I

ANNEXURE

SITE, ENVIRONMENT & UTILITY DESIGN DATA

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1 SITE & ENVIRONMENTAL DESIGN DATA

The Site, Environmental & Utility Design Data of Jhal Magsi, Balochistan, obtained from Pakistan Meteorological Department, web site data for the UCH Power plant and nearby field.

1.1 Temperature

Average maximum dry bulb temperature:	127 ^{o}F
Design maximum dry bulb temperature:	**131 ^{o}F**
Average minimum dry bulb temperature:	47.5 ^{o}F
Design minimum dry bulb temperature:	**30 ^{o}F**
Design wet bulb temperature:	**86 ^{o}F**

1.2 Humidity

Relative Humidity range:	18 - 89%
Average Relative Humidity for monsoon months:	59 - 87%

1.3 Pressure

Minimum barometric pressure:	14.3 psia
Maximum barometric pressure:	14.7 psia

1.4 Rainfall

Heaviest rainfall in one day:	251.5 mm
Design rainfall:	**260 mm**

1.5 Wind Data

Average wind velocity:	0.115-6.8 mph
Design wind velocity for structural design:	**120 mph**

Prevailing wind direction:

Summer:	South-West
Winter:	Northerly

1.6 Seismic Design

Seismic design factor:	0.03 – 0.15 g
Earthquake zone	Zone 2 (uniform building code)
Earthquake magnitude	5.0 – 5.9

1.7 Site Conditions

Site elevation:	180 ft (AMSL)
Site location:	Approx. 400 km from Quetta, Balochistan, Pakistan.

2 UTILITY INFORMATION

Standard utility conditions are presented below; however, these will be confirmed during detailed process design.

2.1 Fuel Gas

Supply header pressure: 80-85 psig
Supply header temperature: 65 ^{o}F (+/- 10 deg F)

Table-1: Raw Gas Composition (mol %)*

Methane	88.98
Ethane	0.86
Propane	0.22
i-Butane	0.03
n-Butane	0.06
i-Pentane	0.01
n-Pentane	0.00
n-Hexane	0.12
Nitrogen	7.27
Carbon dioxide	2.20
Hydrogen sulfide (ppm)	1000
Water (lb/mmscf)	64.5
Gross Heating Value (Btu/scf)	933

Table-2: Fuel Gas Composition (mol %)*

Methane	89.80
Ethane	0.87
Propane	0.23
i-Butane	0.04
n-Butane	0.06
i-Pentane	0.01
n-Pentane	0.00
n-Hexane	0.12
Nitrogen	7.34
Carbon dioxide	1.53
Hydrogen sulfide (ppm)	4.0
Water (lb/mmscf)	7.0
Gross Heating Value (Btu/scf)	938-950

* Fuel gas to be provided from Sales gas header after startup.

2.2 Power Supply

220V / 1 Phase / 50 hz / AC
400V / 3 Phase / 50 hz / AC

2.3 Instrument Air

Instrument air maximum pressure:	145 psig
Instrument air normal pressure:	135 psig
Instrument air minimum pressure:	70 psig
Dew point:	-40 ^{o}F

2.4 Nitrogen

Nitrogen will be available from nitrogen generation package that will extract nitrogen from air.

Nitrogen purity:	99.5 vol%
Minimum supply pressure:	90 psig
Nitrogen Dew point	-84 ^{o}F

2.5 Hot Oil System

Hot Oil supply header pressure:	80 Psig
Hot Oil supply temperature:	350 ^{o}F
Hot Oil Return temperature:	250 ^{o}F

II

ANNEXURE

National Environmental & Quality Standards (NEQS)

REGISTERED No. M-302
L. 7646

The Gazette of Pakistan

EXTRAORDINARY
PUBLISHED BY AUTHORITY

ISLAMABD, THURSDAY, AUGUST 10, 2000

PART-II

Statutory Notification (S.R.O)

GOVERNMENT OF PAKISTAN

MINISTRY OF ENVIRONMENT, LOCAL GOVERNMENT AND
RURAL DEVELOPMENT

NOTIFICATION

Islamabad, the 8th August 2000

S.R.O. 549 (I)/2000.___ In exercise of the powers conferred under clause (c) of sub-section (1) of section of 6 of the Pakistan environmental Protection Act. 1997 (XXXIV of 1997), the Pakistan Environmental Protection Agency, with the prior approval of the Pakistan Environmental Protection Council, is pleased to direct that the following further amendments shall be made in its Notification No. S.R.O. 742(I)/93, dated the 24th August, 1993, namely: ___

In the aforesaid Notification, in paragraph 2._____

[4138(2000)/Ex.GAZ]

Price : Rs. 5.00

(1) for Annex, I the following shall be substituted, namely:_____

Annex-I

"NATIONAL ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/I, UNLESS OTHERWISE DEFINED)

S. No.	Parameter	Existing Standards	Revised Standards Into Inland Waters	Into Sewage Treatment (5)	Into Sea ( )
1	2	3	4	5	6
1.	Temperature or Temperature Increase *	40^0C	δ3ºC	δ3ºC	δ3ºC
2.	pH value (H^+) .	6-10	6-9	6-9	6-9
3.	Biochemical Oxygen Demand $(BOD)_5$ at 20^0C (1)	80	80	250	80**
4.	Chemical Oxygen Demand (COD) (1) .. .	150	150	400	400
5.	Total Suspended Solids (TSS) .. .	150	200	400	200
6.	Total Dissolved Solids (TDS)	3500	3500	3500	3500
7.	Oil and Grease	10	10	10	10
8.	Phenolic compounds (as phenol)	0.1	0.1	0.3	0.3
9.	Chloride (as $C1^-$)	1000	1000	1000	SC***
10.	Fluoride (as F^-)	20	10	10	10
11.	Cyanide (as CN^-) total ..	2	1.0	1.0	1.0
12.	An-ionic detergents (as MBAS) (2)	20	20	20	20
13.	Sulphate (SO_{42-})	600	600	1000	SC***
14.	Sulphide (S^{2-})	1.0	1.0	1.0	1.0
15.	Ammonia (NH_3)	40	40	40	40
16.	Pesticides (3)	0.15	0.15	0.15	0.15

1	2	3	4	5	6
17.	Cadmium [4] .. .	0.1	0.1	0.1	0.1
18.	Chromium (trivalent and hexavalent [4] .. .	1.0	1.0	1.0	1.0
19.	Cooper [4] .. .	1.0	1.0	1.0	1.0
20.	Lead [4] .. .	0.5	0.5	0.5	0.5
21.	Mercury [4] .. .	0.01	0.01	0.01	0.01
22.	Selenium [4]	0.5	0.5	0.5	0.5
23.	Nickel [4] .. .	1.0	1.0	1.0	1.0
24.	Silver [4]	1.0	1.0	1.0	1.0
25.	Total toxic metals .. .	2.0	2.0	2.0	2.0
26.	Zinc .. .	5.0	5.0	5.0	5.0
27.	Arsenic [4] .. .	1.0	1.0	1.0	1.0
28.	Barium [4] .. .	1.5	1.5	1.5	1.5
29.	Iron .. .	2.0	8.0	8.0	8.0
30.	Manganese .. .	1.5	1.5	1.5	1.5
31.	Boron [4] .. .	6.0	6.0	6.0	6.0
32.	Chlorine .. .	1.0	1.0	1.0	1.0

Explanations:

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract Progressively stringent standards to be determined by the Federal Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic Meter of treated effluent, the recipient water body should have 10 cubic meter of Water for dilution of this effluent.

2. Methylene Blue Active Substances; assuming surfactant as biodegradable.

3. Pesticides include herbicides, fungicides, and insecticides.

4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.

5. Applicable only when and where sewage treatment is operational and BOD_5=80mg/I is achieved by the sewage treatment system.

6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

* The effluent should not result in temperature increase of more than 3^0C at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.

** The value for industry is 200 mg/I

Discharge concentration at or below sea concentration (SC).

Note:_____ 1. Dilution of liquid effluents to bring them to the NEQS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.

