MAZAGON DOCK SHIPBUILDERS LIMITED
(Formerly known as Mazagon Dock Ltd.)
CIN: U35100MH1934GOI002079
(A Government of India Undertaking)
Dockyard Road, Mazgaon, Mumbai 400010. India.
ISO 9001:2015 Certified
Website: www.mazagondock.in

EXPRESSION OF INTEREST (EOI)

Department	**: Offshore Projects – East Yard**
E-mail ID	**:** mrgawande@mazdock.com/ pbpatil@mazdock.com
Phone no.	**: 022 – 23762665**
EOI no.	**: EY/OP/T&I/01**
EOI date	**:12.11.2025**
EOI closing date & time	**:19.11.2024: 17:00 Hrs**

Expression of Interest (EoI)

Invitation to reputed firms for forming a Consortium Agreement for ONGC's Project -"Additional Development of Ratna–I (ADR-I) and NLM-14 Project by MDL".

LETTER OF INVITATION

Mazagon Dock Shipbuilders Limited (MDL) seeks response from firms involved in heavy engineering fabrication and willing to submit a proposal for Additional Development of Ratna–I (ADR-I) and NLM-14 Project by MDL in offshore projects for MDL.

MDL is extensively working in the field of Offshore and presently executing 3 orders of ONGC. MDL is looking for firms having offshore projetcs experience in design, engineer, procure, fabricate, subsea pipe laying, load-out, tie down, transport, install, hook-up, recommissioning on EPCI/LSTK basis.

All reputed firms are hereby invited to submit their response to this EoI who are in the field of offshore projects. Firms with relevant experience / qualification in the field of heavy engineering shall submit their interest.

The detailed terms and conditions shall be mutually agreed upon.

INDEX

SECTION-1

DISCLAIMER

1. MDL, its employees and advisors make no representation or warranty and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of the EoI document.
2. MDL may, in its absolute discretion, but without being under any obligation to do so, modify, amend or supplement the information in this EoI document.
3. The issue of this EoI does not imply that MDL is bound to select and shortlist any or all the participating firm. Even after selection of suitable participating firm, MDL is not bound to proceed ahead with the participating firm and in no case be responsible or liable for any commercial and consequential liabilities in any manner whatsoever.
4. The participating firm shall bear all costs associated with the preparation, technical discussion/presentation and submission of EoI. MDL shall in no case be responsible or liable for these costs regardless of the conduct or outcome of the EoI process.
5. Canvassing in any form by the participating firm or by any other agency on their behalf shall lead to disqualification of their EoI.

SECTION-2

SCHEDULE OF EOI PROCESS & CONTACT DETAILS

A. SCHEDULE OF EoI PROCESS

The schedule of activities during the EoI Process shall be as follows -

Sl. No.	Description	Date
1	Issue of EoI document	12.11.2025
3	Last date of Submission of EoI response	19.11.2025: 17:00 Hrs

B. CONTACT DETAILS:

Submission of proposal:

Proposal **(Original + one soft copy)** super scribing the enquiry number, enquiry subject, last date for receipt of EOI and shall be addressed to

Mr. Manoj Gawande,
DGM (Offshore Projects- EY)
Mazagon Dock Shipbuilders Limited, Dockyard road,
Mumbai 400010
E-Mail: mrgawande@mazdock.com

All the correspondences shall be addressed to the following:

i) Mr. Manoj Gawande
DGM (Offshore Projects- EY)
E-Mail: mrgawande@mazdock.com

ii) Mr. Prashant Patil
CM (Offshore Projects- EY)
E-Mail: pbpatil@mazdock.com

SECTION – 3

DETAILS OF EXPRESSION OF INTEREST (EoI)

3.1. ABOUT MDL

Mazagon Dock Shipbuilders Limited (MDL) is a leading submarine and shipbuilding company in the country with a Navratna status. The company was taken over by the Government of India and established as a Public Sector Undertaking under the Ministry of Defence in 1960. Over the last six decades, MDL has delivered over 250 warships/submarines/ platforms to various customers in India and abroad. Out of these 30 major warships/submarines have been delivered to the Indian Navy. The diversified platforms delivered to various customers range from Destroyers, Stealth Frigates, Submarines, Missile Boats, Corvettes, Offshore Patrol Vessels, Multipurpose Support Vessels, Offshore Supply Vessels, Dredgers, Tugs and Cargo-Cum-Passenger Vessels, Offshore Platforms.

Technical Requirement

3.1 AIM

The main aim of this EoI is to invite firms who are interested to participate & submit response to ONGC tender for Additional Development of Ratna–I (ADR-I) and NLM-14 Project.

3.2. SCOPE OF WORK:

Details scope of work for Additional Development of Ratna–I (ADR-I) and NLM-14 Project is enclosed herewith at Enclosure-1.

3.2.1. MDL may sign MOU with the firms found competent after due diligence if required.

3.3. INSTRUCTIONS

3.4.1 Language: All correspondences and documents related to the EoI response shall be in English language only.

3.4.2 The participating firm shall abide by the terms & conditions, as applicable, of the EoI.

3.4.3 All pages of the EoI shall be duly signed by the authorised signatory.

3.4.4 Multiple proposals from the same participating firm should not be submitted.

3.4.5 MDL at their discretion shall inspect the participating firm works/office/reference site premises for the purpose of evaluation, as deemed necessary. MDL decision in this regard shall be final.

3.4.6 Any participating firm which has been debarred/blacklisted by Central/State Governments or by any entity controlled by Central/State Governments from participating in any of their project, as on date of submission of EoI, shall not be eligible to submit the EoI.

