REPORT

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INDEX

Methodology for Survey

1) Reference pillar observation 2 to 3 hrs. And its data process with IGS station for reference pillar accuracy and stack RTK data by DGPS.
2) Transfer the level from Ukhara Railway Station to on Mile Stone At Survey Area Site.
3) To determine rectangular co-ordinates of control points was done from nearby control points to detail survey and GL points by using ETS. For maintaining accuracy, the data where tied with nearby control points. Total Plot survey area 288 Acer.
4) Fixing the Boundary pillar and Grid Pillar (With foundation) on ground with unique number mark on pillar direction by PDIL Site Engineer.
5) Fixing the Grid pillar without foundation on ground unique number mark on pillar direction by PDIL Site Engineer.
6) Total 58 no. of pillars were established in the whole plot 288 Acre Area and also 2 no. Reference/Benchmark pillar on ground. These were set up at different locations on a particular land mark for future reference.
7) Stack out the pillar for coordinate in RTK mode by DGPS.

Methodology for Grid & Contour Survey

1) The grids are stakeout on the field at an interval of 20 m x 20m.
2) The input co-ordinates for the DGPS RTK are obtained with reference to the DGPS Geodetic Benchmarks.
3) The levels are taken at the intersection of these grid points with the help of DGPS. Subsequently the latitude and longitude of these grid points along with its level is recorded.
4) The data recorded in the DGPS is then transferred to the drawing software and the detailed drawing is prepared.
5) The contours are generated with the help of software "Autocad Civil3D".
6) The contours are generated 0.5-meter interval.
7) The existing High Flood Level (H.F.L) of Site near by stream is 113 Meter.
8) There are approximately 25 to 30 Nos. of tree in entire plot area.

Deliverable

1. Report file for Survey
2. Base Map with all detail (1:2500)
3. Contour Map 0.5 meter interval (1:2500)
4. Co-ordinate of survey data in a form of .CSV file.
5. Pillar Coordinate with Pillar image.

Boundary & GRID Pillar UTM Coordinate			
Point ID	**Easting**	**Northing**	**Elevation**
BP1	515497.905	2622171.770	118.601
BP2	515676.125	2622176.771	116.714
BP3	515863.230	2622188.745	116.770
BP4	516036.040	2622199.684	118.195
BP5	516153.802	2622065.999	115.752
BP6	516227.037	2621834.399	114.880
BP7	516227.002	2621834.440	114.877
BP8	516190.098	2621680.185	112.755
BP9	516204.154	2621541.175	109.084
BP10	516133.033	2621448.260	107.681
BP11	516207.874	2621341.014	108.600
BP12	516109.844	2621289.734	109.717
BP13	516093.920	2621177.412	110.734
BP14	516075.083	2621050.350	111.386
BP15	516037.272	2620937.952	111.817
BP16	516156.246	2620868.561	110.773
BP17	516196.793	2620774.835	108.344
BP18	516105.093	2620603.871	113.199
BP19	516036.588	2620483.167	113.526
BP20	515969.992	2620310.616	114.056
BP21	515912.689	2620456.877	114.369
BP22	515787.299	2620543.448	114.525
BP23	515609.173	2620608.688	114.393
BP24	515479.690	2620808.833	116.789
BP25	515415.517	2621008.795	118.911
BP26	515474.475	2621207.959	114.764
BP27	515573.060	2621362.707	112.492
BP28	515408.844	2621315.698	113.782
BP29	515309.242	2621449.034	115.681
BP30	515426.750	2621674.453	112.796
BP31	515478.845	2621869.779	112.054
BP32	515455.487	2622009.271	112.906
GP33	515771.389	2622008.629	114.183
GP34	515771.005	2621809.219	111.984
GP35	515771.556	2621608.985	109.766
GP36	515771.746	2621409.151	110.442
GP37	515764.617	2621218.750	112.717
GP38	515771.475	2621008.913	116.216
GP39	515649.669	2620720.179	116.059
GP40	515971.698	2620608.495	115.107

Grid Pillar UTM Coordinate			
Point ID	**Easting**	**Northing**	**Elevation**
GP1	515571.154	2622008.668	112.125
GP2	515971.617	2622009.433	116.748
GP3	515571.796	2621809.959	110.957
GP4	515971.515	2621809.049	113.889
GP5	516171.604	2621808.955	114.846
GP6	515571.633	2621608.968	110.960
GP7	515970.509	2621609.107	109.765
GP8	515571.633	2621408.946	111.704
GP9	515977.083	2621415.468	109.763
GP10	515571.245	2621209.020	115.406
GP11	515971.690	2621208.748	112.684
GP12	515571.694	2621008.899	119.421
GP13	515971.563	2621008.842	113.386
GP14	515571.017	2620809.168	116.893
GP15	515971.486	2620808.000	115.077
GP16	515771.509	2620608.916	115.641

FOR REFERENCE PURPOSE ONLY

Reference/Bench mark Pillar UTM Coordinate			
Point ID	**Easting**	**Northing**	**Elevation**
RP/BM1	515959.999	2620386.486	113.635
RP/BM2	515552.728	2621225.466	115.846

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP1	2622171.770	515497.9046	118.6011

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP2	2622176.771	515676.1245	116.7143

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP3	2622188.745	515863.2304	116.7702

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP4	2622199.684	516036.0397	118.1945

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP5	2622065.999	516153.8017	115.7516

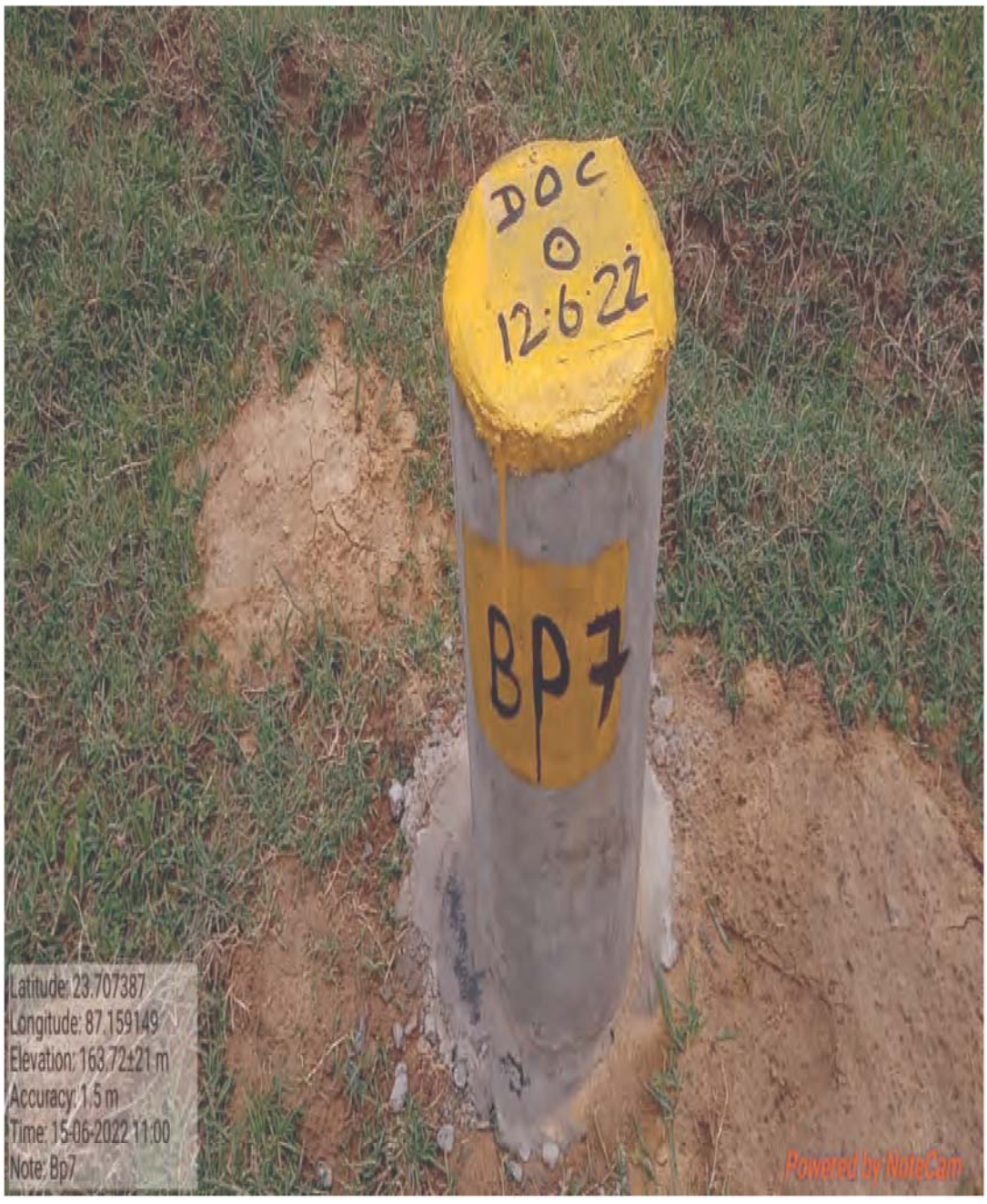
Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP6	2621834.399	516227.037	114.8797

Photo

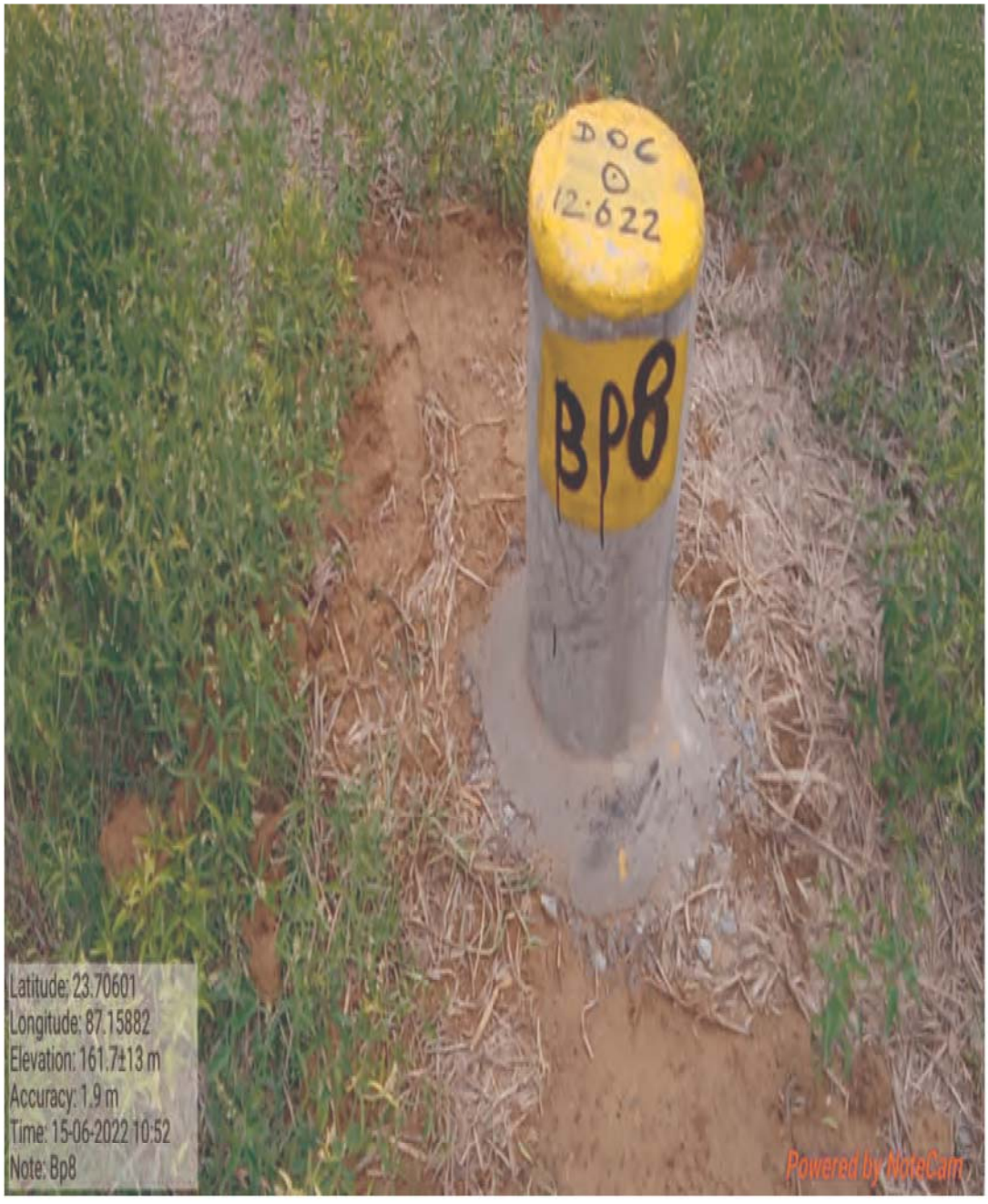
SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP7	2621834.44	516227.002	114.8769

Photo



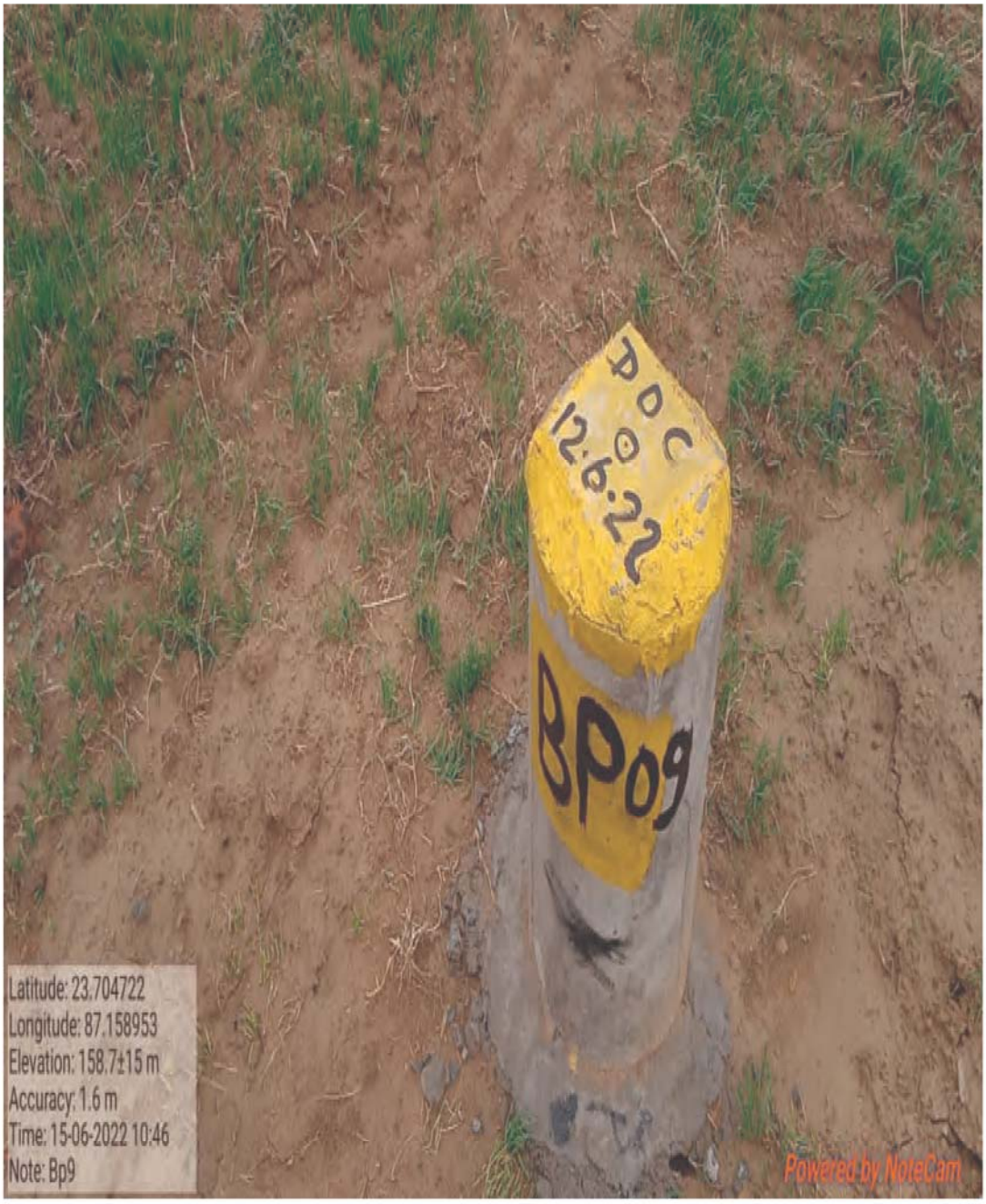
SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP8	2621680.185	516190.0981	112.7553

Photo



SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP9	2621541.175	516204.1537	109.0841

Photo



SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP10	2621448.26	516133.0326	107.6811

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP11	2621341.014	516207.8742	108.5996

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP12	2621289.734	516109.8436	109.7167

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP13	2621177.412	516093.92	110.7336

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP14	2621050.35	516075.0829	111.3857

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP15	2620937.952	516037.272	111.8165

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP16	2620868.561	516156.2462	110.7734

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP17	2620774.835	516196.7929	108.3437

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP18	2620603.871	516105.0932	113.1989

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP19	2620483.167	516036.5875	113.526

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP20	2620310.616	515969.9923	114.0559

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP21	2620456.877	515912.6888	114.3694

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP22	2620543.448	515787.299	114.5253

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP23	2620608.688	515609.1728	114.3927

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP24	2620808.833	515479.6897	116.7888

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP25	2621008.795	515415.5169	118.9109

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP26	2621207.959	515474.4749	114.7638

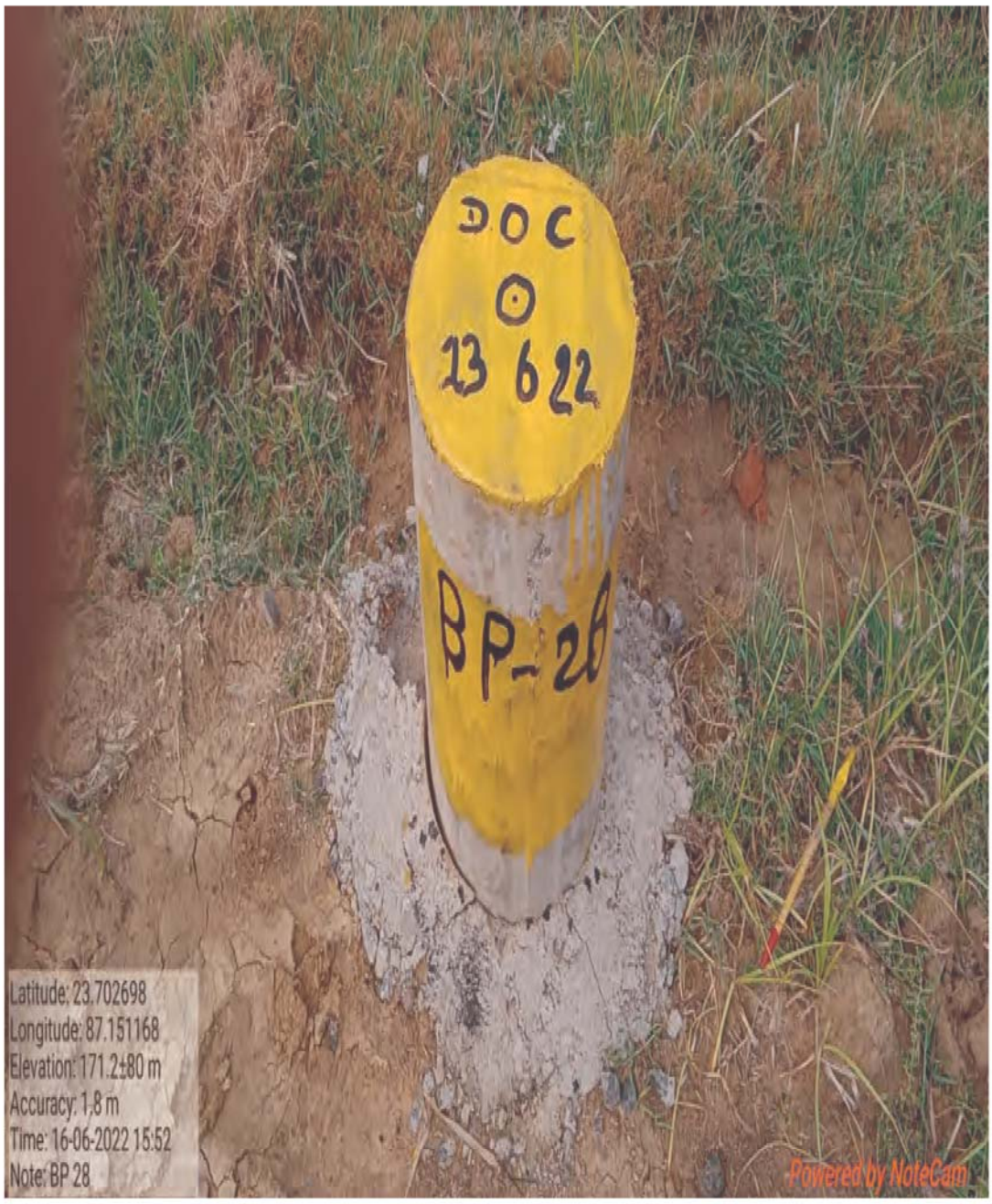
Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP27	2621362.707	515573.0598	112.4921

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP28	2621315.698	515408.8436	113.7817

Photo



SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP29	2621449.034	515309.2416	115.6813

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP30	2621674.453	515426.7498	112.7956

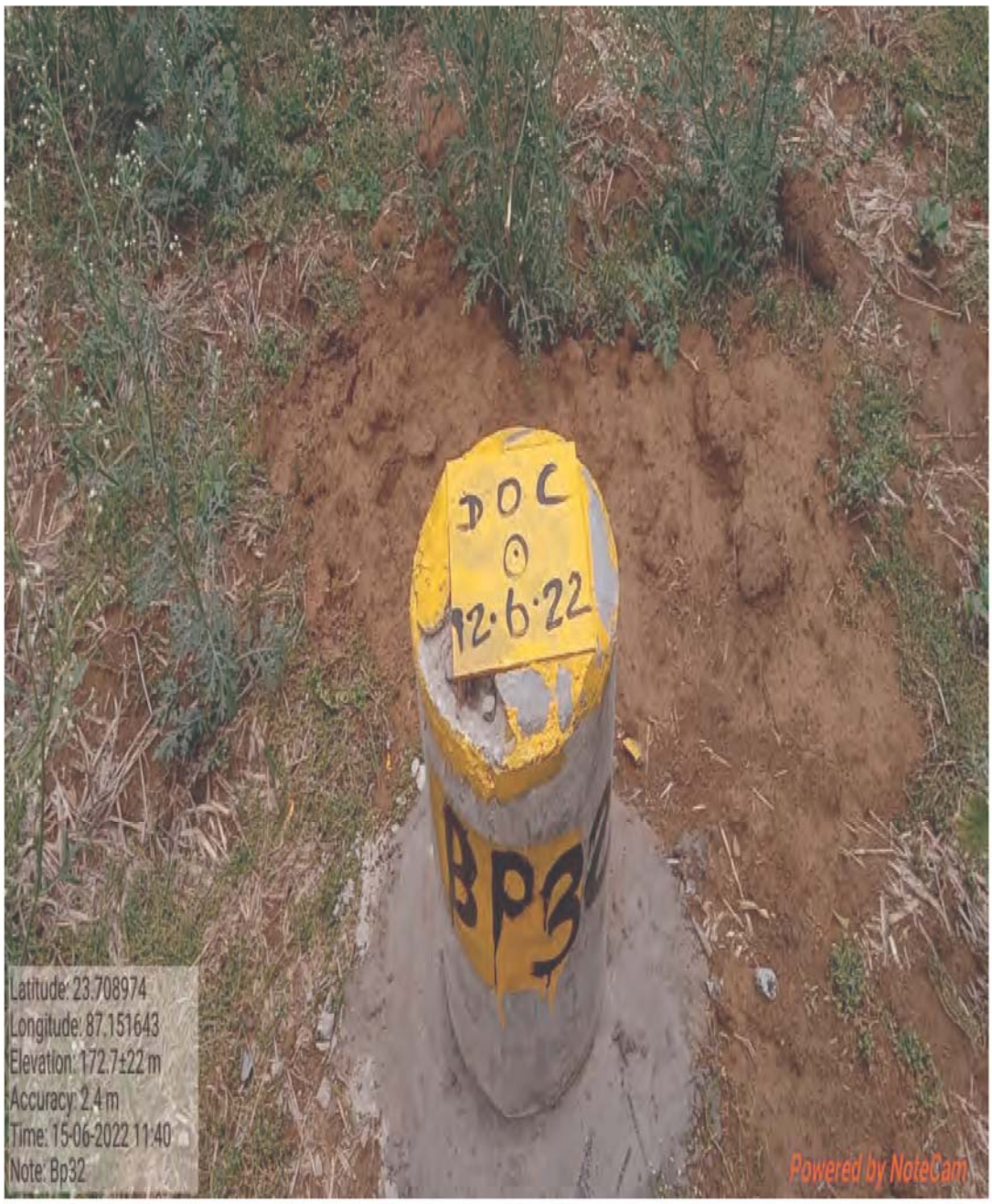
Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP31	2621869.779	515478.8448	112.0535

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	BP32	2622009.271	515455.4872	112.9062

Photo



SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP33	2622008.629	515771.3885	114.1833

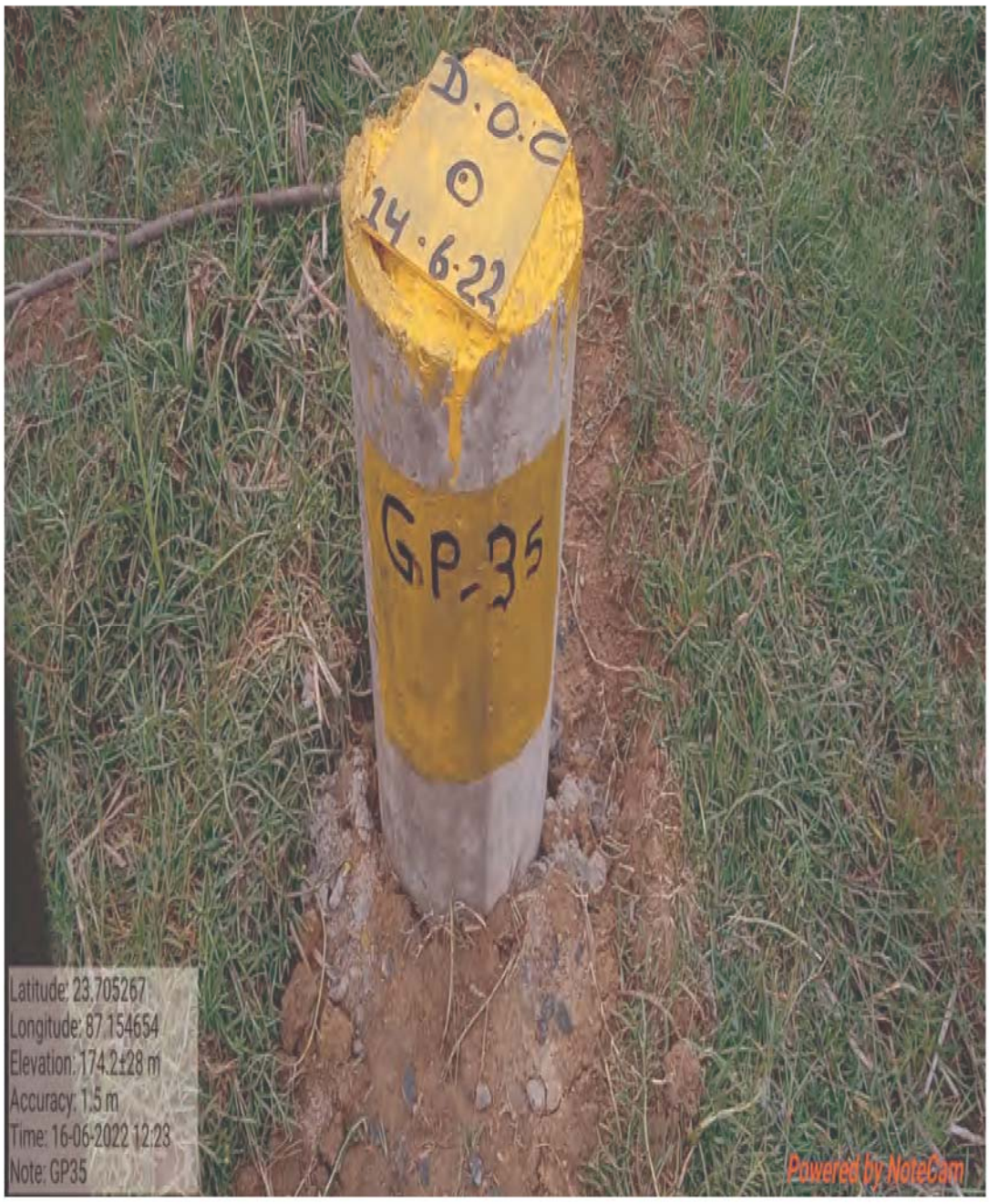
Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP34	2621809.219	515771.0048	111.9842

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP35	2621608.985	515771.5557	109.7663

Photo



SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP36	2621409.151	515771.7455	110.4422

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP37	2621218.75	515764.617	112.717

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP38	2621008.913	515771.4754	116.2162

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP39	2620720.179	515649.6688	116.0593

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP40	2620608.495	515971.6981	115.1071

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP1	2622008.668	515571.1538	112.1254

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP2	2622009.433	515971.6171	116.7478

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP3	2621809.959	515571.7964	110.9569

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP4	2621809.049	515971.5152	113.8891

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP5	2621808.955	516171.6038	114.8456

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP6	2621608.968	515571.6331	110.9604

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP7	2621609.107	515970.509	109.765

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP8	2621408.946	515571.6331	111.7043

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP9	2621415.468	515977.083	109.763

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP10	2621209.02	515571.2446	115.4058

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP11	2621208.748	515971.69	112.6838

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP12	2621008.899	515571.6936	119.4211

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP13	2621008.842	515971.5632	113.386

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP14	2620809.168	515571.0167	116.8932

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP15	2620808	515971.4861	115.0766

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	GP16	2620608.916	515771.5094	115.6414

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	RP/BM1	2620386.486	515959.9986	113.6353

Photo

SUBJECT		BOUNDARY & GRID PILLAR IMAGE & COORDINATE		
UTM COORDINATE (ZONE 45 N)	POINT ID	NORTHING (M)	EASTING (M)	ELEVATION
	RP/BM2	2621225.466	515552.7279	115.8461

Photo

PART - II: TECHNICAL

SECTION –2.8

DESIGN SPECIFICATION – FIRE FIGHTING SYSTEM

PLANT : AIR SEPARATION UNIT ON BUILD-OWN-OPERATE (BOO) BASIS TO GENERATION OXYGEN AND NITROGEN FOR COAL GASIFICATION TO SYNTHETIC NATURAL GAS (SNG) COMPLEX.

PROJECT : COAL BASED SYNTHETIC NATURAL GAS(SNG) PROJECT AT BARDHAMAN, WEST BENGAL, INDIA

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 PURPOSE

The purpose of this document is to establish the requirements of the fire fighting system for applicable facilities of the package plant.

This document is a general specification providing typical requirements of layout, material, testing, etc. for various fire fighting systems.

This specification covers design basis and ex ecution requirements for fire protection system for Coal gasification plant. The provisions shall be made, in order of precedence, as per statutory regulations, OISD guidelines, job specifications and s afe engineering practices.

2.0 SCOPE

Contractor shall provide fire fighting system as mentioned in this document in accordance with OISD/NBC 2016 (and/or Latest Edition) for applicable facilities of the package plant.