2. The concentration of pollutants in water being used will be substracted from the effluent for calculating the NEQS limits" and

(2) for Annex-II the following shall be substituted, namely:____

Annex-II

"NATIONAL ENVIRONMENTAL QUALITY STANDARDS FOR INDUSTRIAL GASEOUS EMISSION (mg/Nm^3, UNLESS OTHERWISE DEFINED)."

S. No.	Parameter	Source of Emission	Existing Standards	Revised Standards
1	2	3	4	5
1.	Smoke	Smoke opacity not to exceed	40% or 2 Ringlemann Scale	40% or 2 Ringlemann Scale or equivalent smoke number
2.	Particulate malter	(a) Boilers and Furnaces		
	(1)	(i) Oil fired	300	300
		(ii) Coal fired	500	500
		(iii) Cement Kilns	200	300
		(b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas.	500	500
3.	Hydrogen Chloride	Any	400	400

1	2	3	4	5
4.	Chlorine	Any	150	150
5.	Hydrogen Fluoride	Any	150	150
6.	Hydrogen Sulphide	Any	10	10
7.	Sulphur Oxides (2) (3)	Sulfuric acid/Sulphonic acid plants		
		Other Plants except power Plants operating on oil and coal	400	1700
8.	Carbon Monoxide	Any	800	800
9.	Lead	Any	50	50
10.	Mercury	Any	10	10
11.	Cadmium	Any	20	20
12.	Arsenic	Any	20	20
13.	Copper	Any	50	50
14.	Antimony	Any	20	20
15.	Zinc	Any	200	200
16.	Oxides of Nitrogen	Nitric acid manufacturing unit.	400	3000
	(3)	Other plants except power plants operating on oil or coal:		
		Gas fired	400	400
		Oil fired	-	600
		Coal fired	-	1200

Explanations:-

1. Based on the assumption that the size of the particulate is 10 micron or more.

2. Based on 1 percent Sulphur content in fuel oil. Higher content of Sulphur will case standards to be pro-rated.

3. In respect of emissions of Sulphur dioxide and Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to National Environmental Quality Standards (NEQS) specified above, comply with the following standards:-

A. **Sulphur Dioxide**

Sulphur Dioxide Background levels Micro-gram per cubic meter (ug/m^3) Standards.

Background Air Quality (SO_2 Basis)	Annual Average	Max. 24-hours Interval	Criterion I Max. SO_2 Emission (Tons per Day Per Plant)	Criterion II Max. Allowable ground level increment to ambient (ug/m^3) (One year Average)
Unpolluted	<50	<200	500	50
Moderately Polluted*				
Low	50	200	500	50
High	100	400	100	10
Very Polluted**	>100	>400	100	10

* For intermediate values between 50 and 100 ug/m^3 linear interpolations should be used. ** No projects with Sulphur dioxide emissions will be recommended.

B. Nitrogen Oxide

Ambient air concentrations of Nitrogen oxides, expressed as NO_x should not be exceed the following:-

Annual Arithmetic Mean	100ug/m^3 (0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere, should be maintained as follows:-

For fuel fired steam generators as Nanogram (10^0-gram) per joule of heat input:

Liquid fossil fuel	130
Solid fossil fuel ..	300
Lignite fossil fuel	260

Note:- Dilution of gaseous emissions to bring them to the NEQS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

[File No. 14(3)/98-TO-PEPC.]

HAFIZ ABDULAH AWAN
DEPUTY SECRETARY (ADMN)

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OIL & GAS DEVELOPMENT COMPANY LIMITED

Job No.: 14-0102
Spec. No.: 0102-GS-9523
Sheets: 23

JHAL MAGSI GAS FIELD
DEVELOPMENT PROJECT

SPECIFICATION FOR PAINTING & PROTECTIVE COATING

0	Issued for Bidding	Mar,16, 12	IN	MSL	TH	MHQ	MZW
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ENAR Petrotech Services (Pvt.) Limited

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1.0 INTRODUCTION

1.1 General

This specification covers Company's requirements for the surface preparation, selection of material, and material application procedures for Protective Coating systems to be used on steel structures, equipment and production facilities for the Jhal Magsi Gas Field Development Project during fabrication, construction and/or operation.

1.2 Terminology

Company	Oil and Gas Development Company Limited
Company Representative	A Company designated Engineer, Party/Parties duly authorized by the company to act on behalf of the company with whom the Supplier shall consult at all reasonable times and whose instructions, request and decision shall be binding on Supplier.
Supplier	Entity with whom the Company will execute a Contract for supply of equipment/material as per this document
Project	Jhal Magsi Gas Field Development Project

2.0 CODES AND STANDARDS

2.1 Codes, Standards and Regulations

The surface preparation and coatings shall be in accordance with this specification, the latest editions of the following Codes and Standards and Statutory Regulations (where applicable):

"Steel Structures Painting Manual Vol. 1" "Good Painting Practice".	Steel Structures Painting Council 4440 Fifth Avenue Pittsburgh, PA 15212, U.S.A.
"Steel Structures Painting Manual Vol. 2 "Systems and Specifications".	Steel Structures Painting Council 4440 Fifth Avenue Pittsburgh, PA 15212, U.S.A.
"Swedish Standard S.I.-05.5900" "Pictorial Surface Preparation Standards for Painting Steel Surfaces".	Swedish Stds. Inst. Box 3295 S-10366 Stockholm 3, Sweden
"Echelle European de Degres D'Enrouillement pour Peintures Antirouille" ("European Scale of Rusting for Anti Corrosive Paint Paints").	European Committee of Paint and Printing Ink manufacturers Association obtainable from: Manufacturers Assn. of Great Britain, Alembic House, Albert Embankment, London
A.S.T.M. A123 "Zinc (Hot Galvanized) Coatings on Products from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip".	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103 U.S.A.

2.2 Order of Precedence

In case of conflict between this specification and its associated specifications and the above codes and standards, the Application Supplier shall bring the matter to the Company's attention for resolution and approval in writing. In all cases the most stringent requirement shall apply.

Should any conflict occur as a result of applying paint manufacturers data sheets and specifications, the order of precedence shall be as follows:

- Data Sheets
- This Specification
- Other reference Project Specifications
- Codes and Standards referred to within this specification and its attachments.

3.0 SCOPE OF SUPPLY

3.1 General

The overall scope of supply for the preparation and painting shall be as indicated within this specification.

3.2 Scope of Supply

The application Supplier appointed to carry out surface preparation and painting shall provide the following as a minimum:

- Supply of all labor sufficient to complete the work
- Supply of all equipment, special tools and power
- Supply of suitable grit/sand
- Supply of all coating materials
- Responsibility for safe storage of consumable materials ambient conditions during operations
- Inspection and testing in accordance with this specification and its attachments
- All documentation as required by this specification and its attachments.

4.0 ENVIRONMENTAL DESIGN CRITERIA

4.1 General

Unless otherwise stated on the data sheets, all equipments and structures will be located in an open exposed area.

4.2 Site Environmental Data

Environmental conditions for all equipments and structures covered by this specification will be listed in the Project Specification on Site Data and Utilities Spec. No. 0102-A-1005.

5.0 APPLICATION PROCEDURE

5.1 General

5.1.1 Supplier's Representative/Guarantee

The Application Supplier shall arrange for the services of a technical representative of the selected coating manufacturer to visit the worksite before the beginning of cleaning and coating operations to advise the Application Suppliers personnel regarding proper equipment, surface preparation and coating procedures. The technical representative shall thereafter make periodic visits to assist the Application Supplier in applying and curing the products and systems at the recommended dry film thickness.

Coating manufacturer and Application Supplier shall give a joint 5 year guarantee as follows:

All coatings will be 'sound' and giving a degree of paint protection efficiency' similar to scale 8 of the European Scale of Degree of Rusting for Anti Corrosive Paints" - for a period of five years.

The guarantee period will start from the provisional acceptance of the completed work.

5.1.2 Inspection

The Company's representatives and the Paint manufacturer's representative shall have access to the Application Suppliers worksites at all times during blasting and coating application and shall be permitted to inspect the work at will. Both representatives shall be given at least two days' notice prior to initial starting of any work covered by the specification. The Company's representatives shall have the authority to reject any work that does not conform to the specification.

