PROJECT :- MAITREE 2X660 MW

CUSTOMER :- BIFPCL

CONSULTANT :- FITCHNER GERMANY

CONTRACTOR :- BHEL

PURCHASE SPECIFICATION
FOR
STEAM & WATER ANALYSIS SYSTEM

C O P

REVISIONS :

APPROVED

(Punit P Singh)

PREPARED	ISSUED	DATE
PRK	416	17-05-2019

CONTENTS

SECTION- A

GENERAL INSTRUCTIONS TO BIDDERS:

All required documents against this Tender/Specification shall be submitted in English only.

Introduction: Bidders are required to offer SWAS to be used in Power Plant applications.

In order to accept the Technical offers / proposals from Bidders for the project mentioned in this Specification (refer Sections C, D, E, F, G, H & I), certain Pre-qualification criteria are required to be met by Bidder.

Pre-qualification requirements are clearly mentioned in AA of Section-B of this Specification. Bidder to read the same carefully and submit the details/documents required for BHEL's acceptance.

In case Bidder does not include the details or meet the requirements of Pre-qualification requirements, their offer will be summarily rejected and Bidder's Technical offers will not be evaluated.

Evaluation methodology: BHEL shall initially open Bidder's PQR documents as per Section-B of this specification for review & acceptance. Only after acceptance of PQR documents, BHEL shall open Bidder's technical offers for evaluation. Technically acceptable vendors will be proposed to customer / End user for vendor approval. Commercial bids of only accepted/approved vendors by End users/Customers, shall be considered by BHEL for further processing.

Bidders are required to submit offers as detailed below:

A. Documents pertaining to Pre-Qualification requirements for Clause AA of Section-B along with point-wise compliance to be uploaded as Part-I Bid.

B. Technical offers/proposals for the Project, whose requirements are mentioned in Sections C &D to be submitted along with point-wise compliance and uploaded as Part-II Bid.

Note 1:-Whenever required during evaluation of PQR and Technical offers/bids, vendor is required to be present at BHEL Electronic Division, Bangalore, for discussions. Further in the event of order, during approval of the Vendor documents by End users/Customers, Vendor shall accompany BHEL representative for discussions.
Note 2:- Technical clarifications w.r.t specifications (if any) shall be discussed with only those vendors who quote for this tender. Bidder shall furnish Clause-wise compliance / deviation list along with the offer, which is mandatory for evaluating the offer. The deviations to be clearly mentioned in the offer and acceptance of these deviations will be subject to customer approval. If Bidder incurs any additional cost for the withdrawal of any deviation, the same shall be borne by the bidder without any cost implication to BHEL.

SECTION- B

AA. Pre-Qualification Requirements (PQR) of Bidders for SWAS:

1. "Bidder shall have successfully completed design, engineering, procurement, manufacturing, shop testing, erection and commissioning of SWAS, which had guaranteed and trouble free performance has been proven at least for 2 (Two) years as on date 22.09.2015, in a Powerplant of min. 500 MW and above". To qualify to this point, bidder to submit the performance certificate from the End users.
2. Original Equipment (Sample Handling System) Manufacturers based outside India, who are making offer for this tender shall have authorized representatives in India for support related to Documentation, Erection, Commissioning & post commissioning services. The Indian representative should have the team of experienced service engineers on payroll. Not Applicable for Indian SHS Manufacturers.
3. For bidder/OEM/System Integrator offering upgraded / latest models of various analysers, PQR of equivalent previous model is acceptable subject to meeting PQR indicated in the above clause AA.1.

   In such cases OEM shall certify that offered model is upgraded version of previous model. Confirmation from bidder/OEM/System Integrator is required.
4. Analysers / SHS OEM shall furnish an undertaking that in case of change in Indian representative / agent / System Integrator, OEM shall continue to support supplies made by previous representatives/agents / System Integrator w.r.t to field service and supply of spare parts.
5. In case Customer/End user does not accept the offered makes of analysers, bidders offers will be acceptable only if they agree to supply Analysers of customer approved make of Analysers without any commercial implications to BHEL.

Note:

1. BHEL shall submit credentials/details furnished by Bidder (SHS/System Integrator) vendor with their offers to customer and await customer's decision for a maximum of 15 days from the date of proposal. If approval is not received within above period, BHEL shall treat the offer as "Not Meeting PQ" criteria and offer shall be rejected.
2. In case Bidder does not submit details mentioned in above clauses (AA) or meet the requirements of Pre-qualification requirements (AA), Offers will be summarily rejected and Bidder's Technical offers/proposals will not be evaluated. Please read carefully the GENERAL INSTRUCTIONS in Section A of this specifications.

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SCOPE OF SUPPLY

SECTION - C

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SCOPE OF SUPPLY FOR MAITREE 2X660 MW

SL NO	ITEM DESCRIPTION	UNITS	QTY PER SET	TOTAL QTY
1	**SAMPLE HANDLING SYSTEM -**			
a	PRIMARY RACKS	NO.	2	4
b	WET PANEL - ENCLOSED WALKWAY THROUGH TYPE PANEL	NO.	1	2
c	DRY PANEL	NO.	1	2
d	CHILLER UNIT - 2x100% REDUNDANT - Min. 5 TR rating (With 25% extra Capacity)	NO.	1	2
2	**ANALYSERS - SWAS Package (Ref Instrument Sch CE/416/MAITREE/SWAS/ANALYSER and SWAS Scheme Ref. Maitree-01-CF-FS-123110-PEM-05 for Service details) - MICROPROCESSOR BASED WITH DIGITAL COMMUNICATION FACILITY RS485 on Modbus protocol shall be provided to all the Analysers.**			
a	CONDUCTIVITY(SPECIFIC, CATION) ANALYSER - SINGLE CHANNEL	NOS.	14	27
b	CONDUCTIVITY(SPECIFIC) ANALYSER FOR HOTWELL - SINGLE CHANNEL	NOS.	4	8
c	pH ANALYSER- SINGLE CHANNEL	NOS.	12	24
d	pH ANALYSER- SINGLE CHANNEL at CW pump discharge header - This is not covered in SWAS Scheme, however This Analyser Transmitter shall be mounted in Dry panel and a secondary Cooler shall be considered in Wet panel for this service.	NOS.	1	2
e	DISSOLVED OXYGEN ANALYSER- SINGLE CHANNEL	NOS.	4	8
f	SODIUM ANALYSER(MULTI CHANNEL- 3 CHANNEL INCLUDING SPARE CHANNEL)	NOS.	1	2
g	SILICA ANALYSER (MULTI CHANNEL- 4 CHANNEL INCLUDING SPARE CHANNEL)	NOS.	2	4
h	FREE RESIDUAL CHLORINE ANALYSER (SINGLE CHANNEL) - This is not covered in SWAS Scheme, however This Analyser shall be mounted in Dry panel and a secondary Cooler shall be considered in Wet panel for this service.	NOS.	2	2
3	**ANALYSERS - RODM Package (All Analysers shall be supplied with suitable individual mounting accessories and Individual Mounting racks) (Ref Instrument Sch CE/416/MAITREE/RODM/ANALYSER for Service details) - MICROPROCESSOR BASED WITH DIGITAL COMMUNICATION FACILITY RS485 on Modbus protocol shall be provided to all the Analysers.**			
a	CONDUCTIVITY(SPECIFIC) ANALYSER - SINGLE CHANNEL with suitable individual mounting accessories and Individual Mounting racks	NOS.	16	16
b	OIL IN WATER ANALYSER - DUAL CHANNEL (With Sample Sequencer and Solenoid Valve shall be mounted in rack) with suitable individual mounting accessories and Individual Mounting racks	NOS.	1	1
d	ORP ANALYSER with suitable individual mounting accessories and Individual Mounting racks	NOS.	5	5
e	pH ANALYSER- SINGLE CHANNEL with suitable individual mounting accessories and Individual Mounting racks	NOS.	13	13
f	TURBIDITY ANALYSER with suitable individual mounting accessories and Individual Mounting racks	NOS.	22	22
g	SODIUM ANALYSER(MULTI CHANNEL- 3 CHANNEL) (With Sample Sequencer and Solenoid Valve shall be mounted in rack) with suitable individual mounting accessories and Individual Mounting racks	NOS.	1	1
h	SILICA ANALYSER (MULTI CHANNEL- 3 CHANNEL) (With Sample Sequencer and Solenoid Valve shall be mounted in rack) with suitable individual mounting accessories and Individual Mounting racks	NOS.	1	1
4	**ANALYSERS - FGD Package (All Analysers shall be supplied with suitable individual mounting accessories and individual racks) - MICROPROCESSOR BASED WITH DIGITAL COMMUNICATION FACILITY RS485 on Modbus protocol shall be provided to all the Analysers.**			
a	pH ANALYSER- SINGLE CHANNEL with Special Sensor Holder (Ref Instrument Sch CE/416/MAITREE/FGD/PH for Service details) with suitable individual mounting accessories and Individual Mounting racks	NOS.	3	6
5	LOOSE SUPPLY ITEMS AS PER ANNEXURE-A	ST	1	2
6	Mandatory Spares as per Annexure- B	ST	1	1
7	COMMISSIONING SPARES- Reagents /Calibrators/Dynamic Calibrators/Standard solutions as required for commissioning & Handing over of System to Owner.	ST	1	2
8	CONSUMABLES OTHER THAN CHEMICAL REAGENTS LIKE PH CELL , DO Sensors ,ETC	ST	1	2
9	CONSUMABLES I.E. CHEMICAL REAGENTS FOR 1 YEAR OPERATION	ST	1	2
10	ANNUNCIATOR - Microprocessor based Minimum 96 Points, Window size : 70 mm x 50 mm	ST	1	2
11	Price for one line of High Pressure & High Temp. - Primary & Secondary cooling to be considered along with other instruments as per P&ID applicable for the project.	ST	1	1
12	Price for one line of Low Pressure & Low Temp. - Secondary cooling to be considered along with other instruments as per P&ID applicable for the project.	ST	1	1
13	Sample/Metering Pump with MCB & Starting panel - Suitable for metering sample.	No.	1	1
14	Following activities will be in Vendor's scope :-			
	i. Supervision of erection, Total commissioning & Handing over of the system to the End user.			
	ii. Erection of inter connecting cabling / tubing between wet & dry panel, chiller & wet panel etc.			
	iii. Complete Erection of Chiller system including proper insulation of pipes between chiller & wet panel.			
	iv. Vendor to also consider 1 no. of Gas filling at Site for Chiller during Commissioning/Handing over. This shall be in addition to Gas filling done at OEM works for inspection.			
	v. BHEL shall issue call for service / commissioning with 07 days' notice. Bidder shall agree to visit BHEL project site within above notice period.			
	vi. BIDDER TO SEND O & M MANUALS / DOCUMENTATION ALONG WITH CONSIGNMENT.			
	vii. BIDDER TO SUBMIT TEST, CALIBRATION & GUARANTEE CERTIFICATES AS PER APPROVED QUALITY CHECKLIST/ PLAN ONCE MATERIALS ARE MADE READY.			
15	Note:-			
	1.0 Vendors to quote unit rates for all above items individually.			
	2.0 Vendors who do not quote prices as per pt. 1.0, shall be disqualified.			
	3.0 BHEL shall use unit rates indicated above for quantity addition/deletion required during execution.			
	4.0 Bidders to quote item wise prices for all the items indicated above. Evaluation for L1 shall be done considering offered prices for all items indicated above however Items in sl. No. 11, 12, & 13 shall be ordered only if required.			
	5.0 Packing should be sea worthy packing and fumigation certificate of wood used is must for all the consignment. All the consignment shall be kept in steel covered crates.			

ANNEXURE - "A"

LOOSE SUPPLY ITEMS FOR SWAS

SL. NO	DESCRIPTION	QTY / UNIT
1	Power Cable to SWAS panels	25 Meter
2	Power Cable to Chiller(3 phase 3 wire)	25 Meter
3	Special Cables between wet and dry panel . (for each cell / analyser Combination)	30 Meter/ run
4	All cabling and Tubing(along with connection fitttings) between wet and dry panel	30 Meter / run
5	Cooling water header, A 106 Gr. B, 2 " NB Sch 40 (between nearest tapping point & chiller and chiller & Wet panel)+ Elbows (20 Nos) and Bends(10 Nos) .	60 Meter
6	Blow down header(Wet Panel) , SS304, 2" NB SCH 40 + Elbows (3 nos.)	20 Meter
7	Blow down header (Primary Racks) , SS 304 , 2" NB SCH 80 + Elbows (3 Nos)	20 Meter
8	Recoverable drain header , SS 316 , 2" NB SCH 40 + Elbows (3 Nos.)	20 Meter
9	Waste Drain header (analyser Panel) A 106 Gr. B , 2" NB SCH 40 + Elbows (6 Nos.)	30 Meter
10	Waste drain header(Primary Racks)) , A 106 Gr. B , 2" NB SCH 40 + Elbows (3 Nos)	30 Meter
11	Waste drain header (wet panel) , A 106 Gr. B , 2" NB SCH 40 + Elbows (3 Nos	20 Meter

Note :-

1.0 Vendors to quote unit rates for all items individually.

2.0 Vendors who do not quote prices as per pt. 1, shall be disqualified.

3.0 BHEL shall use unit rates indicated above for quantity addition/deletion required during execution.

4.0 In addition to the set of flanges(mating & counter) which is mounted on the header in panel/rack , vendors to consider one additional set of mating & counter flanges for all headers,as indicated above.

5.0 For Tubing between wet and dry panel suitable connectors shall be provided.

6.0 Insulation of pipe between Chiller and Wet Panel shall be done at site by bidder.

ANNEXURE - B

MANDATROY SPARES FOR STEAM AND WATER ANALYSIS SYSTEM

Sl. No.	Item	Quantity
(i)	PCB assemblies including power supply cards.	2 nos. of each type and model/analyser
(ii)	Rubber tubes & capillary tubes of all types & sizes	100%
(iii)	Pressure reducing assembly/valve	2 nos. of each type
(iv)	Valves	2 nos. of each type, class and size
(v)	Filter/filter elements of all types	10% of filters
(vi)	Power supply assemblies	2 nos. for each type of analysers
(vii)	Electrodes & cells	10% of each type
(viii)	Back Pressure regulator	2 nos. of each type
(ix)	Lamps of all types, sizes & rating.	200%
(x)	Lamp Holders with series resistor	1 no. of each type
(xi)	Replacement cartridges for ion exchange columns.	2 nos. of each type
(xii)	Rotameter glass tube indicators	2 nos. of each type
(xiii)	Primary & secondary Cooler Assemblies	2 nos. of each type
(xiv)	Flexible Tygon tubing for grab sampling	1 set
(xv)	Temperature compensator	2 nos.
(xvi)	Indicators(pressure, temperature,flow)	2 nos. of each type
(xvii)	Solenoid valve coils	2 nos. of each type and rating
(xvii)	Motors	1 no. of each type and size
(xix)	Switches and gauges (temperature/flow for chiller system)	1 no. of each type

Mandatory spares shall be offered against each line item of the specs. If any item is not available meeting the description of the specs, then functionally equivalent item shall be offered against that line item.

A4 - 11		REF. : MAITREE/416/SWAS/TR REV. NO. : 00 PAGE :

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TECHNICAL REQUIREMENTS
ANALYSER SPECIFICATIONS

SECTION - D

REVISIONS :	APPROVED (Punit P Singh)		
	PREPARED	ISSUED	DATE
	PRK	416	17-05-2019

STEAM AND WATER ANALYSIS SYSTEM (SWAS)

1.0.0 **GENERAL REQUIREMENTS**

1.1.1. The sampling system shall obtain samples from steam and water system, which shall be adequately conditioned and fed to analysers for continuous, analysis and provide parallel facility for grab sampling as specified.

The analyser outputs shall be used for providing:

a. Two galvanically isolated linear analog outputs of 4-20 mA, DC for each parameter provided for monitoring in DDCMIS. For multirange analyser, output going to DDCMIS shall correspond to only one range of analyser. Suitable contact output of the analyser range selector switch shall be provided to inhibit the output while the range selector switch is changed from one range to the other . For multichannel analysers , isolated outputs from each channel should be available for DDCMIS. This signal shall be held at the last value while the channel is not active.

b. Alarm all significant parameters measurements which exceed their permissible limits, with repeat facility in the Central Control Room in the form of potential free contacts.

This will enable the plant chemist and operators either tomake adjustments in the water and steam conditioning system or to modify plant operating procedure so as to minimize equipment damage due to corrosion, scaling etc.

1.1.2. The Bidder shall furnish all items including conductivity cells, pH cells, monitors, all other analysers, sample conditioning components and other devices as specified in the approved P & I Diagram , sample stream specification, and other applicable documents forming a part of this specification. The Bidder shall furnish all required accessories for completeness of the analysers furnished by him even though this may not be specifically stated in other clauses of this specification.

1.1.3. The system shall be furnished complete with all accessories, sample conditioning devices and monitoring instruments (for temperature, pressure, flow), analysers, transmitters, controllers, computing devices, function generators, recorders, alarm initiating devices, interlocks and all required accessories to provide a complete and integrated sampling & analysis system as per the intent & requirements of this specification. Sample line diagram shall be used to implement the design at system level which shall be subject to Owner's approval. All necessary piping, tubing, fittings and valves etc. shall be furnished by the Bidder.

Also, MICROPROCESSOR BASED WITH DIGITAL COMMUNICATION FACILITY RS485 on Modbus protocol shall be provided to all the Analysers.

1.1.4. The system shall be designed in accordance with the recommendations in ASME PTC 19.11 Part II, Water and Steam in Power Cycle.

1.1.5. The Bidder shall be fully responsible on system basis, for proper engineering, selection of hardware, manufacture, testing, installation, commissioning and satisfactory functioning of complete and fully operational Steam & Water Analysis System, meeting the intent of this specification. All system components and accessories required for required for completeness of this system shall be furnished by the Bidder although these may not be individually specified herein.

1.1.6. All system components shall be completely assembled, piped, wired and tested at the factory ready for installation when received at the project site.

1.1.7. The equipment shall be constructed to operate accurately and safely under the operating conditions described or implied in this specification, without undue heating, vibration, wear, corrosion or other operating troubles.

1.1.8. All parts subject to high pressure or temperature or other severe duty shall be of materials suitable for the service.

1.1.9. All piping, tubing, fittings and other wetted parts in the sampling and analysing system shall be of type 316 stainless steel No plastics or rubber shall be permitted except within analysers as furnished by the manufacturer.

1.1.10. The Bidder shall make provision of 25 % spare capacity in chiller for future addition of equipment.

1.1.11. All SWAS system components and accessories shall be from the latest proven product range of qualified manufacturers. The SWAS components and accessories shall be of Owner approved makes and models, fully meeting the qualifying requirements.

1.1.12. a) Sample room located instruments & electronic hardware will be required to operate normally in an air conditioned area as of Specification. However , they shall also be able to operate with ambient room temperature between 4°C – 50°C and relative humidity upto 95%, during air conditioning failure.

The following plant services would be made available by Owner for operation of the system.

a) Electric Power Supply:
   i) 240 V AC UPS for Analysers.
   ii) 415V AC 3 PH 3 wire for chiller
b) Auxiliary Cooling Water Supply.

1.2.1 **SAMPLE CONDITIONING SYSTEM**

GENERAL

1) Sample conditioning shall be designed and constructed to fully meet the intent and requirements of this specification.

2) The sample conditioning system shall provide samples at 25°C or a preset temperature required by the analyser within tolerance of ± 1°C, at a pressure of about 2 kg/cm² and at flow rates as required by individual analysers/streams.

3) Sample line to analyser elements shall incorporate an anti - syphon design to prevent possibility of running dry because of a broken or plugged sample line.

4) Sample conditioning system shall be designed and constructed to receive & condition all samples (listed in the enclosed Sample Stream Specification) as required by the respective analysers connected to the sample streams. This will include all conditioning as specified herein and shall cover the followings:

a) Primary sample cooling (wherever required) in the field.
b) High pressure reduction (wherever required) in the field.
c) Two nos. racks shall be provided per unit by the Bidder for mounting primary coolers and high pressure reducing elements in the field alongwith all required piping, fittings, accessories. The exact grouping & location of these racks shall be as finalised during detail engineering stage. The Bidder shall furnish the unit price of these racks alongwith the offer.
d) Sample filtering.
e) Secondary sample cooling and temperature control.
f) Pressure reduction and control as required.
g) Flow rate control and measurement.
h) Other treatment as required by individual analysers or as specified herein.
i) Wherever the panels/racks are painted, the painting shall be corrossion proof, epoxy based paint. Paint shall be specified during detailed engineering. The paint thickness shall be 100 to 150 microns.

1.2.2. WET & DRY PANEL :

- Wet & Dry panel shall be constructed from 2.5 mm thick structural steel (doors - 2mm) and shall be provided with adequate no. of quick start flouroscent lamps.
Antivibration pads of about 15 mm to be provided for each panel.
-Both Wet & Dry panel shall be designed to provide for easy accessibility to mountings & fittings, piping & wiring in the panel.
- Wet panel shall be walkaway through type with doors on side & removable type plates at the back side.Panel floor shall be of SS 316 plate - 5 mm thick.Panel shall be furnished with ISMC 100 angle as base for mounting.

- Dry panel shall be free standing ,enclosed type panel with back doors

- Junction Boxes for both Wet & Dry Panels shall be provided with extra spare terminals, about 25% of used terminals in the junction box. The terminals shall be Cage clamp type.

- All bulk heads in wet panel shall suit the sample pipes from field

1.2.3. **PRIMARY SAMPLE COOLER**

1) Primary cooling of all samples of temperature in excess of 45°C shall be accomplished by passing each sample through an individual sample cooler of heat exchanger type located in the field as specified below. The design, construction materials & technical features of the cooler shall be subject to Owner's approval.

2) The primary cooler shall use condensate quality plant auxiliary cooling water. Cooling water shall be supplied from Owner's closed cooling water system at a maximum temperature of 40°C and a maximum flow rate of 150 litres per minute. For cooling water circuit, the maximum allowable pressure drop across Owner's auxiliary cooling water supply terminals shall be limited to 0.7 kg/cm^2 with the maximum inlet pressure of 2.5 kg/cm^2.

3) The capacity (flow rate and heat transfer capacity) for both sides of cooling water inlet temperature for the combined flows of each required analyser sample plus a manual grab sample flow rate of 500 ml/min, assuming a fouling factor of 0.2 on both sided of the tube. The capacity calculation shall be submitted by the Bidder along with the proposal and shall be subject to Owner's approval.

4) Sample coolers shall be of submerged helical coil type of shell and tube design with removable shell meeting the intent of ASTMD 1192-1977.
Sample tubing and coils in the coolers shall be continuous and shall extend through the cooling jackets. The sample tubing shall be of seamless type with no welded or other joints inside the cooling jacket. Unions shall be provided to facilitate removal of coils. Sample cooler of coil shaped (tube in tube) design is not acceptable.

5) All sample tubing, fittings and other components wetted by the samples shall be constructed of type 316 stainless steel. The shell and the other components shall be stainless steel or other material approved by the Owner.

6) Primary cooler shall be removable without disturbing the sample connections allowing test and inspection at full sample pressure.

7) Primary cooler shall be protected by a relief valve on the cooling water jacket of each cooler in addition with a relief valve at the cooling water header. Further the cooling water header shall be provided with pressure gauge, flow gauge, temperature gauge, flow switches and isolating valve as shown in P&ID.

8) Provision shall be made for heat exchanger shell drain which will be valved and piped to waste drain header to be supplied by the Bidder.

9) Flow switches as indicated above shall be provided in the cooling water line for loss of cooling water flow annunciation.

10) Pressure gauge, Temperature Gauge, Flow Switch as shown in enclosed schematics shall be supplied along with all necessary accessories. Vendor shall also mount the item at site.

1.2.4 **HIGH PRESSURE REDUCTION**

All high pressure samples (P>100 kg/cm^2) shall be provided with high pressure reducing valve in the field after primary cooler. After primary sample cooling and pressure reduction the sample shall be brought to the SWAS Panel like all other samples. High pressure reducing valve shall be suitable for 400 bar-operating pressure and 200°C operating temperature. These valves shall have renewable valve seat & stellite spindle tip as minimum. Make and model of high pressure reducing valve shall be subjected to Owner's approval.

1.2.5. **SAMPLE FILTER**

Sample particulates removal shall be accomplished by passing all samples through cartridge type filters with type 316 stainless steel body & Owner approved material for filter. The removable type filter elements shall be capable of retaining particulates of 40 microns and larger. The filter elements shall be installed immediately before the secondary coolers as indicated in the enclosed P&ID.

1.2.6 **SECONDARY SAMPLE COOLING SYSTEM**

A. SECONDARY SAMPLE COOLER

1) Each Sample stream with the required flow rate shall be finally cooled from cooler of heat exchanger type as specified below. The design, construction material and technical features of the cooler shall be subject to Owner's approval.

2) The secondary cooler shall also use condensate quality chilled water at 20°C. Chilled water for secondary cooler shall be provided by packaged refrigeration unit (chillers) furnished by the Bidder.

3) Sufficient heat exchanger capacity (flow rate and heat transfer capacity) shall be provided to obtain 25°C ± 1°C sample outlet temperature at the maximum flow rate required by all analysers and grab sample requirements of all sample streams assuming a fouling factor of 0.2 on both sides of the coils. The capacity calculation shall be submitted alongwith the proposal and shall be subject to Owner's approval. The max. drop shall be as permitted by refrigeration system.

4) Sample coolers shall be of submerged helical coil type of shell and tube design with removable shell meeting the intent of ASTMD1192-1977. The sample tube shall be continuous and shall extend through the cooling jacket. The sample tubing shall be seamless type with no welded or other joints inside the cooling jacket. Unions shall be provided to facilitate removal of coils. Sample cooler of coil shaped (tube in tube) design is not acceptable. The cooler shall be so constructed as to provide at least the calculated cooling surface.

5) All sample tubing, fittings and other components wetted by the samples shall be constructed of type 316SS. The shell and other components shall be of stainless steel or other material approved by Owner.

6) Secondary cooler shell shall be removable without disturbing the sample connection allowing test and inspection at full sample pressure.

7) Temperature and flow switches as indicated in the P&ID shall be provided to annunciate high chilled water temperature and low chilled water flow. Further the cooling water header shall be provided with pressure gauge, flow gauge, temperature gauge and isolation valves as shown in P&ID.

8) Secondary cooler shall be protected by a relief valve on the cooling water jacket of each cooler in addition to a relief valve at the cooling water header. Provision shall be made for heat exchanger shell drain which will be valved and piped to waste drain header to be supplied by the Bidder.

Chiller Tank shall be SS316 material

All components of chiller shall be compatible to work with DMCW.

For DMCW Pressure and Temperature Pl. refer SWAS scheme

B. CHILLER SYSTEM

1) Two identical 100% capacity water cooled chillers, mounted on a single frame, shall be provided, common for all generating unit of a project.This 2 x 100 % chiller shall have Two identical 100% capacity chilled water pumps, two identical 100% capacity chilled water circulation pumps.

2) Each chiller unit shall be designed with sufficient refrigeration capacity to ensure each sample stream temperature to 25°C ± 1°C when all streams are simultaneously at max. flow rate and maximum temperature. The chiller capacity shall have a provision of 25% spare capacity above this requirements for future samples.

3) Suitable temperature monitoring & control systems shall be provided for maintaining the chilled water temperature at chiller outlet at 20°C or at a designed preset value and within the desired band.

4) The compressor shall be readily accessible for service and shall include low noise hermatically sealed motors. Compressor assembly shall also include crank case heaters, suction and discharge valves, oil sight glasses, forced feed lubrication system and an integrated motor protection system alongwith the necessary instruments.

5) The condenser shall be water cooled and cleanable shell and tube type, designed and constructed in accordance with the ASME code for unfired pressure vessels. A condenser water regulating valve shall be included.

6) Chiller shall be of the direct expansion type with refrigerant tubes inside a shell. The chiller is to be completely insulated including piping between chiller and wet panel. Chiller system shall be constructed in line with ASME code for unfired pressure vessels.

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7) Refrigerant circuit shall be complete with a thermostatic expansion valve, liquid line solenoid valve, sight glasses, filter-dryer, refrigerant shut-off and charging valves.

8) The flow system shall be designed to provide the required flow to meet the conditions experienced at the chilled water bath.

9) The chiller water pump shall be of the centrifugal type, close coupled, bronze fitted construction, complete with motor. Pump and motor shall be designed for continuous operation.

10) Vibration dampeners shall be provided, matched for the packaged chiller and shall be mounted between the packaged chiller and the channel base.

11) Cooling water and chilled water piping shall be provided with block valves.

12) The Bidder shall provide detailed calculation for chiller capacity and other technical particulars like foundation details/mounting etc. with the proposal. These shall be subject to Owner's approval.

13) The Bidder shall provide suitable arrangement if necessary to convert the 415V AC power supply to a suitable voltage level, for his chiller unit.

14) The chiller system shall be provided with following items, in addition to any other instruments/equipments required for smooth, convenient operation of the system, which shall also be furnished by the Bidder.

a. 100% redundant chilled water pumps with suction and discharge pressure gauges and temperature gauges and other relavent accessories
b. Chilled water circulation pump with 100% standby facility.
c. Storage tank automatic water makeup with manual bypass facility.
d. Tank temperature indicator.
e. Storage tank level gauge.
f. Drain and overflow connection for tank.
g. System Control Unit.
h. Storage tank shall be SS316
i. Chiller alarms shall be wired to DCS.Necessary TB's to be considered in panel.

1.2.6. **PRESSURE REDUCTION AND CONTROL**

a. All samples shall be provided with pressure reducing valve for final pressure reduction to get required sample pressure for analysers.

The same shall be designed for required pressure & high temperature and shall be suitably sized to cater for the down stream flow requirement of the analyser. These valves shall be conveniently located for removal and disassembly for periodic cleaning.

b. Each sample line shall include a safety relief valve set at about 3 kg/cm² downstream of the pressure reducing valve, having stainless steel wetted parts.

c. Each sample line shall be provided with a pressure gauge and a temperature gauge at the downstream of safety relief valve. The gauges shall meet following requirements at minimum.

Body	**Die Cast Alluminium**
Accuarcy	± 1% of Span
Scale	Linear 270° C arc
Range	To cover 125% of max of scale.
Housing	As per NEMA 4 or IP65.
Material	316 SS

d. Each grab sample line shall be provided with a grab sample valve (3 way with nozzle) in series with a back pressure regulating valve. The back pressure regulating valve shall be furnished one for each sample line to maintain constant sample pressure. The variations in sample flow to individual analysers shall not exceed five percent when the total sample flow is increased or decreased due to change in the number of individual analysers utilizing a particular sample.

1.2.7. **FLOW RATE CONTROL AND INDICATION**

Each analyser/cell shall be provided with a flow rate control and indicating device as per sample line flow diagram.

Each flow indicator shall be provided with differential pressure regulator to get require flow of sample at analyser inlet and check valve at the outlet to prevent back flow and draining of process fluid when metering tube is removed.

Flow indicators shall be purge meters with scale of about 100 mm, panel mounting bezel and stainless steel float. The body material shall be of Aluminium. Meter capacity shall be 0 to 1500 cc per minute and shall have accuracy of 3% or better. Meter of poorer accuracy will not be accepted. Flow indicators shall be of Owner's approved make and shall be mounted on the front side of SWAS panels.

1.2.8. **OTHER NECESSARY DEVICES**

A. VALVES

The steam & Water Analysis System shall be provided with the sample shut off valves,

blowdown valves, solenoid actuated valves, pressure reducing valves, safety relief valves, back pressure regulating valves, high pressure reducing values etc.

as indicated in the applicable P&I diagram of SWAS . All High Pressure Valves shall be of 2500 Class Special, as per ANSI B 16.34.Wetted parts and Body shall be **SS 316**.

The requirement of the important valves are specified as under.

(i) The sample shut off valves, blow down valves & pressure reducing valves shall have stellite spindle tip and shall be suitable for an operating pressure of 400 bar and an operating temperature of 400°C.