3.0 DESIGN CRITERIA

The Fire Protection Philosophy is based on Loss Preventive and Control. The adequacy of fire protection facilities for fertilizer plant is very important because of the inherent hazard it carries. A fire in one part/section of the plant can endanger other sections of plant as well. If fire breaks out, it must be controlled / extinguished as quickly as possible to minimise the loss to life and property and to prevent further spread of fire.

Unless otherwise specified in the NIT the design shall meet requirement of applicable OISD / PESO:

National Building Code 2016 (and/or Latest) For Non Hazard Area.

Fire Fighting System design and l ayout is subject to review and appr oval by Local Statutory Authorities. Documentation & obtaining approval of the fire fighting system from local fire service authority shall be in scope of Contractor.

CONTRACTOR shall calculate the fire water requirement for their scope and tie-in for LSTK scope shall be taken from the and O SBL fire water network. Offsite fire water network (OSBL scope) shall be av ailable around the unit. Contractor shall take the required tapping's from this offsite header with an isolation valve for each tapings.

Fire Protection system's detailed location map to be di splayed at Fire Station & Plant Control Rooms.

4.0 FIRE PROTECTION SYSTEMS

The following fire protection facilities shall be provided depending upon the nature or the installation and risk involved wherever applicable.

a) Fire hydrant system
b) Water spray/sprinkler system
c) Gas flooding system

d) Fire detection, alarm & communication system (refer E&I section in NIT)
e) First aid fire fighting equipments including Portable fire extinguishers
f) Personnel protective equipments (PPE)

4.1 Fire Hydrant System

The engineering (sizing, material thickness, supports, etc.,) of fire fighting network for the above mentioned fire protection systems / fire protection facilities, shall be provided by bidder, on the basis of codes, standards, specifications, drawings of this document.

Fire water network shall consist of mostly aboveground and/or underground, if required, piping systems.

Around units the fire water mains shall be laid aboveground and directly buried and/or in trenches, if it is laid underground. The underground ring main network system shall be laid at minimum one meter earth cushion. Top of casing pipe (RCC Hume pipe) of underground piping crossing roads (peripheral road, package unit road, access road/ways) shall be at min. 1.5 metre depth.

All underground fire water piping shall be externally protected from corrosion by wrapping and coating of cold tape as per attached specification, for underground CS pipe which shall extend up to min. 500 mm, above / beyond grade wherever applicable.

Above ground fire water piping shall be painted as per painting specification and the paint shall be conforming to shade as per applicable standatd.

Wherever fire water line will cross the roads, same shall be put under a suitable Hume pipe or culvert, with proper wrapping, coating as an anticorrosive treatment (Cold Tape Type, as per detailed specification provided elsewhere in NIT).

Flushing point with isolation gate valve and pressure gauge points (approx at the rate 300mtr. and at all battery limit tie in points) with isolation gate valve shall be provided on all headers.

Network shall be laid in closed loops to ensure multidirectional flow. Isolation valve to be provided at every 300m (max) and at crossings (Junctions) to ensure easy maintenance and uninterrupted water supply in case of break down and shall be planned in such a way that outage of any section of fire water line should not affect other section.

Hydrant posts shall be installed with a branch “L” shape piping to avoid directly fall of leaking water on main header.

RCC slabs (Minimum 1500mmX1500mmX100mm thk.) shall be provided at the grade level beneath of each Hydrant/Monitor/HVLR// 3way- 4 way fire brigade connection post and respective hose box.

Up to 2.0 m portions of the headers (if above ground) on both sides of hydrant branching and the entire branch piping near of hydrants shall be epoxy painted.

Isolation valves (gate valves, rising spindle) shall be provided below monitors and at all hydrants. Suitable restriction orifice shall be provided at downstream of isolation valve of hydrant post to maintain the pressure requirements as per applicable standard.

Fire water pressure at the farthest point shall be a minimum of 7 kg/cm2 after installation of headers and sub headers.

All fire water piping shall be tested to hydraulic test pressure of 18 kg/ cm2 (g) and/or as calculated considering pump shut-off pressure.

Radiography requirements shall be as per OISD.

For process units, external ring header with hydrants and an internal distribution with monitors and hose reels shall be installed.Hydrant heads shall be placed at a minimum distance of 15m from process equipment.

Monitors around heater areas, if any, shall be necessarily provided and located in such a manner that the heater can be isolated from the plant.

Monitors shall be provided to cover the high rise columns, equipments etc. of height 15 mtr. and above, unless otherwise specified in layout drawing.

There may be cases where due to horizontal obstruction, a particular vessel/ process column may not be approachable by ordinary monitor or hydrant, elevated monitors shall be provided to take care of such conditions.

Tall columns, structure, towers and equipment where it may not be possible to provide access staircases with hydrants on landing, will be considered as protected by hydrants at ground level, provided they are less than 15 m in height. When the height exceeds 15 m, the concerned hydrants shall be replaced by monitors.

Alternate hydrants for protection of loading unloading bays, rail/truck gantries shall be replaced by water/foam monitors.

Number of hydrants shall be based on one hydrant post with two hydrant valves for every 30m (max.) of external perimeter of process units and storage tank area. For utility and other building areas, this distance shall be a maximum of 45m.

Hydrants and/or water monitors shall be located keeping in view the different risks within the premises which are to be protected and ensuring effective coverage.

Double hydrants (as per applicable OISD, hydrant valve with single outlet) on each hydrant post (i.e. two hydrant valves mounted on each stand post) and at every 30m centre to centre, along the hydrant mains, shall be provided.

Extension of hydrants/monitors for spill fire (as required by applicable standard) shall also to be provided.

Indoors hydrants with hydrant valves (landing valves), hose reels and hose box containing accessories, for plant buildings and non-plant buildings, shall be provided as per IS-3844. In case of buildings, hydrants shall be located at not be less than 2 m and not more than 15 m from the face of building.

Landing valves should be installed on each floor level and on the roof, if accessible, in such a way that control line of landing valve is 1 to 1.2 m above the floor level.

Double headed landing valves (two numbers, type-A, Landing valves on single stand post), shall be provided on the landing of first floor and above on all the buildings/Tech structure/platforms etc. with isolation valve at each tapping for landing valve assembly.

The monitors shall have isolation valve. Monitor location shall be given special consideration for protection of cluster of towers, heaters and other high structures, where it may not be pos sible to approach the higher levels. Minimum of two monitors shall be provided for each such area.

Field adjustable variables flow type remote operated monitors shall be provided for the protection of inaccessible equipment.

Contractor to finalise hydrant layout on plot plan, with all the requirements such as number of Hydrants, Monitors, Foam system, sprinkler system etc., based on al l statutory requirements & Code Guidelines, considering ease of maintenance and safe approach for fire fighting. Due consideration is to be given for providing Emergency escape routes also. Hydrants are to be strategically located to obtain maximum advantage of layout.

Fire brigade connection (3 way & 4 way) points with Isolation gate valve as per applicable OISD shall be provided at strategic locations.

Above ground pipe shall be supported on RCC pedestals (refer attached drawing). wrapper plate (thickness same as pipe & covering approx. 120 degree at bottom portion of pipe) shall be provided at each support for above ground pipe (6" NB and above). Supports for piping system and structures shall be provided as per support specifications of NIT. If support specification not provided in NIT, safe adequacy calculations shall be submitted by bidder for review/approval by PMC/owner.

4.1.1 Buried Pipes

The following points to be considered in designing of buried pipes

i) All underground buried metallic piping shall be coated and wrapped with cold tape and laid at minimum one meter earth cushion.
ii) Underground pipe at crossing roads, access ways shall have RCC casing pipe (Culvert or Hume pipe). Underground piping at rail crossing shall be as per Indian railways.
iii) Valve chamber wherever required shall be made of brick or concrete. Valve chamber should be spacious to attend valves during operation/maintenance.
iv) All U.G. headers shall clear equipment foundations.
v) Provide break flange at + 500 MM from floor level to isolate underground pipe from above ground piping with insulating gasket kit.
vi) Pipes shall be laid below electrical cables, if any.
vii) Buried Pipes shall be laid in trenches after excavation, covered with 150mm sand bed all around them, backfilled and properly rammed.
viii) RCC thrust blocks shall be provided as per engineering requirement.
ix) Cathodic protection shall be provided for buried pipes.

4.1.2 Piping in Trenches

The following points to be considered in designing of trench pipes:

i) Piping located below grade, requiring inspection, servicing or provided with protective heating.
ii) Fire water lines/Process lines.
iii) Drain lines requiring gravity flow trenches.
iv) Sump for valves and trenches shall be provided.
v) Suitable draining scheme for trenches shall be provided.
vi) Valves in trenches shall be provided with extended stems. If hand wheels of the valves are located more than 300 mm below the cover plate, the valves shall be provided with extended stems extending to within 100 mm below the cover plate.
vii) The trenches shall be lined with RCC, then provided with 150mm sand bed and also shall be covered with RCC cover after laying of wrapped and coated pipes in them. Top of pipe shall be at min one meter depth.
viii) RCC thrust blocks shall be provided as per engineering requirement.

4.2 Water Spray System, water sprinkler system and water curtain system

Water spray systems shall be provided as per OISD / job specifications.

Water spray, water curtain systems, permanently connected to fire water network, shall be provided with piping system, detectors, spray nozzles (chrome plated brass), deluge valves (dry type, pneumatically & hydraulically operated (only use where air is not available) with manual by pass valve, remote automatic and local manual operation), isolation valves, strainer, low point drain with valve and suitable restriction orifice to maintain the pressure requirements as per OISD.

Minimum 15m distance shall be maintained for Deluge valve / manual Isolation valves located from the equipment which is spray protected.

Instrument air service Piping/ Tubing shall be SS304.

Downstream of deluge valve and sprinkler shall be provided with galvanized carbon steel piping system.

Water spray and sprinkler application rates shall be as per OISD.

4.2.1 Medium velocity Water Spray (MVWS) System

- To be provided for the followings locations, but not limited to.

- Compressor seals
- Lube oil consoles
- Knock out drums (with hydrocarbon bearing service)
- Cable cellars
- Diesel/Petrol/Kerosene oil or any hydrocarbon liquid / oil tank
- Coal/ Pet coke/ solid hydrocarbon material handling plant area
- Pumps under racks.
- Empty bag storage area

4.2.2 High velocity Water Spray (HVWS) System

To be provided for the followings locations, but not limited to.

- Transformers of minimum 10MVA rating or with oil content of minimum 2000 litres.

4.2.3 Water curtain system

Water Curtain System (WCS) Provided as per requirement for Fire Separation / Isolation creates a barrier between adjacent process units, chemical storage tanks (like process unit), or between plant and utility areas with applicable facilities. Prevents radiant heat from spreading to nearby sections. Radiant Heat Protection Protects personnel and equipment from intense heat radiation due to fire in process or storage areas.

Water Curtain System (WCS) to be provided as per standard.

- Equipment that would lead in case of leak to major risk of exposure to external people around plants that shall be proposed by contractor or reviewed during detail engineering.

4.2.4 Sprinkler System

The sprinkler system, with galvanized carbon steel piping, shall be designed and installed at the following locations, but not limited.

Sprinkler system with deluge valves (dry type), shall be installed at the following location/ buildings, if applicable.

- Laboratory
- Chemical room/storage area.

Sprinkler system (wet type with QBD), shall be installed at the following location/ buildings, if applicable.

- All buildings as per NBC 2016 (and/or latest edition)
- Admin Building
- Workshop building
- Technical Building
- Meeting Room/Hall
- Canteen

Wet riser(s) is/are a pipe or a number of pipes, permanently charged with water under pressure, rising through the full height of the building.

4.3 Foam System

Foam system shall be provided for transformer area and hydrocarbon oil tank area.
The transformer area shall be surrounded by at least 2 foam monitors strategically installed.
Hydrocarbon oil tank area and LPG/NG gas skid area shall be surrounded by at least 3 foam monitors strategically installed, so that each tank or each gas skid is fully covered within the monitors throw range.
Water cum foam monitors (SS304 body & nozzle, fixed stand post type, manual operation, 500-750 USGPM variable type flow, self inducting foam induction mechanism) along with portable type foam cans (each 200 Litres capacity) with 3% AFFF Foam, shall be provided for above areas.

The foam system shall be considered for protecting tanks and other applicable equipments for hydrocarbon services as per NFPA requirements. The foam system shall comprise of foam concentrate proportioning equipment, foam makers, piping system and foam discharge devices, as applicable, as per NFPA. The system shall automatically actuate foam on detection of fire.

4.4 Clean agent flooding system

Clean agent protection systems shall be provided in technical rooms (Computer room, Computer console room, UPS room, Battery room, server/database rack room) of the following buildings, but not limited.

- Common Control Room,
- Local Control Rooms
- Main Substation

The design and installation of Clean Agent Fire Extinguishing Systems should meet the requirements of NFPA 2001. (Details mention as per technical Specification attached with NIT).
A clean agent must be having property Zero Ozone Depletion Potential (does not damage the ozone layer)

5.0 MATERIAL SPECIFICATION

a) Materials & equipments used for fire protection system shall be in accordance with NFPA/TAC requirements and/or attached specifications of NIT.
b) Pipes (API 5L Gr. B, SMLS upto 6”NPS or PMS attached with NIT for Fire Services) fittings(ANSI/ASME), Valves(API), flanges(ANSI/ASME), Spray nozzles and deluge valves, quartzoid bulb detectors(QBD), Detector piping, Hydrant, Monitors, Hose Boxes, Hoses shall be as per piping material specifications (PMS), and/or attached specifications of NIT.
c) Cast Iron valves or any cast iron piping component like pipes, fittings, flanges, valves, fasteners, gaskets, etc. shall not be used for firefighting system or for any service.
d) Spiral welded pipes shall not be used.
e) Seamless pipes/fittings are acceptable in lieu of welded pipes/fittings, but welded pipes/fittings are not acceptable in lieu of seamless pipes/fittings.
f) LSAW pipes are acceptable in place of ERW pipes, for same thickness.
g) Double seam, 180 degree apart , is allowed for pipe sizes 36" and larger only.
h) Circumferential seams (minimum 2 meter apart) is allowed for pipe sizes 36" and larger only.
i) Flanges shall be in one piece material, without any joints.
j) All flanged valves (except forged) shall have flanges integral with the valve body.
k) Forgings are acceptable in place of castings but not vice-versa.
l) Valves in saline water (if applicable) service shall be with non ferrous trims and all wetted parts other than trims shall be epoxy coated.

m) Generic material of valves body, required as per process/service conditions but not specifically mentioned, shall not be lower in chemical composition than the connecting pipe material.

n) PN equivalent rating for Class150# valves shall be minimum PN16.

5.1 Hydrant Valve :

Inlet	: 3"-ANSI 150 # RF
Outlet	: 63mm
Pipe Size & material	: 4" CS
Capacity	: 36 cum/hr
Type	: Oblique angle type as per OISD requirement
Material	: SS304

5.2 Water Monitor

Nozzle bore size : 38mm (Aqua fog /foam with arrangement of jet and spray).

End connection	: 4"- 150 # RF
Run Pipe Size	: Min. 6", CS
Capacity	: 2580 LPM
Material	: SS304

5.3 Water cum Foam Monitor:

Nozzle bore size	: 38mm (Non aspirating type-Aqua fog / foam with Arrangement of jet and spray)
Run Pipe Size	: Min. 6", CS
Capacity	: 750 GPM
Material	: SS304
Approval	: UL

5.4 High Volume Long Range Water Monitor (HVLR)

Capacity	: 2000/1000/750/500 GPM (as required)
Horizontal Range	: 75 m approx.
Material	: SS304
Approval	: UL

5.5 Hose Reel

Fire hose reels (IS-444) shall be considered at strategic locations around block as first aid fire contingency. These shall be indoor wall mounted and outdoor floor mounted type on structure and shall have water connection from hydrant network. Each hose reel shall have 30 metre long hose with nozzle. Hose reel shall be minimum 30m long x 20mm bore.

Hose reel shall cover all process areas in ground floor. Indoor wall mounted Hose reel shall be provided with each landing valve. Outdoor floor mounted type on structure at strategic locations @ 01 no(minimum) for each package area.

5.6 Hose Box

Hose boxes shall be made of M.S. material and painted red with dimensions 18 SWG thick M.S. sheet, size 900 mm x 600 mm x 250 mm. Each box shall contain 2 nos.x 15 m of 21/2" fire hose (IS-636 Type-B) with gun metal nozzle, coupling, universal branch pipe (IS-903), MS spanner. 1no. Hose Box with accessories shall be provided for each hydrant post and each fire brigade connection (3 Way, 4 Way with isolation gate valve).

5.7 Portable Fire Extinguishers

Portable fire extinguishers (IS-2190, BIS marked / BIS approved) as per TAC shall be provided for plant & non plant buildings & areas, at strategic locations. Portable extinguishers of 9 kg (wheeled) & 50kg (wheeled) DCP (ABC type), 4.5kg (mounted), 6 kg (mounted) & 22.5kg and above (wheeled) CO2 type shall be provided. Contractor shall specify the numbers and location for Owner's review and approval.

5.8 Deluge valve

Deluge valve shall have flanged body/housing & cover (Cast Steel ASTM 216 Gr. WCB), Internal Metallic parts SS304, Diaphragm Rubber/ Non metallic) UL listed, Red Painted, pneumatically actuated.

6.0 FIRST AID FIRE FIGHTING EQUIPMENTS

The selection of safety equipment should be such that it is correctly related to the type of fire expected in the area.
The general guideline for selection and use shall be as per TAC/IS requirements. Fire extinguishers shall be provided as per TAC/IS.
Contractor shall provide the Fire extinguishers items (BIS approved) as specified in tender.

6.1 Fire extinguisher

Fire extinguishers as per TAC shall be provided for process risk and at each landing of operating platform of technological structures, for the protection of equipment as a means to cope up with fire at incipient stage. Supply of all Fire Extinguishers shall be with BIS Mark.
Powder used in DCP type fire extinguishers shall be MAP 90% ABC powder, UL listed & BIS approved.
The number should be determined based on the max. travelling distance of 15 M. At least one fire extinguisher shall be provided for every 250 m2 of hazardous operating area.
Chemicals/ Consumables used in the fire extinguisher shall UL listed.

Following Fire Extinguisher types shall be provided, as applicable:

1) 6 Kgs., 9 Kgs. Capacity DCP Extinguishers (ABC type) shall be provided on Technological platforms/process ground floor and Control rooms.

2) 4.5 Kgs. Capacity Co2 Extinguishers shall be provided for buildings, sub stations & control rooms.
3) 22.5 Kgs Capacity Co2 Extinguisher shall be provided near transformer bay.
4) 50 Kgs capacity DCP Extinguishers (ABC type) shall be provided at critical operating area in plant.
5) 2 Kgs, 4 Kgs capacity clean agent Extinguishers shall be provided for Control Room, Computer room, Computer console room, UPS room, Battery room, server/database rack room etc.

6.2 Sand Bucket

Sand buckets filled with sand along with scoops, mounted on structural support stand each with at least 3 sand buckets), shall be provided in Transformer bay, Sub Station, buildings, Technical structure, platforms, Pump house, etc.

The sand buckets shall have round bottom with bottom handle having 9 liter water capacity conforming to IS: 2546. The sand stored in bucket shall be fine and free from oil, water or rubbish. Rain protection of suitable design shall be provided for all sand buckets.

7.0 SAFETY EQUIPMENTS/PERSONNEL PROTECTIVE EQUIPMENTS (PPE)

Contractor shall provide the safety items as per the attached PPE's list and specification.

7.1 SAFETY SIGNAGES

Contractor shall provide the safety signage's (in English & Hindi language) as per applicable standard, at strategic locations, for plant/ non plant areas buildings, technological structure, areas.
Safety signage's must be visible under both lighted & darkness conditions.

7.2 SAFETY SHOWER AND EYE/FACE WASH STATION

Safety showers and eye/face wash station units shall be located in all areas where there is a possibility of chemical splash injury of eyes or face or body, or exposure to irritating chemicals. These facilities shall be located in such a way that they do not pose a problem by reaction with water sensitive chemicals and shall be so arranged that there is no obstruction in going from the work spot to their location.
The facilities shall be located at a convenient place. As far as possible, they should be within a distance of 15 m from the place of work.
The units shall be connected to the potable water network and designed to ensure the water is at a safe temperature for use (temperature between 16°C and 38°C). (As per attached data sheet PC217/E/001-912).

7.3 Self Contained Breathing Apparatus (45 Minutes)

Self-contained breathing apparatus (SCBA) suitable for fire fighting, rescue operation in toxic and oxygen deficient atmospheres. The equipment consists of compressed air cylinder, full face wide vision mask (with inner mask), pressure

reducer, pressure gauge, low pressure warning whistle, exhalation valve, speech diaphragm, comfortable shoulder harness and light weight back plate, straps, buckles and easy to wear.
The Cylinder shall be capable to operate for 30 minutes. The Cylinder and Valve shall have CCOE approval. BA Set shall be confirming to IS: 10245 (Part-2). One number of spare cylinders shall also be supplied.

In addition, **ONLINE AIR LINE** mask shall be provided in ASU control rooms (two Nos.) having System for compressed air filtration that meets NIOSH regulations for breathing systems. Three stages of filtration: to dust, water, oil and hydrocarbons from compressed air. Optional Carbon Monoxide monitor is provided to monitor gas concentrations. Provides filtered air for Grade D breathing.

FILTER SYSTEM FOR ONLINE BREATHING APPARATUS :

1st stage:	Filter 5 micron particles and Automatic drain
2nd Stage:	Coalescing filter cloth and drain 0010 microns manual
3rd Stage:	Activated carbon filter of 0.003 microns and manual drain
Regulator:	High pressure adjustable knob range 0-160 PSI gauge and external valve pressure relief
Manometer:	Acrylic translucent, Teflon float, with adjustable valve. Graduations: 0.0 - 1.0 LPM

8.0 EMERGENCY ESCAPE ROUTE

Escape route shall be m arked with signage, exit point. Escape route shall not be obstructed in any way. No single accident should be capable of blocking both alternatives. Escape route should take shortest route to assembly point defined within plant.
In case of process structure, satisfactory access shall be provided to all parts of each floor by means of incombustible internal or external staircases.
Exact numbers, width, location, etc. of such staircases and ramps for basements shall depend on travel distance requirements given under National Building code of India.

9.0 EXECUTION, INSPECTION AND TESTING

All execution, inspection and testing for completion of fire protection system shall be carried out based on codes, standards and specifications. Contractor shall develop detail inspection and t esting procedures for review by owner. Contractor shall carryout demonstration test for each installed system as per scope of work.

The Contractor shall meet all requirements for inspection and testing of the systems.

10.0 QUALITY ASSURANCE SYSTEM

All work/services to be per formed by the Contractor under this contract shall be of specified/approved quality and Contractor shall have a quality assurance/quality control (QA/QC) system during the performance of various activities such as engineering,

procurement, tendering, construction etc. Review/approval of activities by Owner/PMC shall not however dilute the responsibility of Contractor for maintaining quality.

The objective of the quality assurance scheme of the Contractor shall be to ensure the conformity of equipment, material, site construction (if any) to various standards, specifications, drawings and technical requirements that are being mutually agreed between the Contractor and Owner/PMC/TPI. Quality Assurance System should clearly indicate the organizational approach for quality control and quality assurance of the various equipment/construction activities (if any) and also provide a verifiable evidence of the Contractor having carried out all the activities laid down in the bid document and the procedure. Such conformity to quality level shall be ensured by controlling the quality level of purchased items at vendor's/sub-vendor's shop/site and shall cover from source surveillance to final inspection. The Contractor to submit a detailed inspection and testing plan for various shop/site activities for review by Owner/PMC/TPIA.

11.0 INSPECTION

The Contractor is required to organize a proper inspection and expediting system so as to ensure timely delivery of all the items/equipment meeting the specified quality criteria. This function has to be carried out by appropriate deployment of qualified personnel who have wide experience in their respective fields. Inspection of all items supplied under this contract shall be carried out by independent third party inspection agencies like Lloyds/ BV/ TUV/DNV. Third party inspection charges for foreign origin items shall be quoted by bidder. Third Party Inspection shall be done by owner approved third party inspection agencies.

Inspection authority means the Third Party Inspection Agencies (TPIA) approved by the Owner to carryout inspection of materials.

The inspecting authority shall have the right to select random samples for check test and reject materials, if samples furnished as above and tested as per the specifications fail to meet the requirement specified.
All the items shall be inspected and tested in the presence of one or more representatives of the purchaser during various stages of manufacturing. Material shall be considered acceptable for dispatch only after final certificate of acceptance is issued by the Inspector. Testing performed in the presence of the purchaser's representatives shall not relieve the supplier of their own responsibilities and guarantees and any other contractual obligations.

Quality Assurance plan (QAP) / Inspection Test Plan (ITP) shall be submitted by bidder for approval by Third Party Inspection Agency (TPIA).

The Contractor shall make arrangement for inspection and testing by statutory authorities, if applicable, at various stages of the work.

11.1 Scope of Inspection by TPIA:

i) Review of Material test certificate (all batches).
ii) Visual check for surfaces, external appearance (10% random witness).
iii) Dimensional check (10% random witness).
iv) Positive Material Identification (PMI) for alloy steels/austenitic steels (10% random witness).

v) Hydrostatic test (10% random witness for pipes, fittings, valves, strainers, traps, collecting heads, draw off connection, hoses, hose reels, extinguishers, bellows, personnel protective equipments (if applicable for any item), fire fighting/protection equipments.
Hydrostatic test shall be10% random review for other items.

vi) Any testing/demonstration required as per relevant code/standard/specification:10% random review.

vii) Packing: Report review.

viii) Documentation (MTC, Inspection Release Note): 100% Review.

12.0 TESTING

All testing shall be done, as per relevant specifications and/or NIT specifications.

12.1 Non Destructive Testing

10% radiography of butt welds and 10% DP/ MP test of fillet welds shall be done for pipe classes in 150# & 300#.
100% radiography on butt weld joints and 100% DP/MP for fillet welds test shall be done for pipe classes in 600# & above.

Radiography procedure, areas of casting to be radiographed, and the acceptance criteria of valves shall be as per ASME B16.34.

The minimum requirement of radiography shall be as under :

Pipe Class	Size (NPS)	Qty
150	Up to 24”	5%
150	26” & above	100%
300	Up to 16”	10%
300	18” & above	100%
600 & above	All	100%

13.0 DOCUMENTATION

Drawings and documents (4 hard copies, 1 electronic copy & 1 as-built copy of each drawing/document), for firefighting/fire protection system, design basis, general arrangement/layout drawings of fire water/ spray system/ sprinkler system/fire extinguishers/fire fighting equipments, design adequacy calculations, material specifications, material take-offs (line wise/consolidated), supplier drawings/specifications, inspection test plans, test certificates, spares list, etc. Shall be submitted by the Contractor for review/approval/information of Owner/PMC/ Statutory authorities.

One complete set of NATIVE FILES Like .DWG (Autocad) and .DGN of all fire fighting deliverables (As Built) shall be submitted by the Contractor in Pen drive (2 No).

Bidder shall provide the following items complying specifications of tender & as mentioned below:

S.No.	Item	Specification	Quantity	Remarks
1	Cold/low temperature protective suit.	Design leak proof with material to withstand minus 45 degC for 30 minutes minimum, without crack/damage. Colour shall be cherry/brownish red/yellow suitable for use in ASU unit.	10 sets	
2	Fire Proximity Suit	UL listed	10 sets	
3	PVC suit		15 sets	
4	Leak Control Kit : Consisting of 1 no each of leak arresting pad, leakage control of external pipes, internal pipes, large external pipes up to 8 inch, drums / containers leakages, general purpose leakages, large hole leakages in storage tanks.		10 sets	
5	Oil Product Clean up Chemical : - Boom(5 inch dia , 3 mtr. Long) : 6 nos. - Boom(3 inch dia , 3 mtr. Long) : 6 nos. - Granular particles to absorb Oil : 20 Kg		10 sets	
6	Oil Spill Dispersant (Water Based) along with hand held spray nozzle. Dispersant : 40 litre Spray Gun with back pack		10 sets	

S.No.	Item	Specification	Quantity	Remarks
7	Non Sparking Tools One set consisting of : - Shoe handle brush -01 no - 9" Crate opener -01 no - 16oz Claw hammer with Fiberglass handle -01no. -Common knife $5^{3}/_{4}$" Blade : 1 no $10^{3}/_{4}$" OAL, -12" Groove joint plier, -7" Long nose pliers with cutters, -8" Combination Pliers, -Deck scraper, -1 1/2" Blade X 15"Long, -Spray booth scraper, -3" blade X 9 ¼" Long, -Std Screwdriver – 5/16" Tip, -6" Blade, - 3" Phillips Screwdriver, -12" Tin Snips, -8" Adjustable Wrench, -12" Adjustable wrench, -14" pipe Wrench (Aluminium), -12" Bung Wrench (Fits 3/4" X 2")		10 sets	
8	Self-contained Breathing Apparatus Set (30 minute duration) with a spare cylinder (filled-up) & accessories	IS: 10245 (Part-2).& CCOE approved	CCR: 4 sets, Substations: 2 sets (each), Field Operator Cabin: 1set (each).	
9	ONLINE AIR LINE	System for compressed air filtration that meets NIOSH regulations for breathing systems. Three stages of filtration: to dust, water, oil and hydrocarbons from compressed air. Optional Carbon Monoxide monitor is provided to monitor gas concentrations. Provides filtered air for Grade D breathing.	Central control room and offsite control rooms (two sets in each).	
10	Fire escape mask / filter type emergency respirators	IS: 8523	10 sets	
11	Flame Proof Search Light (Rechargeable safety hand held torch): Rechargeable type suitable for Explosive Environment.	PESO Certified	10 Nos.	

S.No.	Item	Specification	Quantity	Remarks
12	Mega Phone Explosion Proof Portable battery operated Public Address System with 1 loud speaker with a range of 1 KM in still air and 500 M in noisy areas		6 set	.
13	Hand Siren With Stand : Approx. range of 1.6 KMS	IS:6026	1 no	
14	Electrically Operated Siren (Range - 3.0 Kms)	IS:1941	1 no	
15	Fireman Axe	Forged Axe head, Insulated Handle, IS-926	10 Nos.	
16	Fibre Glass First Aid Box (with Medicines & other Items)		10 set	
17	Resuscitator : Manually operated for artificial respirators consisting of adult size nose, mouth, face plate, air bulb with oxygen inlet connection, non- return, non- breathing human valves and first aid charge packed in a plastic bag	UL listed	6 Nos.	
18	Water jel blanket	UL/FM listed	10 Nos.	
19	Folding Stretcher : Size 6 feet X 3 feet with tying belts & blanket.	Heavy duty Aluminium, vinyl coated nylon, BIS mark, Load 160kg min.	10 Nos.	
20	Safety Helmet	IS-2925(Latest amendment) & EN-397 Certified, water proof, high impact, heat & chemical resistant, HDPE, ratchet fit, size 51-62 cm. with Inner head band LD PE, ventilated sweatband absorber, coloured "company name" logo.	60 Nos.	
21	Safety Shoes	Leather upper with rubber /synthetic sole & steel cap, thermal resistant, skid resistant	60 pairs	
22	Safety Goggles	IS-5983, chemical & heat resistant	60 Nos.	
23	PVC Hand Gloves	IS: 6994	60 pairs	
24	Nitrile Hand Gloves	As per specification	60 pairs	
25	Electrical resistance, Insulating Rubber Hand Gloves	As per specification	15 pairs	
26	Explosimeter	UL/FM listed & PESO approved	6 Nos.	
27	Wind socks	As per specification	8 Nos.	

