–) 12m CD

REFERENCE DRAWINGS

SR.NO	DRG/DOC. NO.	REV NO.	TITLE

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

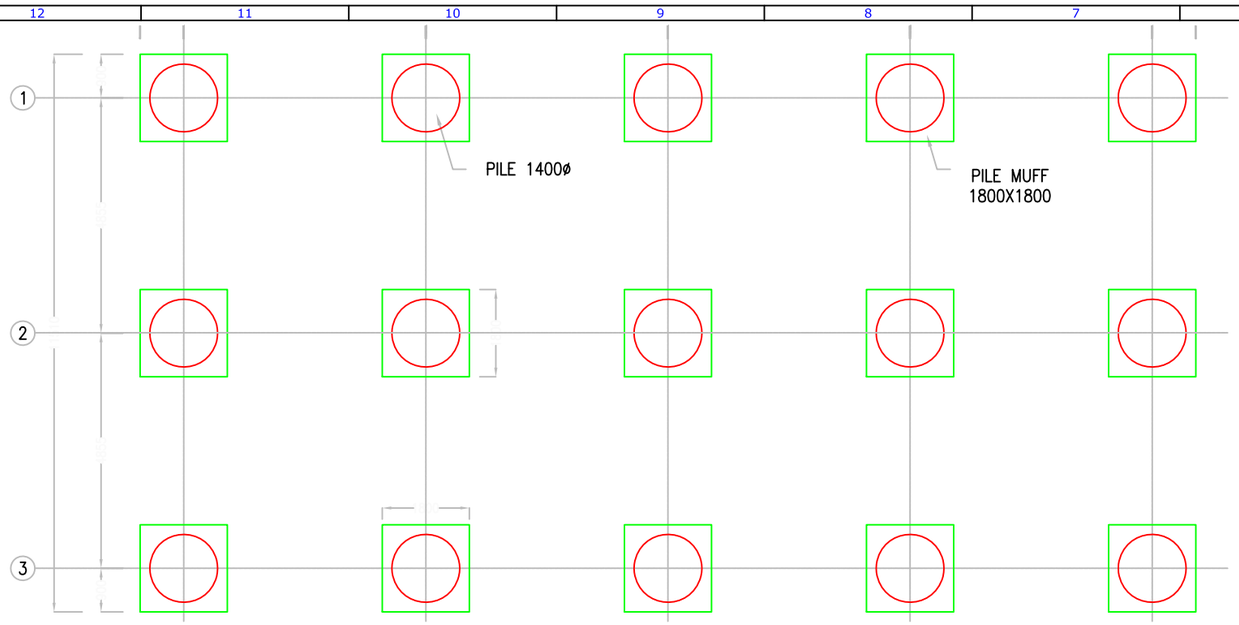
CLIENT :
HALDIA DOCK COMPLEX (HDC),
KOLKATA PORT TRUST (KoPT),
HALDIA.

PROJECT TITLE :
AUGMENTATION OF FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD–156 STANDARD OF 1ST & 2ND OIL JETTIES & 2 NOs. BARGE JETTIES OF HDC, KoPT, HALDIA.

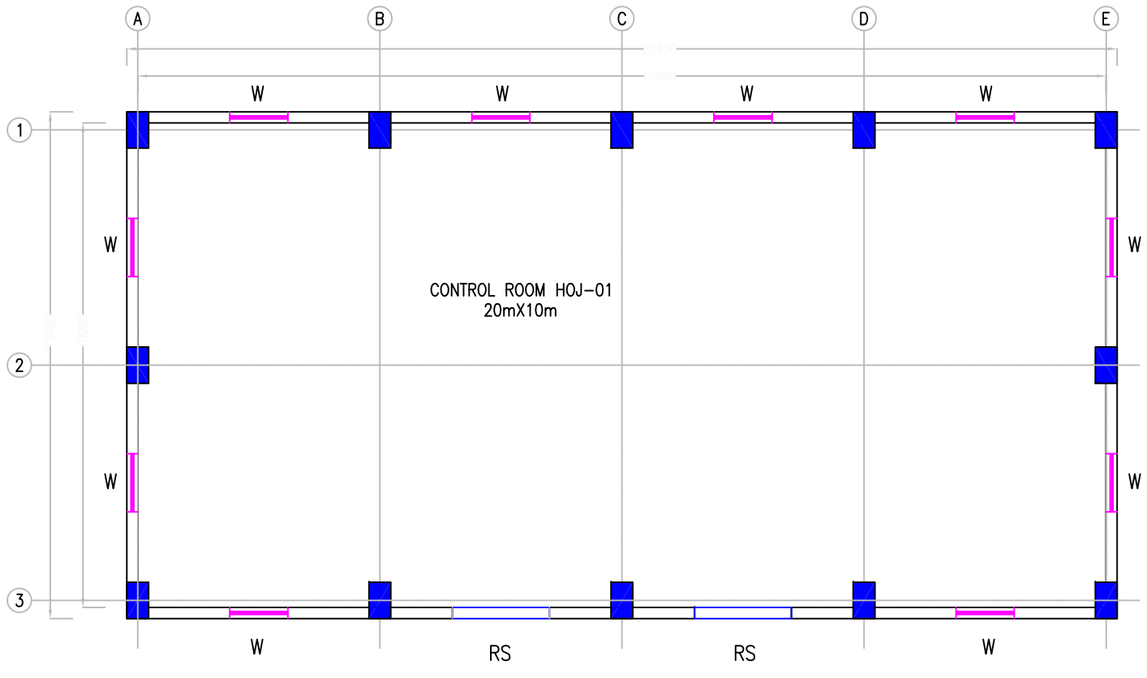
DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

