Project Engineering Management

Bharat Heavy Electricals Limited

(A Govt. Of India Undertaking)

Ref. No. : PE/PG/BIF/E-5815/2017/CORRIGENDA/08 **Date: 04.04.2018**

CORRIGENDA / ADDENDUM-08

SUBJECT: 2X660 MW BIFPCL MAITREE KHULNA STPP-BANGLADESH

PACKAGE: OXYGEN DOSING SYSTEM

Our Ref : ENQUIRY No : PE/PG/BIF/E-5815/2017, Dtd. 28.12.2017

DUE DATE
11-Apr-2018
BY 02:00 PM (IST)

Bidders to note that there is a Minor Change in Technical Specification no. **PE-TS-421-154-A002**, as attached herewith.

Thanking You.

For & on Behalf of BHEL,

Arjun Srivastava
Sr. Engr/PG-I

Arjun Srivastava, Sr. Engineer/PG-I/PEM
Power Project Engineering Institute Building
HRD & ESI Complex Plot No. 25, Sector -16 A,
BHEL-PEM,Noida-201301 (U.P.)
Tel No. 0120-4368839, 9971599688

	AMENDMENT TO TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM 2 X 660MW MAITREE SUPER THERMAL POWER PROJECT AT RAMPAL, BANGLADESH	SPECIFICATION NO.: PE-TS-421-154-A002 AMENDMENT NO # 1 REV. NO. 00 | DATE: 02/04/2018 Page **1** of **1**

The following modifications with respect to Technical Specification for OXYGEN DOSING SYSTEM. BHEL's Technical specification no **PE-TS-421-154-A002** shall apply.

Bidder to note that existing clauses/ details as appearing in the specification stands deleted and clauses/details as mentioned in "Modified to or Read as" column shall be applicable and complied by the bidder as listed below in **SCHEDULE A**.

SCHEDULE-A

MODIFIED CLAUSES/ PAGE NUMBERS:

Sl no.	Vol. No.	Section/ Description	Clause no	Page no	Existing clause/details	Modified to or Read as
1.	IIB	SECTION– IA		396 to 397 of 448	DATA SHEET	The referred Data Sheet stands deleted. Please refer to Annexure-1 for revised Data Sheet.
2.	IIB	SECTION– IIA		402 to 406 of 448	SECTION – IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)	The referred section stands deleted. Please refer to Annexure-1 for revised SECTION – IIA GENERAL TECHNICAL REQUIREMENT (MECHANICAL)
3.	IIB	SECTION– IA		394 to 395 of 448	P&IDs	The referred P&IDs stands deleted. Please refer to Annexure-1 for revised P&IDs.