S.No.	Item	Specification	Quantity	Remarks
28	Sand buckets (9 Ltr. capacities) filled with sand along with scoops, rain protection and mounted on structural support stand (each with at least 3 sand buckets).	IS: 2546	6 set	
29	Red/Green flag each colours		30 Nos.each colours	
30	Safety signs and marking	IS 12349 and IS 9457		
31	Safety shower and eye/face wash station	Refer attached Data sheet of Eye Wash & Safety Shower (PC230/E/001-912)	30 Nos.	
32	Multi Gas detector with LEL, NH3, O2 & Co Sensor		8 Nos.	

Note:

1. Above mentioned quantities are minimum. Quantity shall be finalized as per HAZOP study and detail engineering.

PART - II: TECHNICAL

SECTION –2.8

TECHNICAL SPECIFICATION OF PERSONAL PROTECTIVE EQUIPMENT

PLANT : AIR SEPARATION UNIT ON BUILD-OWN-OPERATE (BOO) BASIS TO GENERATION OXYGEN AND NITROGEN FOR COAL GASIFICATION TO SYNTHETIC NATURAL GAS (SNG) COMPLEX.

PROJECT : COAL BASED SYNTHETIC NATURAL GAS(SNG) PROJECT AT BARDHAMAN, WEST BENGAL, INDIA

1.0 Safety Helmet

Safety helmets are made of fibre glass shall be supplied and shall confirm to IS:2925 (Latest amendment) & EN-397. These shall be moulded seamless in one piece from natural reinforced fibre glass/polyester resin, which can withstand heavy impact. The helmet shall be made of material highly impact, heat & chemical resistant, high dielectric strength and shall also have better quality abrasion resistance and higher softening temperature. The shell structure of the helmet shall be designed to provide extra strength and toughness. The helmet shall have sweat band and adjustable head band and shall bear IS approval. The colour of the helmets shall be decided at the time of placement of order.

2.0 Safety Goggles

A device worn over the eyes & held in place by a headband used for protecting the eyes & eye sockets from flying particles & injurious radiations, chemical & heat resistant and shall conform to IS-5983.

3.0 Stretcher with Blanket

Stretcher (size 6 feet X 3 feet with tying belts & blanket) shall be supplied and shall conform to IS:4037. Material of the stretcher and other related accessories should be as per the IS standard of practice.
Heavy duty aluminium poles for easy handling and heavy duty, vinyl-coated nylon covers that resist stains and will not absorb body or bodily fluids

4.0 Fiber glass First Aid Box with Medicines

Fiber glass First Aid Box portable type with locking arrangement and compartmentalised storage facility and containing the required first aids as below:

- First aid for cuts, burns, sprains (instant relief sprays) - 1 each.
- Antiseptic lotion, liquids (Dettol / Savlon tincture iodine) - 1 bottle
- Pain relieving medicines, anti vomiting medicines etc. - 2 stripes of 10 each.
- 500 mg Paracetamol I.P - 100 tablets.
- Anti snake serum bottle - 1 No.
- Band-Aids - 20 pcs.
- 25 gms of Soda Bi-Carb. I.P. - 1 pkt.
- Wound dressing small (for fingers) - 12 pcs.
- Wound dressing medium (for hands and feet) - 6 pcs.
- Wound dressing large (for body) - 6 pcs.
- Burn dressing large (for body) - 6 pcs.
- Absorbent cotton wool 13 gms each - 6 pcs.

- Dressing arrangements (scissors / blade etc.) - 1 set.
- Eye pad with bandage in separate pkt. - 08 pcs.
- Tourniquet cotton with belt & buckles. - 1 No.
- Polythene wash bottle 500 c.c. - 1 No.
- Book of instruction on first aid to injured - 1 No.
- Copy of First Aid Leaflet issued by DG FASLI – 1 No.

5.0 PVC Hand Gloves

Acid alkali proof PVC hand gloves made of superior quality PVC in yellow colour. The fingers and palm should be embossed/ ribbed for better grip. Palm size should be 9" and overall length 14". The gloves should be confirming to IS: 6994/1973(part-ii).

5.1 Nitrile Hand Gloves

BIS Marked fully Nitrile rubber hand gloves (In pair) shall have inside soft cotton flocked lining. It shall be able to resist Acid, alkali & solvent while providing solid protection against snags, abrasion, puncture & cuts. Nitrile Rubber hand glove should meet requirement of EN-388 & EN-374.The overall length of the Gloves shall not be less than 12 Inches (from middle finger to end of the sleeve).

5.2 Electrical resistance, Insulating Rubber Hand Gloves in pair (one for Right Hand, one for Left Hand.)- 1100 Volts

1. Four Fingers and One Thumb
2. MAKE: CATU / Honeywell / Oberon / SICAME
3. Maximum voltage of use A.C volts: 1000 Volts (rms)
4. Class - 0
5. Size: 9
6. Type: Gauntlet type
7. Max thickness (approx.): 1.6 mm
8. Construction: Seamless
9. Standard: IEC 60903
10. Category: RC
11. Tested by authorized Government Test houses / NABL accredited LAB and relevant test certificate / Batch certificate with hand gloves serial number to be furnished with the material.
12. Made from specially compounded latex or equivalent for complete insulation & totally shock proof.
13. Test certificate of the suplied item to be furnished along with the supply.
14. Packed in sealed plastic bag.
15. The gloves shall be marked indelibly at the back-
    A) Size, class & category of gloves

B) Month and year of manufacturing

16. Following tests will be conducted under inspection of TPIA :
    A) Leakage current Test
    B) Tensile strength and elongation at break
    C) Resistance to mechanical puncture
    D) AC Proof Test
    E) Flame retardancy Test

5.2.1 Electrical resistance RUBBER INSULATING HAND GLOVES in pair (one for Right Hand, one for Left Hand.)- 36 KV (rms)

1. Four Fingers and One Thumb
2. MAKE: CATU / Honeywell / Oberon / SICAME or equivalent
3. Class - 4
4. Max. Voltage of use A.C volts: 36 KV (rms)
5. Size: 10
6. Type: Gauntlet type
7. Max thickness (Approx.): 4.2 mm
8. Construction: Seamless
9. Confirming to IEC 60903
10. Category: RC
11. Tested by authorized Government Test LAB / NABL Accredited LAB and relevant test certificate / Batch certificate with hand gloves serial number to be furnished with the material.
12. Made from specially compounded latex or equivalent for complete insulation & totally shock proof.
13. Technical catalogue and test certificate of the offered item to be furnished along with the offer.
14. Packed in sealed plastic bag.
15. The gloves shall be marked indelibly at the back-
    A) Size, class & category of gloves
    B) Month and year of manufacturing
16. Following tests will be conducted at ERDA
    A) Leakage current Test
    B) Tensile strength and elongation at break
    C) Resistance to mechanical puncture
    D) AC Proof Test
    E) Flame retardancy Test

6.0 Portable Explosive Meter cum Oxygen Meter (Explosimeter)

S.N	Particulars	Specification
1.	Use	Able to measure LEL (In Inert atmosphere) and oxygen in zone 0 area.

2.	Type	The metering unit shall be microprocessor based. It shall be suitable for use in open as well as confined space for one hand operation and rugged with casing of protective rubberized over-mold.
3.	Sensor	Combustible (LEL) sensor- IR type Oxygen sensor: Electro-chemical type. Sensors shall be replaceable type.
4.	Ambient Condition	0°C to 50°C & humidity: up to 90% RH(non-condensing). (Locations e.g Leh/ Ladakh etc. with extreme weather conditions may decide ambient conditions as per site requirement)
5.	Housing	Minimum IP65 or Better. IP rating should also be t ested & certified by accredited agencies like FM/UL/CENELEC/BASSEFA/ATEX/CIMFR/IEC etc.
6.	Area Of Use	The detector shall be intrinsically safe for use in hazardous area classification conforming to Class I, Division I, Group A, B, C & D or Zone - 0, Group-IIA, IIB & IIC, having certified for use by accredited agencies like FM/UL/CENELEC/BASSEFA/ ATEX/CIMFR/IEC etc. and PESO approval at the time of supply of material.
7.	Range	Combustible Gases: 0-100% LEL O_2 : 0 – 25% by Vol. (Min.)
8.	Sampling Pump	Each instrument shall be fitted with motorized pump with audio and visual low flow alarm.
9.	Remote Sampling Accessories	Minimum 10 feet long sampling hose and s ampling probe equipped with quick connect device shall be s upplied along with instrument with suitable filter.
10.	Alarm	Minimum 85 Decibel audible alarm at 30 cm & bright red LED flashing visible alarm with vibration. Two levels of alarms for each gas sensed and low battery as minimum. Set points shall be adjustable over entire range.
11.	Battery	Rechargeable Battery (NiMH / Li-ion) shall be suitable for minimum 8 hrs. duration (with pump). Charger operable with 230V+ 5%, 50 Hz, AC supply shall be s upplied with each instrument.
12.	Size & Weight	Weight shall not exceed 1Kg. (Including Battery & Sampling pump).
13.	Calibration	Frequency Shall be as per OEM recommendation or once in six month whichever is earlier. Calibration shall be eas ily performed using instrument's pushbuttons no other special tools will be required. Instrument should show calibration due date. Minimum 4 N o calibrations within warranty period to be carried out by OEM or its authorized representative.

14.	Accessories	The instrument shall be s upplied with necessary calibration cup/adaptor and calibration tubing to facilitate calibration locally.
15.	Display	Self-illuminating back-light digital display.
16.	Fast Response	Maximum 30 Sec. to reach to 90% of measured value The above response time shall be with 10 feet long sampling hose.
17.	Hands Free Operation	The unit shall also have a suitable arrangement for hands free operation.
18.	Rf Protection	Shall be compliant with EMC directive against EMI/RF interferences.
19.	Accuracy	+/- 2% of measured value
20.	Maximum Resolution	Combustible gas: 1.0% LEL O_2 : 0.1 % by Vol
21.	Performance Guarantee	Minimum 2 years including sensors. The vendor shall guarantee the design, material, workmanship and the performance of the unit for a period of 24 months from the date of supply. Any defect, faulty workmanship or operational defects found during this period shall be rectified by the vendor without any extra cost of Owner/ PMC. Suitable instrument like BG etc shall be furnished by the vendor in line with tender conditions against performance guarantee.
22.	Documentation	Vendor shall be OEM or its authorized supplier having valid authorization from OEM. All other details shall be as per ANSI/ISA 12.03.01(Combustible gases) and ANSI/ISA 92.0.01 to 92.06.01 or equivalent IEC standards.

23.	Inspection, Testing And Performance Parameter	Owner/ PMC reserve its right to get material tested at a lab of repute or vendor to submit third party inspection certificate along with all accessories by Owner/ PMC approved third party inspection agency as per the requirement of Technical Specification. In the event of non-conformity with specifications, Owner/ PMC shall be at liberty to take action as deemed appropriate at its sole discretion. Prior to dispatch of the material from vendor's / manufacture's place the following inspection and tests shall be carried at the vendor place to complete satisfaction of Owner/ PMC representative or his authorized third-party agency without any extra cost to Owner/ PMC for: • Visual inspection of Explosi & Oxygen Meter (Explosimeter) to ensure no apparent damage or deficiency. • Examination of documents / certificates / test reports/ instructions/ Guidelines. • All consumable required for inspection and testing work shall be arranged by vendor at his own cost. • Vendor shall arrange all facilities to carry out inspection and testing. Details of field demonstration: Owner/ PMC at its discretion may ask the vendor for field demonstration/ Training for end users at a location specified by Owner/ PMC.
24.	Packing	Material should be packed in OEM packing.
25.	Damage Of Material	Any damage and / or manufacturing defects to the supplied material will not be accepted.

NOTE:

- The default measurement of LEL shall be for Methane. The detector is calibrated to Methane.
- During supply, vendor shall submit operational & maintenance manual, warranty certificate and TPI report along with each instrument.
- Vendor shall supply calibration certificate by OEM for all the sensors. The calibration certificate should contain identification numbers of the sensors & instruments supplied by the OEM.
- Vendor shall clearly indicate the point-wise acceptance/deviation against the above specification in the offer.
- Vendor shall arrange to rectify the defects within two weeks from reporting of the defect at site/owner's premises specified by the owner without any extra cost to owner during warranty period.
- Vendor shall submit the declaration on the cross-sensitivity of sensors with other gasses of concern.
- Owner/ PMC authorized Inspection Agency shall inspect the material before dispatch of the material for quality assurance, testing & performance evaluation as per technical specification.

7.0 Aluminised Fire Proximity Suit.

7.1 General

The suit shall be made up of aluminised glass fabric. It shall be stitched with fire retardant Kevlar yarn or equivalent threads. The material used for the suit, shall not chemically react with water and shall not show any tendency to absorb oil, grease, petrol etc.

The suit shall include hood, coat, pants, boots, mitts and pouch suitable for accommodating BA set. Shoes shall be of standard size with proper insulation and leather lining with non-skid type sole. Metal zip fasteners shall be provided for easy donning and removal of the suit.

No discomfort shall be experienced while climbing a ladder, in running while carrying a pressurised hose pipe or first aid box. The suit shall get dried easily. The complete set with maintenance manual shall be packed in a strong case / box.

7.2 Shelf life : Minimum 10 years.

7.3 Donning time : 1.5 minutes.

7.4 Protection Level : Outer shell fabric shall withstand a radiant temperature of 2000 deg.F approx.

7.5 Size : Regular size suitable for a fireman of height 5'6" to 6'2" approx.

7.6 Certification : The fabric of the fire proximity suit shall confirm to the any one of the following standards / specifications
European Standard (EN)
Listed by Underwriters
Laboratories UL 214.

8.0 Resuscitator

The Resuscitator should be as per WHO specifications or UL listed. The resuscitator shall be an intermittent positive pressure respirator type for artificial respiration with a human non-return, non- rebreathing valve. The resuscitator shall be of bag type, manually operated and shall be packed in a transparent bag along with a first aid chart displaying its operation. The resuscitator shall be suitable to be used by an adult person.

9.0 Electrically Operated Siren (Range - 3 Kms)

The general requirements, 3 phase electric motor, siren, heads, starter for on/off operations, without warbling relay, acoustic power shall comply with IS:1941 (Part I)/1976. The Siren shall be approx. range of 3 KMS. It shall be suitable anywhere in the country. Siren shall be horizontal complete with mounting. The electric motor shall be totally enclosed with greased sealed ball bearing and shall conform to IS:325.

10.0 Hand Operated Siren (Range - 1.6 Kms)

The shape, components, material, design and construction shall comply with IS:6026-1970. It shall have portable stand as per IS:6026. The Siren shall be approx. range of 1.6 KMS.

11.0 Low Temperature Gas Protective Suit Suitable for Handling LPG, Liquid Oxgyzen and Nitrogen, and Other Toxic Hazardous Gases.

1.	MATERIAL OF CONSTRUCTION	:	Polyamide fabric coated with viton / silicon
2.	SEAMS	:	Sewn with chemical resistance special thread to ensure leak proof design.
3.	SEALANT	:	Shall be used for the suit for achieving chemical resistance.
4.	GLOVES	:	Shall be made up of the same material used for the suit, and they shall be covered with neoprene as an extra protection. Gloves shall be fixed with the wrist.
5.	COLOUR	:	Cherry / Brownish Red / Yellow
6.	LOW TEMPERATURE WITHSTANDING CAPABILITY	:	The suit shall be able to withstand a low temperature of minus 45 deg. centigrade without any physical damages whatsoever
7.	APPROVAL	:	The Vendor shall enclose latest Test Certificates duly approved by DIFR / GIRDA, clearly indicating the followings: - That the gloves can withstand a temperature of minus 45 deg C for a period of 30 minutes. - No cracking, blistering was noticed on the suit after the low temperature test.

12.0 Water Jel Blanket

Water jel blanket (Hydro jel blanket) to be used in case of fire burns shall be supplied the minimum size should be 2.5mX1.5m. It should have necessary approval from any of these agencies (UL of USA, FM of USA, LPCB of UK, and VDS of Germany). Blanket shall be woven out of new wool, impregnated with sterile water based gel. Blanket shall be capable to protect the user from heat, smoke and to

provide to the burn victim. The water gel blanket shall bear approvals of IS/DGMS/DIFR or equivalent.

The wool carried is capable of absorbing upto 13 times its own weight. The Water Jel Blanket shall be packed in good quality poly-jar / canister. Water Jel Blanket shall be having 5 years usable life.

13.0 Fire escape mask / filter type emergency respirators

Emergency respirator is a self rescue hood, ideal for escape from room and buildings contaminated with toxic fumes and gases created by fire or accidental pollution. It should be as per IS: 8523.

14.0 Self Contained Breathing Apparatus (30 Minutes)

Self-contained breathing apparatus (SCBA) suitable for fire fighting, rescue operation in toxic and oxygen deficient atmospheres. The equipment consists of compressed air cylinder, full face wide vision mask (with inner mask), pressure reducer, pressure gauge, low pressure warning whistle, exhalation valve, speech diaphragm, comfortable shoulder harness and light weight back plate, straps, buckles and easy to wear.
The Cylinder shall be capable to operate for 30 minutes. The Cylinder and Valve shall have CCOE approval. BA Set shall be confirming to IS: 10245 (Part-2). One number of spare cylinder shall also be supplied.

In addition, online air line mask shall be provided in oxgyzen and nitrogen control rooms and offsite control room (two sets in each) having System for compressed air filtration that meets NIOSH regulations for breathing systems. Three stages of filtration: to dust, water, oil and hydrocarbons from compressed air. Optional Carbon Monoxide monitor is provided to monitor gas concentrations. Provides filtered air for Grade D breathing.

FILTER SYSTEM FOR ONLINE BREATHING APPARATUS :

1st stage:	Filter 5 micron particles and Automatic drain
2nd Stage:	Coalescing filter cloth and drain 0010 microns manual
3rd Stage:	Activated carbon filter of 0.003 microns and manual drain
Regulator:	High pressure adjustable knob range 0-160 PSI gauge and external valve pressure relief
Manometer:	Acrylic translucent, Teflon float, with adjustable valve. Graduations: 0.0 - 1.0 LPM

15.0 PVC suit

It shall be used in handling acid and alkali. Chemical protection clothing can be manufactured from a special grade heavy duty high visibility yellow PVC. The material shall have excellent chemical resistance, high tensile, tear & elongation strength,

abrasion, ozone as well as heat resistance. The clothing seam shall be welded by high frequency electrical heating.

16.0 Red and Green Flag

Red and green flag suitable for the fire drill operation shall be supplied. Handle should be made of aluminium. The flag should have minimum of 0.5m x0.30m dimensions.

17.0 Fireman Axe

Forged Axe head, Insulated Handle, IS-926.

18.0 Flame Proof Search Light (Rechargeable safety hand held torch)

S.N	Particulars	Specification
1.	Description	Rechargeable Hand-Held Torch
2.	Power	Rechargeable without removing batteries & Charging in Safe area.
3.	Battery Run Hours	Not less than 3 hours after complete one cycle charge. (To be certified by OEM)
4.	Lumens	Not less than 130 lmn. When measured at a distance of 1-2 Metres for major light (Lumens of the torch to be certified by OEM and NABL/ Govt. accredited Lab.)
5.	Clip/Strap	Strap/ clip
6.	Weight with battery & fittings.	Max. 400 Grms.
7.	Certification	Intrinsically safe for use in hazardous area classification conforming to Zone '0' of Gas Group IIC hazardous area Certified by PESO.
8.	IP	Ingress Protection- Min. IP65 or better (To be certified by OEM along with relevant test certificate)
9.	Housing/ Body	Housing body should be made of material of Anti-static, high impact properties
10.	Lens	Polycarbonate
11.	DROP Test	2 Meter to be certified by OEM and NABL accredited Lab./ Govt. approved Lab.
12.	Battery with Compatible Charger	Rechargeable, Li-ion / NiMH. Charger operable with 230V ± 5%, 50 Hz± 3% AC supply and compatible charger shall be supplied with each torch.
13.	Light Source	LED only
14.	Marking	As a minimum the product shall have following markings • Marking towards intrinsically safety of the product. • Name of the Manufacturer
15.	Warranty	Minimum one year including battery and battery charger. The vendor shall guarantee the design, material, workmanship and the performance of the unit for a period of 12 months from the date of acceptance at site..

S.N	Particulars	Specification
16.	Certification	• A copy of relevant approval including PESO and other documentation along with the offer. • During supply, vendor shall submit operational & maintenance manual, warranty certificate along with each instrument.
17.	Packing	Material should be packed in OEM packing
18.	Damage of Material	Any damage and / or manufacturing defects to the supplied material will not be accepted.

19. WINDSOCKS

LED Illuminated Windsock with heavy duty stainless steel SS-304 Stand.

Made of Stainless Steel SS-304, 360-degree rotating system to rotate the sock to wind

i) LED light of 20 watt of above suitable for outdoor installation, Cable of size 2C, 1 Sq./mm copper of 10 mtr with LED light.
ii) Wind Sock made of parachute polyester double lining 2-layer Combination of fluorescent colour red& white or Fluorescent Orange & Lime green with 25 mm wide reflective tape four rows for night reflection of windsock.
iii) The LED illuminated wind socks frame shall be made of heavy duty SS-304 rod and SS-304 strips with Extended Spokes cage two feet long as per design shown in the photos.
iv) The frame shall be fixed on rotatable pipe stand 32mm height 5 Feet long with pedestal flange.
v) Windsock Size: Dia 2 feet × 6 Feet Long made of parachute polyester double lining 2-layer fluorescent colour red & white Combination or Fluorescent Orange & Lime green Combination with 25 mm reflective tape four rows for night reflection.
vi) Windsock shall be fixed with the frame along with red coloured industrial type weather proof Led lights of 20 watt and above 1 Sq./mm cable fitted with light of 10mtr per with each set.
vii) The two bearing to be used must be maintenance free and weather proof

20.0 Sand Drum with Scoop

Metal sand scoops with handle of large size manufactured from best quality steel duly painted.

PART - II: TECHNICAL

SECTION –2.8

TECHNICAL SPECIFICATION OF CLEAN AGENT FIRE EXTINGUISHING SYSTEM

PLANT : AIR SEPARATION UNIT ON BUILD-OWN-OPERATE (BOO) BASIS TO GENERATION OXYGEN AND NITROGEN FOR COAL GASIFICATION TO SYNTHETIC NATURAL GAS (SNG) COMPLEX.

PROJECT : COAL BASED SYNTHETIC NATURAL GAS(SNG) PROJECT AT BARDHAMAN, WEST BENGAL, INDIA

Content

1.0 General

The intent of this specification is complete design, engineering, supply, installation interconnection with existing Fire Detection and Alarm system as per tender condition and Inspection, puff testing, Door integration test, discharge test, pre Commissioning testing to assess the actual performance of the complete Clean Agent Fire extinguishing system (hereunder called CAFES) shall include but not limited to the following activities:

i. Design, Engineering, manufacture, fabrication, assembly, shop testing and shop painting, sequential packing, delivery FOR site, comprehensive insurance, unloading, unpacking, storage at site, site handling, preparation of erection drawings, fabrication and erection as per approved drawings, site testing, painting, commissioning and performance guarantee of Clean Agent Total Flooding System in integration with complete fire detection and alarm system as per NFPA 2001 (Latest Edition).

ii. The fire detection system and alarm system, if already existing and in working condition, it should be checked and confirmed by the party for compatibility with the proposed CAFES. If found computable, the proposed CAFES to be integrated with the same.

iii. The complete system along with all major components, Design Software including Filling stations should be UL approved. Cylinders and Valves should be UL & PESO approved.

iv. The Cylinder should be filled only at PESO & UL Listed filling station. The OEM to provide the system approval for the approved filling station location in India.

v. Supply of all items (including those required to complete the system for successful commissioning) covered under this specification, shall be under the scope of vendor, unless otherwise specifically excluded from the scope of supply. Vendor has to furnish along with their offer, the Bill of Material indicating all items required to complete the system. Responsibility of the Vendor includes supply, execution and installation of any items/material not indicated in the Bill of material / Schedule of rates, but required to complete the system in all respects without any extra price implication to Client. Supply of mandatory spares and initial fill and consumables.

vi. Vendor, prior to submitting his offer, should take a site visit to study the location of installation, the existing fire detection and alarm system of the proposed area to which the Fire extinguishing System shall be hooked up for automatic actuation.

vii. It shall be noted that clean agent system to be provided shall meet the requirements of NFPA-2001 (Latest). Hence anything specified as ‘Mandatory” in NFPA-2001, although not specifically mentioned in this specification, shall form part of this specification.

2.0 System and site specific requirement

The Clean Agent total gas flooding system shall be an engineered system consisting of a fixed nozzle and gas distributing network. The system shall be designed and installed in accordance with the NFPA 2001 (Latest Edition).

i. Selection of the clean agent & design of fire protection system shall follow the standard on "Clean Agent extinguishing System NFPA Standards 2001 (latest edition- amendment) including its safety guideline with respect to "Hazards to the personnel, Electrical clearances & environmental factors in line with the environment consideration as per Ozone Depleting Substances (Regulation & Control) Rule-2000; MoEF; GOI along with amendments published vide latest MoEF Gazette notifications on the subject.

ii. The offered clean agent shall comply with the requirement of the Ozone Depleting Substances (Regulation & Control) Rule-2000; MoEF; GOI alongwith amendments published vide latest MoEF Gazette notifications on the subject.

iii. If the cylinder battery bank to be provided outside the area to be protected, a suitable cylinder bank storage area to be constructed by the Vendor. The location and type of construction of storage area shall be mutually decided during site visit.

iv. The cylinders shall be refilled at PESO approved refilling sites only.

v. All major components excluding Piping, Fittings, Bracket Supports, Cylinder Rack & Hangers should be UL Listed/FM approved. Cylinder Manifold should be UL Listed/FM approved.

vi. The concentration level shall not exceed the NOAEL and LOAEL level as per NFPA guidelines. Pneumatic Horns along with time delay device should be provided in the areas where concentration exceeds the NOAEL Limit.

vii. All work related to mechanical, electrical, Instruments and civil including chipping of existing RCC/brick walls/cutting of steel plates etc. or removal & re-fixing of false ceiling and floor of risk areas, fixing fasteners and other activities required for the execution and commissioning of clean agent system at site.

3.0 Scope

i. This Specification covers the design, engineering, procurement, material supply including all hardware & software, fabrication, installation, inter-connection with Existing / New (as the case may be) fire detection & alarm system, power supply & back-up arrangement, execution, performance testing, commissioning, operation & maintenance training and performance guarantee of Clean Agent Fire Extinguishing System [CAFES] for volume to be protected complying the minimum requirements of "Standard on Clean Agent Fire Extinguishing System", NFPA 2001, 2015, latest Edition" and the Ozone Depletion Substance Regulation & Control Rule-2000; MoEF; GOI along with amendments published vide latest MoEF Gazette notifications on the subject.

ii. System design, comprising of specifications, working plans, flow calculations, design concentration requirement, total flooding quantity, system, design factors, duration of protection, rate of application, discharge time, nozzle selection &

location, etc. shall comply the relevant criteria mentioned in NFPA-2001(latest edition). All the relevant calculations shall be done by FM/UL/LPCB/Vds approved software and submit the copy of certificate.

iii. The system components shall be listed / approved by FM/ UL/Vds/LPCB and cylinders shall be seamless & shall be **PESO** approved.

iv. The system shall be d esigned based on the largest volume to be protected. However, the grouping of cylinders shall be made in such a way that discharge of cylinders takes place corresponding to the volume of the risk under fire.

v. The system shall also comprise of the different modes of operation and electrical manual actuation etc. with necessary control panel as per specification. Operating devices and local control panel shall be provided as per specification.

vi. The vendor shall have to offer 100% clean agent filled standby cylinders. The vendor shall very clearly mention in their offer that they have considered total flooding centralized system and have also offered 100% standby connected cylinders.

4.0 Codes and standards

The latest editions of the following codes, specification and regulations have to be used for the detailed design and specification of clean agent system.

i. NFPA: 2001 (Edition 2015- latest amendments) (Standard for clean agent fire extinguishing system).

ii. IS 15493-2004 latest edition.

iii. SMPV Rules, PESO Nagpur (For storage cylinders)

iv. OISD-STD-116 / 117/ 163 -Latest Edition

v. Ozone Depletion Substance Regulation & Control Rule-2000; Ministry of Environment & Forests of, Govt. of India alongwith amendments published vide latest MoEF Gazette notifications on the subject.

5.0 System Description

The Clean Agent total gas flooding system shall be an engineered system consisting of a fixed nozzle and gas distributing network. The system shall be designed and installed in accordance with the NFPA 2001 (Latest Edition).

The system shall consist of following major components but not limited:

i. Bank of Clean agent cylinders with Gas each fixed with cylinder head valve and non-return valve.

ii. Bank of standby cylinders with Gas fitted with - cylinder head valves and non-return valves.

iii. Gas manifold and high-pressure hoses.

iv. Cylinder rack.

v. Constant Flow Valve

vi. Pressure reducing devices.

vii. Pressure switches.

viii. Pilot cylinders if required.
ix. Electric Actuator
x. Manual push buttons
xi. Inhibitors
xii. Directional valves & Directional Valve Control system
xiii. Flexible Hoses
xiv. Discharge Nozzles
xv. Safety relief valves
xvi. Pipe and Fittings
xvii. Bracket Supports and Hangers
xviii. Caution hooters Caution boards & evacuation alarm
xix. Fire detection and al arm system including Gas release panel/ local control panels and interface unit/ monitor control module etc.
xx. Cylinder bank room (brick construction with RCC roof)

The clean agent gas shall be stored in a metallic seamless cylinder in a pressurized condition at 200 Bar/300 Bar.
The quantity of gas required for the system shall be based on the gas required to blanket the volume of area protected including leakages as per latest NFPA 2001 standard.
The system shall be designed based on the largest volume to be protected. However, the grouping of cylinders shall be made in such a way that discharge of cylinders takes place corresponding to the volume of the risk under fire.

Pipe network shall be designed to achieve the design concentration of gas required for extinguishing the fire in the premises.

The contractor shall include provision for automatic actuation of the system in integration of FDA system in the premises concerned. Annunciation signals related to system operation shall be provided in MFAP as well as locally on panel. Provision for time delays and an evacuation alarm shall also be provided. Contractor shall note that release of gas shall be possible directly from FDA panel as well as local GRP/ local Panel to operate the system from FDA panel and obtain signal/ control. The contractor shall also include all interface units viz: control and monitor module.

Contractor to include power supplies and control interlocking. All wiring - junction boxes, push button station, indication lamps, hooters etc. shall be included in the scope of Contractor. All areas shall have illuminated board "FIRE - EVACUATE INERT GAS SHALL BE FLOODED". Each area shall have hooter adjacent to illuminated sign.

The manual pushbutton of each area shall be located near entry/ exit.

Contractor to develop logic for above and submit working scheme along with the tender. Any interface devices required to hook up this system with the Main Fire Alarm Panel shall be included by the Contractor as part of the scope as a whole.

One no. wall mounted annunciation panel/ gas release panel near cylinder bank shall

be provided for (duplicate) annunciation as well as operation of gas release system

The room volume, volume above false ceiling and the volume below false floor of each premises/room shall be considered for Fighting and detection and for calculation of Gas quantity and other components of the system

Each zone shall be equipped with fire detection system. On receiving the fire signal from the detection system agent gas shall be released automatically after a set time delay and gas shall be discharged into the enclosed space.

The system shall comprise of the following mode of operation and a ctuation and cancellation facility etc. with necessary control panel.

System operation shall be possible by the following means:

a. Automatically due to fire detection in the protected area from main fire alarm panel.
b. Operation of manual release push button located adjacent to protected area.
c. By operating manual lever provided on electrical / manual control head on cylinder.
d. By push button actuation at Clean Agent control panel in manual mode.

The clean agent gas shall be discharged / actuated automatically after an adjustable time delay based on the detection signal received. Pre-discharge alarm (audio + visual) shall be initiated before discharge of gas in main fire alarm panel & local control panel. Hooter shall follow the alarm once the gas is discharged.

