BASIC ENGINEERING DESIGN DATA

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1. SCOPE

This specification recapitulates the site conditions and defines the basis of the "Basic Design Services – 4 WP's" for the Complex Utilities, Interconnectings and Offsites of the Petrochemical Zone at Bandar Assaluyeh in Iran for the MOBIN PETROCHEMICAL COMPANY.

The scope of the "Basic Design Services – 4 WP's" involves the following four (4) Work Packages (refer to Contract for details) :

- WP-1 : Waste Water Treatment and Incineration
- WP-2 : Utility Complex General Facilities
- WP-3 : Zone Interconnectings and Offsites
- WP-4 : Petrochemical Port Topsides

2. PURPOSE

To provide a set of basic data regarding the site conditions and utilities availability conditions which are necessary for the "Basic Design Services – 4 WP's".

This document applies to all the parties which are involved in the design of the Complex Utilities, Interconnectings and Offsites of the Petrochemical Zone at Bandar Assaluyeh.

This information is provided as a convenient summary for reference purposes. It is based on information and data extracted from various sources. Users of this information are responsible for validating said data. Parameters defined herein are subject to confirmation, validation and revision as and if required by the development of the design.

3. PLANT SITE CONDITIONS

3.1 GEOGRAPHICAL LOCATION

Most of the following data shall be confirmed during Basic Design Services and further Engineering Studies.

3.1.1 LOCATION

The site of Bandar Assaluyeh is located on the Persian Gulf sea shore in the Bushehr province of IRAN.

Refer to Overall Site / Arrangement, Drawing n° 6830Z 090 DW 0060 061.

Utility Centre will be located North West of the area assigned to the Petrochemical Zone and Water Centre will be located South West of the Petrochemical Zone.

Two main corridors (East/West+South/North) are used for the interconnectings.

3.1.2 ANGULAR RELATION BETWEEN PLANT NORTH AND TRUE NORTH

52° 22'

3.1.3 GEOGRAPHICAL REFERENCE SYSTEM

See drawing n° 6830Z 090 DW 0060 061.

Petrochemical zone references are:

- Elevation

EL(MSL)=0.00 m

EL(MSL)= EL(MHHW)=EL(CD)-1.27 m

EL(RL)= EL(CD)+0.03 m = EL(MSL)+1.3 m

EL(LAT)= EL(CD)+0.1 m

with:

MHHW : Mean Higher High Water

LAT : Lowest Astronomical Tide

CD : Chart Datum

MSL : Mean Sea Level

RL : Rassed Level

- Reference Benchmark Coordinates (Benchmark NC 1031)

UTM N : 3,047,265.06

UTM E : 654,152.55

EL(RL) : 31.13 m

3.2 SOIL CONDITIONS

Based on the information applicable to a site located in the vicinity (South Pars 2 & 3 gas refinery), the site may be described as follows :

The sedimentation of this plain is a complex mixture of alluvial deposits on the piedmont, river deposits and alluvial terraces belonging to the quaternary period. Thickness of these deposits are variable and the depth to the bedrock is estimated to be greater than 50 m.

The complex mixture of the alluvial deposits has a gradation consisting of angular to sub-angular gravels with a limestone origin seen in a matrix of silt, and sand. At the foothill on the north of the site there is an abundance of cobbles and boulders that have a limestone and anhydrite origin. These large size materials are sub-rounded to sub-angular and clearly show that they are transported by flood flows.

The ground water is expected to be around the mean sea water level and shall not interfere with the various kinds of works.

Settlements shall be limited to 25 mm maximum.

Characteristics of this soil for design purpose are as follows :

- Apparent angle of internal friction φ = 33 degrees
- Coefficient for apparent cohesion C = 0 Kg/cm²
- Bulk Unit Weight

- Wet γ = 18 kN/m^3
- Dry γ = 17.5 kN/m^3

- ♦ Soil agressivity
  - chloride content is :
    - in soil = between 0.003 and 0.008%
    - in water = about 1160 ppm
  - the sulphate content is :
    - in soil
      - * water soluble sulphate content = from 0.06 to 0.37%
      - * total acid soluble sulphate content = from 0.03 to 0.85%
    - in water = about 1250 ppm
- ♦ Soil permeability

Permeability of soil layers is estimated to be in the order of 0.0005 to 0.0012 cm/sec.