5.1.3 Supplier's Personnel

The Application Supplier shall select only competent and fully skilled personnel and shall keep an experienced foreman on the job at all times when work is in progress.

5.2 Surface Application - General

5.2.1 Cleaning

All steel surfaces to be coated shall be cleaned by abrasive blasting.

Blasting abrasives shall be dry, clean and free from contaminations.

Preliminary blasting may be done at night with the prior consent of the Company's representatives provided that all surfaces so blasted shall again be blasted to within the specified tolerances before any coating materials are applied.

Final blast cleaning shall be permitted only during daylight hours and in the presence of the Company’s representative.

All blast cleaned surfaces shall be coated with the specific primer within four hours after blasting, prior to sundown on the same day before rusting occurs. All dust and abrasive particles shall be thoroughly removed from surfaces before the application of any coating. A minimum of 50mm around the edges of blast cleaned surfaces shall be left uncoated unless joining a coated surface. No acid washes or other cleaning solutions or solvents shall be used on metal surfaces after they are blasted. This includes inhibitive washes intended to prevent rusting.

Blast cleaning shall not be done on surfaces that are moist or that may become moist before the application primer.

All N.D.T. of components and surfaces to be coated must be ascertained to have been completed prior to preparation and coating. Any steel not primed on the same day as it was blasted or any steel wet by rain or moisture shall be reblasted.

No blasting shall be permitted when metal surface temperatures are less than 3°C above the dew point, or when the relative humidity of the air is greater than 80%. Temperatures and humidity shall be recorded twice a day.

Blast cleaning shall not be done in proximity to surface coating operations or near other surfaces susceptible to dust and particle contamination.

Any portion of the fabrication to be blast cleaned, including the drilling of bolt holes, shall be complete and in final condition before blasting is started, unless otherwise authorized by the Company. All welded areas shall be given special attention for removal of weld flux slag, weld metal spatter, weld heat oxides, weld flux fumes, slivers and other foreign objects before blasting. Any oil or grease contamination shall be removed by solvent cleaning and the area re-blasted. Blasting shall continue a minimum of 20mm into adjacent coated surfaces.

5.3 Blast Cleaning Requirements

5.3.1 As a minimum, all cleaning shall be to a NEAR-WHITE-BLAST CLEANING in accordance with and as illustrated by Swedish Standard SIS 05 5900 Grade SA 2½.

A Near-White-Blast Cleaned Surface Finish is defined as 'one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint and other foreign matter have been completely removed from the, surface except for the very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or slight residues of paint or coating that may remain. At least 95 per cent of each 5 sq. cm. of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above".

Size of abrasive particles shall be such that anchor profile achieved is a maximum of 50 microns unless otherwise approved by Company. The abrasive selected for use, which will be angular in nature, shall be in accordance with the recommendations of the coating manufacturer. The anchor profile shall be measured and recorded or replicated with: -

- The "Testex Press-O-Film" system or equivalent
- The "Rugotest LCA-CFA No. 3" or equivalent

Sand blasting equipment is to be inspected in respect of discharge rate and pressure, hose sizes and air drying.

Sand/grit is to be stored under cover and shall be "DRY" for feeding into the spray hopper.

After blasting, all grit/sand shall be removed by dry air blowing or vacuum.

5.4 Coating

5.4.1 Supply of Materials

All coating materials and thinners shall be furnished by the Application Supplier in original, unopened containers bearing the manufacturer' label and instructions. For materials having a limited shelf life, the date of manufacture and the length of life shall be shown.

5.4.2 Preparation of Materials

All coating materials shall be stirred in a pot with a power mixer before use to, thoroughly remix the pigments and thinners. Only thinners specified by the coating manufacturer shall be used. Mixing and thinning directions as furnished by the coating manufacturer shall be followed.

5.4.3 Use of Materials

If the coating material requires the addition of a catalyst, the pot life under application conditions shall be clearly stated on the container label and this pot life shall not be exceeded. When the pot life limit is reached, the spray pot shall be emptied, remaining material discarded, the equipment cleaned and new material catalyzed.

Coating materials which have livered, gelled or otherwise deteriorated during storage shall not be used. Thixotropic materials which may be stirred to obtain normal consistency are not subject to this restriction.

Depending upon location, the Application Supplier shall employ the suitable system as listed in this Specification.

Coating systems shall be supplied by one manufacturer who shall assure the Application Supplier that the various components of the coating system are compatible.

5.5 Coating Application

5.5.1 Surface Defects

All surface defects including cracks, surface laminations and deep pitting, likely to be detrimental to the protective painting system shall be removed in accordance with the relevant equipment, vessel, piping or structural code or specification covering surface defects. All fins at saw cuts, barbs and sharp edges shall be similarly removed. Where extensive grinding has been necessary, the dressed areas shall be reblasted to remove all rust and provide an adequate paint key.

5.5.2 Weather

No coating shall be applied during fog, mist, rain, frost, or when the metal surface temperatures are less than 3°C above the air dew point or when the relative humidity of the air is greater than 85% (95% for application of inorganic zinc silicate paints). The Company or his representative may suspend application of coating when, in their opinion, damage to the coating may result from actual or impending weather conditions.

5.5.3 Coating

Each coat shall be applied uniformly over the entire surface. Skips, runs, sags and drips shall be avoided. When these occur they shall be brushed out immediately or the material shall be removed and the surface recoated. On beams and irregular surfaces, edges shall be coated first and an extra pass made later.

Each coat shall be allowed to dry for the time specified by the coating manufacturer. Paint rollers shall not be used.

5.5.4 Film Thickness

Specified film thickness for coating materials shall be strictly observed. Film thickness shall be checked with appropriate film thickness gauges furnished by the Application Supplier. The Application Supplier shall calibrate gauges for the thickness range to be checked, over the type of surface to be coated. When dry film thicknesses are less than those specified, additional coats shall be applied as required at no additional cost to the Company.

5.5.5 Integrity of Coating

Coating shall be free from pin holes, voids, bubbles and other discontinuities. Any such defects shall be repaired at the Application Supplier's expense. Prior to the application of a coating, any damage to the previous coating shall be repaired with the specified material. Upon completion, any damage of fault to the coating system shall be repaired to the satisfaction of the Company at no additional cost.

5.5.6 Contaminations

Precautions shall be taken to prevent the deposition of dust, moisture or other foreign matters on the surface after coating. Any coated surface that becomes contaminated with dirt etc. shall be air blasted or washed down and allowed to dry. If the contamination still exists the affected surfaces shall be reblasted.

5.5.7 Spray Application

The Company reserves the right to inspect all equipment for spray application prior to commencement of spraying. Spray guns, lines and pressure pots shall be clean before adding new material. An adequate moisture trap shall be installed between the air supply and each pressure pot. Suitable pressure regulators and gauges shall be provided for both the air supply to the pressure pot and the air supply to the spray gun. Spray equipment and operating pressure shall comply with the recommendations of the coating manufacturer.

The length of the material hose between pressure pot and spray gun shall not exceed 15 meters. Pressure pot, material hose and spray gun shall all be kept at as nearly the same elevation as possible. The spray gun shall be held at right angles to the surface and each pass shall overlap the previous pass by 50%.

Large surfaces shall receive two passes (except when applying solvent based inorganic zinc) at right angles to each other (crosshatched). Spray shall be applied in a heavy, wet coat. Coating materials containing heavy or metallic pigments that have a tendency to settle shall be kept in suspension in the pressure pot by a power driven, continuous agitator. Other coating materials shall be agitated as frequently as work-ability requires.

The Application Supplier shall follow the paint manufacturer's recommendations in his selection and use of paint spray equipment, and any specific instructions for application.

5.5.8 Brush Application

When coatings are to be applied by brushing, brushes shall be of a style and quality that will permit proper application of material. Round or oval brushes are generally most suitable for bolts, irregular surfaces and rough or pitted steel. Flat brushes are suitable for flat area. Flat brushes shall not be more than 100mm wide. No extending handles shall be used on brushes. Brushing shall be done so that a smooth coat, as nearly uniform in thickness as possible, is obtained. There shall be no detrimental brush marks. Paint shall be worked into all corners and crevices. When applying solvent type coatings, care shall be taken to prevent lifting of previous coats.