The release of gas shall be preceded by an audio-visual alarm in the affected area for alerting and evacuating the personal and for this purpose, during time delay of about 60 seconds (which is settable from the panel) between the initiation of release and actual release of gas. The exact time delay to be incorporated in the system shall be decided during detailed engineering

To avoid an inadvertent mal operation and release of gas, on either of the mode of gas release operation (auto or manual), provision of manual interruption (i.e.) gas discharge inhibition facility through a suitable device on local control panel, main fire alarm panel as well as each protected premises shall be provided so that the agent release can be stopped within the time delay.

Multi sensor type detectors (addressable type) shall be provided below false ceiling, above false ceiling and false floor. Cross zoning of detectors shall be incorporated in such a way that the fire is detected by at least one detector of each type to activate automatic inert gas release system. However, audio visual alarm shall be annunciated even if any one of the type of detector has detected the fire. Refer electrical chapter of this technical specification for details of detection system

Necessary provision shall be m ade in the fire alarm panel for switching off the air-conditioning and ventilation system automatically as soon as the fire is detected.

The Filling station should be PESO approved and UL listed. The manufacturer of the clean agent system should be approved by UL for filling at proposed filling station

/facility. The Certificate of the same should be provided by Manufacturer of system during Bidding .

6.0 Design Criteria

i. Complete design, software used, and all the system components/equipment shall be approved and listed by UL / FM

ii. Design, manufacture and installation of inert gas fire extinguishing system shall be strictly as per NFPA 2001 (latest edition)

iii. 200 bar/300 bar clean agent extinguishing system shall be designed and installed for below false floor, main room and above false ceiling of various risk areas.

iv. The Physical properties and its discharge characteristic of clean agent shall meet the requirements of NFPA-2001 (Latest edition).

v. The concentration level shall not exceed the NOAEL and LOAEL level as per NFPA guidelines.

vi. The design calculation shall be supported by UL listed software.

vii. The system shall be designed for total flooding based on the single largest risk area of the control room to be protected. However, grouping of cylinders shall be made in such a way that discharge takes place corresponding to the volume of the risk under fire. However, Contractor shall check the suitability of common cylinder bank to cover all the rooms/areas as per norms.

viii. The system shall have 100 % Clean Agent gas filled standby cylinders along with manifold and automatic change over for each risk area from the fire alarm panel itself.

ix. The complete volume of the single largest room including the above false ceiling and below false floor shall be considered for estimation of quantity of gas and containers.

x. When determining the gas quantity, the leakage losses from the enclosure shall be considered by the Manufacturer by performing FAN DOOR test /Room Integrity test by approved agency. The exact amount of gas to compensate for leakage compensation shall be designed by the Contractor taking into consideration the type and features of enclosure, un-closable openings if any and other considerations so that design concentration is achieved after discharge.

xi. The discharge time period shall be such that the design concentration can be achieved within 60 -120 seconds. The flow calculations shall establish this criterion.

xii. The quality of gas shall conform to relevant design standard such as NFPA - 2001 or as specified by listing authorities:

xiii. 200/300 Bar Clean agent gas Cylinder Assembly with Gas and cylinder valve (Main + 100%standby) to be provided.

xiv. Manufacturer /Contractor must ascertain that Pressure in Manifold should not exceed more than 60 Bar using Contract Flow Valve. CF Valve should be mounted with every cylinder to assure pressure in manifold less than 60 Bar. CF

valve should be UL Listed/FM approved.

This system shall function in automatic mode by actuation from Fire detection & alarm system in the respective premises. There shall be provision for manual operation also with a selector toggle. When detectors detect fire, the signal shall be communicated to the main control panel, which shows the address (along with location) of the actuated detector. On confirmation of fire by next detector falling in different software zone in the same premises, the respective Air-conditioning & Ventilation system will first trip and evacuation alarm signal will appear in the premises provided with this system followed by actual discharge of the gas (after time lag).

100% reserved cylinders filled with gas and a ccessories shall be pr ovided for all systems. There shall be pr ovision for switch over from main to reserve cylinders automatically from the panel as well as through toggle button.

The complete system along with all major components including Cylinder Manifolds, Design Software including Filling stations should be UL approved. Cylinders and Valves should be UL & PESO approved.

The Filling station should be PESO approved and UL listed. The manufacturer of the clean agent system should be appr oved by UL for filling at proposed filling station /facility. The Certificate of the same should be provided by Manufacturer of system during Bidding .

6.1 Major Design Parameter of Clean Agent suppression system

The Applicable Design code: NFPA 2001, Latest

Version Type of system: Automatically operated,

Fixed piped system Design Pressure: 200 /300 bars.

Cylinder size: 80 ltrs /140 Ltrs. water capacity,

Gas/cylinder Design Concentration: 38.5%

Flooding Factor: 0.47 m3/m3

Discharge time: 95% of design to achieve within 60-120secs.

Cylinder storage temperature: 0° C to 54°C

Flooding Gas Nozzle Type: 360° / 180°

7.0 System Requirements

1) Clean Agent Gas

The quantity of clean agent gas provided shall be sufficient to protect the single largest risk area with 100 % standby. Every individual risk shall have its own distributing pipe, nozzles, alarm and actuation system etc.

Both the main and standby cylinders shall be permanently connected to the distribution piping through manifold and aut o change over. The clean agent discharge shall be substantially completed in a normal 60-120 seconds.

2) Flow Calculation

System flow calculations shall be performed using software listed or approved by UL/FM/LPCB/VDS. The system designed shall be within the manufacturers listed limitations. The contractor shall provide sufficient measure facilities in the risk areas to overcome the situation of over pressurization due to release of clean agent and provide calculation in support of same for each protected area.

The Contractor shall submit the approval certificate/ listing document from UL/FM for the software used for flow calculation.

3) Clean Agent Quantity

Minimum design concentration of Clean Agent gas shall be as per NFPA-2001 (Latest Edition)norms and specified by the approving authority. Quantity of Clean Agent Gas shall be calculated for the total volume of the largest room to be protected.

4) Clean Agent Storage Cylinders

i. All the storage containers shall be kept in an enclosed room.
ii. Cylinders shall also have approval from CCE, Nagpur and UL listed/FM approved.
iii. The cylinders shall be charged to a fill density or super pressurization within the range specified in the manufacturers listed manual.
iv. The contractor shall select the capacity of cylinder based on the total quantity of gas required, storage space available and for better replacement and interchangeability.

The cylinder shall be s eamless, brand new never retested with month & year of manufacture shall be marked on the cylinders.

v. Each cylinder shall have a permanent name plate, specifying the agent, tare and gross weight in addition to the pressurization level, nominal agent volume.
vi. The cylinder shall bear the mark of manufacturer, serial number, single test certificate issued by manufacturer and shall be duly approved by UL/FM.
vii. Cylinder shall conform to the requirement of NFPA 2001 (Latest Edition) and shall be compatible with the engineered system.
viii. Each cylinder shall have a pressure relief valve to protect the cylinders against excess pressure conditions. Pressure gauges and pr essure switches with isolation valves on manifold shall be provided.
ix. Automatic means such as check valve shall be provided to prevent agent loss if the system is operated when any of the cylinders is removed for maintenance.

x. The cylinder storage racks shall be provided for main as well as for reserve cylinders.

xi. The manifold and cylinders shall be securely mounted on the floor and suitably supported in a rack with provision for convenient taking out individual cylinder for servicing, according to the manufacturer's installation manual. Such a service shall be possible without shutting down the system.

xii. The Contractor shall indicate the space provision for room required for the storage of Gas Cylinders and Manifold Piping along with technical offer.

xiii. The gas cylinders shall be provided with Base Plate, foundation bolts & nuts etc. so that, the entire load is evenly spread out over the entire plan area. No concentrated load shall result from the mounting arrangement of the cylinder/containers.

xiv. All the pressure, gauges/switches, manifold connections etc shall be easily removable for servicing / maintenance without any loss of gas.

Discharge Nozzles

Discharge nozzles shall be UL/FM approved /listed. The material of construction shall be of Brass. The selection of nozzle orifice shall be such that 95% of the minimum design concentration of gas is discharged within 60-120seconds, through the nozzles of the system.

Each nozzle shall be permanently marked to identify the manufacturer as well as type and size of the orifice along with tag / part number, orifice code, or other suitable marking as specified in relevant norms / codes.

Piping, Fittings

Pipes shall be of ASTM A-53 or A-106 type (Seamless Carbon Steel High Pressure Sch. 80 pipe) and pipe fittings shall be provided as per the requirements specified in NFPA-2001 (Latest Edition). Pipe thickness calculation shall be as per ASME B31.1 and fittings conforming to ANSI B1.20.1. All CS Studs, Bolts and Nuts shall be Hot Dip Galvanized as per ANSI A153 for corrosion resistance. The Pressure Reduction device shall be easily identifiable. All Valves shall be approved for intended use. The Gaskets, O-Rings and other Valve material shall be compatible to the Clean Agent.

The Clean Agent piping and nozzles shall be planned avoiding fouling with the following facilities, in the areas where Fighting is being envisaged:

- AC ducts.
- Cabling in false flooring.
- Light fittings, detectors etc.
- Other miscellaneous equipment/ fittings

Operating Devices

i. Operating devices shall include Clean Agent releasing devices or valves, discharge controls and shut down equipment necessary for successful performance of the system.

ii. The automatic Clean Agent system shall be of robust design and shall not be readily rendered inoperative. The Clean Agent system shall be designed to function properly for the temperature range specified in NFPA-2001.

iii. The Clean Agent cylinders shall be mounted on front and firmly supported in brackets in a manner that they shall not be easily subjected to mechanical, chemical or other damage, which would render the system inoperative.

iv. In addition to Automatic actuation, there shall be a normal manual control for actuation, which shall be located so as to be conveniently and easily accessible at all times. This control shall cause the complete system to operate in its normal fashion.

v. Manual controls shall not require a pull of more than 40 lb nor a movement of more than 14 inches to secure operation. Each remote manual control for activation shall be located not more than 4 feet above the floor.

Local Control Panel

i. Local control panel shall be free standing, floor mounted type and shall be suitable for both auto and manual operation. The panel shall be naturally ventilated, totally enclosed, dust and vermin proof, with IP-55 enclosure as a minimum. The Clean Agent system shall be actuated automatically from the fire alarm and detection panel. Fire alarm and detection panel, after detecting the fire in the protected area / zone, shall energies the solenoid valve/ electrically operated valve of cylinder to trigger the gas release operation in the respective protected area / zone. In addition to direct actuation of the cylinder valve from main fire alarm panel, those cylinders shall also get actuated through local control panel/ gas release panel. Necessary control / interlock cabling between Fire Alarm and Detection Panel and Clean Agent system panel, using multi-core 2.5mm2, Cu conductor PVC insulated flame-retardant cable, shall be provided by the Clean Agent Vendor. The main fire alarm and detection panel shall be located in pump house Control Room. The location of local control panel shall be decided during the detailed engineering.

ii. The local control panel shall be equipped with adequate capacity of battery charger and Ni-Cd. Battery with 48 hour back up, for efficient operation of the system during mains power failure.

iii. Local control panel shall be provided with all alarms, indicators, caution/sign board and relays/ control switches meeting all the requirements of NFPA-2001 and shall include but not be limited to the following:
   a. Two alarms and one fault indicator lamp for each zone to be protected.
   b. Combination of alarm silence and alarm off switch.
   c. Combination of fault silence and trouble lamp switches.

d. Alarm test switch
e. Alarm re-set switch.
f. The system shall have a positive warning device by sounding alarm to alert personnel of the gas discharge and also a positive indication to show that the system has actuated.
g. Alarm indicating failure of supervised devices of equipment shall give prompt and positive indication of any failure and shall be distinctive from alarm indicating operation of hazardous conditions.
h. All indication lamps shall be LED type with minimum size of 10 mm.

iv. Warning and instruction signs at entrance to and inside Fighting areas shall be provided.
v. Potential free contacts shall be provided to shut off the fire dampers / louvers and Air Conditioning System.
vi. Operating instructions shall be displayed on a name plate fitted permanently on the Clean Agent skid.
vii. Clean Agent extinguishing system shall incorporate a pre-discharge alarm with a time delay, sufficient to allow personnel evacuation prior to discharge. The delay shall be minimum 30 seconds. However, it shall be adjustable from 30 to 120 seconds.
viii. Operating devices shall be by mechanical, electrical and pneumatic means conforming to NFPA2001. The power supply to electrical actuators shall be backed up with reliable battery supply. Such batteries shall be charged automatically by battery chargers. Power supply is taken from the Fire detection alarm system panels of the respective units. Required annunciations such as "Gas released", "Failure of automatic actuation", "Gas release aborted" etc shall be exhibited in the fire alarm panel.
ix. Where pilot cylinders are employed for actuation of the cylinder banks, the number of pilot cylinders shall be as per the listed design manual.
x. All manual operating devices shall be identified to the hazard they protect.
xi. Manual abort switches for each of the area / zone shall be as per NFPA2001 or as specified by listing authorities.
xii. The gas releasing devices at cylinder outlets shall be of reusable type after discharge at any instant.
xiii. Supervision of automatic actuation devices, power supply, manual actuation circuits, and complete wiring shall be provided through control system I panel and the healthiness shall be reported or indicated in the panel automatically.

8.0 Inspection and Testing

The complete system shall be tested to meet the requirement of NFPA 2001 norms. All equipment
/ Devices shall be approved and listed by UL/FM/Vds/LPCB except pipes, fittings & structural support.

Tests not limited to the following shall be performed:

i. A thorough visual inspection of the installed system and hazard area. The piping, operational equipment and discharge nozzles shall be inspected for proper size and location. The locations of alarms and manual emergency releases shall be confirmed. The hazard area shall be inspected closely for un-closable openings and sources of agent loss.

ii. The Contractor shall furnish the composition certificate of Clean Agent from the manufacturer satisfying the requirements of the NFPA-2001.

iii. Gas filling certificate shall be submitted from the manufacturer/ gas filling agency

iv. A check of labelling of devices for proper designations and instructions. Name plate data on the storage cylinders shall be as per specifications.

v. A test for mechanical tightness of the piping shall be conducted as per NFPA-2001.

vi. Storage containers shall meet the statutory requirement of approval / acceptance by CCE, Nagpur.

vii. Design calculation shall be provided by the designer to prove that the area is not over pressurized and extinguishing capability is not affected due to existing ventilation of that area.

viii. Complete system shall be installed, inspected, tested and commissioned as per recommendations of NFPA 2001. Contractor shall also consider Gas for one smallest room for system testing.

ix. Prior to handing over of the system, the Manufacturer shall provide operational training to Employer's operating personnel which shall consist of control system operation, trouble procedures, emergency procedures, safety requirements etc.

x. The performance test of the system shall be carried out by releasing the agent gas in a selected area and all the design parameters shall be measured. All equipment, refilling of gas after test, instruments etc shall be provided by the Contractor for the same.

9.0 Safety

i. All the safety requirements recommended in NFPA2001 or as specified by listing authorities shall be incorporated in the installation by the Contractor.

ii. Appropriate warning signs shall be fixed outside of those areas protected by the system and also in areas where the gas may spread indicating clearly the hazard associated with the system such as Noise, turbulence, cold temperature, physiological effects on personnel etc.

iii. Apart from written warning signs, audio visual type warning signs (i.e.) hooters &strobe lights shall be provided; for pre-discharge and post-discharge activity. The sounder shall have selectable tone options.

iv. The gas shall be discharged after a set time delay on receiving signal from the fire detection system. The duration of the timer shall be set at site after conducting test to find out the duration for evacuation of the personnel from the area.

v. To prevent the loss/release of gas automatically or manually during maintenance, the system shall have the facility of "LOCKOUT". The status of the

system lockout condition shall be annunciated audio visually in the panel.

10.0 Spares required for commissioning and Mandatory Spares

Spares required for commissioning - Any spares/components required for successful commissioning of the supplied system shall be in the scope of the vendor at no extra cost to client. Vendor to provide a list indicating quantities. Any item remaining from this category after successful commissioning shall be the property of client. However, any spares/components required for successful commissioning over and above those supplied under this category, shall be in the scope of the vendor at no extra cost to client.

Mandatory Spares: Mandatory spares/components and also the spares required during warranty period for the supplied system shall be in the scope of the vendor at no extra cost to Client. Vendor to provide a list indicating quantities of the Mandatory spares/components and spares required during warranty period.

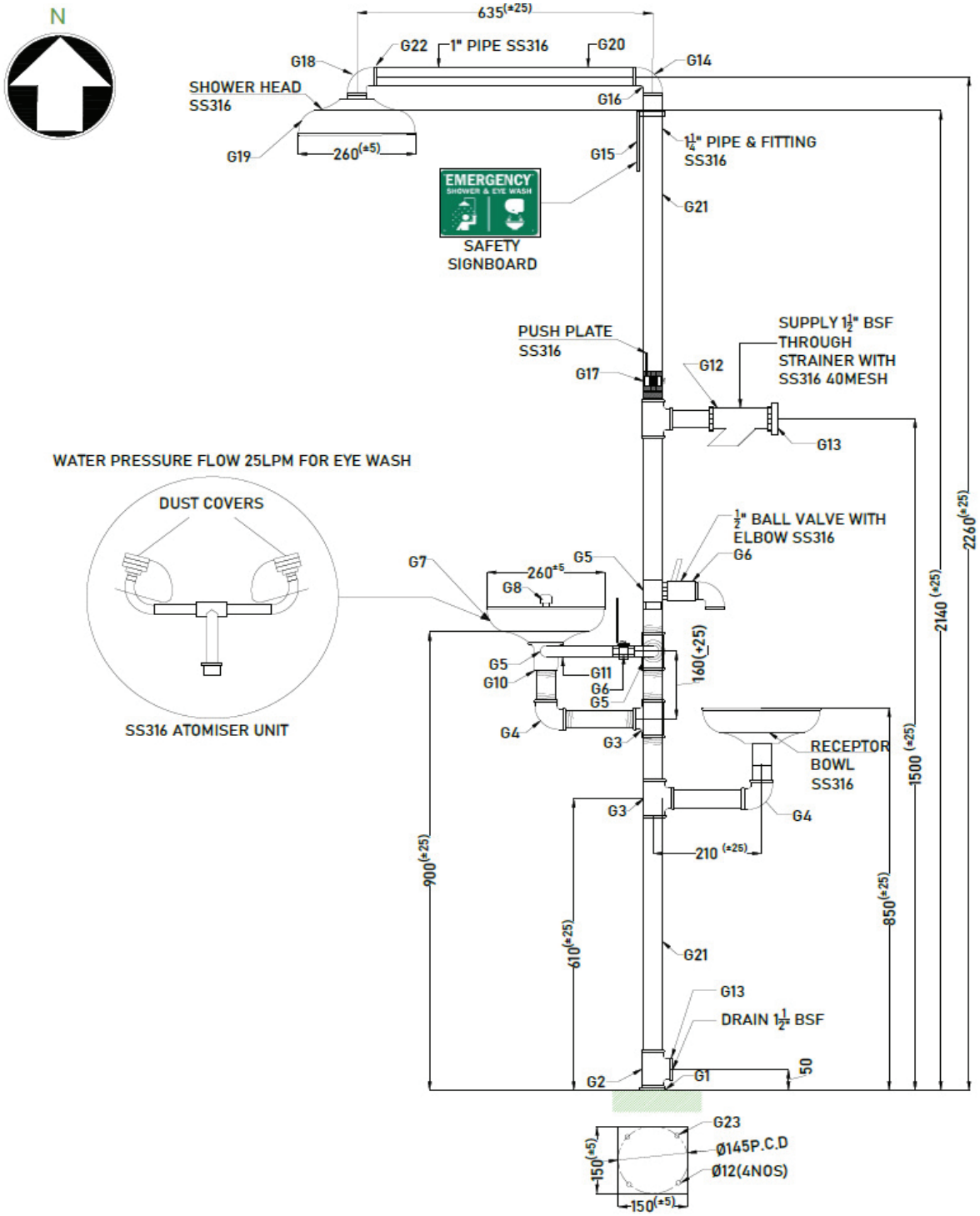
DATA SHEET
OF
EYE WASH & SAFETY SHOWER

DOCUMENT TITLE: DATA SHEET OF EYE WASH & SAFETY SHOWER

Model No.:

SR.	SPECIFICATIONS	REQUIREMENTS	
1.0	**DESIGN CONDITIONS**		
1.1	Design Pressure	10 Kg/cm^2(g)	
1.2	Design Temperature	2^o C (MIN) & 65^o C (MAX)	
2.0	**OPERATING CONDITIONS**		
2.1	Operating Pressure	2 to 3 Kg/cm^2(g) (Recommended)	
2.2	Operating Temperature	20^o C to 37^o C (Recommended)	
2.3	Water	Potable Water	
3.0	**TESTING CONDITIONS**		
3.1	Testing Standard	IS 10592 (Latest Edition)	
3.2	Hydrostatic Test Pressure	15 Kg/cm^2(g)	
3.3	Water flow rate for Safety Shower	110 lpm (Minimum) NOTE: VENDOR TO CONFIRM ON SHOWER SPRAY ANGLE	
3.4	Water flow rate for Safety Eye wash	25 lpm (Minimum)	
4.0	**MATERIAL OF CONSTRUCTION**	**Material**	**Standard / Specification**
4.1	Pipes	Stainless Steel	SS 316
4.2	Fittings	Stainless Steel	SS 316
4.3	Ball Valves	Stainless Steel	SS 316/CF8M
4.4	Pull Rod, Coupling, Levers, Foot Pedal, Chain, Bottom plate, Spring, Foundation bolts and Nuts	Stainless Steel	SS316
4.5	Shower Head	Stainless Steel	SS316
4.6	Receptor Bowl	Stainless Steel	SS316
4.7	Atomizer Unit (twin Fountain Unit)	Stainless Steel	SS316
4.8	Painting / Inspection & Testing Plan	To be as per AIIL Painting Specification / MQAP	
5.0	**AESTHETICS**	All materials are with Stickers marked for indications.	
6.0	**CONNECTION AND OPERATING DETAILS**		
6.1	Supply Connection	1-1/4" BSPF	
6.2	Drain Connection	1-1/4" BSPF	
6.3	Safety Eye Wash Activation	Foot Pedal	
6.4	Safety Shower Activation	Pull Rod / Push Plate	
6.5	Area Footprint:		
6.5.1	Construction Footprint	VENDOR TO CONFIRM	
6.5.2	Operational Footprint	VENDOR TO CONFIRM	
7.0	**WEIGHT & DIMENSION**		
7.1	Dimension & Shipping Weight	VENDOR TO CONFIRM	
7.6	Documents	Instruction Manual with Assembly Instruction, Installation, commissioning, Testing, Maintenance and Training Manual	

DOCUMENT TITLE: DATA SHEET OF EYE WASH & SAFETY SHOWER



SPARE PARTS

A. SPARES PARTS FOR COMMISSIONING:

Contractor shall supply free of cost spare parts and consumables required during Pre-commissioning & Commissioning of the plants until the plant is handed over to the Owner after Performance Test.

B. MANDATORY SPARE PARTS FOR TWO YEARS OPERATION OF FIRE FIGHTING SYSTEM

Contractor shall supply mandatory spares for Fire Fighting Package as listed below; below list of parts is minimum requirement for the fire fighting package system. Vendor may offer and supply number of sets based on his past experience for smooth 02 Years operation of Fire Fighting system.

C. VENDOR'S RECOMMENDED SPARE PARTS

Contractor shall submit list of recommended spare parts of specialised items not covered mandatory spares, along with itemised price. Owner will review and decide the recommended spares required for the project. However, these spares shall not be considered in Price evaluation.

1.0 FIRE FIGHTING :

Sl. No.	Part Description	Size Range (NB)	Quantity Required (% or part or fraction of as built quantity)	Remark
1	Pipes for each size, rating/thk. & material	≤1.5"	5%	min. qty. 6 mtr.
2	Pipes for each size, rating/thk. & material	≥ 2"	2%	min. qty. 6 mtr.
3	Fittings for each size, rating/thk. & material	≤1.5"	5%	min. qty. 1 No.
4	Fittings for each size, rating/thk. & material	≥ 2"	2%	min. qty. 1 No.
5	Flanges for each size, rating/thk. & material	up to 6"	5%	min. qty. 1 No.
6	Flanges for each size, rating/thk. & material	8" to 24"	2%	min. qty. 1 No.
7	Valves for each size, rating/thk. & material	up to 14"	5%	min. qty. 1 No.
8	Hose box, RRL hose (63mm) with couplings, jet nozzle with branch pipe, hydrant valve, landing valve		5%	min. qty. 1 No.
9	Hose reel with valve, nozzle, drum & mountings		5%	min. qty. 1 No.
10	Monitor (Per type & capacity)		1 no. each	
11	Portable fire extinguisher per type & capacity (upto 10 kg)		1%	min. qty. 1 No.
12	Wheel mounted fire extinguisher per type & capacity (greater than 10 kg)		1 no. each	
13	Bolts, Nuts & Gaskets (For each size, rating, material)		10%	min. qty. 1 No.

14	Expansion Bellow (For each size, rating, material)		10%	min. qty. 1 No.
15	Strainer element (For each size, rating, material)		10%	min. qty. 1 No.
16	Spray / sprinkler head per size, rating & material		10%	min. qty. 1 No.
17	Complete Gear Box for gear operated Valves	≥ 16”	5%	min. qty. 1 No.
18	Bolt torque wrenches (Manual)		1 set	min. qty. 1 set.

Notes :

1. Percent of quantity required as mandatory spares is for each item consumed in as built.
2. No substitution in size, rating and material is allowed.
3. Pipe length in meter and other items in No. or Set shall be supplied.
4. Fractional part of quantity shall be converted into nearest upward whole part.

VOLUME - II: TECHNICAL

SECTION-3.1

HEALTH, SAFETY & ENVIRONMENT

PLANT: AIR SEPARATION UNIT ON BUILD-OWN-OPERATE (BOO) BASIS TO GENERATION OXYGEN AND NITROGEN FOR COAL GASIFICATION TO SYNTHETIC NATURAL GAS (SNG) COMPLEX.

PROJECT: COAL BASED SYNTHETIC NATURAL GAS (SNG) PROJECT, AT BARDHAMAN, WEST BENGAL, (INDIA)

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 The purpose of the present document is to outline the minimum safety requirements applicable to personnel, equipment and facilities during erection, pre-commissioning and commissioning activities of OWNER / CONSULTANT Construction Sites. Constructing safe structure and providing safe working environment to the personnel is a vital factor in successful construction business. Safety and health are as much as part of effective project planning and control as the cost, schedules, procurement and quality. Indeed they are all closely interrelated. Productivity, safety and quality can move forward in close proximity.

1.2 OBJECTIVES

OWNER/CONSULTANT Site Management has following main objectives regarding safety at site.

a) No Accident
b) To make the environment safe
c) No harm to people
d) Safety is everyone's responsibility
e) To make the job safe

2.0 GENERAL

2.1 These rules do not exempt the Contractor from statutory Health, Safety and Environmental duties but are intended to assist in attaining a high standard of compliance with those duties, in order to provide a safe and healthy working environment.

2.2 OWNER/CONSULTANT will assist Contractors in any practical way to facilitate safe working, and requires full co-operation in observing these rules.

2.3 The rules for Health and S afety specified herein are in no way intended to relieve the Contractor from any obligation or liability under the Contract, nor is it intended to relieve the Contractor of any of his legal obligations for the avoidance of accidents.

2.4 In all matters arising in the performance of the Contract, the Contractor shall conform with all Statutory Regulations and B y-Laws made with statutory authority by Government Departments or by Local or other Authorities that shall be applicable to the Works.

2.5 The Contractor, in the performance of the Contract, shall not endanger the safety or unlawfully interfere with the convenience of the public in any manner.

2.6 The Contractor's representative on Site shall communicate details of these rules for Health, Safety and E nvironment to all Contractors' employees and t o all Subcontractors and Subcontractors' employees employed on the Site.

2.7 The requirements of the Client/Owner's existing Site Rules/Regulations form part of the Contract and in the case of conflict between the OWNER/CONSULTANT'S rules, the highest standard shall be applied.

2.8 At the tender stage OWNER/CONSULTANT will require to see a copy of the Contractor's policy, organization and arrangements for the Health and Safety at Work. The Contractor shall submitted complete documents Health and Safety Questionnaire. Contractor shall deploy safety officer of adequate experience at each work site or during each shift including Sunday/holiday with approval of EIC/Owner.

3.0 SITE HEALTH, SAFETY AND ENVIRONMENT INDUCTION

3.1 All personnel shall receive OWNER/CONSULTANT and Contractors' site Health, Safety and Environment induction before they commence work on site. The induction shall comprise information on the various hazards which they may come into contact with, instructions on the site emergency procedures, warning and alarm systems, and permit to work system, first aid locations, welfare facilities, access routes and project specific rules.

3.2 It is the responsibility of the Contractor to familiarize all new personnel to the Project on the actual location of muster points, fire alarm points, first aid stations and the like.

4.0 DEMARCATION

4.1 Construction personnel are restricted to the construction areas shown on the Contract Drawings. Any personnel found on/in or interfering with the existing works/plant, without permission, will be dismissed from site. Any work outside of these areas may only be carried out with the written agreement of OWNER/CONSULTANT.

Before any work is started on the site, the Contractor's representative shall report to OWNER/CONSULTANT, who will confirm to the Contractor's representative, the limits of the working area(s) and shall be informed of any special requirements appertaining thereto.

5.0 ACCESS TO THE CLIENT'S FACILITIES/BUILDINGS

5.1 The Client's Facilities, including the canteen/cafeteria and toilets shall not be used by Construction Personnel.

5.2 Construction Personnel shall not enter any of the Owner's building unless escorted by a member of the OWNER/CONSULTANT'S staff (or working with prior agreement to Owner's Permit to Work System).

6.0 BEHAVIOR ON SITE

6.1 All Contractors' personnel shall treat everyone with respect and will refrain from any sexually suggestive or abusive comments or behavior.

7.0 SMOKING, EATING AND DRINKING

7.1 Smoking, eating and drinking is allowed in designated areas.

8.0 DRUGS AND ALCOHOL

8.1 The possession or use of illicit drugs and alcohol at site is not permitted. Anyone who is found, or suspected to be, under the influence of either will be removed from site (subject to the Contractors' disciplinary procedure).

8.2 Anyone taking prescriptive drugs shall advise their employer, in particular those drugs that may impair their performance. Their employer may make arrangements to assign them to more suitable work, but shall ensure that the OWNER/CONSULTANT Construction manager is informed without delay.

9.0 PERMIT TO WORK SYSTEM

9.1 All construction works will be carried out under a permit to work system. It is designed to protect personnel and plant and consists of an organized and predefined safety procedure. It forms a clear record of all foreseeable hazards which have been considered in advance of construction operations.

9.2 The identities of the permit "Issuing Authority" will be OWNER and the "Permit Acceptor" will be the Contractor.

9.3 The following types of permits will be issued:

- Clearance Certificate - all other permits are invalid without this Certificate, (this certificate can be used for general work).
- Hot Job Work Permit.
- Electrical Work Permit.
- Confined Spaces Work Permit.
- Excavations Work Permit.
- Working at Height work Permit.
- Radiography Work Permit.
- Cold Job Work Permit.
- Road Closure Work Permit.

9.4 Written requests for permits must be s ubmitted to Owner at least twenty-four hours in advance and the permits will be issued daily. Permits shall be given to Safety Officers of the contractor, by representatives authorized by Owner in approved formats.

10.0 ACCESS, SITE PASSES AND SECURITY

10. 1 Passes

All personnel and vehicles shall enter and l eave the site via the entrance authorized for construction personnel and traffic. Contractors' employees shall not enter any part of the site other than for the purpose of carrying out the Works.

All personnel shall be issued with a site pass. The site pass must be carried (or displayed on the pass holder's lapel) at all times. Details of all personnel requiring site passes shall be submitted to OWNER/CONSULTANT at least seven working days in advance of the

planned start-on-site date. Site passes shall be submitted for inspection on entering or leaving the site, or when requested for inspection by OWNER/CONSULTANT or Security.