DRAWING TITLE :
FIRE PIPE TRESTLE – CROSS SECTION DETAILS

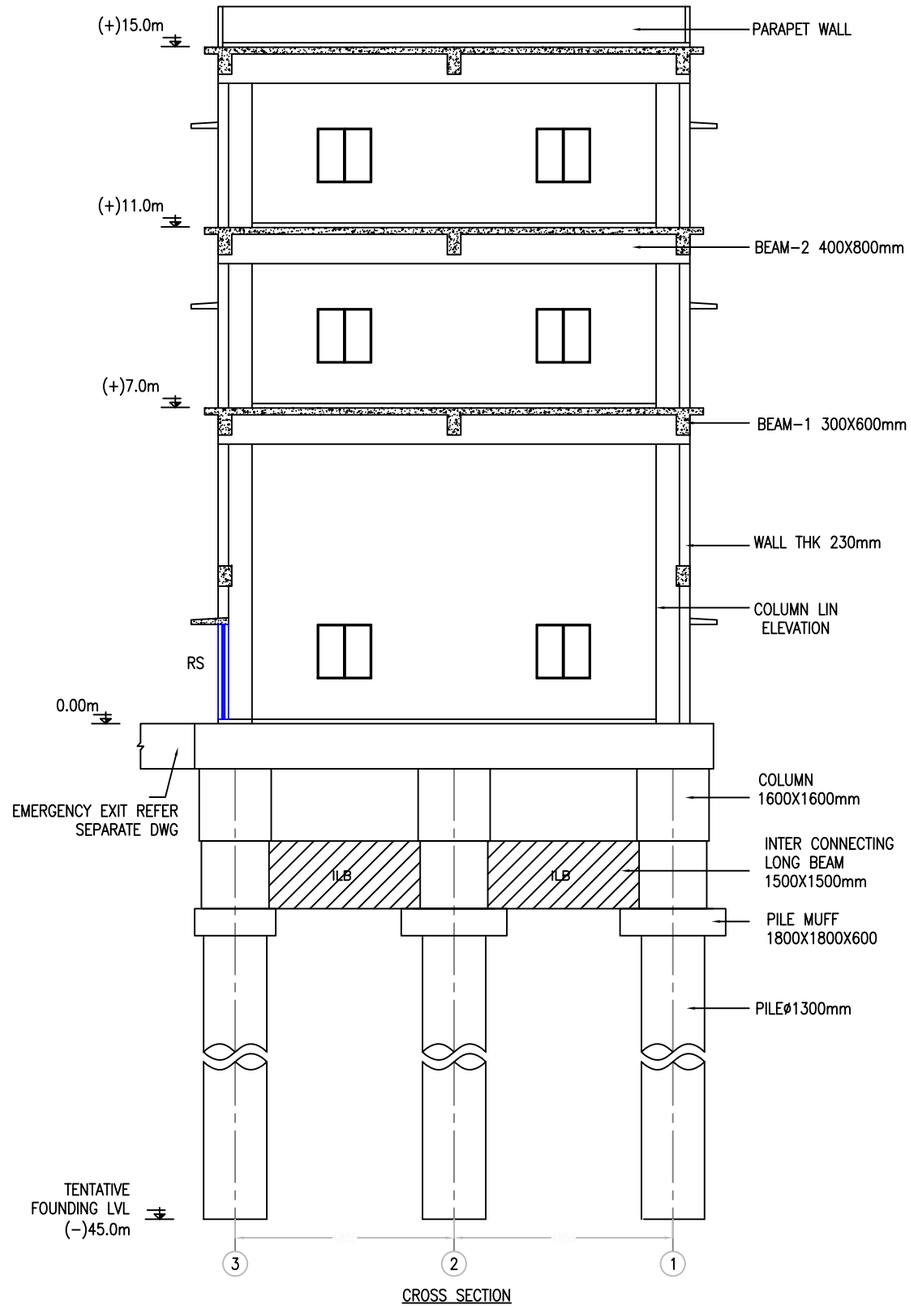
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/INT/HOJ–1&2/6005 (SHEET 05 OF 05)



PILE AND PILEMUFF LAYOUT



PLAN LAYOUT



CROSS SECTION

NOTES:
1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN 'm'
3. CONTRACTOR TO CHECK AND VERIFY DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE – M40
7. GRADE OF STEEL – Fe500D

CONCEPTUAL DRAWING
TENDER DRAWING
GOOD FOR CONSTRUCTION DRAWINGS

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

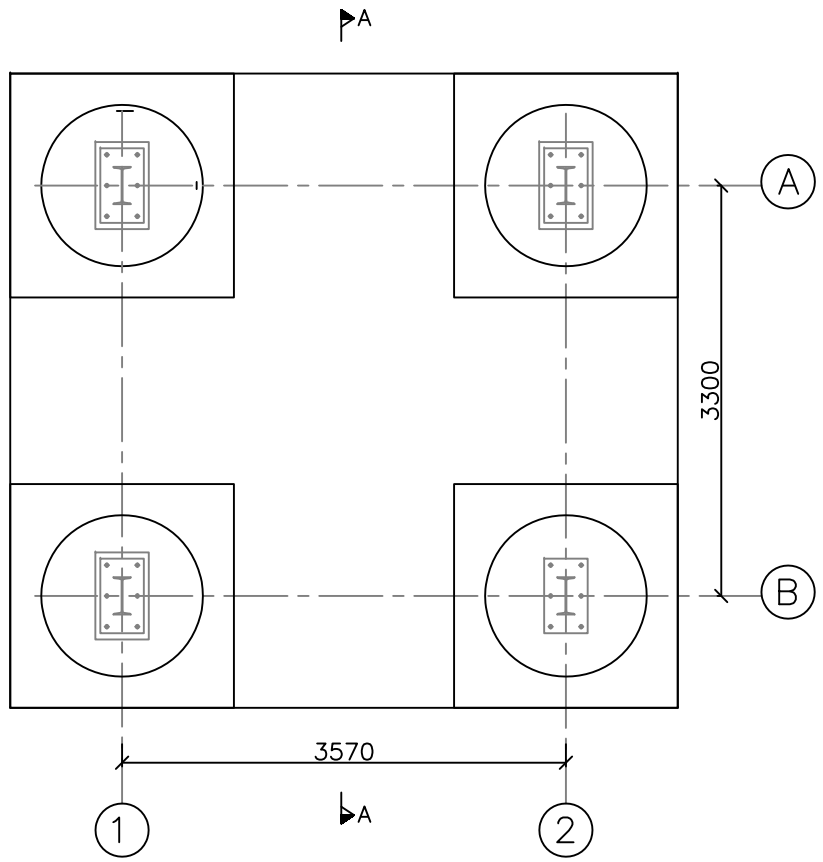
CLIENT :
HALDIA DOCK COMPLEX (HDC), KOLKATA PORT TRUST (KoPT), HALDIA.

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD-156 STANDARD FOR THE PROPOSED OT-II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ-1&2&BJ-1&2

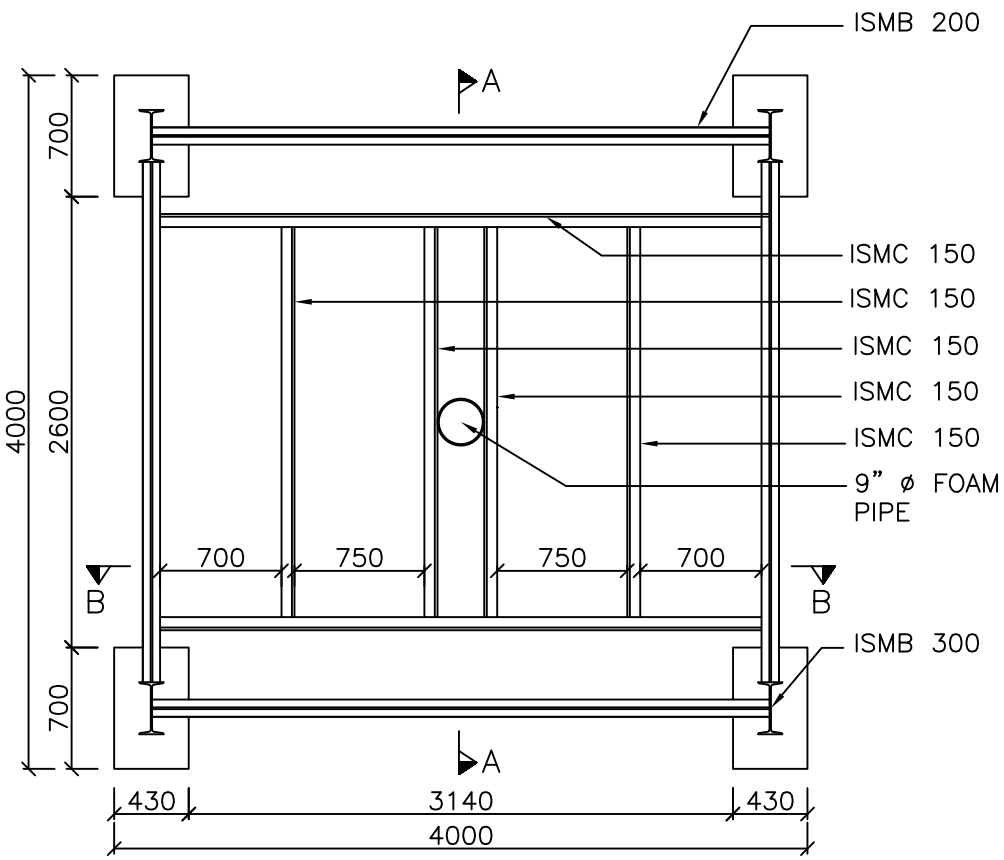
DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