3.3 METEOROLOGICAL DATA

Weather conditions tables for Kangan area during year 1991 - (NIOC)

3.3.1 AIR TEMPERATURE

Month	Air Temperature in Degrees °C									
	Means of							Ground		
	Max °C	Min °C	Mean Daily °C	Highest °C	Date (day)	Lowest °C	Date (day)	Mean °C	Lowest °C	Date (day)
January	17.4	8.2	12.8	23.5	21	2.8	28	6.4	1.0	29
February	17.8	8.0	12.9	23.2	26	2.0	11	5.8	-1.0	11
March	21.9	11.3	16.6	28.5	22	5.6	9	9.6	3.0	9
April	31.2	17.2	24.2	36.0	28	10.5	14	15.1	9.0	14
May	35.1	21.2	28.1	40.0	31	16.0	7	19.4	14.0	7
June	40.0	25.0	32.5	44.4	2	22.0	6	23.2	20.0	6
July	40.1	25.7	32.9	46.0	31	23.0	16	24.1	21.0	16
August	39.6	25.6	32.6	47.0	1	23.0	19	23.9	21.0	31
September	35.6	22.3	29.0	41.0	8	19.0	29	21.0	19.0	29
October	32.6	18.4	25.5	37.0	12	14.0	25	16.9	13.0	26
November	25.8	12.2	19.0	31.5	1	9.0	28	10.1	7.0	28
December	18.1	10.0	14.0	23.0	12	4.0	31	9.5	3.0	23
Year	29.6	17.1	23.3	47.0		2.0		19.4	-1.0	

3.3.2 AIR RELATIVE HUMIDITY AND CLOUD COVER

Month	Mean vapour pressure	Means of relative Humity at hour				Bright Sun Shine (hr)	N° of Obersvation
		03	09	15	Total		
January	11,32	91	62	70	72	***	155
February	10,40	82	52	61	63	174,1	140
March	***	87	50	56	62	220,3	155
April	***	47	27	32	33	250,8	150
May	12,64	39	24	29	29	329,7	155
June	16,16	35	23	31	29	336,2	150
July	22,97	47	36	50	42	332,1	155
August	25,09	53	38	61	49	326,6	154
September	18,21	50	35	43	43	271,1	150
October	11,33	45	21	39	33	276,2	155
November	10,33	62	29	52	45	272,8	150
December	13,08	90	71	82	78	155,7	155
Year	15,15	60	62	50	48	2946	1824

3.3.3 PRECIPITATION

Month	Precipitation in mm			Number of days with :												
				Precipitation												
	Total	Most in a day	Date	Trace	GT 1 mm	GT 10 mm	Total	Rain	Snow	Hail	Dust-storm	Haze	Thunder-storm	Frost	Fog
January	193,0	110,0	14	2	7	2	11	5	0	0	0	14	1	0	2
February	82,4	51,0	28	0	5	1	11	5	0	1	1	17	2	0	0
March	52,6	27,0	7	1	3	2	8	2	0	0	2	16	2	0	1
April	0,2	0,2	10	1	0	0	2	0	0	0	6	8	0	0	0
May	0,0	0,0	**	0	0	0	0	0	0	0	15	8	0	0	0
June	0,0	0,0	**	0	0	0	0	0	0	0	12	12	1	0	0
July	0,0	0,0	**	0	0	0	0	0	0	0	23	6	0	0	0
August	0,0	0,0	**	0	0	0	0	0	0	0	25	1	0	0	0
September	13,0	13,0	28	1	1	1	2	0	0	0	10	5	1	0	0
October	0,0	0,0	**	0	0	0	0	0	0	0	4	10	0	0	0
November	0,0	0,0	**	0	0	0	0	0	0	0	1	7	0	0	0
December	245,0	79,0	7	0	12	7	14	3	0	0	3	3	6	0	4
Year	586,3	110		5	28	13	48	15	0	1	102	107	13	0	7

** Unknown

3.3.4 ATMOSPHERIC PRESSURE

Month	Mean Pressure (millibar)		Mean Temperature °C		
	Station level	Sea level	Dry bulb	Wet bulb	Dew point
January	950.7	***	13.6	10.9	8.2
February	950.6	***	13.9	10.3	6.3
March	***	***	17.7	13.3	***
April	***	***	26.2	16.7	***
May	933.8	1006.2	30.4	18.4	9.4
June	929.1	1000.2	34.8	21.5	13.3
July	926.3	997.3	34.5	24.1	19.1
August	928.1	999.3	33.5	24.6	20.2
September	934.1	1006.5	30.3	20.9	14.8
October	939.4	1013.2	27.0	16.6	8.2
November	942.8	1018.4	20.4	13.4	6.8
December	942.7	1019.6	14.6	12.4	10.5
Year	937.0	1009.6	24.8	16.3	11.7