Loss of site passes must be reported immediately to Owner/Consultant. Lack of a site pass may mean delay at the site entrance. Owner/Consultant shall not accept any responsibility for lost time or costs incurred.

On completion of their assignment, or termination or their employment, all personnel will return their site pass to Owner or Owner representative/ Owner authorized personal.

10.2 **Security**

The security of Contractor's plant, tools, equipment, materials (including free issue materials properly handed-over by Owner/Consultant) are the responsibility of the Contractor. It is the Contractor's responsibility to satisfy themselves that the security arrangements in existence on the site are adequate. The Contractor shall provide any other security measure that he deems necessary for the control and security of Contractor owned equipment and plant, including for free-issue plant and materials, both within the site establishment area and the working areas on the site.

Owner accepts no liability for any loss, damage or deterioration to the Contractor's plant tools equipment and materials.

Owner reserves the right to search at random all personnel, any Contractor's employee, or employees of its servants, agents, Contractors or any vehicle entering or leaving the site. Any package or container being taken into or out of the site may be opened and inspected by security staff or any other persons authorized by Owner/Consultant to make such a search or inspection.

It is the Contractor's obligation and responsibility to ensure that OWNER / CONSULTANT right to search and inspect persons and property, extends to and is brought to the attention of all his personnel.

Personnel shall give all possible assistance and make available any facilities required to assist OWNER/CONSULTANT and the Police in pursuance of the prosecution of any person(s) responsible for alleged malicious damage or loss to the Works or existing installations.

Owner shall not accept any responsibility for the loss or damage of personal effects. The security and safekeeping of personal effects is the responsibility of each individual.

10.3 Construction personnel will not be admitted to the Construction Areas unless they have undergone Owner/ Consultant's induction, and received a security pass.

No Induction, No Pass, No Access to the Site

10.4 OWNER/CONSULTANT reserves the right to deny access to the Construction Site/Areas and/or the Construction Car parks to any person, or vehicle.

10.5 Individuals may be excluded from and refused future entry to the Site and/or Construction Areas for any breach of Safety or Security Rules, or exceeding the speed limit (20 mph on roads leading to the site off the public highway and 5 mph in the construction area).

10.6 No plant/skips waste or materials may leave the Construction Area without the clearance of OWNER/CONSULTANT.

10.7 The taking of photographs on the site is prohibited.

10.8 Vehicles with children under the age of 16 years or animals onboard will not be allowed access.

10.9 Visitors will only be allowed by appointment (two days' notice to OWNER/CONSULTANT is required). Visitors shall be accompanied by a member of the Contractor's team (who has received Health, Safety and Environment Induction) at all times. The visitor will have to obtain a visitor's pass, and be collected from and returned to the main gate.

10.10 Each Contractor will keep a daily register of who is on site. The register will record name, pass number, time-in and time-out (records on time-clocks will not be permitted). This information shall be used to check personnel (role call) in the event of an emergency

11.0 PARKING, DELIVERIES AND VEHICLE PASSES

11.1 Contractors' personnel shall not be allowed to park any vehicle on the main car park or site. All contractors shall park in the Contractors' Temporary Car Park.

11.2 The Contractor shall arrange transport between the parking area(s), the main site gate and the Contractor's establishment and working areas if judged to be necessary.

11.3 Vehicles used solely for transporting of tools and equipment may be allowed access to the working area(s) for unloading/loading only.

11.4 Owners of vehicles parked illegally will have their car pass taken off them and told to remove the vehicle from site. They may have their site pass withdrawn and be refused further access to the Construction Site.

11.5 The Construction Areas will be restricted to construction plant and delivery vehicles.

11.6 The speed limit on site is 10 mph on the approach roads leading to the site off the public highway and 5 mph on the construction areas

12.0 SITE OPENING AND CLOSING TIMES

12.1 The site will be open from 7:30 Hrs. to 16.00 Hrs from Sunday to Thursday. Work outside the agreed normal working hours will be by agreement with Owner (subject to two working days' notice). All applications for out of hour working will identify the scope of work, supervision arrangements and a list of personnel.

13.0 SITE SUPERVISION

13.1 The Contractor must ensure that an employee of suitable seniority and authority, with responsibility for Health and Safety, is always present on site during the course of the works, to supervise and direct the Works and to receive and implement instructions from OWNER/CONSULTANT. Seven days before commencing works on site, the Contractor must notify OWNER/CONSULTANT of the name of that employee.

13.2 All supervisory staff shall be made aware of their responsibilities for safety.

14.0 TRAINING, COMPETENCE OF EMPLOYEES AND NOTIFICATION OF HAZARDS

14.1 Each Contractor must ensure that all his supervision and employees have had adequate safety training and are experienced to carry out their work safely, prior to starting on site. Training should be continuous throughout a project and should include regular toolbox discussions, (on site briefings at the start of each working day/shift).

To this end, the Contractor must also ensure that specific hazards likely to be experienced on the Site, whether notified to them or discovered by them, are notified to their workforce together with any precautions to be taken and local rules to be observed. Similarly, such hazards should be notified to their Subcontractors and, where discovered by them, to OWNER/CONSULTANT.

14.2 Where particularly severe or unusual hazards may arise on site, OWNER/CONSULTANT reserves the right at no additional cost to request Contractors' employees to attend special safety training and instruction sessions, whether carried out on site or externally. OWNER/CONSULTANT also requires Contractors' employees to undergo specified induction safety training. These aspects should be checked prior to submission of Tenders or execution of the works.

15.0 METHOD STATEMENTS

15.1 Contractors shall submit Safety Method Statements and JSA for all work activities, for example:

- Piling Operations.
- Excavation works.
- Lifting operations, as specified.
- Steel erection.
- Hot work operations.
- Radiography/NDT.
- Entry into confined spaces.
- Pressure testing.
- Working at height.
- Shot fired tools.
- Installation of pre-cast concrete planks.
- Pre-cast concrete structure.
- The erection of safety nets and fall arrest equipment.

Safety method statements must also be submitted for activities which have been identified as being of significant risk during the risk assessment process and activities selected by OWNER/CONSULTANT.

15.2 All Safety method statements must be submitted to OWNER/CONSULTANT at least seven days before planned commencement of the works.

15.3 The Safety method statement shall detail:

- The job to be undertaken.

- The individual activities required to complete the job.
- The individual trades/disciplines involved in each activity.
- Plant, equipment and tools be used in each activity.
- Any substances/chemicals to be used and where, and during which activity they will be used (together with a COSHH assessment).
- The Name(s) of the Supervisor(s) for each activity.
- The Name of the person in overall charge of the job.
- A detailed description of how the work will be done including control measures and procedures to complete each activity and the overall job safety.
- All hot work.

15.4 Compliance with the contents of the safety method statement shall be monitored on a daily basis and addressed during Contractors' safety management meetings.

15.5 The Contractor must ensure that employees executing the works are fully briefed and are made aware of the details within the approved Safety Method Statements, prior to starting the task, this includes highlighting hazards associated, associated risk assessments and reduction measures.

16.0 RISK ASSESSMENTS

16.1 Contractors will be required to produce risk assessments for all works under their control. The risk assessment shall be submitted as part of the Safety Method Statement to OWNER/CONSULTANT at least seven days before the job commences, and include the following information:

- Identification of all hazards applicable to significant risk activities.
- Details of measures in place to control the risk.
- Justification that the existing control measures are adequate or if not, a detailed action plan on how the risk(s) shall be controlled.

16.2 The use of Generic Risk Assessments is only acceptable if they follow the logical progression of the method statement and that specific operation, otherwise, task specific risk assessments will be required.

16.3 All risk assessments must be communicated to the workforce who will be responsible for undertaking the work.

17.0 COMPLIANCE WITH STATUTORY REGULATIONS

17.1 Contractors shall carry out their work in accordance with statutory legislation.
It is the duty of the Contractor to have knowledge of all relevant legislation and take account of it in the planning and execution of the work on OWNER/CONSULTANT' Sites.

18.0 INFORMATION TO BE PROVIDED AND POSTED

18.1 Contractors shall have in place, and issue to OWNER/CONSULTANT the following documents or information prior to commencement of their work, (where detailed within these rules):

18.1.1 Safety, Health and Environmental Policy.
18.1.2 Employer's Liability Insurance Certificate.

18.1.3 A detailed Health, Safety and Environment Plan, compliant with the project plan developed by the Planning Supervisor and/or Principal Contractor.
18.1.4 Work Method Statement Lifting Studies.
18.1.5 COSHH Procedures and Assessments.
18.1.6 Noise Procedures and Assessments.
18.1.7 Name of the individual appointed as the Site Safety Supervisor/Advisor.
18.1.8 Test certificates and examination for lifting gear, plant and appliances to be used on site. (Duplicates to be provided for OWNER/CONSULTANT's records.)
18.1.9 Drawings and calculations relating to false work, designed scaffolds, ground works and supporting temporary works.
18.1.10 Details of young persons to be employed on site.
18.1.11 Information relating to hazards associated with plant, operation and materials used in the works.
18.1.12 Proof of training for all personnel engaged in the works.
18.1.13 Daily Labour Returns.
18.1.14 Monthly Return of Accident Statistics to submitted OWNER/CONSULTANT format (Nil returns required).
18.1.15 Personal Injury Report to submitted to OWNER/CONSULTANT format (all injuries, however minor, to be reported). OWNER/CONSULTANT may request a detailed investigation into an accident. OWNER/CONSULTANT' decision on which incidents require detailed investigation is final.
18.1.16 Dangerous Occurrences, Incidents, Damage to Equipment and/or Property report to be submitted to OWNER/CONSULTANT format.
18.1.17 All entries/records of accidents entered into the Contractor's Accident Book shall also be copied into OWNER/CONSULTANT' Accident Book by the Contractor.
18.1.18 Copies of all Statutory Registers to be submitted weekly to OWNER/CONSULTANT.
18.1.19 Copies of the Contractor's Safety Officer/Advisor's reports of their findings on site visits/inspections.

18.2 Accidents, Incidents, Dangerous Occurrences and Notifiable Diseases

18.2.1 Accidents/Incidents/ Dangerous Occurrences/Near Misses

All accidents/incidents/dangerous occurrences/near misses must be notified to OWNER/CONSULTANT immediately, and a report prepared.

For reportable incidents, a copy the report to the Authority must be submitted to OWNER/CONSULTANT on completion but no later than two calendar days after the accident.

18.2.2 OWNER/CONSULTANT reserves the right to decide which accident, incidents or minor injuries shall be Investigated, and to what extent/format/contents of any investigation.

Note: All such notification or reports to OWNER/CONSULTANT do not release the Contractor of his statutory duties to report such matters to the Authorities by the quickest possible means (viz, telephone, fax and e-mail) immediately following the incident/accident.

19.0 PERSONAL PROTECTIVE EQUIPMENT/CLOTHING

19.1 All personnel on OWNER/CONSULTANT' site must wear as a minimum safety helmet, hi-vis vest, safety glasses and protective footwear. Additional personal protective equipment may be required dependent on the tasks being undertaken or as dictated by the risk assessment.

19.2 Contractors shall provide all necessary personal protective clothing and equipment for their employees and renew as necessary. Records of the issue of such equipment must be maintained for inspection by OWNER/CONSULTANT.

19.3 The Contractor shall:

- Provide personal protective equipment which is comfortable and fit for purpose.
- Maintain and clean personal protective equipment.
- Replace free of charge defective, broken or lost personal protective equipment.
- Provide storage for personal protective equipment when not being used.
- Ensure that personal protective equipment is properly used.
- Give training, information and instruction on its use to employees.
- Ensure that all personnel wear suitable clothing at all times **(no shorts, no sports shirts and no colours that may invite aggression - HSE "Keep Your Tops On" is enforced).**
- OWNER/CONSULTANT reserves the right to direct the contractor to change/replace personal protective equipment if they determine that it is unsuitable or inadequate for its proposed use.

20.0 SUBSTANCES (Control of Substances Hazardous to Health – COSHH)

20.1 Substances hazardous to health must be identified prior to taking them onto site and, if they cannot be substituted or eliminated, assessments stating how the substances will be controlled and what precautions will be introduced must be carried out and recorded in writing by a competent person. This assessment must be communicated to, and understood by, the members of the workforce who are likely to come into contact with the substance(s). A copy of all assessments should be submitted to OWNER/CONSULTANT.

20.2 Hazardous substances may only be brought to site with OWNER/CONSULTANT' permission. They shall be kept to a minimum and must be stored in secure, appropriate containers with the contents clearly labelled. The containers must be stored in a secure area, preferably quarantined from the main stores areas, with suitable warning notices and signage posted.

20.3 Hazardous materials must not be allowed to discharge into natural watercourses or drainage systems.

20.4 All hazardous material waste must be kept separate from normal waste and be disposed of in a specialist disposal facility.

21.0 NOISE

21.1 When any operation of a Contractor is likely to expose any employee on site to an average noise level of 85 dB(A) and above, an assessment shall be carried out, by the Contractor, and records maintained for OWNER/CONSULTANT' inspection. In such circumstances, the Contractor must keep stocks of adequate ear defenders or other suitable hearing protection.

21.2 In addition to the foregoing, noise must be kept to a minimum at all times and must not exceed acceptable and/or locally specified rules and conditions relating to noise imposed by the Contract. Due regard must always be given to noise levels, and their effects on the local community and persons not involved in the operations. Permissible times for noisy work operations, and other restrictions, may be imposed by the Local Authority. Contractors receiving Notices or Prohibition Notices under the related legislation must notify OWNER/CONSULTANT of such Notices.

22.0 FIRST AID

22.1 All Contractors shall provide or ensure that they are provided with, such equipment and facilities as are adequate and appropriate in the circumstances for enabling first-aid to be rendered to any of their employees if they are injured or become ill at work.

22.2 No work shall commence on site until Contractors have trained first aid personnel on site. Contractor at all times during execution, shall station at site an emergency vehicle without any extra cost or claim.

23.0 TOOL BOX TALKS

23.1 Tool Box Talks will be implemented by all Contractors. The agenda for these talks will be agreed with OWNER/CONSULTANT prior to the commencing of work.

24.0 HEALTH, SAFETY AND ENVIRONMENT INSPECTIONS/HEALTH, SAFETY AND ENVIRONMENT ADVISORS

24.1 The OWNER/CONSULTANT' Health, Safety and Environment Engineer/Advisor will visit the sites and carry out Site Safety Inspections. Contractors must co-operate in these inspections. Whenever Contractors' own Health, Safety and Environment Advisors visit site they must report their arrival and departure to the OWNER/CONSULTANT' Senior Representative, and provide a report of their findings and any necessary corrective action to be undertaken.

24.2 Contractors on the project must provide a full-time site based Health, Safety and Environment Advisor, when the intensity of the work requires or at the request of the OWNER/CONSULTANT.

24.3 Contractors who do not have full-time site based Health, Safety and Environment Advisors, shall ensure that their Health, Safety and Environment Advisor visits site once per week as a minimum.

24.4 **Appointment of Health, Safety and Environment Supervision**

The Contractor shall appoint safety supervision. The name of each appointee, together with evidence of his or her competence to carry out the requirements of the role, shall be submitted to OWNER/CONSULTANT for their approval.

25.0 HEALTH, SAFETY AND ENVIRONMENT MEETINGS

25.1 Health, Safety and Environment will form part of the agenda at all Site Progress Meetings. The Contractor's Safety Advisor may be asked to attend these progress meetings.

25.2 Once per month OWNER/CONSULTANT' Resident Construction Manager shall convene a Health Safety and Environment Meeting of all Contractors. Attendees at the meeting shall be all Contractors' Safety Advisors and Site Managers.

26.0 HEALTH, SAFETY AND ENVIRONMENT COMMITTEES AND SAFETY REPRESENTATIVES

26.1 OWNER/CONSULTANT encourages the workforce to nominate Safety Representatives as a way of improving communication on Health, Safety and Environment issues. Wherever Contractors' Safety Representatives have been appointed, OWNER/CONSULTANT must be informed of their appointment in writing.

27.0 HOUSEKEEPING

27.1 Contractors are expected to carry out their work in a clean, safe and orderly manner.

27.2 Dust shall be kept to acceptable levels for the work being carried out. Waste materials and rubbish shall be cleared up as the work progresses and not left to introduce a safety hazard for other personnel engaged on the works.

27.3 Construction waste should never obstruct emergency exit routes, Firefighting equipment, emergency alarm call points or other emergency facilities.

27.4 From time to time as judged necessary, at the expiration of the contract, or when instructed to do so by OWNER/CONSULTANT, the Contractor shall undertake to clean and tidy his areas of occupation and work to the satisfaction of OWNER/CONSULTANT. Should the Contractor fail to do this, OWNER/CONSULTANT reserves the right to remove all offending materials and debris and to deduct the cost of this operation from the Contract Price. OWNER/CONSULTANT accepts no responsibility for any materials and/or tools which may be removed during this operation.

27.5 The Contractor must ensure that the following requirements are strictly enforced:

- Ample provision of refuse bins for all rubbish including organic waste such as food scraps, etc.
- Daily clearance of all such bins to the area designated for this discharge.
- No discharge of deleterious matter such as oils or other industrial waste.

27.6 All site offices, toilets, eating facilities, changing rooms, drying areas, stores, etc, which are the responsibility of the Contractor, shall be cleaned daily as a minimum by the Contractor. These facilities shall be checked for vermin on a two weekly rota.

28.0 FIRE PREVENTION

28.1 Before welding, flame or arc cutting of metals, or other processes involving heat or naked lights are permitted, a fire risk assessment shall be carried out by the contractor and arrangements agreed with OWNER/CONSULTANT who will issue a Permit to Work.

28.2 Contractors shall familiarize both themselves and their employees with the fire safety arrangements, fire alarms, means of escape and emergency evacuation procedures.

28.3 Before leaving the premises and site, contractors shall ensure that naked lights and other ignition sources have been ex tinguished and el ectrical apparatus, where practicable, switched off and/or disconnected.

28.4 Contractors shall store Highly Flammable Liquids and Liquefied Petroleum Gases in a manner approved by OWNER/CONSULTANT.

28.5 OWNER/CONSULTANT' fire protection equipment shall only be used in an Emergency. Fire extinguishers/fire blankets for use when carrying out hot work shall be provided by the Contractor.

29.0 REMOVAL OF WASTE FROM CONSTRUCTION SITES

29.1 The removal of waste shall only be undertaken by Licensed Waste Carriers.

29.2 Where there is any doubt of the composition of excavation spoil, it must be analyzed before it is removed from site.

29.3 Evidence of compliance shall be submitted to OWNER/CONSULTANT prior to the removal of any waste from site.

29.4 Controlled waste is any kind of household, industrial or commercial waste. This includes, for example:

- Scrap metal.
- Building, construction, demolition and excavation waste, including waste from any repair or renovation.
- Clinical waste.
- Anything which is unwanted because it is surplus, broken, worn out, contaminated or spoiled in some other way.

Controlled waste disposal must be managed via a chain of transfer notes, maintained by the contractor and readily retrievable for OWNER/CONSULTANT' inspection.

30.0 EXCAVATIONS AND OPENINGS

30.1 No excavation work shall be commenced by the Contractor unless a valid excavation permit has been issued. The Contractor shall have on site at all times while excavation work is being carried out, detection equipment which meets the latest technology.

30.2 Prior to the start of any excavation, OWNER/CONSULTANT shall be consulted and the presence of overhead and buried service records shall be checked. Where "live" services are present, hand excavation must be carried out until the location of the service has been identified, recorded and made safe.

30.3 The Contractor must erect suitable solid edge protection (i.e., double handrails) around excavations or openings. D uring the hours of darkness any excavations, openings or obstructions near or on roadways and walkways must be indicated by a sufficient number of warning lamps.

30.4 The sides of all excavations should be properly shored, battered or stepped to prevent collapse. No excavation work shall commence unless there are adequate resources present to ensure the stability of the excavation. Excavations shall be inspected prior to, or re-commencement of the work to ensure the excavation is still in a safe condition.

30.5 All excavations shall have a proper ladder access point provided.

30.6 Spoil from excavations must be piled at least 1m from the edge of the hole.

30.7 Vehicular traffic shall be restricted from the edges of excavations, to prevent possible collapse.

31.0 ELECTRICITY

31.1 All Contractors must provide their own electrical power supplies or as per Technical ITB.

31.2 Contractors must not interfere with, or work on any of, the Client's electrical installations or equipment without written consent.

31.3 Where Contractors have to work in the vicinity of electrical equipment they must carry out a risk assessment prior to commencement of any works.

ALL EQUIPMENT MUST BE TREATED AS "LIVE" UNLESS ISOLATED/LOCKED OFF AND TAGGED.

31.4 Repair or installation of any electrical equipment must only be carried out by a competent qualified electrician.

31.5 The electrical supply to powered hand tools must not exceed permissible volts, centre tapped giving appropriate volts to earth. Where this is not possible, due to the type of tool being used, the approval of OWNER/CONSULTANT must be sought in writing.

Electrical lighting for use in confined spaces must not exceed 24 volts (and be explosion proof where applicable). Powered hand tools used in confined spaces should, where possible, be air operated.

31.6 Contractors requiring to install temporary electrical supply equipment shall submit a temporary electrical supply procedure to OWNER/CONSULTANT for approval. The procedure shall, where necessary, cover installation of 380/440 volt system, installation of 110 volt system, lighting system, welding equipment installation, inspection testing operation and maintenance of temporary electrical systems.

31.6.1 **Distribution Boards** - Semi-permanent or Long Term

These should be accommodated in weatherproofed locations and be so arranged, if possible, that they will not need to be moved during the Contract. They should be proofed against interference or unauthorized operation and they should be large enough to accommodate all the necessary apparatus required. Each circuit should be clearly labeled and a circuit diagram should be located at each board.

31.6.2 **Distribution Boards** – Temporary

These are usually small portable panels or boards containing two or three socket outlets. They must be of robust construction, preferably all-insulated and should be supplied by heavy duty flexible cables, these cables shall not be spliced. Socket outlets, plug connectors and cable couplers should comply with High Standards or equivalent industry standard.

31.6.3 **Distribution Cables**

These cables run from the main distribution boards to the local distribution boards throughout the site.

The cables will normally be multi-strand multi-core armored PVC cables but, in certain cases, may take the form of Mineral Insulated Copper Clad (MICC) cables. The latter type should be sheathed with PVC.

The installation must be so arranged as to prevent the need for long trailing cables. Socket outlets should be located as near the working point as possible.

Power and lighting circuits should be kept separate.

A full record should be made of all parts of the installation and should be kept up to date when alterations or extensions are made.

31.6.4 **Underground Cables**

Cables may be provided by the Contractor and laid underground or overhead to connect the supply or metering point to the semi-permanent site distribution boards.

The cables must be suitable for the duty and loading expected, e.g., armored PVC cables.

The cables should be buried at a safe depth or taken from a height so as not to obstruct the movement of persons and vehicles and their routes clearly marked both on the site and on the site plans.

The cables should be properly terminated and be provided with efficient circuit protection.

Cable routes should be so arranged that the minimum of obstruction is caused. The cables should be treated with care and given the same supervision and protection as other cables.

31.7 No temporary electrical supply shall be installed or modified without the agreement and approval of OWNER/CONSULTANT.

31.8 Any tool, plant or equipment exceeding 110 volts (55v to earth) shall be connected to an earth leakage circuit breaker (ELCB).

32.0 WORK IN CONFINED SPACES

32.1 All work in confined spaces must be covered by a safety method statement.
Safety method statements for work in confined spaces should include arrangements for the following as a minimum:

- Issue of a permit to work

- Work scope and method.
- Nominated Supervisor.
- Tally man.
- Rescue procedures and equipment.
- Training.
- Tools and equipment to be used, including low voltage or pneumatic.
- Lighting requirements, including standby/emergency.
- Explosion proof fittings.
- Low voltage or pneumatic tools.
- Ventilation.
- Access.
- Bonding to prevent both electrical shock and static discharge.
- Work cycles, to reduce risk of heat exhaustion.
- Fire safety and extinguisher requirements.

32.2 Contractors shall not enter or commence work in any excavation, tank, vessel, pipe or chamber or other enclosed space, until a valid permit to work has been issued. Where Contractor's operations result in a dangerous atmosphere arising during the monitoring of the work activity, the permit to work issuing authority must be informed and all personnel removed from the area.

No new activity shall be introduced into a confined space without the permission and signed approval of the permit to work issuing authority.

Whilst work is ongoing within a confined space, the Contractor will be required to provide a trained standby/tally man.

32.4 All personnel who have to enter confined spaces must have undertaken the training appropriate to this task.

33.0 MOBILE CRANES

33.1 All cranes (including piling rigs, fork lift trucks, mobile elevated work platforms, hand lorries and similar equipment), whether owned by the Contractor or hired, must carry relevant test certificates and thorough examination reports, together with the manufacturer's handbook. Copies of this documentation must be submitted to Owner/Consultant prior to commencing work.

33.2 Only persons who are certificated as competent and authorized shall be allowed to operate cranes. The Contractor must be able to prove the competence of their employees to operate such equipment prior to its use.

33.3 Crane operators or other competent persons must carry out daily inspections and enter these in the crane register. Failure to maintain the register properly may lead to suspension of operations. This obligation is the responsibility of the crane hirer when he is supplying the crane and the operator. In addition, the Contractor will implement a regular inspection and maintenance programme to ensure that all components of the lifting device are in good condition.

33.4 Travel routes for cranes and crane standing must be agreed with OWNER/CONSULTANT in order to avoid such things as overhead lines and other structures, underground services, excavations, made up ground, etc. Loads preader pads of sufficient size and thickness

area, and of suitable material, e.g., metal plates, timber, etc, are to be placed under each outrigger foot, before all crane lifting operations are allowed to commence.

33.5 Crane duty charts (Load Radius Tables) must be displayed on or be available in the crane for easy reference. In addition, crane manufacturers' rigging/de-rigging instructions must be available on site. During rigging/de-rigging of jibs/booms, provision must be made to support sections/either side of rigging points, from below, utilizing tightly packed blocks.

33.6 All cranes shall be fitted with:

- A reverse warning audible alarm.
- Load radius indicator.
- Automatic safe load indication.
- Crane hooks with safety catches.

All of which must be serviceable.

33.7 All lifting equipment accompanying the crane shall comply with the requirements of lifting regulations.

33.8 The assembly, rigging and de-rigging of any crane components, including fly jibs, shall only be done under the supervision of a competent lifting supervisor. An approved risk assessment, together with the manufacturers' rigging/de-rigging instructions must be in place covering rigging activities for the equipment.

33.9 Every Contractor involved in lifting operations with a crane (including a piling rig) or mobile crane shall appoint, in writing, a lifting supervisor to oversee all lifting operations.

33.10 No crane shall travel with a suspended load.

33.11 Outriggers, when installed, must always be used.

34.0 LIFTING OPERATIONS

34.1 A Lifting Study and Safety Method Statement must be prepared for all heavy lifts exceeding 10 tons, or of a complex nature, e.g., tandem lifts or as specified by the Construction Manager (or the Rigging and Lifting Supervisor) and submitted to OWNER/CONSULTANT for review.

34.2 Every lifting operation must be properly planned by a nominated, competent person.

34.3 Every lifting operation shall be appropriately supervised.

34.4 All slinging and rigging of loads must be carried out by competent personnel.

34.5 Clear communications between the crane operator and the person responsible for controlling the lift must be established.

All statutory Inspection Reports/Certification/Documentation and proof of the driver's training shall be photocopied and handed to OWNER/CONSULTANT prior to the setting up of the crane. Certification for lifting equipment to be used in the lift shall be identified and cross checked with the item of plant

35.0 STEEL ERECTION

35.1 The weight of each component in excess of 500 kg shall be clearly marked upon it.

35.2 Erectors must be fully informed of the correct erection sequence, by their supervisor, prior to each stage of work commencing.

35.3 Vertical access provision should, whenever possible, be fixed to the steel before it is lifted into position. Where this is not possible permanent access, ie, stairways or permanent metal ladders, shall be installed as early as possible.

35.4 Where horizontal access along structural members is required, as much work as possible must be completed before the steel is lifted into position. This includes:

Fixing of handrails or posts for securing steel wire ropes to be used in conjunction with safety harnesses or inertia reels.

The fixing of scaffold tubes (needles) to the lower flange of an I-beam to allow a working platform to be erected.

Where scaffold tubes (needles) are used they shall not support a working platform wider than three boards, or one lightweight staging without being “picked up”.

Where no ladder access, permanent stairway, etc, leads onto working platforms, as described above, employees must use man riding baskets or mobile elevated work platforms as far as reasonably practicable to access working areas.

36.0 SCAFFOLDING

36.1 All scaffolding must be of good quality, be erected in compliance Good Practices for Access and Working Scaffolds, and special scaffold structures in steel. In addition to the main guard rail, an additional guardrail is required such that the gap between the toe-board and main guardrail does not exceed 470mm and all boards must be secured, without causing a tripping hazard.

36.2 All scaffolding shall be erected, modified and inspected by qualified competent scaffolders.

36.3 Where materials are to be positioned on scaffolding the Contractor’s supervision must ensure that the scaffolding is not overloaded.

36.4 Before use, scaffolding shall be inspected by an authorized Scaffold Inspector who shall complete a “scaffold tag” and secure it in a prominent position at the base of all ladder access points. The scaffolding tag will clearly show the following information as a minimum:

- Location.
- Reference number.
- Requested by.
- Access Scaffold Classification.
- Maximum distributed load/working lift.
- Maximum number of working lifts to be used simultaneously.
- Date erected.

- Erected by.
- Inspected by.

36.5 Scaffolds shall be inspected at weekly intervals or after storms by the authorised Scaffold Inspector who shall sign and date the "Scaffold Tag" after each inspection. Scaffolding not considered safe shall have the Scaffold Tag withdrawn and a prominent "DO NOT USE" sign displayed.

36.6 A scaffold register shall be maintained by the authorized Scaffold Inspector. This shall contain:

- Date of first and subsequent weekly inspections.
- Individual identifications of all scaffolds which shall be cross-referenced to the Scaffold Tag identity number.
- Clear name and signature of the authorized Scaffold Inspector against each separate scaffold inspected.

36.7 No scaffold may be erected which impedes normal access or can be accidentally struck by moving plant without prior consultation with OWNER/CONSULTANT to ensure that a safe system of work is in place.

36.8 Contractors are not permitted to erect or carry scaffolding near live overhead electrical cables, or equipment because of the danger of tubes making accidental contact with electrically charged apparatus.

36.9 If there is any doubt about the security of any anchorage, suspension points or ties for a scaffold, e.g., strength of existing buildings/structures, or those under construction, OWNER/CONSULTANT must be consulted before proceeding with erection.

36.10 All scaffolds must be provided with suitable access. Where ladders are used for this purpose they must be of adequate length and properly secured by lashing or fixing to prevent displacement.

36.11 Action shall be taken to warn personnel against using partly erected or dismantled scaffolds. A prominent "DO NOT USE" sign shall be clearly displayed.

36.12 OWNER/CONSULTANT shall approve the sitting of the scaffold material racks/compounds.

36.13 Mobile tower scaffolds shall not be constructed with a height greater than 3 times the minimum base width and shall only be used on level ground. Towers shall only be erected by trained personnel.

36.14 In addition to weekly inspections, wooden scaffold boards shall be subject to a monthly inspection to ensure wood has not rotted or been subject to insect damage

36.15 The Contractor shall ensure that the system of work employed for the erection and dismantling of scaffolding shall not expose the Scaffolders to any risk.

36.16 All scaffolding must be erected and dismantled to the requirements laid down in the current regulations and guidance notes and to the requirements of OWNER/CONSULTANT.