****

DATA SHEET

Sl. No	Description	Parameter
Mechanical Items		
1.0	No. of skid(s)for project	Four (two per unit)
2.0	**Cylinders:**	
2.1	Quantity mounted on skid	Ten per skid for Deareator and Eight per skid for CPU outlet (Total Thirty Six)
2.2	Design Standard of empty oxygen cylinder	ISO 9809 Part-1
2.3	Water Capacity	50 liters
2.4	Gas Capacity	10 m^3
2.5	Max Working pressure at 15^OC	204 Kg/cm^2
3.0	**All Tubing:**	
3.1	Material	SS 316
3.2	Diameter	15 NB (1/2" OD), 18 BWG
4.0	**Ball valves**	
4.1	Body, Bonnet, stem	SS 316
4.2	Trim Material	SS 316
4.3	Design standard	MSS-99-2010/ Equivalent
4.4	Test standard	MSS-99-2010/ Equivalent
4.5	Size	15 NB
4.6	End Connections	Ferruled
4.7	Rating	2000 PSI
4.8	Valve operation	Manual or pneumatic as per P&ID
5.0	**Check valves/ NRV**	
5.1	Body, cover, disc/piston & seat	SS 316
5.2	Design standard	MSS-99-2010/ Equivalent
5.3	Test standard	MSS-99-2010/ Equivalent
5.4	Size	15 NB
5.5	End Connections	Ferruled
5.6	Rating	2000 PSI
5.7	Valve operation	Manual
6.0	**Pressure relief valve**	
6.1	Type	Spring loaded, angle type
6.2	Body, bonnet, disc & nozzle	SS 316
6.3	Valve discharges to	Atmosphere (vent)
6.4	Back pressure	Constant
6.5	Set pressure	55 Kg/cm^2 (g) for skid 1 and 22 Kg/cm^2 (g) for skid 2
6.6	Inlet Connections	Ferruled
6.7	Outlet Connections	Ferruled
7.0	**Fittings**	SS-316
8.0	**Pressure Regulator**	
8.1	Quantity	Two per skid (total 8), each mounted to an oxygen cylinder
8.2	Body & trim	SS 316/Brass
8.3	Inlet connection	1/2 "
8.4	Outlet connection	1/2 "
8.5	Operating pressure	204 Kg/cm2(g)
8.6	Set outlet Pressure	48 Kg/cm^2(g) for skid dosing at CPU outlet and 18 Kg/cm^2(g) for skid dosing at deaerator outlet
9.0	**Mass Flow Controller**	
9.1	Expected Flow of O_2 in process	50-400 gm/ hr. (for skid dosing at deaerator outlet); 40-300 gm/ hr. (for skid dosing at CPU outlet)
9.2	MOC-wetted parts	SS 316
9.3	Operating pressure	Pressure reducing valve set pressure (refer P&IDs)
10.0	**Structural steel**	IS 2062
11.0	**Nuts & bolts**	SS 304

SECTION – IIA

GENERAL TECHNICAL REQUIREMENT (MECHANICAL)

1.0 CODES AND STANDARDS

a) MSS-99-2010
b) ASTM G63: Guide for evaluating non-metallic materials for oxygen service.
c) ASTM G93: Standard Practice for Cleaning Methods and Cleanliness Levels for Material and Equipment Used in Oxygen-Enriched Environments.
d) ASTM G 94: std. guide for evaluating Metals for oxygen service.
e) ASTM F1792-97 (2010): Standard Specification for Special Requirements for Valves Used in Gaseous Oxygen Service.
f) ASTM G88: Standard Guide for Designing Systems for Oxygen Service.

The following philosophy oxygen dosing system is considered:-

2.0 SYSTEM DESCRIPTION

The objective of providing the dosing systems is to maintain the chemistry of the boiler feed water and also to comply with different modes of operation i.e. “Combined Water Treatment mode” during continuous plant operation and “Ammoniacal mode or AVT (O) mode” during start-up & shutdown conditions for super critical boiler of main plant.

The chemical feed for Combined Water Treatment (CWT) involves the feed of only aqueous ammonia and gaseous oxygen.

The following philosophy of oxygen dosing is considered:-

a) **During normal operation:-**

- pH is maintained at 8.2-8.5 by dosing aqueous ammonia solution.
- Oxygen dosing rate recommended by BHEL is 30-150 ppb. Exact dosing rate shall be decided by the operator. For sizing of oxygen dosing system, 150 ppb continuous dosing of 99% pure oxygen has been considered.
- Dosing shall normally be done at CPU outlet. However provision shall be given for dosing at deaerator outlet also. For this purpose two separate skid based oxygen dosing systems shall be supplied for each unit. However, dosing shall be done at one place at a time only.
- Dosing rate shall be controlled from DCS by regulating mass flow controller (MFC) provided on each O_2 dosing skid under full load conditions based on dissolved oxygen level at economizer inlet. Oxygen dosing rate can be adjusted in the range of 30-150 ppb from DCS. However, **Customer** may also chose to manually feed a particular set point within this range and operate the oxygen dosing automatically based on this set point.
- The oxygen dosing shall automatically turn off by closing the mass flow controller (MFC), if cation conductivity in the cycle goes above 0.3 us/cm.

b) **Startup sequence:-**

- Deaerator vent is kept open.
- Ammonia is dosed at CPU outlet to achieve a pH of 9.2.
- Cation conductivity reaches below 0.15 µs/cm (at 25˚C) and the trend is downwards.
- Deaerator vents are closed.
- Oxygen feed is manually started from DCS.

c) **Shut down sequence:-**

- Oxygen feed needs to be stopped one hour before shut down and deaerator and LP heater vents needs to be opened.
- Ammonia dosing rate needs to be increased to achieve pH in the range of 9.2.