3.4. PROCESS TO BE CONFIDENTIAL:

Information relating to the examination, clarification, evaluation and comparison of EoI and recommendations shall not be disclosed to participating firm. Any effort by participating firm to influence MDL processing of EoI or selection decisions may result in the rejection of the EoI.

3.5. MISCELLANEOUS:

3.5.1. Right to accept or reject any or all Applications:

i. Notwithstanding anything contained in this EoI, MDL reserves the right to accept or reject any application and to annul the EoI process and reject all applications, at any time without any liability or any obligation for such acceptance, rejection or annulment and without assigning any reasons, thereof. In the event that MDL rejects or annuls all the applications, it may at its discretion, invite all eligible participating firms to submit fresh applications.

ii. MDL reserves the right to disqualify any applicant during or after completion of EoI process, if it is found there was a material misrepresentation by any such applicant or the applicant fails to provide within the specified time, supplemental information sought by MDL.

iii. MDL reserves the right to verify all statements, information and documents submitted by the applicant in response to the EoI. Any such verification or lack of such verification by MDL shall not relieve the applicant of his obligations or liabilities hereunder nor will it affect any rights of MDL.

3.5.2. Governing Laws & Jurisdiction:

The EoI process shall be governed by, and construed in accordance with, the laws of India and the Courts at Mumbai (India) shall have exclusive jurisdiction over all disputes arising under, pursuant to and / or in connection with the EoI process.

SECTION– 4

PRE-QUALIFICATION CRITERIA

The determination of eligibility will take into account the technical and experience capabilities and past performance of the participating firm (including its subsidiaries/group companies); it will be based upon an examination of documentary evidence of the participating firm qualifications submitted by the participating firm as well as such other information, as the MDL deems necessary and appropriate. The participating firm willing to associate with MDL should meet the following Pre-Qualification Criteria:

4.1. **Technical Qualification: -**

The Bidder must possess, prior to the deadline of submission of bids, experience of having executed as EPC contractor at least

1. One (1) new Offshore Oil or Gas or Water Injection Process Platform OR Living Quarter Platform OR Well Head Platform OR FPSO Project.

   Note: EPC Project of above facilities must necessarily consist of fixed offshore structure along with Jacket and Piles except in case of new FPSO Project.

   The experience for needs to be on EPCI basis by bidder by himself

   i) The projects should have been completed during the last fifteen years.

   ii) Bidder shall have successfully accomplishing activities, i.e., Project Management, Design & Detail Engineering, Procurement, Fabrication, Transportation, Installation, Hook-Up, Testing and Pre-commissioning in EPCI project listed at above.

2. The Bidder must himself have the relevant experience in Project Management for completed offshore project(s) (based on which bidder is seeking experience in clause 1 above) and for at least one of the following main activities:

   a) Fabrication of Jacket or Deck of Oil or Gas Process Platform or Water Injection Platform or Living Quarter Platform or Well Head Platform or new built/ conversion of FPSO.

   b) Installation of Jacket or Deck of Oil or Gas Process Platform or Water Injection Platform or Living Quarter Platform or Well Head Platform.

   Bidder shall also be required to perform by themselves (and not through other arrangement like through supporting company, Parent/ Subsidiary/ Sister Subsidiary/ Co-subsidiary/ Technical collaboration/ Sub-contracting), Project Management and at least one of following main activities based on which they are seeking their qualification in Clause No. 2.

   a) Fabrication of Jacket or Deck of Well Head Platform.

   b) Installation of Jacket or Deck of Well Head Platform.

   c) Laying of submarine pipeline

   d) Procurement of structural Steel for jacket & deck and procurement of major equipment deck crane / Separator well platform

4.2. **Commercial Qualification: -** The bidder shall submit the following as applicable as a part of commercial qualification.

i. Shop & Establishment registration certificate.
ii. Certificate of Incorporation / Partnership deed.
iii. Bidder shall not be under a declaration of ineligibility issued by Govt. of India / State govt. / Public Sector Undertakings etc.
iv. MSME, Start-up certificate.
v. GST certificate
vi. Bidders Company Profile.
vii. List of infrastructure/equipment held by them along with details of their manufacturing facilities.
viii. Details of personnel (Project Management Team) with designation, qualification and experience to determine their capabilities.

4.3. **Financial Qualification: -**

a) Shall have average annual turnover of INR 9,80,16,03,865.45 (equivalent to $ 11,05,15,322) during the last three financial years ending as on 31 Mar 2025 to participate in this EOI.
For the purpose of ascertaining parameter of Turnover of the bidder, average turnover from operation of the bidder for the previous (Latest) ***three financial years*** shall be considered. Average turnover from operation of the bidder for the previous ***three financial years*** shall be calculated by dividing the turnover from operation of ***previous three years by three***, irrespective of the fact that quoted turnover for one particular year is for a period of less than 12 months or complete 12 months. The date (i.e. the financial year closing date) of the immediate previous year's ***Audited Standalone Annual Financial Statement/ Audited Consolidated Annual Financial Statement (To specify clearly either standalone or consolidated)*** should not be older than twenty four (24) months from the actual date of bid closing (i.e. in case of tender extension, the final extended bid closing date will be considered).

The Bidder shall enclose with its Proposal as per **Annexure-2**, certificate issued by Chartered Accountant with their seal and signature, stating the firms net worth & turnover during the past three years
OR
Firm to submit Balance Sheet and Profit and Loss statement for last 3 years in order to ascertain its average annual turnover.

b) Net-worth of Bidder: Positive
Net worth shall mean: "Share Capital + Reserves created out of profits and securities premium account (excluding revaluation reserves) - Deferred Expenditure - Miscellaneous Expenditure to the extent not written off and carried forward Loss - Reserves created out of write back of depreciation and amalgamation".