3.3.5 WIND CONDITIONS

Month	N° Calm	North wind		North East Wind		East Wind		South East Wind		South Wind		South West Wind		West Wind		North West Wind		Wind speed distribution (m/sec)									Fastest Wind			
		Number	Mean of Spead	Number	Mean of speed	Number	Mean of speed	Number	Mean of speed	Number	Mean of speed	Number	Mean of speed	Number	Mean of speed	Number	Mean of speed	01 - 03	04 - 06	07 - 10	11 - 16	17 - 21	22 - 27	28 - 33	34 - 40	40 and more	Direction	Speed	Day	Time
January	89	1	2	15	3	6	3	3	4	27	4	3	4	8	4	3	4	30	36	0	0	0	0	0	0	0	190	7	11	**
February	72	2	4	11	3	16	3	1	2	22	5	1	5	9	4	6	6	31	29	8	0	0	0	0	0	0	190	10	21	**
March	69	2	4	21	3	6	4	4	4	15	5	10	4	16	4	12	6	37	38	11	0	0	0	0	0	0	190	10	29	12
April	59	6	6	7	3	3	4	1	2	19	6	8	4	24	5	23	5	25	53	12	1	0	0	0	0	0	190	12	11	12
May	32	1	7	0	0	0	0	2	2	4	3	12	5	44	5	60	6	18	74	30	1	0	0	0	0	0	290	13	14	9
June	35	2	4	8	4	2	5	3	4	35	6	19	5	15	4	31	6	27	60	28	0	0	0	0	0	0	190	10	21	15
July	62	0	0	4	3	2	4	0	0	69	6	17	5	7	4	4	5	13	50	30	0	0	0	0	0	0	190	10	18	15
August	62	0	0	2	3	2	2	0	0	62	7	20	6	4	4	2	5	10	37	43	2	0	0	0	0	0	190	12	8	15
September	53	0	0	4	4	2	5	2	6	64	7	14	4	6	5	5	7	15	39	42	1	0	0	0	0	0	70	13	27	**
October	69	1	8	12	4	4	3	1	3	38	6	13	5	8	4	9	5	21	49	16	0	0	0	0	0	0	190	10	15	12
November	72	0	0	12	3	4	3	0	0	35	5	14	4	5	5	8	5	25	48	5	0	0	0	0	0	0	260	9	16	**
December	79	2	4	29	4	9	3	1	6	21	5	2	6	8	4	4	3	35	38	3	0	0	0	0	0	0	170	13	14	9

3.3.6 STORM WIND SPEED/DURATION CHARACTERISTICS (SOURCE A.H. GLENN & ASSOCIATES REPORT)

Vicinity 26° 46' 20" N, 52° 05' 59" E : South Pars Gas Field - Persian Gulf = Annual

(Offshore data) Return period years	3 seconds gust (m/s)	15 seconds gust (m/s)	1 minute (m/s)	0.5 Hour (m/s)
1	26.5	24.4	22.7	18.8
10	34.7	32.0	29.7	24.6
100	43.0	39.6	36.7	30.4

Note: maxi speed of all directions at 10 m above ground level.

4. BASIS OF THE ENGINEERING STUDY

4.1 GENERAL

4.1.1 UNITS OF MEASURE

As a general rule, the SI metric system of units shall be used and particularly:

- Pressure (gauge) — bar g
- Pressure (absolute) — bar a
- Temperature — °C
- Mass — kg
- Length — m & mm except the pipes diameter for which "inches" are allowed
- Liquid relative density — sp. gr. T°C/15°C
- Liquid absolute density — kg/m^3 at 15°C
- Vapor flowing density — kg/m^3
- Flow rates
  - Mass — kg/h
  - Vapor — kg/h
  - Liquid — m^3/h
- Normal conditions
  - Vapor — Nm^3 (m^3 at 0°C & 1.013 bar a) or S m^3 vapor (at 15°C & 1.013 bar a)
  - Liquid — Std m^3 (m^3 at 15°C)
- Specific enthalpy — kJ/kg
- Heat rate — MW
- Gross heating value — kJ/kg
  kcal/kg
  kcal/Nm^3
- Low heating value — kJ/kg
  kcal/kg
  kcal/Nm^3
- Viscosity(dynamic) — mPa.s

For complete list of SI-Units refer to ISO 31-0

In addition to the above units, the following units shall be used for material balance purposes :

- Vapor flow rate = MMSCFD Million Standard cubic feet per day (at 15°C & 1.013 bar.a).

  MTPY Metric Ton per year

  tpd Metric ton per day

- Liquid flow rate = SBLPD or SBOPD Standard barrel of liquid, or of oil, per day (at 15°C & 1.013 bar.a.).

  MTPY Metric Ton per year

  tpd Metric ton per day

4.1.2 CODES AND STANDARDS

The applicable codes and standards are listed when required by the application.

4.1.3 SERVICE LIFE

The design service life of the offsite and utility plant is 30 years.

4.1.4 EQUIPMENT DESIGNATION

The main equipment of the plant shall be identified by means of an item number made in the format shown in Project Procedure n°203 "Equipment and lines numbering".