Adhesion tests shall be made at the discretion of the Supplier or his representative.

5.6 Protection

The Application Supplier shall protect buildings, structures and equipment from droppings and spray, and shall be solely responsible for all damage to other equipment and facilities as a result of coating operations.

5.7 Field Welds

No coating shall be placed on edges or surfaces prepared for field welds or within 50mm of these areas.

5.8 Bolt Holes

Care should be taken to ensure that bolt holes receive the required coatings.

6.0 GALVANISING

6.1 General

All grating, and other items so specified dipped on the Project Drawings, shall be hot-dipped galvanized in accordance with ASTM A.123.

6.2 Repair of Galvanized Surfaces

All galvanized surface that require welding, cutting, drilling or other preparation and any galvanized surface that has been damaged shall be repaired with the specified coating repair system.

Before application of repair coating, surface shall be washed with fresh water; rust and other deposits shall be removed by power sanding and the area thoroughly cleaned with solvent and / or grease removing agent. Coating material shall be applied immediately after completion of surface preparation.

7.0 PREPARATION OF NON FERROUS SURFACES

7.1 General

Prior to applying coating material, surfaces shall be degreased using an emulsifying agent and then washed thoroughly in fresh water and allowed to dry. All surfaces shall be given a 'sweet blast' immediately before coating.

7.2 Stainless Steel Parts

Stainless steel parts shall not be painted.

8.0 SURFACES NOT TO BE COATED

Equipment and component drawings will indicate areas that do not require coatings, which will generally include:

- Flanged faces
- Tapped holes
- Machined parts
- Stainless steel parts
- Plastic or PVC based materials
- Cupro-nickel parts

Grit or sand blasting is NOT to be carried out local to:

- Machined surfaces
- Running bushes or bearings
- Instrument glasses
- Cables
- Or any other items of equipment that will incur damage without adequate covering or protection

All openings in mechanical equipment and process piping are to be adequately plugged or covered prior to blasting to prevent the ingress of sand or grit.

Any coatings, drips, runs or streaks that go accidentally onto the above listed surfaces, are to be removed without the use of power tools.

All tapped holes are to be re-tapped after painting of equipment.

Name plates and "Tag" identifications shall not be painted so obliterating markings thereon.

Prefabricated parts that require welding shall not be painted local to the weld preparation.

A strip 50mm wide from the weld bevel is to be left unpainted.

9.0 DEVIATIONS

"Small" items of proprietary equipment can be supplied with a preparation and protective coating system and finish to the equipment Vendors "own standard"; provided that the Vendor confirms to the Company or his representative, in writing, that the Vendor's "own standard" is "as good as" or "better than" the preparation and finish as required by this Specification inclusive of the "five year" guarantee specified in Para. 5.1.1. of this specification.

Upon request, the Vendor will be supplied with details of climatic and environmental conditions applicable.

Vendors who 'choose' the above deviation are required to provide.

- A written data sheet of "own standard" paint system and top coat color to, be included in the Vendors data book or installation maintenance manual.
- A written data sheet of a 'Repair Procedure' for the paint system to be, included in the Vendors data book or installation/maintenance manual.
- A quantity of 'primer - tie coat' and 'top coat' (matching color), for making good by others. The paint is to be included as part of the equipment.

THE SUPPLIER PAINT SYSTEM MUST BE COMPATIBLE WITH THE PAINT SYSTEMS (FOR SPECIFIC AREAS) AS LISTED IN THIS SPECIFICATION.

10.0 COATINGS REPAIR PROCEDURE

10.1 General

This Repair Procedure is to be used for repairing 'small' areas of coating damage incurred:

- During fabrication in equipment supplier works
- During fabrication/construction of steelwork
- During hook-up work
- During pre-commissioning and start up
- During full on stream operation, up to a five year period from start up.

10.2 Exclusions

This Repair Procedure does not cover:

- Major or extensive areas of repair
- Major or extensive repair/maintenance of areas after start up

In such cases, the remaining 'undamaged' coatings are to be removed back to base metal and the applicable preparation and coating system is to be applied anew.

The Company or his representative is to be informed of any major damage to coatings during all stages of fabrication and/or construction.

10.3 Small Areas

Repairs to 'small,' areas of coatings will apply to two separate standards:

10.3.1 The Standard Coating Systems as listed in this Specification.

10.3.2 The Standard Coating System as used by a Vendor of some small items of equipment.

Repairs covered by (10.3.1) are to be as per systems shown.

Repairs covered by (10.3.2) are to be as per the specific 'Coatings Repair Procedure' which will be located within the equipment Vendors installation/maintenance manual, for the item of equipment requiring repair. The Vendor will have also included for quantities of 'primer' 'tie coat' of mating color in his 'spares' supply.

10.4 Dressing Back

For all small repairs, the damaged coating is to be removed back to base metal and to an area that overlaps into 'sound' undamaged coating. Damaged areas of coatings are to be removed with hand tools or power tools and not 'grit or sand blasting'. The preparation (prior to coating) shall be as per this Specification (10.3.1) or Supplier specification (10.3.2) whichever is applicable.

11.0 APPROVED PAINT MANUFACTURERS

Coating systems listed in this specification are to be applied with suitable materials from the following approved list of paint manufacturers available in Pakistan:

ICI
BERGER
SIGMA COATINGS

Any deviation from this list shall be subject to prior approval by the Company.

12.0 PAINT SYSTESM

12.1 Key List

Code	Work Location	
1A	Shop or Field	Surface preparation – Blast clean SA-3
1B	Shop or Field	Surface Preparation – Blast clean SA 2 ½
2	Field	Surface Preparation – needle gun, water wash and scrub, power tool clean ST-3
5	Shop	Primer – 75 microns DFT zinc phosphate (high build)
8	Shop or Field	Primer 40 microns DFT urethane zinc rich (moisture tolerant)
9	Shop or Field	Primer 50 microns DFT urethane zinc rich (moisture tolerant)
10	Field	Intermediate – 75 microns DFT urethane M10 (moisture tolerant)
11	Shop or Field	Top Coat – 75 microns DFT modified Alkyd gloss (high build)
12	Shop or Field	Top Coat – 150 microns DFT urethane pitch (moisture tolerant)
13	Shop or Field	Top Coat – 50 microns DFT urethane gloss (moisture tolerant)
14	Shop or Field	Undercoat – 30 microns DFT urethane undercoat (moisture tolerant)
15	Shop	Primer – Inorganic zinc silicate 75 microns DFT
16	Field	Top Coat – Aluminum silicone 25 microns DFT
17	Field	Tough up – Inorganic zinc silicate 75 microns DFT

12.2 Application

Details of paint systems and the applications are listed below:

System 1 - Structural steel for Buildings

System 2 - Structural supports, tank internals

System 3 - External roofs, tank externals

System 4 - Structural steel, piping and vessels below 100°C

System 5 - Piping and Vessels above 100°C

	System 1	**System 2**	**System 3**	**System 4**	**System 5**
Surface preparation	1B	1B	1B	1A	1A
Primer	5-AS	9-AS	8-AS	5-AS	15-B
Undercoat	14-AS	10-AS	10-AS	14-AS	-
Top Coat	13-AS	12-AS	13-B	13-AS	16-AS
TOUCH UP	13-	12-	13-	13-	17-
	Brush	Brush	Brush	Brush	Brush
Minimum DFT (microns)	150	250	130	150	90
Maximum DFT (microns	170	280	160	170	100

Legend: AS - Airless spray application
B - Brush application

12.3 Pumps, Machinery and Electrical Equipment

12.3.1 Surface Preparation and Painting at manufacturer's Works for Equipment Installed Outside Buildings.

Manufacturers shall specify their standard painting system for the site conditions, and shall specify surface preparation, type of coating, number of coats, dry film thickness and color. Should this system be unacceptable to the Company, the requirements of this specification shall govern.

Painting at Site

No painting is permitted but the shop finish shall be made good if damaged.

Color matching

If required by the Company, finish painted items shall be painted for color matching.