Further, the date (i.e. the financial year closing date) of the immediate previous year's ***Audited Standalone Annual Financial Statement/ Audited Consolidated Annual Financial Statement*** for the purpose of calculation of Net-worth, should not be older than twenty four (24) months from the EoI closing date.

c) Working Capital: INR 2,94,04,81,159.63 or more.
Working Capital shall mean "Current Assets minus Current liabilities" as per latest year's ***Audited Standalone Annual Financial Statement / Audited Consolidated Annual***

Financial Statement. The date (i.e. the financial year closing date) of the immediate previous year's ***Audited Standalone Annual Financial Statement/Audited Consolidated Annual Financial Statement*** for the purpose of calculation of Working Capital, should not be older than twenty four (24) months from the bid closing date.

If the bidder's working capital is inadequate in meeting the tender requirements, then the bidder can make good this shortfall through a line of credit confirming the availability of unutilized line of credit for meeting the entire quantum of shortfall in the Working Capital and not limited to the Working Capital required for the tender from his banker, through a letter specifically mentioning the tender number as per enclosed format at Appendix B-29 of Part-III Appendices of tender document. The line of credit should be from Scheduled Commercial Bank working in India. The foreign bidder can provide line of credit from a foreign bank also.

SECTION– 5

Bid Rejection Criteria

MDL may at its sole discretion and at any time during the evaluation of proposal, disqualify any bidder, if they have:

a) Bids received after due date.
b) Bidder's failure to furnish sufficient or complete details for evaluation of the bids within the given period.
c) Incomplete / misleading / false / ambiguous in the proof of eligibility requirements.
d) Failed to produce timely clarifications related thereto, when sought.
e) Bids not meeting qualification criteria mentioned above.
f) Submitted more than one proposal for single specialisation area.
g) Declared ineligible by the Government of India / State govt. / Public sector undertaking.
h) Bids with technical requirements and or terms not acceptable to MDL.
i) Information relating to the evaluation, clarification and recommendation for pre- qualification shall not be disclosed to bidders or any other persons not officially concerned with such process until the pre-qualification process is completed. Any effort by the bidder to influence MDL prequalification process may result in rejection of his EOI.

SECTION– 6

Documents to be submitted along with EoI

Submission of EoI: - List of documents to be submitted as part of EoI:

Participating firm should submit following documents along with their Proposal.

Sl.	Document Description	Filled in Formats to be Submitted with Proposal	Remarks

1.	Covering Letter		As per format attached
2.	General information	Annexure-1	
3.	Financial Information	Annexure-2	
4.	Pre-Qualification Document		As per section-4
5.	Documents in support of area of Interests.		
6.	Scope of Work (Signed and stamped)		As per Enclosure 1

Format for Covering Letter

[On the Letterhead of the Participating firm]

To,

Mr. Manoj Gawande,
DGM (Offshore Projects- EY)
Mazagon Dock Shipbuilders Limited (MDL),
Mumbai-400010, India.
Contact No- 022-23762665,
E-Mail: mrgawande@mazdock.com

Ref: Submission of Expression of Interest (EoI)

Sir,
Being duly authorized to represent and act on behalf of…… (Hereinafter Referred to as "the Applicant"), and having reviewed and fully understood the EOI and information provided, the undersigned hereby applies in response to the EoI document.

We would like to associate with MDL for following offshore related works and submit our proposal in this regard. We understand that you are not bound to accept the EoI.

Sr. No.	**Area of Interests**	**(Firm to tick)**
1	Additional Development of Ratna–I (ADR-I) and NLM-14 Project	

I am enclosing the Expression of Interest with the details as per the requirements of the EoI document, for your evaluation.

I hereby declare that the details furnished in this EoI proposal are true and correct to the best of my knowledge and belief. In case any of the information is found to be false or untrue or misleading or misrepresenting, I am aware that I will be held liable for it and MDL is free to take any legal / commercial action not limited to barring / blacklisting.

We hereby declare that we are not under a declaration of ineligibility / blacklisting /debarring from doing business issued by Govt. of India / State govt. / Public Sector Undertakings etc.

Yours faithfully,
(Signature & Seal of Authorised Signatory)
Name & Designation :
Date:

Annexure-1

General Information to be submitted by Applicant along with cover letter

1. Name of the Company
2. Legal status of the Company:
3. Brief description of the Company including details of its business groups/subsidiaries/ affiliates:
4. Date of Incorporation:
5. Date of Commencement of Business:
6. Full address including Telephone nos. / Fax nos.:

   Registered Office:

   Head Office:

   Address for communication:

   Contact Details:

   Office Address in India, if any:

7. Documents to be enclosed:

   a. As per pre-qualification criteria

Signature & Seal: Authorised Signatory of the Party

Annexure-2

Financial Information

Date: [insert day, month, year]

Legal Name: *[insert full name]*

Financial Data

Sl. No.	Last three Financial Year	Annual Turnover	Profit after Tax (PAT)	Net worth as at the end of the financial year
1				
2				
3				

2. Financial documents

The participating firm shall provide copies of the financial statements including balance sheets all notes and related income statements for last 3 *years.*

The financial statements shall:

- Reflect the financial situation of the participating firm submitting EoI.
- Be audited by a certified accountant.
- Be complete, including all notes to the financial statements.
- Correspond to accounting periods already completed and audited (no statements for partial periods shall be accepted).