(ii) The back pressure regulating valve shall be of globe type and shall be suitable for a pressure range of 0-50 psi. The back pressure regulating valve shall consist of a range spring and a diaphragm assembly. The back pressure of the regulating valve is adjusted to the required set point by the range spring. In case of any excess pressure the diaphragm shall be lifted to release the excess pressure to maintain back pressure equal to the set value. Stainless steel trim with linear flow characteristics shall be provided. Bidder shall submit the data sheet of these valves and these shall be subject to Owner's approval during detailed engineering stage.

B. TEMPERATURE GAUGES

Temperature gauges shall be of 100mm Hg in steel type thermometers with stainless steel capillary length required for installation. Bimetallic type thermometer will not be acceptable. Each gauge shall have a dial engraving or separate phenolic name plate to identify the service. Service engravings, temperature gauge ranges, make and model and other technical features shall be subject to owner's approval. Gauges shall be located on the front of sampling conditioning panel. Accuracy of measurement shall be ± 1% of full scale or better.

C. PRESSURE GAUGES

Pressure gauges shall be of 100mm dia, stainless steel movement and bourdon tubes & nylon bearings, each gauge shall have dial engraving or separate phenolic name-plate to identify the service. Service engravings, make, model and ranges & other technical features of pressure gauges shall be subjected to Owner's approval. Pressure gauge shall be located on the front of sample conditioning panel. Accuracy of measurement shall be ± 1% of full scale or better.

D. LEVEL GAUGES

Level gauges shall be tempered, borosicilcate transparent type of minimum pressure rating of 300 psig. Make and model of level gauge shall be subjected to Owner's approval.

E. FLOW SWITCH

Two flow switches shall be provided, one on the primary cooling water outlet and one on the chiller outlet. The switches shall be provided with 2 SPDT alarm contacts which open on low flow for annunciation. The contacts rating shall be 5A at 240 V AC / 0.25A at 220V DC and accuracy shall be ± 1%. Make & model of flow switches shall be of Owner's approved vendors.

F. TEMPERATURE SWITCH

Temperature switches shall be provided with 2 SPDT alarm contacts. The contacts rating shall be as 5A at 240 V AC / 0.25A at 220V DC. All switches shall be repeatable within ± 1% of full scale range.

G. SAMPLE PATCH BOARD

A quick disconnect patch board area shall be furnished on the SWAS panel. The patch board shall allow sample to be routed to any analyser through quick disconnect valve at patch board on the sample conditioning panel. The area shall consist of a patch board with bulk head tube fittings with double end shut-off and hose inserts. Body protector plugs shall be provided for each bulkhead tube fittings. Number of hose inserts, disconnect fittings etc. shall be as shown in the P & I Diagram and other specification documents.

The plugs shall be of type 316 SS construction. Sufficient length of 6mm ID, 9.5mm OD Tygon tubing shall be provided for complete spanning of the patch board area for interconnection of the bulkhead tube fittings. Each connection shall be provided with a phenolic name plate engraved with a legend acceptable to the Owner.

H. GRAB SAMPLE

Grab sample valves on the front of SWAS panel shall be provided to direct grab samples to trough through grab sample nozzles or to the drain header. Approximately 300mm of flexible Tygon tubing shall be provided for each sample to allow grab sample collection and prevent splashing. Grab sample nozzles shall be provided with adapter and panel mounting flanges. All these items i.e. nozzles, adapter and flanges shall be of Owner approved make.

I. SAMPLE SINK

A continuous sink, located at the place of grab sample analysis, shall be provided. The sink shall be of 316 stainless steel, 14 guage minimum. The sample sink shall be connected to waste drain header. Sample sink shall contain an integral stainless steel ledge to accommodate sample container. DM water connection shall be provided for cleaning of sample container

2.0. ANALYTICAL INSTRUMENTS

2.1. All analysers, cells, monitors etc. as offered shall be field proven and of international reputed make. Field-proven, Microprocessor based analyser with self diagnostic feature shall be considered. The Bidder shall furnish along with his proposals all the required details in respect of each and every type of analysers/cells/monitors to establish that the offered analytical instruments are well proven for the similar applications. The Bidder shall indicate in the offer the exact chemical composition of each and every reagent. The make, type, model etc. of various analytical instruments shall be subjected to the Owner's approval.

2.2 All analysers, cells, monitors and accessories shall be furnished as per P&I diagram All analysers, monitors shall be furnished with all accessories wired, piped and mounted on analyser panel.

2.3. Alarm contacts shall be furnished with the analysers/monitors for annunciation of high or / and low alarms as indicated in list of analysers. The contact rating shall be 5A at 240 V AC./ 0.5 A at 220V DC.

2.4. The Bidder shall provide 2 x 4-20 mA linear isolated current output signals from analysers /monitors for recorders, DDCMIS and controls etc. as specified.

2.5. Analyser specification enclosed in Table-A

2.6 Other Requirement:

1 All the analysers / cells shall have
   a) Open corrosion resistant drain to waste header.
   b) Automatic temperature compensation shall be provided wherever required.

2 All chemical re-agents required for 12 months operation is to be supplied, as per shelf life.

3 Analysers/monitors shall be suitable for operating under the conditions specified in instrument schedule enclosed.

2.7 Bidders shall meet following Provenness criterion for offered analyser models:
-Offered SWAS System should be working satisfactorily for a minimum period of two years as on date 22.09.2015 in a powerplant of min. 500 MW and above

BHEL shall accept only those models which shall meet provenness criterion listed above.

2.7 In the event of order :-

a) Vendor shall submit drawings, data sheets, Technical literature, detailed BOM for complete system for approval by BHEL/NTPC.

b) Indicate Shelf life of reagents.

c) Vendor shall depute his representative to site for verification of material received at site, with repect to approved BOM / documents. A MOM shall be made with BHEL site incharge for completeness of supplies. Material shall be repacked and Handed over to BHEL site incharge.

d) Quality plan .Vendor to note that following Tests are to be conducted as minimum:
- Hydraulic pressure Tests for all fittings tubing, etc.
- Functionality Tests for all components.
- Calibration & Accuracy Test for all measuring instruments.
- Calibration / compliance Report for all Analysers, as per range approved in datasheet.
- IR & HV Tests for all electrical components.
- Material TC's to be furnished for verification.

e) Item No. of BOM as approved or Item No. of BOM issued along with MC shall be put on the respective Boxes & Packing list by the vendor for easy correlation & identification at the time of MRC.

f) SHS items shall be supplied ,post inspection, in sturdy wooden packing. Packing shall be designed such that materials can be stored in open environment for 2/3 years. BHEL packing standard is enclosed for reference & compliance.

g) Analyser shall be supplied in metallic container as per instructions indicated in Annexure-I

Note:- BHEL will discuss deviations wrt Specifications listed in this section with only those bidders which shall participate in this bid.

ANNEXURE – 'I'

- Analysers & Spares shall be packed project wise in lockable Metal Container suitable for outside storage at project sites. Typical requirements are as below:-

  - Type: Standard Outdoor type MS container, fully closed.
  - Dimension: Vendor to decide based on Qty of Analysers & Spares.

General condition:

1) The container shall be suitable to store imported and sophisticated components in open environment at thermal power plants. It shall be leak proof.
2) Container shall be provided with proper glass wool thermal insulation at inside.
3) Wall thickness (all sides), reinforcement, supporting lugs, lifting lugs, etc., shall be suitable to store and transport the container with the permissible load as required.
4) Doors shall have suitable latches to lock the container with pad locks for safety purpose.
5) Interior and external surface shall be completely painted as per the standard practice and it shall be Suitable for sea-shore atmosphere.
6) Containers shall be provided with Tag Plates with Project Name.

IMPORTANT NOTE: Mandatory Spares shall be sent in pre-decided lots in containers /secure boxes distinctly marked in Red colour with boldly written "S" mark on each face of the containers /secure boxes.

Sl. No.	Requirements	Hydrazine	Silica	Sodium	Dissolved O2	Conductivity
1	Type	Continuous electro-chemical	Continuous colorimetric	Continuous flow through sample	Continuous flow through sample	For Hotwell, removable type cells, for others flow through cells.
2	Accuracy	±5%	±5% of reading	±10% of reading	±5% of reading	</=±1%
3	Response time(90% of full scale)	</=3 min	</=15min (including sample switching)	</=4min	</=30 sec.	</= 5 sec
4	Range As per instrument schedule .freely programmable	0-50, 0-100 ppb	0-50 ,0-100 & 0-500ppb	0-1, 0-10, 0-200 ppb	0-20 & 0-200 ppb	0-1, 0-10 & 0-100 micromho/ cm (for sp.conductivity) 0-1 micromho/ cm log scale (for cation conductivity)
5	No. of Streams	Single	Multi stream.	Multi stream.	Single stream,	Single
8	remarks	-----	Sample shut off solenoid valve to be provided	-------	-----	Dual cation exchange shall be provided for cation conductivity. Auto Temp. Compensation to be given.

Notes:-

1. Temperature Compensation for analysers shall be provided, wherever applicable.

Sl. No.	Requirements	Oil In Water	pH	Phosphate	Turbidity
1	Type	UV Fluorescence	Cell flow through type	Colorimetric	Light reflection principle
2	Accuracy	±5% FSD	</=±1%	±5% of reading	</=±2% for range 0-50 NTU, </=5% for range 50-200 NTU
3	Response time(90% of full scale)	</=30 sec.		</=16min	</= 5 min
4	Range As per instrument schedule .freely programmable	0-100 ppm	6-11	0-10 ppm	0-100 & 0-200 NTU
5	No. of Streams	Two Streams	Single	Single	Single
8	remarks	Required accessories to be provided.	Auto Temp. Compensation to be given.	Up to 500 mg/l of silica, interference should be negligible.	

Notes:-

1. Temperature Compensation for analysers shall be provided, wherever applicable.

Note: For cation conductivity measurement - cation column
resin should change its colour indicating depletion of its capacity and shall be regenerative type resin and not replaceable type. Column caps shall be SS316. This shall be complied for cation conductivity.

Sl. No.	Requirements	ORP				
1	Type	Flow Through				
2	Accuracy	+/-2% of reading				
3	Response time(90% of full scale)	3-5 secs				
4	Range As per instrument schedule freely prog.	0-200 NTU				
5	No. of Streams	Single				
6	Remarks	Required accessories to be provided				

Notes:-

1. Temperature Compensation for analysers shall be provided, wherever applicable.

DRAWINGS AND DOCUMENTS

Bidder shall furnish following drawings and documents after award of contract:
a) Final version of all the drawing and document furnished along with bid
b) Drawing and document submission schedule
c) Power supply scheme
d) Interconnection and wiring diagram.
e) Spare part list
f) Consumable list
g) QAP
h) Inspection and Test report
i) Training details
j) O&M Manual
k) Any other scheme, data, drawing, document, etc required to establish product quality and completeness of supply

NOTE: - Vendors need to offer all components/accessories required to meet the intent of the specification. If it is found, at any stage of procurement /commissioning, that some components./accessories have not been offered/supplied, same shall be supplied without any cost/time implication to BHEL to meet the system / product requirement.

Ref: CE/416/MAITREE/SWAS/ANALYSER

Sl. NO.	KKS NO	DESCRIPTION	INST TYPE	MEDIUM	Op Press	Design Press	Unit Press	Op Temp	Design Temp	Unit Temp	RANGES	Range Unit
1	01MAG11CQ011	COND-2 TNK (L) SP CONDVTY	CT	COND	FULL VACUUM	-	Kg/cm2	46	55	DegC	0-10	uM/cm
2	01MAG11CQ012	COND-2 TNK (R) SP CONDVTY	CT	COND	FULL VACUUM	-	Kg/cm2	46	55	DegC	0-10	uM/cm
3	01PAB10CQ001	CW PUMPs DISCH HDR PH	PHT	Sea Wtr	2.53	6	Kg/cm2	34	50	DegC	1-14	PHT
4	00LCR80CQ001	MAKE UP WATER SPEC COND	CT	M/U WTR	5.4	9.8	Kg/cm2	45	50	DegC	0-10	uM/cm
5	01CUS00CQ001	COND COOLING WTR PH	PHT	WTR	3.04	5.4	Kg/cm2	33	60	DegC	0-14	PH
6	01CUS00CQ002	COND COOLING WTR SPEC COND	CT	WTR	3.04	5.4	Kg/cm2	33	60	DegC	0-10	uM/cm
7	01HAG15CQ001	WTR STRG DOWNCOMER CAT COND	CCT	WATER	300.8	320.68	Kg/cm2	347	374	DegC	0-1	uM/cm
8	01HAG15CQ002	WTR STRG DOWNCOMER SPEC COND	CT	WATER	300.8	320.68	Kg/cm2	347	374	DegC	0-10	uM/cm
9	01HAG15CQ003	WTR STRG DOWNCOMER SILICA	SiT	WATER	300.8	320.68	Kg/cm2	347	374	DegC	0-10	uM/cm
10	01HAG15CQ004	WTR STRG DOWNCOMER PH	PHT	WATER	300.8	320.68	Kg/cm2	347	374	DegC	0-14	PH
11	01HAH20CQ001	SEPARATOR O/L STM PH	PHT	STM	295.08	312.2	Kg/cm2	437	471	DegC	0-14	PH
12	01HAH20CQ002	SEPARATOR O/L STM CATION CONDUCTIVITY	CCT	STM	295.08	312.2	Kg/cm2	437	471	DegC	0-1	uM/cm
13	01HAH20CQ003	SEPARATOR O/L STM SILICA	SiT	STM	295.08	312.2	Kg/cm2	437	471	DegC	0-10	uM/cm
14	01HAH20CQ004	SEPARATOR O/L STM SODIUM	NaT	STM	295.08	312.2	Kg/cm2	437	471	DegC	0-20	ppb
15	01LAB00CQ011	DEA O/L PH	PHT	COND	13.46	30.43	kg/cm²	188	200	DegC	0-14	PH
16	01LAB00CQ012	DEA O/L DISSOLVED OXYGEN	DOT	COND	13.46	30.43	kg/cm²	188	200	DegC	0-20	ppb
17	01LAB80CQ001	FW TO ECO PH	PHT	Feed Water	315.3	324.6	kg/cm²	293.5	300	DegC	0-14	PH
18	01LAB80CQ002	FW TO ECO CATION CONDUCTIVITY	CCT	Feed Water	315.3	324.6	kg/cm²	293.5	300	DegC	0-1	uM/cm
19	01LAB80CQ003	FW TO ECO DO2	DOT	Feed Water	315.3	324.6	kg/cm²	293.5	300	DegC	0-20	ppb
20	01LAB80CQ004	FW TO ECO DO2	DOT	Feed Water	315.3	324.6	kg/cm²	293.5	300	DegC	0-20	ppb
21	01LAB80CQ005	FW TO ECO SILICA	SiT	Feed Water	315.3	324.6	kg/cm²	293.5	300	DegC	0-10	uM/cm
22	01LBA01CQ001	MAIN STM PH	PHT	STM	242.2	265.78	kg/cm²	565	573	DegC	0-14	PH
23	01LBA01CQ002	MAIN STM CATION CONDUCTIVITY	CCT	STM	242.2	265.78	kg/cm²	565	573	DegC	0-1	uM/cm
24	01LBA01CQ003	MAIN STM SILICA	SiT	STM	242.2	265.78	kg/cm²	565	573	DegC	0-10	uM/cm
25	01LBB10CQ001	REHEAT STM PH VALUE	PHT	STM	52.33	67.2	kg/cm²	596	601	DegC	0-14	PH
26	01LBB10CQ002	REHEAT STM CAT COND	CCT	STM	52.33	67.2	kg/cm²	596	601	DegC	0-1	uM/cm
27	01LBB10CQ003	REHEAT STM SILICA	NaT	STM	52.33	67.2	kg/cm²	596	601	DegC	0-20	ppb
28	01LCA20CQ001	CEP DISCH CATION CONDUCTIVITY	CCT	COND	29.5	47.1	kg/cm²	46.3	55	DegC	0-1	uM/cm
29	01LCA20CQ002	CEP DISCH PH VALUE	PHT	COND	29.5	47.1	kg/cm²	46.3	55	DegC	0-14	PH
30	01LCA20CQ003	CEP DISCH DISSOLVED OXYGEN	DOT	COND	29.5	47.1	kg/cm²	46.3	55	DegC	0-20	ppb
31	01LCA20CQ004	CEP DISCH SPECIFIC CONDUCTIVITY	CT	COND	29.5	47.1	kg/cm²	46.3	55	DegC	0-10	uM/cm
32	01LCA20CQ005	CEP DISCH SILICA	SiT	COND	29.5	47.1	kg/cm²	46.3	55	DegC	0-10	uM/cm
33	01LCA50CQ001	DEA I/L WATER PH	PHT	WTR	29.5	44.12	kg/cm²	160	200	DegC	0-14	PH
34	01LCA50CQ002	DEA I/L WATER SPEC COND	CT	WTR	29.5	44.12	kg/cm²	160	200	DegC	0-10	uM/cm
35	01LCA50CQ003	CPU O/L SILICA	SiT	COND	29.5	47.1	kg/cm²	46.3	55	DegC	0-10	uM/cm
36	01LCA50CQ004	CPU O/L PH	PHT	COND	29.5	47.1	kg/cm²	46.3	55	DegC	0-14	PH
37	01LCA50CQ005	CPU O/L SPECIFIC CONDUCTIVITY	CT	COND	29.5	47.1	kg/cm²	46.3	55	DegC	0-10	uM/cm
38	01MAG10CQ011	HOTWELL CONDUCTIVITY	CT	COND	vacuum	6.8	kg/cm²	46	55	DegC	0-10	uM/cm
39	01MAG10CQ012	HOTWELL CONDUCTIVITY	CT	DMCW	vacuum	6.8	kg/cm²	46	55	DegC	0-10	uM/cm
40	01PGC15CQ001	DMCW I/O OF TG PHE SPEC COND	CT	DMCW	9.8		Kg/cm2	38		DegC	0-10	uM/cm
41	01PGC15CQ002	DMCW I/O OF TG PHE PH VALUE	PHT	DMCW	9.8		Kg/cm2	38		DegC	0-14	PH
42	01PGC40CQ001	DMCW I/O OF SG PHE SPEC COND	CT	DMCW	11.76		Kg/cm2	38		DegC	0-10	uM/cm
43	01PGC40CQ002	DMCW I/O OF SG PHE PH VALUE	PHT	DMCW	11.76		Kg/cm2	38		DegC	0-14	PH
44	00GAC06CQ011	RAW WTR PMP DISCH HDR FRCA	Free Chlorine	Sea Wtr	28.4	7	Kg/cm2	Ambient	50	DegC	0-10	PPM
45	00GAC06CQ012	RAW WTR PMP DISCH HDR FRCA	Free Chlorine	Sea Wtr	28.4	7	Kg/cm2	Ambient	50	DegC	0-10	PPM

INSTRUMENT SCHEDULE FOR UF SYSTEM

Project : MAITREE Project R4N0					OPER	DESIGN	OPER	DESIGN	OPER	DESIGN	Min Inst Range	Max Inst Range	Max Inst Range Unit	TYPE	PROCESS CONNECTION-INST	PROCESS CONNECTION-PIPING	ELECTRICAL CONNECTION
Ref: CE/416/MAITREE/RODM/ANALYSER					PRESS	PRESS	TEMP	TEMP	Flow	Flow							
S.No	**Tag No.**	**Description**	**Legend**	**Qty**	Kg/cm2	Kg/cm2	DEGC	DEGC	m3/hr	m3/hr							
1	00GCB05CQ001	Turbitity analyser with isolation Ball valve at self cleaning strainer Common Outlet line	TURB	1	5.0	10.0	20-33	20-33	1805	1805	0	20	NTU		1/2 NPT	1/2 NPT	1/2 NPT
2	00GCB05CQ002	Oil in water analyser(Dual channel) at self cleaning strainer Common Outlet line CH1- UF inlet CH2 RO -Inlet	OIL	1	5.0	10.0	20-33	20-33	1805	1805	0	15	PPM				1/2 NPT
3	00GCB05CQ003	Conductivity transmitter with isolation ball Valve at self cleaning strainer common Oulet line	COND	1	5.0	10.0	20-33	20-33	1805	1805	0	25000	us/cm	K=1.0	1/2 NPT	1/2 NPT	1/2 NPT
4	00GCB10CQ002	PH Analyser at Feed Distribution Channel inlet lne	PH	1	1.0	2.0	20-33	20-33	1805	1805	0	14	pH		1/2 NPT	1/2 NPT	1/2 NPT
5	00GCB10CQ003	ORP Anlayser at Feed Distribution Channel inlet lne	ORP	1	1.0	2.0	20-33	20-33	1805	1805	-1000	1000	mV		1/2 NPT	1/2 NPT	1/2 NPT
6	00GCB11CQ001 00GCB12CQ001 00GCB13CQ001 00GCB14CQ001 00GCB15CQ001 00GCB16CQ001 00GCB11CQ002 00GCB12CQ002 00GCB13CQ002 00GCB14CQ002 00GCB15CQ002 00GCB16CQ002 00GCB11CQ003 00GCB12CQ003 00GCB13CQ003 00GCB14CQ003 00GCB15CQ003 00GCB16CQ003	Turbitity Analyser with isolation Globe Valve at UF Permeate Pump Common Discharge line	TURB	18	1.0	1.0	20-33	20-33	360	360	-1	1	Kg/cm2		1/2 NPT	1/2 NPT	1/2 NPT
7	00GCN05CQ001	PH Analyser with isolation ball valve at UF CIP/Recirculation pump Common discharge line	PH	1	1.0	1.0	20-33	20-33	185	193	0	14	PH		1/2 NPT	1/2 NPT	1/2 NPT

INSTRUMENT SCHEDULE FOR Ist PASS RO SYSTEM

Project : MAITREE Project R4N0					OPER	DESIGN	OPER	DESIGN	OPER	DESIGN	Min Inst Range	Max Inst Range	Max Inst Range Unit	TYPE	PROCESS CONNECTION-INST	PROCESS CONNECTION-PIPING	ELECTRICAL CONNECTION
Ref: CE/416/MAITREE/RODM/ANALYSER					PRESS	PRESS	TEMP	TEMP	Flow	Flow							
S.No	**Tag No.**	**Description**	**Legend**	**Qty**	Kg/cm2	Kg/cm2	DEGC	DEGC	m3/hr	m3/hr							
8	00GCB05CQ001	Oil in water analyser (Dual channel) with isolation valve at static mixer Oulet line	OIL	1	1.0	1.0	20-33	20-33	918	918	0	15	PPM		1.5"(40NB)	1.5"(40NB)	1/2 NPT
9	00GCF01CQ001 00GCF01CQ006	Turbidity transmitter with isolation ball Valve at static mixer Oulet line CH1- UF inlet CH2 RO -Inlet	TURB	2	1.0	1.0	20-33	20-33	918	918	0	1	NTU		1/2 NPT	1/2 NPT	1/2 NPT
10	00GCF01CQ002	PH transmitter with isolation ball Valve at static mixer Oulet line	PH	1	1.0	1.0	20-33	20-33	918	918	0	14	PH		1/2 NPT	1/2 NPT	1/2 NPT
11	00GCF01CQ003	Conductivity transmitter with isolation ball Valve at static mixer Oulet line	COND	1	1.0	1.0	20-33	20-33	918	918	0	25000	us/cm	K=1.0	1/2 NPT	1/2 NPT	1/2 NPT
12	00GCF01CQ004 00GCF01CQ005	ORP transmitter with isolation ball Valve at static mixer Oulet line	ORP	2	1.0	1.0	20-33	20-33	918	918	-1000	1000	mV		1/2 NPT	1/2 NPT	1/2 NPT
13	00GCF02CQ001	Conductivity indicating Transmiter with isolation Ball valve at Ro Block permeate line	COND	1	1.5	1.5	20-33	20-33	367	367	0	1200	us/cm	K=0.1	1/2 NPT	1/2 NPT	1/2 NPT
14	00GCF03CQ001	Conductivity indicating Transmiter with isolation Ball valve at Ro Block permeate line	COND	1	1.5	1.5	20-33	20-33	367	367	0	1200	us/cm	K=0.1	1/2 NPT	1/2 NPT	1/2 NPT
15	00GCF04 CQ001	Conductivity indicating Transmiter with isolation Ball valve at Ro Block permeate line	COND	1	1.5	1.5	20-33	20-33	367	367	0	1200	us/cm	K=0.1	1/2 NPT	1/2 NPT	1/2 NPT
16	00GCN08CQ001	PH type ofAnalog indcating Transmitter with isolation ball valve at Chemical cleaning tank outlet line	PH	1	1.0	1.0	20-33	20-33	430	450	0	14	PH		1"(25NB) Flange	1"(25NB) Flange	1/2 NPT

INSTRUMENT SCHEDULE FOR 2ND PASS RO SYSTEM

Project : MAITREE Project R4N0					OPER	DESIGN	OPER	DESIGN	OPER	DESIGN	Min Inst Range	Max Inst Range	Max Inst Range Unit	TYPE	PROCESS CONNECTION-INST	PROCESS CONNECTION-PIPING	ELECTRICAL CONNECTION
Ref: CE/416/MAITREE/RODM/ANALYSER					PRESS	PRESS	TEMP	TEMP	Flow	Flow							
S.No	**Tag No**	**Description**	**Legend**	**Qty**	Kg/cm2	Kg/cm2	DEGC	DEGC	m3/hr	m3/hr							
17	00GCF41CQ001	PH transmitter with isolation ball Valve at static mixer Oulet line	PH	1	1.0	1.0	20-33	20-33	155.0	155.0	0	14	PH		1/2 NPT	1/2 NPT	1/2 NPT
18	00GCF41CQ002	Conductivity transmitter with isolation ball Valve at static mixer Oulet line	COND	1	1.0	1.0	20-33	20-33	155.0	155.0	0	25000	us/cm	K=1.0	1/2 NPT	1/2 NPT	1/2 NPT
19	00GCF41CQ003 00GCF41CQ004	ORP transmitter with isolation ball Valve at static mixer Oulet line	ORP	2	1.0	1.0	20-33	20-33	155.0	155.0	-1000	1000	mV		1/2 NPT	1/2 NPT	1/2 NPT
20	00GCF42CQ001	Conductivity Type of Analog indicating Transmiter with isolation Ball valve at Ro Block Permeate line	COND	1	1.5	1.5	20-33	20-33	62	62	0	10	us/cm	K=0.01	1/2 NPT	1/2 NPT	1/2 NPT
21	00GCF43CQ001	Conductivity Type of Analog indicating Transmiter with isolation Ball valve at Ro Block Permeate line	COND	1	1.5	1.5	20-33	20-33	62	62	0	10	us/cm	K=0.01	1/2 NPT	1/2 NPT	1/2 NPT
22	00GCF44CQ001	Conductivity Type of Analog indicating Transmiter with isolation Ball valve at Ro Block Permeate line	COND	1	1.5	1.5	20-33	20-33	62	62	0	10	us/cm	K=0.01	1/2 NPT	1/2 NPT	1/2 NPT
23	00GCN09CQ001	PH type ofAnalog indcating Transmitter with isolation ball valve at Chemical cleaning tank outlet line	PH	1	1.0	1.0	20-33	20-33			0	14	PH		1"(25NB) Flange	1"(25NB) Flange	1/2 NPT

INSTRUMENT SCHEDULE FOR MB SYSTEM

Project : MAITREE Project R4N0					OPER	DESIGN	OPER	DESIGN	OPER	DESIGN	Min Inst Range	Max Inst Range	Max Inst Range Unit	TYPE	PROCESS CONNECTION-INST	PROCESS CONNECTION-PIPING	ELECTRICAL CONNECTION
Ref: CE/416/MAITREE/RODM/ANALYSER					PRESS	PRESS	TEMP	TEMP	Flow	Flow							
S.No	**Tag No**	**Description**	**Legend**	**Qty**	Kg/cm2	Kg/cm2	DEGC	DEGC	m3/hr	m3/hr							
24	00GCF73CQ001	Conductivity analyser transmitter with isolation Ball valve at MB Outlet	COND	1	3.5	3.5	20-33	20-33	62.0	62.0	0	0.5	us/cm	K=0.01	1/2 NPT	1"(25NB) Flange	1/2 NPT
25	00GCF73CQ002	PH Analyser transmitter with isolation ball valve at MB Outlet	PH	1	3.5	3.5	20-33	20-33	62.0	62.0	0	14	PH		1/2 NPT	1"(25NB) Flange	1/2 NPT
26	00GCF76CQ001	Silica Analyser transmitter with isolation Ball valve at MB Outlet CH-1	SILICA	1	3.5	3.5	20-33	20-33	62.0	62.0	0	10	ppb		1/2 NPT	1"(25NB) Flange	1/2 NPT
27	00GCF76CQ002	Sodium Analyser transmitter with isolation Ball valve at MB Outlet CH-1	SODIUM	1	3.5	3.5	20-33	20-33	62.0	62.0	0	10	ppb		1/2 NPT	1"(25NB) Flange	1/2 NPT
28	00GCF74CQ001	Conductivity analyser transmitter with isolation Ball valve at MB Outlet	COND	1	3.5	3.5	20-33	20-33	62.0	62.0	0	0.5	us/cm	K=0.01	1/2 NPT	1"(25NB) Flange	1/2 NPT
29	00GCF74CQ002	PH Analyser transmitter with isolation ball valve at MB Outlet	PH	1	3.5	3.5	20-33	20-33	62.0	62.0	0	14	PH		1/2 NPT	1"(25NB) Flange	1/2 NPT
30	00GCF76CQ001	Silica Analyser transmitter with isolation Ball valve at MB Outlet CH-2	SILICA	1	3.5	3.5	20-33	20-33	62.0	62.0	0	10	ppb		1/2 NPT	1"(25NB) Flange	1/2 NPT
31	00GCF76CQ002	Sodium Analyser transmitter with isolation Ball valve at MB Outlet CH-2	SODIUM	1	3.5	3.5	20-33	20-33	62.0	62.0	0	10	ppb		1/2 NPT	1"(25NB) Flange	1/2 NPT
32	00GCF75CQ001	Conductivity analyser transmitter with isolation Ball valve at MB Outlet	COND	1	3.5	3.5	20-33	20-33	62.0	62.0	0	0.5	us/cm	K=0.01	1/2 NPT	1"(25NB) Flange	1/2 NPT
33	00GCF75CQ002	PH Analyser transmitter with isolation ball valve at MB Outlet	PH	1	3.5	3.5	20-33	20-33	62.0	62.0	0	14	PH		1/2 NPT	1"(25NB) Flange	1/2 NPT
34	00GCF76CQ001	Silica Analyser transmitter with isolation Ball valve at MB Outlet CH-3	SILICA	1	3.5	3.5	20-33	20-33	62.0	62.0	0	10	ppb		1/2 NPT	1"(25NB) Flange	1/2 NPT
35	00GCF76CQ002	Sodium Analyser transmitter with isolation Ball valve at MB Outlet CH-3	SODIUM	1	3.5	3.5	20-33	20-33	62.0	62.0	0	10	ppb		1/2 NPT	1"(25NB) Flange	1/2 NPT
36	00GCN65CQ001	PH transmitter with isolation ball Valve at static mixer Oulet line	PH	1	1.0	1.0	20-33	20-33	150	150	0	14	PH		1/2 NPT	1/2 NPT	1/2 NPT
37	00GCN66CQ001	PH transmitter with isolation ball Valve at static mixer Oulet line	PH	1	1.0	1.0	20-33	20-33	150	150	0	14	PH		1/2 NPT	1/2 NPT	1/2 NPT