Each skid shall consist of the following components:-

4.1.1 Cylinder banks

Each oxygen dosing skid shall consist of a two banks of five oxygen cylinders each for deaerator and two banks of four oxygen cylinders each for CPU outlet. The automatic change-over of cylinder takes place on the basis of pressure i.e. the cylinder banks dosing at Condensate Polishing Unit (CPU) outlet will switch over at 47 kg/cm2(g) and the cylinder banks dosing at deaerator outlet at 17 kg/cm2(g).

4.1.2 Pressure Regulator:

The line pressure regulator is used for reducing a high supply pressure (204 bars cylinder pressure) to 50 kg/cm2(g) pressure in skid dosing at CPU outlet and to 20 kg/cm2(g) pressure in skid dosing at deaerator outlet.

4.1.3 Valves, tubing, vents and instrumentation shall be as per the enclosed P&ID and the data sheet. The MOC and specification of the equipment shall be as per the enclosed data sheet.

4.2 CONTROL PHILOSOPHY (OXYGEN DOSING SYSTEM)

The mode of operation of the oxygen dosing system shall be from Plant DCS only. All the logics, controls and interlocks shall be implemented in Plant DCS. Local manual intervention is not envisaged. Both manual/automatic controls shall be implemented in DCS. The provision to select “Auto” or “Manual” mode shall be provided in Plant DCS -OWS only.

The oxygen gas shall be at high pressure (204 Kg/cm2) in the cylinders. The same shall be brought to a lower pressure by the Pressure Regulator (set pressure of 50 Kg/cm2 for skid dosing at CPU outlet and set pressure of 20 Kg/cm2 for skid dosing at deaerator outlet attached with each cylinder.

Each set of oxygen cylinders in the skid shall have a dedicated set of solenoid valve, pressure gauge and pressure transmitter. Ten/eight cylinders provided on skid are connected and Five/four cylinder will serve at a time based on the pressure at the inlet of solenoid valve. In case the pressure at the inlet of SV1 reaches at the set point, the solenoid valve SV1 will close and solenoid vale SV2 will open and other cylinder shall be taken in to service provided the pressure at the inlet of SV2 is not low and vice versa. Alarm for pressure low at the inlet of solenoid valves shall be provided in DCS.

A pressure relief valve shall be fitted at the downstream of solenoid valve to relieve system pressure if the system pressure goes above set pressure.

The pressure of the oxygen shall be further reduced by pressure reducing valves for skid dosing at CPU outlet and skid dosing at deaerator outlet based on the feedback received from pressure transmitter {set point –“ADEQUATE--(Set points–48 kg/cm2 for skid dosing at CPU outlet & pressure transmitter {set point –“ADEQUATE--(20 kg/cm2 for skid dosing at deaerator outlet) provided at the downstream of pressure reducing regulating valve. The flow and pressure of oxygen can be monitored from DCS by the signal from mass flow controller for skid dosing at CPU outlet and for skid dosing at deaerator outlet and from pressure transmitters for skid dosing at CPU outlet & for skid dosing at deaerator outlet provided at the downstream of pressure reducing regulating valve. The flow of oxygen dosing will be controlled manually/automatically from DCS by adjusting flow MFC for skid dosing at CPU outlet & for skid dosing at deaerator outlet provided on skid, based on the feedback from the dissolved oxygen analyzer located in the economizer inlet. The MFC shall have a position feedback transmitter that shall transmit the feedback signal to Plant DCS. In case working MFC malfunctions, automatic changeover of MFC shall take place.

All solenoid valves mounted in the oxygen dosing skid shall be of 24 VDC rating. All the field instruments, MFC and solenoid valves shall be terminated at a junction box in the skid by BHEL’s oxygen dosing vendor for further connection to Plant DCS. The cabling from JB to plant DCS shall be in BHEL scope.