37.0 LADDERS/STEPS

37.1 Ladders must be in good condition and free from defects, i.e., broken rungs, split stiles.

37.2 Ladders must not be painted.

37.3 Ladders must:

- Be securely fastened at the top.
- Be properly positioned at the base.
- Extend at least 1m (5 rungs) above the working platform.
- Be at an angle of 300mm out for every 1.2m vertical drop.

37.4 **All steps used on the project Site**.

37.5 Only one person must be allowed on a set of steps at any one time.

37.6 Persons must work with a set of steps of the appropriate height for the task.

37.7 The top rung of the steps must be kept at waist height, no work to be carried out above this height on steps.

37.8 Ladders are to be used as a means of access not as a working platform except for light, minor or one off activities. Then the person must wear a harness and tie-off to a suitable anchorage whilst carrying out the minor task.

38.0 FALL PROTECTION

38.1 Depending on the task and the risks, harnesses and appropriate anchorages/running lines will be used for activities carried out above a height of 2 meters.

38.2 Fall protection equipment shall be subject to regular inspection by a competent person, and a register maintained for OWNER/CONSULTANT' inspection.

38.3 During the execution of work at height, where it is not practicable to work from within a standard working platform with double handrail and toe boards (for example erection of structural steelwork, installation of roof components, etc), safety netting capable of catching a falling person must be installed as far as reasonably practicable.

38.4 The provision of safety netting does not relieve individuals from utilizing fall protection devices during the execution of the works.

38.5 The safety nets should be manufactured to Indian Standard and erected in accordance with good practices by a competent person.

38.6 The safety nets must bear a label stating the normal size of the net; the date of manufacture, the deflection at the centre of the net during the prescribed test and the maximum distance below the working height for which the net is designed to be used.

38.7 Test certificates must be provided for all safety nets, which will state the breaking strength of the net and provide details of the drop test carried out.

38.8 All safety nets must be periodically tested at intervals not exceeding three months – and records of these tests must be retained.

38.9 A formal inspection of safety nets must be carried out weekly to check for damage, loose ties, changes in anchorage points, etc. Records of these inspections must also be retained.

39.0 MOBILE ELEVATED WORK PLATFORMS

39.1 The term Mobile Elevated Work Platform (MEWP) covers the following types of equipment:

- Scissor lifts.
- Telescopic booms or jibs.
- Articulating and telescopic booms.

39.2 Anyone who is to operate a MEWP must be competent and have received formal training accredited by manufacturer.

39.3 Prior to any MEWP being used on site, a formal risk assessment must be carried out to identify any potential hazards which may exist as a consequence.

39.4 Whilst working within the platform of a MEWP, all personnel must wear a safety harness which is attached to a secure anchorage point within the platform.

39.5 Before commencing work from a MEWP, the surrounding area should be cordoned-off to prevent personnel straying into a potentially hazardous area.

39.6 The Safe Working Load specified on the MEWP must not be exceeded.

39.7 If the MEWP has been manufactured with outriggers or stabilizers, they must always be deployed.

39.8 Prior to commencing work, ground conditions must be checked to ensure that the ground bearing capacity will not be exceeded by the loading from the MEWP. Where required, spreader plates shall be used to distribute the loading.

39.9 The MEWP shall only be permitted to travel with the platform occupied and/or the boom extended if it is within the machine's specified operational capabilities.

39.10 MEWP shall not be used as a jack, prop or support.

39.11 MEWP shall not be used as a crane or lifting device.

39.12 MEWP shall not be used primarily for the transport of goods or materials.

39.13 MEWP shall not be used in wind speed exceeding 30 mph (12.5 m/s).

39.14 All MEWPs must be subjected to a regular maintenance and inspection regime, which as a minimum will require weekly inspections by a competent person and a thorough examination every six months.

40.0 CONTRACTORS' TOOLS AND EQUIPMENT

40.1 All Contractors' tools and equipment must be fit for purpose. Tools should be CE marked.

40.2 Guards and electrical trip switches must work effectively and must not be removed or by-passed.

40.3 All tools shall be of good quality and maintained in a safe working condition. Home made tools are not permitted.

40.4 The Contractor shall provide suitable storage with suitable racks and bins for storing tools and equipment.

40.5 All temporary construction leads, lighting and portable electric tools shall be of appropriate volts.

40.6 The Contractor shall nominate or employ the services of a competent qualified person to inspect and tag electrical power hand tools, transformers, distribution boards, extension cables, etc, on an at least a three monthly basis (PAT testing). The tag shall display name, signature of the individual inspecting the tool and date of inspection.

40.7 The Contractor shall keep, on site, a register of all electrical power hand tools in use. The register shall detail:

- Individual identity number of the tool.
- Name, signature and company of the qualified electrician carrying out the inspection.
- Date of inspection.
- Maintenance and Inspection schedule.
- Remarks on condition of tool and whether repaired or withdrawn from use.

40.8 No electrical powered hand tool shall be used unless it is tagged with a current "INSPECTION" tag.

40.9 All electrical leads must be connected to the power source through standard industrial waterproofed plugs and sockets, which shall be in good condition.

41.0 MECHANICAL PLANT AND EQUIPMENT

41.1 Mechanical plant and equipment is defined as:

- Earthmoving plant.
- Road making plant and equipment.
- Concrete batching plant and mixers.
- Forklift trucks.
- Miscellaneous plant, including generators and compressors.
- Mobile elevating work platforms (e.g., star- lift, cherry picker, etc).

41.2 All items of mechanical plant transported to the project shall be in a safe and sound condition and shall be properly maintained. Emissions shall be to acceptable limits and no smoke shall be discharged.

41.3 A programme of regular, preventative maintenance shall be established by the Contractor, as per the manufacturer's handbook, to ensure that all plant equipment is systematically inspected, maintained and repaired as necessary.

41.4 The preventative maintenance programme and the Contractor's employee responsible for taking the action shall be clearly detailed, identified and given to OWNER/CONSULTANT.

41.5 A safe system of work must exist during all maintenance and repair operations to ensure that no part of the machinery is set in motion while work is being carried out.

41.6 Plant maintenance must not be carried out within the main construction site.

41.7 Where refueling is required, facilities provided shall be adequately covered by fire extinguishers, earthing, warning signs, bonding and proper fuel dispensers. Refueling areas shall be curbed to avoid spills.

41.8 Waste oil removed from vehicles after servicing shall be sent to the appropriate off-site waste disposal facility and this is the responsibility of the Contractor.

41.9 The OWNER/CONSULTANT'S tools, plant and equipment may not be used by Contractors without their express permission.

42.0 COMPETENCY/PLANT EQUIPMENT

42.1 All drivers and operators of mobile plant (mechanically propelled vehicles) shall be in possession of the appropriate license for the class of vehicle.

42.2 It is the responsibility of the contractor to ensure that all drivers, operators and banks men of mobile plant (mechanically propelled vehicles) are certificated as competent.

42.3 **General**

42.3.1 Every dangerous part of machinery shall be securely guarded.

42.3.2 Any guards removed for maintenance or repair purposes must be replaced before the machine is set in motion.

42.3.3 No mobile plant (mechanically propelled vehicles) shall carry passengers unless a proper fixed seat is provided, except when the equipment is specifically designed for standing personnel.

42.3.4 Mobile plant (mechanically propelled vehicles) must be parked on firm level ground when unattended, the engine stopped, brakes on and any load or attachment lowered to the ground and the keys left in the ignition.

42.3.5 No mechanical plant or equipment shall be sited on or operated on any area of the project without express the permission of OWNER/CONSULTANT.

42.3.6 All items of mobile plant (mechanically propelled vehicles) shall be fitted with a reverse warning audible alarm.

42.3.7 All drivers/operators of mobile plant (mechanically propelled vehicles) shall strictly obey the instructions of the site security, traffic regulations and speed limits. A banks man shall be in attendance during all reversing procedures.

42.4 **Inspection**

All mobile equipment (mechanically propelled vehicles) shall be inspected by a competent person appointed by the Contractor prior to use on site. Equipment considered to be unsafe, by OWNER/CONSULTANT, shall not be allowed access to the site.

42.5 Flame Arrestors

42.6 All mobile plant for use in Petro Chemical Live Plant Areas, or during the Start-up and Commissioning Phase of the project, must be fitted with Exhaust Flame Arrestors and Chalwyn Valves where there is a risk of flammable gas releases.

43.0 MACHINERY GUARDING

43.1 Unauthorized personnel must not operate, interfere or tamper with plant or equipment.

43.2 Persons authorized to use machines must first check that guards are in position and that any other safety devices, e.g., emergency stops, are in working order.

43.3 All plant or equipment brought onto the site must be properly guarded to prevent injury and be CE marked.

NO GUARD OR FENCE MAY BE REMOVED FROM MACHINERY.

44.0 WELDING

44.1 Welding sets shall be in good condition, properly maintained and earthed.

44.2 Isolation switches on welding sets shall be readily accessible.

44.3 Terminals and live components shall be adequately protected.

44.4 Cables shall be frequently inspected to ensure the insulation is intact.

44.5 Damaged cables or electrical holders shall be properly repaired or replaced.

44.6 The welding return cable shall be secured onto the work piece. If this is not practical it shall be as near as possible.

44.7 Proper cable connectors shall be used when connecting runs of cables.

44.8 Welders shall wear:

- Face and eye protection with correct grade of filter.
- Welder's gauntlets.
- Long sleeved flame retardant overalls.

Welders shall wear safety helmets at all times, except whilst welding, when it is agreed as impractical and written permission is granted by OWNER/CONSULTANT, subject to mitigation of hazard, i.e., no work overhead, or shielded from falling objects.

44.9 Welding areas should whenever possible be screened off using flame retardant blanket or other suitable material. All combustible materials must be cleared from the vicinity of all welding operations.

44.10 Asbestos material shall not be used on the project.

44.11 Electric Arc Welding equipment and ac cessories shall conform to Latest Engineering Standards.

44.12 Fire extinguishers must be provided and kept adjacent to any welding or cutting activity.

45.0 ABRASIVE WHEELS

45.1 Contractors must ensure that any of their employees authorized to change Abrasive Wheels have attended an approved course of training and have been appointed in writing.

45.2 Details of each employee trained must be entered in the training register kept on s ite. Contractors must produce certificates and registers on request.

45.3 Machines used to drive Abrasive Wheels must be in good condition and properly guarded.

45.4 Pedestal or bench mounted grinders must have an emergency stop button and be fitted with a properly adjusted tool rest and guard.

45.5 All hand held grinders shall have a “Dead Man” switch and appropriate guards fitted.

45.6 The use of hand held angle grinders over 115mm shall only be permitted for specific tasks, subject to Owner’s / Consultant’s approval.

46.0 USE OF GAS AND OXYGEN EQUIPMENT

46.1 Compressed gas cylinders shall:

- Be in good condition and not suffering from corrosion.
- Be properly colour coded (reference should be made to National Standards).
- Be individually identified.

Hoses shall be properly colour coded to the internationally recognized standard for the gas being used, in good condition and fitted with hose connectors attached by permanent clips.

Check valves and flashback arrestors must be used on both hoses at all times.

46.2 Users shall check the equipment for perished, damaged hoses, regulators, and pr essure gauges, etc. Defects must be reported to their supervisors and f aulty equipment must be replaced.

46.3 When on site, cylinders must be in trolleys or secured in an upright position at all times. A bottle key shall be kept with cylinders in use.

46.4 Stored oxygen and fuel gas cylinders shall be kept separate with minimum separation distance of 5m. Cylinders must never be stored or used in a horizontal position cylinders must be secured in an upright position. Empty cylinders must also be separated from full cylinders. Cylinders shall be stored in lockable open mesh bottle cages.

46.5 All gas cylinders must be handled with care and they must not be misused or abused. They must be properly shut off when not in use and safety caps must be fitted when being moved.

46.6 Great care must be taken to ensure that gas equipment, including hoses, are not allowed to cause obstruction of roadways, walkways, manholes, ladders or other means of access where they can cause hazards or be damaged. Hoses not in use should be coiled up and put in a safe place. Hoses should whenever possible be supported off the ground.

46.7 Where any operation involves the use of gas and oxygen equipment in enclosed or semi-enclosed spaces, Contractors' supervision must carry out frequent checks to ensure these procedures are complied with.

46.8 During meal breaks and at stopping times, hoses and equipment must be removed from confined spaces or excavations. Oxygen or gas cylinders must not be taken into confined spaces for use or storage.

46.9 No modification to tanks or drums which have contained flammable liquid shall be undertaken at the site.

47.0 ABRASIVE AIR BLAST CLEANIN

47.1 Blast cleaning shall be carried out in an enclosed designated area.

Provision shall be made to prevent the spread of grit and dust out of the blast area and to collect and dispose of the spoil to an approved location.

47.2 The blast cleaning area shall be indicated by prominent warning signs.

47.3 Only approved abrasives having no free silica shall be used.

47.4 Personnel involved in the actual blasting of material shall be protected by a positive pressure, blast hood, meeting approved standards and providing both respiratory and eye protection, with breathing air supplied via a suitable filter.

47.5 The nozzle shall be fitted with a properly functioning dead man's handle, and anti-static abrasive blast hoses. It is required that all equipment be grounded and checked for ground potential

47.6 A standby man shall stay by the blast pot.

48.0 COMPRESSED AIR

48.1 All air receivers and compressors shall be in good condition and properly maintained.

48.2 Air receivers shall be individually identified and marked with their safe working pressure.

48.3 Air receivers shall be accompanied by a valid test certificate which shall be kept on site by the Contractor and shown to OWNER/CONSULTANT before bringing the vessel onto site.

48.4 All air receivers must be fitted with a properly set pressure relief valve.

48.5 Air receivers shall be examined and the pressure relief valve tested by an independent examiner at yearly intervals.

48.6 There shall be a register of all air receivers containing:
- Individual identification numbers.
- Dates of independent inspections.
- Name and signature of independent examiner.
- Rates safe working pressure.
- Pressure at which pressure relief valve lifted shall be kept on site by the Contractor along with all current certification.

48.7 The requirements inclusive also apply to compressor mounted air receivers.

48.8 All compressed air fittings shall be wired and/or restrained to prevent them from whipping should the coupling separate.

48.9 Only hose clamps designed for compressed air service shall be used. Worm drive (Jubilee) clips are not acceptable.

COMPRESSED AIR MUST NEVER BE USED FOR CLEANING CLOTHES.

48.10 Nozzles used for air blowing must be fitted with a “Dead Man” valve.

49.0 MOBILE PHONES AND PAGERS

49.1 Radios, personal CD and tape players are not allowed in the construction areas.

49.2 Mobile phones and pagers are prohibited in the designated construction areas by any hands-on personnel. External to the designated construction areas, providing it does not detract the user from any safety requirements and the user is stationary, then mobile phones and pagers may be used. **Other uses of this equipment will be at the discretion of OWNER/CONSULTANT.**

50.0 RADIOGRAPHY/NDT

50.1 Contractors who carry out radiography/NDT on the site must comply with safe systems of work. In particular, they MUST ensure that:
- Radiography areas are clearly marked using barrier tapes, notices and flashing lights.
- Audible warning (horns) must be sounded before a source is exposed.
- Only Classified Workers are engaged in radiography work.
- All other personnel are clear of the area before radiography takes place.

- Radiography work is supervised by a Qualified Radiological Protection Supervisor. Such supervisors must be nominated in writing and notified to OWNER/CONSULTANT.
- Any incident which may have resulted in over-exposure of any personnel is brought to the attention of OWNER/CONSULTANT for investigation.
- They have a written emergency procedure to be followed in the event of loss of an isotope or damage or malfunction of associated equipment. This procedure must be submitted to OWNER/CONSULTANT for approval before commencement.
- A certified meter is available on site.
- Radiography is carried out at the times agreed with OWNER/CONSULTANT normally this will only be during silent hours. OWNER/CONSULTANT requires twenty-four hours notice of such planned work.

50.2 Contractors who are not involved in radiography work must ensure that their employees observe warning notices, alarms and barriers in use where such work is being carried out.

50.3 Contractors must ensure that statutory notification is made to the authorities of radiography works.

50.4 Disposal of spent radioactive sources shall be agreed with OWNER/CONSULTANT.

51.0 WORKING OVER WATER/DIVING OPERATIONS

51.1 The Contractor shall provide a buoyancy aid to any employee working over (or near) water where there is a likelihood of falling in.

The Contractor shall also supply a sufficient number of life buoys to be permanently located at the point(s) of danger. The life buoys shall be attached to a throwing line.

Where rescue of a person falling into the water may be difficult, OWNER/CONSULTANT may require the Contractor to supply a standby boat, crewed by a competent boatman trained in rescue and resuscitation techniques.

51.2Diving operations may only be carried out using approved specialist diving contractors, employing certified commercial divers, and upon acceptance by OWNER/CONSULTANT of their Health, Safety and Environment plan and method statements (Diving Rules).

52.0 ASBESTOS

52.1 Only certified Contractors are allowed to handle asbestos.

53.0 IMPROVEMENT AND PROHIBITION NOTICES

53.1 In the event of an Improvement or Prohibition Notice being served by an Inspector, the OWNER/CONSULTANT Senior Representative must be notified immediately and the Contractor shall comply with the terms of such Notice immediately.

54.0 CARTRIDGE OPERATED FIXING TOOLS

The use of Cartridge Operated tools shall only be permitted with the express permission of OWNER/CONSULTANT, subject to an approved method statement and risk assessment, and use only by competent, trained operators).

55.0 SITE ESTABLISHMENT AND AMENITIES

55.1 Details of temporary services to be provided by Contractor or as Per Technical portion of ITB.

56.0 ACCOMMODATION

56.1 An area will be allocated for temporary site establishment facilities/services.

56.2 When required by the Contract, the Contractor shall provide and maintain (including de-watering when necessary) a suitable level and hardcore surface in the area allocated for temporary buildings such as offices, stores, workshops, mess huts and a stores compound.

56.3 When required by the Contract, the Contractor shall provide all site offices, stores facilities, workshops and mess huts for the accommodation of staff/site personnel. Proposals for the Contractor's temporary buildings shall be submitted to OWNER/CONSULTANT for approval with their tender.

56.4 Storage in Permanent Buildings

No Plant, Contractor's Equipment or Construction Aids shall be stored in any permanent building without first obtaining the written permission of OWNER/CONSULTANT. Such permission will not relieve the Contractor of the obligation to protect the building from damage whilst used as a store. If permission to use the building is refused by OWNER/CONSULTANT, the Contractor shall provide alternative storage facilities at no additional cost to OWNER/CONSULTANT.

56.5 Sanitary Facilities

All toilets and washing facilities shall be provided by the Contractor.
The supply and installation of necessary water sewage/drainage pipe work, pits, etc, for the facilities and the regular emptying and servicing are the responsibility of the Contractor.

56.6 Canteen

The Contractor must provide mess-huts for his employees and arrange any canteen facilities required for his employees and those of any others employed by him in connection with the Work.

57.0 TEMPORARY SERVICES

57.1 Telephone, Facsimile, etc

Arrangements for the provision of telephones, computer modems and/or facsimile facilities shall be made directly with providers of such facilities by the Contractor.

57.2 Electricity

If under the contract the Contractor is responsible for providing electricity for the site establishment amenities and w orking area(s), the Contractor shall ascertain the type, location and available spare capacity of the electrical point(s) of supply and provide cable, connections, isolating switches and earth leakage protection of approved specification.

If the Contractor's requirements for temporary electrical supplies exceed those agreed and render the available service inadequate, the Contractor shall provide the additional requirements at no extra cost to OWNER/CONSULTANT.

Electrical installations including all cables, temporary connections, wandering leads and all electrical facilities and/or equipment required for the execution of the Works shall be properly installed and maintained by the Contractor.

Temporary electrical installations must comply with all appropriate statutory requirements, the latest edition of the Institution of Electrical Engineers Regulations, COP for Distribution of Electricity on Construction and Building Sites and Electrical Safety on Construction Sites.

Electrical equipment and installation shall at all times be subject to inspection and approval by OWNER/CONSULTANT but this shall not relieve the Installer/User of their responsibilities for the safety of the system.

Electrical equipment or cables forming part of the permanent installation shall not be used by the Contractor for temporary services.

Temporary buildings shall have an external isolating switch.

The Contractor shall supply, install and maintain any temporary workface lighting.

57.3 **Water**

Supply of potable water for drinking and r aw water for washing/toilet facilities, mixing concrete, hydrostatic testing and other construction purposes shall be in Contractor's scope. The Contractor shall ascertain the location of the supply point and shall provide and install any temporary pipe work necessary for the provision, use and disposal of such water.

58.0 DISCHARGES INTO THE INTERNAL AND EXTERNAL DRAINAGE SYSTEMS, LAND AND CONSTRUCTION AREAS

58.1 All proposed controlled discharges into the site drainage systems shall be a greed with OWNER/CONSULTANT.

58.2 Any water discharged on existing roads, hard shoulders or drainage systems shall first pass through a filtering interceptor (which must be regularly cleaned) to prevent the discharge of sludge or solids.

58.3 Any damage to the Works caused by prolonged or excessive pumping and any damage or nuisance arising out of pumping operations shall be the liability of the Contractor.

58.4 Subsequent to filling with water and testing of any part of the Works for hydraulic testing, the Contractor shall be responsible for safe disposal of the water, and shall ensure that the rate of discharge is controlled and kept within the capabilities of any drainage system utilized.

58.5 The Contractor shall provide all requisite equipment and materials to ensure that all drains, rivers, streams or waterways are safeguarded against pollution.

59.0 MAINTENANCE OF ROADS AND DRAINS

59.1 Existing roads, road gullies and drains shall be inspected by OWNER/CONSULTANT and the Contractor prior to work commencing. A record of this inspection shall be compiled and on the completion of the Works, a further inspection will be carried out and any necessary repairs to road surfaces or cleaning of drains shall be to the Contractor's cost.

59.2 The Contractor shall provide temporary protection to any existing roads to prevent all possibility of damage whatsoever arising from the Works.

59.3 The Contractor shall at all times in the execution of the work maintain all public and site roads in a clean condition to the satisfaction of OWNER/CONSULTANT.

59.4 The Contractor shall immediately remove all mud, earth and debris from road surfaces.

59.5 Track-laying cranes and similar vehicles must not travel on finished roads without written authority from OWNER/CONSULTANT and then only with the use of timber mats or approved precautions to prevent damage to the roads. Timber mats or other approved precautions shall be supplied by the Contractor.

60.0 MATERIALS – STORAGE AND CONTROL

60.1 The Contractor must give a minimum of twenty-four hours notice of the intention to uplift and transport materials/equipment supplied free-issue from OWNER/CONSULTANT/Client' storage facilities to the point of erection or Contractor's storage facility.

60.2 Free-issue materials/equipment furnished by OWNER/CONSULTANT shall be accepted by the Contractor and become the responsibility of the Contractor until acceptance of the Works. Any damage caused to free-issue materials after acceptance shall be repaired or replaced by the Contractor to OWNER/CONSULTANT' satisfaction.

60.3 **Storage of Petrol, Fuels, Lubricants etc**

All fuel and construction materials which may contaminate the site drains, land or watercourses shall be stored in bounded areas. Refueling of plant shall be via bounded bowers. All construction plant in static locations shall have drip trays which shall be cleared daily.

60.4 **Environmental Impacts**

The Contractor shall, prior to commencement of the work, present to OWNER/CONSULTANT for their approval a register of environmental impacts that necessarily arise from their works.

Each identified environmental impact shall be accompanied by an individual Risk Assessment, clearly showing the reduction measures put in place to ensure mitigation of residual risk.

61.0 PENALTY

The Contractor shall adhere consistently to all provisions of HSE requirements. In case of noncompliance's and also for repeated failure in implementation of any of the HSE provisions, Consultant/Owner may impose stoppage of work without any cost & time implication to the Owner and/or impose a suitable penalty.

The amount of penalty shall be limited to 0.5 % (Zero decimal five percent) of the contract value.

Gate pass issued by CISF will bear "Medically Fit" stamp based on the E-I-C's recommendation. Accordingly, this shall be treated as part of the tender.

MEDICAL CERTIFICATE

Affix latest PHOTO impression of the workmen half covering the photo.

Form for Medical Check Up for the Workman engaged by the Contractor

Certified that I, _____ have examined Shri _____Age _____
who has signed / thumb impression above on t he photo in my presence. The details of his examination
as required are given in the enclosed medical examination report. I certify that all clinical and pathological tests were done i n my hospital/dispensary under my instructions. General and physical examinations of Shri _____ do not reveal any abnormality. He does not suffer from any
acute / chronic disease or any contagious or infectious disease. He is medically fit to work inside plant. He is free from Vertigo, Epilepsy or Fits, general giddiness and height related disease. His B.P.Pulse, Eyesight etc. are normal.

In my opinion, Shri _____ is physically and mentally fit for undertaking physical labour inside the plant.

Sign_____
Date: _____

Signature and Rubber stamp of medical practitioner with name

Note: This certificate is to be given on the letterhead of the registered medical practitioner who is possessing MBBS qualification as recognized by the Indian medical council. Below the signature, the
rubber stamp of the medical practitioner should be affixed. The letterhead normally should contain the following:

1) Name of the Medical practitioner:
2) Qualifications:
3) Registration Number:
4) Designation:
5) Address:

62.0 ADDITIONAL SAFETY REQUIREMENT

A. Strict implementation of IS marked safety helmets & IS/CE marked safety shoes for contract personnel

All the contractors working inside the plant shall ensure that their supervisors/labourers compulsorily wear IS marked safety helmets & IS/CE marked safety shoes while entering plant premises. No contract personnel shall be allowed inside battery area without wearing IS marked safety helmets & IS/CE marked safety shoes. All EIC's/site engineers and F&S department shall sensitize and spread awareness among the contract personnel.

Name of Tenderer: …..……..

Signature & Seal of Tenderer: ……

VOLUME-II: TECHNICAL

SECTION – 3.2

QUALITY ASSURANCE PLAN

PLANT: AIR SEPARATION UNIT ON BUILD-OWN-OPERATE (BOO) BASIS TO GENERATION OXYGEN AND NITROGEN FOR COAL GASIFICATION TO SYNTHETIC NATURAL GAS (SNG) COMPLEX.

PROJECT: COAL BASED SYNTHETIC NATURAL GAS (SNG) PROJECT, AT BARDHAMAN, WEST BENGAL, (INDIA)

CONTENTS

1.0 QUALITY ASSURANCE/ QUALITY CONTROL:

All work/services to be performed by BOO OPERATOR under this contract shall be of specified/approved quality and BOO OPERATOR shall have a QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) system during the performance of various activities such as engineering, procurement, tendering, construction etc. Review of the activities by CGIL/PMC shall not however, dilute the responsibility of BOO OPERATOR for maintaining quality.

1.1 QA/QC Procedure:

BOO OPERATOR shall submit the QA/QC Procedure to be adopted for the engineering procurement and construction activities of the PLANT for review to CGIL/PMC. The QA/QC procedure shall cover all activities to be performed by BOO OPERATOR/Contract/Vendors. Some of the important activities & procedures to be evolved are listed below:

a) General Document control:

- Coordination
- Non-conformance report of sub-Bidders.
- Output identification and traceability
- QA system review

b) Residual Basic Engineering:

- Residual Basic Engineering & detail engineering performing, checking, review and approval.
- Drafting - performing, checking, review & approval.
- Engineering for procurement.

c) Procurement / Inspection; Incoming material control Welding qualification and repair:

- Manufacturing/fabrication process control.
- Applicable non-destructive examination.
- Coating/lining.
- Preservation.
- Post-weld heat treatment wherever applicable Packaging and dispatch control
- Transportation
- Inspection/Test plans for all specific and mandatory tests (as per drawings and codes) with clear indication of Witness, Verification and Hold points.

d) Construction Pre-construction activities viz., incoming material all control receipt control etc. Job construction, Welding qualification and repair Inspection/Test Plans for all specified and tests (as per drawing & codes).with clear indication of witness, Verification and Hold points.

BOO OPERATOR shall prepare Construction QA Plans for review of the PMC/CGIL & the same shall cover as minimum the areas as under, and shall confirm their compliance to approved codes/standards/specifications, etc. Site preparation Tie-ins Buildings and structures Incorporation of all witness tests/hold points of the construction work Clean-up testing Instrumentation installation and construction. As a part of Construction & Quality Assurance BOO OPERATOR shall also comply with the following activities:

- Stage wise inspection of quality of work as per approved QA plan and contract specifications.

- Develop welding procedures and welders qualification procedures for their work.

- Ensure compliance of various statutory rules, regulations and safety measures and to arrange and co-ordinate site inspection, testing etc. as required under local- statutory rules and regulations prevalent in India.

- Take all necessary precautions to protect construction work and material from damage by climate, outside elements and construction activities.

- Ensure that materials used are in accordance with the drawings and Project specification.

- Review safety procedures prepared by BOO OPERATOR for compliance with applicable codes, regulations and CGIL requirements.

- Prepare schemes for heavy/critical equipment's erection/lifts/rigging before and submit the same for PMC review.

- Ensure alignment (hot/cold) of all critical rotary equipment/machinery and their up-keep/ maintenance as per supplier’s recommendations.

- Perform house-keeping activities which include maintaining sanitary facilities, sweeping clean-up, removal of excess materials/temporary facilities, scaffolding, as necessary.

- Conduct periodic Quality/Technical Audits for ensuring quality and conformance with the Contract.

- To take immediate appropriate corrective actions as & when such discrepancy arises to fulfill quality, safety obligations. i) All inspection and Test Plans are required to be submitted for finalization and approval' to PMC immediately after award of contract.

The QA/QC Procedure shall also include Quality Plans, mostly in tabular formats defining the specific quality practices and flow of every identifiable activity of a discipline. All disciplines concerned with the performance of work are to be covered. These quality Plans should indicate the following

1.2 For Design and Engineering:

Activity description Preparation, checking, review and approval requirements Code of conformance (applicable standard specification number) Applicable procedure number Q A. data/records produced.

1.2 For Procurement & Construction:

- Activity description Procedure number/Inspection and Test Plan number Conformance Code Testing and Inspection Code.

The QA/QC Procedure together with Quality Plans will be discussed during kick-off meeting and Hold, Witness and Verification points and PMC / CGIL / Licensor review/audit

requirements will be finalized between BOO OPERATOR and PMC / CGIL.

2.0 IMPLEMENTATION:

During the performance of the contract, BOO OPERATOR shall:
Implement approved Quality Assurance programme including but not limited to:

2.1 Performance of internal quality audits, preparation of audit reports and submission for review of PMC. BOO OPERATOR shall evolve a comprehensive system of planned and documented audit to verify whether various performed activities comply with detailed procedures, specifications, guidelines etc. and to determine the effectiveness of QUALITY SYSTEM. Scope of such internal audits shall be furnished to PMC for review. Verification documents shall be generated during audit and submitted periodically to PMC for review. Throughout all stages of the scope of contract, BOO OPERATORs procedures, documents, activities, products & services and those of his sub-bidder's shall be subject to CGIL/PMC Review / approval. Such surveillance and audit are optional and shall not relieve BOO OPERATOR of his contractual obligations and liabilities.

- Generation of Q. A. records (mostly inspection and test plans) as per Quality Plan and submission for review by PMC/CGIL. BOO OPERATOR shall submit all quality records (generated during activity execution) and audit results on well laid formats/performance for CGIL/PMC- review. The rights of such review are reserved by CGIL/PMC. CGIL/PMC may review it in full, parts or selectively. However, complete correctness of the Q. A. records shall be the sole responsibility of BOO OPERATOR irrespective of its review by CGIL/PMC.

2.2 Facilitate CGIL/PMC in the quality audit at works.

2.3 Certify "QA Programme" documents of BOO OPERATORs and submit to CGIL/PMC- for review.

2.4 Carry out audits/inspection at BOO OPERATORs works as per approved Q. A. programme and submit the reports for review by CGIL/PMC.

2.5 Get similar Q. A. System implemented at his Sub-Bidder’s works/office. Q .A. records from BOO OPERATOR shall be reviewed and certified for compliance by BOO OPERATOR before submitting to CGIL/PMC for information.