(Signature & Seal)
Authorised Signatory of the Party

Certificate from Chartered Accountant:

This is to certify that _____(name of the Applicant) has received the payments shown above against the respective years and that the net worth is as computed.

Name of the Authorized Signatory representing Auditing firm:
Designation:

Name of firm (Chartered Accountant):
Signature of the Authorized Signatory:
Seal of Audit firm.

ANNEXURE
TO
SECTION-4A

SUBMARINE PIPELINES AND RISERS
(RIGID PIPELINE)

PRANAV ANAND	MOHANA KRISHNA T	Sanjay Chadha				
PA	TMK	SC	Issued for Bid	19	31.07.2025	0
Prepared By	Reviewed By	Approved By	Remarks	No. of Pages	Date	Rev.

TABLE 4.1A
ENVIRONMENTAL PARAMETERS

A.0 The following represents the minimum requirements for the stability of proposed submarine pipelines and risers (Field-wise)

A.1 Heera and Ratna Fields

A.1.1 Submarine Pipeline (Heera and Ratna)

		During Installation	**During Operation**
a)	Pipeline Condition	Empty	Full of product
b)	Significant Wave Height	6.61 m	9.14 m
c)	Significant Wave Period	10.3 Sec.	12.3 Sec.
d)	Wave direction	Perpendicular to Pipeline	Perpendicular to Pipeline
e)	Current Velocity at Mud line (Tidal + Wind drift)	0.45 m/sec	0.45 m/sec
f)	Current Direction	Perpendicular to Pipeline	Perpendicular to Pipeline
g)	Force Coefficients:		
	i) Drag Coefficient	0.75	0.75
	ii) Lift coefficient	0.75	0.75
	iii)Inertia co-efficient	3.29	3.29
h)	Bottom Friction coefficient		
	i) For thermal analysis	0.5	0.5
	ii) For lateral Stability	0.5	*Based on Soil data as per pre-engg. Survey Report restricted to 0.7
	*In case, the value of Bottom Friction Coefficient as per pre-Engg. Survey exceeds 0.7; same shall be restricted to 0.7 for On-Bottom Stability Design.		
i)	Astronomical Tide	3.66 m	4.0 m
j)	Storm Surge	0.61 m	1.3 m
k)	Water depth (Chart datum)		
	For stress calculation & stability	Min. along route	Min. along route + storm Surge
	For checking of pipe buckling	Max. along route + max. tide + storm surge + crest	Max. along route + max. tide + storm surge + crest
l)	Sea water density (Kg/m^3)	1030	1030

A.1.2 Riser (Heera and Ratna)

A.	**Environmental Parameters:**		
		During Installation	**During Operation**
a)	Max. wave height	11.58 m	17.7 m
b)	Max. wave period	11.0 sec	14.3 sec.
c)	Astronomical tide	3.66 m	4.0 m
d)	Storm tide/total tide	0.61 m/4.27 m	1.3 m/5.3 m
e)	Current velocity		
	i) Bottom (mud line)	0.45 m/sec	0.45 m/sec
	ii) 1/4 depth	0.878 m/sec	0.94 m/sec
	iii) 1/2 depth	1.049 m/sec	1.16 m/sec
	iv) 3/4 depth	1.22 m/sec	1.37 m/sec
	v) Surface	1.387 m/sec	1.60 m/sec
B.	The risers shall be designed for operational condition considering the following marine growth:		
-	from mud line to 30 m below chart datum	50 mm (on radius)	
-	from 30 m below chart datum to EL. (-) 2.0 M CD	100 mm (on radius)	
-	from EL. (-) 2.0 M CD to EL. (+) 6.0 M CD	150 mm (on radius)	
	The marine growth density shall be taken as 1400 kg/m³		
C.	The riser shall be provided with splash zone external corrosion allowance in addition to Monel wrap. This allowance shall be as per Table 4.2A enclosed.		
D.	The splash zone for the riser is defined as zone between elevation (-) 2.0 m and up to the bottom of hanger clamp, or (+) 6.0 m elevation w.r.t CD, whichever is higher.		
E.	Internal corrosion allowance in wall thickness for steel pipeline and risers shall be as per Table 4.2A enclosed.		
F.	**Other Parameters**		
	Force Coefficients	During Installation	During Operation
	Drag Coefficient, CD	0.6	0.6
	Inertia Coefficient, CM	2.0	2.0
G.	**Sea Water Temperature**		
	Minimum	22.8 °C	
	Maximum	30.0 °C	
H.	**Air Temperature**		
	Minimum	16 °C	
	Maximum	40 °C	

A.2 Neelam Field

A.2.1 Submarine Pipeline (Neelam)

		During Installation	During Operation
a)	Pipeline Condition	Empty	Full of product
b)	Significant Wave Height	7.2 m	9.7 m
c)	Significant Wave Period	10.16 Sec.	10.69 Sec.
d)	Wave Direction	Perpendicular to Pipeline	Perpendicular to Pipeline
e)	Current Velocity at Mud Line (Tidal + Wind Drift)	0.44 m/s	0.44 m/s
f)	Current Direction	Perpendicular to Pipeline	Perpendicular to Pipeline
g)	Force Coefficients:		
	i) Drag Coefficient	0.75	0.75
	ii) Lift Coefficient	0.75	0.75
	iii)Inertia Coefficient	3.29	3.29
h)	Bottom Friction Coefficient		
	i) For Thermal Analysis	0.5	0.5
	ii) For Lateral Stability	0.5	*Based on Soil data as per pre-Engg. Survey Report
	*In case, the value of Bottom Friction Coefficient as per pre-Engg. Survey exceeds 0.7; same shall be restricted to 0.7 for On-Bottom Stability Design.		
i)	Astronomical Tide	3.66 m	4.6 m
j)	Storm Surge	0.61 m	1.23 m
k)	Water Depth (Chart Datum)		
	For stress calculation & stability	Min. along route	Min. along route + Storm Surge
	For checking of pipe buckling	Max. along route + max. tide + storm surge + crest	Max. along route + max. tide + storm surge + crest
l)	Sea water density (Kg/m^3)	1030	1030