12.4 Instruments, Instrument Panels, Consoles and Cabinets

12.4.1 Surface Preparation and Painting at Manufacturer's Works for Equipment Installed Inside Fully Enclosed Buildings.

This equipment shall have its surface prepared, primed and finished in accordance with Manufacturer's standards. In general this shall consist of:

- One coat of primer and
- two coats of enamel

12.4.2 Surface Preparation and Painting at Manufacturer's Works for Equipment Installed outside Buildings this equipment manufacturer shall specify their standard system for the site conditions and shall specify surface preparation, type of coating, number of coats, dry film thickness and color. Should this system be unacceptable to the Company, the requirements of this specification shall govern.

Painting at Site

No painting is permitted but the shop finish shall be made good if damaged.

Colon Matching

If required by the Company, finish painted items shall be painted for color matching.

12.5 **Protective Coatings for Valves**

12.5.1 Scope

This specification covers the preparation and external coating requirements for assembled valves.

12.5.2 Surface Preparation and Application

Following complete assembly of valves, all oil and grease shall be completely removed and surface thoroughly wire brushed to remove all loose and friable material.

Apply one coat of System No. 2 (a Zinc Dust Filled Primer) to a dry film thickness of 75 microns. All valve stems and stuffing box guides shall be suitably protected with grease after coating has been completed.

This does not apply if the Supplier's standard practice of preparation is by grit or shot blasting either before assembly or, with proper masking precautions, after assembly. If abrasive blasting is carried out, the use of an inorganic primer (System No. 1) is to be applied.

13.0 COLOUR CODING

Fire water piping shall be painted solid red in a suitable weather resistant paint available in Pakistan.

Pipe work shall generally be painted silver with color coding as below.

Color coding of pipe work shall be as per the Piping Service Designations. Each pipe shall be color coded with three painted bands (with the exception of Fire Water piping) identifying

- Product Medium
- ANSI Piping Class
- Piping Material

Color coding shall be prepared by Supplier and agreed by Company/Company representative from the appropriate range of suitable paints available in Pakistan.

OIL & GAS DEVELOPMENT COMPANY LIMITED

Job No.: 14-0102
Spec. No.: 0102-GS-9524
Sheets: 25

JHAL MAGSI GAS FIELD
DEVELOPMENT PROJECT

SPECIFICATION FOR PACKING & PROTECTION OF MATERIAL AND EQUIPMENT

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ENAR Petrotech Services (Pvt.) Limited

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1.0 GENERAL

1.1 Scope

This specification represents the minimum requirements which the Supplier shall follow for the packing and protection of materials and equipment during their transportation, storage and handling for Jhal Magsi Gas Field Development Project.

Supplier shall proceed under his own responsibility and according to the general practice to the sea packing or sea protection of his supply.

This packing shall also be carried out in order to satisfy the transportation conditions.

The packing shall be strong enough to support without damage sea transportation as well as long duration storage in harbor facilities and/or site.

In no case, shall material/equipment belonging to different orders be packed in one single packing.

It shall be mandatory to pack the spare parts in separate packing. The spare parts packages may be included in the main equipment packing.

1.2 Definitions

Company	Oil and Gas Development Company Limited
Company Representative	A Company designated Engineer, Party/Parties duly authorized by the company to act on behalf of the company with whom the Supplier shall consult at all reasonable times and whose instructions, request and decision shall be binding on Supplier.
Supplier	Entity with whom the Company will execute a Contract for supply of equipment/material as per this document
Project	Jhal Magsi Gas Field Development Project

1.3 Purpose

All the materials are subject to certain fragility due to physicochemical and mechanical risks of their own.

Therefore, each material shall have its particular protection and packing taking into account:

- Different transportation they shall go through (vibrations, shocks, etc…)
- Transshipment, handling and lifting
- Storage, for more or less long periods, in the open air.
- Every packing should stay reliable for duration of one year minimum.

2.0 TYPES OF PACKING & PROTECTION RECOMMENDED ACCORDING TO TYPE OF MATERIAL

2.1 Sea Packing

The packing shall be strong enough to support without damage during transportation as well as long duration storage in harbor facilities and/or site.

2.1.1 Pallets

Every material delivered in pallets such as certain products in bags, bricks, etc.

a) Protection

i Against Humidity: plastic coating
ii Mechanical:
- Corners reinforcement through metallic or iron angles
- Face protection to be insured by bituminous paper or cardboard.

The whole being secured by stainless steel strips.

2.1.2 Bundles **(Appendix – A)**

Constitution of bundles strapped by metallic strips, or dunnage in order to avoid twisting:

- Either by strips belting the bundle if it is not too heavy
- Or by U bars tied together by threaded rods with nuts and lock nuts
- Or by wedges, intermediate or circular wooden pieces to ensure protection against sharp edges and rigidity of the sets, the wedges being tied together by nails, bolts or strips.

a) Concerned Materials

- Straight pipes of ¼", 20′ - 43′ long
- Steel bars
- Plain sheets
- Structural steel
- Structures

b) Protection

Protection Against Corrosion

Protection against corrosion is to be made in accordance with the particular conditions of the order.

Protection of Mechanical Items

- Threaded ends shall be protected by screwed bushings.
- If necessary, ends shall be supplied with metallic plastic or wooden protective devices, bevel protectors/companion flanges
- When handling stainless steel pipes:
  - Do not use steel slings
  - Do not hook up pipes by their ends
  - Use leather straps

2.1.3 Reels

(fig. attached as **Appendix – A)**

a) Concerned Materials

Metallic or electric cables, ropes, flexible pipes, etc.

b) Protection

i Against corrosion: ends to be enveloped or lambed, steel metallic cables must be coated with a film of grease.

ii Mechanical: cables are to be coiled around wooden or metallic reels and protected by a wooden stave.

2.1.4 Cradles

(fig attached as **Appendix – B)**

a) Concerned Materials

Materials of great dimensions, heavy weight, neither fragile nor needing mechanical or physicochemical protection such as oily water separators, corrosion inhibitor packages, drag reducer packages etc.

b) Protection

- Against Corrosion

  Cleaning and coating are to be made in accordance with the particular conditions of the order. A good protection of nozzles, nozzle flanges and machined pars shall be done by plugging or by applying coating process. Utilization of a corrosion inhibitor will be recommended in certain cases.

- Protection Against Mechanical Items

  Wooden or metallic cradles with belts made of flat steel bars attached through turnbuckles to the cradles.

  In every case, Supplier shall provide lifting devices (rings, lugs or hooks) in definite and easily spotted points for sling lifting.

  When belting by flat steel bar or by cradle, it is necessary to place another material avoiding friction such as felt, rubber or plastic in between the material and the belt. Moreover if it is not possible to use a crane hook for handling, Supplier shall supply for the transportation duration, the necessary accessories such as spreader bars, slings, ropes, etc.

2.1.5 Frames for Shaped Steel Sheets

(fig. attached as **Appendix – C)**

In order to avoid shaped steel sheets deformation/twisting during transportation and handling, they are layed on top of the other with intermediate shims inside a rigid frame. Such frame shall have padeyes for easy handling by hooks and slings.

2.1.6 Crates

(fig. attached as **Appendix – D)**

a) Concerned Materials

Vessels with external elements/equipment not allowing the utilization of cradles or the barge transportation such as piping, air coolers, steel structures, etc.

b) Protection

Protection against corrosion is to be made in accordance with the particular conditions of the order and in every case:

- Machined parts shall be wrapped with adhesive plastic tape
- Contact surfaces of metallic structural parts shall be protected by a rustproof material.
- Pipe ends shall be coated with kraft paper or jute cloth or fitted with proper protective devices.

Protection for Mechanical items (anti-shocks): material shall be steadied either directly on the crate bottom tray or by means of cradles. Another wedging shall be made on the cove tray for complete immobilization.

2.1.7 Full Packing Cases

a) Concerned Materials

Sets requesting mechanical protection against shocks and eventually physico-chemical protection such as machined pieces, small fragile piping, mechanical parts, valves, fittings, bolts, hand tools, insulation material, glass parts etc.

b) Protection

Against corrosion:

- Machined parts shall be wrapped with an adhesive plastic coating
- Tools, valves accessories shall be wrapped in paper with corrosive inhibitor.
- Bolts and nuts shall be greased and wrapped in jute bags according to size.