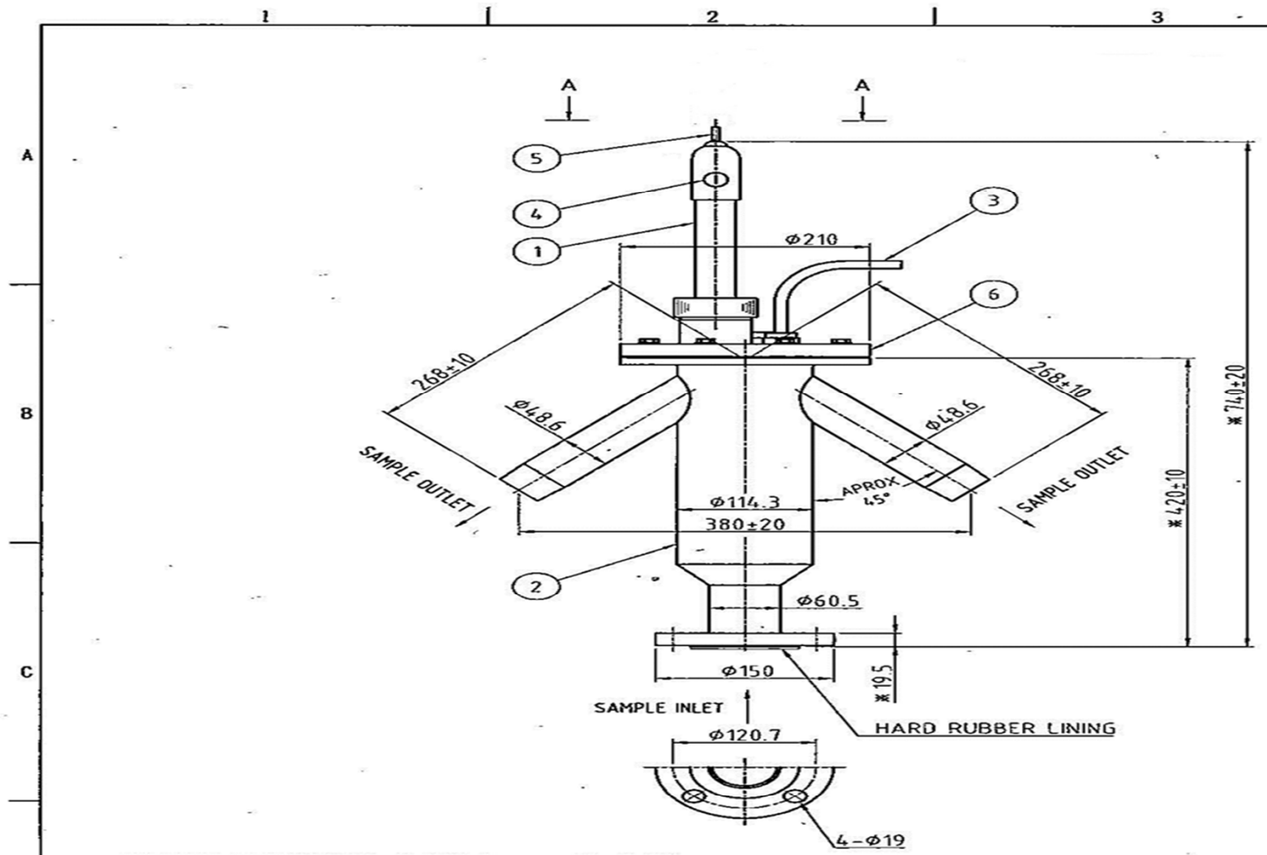
INSTRUMENT SCHEDULE FOR REMINERALISATION SYSTEM

Project : MAITREE Project R4N0					OPER	DESIGN	OPER	DESIGN	OPER	DESIGN	Min Inst Range	Max Inst Range	Max Inst Range Unit	TYPE	PROCESS CONNECTION-INST	PROCESS CONNECTION-PIPING	ELECTRICAL CONNECTION
Ref: CE/416/MAITREE/RODM/ANALYSER					PRESS	PRESS	TEMP	TEMP	Flow	Flow							
S.No		**Description**	**Legend**	**Qty**	Kg/cm2	Kg/cm2	DEGC	DEGC	m3/hr	m3/hr							
38	00GCP07CQ001	PH Type of Analog Indicating transmitter with isolation ball Valve at static mixer Oulet line	PH	1	2.5	3.0	20-33	20-33	290.0	318.0	0	14	ph		1/2 NPT	1"(25NB) Flange	1/2 NPT
39	00GCP07CQ002	ConductivityType of Analog Indicating transmitter with isolation ball Valve at static mixer Oulet line	COND	1	2.5	3.0	20-33	20-33	290.0	318.0	0	1000	us/cm	K=0.1	1/2 NPT	1"(25NB) Flange	1/2 NPT
40	00GCP12CQ005	PH Type of Analog Indicating transmitter with isolation ball Valve at static mixer outlet line	PH	1	2.5	3.0	20-33	20-33	579.0	585.0	0	14	ph		1/2 NPT	1"(25NB) Flange	1/2 NPT
41	00GCP12CQ002 00GCP12CQ003	ConductivityType of Analog Indicating transmitter with isolation ball Valve at static mixer outlet line	COND	2	2.5	3.0	20-33	20-33	579.0	585.0	0	2000	us/cm	K=1.0	1/2 NPT	1"(25NB) Flange	1/2 NPT
42	00GCP12CQ004	Turbidity Type of Analog Indicating transmitter with isolation ball Valve at static mixer outlet line	TURB	1	2.5	3.0	20-33	20-33	579.0	585.0	0	5	NTU		1/2 NPT	1"(25NB) Flange	1/2 NPT
43	00GCP12CQ006	ConductivityType of Analog Indicating transmitter with isolation ball Valve at static mixer outlet line	COND	1	2.5	3.0	20-33	20-33	579.0	585.0	0	2000	us/cm	K=1.0	1/2 NPT	1"(25NB) Flange	1/2 NPT

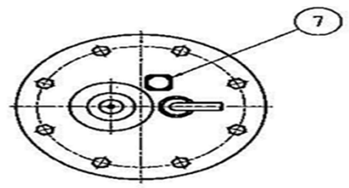
pH Meter

Ref/ CE/416/MAITREE/FGD/PH

Inst Tag No.	Service	Process Condition		Range	Output Signal	Probe Holder					Probe		Cleaning System		Qty
		Press.(kPag) Max./Nor.	Temp.(degC) Max./Nor.			Type	Process Connection			Material	Type	Wetted parts Materials		Alarm point (pH) (L/H)	
							Inlet		Outlet						
							Type/Rating	Size	Type/Rating	Size					
01 HTD 02 CQ 001	1-Absorber pH A	100 / 60	68 / 58	0 - 8 pH	4-20mA	Special Flow-through Holder (See the below for construction)				316 SS w/ Rubber Lining or Eq.	Grass Electrode w/ Refillable KCl	PP or Eq.	Chemical Solution Jet and Water Jet with Cleaning Control Unit for Remote Cleaning (Chemical Reagent : 5 - 15 wt% HCl)	5.2/6.5	2
01 HTD 02 CQ 002	1-Absorber pH B	100 / 60	68 / 58	0 - 8 pH	4-20mA	Special Flow-through Holder (See the below for construction)				316 SS w/ Rubber Lining or Eq.	Grass Electrode w/ Refillable KCl	PP or Eq.	Chemical Solution Jet and Water Jet with Cleaning Control Unit for Remote Cleaning (Chemical Reagent : 5 - 15 wt% HCl)	5.2/6.5	2
01 HTD 02 CQ 003	1-Absorber pH B	100 / 60	68 / 58	0 - 8 pH	4-20mA	Special Flow-through Holder (See the below for construction)				316 SS w/ Rubber Lining or Eq.	Grass Electrode w/ Refillable KCl	PP or Eq.	Chemical Solution Jet and Water Jet with Cleaning Control Unit for Remote Cleaning (Chemical Reagent : 5 - 15 wt% HCl)	5.2/6.5	2



ITEM	DESCRIPTION	REMARKS
1	ELECTRODE HOLDER	PP,FKM
2	CHAMBER	SUS316 HARD RUBBER LINING
3	REAGENT SOLUTION TUBE	ø6× ø11× 5m
4	KCl INLET	
5	LEAD WIRE OF ELECTRODE	
6	FLANGE WITH NOZZLE	PP
7	VENT HOLE	Rc1/2 WITH PLUG



A-A VIEW

HARD RUBBER LINING THICKNESS : 3~5 mm
(* MARKED DIMENSIONS DO NOT INCLUDE LINING THICKNESS)
FLANGE : 2" ANSI 150LB RF EQUIVALENT
NOTE) THE TOLERANCE OF FLANGE DIMENSIONS IS BASED ON ANSI B 16.5-2003.

TITLE
OUTLINE & DIMENSIONS DRAWING OF ELECTRODE HOLDER WITH CHEMICAL CLEANER

REV.	DATE	DWG BY	CHKD BY	APPD BY	DESCRIPTION
3					
2					
1					

SECTION - E

SWAS SCHEMES

REV	DATE	ALTERED	CHECKED	APPROVED	NOTE
05	09.05.18	PS	RKR	SSB	Doc is revised in line BIFPCL/FICHTNER comment dtd:23.04.18.
04	27.02.18	NtJ -sd-	RKR -sd-	SSB -sd-	Doc is revised in line FICHTNER comment dtd 05.02.18.
03	06.12.17	NtJ -sd-	RKR -sd-	SSB -sd-	Doc is revised in line FICHTNER comment dtd 30.11.17.
02	16.11.17	NtJ -sd-	RKR -sd-	SSB -sd-	Doc is revised in line with meeting b/w BHEL and consultant dtd 06-11-17 to 10-11-17 in kolkata,.
B	21.07.17	NtJ -sd-	RKR -sd-	SSB -sd-	Prev Doc No Maitree-01-CF-FS-421145/110-PEM-A
A	12.05.17	NtJ -sd-	RKR -sd-	SSB -sd-	Document 1st submision.

PROJECT

2x660MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH
(EPC MAIN PLANT PACKAGE)

OWNER CONSULTANT:

FICHTNER

M/s FICHTNER GmbH
& Co KG,
Stuttgart,GERMANY

OWNER:

BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED, BANGLADESH

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NOIDA

SCALE:

SHEET 1 OF 19

	DATE	NAME
DRAWN BY	12.05.17	NtJ
DESIGN BY	12.05.17	NtJ
CHECKED BY	12.05.17	RKR
APPROVED BY	12.05.17	SSB

SUPERSEDES:

SUPERSEDED BY:

SYSTEM:

TITLE

SWAS SCHEMES

SIZE:

ANNEX:

PROJECT NO.: 421

DRAWING NO.: Maitree-01-CF-FS-123110-PEM-05 REV -05

LEGEND :

	ISOLATING VALVE (NORMALY OPEN)
	ISOLATING VALVE (NORMALLY CLOSED)
	PRESS REDUCING VALVE
	BACK PRESS REGULATOR
S	SOLENOID OPERATED VALVE
	SAFETY RELIEF VALVE
	3 WAY NEEDLE VALVE
	SAMPLE COOLER
	SAMPLE FILTER
	EXPANDER
	FLOW INDICATOR WITH REGULATING VLV
QDV	QUICK DISCONNECTION VALVE
CC	CATION COLUMN
CE	CONDUCTIVITY ELEMENT
pHE	pH ELEMENT
DOE	DISSOLVED O2 ELEMENT
	DOUBLE ISOLATION VALVE (NORMALY OPEN)

△2

A	ANALYSER IN DRY PANEL
PI	PRESSURE GAUGE
TI	TEMPERATURE GAUGE
TS	TEMPERATURE SWITCH
FIS	FLOW INDICATING SWITCH
LS	LEVEL SWITCH
———	IMPULSE LINE
– – –	CABLE
CR	CONTROL ROOM
DCS	DISTRIBUTED CONTROL SYSTEM
OWS ALARM	ALARM ON OWS IN CONTROL ROOM
	INDICATES RESPECTIVE SCOPE
EDN	BHEL–EDN
B(T)	BHEL–TRICHY
CUST	CUSTOMER
	GLOBE VALVE

NOTES :

1. ONE SET OF ALARM CONTACTS OF SPDT TYPE SHALL BE PROVIDED WITH EACH ANALYSER/MONITOR.
   4–20 mA SIGNAL FROM ALL ANALYSERS SHALL BE HOOKED–UP TO DCS FOR MONITORING PURPOSE AS WELL AS ALARMS.
2. ALL SAMPLING LINE SHALL BE ANNEALED SEAMLESS 316 SS OF 12mm O.D.
   ALL SAMPLING LINES SHALL BE SLOPED TOWARDS THE SAMPLING PANEL.
3. ALL PRIMARY COOLERS SHALL BE LOCATED IN FIELD.
4. SAMPLE OUTLET TEMP SHALL BE AROUND 45 DEG C AT PRIMARY COOLER OUTLET AND SAMPLE TEMP AT SECONDARY COOLER OUTLET SHALL BE 25°C.
5. SAMPLE ENTRY IN PANEL SHALL BE FROM ''TOP'' AND CABLE ENTRY FROM ''BOTTOM''.
6. SAMPLE TEMP HI (COMMON) GROUP ALARM SHALL BE PROVIDED IN DCS.
7. SECONDARY PRESSURE REDUCING VALVE SHALL BE PROVIDED ONLY, IF REQUIRED BY VENDOR DESIGN.
8. WET PANEL SHALL BE "OPEN TYPE" WITH CANOPY AND DRY PANEL SHALL BE ENCLOSED TYPE WITH ILLUMINATION.
9. DOUBLE ISOLATION VALVE IS TO BE PROVIDED FOR ALL THE SERVICES WHERE PRESSURE IS MORE THAN 40kg/cm2(39.23 BAR).

△2

BHEL	BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE LEGEND	DRG. NO. MAITREE–01–CF–FS–123110–PEM–05 SHEET 2 OF 19 REV 05

NOTES:

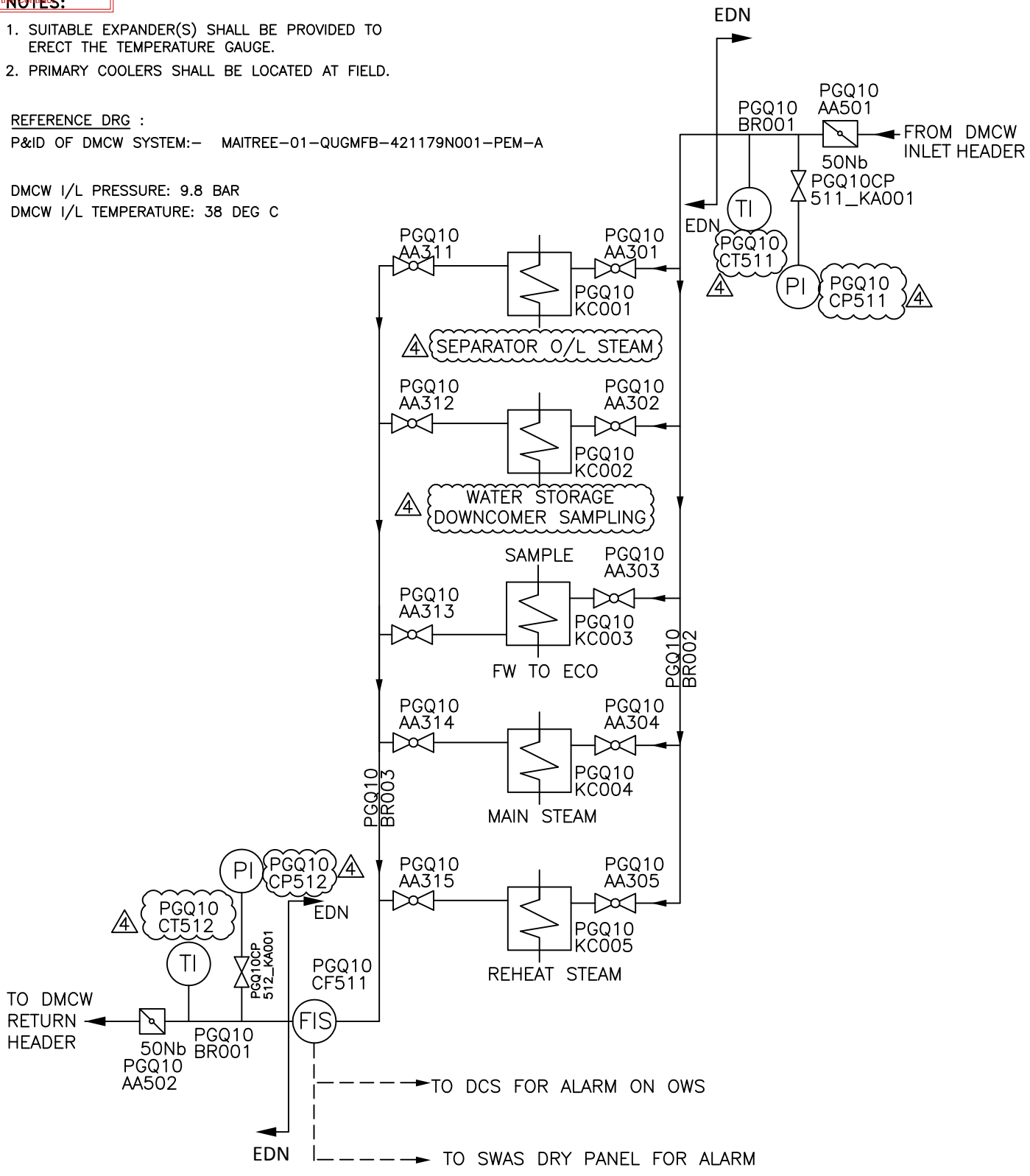
1. SUITABLE EXPANDER(S) SHALL BE PROVIDED TO ERECT THE TEMPERATURE GAUGE.
2. PRIMARY COOLERS SHALL BE LOCATED AT FIELD.

REFERENCE DRG :

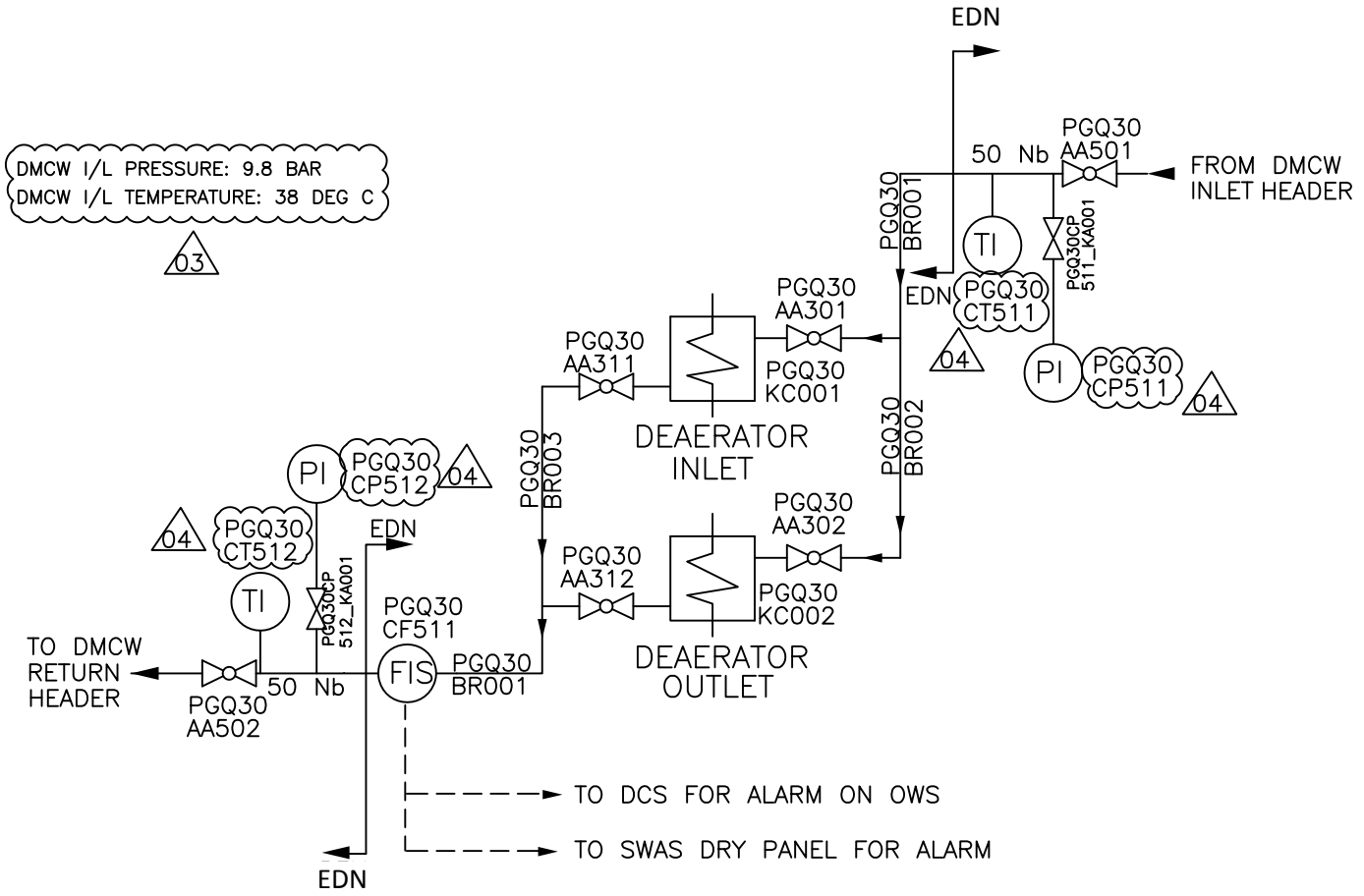
P&ID OF DMCW SYSTEM:– MAITREE–01–QUGMFB–421179N001–PEM–A

DMCW I/L PRESSURE: 9.8 BAR

DMCW I/L TEMPERATURE: 38 DEG C



BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE DMCW SCHEME FOR PRIMARY COOLERS	DRG. NO. MAITREE–01–CF–FS–123110–PEM–05	
		SHEET 3 OF 19	REV 05



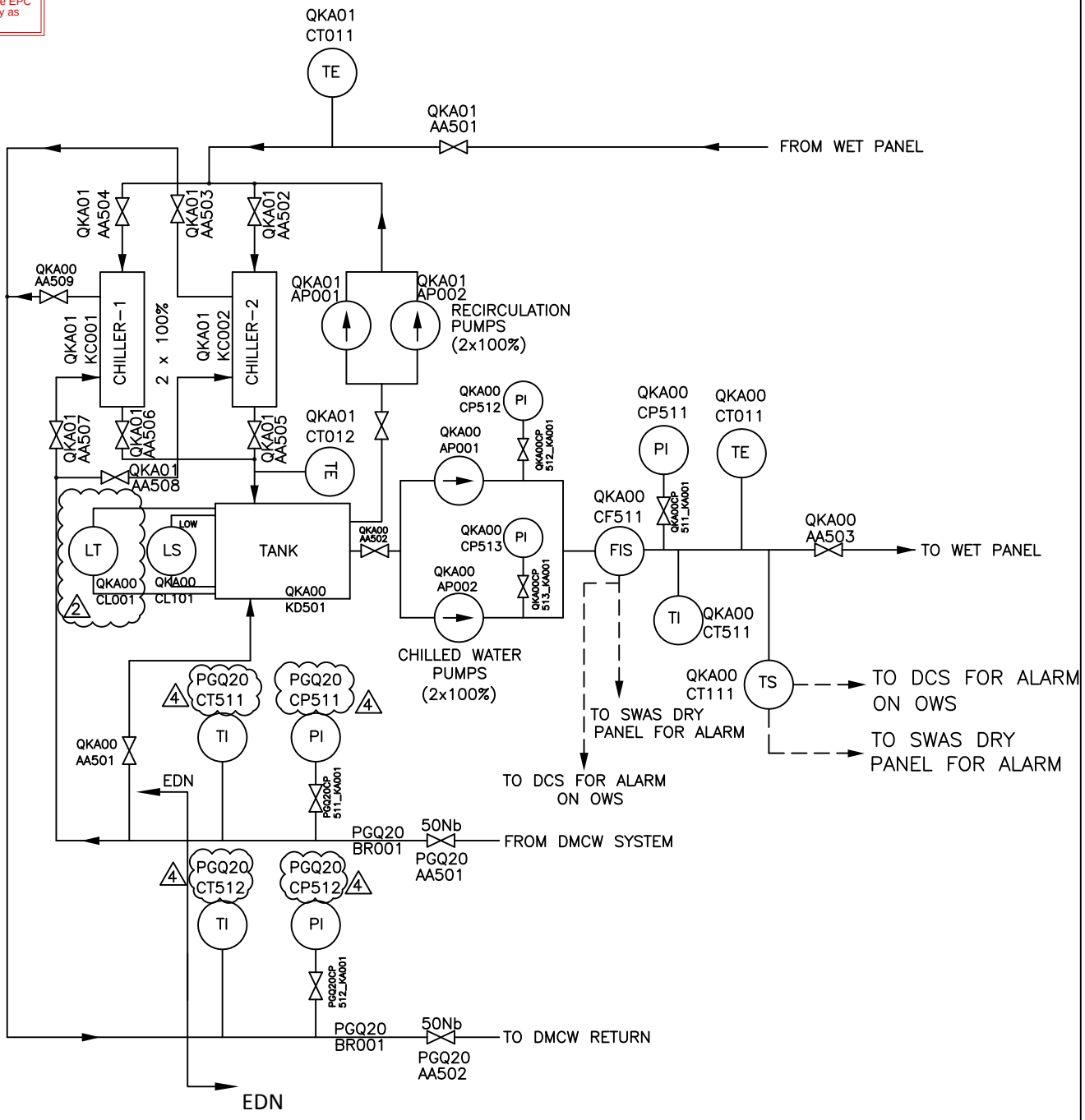
NOTES:

1. SUITABLE EXPANDER(S) SHALL BE PROVIDED TO ERECT THE TEMPERATURE GAUGE.
2. PRIMARY COOLERS SHALL BE LOCATED IN FIELD.

REFERENCE DRG :

P&ID OF DMCW SYSTEM:– MAITREE–01–QUGMFB–421179N001–PEM–A

BIFPCL MAITREE KHULNA STPP	TITLE	DRG. NO. MAITREE–01–CF–FS–123110–PEM–05	
MAITREE (2X660 MW)	DMCW SCHEME FOR PRIMARY COOLERS	SHEET 4 OF 19	REV 05



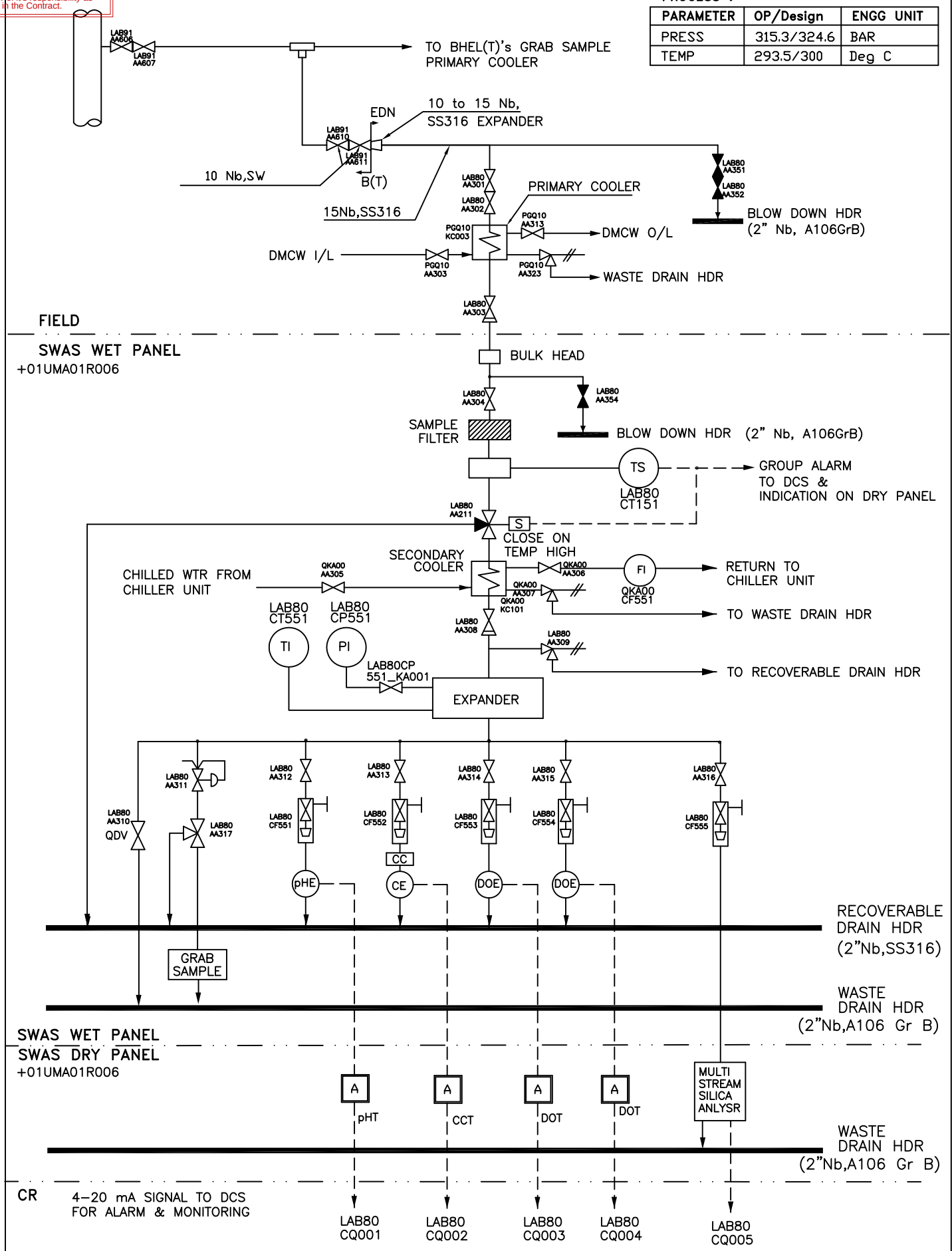
NOTES

1. ALL SECONDARY COOLERS ARE LOCATED IN SWAS WET PANELS.

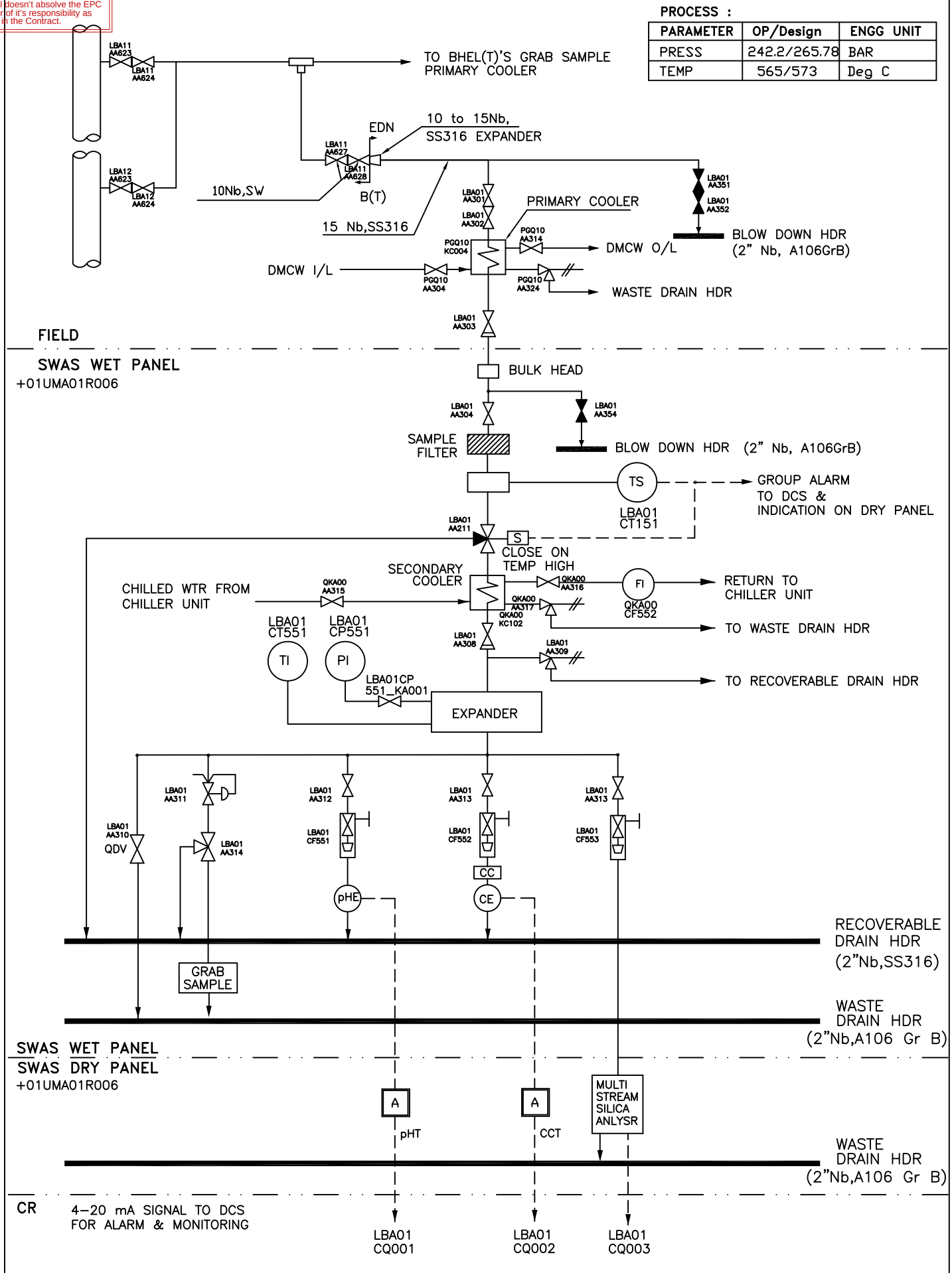
BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE CHILLED WATER SCHEME FOR SECONDARY COOLERS	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 5 OF 19	REV 05