A.2.2 Riser (Neelam)

A.	**Environmental Parameters:**		
a)	Max. Wave Height	11.58 m	18.0 m
b)	Max. Wave Period	11.0 sec	14.4 sec
c)	Astronomical Tide	3.66 m	4.6 m
d)	Storm Tide/Total Tide	0.61 m / 4.27 m	1.23 m / 5.83 m
e)	Current Velocity		
	i) Bottom (mud line)	0.44 m/sec	0.44 m/sec
	ii) 3/4 depth	0.77 m/sec	0.90 m/sec
	iii) 1/2 depth	0.92 m/sec	1.12 m/sec
	iv) 1/4 depth	1.1 m/sec	1.31 m/sec
	v) Surface	1.25 m/sec	1.55 m/sec
B.	The risers shall be designed for operational condition considering the following marine growth:		
-	from mud line to EL. (-) 30 m CD	50 mm (on radius)	
-	from EL. (-) 30 m CD to EL.(-) 2.0 m CD	100 mm (on radius)	
-	from EL. (-) 2.0 m CD to EL.(+) 6.0 m CD	150 mm (on radius)	
	The marine growth density shall be taken as 1400 kg/m³		
C.	The riser shall be provided with splash zone external corrosion allowance in addition to Monel wrap. This allowance shall be as per Table 4.2A enclosed.		
D.	The splash zone for the riser is defined as zone between elevation (-) 2.0 m and up to the bottom of hanger clamp, or (+) 6.0 m elevation w.r.t. CD, whichever is higher.		
E.	Internal corrosion allowance in wall thickness for steel pipeline and risers shall be as per Table 4.2A enclosed.		
F.	**Other Parameters:**		
	Force Coefficients	During Installation	During Operation
	Drag Coefficient, CD	0.6	0.6
	Inertia Coefficient, CM	2.0	2.0
G.	**Sea Water Temperature**		
	Minimum	22.8 °C	
	Maximum	30.0 °C	
H.	**Air Temperature**		
	Minimum	16 °C	
	Maximum	40 °C	

TABLE 4.2A
SUBMARINE PIPELINE DESIGNATION TABLE

PART A: PIPELINE SEGMENTS UNDER ADR-1

Sl. No.	Segment No.	1	2
1	Originating platform	R-12-6A (New)	VGN-A (New)
2	Terminating Platform	RJP (New)	RJP (New)
3	Approximate Pipeline length (km)	16.6	4.9
4	Pipeline OD (mm)	273.1	168.3
5	Pipeline OD (inch)	$10\ ^{3}/_{4}$	$6\ ^{5}/_{8}$
6	Material Specification		
a	Pipeline/Riser	C.S.NACE	C.S.NACE
7	Pipeline/Riser Grade	X-60	X-60
8	Wall thickness (mm), including corrosion allowance		
a	Pipeline	12.7	11.0
b	Riser (including Riser bend, splash zone and Zone 2 pipe)	20.6	18.3
9	Corrosion Allowance (mm)		
a	Pipeline/Riser /Zone-2 Pipe (Internal)	6	6
b	Riser Splash Zone (External)	6	6
10	Service	W.F.	W.F.
11	Design Pressure (kg/cm^2)	As per Process Design Basis	
12	Design Temperature (°C)	As per Process Design Basis	
13	Offshore hydro test pressure (kg/cm^2)	1.25 times the Design Pressure	
14	Design Life	25 Years	
15	External Anti-Corrosion Coating		
a	Material	As per Specification No. 2012A Rev 1	
b	Density	900 kg/ m^3	
c	Thickness (mm)	3	2.5
16	Internal Anti-Corrosion Coating	Yes, FBE	No
17	Concrete Coating		
a	Material	As per Specification No. 2013 Rev 2	
b	Density	3044 kg/m^3	
c	Minimum Thickness (mm) – pipeline	40	50
d	Thickness (mm) – Riser	30	30

Sl. No.	Segment No.	1	2
18	Number of risers to be installed	2	2
a	Originating platform	1 (Internal)	1 (Internal)
b	Terminating Platform	1 (Internal)	1 (Internal)
19	P/L crossings (Nos.)	3	0
20	Pipeline Free Span (Nos.)	17	5
21	Trenching and Burial of pipelines	Not Required	
22	Approximate water depth w.r.t Chart Datum C.D (m)		
a	Originating Platform	*	*
b	Terminating Platform	*	*
23	ANSI Flange Rating		
a	Originating Platform	900#	900#
b	Terminating Platform	900#	900#
24	Platform Co-ordinates		
a	Originating Platform	R-12-6A	VGN-A
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
b	Terminating Platform	RJP	RJP
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
25	Riser Location (Platform Face)		
a	Originating Platform	East	East
b	Terminating Platform	West	West
26	Riser Protector to be provided on jacket face		
a	Originating Platform	No	No
b	Terminating Platform	No	No
27	Field	Ratna	