4.2 SEISMIC DESIGN CONDITIONS

The earthquake and loads shall be computed according to Uniform Building Code (UBC) edition 1997 – Chapter 16, Division IV.

The following parameters should be used:

- Horizontal Ground Acceleration = 0.40 g
- Seismic zone Factor = 0.4 (zone 4)
- Seismic importance Factor:

  For a practical approach, the recommendations for ASCE (American Society of Civil Engineers): "Guidelines for seismic evaluation and design of Petrochemical Facilities" may be used. As a general rule, the following can be considered:

  - "essential" category of structures, buildings and equipment (i.e. for which operability is necessary for Emergency operations subsequent to an earthquake, such as fire protection and associated equipment / structures) should be designed with I = 1.25.
  - other categories of structures, buildings and equipment (for which maintaining operability is not essential) should be designed considering an importance factor I = 1.00 (for equipment supporting structures, pipe racks or equipment on isolated foundations, the risk of failure of the structure being low) and I = 1.25 (for equipment containing significant quantity of highly toxic products, or high equipment on structures).

Potential risk should be examined case by case on this bases.

4.3 DESIGN CONDITIONS

4.3.1 AMBIENT AIR TEMPERATURE :

– Maxi dry bulb temperature in summer	=	48 °C
– Mini dry bulb temperature in winter	=	+5 °C
– Maxi temperature reached in the sunshine for black exposed surface	=	85 °C

4.3.2 DESIGN AIR TEMPERATURE FOR PROCESS AIR-COOLERS

Air temperature to be used for process air-cooler design =

– Summer	=	+48 °C
– Winter	=	+37 °C
– Minimum air temperature for fan power design calculation	=	+5 °C

4.3.3 DESIGN AIR CONDITIONS FOR GAS TURBINE, DIESEL ENGINE AND AIR COMPRESSOR

- Summer :

• Temperature	=	48 °C
• Relative humidity	=	65%
• Design barometric pressure at sea level mbar	=	990

- Winter :

• Temperature	=	14 °C
• Relative humidity	=	80%
• Design barometric pressure at sea level mbar	=	1020

4.3.4 DESIGN TEMPERATURE FOR AIR CONDITIONING

– Indoor temperature :

• Maximum (Summer)	=	+25 °C ± 2 °C
• Corresponding relative humidity	=	50% ± 5%
• Minimum (Winter)	=	+22 °C ± 1 °C
• Corresponding relative humidity	=	45% ± 5%

– Outdoor temperature :

- Maximum (Summer) = +44 °C
- Minimum (Winter) = +5 °C

Day/night temperature fluctuation.

- Maximum (Summer) = +15 °C
- Minimum (Winter) = +8 °C

4.3.5 DESIGN AIR TEMPERATURE FOR ELECTRICAL EQUIPMENT.

– Outdoor temperature :

- Maximum = +48 °C
- Minimum (Winterising not required) = +5 °C

– Indoor temperature (as per 10th Cracker Plant Basic data):

- Maximum = +45 °C
- Minimum = +10 °C

4.3.6 SOIL DESIGN TEMPERATURE FOR CABLE SELECTION

+30 °C

4.3.7 DESIGN THERMAL VARIATION (ΔT) FOR STRUCTURAL CALCULATION.

±22 °C

4.3.8 DESIGN RELATIVE HUMIDITY FOR AIR CONDITIONING.

– Outdoor relative humidity

- At maximum temperature (Summer) = 65%
- At minimum temperature (Winter) = 100%

4.3.9 RELATIVE HUMIDITY FOR ELECTRICAL EQUIPMENT DESIGN.

80%

4.3.10 TEMPERATURE FOR MECHANICAL, CIVIL AND STRUCTURAL DESIGN

55 °C

4.3.11 DESIGN VELOCITY AND DIRECTION OF PREVAILING WIND

– Prevailing wind Direction for design purpose =

From North West (for mechanical and civil design purpose shall be considered from all directions)

– Wind velocity at 10m above ground level for =

- Structure calculation

In case of structural design as per UBC 97 the following parameters shall be used :

- basic wind speed 34.7 m/s (at 10m above ground)
- exposure D
- importance factor as per UBC table 16.K

- Flare thermal radiation = 16.0 m/s

– Wind velocity for thermal calculations = 5 m/s

4.3.12 DESIGN FOR RAINFALL VALUES

Data are based on 9th Olefins Cracked gas site data :

Duration	mm.
3 minutes	17
10 minutes	24
1 hour	40
24 hours	70

Rainfall value for sewer design : 40 mm/h

4.3.13 SOLAR RADIATION

– Solar radiation (maximum) = 0.98 kW /m^2. (310 BTU/hr. ft^2)