PROCESS :

PARAMETER	OP/Design	ENGG UNIT
PRESS	315.3/324.6	BAR
TEMP	293.5/300	Deg C



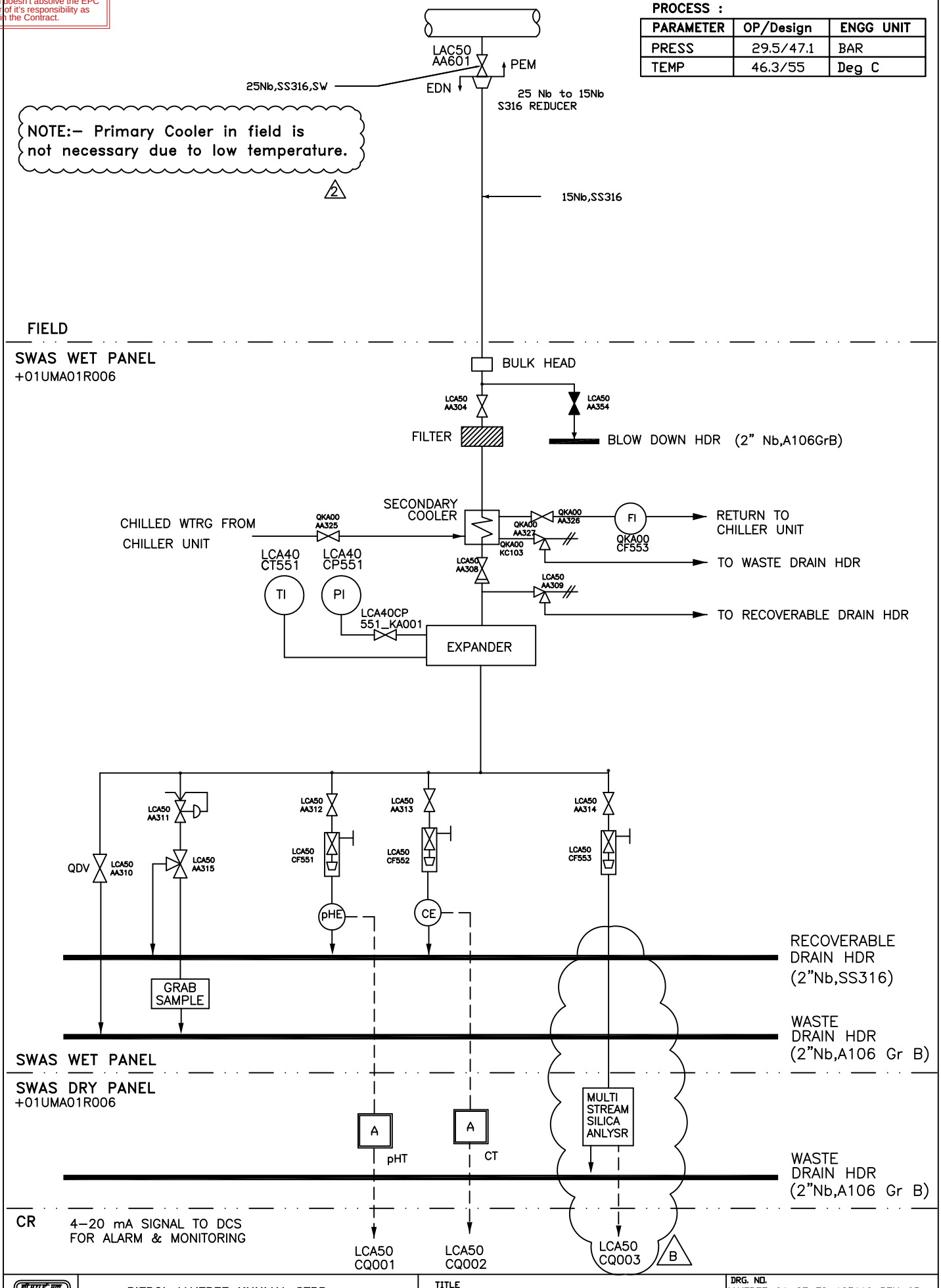
BIFPCL MAITREE KHULNA STPP	TITLE	DRG. NO.	
MAITREE (2X660 MW)	FEED WATER TO ECONOMISER	MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 6 OF 19	REV 05



BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE SH STEAM/MAIN STEAM	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 7 OF 19	REV 05

PROCESS :

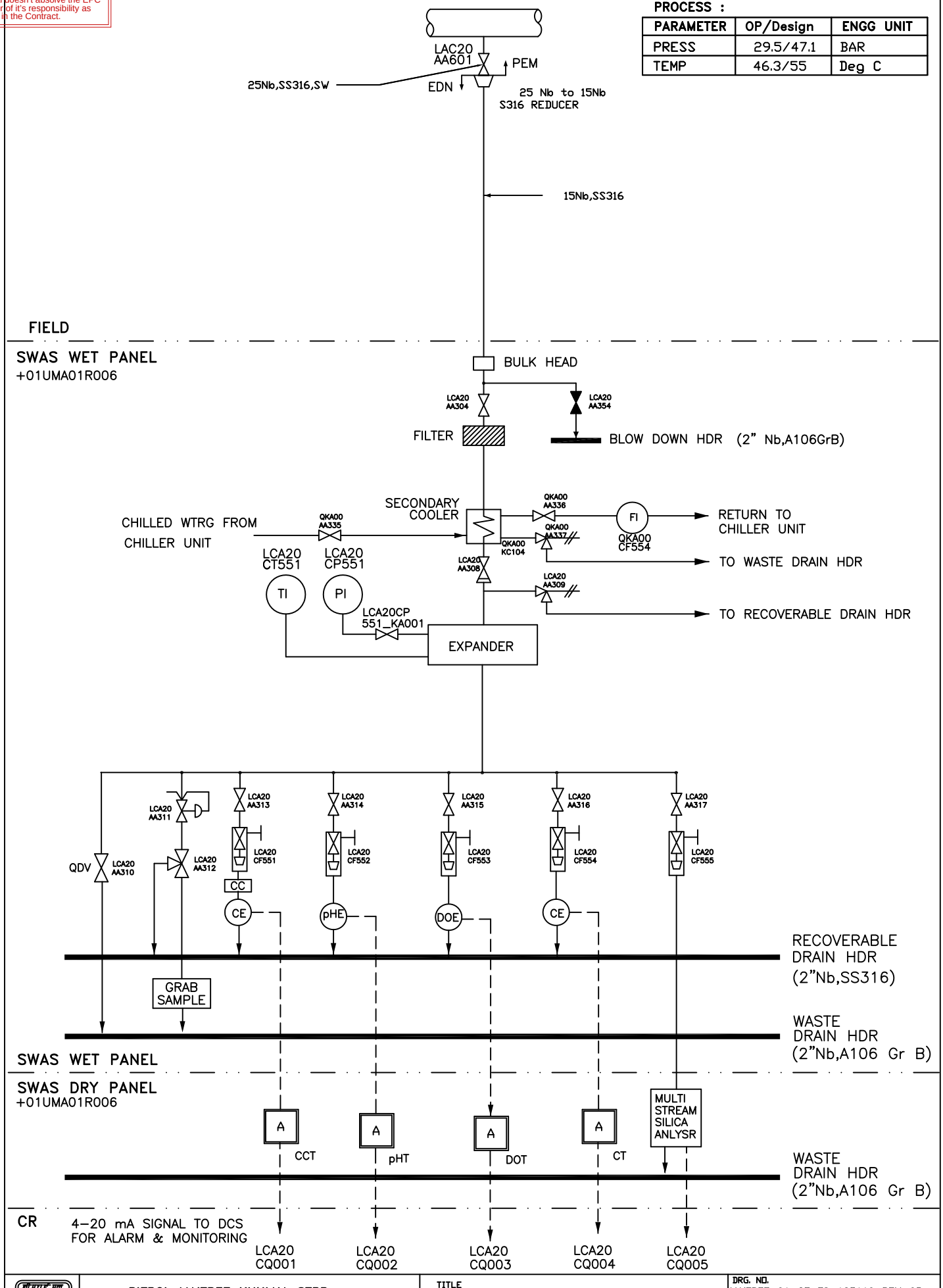
PARAMETER	OP/Design	ENGG UNIT
PRESS	29.5/47.1	BAR
TEMP	46.3/55	Deg C



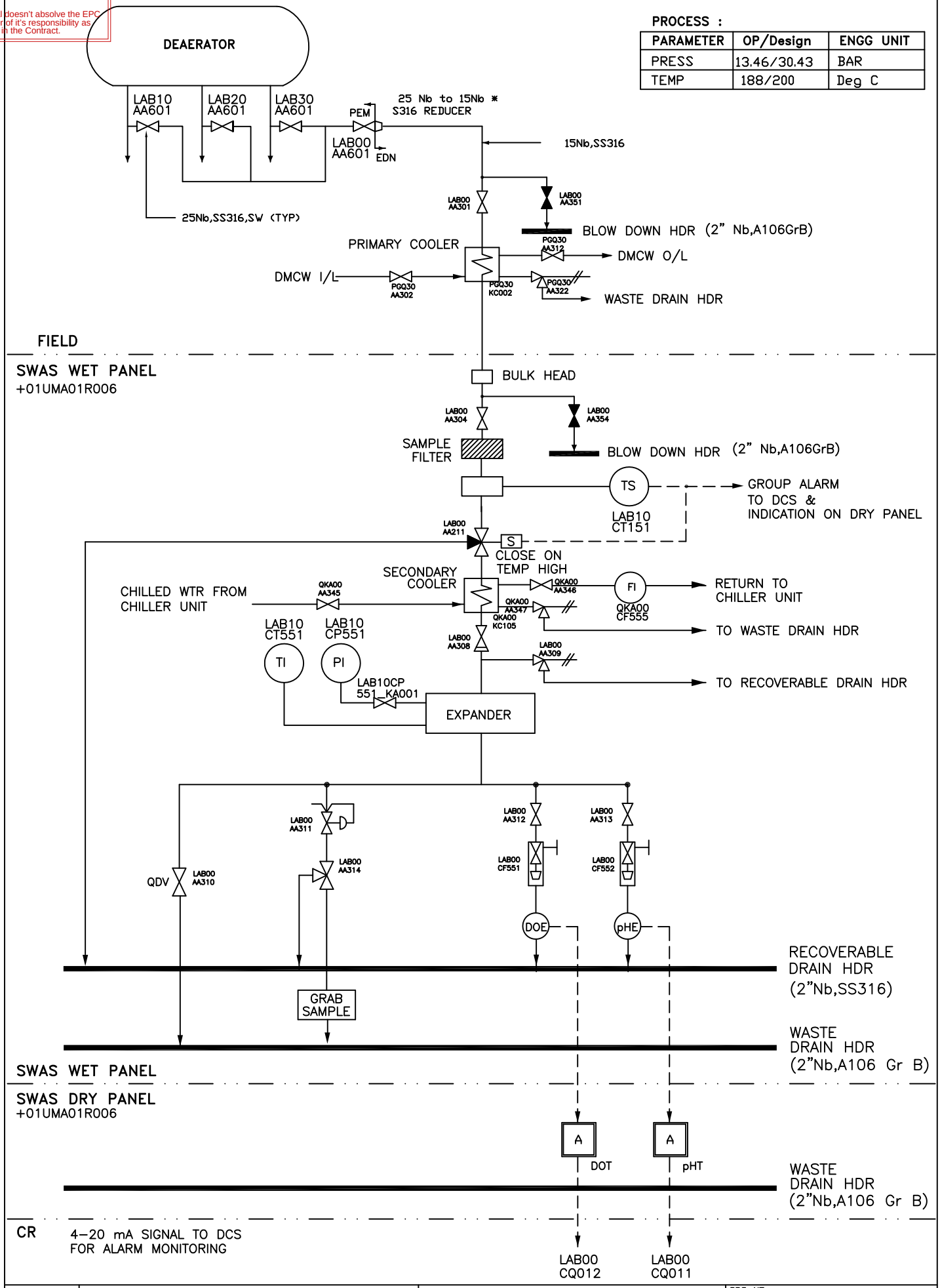
BIFPCL MAITREE KHULNA STPP	TITLE	DRG. NO.	
MAITREE (2X660 MW)	CONDENSATE POLISHER O/L	MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 8 OF 19	REV 05

PROCESS :

PARAMETER	OP/Design	ENGG UNIT
PRESS	29.5/47.1	BAR
TEMP	46.3/55	Deg C



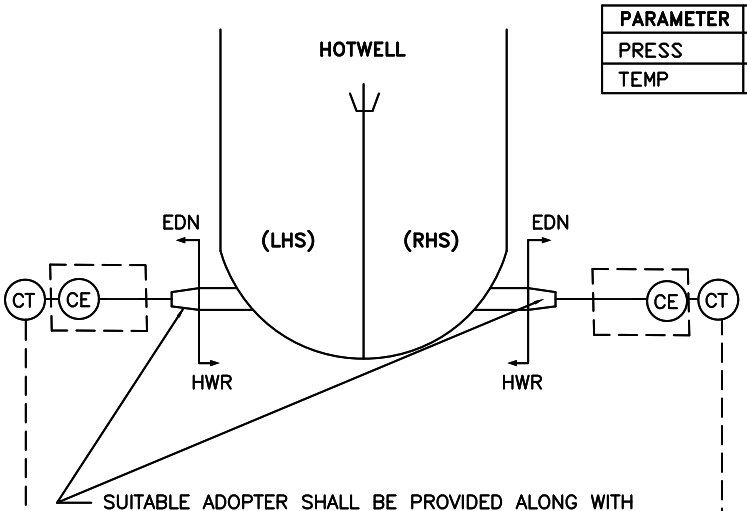
BIFPCL MAITREE KHULNA STPP	TITLE	DRG. NO.	
MAITREE (2X660 MW)	CONDENSATE AT CEP DISCHARGE	MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 9 OF 19	REV 05



BIFPCL MAITREE KHULNA STPP	TITLE	DRG. NO.	
MAITREE (2X660 MW)	DEAERATOR OUTLET	MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 10 OF 19	REV 05

PROCESS :

PARAMETER	OP/Design	ENGG UNIT
PRESS	FULL VACUUM & 6.8	BAR
TEMP	46./55	Deg C



SUITABLE ADOPTER SHALL BE PROVIDED ALONG WITH PROBE FOR TAPPING POINT SIZE= 60.3X5.54 mm LENTGH OF PROBE SHALL BE DECIDED CONSIDERING HOTWELL WALL THK + STUB HEIGHT + LENTGH OF ADOPTER.

FIELD

SWAS DRY PANEL
+01UMA01R006

CR
4–20 mA SIGNAL
FOR ALARM &
MONITORING TO DCS

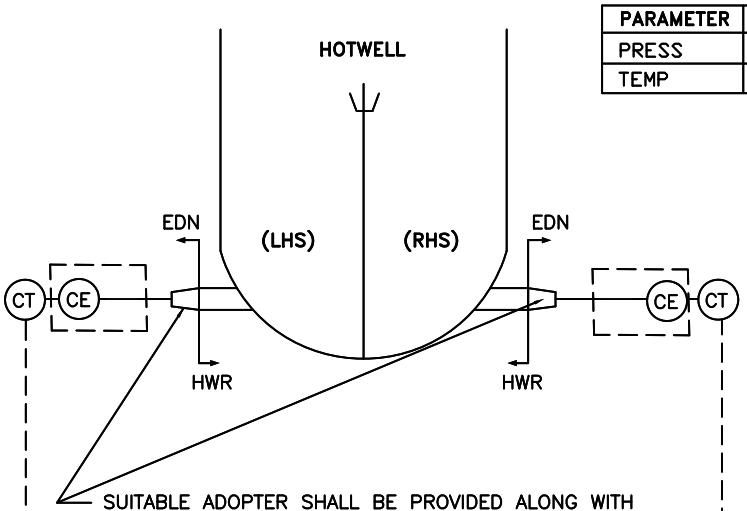
MAG10
CQ011

MAG10
CQ012

BIFPCL MAITREE KHULNA STPP	TITLE	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
MAITREE (2X660 MW)	HOTWELL - A	SHEET 11 OF 19	REV 05

PROCESS :

PARAMETER	OP/Design	ENGG UNIT
PRESS	FULL VACUUM & 6.8	BAR
TEMP	46./55	Deg C



SUITABLE ADOPTER SHALL BE PROVIDED ALONG WITH PROBE FOR TAPPING POINT SIZE= 60.3X5.54 mm LENTGH OF PROBE SHALL BE DECIDED CONSIDERING HOTWELL WALL THK + STUB HEIGHT + LENTGH OF ADOPTER.

FIELD

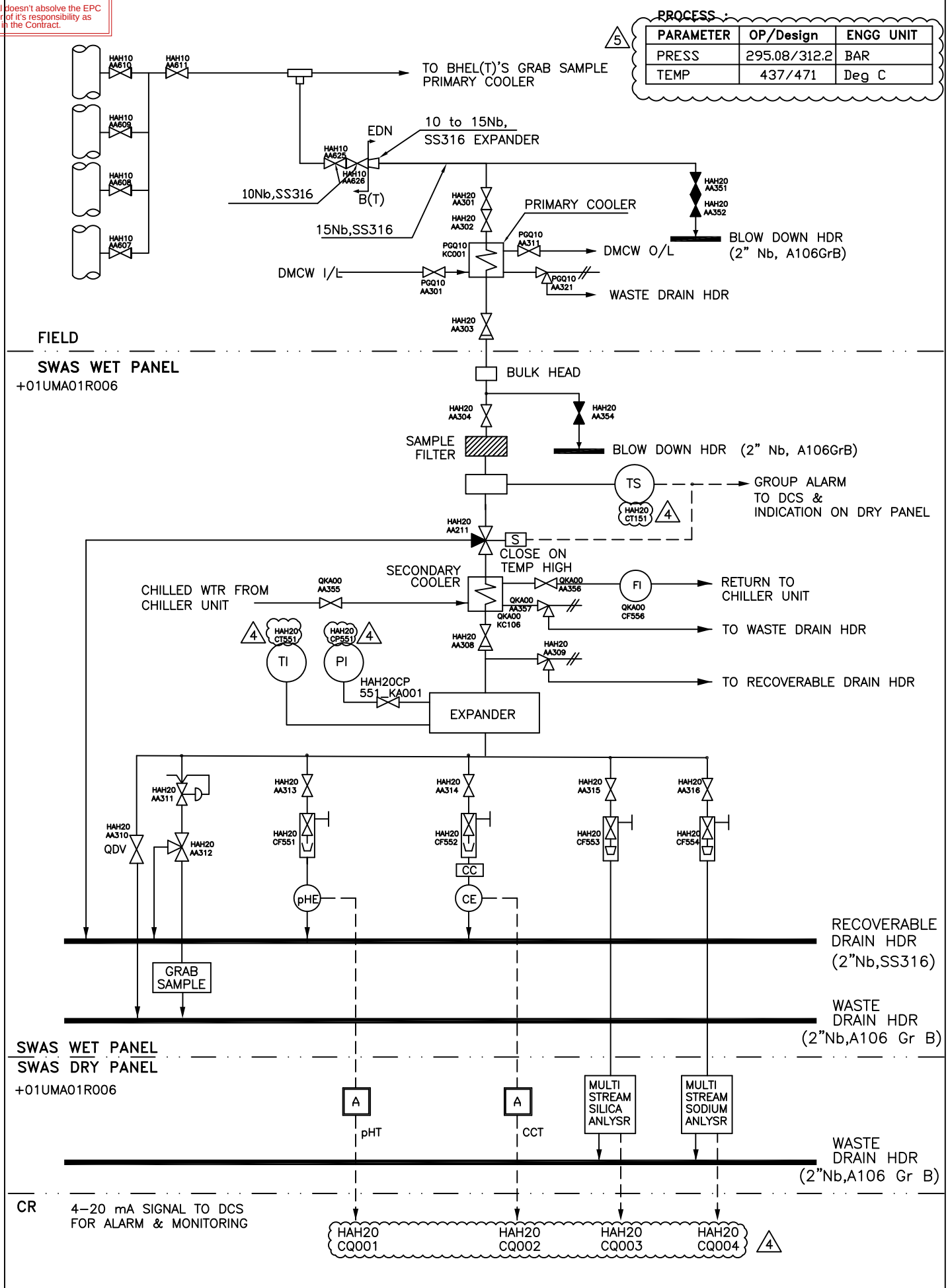
SWAS DRY PANEL
+01UMA01R006

CR
4–20 mA SIGNAL
FOR ALARM &
MONITORING TO DCS

MAG11
CQ011

MAG11
CQ012

BIFPCL MAITREE KHULNA STPP	TITLE	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
MAITREE (2X660 MW)	HOTWELL - B	SHEET 11 OF 19	REV 05



BIFPCL MAITREE KHULNA STPP

MAITREE (2X660 MW)

TITLE

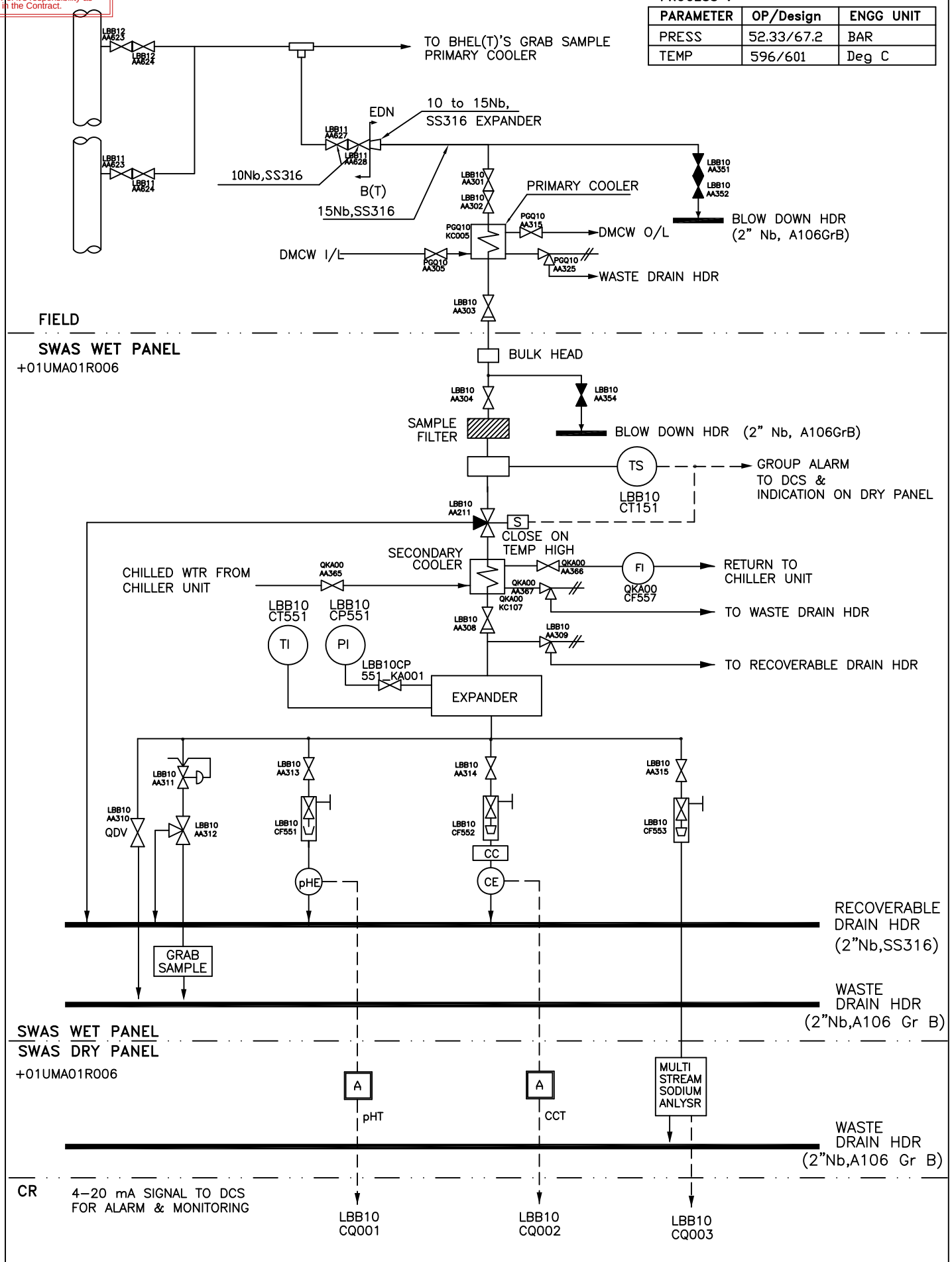
SEPARATOR OUTLET STEAM

DRG. NO. MAITREE-01-CF-FS-123110-PEM-05

SHEET 12 OF 19 REV 05

PROCESS :

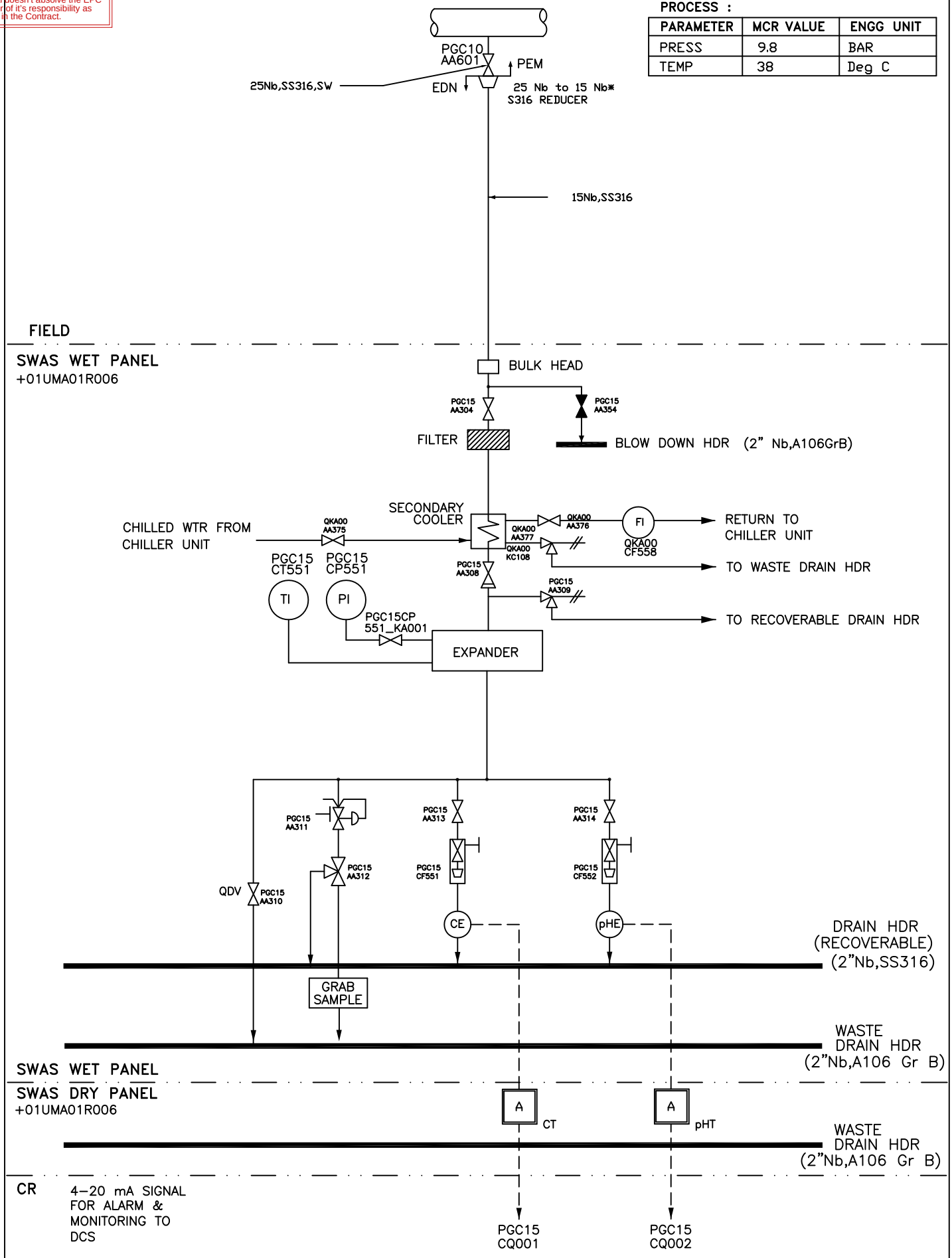
PARAMETER	OP/Design	ENGG UNIT
PRESS	52.33/67.2	BAR
TEMP	596/601	Deg C



BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE REHEATER STEAM	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 13 OF 19	REV 05

PROCESS :