(*) Refer Structure Scope of Work for details

Sl. No.	Segment No.	3	4
1	Originating platform	R-13A	RJP (New)
2	Terminating Platform	RJP (New)	R-12A
3	Approximate Pipeline length (km)	17	17.7
4	Pipeline OD (mm)	168.3	273.1
5	Pipeline OD (inch)	6 5/8	10 3/4
6	Material Specification		
a	Pipeline/Riser	C.S.NACE	C.S.NACE
7	Pipeline/Riser Grade	X-60	X-60
8	Wall thickness (mm), including corrosion allowance		
a	Pipeline	11.0	15.9
b	Riser (including Riser bend, splash zone and Zone 2 pipe)	18.3	23.8
9	Corrosion Allowance (mm)		
a	Pipeline/Riser /Zone-2 Pipe (Internal)	6	6
b	Riser Splash Zone (External)	6	6
10	Service	W.F.	W.F.
11	Design Pressure (kg/cm^2)	As per Process Design Basis	
12	Design Temperature (°C)	As per Process Design Basis	
13	Offshore hydro test pressure (kg/cm^2)	1.25 times the Design Pressure	
14	Design Life	25 Years	
15	External Anti-Corrosion Coating		
a	Material	As per Specification No. 2012A Rev 1	
b	Density	900 kg/m^3	
c	Thickness (mm)	2.5	3
16	Internal Anti-Corrosion Coating	No	Yes, FBE
17	Concrete Coating		
a	Material	As per Specification No. 2013 Rev 2	
b	Density	3044 kg/m^3	
c	Minimum Thickness (mm) – pipeline	40	40
d	Thickness (mm) – Riser	30	30

Sl. No.	Segment No.	3	4
18	Number of risers to be installed	2	2
a	Originating platform	1 (External)	1 (Internal)
b	Terminating Platform	1 (Internal)	1 (External)
19	P/L crossings (Nos.)	3	6
20	Pipeline Free Span (Nos.)	17	18
21	Trenching and Burial of pipelines	Not Required	
22	Approximate water depth w.r.t Chart Datum C.D (m)		
a	Originating Platform	*	*
b	Terminating Platform	*	*
23	ANSI Flange Rating		
a	Originating Platform	N.A.	1500#
b	Terminating Platform	900#	N.A.
24	Platform Co-ordinates		
a	Originating Platform	R-13A	RJP
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
b	Terminating Platform	RJP	R-12A
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
25	Riser Location (Platform Face)		
a	Originating Platform	East	East
b	Terminating Platform	West	East
26	Riser Protector to be provided on jacket face		
a	Originating Platform	Yes	No
b	Terminating Platform	No	Yes
27	Field	Ratna	
(*) Refer Structure Scope of Work for details			

PART B: PIPELINE SEGMENTS UNDER NLM-14

Sl. No.	Segment No.	5	6
1	Originating platform	NLM-14 (New)	NLM-9
2	Terminating Platform	NLG	NLM-14 (New)
3	Approximate Pipeline length (km)	11.7	5.2
4	Pipeline OD (mm)	323.9	168.3
5	Pipeline OD (inch)	12 3/4	6 5/8
6	Material Specification		
a	Pipeline/Riser	C.S.NACE	C.S.NACE
7	Pipeline/Riser Grade	X-60	X-60
8	Wall thickness (mm), including corrosion allowance		
a	Pipeline	14.3	11.0
b	Riser (including Riser bend, splash zone and Zone 2 pipe)	20.6	18.3
9	Corrosion Allowance (mm)		
a	Pipeline/Riser /Zone-2 Pipe (Internal)	6	6
b	Riser Splash Zone (External)	6	6
10	Service	W.F.	G.L.
11	Design Pressure (kg/cm^2)	As per Process Design Basis	
12	Design Temperature (°C)	As per Process Design Basis	
13	Offshore hydro test pressure (kg/cm^2)	1.25 times the Design Pressure	
14	Design Life	25 Years	
15	External Anti-Corrosion Coating		
a	Material	As per Specification No. 2012A Rev 1	
b	Density	900 kg/ m3	
c	Thickness (mm)	3	2.5
16	Internal Anti-Corrosion Coating	Yes, FBE	No
17	Concrete Coating		
a	Material	As per Specification No. 2013 Rev 2	
b	Density	3044 kg/m3	
c	Minimum Thickness (mm) – pipeline	40	50
d	Thickness (mm) – Riser	30	30

Sl. No.	Segment No.	5	6
18	Number of risers to be installed	2	2
a	Originating platform	1 (Internal)	1 (External)
b	Terminating Platform	1 (External)	1 (Internal)
19	P/L crossings (Nos.)	9	0
20	Pipeline Free Span (Nos.)	12	5
21	Trenching and Burial of pipelines	Not Required	
22	Approximate water depth w.r.t Chart Datum C.D (m)		
a	Originating Platform	*	*
b	Terminating Platform	*	*
23	ANSI Flange Rating		
a	Originating Platform	#900	N.A.
b	Terminating Platform	N.A.	#900
24	Platform Co-ordinates		
a	Originating Platform	NLM-14	NLM-9
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
b	Terminating Platform	NLG	NLM-14
	i. Type of Centre	*	*
	ii. Easting	*	*
	iii. Northing	*	*
	iv. Orientation	*	*
25	Riser Location (Platform Face)		
a	Originating Platform	East	West
b	Terminating Platform	West	East
26	Riser Protector to be provided on jacket face		
a	Originating Platform	No	Yes
b	Terminating Platform	No	No
27	Field	Neelam	
(*) Refer Structure Scope of Work for details			

Notes to Table 4.2A

1. LSTK Contractor's scope includes survey, design, engineering, procurement, transportation, fabrication, internal and external anti-corrosion & concrete weight coating, cathodic protection, installation, free span correction, crossing installation, sub-sea tie-ins / hook-ups, pigging, hydro-testing, pre-commissioning, and commissioning assistance.