At each dosing point, viz. CPU outlet and deaerator outlet, an injection assembly containing 15 NB tubing, fixing collar, solenoid valve and NRV shall be supplied loose by oxygen dosing vendor and & erection/commissioning shall be done by BHEL.

The set points indicated below for operation of pressure reducing valve are tentative. Final value of the same shall be decided by oxygen dosing vendor during detailed engineering as per the requirement of the flow meter-cum-transmitter manufacturer.

For Skid dosing at CPU Outlet (CEP Discharge)

Source of signal	Tag Number	Set Point (suggested)	Interlock	Alarm in DCS	Remarks
During Normal Operation:-					
Pressure transmitter	PT (QCL11CP001/2)	55 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL11CP001/2)	47 Kg/cm2 (g) (LOW)	Close SV-1(QCL11AA201) & Open SV-2 (QCL12AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	PT (QCL12CP001/2)	55 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL12CP001/2)	47 Kg/cm2 (g) (LOW)	Close SV-2(QCL12AA201) & Open SV-1(QCL11AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders. Manually replace cylinder 2 with filled cylinder.
Pressure transmitter	PT (QCL10CP001/2)	46 Kg/cm2 (g) (LOW)	Close MFC (QCL10AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	PT (QCL10CP001/2)	50 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing valve reqd.
Pressure transmitter	PT (QCL10CP001/2)	48 Kg/cm2 (g) (Adequate)	Open Permissive pressure of MFC(QCL10AA202),	Not applicable	
Cation Conductivity analyzer	(SWAS PANEL SCOPE)	0.3 µs/cm (at 25˚C), increasing (HIGH)	Close MFC (QCL10AA202)	Yes (Oxygen dosing stopped due to high cation conductivity in feed water cycle)	Increase ammonia pH set point to raise pH to 9.2-9.5 range
Dissolved oxygen analyzer	(SWAS PANEL SCOPE)	30 ppb (LOW), decreasing	Gradually open MFC (QCL10AA202) to increase DO provided signal from PT (QCL10CP001) is "NOT LOW" (i.e < 45 Kg/cm2 (g))	Yes (Low DO level in feed water cycle)	Initial set point may be chosen as 90 ppb. However, provision may be kept to choose exact set point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb.
Dissolved oxygen analyzer	(SWAS PANEL SCOPE)	150 ppb, increasing (HIGH)	Close MFC (QCL10AA202) to decrease DO	Yes (Oxygen dosing stopped due to high DO level in feed water cycle)	
During Start up:-					
Cation Conductivity analyzer	(SWAS PANEL SCOPE)	0.15 µs/cm (at 25˚C), decreasing (ADEQUATE)	Open MFC (QCL10AA202) , provided signal from PT-3 is "NOT LOW" (i.e < 46 Kg/cm2 (g)) & signal from DO analyzer is "NOT HIGH" (i.e > 150 ppb)	Yes (Oxygen dosing started)	