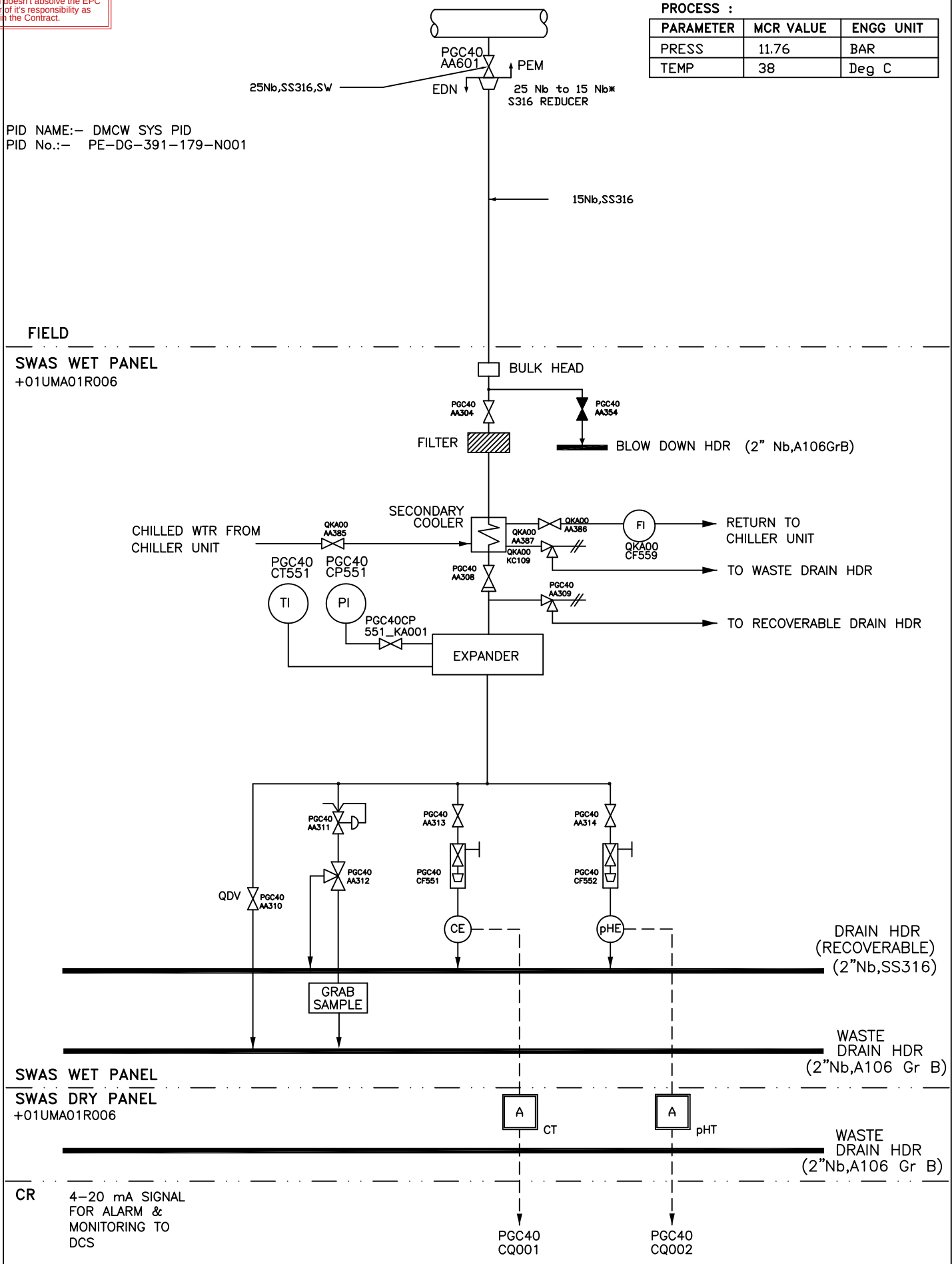
PARAMETER	MCR VALUE	ENGG UNIT
PRESS	9.8	BAR
TEMP	38	Deg C



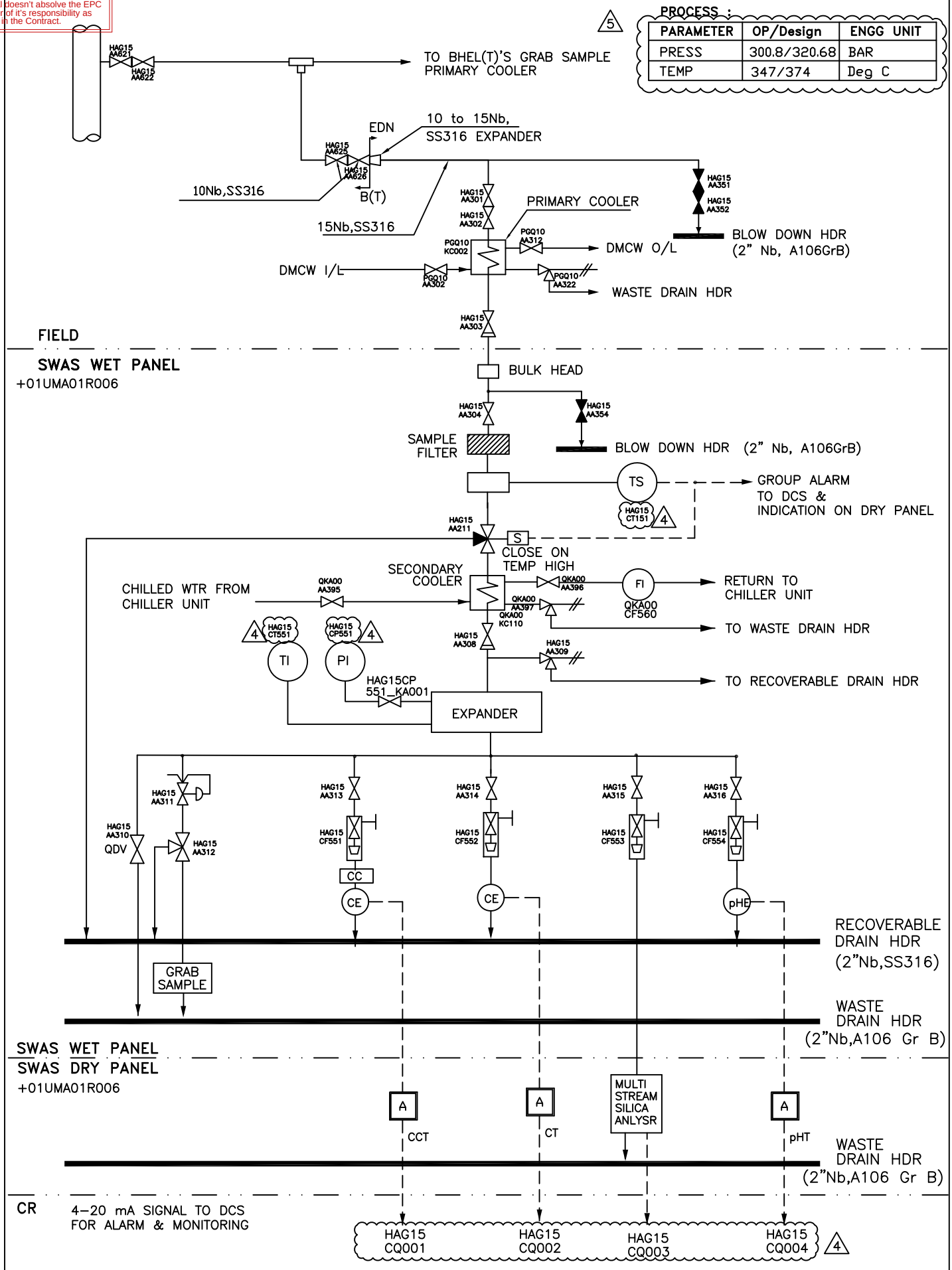
BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE DMCW I/L OF PHE (TG AUX)	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 14 OF 19	REV 05

PROCESS :

PARAMETER	MCR VALUE	ENGG UNIT
PRESS	11.76	BAR
TEMP	38	Deg C



BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE DMCW I/L OF PHE (BLR AUX)	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 15 OF 19	REV 05



BIFPCL MAITREE KHULNA STPP

MAITREE (2X660 MW)

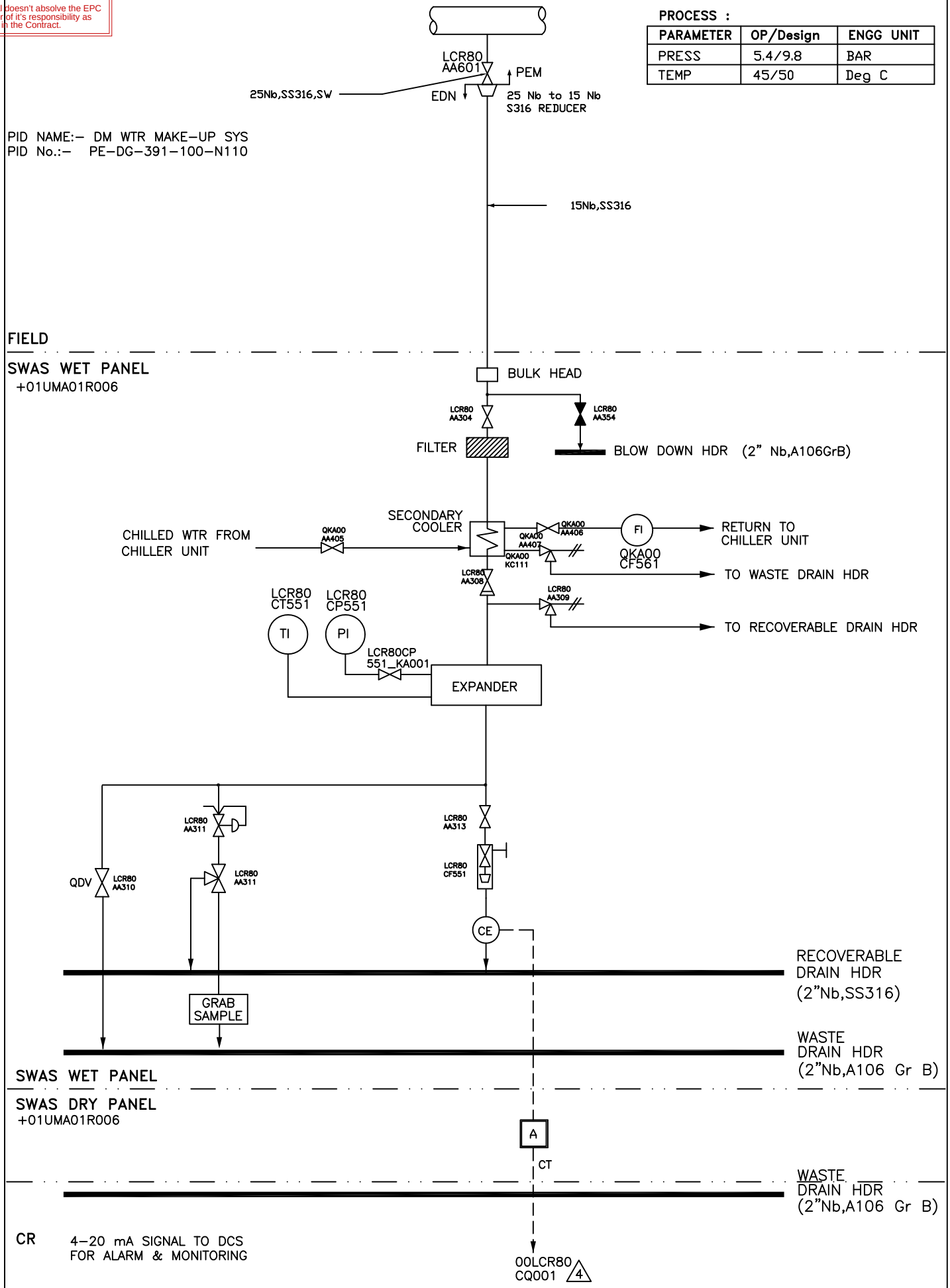
TITLE: WATER STORAGE DOWNCOMER SAMPLING 4

DRG. NO. MAITREE-01-CF-FS-123110-PEM-05

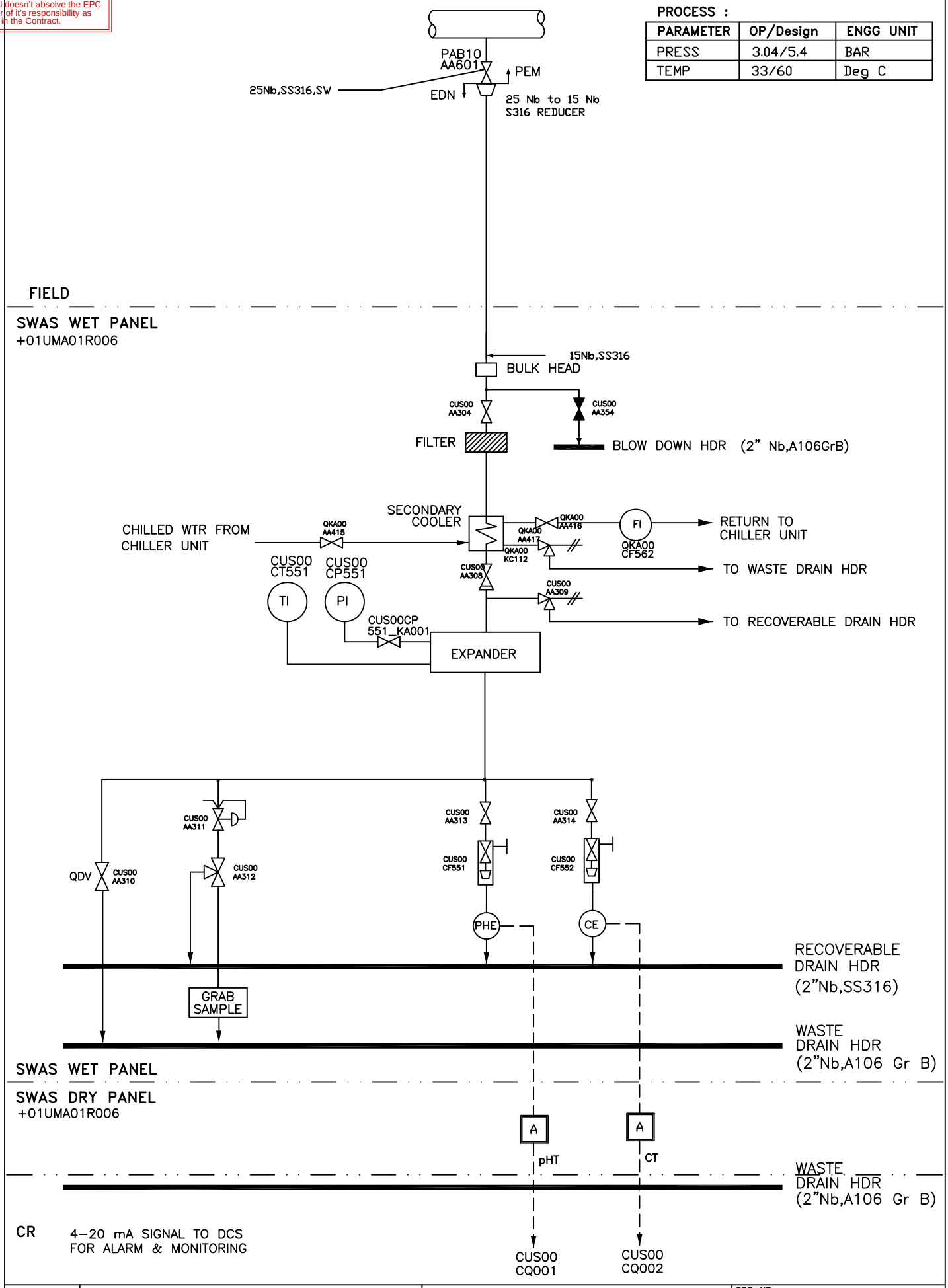
SHEET 16 OF 19 REV 05

PROCESS :

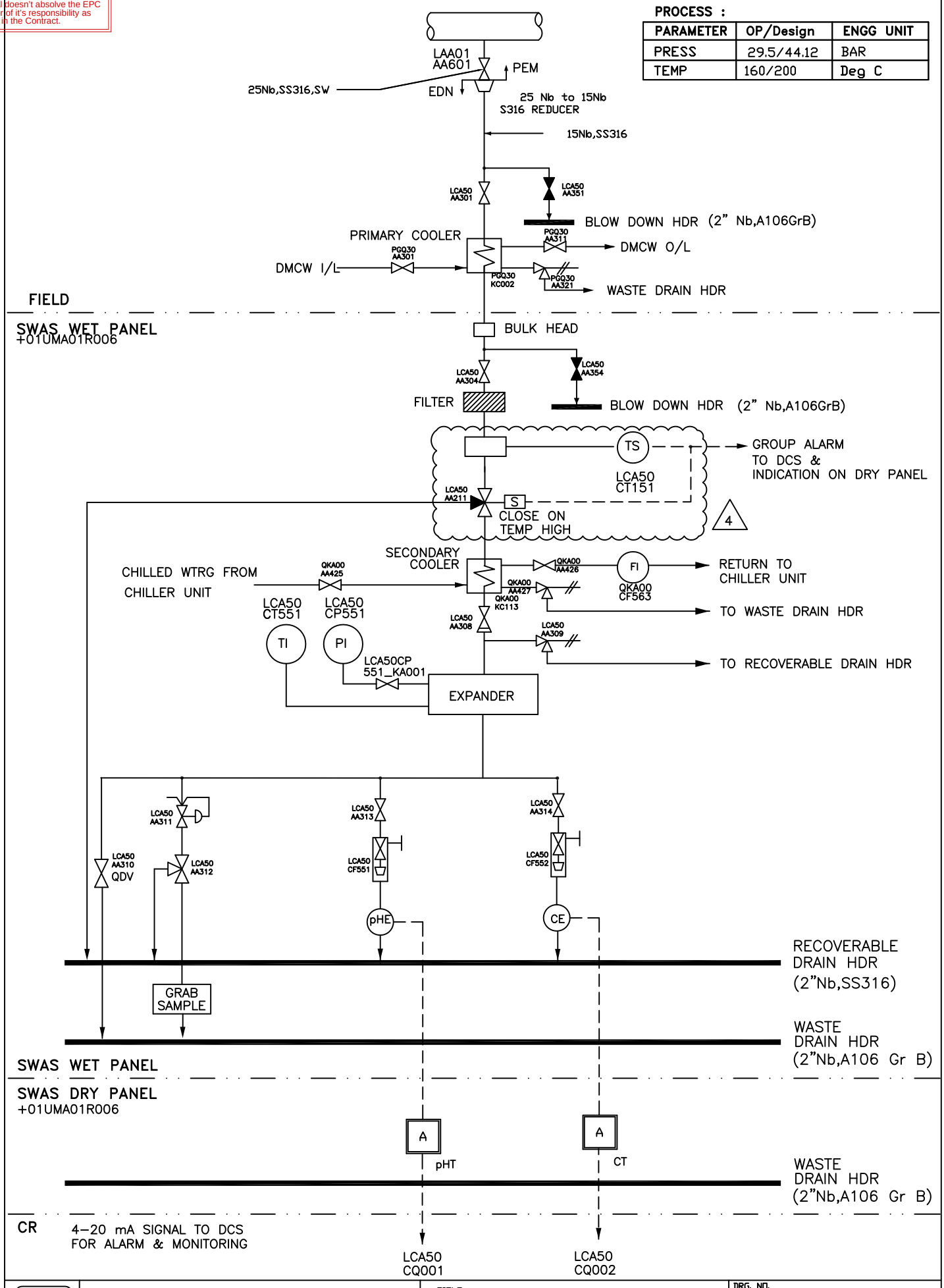
PARAMETER	OP/Design	ENGG UNIT
PRESS	5.4/9.8	BAR
TEMP	45/50	Deg C



BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE MAKE-UP WTR TO CONDENSER	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 17 OF 19	REV 05

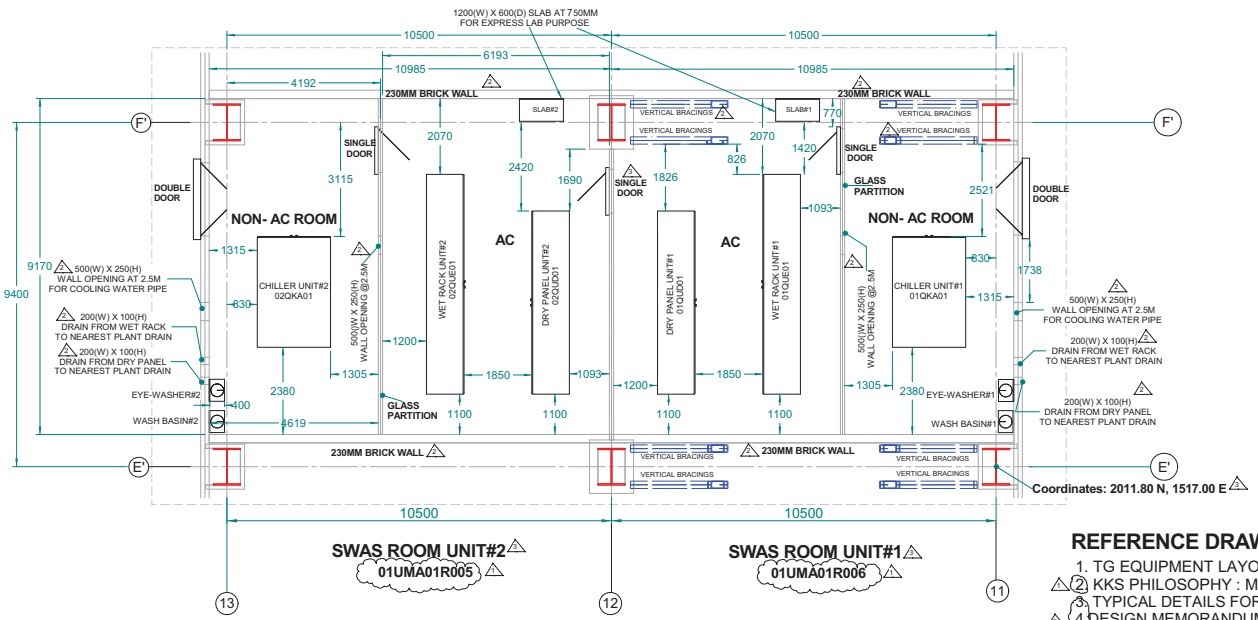


BIFPCL MAITREE KHULNA STPP MAITREE (2X660 MW)	TITLE CONDENSATE COOLING WTR	DRG. NO. MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 18 OF 19	REV 05



BIFPCL MAITREE KHULNA STPP	TITLE	DRG. NO.	
MAITREE (2X660 MW)	DEAREATOR INLET WATER	MAITREE-01-CF-FS-123110-PEM-05	
		SHEET 19 OF 19	REV 05

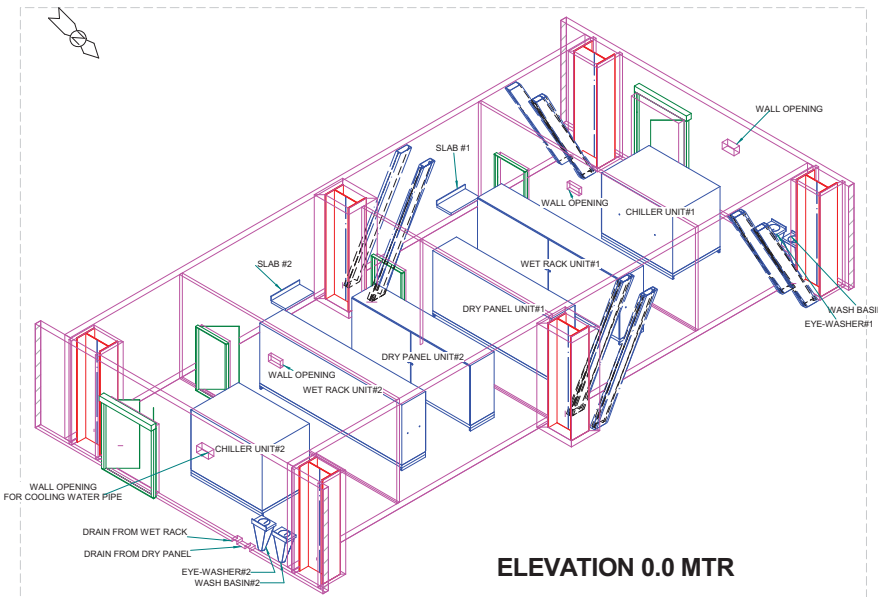
ELEVATION 0.0 MTR



BOQ- SWAS ROOM UNIT # 1&2					
S.NO	AREA NAME	DESCRIPTION	DIMENSIONS (WxDxH) mm x mm x mm	QTY	SCOPE
1	SWAS ROOM UNIT-1	CHILLER	2000 x 3000 x 2300	1	BHEL-EDN
2	SWAS ROOM UNIT-1	DRY PANEL	5000 x 1000 x 2300	1	BHEL-EDN
3	SWAS ROOM UNIT-1	WET RACK	6000 x 1000 x 2300	1	BHEL-EDN
4	SWAS ROOM UNIT-2	CHILLER	2000 x 3000 x 2300	1	BHEL-EDN
5	SWAS ROOM UNIT-2	DRY PANEL	5000 x 1000 x 2300	1	BHEL-EDN
6	SWAS ROOM UNIT-2	WET RACK	6000 x 1000 x 2300	1	BHEL-EDN

REFERENCE DRAWINGS:

1. TG EQUIPMENT LAYOUT DRAWING AT GROUND FLOOR : MAITREE-00-UMA-LH-120003-PEM
2. KKS PHILOSOPHY : MAITREE-00-DB-FE-123001-PEM
3. TYPICAL DETAILS FOR DUCT FABRICATION/SUPPORT/ERECTION FOR AC SYSTEM: MAITREE-00-SAC-LU-112131-PEM
4. DESIGN MEMORANDUM FOR AC SYSTEM WITH PID AND HEAT LOAD CALCULATIONS: MAITREE-00-SAC-DB-112101-PEM
5. DESIGN MEMORANDUM FOR LIGHTING SYSTEM: MAITREE-00-BTW-EDB-105015-PEM
6. DESIGN BASIS FOR FIRE PROTECTION & DETECTION SYSTEM: MAITREE-0-SG-BDB-375001-PES-1
7. CABLING LAYOUT IN TG HALL (BELOW OPERATING FLOOR): MAITREE-01-BTW-EDB-105173-PEM-0



ELEVATION 0.0 MTR

NOTES:

1. WET RACK : CABLE ENTRY FROM SIDE, SAMPLE ENTRY FROM TOP, COOLING WATER ENTRY / EXIT FROM SIDE. GRAB SAMPLE COLLECTION TRAY DRAIN FROM OUTSIDE.
2. DRY PANEL : CABLE ENTRY FROM SIDE, SAMPLE ENTRY FROM TOP.
3. DRY PANEL AND WET RACK ROOM SHALL BE AIR CONDITIONED.
4. WALL SEPARATING THE DRY PANEL, WET RACK & CHILLER UNIT ROOM SHALL BE EXTENDED UPTO NEXT FLOOR.
5. WALL OPENING OF 500(W)X250(H) SHALL BE PROVIDED FOR SAMPLE PIPE ENTRY IN WET RACK FROM FIELD AND SAME HAS BEEN INDICATED IN THE LAYOUT.
6. WALL OPENING OF 500(W)X250(H) SHALL BE PROVIDED ON WALL SEPARATING WET RACK & CHILLER UNIT FOR SAMPLE COOLING PIPES ENTRY FROM CHILLER UNIT TO WET RACK AND SAME HAS BEEN INDICATED IN THE LAYOUT.
7. ROUTING OF DRAIN PIPE FROM BOTH AC & NON AC ROOM TO NEAREST PLANT DRAIN. DRAIN FROM SWAS ROOM CAN BE CONNECTED TO THIS DRAIN. SLOPE OF THE DRAIN MAY BE KEPT AS 1 IN 1000. DRAIN OPENINGS HAVE BEEN INDICATED IN THE LAYOUT.
8. ---DELETED---
9. ALL DIMENSIONS ARE IN MM.
10. CLEAR SPACE BETWEEN FINISHED FLOOR AND CEILING SHALL BE MINIMUM 3.2M.
11. A SLAB OF 1200(W) X 600(D) AT 750MM SHALL BE PROVIDED IN EACH ROOM FOR EXPRESS LAB PURPOSE AS INDICATED IN LAYOUT.

LEGENDS:

IPDS GENERATED DOCUMENT

NO	DATE	ALTERED	CHECKED	APPROVED	NOTE
03	20.08.18	SuN	PS	SSB	Revised in line with Customer comments dated 04.08.18
02	25.06.18	SuN	PS	SSB	Revised in line with Customer comments dated 20.04.18
01	13.03.18	SuN	PS	RKR/SSB	Revised in line with Customer comments dated 12.02.18
00	19.01.18	SuN	PS	RKR/SSB	Document tst submission.

PROJECT :
2x660MW MAITREE SUPER THERMAL POWER PROJECT, RAMPAL, BANGLADESH
(EPC MAIN PLANT PACKAGE)

OWNER CONSULTANT: FICHTNER
M/s FITCHNER GmbH & Co KG,
Stuttgart, GERMANY

	DATE	NAME
DRAWN BY	19.01.18	SuN
DESIGN BY	19.01.18	SuN
CHECKED BY	19.01.18	PS
APPROVED BY	19.01.18	RKR/SSB
SUPERSEDES:		
SUPERSEDED BY:		
SYSTEM:		

OWNER: BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT.) LIMITED, BANGLADESH

BHARAT HEAVY ELECTRICALS LTD. POWER SECTOR PROJECTS ENGINEERING MANAGEMENT NEW DELHI

SCALE | SHEET 01 OF 01

TITLE SWAS ROOM LAYOUT

SIZE: | PROJECT NO. 421 | FILE:
ANNEX: | DRAWING NO. Maitree-01-CW-FC-123403-PEM-3 | REV 03

SIZE-A1

COMPUTER FILE NAME

Electronics Division, BHEL-Bangalore.

CHECK LIST FOR STAINLESS STEEL COMPRESSION FITTINGS
NUMBER :CE/416/SSF/CL REVISION : 00 DATE : 21-07-15
CONTRACTOR : M/s BHEL-EDN

SL NO.	TESTS/CHECKS	QUANTUM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS.	AGENCY**				REMARKS
				M	C	N	D*	
1	DIMENSIONS	REFER NOTE : 1		P	V	V		
2	MATERIAL	SAMPLE/	APPROVED SPECS./	P	V	V		
2.1	CHEMICAL	HEAT /	DATA SHEETS	P	V	V	✓	
2.2	PHYSICAL, HARDWARE	LOT						
3	PROOF PRESSURE TEST	5 RDM. SAMPLE		P	V	V	✓	
4	DISMANTLING RE-ASSEMBLY TEST	3 RDM. SAMPLE	MANUFACTURER'S STANDARD	P	V	V		
5	HYDRAULIC IMPULES & VIBRATION TEST	5 RDM. SAMPLE		P	V	V	✓	

LEGEND :
* RECORDS, IDENTIFIED WITH ' ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

** M: MANUFACTURER/SUB CONTRACTOR, C:CONTRACTOR/NOMINATED INSP.AGENCY
N: CUSTOMER "P" PERFORM "W" WITNESS "V" VERIFICATION

NOTE 1) QUANTUM OF CHECK SHALL BE AS BELOW :
100% - BY MANUFACTURER
NIL -BY M/s BHEL
NIL CUSTOMER

2) MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.