2. The Pipeline lengths indicated in Table 4.2A are indicative only as per indicative route given in the field layout drawings. These shall be firmed up as per actual pipeline route survey during detailed engineering to be carried out by the contractor. While finalizing the pipeline route, very high levels of seabed undulations shall be avoided but keeping the pipeline alignment within the survey corridor. LSTK Contractor's scope for survey for all pipeline route corridors includes all route surveys (pre-engineering, pre-construction, post-installation surveys and CP survey). Tentative jacket face for risers is indicated in Table 4.2A. However, these riser locations at existing platforms shall be finalized after pre-engineering/ riser face survey of platform during detail engineering. Contractor shall carry out Spider Deck survey of each platform for existing riser locations and then finalize new riser location and respective pipeline route. The proposed riser location drawing and pipeline route survey corridor drawing shall be submitted to Company for review prior to start of the jacket face survey activities.

3. Line pipe material for pipelines and risers for all above well fluid pipelines/risers shall conform to relevant Function Specifications along with corresponding Addendums as indicated at Appendix B of this Annexure to Section 4A. Monogramming of the line pipes shall be done as per latest Edition of API 5L.

4. Pipeline and Riser wall thicknesses provided in Table 4.2A are firm for S-lay method and are inclusive of internal corrosion allowance and external corrosion allowance wherever applicable. Contractor shall, however, design and verify the wall thickness of pipelines and risers during detail engineering. If the Contractor during detail engineering proposes additional wall thickness for pipeline and riser on-account of lay-ability considerations (based on lay barge configurations), same shall be done without additional time and cost to the Company.

5. ID of Riser, riser splash zone and zone-2 pipe is to be kept same as ID for pipeline. Furthermore, ID of topside piping from minor barrel up to riser transition bend is to be kept as same as ID of pipeline riser system.

6. Risers shall be provided with Monel sheathing in splash zone in accordance with bid specifications.

7. Risers shall be preinstalled in case of all new platforms.

8. In case of existing platform's jackets, Risers shall be installed external to the jacket by stalk on method with Welded joints at riser base. However, external riser installation with flanged connection (Set of WNRTJ type flange of required pressure rating with corresponding swivel flange) to the pipeline at subsea is also acceptable where stalk-on riser installation is not feasible/possible due to overhang of top side deck/other safety considerations. Also, the flanged Tie-in spool for riser-pipeline connection shall be designed for Zone-II. Riser includes 12.20 meters horizontal length of Zone-2 pipe for stalk-on risers and tie-in spool length in case of flanged tie-in of riser with pipeline. Riser and pipeline connection with expansion spool, if any, at the riser end shall be considered in the Zone-II.

9. Riser protector as per the structural design criteria shall be provided in case the riser protector is not available at the proposed riser location. However, in case riser protector / boat landing exists on the

jacket face, where new riser is to be installed, removal & re-installation of riser protector/ boat landing along with strengthening complying with the Structural design criteria shall be in the scope of work of the Contractor.

10. Number/type of clamps and their locations for risers at existing platform shall be finalized/ designed during detail engineering on the basis of existing jacket geometrical configuration. Cost for providing these riser clamps and new structural members, wherever required, shall be included in the lump sum price of the turnkey contract. Further, there is no unit adjustment price for riser and riser clamps.

11. If riser clamps exist at new riser location on existing platform jacket, the same shall be removed as part of riser installation. Demolished/removed pipes and any other material shall be disposed of.

12. Number of crossings and free spans shall be firmed up on the basis of as-laid survey. Only grout filled bag supports shall be used for pipeline crossings and free span corrections.

13. Supply and application of field joint internal FBE coating in offshore by robotic arm method in order to maintain same ID of Pipeline at joints. Detailed specification and procedure for internal FBE coating of line pipes at yard including the procedure for internal coating of field girth weld joint at offshore with QA/ QC plans for this activity shall be developed by the successful bidder and shall be submitted to ONGC for review and approval.

14. Concrete coating thickness for pipelines mentioned in Table 4.2A is minimum only. Actual concrete thickness of pipelines shall be finalized during detail engineering.

15. All subsea flanges, fittings and Specialties shall be suitably coated with marine Epoxy coating and anti-fouling paint, suitable for long term sub-sea service. Contractor shall prepare and submit details of the coating and painting scheme suitable for the prevailing conditions for Company approval.

16. Pigging and Hydro-testing of submarine pipeline shall be carried out by the Contractor as per Company specification attached with the bid package. Pigging and hydrotesting of pipeline segments shall be done from pig barrel to pig barrel.

17. Contractor shall provide 04 Nos. of poly pigs as loose supply material to company for each pipeline segment.

18. All the pipeline segments shall be filled up with sea water dozed with corrosion inhibitor, bactericide and oxygen scavenger as per ONGC FS 2022.