4.3.14 SOIL FROST LINE

Not applicable

4.3.15 DESIGN BAROMETRIC PRESSURE

Max : 1020 mbar at sea level
Min : 990 mbar at sea level
Reference : 1010 mbar at sea level

4.3.16 OTHER DATA :

- Sea breeze : to be considered (e.g. for electrical and instrument equipment and painting, etc...)
- Sandstorm : to be considered
- Thunder and lightning : to be considered
- Maximum presence of H2S : 10 ppm
  SO2 : 2 ppm

4.4 OCEANOGRAPHIC DESIGN CONDITIONS

4.4.1 SEAWATER TEMPERATURE AT INTAKE.

Maximum 35 °C

4.4.2 TIDAL MOVEMENT

Tide is semi-diurnal with diurnal inequalities along the coast.

Astronomical levels are the following:

Tide condition		Elevation above Chart Datum (m)
Highest Astronomical Tide	HAT	+1.9
Tropic Higher High Water	THHW	+1.5
Mean Higher High Water	MHHW	+1.3
Mean Tide Level	MTL	+0.9
Mean Lower Low Water	MLLW	+0.5
Tropic Lower Low Water	TLLW	+0.3
Indian Spring Low Water	ISLW	0.0 (CD)
Lowest Astronomical Tide	LAT	-0.1

Storm surge is indicated as 0.3m , so corresponding highest water level would be =+ 2.2 m CD.

4.4.3 100 YEAR WAVE DATA (AT WATER DEPTH OF 20 M)

The 100 years design wave condition (at water depth of 20m) is defined by a significant wave height and period of respectively 4.1 m and 9.7 sec.

For more information, please refer to Conceptual Design Studies – Final Report – March 2001, Chapter 7.

4.4.4 CURRENT SPEED AT HARBOUR LOCATION (100 YEAR RETURN PERIOD)

The current speed in spring conditions has a maximum of 1 knot at the surface and is directed northward in flood and southward during ebb.
Strong winds may increase the current near the harbour but it should rarely exceed 2 knots.
Extreme current values have been assessed by others at 1.2 m/s at 1 m below the surface and 0.6 m/s at 1 m above the bottom.

For more information, please refer to Conceptual Design Studies – Final Report – March 2001, Chapter 7.

4.4.5 THICKNESS OF MARINE GROWTH FOR ENVIRONMENTAL LOADING

Data to be confirmed**.**

Elevation with reference to LAT, m	Thickness on radius, m
+2.0	0.075
-6.0	0.075
At sea bed	0.050

Thickness between indicated levels to be estimated by linear interpolation.

4.5 ENVIRONMENTAL SPECIFICATIONS

4.5.1 EMISSIONS TO ATMOSPHERE

4.5.1.1 STACK GAS EMISSION LIMITATION

Limitations applicable to stack gas pollutant emissions are provided in following table (Air and Stack emissions).

Source	Parameter	Limit (1)
Boiler & Furnace (3)	Solid particles	20 mg/Nm^3
	Sulphur Oxide as SO_2	500 mg/Nm^3
	Nitrogen Oxide as NO_2	300 mg/Nm^3 (dry, 3% O_2)
Gas turbine (3)	Solid particles	50 mg/Nm^3
	Sulphur Oxide as SO_2	0.2 tpd/MWe for the first 500 MWe + 0.1 tpd/ MWe for each additional MWe of capacitity over 500 MWe
	Nitrogen Oxide as NO_2	125 mg/Nm^3 (dry, 15% O_2)
Waste Incinerator (2) (4)	Carbon monoxyde	100 ppm
	Nitrogen Oxide as NO_2	300 ppm
	Sulphur Oxide as SO_2	700 ppm
	Hydrocarbon	2000 ppm
	Benzene	5 ppm
	Toluene	35 ppm
	Xylene	30 ppm
	Solid particles	120 mg/Nm^3

(1) Nm^3 refers to a cubic meter at normal temperature (0°C) and pressure (1,013 mbar) under dry conditions

(2) Dry condition, 6% O_2

(3) Data to be updated after placement of Order for Steam and Power Generation Package.

1 (4) Limit for HCl:10mg/Nm^3, HF:5mg/Nm^3, heavy metals:5mg/Nm^3, dioxines (2,3,7,8–TCDD equivalent): 1ng/Nm^3

4.5.2 WATER GUIDELINES CRITERIA

4.5.2.1 LIMIT ON LIQUID EFFLUENTS

Liquid effluent discharge to surface waters must meet the following standards as required in IEOP standards except for COD (60 mg/l) which is lower than for other internationally recognised standards and can't be achieved without expensive tertiary waste water treatment (to be reviewed to basic design phase of waste water treatment plant).

