Indigenous
(Revisions - 01)

Electronics Division, Bangalore

BHEL - EDN

TENDER DOCUMENTS

COVERING, COMMERCIAL TERMS & CONDITIONS & ANNEXURES

FOR RFQ. NO LCM0000815 DTD 12/07/2013

RFQ DUE DATE: 05/08/2013

ITEM: PROGRAMMABLE LOGIC CONTROLLERS

PROJECT: IOCL VADODRA GTG(1 x 30 MW)

LOCATION: GUJARAT

Bharat Heavy Electricals Ltd.,

(A Government of India undertaking)

Electronics Division

PB No. 2606 , Mysore Road Bangalore , 560026 INDIA

Fax : +91 80 26989217

☎ : +91 80 26998781
+91 80 26989142
+91 80 26998098

Date:

M/s.

Attn. Mr/Ms.

Sub: Receipt of Tender Enquiry (RFQ) No LCM0000815 **dtd** 12/07/2013
with tender specifications for PROGRAMMABLE LOGIC CONTROLLERS
Project : IOCL VADODRA GTG(1 x 30 MW)
Due Date for submission of Offer. 05/08/2013

We are forwarding herewith our Enquiry (Request for Quotation) referred above along with following tender documents:

- ☑ 1 Enquiry header complete with item description, quantity and delivery schedule.
- ☑ 2 Purchase specifications.
- ☑ 3 Instructions to bidders (3 pages).
- ☑ 4 BHEL standard terms & conditions (Indigenous-11 pages) along with
  - ☑ a) Loading factors for non-compliance of Commercial Terms & Conditions (8 Pages) Annexure - I
  - ☑ b) Proforma for performance bank guarantee (for Indigenous-3 Pages) with instruction for PBG submission and with list of BHEL consortium bankers. Annexure- II, III(a) & III(b).
  - ☑ c) Guidelines for Reverse Auction procedure (wherever applicable)- 2 Pages. Annexure - IV.

Please acknowledge receipt and confirm submission of complete offer within tender due date.

PURCHASE EXECUTIVE

Tender Enquiry (RFQ) No: LCM0000815 **dtd** 12/07/2013
Project: IOCL VADODRA GTG(1 x 30 MW) **Item** PROGRAMMABLE LOGIC CONTROLLERS

REQUEST FOR QUOTATION

MMI:PU:RF:003

BHARAT HEAVY ELECTRICALS LIMITED
Electronics Division
PB No. 2606, Mysore Road Bangalore - 560026
INDIA

RFQ NUMBER:
LCM0000815

RFQ DATE :
12.JUL.2013

Due Date
05.AUG.2013
Time: 13:00 HRS

VENUE :
NEW ENGG. BLDG

(for all correspondence)
Purchase Executive : MESHRAM LC
Phone : 26998781
Fax : 00918026989227
E-mail: meshram@bheledn.co.in

Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by **13.00** hours IST and will be opened on the same day at **13.30** hours at the venue mentioned above. **PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.**

Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date*
1	PR0850000319 PLC for HRSG-BMS Controls Programmble Logic Controller for HRSG-BMS Controls Type QMR/TMR As per Specification Test Certificate	1	ST	1	~~09.DEC.2013~~
2	PR0850000327 PLC for BOP ESD Controls Programmble Logic Controller for BOP ESD Controls Type QMR/TMR As per Specification Test Certificate	1	ST	1	~~09.DEC.2013~~
3	PR0850000335 MANDATORY SPARES- HRSG BMS & BOP ESD PLC Mandatory spares for HRSG BMS PLC & BOP ESD PLC As per specification Test Certificate	1	ST	1	~~09.DEC.2013~~

Total Number of Items - 3

Please note that the tender will be opened in the presence of the bidders or his authorised representatives (maximum two per organisation) who choose to be present with authorisation letters. Refer annexure for the terms and conditions.

Preference will be given to vendors who accepts our standard payment terms .

Please specify Terms of delivery, Excise duty, sales tax, Ex-BHEL, Ex-works surcharge, Insurance,P&F, Freight and other taxes very clearly .

For evaluation,exchange rate(TT selling rate of SBI) as on scheduled date of tender opening (Part-I bid incase of two part bid) shall be considered.

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

i). This is only RFQ not an order.
ii). In all correspondence quote RFQ No. & due date.
iii). In Quotation BHEL material code / RFQ Sl. No. should be mentioned clearly.
iv). Quotation Envelope / Fax not superscribed with RFQ No.and due date is liable for rejection.
v). Quotation should remain valid for a minimum peiod of 8 weeks from date of price bid opening or reverse auction.
vi). In case of non-receipt of Quotation or regret letter for 3 consecutive RFQs you are liable to be removed from our vendors list.
vii). All Prices should be written in words and numbers.
viii). Excise Chapter Heading should be mentioned for all items where VAT is applicable .

*DELIVERY PERIOD SHALL BE RECKONED AS 12 WEEKS FROM THE DATE OF ISSUE OF MANUFACTURING CLEARANCE/DOCUMENT APPROVAL BY BHEL/IOCL WHICHEVER IS EARLIER.

For and On behalf of BHEL.

Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division
PB No. 2606 , Mysore Road Bangalore , 560026 INDIA

Fax : +91 80 26989227
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+91 80 26989142
+91 80 26998 . . .

INSTRUCTIONS TO BIDDERS

BHEL RFQ No.& Date..LCM0000815 DTD 12/07/2013

Due date:..05/08/2013 Project:IOCL VADODRA GTG(1 x 30 MW)

Item:..PROGRAMMABLE LOGIC CONTROLLERS

BIDDER is requested to read the instructions marked as (✓) carefully and submit their quotation covering all the points:

✓ Deviation to this specification/item description, f any shall be brought out clearly indicating "DEVIATION TO BHEL SPECIFICATION" without fail, as a part of technical offer.

✓ **Quotation shall be submitted in** :

● ~~SINGLE PART BID (Techno-commercial offer with prices alongwith price summary in a sealed envelope~~).

OR

✔ ● TWO PART BID (Techno-commercial i.e. UN-PRICED offer in a sealed envelope and Price offer in a separate sealed envelope alongwith Price Summary). Both these envelopes shall be again kept in a single sealed envelope. If priced offer is not submitted alongwith technical offer, offer is liable for rejection.

Note : BIDDER shall ensure to super scribe the en velope with RFQ n umber, RFQ Date , RFQ D ue date, Item Description and Project clearly & boldly on each envelope. BHEL standard Commercial Terms and conditions must accompany techno-co mmercial offer w ithout fail. BHEL standard commercial terms & conditions duly filled, signed & stamped only to be sent. Your standard printed commercial terms not needed and will not be accepted by BHEL.

✓ ***In case of two part bids, filled in commercial terms & conditions must accompany unpriced techno-commercial offer, failing which your offer is liable for rejection.Priced offer shall be complete in all respects indicating basic prices, applicable Taxes and Duties, Packing & forwarding charges (if applicable) and Freight & Insurance charges, etc. and compulsarily sent alongwith techno-commercial offer.***

✓ ***In addition Bidder shall also quote for Erection & Commissioning Charges (E&C Charges), Documentation charges, Service Charges, Testing Charges (Type and Routine), Training Charges, Service tax, etc. wherever applicab le. The price summary m ust indicate all the elements c learly, which will be considered for arriving at "Total cost to BHEL".***

✓ ***Tender (quotation) to be dropped in the Tender Box with 3 compartments (Monday / Wednesday/ Friday) kept in our reception area with caption "CE, SC&PV, DEFENCE", before 13.00 Hrs. on due date mentioned on the RFQ (Request for quotation) Monday, Wednesday, Friday. Tenders will be opened on due date and time mentioned on the RFQ.***

✓ Note: For Freight charges, service tax applicable for direct despatches from vendor works (persently service tax is applicable on the 25% (twenty five parcent)) of the freight amount.

DETERMINATION OF THE "TOTAL COST TO BHEL":

Total basic value + Packing & Forwarding charges + Excise Duty+Education Cess+Sales Tax/VAT + Lumpsum Freight with service tax + Insurance (as per BHEL Insurance premium) + Service Tax (as applicable)+ loading factor value on total basic material value (for deviations to Commercial Terms & Conditions) = "TOTAL COST TO BHEL".

Note : In case BHEL customer reimburse any one of the cost element like Excise duty, Sales Tax, Service Tax, Freight & Insurance charges, same will be removed for arriving at "TOTAL COST TO BHEL", in turn the lowest bidder. However vendor has to quote for all the cost components.

The lowest technically & commercially acceptable offer arrived as above and meeting BHEL norms will be considered for further processing.

✓ As far as possible, the quotations shall be free from corrections/overwriting. Corrections if any should be initialed with your seal. Any typographical error, totalling mistakes, currency mistake, multiplication mistake, summing mistakes observed in your priced bids, BHEL m ay consider as per existing rules for evaluation of the lowest quote. BIDDER shall honour the same in case Order is awarded for the said TENDER ENQUIRY / RFQ.

✓ **RISK PURCHASE CLAUSE** :- The purchaser at his discretion may also make purchase of the materials **NOT** supplied in time at the **RISK & COST** of the supplier. Under such situation, it will be obligatory on the part of the supplier who fails to supply the goods in time to make good to BHEL any loss due to risk purchase.

✓ This item is enquired for IOCL VADODRA GTG(1 x 30 MW)..... project, which qualifies for following benefits :

i) ~~Deemed export project, Mega power project and contract won against international competitive bidding basis (ICB), hence, Excise duty is fully exempted. Necessary documents for availing Excise duty exemption by suppliers will be furnished by BHEL.~~

~~In case vendor is importing any raw materials / components for the enquired item, same are eligible for Zero Customs duty. As per para 8.7 of Hand Book of procedures of EXIM policy, BHEL will part the import licence with the vendors to obtain import licence by themselves and custom clear the raw materials / components by availing zero customs duty. Hence, please furnish list of raw materials / components to be imported by you with Quantity and CIF value (for which BHEL has to share import licence). The benefit due to the above shall be passed on to BHEL and confirmed in the quotation. If there are no imported raw materials / components, same shall be confirmed in the offer.~~

ii) ~~Deemed Export contract, NOT a Mega Power Project but won against International Competitive Bidding (ICB) and hence this project is eligible for Terminal Excise duty benefit from DGFT as per present EXIM policy. Vendor to submit (a) Disclaimer certificate and (b) Copy of Excise Invoice attested by Suptd.of Central Excise (Signature in Blue ink with seal)(APPLICABLE ONLY FOR PIPAVAV PROJECT)~~

iii) ~~Physical export contract eligible for complete exemption of Excise duty and Sales tax against submission of necessary documents by BHEL like ARE1 form and Form-H.~~

✓ BIDDER shall ensure to indicate cl early Excise duty, Education Cess, Sales Tax/VAT, Octroi, entry tax, Service Tax and freight charges as applicable, for the quoted items or services. In the absence of the clarity

FOR IOCL VADODRA GTG PROJECT:EXCISE DUTY+CESS,CST/VAT,SERVICE TAXES ARE REIMBURSABLE BY CUSTOMER TO BHEL. THE SAME WILL NOT BE CONSIDERED FOR ARRIVING AT " TOTAL COST TO BHEL". VENDOR SHALL NECESSARILY SUBMIT EXCISE INVOICE,ACKNOWLDEGED LR TO BHEL.

of these, any claim at a later date will not be entertained. Also any changes in taxes and duties after award of the contract, will not be considered except such are those, which are imposed by Govt. notification within the contractual delivery. Please note, seeking price amendments for change in Excise Duty due to crossing of Turnover limits will not be considered, under any circumstances.

- ✓ Quotations with, payment terms of "Advance" or "Inland letter of credit' will not be considered. & such offer / quotation is liable for rejection commercially.
- ✓ On award of contract if BIDDER seeks dilution of the ordered specification and if such deviation is acceptable to BHEL, BIDDER shall pass on mutually agreed price reduction to BHEL.
- ✓ Any dispute arising out of this, shall be referred to the sole arbitration of Head of Dept. (Materials Management-CE), EDN, Bangalore or any other officer nominated by him and his decision shall be final and binding on the parties. The venue of the arbitration in all cases shall be Bangalore.
- ✓ All suits in respect of this lie in the court of Bangalore only.
- ✓ BHEL reserves the right to RE-FLOAT/ REJECT / CANCEL this TENDER ENQUIRY (RFQ) without assigning any reason or cause thereof. Quotes received against this TENDER ENQUIRY are subject to and governed by all these terms and conditions. BHEL's decision will be final in awarding of the contract and binding.
- ✓ As per our recent purchase policy, any offer received after due date and time will be treated has "Late offer" and will be rejected. Hence pl. submit offer within due date and time to avoid rejection due to late submission. It is the responsibility of vendor to submit offer in tender box within due date and time. Offer sent by fax/e-mail/courier/post etc. Which is received late will be tearated as late offer and BHEL will not be responsible for late offer. In case of the "Regret to Quote" , it should be submitted in tender box within due date and time. Late offer will be returned to vendors in sealed condition.
- ✓ Forward quotation / offer for this tender within due date and time. In case of `not quoting' please send 'regret letter' which is a mandatory requirement. In case we do not receive offer / regret letter from you, we treat as 'Regret to quote' for this tender by you. In case of non receipt of "Regret Letter or Offer" it will be treated as "Regret to Quote" for this enquiry.
- ✓ In case of rejection due to (a) commercial grounds or (b) technical grounds, the sealed price bids will be returned back to respective vendors after release of PO and receipt of order Acknowledgement from the successful bidder.
- ✓ PBG to be sent by issuing bank directly to BHEL, Purchase department. PBG shall be from any one of the BHEL consortium banks only.
- ✓ All bank charges to vendors account only,
- ✓ Please quote your best, lowest, competitive, reasonable offer. Please indicate the prices in both figures & words.
- ✓ Please sign the offers. Unsigned bids/offers may not be considered & the offer is liable for rejection.
- ✓ Filled in BHEL standard terms and conditions should be submitted in original only. Zerox copy should not be attached.

PURCHASE EXECUTIVE

Electronics Division, Bangalore

BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY

RFQ. NO. & DATE LCM0000815 DTD 12/07/2013 DUE ON: 05/08/2013

SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
01	**PRICE BASIS**	Firm i.e., from the date of PO to completion of supply if E&C is not applicable. If E&C is in supplier's scope, then the prices shall remain Firm till commissioning & handing-over of the complete system. **(PVC clause not acceptable).**	**AGREE**	
02	**VALIDITY**	Valid upto 8 weeks from the date of opening of price Bid **(not technical bid), /date of Reverse Auction.**	**AGREE**	
03	**TERMS OF DELIVERY**	Ex works (including Packing & Forwarding charges but excludingTaxes and Duties). Packing shall be roadworthy, best suited for m ultiple transshipments and to take care of transit damages. ***Indicate Station of despatch :*** ***Indicate place of manufacturing:*** ***Indicate type & method of packing being adopted:***	**AGREE** _____ _____ _____	
04	**DESTINATION**	Items are for direct despatch to BHEL's customer site located at : IOCL VADODRA GTG(1 x 30 MW) Road Permit if applicable will be issued by BHEL alongwith Despatch Clearance. ***Hence, vendor may take a special note to indicate whether Central Sales Tax or Local State Sales Tax or VAT will be applicable.***	**AGREE**	
05	**DOCUMENTS** (Pl. see loading Factor)	**Along with quotation :** As called in purchase specificati on shall be furnished alongwith un-priced bid. If not called in Purchase Specification then vendor shall submit two sets of Original catalogues, Data sheets, Bill of materials, Dimensional drawings, mounting details and any other relevant documents with un-priced bid. **After issue of PO:** As called in Purchase spec ification for the complete scope of supply within two weeks on receipt of PO for BHEL/ customer/consultant approval. If not called in Purchase Specification then vendor shall submit two sets of Drawings, Bill of materials, data sheets, Catalogues, Quality plan, Test procedure and Type Test Report for the complete scope of supply within **Two weeks** on receipt of PO for BHEL / Customer / Consultant approval.	**AGREE**	

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DUE ON: 05/08/2013

Electronics Division, Bangalore

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SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
06	**PENALTY (FOR DELAY IN SUBMISSION OF DOCUMENTS FOR BHEL / CUSTOMER APPROVAL) :** (Pl. see loading Factor)	In the event of delay in submission of complete set of documents (including soft copy wherever applicable) in required sets beyond 2 weeks from receipt of Purchase order (vendor to confirm date of receipt of PO in writing), Penalty @ 2% (two percent) per week but limited to a max. of 10% (Ten percent) value of the basic material value will be applicable. Penalty if applicable shall be deducted at the time of settlement of 75% payment. If penalty is applicable for duratio n of less than a week penalty @ 2% (two percent) of the basic material value will be charged.	**AGREE**	
07	**EXCISE DUTY & EDUCATION CESS**	To confirm whether applicable. If applicable, indicate prevailing rate of Excise duty and maximum rate of Excise duty (against proof of Excise Invoice) However, for calculation purpose and arriving at **"Total cost to BHEL"** maximum rate of Excise Duty will be considered. In case Excise Duty remain FIRM throughout the contract, the same shall be specifically indicated. Otherwise, maximum Excise duty will be considered for arriving at lowest bidder. However, reimbursement of Excise Duty shall be at actuals against proof of Excise Invoice only. ~~Physical export contract eligible for complete exemption of Excise duty & Sales tax against submission of necessary documents by BHEL like ARE1 form and Form H.~~	**AGREE** **Excise Duty rate at present ……%** **Maximum rate of Excise duty .....%** **Education Cess.....%**	

BHEL-EDN **VENDOR'S SIGNATURE WITH SEAL**

FOR IOCL VADODRA GTG PROJECT:EXCISE DUTY+CESS,CST/VAT,SERVICE TAXES ARE REIMBURSABLE BY CUSTOMER TO BHEL. THE SAME WILL NOT BE CONSIDERED FOR ARRIVING AT " TOTAL COST TO BHEL". VENDOR SHALL NECESSARILY SUBMIT EXCISE INVOICE,ACKNOWLDEGED LR TO BHEL.

LCM0000815 DTD 12/07/2013 DUE ON: 05/08/2013

Electronics Division, Bangalore

BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY

SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
~~08~~	~~IN CASE PROJECT IS DEEMED EXPORT, MEGA AND NON MEGA AND WON AGAINST INTERNATIONAL COMPITITIVE BIDDING (ICB)~~	~~In case vendor is importing any raw materials / components for the enquired item, same are eligible for Zero Customs duty. As per para 8.7 of Hand Book of procedures of EXIM policy, BHEL will part the import licence with the vendors to obtain import licence by themselves and custom clear the raw materials/ components by availing zero customs duty. Hence, please furnish list of raw materials / components to be imported by you with Quantity and CIF value (for which BHEL has to share import licence). The benefit due to the above shall be passed on to BHEL and confirmed in the quotation.~~ ~~If there are no imported raw materials/components, same shall be confirmed in the offer.~~ ~~Excise duty is fully exempted. Necessary documents for availing Excise duty Exemption by suppliers will be furnished by BHEL.~~	~~Agreed~~ ~~Furnished~~ ~~Yes, benefit passed on to BHEL in the quotation.~~ ~~We, confirm that there are no imported components.~~	
~~09.~~	~~IN CASE PROJECT IS DEEMED EXPORT, WON AGAINEST INTERNATIONAL COMPITITIVE BIDDING (ICB) BUT NOT A MEGA PROJECT.~~	~~The project is eligible for claiming Terminal Excise duty benefit from DGFT as per present EXIM policy. PL Confirm that you will submit (original)~~ ~~a) Disclaimer Certificate.~~ ~~b) Copy of Excise Invoice attested by Suptd of Central excise authorities with signature & seal, in Blue ink to enable BHEL to claim terminal Excise duty benefit from DGFT.~~	~~CONFIRMED~~	
10	**SALES TAX**	To confirm whether applicable. If applicable, indicate current rate of sales tax against form "C" For issue of form "C", vendor has to furnish "E1/E2" form **Please confirm that "E1/E2 Sale form" will be submitted** ~~For physical export project, Sales Tax is exempted against submision of necessary documents by BHEL. However, vendor to indicate rate of Sales Tax applicable (against form 'C/37') for the item enquired~~.	**AGREE** **Sales Tax rate at present.....%** **CONFIRMED**	

BHEL-EDN **VENDOR'S SIGNATURE WITH SEAL**

FOR IOCL VADODRA GTG PROJECT:EXCISE DUTY+CESS,CST/VAT,SERVICE TAXES ARE REIMBURSABLE BY CUSTOMER TO BHEL. THE SAME WILL NOT BE CONSIDERED FOR ARRIVING AT " TOTAL COST TO BHEL". VENDOR SHALL NECESSARILY SUBMIT EXCISE INVOICE,ACKNOWLDEGED LR TO BHEL.

LCM0000815 DTD 12/07/2013 DUE ON: 05/08/2013

Electronics Division, Bangalore

BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY

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		Note : Please see the state indicated above Sl. No. 4 (Page 1 of 11) to which materials to be despatched before indicating rate of Sales Tax. **Furnish following :** **CST Regn No.** **LST Regn No.** **TIN No.**	**INDICATED**	
11	**VALUE ADDED TAX**	Since it is inter-state movement of goods, VAT is not applicable. Only CST against form C is applicable. OR Both are in the same State, VAT is applic able please indicate VAT applicable @_____%	**AGREE** **QUOTED**	
12	**OCTROI**	To confirm whether applicable, if applicable indicate current rate of Octroi_____%	**AGREE**	
13	**SERVICE TAX ON E & C & TRAINING CHARGES**	To confirm whether applicable, if applicable indicate current rate of Service Tax _____% ***Furnish following :*** ***Service Tax Regn. No.*** ***Confirmation that Service Tax register is maintained.***	**AGREE** ***FURNISHED*** ***CONFIRMED***	
14	**FREIGHT CHARGES**	**Freight charges shall be to vendor's account. Please indicate Freight charges separately as lumpsum charges in priced offer, Plus service tax if any.** Vendor's offer will be evaluated on "Total cost basis" including freight charges. Vendor shall book the consignment through their approved Road carriers on "Freight pre-paid" door delivery consignee copy attached basis, and freight charges to be claimed from BHEL through a	**Agreed and quoted in lumpsum with Service Tax in price bid** **Service Tax _____ %**	

FREIGHT CHARGES AND APPLICABLE SERVICE TAX SHALL BE CLEARLY INDICATED IN THE PRICED OFFER.

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		separate Invoice against proof of L/R copy and original money receipt and transporter bill to vendor received from the Transporter. The freight charges will be reimbursed to vendor, limited to freight quoted by the vendor in his offer or actual payment made to Transporter, whichever is **lower**. Vendor shall furnish following details alongwith Freight payment Bill : a) Net weight b) Gross weight c) Volume of each package d) No. of packages e) Loose items, if any f) Distance from vendor's works to destination. This is needed for justifying freight amount quoted by you.		
15	**TRANSIT INSURANCE** **(To BHEL A/c)**	By BHEL/BHEL power sector/Customer. Insurance Agency will be indicated in despatch clearance letter/fax /E-mail issued by BHEL. Immediately after despatch of material the vendor should intimate by fax/e-mail/ courier to the insurance agency directly for coveri ng insurance and a copy of such intimation sent to insurance agency Indicated in the despatch instructions directly by vendor should be given to BHEL alongwith despatch documents for payment NOTE : BHEL will not send insurance intimations to insurance company on your behalf. Hence it is your resposibility to intimate to insuranc e agency.	**AGREE**	

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16	**DELIVERY PERIOD** (Pl. see loading Factor)	Within_12_ weeks from the date of issue of document approval or manufacturing clearance by BHEL. whichever in earlier (or) ~~Within_____ weeks from the date of issue of of PO (in case document approval is not applicable)~~	**AGREE**	
17	**WARRANTY** (Pl. see loading Factor)	SHALL BE IN LINE WITH TECH SPECS CE/415/BoP/0930 **REV NO:00 CLAUSE No13 a(PAGE 17 OF 23)**	**AGREE**	
18	**TERMS OF PAYMENT (FOR MATERIAL SUPPLY & TYPE TEST CHARGES)** (Pl. see loading Factor) (75+10+15)%	a)75% basic + 100% Taxes , Duties and freight charges with 45 days credit from the date of receipt of complete set of original despatch documents . Original Performance Bank Guarantee (If applicable) to be sent by issuing bank directly to BHEL. Original consignee copy of L/R (lorry receipt) shall accompany the goods. **Note : In case PBG is not furnished only 65% payment will be released against 75% claim without the consent of Vendor.** **This 10% basic amount withheld amount towards PBG will be paid against submission of supplementary invoice & Original PBG (or) against supplementary invoice without PBG after 42 months from the date of despatch provided BHEL Commercial Dept. confirms that there is no site issue pending for this P.O. items supplied by you.** b) Balance 10% basic amount with 30 days credit from receipt of materials at site against consignee receipt certificate (CRC). i.e. acknowledgement/seal on backside of the LR for having received the consignment by consignee and proof of supply of O&M manuals in requisite sets, against a supplementary Invoice. c) Balance 15% basic amount with 30 days credit on completion of Erection & commissioning work on pro-rata basis against supplementary Invoice with **"Proof of completion of E&C"** (like MOM, Site protocol, Job completion certificate), signed by BHEL site office or Customer and your representative. ***Note : No advance will be paid and no inland L/C will be accepted. Payment thro' bank may not be acceptable to BHEL (as all payments or made thro' EFT only) Hence please avoid payment thro' bank.***	**AGREE**	

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SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
	TERMS OF PAYMENT (FOR E&C)	100% Lumpsum E&C / Installation charges with Service Tax (if applicable) shall be paid with 30 days credit on completion of Erection & commissioning work on pro-rata basis against submission of "Proof of completion of E&C"(like MOM, Site protocol, Job completion certificate), signed by BHEL site office or Customer and venders' representative. Separate Invoice shall be submitted for charges towards E&C payment.	**AGREE**	
	TERMS OF PAYMENT (FOR TRAINING)	100% payable with 30 days credit on completion of Training. Separate invoice shall be submitted for Training charges	**AGREE**	
	TERMS OF PAYMENT (FOR ENGINEERING & DOCUMENTATION CHARGES)	100% with 30 days credit on approval of final documents. Separate invoice to be submitted for Engineering & documentation charges	**AGREE**	
19	**GENERAL**	BHEL has discontinued cheque payments and all payments will be through Electronic fund Transfer (EFT) only. Please provide necessary details (if you have not furnished earlier) in the BHEL's standard format.	AGREE	
20	**SHORTAGES / DAMAGES**	In the event of shortage/damage on receipt of goods and on opening of packages at site,all such shortages/ damages shall be made good within reasonable time of such intimation and cost of such material will be reimbursed only on settlement of Insurance claim limited to insurance settled amount.	**AGREE**	
21	**PENALTY** (Pl. see loading Factor)	In the event of delay in agreed contractual delivery, penalty @ 2 % (two percent) per week but limited to a max of 10% (Ten percent) value of undelivered portion (basic material cost) will be applicable. Date of issue of inspection call by vendor along with test certificates / Test Reports / Certificate of Conformance / Calibration reports, as proof of completion of manufacturing will be treated as date of despatch for penalty calculation. In the absence of furnishing such relevant above cited document as proof of completion of manufacturing alongwith inspection call, actual date of Inspection will be considered as date of despatch, and BHEL will not be responsible for delay in actual date of inspection. Hence please issue inspection call with test certificates/ reports compulsorily to avoid penalty.	**AGREE**	

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BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY

SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
		Penalty will be applicable after _12__ weeks from the date of issue of document approval or manufacturing clearance whichever is earlier (or) ~~Penalty will be applicable after _____ weeks from the date of issue of PO (in case document approval is not applicable)~~ Penalty if applicable shall be deducted at the time of settlement of 75% payment. If penalty is applicable for duration of less than a week, penalty @2 % (two percent) of the basic material value will be charged. In case of vendor availing Duty concession under duty free licence under para No. 8.7 of EXIM policy procedure, any delay in furnishing documents for this purpose by BHEL will be suitably adjusted while calculating penalty.		
22	**PERFOR-MANCE BANK GUARANTEE** (Pl. see loading Factor)	Original PBG for 10% of the basic material cost shall be furnished in the BHEL prescribed format only (Annexure-II), directly by issuing bank to BHEL for processing **75**% payment. PBG shall be valid for 36 months + 6 months claim period from date of despatch (totally 42 months from the date of despatch) PBG shall be from any of the BHEL consortium Bankers as per Annexure-III(b), and banker should send PBG directly to BHEL please see instruction for PBG submission attached - Annexure - III(a) Please indicate the Banker name from whom PBG will Issuing bank name be furnished without fail. PBG proforma enclosed. If PBG is not submitted as per enclosed BHEL standard proforma, i.e., PBG is submitted in Vendor's format (other than BHEL proforma) or quoted Revolving PBG, it will be treated as Vendor has not agreed for PBG clause (non submission of PBG only) and price will be loaded as per the loading factors enclosed(Annexure - I) to arrive at " total cost to BHEL" and BHEL reserves the right to commercially reject the offer when the item enquired demands performance bank guarantee.	**AGREE** **Issueing Bank Name indicated**	

LCM0000815 DTD 12/07/2013

DUE ON: 05/08/2013

Electronics Division, Bangalore

BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY

SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
23	**INSPECTION**	Prior written notice of atleast 7 days shall be given along with 2 sets of internal test certificates/COC and applicable test certificates. Materials will be inspected by BHEL-EDN-QS/CQS or M/s PDIL (BHEL authorised Inspection Agency) or Customer / Consultant or jointly by BHEL & Customer / consultant. All tests have to be conducted as applicable in line with approved Quality plan or QA Checklist or Purchase specification and original reports shall be furnished to BHEL-EDN, Bangalore for verification/acceptance and issue of despatch clearance.	**AGREE**	
24	**MODE OF DESPATCH**	By road on door delivery Consignee Copy attached basis as per BHEL despatch instructions through your approved transporters, only on receipt of despa tch clearance from BHEL.	**AGREE**	
25	**DESPATCH DOCUMENTS**	Complete set of despatch documents in 3 sets shall be forwarded to BHEL directly. Despatch documents include Commercial Invoic e, Excise Invoice (if ED is applicable), Lorry receipt (L /R), Packing list, Warranty certificate, Insurance intimation letter, "NIL" short shipment certificate, disclaimer certificate & attested excise invoice & Original Performance Bank Guarantee (Directly from issuing bank to BHEL). One set of Invoice, Packing list and L/R shall be faxed immediately after despatch to BHEL-EDN, Bangalore.	**AGREE**	
26	**O & M MANUALS**	As built Drawings, O & M Manuals and other approved documents in 2 sets shall be furnished immediately after despatch directly to BHEL Purchase Dept., 1 set of above shall also be sent in soft media (CD ROM). Two sets of hard copies of above shall be directly despatched to site along with the material.	**AGREE**	

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BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY

SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
		Note : Supply of above documents (O&M) in required No. of sets along with Despatch documents and material shall be indicated in packing list. **If not mentioned BHEL may insist for submission in required sets once again.**		
27	**SPLIT ORDERING** ☑	~~BHEL reserve the right to split the Purchase order based on the itemwise lowest offer.~~ **(OR)** Items will not be split on itemwise lowest offer. All items will be ordered as a package on a single Technically acceptable lowest B idder.	**AGREE**	
~~28~~	~~**QUANTITY TOLERANCE**~~	~~Please indicate Quantity toler ance applicable in each of the line item wherever Quantity tolerance applicable for the Quoted items.~~ ~~For Impulse/seamless pipes one random length of + 6 mtrs. applicable for each variety of pipes.~~	~~**CONFIRMED**~~	~~**QUANTITY TOLERANCE .....%PER VARIETY**~~
29	~~**SLAB RATE**~~	~~If the price quoted varies based on the quantity to be ordered, then slab rates may be quoted.~~	~~**SLAB RATES INDICATED IN OFFER**~~	~~**SLAB RATES APPLICABLE/ NOT APPLICABLE**~~
~~30~~	~~**SPECIAL CLASS (EXCIST DUTY DRAW BACK FROM DGFT)**~~	~~Following documents (Original) shall be submitted for availing Excise duty draw back benefit from DGFT along with despatch documents to BHEL-EDN, Bangalore~~ ~~a) Disclaimer certificate as per the proforma, which will be, sent with the PO.~~ ~~b) Copy of Excise Invoice duly attested by Suptd of Central Excise (signature in blue ink & seal)~~ ~~Pl. refer enclosure to RFQ.~~	~~**AGREE**~~	
31	**ERECTION & COMMISSION-ING (E & C) / INSTALLATION / ASSEMBLY AT SITE** REFER TO TECH SPECS CE/415/ BOP/0930/00 CLAUSE 14.0	Indicate lumpsum charges (includes To & Fro Fare, Boarding, Lodging, Local Conveyance, etc.) for Supervision of Erection, Commissioning and handingover to customer. The quotation shall clearly indicate scope of work, likely duration of commissioning, pre-commissioning check list and service taxes if any to consider for arriving at total cost to BHEL. ***Note : If E&C is not quoted (wherever called for in the BHEL purchase specification) BHEL reserve the right to reject your offer.*** ***If lumpsum charges are not quoted, offer may be rejected.***	**AGREE & CONFIRMED QUOTED IN LUMPSUM CHARGES IN PRICE BID**	

BHEL-EDN **VENDOR'S SIGNATURE WITH SEAL**

Kindly indicate lump sum charges for E & C work at site by considering the scope of services indicated in technical specification CE/415/BoP/0930/00 REV NO:00 PG NO:18 OF 23.

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Electronics Division, Bangalore

BHEL STANDARD COMMERCIAL TERMS AND CONDITIONS FOR INDIGENOUS SCOPE OF SUPPLY

SL. NO.	TERMS	BHEL ACCEPTABLE TERM	BIDDER'S CONFIRMATION	DEVIATION IF ANY
32	**REVERSE AUCTION** ✔	Against this enquiry for the subject item/system with detailed scope of supply as per enquir y specifications, BHEL EDN reserves the right to follow **REVERSE** AUCTION **PROCEDURE i.e. ON LINE BIDDING ON NETWORK,** before finalising t he Purchase order on technically competent bidders, as per the guidelines given in Annexure-IV. In case BHEL does not resort to Reverse Auction, the Price bids and price impacts (if any) already submitted and available with BHEL shall only be opened as per BHEL's standard practice without seeking anymore price impacts on account of BHEL not going for Reverse Auction and process further.	**AGREE**	
33	~~**SPECIAL CLAUSE APPLICABLE FOR EXPORT JOB ONLY**~~	~~Article packed with raw/solid wood packing material should be treated as per ISPM - 15 (fumigation) and accomplished by Phytosanitory/Fumigation certificate **DESTINATION SEA PORT/ AIRPORT IN INDIA** .....~~	~~**AGREE**~~	

THE ABOVE FILLED-IN AND SIGNED DOCUMENT SHALL BE FURNISHED AS PART OF UN-PRICED CUM-TECHNICAL BID WITHOUT FAIL (IN ORIGINAL).

NOTE : LOWEST BIDDER WILL BE DECIDED BASED ON THE *"TOTAL COST TO BHEL"* BASIS INCLUDING LOADING FACTORS (FOR DEVIATIONS TO BHEL STANDARD COMMERCIAL TERMS & CONDITIONS).

Electronics Division, Bangalore

ANNEXURE-I

LOADING FACTORS SHEET (8 pages)

BHEL RFQ NO. & DATE: LCM0000815 DTD 12/07/2013 DUE ON: 05/08/2013

DEVIATIONS ARE LIMITED TO FOLLOWING ONLY, FURTHER DEVIATION ON ANY OF THE FOLLOWING MAY LEAD BHEL TO REJ ECT THE OFFER UNILATERALLY ON COMMERCIAL GROUNDS.

NOTE: THIS LOADING FACTOR INDICATED BELOW WILL BE ADDEDON QUOTED PRICE TO EVALUATETHE LOWEST QUOTE (IN CASE OF DEVIATION TO BHEL'S TENDER SPECIFIED TERMS AGAINST EACH TENDER).

SL NO	COMMERCIAL TERMS	BHEL STANDARD TERM	IF YOU QUOTE	LOADING FACTOR FOR NON-COMPLIANCE OF BHEL STANDARD TERM
A.	FOR INDIGENOUS SCOPE OF SUPPLY.			
1	TERMS OF PAYMENT (WHERE SCOPE INCLUDES E&C):	a) 75% basic + 100% taxes, duties & frieght charges with 45 days credit from the date of receipt of complete set of original despatch documents including Original Performance Bank Guarantee for 10% of the basic material value. (If applicable) to BHEL. b) Balance 10% with 30 days of receipt of materials at site and proof of supply of O&M manuals in required sets, against a supplementary Invoice and c) Balance 15% with 30 days credit from the date of completion of Erection & commissioning work on pro-rata basis against supplementary Invoice with "Proof of completion of E&C" (like MOM, Site protocol, Job completion certificate, signed by BHEL site office or Customer and your representative.	90% WITH 45 DAYS CREDIT ALONGWITH ADDITONAL BG FOR 15% OF THE BASIC MATERIAL VALUE VALID TILL COMPLETION OF COMMISSONING APART FROM PBG 10% OF THE BASIC MATERIAL VALUE. BALANCE 10% OF MATL COST WITH CREDIT 3 0 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE	NIL
		-SAME AS ABOVE-	100% WITH 45 DAYS CREDIT ALONGWITH ADDITIONAL BG. FOR 25% OF THE BASIC MATERIAL VALUE VALID TILL COMPLETION OF COMMISSIONING APART FROM PBG 10% OF THE BASIC MATERIAL VALUE	NIL

Electronics Division, Bangalore

SL NO	COMMERCIAL TERMS	BHEL STANDARD TERM	IF YOU QUOTE	LOADING FACTOR FOR NON-COMPLIANCE OF BHEL STANDARD TERM
		-SAME AS ABOVE-	90% - WITH 45 DAYS CREDIT WITHOUT ADDITIONAL BG. BALANCE 10% OF MATL COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE	15% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	100% WITH 45 DAYS CREDIT WITHOUT ADDITIONAL BG	17% OF THE 100% BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	75% WITH LESS THAN 45 DAYS CREDIT. BALACE 10% OF MATL COST WITH CREDIT 30DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE BAL. 15% WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF COMMISSIONING COMPLETION CERTIFICATE	1.5% OF THE 75% BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	90% WITH LESS THAN 45 DAYS CREDIT WITHOUT ADDITIONAL BG. BALANCE 10% OF MATL. COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGEE RECEIPT CERTIFICATE	16.35% OF THE BASIC MATERIAL VALUE (I.E. 15% +1.5% OF THE 90% BASIC MATERIAL VALUE)

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SL NO	COMMERCIAL TERMS	BHEL STANDARD TERM	IF YOU QUOTE	LOADING FACTOR FOR NON-COMPLIANCE OF BHEL STANDARD TERM
		-SAME AS ABOVE-	100% WITH LESS THAN 45 DAYS CREDIT WITHOUT ADDITIONAL. BG.	26.5% OF THE BASIC MATERIAL VALUE (I.E. 25% +1.5% OF THE 100% BASIC MATERIAL VALUE)
		-SAME AS ABOVE-	75% THROUGH BANK. BALANCE 10% OF MATL COST WITH CRE DIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE BAL 15% WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF COMMISSIONING COMPLETION CERTIFICATE	10% OF THE 75% BASIC MATREIAL VALUE
		-SAME AS ABOVE-	90% THROUGH BANK. ALONGWITH BG FOR 15% OF THE BASIC MATERIAL VALUE VALID TILL COMPLETION OF COMMISSIONING APART FROM PBG 10% OF THE BASIC MATERIAL VALUE. BALANCE 10% OF MATL COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE	10% OF THE 90% BASIC MATERIAL VALUE
		-SAME AS ABOVE-	100% THROUGH BANK. ALONGWITH BG FOR 25% OF THE BASIC MATERIAL VALUE VALID TILL COMPLETION OF COMMISSIONING APART FROM PBG 10% OF THE BASIC MATERIAL VALUE.	10% OF THE 100% BASIC MATERIAL VALUE

Electronics Division, Bangalore

SL NO	COMMERCIAL TERMS	BHEL STANDARD TERM	IF YOU QUOTE	LOADING FACTOR FOR NON-COMPLIANCE OF BHEL STANDARD TERM
		-SAME AS ABOVE-	90% THROUGH BANK WITHOUT ADDITIONAL BG BALANCE 10% OF THE MATL COST WITH CREDIT 30 DAYS FROM THE DATE OF RECEIPT OF CONSIGNEE RECEIPT CERTIFICATE	24% OF THE BASIC MATERIAL VALUE (I.E. 15% + 10% OF THE 90% BASIC MATERIAL VALUE)
		-SAME AS ABOVE-	100% THROUGH BANK WITHOUT ADDITIONAL BG	35% OF THE BASIC MATERIAL VALUE (I.E. 25% +10% OF THE 100% BASIC MATERIAL VALUE
2.	**TERMS OF PAYMENT (WHERE SCOPE DOES NOT INCLUDE E&C)**	a) 90% with 45 days credit from the date of receipt of complete set of original dispatch documents including Original Performance Bank Guarantee for 10% of the basic material value (If applicable) toBHEL. b) Balance 10% with 30 days credit from the date of receipt of materials at site and prof of supply of O&M manuals in required sets, against a supplementary Invoice.	100% WITH 45 DAYS CREDIT ALONGWITH ADDITIONAL BG FOR 10% OF THE BASIC MATERIAL VALUE VALID TILL RECEIPT OF MATERIAL AT SITE APRT FROM PBG 10% OF THE BASIC MATERIAL VALUE.	NIL

Electronics Division, Bangalore

SL. NO.	COMMERCIAL TERMS	BHEL STANDARD TERM	IF YOU QUOTE	LOADING FACTOR FOR NON-COMPLIANCE TO BHEL STANDARD TERM
		-SAME AS ABOVE-	100% WITH 45 DAYS CREDIT WITHOUT ADDITIONAL BG.	10% OF THE 100% BASIC MATERIAL VALUE
		-SAME AS ABOVE-	100% WITH LESS THAN 45 DAYS CREDIT WITHOUT ADDITIONAL BG.	11.5% OF THE BASIC MATERIAL VALUE (I.E. 10% + 1.5% OF THE 100% BASIC MATERIAL VALUE)
		-SAME AS ABOVE-	90% THROUGH BANK BALANCE 10% OF MATL COST WITH CREDIT 30 DAYS OF CONSIGNEE RECEIPT CERTIFICATE	10% OF THE 90% BASIC MATERIAL VALUE
		-SAME AS ABOVE-	100% THROUGH BANK ALONGWITH ADDITIONAL BG FOR 10% OF THE BASIC MATERIAL VALUE VALID TILL RECEIPT OF MATERIAL AT SITE APRT FROM PBG 10% OF THE BASIC MATERIAL VALUE	10% OF THE 100% OF THE BASIC MATERIAL VALUE
		-SAME AS ABOVE-	100% THROUGH BANK WITHOUT ADDITIONAL BG.	20% OF THE BASIC MATERIAL VALUE (I.E. 10% + 10% OF THE 100% BASIC MATERIAL VALUE)
	Note : Payment terms like (a) Advance (b) Inland L/C (c) Proforma Invoice (d) Against Exchange of dispatch documents (e) CAD i.e. Cash against documents and (f) High sea sales will not be accepted. It may lead to commercial rejection of your offer.			
B.	FOR IMPORTED SCOPE OF SUPPLY :			
	TERMS OF PAYMENT (WHERE SCOPE DOES NOT INCLUDE E&C)	Against “SIGHT DAAFT” on presentation of dispatch documents to our Bankers. The payment terms are as follows; a) 90% of the FOB value is payable on negotiation of	100% AGAINST SIGHT DARFT	10% OF THE 100% FOB VALUE.

		complete set of original documents including original Performance Bank Guarantee for 10% of the FOB value (if applicable), b)Balance 10% of the FOB value on 60th day from the date of Air Way Bill or Bill of Lading & against specific authorization by BHEL		
		-SAME AS ABOVE-	90% THROUGH LETTER OF CREDIT. BALANCE 10% FOR THE FOB VALUE ON 60TH DAY FROM THE DATE OF AIR WAY BILL OR BILL OF LADING & AGAINST SPECIFIC AUTHORISATION BY BHEL. ALL BANK CHARGES OUTSIDE INDIA TO BENEFICIAY'S A/C.	2.5% OF THE 100% FOB VALUE
	Note : Payment terms like (a)Advance (b) Telegraphic transfer (T/T) (c) Confirmed L/C (d) CAD i.e. Cash against documents and (e) High sea sales will not be considered. It may lead to commercial rejection of your offer.			
C	PENALTY FOR DELAY IN SUBMISSION OF DOCUMENTS FOR BHEL / CUSTOMER'S APPROVAL (COMMON FOR INDIGENOUS / IMPORTED)	In the event of delay in submission of complete Set of documents (including soft copy) in required sets beyond 2 week from receipt of Purchase Order (supplier to confirm date of PO in writing), penalty @ 2% (two percent) per week but limited to a max. of 10% (Ten percent) value of PO will be applicable.	If not agreed.	10% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	If max. 5% is agreed.	5% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	If @ ½% (half percent) per week but limited to a max. of 10% (Ten percent) is agreed.	7.5 % OF THE BASIC MATERIAL VALUE
		-SAME AS ABOVE-	If @ ½% (half percent) per week but limited to a max. of 5% (Five percent) is agreed.	10% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	If @ 1% (one percent) per week but limited to a max. of 10% (Ten percent) is agreed.	5% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	If @ 1% (one percent) per week but limited to a max. of 5% (Five percent) is agreed.	7.5 % OF THE BASIC MATERIAL VALUE.
D	PENALTY FOR DELAY IN DELIVERY (COMMON FOR	In the event of delay in agreed contractual delivery, penalty @ 2% (two percent) per week	IF NOT AGREED	10% OF THE BASIC MATERIAL VALUE.

	INDIGENOUS / IMPORTED)	but limited to a max of 10% (Ten percent) value of undelivered portion will be applicable.		
		-SAME AS ABOVE-	If max. 5% is agreed.	5% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	If @ ½% (half percent) per week but limited to a max. of 10% (Ten percent) is agreed.	7.5 % OF THE BASIC MATERIAL VALUE
		-SAME AS ABOVE-	If @ ½% (half percent) per week but limited to a max. of 5% (Five percent) is agreed.	10% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	If @ 1% (one percent) per week but limited to a max. of 10% (Ten percent) is agreed.	5% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	If @ 1% (one percent) per week but limited to a max. of 5% (Five percent) is agreed.	7.5 % OF THE BASIC MATERIAL VALUE.
E	DELIVERY & PENALTY (COMMON FOR INDIGENOUS/IMPORTED)	Within……weeks from the date of issue of document approval or manufacturing clearance by BHEL. (or) Within……weeks from the date of issue of po (in case document approval is not applicable).	IF NOT AGREED FOR THE STIPULATED DELIVERY IN THE ENQUIRY (RFQ) BUT AGREED FOR PENALTY CLAUSE AS PER BHEL RFQ.	2% PER WEEK UPTO MAX OF 10% OF THE BASIC MATERIAL VALUE FOR THE QUOTED DELIVERY BEYOND THE STIPULATED DELIVERY IN THE ENQUIRY.
		-SAME AS ABOVE-	IF SPECIFIED DELIVERY IN ENQUIRY (RFQ) IS AGREED BUT PENALTY CLAUSE IS NOT AGREED.	10% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	IF SPECIFIED DELIVERY IN ENQUIRY (RFQ) IS AGREED & PENALTY CLAUSE IS AGREED BUT GRACE PERIOD IS SOUGHT.	2% PER WEEK UPTO MAX OF 10% OF THE BASIC MATERIAL VALUE FOR THE QUOTED GRACE PERIOD BEYOND THE STIPULATED DELIVERY IN THE ENQUIRY.
		-SAME AS ABOVE-	IF BOTH DELIVERY & PENALTY NOT AGREED, AS PER BHEL TERMS.	10% OF THE BASIC MATRIAL VALUE PLUS 2% PER WEEK DELIVERY QUOTED BEYOND STIPULATED DELIVERY PERIOD
	Note : Any delivery quoted beyond 5 weeks from the stipulated delivery, offer is liable for rejection.			
F	PERFROMANCE BANK GUARANTEE (COMMON FOR INDIGENOUS / IMPORTED)	PBG for 10% of the basic material cost shall be furnished in the BHEL prescribed format only, along with 75 / 90% Invoice directly to the purchase dept. from the Bank.	IF NOT AGREED	10% OF THE BASIC MATERIAL VALUE.

		-SAME AS ABOVE-	IF 5% IS AGREED	5% OF THE BASIC MATERIAL VALUE.
		-SAME AS ABOVE-	OTHER THAN THE ABOVE	(10% MINUS THE AGREED MAX. %) OF THE BASIC MATERIAL VALUE WILL BE LOADED
		-SAME AS ABOVE-	PBG for 10% of the basic material cost furnished in Supplier's standard format, alongwith 75 / 90% Invoice directly to Purchase dept.	10% OF THE BASIC MATERIAL VALUE
G	WARRANTY	SHALL BE IN LINE WITH TECH SPECS CE/415/BoP/0930REV NO:00 CLAUSE No13 a(PAGE 17 OF 23)	IF NOT AGREED FOR THE STIPULATED WARRANTY PERIOD IN THE ENQUIRY.	0.5% OF THE BASIC MATERIAL VAL PER MONTH FOR THE DIFFERENCE . IN PERIOD .

Electronics Division, Bangalore

PROFORMA OF PERFORMANCE BANK GUARANTEE
(FOR INDIGENOUS PURCHASE ORDERS)

ANNEXURE-II

Note : 1) To be executed in Rs. 200/- Non-Judicial stamp paper.
2) To be submitted by issuing bank to purchase Dept. directly. Please give BHEL address to banker.
3) Do not enclose with Bank document.
4) Modification & Ommissions to this are not permitted.

PERFORMANCE GUARANTEE
(PROFORMA OF BANK GUARANTEE)

THIS DEED OF GUARANTEE made and executed on the _____ day of _____ (year), by the _____ (Bank), registered under the Companies Act 1956/Nationalised Bank constituted under the Banking Companies (acquisition and transfer of undertakings) Act constituted under the State Bank of India Act / Subsidiary Banks, Act, having its registered / head office at _____ represented herein by its Branch Manager / authorised representatives Sri._____ & Sri._____ (Hereinafter called 'guarantor' which term shall mean and include its successors and assigns)

IN FAVOUR OF BHARAT HEAVY ELECTRICALS LIMITED

_____ (Buyer's Name), a company registered under the companies Act, 1956 having its registered office at BHEL House at Siri Fort, New Delhi-110 049 and its Electronics Division at Mysore Road, Bangalore - 26 (hereinafter referred to as the 'Company' Which term shall include its successors and assigns):

Whereas the company has placed an order on _____ (State the name of the company / firm and its address) (hereinafter referred to as the 'Supplier' which term shall mean and include its liquidators, successors and assign) for the supply of system under order / Contract No_____ Dt _____.

AND WHEREAS the supplier has agreed to supply the materials and carryout the works as detailed and in accordance with the terms set out in the said order / contract.

Electronics Division, Bangalore

PROFORMA OF PERFORMANCE BANK GUARANTEE
(FOR INDIGENOUS PURCHASE ORDERS)

AND WHEREAS the company is not required to pay to the supplier a sum of Rupees _____ being the 10% of the value of the goods supplied / Works performed / Services rendered under the said order / contract between the supplier and the company, till the company is satisfied with the mechanical Warranties and the performance standards stipulated in the said order / contract between the company and the supplier has been duly fulfilled, except, against a Bank Guarantee for the said sum of Rs._____ in favour of the company by reputed Bank, in which case the company has agreed to make payment to the supplier of the said sum of Rupees_____ being (.....%) of the value of the goods supplied / Works performed / Services rendered under the agreement between the supplier and the company and the Guarantor has at the request of the supplier, agreed to furnish this Guarantee subject to the terms and conditions stated below :

NOW THIS DEED WITNESSES THAT IN pursuance of the above said agreement, the guarantor hereby agrees and covenents with company is as follows:-

1) **That during the period this contract of Guarantee remains effectual, the guarantor shall be liable in respect of the amount due and owing to the company in respect of the payments to the extent of Rs_____ (in words) _____ against any loss or damage caused to or suffered by the company by reasons of any breach of the terms of the said order / contract / Agreement by the supplier.**

2) **The Guarantor hereby undertakes to pay the amounts and payable under this guarantee without any demur, merely on demand from the company intimating that the amount claimed is due by way of loss or damage caused to or suffered or would be caused or suffered by the supplier of any terms contained in the said order / contract. Any such demand made on the guarantor shall be conclusive as regards the amount due and payable by the Guaran tor irrespective of the fact whether the Contractor / supplier admits or denies.**

3) **The Guarantor further agrees that the agreement herein contained shall remain in force and effect till all the supplies to be made / Works to be performed/Services to be rendered under the said order / contract / agreement are completed to the entire satisfaction of the company or till company certifies that the terms and conditions of the said order / contract /**

Electronics Division, Bangalore

PROFORMA OF PERFORMANCE BANK GUARANTEE
(FOR INDIGENOUS PURCHASE ORDERS)

agreement have been fully and properly carried out by the said supplier and accordingly discharges the Guarantee. Unless a demand or claim under this guarantee is made on the guarantor in writing on or before the expiry of claim period indicated in clause 6 below, the guarantor shall be discharged from all the liability under this guarantee thereafter.

4) The guarantor further agrees with the company that the company shall have the fullest liberty without the consent of the guarantor and without effecting in any manner the obligations of the guarantor hereunder to vary any of the terms of the said order / contract / agreement or extend the time of performance by the said supplier from time to time or refrain from exercising the power exercisable by the company against the said supplier or to forebear or omit to enforce any of the terms and conditions relating to the said order / contract / agreement, and the guarantor shall not be relieved of its liability in whole or in part, by reason of any act, commission or forbearance on the part of the company or by reason of any such variation, or extension being granted to the said supplier or by reason of any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving the guarantor.

5) The guarantor undertakes not to revoke this guarantee during its currency except with the previous consent of the company in writing.

6) Notwithstanding anything herein above obtained, the liability of the guarantor under these presents is restricted to Rs._____. The guarantee shall be in force till its expiry on _____ unless a demand is made on the guarantor within SIX months from the date of expiry, all the liability of the guarantor under this guarantee shall stand fully discharged. The decision of the claimant in regard to breach of contract is final and binding on the Bank.

IN WITNESS whereof, the guarantor, acting through it authorised representative has executed this deed of Guarantee on the day, month and year first above written.

(Seal of the Bank to be affixed)

WITNESS

1.

2.

ANNEXURE - lll(a)

INSTRUCTIONS FOR PBG SUBMISSION

SUB : POINTS TO BE COMPILED FOR THE SUBMISSION OF BANK GUARANTEES / PERFOMANCE BANK GURANTEES

Pursuant to the guidelines issued by BHEL corporate office and CVC the following points are to be taken care of during submission of BGs/PBGs. These conditions will incorporated in the purchase orders :

* **BGs/PBGs of PSU banks in addition to BHEL consortium banks are only acceptable. List of BHEL Consortium Banks Enclosed.**

* **In case of BGs/PBGs issued by non consortium PSU banks the same are to be enforceable in Bangalore.**

* **In case of BGs/PBGs issued by Foreign banks the same to be confirmed by BHEL consortium bank in India.**

* **It is insisted upon that BGs/PBGs issued by issuing bank on behalf of your company should be sent to BHEL EDN directly by the issuing bank under Registered Post (AD) with a covering letter of bank indicating contact no., fax no., E-mail ID, issuing officer name, address of the issuing bank etc.**

* **Please ask the banker to post original PBG directly to : (Exective refered in PO)**

  DGM/Purchase, Purchase Dept., NEB llnd (second) Floor, BHEL, Electronics Division, Mysore Road, Bangalore - 560 026, Ph : 080 26989191

* **We will not accept any BGs/PBGs from your office directly. In case you collect BGs/ PBGs from issuing bank and send to us, the same will be returned back to your office.**

* **Expired BGs/PBGs will be returned after the expiry of the guarantee period including claim period or upon fulfillment of the relevant contract whichever is earlier.**

* **Please give Purchase dealing Executive name, postal address, P.O. No., tel ph no. to bank and insist bank to write these details on the envelope.**

Electronics Division, Bangalore

Annexure-III (b)

BHEL MEMBER BANKS (LIST OF CONSORTIUM BANKS)

PBG SHALL BE ISSUED FROM THE FOLLOWING 22 BANKS ONLY:

1	State Bank of India
2	Deutsche Bank AG
3	Canara Bank
4	HDFC Bank Ltd.,
5	Punjab National Bank
6	CITI Bank NA,
7	Bank of Baroda
8	Standard Chartered Bank,
9	State Bank of Hyderabad
10	ICICI Bank Ltd.
11	The Hongkong and Shanghai Banking Corporation Ltd.
12	IDBI Bank Ltd.
13	State Bank of Tranvancore
14	Corporation Bank
15	Kotak Mahindra Bank Ltd.
16	ABN AMRO Bank N.V.
17	Syndicate Bank
18	Indian Bank
19	Oriental Bank Of Commerce
20	UCO Bank
21	Central Bank of India
22	The Federal Bank Ltd.