PREPARED BY
M/S BHEL

CHECK LIST FOR IMPULSE PIPES AND TUBES

NUMBER : CE/416/SP/CL REVISION : 00 DATE : 21-07-15

CONTRACTOR : M/S BHEL-EDN

SL NO.	TESTS/CHECKS	QUANTUM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS.	AGENCY**				REMARKS
				M	C	N	D*	
1	CHEEH FOR DIMENSION, GRADE, SURFACE-DEFECTS	SEE NOTE: BELOW	APPROVED DATA SHEET AND CORES SPONDING ASTM STDSFOR GRADE OF MATERIAL	P	V	V	√	
2	CHEMICAL PROPERTIES AND PHY. PROPERTIES AS PER RELEVANT ASTM. (GRADE SHALL BE AS PER APPROVED DATA SHEET)	FOR LOT		P	V	V	√	MANUFACTURER TO PROVIDE TEST CERT. AS PER RELEVANT ASTM STDS. MENTIONED IN SPECS.
3	FLATTENING TEST.		DO	P	V	V	√	
4	FLARING TEST	##		P	V	V	√	
5	BENDING TEST.	**		P	V	V	√	
6	HYDRAULIC TEST OR EDDY CURRENT TEST			P	V	V	√	
7	HARDNESS CHECK	##		P	V	V	√	

LEGEND :

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N: CUSTOMER "P" PERFORM "W" WITNESS "V" VERIFICATION

NOTE : 1) QUANTUM OF CHECK SHALL BE AS BELOW :
100% - BY MANUFACTURER.
NIL -BY M/S BHEL
NIL - BY CUSTOMER

2) MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.
3) ## APPLICABLE FOR TUBES ONLY
4) ** APPLICABLE FOR CS PIPES ONLY.
5) WHEN MATERIAL CORRELATION IS NOT POSSIBLE , MATERIAL SAMPLES ARE TO BE TESTED AT THIRD PARTY LAB & TEST CERTIFICATES ARE TO BE SUBMITTED FOR NTPC REVIEW - CHP

PREPARED BY
M/S BHEL

CHECK LIST FOR FLOW SWITCH
NUMBER : CE/416/FS/CL REVISION : 00 DATE : 21-07-15
CONTRACTOR : M/s BHEL-EDN

SL NO.	TESTS/CHECKS	QUANTUM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS.	AGENCY**				REMARKS
				M	C	N	D*	
1.0	TYPE , MODEL , SL . NO . TAG NO. , RANGE.			P	V	V	✓	
2.0	SIZE , DIMENSIONS	REFER NOTE : 1 BELOW	AS PER APPROVED DATA SHEETS	P	V	V	✓	IN CASE OF IMPORTED ITEMS, CONTR. SHALL REVIEW TC's & NOT INSPECT.
3.0	REPEATABILITY			P	V	V	✓	
4.0	HV / IR	100%		P	V	V	✓	
5.0	CONTACT RATNG / NO. OF CONTACTS	RANDOM		P	V	V	✓	
6.0	MATL. T.C. FOR BODY, WET PARTS.	ONE/LOT		P	V	V	✓	
7.0	ACCESSORIES AS APPLICABLE	100%		P	V	V	✓	

LEGEND :
* RECORDS, IDENTIFIED WITH ✓ SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

** M: MANUFACTURER/SUB CONTRACTOR, C:CONTRACTOR/NOMINATED INSP.AGENCY
N: CUSTOMER "P" PERFORM "W" WITNESS "V" VERIFICATION

NOTE : 1) QUANTUM OF CHECK SHALL BE AS BELOW :
100 % - BY MANUFACTURER.
NIL - BY CONTRACTOR.
NIL -BY M/S CUSTOMER.
2) MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST.

PREPARED
M/S BHEL

CHECK LIST FOR TEMPERTURE SWITCH

NUMBER : CE/416/TS/CL REVISION : 00 DATE : 21-07-15

CONTRACTOR : M/s BHEL-EDN

SL NO.	TESTS/CHECKS	QUANTUM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS.	AGENCY**				REMARKS
				M	C	N	D*	
1.0	TYPE, MODEL, SL. NO., TAG NO., RANGE.			P	W	V	✓	
2.0	DIMENSIONS CHECK	REFER NOTE : 1 BELOW	APPROVED SPECS./ DATA SHEETS	P	W	V	✓	IN CASE OF IMPORTED ITEMS, CONTR.
3.0	REPEATABILITY			P	W	V	✓	SHALL REVIEW
4.0	SWITCHING DIFERENTIAL							TC's & NOT INSPECT.
5.0	CONTACT RATING / NO. OF CONTACTS	RANDOM		P	W	V	✓	
6.0	MATL. T.C. FOR BULB, CAPILLARY, ARMOUR	ONE/LOT		P	V	V	✓	
7.0	HV / IR	RANDOM		P	W	V	✓	
8.0	DEGREE OF PROTECTION	TYPE TEST		P	V	V	✓	
9.0	THERMOWELLS							
9.1	DIMENSIONS	100%		P	V	V	✓	
9.2	MATL. T.C. FOR THERMOWELL	ONE/LOT		P	V	V	✓	
9.3	HYD. TEST	100%		P	W	V	✓	
9.4	IBR CERT. IF APPLICABLE.			P	V	V	✓	

LEGEND :

* RECORDS, IDENTIFIED WITH ' ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

** M: MANUFACTUIRER/SUB CONTRACTOR, C:CONTRACTOR/NOMINATED INSP. AGENCY
N: CUSTOMER "P" PERFORM "W" WITNESS "V" VERIFICATION

NOTE : 1) QUANTUM OF CHECK SHALL BE AS BELOW :

100 % - BY MANUFACTURER.
NIL - BY CONTRACTOR.
NIL - BY M/s CUSTOMER.

2) MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.

PREPARED BY :
M/S BHEL

CHECK LIST FOR TEMPERATURE GAUGE / PAGE 1 OF 2

NUMBER : CE/416/TG/CL REVISION : 00 DATE : 21-07-15

CONTRACTOR : M/s B H E L - EDN

SL NO.	TESTS/CHECKS	QUANTUM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS.	AGENCY**				REMARKS
				M	C	N	D*	
1.0	CHECK FOR		APPROVED SPECS. /					
1.1	DIAL SIZE		APPROVED DATA	P	V	V	√	
1.2	MODEL NO/TAG NO		SHEETS	P	V	V	√	
1.3	RANGE/SCALE			P	V	V	√	
1.4	END CONNECTION	SEE		P	V	V	√	BY GO / NOGO
2.0	CALIBRATION	NOTE-1						GAUGE
2.1	ACCURACY	IN PAGE		P	V	V	√	
2.2	REPETABILITY	2 OF 2		P	V	V	√	
2.3	HYSTERISIS			P	V	V	√	MFR TO
3.0	OVER TEMEPRATURE TEST		DO	P	V	V	√	CARRY OUT ROUTINE
4.0	AMBIENT TEMP. COMPENSATION CHECK	1 OF TYPE		P	V	V	√	TEST ON 100 %
5.0	REVIEW OF T.C FOR MATERIALS OF-	FOR LOT						WHEN MAT'L CORELATION
5.1	SENSOR			V	V	V	√	ARE NOT
5.2	MOVEMENT			V	V	V	√	AVAILABLE
5.3	PROCESS CONNEC.			V	V	V	√	MFR'S
5.4	HOUSING			V	V	V	√	COMPLIANCE
6.0	REVIEW OF TC FOR DEGREE OF PROTEC.	TYPE TEST		V	V	V	√	TO BE PROVIDED
7.0	THERMOWELL							
7.1	HYD TEST ON THERMOWELL			P	V	V	√	IBR CERT. TO BE
7.2	MATERIAL T.C FOR THERMOWELL			V	V	V	√	PROVIDED IF CALLED IN
7.3	DIMENSIONAL CHECK		AS PER APPROVED DRAWING		V	V		SPECS.

LEGEND:

* RECORDS,IDENTIFIED WITH '√ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION

** M:MANUFACTURER/SUB CONTRACTOR,C:CONTRACTOR/NOMINATED INSP.AGENCY. N:CUSTOMER "P" PERFORM "W" WITNESS "V" VERIFICATION

CHECK LIST FOR TEMPERATURE GAUGE / PAGE 2 OF 2

NUMBER : CE/416/TG/CL REVISION : 00 DATE : 21-07-15

CONTRACTOR : M/s B H E L - EDN

NOTE : 1) QUANTUM OF CHECK SHALL BE AS BELOW :
100 % - BY MANUFACTURER.
NIL - BY M/s BHEL.
NIL - BY CUSTOMER

2) MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.

PREPARED BY :
M/S BHEL

CHECK LIST FOR PRESSURE & DIFFERENTIAL PRESSURE SWITCH

NUMBER : CE/416/PS/CL REVISION : 00 DATE : 21-07-15

CONTRACTOR : M/s B H E L - EDN

SL NO.	TESTS/CHECKS	QUANTUM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS.	AGENCY**				REMARKS
				M	C	N	D*	
1.0	CHECK FOR		APPROVED SPECS. /					
1.1	MODEL NO. TAG NO.		DATA SHEETS	P	V	V	√	
1.2	RANGE			P	V	V	√	
1.3	END CONNECTION			P	V	V	√	BY GO/ NO GO GAUGE
2.0	REPEATABILITY	SEE		P	V	V	√	
2.1	HYSTERISIS DIFFERENTIAL	NOTE-1 BELOW		P	V	V	√	
3.0	OVER PRESSURE AND LEAK TEST		DO	P	V	V	√	MFR. TO CARRY OUT
4.0	ELECTRICAL INSUL--ATION / H.V TEST							ROUTINE TEST ON
5.0	REVIEW OF T.C FOR MATERIALS OF-	FOR LOT		V	V	V	√	WHEN MAT'L CORELATION
5.1	SENSOR			V	V	V	√	ARE NOT
5.2	MOVEMENT			V	V	V	√	AVAILABLE
5.3	HOUSING			V	V	V	√	MFR'S
6.0	TC OF MICRO SWIT--CH			V	V	V	√	COMPLIANCE TO BE
7.0	REVIEW OF T.C FOR DEGREE OF PROTEC--TION.	TYPE TEST		V	V	V	√	PROVIDED.

LEGEND:

* RECORDS,IDENTIFIED WITH ' √ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION

** M:MANUFACTURER/SUB CONTRACTOR,C:CONTRACTOR/NOMINATED INSP.AGENCY. N:CUSTOMER "P" PERFORM "W" WITNESS "V" VERIFICATION

NOTE : 1) QUANTUM OF CHECK SHALL BE AS BELOW : 100 % - BY MANUFACTURER
NIL - BY CONTRACTOR.
NIL - BY M/s CUSTOMER

2) MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.

3) IN CASE OF IMPORTED PRESSURE SWITCHES DP SWITCHES BHEL SHALL REVIEW TC AND SHALL NOT INSPECT.

PREPARED BY :

M/S BHEL

CHECK LIST FOR PRESSURE GAUGE & DIFFERENTIAL PRESSURE GAUGE

NUMBER : CE/416/PG/CL REVISION : 00 DATE : 21-07-15

CONTRACTOR : M/S B H E L - EDN

SL NO.	TESTS/CHECKS	QUANTUM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS.	AGENCY**				REMARKS
				M	C	N	D*	
1.0	CHECK FOR		APPROVED SPECS. /					
1.1	DIAL SIZE		DATA SHEETS	P	V	V	√	
1.2	MODEL NO/TAG NO			P	V	V	√	
1.3	RANGE/SCALE			P	V	V	√	
1.4	END CONNECTION	SEE		P	V	V	√	
2.0	CALIBRATION	NOTE-1						
2.1	ACCURACY	BELOW		P	V	V	√	
2.2	REPETABILITY			P	V	V	√	
2.3	HYSTERISIS			P	V	V	√	MFR TO
3.0	OVER PRESSURE AND LEAK TEST		DO	P	V	V	√	CARRY OUT ROUTINE
4.0	OPERATION OF PR. RELIEF DEVICE.	# ONE		P	V	V	√	TEST ON 100 % .
5.0	REVIEW OF T.C FOR MATERIALS OF-	FOR LOT		V	V	V	√	WHEN MAT'L CORELATION
5.1	SENSOR			V	V	V	√	ARE NOT
5.2	MOVEMENT			V	V	V	√	AVAILABLE
5.3	PROCESS CONNEC.			V	V	V	√	MFR'S
5.4	HOUSING			V	V	V	√	COMPLIANCE
6.0	REVIEW OF TC FOR DEGREE OF PROTEC.	TYPE TEST		V	V	V	√	TO BE PROVIDED
7.0	ACCESSORIES, AS APPLICABLE	SEE NOTE-1		V	V	V	√	

LEGEND:

* RECORDS,IDENTIFIED WITH ' √ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION

** M:MANUFACTURER/SUB CONTRACTOR,C:CONTRACTOR/NOMINATED INSP.AGENCY. N:CUSTOMER "P" PERFORM "W" WITNESS "V" VERIFICATION

NOTE : 1) QUANTUM OF CHECK SHALL BE AS BELOW :
100 % - BY MANUFACTURER.
NIL - BY M/s BHEL.
NIL - BY M/s CUSTOMER
2) MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.
3) # ONE FOR PR. GAUGE AND ONE FOR DP GAUGE.

PREPARED BY :
M/S BHEL

PROJECT :- MAITREE 2X660 MW

CUSTOMER :- BIFPCL

CONSULTANT :- FITCHNER GERMANY

CONTRACTOR :- BHEL

SECTION - G

APPROVED VENDOR LIST

REVISIONS :

APPROVED

(Punit P Singh)

PREPARED	ISSUED	DATE
PRK	416	17-05-2019

C O P

VENDOR LIST

SS TUBES AND PIPES: Maharashtra Seamless(CS only), Sumitomo / Kawasaki/ Nippon Japan, TPS Technitube Germany Veluric & Manessmann Germany, BHEL-Trichy, Trouvay & Cauvin France, ISMT Ahmedabad, Sandvik Mumbai Jindal Saw (DR Category), Ratnamani Metal & Tubes (DR Category), Shubhalaxmi Metal & Tubes (DR Category)

PRESSURE GAUGES : AN Instruments Kolkata, Manometer,WIKA India, Goa Thermostatic Goa, PTCI Kolkata Gauges Bourdon Panvel, H.Guru (South India) Bangalore, Walchand Dharwad (DR), Budenberg UK, Forbes Marshall Hyd (DR)., Wise Control Korea, Nagano Keiki Japan, Baumer Vapi, H Guru Rishra, Precesion Mass Products (Ashcroft) Gandhinagar. H Guru Rishra, US Gauge USA (DR), Winters USA (DR), Gauges Bourdon UK (DR).

TEMPERATURE GAUGES: Budenberg UK, Precesion Mass Products (Ashcroft), WIKA India, Wise Control Korea, Nagano Keiki Japan, H.Guru (South India) Bangalore, AN Instruments Kolkata, Nuova Fima Italy, Goa Thermostatic Goa, Goa Instruments Industries Goa, Baumer Vapi, H Guru Rishra, Forbes Marshall Hyd (DR), Gauges Bourdon Panvel Konics Korea (DR Category), Pyro Electric Goa (DR Category), US Gauge USA (DR Category), Winters USA (DR Category)

PRESSURE SWITCH : Indfoss, Switzer, SOR-USA , Gauges Bourdon, Trafag Ranipet, Herion, Barksdale, Precesion Mass Products(Ashcroft) Gandhinagar, ITT Barton USA, Dressor Germany, Delta Controls UK, Nagano Keiki, Wika (DR Category), Georgin France (DR Category), United Electric USA (DR Category) SMC Japan (DR Category), Neodyne USA (DR Category), Wise Controla Korea (DR Category), Baumer Vapi (DR Category)

TEMPERATURE SWITCH : Indfoss, Switzer, SOR-USA , Gauges Bourdon, Trafag Ranipet, Precesion Mass Products(Ashcroft) Gandhinagar, ITT Barton USA, Dressor Germany, Delta Controls UK, Georgin France (DR Category), United Electric USA (DR Category), SMC Japan (DR Category), Gauges Bourdon

Cage Clamp type Terminals : Wago Noida , Phoenix, Noida,
Annunciator:- Procon, Hathway, Ronan

INSTRUMENT VALVES : BHEL - Trichy., DK Tech Korea, Hamlet Israil, Excel Hydro Mumbai, IL Palghat, Swagelok USA, Parker USA, HY Lok Korea, HP Valves and Fittings Chennai, Hydair Lonavala.
SOLENOID VALVES: Rotex Vadodara, Avcon Mumbai, Herion Germany, IMI Norgren Germany, Jafferson Argentina, Asco Chennai/USA, Festo Bangalore, SMC Noida, Parker, Schneider Germany

Flow Switch : Precision Mass Products Private Limited (Earlier Aschcroft),Univeral Flow Meter USA, SWITZER INSTRUMENT LTD, Levcon Kolkata., GAUGES BOURDON (INDIA) PVT. LTD, DK Instruments Kolkata Krone Marshal Pune, Chemtrol India (DR Category), V Automat Delhi, Magnetrol Belgium, Auxitrol UK, Mericoid USA Delta Control UK, Merium USA, Sunag Corporation (DR Category)

COMPRESSION FITTINGS: Hamlet Israil, Parker USA, Precision Mumbai, DK Tech Korea, HY Lok Korea, Astech Mumbai, Hydair (Fluid Control) Mumbai, HP Valves and Fittings Chennai, Excel Hydro Mumbai, Swagelok USA, Panam Mumbai, Parker Hannifin India Pvt Ltd (DR Category)

ANALYSER VENDOR LIST:

CONDUCTIVITY ANALYSER: Hach Switzerland, Emerson Process Mgt Navi Mumbai, Yokagawa Japan, ABB UK , Honeywell USA (DR Category), DKK Japan (DR Category), Orion USA (DR Category), SWAN (DR Category)

DISSOLVED OXYGEN ANALYSER: Hach Switzerland, Emerson Process Mgt USA, ABB UK Honeywell USA (DR Category), DKK Japan (DR Category), Orion USA. , SWAN (DR Category)

HYDRAZINE ANALYSER: Hach Switzerland, Orion USA, ABB UK, DKK Japan (DR Category), Rosemount Inc Irvine (DR Category)

PH ANALYSER: ABB UK, Hach Switzerland, Emerson Process Management Navi Mumbai, , SWAN (DR Category) Yokogawa Japan, Honeywell USA (DR Category), DKK Japan (DR Category), Orion (DR Category)

PHOSPHATE ANALYSER: Hach USA, Hach Switzerland, ABB UK, DKK Japan (DR Category), Orin USA (DR Category) Rosemount Inc Irvine (DR Category)

SILICA ANALYSER: Hach USA, Hach Switzerland, ABB UK, DKK Japan (DR Category), Orin USA (DR Category) Rosemount Inc Irvine (DR Category) , SWAN (DR Category), Rosemnount Analytical (DR Category)

SODIUM ANALYSER: Hach Switzerland, ABB UK, DKK Japan (DR Category), Orin USA, , SWAN (DR Category)

Turbidity ANALYSER: ABB UK, WTW Germany, E&H Germany, Emerson USA, , SWAN (DR Category) , DKK Japan (DR Category)

ORP and Oil in Water Anlyser - Bidder to submit PQR Credentials for vendor approval.

Note:- 1. Vendors to note that above indicated vendors are part of NTPC/Fitchner Germany vendor list. Vendors still in DR category are also indicated these are subject to NTPC/Fitchner Germany approval.

2. Vendors to note that if they are offering makes other than makes indicated above, then BHEL shall approach customer for approval of offered makes.. If customer does not accord Approval of , offered makes for any item (from Your quoted vendors), Items shall be supplied as per customer approved vendors only. This shall be done without any commercial implications.

SECTION - "H"

- Analysers & Spares shall be packed project wise in lockable Metal Container suitable for outside storage at project sites. Typical requirements are as below:-

  - Type: Standard Outdoor type MS container, fully closed.
  - Dimension: Vendor to decide based on Qty of Analysers & Spares.

General condition:

1) The container shall be suitable to store imported and sophisticated components in open environment at thermal power plants. It shall be leak proof.
2) Container shall be provided with proper glass wool thermal insulation at inside.
3) Wall thickness (all sides), reinforcement, supporting lugs, lifting lugs, etc., shall be suitable to store and transport the container with the permissible load as required.
4) Doors shall have suitable latches to lock the container with pad locks for safety purpose.
5) Interior and external surface shall be completely painted as per the standard practice and it shall be Suitable for sea-shore atmosphere.
6) Containers shall be provided with Tag Plates with Project Name.

Analysers and Mandatory spares shall be packed in separate boxes as per above specifications.

Important Note: Mandatory Spares shall be sent in pre-decided lots in containers / secure boxes distinctly marked in Red colour with boldly written "S" mark on each face of the containers /secure boxes.

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REVISION HISTORY SHEET

REV NO.	DATE	NATURE OF CHANGE	REASONS	CHANGED BY	APPROVED BY
00	06/03/92	SUPERCEDS CN43000	-	VS MAS SHG	N.J
01	19/06/93	GENERAL	FEEDBACK FROM QUALITY	SHG	N.J
02	24/06/93	CL 3.4.10	FEEDBACK FROM QUALITY	SHG	N.J
03	01/07/93	SEMICONDUCTOR & PHTOVOLTAIC PANELS ADDED	FEEDBACK FROM DESPATCH	SHG	N.J
04	17/10/94	TOTALLY REVISED	FEEDBACK FROM QUALITY	SHG	N.J
05	08/06/95	ANNEXURE ADDED	FEEDBACK FROM QUALITY & ACCEPTANCE CRITERIA OF WOOD ADDED	SHG	N.J
06	17/11/95	CL 2.5.10 ALTERED	FEEDBACK FROM QUALITY & SHIPPING	SHG	N.J
07	05/03/97	UNDER CL 3.0 & 3.9.1 RPP ADDED ACCEPTANCE CRITERIA REMOVED	FEEDBACK FROM SHIPPING & QC	SHG	N.S
08	29/08/2001	CL 2.2.8 & 4.1 CHANGED	FEEDBACK FROM SHIPPING & QC	SHG	NS
09	15.12.2009	INCLUSION OF PINE WOOD AND SOME CLAUSES HAVE AMENDED	FEEDBACK FROM SHIPPING	PGD / KPN	MSS
10	21.06.2013	Inclusion of recommendations pertaining to spares in page-11&28	Recommendations from Corporate systems & IT	HRN	MSS

REV-10.

APPROVED: M. Sivaramaiah

PREPARED: HRN

ISSUED: STDS GROUP DATE: 21/06/13

	PLANT STANDARD	ED 049 00 99 REV NO 10 PAGE 1 OF 28

PROCEDURE FOR PACKING OF CONTROL EQUIPMENTS PRODUCTS USING RUBBER WOOD, SILVER OAK WOOD, PINE WOOD AND CARTONS

1.0 SCOPE: This standard covers the guidelines for packing of Control Equipments, semiconductor devices and Photo voltaic panels/cells.

2.0 MATERIALS:

2.1 WOOD:

2.1.1 **INLAND:** The wood shall be Rubber wood (Havea Brasiliensis) for packing of cubicles, loose items, spares and photovoltaic items meant for customers in India.

2.1.2 **EXPORT:** Silver Oak (Grevillea Robusta) / Pine wood shall be used for packing of cubicles and loose items meant for export.

2.2 DIMENSIONS:

2.2.1 Thickness of planks for Front, rear, top and bottom sides and binding, jointing battens shall be 25 +2/-3 mm.

2.2.2 Width of all planks including the tongue shall be more than 125 mm after planing, except to adjust total height of item to be packed.

2.2.3 Minimum number of planks shall be used for a shook.

2.2.4 In any case, only one plank can be of width less than 125 mm, but greater than 100 mm.

2.2.5 Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of panel, as given in Figure-2).

2.2.6 External sides of front and rear planks to be planed to facilitate writing of address and other markings.

2.2.7 Width of binding planks shall be minimum 100 mm.

2.2.8 Distance between any 2 binding planks shall be less than 750 mm. As shown in Fig-3, diagonal planks shall be used in between vertical binding planks when distance between inner to inner of vertical planks is more than 750 mm

2.2.9 Distance of the outer edges of these planks from the edge of case shall be less than 250 mm.

2.2.10 Diagonal planks are not required for top planks and width side also, if the width of pallet is less than 750 mm.

2.2.11 **Jointing of planks:** Single length planks shall be used for cubicles whose overall length is less than 2400 mm. For cubicles of length more than 2400 mm, jointing is permitted. The jointing shall be done with one single or maximum of 2 planks of wood same as other planks of width 250 mm (minimum) with two rows of nails on either side of the joint in zigzag manner. From the joint along height side it shall be of lap joint with over lap of at least the width of plank.

2.2.12 **Tongue and Groove joints:** Two Consecutive planks shall be joined by tongue and groove joint. Depth of tongue shall be 12$\pm$1 mm, thickness of tongue shall be 8 $\pm$1 mm. The groove dimensions shall be such that the tongue fits tightly into the groove to make a good joint.

2.3 **PERMISSIBLE DEFECTS: -** Wood shall be free from knots, bows, visible sign of infection and any kind of decay caused by insects, fungus, etc.

End splits: Longest end splits at each end shall be measured and lengths added together. The added length shall not exceed 60 mm per meter run of shook's. Wood pins shall be used to prevent further development of split.

Surface cracks: Surface cracks with a maximum depth of 3 mm are permissible. A continuous crack of any depth all along the length is not allowed.

2.4 .0 CHEMICAL TREATMENTS FOR PRESERVATION OF WOOD:-

2.4.1 This treatment provides protection to the packing wood against deterioration due to fungi and attack by termites, borers and marine organism and any kind of infections.

2.4.2 The wooden planks, after making tongues / grooves shall be treated with chemicals. For pine wood, treatment with ASCU/ CCA solution need not be done.

2.4.3 The chemical used shall be ready mix ASCU paste. This consists of Arsenic pent oxide, copper sulphate sodium dichromate. This Paste shall be mixed at the rate of 1 kg of paste per 10 liters of water to the extent of water used. Alternate this CCA paste as mentioned at Para 2.4.5 can also be used.

2.4.4 The chemical treatment shall be done at the premises of the contractor. A cement concrete tank of capacity to hold a minimum of 2000 liters of solution shall be constructed. The solution

shall be prepared in the presence of BHEL- EDN's Representative by contractor. The wooden planks shall be soaked in the solution for a minimum of 12 hours. The solution shall be replenished after treating a maximum of 12 cubic meters of wood. A log book shall be maintained by the contractor to give the details of date of preparation of solution, quantity of solution prepared, quantity of chemicals used, Quantity of wood treated and the details of replenishment. Samples of solutions before mixing will be got tested at the laboratories designated by BHEL. The testing fees to be paid to the laboratories will have to be borne by the contractor. The paste shall be tested as and when required.

2.4.5 Specifications for water soluble type wood preservatives: Copper – Chromium – Arsenic [CCA]:

Copper – Chromium – Arsenic preservative formulation shall be as per IS : 10013 Part – II – 1981 shall consist of following active ingredients in nominal proportions by weight as shown below:

Arsenic Pent oxide	$AS_2O_52H_2O$	12.5
Copper Sulphate	$CuSO_45H_2O$	37.5
Sodium Dichromate	$Na2Cr_2O_75H_2O$	50.0
Or		
Potassium Dichromate	$K2Cr_2O_7$	

2.5 **OTHER MATERIALS**:

2.5.1 NAILS: The dia. of the nails shall be 3.15 mm. The length of the nails shall be 65 mm wherever two planks of 25 mm thickness are joined and 75 mm wherever a 25 mm planks is joined to a 50 mm plank.

2.5.2 BLUE NAILS: These are used for nailing bituminized Kraft paper/hessian cloth to the planks. The length of the nails shall be 16 mm.

2.5.3 HOOP IRON STRIPS: These are used for strapping the boxes. The width of the strips shall be 19$\pm$1 mm and thickness 0.6 $\pm$0.01 mm. The material shall be free from rust.

2.5.4 CLIPS: These shall be used for strapping the hoop iron strips on the boxes.

2.5.5 BRACKETS: These brackets are used for nailing to the corners of cubicle boxes. The brackets shall be of mild steel of thickness 2 $\pm$1 mm and width 25$\pm$1 mm. The brackets shall be of "L" shape, the length of each side being 100$\pm$2 mm. Two holes shall be provided towards the end of each side for screwing /nailing.

2.5.6 FASTENERS: Bolts, double nuts, spring washers will have to be used for packing of some special items like transformers, reactors, breakers, etc., to hold the job to the bottom plank of the box. The bolts, nuts, washers will be provided by BHEL. However, drilling of holes will have to be done using contractor's tools.

2.5.7 POLYETHYLENE SHEET: The polyethylene sheets are used to make covers to the jobs individually. The material shall have a thickness of 0.175 mm (175 microns). The polyethylene sheet shall be clear and transparent.

2.5.8 BITUMINISED WATER PROOF KRAFT PAPER: This is used for lining the inside of shoots of cubicles.

2.5.9 BITUMEN COATED HESSIAN POLYETHYLENE KRAFT PAPER: This is used for lining the inside of top planks of cubicles and for lining of all inner sides of boxes.

2.5.10 RUBBERISED COIR: The rubberized coir is used as cushioning material .For the packing of loose items, items are to be arrested by using rubberized coir. For the packing of cubicles rubberized coir of thickness 25mm and width 75mm shall be used.

2.5.11 FOAM RUBBER / 'U' FOAM: This is used for covering the delicate items. This material is normally provided by BHEL.

2.5.12 THERMOCOL (EXPANDED POLYSTYERENE) SHEETS): This is used for covering delicate items. This material is normally provided by BHEL.

2.5.13 MARKING PLATE: This shall be of anodized aluminum sheet. Details and specifications are given in Fig-5.

2.5.14 PACKING SLIP HOLDER: This shall be of galvanized iron /tinned

2.5.15 SILICA GEL: This shall be of indicating type.

2.5.16 COTTON BAGS: These are used for holding silica gel. The bags shall have the following matter indicated them:

BHEL-EDN, BANGALORE - 5 60 026
SILICA GEL INDICATING TYPE
BLUE : ACTIVE
ROSE : REDUCED ACTIVITY
WHITE : NO ACTIVITY. TO BE REPLACED WITH FRESH SILICA GEL

2.5.17 COTTON/ PLASTIC TAPE: This is used for tying small items .And also to prevent vibrations of moving parts within the cubicles.

2.5.18 MARKING INK: The ink used normally is black in color. In some special cases other color also will have to be used. The ink shall be non-fading/indelible and non-washable by water.

2.5.19 POLYETHYLENE BAGS: These are to be used for keeping the, Packing slips. The bag shall be of size 70 mm X 100 mm (minimum).

2.5.20 Hessian cloth, twine thread, paint will have to be used in packing certain items.

2.5.21 Mechanical Latching clamps: For CLW Railway panels and similar Panels self locking clamps can also be used on need basis in conjunction with or apart from regular bolt and nut fixing arrangement. [Refer Drawing Fig-7]. For reusable boxes, these clamps provide easy locking and unlocking arrangement. These clamps will be made available from BHEL in some cases.

3. 0 *PACKING* SPECIFICATIONS: Different types of packing are used as follows:

1) Packing of cubicles with rubber wood.
2) Packing of cubicles with Silver Oak wood / Pine wood
3) Packing of empty cubicles with rubber wood.
4) Packing of loose items/spares with rubber wood.
5) Packing of loose items /spares with Silver Oak wood.
6) Packing of Photo-voltaic items with rubber wood.
7) Packing using bitumen coated hessian polyethylene Kraft papers.
8) Supply of rubber wood pallets for empty cubicles.
9) Packing of semiconductor panels.
10) Packing of material covered under category of RPP (Registered Postal Parcel)
11] Packing of materials using PVC [sunspace] / corrugated Kraft paper cartons.
12] Packing of materials using heavy duty cartons

3.1 PACKING OF CUBICLES WITH RUBBER WOOD:

3.1.1 The packing is to be done as per clause 2.O in all respects.

3.1.2 The cubicles are already fixed on wooden pallets. Hence the contractor need not arrange the bottom pallets normally.

3.1.3 The cubicles will be of different sizes both widthwise and lengthwise. The cubicles may be made up of single suite, 2 Suite, 3 Suite, 4 Suite, etc., The width of the cubicles generally varies from 400 mm to 1650mm.The length of the cubicle, generally varies from 1500 mm to 4800 mm. The height is normally 2430 mm. In some cases the height may be less/more.

3.1.4 BITUMINISED WATER PROOF KRAFT PAPER: The inner surface of 4 sides of shook's shall be nailed with Bituminized water proof Kraft paper (as per 2.5.8) using blue nails (as per 2.5.2)wherever 2 pieces of Kraft paper are used, the joint shall have an overlap of minimum 20 mm.

3.1.5 BITUMEN COATED HESSIAN POLYETHYLENE KRAFT PAPER: The inner surface of top cover shall be nailed with Bitumen coated Hessian polyethylene Kraft paper (as in 2.5.9). This sheet shall project outside on 4 sides by at least 100 mm and shall be nailed properly on sides. Joining of sheets should have overlap of minimum 20 mm.

3.1.6 POLYETHYLENE SHEET COVERING: The cubicles shall be covered with a polyethylene petticoat (Polyethylene sheet as per 2.5.7). This shall be 'tailor made' to fit the cubicle. The sealing shall be such as not to allow any moisture to enter the cubicle.

3.1.7 SILICA GEL: Silica gel (as per 2.5.15) packed in cotton bags shall be kept at different places inside the cubicle as per EDN directions. Each suit of cubicle shall be provided with 1 kg of Silica gel (for a 4 suit cubicle 4 kgs of Silica Gel to be used. The bag containing silica gel to be as per 2.5.16).