Mechanical Protection shall be by wooden case with one face planed; joined edge, with bituminous kraft paper for internal with an overlapping coating. The cover shall be made of 2 layers of wood bituminous kraft paper in between the 2 layers.

2.1.8 Groove & Tongue Wooden Package

a) Concerned Materials

Those requiring physicochemical protection such as electric material (motors, panels, equipment) electro-mechanical generators, electronics, electro-pumps, control valves, motorized reducing gears.

b) Protection

- Protection against corrosion is such that material shall be placed inside plastic bags with dehydrating products. Machined parts shall be protected by a waterproof plastic film.

- Protection for Mechanical items: wooden case with both faces planed and grooved, with waterproof paper for internal coating. The cover shall be made of 2 layers of planed and grooved wood with an overlapping bituminous kraft paper in between the two layers. Mobile pieces inside the equipment shall be tightly fixed to structures.

2.1.9 Protective Packing

a) Concerned Materials

Fragile materials such as:

- Pressure gauges, vacuum meters, thermometers

- Measuring and control equipment

- Control panels, electronic equipment, laboratory equipment, electric material, and glass equipment.

b) Protection

- Protection against corrosion and humidity shall be plastic bags and de-hydrating products. Cases are to be coated internally with bituminous kraft paper.

- Protection for Mechanical items: material shall be fixed on shock absorbers or in an internal case placed on shock absorbers. Shock absorbers may be springs, wedges, mats, expanded plastics, etc. Mobile pieces and delicate components shall be blocked before packing.

Cases shall be planed, grooved and tongued: cover shall be made of two layers of wood with an overlapping bituminous kraft paper in between the two layers.

2.1.10 Steel Barrels

a) Concerned Materials

Chemical products, coal tar, catalysts, powders, chemical reactive, coils, etc.

b) Protection

Sealed closure in order to avoid any loss or moisture penetration

Containers

Containers used for grouping parcels shall be in accordance with ISO 668 standards.

2.1.11 Special Containers

Valuable turbine rotors shall be packed in pressurized hermetic sealed containers filled with low pressure dry air or nitrogen.

2.2 Types of Packing Case Fabrication

2.2.1 Quality of Wood

Compact and dry fir wood or any similar wood available in the country shall be used or even phenolic Douglas fir wood reinforced by fir boards.

Wood shall have the following essential characteristics:

- Dyness: about 20%
- Diameter of vicious or unstable knots shall be less than half of the board width
- Free of cracks longer than 12".
- Flaws accepted on condition they do not include bark and within the following limits:
  - Length: $^{1}/_{5}$ of the length of the wooden piece
  - Width: ½ of the width of the wooden piece
  - Thickness: ¼ of the thickness of the wooden piece.
- board thickness and rail thickness shall be in accordance with the case weight and dimensions. It shall be in accordance with the type of material packed and the way it is straddled inside the packing.

In accordance with these parameters, the following parameters are given as guidance:

GROSS WEIGHT	BOARD THICKNESS BEFORE PLANNING	RAIL THICKNESS BEFORE PLANNING
Up to 1100 lbs	¾" to ⅞"	¾" to ⅞"
From 1100 to 4400 lbs	¾" to ⅞"	⅞" to $1^{1}/_{16}$"
From 4400 to 11000 lbs	⅞" to $1^{1}/_{16}$"	$1^{1}/_{16}$" to 1¼"
From 11000 to 22000 lbs	$1^{1}/_{16}$"	$1^{1}/_{16}$" to 1¼" or 1½"
From 22000 to 48500 lbs	$1^{1}/_{16}$" to 1¼"	1¼" to 1½"
From 48500 lbs and over	1¼" or 1½"	1½"

2.2.2 Case Fabrication

a) Crates

(fig. attached as **Appendix – D)**

Crates shall be erected in such a way that empty surfaces shall match filled surfaces.

Material placed inside the cases or crates shall be covered with a polyethylene bag specially treated to fight against sun and heat and to prevent rain or water jet infiltration.

b) Full Packing Cases

Boards must be placed side by side or jointed by male and female interlocking having a minimum depth of ½" specially if sea traveling is forecast through traditional ships where several handlings are expected. Boards width shall not exceed 10" or be less than 5".

Up to 1100 lbs weight and if the length is limited to 8′-2" and if the contained material allows it, cases may be built without bottom timber beam. Such beams shall be replaced by supporting rails 1" thick for the walls and 1½" thick for the bottom. Distance between rails shall be one meter along case length.

Supporting rails shall have a minimum width of 3". Bottom boards shall have 1¼" thickness.

Over a net weight of 1100 lbs, cases shall be provided with longitudinal timber beams at their bottom. Their cross section shall be in accordance with the type of packed material and its weight.

Concerning timber beams and reinforcing bars the following data is used:

- up to a net weight of 2200 lbs, use pieces of 3" × 3" cross section
- from 2200 lbs up to 3370 lbs, use pieces of 4" × 4" cross section
- from 3370 lbs to 13200 lbs, use pieces of 5" × 5" cross section
- from 13200 lbs up to 19850 lbs, use pieces of 8" × 8" cross section
- from 19850 lbs up to 44100 lbs, use pieces of 8" × 8" cross section.

Spacing between bars shall be from 2′-8" to 6′-6". This spacing shall nevertheless be in accordance with the dimensional, qualitative and constructive characteristics of the contained material.

Ends of reinforcing elements shall be beveled at 45 deg to facilitate lifting slings insertion.

Beneath the case, small rails 1½" to 2" thick shall be placed as spacing pieces to protect the case against the lifting slings.

Position and length of such rails shall be established in accordance with the case length and its center of gravity.

c) Cases for More Than 11,000 lbs

For cases weighing more than 11,000 lbs net weight, it is recommended to place angle irons where the lifting slings are to be applied.

The walls and the cover may also be made out of Douglas fir phenolic marine plywood but shall have a fir structure of 1½" × 5" minimum.

Cases shall always be internally coated with bituminous paper of high impermeability and capable of withstanding strong temperature variation, whatever be the protection adopted for the contained material.

d) Plywood Utilization

Plywood panels may be used for pickings instead of sawn wood. Panel thickness will depend on the cases dimensions and weight and will depend also on the density of the goods, the structure of the case and the way it is steadied. Plywood quality shall be that one which can withstand humidity. In accordance, following data is given as guidance:

- Gross weight up to 1100 lbs thickness ¼" to $^{5}/_{16}$"
- From 1100 lbs to 11000 lbs thickness ⅜"
- From 11000 lbs to 33000 lbs thickness ½"
- Over 33000 lbs thickness ⅝"

2.3 Modules/Packages/Assemblies

2.3.1 Weight & Dimensions of a Module

a) Available Transportation Capacities

b) Available Lifting Capacities

For onshore locations, modules up to 150 tons may be carried out if roads with hard coating are available. Limit shall be brought down to 50 tons if only tracks are available. It is even preferable to bring down this limit to 36′ × 8′-2" × 13′ in order to take into account classical obstacles such as bridges, electric lines, tunnels, etc. afford only this lower limit.

For offshore locations, modules up to 400 tons and more may be carried out. However, this last tonnage can be shipped only on specialized ships of 10,000 or 15,000 tons.

Exceptional weight may go up to 2,000 tons derrick barges or lifting means are consequently forecast.

2.3.2 Module Structures

A module constitutes a lift able and transportable assembly. Bearing structures will, therefore, be made up of standard rolled sections or box girders.

Structure calculation basis shall take into account the whole module life, especially the very short and stressful periods that constitute transshipment.

Module shall be provided with the necessary slings, lifting beams, shackles, etc. for crane handling.

a) Close Modules

These modules shall be closed by simple wind cutter partitions of fireproof separators according to request.

They shall be mechanically ventilated and even air conditioned if requested for safety reasons or weather conditions.

b) Cage modules

Cage modules shall be adopted when modules have to be piled up.

c) Skids

Skids shall be used preferably for mechanical equipment such as diesel generating sets, motor pumps, filters, separators, etc.