Please Note : It is preferable if PBG is obtained from BHEL consortium Banks listed above. BHEL may accept PBG from other Nationalised Banks also which are not listed above. PBG will not be accepted from scheduled Banks and Co-operarive Banks.

Electronics Division, Bangalore

ANNEXURE - IV

GUIDELINES FOR REVERSE AUCTION PROCEDURE

Against this enquiry for the subject item/system with detailed scope of supply as per enquiry specifications, BHEL-EDN proposes to resort to"REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING ON NETWORK, before finalizing the purchase order on technically competent bidders as per the guidelines given below:

1. Reverse Auction procedure shall be applicable for 2 Part bid tenders only.
2. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate, BHEL will engage the services of a service provider, having network all over the world. The online bidding can be done from the vendor's respective offices on their computers with Internet facility or at any of the cyber cafe, for which service provider's representative will provide all necessary training and assistance before commencement of on line bidding. Training is free of cost .
3. Vendors have to fax the Compliance form in the prescribed format (provided by Service provider) before start of Reverse auction. Without this, Reverse auction will not be started. Delay in faxing the above will lead to disqualification.
4. BHEL will send the Auto formulated EXCEL sheet which will help to arrive at "Total Cost to BHEL" like Basic Material cost, Packing & forwarding charges, Excise duty, Sales Tax/VAT, Freight charges, Insurance (by BHEL), Service Tax for Services,(-) ED disclaimer if any, and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the vendor to enable them to fill-in the price and keep it ready for keying in during the Auction.
5. Reverse auction will be conducted on a mutually agreed schedule and time.
6. After Reverse auction is conducted , successful bidder has to Fax the Filled-in Excel sheet showing the final value accepted in Reverse Auction with breakup of each element as indicated in Sl No. 4 above to the service provider within 48 hours of Auction without fail.

   Note: No changes are allowed in Rate of Excise Duty, Sales Tax, Freight, Insurance, Service Tax and Loading factors after auction is completed.
7. After the reverse auction is conducted, the bidder whose price is lowest (total cost to BHEL, after considering all factors as per enquiry including Loading factors for deviations to BHEL standard Commercial Terms & conditions), BHEL will process the tender as per BHEL purchase norms. Purchase order will be issued without loading factors for deviations.

   Note: BHEL will also reserve the right to open the sealed price offer submitted by the vendors for comparison purpose, if deemed necessary, without any intimation to the technically and commercially accepted bidders.
8. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts (if any) already submitted and available with BHEL shall only be opened as per BHEL's standard practice without seeking anymore price Impacts on account of BHEL not going for Reverse Auction. Hence please quote your best lowest price in first instant itself.
9. Training by service provider will be given only once for the subsequent reverse auction. Training will not be given for a company which has already taken training for the FIRST REVERSE AUCTION conducted by BHEL-EDN, Bangalore.

Electronics Division, Bangalore

GUIDELINES FOR REVERSE AUCTION PROCEDURE

10. **Activities involved in Reverse Auction :**

a) BHEL will inform the vendor in writing, the Service provider's information to enable them to contact & get trained. Alongwith the above information Business rules/policy also will be sent.

b) Vendors have to contact Service provider and send Compliance form for having understood Reverse Auction procedure and ready for Auction.

c) BHEL will send the Auto formulated Excel sheet (blank format without prices) as mentioned in Sl No.4 above to the respective vendors.

d) Vendors have to fill-in the Excel sheet (provided by BHEL) including Loading factors and get ready for Reverse Auction.

e) Date & Time of Reverse Auction and Website address will be intimated by Service Provider.

f) Bid decrement will be indicated in the Website after the Sealed bid is over and before start of Reverse Auction.

g) Vendors will have to key-in the "Total cost to BHEL" (as worked out in the Excel sheet mentioned in Sl No.4 above) in the "Sealed Bid" of the Reverse Auction within specified time duration of 20 to 30 minutes. After "Sealed Bid " auction, the lowest bidder's value or BHEL's start bid price will be the starting bid value for the commencement of Reverse Auction (English Reverse).

h) At the end of Reverse Auction time (English Reverse), the lowest bidder value will be known on the network.

i) Successful bidder has to fax the filled-in EXCEL sheet showing the final value accepted in the Reverse Auction with breakup of each component within 48 hours of completion of the Reverse Auction without altering any of the terms to the service Provider. Any alterations will be taken as sabotaging the tender process and will invite disqualification of vendor to conduct business with BHEL for the period of 2 years.

j) The loading factors for non-conformance to BHEL standard commercial terms are only for arriving at lowest Bidder. In the event of Purchase order, same will be issued without loading factor values indicated in EXCEL Sheet. We repeat PO, will be issued for scope of supply+ Packing & Forwarding charges if any, Excise duty, Sales Tax, Service Tax for services and Freight & Insurance. Insurance will be to BHEL Account.

-x--x-x--x-x--x-

TECHNICAL SPECIFICATION FOR

PROGRAMMABLE LOGIC CONTROLLER (PLC)

(TYPE: QMR/TMR)

CAPTIVE POWER PLANT

PROJECT : 1X FR6B GTG, 1X 125 TPH HRSG

CUSTOMER : I.O.C.L. VADODARA

REV : 00	APPROVED BY D.P.MAJAKAR			
	PREPARED BY K.SHRIRAM	CHECKED BY V.K.YADAV	ISSUED BY CE-ENGG.-BOP	DATE 10/04/2013

REVISION HISTORY SHEET

REV No.	DATE	NATURE of CHANGE	REASON	PREPARED BY	CHECKED BY	APPROVED BY
00	10/04/13	FIRST ISSUE	---	KS	VKY	DPM

Technical Conditions.

1. In case of any query on the Technical matter w.r.t. BHEL Specification, Bidder shall contact BHEL, within 1 week of receipt of Enquiry for seeking clarifications. This shall not be used for seeking bid submission due date extension. No query will be entertained after Bid submission is completed.

2. Offers with incomplete information will not be considered for evaluation and are likely to be rejected outright without any further interaction with the Bidder.

3. After Bid submission, in case Bidder proposes Unsolicited Tender Modifications such as typographical mistakes etc., such modifications will not be considered for evaluation.

4. Superior Technical features proposed if any by the Bidder, over & above BHEL enquiry specification requirements cannot be given any special preference w.r.t. price, delivery and comparison with other Bidders.

5. No Deviations are permissible. Any deviations are proposed by the bidder, shall be considered withdrawn, without claiming any commercial implications.

6. In case of contradiction between any specification (refer sheet 5 of 23 point No. 3.1), vendor shall bring to BHEL's notice and BHEL's decision in this regard shall be final and binding.

7. Vendor shall give clause wise compliance to all the clauses of this main specification along with sub-specifications for individual items. Otherwise it is presumed that supplier is fully complying with the specifications. Deviations/clarifications are not allowed after placement of P.O. (Purchase Order).

8. If any defect in the material during manufacturing process, transportation activities etc, Vendor is sole responsible for the replacement with in a period of 3 weeks from the supply/identified as defective.

9. Vendor to offer Hardwired console for each PLC including requisite number of interconnecting pre-Fab cables (Distance between Hardwired Console and PLCs is 80 meters approximately).

10. Vendor to consider multiple site-visits for Erection supervision and commissioning for each PLC based on site readiness/customer requirements for the offered package on lump sum basis.

11. Vendors to submit their offer-compliance to reliability Engineering points of IOCL document as per attached (Annexure-3).

NOTE:-All vendors quoting for this tender, shall be in the approved PLC vendor list of IOCL. If not, they shall initiate action for getting the approved vendor status parallelly and complete this activity within 30 Days of submission of technical/commercial bid. All the necessary technical, commercial, quality related documents, special tests etc. shall be directly routed to IOCL/BHEL as applicable for the above activity. All the commercial expenditure for the above said activities is in the scope of vendor. If the vendor does not meet the above mentioned requirements, the vendor's offer is liable for rejection.

1. SCOPE

This specification covers the scope of Design, Engineering, Configuration, Supply & Manufacture, Programming, Inspection, testing, Factory Acceptance Testing (FAT) at vendor works, documentation, shipping, installation supervision & commissioning, Site Acceptance Testing (SAT) & Integrated SAT of TMR/QMR type TUV AK6 certified and SIL-3 certified IEC 61511 P LC System at IOCL, VADODARA site, GUJARAT, INDIA.

Vendor shall be responsible for implementation of complete PLC System for CPP of VADODARA Refinery Project on turnkey basis with scope of work as listed below, but not limited to the followings:

- Design and Engineering.
- Procurement, Supply, Factory testing and Acceptance.
- Erection Supervision, field calibration / testing, and commissioning.
- Training
- SAT & ISAT.

Schedule for the preparation and submission of drawings and documents for PLC engineering shall be as agreed mutually between vendor and BHEL/IOCL after the award of contract within a time frame of 4 weeks.

The Purchaser/IOCL shall participate in the following activities of PLC engineering, however reserve the right to participate or visit the vendor premises at their discretion:

- Kick-off Meeting
- System Definition Meeting
- Software Definition Meeting at PLC Works / IOCL
- Review of PLC / Sub-Vendor drawings / documents.
- Factory Acceptance Test at PLC works.
- Co-ordination and assistance with DCS / PLC / Sub-Vendor
- Loop checking & commissioning.

The descriptions and requirements contained in this specification are concise by necessity and cannot include all details. However, it is the responsibility of the vendor to execute the job on a turnkey basis in accordance with the specifications and internationally recognized good engineering practices for smooth and successful operation of the CPP of VADODARA Refinery Project.

Any activity specifically not listed in this document, does not absolve the vendor of their responsibility to include such activities in their scope of work & supply, which otherwise is necessary, to complete successful functioning of PLC system as p er scope for the CPP of VADODARA Refinery Project. All such type of activities shall be carried out by the Vendor without any time/ cost implication.

The PLC system shall also to meet the total functional requirement, specifications and plant operational requirement as per Process scheme, process description and any other requirement as defined in this bid package.

If at any point of time of execution of the job, the PLC or any other system supplied is found inadequate to meet the above requirements, In that case any addition/ modification required in software/ hardware shall be carried out by the Vendor without any time/ cost implication.

2. PROVEN TRACK RECORD (PTR)

2.1 The system (with all its sub-systems) as being offered/supplied should have been installed and operating satisfactorily in hydrocarbon processing plant for at least 1 Year (as corroborated by user certificate).

2.2 The system should be supplied, energized, integrated, tested etc. from an established vendor's factory in India and meeting the criteria mentioned above in point no. 2.1.

2.3 PLC system shall be designed with minimum availability requirement of 99.99% or better with a MTTR figure of 8 hours. Minimum level of redundancy has been specified in the package. Additional redundancy if required must be provided by Vendor to meet these specified availability requirements.

3. TECHNICAL DETAILS

3.1 The detailed technical specification shall be read along with following specifications, data sheets and configuration diagrams as mentioned below:

a) **Job Specification (CE/415/BoP/0930/00 REV 00)**
b) **Annexure 1- TECHNICAL SPECIFICATION FOR PLC SPECIFICATION (QMR/TMR) (CE/415/BoP/0930/01 REV 00)**
c) **Annexure 2- PLC VENDOR LIST(BOUGHT OUT ITEMS)(CE/415/BoP/0930/02 REV 00)**
d) **Annexure 3- IOCL-RELIABILITY STUDY RECOMMENDATIONS) (CE/415/BoP/0930/03 REV 00)**
e) **Annexure 4- SCOPE OF SUPPLY(CE/415/BoP/0930/04 REV 00)**
f) **Annexure 5- INPUT/OUTPUT COUNT (CE/415/BoP/0930/05 REV 00)**
g) **Annexure 6- System configuration diagram (CE/415/BoP/0930/06 REV 00)**

SYSTEM CONFIGURATION DIAGRAM SHALL BE PROVIDED BY VENDOR, FOR THE SYSTEM PROPOSED CONSIDERING THE CONFIGURATION DIAGRAM ENCLOSED IN THE SPECIFICATION.

3.2 Anything contradictory to above specifications within any of technical details, observed shall be brought to BHEL's notice in advance for clarification.

3.3 Galvanic isolation to be provided, for all inputs and outputs of PLC.

3.4 Desktop PC's make and model shall be furnished to PLC vendor after P.O. (Purchase Order) for matching make and model of main DCS system as per IOCL requirement.

3.5 The desktop system should be provided with necessary software (installed Anti-Virus software) loaded.

3.6 ONE set of license of all software used in PLC programming/graphic building to be given to customer along with system.

3.7 BHEL will provide field cabling up to termination cabinet of PLC.

3.8 Cable glands, covered cable trays and accessories for vendor supplied cables and Gland Plate in PLC Panel are in PLC vendor's scope of supply.

3.9 PLC internal distribution, wiring, erection supervision & commissioning, inter-panel wiring are in PLC vendor's scope of supply.

3.10 Cable between PLC Hardwired consoles to PLC panel is in PLC vendor's scope of supply. Also cable (UTP-CAT 6) between PLC and DCS shall be in vendor's scope. BHEL shall provide the expected length, number of runs, and technical specification of connectivity to Metso DNA DCS system, for supply of correct interconnecting cables during detailed engineering. The scope of hardwired console is in scope of PLC vendor. The list of console items shall be furnished by IOCL/BHEL during detailed engineering.

3.11 PLC shall have Sequence of Events (SOE) functionality. SOE signals shall be transferred to AIMS (alarm Information Management system) of DCS through the required redundant ports (Ethernet).

3.12 Redundant Master clock signal accepting ports shall be provided in the offered PLCs. Type of signal shall be informed by the Vendor.

3.13 All the power supply in the system shall be dual redundant.

3.14 Additional redundancy if required, must be provided by vendor to meet these specified availability requirements.

3.15 Vendor shall ensure safe and secure grounding system for PLC system. All the necessary cables and accessories shall be considered and supplied by vendor along with the system.

3.16 System Loading: Loading for the controller shall not exceed 60% with installed & future spare inputs & outputs. The system memory shall have sufficient capacity for 30% additional application programming & configuration in future.

3.17 The system shall run exhaustive diagnostic routine to generate system Alarms in case of processor failure, I/O module failure in open or closed state, power supply failure, communication failure,etc. The diagnostics shall be performed in every scan of the PLC and shall be annunciated on AIMS.

3.18 Site support till SAT (site Acceptance test) and integrated SAT shall be provided without any obligation on number of visits. This shall be as and when required and desired by BHEL/IOCL at site during installation-supervision & commissioning.

4. SEQUENCE OF EVENT

4.1 The configuration of inputs and functions of SOE equipment shall be carried out using dedicated terminal, which is also provided with a printer.

4.2 Once configured, the access to configuration shall be denied except with minimum 3 level of password protection.

4.3 The resolution of sequence of event recording shall be minimum of 100 milliseconds.

4.4 The system must have facility of keeping at least 96 hours of record of the time of occurrence of event with last in and first out facility.

4.5 It shall be possible to configure/modify/reconfigure the system online through a dedicated programming unit.

4.6 Engineering shall be carried through **application/system software** using menu driven commands.

4.7 Any addition and deletion of inputs should be menu driven only and should be possible to be done during running condition with top-level password protection.

4.8 It shall be possible to archive data from the SOE Station on DVD drive. DVD writer along with all necessary software shall be part of system supplied by the vendor. The DVD driver and writer must

be with latest hardware and latest software.

4.9 The system shall have extensive set of diagnostic package, which shall be able to provide the fault alarms up to the module level. The same shall be also printable on a printer.

4.10 The system shall able to generate an audit report, which can be printed on demand.

4.11 The audit report shall be able to provide shutdown area, time of shutdown and reason for shutdown.

4.12 Sequence of events shall also record PLC shutdown outputs.

5. CABLES

5.1 All the cabinets and panels shall be completely wired. Interconnection shall be done with pre-fabricated cables. All types of system cables indoor / outdoor for the supplied PLC system shall be supplied by vendor. However, cables between fields to PLC are in BHEL scope. (Signal, Control and Power cables)

5.2 Prefabricated cables with mating connectors shall be used for interconnecting cabinets supplied by the PLC system Vendor. The prefabricated cables shall be as per the standard design of the PLC system principle manufacturer (Certified by principle manufacturer and no third party Termination panels allowed).

5.3 All cables shall have PVC insulated primary insulation of 85°C PVC as per IS-5831 Type C and inner and outer jacket shall be 90°C PVC to IS-5831 Type ST-2.Oxygen index of PVC shall be over 30% and temperature index shall be over 250°C.

5.4 All cables shall be twisted and armoured. Armour over inner jacket shall be of galvanized steel wire/flat as per IS-1554 part-I. Cables shall be fire retardant (FRLS) they shall be as per standard IEC 332 Part III Cat. A.

5.5 The insulation grads shall be 1100V as a minimum and shall meet insulation resistance voltage and spark test requirements as per BS-5308 Part-II. For signal and control cables inner jacket colour shall be black.

SIGNAL/ALARM CABLES

5.6 Single pair shielded signal cables shall be used between field instruments and junction boxes/local control panels.

5.7 Multipair individually and overall shielded signal/alarm cables shall be used between junction boxes/local control panels and main control room, in general.

5.8 Shield shall be aluminium backed mylar polyester tape bonded with the metallic side down helically applied with either side having 25% overlap and 100% coverage. The minimum shield thickness shall be 0.05 mm in case of single pair/triad and 0.075 mm incase of multipair/triad cable.

5.9 Drain wire shall be provided for individual pair and overall shield, which shall be 0.5mm2 multi, stranded bare tinned annealed copper conductor. The drain wire shall be in continuous contact with aluminium side of the shield.

5.10 All multi pair cables shall have 6 pair/12 pairs only while multitriad cable shall have 6 triads/8 triads only.

5.11 All cable conductors shall be of minimum 1.5sqmm size.

5.12 All internal cables shall be cross ferrulled.

POWER CABLES

5.1 All power supply cables shall be as per IS-1554 part I and shall have copper conductors.

5.2 Minimum conductor size shall be 2.5mm2 of copper conductor. The cables shall be PVC insulate and armoured.

5.3 Higher size conductors shall be used in case of long distance Power cable, where voltage drops more than 3 volts than the specified Supply voltage.

5.4 Any other special cable required for instruments shall also be supplied as per requirements.

5.5 Vendor shall ensure that these cables are armoured type and shall meet all other requirements.

CABLE GLANDS and METALLIC CONDUITS.

5.6 Vendor shall supply all cable glands required for glanding the above-mentioned cables at both ends of the panels.

5.7 All cable glands shall be of type 304 SS; double compression type with check nuts suitable for armoured cable and shall have PVC shrouds. Flame proof glands wherever required shall be supplied with Ex (d) certification. Vendor shall supply a minimum of 20% of cable glands as spare. Purchaser shall provide the details of the cable type and sizes to enable the vendor for supply of proper cable glands during KOM.

All cable entries to the panel shall be from panel bottom only, using double compression cable glands with check nut of adequate size. Cable gland plate thickness shall be a minimum of 3.15 mm. All unused cable entries must be plugged. Cable gland plates can be provided in three pieces, in equal size. Cable gland plate's material shall be of CRCA material.

6.0 COMMUNICATION/ FOREIGN DEVICE INTERFACE

6.1 The PLC shall communicate with DCS, using Industry standard MODBUS on T CP/IP or serial protocol.

6.2 DCS will be master and PLC will be in slave configuration. (Redundant communication from PLC to DCS, Hardwired connectivity to PLC from DCS / HWC / others.).

6.3 Vendor shall give redundant MODBUS communication port for the same. In addition, shall include all hardware and software required at PLC end for the establishment of communication. The necessary components like switches, firewalls etc shall be mounted on dedicated PLC network panel. Make of components shall be provided to vendor during detailed engineering.

6.4 Vendor shall give reference of any such MODBUS communication established between PLC system and **metsoDNA DCS system and various other systems**.

6.5 Vendor shall be jointly responsible for MODBUS communication between PLC and **metsoDNA DCS system and various other systems**.

6.6 Vendor shall give all engineering assistance to DCS System vendor for establishment of communication between the two systems.

6.7 All serial links and interfaces shall be dual redundant, configured in the hot standby mode. **(Both modules working in parallel with dynamic data equalization, one primary and the other secondary, which shall take over automatically on failure of primary Module).**

6.8 The number of such dedicated links/interface shall be decided based on the capability and capacity of interface unit (gateways).

7.0 TIME SYNCHRONIZATION

7.1 PLC clock shall be time synchronized to master satellite clock. Master satellite clock system is procured as part of DCS scope of supply.

7.2 PLC vendor shall consider necessary hardware and software for the above. Vendor shall also specify the type of clock signals required for synchronization.

7.3 PLC vendor shall consider redundant inputs for master clock signal acquisition.

8.0 POWER SUPPLY

8.0 **Power supplies and their Distribution: BHEL will provide 1 no. Redundant feeders of 110VA/C (UPS), 50Hz at one location only. Provision for AUTO TRANSFER SWITCH (ATS) shall be made available in PDBs, Provided by VENDOR. NUMBER/SIZING and MAKE of ATS shall be provided to VENDOR during Detailed Engineering.**

8.1 Further internal distribution of power for panel, I/O cards etc. is in PLC vendor's scope of supply. Separate UPS feeder will be provided in control room (100 meter away from Rack room) for hardwired console.

8.2 Internal wiring, components (push buttons, mechanical switches, etc.), wiring between PLC panel to hardwired console is in vendor's scope of supply.

8.3 One non-redundant 240V A/C (Non UPS) supply will be provided at one location for panel lighting.

8.4 All power supplies in the system shall be dual redundant. Any other power supplies, if required by vendor, shall be generated by vendor, providing dual redundant power supply modules, within respective cabinets.

8.5 This distribution shall be designed in such a way that a single power fault in any instrument branch system shall not cause a trip of the entire system.

8.6 Each consumer shall be provided with a separate switch and fuse for isolation and protection of the system.

8.7 Vendor shall provide suitable power distribution board along with necessary cables for feeding power to various equipments supplied by vendor. Loads in this package shall be in vendor's scope.

8.8 Vendor shall provide voltmeter and Ammeter (Digital) in each main feeder entry point inside the power supply distribution from PLC PDB to cabinets, consoles etc. & it shall be redundant.

8.9 Vendor shall size and supply the redundant cables for which, Necessary provision shall be made in each PLC and other equipment's, cabinets, consoles, ACDBs etc. for receiving two nos. power cables with fuse, and individual cable isolation without interruption.

8.10 Supply & installation of all cables and cable's accessories for all incoming/outgoing cables from the vendor supplied control room cabinets/racks/panels shall be in vendor's scope.

8.11 Controller switch over time shall be less than 5 msec. Operation of PLC shall be completely unaffected by a momentary loss of power up to 50 milliseconds.

8.12 Vendor shall provide 30% spare feeders or at least one feeder of each rating, being used.

8.13 Redundant Power supplies distribution cabinets, for PLC systems & Items shall be supplied by PLC vendor.

Power Supply Requirement:

a)SOE Station Computer	: 110 V AC 50Hz UPS
b)EWS/OWS	: 110 V AC 50Hz UPS
c)PLC	: 110 V AC 50Hz UPS
d)Solenoid Valves	: 24 V DC/ 110 VDC
e)Input interrogation Voltage	: 24 V DC
f)Panel/ Cabinet lighting	: 240 V AC,50 Hz
g)Printer	: 110 V AC 50Hz UPS

In order to obtain proper fuse coordination following point must be taken into consideration.

a) All the feeders for DCS shall feed to separate sets of bus bars (line and neutral).
b) All the sets of feeders shall be fully independent and shall not be joined together at any point.

Voltmeter and ammeter in each main power feeder entry point, inside the power supply distribution - board, shall be provided by the Vendor (Analog type).

9.0 EARTHING

9.1 Earthing for vendor supplied system shall be in vendor's scope including supply of copper cables, copper earth bus bar, Earth pit for system earth, IS earth & general earthing for PLC System panels etc., as required as per PLC system vendor's recommendation and Code of practice for control room and any other areas for systems & equipment supplied for CPP Package by Vendor.

9.2 Each panel, cabinet, console and other equipment supplied by vendor shall be provided with an earthing lug.

9.3 All these lugs shall be properly secured to the AC-mains earthing bus. All circuit grounds of electronic instruments, shields and drain wires of signal cables shall be connected to instrument ground bus, which is electrically isolated from the AC-mains earthing bus.

9.4 This bus shall be typically 25 mm and 6 mm thick of copper.

9.5 The instrument ground bus is connected to independent instrument system ground buses through insulated wires.

9.6 Earthing Pits shall be redundant, individual & separate to each Unit PLC, failure of system should not lead to common failure.

9.7 All earthing cables (Copper) and strips (GI / Cu) between earth pit to the various control systems, supplied by Vendor in control room and in any other areas are in Vendor's scope.

10.0 LINE MONITORING

Line monitored cards with auto testing feature shall also be provided for all I/Os.

Note: For signals coming from DCS/Mark-6E resistance mounting if any, shall be done on the PLC marshaling cabinet.

11.0 SPARE PHILOSOPHY

11.1 Start-up and Commissioning spares are those, which would be required during plant or equipment testing, start-up and commissioning.

11.2 All spares-used until the plant is finally handed over by the vendor to the purchaser, come under this Category.

11.3 Vendor shall provide all start-up and commissioning spares as required without any additional cost to the purchaser/BHEL.

11.4 **Consumable spares**- Consumable spares shall be provided. It Includes printer papers, cartridges, floppies, CD/DVD etc.

11.5 **Spare Philosophy**

a) PLC Spare Philosophy:

System Spares Bus Capacity	**40%**
Installed Spares I/O Level(MODULE Wise)	**20%**
Marshalling	**20%**
Spare Space I/O Level	**10%**
I/O interface hardware	**20%**

All terminals of relays/ barriers/other devices shall be wired upto field marshaling terminals.
Further IS and Non-IS input/output modules should not be mixed. Field/Hardwired Console/DCS signals shall be in dedicated cards and not mixed. TBs for terminating spare cores of field/any other signal cable shall be provided in all marshaling cabinets.

Provision to be made in hardware and software estimation for configuration of additional 5% of All Inputs/Outputs as contingency, over and above the Inputs/Outputs covered in the PLC Input/Output count estimation elsewhere in the specification.

Note: - Mandatory spares as listed in Point 11.10 (given below) shall be separately offered with unit price.

11.10 PLC Mandatory Spares (whichever is maximum)

Each type of Module used in PLC i.e. I/O Cards, all type of processor cards, all type of power supply cards, communication cards, Interface cards, controller cards etc. as required for the System, 5% of total installed quantity or Two of each type (whichever is maximum) shall be provided as mandatory spares.