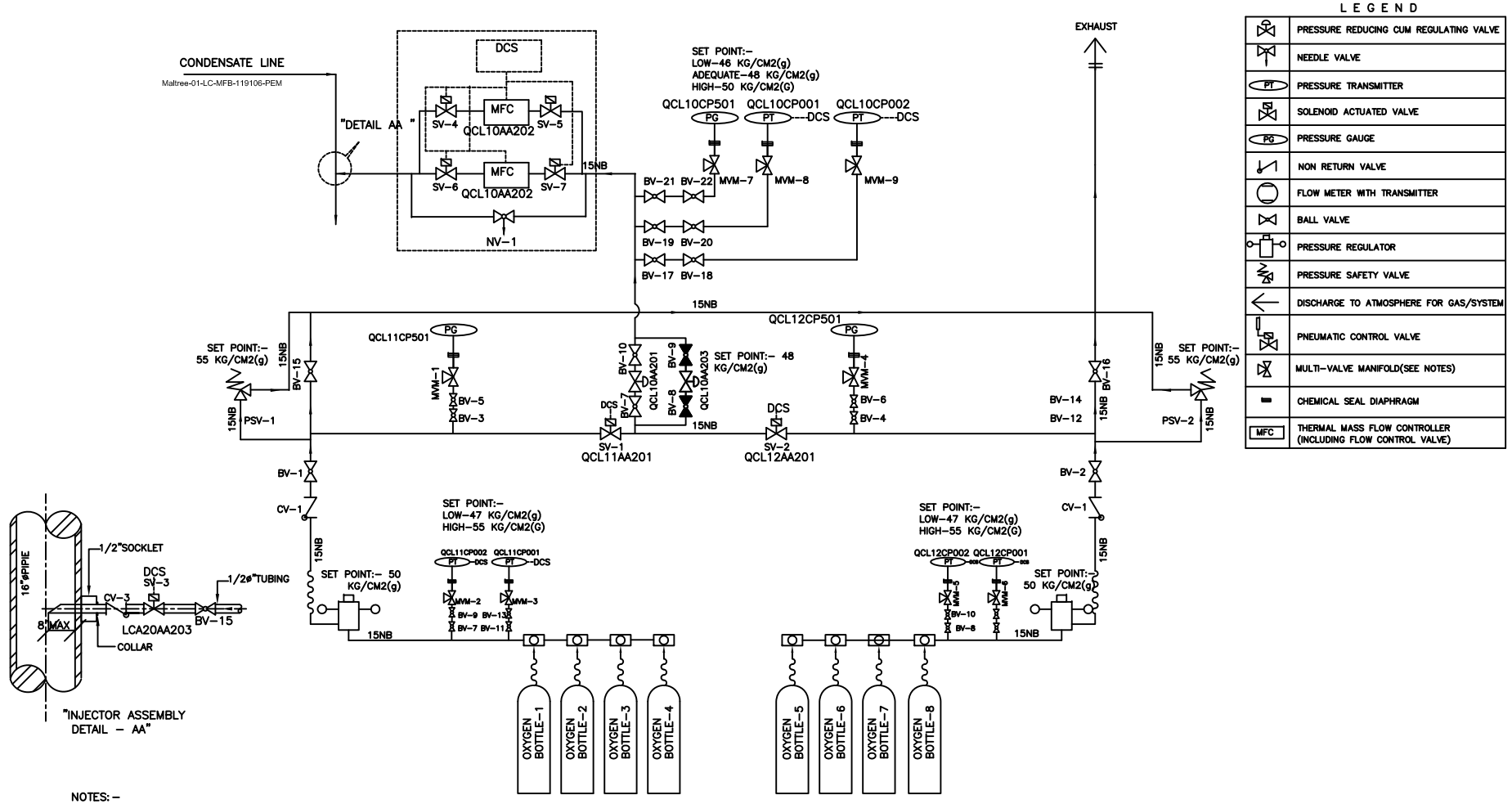
For Skid dosing at deaerator Outlet

Source of signal	Tag Number	Set Point (suggested)	Interlock	Alarm in DCS	Remarks
During Normal Operation:-					
Pressure transmitter	PT (QCL21CP001/2)	22 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL21CP001/2)	17 Kg/cm2 (g) (LOW)	Close SV-1(QCL21AA201) & Open SV-2 (QCL22AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	PT (QCL22CP001/2)	22 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL22CP001/2)	17 Kg/cm2 (g) (LOW)	Close SV-2 (QCL22AA201) & Open SV-1 (QCL21AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders. Manually replace cylinder 2 with filled cylinder.
Pressure transmitter	PT (QCL20CP001/2)	18 Kg/cm2 (g) (LOW)	Close MFC (QCL20AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	PT (QCL20CP001/2)	24 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing regulating valve reqd.
Pressure transmitter	PT (QCL20CP001/2)	20 Kg/cm2 (g) (Adequate)	Open Permissive pressure of MFC (QCL20AA202).	Not applicable	
Cation Conductivity analyzer	(SWAS PANEL SCOPE)	0.3 µs/cm (at 25˚C), increasing (HIGH)	Close MFC (QCL20AA202)	Yes (Oxygen dosing stopped due to high cation conductivity in feed water cycle)	Increase ammonia pH set point to raise pH to 9.2-9.5 range
Dissolved oxygen analyzer	(SWAS PANEL SCOPE)	30 ppb (LOW), decreasing	Gradually open MFC (QCL20AA202) to increase DO provided signal from PT(QCL20CP001) is "NOT LOW" (i.e < 18 Kg/cm2 (g))	Yes (Low DO level in feed water cycle)	Initial set point may be chosen as 90 ppb. However, provision may be kept to choose exact set point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb.
Dissolved oxygen analyzer	(SWAS PANEL SCOPE)	150 ppb, increasing (HIGH)	Close MFC (QCL20AA202) to decrease DO	Yes (Oxygen dosing stopped due to high DO level in feed water cycle)	