2.6 Carry-out audits at BOO OPERATORs' office/works and submit the report to CGIL/PMC for information.

2.7 Ensure that all personnel shall be assigned tasks commensurate with their qualification. Specialized workmen shall be qualified and certified.

2.8 Handle non-conformance brought out by internal and external sources as follows:

- Non Conformance Handling (Internal sources):
  Non-conformance brought out by BOO OPERATOR's own review/audit shall be resolved by BOO OPERATOR himself. One level higher than those responsible to carry-out the activity shall resolve the non-conformance. Such resolution shall be in full knowledge of Departmental Manager. Corrective action shall be initiated at the earliest. Report of such resolution shall be submitted to CGIL/PMC for information.

- Non Conformance Handling (External sources):
  Non-conformance brought out by CGIL/PMC through any of the following shall be

resolved by BOO OPERATOR. Such corrective actions shall be submitted to CGIL/PMC for review. However, corrective action shall be initiated at the earliest.

- Technical Reviews
- Q. A. Review & Surveillance
- Inspection
- External Audit (CGIL/PMC)

2.9 Glossary of Terms used in the Section:

i) Hold Point:

A Point designed by CGIL/PMC/BOO OPERATOR in the approved Quality Plan submitted by BOO OPERATOR in the kick-off meeting which requires inspection/verification and acceptance by CGIL/PMC before any further progressing is permitted. BOO OPERATOR shall not process the activity/ item beyond a hold point without written approval by CGIL/PMC/BOO OPERATOR except where prior writer permission for further processing is available.

ii) Witness Point:

An activity designated by CGIL/PMC/BOO OPERATOR which requires witnessing by CGIL/PMC/Licensor as the activity is performed. After proper notification has been provided (notification modalities and period shall be finalized in kick-off meeting) BOO OPERATOR is not obliged to hold further processing if CGIL/PMC/Licensor is not available to witness the activity or does not provide comments before the date notified. Basis of acceptance shall be as per relevant technical specification.

iii) Verification Point:

Point where CGIL/PMC/Licensor Plans to audit, monitor or witness in-process activity. BOO OPERATOR is not obliged to provide any advance written notification of these points. Basis of acceptance shall be as per relevant technical specification.

iv) Quality Surveillance:

Monitoring or making observations to verify whether or not material/items or services conform to specified requirements. Surveillance activities may include audit, inspections, witness of testing, review of Quality documentation, personnel qualifications etc.

v) Q. A. Records Documents which demonstrate achievement of required quality and verify effective operation of Quality System, viz.

- Inspection reports
- Test data/Inspection
- Test Plans
- Qualification reports
- Validation reports
- Audit report
- Material review reports
- Calibration data

vi) Quality Audit:

A systematic examination of the acts and decisions by people with respect to quality in order to independently verify or evaluate and report degree of compliance to the operational requirement of the quality programme, or the specifications or contract requirements of the product or service.

3.0 CONSTRUCTION EQUIPMENT:

BOO OPERATOR is required to organize and mobilize the construction equipment and other tools tackles in a sequential manner to ensure that plant installation is carried out in a mechanized manner and its mechanical completion is achieved within targeted time schedule. BOO OPERATOR shall without prejudice to his responsibility to execute and complete the work strictly as per the specifications and other laid down procedures by mechanizing the construction activities to the maximum extent by deploying all necessary construction equipment/ machinery of adequate capacities and numbers. For this purpose, BOO OPERATOR shall deploy a Rigging team headed by a Rigging foreman reporting to Area Engineer responsible for equipment erection. Area Engineer should be well conversant with various erection techniques and shall be responsible for preparing erection schemes in accordance with the approved procedures and based on crane manuals suiting to plan layout. Area Engineer will have to foresee various other constructive activities in the surroundings while planning erection schedules including safety aspects of man and machinery also. BOO OPERATOR will prepare erection schedule based on the overall project schedule of the Plant in phased manner with erection schemes of various equipments, vessels and submit to CGIL/PMC for approval, Monitoring and control of erection schedule and erection activities will be carried out as per the approved construction procedures. or efficient working and maintenance of construction aids, BOO OPERATOR shall establish and maintain crane Yard/workshop equipped with regular maintenance faCGILity for various construction aids for carrying out routine field maintenance during performance for the contract. Temporary approach road, wherever required for the movement of the Crane and other vehicles for equipment erection and transportation of material shall be properly planned and be made by BOO OPERATOR for quick mobilization of the transportation system. The proper padding for the crane movement shall be done to avoid any delays of erection schedule. Weekly/fortnightly maintenances shall be planned in such a way that it should not hamper the erection schedule BOO OPERATOR shall ensure the timely augmentation of the Plant, equipment and machinery depend upon the exigencies of the requirement to meet the overall project schedule. During performances of the work, BOO OPERATOR to ensure to keep structures, materials or equipment is adequately braced by Guys, Struts or otherwise approved means which shall be supplied and installed by BOO OPERATORs as required till the erection works is satisfactorily completed. Such guys, shoring, bracing, strutting, planking supports etc. shall not interfere with the work of other agencies and shall not damage or cause distortion to other works executed by him or other agencies. BOO OPERATOR to submit the construction equipment schedule along with the bid. A specimen of the same is enclosed herewith.

Sl.No	ACTIVITY DESCRIPTION	DURATION IN MONTHS													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
A.	**TEMPORARY WORKS**														
1	SITE OFFICE & MOBILISATION														
2	CONSTRUCTION POWER-DG SET														
B	**CIVIL WORKS**														
1															
2															
3															
C	**MECHNICAL EQUIPMENT**														
1															
2															
3															
D	**PIPING**														
1															
2															
3															
E	**ELECTRICAL/ INSTRUMENTATION**														
1															
2															
3															
F	**INSULATION/ PAINTING**														
1															
2															

3															
G	**MISC**														
1															
2															
3															

Note: May be corrected suiting to job requirement.

4.0 CONSTRUCTION MAN POWER:

BOO OPERATOR is required to organize and mobilize construction staff in a sequential manner to ensure that Plant installation is carried out in accordance with the S curve defined with other chapter of the Bid package. Mobilization of construction staff should be such that "S" curve based on the time schedule and progress achieved in the phased manner should match with the overall project time schedule. For this purpose, BOO OPERATOR shall clearly indicate in his construction methodology that work shall be done departmentally or by engaging such sub-bidder or the combination of both. BOO OPERATOR will prepare detailed methodology for the work to be carried out departmental as well as by Sub-Bidder clearly defining the scope and responsibility of main BOO OPERATOR and Sub-Bidder.

BOO OPERATOR proposes to engage Sub-Bidder for the erection of various activities, he must enter into an agreement of Memorandum of Understanding and same shall be furnished along with their credential with the bid. Sub-Bidder's credential will be evaluated along with the offer. BOO OPERATOR shall not be permitted to change the Sub-Bidder after the award of work under any circumstances. Non-compliances of the above will be strictly dealt with relevant provision(s) of the contract. During the execution of works at site, if the principal BOO OPERATOR engages Sub-Bidders for execution of works at site as per approval obtained from CGIL/PMC in line with contract provision(s)and in the event Sub-Bidder complains in writing to CGIL with regard to the non-payment of their dues from the principal BOO OPERATOR for the works executed by them and site (excluding final payments and payments due after termination of Sub-Bidders' services by the main BOO OPERATOR), CGIL reserves their right to make such payment to the Sub-Bidders based on approved measurement with due notice to the principal BOO OPERATOR. CGIL shall release such payments to Sub-Bidder at the cost and risk of the main BOO OPERATOR in order to ensure smart execution of work at site. The above such payment made by CGIL to the Sub-Bidder shall be adjusted in the running account bills or any other payment due to the concerned principal BOO OPERATOR. BOO OPERATOR to submit the construction manpower schedule as per the specimen enclosed. All Sub-Bidders will be managed by the main BOO OPERATOR construction staff who will perform the duties of construction management and will administer, co-ordinate, and inspect the work of the sub-Bidder and be responsible for the Quality. BOO OPERATOR will establish the pre-requisite for successful construction of sub-Bidder work. However, by deploying the sub-Bidder(s) as approved by CGIL/PMC for any discipline does not absolve the principal BOO OPERATOR for his total responsibility under the subject contract. BOO OPERATOR to ensure that in case of Sub-contract failure to execute the works as per standards/specifications/drawings and negligence & disobedience in carrying out any order or instruction of CGIL/PMC will be viewed very seriously & dealt with appropriately in accordance with provision(s) of the contract. BOO OPERATOR to submit the construction manpower schedule along with the bid.

5.0 QUALITY ASSURANCE SYSTEM AND INSPECTION REQUIREMENTS FOR BOUGHT OUT ITEMS & DURING CONSTRUCTION:

5.1 Quality Assurance System:

Contractors are required to follow a well-documented quality assurance and quality control system covering all phases of project viz. design/engineering, procurement, installation, testing and commissioning. TEIL typical specification "Specification for Turnkey BOO OPERATOR's Quality Assurance System" is attached with the bid package to provide necessary guidelines to contractors in this respect and contractor shall have to demonstrate that the project shall be executed by following an acceptable QA/QC system.

5.2 Inspection Co-ordination Methodology:

Contractors are required to develop their own resources for inspection of all bought-out items supported by third party inspection services for specific cases. A typical inspection co-ordination write-up defining PMC's involvement during inspection of various equipment is enclosed herewith.

5.3 Inspection Requirement during construction:

Considering that the day to day supervision of construction activities is the responsibility of the turnkey contractor, CGIL/PMC’s role during construction phase is for quality surveillance. Typical write-up on inspection requirements during construction phase is attached herewith. The contractor is required to follow and comply with the above requirements during the bidding and contract execution stage.

5.4 Specification for BOO OPERATOR's Quality Assurance System:

5.4.1 Introduction:

This specification establishes the Quality Assurance requirements to be met by BOO OPERATOR during execution of CONTRACTED SERVICES. In case of any conflict between the requirements of this specification and other documents such as technical specifications, contract conditions etc. the Contractor shall notify PMC/CGIL of all such conflicts for final resolution.

5.4.2 Scope of Work by BOO OPERATOR:

Prior to the award of contract: The following documents shall be submitted along with the bid for evaluation:

5.4.3 Quality Policy, Quality Objective & Company Quality Manual (Apex Document) Project Quality Plans (Tentative). After the award of contract: Within 4 weeks after the award of the Contract the Contractor shall participate in the pre-start meeting with PMC /CGIL to finalize "Project Quality Plans" as regards to the following:

- Standard practices specified by the contractor.
- Hold, Witness and Verification point.
- PMC/ CGIL’s review/ audit requirements.

VOLUME-II: TECHNICAL

SECTION – 3.3

DRAWINGS AND DOCUMENTS

PLANT: **AIR SEPARATION UNIT TO BE DEVELOPED BY BOO PROCESSOR TO GENERATION OXYGEN AND NITROGEN FOR COAL GASIFICATION TO SYNTHETIC NATURAL GAS (SNG) COMPLEX.**

PROJECT: **COAL BASED SYNTHETIC NATURAL GAS (SNG) PROJECT, AT BARDHAMAN, WEST BENGAL, (INDIA)**

CONTENTS

1.0 PROCESS DRAWINGS AND DOCUMENTS

This chapter details out various drawings and documents to be generated at various stages during the course of execution of the Project by BOO PROCESSOR for different project activities. Categorization of the documents / drawings for review / information / records of PMC and the review requirements of CGIL/ PMC along with routing of the documents / drawings will be conveyed separately as a philosophy.

Drawings and documents to be prepared by BOO PROCESSOR under the contract is the key to the timely completion of the plant. BOO PROCESSOR to ensure that all drawings and documents to be submitted by him to CGIL and/ or PMC shall be of professional quality and conforming to the contractual requirements. BOO PROCESSOR also undertakes to institute a formal drawing control system which will be documented and submitted to CGIL/PMC for review or approval.

The drawings / documents are generated by BOO PROCESSOR at various stages of the project covering different activities. The drawings / documents generated will be in the category of Approval/review/information. The drawings and documents required with bid and after order are given below. The categorisation for the Drawings/docs will be informed separately. However, this will in no way relieve BOO PROCESSOR of responsibility to conform to drawings, standards, specification, codes and contractual requirements / obligations.

BOO PROCESSOR shall prepare the drawing numbering procedure and submit to CGIL/PMC for review. Each Drawing submitted by BOO PROCESSOR shall be clearly marked with the name of CGIL, PMC with revision number & date. It should contain the minimum following details:

1. Size of Drawing.
2. Discipline of Engineering for which the drawing is issued.
3. Discipline wise segregation of numbering sequence.

BOO PROCESSOR to note that the number corresponds to ASU plant and shall be prefixed to all related documents/deliverables which shall be indicated to successful BOO PROCESSOR. For drafting of Drawings Computer aided design and drafting, AutoCAD shall be used. Further, standard, approved and well established P.C. based computer programmes/software packages, available in market shall only be used by BOO PROCESSOR/his sub-bidders/vendors etc. BOO PROCESSOR shall bring out the list of all such packages in the offer for each discipline for evaluation of bid. Every time a computer aided design is submitted for review/ approval to CGIL/PMC, it shall accompany with input/output data on Compact disc (CD) along with the name of the software package and operable on any system along with the requisite No. of Hard Copies.

For drawing, data sheet and all graphic works AUTOCAD release 14 and for all texts, MS Word Package 2013 or above shall only be used. Soft Copies of all calculations & Drawings shall be made available by BOO PROCESSOR for PMC review/records. Line List, Data Sheet & spread sheets shall be provided in MS Excel & all text items shall be in MS Word.

The review by the PMC/CGIL shall not be construed by BOO PROCESSOR, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and drawings.

Each drawing submitted by BOO PROCESSOR shall be clearly marked with the name of the OWNER, the unit designation, the specifications, title, the specification number and the

name of the Project with revision No. and date. If standards catalogue pages are submitted the applicable items shall be indicated therein. All titles, noting,-markings and writings on the drawings shall be in English. All the dimensions should be in metric units. Upon receiving comments on Drawings and Documents by BOO PROCESSOR, the subsequent submission should give compliance report, separately on each of the comments, document-wise. Comments given by PMC/CGIL to be discussed and finalized within agreed schedule.

The schedule of submission of the Drawings and Documents shall be in accordance with project plans only. The detailed list under different category, document-wise, shall be prepared by BOO PROCESSOR for approval of CGIL/PMC. This activity is to be completed within one month of Fax of Intent.

Sequence of submission of drawing is essential for proper review of documents and timely completion of the project is to be adhered. In case sequence is not maintained, the documents submitted will not be reviewed by CGIL/PMC and responsibility of timely execution of plant shall be to BOO PROCESSOR's accounts.

2.0 CATEGORY OF DOCUMENTS:

Sl.No	Category	Action by CGIL/PMC
1	Records/ Information	BOO PROCESSOR can continue to progress with the work. This drawings or documents will be retained with CGIL/PMC for information only. CGIL/PMC reserves the right to advise BOO PROCESSOR of any comments at any time and BOO PROCESSOR is liable to respond to satisfy that the work being done is in accordance with the contract; deviations, if any will be BOO PROCESSOR's risk and cost.
2.0	Review	CGIL/ PMC will review and advise BOO PROCESSOR of any comments on BOO PROCESSOR's Drawings/ Documents within specified schedule (i.e, 2 weeks), from date of receipt in PMC office. The review period is defined as date of receipt of documents by PMC, to date of issue of comments by PMC. This review period shall be valid only if submission of drawings is done by BOO PROCESSOR in accordance with approved drawings/ documents schedule as indicated in ITB. In case of any non-conformity to the above by BOO PROCESSOR due to which the period of review extends beyond 2 weeks by PMC, Schedule delay, if any will have to be absorbed by BOO PROCESSOR.

The documents falling under Review category will be returned with comments within specified time schedules subject to fulfilling other conditions enumerated. The information category document will be retained for information only but however CGIL/PMC reserves the right to comment at any stage of the Project, but not later than two weeks of receipt.

2.1 As-Built Drawings:

BOO PROCESSOR will furnish reproducible and electronic files of all the drawings under their scope to CGIL / PMC, certified as "As-Built Issue" by Third Party Inspection Agency (TPIA) for Vendor Items coming under Third Party Inspection / BOO PROCESSOR for all other drawings.

Upon completion of identifiable units or components of the fabrication, construction and installation phase of the project BOO PROCESSOR will complete all the related plans to the "as built' stage including all Vendor drawings and furnish CGIL/PMC with the following:

One complete set of all original tracings/ copies.

a) One complete set of reduced size (A3-297x420 mm) reproducible copies of all drawings.

b) One set of floppies for all documents/drawings/data.

c) All the as built drawings duly certified should be scanned and converted into electronic files made on magnetic/discs/optical long storage. All other project documents such as operating and m aintenance manuals, manufacturers' Catalogues etc. shall also be scanned on magnetic/optical discs for safe storage and retrievals by CGIL when needed. 15 complete sets of full size prints of the drawings and 4 sets of reduced size prints.

d) 6 complete bound sets of Manufacturer's specifications.

e) 6 complete sets in hard binders of the Manufacturers data book including certified prints and data for all items including test reports. Data Books shall be complete with index as tag numbers associated with Manufacturer's data shown. Equipment data shall include as a m inimum requirement the principal and des cription of operation, drawings and dimensions, spare parts lists and unpriced purchase orders and bill of material.

f) 6 bound copies each of the Spare Parts data books and t he Lubricants inventory Schedule.

g) 6 complete sets of field records shall be s igned by both BOO PROCESSOR's and CGIL's Representative at the site.

h) Original approvals and related drawings and documents from the statutory authority.

i) Copies of correspondence with the statutory authorities.

Sl. No	Description	With Bid	Remarks
1	Process Flow diagram	√	
2	Design Basis	√	
3	P & ID with interlock and logic diagram and write-up	√	
4	A write-up explaining the configured plant and how various demands will be met by BOO PROCESSOR	√	
5	Data sheet for equipments		
6	Flare Load summary (if applicable)	√	
7	Utility (both normal and peak consumption figures)	√	
8	Tie-In List	√	
9	Process Description	√	
10	Material balance and Stream Summary	√	

Sl. No	Description	After Job Award			Remarks
		For Review	For Information	For Record	
1	Process Flow diagram	√		√	
2	Design Basis	√	√	√	
3	P & ID with interlock and logic diagram and write-up		√	√	
4	Equipment Specification		√	√	
5	A write-up explaining the configured plant and how various demands will be met by BOO PROCESSOR	√		√	
6	Data sheet for equipments	√		√	
7	Flare Load summary	√		√	
8	Utility (both normal and peak consumption figures)	√		√	
9	Interface Engineering Data	√		√	
10	Report on HAZOP study	√		√	
11	Instrument data sheets	√		√	
12	Control Philosophy	√		√	
13	Line Schedule	√		√	
14	Tie-In List	√		√	
15	Electrical Load list	√		√	
16	Process Description		√	√	

Bidder shall submit all the data/ drawing/ documents mentioned in above table along with the Bid.

Note:

BOO PROCESSOR to note that all final drawings and doc uments including installation, operation and Maintenance manuals for all disciplines, viz., Process, Mechanical, Electrical, Instrumentation, General Civil, Structural, Architectural, Rotating, Static, Heat and Mass Transfer, Environmental etc covering all equipment/ item for the entire plant shall be furnished in 3 sets of hard copy and al so soft copies for CGIL's record, after the commissioning of the plant or before. The above also includes all inspection and test records, FATs, Performance Test Records, Material test Certificates, Characteristic curves, Catalogues, Nomographs etc.

S.no.	Name of Document	With Bid	Drawings/Documents Required After Award of Contract		
			For review/ approval	For information	Final Approved/ As-built
MECHANICAL STATIC EQUIPMENT					
A. STORAGE TANK					
1.1	Contractor document index with schedule of submission	-	-	Y	-
1.2	Mechanical Engineering Datasheet	-	-	Y	Y
1.3	General arrangement drawings of tank indicating design data , fabricated equipment weight, general notes, nozzle schedule, details of shell, supporting arrangement , main weld seams ,nozzle orientation plan etc.	N	Y	-	Y
1.4	Bottom And Annular Ring Layout & Weld Detail	N	-	Y	Y
1.5	Detail of sump for drain nozzles	N	-	Y	Y
1.6	Shell plate layout (showing location of nozzles and manhole)	N	-	Y	Y
1.7	Mechanical design calculations complying with the specifications and codes.	N	Y	-	Y
1.8	Detail of wind girder	N	-	Y	Y
1.9	Stairways, intermediate & top plate form	N	-	Y	Y
1.10	Roof plate layout & weld detail	N	-	-Y	Y
1.11	Detail of nozzles on shell & roof	N	-	Y	Y
1.12	Details of internals like guide rollers, roof stoppers, still wells, dip pipe, heating coil e.t.c	N	-	Y	Y
1.13	Materials test certificates duly stamped by inspecting authority (**)	N	-	-	Y
5.14	QAP & inspection and test plan (**)	N	Y	-	Y
1.15	Welding procedure and qualification test reports (**)	N	-	Y	Y
1.16	Destructive and non destructive procedure & test reports (**)	N	-	Y	Y
1.17	Heat treatment, Hydro test procedure and time temperature charts (**)	N	-	Y	Y
1.18	Records of vacuum box test, spark test for rubber lining, plumpness, roundness, peaking, banding etc. (**)	N	-	Y	Y
1.19	Radiographic examination reports (**)	N	-	-	Y
1.20	Certified 'as built' drawings Incorporating actual dimensions And material used, duly certified by the inspector	N	-	Y	Y
1.21	Completion certificates (including inspection certificates, hydrostatic test certificate , local code requirements) (**)	N	-	Y	Y
1.22	Vendor's quality assurance Practice **(**)**		-	-	Y
1.22	1. Final civil load data including details of foundation/anchor bolts 2. Foundation settlement check record (**)	N	-	Y	Y
1.23	List of spare parts and details (**)	N	-	Y	Y

S.no.	Name of Document	With Bid	Drawings/Documents Required After Award of Contract		
			For review/ approval	For information	Final Approved/ As-built
1.24	Information on all bought out Components i.e vendors, size, model No., catalogues, installation & Operating manual, drawings and Calculations as applicable	-	-	Y	Y
	Document marked as (**) are to be approved by authorized Third Party Inspection Agency and relevant Statutory Authorities, as applicable				
B.	**PRESSURE VESSEL/ FILTER/COLUMN/ REACTOR e.t.c**				
1.1	Mechanical Engineering Datasheet	-	-	Y	Y
1.2	General arrangement drawings indicating design data , fabricated equipment weight, general notes, nozzle schedule, details of shell, heads supporting arrangement , main weld seams ,nozzle orientation plan etc	N	Y	-	Y
1.3	Detail of nozzles, manholes, accessories etc.	N	-	Y	Y
1.4	Detail of internals such as tray, tray support ring, bolting bars etc.	N	-	Y	Y
1.5	Detail of demister	N		Y	Y
1.6	Mechanical & Structural Design calculations, Hydrodynamic calculation for Internals including fabrication drgs. of main equipment & Internals complying with the specifications and codes.	N	-	Y	Y
1.7	Detail of packing support, demister support, grating & grating support	N	-	Y	Y
1.8	Detail of internal distributor	N	-	Y	Y
1.9	Detail of external clips such as ladder, platform, pipe support	N	-	Y	Y
1.10	Detail of insulation ,fireproofing	N	-	Y	Y
1.11	Detail of pipe davit	N	-	Y	Y
1.12	Detail of lifting lug, tailing lug & trunion etc. including design calculation	N	-	Y	Y
1.13	Shell development drawings incorporating all attachments and weld seams	N	-	Y	Y
1.14	Name plate drawing detail along with name plate bracket	N		Y	Y
1.15	Template Drawing For Anchor Chair Of Equipment	N	-	Y	Y
1.16	Mechanical design calculation (strength calculation)	N	Y	-	Y
1.17	Approved certificate & approved Documents from statutory Authority (if applicable)	N	-	Y	Y
1.18	Certified 'as built' drawings Incorporating actual dimensions And material used, duly certified by the inspector	N	-	Y	Y
1.19	Data folder as per specification	N	-	Y	Y
1.20	Materials test certificates duly stamped by inspecting authority (**)	N	-	-	Y
1.21	QAP & inspection and test plan (**)	N	Y	-	Y
1.22	Welding procedure and qualification test reports (**)	N	-	Y	Y

S.no.	Name of Document	With Bid	Drawings/Documents Required After Award of Contract		
			For review/ approval	For information	Final Approved/ As-built
1.23	Destructive and non destructive procedure & test reports (**)	N	-	-	Y
1.24	Heat treatment, Hydro test procedure and time temperature charts (**)	N	-	Y	Y
1.25	Radiographic examination reports (**)	N	-	-	Y
1.26	Records/ drawings, charts duly approved, signed and stamped by Statutory Authorities (**)	N	-	-	Y
1.27	**Completion certificates** (including Inspection certificate, hydrostatic Test certificate, local code requirements, rubbing of code Stamp and name plate etc.) **(**)**	N	-	-	Y
1.28	Packing and forwarding instruction (**)	N	-	-	Y
1.29	Transportation drawing showing overall dimension, C.G. weight and handling instructions duly approved by appropriate authority	N	-	Y	Y
1.30	Erection scheme drawings Including weights, C.G., slinging Facilities, guideline & instructions	N	-	Y	Y
1.31	Assembly & Installation Detail **(**)**	N	-	Y	Y
1.32	Final civil load data including details of foundation/anchor bolts	N	-	Y	Y
1.33	List of spare parts and details (**)	N	-	Y	Y
1.34	Material & Purchase Requisition of equipment	N	-	Y	Y
Document marked as (**) are to be approved by authorized Third Party Inspection Agency and relevant Statutory Authorities, as applicable					
C. HEAT EXCHANGERS					
1.1	**Mechanical Engineering Datasheet**	N	-	Y	Y
1.2	General arrangement drawings indicating design data , fabricated equipment weight, general notes, nozzle schedule, details of shell, heads supporting arrangement , main weld seams ,nozzle orientation plan etc.	N	-	Y	Y
1.3	Tube bundle details & tube layout. Detail drawings	N	-	Y	Y
1.4	Details of nozzles and exchanger support	N	-	Y	Y
1.5	Details of gaskets	N		Y	Y
1.6	Heat exchanger detailed drawings and parts list	N	-	Y	Y
1.7	Mechanical design calculations complying with the specifications and codes.	N	Y		Y
1.8	For expansion bellow : Expansion bellow mechanical Design calculation along with detailed Drawings indicating design data, Component details, material Details, fabrication procedure, NDT Proposed, heat treatment Procedure e.t.c	N	-	Y	Y

S.no.	Name of Document	With Bid	Drawings/Documents Required After Award of Contract		
			For review/ approval	For information	Final Approved/ As-built
1.9	List of spare parts with details, special accessories, tools & tackles, etc.	N		Y	Y
1.10	Name plate drawing detail along With name plate bracket	N	-	Y	Y
1.11	Approved certificate & approved Documents from statutory Authority (if applicable)	N	-	Y	Y
1.12	Manufacturer's Data Report	N	-	Y	Y
1.13	Final civil load data including details of foundation/anchor bolts	N	-	Y	Y
1.14	Welding procedure and qualification test reports (**)	N	-	Y	Y
1.15	Transportation drawing showing overall dimension, C.G. weight and handling instructions duly approved by appropriate authority (**)	N	-	Y	Y
1.16	Destructive and non destructive procedure & test reports (**)	N	-	Y	Y
1.17	Heat treatment, Hydrotest procedure and time temperature charts (**)	N	-	Y	Y
1.18	Procedure for repair of damaged tubes (**)	N	-	Y	Y
1.19	QAP & inspection and test plan (**)	N	Y	-	Y
1.20	Records of NDT tests e.g. radiography, ultrasonic testing(UT), magnetic partical / Penetrant testing (MP/PT), hardness etc. (**)	N	-	-	Y
1.21	Materials test certificates duly stamped by inspecting authority (**)	N	-	Y	Y
1.22	PWHT charts (**)	N	-	Y	Y
1.23	Test on production test coupons (**)	N	-	-	Y
1.24	Hydraulic/pneumatic test reports (**)		-	-	Y
1.25	Mock-up test for tube to tube sheet joint (**)		-	-	Y
1.26	Certified 'as built' drawings Incorporating actual dimensions And material used, duly certified by the inspector	N	-	-	Y
1.27	Radiographic examination reports (**)	N	-	-	Y
1.28	Completion certificates (including Inspection certificate, hydrostatic Test certificate, local code requirements, rubbing of code Stamp and name plate etc.) (**)	N	-	-	Y
1.29	Mechanical guarantee certificate	N	-	-	Y
1.30	Inspector's final certificate (**)	N	-	-	Y
1.31	Packing and forwarding instruction (**)	N	-	-	Y
1.32	Instruction for erection and Installation, bolt tensioner device Catalogue (if BTD applicable), etc (**)	N	-	Y	Y

S.no.	Name of Document	With Bid	Drawings/Documents Required After Award of Contract		
			For review/ approval	For information	Final Approved/ As-built
1.33	Site Preservation Procedure	N	-	Y	Y
1.34	Material & Purchase Requisition of equipment	N	-	Y	Y

Document marked as (**) are to be approved by authorized Third Party Inspection Agency and relevant Statutory Authorities, as applicable

LEGEND: Y – Yes, N – No

Notes :

1. Final documentation shall be supplied in both hard copy and soft copy formats, including Pen drive and CD. Applicable software formats include MS Office 2000—specifically Word, Access, and Excel.
2. Documents marked with (**) shall be approved by the authorized Third Party Inspection Agency and relevant Statutory Authorities, as applicable.
3. Final documentation shall be provided in 3 hard copies, soft copies on pen drives or CDs, and also submitted electronically via email.
4. All drawing & documents shall be submitted in A2/A3 or A4 paper size .Documents in higher paper size shall be submitted in exceptional circumstances or as indicated in MR/Tender.
5. Bill of material (showing part no. MOC, Size, quantity, weight of each part) shall form part of the respective drawing.
6. Each vendor drawing/data listed under “Review & Information” shall be reviewed by the BOO CONTRACTOR to ensure strict compliance with the NIT and code requirements. Such documents must bear the reviewer’s signature and seal of the BOO CONTRACTOR prior to submission for PMC’s/Owner review, record, and final documentation. Drawings submitted without the BOO Contractor’s review shall be returned.