DRAWING TITLE :
CONTROL ROOM FOR HOJ-01

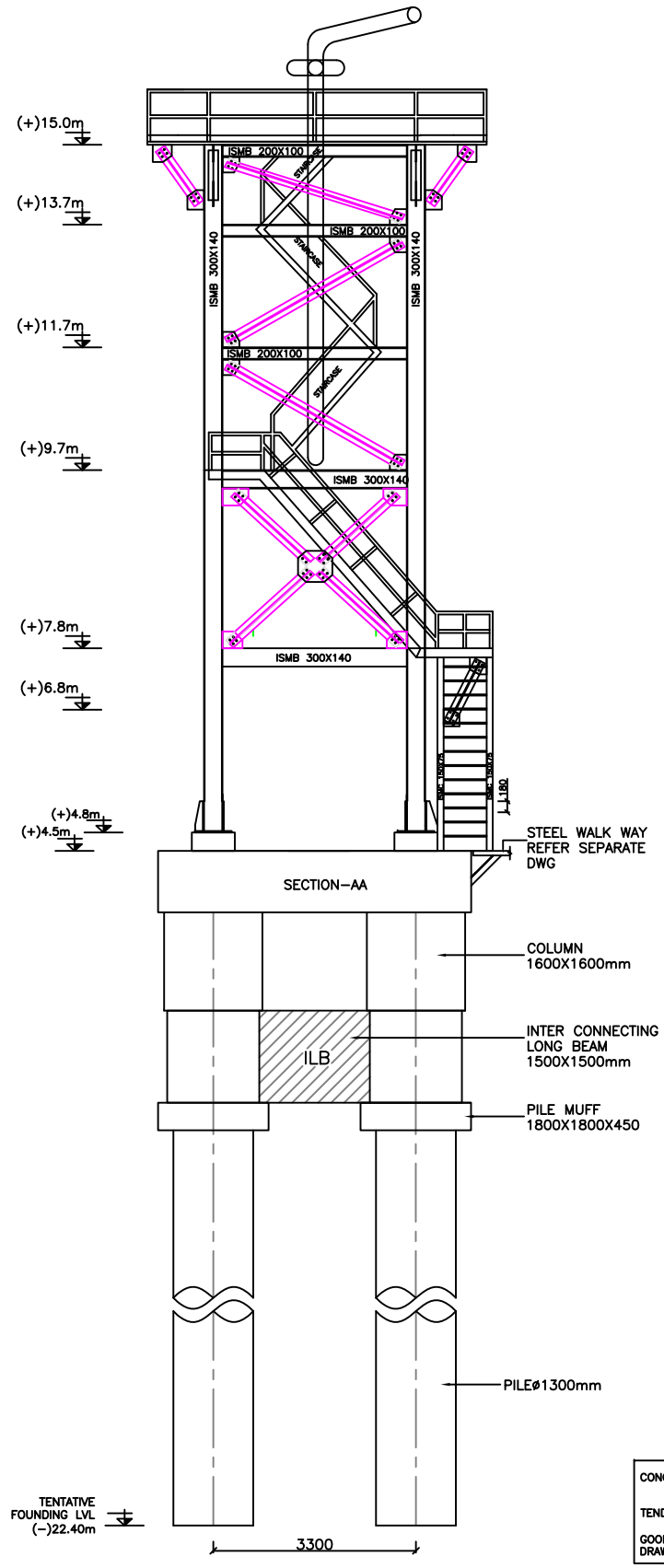
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/INT/HOJ-1/7001



PLAN AT BOTTOM LEVEL (+)4.8m



PLAN



CONCEPTUAL DRAWING

TENDER DRAWING

GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN 'm'
3. CONTRACTOR TO CHECK AND VERIFY DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE – M40
7. GRADE OF STEEL – Fe500D

ENGINEERING FIRM:

Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

CLIENT :

HALDIA DOCK COMPLEX (HDC), KOLKATA PORT TRUST (KoPT), HALDIA.

PROJECT TITLE :

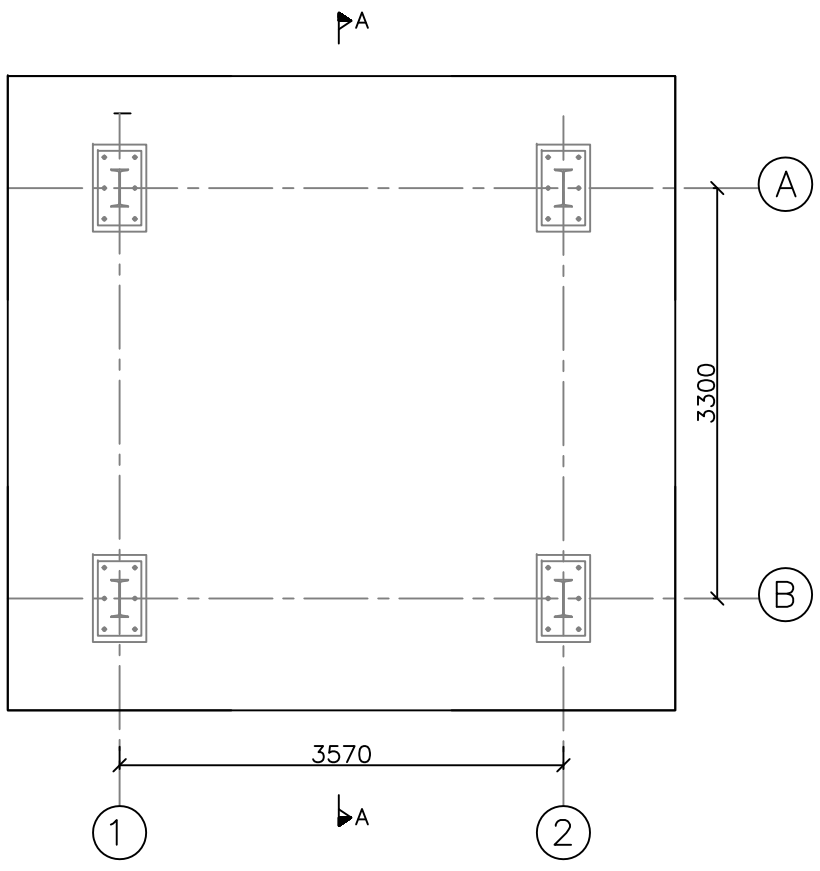
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD–156 STANDARD FOR THE PROPOSED OT–II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ–1&2&BJ–1&2

DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

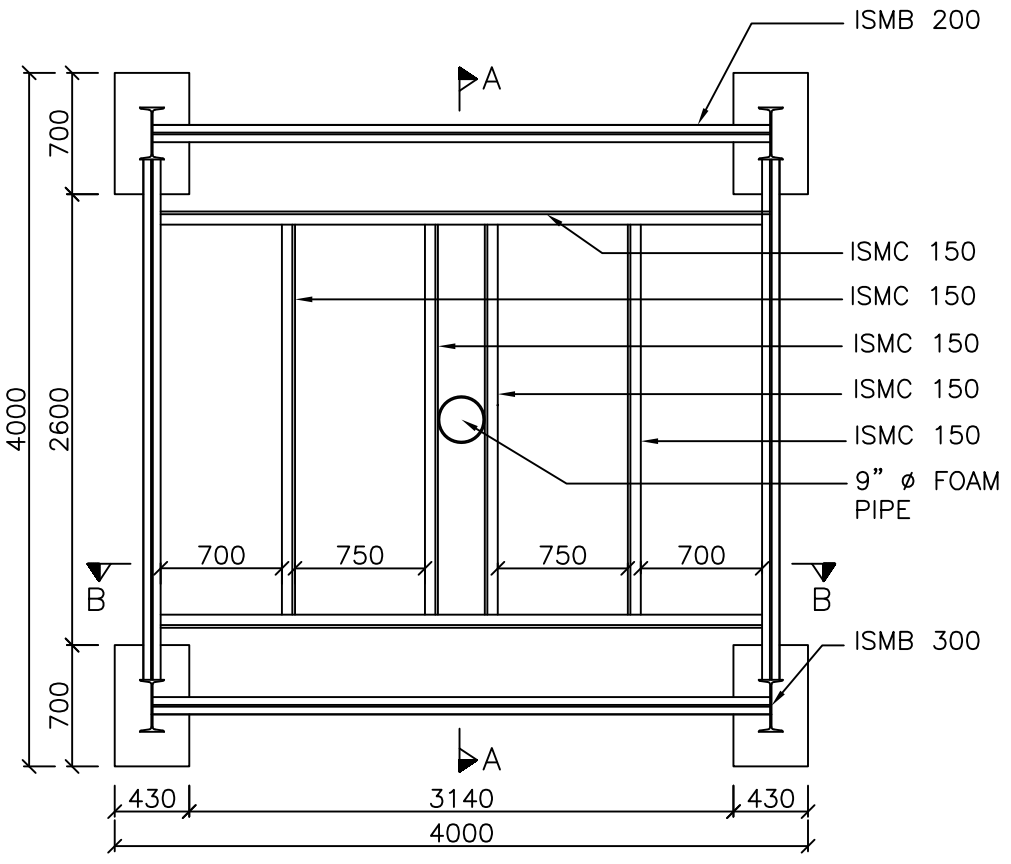
DRAWING TITLE :

OFFSHORE STRUCTURE
HOJ–1&2 – TOWER MONITOR– 1,3,4&6

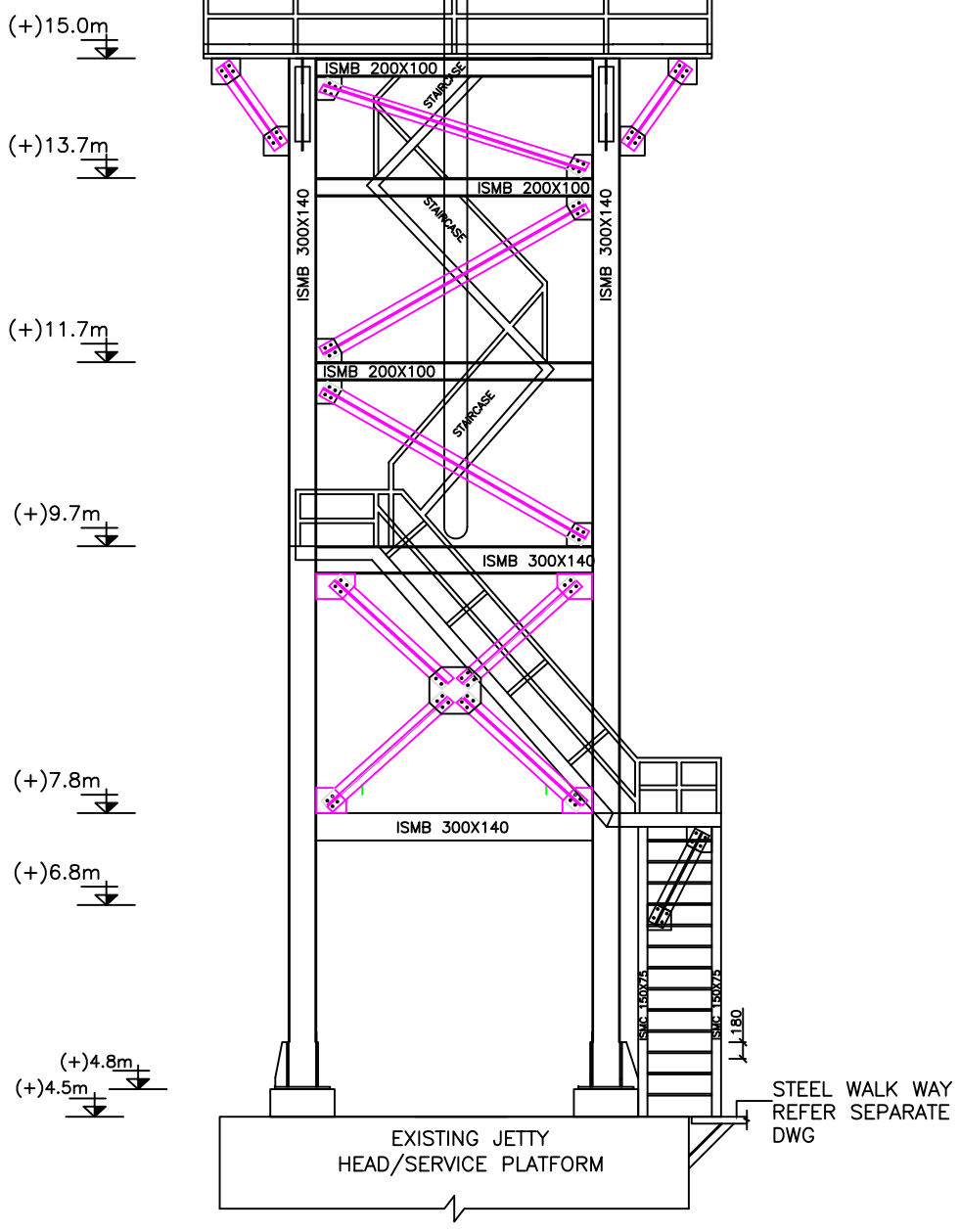
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/AUGFF/HOJ–1&2/8001



PLAN AT BOTTOM LEVEL (+)4.8m



PLAN



CONCEPTUAL DRAWING
TENDER DRAWING
GOOD FOR CONSTRUCTION DRAWINGS

NOTES:

1. ALL DIMENSIONS ARE GIVEN IN "mm" UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE IN 'm'
3. CONTRACTOR TO CHECK AND VERIFY DIMENSIONS BEFORE EXECUTION OF WORK.
4. FIGURED DIMENSIONS SHALL BE FOLLOWED.
5. EXECUTIVES SHALL CHECK THIS DRAWING BEFORE TAKING EXECUTION IN HAND.
6. GRADE OF CONCRETE – M40
7. GRADE OF STEEL – Fe500D

ENGINEERING FIRM:
Prof. R. SUNDARAVADIVELU., FNAE,
INSTITUTE CHAIR PROFESSOR,
MEMBER BOG IIT MADRAS,
Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