During Start up:-					
Cation Conductivity analyzer	(SWAS PANEL SCOPE)	0.15 µs/cm (at 25˚C), decreasing (ADEQUATE)	Open MFC (QCL20AA202), provided signal from PT-3 is "NOT LOW" (i.e < 22 Kg/cm2 (g)) & signal from DO analyzer is "NOT HIGH" (i.e > 150 ppb)	Yes (Oxygen dosing started)	

FIRST ANGLE PROJECTION ALL DIMENSIONS ARE IN MM

DRAWING No.



LEGEND

	PRESSURE REDUCING CUM REGULATING VALVE
	NEEDLE VALVE
PT	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
PG	PRESSURE GAUGE
	NON RETURN VALVE
	FLOW METER WITH TRANSMITTER
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE FOR GAS/SYSTEM
	PNEUMATIC CONTROL VALVE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM
MFC	THERMAL MASS FLOW CONTROLLER (INCLUDING FLOW CONTROL VALVE)

NOTES:-
1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
2 ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT CEP DISCHARGE (TOTAL=2 NOS).
3 ONE NUMBER INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE (TOTAL = 2 NOS).
4 ALL THE VALVES SHALL BE OF SS 316.
5 ALL TUBING SHALL BE OF SS 316, 15 NB AND 18 BWG.

BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT) LTD.

2X660 MW BIFPCL MAITREE KHULNA STPP, (BANGLADESH)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
A	DRN	SP		
	DESN	SP		
	CHD	JP		
	APPD	JP		

TITLE P&ID FOR OXYGEN DOSING SKID AT CPU OUTLET

DRAWING No.