3.1.8 LOOSE PARTS: Any loose parts in the cubicles shall be tied using cotton/ plastic tape. Wooden battens shall be provided wherever necessary.

3.1.9 WOODEN BATTENS: In case of cubicle which are not rectangular in shape like control desks, sufficient number of wooden rafters/battens of proper size shall be provided to give strength to the package.

3.1.10 RUBBERISED COIR: Gap between the cubicle and the case shall be filled with rubberized coir (as per 2.5.10) with distance between consecutive layers less than 500 mm.

3.1.11 CLAMPING: Packing shall be bound at edges by nailing M.S.clamps / Brackets (as per 2.5.5). Each vertical edge shall have minimum 3 clamps. Top horizontal edges will have one clamp for every meter length of package. However, minimum 4 clamps shall be nailed at the top for any cubicle.

3.1.12 PACKING SLIP: Packing slip kept in the polyethylene bag (As per 2.5.19) shall be placed in the box at appropriate place. In addition, one more packing slip covered in polyethylene cover and packing slip holder (as per 2.5.14) shall be nailed to front / rear of case.

3.1.13 MARKING PLATE: One no. (As per 2.5.13) shall be nailed to the front side of the case.

3.1.14 CASE MOUNTING: After complete packing, stencil marking of various details and marking of symbols shall be done as per BHEL instructions using indelible / non washable marking ink.

3.2 PACKING OF CUBICLES WITH SILVER OAK / PINE WOOD: Packing of cubicles for export shall be done exactly in same manner as described at 3.1 except for the following changes: -

Wood shall be Silver oak/ Pine wood instead of rubber wood.
- Double polyethylene petticoat instead of one.
- Fumigation may have to be done if required (BHEL Scope).

3.3 Different types of Cubicles with sizes for Packing

SL	TYPE OF CUBICLE VARIANT	DIMENSIONS [Internal sizes]
01	Single suite cubicle	- 900 x 950 x2500
02	Two suite cubicle	- 1650 x 950 x 2500
03.	Three suite cubicle	- 2400 x 950 x2500
04.	Four suite cubicle	- 3150 x 950 x 2500
05.	Regulation cub	- 1300 x 1350 x 2500
06.	Thy cub	- 2870 x 1350 x 2500
07.	VFD Cub	- 3800 x 1550 x 2500

3.4 PACKING OF LOOSE ITEMS/SPARES USING RUBBER WOOD:

3.4.1 Shape of cases shall be square, rectangular with single gabled roof or with double gabled roof depending on the nature of the job to be packed. Construction shall be as per drawings enclosed. Only gable will be additional as required.

3.4.2 Wood shall be rubber wood with Tongue and Groove joint as per clause 2.2.12.

3.4.3 Chemical treatment as per clause 2.4 to be done.

3.4.4 Width of planks shall be at least 100 mm. Width of binding planks (battens) shall be at least 75mm.

3.4.5 External surface of planks on front and rear shall planed 100% (except bottom plank).

3.4.6 Inner surfaces of all 6 sides shall be lined with bitumen coated hessian polyethylene Kraft paper (as per clause 2.5.9) using blue nails.

3.4.7 Rubberized coir of minimum 25mm thickness and 100 mm width shall be nailed to inner surfaces of bottom and 4 sides of box.

3.4.8 Internal packing: Items that go into the box shall be packed using polyethylene sheet/ U foam/ thermocol sheets/ air bubbled sheets/ paper cartoons and cotton tape. Any space left. Between the job and the sides and the top of the box shall be filled with rubberized coir to get proper cushioning effect.

3.4.9 Certain items like transformers, reactors, breakers, etc., shall be bolted to the bottom of the box using bolts, nuts and washers.

3.4.10 Silica gel as per clause 2.5.15 held in cotton bags as per clause 2.5.16 shall be kept at proper places in the box.

SL NO	BOX INNER DIMENSIONS (mm)	VOLUME (liters)	QUANTITY OF SILICA GEL (grams)
1	300X300X300	27	100
2	400X400X400	64	100
3	500X500X400	100	100
4	600X600X400	144	100
5	700X700X400	196	100
6	770X770X500	297	100

3.4.11. Packing slip kept in polyethylene bag (clause 2.5.19) shall be placed in the box.

3.4.12. Marking plate as per clause 2.5.13 shall be nailed to side of the box.

3.4.13. Two numbers of hoop iron strips as per clause 2.5.3 shall be strapped tightly on the case using clips.

3.4.14. Stencil marking of various details and marking of various symbols shall be done as per BHEL instructions using indelible/non-washable marking ink.

3.4.15 Loose items to be kept inside the cubicle

- The components which are removed from cubicle for shipping purpose only, such as meters shall be kept inside the cubicle individually kept in wooden box and tied firmly in bottom of Cubicle.

- Other items which are given loose in addition to cubicle shall be packed in separate boxes (like cables).

- For transformer cubicles loose items shall be packed in separate boxes and these boxes may be tied firmly in bottom of cubicles.

- Items which are bigger in size such as impulse tubes may be kept in top of cubicles firmly bunched and tied.

3.5. PACKING OF LOOSE ITEMS USING SILVER OAK / PINE WOOD: Packing of loose items for export shall be done in same manner as at clause.3.4 . except for the following changes:

-Wood shall be Silver oak/ Pine wood instead of rubber wood.
-Fumigation may have to be done.
-2 polyethylene covers to be provided.

3.6 PACKING OF PHOTO VOLTAIC PANELS, ETC.USING RUBBER WOOD:
Same as 3.4 above except for the following changes:

- Wood need not be treated with chemical solution.

- Tongue and groove jointing is not required. But planks shall be so joined as to not leave any gap at the joint. Bituminized Kraft paper and Bituminized Kraft sheet need not be used.

- Silica gel need not be used.

3.7 PACKING USING BITUMEN COATED HESSIAN POLYETHYLENE KRAFT PAPER:

3.7.1. This method is adopted for packing of poles, frames, Empty boxes, etc.

3.7.2. Job shall be covered and stitched tightly with bitumen coated hessian polyethylene Kraft paper.

3.7.3. Marking has to be done as mentioned in CL 3.4.14.

3.8 SUPPLY OF RUBBER WOOD PALLETS FOR EMPTY CUBICLES:

3.8.1. The wood shall be rubber wood.

3.8.2. Thickness of planks shall be 25 $\pm$2 mm. The size of the supporting battens at bottom shall be 75 $\pm$2 mm (width) and 100$\pm$2 mm (height).

3.8.3. If the width of the pallet is 1000 mm or less, only 2 supporting battens at the edges may be provided. In case of pallets having width of more than 1000 mm, one extra supporting batten shall be provided in the middle.

3.8.4. Jointing of top planks is not permitted for pallets of width less than 1000mm. For pallets of width more than 1000 mm, jointing of top plank is permitted. However, joint shall be at the center of the supporting batten.

3.8.5 The consecutive top planks shall be so nailed as to leave no gap. Tongue and groove joint is not required.

3.9 PACKING OF SEMICONDUCTOR DEVICES

Semiconductor devices shall be received in prepackaged condition as per the device type and packed in plywood boxes as per the following procedure,

- Provide thrmocole sheets/rubberized coir.
- Stack the preplaced devices inside the case.
- Fill up gaps with thermocol sheets/rubberized coir.
- Close the top cover and nail.
- Provide suitable marking of the package details.

3.9.1 Packing of material for Registered Post Parcel (RPP) RPP packing boxes to be made in-house with 12mm (for sides) and 6mm thick (for top and bottom) commercial quality ply wood sheet. The size of the box should be decided on the material to be dispatched. Between material 10mm and 15mm thick thermocole sheets or rubberized coir/foam should be provided as cushion.

3.9.2. Packing of materials using sunpac cartons and corrugated Kraft paper cartons: Individual items can be packed using sunpac or polyprophelene [PVC]/ corrugated Kraft paper cartons of suitable sizes and gram mage depending upon the items to be packed. Heavy duty cartons can also be used for packing of loose items, manuals, repaired items and others.

3.9.3. Packing of materials using Heavy duty cartons: Panels can also be packed using Heavy duty carton with other required packing materials having 2000gsm corrugated board of 7 ply 15 thick. Loose items and spares can be packed using 5ply 2000gsm corrugated heavy board with other packing materials. Different sizes of cartons are required depending upon the sizes of the items being packed. Details are separately given.

4.0 ADDITIONAL POINTS TO BE FOLLOWED FOR EXPORT ORDER SEAWORTHY PACKING:

4.1 Packing to be done as per Fig - 6.
Thickness of G.I.sheet 0.3 mm. plus or minus 0.05 [0.3-0.05]

Additional points to be taken care for :

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

(Recommendations from Corporate Systems & IT)

Sl	Activity
1	All Initial and O&M spares preferably supplied in one lot to site and progressive inventory till all spares are accumulated could be kept at units.
2	Spares (Initial and O&M) should be supplied in separate Boxes / Containers and not mixed in main supply boxes.
3	**i)** Initial spares Box / Container to be labeled as "INITIAL SPARES " in RED. Ref fig: 14 (Page-26). **ii)** O & M spares Box /Container to be labeled as" O&M SPARES " in GREEN. Ref fig: 14 (Page-26).
4	**iii)** Initial Spares Box to have red Color strip as per diagram. Ref fig: 14 (Page-26). **iv)** Majority of spares (initial and O&M) are for indoor storage at site. **v)** O&M spares box to have green Color strip as per diagram. Ref fig: 14 (Page-26).
5	**vi)** Spares (Initial and O&M) Packing list kept inside the boxes and affixed securely outside the box to contain **vii)** Custom name **viii)** Project / Power station Name **ix)** Customer PO No and date **x)** Sl no of customer PO. **xi)** Quantity total & dispatched. **xii)** Unit work order number **xiii)** All above to be developed from Unit IT System
6	**xiv)** All spares (Initial and O&M) items to have tags (wono, item customer order no, customer item.description)
7	**xv)** Supply of spares by Vendor should also be instructed for following point 2,3,4,5,6 mentioned above.

Action By : Sites on arrival of spares (Initial and O&M)Receipt .

	Activity
1	Material utilized if any from Initial and O&M spares , should have prior written approval of concerned MUs. Such MUs shall also confirm replacement dates which should be entered in the system for creation of repository.

5.0 DETAILS OF DRAWINGS/FIGURES ENCLOSED

FIG-1: Details Of Cubicle Packing Box
FIG-2: Binding Of Panel
FIG-3: Lifting Of Packed Case
NOTE: 1) Spreaders are to be used only for lifting the case.
2) Spreaders are wooden items & not nailed to the case.
3) Height between crane hook & spreaders to be kept Minimum to void rotation of case while lifting.
FIG-4: Lifting And Moving Un Packed Case
FIG-5: Marking Plate
FIG-6: Closed Packing Case With G.I. Sheet Showing Layers Of Packing Materials.
FIG-7: Mechanical Latching Clamp
FIG-8 to 15 : Sample Packing drawing of single/ double / triple & four suit pane.l

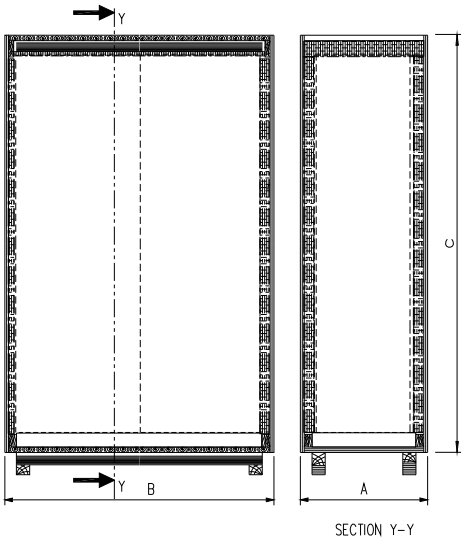


FIG-1 : DETAILS OF CUBICLE PACKING BOX.

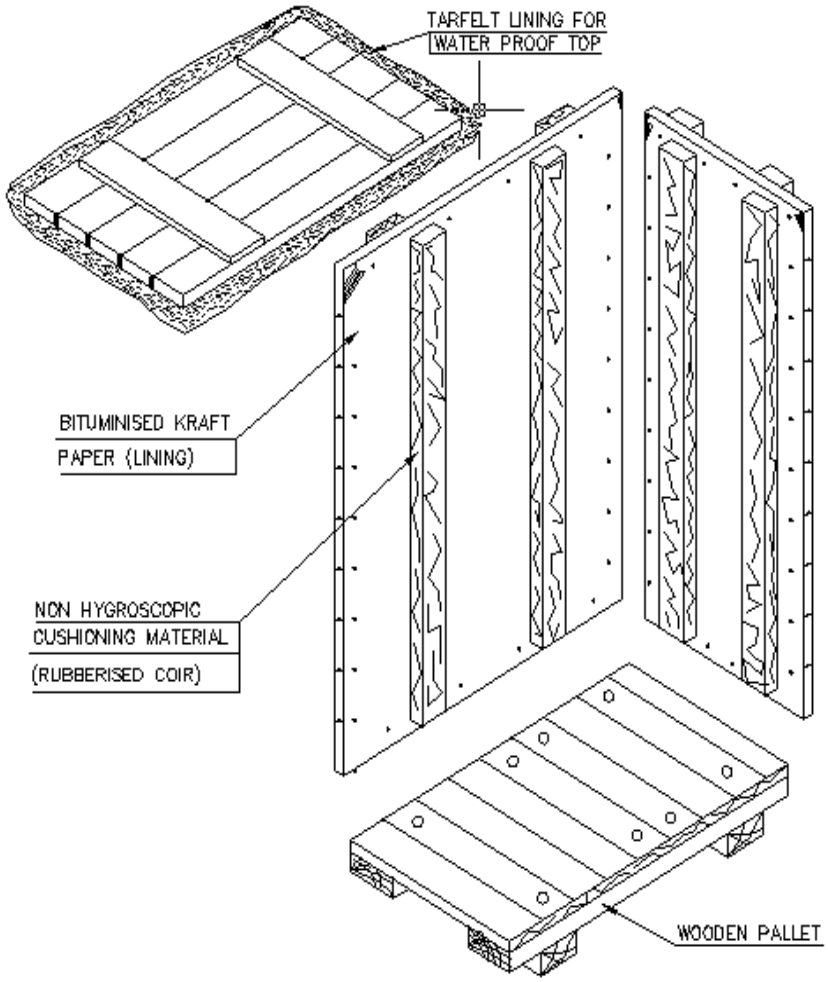
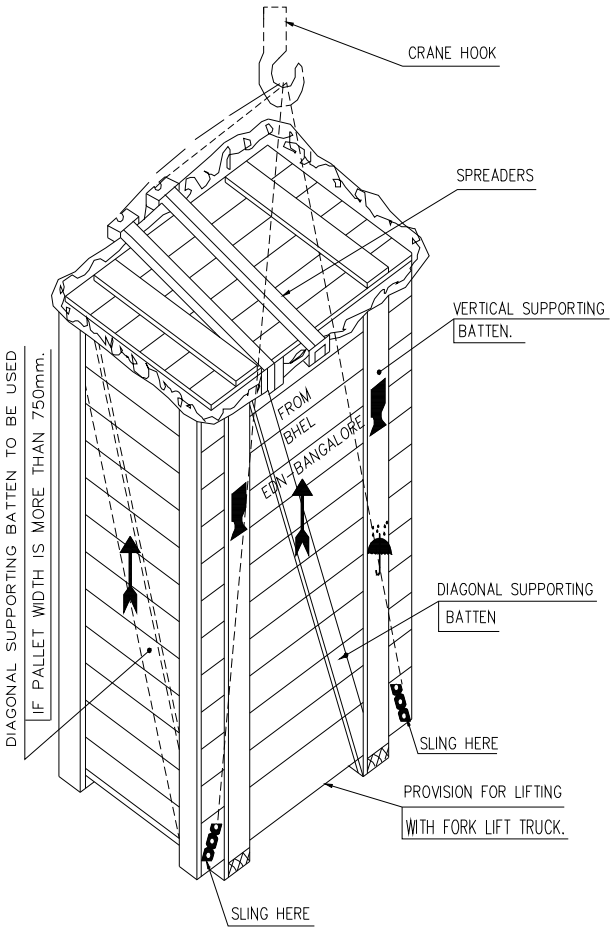


Fig. 2 : Binding of Panel



FIG–3 : LIFTING OF PACKED CASE.

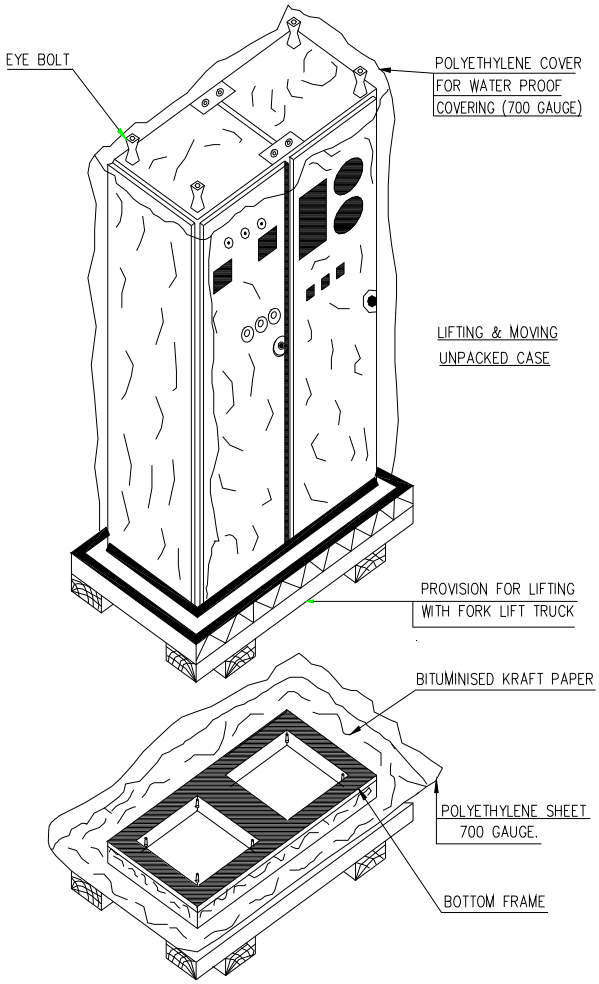


FIGURE-4

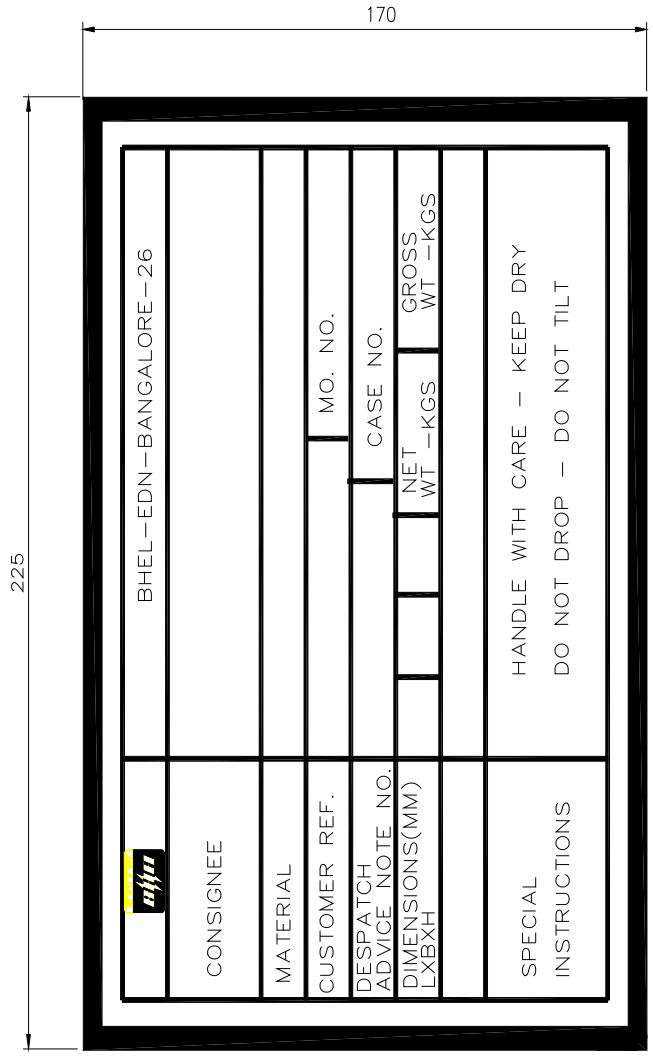
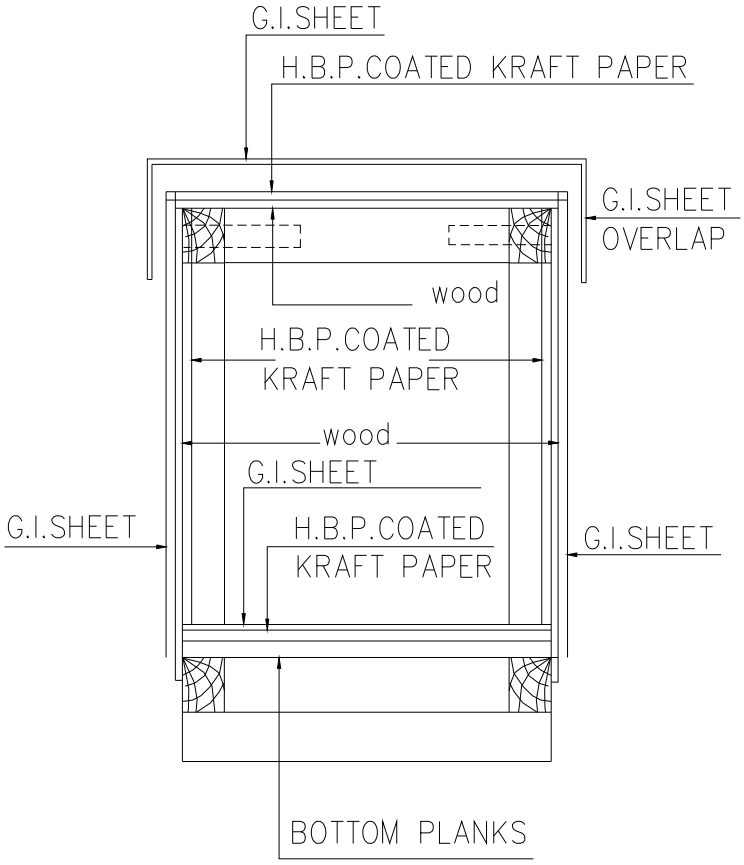
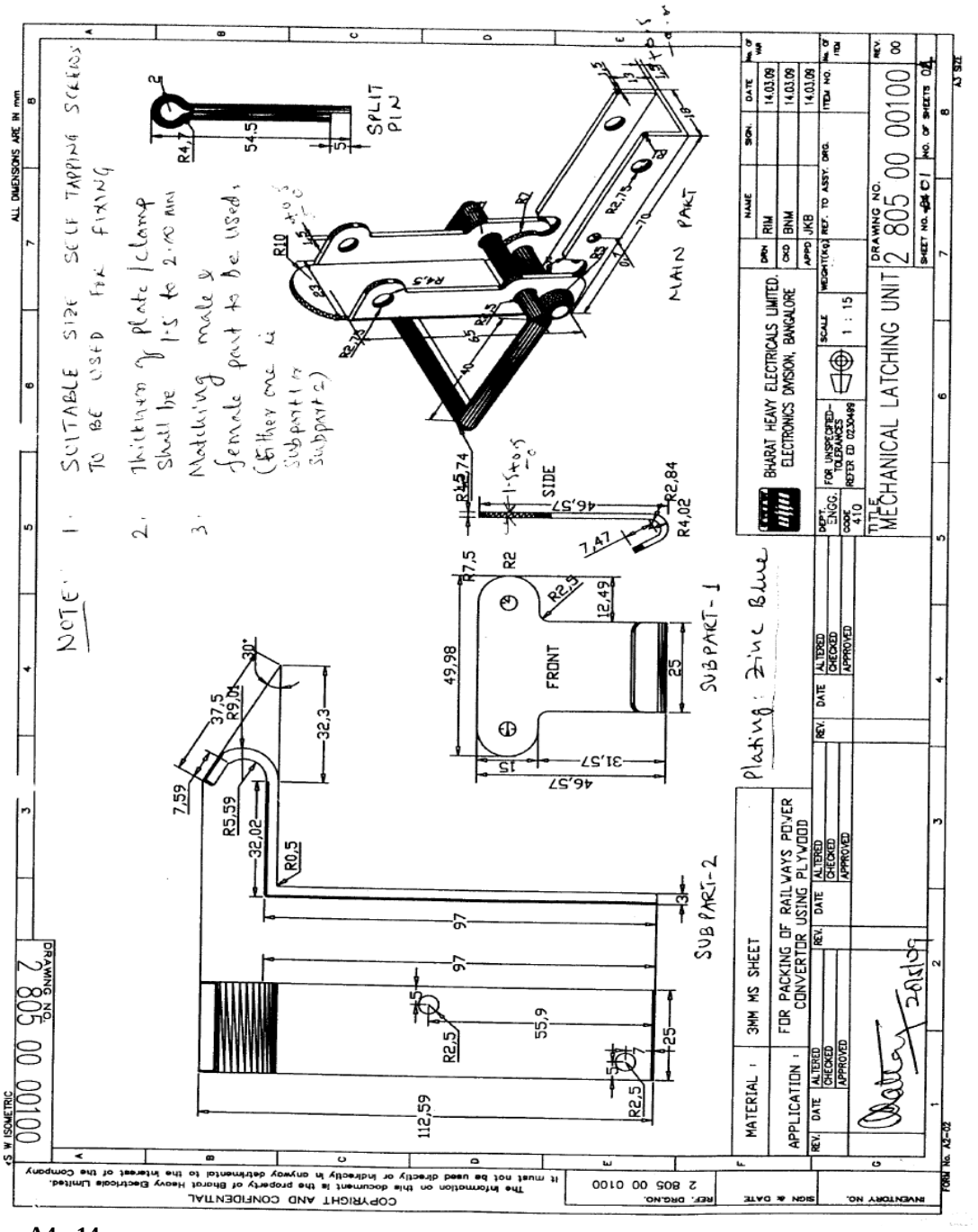


FIG-5 : MARKING PLATE.



FIG–6 : CLOSED PACKING CASE WITH G.I.SHEET
SHOWING LAYERS OF PACKING MATERIALS.