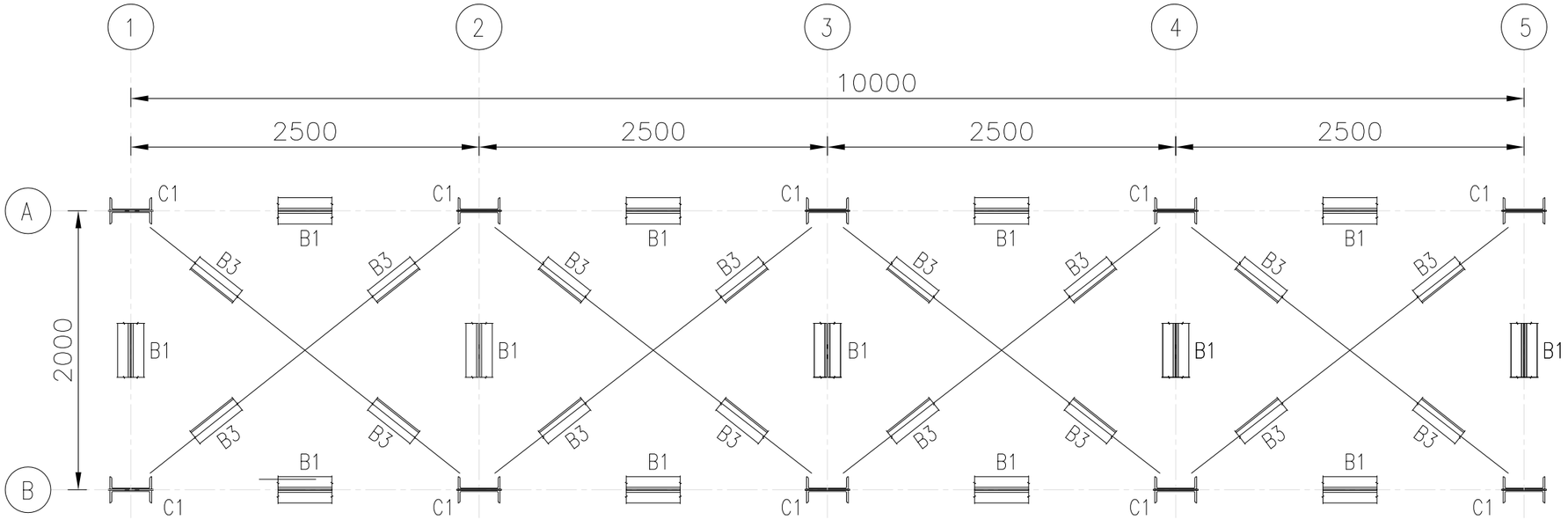
CLIENT :
HALDIA DOCK COMPLEX (HDC), KOLKATA PORT TRUST (KoPT), HALDIA.

PROJECT TITLE :
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD–156 STANDARD FOR THE PROPOSED OT–II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ–1&2&BJ–1&2

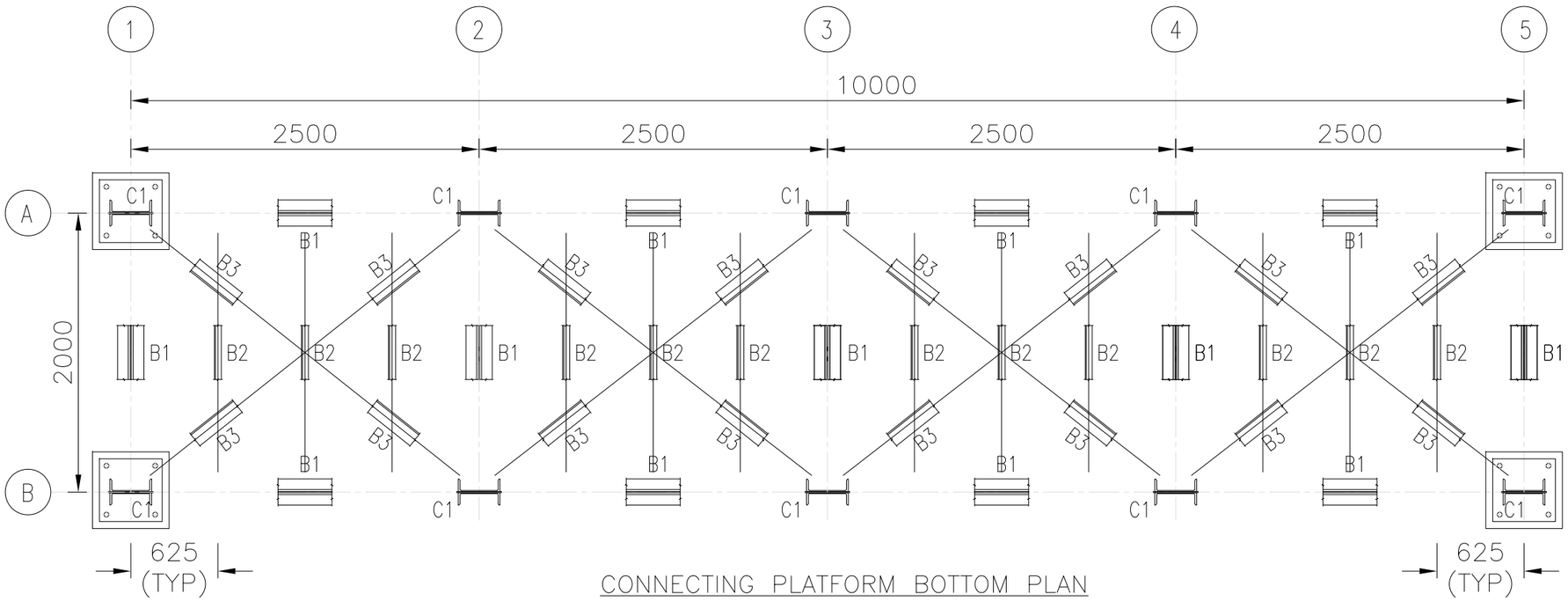
DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

DRAWING TITLE :
OFFSHORE STRUCTURE
HOJ–1&2 – TOWER MONITOR– 2&5

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOR/HDC/AUGFF/HOJ–1&2/B002



CONNECTING PLATFORM TOP PLAN



CONNECTING PLATFORM BOTTOM PLAN

WELDING DETAILS

SI.NO	TYPE OF WELD	SHAPE	REMARKS
1	FIELD FILLET WELD SINGLE SIDE ALLROUND	TYP	
2	FIELD FILLET WELD DOUBLE SIDE	TYP	

NOTES:

1. ALL DIMENSION ARE IN MM
2. ALL LEVELS ARE IN M
3. WELDING DETAILS – IS CODE 813

MEMBER SCHEDULE

MEMBER MKD	SECTION	SHAPE	REMARKS
C1	2 ISMC 300	I	
B1	2 ISMC 300	I	
B2	ISMC 100	[	
B3	ISA 110X110X10	⌐	
B4	2 ISA 110X110X10	T	

ENGINEERING FIRM:

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DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

CLIENT :

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PROJECT TITLE :