2.3.3 Shipping Preparation

Mobile elements (spring supports, etc.) shall be immobilized. Equipment shall be protected as follows:

a) Measuring and control equipment, which are too fragile for transportation, shall be dismounted, packed separately, carefully marked and shipped with the module.

b) Valves, control valves and other equipment, dismounted for the hydraulic tests and replaced by plugs, shall stay dismounted but will be packed separately, carefully marked and shipped with the module.

c) Tanks and pipes shall be emptied and dried.

d) Stainless steel elements shall be coated with a coating which shall be in accordance with the steel grade.

e) All the openings shall be closed.

f) Flanges and screwed fittings shall be mechanically protected and also rust proof protected.

g) Equipment such as electric motors, relay, panels, MCC shall be heated by their own equipment or by provisional means.

h) If the internal equipment request an inert atmosphere, this atmosphere shall be introduced and maintained in the module or in the compartment of the module where these equipment are housed.

i) In the same way, if the equipment inside the module requests air conditioning, this air conditioning shall be maintained through an external source of energy.

j) Enough desiccant material shall be placed inside certain equipment such as motors, pumps, valves, etc.

2.3.4 Slings & Lifting Accessories

As soon as the module get a certain weight (over a few tens of tons), it is recommended to fit the module with its slings, shackles, with the pins blocked or even welded and eventually with the lifting beam as soon as it leaves for the field.

This necessitates that the structure and the sea fastening be designed to this effect. This arrangement will prove to be most efficient especially when there will be several crane handlings.

This construction shall provide the calculating notes of the lifting elements and especially for the cables (test load, deflection angle between the strands, safety factor, etc.).

2.3.5 Center of Gravity

It will be determined through calculation but verified through weighing. In certain cases the lifting ears will be welded only after the practical determination of the center of gravity.

2.3.6 Orientation

In order to facilitate handling operations on the job site, the orientations marks North South or East West shall be marked, when possible, on the module, in the manufacturing plant, in accordance with the layout drawing.

2.4 Special Regulations

2.4.1 Steadying

All packed material shall be internally steadied in an adequate manner in order to avoid any displacement during transportation.

2.4.2 Protective Products

When transporting material coated with protective products. Supplier and/or company in charge of the packing shall indicate the effective duration of the protective material and give all information concerning a good transportation of the merchandise.

2.4.3 Protection Against Humidity

Hot sealed plastic bags, composed of cloth, aluminum and a double layer of polyethylene, shall be used for material such as panels, electric gears, hydraulic gears and similar ones which are much affected by humidity. Introduction of dehydrating products shall maintain above mentioned material in an atmosphere having less than 35% humidity. Polyethylene bags must not be used.

Polyethylene bags can be used only as open covers to allow free air circulation. These covers shall be special for protection against heat and sun and will serve only to protect material against rain and water jets.

2.4.4 Fork Pockets

For all parcels, which cannot be manually handled, especially those exceeding 1100 lbs, special pockets shall be provided to allow the handling with fork lift trucks.

2.4.5 Trimming Points

As far as possible and particularly for parcels uneasy to handle manually, trimming points shall be provided preferably at the higher angles of the parcels in order to avoid damage to the pickings when trimming operations are carried out for transportation.

3.0 PACKING FOR AIR TRANSPORT

Packing for air-transported goods shall be identical to that provided for above sea-transported goods. Anyway the following features shall be taken into account when packing:

- Many handlings on site by means of motorized equipment (lift trucks, transpallets, etc)

- Extended storage (at least one year) in the open air, sea environment, tropical climate.

Consequently, cases or packages shall be conditioned accordingly.

Each part contained in the said package shall be protected to take the above conditions into account so as to allow partial unpacking of cases or packages.

APPENDICES

APPENDIX – A

PIPES AND REELS

REFERENCE A1 – PIPE FIXATION

REFERENCE A2 – THREADED PIPE FIXATION

REFERENCE A3 – REEL

APPENDIX – B

CRADLES FOR CYLINDRICAL EQUIPMENT

B1 CRADLE FOR TANKS COLUMNS AND HEAT EXCHANGERS

B2 CRADLE FOR TANKS COLUMNS HEAT EXCHANGERS AND EQUIPMENT OF CYLINDRICAL FORM

APPENDIX – C

FRAMES

IMPORTANT NOTE

Specify on the frame, with indelible paint, if handling shall be :

– through slings and lifters

– by fork lift truck. In this case specify the fork position.

APPENDIX – D

CRATES

REFERENCE 01 – UP TO 500 KG
(WITHOUT TIMBER BEAM AT THE BOTTOM)

REFERENCE 02 – OVER 500 KG
(WITH TIMBER BEAM AT THE BOTTOM)

APPENDIX – E

FULL PACKING CASES

REFERENCE E1 – CASE FOR LOADS UP TO 500 KG
(WITHOUT TIMBER BEAM AT THE BOTTOM)

REFERENCE E2 – CASE FOR LOADS OVER 500 KG
(WITH TIMBER BEAM AT THE BOTTOM)

CASES FOR LOADS OVER 5 TONS

GROVE AND TONGUE WOODEN CASE OR PLY WOOD CASE

OIL & GAS DEVELOPMENT COMPANY LIMITED

Job No.: 14-0102
Spec. No.: 0102-STA-4000
Sheets: 13

JHAL MAGSI GAS FIELD
DEVELOPMENT PROJECT

SPECIFICATION FOR STEEL STRUCTURES

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ENAR Petrotech Services (Pvt.) Limited

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1.0 GENERAL

1.1 Scope

This specification covers the requirements for the design of structural steelwork, for equipment support and access facilities such as stairways, ladders, walkways, etc. for Jhal Magsi Gas Field Development Project.

1.2 Definitions

Company	Oil and Gas Development Company Limited
Company Representative	A Company designated Engineer, Party/Parties duly authorized by the company to act on behalf of the company with whom the Supplier shall consult at all reasonable times and whose instructions, request and decision shall be binding on Supplier.
Supplier	Entity with whom the Company will execute a Contract for supply of equipment/material as per this document
Project	Jhal Magsi Gas Field Development Project

1.3 Errors or Omissions

1.3.1 The review and comment by the Company/ Company Representative of any Supplier's or its Sub-Supplier's drawings, procedures or documents shall only indicate acceptance of general requirements and shall not relieve the Supplier of its obligations to comply with the requirements of this specification and other related parts of the contract documents.

1.3.2 Any errors or omissions noted by the Supplier in this Specification shall be immediately brought to the attention of the Company.

1.4 Deviations

All deviations to this specification, other specifications or attachments shall be brought to the knowledge of the Company/ Company Representative in the bid. All deviations made during the procurement, design, manufacturing, testing and inspection shall be with written approval of the Company/ Company Representative prior to execution of the work. Such deviations shall be shown in the documentation prepared by the Supplier.

1.5 Conflicting Requirements

In the event of conflict, inconsistency or ambiguity between the contract scope of work, this Specification, National Codes & Standards referenced in this Specification or any other documents, the Supplier shall refer to the Company/ Company Representative whose decision shall prevail.

1.6 Reporting Procedure

1.6.1 A reporting and documentation system shall be agreed between the Company and the Supplier for the status of procurement, design, manufacturing, inspection, testing and shipment of the equipment/material to be supplied under this specification. Supplier shall provide reports and summaries for production performance and testing operations in conformance with a manufacturing schedule approved by Company/ Company Representative.

1.6.2 Daily, weekly, monthly and run summaries of all major aspects of the production process shall be provided as reports to the Company/ Company Representative.

2.0 MATERIAL

The material to be used in structural works elements manufactured shall comply with the following standards:

ASTM A - 6	General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.
ASTM A-36	Standard Specification for Structural Steel The minimum yield strength to be considered for structural steel shall be 36,000 psi. All nuts and bolts head shall be hexagonal. The dimensions and tolerances are to be in full compliance with the reference standards.
ASTM A - 325	Standard Specification for High Strength Bolts for structural steel joints
ASTM F-436	Hardened Steel Washers for Use with High Strength Bolts

3.0 DESIGN

3.1 Design Loads and Load Evaluation

Foundations and structures shall be designed to include all dead loads, live loads, equipment, loads, vibration, pipe, pipe expansion, thermal and friction, wind, seismic, impact and erection, operating loads and forces.