Substance	Limit (mg/l)
Al	5
As	0,1
Ba	5
Be	0,1

Substance	Limit (mg/l)
Ca	75
Cd	0,1
Cl	1
Cl^-	600(1)
CH_20	1
C_6H_5OH	1
CN	0,5
Co	1
Cr VI	0,5
Cr III	2
Cu	1
Fe	
F	2,5
Fc	3
Hg	Under limit
K	
Li	2,5
Mg	100
Mn	1
Mo	0,01
Ni	2
NH_4	2,5
NO_2	10
NO_3	50
Phosphates/ phosphorous	6
Pb	1
Se	1
H_2S	3
SO_3	1
SO_4	400 (1)
V	0,1
Zn	2
Fat	10
detergent (ABS)	1,5
BOD5	30* (50)
COD	150
DO	2
Total dissolved salt	(1)

Substance	Limit (mg/l)
Total suspended solids	40*(90)
pH	6.5 - 8.5
Radio activity	0
Turbidity	50
Color	85
Temperature	(2)
Coliforms indigestive system	400 MPN / 100 ml
Total coliforms	1000 MPN / 100 ml

* The concentration in ( ) is the value accepted for peak

(1) Concentration of SO4, Cl and soluble material < 10 % of increase (compared to the inlet concentration) after 200 m of the discharge point.

(2) The temperature increase of the water must be less than 3°C after 200 m from the discharge point.

4.5.3 NOISE LIMITATIONS

Noise nuisance from machinery and burners is normally specified as "sound pressure level", which for standard design shall not exceed, in work areas, 85 dB(a) at 1m distance from each source.

Maximum allowable noise limit shall not exceed 120 dB(a) for emergency conditions, such as safety/relief valve blow-off.

4.5.4 FLARE RADIATION LIMIT

The flare system design shall be such that the maximum acceptable heat radiation (excluding solar radiation : 0.98 kW/m^2) in case of flaring shall not exceed the values listed in the following table :

MAXIMUM ACCEPTABLE HEAT RADIATION IN CASE OF FLARING

Location	Radiation levels (kW/m^2)
At fences of the remote flare area	4.73
At Complex Offsites Buildings	1.58

4.5.5 SAFETY

1

Refer to fire protection / detection job specification 6830Z 090 JSD 1900 001.

4.6 RAW MATERIALS AND PRODUCTS

Refer to the dedicated Process Basic Data documents, i.e.:

- WP 1.1 Hold doc. Number Hold doc. title
- WP 1.2 6830Z 012 CN 007 001 Incineration Plant Basic Data
- WP 2.0 6830Z 020 CN 007 001 Utility Complex - Basic Data
- WP 3.0 6830Z 030 CN 007 001 Basic Data (IOGF) – Process
  6830Z 030 CN 007 002 Basic Data (IOGF) – Utilities
- WP 4.0 Hold (Document and Data by Others)

4.7 UTILITIES

4.7.1 WATER

4.7.1.1 DISTRIBUTION SYSTEMS

Hereafter the following systems :

- Desalinated water
- Potable water
- Demineralized water
- Service water (Utility water)
- Sea water
- Cooling water

4.7.1.2 OPERATING CONDITIONS AT PRODUCER'S BATTERY LIMIT

System	Temperature (°C)			Pressure (bar g)		
	Min.	Norm.	Maxi.	Min.	Norm.	Maxi.
Desalinated water	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions					
Potable water						
Demineralized water						
Service Water						
Sea water supply						
Sea water return						
Cooling water supply						
Cooling water return						

4.7.1.3 OPERATING CONDITIONS AT USER'S BATTERY LIMIT

System	Temperature C°			Pressure (bar g)		
	Min.	Norm.	Maxi.	Min.	Norm.	Maxi.
Desalinated water	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions					
Potable water						
Demineralized water						
Service Water						
Sea water supply						
Sea water return						
Cooling water supply						
Cooling water return						

4.7.1.4 MECHANICAL DESIGN CONDITIONS

System	Temperature (°C)	Pressure (bar g)
Desalinated water	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions	
Potable water		
Demineralized water		
Service Water		
Sea water supply		
Sea water return		
Cooling water supply		
Cooling water return		