A4 - 14

Fig – 7 : Mechanical Latching Clamp

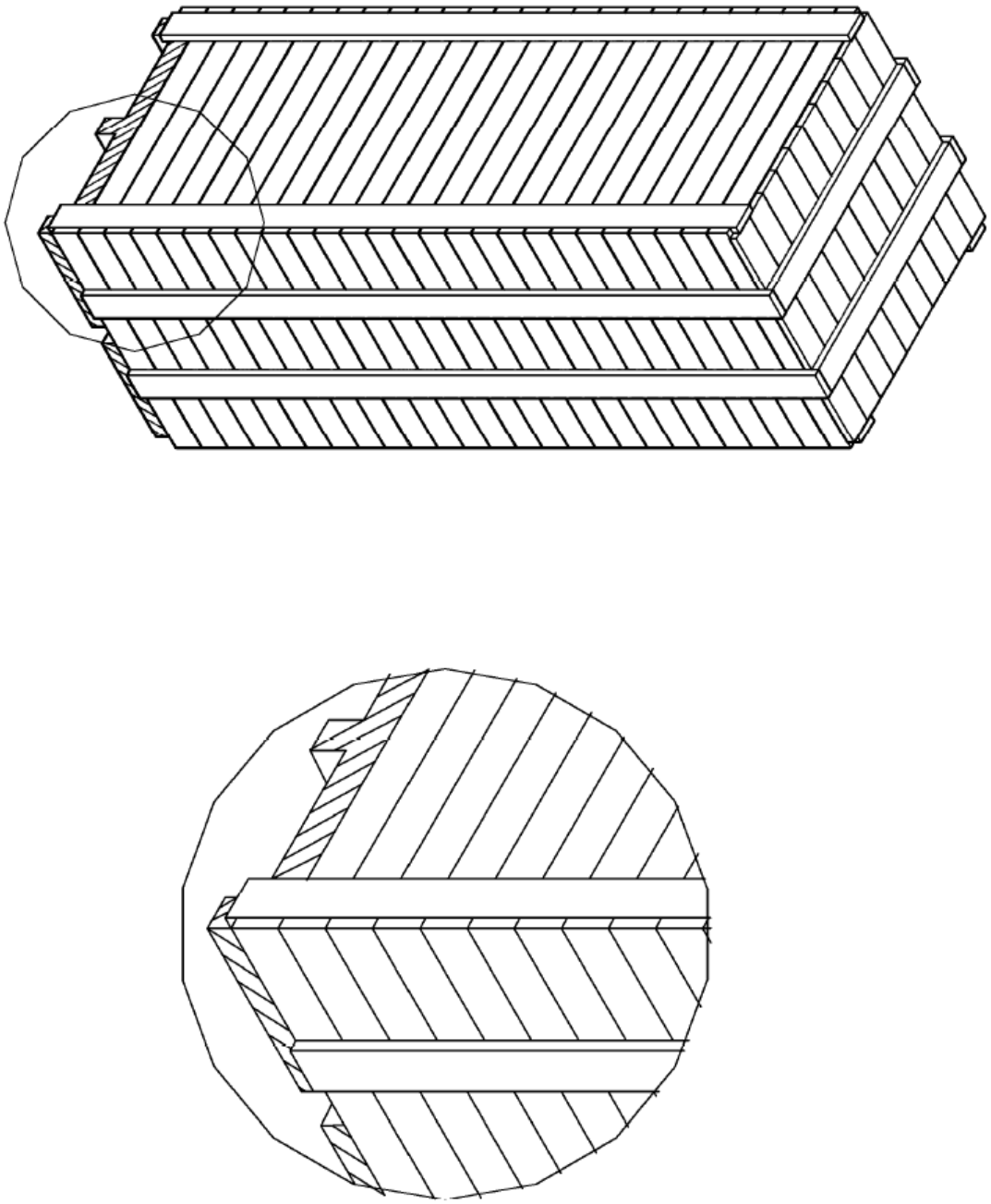


Fig – 8 : Single Suit Cubicle Packing View

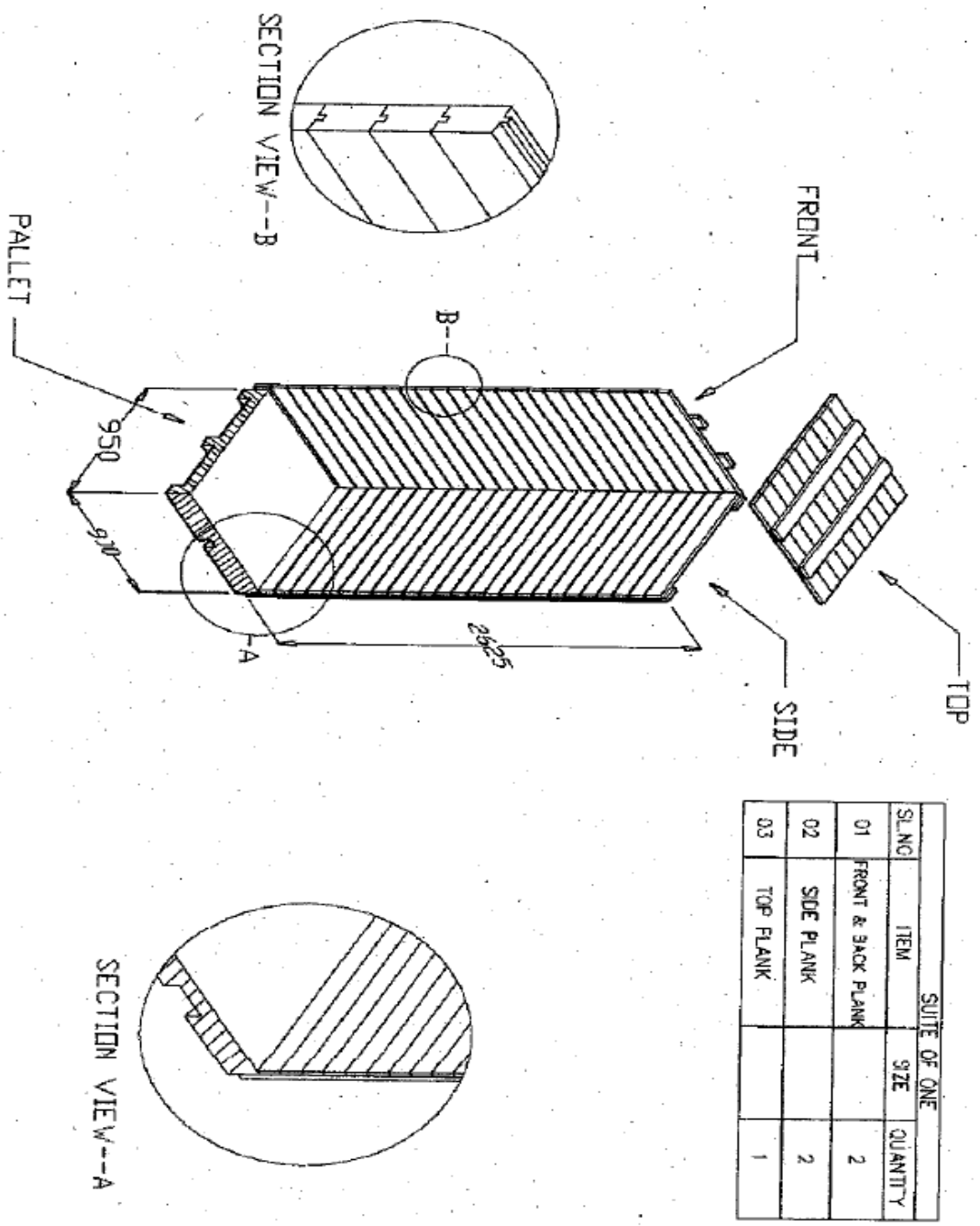


Fig – 9 : Single Suit Packing Assembly Drawing

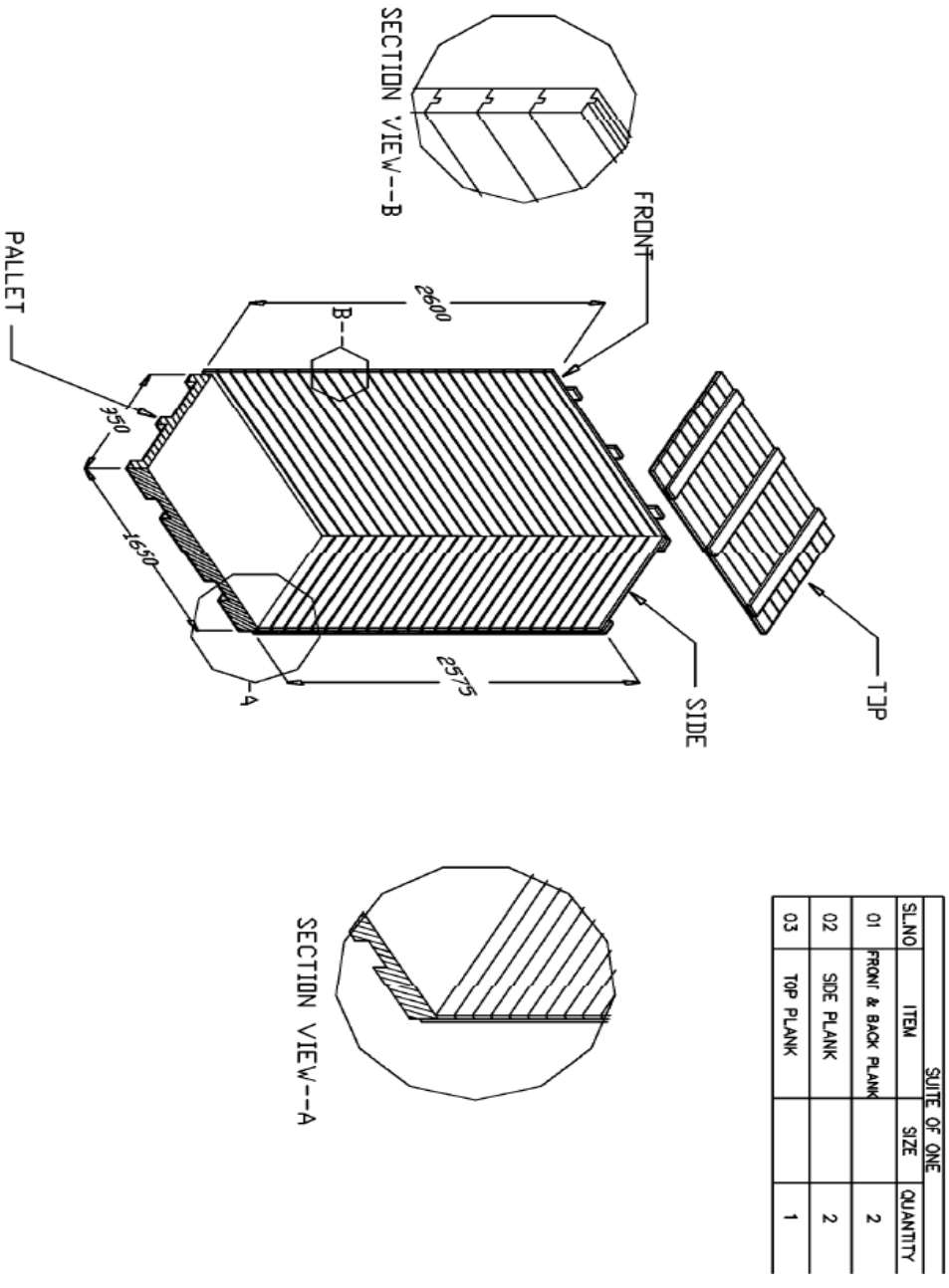
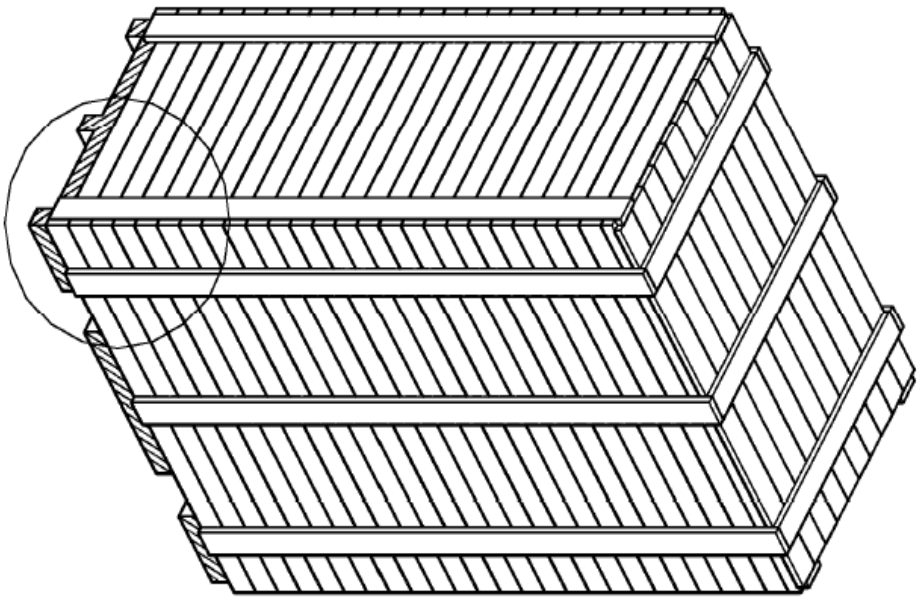


Fig – 10 : Two Suit Packing Assembly Details



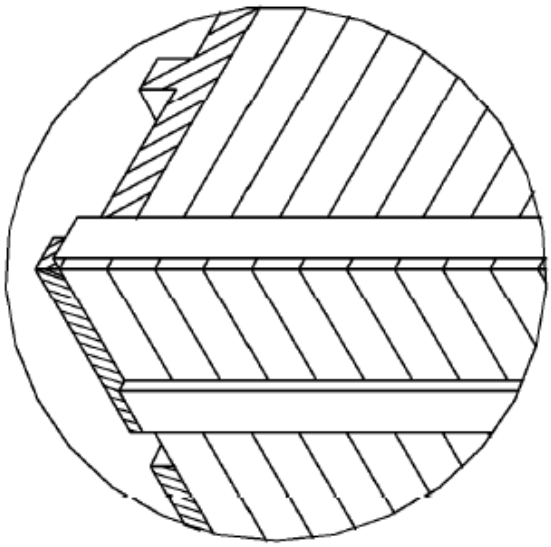
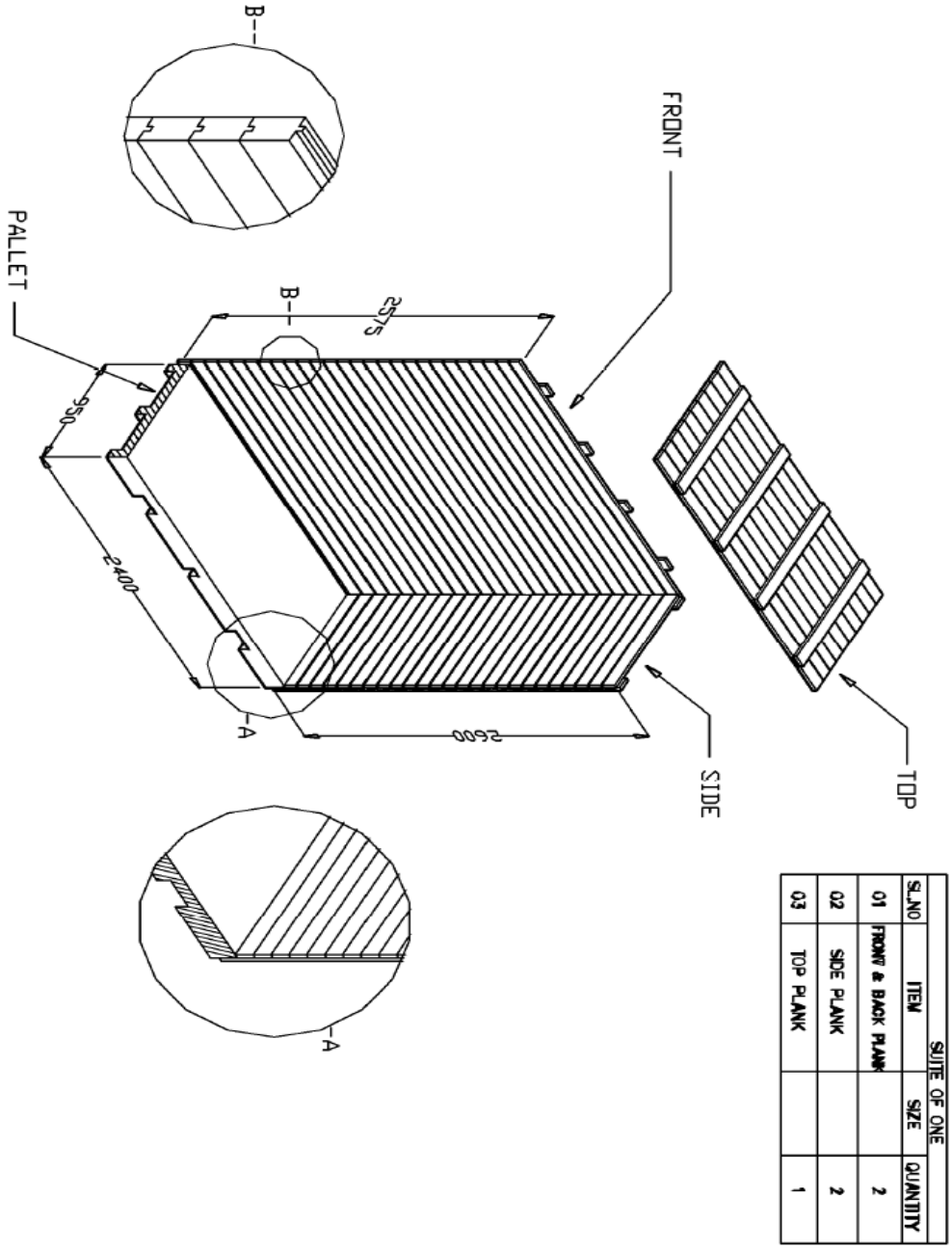


Fig – 11 : Two Suit Panel Packed view



SUITE OF ONE			
SL.NO	ITEM	SIZE	QUANTITY
01	FRONT & BACK PLANK		2
02	SIDE PLANK		2
03	TOP PLANK		1

Fig – 12 : Three Suit Panel Packing Assembly View

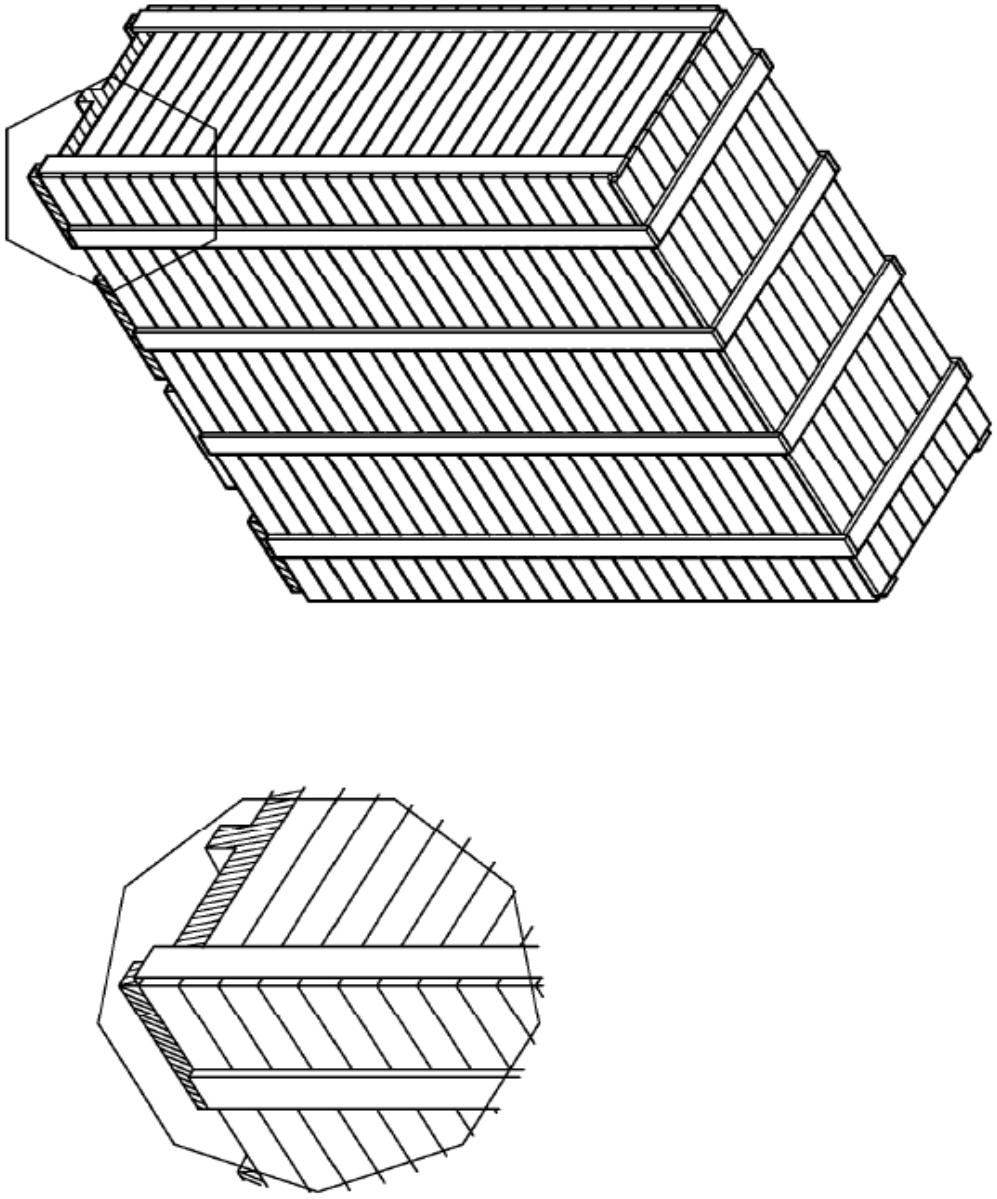
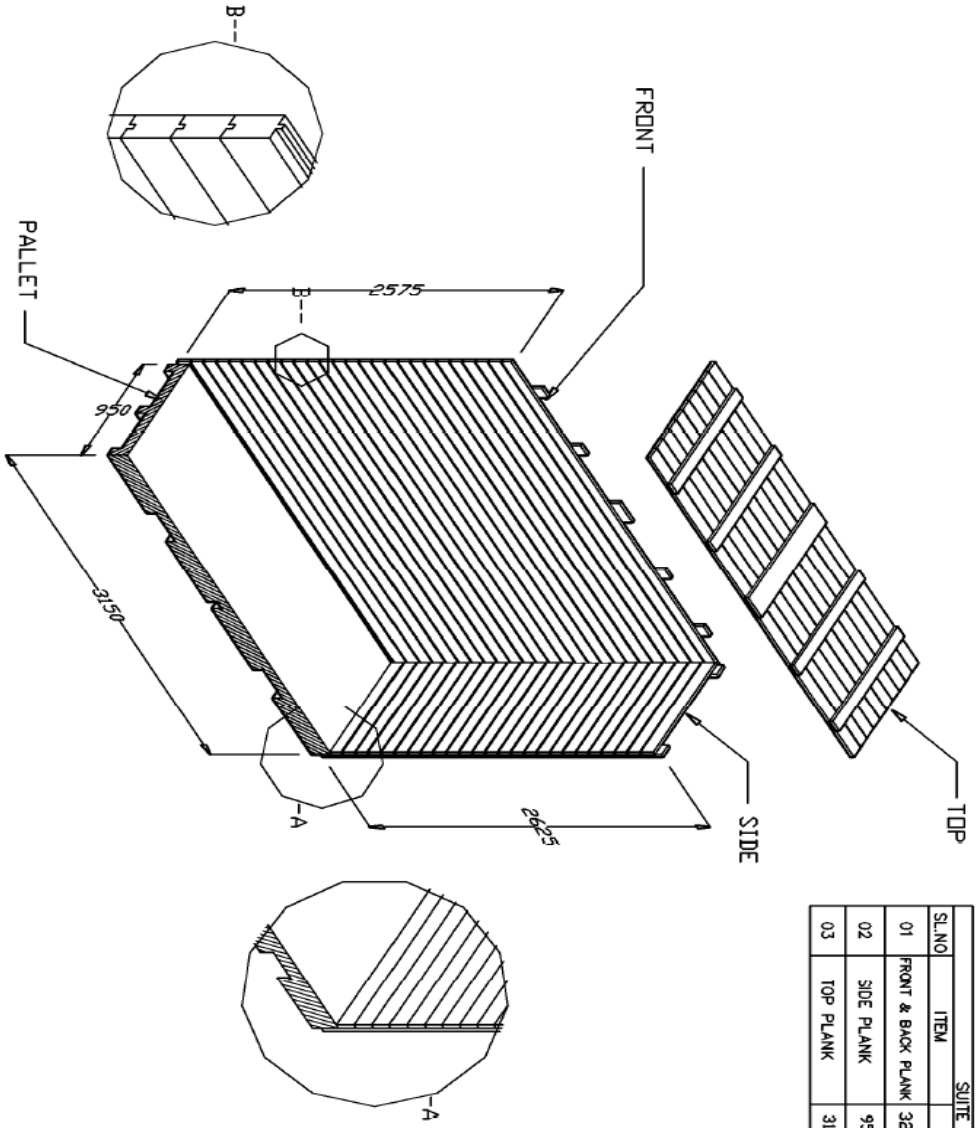


Fig -13 : Three Suit Panel Packed View



SUITE OF ONE		
SL.NO	ITEM	SIZE	QUANTITY
01	FRONT & BACK PLANK	3200X2575	2
02	SIDE PLANK	950X2500	2
03	TOP PLANK	3150X1000	1

Fig – 14 : Four Suit Panel Packing assembly Detail

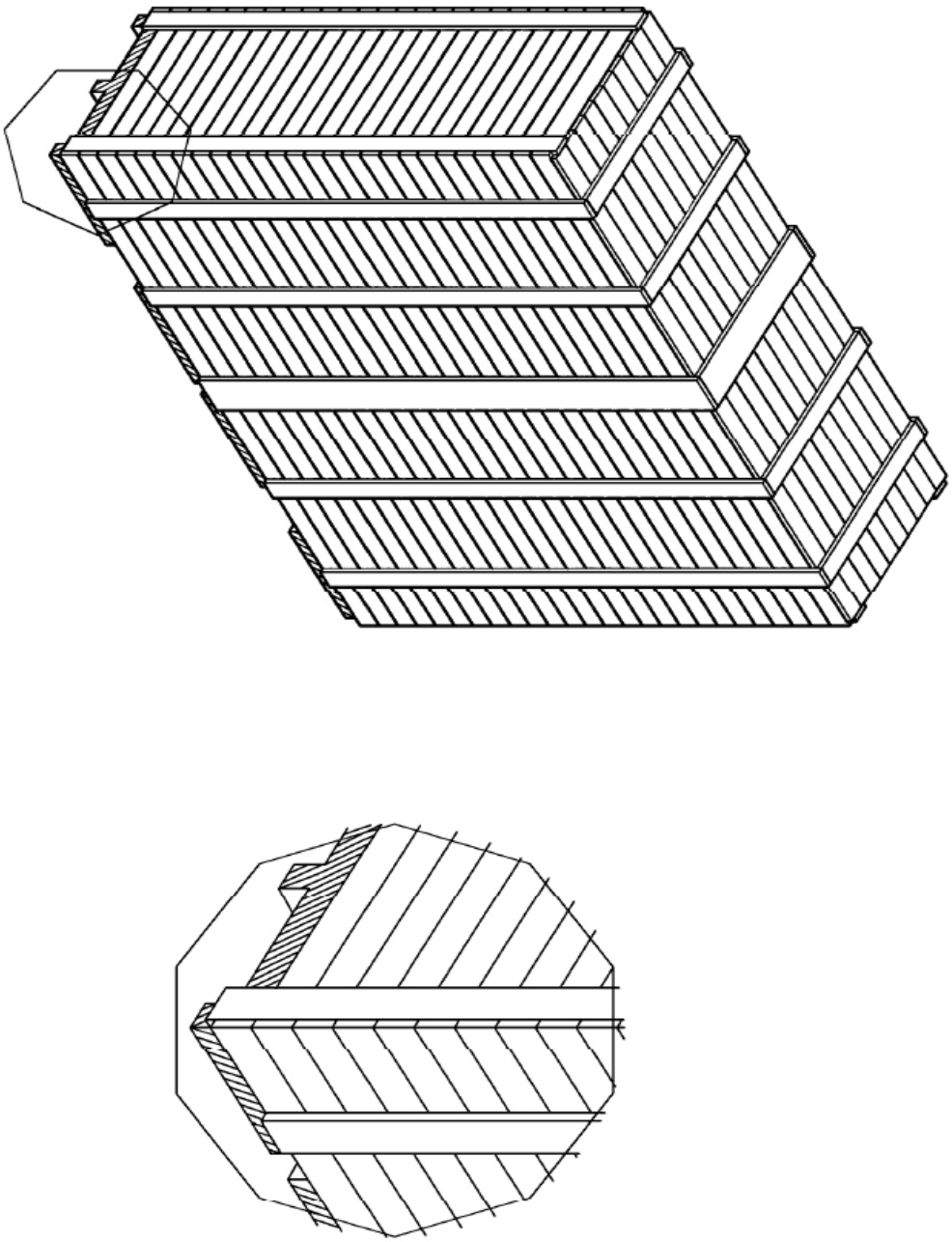
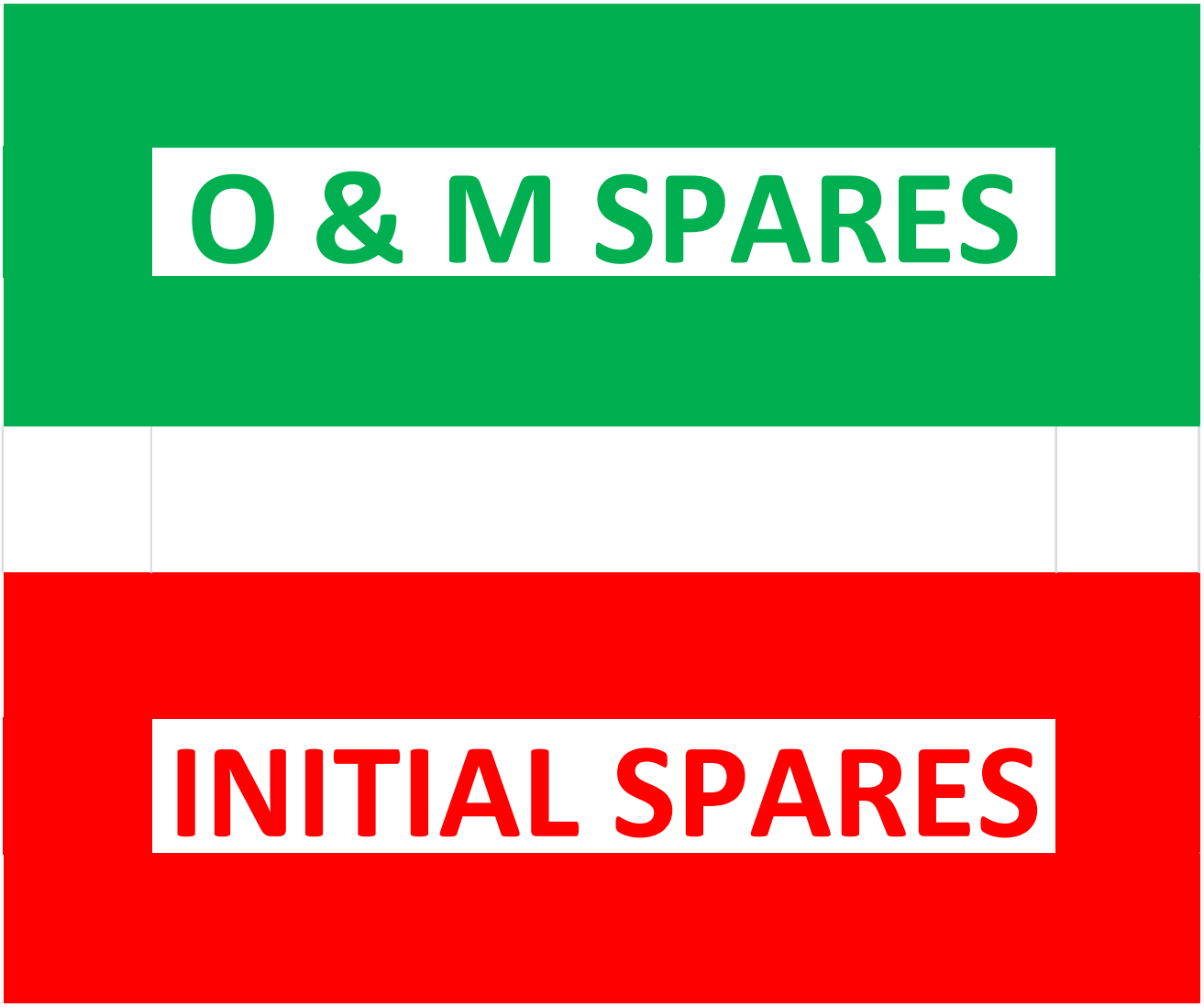


Fig -15 : Four Suit Panel Packing View

Easy spares [Initial and O&M] Traceability and Identification at units and as well as at sites:

Fig: 14



ENGINEERING CHECKLIST
PROJECT: MAITREE 2X660 MW
Important Note: Bidders to Mandatorily fill the below checklist and submit along with technical bid, otherwise offers shall be rejected.

Sl. No.	DESCRIPTION	NOT CONFIRMED (If applicable Please Tick Mark 'v')	CONFIRMED (If applicable Please Tick Mark 'v')
1	All Analysers shall have 2 x 4-20 mA, galvanically isolated outputs and relay contacts for alarms shall be provided as per Specs.		
2	MICROPROCESSOR BASED WITH DIGITAL COMMUNICATION FACILITY RS485 on Modbus protocol shall be provided to all the Analysers.		
3	All offered analyser shall be suitable for 240 V supply & shall be 4 wire analysers.		
4	Mandatory spares shall be offered against each line item of the specs. If any item is not available meeting the description of the specs, then functionally equivalent item shall be offered against that line item.		
5	All The RODM and FGD package Analysers shall be provided with suitable individual mounting accessories and Individual Mounting racks for each Analyser		
6	Pl. furnish the cell constants for each Tag No. and confirm that in the event of any change in cell constant required during approval stage, same shall be done without any commercial implication.		
7	All sample wetted parts & Sampling tubes/coil of Primary & Secondary coolers shall be SS316/Inconel material. Also cooling water lines from headers to Coolers shall be SS 316		
8	Pl. confirm that offer includes high pressure reducing valve in the primary rack for all High Pr. Samples (>100 Kg/cm2)		
9	Chiller for the project shall have required 2x100% REDUNDANT - Min. 5 TR rating (With 25% extra Capacity) & shall be with SS 316 Tank		
10	1 time Gas filing shall be considered for Chiller at site during commissioning/handing over. This is in addition to gas filling done for functional checking during inspection at vendor works.		
11	Packing shall be as per corporate standard indicated in Specs.		
12	Pl. confirm that all analyzers shall be provided with all consumables & reagents required for 12 months operation after commissioning of system.		
13	All items with limited shelf life shall be supplied during commissioning only. If any items require replacement due to expiry of shelf life, same shall be replaced without any commercial implication to BHEL-EDN (Such as Tygon tube, pH Cells, DO sensors, Reagents).		
14	All headers in Primary racks & Wet Panel shall be supplied with suitable sized counter and mating flanges. In addition to this, 1 set of mating & counter flanges shall be provided for all the cooling water headers for connecting to tapping point in field.		
15	Pl. confirm that all components/accessories required to meet the intent of the specification shall be offered. If it is found, at any stage of procurement /commissioning, that some components/accessories have not been offered/supplied, same shall be supplied without any cost/time implication to BHEL to meet the system / product requirement		
16	Pl. confirm that for tubing between wet and dry panel suitable DFDC connectors shall be provided		
17	Pl. confirm that Insulation of Pipe between Chiller and wet panel shall be done at site.		
18	Pl. confirm that stream selector shall be with pulse based selection.		
19	Mandatory Spares shall be sent in pre-decided lots in containers /secure boxes distinctly marked in Red colour with boldly written "S" mark on each face of the containers /secure boxes.		
20	Items used for SWAS system shall be from Approved vendors indicated in Specs. For items not covered in the list bidders approved vendors will be acceptable.		
21	Site work for both Analysers & Sample Handling system shall be as per Scope of Supply		
22	If offered Models of Analysers are not accepted during document approval, same shall be replaced by Analyser models of customer approved vendors without any commercial impact.		
23	Individual Flow indicators are provided in return cooling water lines of each primary & secondary coolers.		
24	Bulkhead in Primary racks & Wet Panel shall be suitable for pipe sizes indicated in Enquiry specs		
25	Primary & Secondary cooler shell drain shall be valved and piped to waste drain header as per Specs.		
26	Loose supply item such as cabling and tubing shall be calculated by considering the Total Qty of Analyser for both the units (2 Units) and 30 Meter per run.		
27	At later stage if it is found that vendor offer is not in line with tender specification requirements, then vendor to supply material in line with tender specification without any price impact to BHEL.		

(Company seal and Signature)