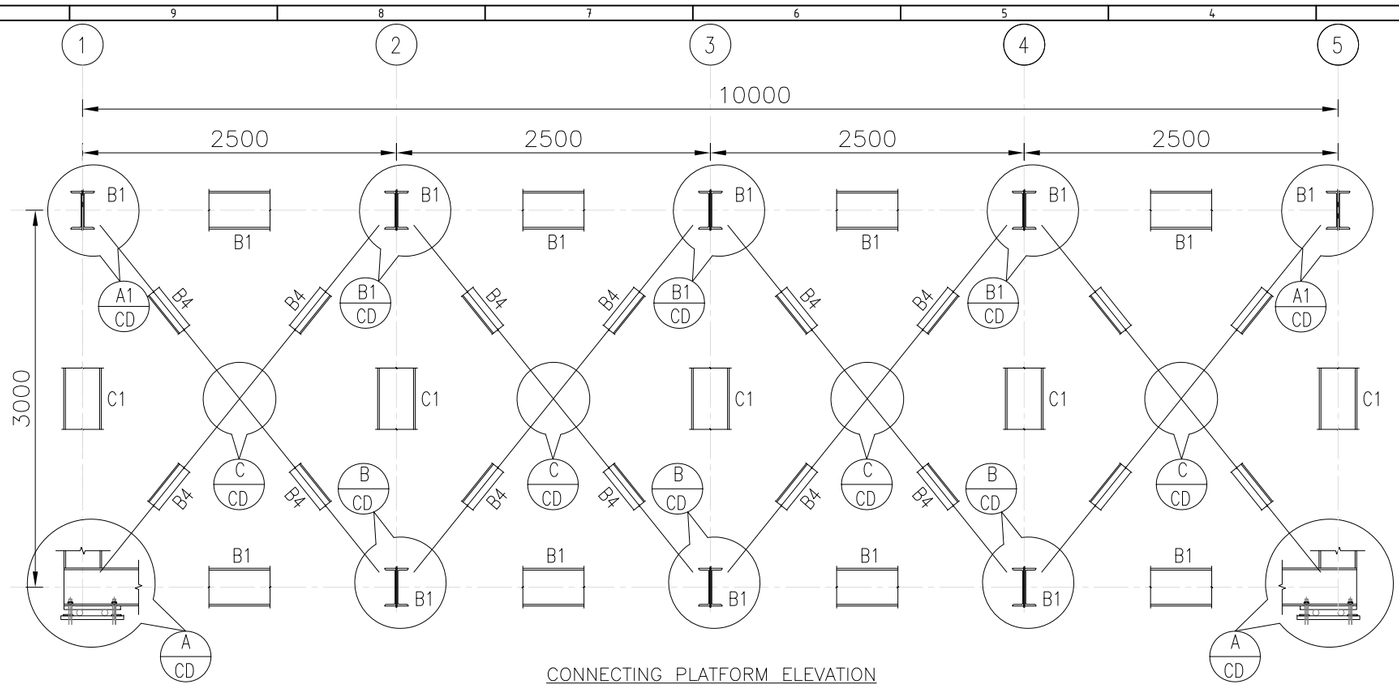
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD-156 STANDARD FOR THE PROPOSED OT-II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ-1&2&BJ-1&2

DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

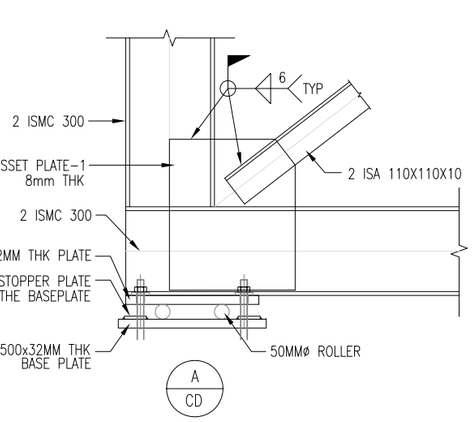
DRAWING TITLE :

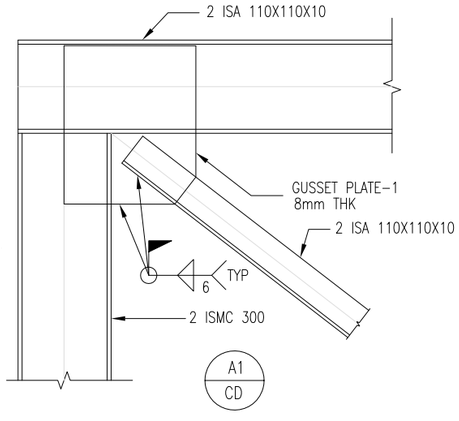
PLAN & ELEVATION OF CONNECTING PLATFORM – 10m LENGTH TOWER MONITOR TO SERVICE/JETTY HEAD

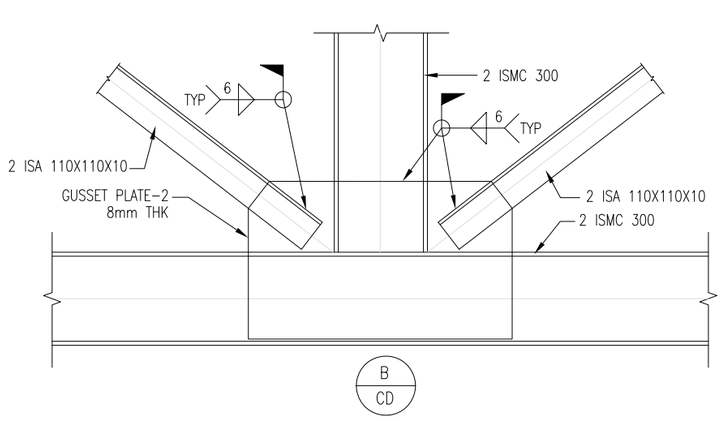
SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/AUGFF/HOJ-1&2/0001 (SHT 01 TO 04)

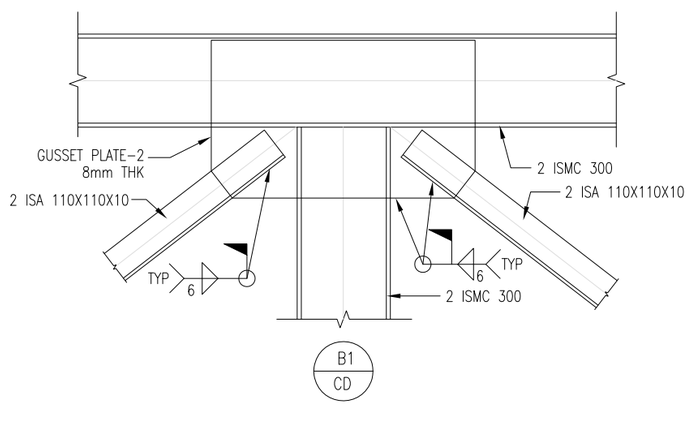


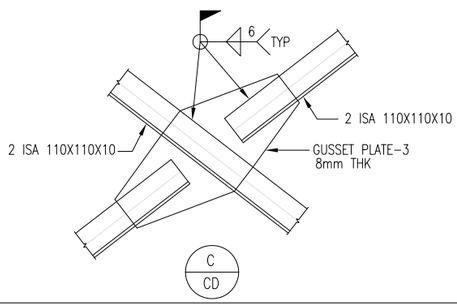
CONNECTING PLATFORM ELEVATION

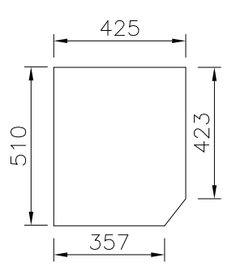




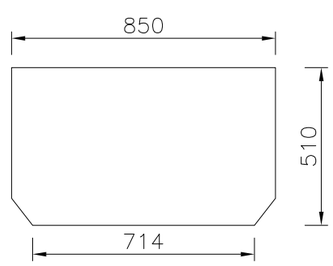




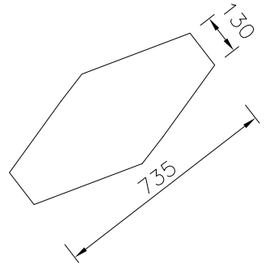




GUSSET PLATE-1
DIMENSION DETAILS



GUSSET PLATE-2
DIMENSION DETAILS



GUSSET PLATE-3
DIMENSION DETAILS

WELDING DETAILS

SI.NO	TYPE OF WELD	SHAPE	REMARKS
1	FIELD FILLET WELD SINGLE SIDE ALLROUND	TYP	
2	FIELD FILLET WELD DOUBLE SIDE	TYP	

NOTES:

1. ALL DIMENSION ARE IN MM
2. ALL LEVELS ARE IN M
3. WELDING DETAILS – IS CODE 813

MEMBER SCHEDULE

MEMBER MKD	SECTION	SHAPE	REMARKS
C1	2 ISMC 300	I	
B1	2 ISMC 300	I	
B2	ISMC 100	[	
B3	ISA 110X110X10	⌐	
B4	2 ISA 110X110X10	T	

ENGINEERING FIRM:

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DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

CLIENT :

HALDIA DOCK COMPLEX (HDC), KOLKATA PORT TRUST (KoPT), HALDIA.

PROJECT TITLE :

INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD–156 STANDARD FOR THE PROPOSED OT–II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ–1&2&BJ–1&2

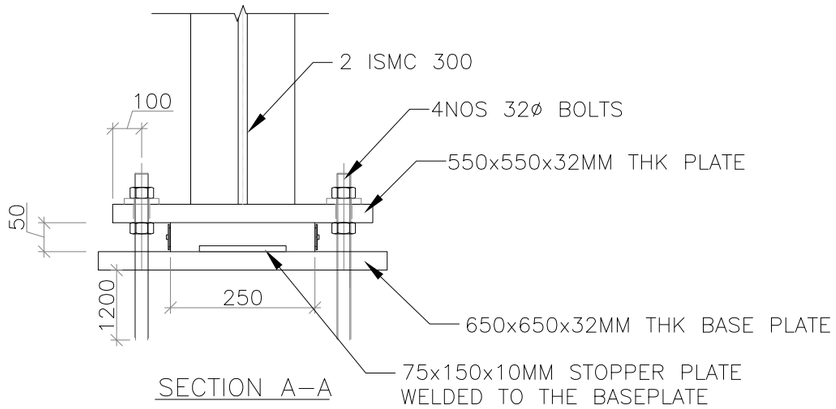
DRN.	CHK.	APP.	DATE	REV
KK	HA	RSUN	01/02/2019	00

DRAWING TITLE :

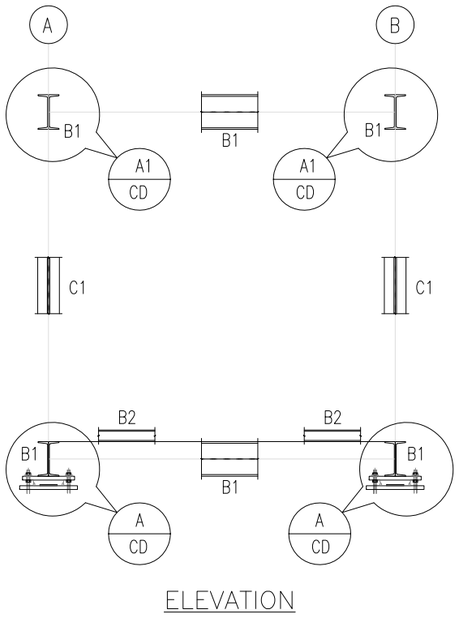
ELEVATION OF CONNECTING PLATFORM
10m LENGTH AND GUSSET PLATE
CONNECTION DETAILS

SH.SCALE: AS SHOWN

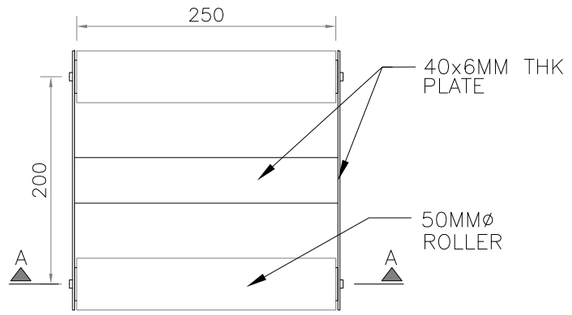
DRAWING NUMBER: IITM/DOE/HDC/AUGPF/HOJ–1&2/9002 (SHT 02 TO 04)



SECTION A–A

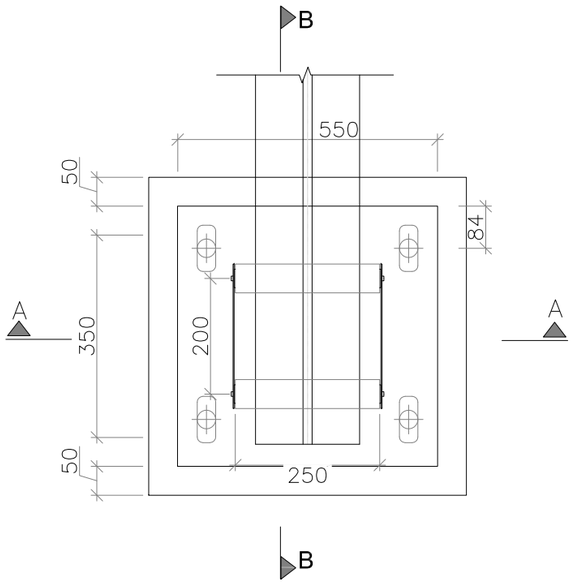


ELEVATION

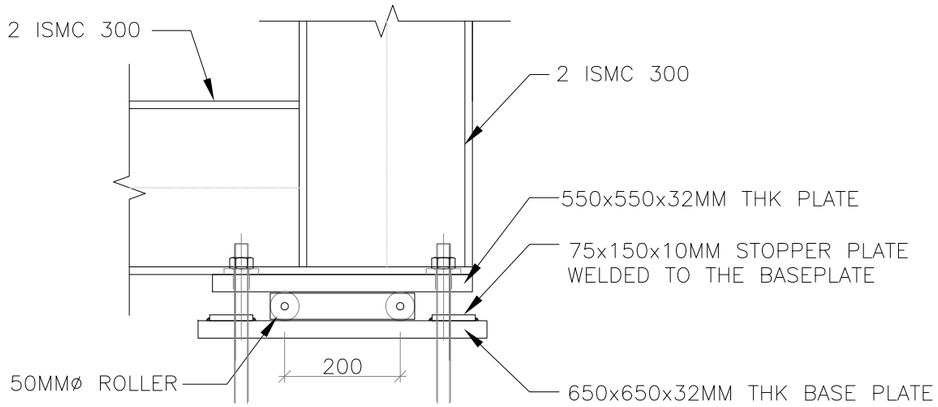


PLAN

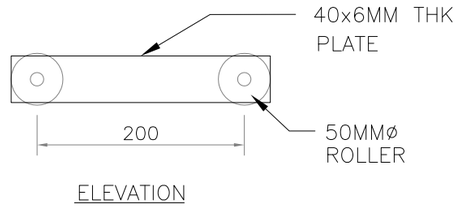
SECTION–AA



PLAN A (ROLLER SUPPORT)