4.7.1.5 WATER ANALYSIS OR SPECIFICATION

	Analysis	Specification			
Quality	Sea water (2)	Desalinated water	Demineralized water	Potable water (1)	Service water (Utility water)
Origin	Pumping station	Desalination units	Demineralization units	Remineralisation and chlorination unit	Waste Water Treatment
Ca^{++}	(g/l) 0.46	(ppm) 0.1			
Mg^{++}	(g/l) 1.53	(ppm) 0.3			
Na^{+}	(g/l) 12.29	(ppm) 3.0			
Fe^{++}	nil	(ppm) 0.15	< 0.02 mg/l		
Ba^{++}	nil				
Cl^{-}	(g/l) 22.65	(ppm) 6.0	< 0.01 mg/l		
SO_4^{--}	(g/l) 3.21				
CO_3H^{-}	(g/l) 0.11				
CO_3^{--}	(g/l) 0.02				
Cu^{++}		< 0.10 ppm	< 0.01 mg/l		
SiO_2			< 0.02 mg/l		
Free Cl_2		(ppm) 0.2		(ppm) 0.1	(ppm) 0.5
Primary salinity	(ppm) 79.02				
Secondary salinity	(ppm) 20.64				
Secondary alkalinity	(ppm) 0.34				
Density at 15°C	(g/cm^3) 1.023				
pH	8.2	6.0 – 7.0	6.5 – 8.5	8.0 – 9.0	6.5 – 8.5
Viscosity (cP)	1.05				
Resistivity at 20°C (ohm-m)	0.18	250-500	10^9		
Total salt content	(g/l) 37.41				
Dissolved oxygen (ppm)	8 - 10	6			
Suspended solids	(g/l) 0.092	Nil		Nil	< 30 mg/l
Total dissolved solids	(g/l) 45.56	(ppm) 10	< 1 mg/l	(ppm)100-150	
BOD5					< 30 mg/l
COD					< 150 mg/l

(1) Specification in accordance with WHO requirements

(2) Analysis estimated to be confirmed by Contractor during further phase.

4.7.2 COMPRESSED AIR

4.7.2.1 DISTRIBUTION SYSTEMS

- Service air
- Instrument air
- Nitrogen
- Oxygen

4.7.2.2 OPERATING CONDITIONS AT PRODUCER'S BATTERY LIMIT

System	Temperature (°C)			Pressure (bar g)		
	Mini.	Normal	Maxi.	Mini.	Normal	Maxi.
Service air	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions					
Instrument air						
Nitrogen						
Oxygen						

4.7.2.3 OPERATING CONDITIONS AT USER BATTERY LIMIT.

System	Temperature (°C)			Pressure (bar g)		
	Mini.	Normal	Maxi.	Mini.	Normal	Maxi.
Service air	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions					
Instrument air						
Nitrogen						
Oxygen						

4.7.2.4 MECHANICAL DESIGN CONDITIONS

System	Temperature (°C)	Pressure (bar g)
Service air	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions	
Instrument air		
Nitrogen		
Oxygen		

4.7.2.5 OTHER CHARACTERISTICS

a) Service air

Service air is not dried.

b) Instrument air

- Dew point at operating pressure : -40°C @ atmosphere.
- Oil content : nil
- Maxi. particle size : 5 μ

c) Nitrogen

- Purity : 99.9 % vol

d) Oxygen

- Purity : O2 : 99.8 % vol
  Argon : 0.195 % vol
  Nitrogen : 0.005 % vol

4.7.3 STEAM

1 The steam is produced in the combined heat and power plant by six heat recovery steam generators (330 tons/h max capacity each) and two auxiliary steam boilers (75 tons/h capacity each)

4.7.3.1 OPERATING CONDITIONS AT PRODUCER'S BATTERY LIMIT

System	Temperature (°C)			Pressure (bar g)		
	Mini.	Normal	Maxi.	Mini.	Normal	Maxi.
High pressure steam	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions					
Boiler Feed Water						
Steam condensate return						

4.7.3.2 OPERATING CONDITIONS AT USER BATTERY LIMIT.

System	Temperature (°C)			Pressure (bar g)		
	Mini.	Normal	Maxi.	Mini.	Normal	Maxi.
High pressure steam	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions					
Boiler Feed Water						
Steam condensate return						

4.7.3.3 MECHANICAL DESIGN CONDITIONS

System	Temperature (°C)	Pressure (bar g)
High pressure steam	Refer to document 6830Z 90 CN 0007 002 : Utilities Conditions	
Boiler Feed Water		
Steam condensate return		

4.7.3.4 OTHER CARACTERISTICS

1 Steam quality is not available from Heat and Power Plant.

4.7.4 NATURAL AND TREATED GAS

Sources are :

1

- Rich gas from South Pars 1,2,3
- Lean gas from Ethane Recovery Complex
- Gas from IGAT3 pipeline

4.7.4.1 OPERATING CONDITIONS AT USER BATTERY LIMIT.

System	Temperature (°C)			Pressure (bar g)		
	Mini.	Normal	Maxi.	Mini.	Normal	Maxi.
Lean gas from Ethane Recovery Plant	-	40	40	59.9	64.2	64.2
Rich gas from South Pars Phase 1	32.2	35.5	37.2	53.9	58.2	61.2
Rich gas from South Pars Phases 2,3	32.2	35.5	37.2	53.9	58.2	61.2
Gas from IGAT3 to 4th Methanol and Ammonia/Urea Complex	(1)	(1)	(1)	(1)	54(2)	(1)
Gas from IGAT3 to gas turbines and boilers in heat and power plant	(1)	(1)	(1)	(1)	28(2)	(1)