3.2 Other Loads

3.2.1 Pipe Anchors

Pipe anchors shall be designed for the forces and moments developed from the line stressing. When more than one anchor is supported on one support, due account shall be taken for the direction of thrust, but in any case members shall be designed to resist any one anchor thrust as a minimum. Anchor support members in structures shall be suitably braced to reduce deflection to a minimum.

3.2.2 Roofs

For the design of roofing, and in addition to climatic and seismic loading, a concentrated load of 220 lb on a square of 12′-7" must be taken into account.

The frame will be designed for a differential vertical settlement specified by the Company.

3.2.3 Stresses

Permissible stresses in structure design shall be in accordance with the reference Codes and Standards.

3.3 Miscellaneous

3.3.1 Connections

All shop connections shall be preferably made by welding, high tensile bolts or ordinary bolts.

All site connections shall be made by high tensile bolts or ordinary bolts. All field holes shall be made by drilling (oxy-cutting strictly forbidden).

A minimum of 2 bolts shall be used in all bolted connections.

It is strongly recommended that ordinary grade and higher-grade bolts do not have the same diameter for the entire project. This will eliminate the possibility of incorrect bolts being used.

Hole dia. for bolts shall be in accordance with AISC Standards "Structural Steel Detailing".

Washers are required with bolts in accordance with the Standards. A locking device shall be employed on bolts to prevent the nuts loosening in connections subjected to vibration from machinery.

Welding shall be restricted to shop fabrication only and performed in accordance with the AWS D.1.1 "Structural Welding Code".

3.3.2 Flooring

A platform should be provided for any item of equipment, which requires attention for operation or servicing whenever this is located at more than 7′ above ground level or other platforms.

Solid floor plates shall have a raised pattern affording a non-slip surface and shall be ¼" minimum thick exclusive of pattern.

Solid floor plates shall be attached to the supporting steelwork with ½" Countersunk bolts unless otherwise noted on the drawings. Unsupported edges shall have 2½" × ⅜" butt strap. A ¾" drainage hole shall be provided in each panel.

Open grid flooring shall be galvanized and shall have main bars not more than 1½" spacing.

Open grid flooring shall be attached to the supporting steelwork with clips or other effective means. Holes or cutouts in panels shall be made and shall have perimeter stiffening strips welded in.

3.3.3 Stairways

Stairways shall be provided for access to platforms serving equipment, which requires regular and frequent operational attendance or rapid escape or access in the event of an emergency.

Stairs shall have a minimum width of 2′-8" and shall be arranged with a slope not exceeding 45°.

All stairs in the same structure shall have the same slope and stair handrails shall be continuous with platform handrails.

Maximum vertical difference in level in a single flight shall be 15′.

Landings shall be 4′ minimum length.

Stair tread width shall be 8" minimum and be hot dip galvanized open grid type to match flooring. Treads to have visible edges.

The horizontal distance between adjacent nosing shall not exceed the tread width. The vertical distance between treads may vary between 7.5" and 8.5" although all rises in any flight shall be the same.

3.3.4 Ladders

Ladders shall be provided only with Company's approval:

- For access to platforms not served by stairways.
- As an emergency escape from a platform already served by a stairway and/or a ladder.
- For access to locations where no platform is necessary but where observation of a process condition is required, involving no manual effort and which will not create a hazardous situation, e.g. to check a level indicator.

Changes of inclination should be avoided as far as possible but if this is an impractical, intermediate platform shall be provided to avoid a change of inclination within a "flight".

When access to an upper platform is from the side or front of ladder, the ladder shall be extended for a distance of not less than 3ft or equivalent hand holds shall be provided. Stringers at the top of ladders where "walk through" access is required shall be suitably placed apart.

Side access to ladders is preferred.

3.3.5 Safety

Safety cages shall be provided for ladders serving platforms more than 16′ above grade. Where height between platforms will not permit access to a full cage, partial caging permitting side entry shall be provided.

Self-closing safety gates are required for ladders serving platforms 6'-6" or more above grade.

Dimensions

Ladders width	1′-8"
Rung Spacing	10" to 12"
Rung Diameter	¾"
Clearance to nearest obstruction	9.5" (min)
Cage Diameter (inside)	2′-8"
Centerline cage to centerline rungs	1′-4"

3.3.6 Platforms & Walkways

- Platforms and walkways shall be a minimum of 2′-8" wide.
- Where pipes or fittings intrude on a passageway, a minimum clear way of 1′-6" is required.
- Headroom clearance shall be a minimum of 6′-6" taking into account electrical fittings and other obstructions.

3.3.7 Hand Railing & Toe Plates

- Handrails shall extend around edges of all platforms, landings, walkways and stairs.

- Except at stair and ladder openings, toe plates shall extend continuously around the edges of platforms, landings, stiles and walkways situated more than 6'-6" above grade. Toe plates shall also be provided around all pipe penetrations through landings and around large openings.

- <u>Dimension</u>

Top rail above platform	3′-6" (approx.)
Bottom rail above platform	1′-8" (approx.)
Top rail above stair nosing	2′-8" (approx.)
Bottom rail above stair nosing	1′-4" (approx.)
Outer dia. of rails	1½" (approx.)
Hand rail standard spacing	7′ (approx.)
Toe plate upstand above flooring	4"

The fabrication shall comply with the:

– Code & Reference Standards
– Approved Drawings

Variations or modifications if any shall be previously approved by the Company /Company Representative.

The structure shall be manufactured to allow as much shop assembling as possible, compatible with easy transport, quick and economical erection at jobsite.

All steelwork elements shall be delivered at site properly protected with a rustproof paint coat.

When prefabricated elements are delivered, they shall be duly marked for ease in identification during assembling duties.

When delivered at site, all portions of structural prefabricated assembly shall be stored with all necessary precautions to avoid damage or possible distortions of such elements.

All damaged structural parts will be rejected by the Company/Company Representative and replaced at the Supplier's expense.

The positioning of all steelwork, the plumbing of stanchions and columns and the assembly of every part of the structure with due accuracy shall be in accordance with the approved drawings.

No permanent connections shall be made until as much of the structure as will be stiffened by such connections has been approved or accepted with respect to alignment.

The Company/ Company Representative shall prepare the fabrication drawings and the following is to be taken into consideration when preparing such drawings:

– The Supplier shall develop all construction or fabrication details and all other details not included in the tender drawings.

– The fabrication drawings shall show:

  a) The example of subassembly marking.
  b) The erection match mark between subassemblies and civil works,
  c) The material take off (quantities),
  d) The recommendations of erection such as mounting sequence, if any,
  e) The loads on foundations,
  f) The reference to other drawings when deemed necessary

– The fabrication drawings shall be completed with all indications relating to bevels and welds to be carried out:

  a) In the workshop,
  b) In the jobsite, if any,

  And to the bolts required for erection in the job site. Such bolting material shall appear in the material take off defined here above.

– When bidding, the Supplier shall quote the price per Kg.

– The limit of supply will be, but not limited to:

  a) All structure components,

b) Erection bolts,
c) Stairways, ladders and hand railings,
d) Foundation bolts for structural works.

3.3.8 Temporary Bracing

Adequate bracing which may include guys and such temporary members as may be considered necessary for safety, shall be installed and shall be left in position until such time as conditions of safety permit its removal.

3.3.9 Inspection & Tests

The inspection and tests will consist in the following:

- Examination and checking the certificates stating the grades of steel used in material entering the structural works,
- Checking their compliance with specifications and drawings,
- Mechanical test certificates where required by the Codes & Standards,
- Checking the full compliance of structural elements sizes dimensional,
- Workmanship inspection in compliance with the related Codes,
- Painting or coating inspection.

On completion of each test or inspection, the results shall be drawn up in inspection reports. The results shall be indicated in a bound file showing all the results according to the above list and forwarded to the Company for information and proper approval and filing.