1. IS isolating Barriers - 10% of total installed quantity or 2 nos minimum of each type.
2. Isolators/ Signal Multipliers - 10% of total installed quantity or 2 nos minimum of each type.
3. IS mV/I Converters, IS RTD/I Converters, Alarm cards (receiver switches) - 10% of total installed quantity or 2 nos minimum of each type.
4. Prefabricated cables - 2 Sets with connecting plugs for each type of peripherals and I/O hardware.
5. Relays - 20% of total installed quantity of each type.
6. Fuses - 20% of total installed quantity of each type.
7. Push Buttons, Lamps, Selector switches, Switches - 20% of total installed quantity of each type.
8. MCBs - 20% of total installed quantity of each type.
9. System Cabinet Air Filter - 100% of total installed quantity.
10. Consumables:
    a) Printer Paper (A3 size) - 12 boxes (1000 sheets/box).
    b) Printer Paper (A4 size) - 08 boxes (1000 sheets/box).
    c) Ink Cartridge for colour laser printer - 03 sets.
    d) Ink Cartridge for B/W Laser printer - 03 sets.
    e) Printer Head - 04 nos.
    f) Printer ribbons -15 nos.
    g) DVD-R/W Discs - 05 boxes (10 per box).
    h) All papers shall be of minimum 60 GSM.

Percentage spares shall be provided for relays, push buttons, hand switches, selector switches, status lamps, Annunciator windows, emergency shutdown switches, timers, auxiliary instruments based on actual count requirements.

All spares, I/O auxiliaries shall be mounted with full wiring up to terminal block of marshalling rack/cabinets.

11.11 MANDATORY SPARES :

Mandatory spares shall be dealt separately. Purchase Specifications (PS)/ Purchase Requisitions (PR) approved/ reviewed shall not be considered as acceptance of mandatory spares, if it is part of PS/ PR. All the mandatory spares shall be addressed for each item separately after all procurement (i.e on finalized BOM after dispatch) is over. The mandatory spares quantity shall be arrived at based on the final quantity after engineering is completed.

Vendor shall prepare separate transmittals for mandatory spares, which shall identify list and tag number (wherever applicable). Vendor shall prepare format for such submission for BHEL / IOCL's approval for each item. The mandatory spares already reached to site shall have receipt note from BHEL / IOCL or its representative and same shall be attached with the transmittal.

11.12 COMMISSIONING SPARES :

Commissioning spares shall be supplied as required for commissioning of the plant. The same shall be included in vendor's Bid. Vendor shall procure these spares as per recommendation of Vendors / Suppliers and these shall be available at the time of commissioning.

12.0 INSPECTION & TESTING:

All PLC oriented items shall undergo factory testing and inspection by Customers' authorized representatives (BHEL/IOCL), unless specified otherwise. Wherever inspection at manufacturer's shop is waived because of any reason, the sub vendor's own testing reports shall be verified before dispatch. In no c ase, items shall be released without proper inspection/ verification. The material shall be dispatched only after obtaining written dispatch clearance.

The inspection and testing shall be carried out as per related specifications, international codes and practices/ standards approved documents and / or any other document attached along with. specifically suggesting testing to be carried out at manufacturer's works.

No system or system oriented item shall be dispatched without factory testing witnessed by representatives of Customer / purchaser/ Owner. The testing procedures shall be detailed out by Vendor based on testing requirements indicated in individual system specifications, and shall be reviewed by BHEL / owner. Vendor must certify that the system is actually ready before calling the BHEL / Owner for FAT. Also all the necessary approved documents and literatures are to be submitted 2 months before calling for FAT.

Vendor shall submit all test records / test results, for records to purchaser as bound volume along with the test procedure for each test carried out.

Testing procedures shall be developed by vendor based on relevant codes, international standards and practices followed for PLC systems & associated various items, unless otherwise indicated separately.

12.1 FAT will be conducted for complete PLC system at vendor's factory location. Detailed software and hardware check will be done at PLC vendor's factory.

12.2 All engineering, related to connectivity like assigning the MODBUS address, port address etc. Shall be completed at respective vendor's works before dispatch to site.

12.3 It is the joint responsibility of DCS and PLC vendor to establish communication between the two Systems to up to customer's satisfaction.

12.4 The details of the type of communication, has been given elsewhere in the specification. Scan time Verification shall be carried out during Factory Acceptance Test based on the specified requirements by considering discrete inputs given, a step input change.

12.5 The scan time values so observed shall be within 90% of confidence level. In case of analog inputs, input shall either be ramp or minimal step.

12.6 However such reading should be noted only for reference. PLC shall undergo factory testing and Factory Acceptance Test (FAT) at PLC vendor's works and integrated Site Acceptance Test (ISAT) at I.O.C.L. VADODARA Site. Vendor to provide the FAT and ISAT procedure for approval of BHEL / Owner and Testing shall be carried out as per BHEL / Owner approved procedures.

12.7 Demonstration of Integrated Testing of PLC with DCS at site under the witness of BHEL/IOCL.

12.8 After completion of FAT at vendor's factory, PLC vendor shall be given dispatch clearance.

12.9 SAT / ISAT - An integrated SAT will be conducted for complete DCS, PLC and associated / allied systems at site after commissioning of the system. After conduction of SAT the system will be taken over by customer.

12.10 Vendor is liable to replace the defective parts / cards identified during the period between Installation, supervision and completion of SAT and ISAT.

12.11 During the period of FAT, any change in system design (Software change or hardware change) shall be carried out by the vendor without time and cost implication.

13 DOCUMENTATION:

13.1 Documentation along with technical BID to be provided by vendor (preferably in A4 and A3 sizes). Followings Documents to be submitted as part of the technical offer (without Any price implication):

a) Offered system write-up, technical catalogue/data sheets of PLC and its modules.
b) PLC and sub system architecture.
c) PTR (Proven Track Record) and reference list.
d) A copy of TUV Certificate & Configuration along with Systems Wise details (Components / Modules & Model / Type etc.) approved for SIS utility. List of restrictions specified for the system with TUV certificate.
e) Bill of material.
f) Unpriced list of each module / item of PLC & its subsystem.
g) Power consumption and heat load calculation of each subsystem and total requirement.
h) Earthing scheme for total package/ panels.
i) Panel IA/PA/GA.
j) PLC system configuration.
k) Foreign device (DCS, PLC's) MODBUS interface details (as proposed). Detailed BOQ for both OEM and sub vendor items.
l) Project execution schedule.
m) Processor loading calculations.

13.2 During detail engineering (After Placement of order) - All engineering documents listed in Point no. 13.1 with revised/ updated documents during technical scrutiny shall be submitted in sets of 2 for approval.

13.3 Along with dispatch of PLC - All final drawings/ documents/ O&M manuals shall Be submitted to site in sets of 12 (hard copies) and two sets of soft copies preferably in DVD's.

13.4 In addition vendor should provide 2 hard copies and 2 soft copies of all documents mentioned in 13.3 to BHEL purchase department for BHEL records.

DOCUMENTS FOR REVIEW/RECORDS.

Sl. NO	Description	For Owner's Consideration		Remarks
		Review	Records	
1.	Documents and drawings list and schedule including various systems like PLC.	✓		
2.	Sub-Vendor list	✓		
3.	Instrument power consumption & UPS requirement		✓	
4.	Utility Requirements		✓	
5.	Cable / Tubing schedule		✓	
6.	Logic diagrams	✓		
7.	Functional schematics including complex loops	✓		
8.	PLC Input /Output Summary	✓		
9.	Logistic support certificates for various systems viz. PLC,	✓		
10.	Serial link and interface details for various systems viz. PLC.		✓	
11.	Point data base		✓	
12.	Power supply / feeder distribution drawings		✓	
13.	Interconnection cable details		✓	
14.	Catalogs including technical information and programming manuals, Installation, operation and maintenance manuals		✓	
15.	Loop Checking/ Calibration Reports		✓	
16.	As-built drawings/ documents		✓	
17.	Sub vendor drawings & documents List	✓		
18.	Hardware console layout	✓		
19.	Layout of panels/ cabinets	✓		
20.	Graphic display drawings including overview graphics group views, assignments etc. for DCS & Interlock Graphics for ESD PLC.	✓		
21	Log and MIS reports, Trend Groups	✓		
22	Instrumentation/ Electrical interface details including MOVs		✓	
23	Control room/ Satellite Rack room layout	✓		
24	Instruments/ Cabinets grounding details		✓	
25	Mandatory spares summary	✓		
26	Safety Integrity level validation and verification report	✓		
27	Special test equipment/ tool requirement for maintenance		✓	
28	**Package PLC Sub vendor documents**	✓		

Note-1: VENDOR shall prepare & submit the as built drawings / documents after commissioning. All the drawings/documents listed shall be converted into "As Built" after commissioning of Project. "As Built" shall include documents generated by Vendor & documents generated/ submitted by various sub-vendors.

For intermediate documents e.g. I/O list etc., which is provided as an input to DCS vendor, "As Built" is not required to be prepared.

Note-2: Any other document/drawing not listed above (including the package vendor's items, sub-ordered by the Vendor) but required to carry out the engineering and for integration of other equipment packages, sub-ordered by VENDOR shall also be prepared and furnished to Customer /Owner.

Vendor shall provide four sets of back up configuration, in CD media. The drawings should be in AutoCAD (latest version) and all documents in electronic media in addition to hardcopy.

13a. WARRANTY:

Warranty shall be 36 MONTHS FROM THE MECHANICAL COMPLETION DATE (Panel erection, cabling up to panel before energising) OR 15 MONTHS FROM THE DATE OF TAKING OVER BY OWNER (IOCL) WHICHEVER IS EARLIER.

1.1. VENDOR shall be fully responsible for the manufacture in respect of proper design, quality workmanship and operation of all the equipment, accessories etc supplied by VENDOR for a period of 15 months from the date of taking over by the OWNER at the site as mentioned in this specification or 36 m onths from the mechanical completion date whichever is earlier.

1.2. It shall be obligatory on the part of VENDOR to modify and/or replace any hardware and modify the operating, application and diagnostic software free of cost, in case any malfunctions is revealed even during on line operation after taking over within the warranty period.

1.3. VENDOR shall also provide the total maintenance of the system during warranty period.

1.4. In addition to above, VENDOR shall submit a proposal for comprehensive Post warranty AMC of Five (5) years operation & maintenance of c omplete s ystem with year wise breakup (This shall also cover all the bought out items supplied for PLC System.) along with spares. Brief requirements of the maintenance contract are mentioned below.

- In the event of any malfunction of the system hardware/software, experienced service engineer shall be made available at the site within 24 hours on the receipt of such information from the OWNER.

- The contract shall include supply of maintenance spares, tools & tackles as required, travel, boarding & lodging of service engineer.

- The Post warranty maintenance VENDOR shall cover following services also:

- Preventive maintenance

Once in a year, involving complete overhaul of the system, inspection of hardware and software, fault prediction, inspection of power supply quality, environmental & operating condition checks, calibration checks major repairs/replacements and detailed reporting.

- Periodic maintenance

Site visits, minimum four times in a year, inspection of general healthiness of the system, study and advice on daily maintenance, inspection of hardware & software, if any problem is reported, running of test programs on-line servicing and solving reported problems. Complete checks for hardware and software shall be conducted for all OEM supplied systems.

Shutdown Visit: During annual shutdown of the plant Vendor engineer shall visit and carryout all the checks required. These visits shall not be part of periodic/preventive maintenance visit

- Software Maintenance

Maintain existing software to improve and utilize existing application and improve performance of the system. Minor modification of the software shall also be covered under this scope. Upgrade of OS and Vendor application package.

- Emergency service

The Vendor engineer shall report within 24 hours of first intimation through telephone / email / fax. Any failure shall be on system suppliers account. The engineer must report at site within 24 hours of report of failure, with necessary spares. The system must be brought back in operation within 24 hours after reporting at site. The number of such visits shall be maximum 15 per year.

- Spare Maintenance Contract (SMC):

All the cards will be stocked at site or at the nearest convenient location from the site depending on the criticality. In case of usage of any of the card, that will be back charged to the owner. In case of failure the card with the SMC but not stocked /supplied shall be provided.

Note: PLC System vendor to note that Owner's engineers may associate / participate with system engineers for On-job training, when any activity is carried out under Post warranty maintenance contract.

It shall be obligatory on the part of Vendor to modify and/or replace any hardware and modify the operating, application and diagnostic software free of cost, in case any malfunctions is revealed even during on line operation after taking over within the warranty period. Vendor shall also provide the total maintenance of the system during warranty period.

14.0, INSTALLATION SUPERVISIONAND COMMISSIONING SCHEDULE:

14.1 Erection & Commissioning:

Vendor shall consider in its scope the complete Commissioning of the PLC package and Erection supervision. Vendor to quote as lump sum charge, per man-day rate will not be accepted. Readiness of site shall be informed by BHEL to vendor. Vendor to note that entire commissioning shall be carried out in different stages.

14.2 Entire package may require implementing in various phases, which can be summarized as follows:

- Complete erection Supervision to be under PLC vendor scope for single point responsibility and fast execution without any further delay in lining up of required manpower from purchaser end, for Erection of hardware supplied under this package.
- Erection Supervision of field cabling

- Laying and termination of inter panel cabling for all cable in vendor's scope of supply.
- Supervision of Erection and commissioning of operator/hardware console.
- Loop checking and system commissioning for plant operation.
- Site Acceptance test.
- Furnishing details regarding site Storage and Handling instructions.

14.3 Above phases are indicative only, actual implementation may depend on site front availability. Vendor shall assess correctly the duration of the total period of installation supervision and Commissioning of this nature of plant.

14.4 Vendor may consider sufficient period of site stay and site visits of their Engineers. No additional or extra payment will be made for site services other than price indicated in its price offer.

14.5 Vendor shall quote for lump-sum price for Installation, supervision and Commissioning, without any specified time duration. Vendor shall list out the front requirement for erection and commissioning at various stages.

14.6 Vendor shall quote for Installation supervision and Commissioning on turnkey basis. Vendor shall ensure continuous presence during all the stages of the project Installation supervision and commissioning activities.

14.7 Vendor shall strictly adhere to this scope division:

Activity	Scope
Transportation up to Stores	Vendor
Unloading	Purchaser
Supply Verification as per packing list, Transit damage inspection	Purchaser
Storage	Purchaser
Custody of items in stores	Purchaser
Issue of Items from Stores	Purchaser
Shifting of equipments to Intended Location	Purchaser
Unpacking of equipments	Purchaser under supervision of Vendor
Installation of equipments at intended location	Purchaser under supervision of Vendor
Supply of Accessories for installation of equipments	Purchaser
Inter equipment Cable supply	Vendor
Inter equipment Cable terminations	Vendor
Cable Lugging, Ferruling, Terminations, supply of cable glands for cables under vendor scope entering the PLC cabinets.	Vendor
Supply of cable from field to system	Purchaser
Laying cable from Field to system	Purchaser
Cable trays supply and laying in control room for field cables.	Purchaser
Cable trays supply and laying in control room for PLC inter panel Wiring and between PLC & DCS.	Vendor
Loop Checking in Control Room from System to marshaling Vendor Terminals	Vendor
Loop Checking from field to marshalling Terminals	#Vendor Purchaser
Erection	Purchaser
Erection Supervision	Vendor
Commissioning	Vendor
Commissioning Supervision	Purchaser
Erection & Commissioning coordination	Vendor
Provision of erection & commissioning tools & tackles	Vendor
Erection consumables for earthing of PLCs.	Vendor

- Joint activity by Vendor and Purchaser.

All type of report formatting, SOE, Trip & Pre-trip Settings, various protocols, etc. may be finalized during site activity, but before commissioning.

Vendor shall consider 50% software modifications & 25 % wiring modifications at site and other related changes, including changes in the related drawings and documents (after code-1 approval) without any cost implication.

Vendor's engineers' shall be available round the clock and work in shifts during installation supervision and commissioning of the plant.

All the above requirements shall be in Vendor's scope and shall be considered in its bid.

14.8 Vendor shall depute adequate number of experienced engineers for PLC system, on continuous basis at site till handing over of the systems to BHEL/IOCL.

14.9 These Engineers shall participate in FAT for better understanding of the system. Vendor shall forward 'Resume' of these engineers to BHEL/IOCL for approval.

15.0 MAINTENANCE TOOLS & TACKLES:

15.1 One set of all special tools shall be furnished and shipped with equipment for dismantling, maintenance, adjustment, and calibration of the equipment.

15.2 The tools shall be shipped in separate constructed wooden boxes provided with hinged covers and padlock hasps.

15.3 The Vendor shall supply under this contract all maintenance tools for equipment and it shall be boxed separately and the boxes shall be appropriately marked for shipment and identification of contents.

15.4 The maintenance tools shall include cable and all specialized equipment for control system maintenance such as extender boards, scopes, and all software and hardware.

15.5 Vendor shall note that if any other tools and tackles are found to be necessary during engineering or erection, testing, commissioning up to take-over of plant and same is not specifically included in Schedule of Maintenance Tools and Tackles, the same will be deemed to have been already included by the Vendor in his scope and no price implication due to same would be accepted.

16.0 TRAINING:

Vendor shall arrange training for Owner's personnel. Different type of courses shall be offered for owner engineers, instrument maintenance engineers and technician. Vendor shall indicate a detailed proposal for training in the offer. Travel and living expenses of the owner's personnel shall be borne by the Owner. The various facilities available in the system for operation, actions required during emergencies and identifying the various diagnostic messages shall be the main contents of the operation training. The duration of this training shall be as follows:

Hardware and software maintenance training: -

Course duration : Six man weeks (6) for PLC.

Location : PLC Vendor's works (respectively).

Site training: - : 30 working days, in number of batches and each batch consists of five persons.

17.0 Additional General Requirements:

1. Mandatory spares shall be offered for PLC (QMR/TMR) wise.
2. Vendor to submit offers PLC wise.
3. Erection supervision charges lump sum.
4. Commissioning charges per PLC system.
5. Unit prices of major items used in PLC system like panel, Fan racks with fan, Monitoring ckts, breaker, all types of racks, each type of Module, Power supply units, Relays, Barriers, contactors, TBs, Pre-fab cables all types, fuses, System Software's licenses, other charges (if any) and additional engineering man-hour charges per panel (lump sum) to be furnished.
6. **Vendor to submit offer in TWO parts (Technical and commercial) separately.**
7. TUV certificates and references etc.
8. Over all Configuration.
9. Technical Data sheets of all items.
10. Recommended spares for 2 years operation shall be offered with price validity for 2 years period.

18.0 LOGISTIC SUPPORT:

Logistic support certificate as p er format below shall be provided on part of each purchase specification Certificate. The logistic support certificate shall be signed by a corporate level person of the vendor and submitted along with technical bid.

Certificate For Logistics Support (by Principal)

(To be signed by Principal's corporate level signatory on company's letterhead)

I, on behalf of M/s…confirm that the * quoted by M/s…for Captive Power Plant of VADODARA Refinery Project shall continue to be supported by us. The quoted item shall not be withdrawn from Indian market as a matter of our corporate policy.

I further confirm that in case of placement of order by IOCL on M/s…. we shall continue to support M/s…..in providing back-up engineering, maintenance support and spare part to IOCL for a period of 15 years from the date of placement of order.

SIGNATURE WITH SEAL
AUTHORIZED, SENIOR MANAGEMENT LEVEL

* DCS/ PLC/ Machine monitoring system/ all types of analyzers and chromatograph, Steam Turbine Control System, GTG control system, BMS, antisurge controllers, and any other Control System provided by Bidder.

LOGISTIC SUPPORT CERTIFICATE

(TO BE SIGNED BY VENDOR'S CORPORATE LEVEL SIGNATORY ON COMPANY LETTER HEAD)

I, ONBEHALF OF M/s _____ CONFIRM THAT THE QUOTED _____ BY US THROUGH M/s _____ FOR IOCL, CPP-VADODARA REFINERY PROJECT, GUJARAT (INDIA) AGAINST MATERIAL REQUISITION SHALL CONTINUE TO BE SUPPORTED BY US AND PRINCIPAL M/s _____ .

I, FURTHER CONFIRM THAT IN CASE OF PLACEMENT OF ORDER BY M/s. IOCL ON M/s. _____ WE SHALL CONTINUE TO SUPPORT M/s. IOCL IN PROVIDING BACK-UP ENGINEERING, MAINTENANCE SUPPORT, AND SPARE PART SUPPORT FOR A PERIOD OF NOT LESS THAN FIFTEEN (15) YEARS FROM THE DATE OF PLACEMENT OF ORDER.

(SIGNATURE WITH SEAL)

Annexure-1

Annexure-1

PART- I General Specification for DCS & PLC System

PART- II Testing, Installation, Commissioning and Acceptance Of DCS & PLC System

PART- III General Requirements of DCS and PLC System

ATTACHMENT- 1 Specification for server grade Computer (1 sheet)

ATTACHMENT- 2 GROUNDING AND POWER DISTRIBUTION SCHEME

PART – I

GENERAL SPECIFICATION FOR DCS & PLC SYSTEM

1. SCOPE

This specification defines the minimum requirements of a distributed control system & emergency shutdown system designed for reliable, effective and optimum control, monitoring & emergency shutdown of a process plant. Where any conflict exists between this specification and the attachments, the Owner shall be consulted before proceeding with procurement/engineering. The CONTRACTOR shall not deviate from this specification without the prior written approval from the Owner.

2. References

The design, manufacture, inspection, testing and installation of all equipment and system covered under this section shall conform to the latest editions of codes and standards at the time of procurement.

Codes & Standards

IEC 801.4	Electromagnetic compatibility for industrial process measurement & control equipment
IEC529	Classification of degree of protection provided by Enclosures.
NEC	National electrical code
NFPA-496	Purged and pressurised enclosures for electrical Equipment.
ISA-S51.1	Process instrumentation Terminology.
ISA-S5.2	Binary logic diagrams for process operations.
ISA-S5.3	Graphic symbols for Distributed Control/Shared display Instrumentation / Logic and Computer system.
ISA-S5.4	Instrument Loop Diagrams
ISA-S18.1	Annunciator Sequences and Specifications.
ISA-RP55.1	Recommended practice-Hardware testing of Digital process computers.
ISA-S71.01	Environmental conditions for process measurement & control systems - Temperature & Humidity.
ISA-S71.04	Environmental conditions for process measurement & control systems - Airborne Contaminants.
ICS-6	Enclosures for Industrial control and systems.

3. Definitions

The various terms used in this specification are defined as follows.

3.1 Distributed Control System: The class of instrumentation which in addition to executing the stated control function also permits transmission of control, measurement and operating information to and from a single or plurality of user specified locations connected via a communication sub-system.

3.2 Switch over Time: Time required for a backup instrument to come on-line automatically in case of failure of the main instrument.

3.3 Loop Integrity: A system shall be said to have loop integrity if the failure of one component in the system/sub system does not affect more than one loop.

3.4 Interchangeability: Systems/sub-systems shall be said to have full interchangeability if the functions and information available on one system/sub-system shall also be available on the other in totality.

3.5 Redundancy: A system component shall be termed as Redundant if it takes over the operation automatically on failure of the main component without causing any interruption in the system and upsetting the process. The repaired or replaced device shall be brought in-line only through operator action.

3.6 Scan Time: Scan time for different sub-systems shall be defined as follows:

a) Process Control System (Close – Loops): Scan time for a close-loop shall be defined as the Cycle time taken by controller to read and process input, perform control calculations and update control output for all the loops configured within the controller.

b) Process Control System (Open – Loops): Scan time for an open loop shall be defined as the Cycle time required by the data acquisition subsystem to read input, processing and computation of all the open loops configured with in the data acquisition sub-system.

c) Programmable Logic Controller: The scan time for a programmable logic controller shall be defined as the cycle time taken by the system to read input, input processing executing logic and updating control output for all the logic configured within the programmable logic controller.

3.7 Bus-Degradation: Bus-degradation shall be defined as a change in the system performance from the specified one while loading the communication sub-system from 10 through 100 percent.

3.8 Real time Trend: Real time trend shall be defined as a continuously progressing graphical record showing continuously updated parameter with most recent value and a past record of minimum 10 minutes without depressing any additional key for moving backward in time.

3.9 Call-up Time: Call up time shall be defined as the time taken by the system to display a particular display /data on the CRT after getting the corresponding command from the operator.

3.10 Display Update Rate: Display update rate shall be defined as the rate at which the information present in the system input terminal is getting updated on current display on the CRT.

4. System Overview : DCS/PLC systems for units are proposed to be located in control rooms as indicated in following table

No.	Control room	Location	List of Process units grouped	Remarks
1	**CGP-II**	Existing C/R for GT # 4 & GT # 5.	GT # 6, HRSG #6 & associated balance of plant.	

For new units following philosophy shall be applied

- All analogue loops, digital loops connected to DCS system shall be conventional type (4~20mA, discrete I/O etc). All analog input & output shall be HART compatible.

5. General Requirements

5.1 The system shall be microprocessor based having functional distribution and database distribution, sub-system wise. This system shall also have networking capability with other systems distributed, geographically in the various units of a plant. In addition, system shall have capability to exchange information with other software packages, devices & platform via industry standard communication protocol.

5.2 The system shall be designed 'fault avoidant', as a minimum by selecting high grade components of proven quality and proper design of system electronics. Redundancy shall be provided, as a minimum, as per this specification to improve the system availability and reliability.

5.3 All sub-systems of the system shall be able to operate satisfactorily from 15ºC to 50ºC and 20 to 80% non-condensing humidity.

5.4 The system shall be of modular construction and expandable, in future by adding additional modules. The type of modules shall be kept to the minimum possible in order to have interchange ability and low inventory.

5.5 The system software shall be governed by the operating system running in a real time mode and shall be able to meet all functional requirements specified in the specifications as a minimum. Any other standard/special software package, if available, shall also be offered describing the full capabilities.

5.6 The system shall have a high MTBF value and shall have a well proven record of operating satisfactorily in a hydrocarbon processing plant for a minimum of one year. No prototype instrument or instruments of an experimental nature shall be offered or supplied. CONTRACTOR shall guarantee availability of spare parts and maintenance support for the period of 15 years from placement of order.

5.7 Galvanic isolation shall be provided for all field signals. Isolation shall be provided between Engineering / operator console / PLC Programming terminal and related sub-systems connected to it if there is any possibility of high voltage from CRTs being transmitted to the sub-systems.

5.8 Electronic components/cards for controllers, data acquisition system, operator interface, engineering interface subsystem & gateway interface subsystem for DCS / PLC shall comply with ISA G3 class (As per ANSI/ISA-S71.04).

5.9 The system shall have the capability of detecting the open sensors. The open sensor reading either upscale or downscale shall be field configurable.

5.10 The system shall have an extensive set of self-diagnostic routines which shall locate and identify the system failure at least up to module level including redundant components/through detailed CRT displays and report printout.

5.11 For each cabinet common alarm shall be provided for high temperature, fan failure or power supply failure & shall be alarmed on DCS.

5.12 On-line replacement of any module shall be possible in such a way that removal and addition of a module shall be possible without de-energizing the system. Further, there should not be any interruption in the system while replacing a faulty module wherever redundant modules are provided.

5.13 CONTRACTOR / OEM shall consider 50% software modifications & 25 % wiring modifications at site without any cost implication.

5.14 The system shall be suitable for power supply as specified in this specification. Suitable battery back-up shall be provided for volatile memory protection only. DCS/PLC/ESD/other systems shall be capable of operating on floating or grounded UPS power supply. Exact type of UPS supply shall be confirmed during detail engineering.

5.15 One set of licensed system software for PLC shall be supplied with the system and two sets of application software shall be supplied with the system.

5.16 For new units, solenoid valves shall op erate on 24 DC & shall be intrinsically safe. Suitable barriers to be provided for the sa me. In case of modifications/up gradation to existing units philosophy of existing unit will be applicable.

5.17 Separate battery bank & charger for 24 V DC power supply shall be provided for powering barriers, relay coils etc. Separate power distribution cabinet shall be provided.

5.18 UPS battery & 24 VDC system shall be sized for 30 minutes.

5.19 Interrogation voltage shall be 24 VDC.

5.20 DCS / PLC OEM shall supply Fire wall software with required number of licenses.

5.21 PLC engineering and execution shall be carried out by Original Equipment Manufacturer (OEM)/ OEM's Expert. In case th e same is carried out by others (with prior approval from Owner,) then OEM's expert shall be involved during engineering / execution and Inspection of system. Inspection shall be offered only after OEM expert's checking & approval.

6. Spares Philosophy

6.1 Installed spares of 20% of the net used quantity shall be provided in each sub-system module wise (i.e. Input/output cards, terminals, relays, barriers etc.) including hard-wired instrumentation. Installed spares shall be wired up to terminal blocks. This also implies to PLC/ESD and other systems (if any).