SECTION B–B



ELEVATION

RETAINER ARRANGEMENT FOR ROLLER SUPPORT

WELDING DETAILS

SI.NO	TYPE OF WELD	SHAPE	REMARKS
1	FIELD FILLET WELD SINGLE SIDE ALLROUND	TYP	
2	FIELD FILLET WELD DOUBLE SIDE	TYP	

NOTES:

1. ALL DIMENSION ARE IN MM
2. ALL LEVELS ARE IN M
3. WELDING DETAILS – IS CODE 813

MEMBER SCHEDULE

MEMBER MKD	SECTION	SHAPE	REMARKS
C1	2 ISMC 300	I	
B1	2 ISMC 300	I	
B2	ISMC 100	[	
B3	ISA 110X110X10	⌐	
B4	2 ISA 110X110X10	T	

ENGINEERING FIRM:

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Dr. NILANJAN SAHA,
DEPARTMENT OF OCEAN ENGINEERING,
IIT MADRAS, CHENNAI – 36

SIGNATURE :

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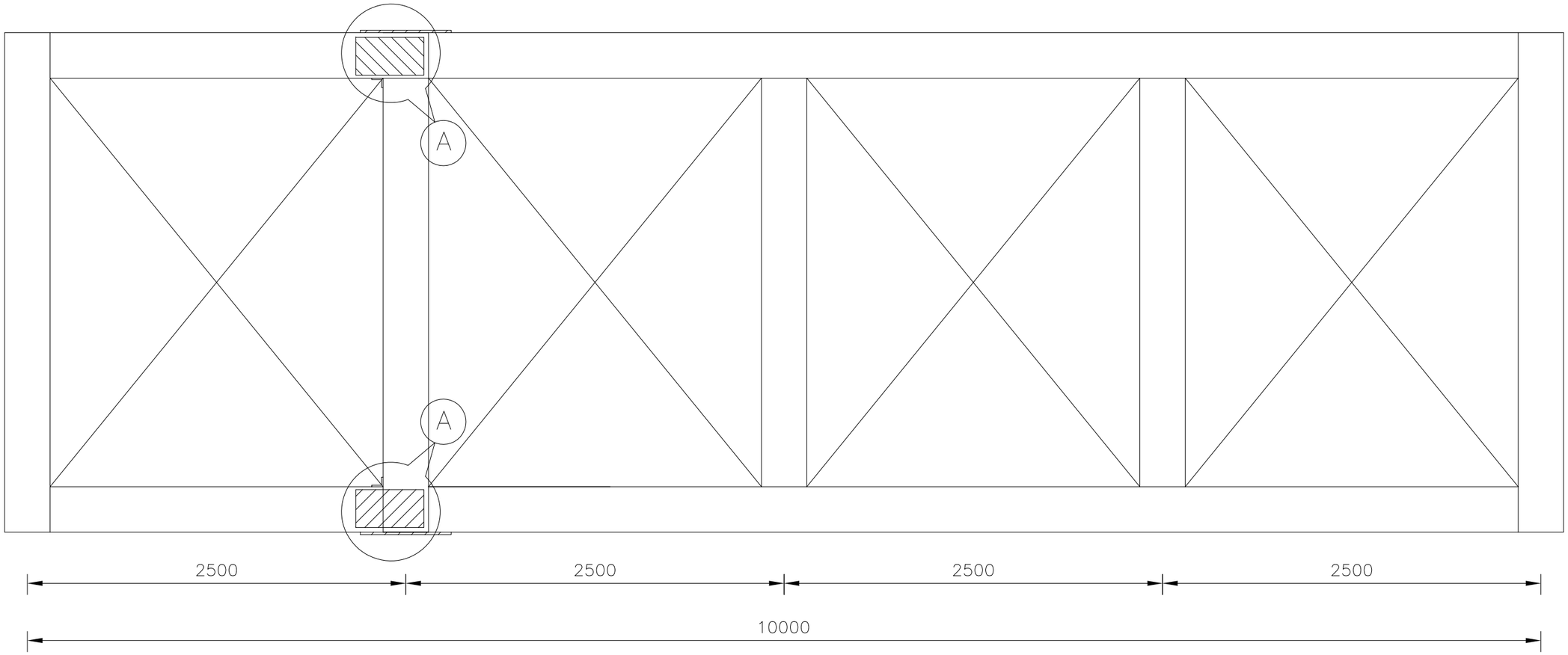
INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD–156 STANDARD FOR THE PROPOSED OT–II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ–1&2&BJ–1&2

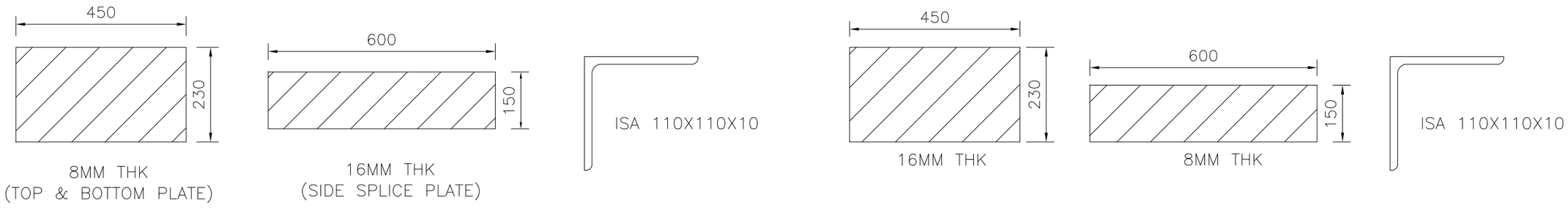
DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

DRAWING TITLE :

PLAN & CROSS SECTION BASE PLATE & ROLLER ARRANGEMENT (TOWER MONITOR TO SERVICE/JETTY HEAD)

SH.SCALE	DRAWING NUMBER
AS SHOWN	IITM/DOE/HDC/AUGFF/HOJ–1&2/9003 (SHT 03 TO 04)





CONNECTING PLATE DIMENSION DETAILS–A

WELDING DETAILS

SI.NO	TYPE OF WELD	SHAPE	REMARKS
1	FIELD FILLET WELD SINGLE SIDE ALLROUND	TYP	
2	FIELD FILLET WELD DOUBLE SIDE	TYP	

NOTES:

1. ALL DIMENSION ARE IN MM
2. ALL LEVELS ARE IN M
3. WELDING DETAILS – IS CODE 813

MEMBER SCHEDULE

MEMBER MKD	SECTION	SHAPE	REMARKS
C1	2 ISMC 300	I	
B1	2 ISMC 300	I	
B2	ISMC 100	[	
B3	ISA 110X110X10	⌐	
B4	2 ISA 110X110X10	T	

ENGINEERING FIRM:

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SIGNATURE :

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PROJECT TITLE :

INTEGRATED FIRE FIGHTING FACILITIES IN COMPLIANCE WITH OISD–156 STANDARD FOR THE PROPOSED OT–II & AUGMENTATION OF FIRE FIGHTING FACILITIES IN HOJ–1&2&BJ–1&2

DRN.	CHK.	APP.	DATE	REV
KK	SH	RSUN	01/02/2019	00

DRAWING TITLE :

ELEVATION OF CONNECTING PLATFORM AND CONNECTING PLATE DETAILS

SH.SCALE: AS SHOWN

DRAWING NUMBER: IITM/DOE/HDC/AUGPF/HOJ–1&2/9004 (SHT 04 TO 04)