SHEET 01 OF 02 REV 02

REV.	DATE	ALTD	CHD	APPD

JOB No. 421

STATUS CONTRACT

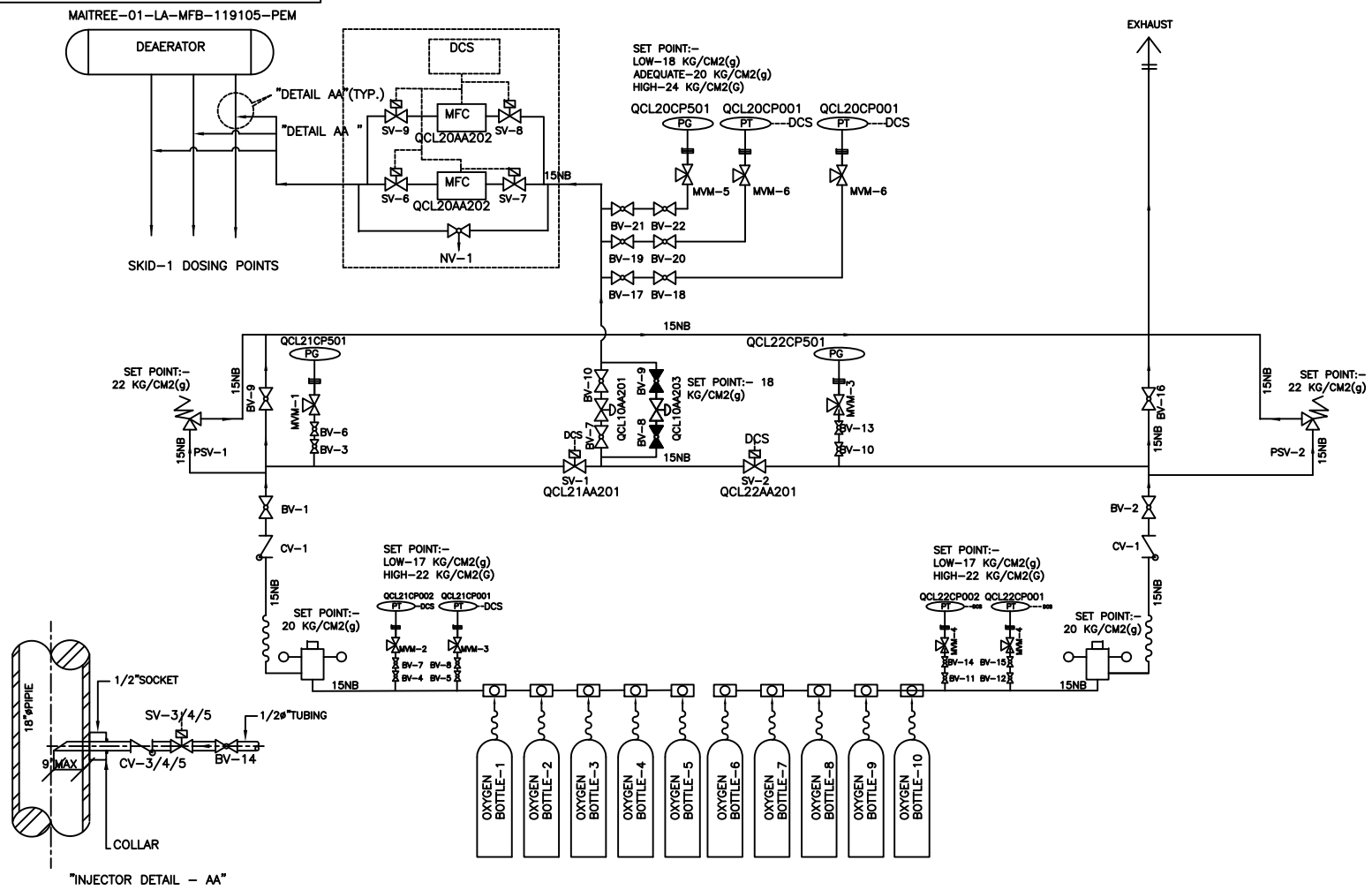
DISTRIBUTION

SIZE-A3

COMPUTER FILE NAME :

FIRST ANGLE PROJECTION ALL DIMENSIONS ARE IN MM

DRAWING No.



LEGEND

	PRESSURE REDUCING CUM REGULATING VALVE
	NEEDLE VALVE
PT	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
PG	PRESSURE GAUGE
	NON RETURN VALVE
	FLOW METER WITH TRANSMITTER
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE FOR GAS/SYSTEM
	PNEUMATIC CONTROL VALVE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM
MFC	THERMAL MASS FLOW CONTROLLER (INCLUDING FLOW CONTROL VALVE)

NOTES:-

1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
2 ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET (TOTAL=2 NOS).
3 THREE NUMBERS INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE (TOTAL = 6 NOS).
4 ALL THE VALVES SHALL BE OF SS 316.
5 ALL TUBING SHALL BE OF SS 316, 15 NB AND 18 BWG.

REV.	DATE	ALTD	CHD	APPD

JOB No. 421
STATUS CONTRACT
DISTRIBUTION

BANGLADESH-INDIA FRIENDSHIP POWER COMPANY (PVT) LTD.
2X660 MW BIFPCL MAITREE KHULNA STPP, (BANGLADESH)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE		NAME	SIGN	DATE
A	DRN	SP		
	DESN	SP		
	CHD	JP		
	APPD	JP		

TITLE P&ID FOR OXYGEN DOSING SKID AT DEAERATOR OUTLET

DRAWING No.

SHEET 02 OF 02 REV 02

SIZE-A3

COMPUTER FILE NAME :