LIST OF MACHINERY DRAWINGS & DOCUMENTS:					
Sl No.	**Description**	**With Bid (Y/N)**	**For Review/ Approval**	**For Information**	**Final/ Approved/ As-built**
A.	**Pumps**				
1.0	List of drawings / documents including drawing number, revision number, description and approval status	N		Y	Y
2.0	Detailed manufacturing programme (Time bar chart)	N		Y	Y
3.0	Certified dimensional outline drawing	N	Y	-	Y
4.0	Cross sectional drawing and bill of material	N		Y	Y
5.0	Shaft seal drawing and bill of material	N		Y	Y
6.0	Shaft coupling assembly drawing and bi ll of materials including allowable misalignment clearances, shaft bores & key ways dimensions with tolerances and the style of coupling guard	N		Y	Y
7.0	Primary & auxiliary sealing schematic and bill of materials i ncluding seal fluid, fluid flows, pressure pipe and valve sizes, instrumentation, orifice sizes, and piping arrangement drawings	N	Y	-	Y
8.0	Cooling or heating schematic and bill of materials including c ooling & heating media, fluid flows, pressure, pipe and v alve sizes, instrumentation, orifice sizes and pi ping arrangement drawings	N	Y	-	Y
9.0	Lube oil schematic and bill of materials	N		Y	Y
10.0	Lube oil system arrangement drawing including sizes, rating and l ocation of all customer connections	N		Y	Y
11.0	Lube oil component drawings data	N		Y	Y
12.0	Electrical and instrumentation schematics, wiring diagrams and bill of materials	N		Y	Y
13.0	Electrical and instrumentation arrangement drawing and list of components	N		Y	Y
14.0	Performance curves	N	Y		Y
15.0	Pump specification sheet with complete details	N	Y	-	Y

	in Performa enclosed with enquiry / order				
16.0	Certified foundation assembly drawing of pump with driver & all accessories mounted on base plate with load diagram for foundation design (In case of motor being procured by purchaser, motor frame details will be s upplied to vendor within 4 weeks.)	N	Y	-	Y
17.0	Engineering flow diagram showing: - Lubrication & sealing lines - Flushing / washing lines - Cooling / steam lines	N		Y	Y
18.0	Reference list for pumps supplied in past for similar duty conditions. Reference list shall contain complete address of user, user's purchase order num ber, brief specifications and date of commissioning , if owner desires	N		Y	
19.0	Lube oil schedule	N	-	Y	Y
20.0	Automatic recirculation valve assembly drawing, sectional drawing with bill of material	N		Y	Y
21.0	Quality Assurance Plan / Inspection test plan	N	Y	-	-
22.0	Material test certificates and I nspection & performance test report along with dispatch clearance certificates from inspector	N	-	-	Y
23.0	Instruction manuals describing installation, operation and maintenance procedures	N	-	-	Y
24.0	Spare parts list	N		Y	Y
25.0	Parts catalogue complete with reference drawing nos. and sketches etc.	N	-	-	Y
B.	**COMPRESSORS**				
1.0	List of drawings / documents including drawing number, revision number, description and approval status	N		Y	Y
2.0	Detailed manufacturing programme (Time bar chart)	N		Y	Y
3.0	Specification sheet complete filled in PDIL proforma enclosed with enquiry/order.	N	Y	-	Y
4.0	Equipment layout with main overall dimensions	N	Y	-	Y

	including those required for foundations and piping design for compressor and auxiliaries. (This layout shall include the driven equipment and its auxiliaries).				
5.0	Performance curves for Centrifugal compressor :	N	Y		Y
	i) For turbine driven compressor, Discharge pressure, Brake horse power, Polytropic head and Efficiency Vs Inlet capacity (from surge point to 115 % of rated capacity) of the compressor at specified inlet pressure, temp. and mol. wt. of the gas and at 80, 90, 100 and 105 % speed for each stage and f or overall compressor				
	ii) For constant speed motor driven compressors D ischarge pressure , Brake horse power , Polytropic head and Efficiency Vs Inlet capacity (from surge point to 115 % of rated capacity) of the compressor at specified inlet pressure, temp. and mol. wt of the gas for each stage and for overall compressor				
	iii) Torque Vs Speed curve for the compressors.		-		
6.0	Performance Curve	N		Y	Y
7.0	i) Calculation of the lateral critical speeds of the compressors. ii) Calculation of the torsional critical speeds. Analytical report for torsional vibration of whole set. iii) Thrust loading curves for each casing / barrel for various operating conditions. iv) Response curve of deflection Vs RPM for varying amount of imbalance. v) Torsional critical response curve	N	-	Y	Y
8.0	Overall dimensional drawing with all main dimensions, size and l ocation of piping connections for compressors and its auxiliaries.	N	Y	-	Y
9.0	Cross sectional drgs. Of the compressor showing details of construction including sealing details, bearing et c. With part no.,	N		Y	Y

	description and material of construction.				
10.0	Coupling drawings	N	-	Y	Y
11.0	Seal assembly drawings & Bill of material	N	-	Y	Y
12.0	Lube oil Pumps a) Specification sheet b) Performance curve c) Cross Sectional drawing	 N N N		 Y Y Y	 Y Y Y
13.0	Certified foundation scope drawing of the compressor w ith driver and al l accessories resting on the foundation and control panel. In the event of motor not in the scope of supply of vendor the motor frame dimensions shall be supplied by the purchaser later). Direction and magnitude of all unbalanced forces, couples and centre of gravity along with direction of rotation shall also be mentioned	N	Y	-	Y
14.0	a) Engineering flow diagram indicating all instruments, valves, etc. marked with battery limit of supply of : - Process Gas lines - Cooling Water lines - Lubricating Oil lines - Condensate drain and vent lines The above drawings shall identify all components by size, pressure rating and material b) Material balance for gas, lube & seal oil.	N	Y	-	Y
15.0	Piping layout plan and el evation drawings for gas, cooling water and utility lines, lube and seal oil lines etc.	N		Y	Y
16.0	Driver : Selection details a) Speed - torque diagram b) GD2 of the rotating masses of the compressor referred to the motor speed	N	-	Y	Y
17.0	a) Piping isometrics for gas pipes DN>20, piping manifold and all oil lines. b) Flexibility analysis for gas lines.	N	-	Y	Y

18.0	Piping support location drgs. With forces, moments and movements for gas pipes and with weights for all lines.	N		Y	Y
19.0	Certified allowable forces, moments, movements, stresses for compressor nozzles.	N		Y	Y
20.0	Bill of Material for Piping and supports.	N		Y	Y
21.0	Bill of Material for insulation for Pipings.	N		Y	Y
22.0	Bill of quantity for Painting for piping, equipments and auxiliaries.	N		Y	Y
23.0	Thermal calculation for heat exchangers, Mechanical calculation and fabrication drawings for heat exchangers and Pressure vessels.	N		Y	Y
24.0	Inspection and Test Procedure.	N		-	Y
25.0	Quality Assurance Plan / Inspection test plan	N	Y		-
26.0	Inspection and t est reports, material test certificates, radiographic reports duly approved by specified inspecting authority, certificates for compressors, heat exchangers, pressure vessels, pipings, valves, instruments and other auxiliaries.	N	-	-	Y
27.0	Lubrication schedule	N	-	Y	Y
28.0	Reference list supplied in past for similar duty conditions. Reference list shall contain complete address of user, user's purchase order number, brief specifications and dat e of commissioning , if owner desires	N		Y	
29.0	Instruction manual for erection, installation, operation and maintenance of compressor and its accessories (important clearances to be maintained should be clearly specified.).	N	-	-	Y
30.0	Spare parts list	N		Y	Y
31.0	List of special tools	N	-	Y	Y
32.0	Installation list of similar machines shall also include the following : a) Client, location and year of installation b) Drive c) Model No. and type of compressor	N	-	Y	-

	d) Duty condition of the compressor e) Speed and KW rating				
C.	**TURBINE**				
1.0	List of drawings / documents including drawing number, revision number, description and approval status	N		Y	Y
2.0	Detailed manufacturing programme (Time bar chart)	N		Y	Y
3.0	Specification sheet with complete details in proforma enclosed with enquiry/order	N	Y	-	Y
4.0	Equipment layout with main overall dimensions including those required for foundations and piping design for Turbine and auxiliaries.	N	Y	-	Y
5.0	Performance curves for steam turbine : a) steam consumption versus KW (for various extraction rate in case of extraction turbine) b) overall efficiency vs. load curve c) steam consumption correction curves d) curve showing variation of exhaust temperature with inlet flow (i.e. under various loads) : - for change in live steam pressure - for change in live steam temperature - for change in speed from governor set point speed to max. continuous speed - for change in cooling water inlet temperature from 25°C to 35°C	N		Y	Y
6.0	Thrust loading curves of each casing / barrel for various operating conditions	N	-	Y	Y
7.0	Overall dimensional drawing with all main dimensions, size and location of piping connections for turbine and its auxiliaries.	N	Y	-	Y
8.0	Cross sectional drawings of the turbine showing details of construction including governor, inlet trip and control valves sealing	N		Y	Y

	details, bearing details etc. With part no., description and material of construction.				
9.0	Description of governing system	N	-	Y	Y
10.0	Blading plan for turbine	N	-	Y	Y
11.0	Coupling drawings	N	-	Y	Y
12.0	a) Engineering Flow diagram indicating all the Instruments with limit of supply of steam and condensate lines, lube and control oil lines, Flushing and washing line and cooling water lines. b) Material balance for steam condensate, lube & control oil.	N	Y	-	Y
13.0	Certified civil scope drawings for foundation of steam turbine and all auxiliaries.	N		Y	Y
14.0	Piping layout plan, elevation and s upport drawings for steam and condensate lines, lube and control oil lines, gland sealing steam lines, flushing and washing lines.	N		Y	Y
15.0	a) Piping isometrics for steam pipes for DN>20, piping manifold and all oil lines b) Flexibility analysis for steam lines	N		Y	Y
16.0	Piping support location drgs. With forces, moments and movements for steam and condensate pipes and with weights for all lines	N		Y	Y
17.0	Certified allowable forces, moments, movements, stresses for turbine nozzles.	N	-	Y	Y
18.0	Calculation of the lateral critical speeds of the turbines, Campbell diagram and G oodman diagram.	N	-	Y	Y
19.0	Bill of materials for piping and supports.	N		Y	Y
20.0	Bill of materials for insulation for piping.	N		Y	Y
21.0	Bill of quantity for painting for piping, equipments and auxiliaries.	N		Y	Y
22.0	Thermal calculation for heat exchangers, Mechanical calculation and fabrication drawings for heat exchangers and pressure vessels.	N		Y	Y

23.0	Instruction and M aintenance manual for erection & maintenance of turbine and i ts accessories (important clearances to be maintained should be clearly specified.).	N	-	-	Y
24.0	Cross sectional drawings of the Barring gear.	N	-	Y	Y
25.0	Lubrication schedule	N	-	-	Y
26.0	Inspection and Test Procedure.	N	-	-	Y
27.0	Quality Assurance Plan / Inspection test plan	N	Y	-	Y
28.0	Inspection and t est reports, material test certificates, radiographic reports duly approved by specified inspecting authority.	N	-	-	Y
29.0	Reference list for Turbines supplied in past for similar duty conditions. Reference list shall contain complete address of user, user's purchase order number, brief specifications and date of commissioning , if owner desires	N		Y	-
30.0	Spare parts list			Y	Y
31.0	Parts catalogue complete with reference drawing nos. and sketches etc.	N	-	-	Y
D.	**FANS & BLOWERS**				
1.0	Specification sheets completely filled in proforma.	N	Y	-	Y
2.0	Characteristic Curves - Performance curves, showing discharge pressure, capacity, and brake horse power at the inlet specified conditions (Pressure, capacity, temperature, molecular weight).	N	Y		Y
3.0	Spare parts list	N		Y	Y
4.0	Details of Lubrication and sealing system	N	-	-	Y
5.0	Data for selection of motor :	N	Y	-	Y
	a) Type				
	b) HP absorbed at duty point				
	c) RPM				
	d) Recommended HP				

	e) Max. starting torque as % NRT				
	f) G D^2 figure for rotating mass of the Fan / Blower				
	g) Speed vs. Torque for the Fan / Blower				
6.0	General Arrangement Drawing with all main dimensions, size and location of connections for ducting with all horizontal & vertical clearance necessary for installation and disassembly.	N	Y	-	Y
7.0	Cross sectional drawing of fan with parts list	N		Y	Y
8.0	Instruction manual for erection, installation operation and m aintenance of fan and its accessories (Important clearances to be maintained should be clearly specified).	N	-	-	Y
9.0	Quality Assurance Plan / Inspection test plan	N	Y	-	Y
10.0	Lubrication schedule	N	-	Y	Y
11.0	Reference list indicating duty condition, location, year of installation, name of client, if owner desires			Y	-
12.0	GA drawing with all details & dims. Including fan, drive, motor	N	Y	-	Y
13.0	Description of capacity control with details	N	-	-	Y
E.	**AGITATORS**				
1.0	Specification sheets completely filled in PDIL proforma.	N	Y		Y
2.0	General Arrangement Drawing with all main dimensions, size and location of connections for installation and disassembly.	N	Y		Y
3.0	Spare parts list			Y	Y
4.0	Details of Lubrication and sealing system	N	-	Y	Y
5.0	Instruction manual for erection, installation operation and m aintenance of fan and its accessories (Important clearances to be maintained should be clearly specified).	N	-	-	Y
6.0	Quality Assurance Plan / Inspection test plan	N	Y		Y
7.0	Reference list indicating duty condition,	N		Y	

	location, year of installation, name of client , if owner desires				
F.	**EOT**				
1.0	Data sheets - completely filled	N	Y		Y
2.0	General arrangement Drg. showing various details & all principal dimensions of the assembled unit, horizontals and vertical clearances and approaches	N	Y		Y
3.0	Spare parts list	N		Y	Y
4.0	Quality Assurance Plan / Inspection test plan	N	Y		Y
5.0	Reference list indicating, location, year of installation, name of client , if owner desires	N		Y	
G.	**HVAC System**				
1.0	List of drawings / documents including drawing number, revision number and Description & approval status	N		Y	Y
2.0	Specification sheets -Completely filled in agreed proforma.	N	Y		Y
3.0	General Assembly drawings with main overall dimensions including those required for accessories and auxiliaries and all horizontal & vertical clearances for dismantling, direction of rotation etc	N	Y		Y
4.0	Quality Assurance Plan / Inspection test plan	N	Y		Y
5.0	Spare part list	N		Y	Y
6.0	Cross-Sectional drawing of AC Plant and auxiliaries alongwith Bill of Materials.	N		Y	Y
7.0	Reference list for similar types of AC Plant supplied in past for similar duty conditions. Reference list shall contain complete address of user, user' s purchase order number, brief specifications and date of commissioning along with operating conditions , if owner desires	N		Y	

1.0 DRAWING & DOCUMENT SUBMISSIONS OF Fire Fighting :

The below mentioned drawing / document categories are indicative and have to be finalized with OWNER / CONSULTANT within three weeks from the Effective date of Contract.

The below mentioned drawings / documents are the minimum required documents which the Contractor shall provide during the Project execution stage. Any additional documents as required by OWNER / CONSULTANT for the Project execution purpose shall be provided by Contractor.

One complete set of NATIVE FILES of all fire fighting deliverables (As Built) shall be submitted by the Contractor.

Sl. No.	Description	With Bid (Y/N)	Approval/ Review	Information	Final/ Approved/ As-built
1	**Document schedule**	**N**	**Y**	-	**Y**
2	**Drawing schedule**	**N**	**Y**	-	**Y**
3	**Documents**				
3.1	Design Basis of Fire Protection System	**Y**	**Y**	-	**Y**
3.2	Fire and Gas Detector Selection Criteria	**N**	**Y**	-	**Y**
3.3	PMS and VMS	**N**	-	**Y**	**Y**
3.4	Water demand of different ISBL facilities	**N**	-	**Y**	**Y**
3.5	Utility Requirements	**N**		**Y**	**Y**
4	**Data sheets and QAP**				
4.1	Fire Fighting Equipment Datasheets	**N**	**Y**	-	**Y**
5	**Drawings**				
	P&ID				
5.1	Schematic diagram/PFD	**Y**	**Y**	-	**Y**
5.2	P&ID of Fire water network system	**Y**	**Y**	-	**Y**
5.3	P&ID of Fire water Pumping system	**N**	**Y**	-	**Y**
5.4	P&ID of Fire water spray system / deluge system / detection system	**N**	**Y**	-	**Y**
5.5	P&ID of Fire detection alarm system	**N**	**Y**	-	**Y**
	Layout / Construction GAD & Isometrics				
5.5	Equipment layout of Fire water Pump house	**N**	**Y**	-	**Y**
5.6	Piping GAD of Fire water network system	**Y**	**Y**	-	**Y**
5.7	Piping GAD of Fire water Pumping system	**N**	**Y**	-	**Y**
5.8	MVWS zoning layout of TWG	**N**	**Y**	-	**Y**

5.9	MVWS and QB detection system layout	**N**	**Y**	-	**Y**
5.10	Fire Extinguishers layout	**N**	**Y**	-	**Y**
5.11	Fire Exposed Envelop Plan – Fire Proofing	**N**	**Y**	-	**Y**
5.12	Civil Pipe supports with load calculation, deluge valve housing details.	**N**	**Y**	-	**Y**
5.13	Structural pipe supports for MVW system	**N**	-	**Y**	**Y**
5.14	Isometrics with BOQ / BOM	**N**	-	**Y**	**Y**
6	**Reports & Calculations**				
6.1	Design calculation for Fire water network System	**N**	**Y**	-	**Y**
6.2	Design calculation for MVWS/HVWS/ Sprinkler System	**N**	**Y**	-	**Y**
6.3	Pipenet Hydraulic analysis for Fire water network and spray System	**N**	**Y**	-	**Y**
6.4	Design calculation of Civil supports / Foundation / Pedestals	**N**	**Y**	-	**Y**
7	**General Documents**				
7.1	Fire Water Pump & Jockey pump Foundation details	**N**	-	**Y**	**Y**
7.2	Operation & control philosophy of pump selection for sequencing	**N**	-	**Y**	**Y**
7.3	Cable routing diagram	**N**	-	**Y**	**Y**
7.4	Interface document with other contractor	**N**	-	**Y**	**Y**
7.5	MR of Fire fighting equipments	**N**	-	**Y**	**Y**
7.6	MR of Diesel engine driven Fire water pumps & Motor driven Jockey pumps	**N**	-	**Y**	**Y**
7.7	Vendor's drawings & documents of Fire fighting equipments	**N**	-	**Y**	**Y**
7.8	Operation & Maintenance Manual	**N**	-	**Y**	**Y**
7.9	Inspection Test Plan (ITP) and QAP	**N**	-	**Y**	**Y**
7.10	Safety requirements compliance report	**N**	-	**Y**	**Y**
7.11	Design calculation & adequacy check results of E equipment, Piping and each system network.	**N**	-	**Y**	**Y**
7.12	Gas suppression system with calculation	**N**	-	**Y**	**Y**

VOLUME - II: TECHNICAL

SECTION – 3.4

INFORMATION REQUIRED IN THE TECHNICAL PROPOSAL

PLANT: AIR SEPARATION UNIT TO BE DEVELOPED BY BOO PROCESSOR TO GENERATION OXYGEN AND NITROGEN FOR COAL GASIFICATION TO SYNTHETIC NATURAL GAS (SNG) COMPLEX.

PROJECT: COAL BASED SYNTHETIC NATURAL GAS (SNG) PROJECT, AT BARDHAMAN, WEST BENGAL, (INDIA)

CONTENTS

LIST OF ATTACHMENT

Attachment Number	Description	Number of Sheets

Successful Bidder shall furnish the plant data within 15 days from the Price Bid opening as mentioned in below clauses:

1.0 PLANT DATA:

1.1 ASU PLANT:

1.1.1 PRODUCT HP OXYGEN GAS, HP NITROGEN GAS and LP NITROGEN GAS:

Sl. No.	Description	Units	At 100% capacity	At 120% capacity	At 50% capacity
i	Capacity				
a.	HP Oxygen	Nm^3/hr			
	Pressure ____ (Min.)	Kg/Cm^2abs			
	Temperature ____ (Max.)	^OC			
b.	HP Nitrogen	Nm^3/hr			
	Pressure ____ (Min.)	Kg/Cm^2abs			
	Temperature ____ (Max.)	^OC			
c.	LP Nitrogen	Nm^3/hr			
	Pressure ____ (Min.)	Kg/Cm^2abs			
	Temperature _____(Max.)	^OC			

1.1.2 BY-PRODUCT ARGON:

Sl. No.	Description	Units	At 100% capacity	At 120% capacity	At 50 % capacity
i	Capacity	Nm3/h			
	Pressure	Kg/cm^2a			
	Temperature	^OC			

2.0 RAW MATERIAL & UTILITY CONSUMPTION:

Sl. No.	Raw Material & Utility	Units	Plant Capacity			
			50%	100 %	120%	Remark
1.	Steam Condensate export	M^3/hr				
2.	Turbine Condensate export	M^3/hr				
3.	Net import of MP steam	MT/hr				
4.	Power Consumption	KWhr				
5.	Cooling water circulation	M^3/hr				
6.	Service water requirement	M^3/hr				

7.	Drinking Water	M^3/hr				
8.	Fire water	M^3/hr				

PLANT START UP REQUIREMENT:

Sl. No.	Item (Bidder to specify)	Units	
1.			Bidder to specify
2.	Normal		Item-wise quantity, quality at B.L.
3.	Peak, including duration		required for start-up
4.	B/L Pressure		
5.	B/L Temperature		
6.	Minimum purity required		
7.	Minimum acceptable limit of		

3.0 CATALYST /CHEMICAL REQUIREMENT :

Bidder to specify Item-wise information on catalysts used in their process as per pro-forma given below:

Type	Supplier	Loaded Volume	Expected Life
		m^3	Years

5.0 EFFLUENTS AND EMISSIONS:

5.1 Liquid Effluents(if any):

a) Continuous

b) Intermittent

5.2 Gaseous Emissions(if any):

a) Continuous

b) Intermittent

7.0 LIST OF EQUIPMENT

8.0 LIST OF ON-LINE ANALYZERS

9.0 FLOW MEASURING INSTRUMENTS AT PLANT B/L:

Description	Flow Meter *	Applicable	Unit	Limits of	Repeatability

		Standards		**Accuracy****	
Gaseous Nitrogen	Coriolis Flowmeter	AGA 11	Nm3/ hr	+/- 0.35 %	+/-0.2%
Gaseous Oxygen	Coriolis Flowmeter	AGA 11	Nm3/ hr	+/- 0.35 %	+/-0.2%
Liquid Nitrogen for Merchant Sale from BOO Processor	Coriolis Flowmeter	BOO Processor to propose Owner will review and Approve	kg/hr, Tonne /hr	+/- 0.35 % of actual measured flow rate with a density accuracy of 0.0005 g/cc or better.	

* Recommended

** (of Flow Rate) (Instrument Accuracy)

BOO Processors hall consider Cooling water supply/return flow /Turbine Condensate measurement by Magnetic type flow meter type and s team flow measurement by orifice/venturi/ flow nozzle.

Notes :

i. All the flow meters above shall be provided with totalizer.
ii. Flow meter shall be provided with Pressure, Temperature compensation
iii. Digital display of measurement of liquid Nitrogen, shall be made available at the battery limit.

Above meters shall be ut ilized for custody transfer. All the measurement data shall be accumulated including any verification or proving (as applicable) computed in the respective stream flow computers in the control room in an audit trail environment as per the requirements of API MPMS 21. Custody HMI system shall be only for acquiring data, reporting, trending, alarming, net fiscal accounting etc. No data computation shall be performed in the Custody HMI system for the purpose of billing. The complete system shall have redundant Ethernet architecture including stream flow computer and W indows HMI. A Custody HMI system shall also to be provided in OWNER Control Room (Location of Control room to be dec ided during Kick Off Meeting) for acquiring data, reporting, trending, alarming, net fiscal accounting etc.

For all liquid measurement, applicable certificate of approval from concerned Government body viz. Weight and Measures etc. shall be obtained by BOO operator for the flow meter, provers and the stream flow computers etc. If any such statutory approval is also required for gas flow measurement, then the same shall be obtained by BOO operator.

All gas flow measurement points shall be in full compliance to the respective standards including design, selection, installation, field verification guidelines. In-situ field performance testing shall be performed at field operating conditions for Oxygen & Nitrogen as listed in respective AGA standard with a reference module in-built. The complete as system shall be built such that common influences as listed do not affect the field performance of the meter.

10.0 OTHER TECHNICAL INFORMATION TO BE SUBMITTED ALONG WITH THE BID:

In addition to the requirements indicated in the earlier paragraphs, the following technical information:

a) Process Flow along with material balance/Stream summary
b) Steam Balance Diagram
c) Water Balance Diagram
d) Process description indicating the functions of various sections.
e) Turndown capability and operating range.
f) System suggested for on-line product quality control.
g) The details of effluent treatment facilities included in the battery limit and the quantities of gaseous, liquid and solid wastes released from the plant along with their specifications for normal operation and during regeneration, if any.
h) Utility summary including the requirements of start-up / shutdown.
i) Plant battery limit tie point details.
j) Equipment Layout plan:

Equipment Layout plan showing location of various equipment based on relevant appropriate norms.

PLANT NORTH

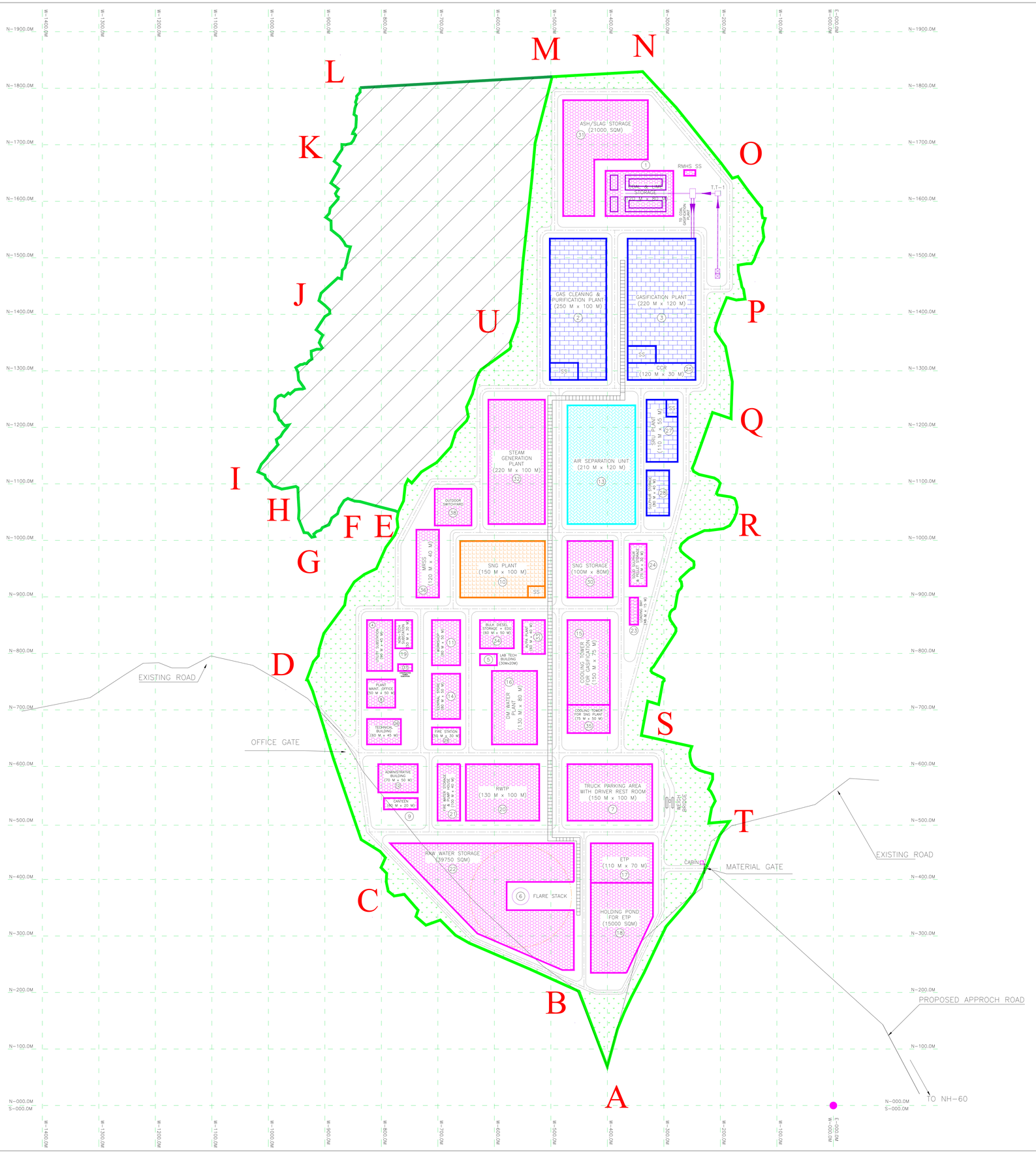


TABLE FOR FACILITIES/UNITS

SL.NO.	BLOCK DESCRIPTION	SIZE IN METRE	REMARKS
1.	COAL & LIME STORAGE	120 M x 80 M	
2.	GAS CLEANING & PURIFICATION PLANT	250 M x 100 M	
3.	GASIFICATION PLANT	220 M x 120 M	
4.	OFFSITE & UTILITIES SUBSTATION	90 M x 45 M	
5.	LAB TECH BUILDING	30 M x 20 M	
6.	FLARE STACK	R 90M	
7.	TRUCK PARKING AREA WITH DRIVER REST ROOM	150 M x 100 M	
8.	PLANT MAINT. OFFICE	50 M X 50 M	
9.	CANTEEN	60 M x 20 M	
10.	SNG PLANT	150 M x 100 M	
11.	WORKSHOP	80 M x 50 M	
12	ADMINISTRATIVE BUILDING	70 M x 50 M	
13.	AIR SEPARATION UNIT	210 M x 120 M	
14.	CENTRAL STORE	80 M x 50 M	
15.	COOLING TOWER FOR GASIFICATION PLANT	150 M x 75 M	
16.	DM WATER PLANT	130 M x 80 M	
17.	ETP	110 M x 70 M	
18.	HOLDING POND FOR ETP	15000 SQ.M	
19.	NON PLANT BUILDING SUBSTATION	50 M x 30 M	
20.	RAW WATER TREATMENT PLAT	130 M x 100 M	
21.	FIRE WATER STORAGE	100 M x 40 M	
22.	RAW WATER STORAGE	39750 SQ.M	
23.	LOADING BAY	48 M x 15 M	
24.	SOLID SULPHUR & PELLET STORAGE	75 M x 30 M	
25	CENTRAL CONTROL ROOM	120 M x 30 M	
26.	TECHNICAL BUILDING	60 M x 45 M	
27.	SRU PLANT	110 M x 55 M	
28.	SULPHUR STORAGE	80 M x 40 M	
29.	FIRE STATION	50 M x 30 M	
30.	SNG STORAGE	100 M x 80 M	
31	ASH/SLAG STORAGE	21000 SQ.M	
32	STEAM GENERATION PLANT	220 M x 100 M	
33	IA/PA PLANT	60 M x 40 M	
34	BULK DIESEL STORAGE + EDG	60 M x 50 M	
35	COOLING TOWER FOR SNG PLANT	50 M x 75 M	
36	MAIN RECEIVING SUBSTATION	120 M x 40 M	
37	CONSTRUCTION POWER SUBSTATION	25 M x 12 M	
38	OUTDOOR SWITCHYARD	65 M x 65 M	

LEGEND :~

- OFFSITE FACILITIES
- LSTK-1 FACILITIES
- LSTK-2 FACILITIES
- LSTK-3 FACILITIES
- GREEN BELT AREA
- ADDITIONAL LAND AREA (FOR FUTURE ACQUISITION)

TOTAL LAND AREA = 190 ACRE (APPROX.)
TOTAL PLANT AREA = 156 ACRE (APPROX.)
GREENBELT AREA = 34 ACRE (APPROX.)

ADDITIONAL LAND AREA = 60 ACRE (APPROX.)
(FOR FUTURE ACQUISITION)

NOTE :-

1. BLOCK FACILITIES ARE INDICATIVE ONLY. THIS IS PRELIMINARY LAYOUT.

PRELIMINARY LAYOUT FOR DFR PURPOSE

REV.	DATE	DESCRIPTION	PPD.	CKD.	APPD.
P3	01.08.25	UPDATED AND ISSUED	Anil	AM/DR	PK
P2	24.07.25	UPDATED AND ISSUED	Anil	AM/DR	PK
P1	11.03.25	PRELIMINARY ISSUE	AS	AM/DR	PK
P	29.05.24	PRELIMINARY ISSUE	AS	AM	PK

CLIENT : CGIL (JV OF GAIL AND CIL)

REV. P3

SHEET 1 OF 1

LOCATION : INDIA

SCALE :~ 1 : 2500

TITLE : PRELIMINARY LAYOUT OF COAL BASED SNG PLANT CAPACITY : 80,000 NM3/hr. SNG

DRG. No.:~ PC217-0000-0001

FILE :~ PC217-0000-0001_REV P3

DRG. SIZE: A0

PDIL — PROJECTS & DEVELOPMENT INDIA LTD. NOIDA