1

(1) Data on hold

4.7.4.2 MECHANICAL DESIGN CONDITIONS

System	Temperature (°C)	Pressure (bar g)
Lean gas from Ethane Recovery Plant	75	74
Rich gas from South Pars Phase 1	55	68
Rich gas from South Pars Phases 2,3	55	68
Gas from IGAT3 to 4th Methanol and Ammonia / Urea Complex	75(1)	70(1)
Gas from IGAT3 to Heat and Power Plant	(1)	(1)

1

(1) Data assumed to be confirmed

4.7.4.3 COMPOSITION

Compositions are the following :

Data in mole %	Rich gas from Phase 1	Rich gas from Phases 2, 3	Lean gas from Ethane Recovery Unit	Gas from IGAT3
C1	86.287	87.000	95.437	(1)
C2	5.467	5.560	0.341	(1)
C3	2.181	2.050	0.002	(1)
IC4	0.387	0.375	0.000	(1)
NC4	0.525	0.553	0.000	(1)
IC5	0.115	0.007	0.000	(1)
NC5	0.090	0.002	0.000	(1)
MC5	0.002	0.000	0.000	(1)
C6	0.029	0.001	0.000	(1)
C7	0.005	0.019	0.000	(1)
C8	0.000	0.007	0.000	(1)
C9	0.000	0.001	0.000	(1)
CH	0.002	0.000	0.000	(1)
MCH	0.002	0.000	0.000	(1)
N2	3.580	3.553	3.758	(1)
CO2	1.327	0.868	0.462	(1)
COS	0.000	0.001	0.000	(1)
H2O	0.000	0.003	0.000	(1)
BENZENE	0.001	0.000	0.000	(1)
				(1)
TOTAL	100.000	100.000	100.00	(1)
				(1)
Molecular weight	18.75	18.49	16.77	(1)
Sulfur (wt ppm)	0.000	0.000	4	(1)

(1) Composition is not known

1

4.7.5 DIESEL OIL

Fuel oil is used as back-up fuel for gas turbines and boilers when necessary (start-up, emergency situation, fuelgas cutout).

Quality required is Diesel commercial quality.

Lower Heating Value (LHV) : 10040 Kcal//kg
Density@15°C: 860 kg/m3

4.7.6 HYDROGEN

4.7.6.1 COMPOSITION

Hydrogen available from Production Plants have the following composition:

	H2 from 4th aromatics % vol	H2 from 9th olefins % vol	H2 from 10th olefins % vol
Hydrogen	91.5	99.99	99.99
Methane	2.97	-	-
Ethane	2.83	-	-
Propane	1.65	-	-
Butanes	0.687	-	-
Pentanes	0.183	-	-
C6 normal	0.08	-	-
C6 naphtenes	0.005	-	-
Benzene	0.03	-	-
C7 normal	0.02	-	-
Toluene	0.02	-	-
EthylBz+styrene	0.01	-	-
Xylenes	0.01	-	-
C9 aromatics	0.005	-	-
CO+CO2	-	1 ppm vol max	1 ppm vol max
Ethylene	-	-	1 ppm vol max
CH4+N2	-	20 ppm vol max	0.01 max
H2O	-	0.5 ppm vol max	-
Total	100	100	100

4.7.6.2 OPERATING CONDITIONS AT PRODUCER'S BATTERY LIMIT

System	Temperature (°C)			Pressure (bar g)		
	Mini.	Normal	Maxi.	Mini.	Normal	Maxi.
Hydrogen from 4th aromatics	-	38	-	-	18	-
Hydrogen from 9th olefins	-	-41	-	31.4	28.9	28.9
Hydrogen from 10th olefins	-	Ambient	-	-	33	-

4.7.6.3 OPERATING CONDITIONS AT USER BATTERY LIMIT.

1 To be defined later as user for hydrogen is not finalised.

4.7.6.4 MECHANICAL DESIGN CONDITIONS

System	Temperature (°C)	Pressure (bar g)
Hydrogen from 4th aromatics	85	23.6
Hydrogen from 9th olefins	30	36.6
Hydrogen from 10th olefins	60	38.1

1

4.7.7 ELECTRICITY

Electricity is produced by six gas turbine generators.

1 The gas turbine generators are GE frame PG 9171 E having an iso output of about 123.4 MW.

For the power distribution basic design, refer to 6830Z 90 JSD 1600 001

4.8 EQUIPMENT AND PIPING DESIGN

Refer to document Process Sizing Criteria 6830Z 90 CN 0007 003.