6.2 In addition, the system shall have the following minimum spare capability.

a. In addition to installed spares of 20%, process input/output racks (Analog & Digital) shall have 10% useable spare space to install additional modules of each type in future. However, internal wiring for the same shall be completed up to I/O terminals with all necessary hardware. Installation of only I/O cards should make this spare space usable.

b. Loading for the controller shall not exceed 60% with installed & future spare input & outputs. The system memory shall have sufficient capacity for 30% additional application programming & configuration in future.

c. The communication sub-system shall have sufficient capability to take care of system expansions as mentioned above without degrading the system performance.

d. Sufficient additional software capacity shall be available in the system to take care of spares requirement as specified above.

e. The bus loading shall not be more than 60%.

6.3 Consumable spares: Any paper and ink required for printers, Assignable recorders, video copier, floppies and all other consumable items, as indicated below shall be supplied along with the system for each unit.

1	Printer Paper (A3 size)	- 12 boxes (1000 sheets/box)
2	Printer Paper (A4 size)	-08 boxes (1000 sheets/box)
3	Ink Cartridge for colour laser printer	-03 sets
4	Ink Cartridge for B/W Laser printer	-03 sets
5	Printer Head	-04 nos.
6	Printer Ribbons	-15 nos.
7	DAT Tapes	-10 Nos.
8	Floppy Disks	-04 boxes (10 per box)
9	CD-RW Discs	- 05 Boxes(10 per box)

All papers shall be minimum 60 GSM.

6.4 CONTRACTOR shall include in his scope of supply all commissioning spares required for complete control system.

6.5 CONTRACTOR shall supply mandatory spares as per the list attached elsewhere in the bid document.

7. System Redundancy

Following system redundancy shall be available as a minimum.

Controller	1:1
Input / output cards For closed loops	1:1
Input/output cards For interlocking & sequencing.	1:1
Communication Bus / Cards	1:1
Power supply	1:1 (n:n)

8. System Configuration : The system configuration shall consist of following major sub-systems:

8.1 Controller, I/O modules & Communication sub-system: This sub-system consists of Control processor, memory, network interfaces, power supply, input/output cards for interface with field instrumentation like Transmitter, switches and final control elements to control process parameters like flow, temperature, level etc. The sub- system shall include a comprehensive set of control algorithms to provide closed loop control and data monitoring capability to the system. Various sub-systems communicate with each other through communication subsystem.

8.2 Operator Interface Sub-system: Operator interface sub-system shall consist of Operator Interface stations (OIS) for monitoring and controlling process parameters and performing other process related functions. Number of OIS to be supplied for each unit is as indicated in system configuration drawing.

8.3 Engineer's Interface Sub-system: Engineer's interface sub-system shall consist of an Engineering Station, which is used primarily for configuring, tuning and maintaining the system. It should be equipped with removable storage media like DVD re-writer etc. Engineering station shall be located in Engineering room.

8.4 Other Computer Sub-systems:

HART Maintenance System

Hart maintenance system (HMS) shall be used for remote calibration, configuration viewing/modifications, diagnostics & performance monitoring of HART field instruments. The HMS shall be from Emerson AMS suite.

OPC SERVER

DCS/PLC/GTG control system shall have OPC connectivity to ERP/MIS system. The data from the multi OEM control systems shall be made available for IOCL MIS system using OPC. Data from all the system shall be used for monitoring and analysis as per IOCL systems. OEM shall also provide necessary software / hardware (OPC server & software) and manpower support / assistance for establishing connectivity of the system with ERP & APC. The OPC server system should have minimum 5000 tags capacity & capability.

8.5 Programmable Logic Controller: GTG & HRSG Plant startup and safety shutdowns, critical sequencing & all other interlocks shall be performed by a separate programmable logic controller which shall communicate with other sub-systems over the communication sub-system. GTG controller shall perform the safety interlock functions for Gas Turbine and will not be a part of the ESD PLC system.

9.0 FUNCTIONAL SPECIFICATION:

9.1 Functional requirements: The system, as a minimum, shall meet the following requirements without the supervisory computer:

a) Control & Data acquisition.

b) Alarming, Logging, historization, data storage & retrieval.

c) Report generation

d) System shall have some free memory space available for the user and CPU shall have the additional capability to perform a few process optimization programs or generate management reports.

e) Plant process and safety shutdowns shall be performed by separate PLC system (TMR or QMR - programmable logic controller). PLC hardware shall meet TUV class VI (SIL3) requirements according to DIN V 19250 (TUV certified hardware).

f) System configuration & builder facility.

g) Sequence of event recording with minimum 100 millisec resolution.

9.2 Controller, Input / Output & Communication Sub system: DCS & PLC control system consists, Controllers, input/output cards for data transmission to controller for monitoring & control, communication interfaces & data Hi-ways for integrating peripheral sub-systems. All these basic units of the system shall perform the process interfacing, data acquisition & plant control functions.DCS control system shall meet the following requirements as a minimum.

9.2.1 **Controllers:** The controller capability shall be primarily used for regulatory control / monitoring of process parameters of the process.Scan time of input signals for control loop shall be 250 / 500 msec. and for monitoring & digital points shall be 1 sec. Critical regulatory control loops shall be executed at <=250 msec & non critical control loops shall be executed at 500 msec. The controller loading shall not exceed 60% when configured for scan time mentioned above or maximum control loops in one controller shall not exceed 100 nos. Controller shall be capable for performing advance calculations, solving equations (for multi variables) etc. in addition to standard algorithms provided for following control functions as minimum.

Regulatory Control	Proportional, Integral, Derivative (PID) PID with Feed forward, Ratio Bias, Cascade/Remote cascade, Auto/manual station, signal selector, split control, signal limiter etc.
Calculation	Arithmetic such as Add, Subtract, Multiply, Divide, Average etc. Other function blocks for square root extraction, integration, lead/lag, dead time, pressure & temperature compensation, linearisation, ASTM correction etc.
Discrete Logic	AND, OR, NOT, XOR, NOR, NAND, Delay, On/Off delay timer, Comparator, Flip flops etc.

9.2.2. **Input / Output Cards:** Input cards shall be capable of accepting process signals in the same state as transmitted from various field sensors without requiring external or auxiliary signal conditioning devices. The standard input signals are 4-20mA DC, Pulse, Thermocouples, Resistance temperature detector (RTD) and discrete inputs. The controller shall be capable of processing linear and non-linear analog inputs, providing square root extraction for flow signals, linearization and compensation for thermocouples. Analog output shall be 4-20 mA DC (current signals) and potential free contacts for the discrete outputs. Isolated cards shall be used.

No. of channels per card shall not exceed following numbers.

Analog input/output	: 16 Nos.
Analog, RTD/ T/C	: 16 (32 nos. for D/A cards. Multiplexers shall not be used)
Digital input/output	: 32 Nos

Signals from/to hazardous process plant shall be required to transmit via safety barriers. Active type barriers shall be used for all analog inputs & intrinsic safe outputs. Barriers shall be MTL 5000 or equivalent P&F KFD series only.

Milli volt / RTD to current converter & barrier shall be configurable type

Fail safe TUV class VI (SIL3) approved relays with LED indication shall be used for all digital outputs. Also relays shall be used for isolating discrete digital inputs from electrical (MCC) control circuit.

All components / modules in controller subsystem shall be redundant including the power supply cards. Each set of controllers in DCS shall have its independent, redundant power supply. System cabinets shall be segregated for CPU & its related I/O racks. No two sets of controllers shall share the same system cabinet.

I/O bus and I/O interface card at controller rack & I/O rack shall be redundant

9.2.3. **Communication:** The communication sub-system shall be a digital communication bus that provides a high speed data transfer between the operator consoles, Processor, process I/O device, and other devices connected to the system.

Communication sub-system shall be dual redundant, consisting of two separate communication bus and separate system (modules). In case of systems having Traffic directors, Traffic director shall also be redundant.
Communication speed on the communication bus (data Hi-way) shall be minimum 5 Mbps.
The overall system performance shall not be degraded whether communication sub-system is 10% loaded or 100% loaded. In case of main bus failure or any communication device failure, the transfer to the backup device or bus shall be automatic without interrupting the system operation and without any operator's intervention.
Information about the failed device / bus shall be displayed on the operator console. It shall be possible to switch over the communication from main bus to the redundant bus manually without disrupting the system operation.
A device shall be connected or disconnected from the system without disrupting the operation. Separate Digital Master Clock (GPS based) shall be provided & all control system clocks shall be synchronized with Master Clock. In general, the transmitting message shall identify the Transmitting device and the Receiving device.
The transmitting device shall receive a reply from the receiving device on the receipt

of correct message. Lack of response shall be considered as a receiver failure.
The mechanism used by the communication system for error checks and control shall be transparent to the application information. Error checking on all data transfer shall be done by cyclic redundancy check and other advanced codes. Communication interface for integrating different subsystems like PLC etc. shall be separate from controller & data acquisition subsystem.
Different subsystems shall be communicated with DCS by using different communication interface.
Multi-dropping of different subsystems to a common communication interface is not acceptable. A dedicated gateway shall be provided for interfacing each PLC with DCS.
For other foreign devices listed below, redundant communication interfaces along with dedicated controller system shall be provided

- Analyzer system
- Anti-surge controller
- Vibration monitoring system
- APC computer

9.3. Operator interface Sub-system

9.3.1. **General :** The operator interface sub-system shall provide the centralized information to the plant operators. Operators will monitor the process & initiate all control functions from Operator Interface Station (OIS).
Each Operator Interface Station (OIS) shall have separate electronics. The electronics of OIS shall be server grade computer or equivalent with specifications similar to as indicated in Attachment-II. Ordinary commercial grade monitors & personal computers shall not be supplied for OIS. OIS shall be equipped with removable storage media like CD Re-writer.
Each OIS shall consist of 24" LCD / CRT and operator keyboard. LCD / CRT shall have touch screen. OIS shall be Console type. One logging printer, one alarm and event printer shall be provided for each Process Unit.
The real time clocks on each operator console shall be crystal controlled, which shall be independent of line frequency.
CRT data display update rate shall not be more than two (2) seconds.

9.3.2. **Operator Key Board:** Operator keyboard shall be self-explanatory, easy to operate and shall meet all the functions to configure, operate and maintain the system. Conversational user-friendly software shall be used for operation, configuration and maintenance of system.
Operator keyboard shall be touch sensitiv e membrane or standard qwerty type. Keyboard shall h ave 64 assignable function k eys in addition to alphanumeric & other control keys. In case 64 assignable keys are not available, soft keys shall be engineered.

9.3.3. **Process Displays:** System shall provide following standard displays.

- **Overview Display:** Overview display shall be used to monitor overall plant operation & to access displays that are more detailed when conditions warrant.
- **Control Group Display:** Group display shall be limited to the group of inputs as displayed in the overview display. Each group shall preferably include eight (8) No. of faceplates. Each input in the group shall be identified by the tag number, unit of measurement and process description, which shall be displayed on

the CRT screen.

- Display shall provide minimum following details / information.

a) Process variable in analog form shall show, as a percentage of the transmitter span on a linear scale bar graph of 0-100% or Engineering unit in alphanumeric display.
b) Set point value in analog form as a percentage of the transmitter span on linear scale bar graph of 0-100% and in alpha-numeric display for engineering units.

c) Output value in analog form as a percentage on linear scale bar graph of 0-100%.

d) Controller mode (i.e. auto / manual, cascade, calibration.)

e) Process alarm on process variable, deviation or velocity.

f) Selected loop within the group shall be identified by cursor marking or similar identification.

g) Control valve failure position.

h) The contact input/output shall be represented by simulated graphic color display and configurable alphanumeric status description.

It shall be possible to repeat any tag number in more than one group panel display, However change in data configuration shall be possible only from one pre-assigned group.

- Loop Display: Loop Display shall provide a separate detailed display for each of the process input. The graphic representation of analog and digital point shall be similar to control group display. However in addition following information shall also be presented in alpha-numeric form as a minimum:

a. Controller tuning constants
b. Process variables zero and span values.
c. Alarm set point on various parameters. d. Limits on set point, output, velocity etc.
d. Controller action (direct/reverse).
e. Failure position of final control element.
f. Computational constants like ratio or bias.
g. Integrated value.
h. Output to the final control element.
i. Engineering units.

It shall be possible to change the following parameters through the keyboard of operator console:

1. Tuning parameters
2. Zero and span.
3. Limits on set points, output, velocity etc.
4. Configuration of any loop.
5. Alarm set points.
6. Control mode.
7. Output to the final control element.
8. Digital signal status for start/stop or open/close command.

Loop display shall also display trends for process variable, set point and output

with a sample interval time scale of 1 second and full scale time base of 60 second for tuning the process control loops.

- Graphic Display: It shall be possible to build and display the dynamic graphics of different sections of plant on the human machine interface. Graphic displays shall be interactive type through w hich it shall be possible to control process, and send 'start/stop' & 'open/close' commands for motor / valve. The system standard feature shall have in built s ymbol library as per ISA-5.1 and 5.3 and standard industrial equipment symbols for distillation columns, heat exchanger, pumps, compressors, tanks etc. shall also be provided as a standard.

System shall have capacity to handle minimum 600 graphics.

- Trends Display:The system shall be capable of displaying the following trends:

    a. Real time trends.
    b. Historical trends.

Storage of historical data shall be stored on the non-volatile memory device like hard disc, floppy diskettes etc. in such a way that such historical data can be utilized for archival storage and subsequent recall.
Real time and historical trend shall be possible of any parameter or v ariable like measured variable, set point, output etc.
It shall be possible to sample and store data of instantaneous and average value at the intervals mentioned below.
At intervals 1 second and above for the real time trend.

At 5, 10, 30, 60 seconds and 10 minutes interval for historical trend.

Selection of the tag nu mber and sampling time for real ti me and historical trending shall be possible from operator keyboard.

The system shall be sized to have real time trending for all the tags. The real time trending sampling period shall be 1 sec. Historical trending requirements are mentioned below:

- At 5 sec. sample rate for a period of 10 days for all tags.
- Hourly averages for all tags for 20 days.
- Eight hourly averages for all tags for 25 days.
- Daily averages for all tags for 1 Month.

It shall be possible to transfer the data to the removable electronic device for historical data storage & archiving.
The system shall also have a multi-trend capability to display set point, measured variable and output on the t rend of either the same process variable and / or any other process variable.
Trend display shall be single line type or bar graph type with additional information like loop tag number, engineering units, span, present value of the trended point,alarm status etc displayed.

- Alarm Monitoring and Display:

- Alarm summary display

a. It shall be possible to dis play summary of all alarms in the sequen ce of their occurrence and shall disappear from display only when they acknowledged & cleared.

b. The system shall be able to display on alarm summary a minimum of 100 alarms. The minimum number of alarms per page shall be 20.

- Alarm History

a. The history of alarm conditions shall be maintained in the data base for alarm history display and printed on shift basis for the parameters specified during detail engineering. The alarm display / print out s hall list minimum following information for each alarm.

    1. The date and time of occurrence.
    2. Point identification (i.e. Tag number)
    3. Point description.
    4. Type of alarm (absolute value or deviation).
    5. Time of acknowledgement.
    6. Time of return to normal.
    7. Serial number of alarm in the sequence of occurrence.

b. The system shall be able to display and print out the alarm history of minimum 4000 alarms.

- System alarms

System shall have capability of on-line self-diagnosis. Any abnormal conditions in any sub-system or any other function device shall be displayed as system alarm message on the operator console irrespective of the display selected.

- Configuration Displays:

Configuration display shall provide a separate detailed display for each loop indicating the configuration of that loop. When control requires data from/to more than one loop, all inter related loops shall also be displayed on one page or with proper cross reference of other page. Following information is required to be displayed for configuration:

1. Loop configuration giving designation of each block.
2. Control block interconnection showing soft wiring or hard wiring.
3. Value of each block parameter like P, I, D, ratio bias, dead time, lead time etc.

It shall be possible (by user friendly software) to copy and configure other loops from configured loop display.

- Logging Function:

It shall be possible to log all measured and computed parameters, operator actions, alarms etc. from operator consoles.

Logging shall be required on hourly, shift (8 hourly) and daily basis or some case for

weekly and monthly basis.

All parameters required for logging shall be stored in memory in accordance with data base update rate. However, it shall be possible to perform basic arithmetic calculations such as averaging, summing, efficiency calculations etc. prior to logging.

The log formats shall be user definable. For extended logging like weekly and monthly reports, system shall have capability of writing program in high level language. High-level language compiler software, sufficient memory space and necessary hardware shall be provided.

Number of log reports shall be as per number of log formats defined like hourly report format, daily report format etc. Number of pages in each log report shall be sufficient to accommodate all the parameters required for logging.

Hourly report shall be printed only on demand by manual initiation and not at the end of every hour. All other reports shall be printed automatically at the end of the pre-defined time as well as on demand. The maximum storage time for log information shall be 15 minutes after the pre-defined print out time.

9.4. Engineer Interface Sub-System

Engineer Interface sub-system consist operator console with engineering functionality. It is primarily interface unit for engineer, used for configuring, tuning and maintenance of the control system.

This sub-system consists of 24" color CRT, Operator cum Engineering keyboard and a dedicated printer.

Engineering console shall have capability to display all the plant views those are configured for operator console.

Engineering console, like any other sub-system shall be capable of communicating with all other sub-systems over the communication sub-system.

It shall be possible to perform all system configuration functions from the engineering console.

Tuning of a control loop shall be possible from engineering as well as from operator console however when selected ‘Tuning mode’ through key-lock switch / software password provided on the operator console, it can be operated only from Engineering console. In case of simultaneous commands from operator and Engineering console, operator console shall over-ride.

During the working, on the engineering station, any change made shall not interfere with the running process or the program. The change will occur only when it is down loaded into the system. Down loading shall be provided with proper security.

All detailed diagnostics of the system shall appear on the engineering console with a print out on the configuration and Maintenance (C&M) printer (A3 size Laser printer). A common diagnostic message on the operator console shall indicate the need of the maintenance.

Any special diagnostic package if available with the system shall also be offered. Detailed description and capability of this package shall be supplied.

C&M Printer shall be used for printing the change in configuration made or system alarms as and when they appear and to print out any engineers command from engineering console.

Hard copy units shall be used to take hard copy of the engineers console or OIS.

10.0 Other Computer Sub Systems

HART Maintenance System:

Hart maintenance system (HMS) shall be used for remote calibration, configuration viewing/modifications, diagnostics & performance monitoring of HART.

One HMS system shall be supplied which shall have sufficient capacity for accommodating all units in that project. In addition to this there shall be spare capacity for additional 30% tags. Monitoring station shall consist of 24" LCD/CRT, minimum Pentium -IV PC (with DVD Re-write drive) with 'Asset management software' from M/s Emerson compatible with SMART HART .

OPC SERVER

DCS/PLC system shall have OPC connectivity to ERP/MIS system. OEM shall also provide necessary software / hardware (OPC server & software) and manpower support / assistance for establishing connectivity of the system with ERP & APC.
A provision shall be made in new control systems to interface with existing Real Time Database Management System (RTDBMS).

11.0 Programmable Logic Controller

11.1. General

Programmable logic controller shall be microprocessor-based system, which shall be used to execute all the process, and safety shut down logic of the process plant. Programmable logic controller shall be independent unit.

'Fail safe' QMR or TMR PLC shall be provided. PLC hardware shall meet requirements of Class VI according to DIN V 19250 (TUV certified hardware). TMR PLC shall be configured for 3-2-0 mode configuration & QMR PLC for 4-2-0 mode configuration.

The scan time of programmable logic controller shall be less than 200 milli second inclusive of processor time required for diagnostics and peripheral data transfer (If better scan time is required as per licensor's package then the same shall be applicable instead of 200 msec). Redundant power supply units shall be provided for each individual I/O rack, each processor cabinet and programming terminal.

Controller switch over time shall be less than 5 msec.

Operation of PLC shall be completely unaffected by a momentary loss of power up to 50 milliseconds.

PLC shall have extensive self-diagnostic capabilities & c apable to i dentify any faulty channels in input/output cards, faulty system cards & power supplies etc. The outputs shall be fail safe design & shall have secondary means of de-energize in case of CPU failure.

PLC shall have Operator console (24") with printer & separate Engineering Console (24") with Laser printer. Operator console shall be located in the operator area while engineering console to be located in engineering room.

PLC shall have functionality for sequence of event recording (SER). Resolution of SER shall be same as PLC scan time.
SER format shall be displayed on Engineering console as well as Operator console. Time stamping of the alarms shall be displayed in HH:MM:SS:msec (e.g. 11:10:15:240) SER printer shall be connected to PLC Operator console for log recording & printing.

Maintenance override switches shall be software type. Process override s witches shall be hardware type & with key lock. Process override s witches shall be mounted on auxiliary console.

11.2. System Configuration

The basic system shall consist of the following major sub-systems.

11.2.1. Input / Output system

Each input shall be provided with filters to filter out any noise in the input line and contact bouncing noise. Each I/O shall be galvanically / optically isolated from external control circuit. The minimum isolation level between I/O and logic circuit shall be 1000 volts DC.
Each I/O shall be protected against the reversal of polarity of the power voltage to I/O.
Fail safe TUV approved (class VI) relays with LED indication shall be used for all digital outputs. Relays shall also be used for isolating discrete digital inputs from electrical (MCC etc.) circuits. For interposing with MCC section interposing relays / contactors as per required ratings shall be used which can be non TUV.
PLC output shall be voltage free contacts with contact rating, as given below. All output shall be short circuit proof and protected by indicator type fuse.
The number of Inputs/outputs per I/O card shall not exceed 32.
The output contact rating shall be as follows (Relay contact rating):

Sl. No.	Applicable for	Voltage Rating	Current Rating
1	All outputs for driving solenoid Valves and alarm annunciator system Unless otherwise specified.	Note 1	Note 1
2	All LT motors / p umps / compressor Outputs, unless otherwise specified	110 V DC	5.0 Ampere
3	All HT motors / pu mps / compressor (6.6 KV and above) output Unless otherwise specified.	110 V DC	5.0 Ampere

Note 1: For new units solenoid valves shall be 24 VDC, intrinsically safe. Suitable barrier is to be provided. For modification, expansion of existing units, interposing relay contact rating shall be 110 VDC, 1A inductive for driving solenoid valves.
The communication bus of I/O system with processor shall be redundant and shall hav e continuous check for any fault / error.
It shall be possible to replace I/O module while the system is in operation without affecting normal system operation.
The input interrogation voltage shall be 24 VDC.
TMR I/O cards shall be used for all inputs & output to solenoid valve & pumps for ESD. However in case of only status indication, which are not used in any interlock / alarm function, the 'Simplex' discrete card can be used.
For triplicate field transmitters / switches, three individual inputs (analog / Discrete) shall be assigned to three different (TMR) input cards and QMR accordingly.

For TMR PLC, the hot slot shall be provided for all the TMR I/O cards without I/O card installed in hot slot. For Simplex I/O cards, redundant I/O cards shall be provided in hot slot.

For QMR PLC redundant I/O cards shall be provided.

11.2.2. **Processor System**

The processor shall have capability to implement all the control functions required to implement as per the logic schemes indicated / package OEM's requirement.

The size of the memory shall be sufficient for storage of the program instructions required by the logic schemes. At least 50% spare memory capacity shall be available for program modification or addition at later date.

Memory shall be non-volatile. However in case volatile memory is provided, battery backup shall be provided with a minimum of 3 months lifetime to keep the program storage intact.
'Battery Low' information should be available in advance, at least one week before the battery gets drained. One potential free contact shall be made available for hardwired annunciation.

The processor system shall be Triple or quadruple modular redundant.

11.2.3. **PLC Engineering Console, Operator console**

The PLC Engineering Console terminal shall be capable for programming, program storing, fault diagnostics, monitoring, SOE storage etc.

Operator console shall be capable of monitoring logics, displaying, storing & printing SOE/alarm.

Both shall consist of a monitor having 24" size LCD / CRT screen, Minimum P-IV PC, DVD re-writer, keyboard and printer.

The Engineering terminals shall be tabletop type while PLC Operator console shall be similar to DCS OIS.
One programming terminal shall be provided for each process unit. In case of a common engineer's room for cluster of Process units, one common programming terminal shall be provided for programming of PLC for all the units of cluster.
Programming terminal shall have capability to identify, reject and give warning signal for any illegal entries.
Manual forcing of any input or output connected to PLC shall be possible by keyboard.

It shall be possible to print out the ladder / logic diagram on the dedicated PLC printer. In addition to it the printer shall also print the followings.

a. The diagnostic messages as and when generated and diagnostic reports, when called for.

b. Process alarms connected to the programmable logic controller as and when they appear or alarms will be stored in history.

c. The I/O maps showing status of all inputs and corresponding output in a user defined format.

11.2.4. **Interface with Distributed Control System**

The PLC shall be required to interface to the Process control System (DCS) for the following information/Function. Suitable hardware & software shall be provided.

a. Display of all input & output status and first out alarm generated by PLC.

b. Interface with DCS, to send/receive commands from the operator's console (DCS) for the operation of certain logic in PLC.

c. To display diagnostic messages of PLC.

The interface shall be redundant fault tolerant and the changeover shall be bu mpless. The interface unit shall be separate from controller and data acquisition subsystem.

11.2.5. **System Software**

The system software shall include all program s for the PLC and programming terminal system which are requir ed to perform all PLC functions, including communication and self-diagnostics.
Logic programmers (Software) shall be recorded on the floppy/compact disc or cassette tape shall be delivered along with the system.

The PLC programming language for implementation of logic operations shall be based on the following representations:

a. Logic diagram – Binary logic symbols such as AND, OR, NOT, Gates, Timers and flip-flop ;

b. Ladder diagram – Series parallel connection of relay contacts.

c. Cause & Effect matrix logic

Diagnostic package and its related hardware and software shall be supplied. Any other diagnostics package with advance feature is available the same shall be described with its feature and separate quote.

Software package for displaying I/O map showing status of inputs and corresponding output as per logic shall be offered. The I/O map format shall be users definable.

12.0 Auxiliary Hardware

Following auxiliary hardware shall be provided with the system

Logging Printer
One Colour laser jet logging printer shall be provided for each process unit. Logging printer shall provide following facilities:

a. Printing of hourly, shift and daily log

b. Shut down report printing.

Printer cover / Acoustic Box shall be provided to reduce printing noise.

Alarm and Event Printer
One black & white deskjet Alarm & event printer shall be provided for each process unit.

a. Alarm printer shall log the process and system alarm messages as and when they occur and alarm history for every shift of operation or on demand from operator console.
b. Print out shall show as a minimum the tag number, description, date and time of occurrence, time of acknowledgement and time of return to normal.
c. Event logging such as operator actions.

Noise boxes/acoustic covers shall be provided to reduce printing noise.

Log, Alarm or Event printers when shared by More than one OIS of the process unit it shall be possible to print page from any of those OIS.

Engineering Printer (A3 & A4 size Laser)
Engineering printer shall be used for printing the configuration made or changed, system alarms when appear. Also any residing data in Engineering console may be printed, on demand, by command from engineering console. Engineering printers shall be supplied separate for DCS & PLC programming Terminals. In common engineer's room at least one printer per each type of programming terminal shall be supplied. The network engineering printer shall be colour laser jet suitable for paper size upto A3 . The printer will have scan and fax functionality.

Hard Copy Unit (A3 size Colour Laser Printer)
Hard copy unit (colour laser printer) shall be used to print color copy of CRT screen page on demand from operator console / Engineering console. CRT page shall not be locked for more than 5 seconds while taking the video-copy. One hard copy units shall be supplied for each unit & shall be shared by all OIS in that unit.

Sequence/ Event Report (SER) Printer
Sequence of event printer shall be us ed for printing report & shall be connected to PLC through PLC Operator Console. This printer shall be black and white deskjet printer.

PLC (ESD) Engineering Station Printers (A4 size Laser)
These printer shall be used to print data residing in PLC engineering stations.

HMS Station Printer (A4 size Laser)
These printers shall be used to print data residing in HMS engineering station.

Alarm and Annunciation System:
Annunciation system is used to indicate and sound alarm for any process abnormality, trip / status change of Electric drive. Annunciation system shall be of modular design & programmable type. Electrical circuit is designed to read the change of state of discrete signal and generate the output to illuminate the window and give the alarm. The alarm can be silenced by acknowledge switch. Window light can be reset automatically or manually as desired, when the state of signal returns to the prior alarm state.
Annunciation system can be configured for any of sequences of ISA standard. There shall be a provision in circuit design to change the state of signal required to generate alarm (from Open to Close or vice versa) simply by changing the jumper position on circuit board.

Lamps in window shall be replaceable from the front.

Minimum 96 annunciator windows shall be supplied for each unit & shall be mounted on Aux. Console.

Hooter in general, shall be solid state type with audibility of the order of 100 dB at the distance of 3 meters.

An interruption of power supply up to 20 msec shall not affect the functioning of unit.

Auxiliary Consoles:

Auxiliary consoles shall be provided to mount assignable recorders, ESD switches, process override (bypass) switches etc. Outline dimensions and shape of console shall be similar to OIS consoles as it is installed adjacent with OIS.

In view of arrangement of operator consoles, any Corner/ Dummy consoles (if required) shall be included.

Furniture:

All required furniture to install the system sub components, like Tables for table top type PC, Key board, table & revolving chairs for operators etc. shall be included in scope of supply. Furniture shall be strong and shall have good aesthetic look. Chairs shall be of Godrej make. Minimum 10 nos. revolving chairs shall be supplied for the job.

13.0 Power Supply and Distribution:

The system shall normally operate on uninterrupted power supply unless otherwise specified. The system shall be designed to operate on power supply of following specification.

Voltage:	110V AC +/- 10%
Frequency:	50Hz + 3%
Harmonic contents:	Less than 5%
Static transfer time:	Max 5 millisecond

All DCS & PLC components located in the control room shall be provided with redundant power supplies & redundant feeders. Voltmeter & Ampere meter shall be provided for each incoming feeder.
In redundant configuration, individual bulk power supply shall not be loaded more than 40% under full load.

All cubicles lighting shall be on 240V, 50Hz normal reliable power supply.

Power distribution network shall be designed such that a single power fault in any instrument branch system shall not cause a trip of the entire system. Each consumer shall be provided with a separate double pole MCB of suitable rating for isolation and protection. Refer to dwg. No.B-6235-755 for power distribution scheme.

Power distribution board shall not be allowed to install in the field. S eparate power cable shall run from power distribution cabinet in CCR to individual instrument in the field.

Separate power distribution cabinets shall be provided for AC power distribution,24 VDC power distribution.110VDC power distribution for existing control room wherever 110 VDC power supply is used for Solenoid Valve or for other systems..

Transmitters in field are normally two wire type, however in case of any transmitter / field instrument needs separate 24 V DC power supply, it shall be powered from common DC distribution using individual power cable run, and double pole MCB for isolation. Separate battery bank & charger shall be provided for 24 VDC.

The distribution network shall be designed in such a way that overload in any branch shall not trip the main power supply.

14.0 Equipment Assembly:

14.1 General:

All hard wired instruments like indicators, recorders, annunciators and system back up instruments like manual loading station etc, when used, shall be mounted on the control panels or hard wired Aux. console. Control panel shall be considered only when mounting of Instruments on Aux. console is not feasible.

Sub components of the Instrument shall be located at the back of the panel. The control panel shall be freely accessible from front and/or back as required.

All the system cabinets and other blind panels shall be installed in Rack room. Minimum space of 1500 mm shall be kept between two rows of cabinets / Panels.

In general following cabinets shall be required.

a. Power distribution cabinets (for AC distribution and DC distribution)
b. Barrier, field termination assembly & Marshalling cabinets
c. Controller system cabinet.
a. Relay cabinets.
b. Other auxiliary card mounting cabinets.
c. PLC Processor cabinets.
d. PLC I/O system cabinet.

Separate set of above cabinets shall be provided for each unit.

All the cabinets and panels shall be completely wired. Interconnections shall be done preferably with pre-fabricated cables.

14.2 System Cabinets:

All the cabinets shall be of free standing, enclosed type and shall be designed for bottom entry for cable connection. Cabinet structure shall be sound and rigid and shall be provided with removable lifting lugs.

Cabinets shall be 'Rittal' make, fabricated from cold rolled steel (CRCA) sheet of minimum 3 mm thick suitably reinforced to prevent warping and buckling. Doors shall be fabricated from CRCA sheet of minimum 1.6 mm thick. Cabinets shall be thoroughly de-burred and all sharp edges shall be grounded smooth after fabrication.

Cabinet dimensions (Height (H) x Width (W) x Depth (D)) shall be maximum 2100 H X 600/800 /1200 W X 800 D. Construction shall be modular preferably to accommodate 19" standard electrical racks. Maximum swing out for pivoted card racks doors and drawers shall be limited to 600mm maximum.

Cabinet shall be equipped with front and rear access and doors. Doors shall be with lockable handles and concealed hinges. Hinges design shall be selected for easy door removal.
To have sufficient air circulation for removal of dissipated heat from the cabinets, vent louvers with screen shall be provided. If necessary, exhaust fans shall be provided on

top to the cabinet. Illumination shall be provided for all cabinets by florescent lamps with door operated switch.
Equipment, within the cabinet, shall be laid out in an accessible and logically segregated manner. Clamping rails shall be provided for incoming cables to prevent excessive stress on the individual terminal. All metal parts of the cabinet including doors shall be electrically continuous and shall be provided with a common grounding lug.

14.3 **Wiring for Cabinets & Control Panels**

Terminal blocks with spring terminal shall be provided in the racks for signal cable connections between field and system cabinets. Stack type / multi-tier terminal blocks shall not be used. Cable entries shall be from the bottom. Removable type gland plates shall be provided. Terminals shall be of Phoenix make or equivalent.

All internal wiring which terminate at the terminal blocks shall be identified by ferrule marker and shall be as per the document furnished by the CONTRACTOR / OEM.

All wiring from terminal to terminal shall be continuous, with no splicing. Termination shall be via flat pin/ring type or U type terminal lugs.

All of the field wiring connections shall be made on the same side of the terminal block and shall have separate ducts for field cables**.**

Each Cabinet / Panel shall have isolated ground buses to be used for system grounding and cable shields.

Wires for wiring within DCS/PLC panel have been classified to use different sizes and separate color code based on type of signal / power it carries. Following types are categorized.

AC Power	2.5 mm²
DC Power (24VDC/110 V DC) / Digital signal.	1.5 mm²
Thermocouple / Signal	0.75mm²
Grounding wire (Green)	2.5~10 mm²

Each class shall be separated in raceways or bundles and allocated separate terminal strips.
Prefabricated cables with mating connectors shall be used for interconnecting cabinets supplied by the DCS & PLC System OEM.
All framing and reinforcing members, wiring and devices located and mounted in the panel and/or rack shall not restrict access to any other device for removal or maintenance. All terminals shall be easily accessible. Any adjustment of equipment or terminal fastening/loosening shall be possible without use of special tools. All terminal and equipment shall be clearly identified by terminal No., tag number or nameplate.

Sufficient space shall be provided between rows of terminal blocks for bending the field cable and fanning out the leads for maintenance.

15.0 Earthing:

Each panel, cabinet, console and other equipment in control room shall be provided with an earthing lug. All these lugs shall be properly secured to the AC mains earthing bus.

Redundant earth pits & bus shall be provided for the system earth. Both earth pits shall be connected to form a ring.

All circuit grounds of electronic instruments, shields and drain wires of signal cables shall be connected to instrument ground bus which is electrically isolated from the AC m ains earthing bus. This bus shall be typically 25mm wide and 6 mm thick of copper.

The instrument ground bus is connected to independent instrument system ground buses through insulated wires.

Cable shields of thermocouple extension cables for grounded junction thermocouples shall not be grounded in the control room.

Separate earth pits shall be provided for system earth, shield earth, frame earth as per GTG ,DCS & PLC control system requirements.

Refer Drg. No:B-6235-775 for Typical Instrument Grounding Layout.

16.0 Miscellaneous Requirements:

16.1 **Transient, static & EMI protection**

All electrical equipment shall incorporate electrical transient protection on the power input & on all interfaces to inputs & outputs.

System shall withstand applied surges without damage to components or without operating errors according to requirements of IEEE C37.90.1, surge withstand capability.

All system components shall have electromagnetic interference (EMI) immunity as per SAMA OWNER 33.1.

PART – II

TESTING, INSTALLATION, COMMISSIONING AND ACCEPTANCE OF PLC SYSTEM

1. **Scope:**

1.1. This specification defines the basic guidelines to CONTRACTOR / DCS & PLC system OEM for factory testing and acceptance, installation. Commissioning and field acceptance of the fully integrated system.

1.2. These guidelines shall also be applicable to all subsystems and hardware bought by DCS & PLC OEM.

1.3. On the bas is of this specification, CONTRACTOR / OEM shall submit their own testing, installation, commissioning and acceptance procedures for hardware & software. Hard ware test procedures shall include purpose of test, test definition of input, testing method, results expected and acceptance criteria. For software, it shall include details of the method, list of tests, sequence of execution, results expected and acceptance criteria.

1.4. The testing and acceptance of the system shall be carried out on the mutually agreed procedures and criteria based on these specification and CONTRACTOR / OEM's standard procedures.

2. Factory Testing and Acceptance :

2.1 **General :**

2.1.1. CONTRACTOR / OEM shall test and demonstrate the functional integrity of the system hardware and software. No materiel or equipment shall be delivered until all required tests are successfully completed and certified 'Ready for Shipment' by the OWNER.

2.1.2. The OWNER reserves the right to be participant and satisfy himself at each and every stage of inspection. The OWNER shall be free to ask for any specific test to witness on any equipment it feels necessary, although not listed in this specification. The cost of performing all tests shall be borne by the CONTRACTOR / OEM.

2.1.3. CONTRACTOR / OEM to note that acceptance of any equipment or the exemption of inspection or testing shall in no way absolve the CONTRACTOR / OEM of the responsibility for de livering the equipment meeting all the requirements specified.

2.1.4. It shall be CONTRACTOR / OEM's responsibility to modify and / or replace any hardware and modify the software if th e specified f unctions are not completely achieved satisfactorily during testing and factory acceptance.

2.1.5. The schedule for the factory testing shall be included in the proposal by CONTRACTOR

2.1.6. Failure of components / module / sub-system: CONTRACTOR / OEM shall not replace any system component / module / sub-system unless it has failed. A log of failed components /modules in a sub-s ystem shall be m aintained which shall give description regarding the failed component / module, effect of failure on the su b-system, cause of failure and nu mber hours of operation b efore it failed.

2.1.7. If malfunction of a component / module in a sub-system repeat, the test shall terminate and CONTRACTOR / OEM shall repl ace the faulty component / module. Thereafter the test shall commence all over again. Even af ter this replacement, the sub-system fails to meet the requirements, CONTRACTOR / OEM shall replace the full sub-system to the one meeting the requirements and the system shall be tested all over again.

2.1.8. If a sub-system fails during the test and is not repaired and made successfully operational within four hours active repair time after the failure, the test shall be suspended and restarted all over again only after the CONTRACTOR / OEM has replaced the device in to the acceptable operation.

2.1.9. The inspection and factory acceptance shall be carried and in two phase s - Phase I and Phase II. The minimum requirements for testing are as follows :

2.2 Testing details

2.2.1. **Phase – I**

2.2.1.1 CONTRACTOR / OEM shall perform tests at his works to ensure that each component functions as per its respective specifications and the test. This in house testing report shall be submitted in detail to the OWNER for review within two weeks of testing is done. All sub-systems shall undergo a minimum of 30 days burning period.

2.2.1.2 The test log book shall contain the following information about the tests :

a. Date / time
b. Assembly designation / loop tag number.
c. Test input.
d. Test result and sign off with personnel name.
e. Action required (if deficiency is detected).
f. Action taken, date of completion and sign off.
g. Special test methods (including special equipment requirement, bypasses used etc).

2.2.1.3 Following tests that all be perfor med by the CONTRACTOR & D CS & P LC System OEM and report shall be forwarded to the OWNER.

- **Quality Control test :**

a. Quality control tests shall be carried out to assure quality of all components and modules in accordance with DCS & PLC System OEM's own quality control and assurance procedures. CONTRACTOR / OEM shall forward the details of these procedures for OWNER review.

b. The sampling procedures for all purchased components or components manufactured by the DCS & PLC System OEM for qual ity assurance tests shall be in accordance with relevant international standards.

c. All assemblies shall be aligned and adjusted and all test observations shall be recorded as manufacturers published set ups and testing methods.

- **System Pre-test: CONTRACTOR** / OEM shall check physically the workmanship of all sup ply parts including the system hardware prior to powering up the system and all other accessories. These shall be inspected externally and internally.

- **System Power – up test :** CONTRACTOR / OEM as a minimum shall check the fun ctions of all the system hardware and software including diagnostic software at sub-system level by simulating the inputs.

2.2.2. **Phase – II**

2.2.1.1. This test shall be performed systematically, for full functional test in total assembled condition of system, with the hardware and software. This test shall be performed in the presence of purchaser representative. All the sub-system shall also be connected to make it a total integrated system. The system shall be simulated for each function test. (CONTRACTOR / OEM purchased items e.g. programmable logic controller etc shall also be connected in the system. Barrier cabinets shall be used as the connecting points for test inputs and outputs.)

2.2.1.2. The duration of the testing shall be mentioned by the CONTRACTOR / OEM with reasons. System shall be shipped to site only after this testing and certified ready for shipment by OWNER.

2.2.1.3. Data review test :

a. OWNER shall perform a comparison of all current data. Any revision or changes required shall be informed to the CONTRACTOR.

b. The test report / logbook forwarded by CONTRACTOR / OEM after Phase I testing shall be reviewed. OWNER has right to witness any test performed in Phase I, if found necessary.

2.2.1.4. Testing record:

a. During testing of Phase II, each test carried out shall be recorded. Any deficiency or problem shall be clearly brought out and shall be corrected.

b. Any change in the data or configuration etc. informed to the CONTRACTOR / OEM shall be recorded and carried out by the CONTRACTOR / OEM.

2.2.1.5. Visual and mechanical testing: Visual and mechanical testing shall be carried out in principle to assure correct, proper, good and neat workmanship by the CONTRACTOR/OEM.

2.2.1.6. Functional testing: Functional testing shall include the simulation of each input and output to verify proper system response for both analog and discrete signals. The testing, as a minimum, shall include:

- Complete system configuration loading.
- Demonstration of all controller functions from local as well as from central level.(e.g. Changing of tuning constants, loop tuning, checking of algorithm functions, changing Algorithm, changing controller mode, changing controller action etc.)
- Checking of scan time values for controllers and data acquisition sub-system.
- Checking of loop configuration for correctness with respect to ranges, limits, alarm points, engineering units etc.
- Checking of all types of CRT displays including process and system displays on Operator and Engineering console.

- Checking of correct functioning of keyboard for Operator, Engineering and PLC console.

- Checking of CRT refresh rate, data base update and display call-up times.

- Checking in following details during takeover of the back-up units in case of main unit failure. This shall include:
  a. Uninterrupted controller operation shall be checked. The failed controller database, point record, input etc. should be transferred to the backup controller without any interruption. The same shall be repeated for transfer back from back up controller to the main controller card. Maximum transfer time shall not exceed the specified value. The test shall be repeated for controller cards.

  b. Uninterrupted auto and manual transfer of main communication bus and interfaces to the redundant ones shall be checked. Further, it shall be checked that the transfer back to main bus or interface should not be automatic. This test shall be performed for all interface units in the system.

  c. Uninterrupted operation of system should be checked on failure and resumption of the power supplies, where redundant floating power supplies are provided.

- System diagnostics shall be thoroughly checked for all sub-systems on local level as well as on operator/engineering console. These include failure of a sub -system, module, power supply, interface unit; failure of transfer to redundant module on main module failure etc and other detailed diagnostic displays. Diagnostic alarms for any ventilation fan failure shall also be checked.

- Testing of proper functioning of all printers and hard copy units.

- Testing of system features like interchangeability between CRTs of a console, synchronization of system clocks, selective tuning from Engineering console, key-lock functions etc.

- Checking of various log formats, shut down reports, I/O mapping and other MIS formats printing.

- Checking of shut down and interlocks configuration and proper operation thoroughly.

- System operation and power supply specifications as specified.

- Checking of operation of all interfaces with the system like interface with PLC, computer, analyzer system etc as specified.

- Checking of bus-degradation while loading the bus from 10% to 100%.

- Simulation of power failure and restarts.

- Checking of all hardwired instrumentation including all alarm cards,

alarms annunciator system, switches and other indicating instruments.

- The CONTRACTOR/OEM shall notify the OWNER at least three weeks prior to final system testing is planned. In the event of arrival of representatives, if the system is not ready state for testing, the CONTRACTOR/OEM will be liable for back charges for any extra time and expenses incurred.

3. Installation Testing and Commissioning :

3.1 CONTRACTOR / OEM shall offer the services of the installation team which would install the equipment in the control room, lay the interconnecting cabling inside the control room, check, test and commission the system.

3.2 All technical personnel assigned to the site by the CONTRACTOR / OEM shall be fully conversant with the supplied system and software package, and shall have both hardware and software capability to bring the system on line quickly and efficiently with a minimum of interference with other concurrent construction and commissioning activities.

3.3 CONTRACTOR/ OEM's responsibility at site shall include all activities necessary to be performed to complete the job as per specifications including.

a. Receipt of hardware/software and checking of completeness of supplies.

b. Installations of the system including free supply equipment and field cable termination in the system.

c. Checking of the equipment installation.

d. Checking of interconnection, hardware and software configuration, overall system functioning etc.

e. Loop checking.

f. Liaison with DCS & PLC System OEM's home office.

g. Field-tests.

h. Commissioning and on-line debugging of the system.

i. Performance of final acceptance test (SAT).

3.4 Loop checking :

3.4.1. Loop check shall be carried out by the CONTRACTOR/ OEM including checking the interconnection configuration and overall system functioning.

3.4.2. DCS & PLC System OEM's scope of work in loop checking shall include checking termination of field cables in the control room; checking of interconnection between instrument / equipment in the control room; ferruling, tagging of interconnecting cables in control room, and assisting in performing overall loop performance check.

3.4.3. Loop checking shall be carried out to check the functional performance of all elements comprisingthe loop and thereby enduring proper configuration, functioning and interconnection.

3.4.4. DCS & PLC System OEM shall assist/co-ordinate with the CONTRACTOR for smooth and proper loop checking. Any discrepancy found during checking shall be brought to the notice of Engineer-in-charge. All loop checking shall be performed in his or his authorized representative's presence. All readings shall

be recorded on a suitable format and shall be submitted for approval.

3.4.5. All the components in the loop shall be checked for proper functioning.

A. All field instruments connected to control room shall be checked at 0%, 25% , 75%, and 100% of FS (for both increasing and decreasing signals) and the mode of generating signal from the field shall be as follows (Refer Table-A 'Mode of Simulation') for different type of instrument .

B. Receiver alarm cards shall be checked for different settings on both increasing and decreasing signals.

C. Shutdown schemes shall be check ed for p roper functioning, configuration actuation.

D. Performance of individual loop may be accepted, for an overall accuracy of +1.0 unless otherwise specified. Where deviation exists, recalibration of instruments, based on scope of work, shall be carried out either by CONTRACTOR / OEM.

E. Signal from controllers / shutdown scheme control valves / shutdown valves shall be checked the respective valves. The stroke checking including checking of time of operation of control valves shutdown valves also forms a part of loop checking.

F. After loop checking is completed. CONTRACTOR/ OEM shall connect back all terminals and connections removed for loop checking.

Table – A (Mode of Simulation)

No.	Instrument Type	Mode of generating Signals
A	Differential pressure/flow instrument, DP type level	By applying impulse signal to transmitter through squeeze bulb or regulator in field.
B	Pressure instruments.	Pressure signals by using instrument air, regulator and standard gage or using portable hydro pump and standard gauge.
C	External displacer type	Chamber shall be filled with water for different levels and specific gravity correction shall be applied.
D	Other type of tank level instruments.	By lifting the float for 0%, 100% Of range.
E	Temperature loops with thermocouple (With checking of burnout	Appropriate mV signals shall be fed at thermocouple head.
F	Temperature loops with RTD. (With checking of burnout condition)	Appropriate Resistance signal shall be fed to RTD head.
G	Field switches for alarm and shutdown	Abnormality shall be simulated by Connecting & disconnecting the wires at field instrument end.
h	OWNER supplied items.	As per Engineer-in charge instructions.
i	Special instruments and any other type of instruments.	As per Engineer-in charge instructions.

3.4. **Field Testing:**

3.4.1 All the equipment shall be checked thoroughly after its receipt at site. The tests, as a minimum shall include:

a. Visual and mechanical testing.

b. Complete system configuration loading.

c. Demonstration of all system functions.

d. Checking of loop configuration.

e. Checking of all CRT displays.

f. Checking of correct functioning of all keyboards.

g. Demonstration of all system diagnostics.

h. Checking of correct changeover of redundant devices.

i. Checking of bus-degradation.

j. Checking of proper functioning of all printers and hard copy units, sample printing o f all type of log reports shutdown reports and MIS reports.

k. Checking of all disc drives, historical trending points, alarm summary and alarm history.

l. Complete checking of shutdown system.

m. Complete checking of hard-wired instruments.

n. Demonstrations of proper operation of system at specified power supply specifications.

4. Final acceptance test (Site Acceptance Test) :

The OWNER will take over the system from the CONTRACTOR / OEM after the final acceptance test, which is defined as successful uninterrupted operation of the integrated system for three weeks for all units of the plant. CONTRACTOR / OEM's personnel shall be present during the test. Any malfunctioning of the system components shall be replaced / repaired as required. Once the system failure is detected, the acceptance test shall start all over again from the beginning. The warranty period commences from the day of successful completion of Guarantee Test Run of the unit.

5. Testing / Calibration of equipment :

CONTRACTOR / OEM shall make available all consumables, instruments and equipments necessary for testing, calibration, maintenance etc, as defined in scope of works. All instruments and equipment used for the above purpose shall be of standard make with accuracy better than the accuracy expected from the calibrated / tested instruments, and certified by National Physical Laboratory or other equivalent agencies. These instruments / equipment are necessary only during testing / calibration / maintenance.

Two standard engineering tool kits with all the required test instruments / accessories such as continuity tester, multi meter (Fluke make or better), 4-20mA simulator, field bus calibrators / testers, shall be supplied.

PART – III

GENERAL REQUIREMENTS OF DCS and PLC SYSTEM

1. **Scope :**

1.1. This specification defines the general requirements expected to be fully complied by the DCS & PLC System OEM including logistic supports, documentation, warranty, maintenance contract and shipping instruction etc.

1.2. The requirements defined in this specification shall also be applicable for all sub-systems and hardware bought and supplied by DCS / PLC System / OEM from manufacturers other than his own.

2. Logistic Support Services

2.1. Training

2.1.1. The requirements of structured training for OWNER personnel (as specified below consisting of hardware / software maintenance engineers) in the operation of equipment, hardware maintenance, software maintenance, operational software and diagnostic programs, are set forth herein.

- Hardware & Software Maintenance training
  - 20 Man weeks for DCS at DCS OEM's works.
  - 6 man weeks for PLC at PLC OEM's works.
  - 6 man weeks for GTG at GTG OEM's works

- Operation training
  - 15 Man weeks for GTG & DCS at GTG & DCS OEM's works

- Site Training
  - Operation/Maintenance: 30 working days.

2.1.2. CONTRACTOR / OEM shall furnish details of course outlines, manuals for training. The outline of each course shall give the subject matter, a short resume of the pre-requisite subjects (if applicable), the position of the course in the training program etc. In order that the selected trainees shall have, time to participate in the course sufficient, advance notice of minimum 8 weeks shall be given by the CONTRACTOR / OEM. The course outlines shall be submitted 10 weeks ahead for review.

2.1.3. **GTG, DCS & PLC Hardware and Software Maintenance Training**

2.1.3.1 GTG, DCS & PLC System OEM shall conduct a course in hardware (module level and optional component level) maintenance, software maintenance and diagnostics of the system for OWNER at OEM's facility. The course shall be conducted prior to the factory system performance tests so that trained personnel can participate effectively in the final testing.

2.1.3.2 The hardware maintenance-training course shall cover every equipment item supplied as part of the Gas turbine controller, Distributed Control System & PLC system. This course shall include :

a. Actual operation, detection and correction of faults in equipment.
b. Familiarization with maintenance procedures for the system offered.

2.1.3.3 Some of the topics covered in the course shall include :

a. Fundamentals of the system
b. Equipment logic diagrams
c. Diagnostic procedures
d. Peripherals maintenance
e. Preventive maintenance procedures.

2.1.3.4 Software maintenance training shall cover all software supplied with the system. The trained personnel shall be able to write and debug the application and system software.

2.1.3.5 The DCS & PLC system OEM is required to quote man-hour rates for in-house and on-site training separately for additional training, if required by the OWNER.

2.2. Spare Parts support :

2.2.1. The GTG, DCS & PLC System OEM shall warrant that spare parts for the system would be available for a minimum of fifteen years. The spare parts support certificate shall be signed by a corporate level person of the OEM.

2.2.2. After this period, if OEM discontinues the production of spare parts, OEM shall give at least twenty four (24) months notice prior to such discontinuation so that the OWNER may order his requirements of his requirements of spares in one lot.

3. Documentation :

GTG, DCS & PLC System OEM shall furnish all the manuals necessary to test, operate and maintain GTG, DCS & PLC System hardware and software

3.1. **System Manuals:**

3.1.1 Hardware Manuals : System Hardware manuals shall be submitted for assuring satisfactory operation and maintenance of the system. Detailed literature for installation and maintenance of all hardware, start up procedures shall be provided. Detail specifications & literature for all bought out items.

3.1.2 Software Manuals: Software manuals shall be supplied for system software, other programs used as supporting software, bought out software etc. Software reference manuals, programming manuals shall also be supplied.

SIX copies of hardware & software manuals shall be submitted.

3.2. **Engineering Drawings :** The CONTRACTOR / OEM shall provide a complete set of engineering drawings/ documents for the OWNER / record. The set shall include following drawings/document as a minimum.

- System Configuration diagram
- Bill of material with part numbers
- System loading, power consumption & heat dissipation calculations
- Hardware specifications & general arrangement drawings
- Software specifications
- I/O assignment
- Internal wiring diagrams
- Complex control schemes
- Functional schemes
- Graphics, logging & report formats
- Instrument loop drawings
- Inspection & test reports

CONTRACTOR / OEM shall develop loop sketches containing full information of each loop. (one drawing per loop) including field termination, junction box details, cable numbering, rack number, bus address code, device address code, power supply connections, final actuating device details includ ing positioner and air supply etc. and furnish these before the installation of system.

All field modifications shall be carefully recorded by the CO NTRACTOR / OEM's commissioning personnel and changes shall be incorporated into final drawings. Twelve hard copies & three soft copies of each drawing, catalogues shall be submitted.

4. Warranty :

4.1. CONTRACTOR / OEM shall be fully responsible for the manufacture in respect of proper design, quality workmanship and operation of all the equipment, accessories etc supplied by CONTRACTOR / OEM for a period of 15 months from the date of taking over by the OWNER at the site as mentioned in this specification or 36 months from the mechanical completion date whichever is earlier.

4.2. It shall be obligatory on the part of CONTRACTOR / OEM to modify and/or replace any hardware and modify the operating, application and diagnostic software free of cost, in case any malfunctions is revealed even during on line operation after taking over within the warranty period.

4.3. CONTRACTOR / OEM shall also provide the total maintenance of the system during warranty period.

4.4. In addition to above, CONTRACTOR shall submit a proposal from Stack Analysers and GTG, DCS & PLC OEM for comprehensive Post warranty AMC of Five (5) years operation & maintenance of complete system with year wise breakup (This shall also cover all the bought out items supplied by Stack Analysers and GTG, DCS & PLC System OEM.) along with spares. Brief requirements of the maintenance contract are mentioned below.

- In the event of any malfunction of the system hardware/software, experienced service engineer shall be made available at the site within 24 hours on the receipt of such information from the OWNER.
- The contract shall include supply of maintenance spares, tools & tackles as required, travel, boarding & lodging of service engineer.
- The Post warranty maintenance **CONTRACTOR** shall cover following services also:

- Preventive maintenance

Once in a year, involving complete overhaul of the system, inspection of hardware and software, fault prediction, inspection of power supply quality, environmental & operating condition checks, calibration checks major repairs/replacements and detailed reporting.

- Periodic maintenance

Site visits, minimum four times in a year, inspection of general healthiness of the system, study and advice on daily maintenance, inspection of hardware & software, if any problem is reported, running of test programs on-line servicing and solving reported problems. Complete checks for hardware and software shall be conducted for all OEM supplied systems like: GTG ,DCS /PLC. The stack emission monitoring analysers shall be calibrated using standard calibration gas mixtures. The sampling system shall also be checked.

Shutdown Visit: During annual shutdown of the plant OEM engineer shall visit and carryout all the checks required. These visits shall not be part of periodic/preventive maintenance visit

- Software Maintenance

Maintain existing software to improve and utilize existing application and improve performance of the system. Minor modification of the software shall also be covered under this scope. Upgrade of OS and OEM application package.

- Emergency service

The OEM engineer shall report within 24 hours of first intimation through telephone / email / fax. Any failure shall be on system suppliers account. The engineer must report at site within 24 hours of report of failure, with necessary spares. The system must be brought back in operation within 24 hours after reporting at site. The number of such visits shall be maximum 15 per year.

- Spare Maintenance Contract (SMC):

All the cards will be stocked at site or at the nearest convenient location from the site depending on the criticality. In case of usage of any of the card, that will be back charged to the owner. In case of failure the card with the SMC but not stocked /supplied shall be provided.

Note: Stack emission analysers and GTG,DCS & PLC System OEM to note that Owner's engineers may associate / participate with system engineers for On-job training, when any activity is carried out under Post warranty maintenance contract.

ATTACHMENT -I

Specification for Server grade computer (Reputed makes such as IBM / DELL/ HP)
The **minimum** specifications of the computers should be the following:

Redundant power supply
Redundant hard disk (SCSI)
RAID –1 controller
Dual Channel 10/100 Ethernet card.
One hot spare hard disk (SCSI)
DVD Drive – CDRW drive
Floppy Drive – 3.5", 1.44Mb
External Hard drive : 200 GB

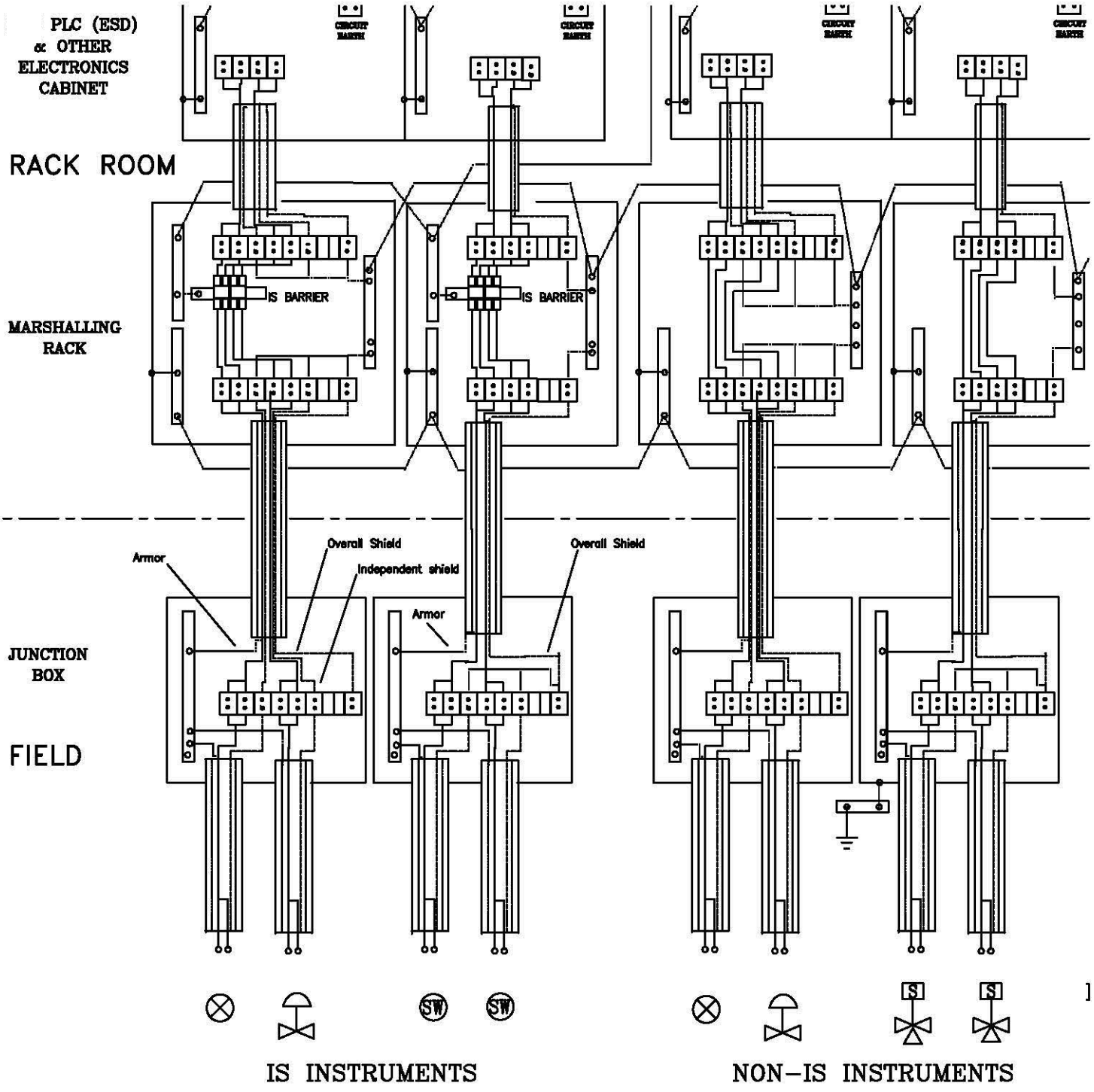
In addition to above, following requirements are also to be taken care,

CPU	: Latest configuration (Pentium - IV @ 1.2 GHz Or better)
Memory(RAM)	: 512 MB minimum
Cache	: 1 MB (min)
HDD capacity	: >40 GB
Cooling Fans with dust filters	: Yes

Mechanical & environmental specifications

Temperature	: 0-50 Deg C, operating
Humidity	: 60±5%,temp.27±3degC,noncondensing.
Vibration	: 5 to 17 Hz, 0.1" double amplitude displacement ; 17 to 500 Hz, 1.5G acceleration.
Shock (Operation)	: 10G acceleration peak (11 msec duration)
Safety	: UL approved
EMI	: FCC/VDE class A
CE compliant	: YES
Safety	: UL/CSA/TUV approved
Monitor	: Full color, Non Interlaced, 24".

ATTACHMENT-2
GROUNDING AND POWER DISTRIBUTION SCHEME



Note:-

1) If Vendor requires the independent system earth for equipments, the another system earth shall be provided.
2) Redundant earth pits & bus shall be provided for the system earth. Both earth pits shall be connected to form a ring.
3) Stancions, cable duct/tray shall be connected to earth bar at the field.

Legend:-

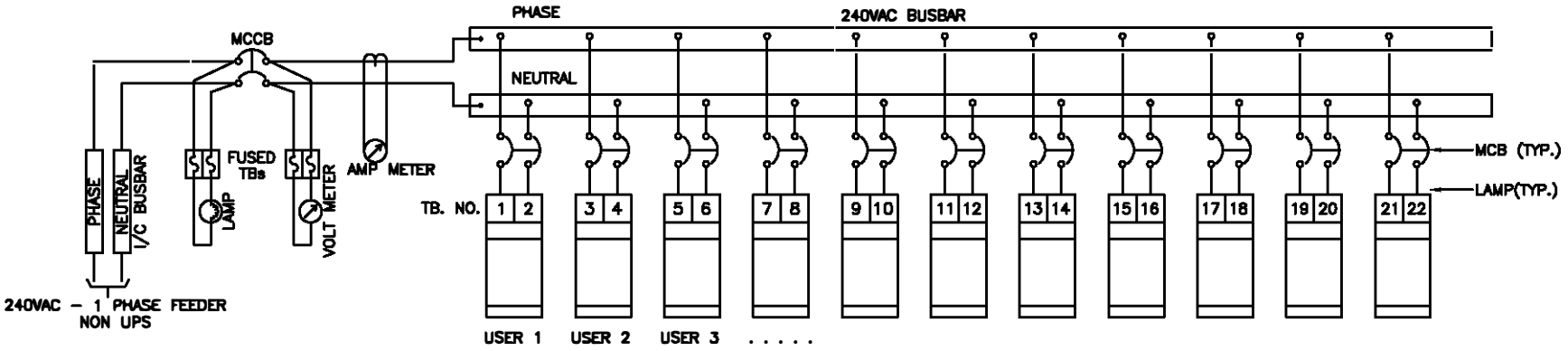
———— GROUNDING WIRE

---------- SHIELD OF CABLE

TYPICAL

8-6235-755
SHEET 1 OF 4

240VAC GENERAL POWER SUPPLY DIST. SCHEME



NOTES:

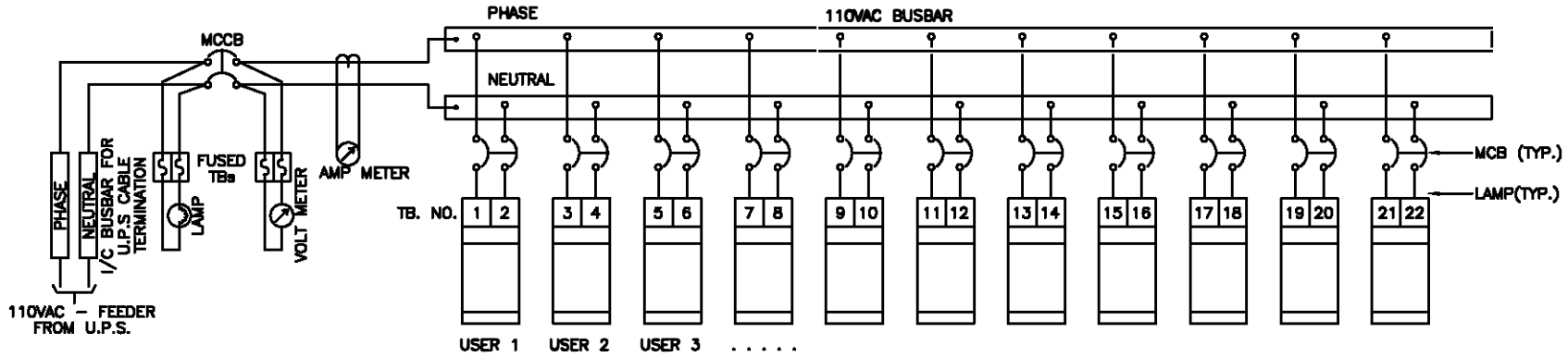
1) RATINGS OF MCCB/MCB'S TO BE DECIDED BASED ON LOAD REQUIREMENT.

2) CABLE SIZE,TERMINAL SIZE TO BE DECIDED BASED ON LOAD

CLIENT	INDIAN OIL CORPORATION LTD. VADODARA GUJARAT
	PROJECT : GT 6
TITLE	INSTRUMENT POWER SUPPLY DIAGRAM
SCALE NTS	DWG.NO. B–6235–755
	2/4 REV. 1

ATTACHMENT-2
GROUNDING AND POWER DISTRIBUTION SCHEME

110VAC UPS POWER DIST. SCHEME(FOR FIELD INST.)



NOTES:

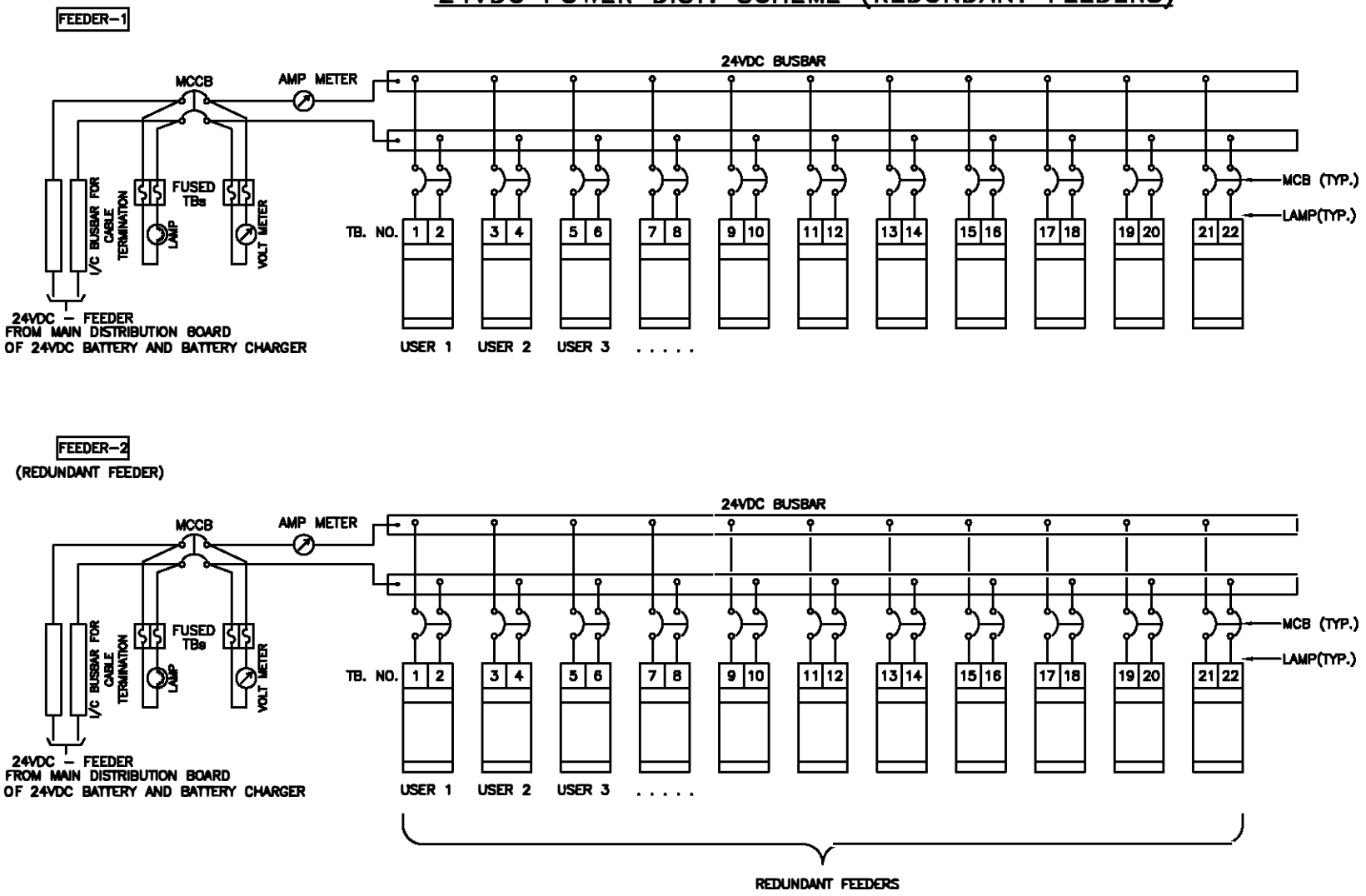
1) RATINGS OF MCCB/MCB'S TO BE DECIDED BASED ON LOAD REQUIREMENT.

2) CABLE SIZE,TERMINAL SIZE TO BE DECIDED BASED ON LOAD

CLIENT	INDIAN OIL CORPORATION LTD. VADODARA GUJARAT
	PROJECT : GT 6
TITLE	INSTRUMENT POWER SUPPLY DIAGRAM 3/4
SCALE NTS	DWG.NO. B-6235-755 REV. 1

ATTACHMENT-2
GROUNDING AND POWER DISTRIBUTION SCHEME

24VDC POWER DIST. SCHEME (REDUNDANT FEEDERS)



NOTES:

1) RATINGS OF MCCB/MCB'S TO BE DECIDED BASED ON LOAD REQUIREMENT.

2) CABLE SIZE,TERMINAL SIZE TO BE DECIDED BASED ON LOAD

CLIENT: INDIAN OIL CORPORATION LTD. VADODARA GUJARAT

PROJECT : GT 6

TITLE: INSTRUMENT POWER SUPPLY DIAGRAM

4/4

SCALE NTS | DWG.NO. 8-6235-755 | REV. 1

Annexure-2

TITLE: VENDOR LIST FOR TMR/QMR PLCs(BOUGHT OUT ITEMS)

REVISION : 00	APPROVED BY : D.P.MAJAKAR		
	PREPARED	CHECKED	DATE
	K.SHRIRAM	VIVEK KUMAR YADAV	10-04-2013

REVISION HISTORY

Revision Number	DATE	NATURE OF CHANGE	REASON	PREPARED BY	CHECKED BY	APPROVED BY
0	10-04-2013	FIRST ISSUE				

INTERPOSING RELAYS:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	OMRON	G2-R2SND	RELAY SHALL HAVE ATLEAST 2 CHANGE OVER CONTACTS.
2.	JYOTI	RE-302	

PANEL MAKE FOR PLC AND ASSOCIATED MARSHALLING, PDBs and HARDWIRED CONSOLES:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	RITTAL		

CABLES-HIGH VOLTAGE (XLPE):-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	CABLE CORPORATION OF INDIA		
2.	FORT GLOSTER IND LTD		
3.	INDUSTRIAL CABLES (I) LTD		
4.	RPG CABLES LTD		
5.	NICCO CORPORATION LTD		
6.	TORRENT CABLE LTD		
7.	UNIFLEX CABLES LTD		
8.	UNIVERSAL CABLES LTD		
9.	POLYCAB WIRES PVT		

CABLES-MEDIUM VOLTAGE POWER (PVC):-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	ASSOCIATED FLEXIBLES & WIRES PVT LTD		
2.	CABLE CORPORATION OF INDIA		
3.	FINOLEX CABLES LTD		
4.	FORT GLOSTER IND LTD		
5.	INDUSTRIAL CABLES (I) LTD		
6.	KEI INDUSTRIES LTD		
7.	NICCO CORPORATION LTD		
8.	OMEGA CABLES LTD		
9.	RADIANT CABLES LTD		
10.	TORRENT CABLES LTD		
11.	UNIVERSAL CABLES LTD		
12.	INCAB INDUSTRIES LTD (PUNE)		
13.	POLYCAB WIRES PVT LTD		

CONTROL CABLES (PVC):-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	ASSOCIATED CABLE PVT LTD		
2.	ASSOCIATED FLEXIBLES & WIRES P LTD		
3.	NETCO CABLE INDUTRIES PVT LTD		
4.	CABLE CORPORATION OF INDIA		
5.	CMI LTD		
6.	DELTON CABLES LTD		
7.	FINOLEX CABLES LTD		
8.	FORT GLOSTER IND LTD		
9.	INDUSTRIAL CABLES (I) LTD		
10.	KEI INDIA LTD		
11.	NICCO CORPORATION LTD		
12.	OMEGA CABLE LTD		
13.	RADIANT CABLES LTD		
14.	RELIANCE ENGINEERS LTD		
15.	TORRENT CABLES LTD		
16.	UNIVERSAL CABLES LTD		
17.	SATELLITE CABLES (P) LTD		
18.	SUYOG ELECTRICALS		
19.	INCAB INDUSTRIES LTD (PUNE)		

SWITCH FUSE UNIT:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	CONTROLS & SWITCHGEAR		
2.	ABB		
3.	INDO ASIAN FUSE GEAR		
4.	L&T		
5.	SCHNEIDER ELECTRIC		
6.	SIEMENS.		

FUSES:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	CONTROLS & SWITCHGEAR		
2.	GE POWER CONTROL		
3.	BUSMANN		
4.	FERRAZ		
5.	ABB		
6.	SCHNEIDER ELECTRIC		
7.	SIEMENS		
8.	INDO ASIAN FUSE GEAR		
9.	L&T		

TIMERS:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	Bhartia Industries		
2.	Concord Controls		
3.	Electronic Automation		
4.	L&T		
5.	SIEMENS		

ELECTRONIC METERS:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	Alstom		
2.	Automatic Electric		
3.	IMP Power		
4.	MECO Instruments		
5.	Rishabh Instruments		

PUSH BUTTONS AND LAMPS:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	Concord Controls		
2.	L&T		
3.	RAAS Controls		
4.	Siemens		
5.	Teknic Controls		
6.	Vaishno Electricals.		

MCBs:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	Havell's India		
2.	Indo Asian Fuse gear		
3.	MDS Switchgear		
4.	Standard Electricals		

TEMPERATURE ELEMENT FOR CABINETS:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	ALTOP INDUSTRIES		
2.	DETRIV INSTRUMENTS & ELECTRONICS LTD		
3.	GENRAL INSTRUMENTS CONSORTIUM		
4.	TEMP-TECH		
5.	PYROTECH		

BARRIERS:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	PEPPER-L + FUCHS		
2.	MTL (5000 SERIES)		

ALARM ANNUNCIATION:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	APLAB LTD		
2.	DIGICONT		
3.	IDECIZUMI		
4.	IIC		
5.	E.C.I.L		
6.	PROCON INST. (P) LTD		
7.	ICS TRIPLEX		
8.	ROCHESTER INST		
9.	RONAV ENGG CO		

TERMINAL BLOCKS:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	ELMEX		
2.	PHOENIX		
3.	WAGO		

BULK POWER SUPPLIES:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	PHOENIX		
2.	COSEL		
3.	APLAB		
4.	SIEMENS		
5.	NONEYWELL		
6.	EMERSON SOLA HD		

SYSTEM POWER SUPPLIES:-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	VENDOR TO PROVIDE TUV APPROVED SYSTEM POWER SUPPLIES.		

AUTO TRANSFER SWITCH (FOR 110 V AC):-

Sl.No.	VENDOR NAME	TYPE	REMARKS
1.	APC		
2.	APLAB		
3.	DB POWER		
4.	DELTA		
5.	EMERSON LIEBERT		
6.	HIREL		

Annexure-3

IOCL-RELIABILITY STUDY RECOMMENDATIONS

INDEX

Chapter – 11

INSTRUMENTATION POWER DISTRIBUTION SYSTEM

11- A RECOMMENDATIONS

For any instrumentation system the reliability of its power distribution system is very important. The power distribution system shall be adequately designed for a system with respect to its capacity and redundancy. The system / practices recommended for adoption in instrumentation power distribution system at refineries are given below. These recommendations have been arrived from failure analysis in the past and experienced gathered from day to day operation / OEM / Specialists.

11.1 **Two separate AC distribution boards (Dual ACDB), fed from parallel redundant UPS are desirable for instrumentation power distribution system for the improved reliability of instrumentation system.** ~~***(Refer Schematic- 11C- 1A).***~~ ~~**However, if the installation of additional ACDB is not feasible because of space constraints in the control room, or any other reasons, then** ***Schematic- 11C- 1B*** **may be implemented.**~~

11.2 The* UPS *supply shall not be used for the utility supplies like cooling fans, lighting power sockets in the consoles / panels / cabinets / Local Control Panels, etc. A separate non-UPS supply shall be used for the same.

11.3 A summery (common) alarm of all critical UPS alarms shall necessarily be provided in the DCS / hardware annunciation in the control room or any manned location.

11.4 Only copper cables and tin-plated copper lugs are preferable for Instrumentation power distribution system i.e. from ACDB/ DCDB to down stream distribution systems.

11.5 ~~UPS Battery back up should be available for a minimum period of 60 min, at full load condition. The same to be ens ured during capacity discharge test of the ba ttery bank during planned shut down.~~

11.6 Protection coordination with respect to the fuse/MCB ratings from the suppl y source ACDB / DCDB to the dow nstream distribution panels should be as per the recommendation of the OEM / supplier of the system. However, if such recommendation is not available, a joint review by an identified group of electrica l and instrumentation people shall be carried out to ensured the same.

11.7 ***Power supply to all critical devices like, PLC, DCS, operator console etc. shall be drawn through individual feeders and not by "looping in" or "looping out" from a common source*** ~~***(Refer Schematic- 11C- 2).***~~

11.8 It is desirable to segregate the DC power supply source, for instrumentation emergency shut down syst em, from emergency lighting system.

11.9 ***Minimum two numbers of Bulk Power Supplies (BPS) shall be configured for powering all critical instrumentation systems***. ~~**(Refer Schematic- 11C- 1A & 1B)**~~

11.10 ***Such redundant BPS shall be fed from two separate AC feeders. Power looping in and looping out shall be avoided / eliminated.*** ~~***(Refer Schematic- 11C- 1A & 1B).***~~

11.11 ***The loading of individual BPS should be such that the failure of single BPS shall not result in loading of the other operating / redundant BPS beyond 70% of their individual rated capacity.***

11.12 "BPS failure" *alarm* shall be provided in hardw are annunciation system and in DCS with highest priority.

11.13 **Auxiliary power supply to the individual flame scanners to be sourced from separate locations.**

11.14 **Elemination of unw anted fuses & use of proper fuses in power distribution to be ensured.**

11.15 **Unit wise segregation of power supply distribution to facilitate necessary maintenance during individual unit shut down to be ensured.**

11.16 **Use of multiple set of BPS (Bulk Power Supply) of smaller capacity in place of single set of higher capacity per unit shall be considered.**

11.17 **Proper segregation of data bus / prefab cables & power cables below false floor shall be ensured.**

Chapter – 12

FAULT-TOLERANT AND REDUNDANT EMERGENCY SHUT DOWN SYSTEM

12A RECOMMENDATIONS

It is very important to design an emergency shut down system (ESD) for reliability (availability) as well as safety. The safety as pect is imp ortant for process control but so is the economic impact of a spur ious or nuisance trip of an ESD. Reliability or availabili ty does not mean that a system remains on-line in an unsafe mode, but it means that a system can remain on-line, tolerating one or more failures and still be capable of producing the appropriate outputs for safe shut down until the failures are detected and repaired. A well-designed inst rumentation system for critical control applicati ons shall have a balance of safety and reliability by considering appropriate voting philos ophy, adequate failure analysis and self-diagnostic features in the input s ensors, logic controllers, and the final control elements. The fo llowing are the recommendations for design considerations. ~~Detailed ex planation to these recommendations marked as (◄) has been enclosed at Section 12B of this chapter.~~

12.1 ***Redundancy philosophy in ESD system should be implemented at all levels for the critical loops (process inputs, logic solvers (PLC) and out puts) to achieve both, safety and reliability***. ◄

12.2 For emergency shut down syst em, all the input signals for the existing critical loops should be analog (taken from transmitters rather than from switches), exc ept for those signals where the OEM does not recommend it. ~~However , the same shall be followed in totality for the new projects.~~ ◄

12.3 ***The emergency shut down system shall be implemented in a dedicated PLC and the regulatory control / monitoring in the controller sub-system of DCS***. ◄

12.4 ***The transfer of data between the logic solver and the controller sub-systems through soft link (that is, transfer of data between PLC and DCS controller and vis-à-vis) should only be used for monitoring purpose and not for control and trip, unless recommended by licensors / statutory bodies like TUV etc.***

12.5 The "Common Mode Failures" shall be eliminated or minimized. **(**The common mode failure is the failure of multiple equipments in a system, because of failure of single equipment).

12.6 An effective alarm system with sequence of event recording shall be configured considering the process requirements and also human factor.

12.7 Input signal voting shall be configured for all the tripping interlocks.

12.8 All the inputs and outputs related to a trip circuit shall be configured in the SOE with comprehensive description.

12.9 Emergency shutdown push buttons for all the electrical drives shall be connected directly to the MCC and not through PLC

Chapter – 13

PROCESS MONITORING AND ALARM MANAGEMENT SYSTEM

13A RECOMMENDATIONS

The latest DCS of our refineries have powerful features of process monitoring and alarm management with respect to the safety and reliability of a process plant. All such features of the DCS must be optimally exploited to the best of their capability for an un-interrupted and safe operation of process plants. Following are the recommendations for process monitoring and alarm management system. ~~Detailed explanation to these recommendations marked as (◄) has been enclosed at Section-13B of this chapter.~~

13.1 The number of process alarms shall be optimized. ◄

13.2 Process alarms shall be judiciously prioritized (emergency / high / low etc.) on the basis their criticality.

13.3 ***Important events if not configured in the "DCS alarm management system", may result in plant interruption without generating an opportunity of taking the corrective actions. ~~Few important parameters which are normally not incorporated in the DCS alarm management system and need to be configured in the DCS of the near by control room are enclosed (ref 13-B). This is typical list of alarms, however, such type of critical events may be configured in the existing alarm management system.~~*** ◄

13.4 The descriptor of the alarms shall be configured in simple language, especially for the alarms which are non-related to process plants like "BPS failure", "UPS trouble" etc. ◄

13.5 Process monitoring and control

To strengthen monitoring of critical equipments, it is desirable to configure the following critical status / parameters in the existing graphics or in the form of additional graphics in the DCS:

- Prevailing status (Auto / Manual) of the critical controllers.
- Prevailing status (Auto / Manual) of the critical drives.
- FOCUS (high light) on non selection of "Desired" mode for critical drives and controllers.
- RUN status of the critical drives.
- "Manual Bypass" selection.
- "RUNNING HOUR" indication for critical drives.

13.6 Process control

The operators change the process set points and the controller outputs through "keyboard" of the operator's console. It has been experienced that, the improper punching of digits through the "Keyboard" lead to undesirable consequence and, and even plant interruptions. To avoid such incidents, ***all critical loops should be configured for "Output tolerance alarm" and "Set Point Tolerance alarm***". This feature will generate an alarm when an operator changes "Set point" or "output" beyond the pre-defined tolerance percentage.

13.7 Structured review of prevailing process alarm may be carried out on regular basis.

INTERFACE:

13.8 To avoid confusions related to electrical / mechanical interface, it is recommended to built additional graphics or to modify the existing related graphics, showing the stat us of the critical commands. For example, if the start command of a compressor is generated from the output card of the system (D CS / PLC), the spare contact (if available) of the respective out put relay may be configured in a separate input point to facilitate to monitor the status of the command in the graphics.

13.9 In some of our instal lations (like PR), PLC consoles are installed to understand the status of the "L ogic flow" of the respect syste m. Through these consoles one can monitor and identify the point, for which the logic is stuck up. However, for the other installation PL C console is not available, but the PLC-DCS communication is available for data transfer. In such installations, drive wise a meaningful group of tags may be configured in the DCS to understand the problem of the respec tive drive with re spect to the interlock.

Chapter – 15

INSTRUMENTATION EARTHING SYSTEM

15A *RECOMMENDATIONS*

The earthing system in the instru ment control and communication, plays an important role for re liable operation of DCS / PLC systems. The inadequacy in this system may gener ate spurious tripping signals for the plants without generating a comprehensive alarms. Major failures of DCS / PLC hardware have been experienced due to non-availability of an effective earthing system. The following actions are desir able for the reliability of the instrumentation earthing system. D~~etailed explanat ion to these recommendations marked as (◄) has been enclosed at Section 15B of this chapter~~

15.1 ***A single earth pit shall not be used for any system. Instead, an Earth-grid (earth-pit network) shall be made of minimum two numbers of earth pits connected in parallel. (Number of earth pits required for an earth-grid will depend on the permissible earth-resistance specified by the respective system manufacturer). Suitable distance shall be maintained between various earth pits (minimum 3 meters) as per guidelines of API RP550***. ◄

15.2 Separate earth-pit networks is des irable for various instrumentation sub-systems like DCS / P LC earth, cable-screen earth, chassis earth, power earth etc. so that the problem in one system is not affecting the other system. ◄

15.3 Unit wise dedicated of earth-p it network is desirable for the Mark –IV / V systems, air compressor control systems etc. for higher reliability and ease of shut down maintenan ce of these earth-pit networks. (~~Refer Schematic- 15C.1, 15C.2 & 15C.3~~)◄

15.4 Earth-pit head must be covered properly, and clearly visible identification tags are in place as indicated in the system documents.

15.5 ***Periodic checks of each earth pit shall be carried out and maintenance record must be kept.***

15.6 ***The earthing cables from the earth*-pit to the respective systems shall be insulated and use of bare cable / strips shall be avoided. Such cable shall be laid aw ay from power cables etc.**

Chapter – 17

FIELD INSTRUMENTATION

17A RECOMMENDATIONS

On the basis of the study of our previous failures, some critical issues are considered for further improvement, which is furnishe d below for implement ation in the in-house projects and als o for phase-wise implementation in the existing systems as far as possible. Some recommendations are furnished below for implementation. ~~Detailed explanation to t hese recommendations marked as (◄) has been enclosed at Section 17B of this chapter.~~

17.1 SOLENOID OPERATED VALVES (SOV)

The Solenoid valv es are non-redundant and probably the most critical element of an emergency shut down system. Failure of SOV leads to plant interruption in most of the cases. Following is recommended for the reliability improvement of this critical device.

17.1.1 In case of UPS supply (110V ac) is used for SOV, an isolation transformer (1:1) is desirable to be used for powering the SOV, to arrest any “earth fault” generated in the field devices (SOV).

17.1.2 The supply voltage of the SOV (for DC supply) shall be monitored on-line in DCS with trending and alarm configuration. This is to ensure that the voltage is not exceeding the recommended coil voltage. ◄

17.1.3 Considering the criticality of this device (SOV), it is recommended to procure SOV from reputed manufactures only.

Annexure-4

SCOPE OF SUPPLY

Rev: 00	APPROVED BY : D.P.MAJAKAR			
	PREPARED BY	CHECKED	ISSUED	DATE
	BSS	VKY	CE-ENGG	10/04/2013

REVISION HISTORY SHEET

REV No.	DATE	NATURE OF CHANGE	REASON	PREPARED BY	CHECKED BY	APPROVED BY
00	10/04/2013	FIRST ISSUE	---	BSS	VKY	DPM

1. DOCUMENTS TO BE FOLLOWED FOR OFFER

1.1 Technical Specification for PLC (QMR/TMR)
Document No. CE/415/BOP/0930/00, REV-00.

1.2. PLC Input/Output Count Estimation
Document No. CE/415/BOP/930/05, Annexure-5 (Rev00)

2. SCOPE OF SUPPLY

FOR HRSG BMS PLC

SL. NO.	DESCRIPTION	QTY	UNIT PRICE	
A).	**HRSG BMS PLC SYSTEM**			
1	HRSG Burner Management system (BMS) PLC system(comprising of all required hardware and software), including interconnection cables /prefab cables/network cables/lugs/cable glands/laying /termination/cross ferruling(as required at site) / Start-up and commissioning spares ,etc.	1 Set		
2	Marshalling cabinets including HART compatible Barriers and isolators for Analog input, DI Barriers/Proximity convertor, DO barriers Interposing Relays for input/output, PDB etc.	1 Set		
3	Hardwired Console with Lamps and Push Buttons, , including Alarm Facia ,interconnection cables /prefab cables/network cables/lugs/cable glands/laying /termination/cross ferulling,etc.(as required at site) of HRSG BMS/ESD PLC.	1 Set		
4	Erection Supervision & complete commissioning of HRSG BMS PLC system on Lump sum basis considering multiple site visits, manpower deployment boarding, lodging, travelling ,local transport and any other associated expenditure as per clause 14 of PLC Specification, Doc. No.CE/415/BoP/0930/00, REV-00.			
5	HRSG BMS PLC Recommended Spares for 2 years Operation as per PLC Specification page 21 of 23, Clause 17, Doc.No. CE/415/BoP/0930/00, REV-00	1 Set		
6	Any other items & services (not covered elsewhere) required to complete the Erection supervision & Commissioning, FAT, SAT, ISAT and handing over to customer (IOCL).			
7	Post Warranty Maintenance Contract (AMC) charges at IOCL Vadodara site for Complete HRSG BMS/ESD PLC on Lump sum basis for a period of 5 years per annum basis.			
8	Software licenses & Engg. Tools (latest version) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00 (For HRSG BMS).	1 Set		

9	Documentation (Hardware & software) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00			
10	PLC Inter panel wiring scheme/schedule & termination details as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00			
11.	Interconnecting cables/prefab cables/cable glands/lugs/network components/accessories /other associated items, etc. – Quantity/Type (For HRSG BMS)			
12.	Application software as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00			

FOR BOP ESD PLC

SL. NO.	DESCRIPTION	QTY	UNIT PRICE	
B).	**BOP ESD PLC SYSTEM**			
1	BOP ESD PLC system(comprising of all required hardware and software), including interconnection cables /prefab cables/network cables/lugs/cable glands/laying /termination/cross ferruling(as required at site) / Start-up and commissioning spares ,etc.	1 Set		
2	Marshalling cabinets including HART compatible Barriers and isolators for Analog input, DI Barriers/Proximity convertor, DO barriers Interposing Relays for input/output, PDB etc.	1 Set		
3	Hardwired Console with Lamps and Push Buttons, , including Alarm Facia ,interconnection cables /prefab cables/network cables/lugs/cable glands/laying /termination/cross ferulling,etc.(as required at site) of HRSG BMS/ESD PLC.	1 Set		
4	Erection Supervision & complete commissioning of BOP ESD PLC system on Lump sum basis considering multiple site visits, manpower deployment boarding, lodging, travelling ,local transport and any other associated expenditure as per clause 14 of PLC Specification, Doc. No.CE/415/BoP/0930/00, REV-00.			
5	BOP BMS PLC Recommended Spares for 2 years Operation as per PLC Specification page 21 of 23, Clause 17, Doc.No. CE/415/BoP/0930/00, REV-00	1 Set		
6	Any other items & services (not covered elsewhere) required to complete the Erection supervision & Commissioning, FAT, SAT, ISAT and handing over to customer (IOCL).			
7	Post Warranty Maintenance Contract (AMC) charges at IOCL Vadodara site for Complete BOP ESD PLC on Lump sum basis for a period of 5 years per annum basis.			
8	Software licenses & Engg. Tools (latest version) as per PLC Specification Doc.No.			

	CE/415/BoP/0930/00, REV-00 (For BOP ESD).			
9	Documentation (Hardware & software) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00			
10	PLC Inter panel wiring scheme/schedule & termination details as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00			
11	Interconnecting cables/prefab cables/cable glands/lugs/network components/accessories /other associated items, etc. – Quantity/Type (For BOP ESD)			
12	Application software as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00			
13	PLC Engineering consoles 24" and PC (Minimum Raid-5) including all required software/OS/network cables and accessories, etc (as required at site) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00 (FOR ENTIRE PLC SYSTEM)	1 Set		
14	PLC OPERATOR consoles 24" and PC (Minimum Raid-5) including all required software/OS/network cables and accessories, etc (as required at site) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00 (FOR ENTIRE PLC SYSTEM)	1 Set		
15	PLC SOE STATION console 24" and PC (Minimum Raid-5) including all required software/OS/network cables and accessories, etc (as required at site) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00 (FOR ENTIRE PLC SYSTEM)	1 Set		
16	PLC Laptop / Notebook Computer 15.6" Display, Intel Core i5 Processor, minimum 2.26GHz, 3MB L3, 320GB HDD, 3 GB RAM, DVD Writer including all required software/OS/network cables and accessories, etc (as required at site) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00 (FOR ENTIRE PLC SYSTEM)	1 Set		
17	BLACK AND WHITE LASER PRINTER (A3) including all required software/OS/network cables and accessories/, etc (as required at site) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00 (FOR ENTIRE PLC SYSTEM)	1 Set		
18	COLOUR LASER PRINTER (A3) including all required software/OS/network cables and accessories, etc (as required at site) as per PLC Specification Doc.No. CE/415/BoP/0930/00, REV-00 (FOR ENTIRE PLC SYSTEM)	1 Set		
19	Mandatory Spares (Item break-up shall be submitted) as per PLC Specification, page 13 of 23 Clause 10.10, Doc.No. CE/415/BoP/0930/00, REV-00	1 Set		
20	Training as per PLC Specification Clause 16. 0, Page 21 of 23 Doc.No. CE/415/BoP/0930/00, REV-00			

Points to be considered by the bidder while submitting offer ;

1. Technical Specifications for PLC (QMR/TMR) Doc. CE/415/BOP/0930/00 Rev 00, PLC Input/Output Count Doc. No. CE/415/BOP/0930/05 Rev00, Annexure – 5 Rev -00, and scope of supply Doc.No. CE/415/BoP/0930/04 Rev 00 and ensure compliance.
2. Panel Hardware shall be of stainless steel make.
3. Design documentation like Master Drg. List , Overall General Arrangement (OGA) , GA, Schematic drgs., for both hardware and software, wiring schedule, QAP/Test Protocol, Progress report of ordered package etc. will have to be furnished by the successful bidder for purchaser review prior to manufacturing.
4. Any other items, services etc. required to complete the E&C, FAT, SAT, ISAT and handing over to customer (IOCL) shall be in bidder scope.
5. Detailed earthing documents shall be furnished on placement of order for approval from the purchaser.
6. Progress of Engg. & manufacturing of PLC (ESD/BMS) will be reviewed periodically by BHEL/IOCL at vendor works or other locations as needed.
7. FAT will be witnessed by BHEL/IOCL at vendor's works as per PLC Specification Doc. CE/415/BOP/0930/00 Rev 00.
8. All system panels and marshalling panels will conform to IP32.
9. Provision to be made in hardware and software estimation for configuration of additional 5% of field Inputs/Outputs as contingency, over and above the Inputs/Outputs covered in the PLC Input/Output Count Doc. No. CE/415/BOP/0930/05 Rev00, Annexure – 5 Rev -00.
10. Unit rates for various items as per Annexure-1.

ANNEXURE-1

UNIT RATES:-

Sl No.	Description	Unit Price
1.	FAN RACK WITH FAN AND MONITORING CIRCUIT.	
2.	POWER SUPPLY MONITORING CIRCUIT.	
3.	ALL TYPES OF MCBs.	
4.	ALL TYPES OF RACKS.	
5.	ALL TYPES OF ANALOG INPUT MODULE.	
6.	ALL TYPES OF DIGITAL INPUT MODULE.	
7.	ALL TYPES OF DIGITAL OUTPUT MODULE.	
8.	ALL TYPES OF FIELD TERMINATION ASSEMBLY.	
9.	PLC CONTROLLER.	
10.	ALL TYPES OF POWER SUPPLY UNIT & POWER SUPPLY CARD/MODULE.	
11.	ALL TYPES OF RELAYS.	
12.	ALL TYPES OF BARRIERS.	
13.	ALL TYPES OF TERMINAL BLOCKS.	
14.	ALL TYPES OF PREFAB CABLES.	
15.	ALL TYPES OF FUSES.	
16.	ALL TYPES OF COMMUNICATION MODULES.	
17.	Power Distribution Board (PDB).	
18.	ALL APPLICABLE LICENSES.	
19.	ALL TYPES OF LAMPS.	
20.	ALL TYPES OF PUSH BUTTONS.	
21.	CABINET AIR FILTER	
22.	CONSOLE	
23.	EMPTY CUBICLE 800 (W)x800(D)x 2100 mm(H) (RITTAL make only with IP-32 class) EMPTY CUBICLE 1200 (W)x 800(D) x 2100 mm(H)(RITTAL make only with IP-32 class)	
24.	PLC Engineering/Operator/SOE station consoles 24” and PC (Minimum Raid-5)	
25.	Network switch	
26.	ALARM FACIA	

NOTE: - Under each category of above (ANNEXURE-1) items, vendors are requested to ensure furnishing of unit prices of no. of varieties, as applicable to the proposed system in accordance with the PLC Specification Doc. CE/415/BOP/0930/00 Rev 00

Annexure-5

HRSG BMS PLC						
Sl No.	**CATEGORIES**	**BASE COUNT**	**INSTALLED SPARE 20%**	**OVERALL COUNT**	**BARRIER COUNT**	**RELAY COUNT**
1	AI (WITH BARRIER)	15	3	18	18	
2	AI (WITHOUT BARRIER)	0	0	0	0	
3	DI (WITH BARRIER)	215	43	258	258	
4	DI (WITH RELAY)	0	0	0		0
5	DI (FROM DCS - P.F)	62	13	75		
6	DI (FROM BoP PLC - P.F)	15	3	18		
7	DI (FROM MARK VIe - P.F)	5	1	6		
8	DI (FROM HWC - P.F)	4	1	5		
9	DO (WITH BARRIER)	155	31	186	186	
10	DO (WITH RELAY)	16	4	20		20
11	DO (TO DCS - P.F)	12	3	15		
12	DO (TO BoP PLC - P.F))	12	3	15		
13	DO (TO MARK Vie - P.F)	0	0	0		
14	DO (TO HWC FOR WINDOWS- P.F))	29	6	35		
15	DO (TO HWC FOR INDICATIONS- P.F))	10	2	12		
16	SOFT SIGNALS (TO DCS)	1950	390	2340		

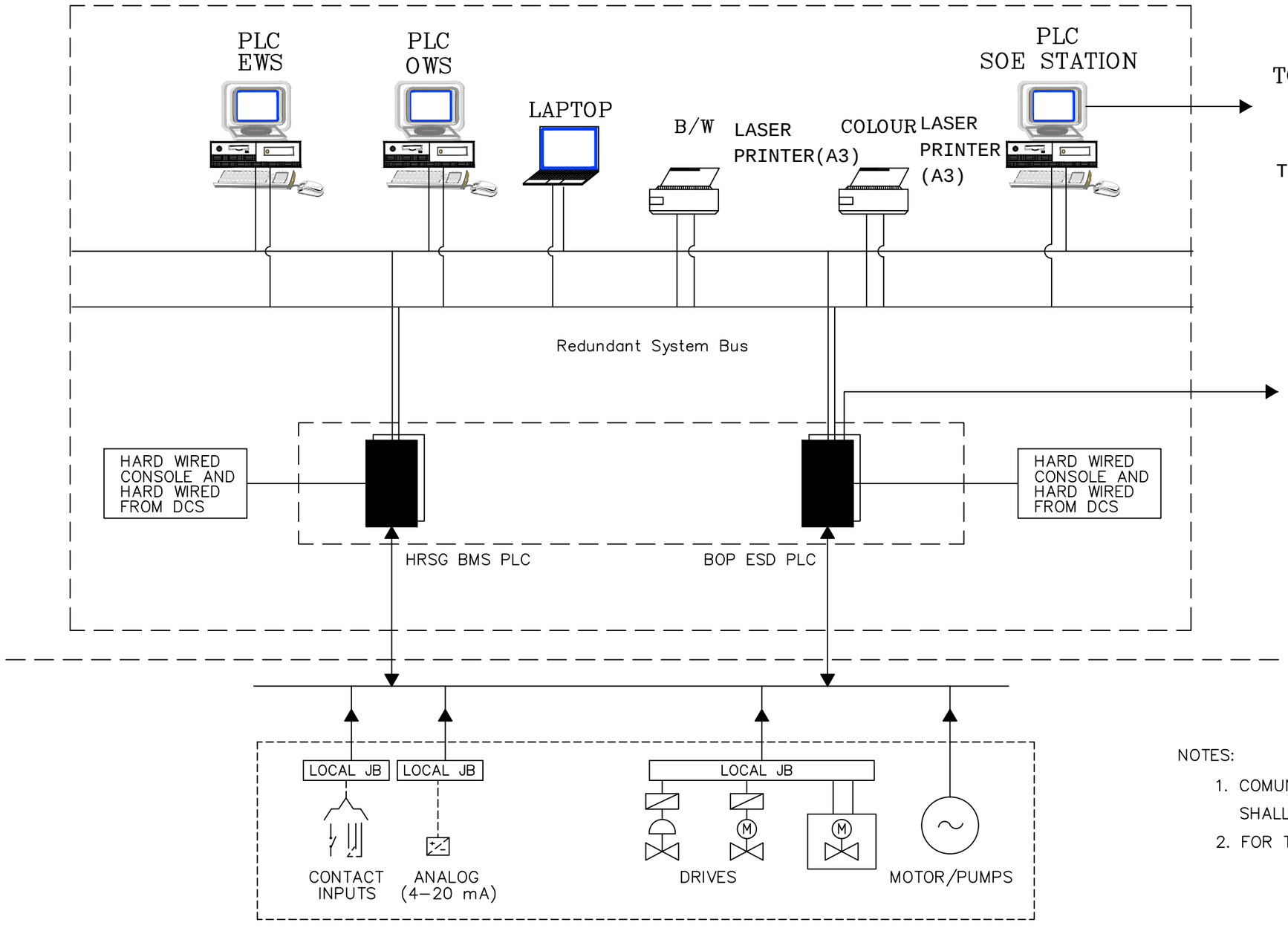
TYPE OF PUSH BUTTONS,LAMPS,HWC ITEMS ETC SHALL BE PROVIDED DURING DETAILED ENGINEERING.

HRSG BOP PLC						
Sl No.	**CATEGORIES**	**BASE COUNT**	**INSTALLED SPARE 20%**	**OVERALL COUNT**	**BARRIER COUNT**	**RELAY COUNT**
1	AI (WITH BARRIER)	33	7	40	40	
2	AI (WITHOUT BARRIER)	132	27	159		
3	DI (WITH BARRIER)	35	7	42	42	
4	DI (WITH RELAY)	352	71	423		423
5	DI (FROM DCS - P.F)	182	37	219		
6	DI (FROM BMS PLC - P.F)	12	3	15		
7	DI (FROM MARK VIe - P.F)	5	1	6		
8	DI (FROM HWC - P.F)	176	36	212		
9	DO (WITH BARRIER)	15	3	18	18	
10	DO (WITH RELAY)	201	41	242		242
11	DO (TO DCS - P.F)	12	3	15		
12	DO (TO BMS PLC - P.F))	15	3	18		
13	DO (TO PACKAGES)	12	3	15		
14	DO (TO MARK Vie - P.F)	5	1	6		
15	DO (TO HWC FOR WINDOWS- P.F))	39	8	47		
16	WINDOWS FOR DCS	35 NOS OF WINDOWS ARE NEEDED FOR DCS WITH TERMINATIONS				
17	DO (TO HWC FOR INDICATIONS- P.F))	180	36	216		
18	SOFT SIGNALS (TO DCS)	3900	780	4680		

TYPE OF PUSH BUTTONS,LAMPS,HWC ITEMS ETC SHALL BE PROVIDED DURING DETAILED ENGINEERING.

Annexure-6

SYSTEM CONFIGURATION DIAGRAM



NOTES:

1. COMUNICATION BETWEEN DCS AND PLCs SHALL BE VIA MODBUS SERIAL 485
2. FOR TENDER PURPOSE

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED

	NAME	SIGN	DATE
DRAWN	PA		10.04.13
CHECKED	KS		10.04.13
APPROVED	DPM		10.04.13

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

DEPT. ENGG | CODE 415

TITLE: NETWORK CONFIGURATION DIAGRAM

No. OF SHEETS 01 | SHEET No. 01

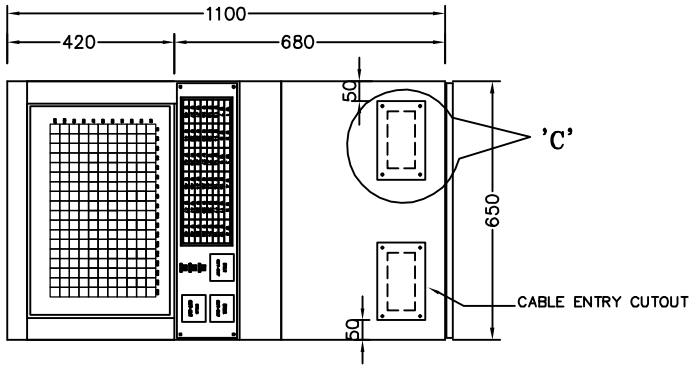
WBS. No. | DRG. No. | REV

REF. DRG. No. | SIGN. & DATE | INVENTORY No.

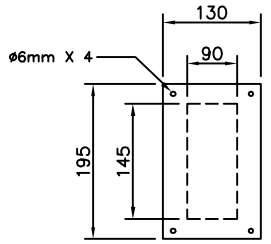
FOR TENDER PURPOSE ONLY.

THE PHYSICAL DIMENSIONS OF THE CONSOLES AND NUMBERS SHALL BE FINALISED DURING DETAILED ENGINEERING.

ANY CHANGE IN HARDWARE CONSOLE DESIGN/DISTRIBUTION IS TO BE INCORPORATED BY THE VENDOR WITHOUT PRICE IMPLICATION.

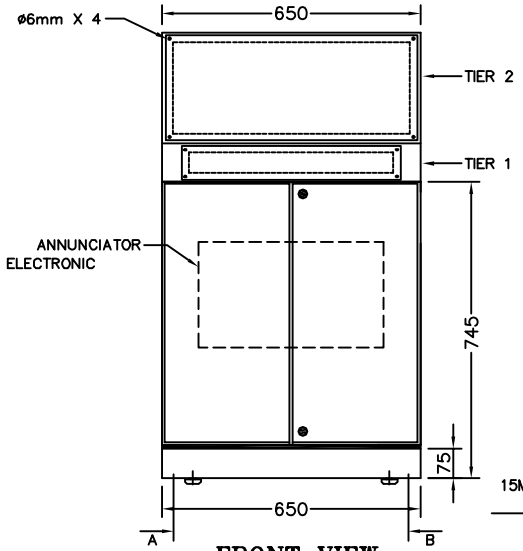


TOP VIEW

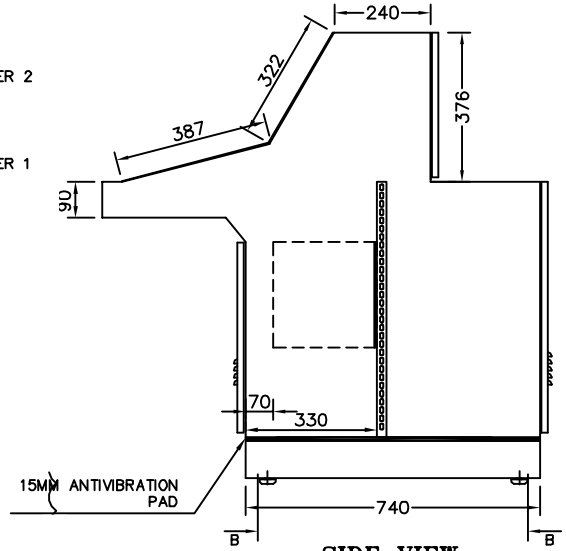


DETAILS OF 'C'

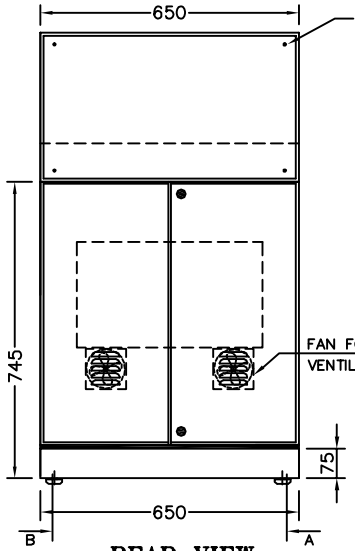
VENDOR TO CONSIDER SPACE FOR MOUNTING OF EWLI. DETAILS SHALL BE PROVIDED DURING DETAILED ENGINEERING.



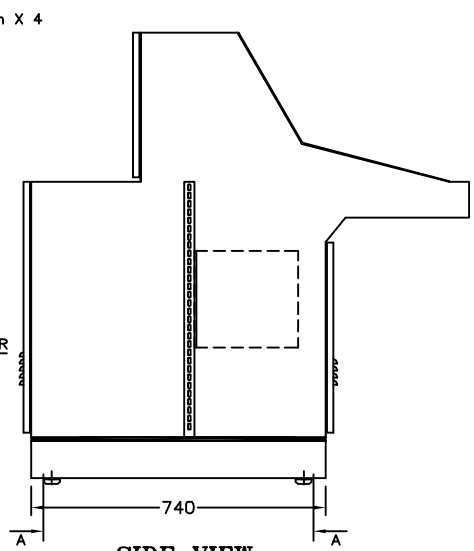
FRONT VIEW



SIDE VIEW
SECTION B-B



REAR VIEW



SIDE VIEW
SECTION A-A

TYPICAL HARD WIRED CONSOLE DESIGN

VENDOR TO ENGINEER THE HWC TO MATCH FURNITURE SUPPLIED BY DCS VENDOR DURING DETAILED ENGINEERING.