19. Design life of the pipelines & risers shall be as mentioned in Table 4.2A.

20. Contractor shall firm up Table 4.2A during detail engineering and shall get the same approved by the company.

21. Contractor shall submit all drawings/layouts/as-built/Survey Report in WGS-84-UTM; Zone-42 System.

TABLE 4.3A
COMPOSITE CABLE DESIGNATION TABLE

Following Composite Cables shall be laid standalone along with installation of associated J-Tubes:

Sl.	Segments	Size (sq. mm)	Length (km)	J-tubes (12")
1	RJP to R-12-6A	240	16.6	2 (1 no. at each platform)
2	RJP to VGN-A	240	4.9	2 (1 no. at each platform)

Notes to Table 4.3A

1. Composite Cables are to be laid in route corridor of respective pipelines in Table 4.2A. Pre-engineering survey, pre-construction survey and post-construction survey of respective pipelines to also include required surveys for laying of composite cable. LSTK Contractor's scope also includes pre-engineering, pre-construction and post-construction jacket face survey for I/J tube for Composite Cable.

2. Length of Composite Cables shall be as per detailed engineering to be carried out by Contractor. Contractor to confirm the suitability of I/J-Tubes based on the Composite Cable size.

3. Scope includes engineering, procurement and installation of I/J-Tube for pulling of Composite Cable at platforms as per pre-engineering survey to be carried out by the Contractor. Further the drawing of I/J tube shall be vetted by Composite Cable Vendor.

4. Scope of LSTK Contractor includes carrying out lay analysis, laying of Composite Cable standalone on the seabed as per the route alignment firmed up during detailed engineering. Scope of work for the contractor also include installation of I/J-tubes for the Composite Cable on the respective host platforms. Pulling/installation of cable within the I/J-tube for all the platforms along with the hook up of termination is within the scope of the LSTK Contractor. Functional testing of Composite Cable shall be carried out by the Vendor(s) at their premises, which shall be witnessed by the Contractor of this tender before taking over by them as FOB. Refer Electrical and Instrumentation Scope of Work for further details.

APPENDIX 'A'
LIST OF DRAWINGS (REFER DRAWING VOLUME OF BID DOCUMENT)

Sl. No.	Document/Drawing Title	Doc. /Drawing No.	Rev No.
1	Ratna Field Layout	7126-OGEP-PL-3001	0
2	Neelam Field Layout	7126-OGEP-PL-3001	0
3	Clearance for Drilling Rig (Sheet 1 of 2)	PL-EP-DRC-008-1	0
4	Clearance for Drilling Rig (Sheet 2 of 2)	PL-EP-DRC-008-2	0

APPENDIX 'B'
LIST OF SPECIFICATIONS

Sl. No.	Functional Specification	Functional Specification Name	Rev. No.
1	FS 2011	Route Survey	Rev 2
2	FS 2012A	Corrosion Protection Coating (3LPP)	Rev 1
3	FS 2013	Concrete Weight Coating	Rev 2
4	FS 2014	Field Joint Coating	Rev 1
5	FS 2015	Installation Of Submarine Pipelines & Related Facilities	Rev 2
6	FS 2018	Long Radius Bends	Rev 0
7	FS 2020B	C.S. Seamless Line Pipe for Submarine Pipeline (Sour Service) along with Addendum and Addendum 2	Rev 5
8	FS 2022	Hydrostatic Testing of Submarine Pipeline	Rev 1
9	FS 2024B	Fittings And Flanges for Submarine Pipeline (Sour Service)	Rev 0

APPENDIX 'C'
JACKET DEFLECTIONS

Following jacket movements for existing well platforms from mud line to hanger clamps are to be considered:

Neelam Field

100 year storm				
	North/South	Mudline	:	125 mm
		Spider Deck	:	217 mm
	East/West	Mudline	:	61 mm
		Spider Deck	:	125 mm
1 year storm				
	North/South	Mudline	:	125 mm
		Spider Deck	:	217 mm
	East/West	Mudline	:	61 mm
		Spider Deck	:	125 mm

R10A Platform:

100 year storm	:	North/South	Mudline	:	400 mm
			Hanger Clamp	:	420 mm
		East/West	Mudline	:	154 mm
			Hanger Clamp	:	176 mm
1 year storm	:	North/South	Mudline	:	180 mm
			Hanger Clamp	:	200 mm
		East/West	Mudline	:	112 mm
			Hanger Clamp	:	127 mm

APPENDIX 'D'
WAVE EXCEEDENCE TABLE

Number of Waves Exceeding Specified Height in 1 Year:

Offshore Bombay Area:

WAVE HEIGHT (Ft.)	NUMBER OF WAVE EXCEEDANCES				
	S DIR	SW DIR	W DIR	NW DIR	ALL DIR
0	1276045	770535	1015713	1220511	4282804
5	61704	219347	220985	69788	571824
10	3132	37929	31902	3764	76727
15	167	5878	4073	177	10295
20	11	869	493	8	1381
25	0	126	59	0	185
30	-	18	7	-	25
35	2	1	-	-	3
40	-	0	-	0	-

PART-IV

SECTION-4A

SUBMARINE PIPELINES AND RISERS

(RIGID PIPELINE)

R.P. PUROHIT CE(C&M)	ROHIT PANT DGM(M)	SANJAY NARAIN DGM(C&M)	
R.K. GUPTA Dy.G.M.(C&M)	N.V.PAI Dy.G.M.(C&M)	B.P.MALIK Dy.G.M.(C&M)	K.P.VARGHESE Dy.G.M.(C&M)
PREPARED BY			
A.K.MISHRA Dy.G.M. (C&M)		D.R.KAMBLE GM (C&M)	
REVIEWED BY		APPROVED BY	
25	01.08.2016	5	
TOTAL NO. OF PAGES	DATE	REV.NO.	

SECTION-4A

SUBMARINE PIPELINES & RISERS
(RIGID PIPELINE SYSTEM)

CONTENTS

TABLES & APPENDICES
(PLACED AT ANNEXURE TO SECTION 4A)

4.1 GENERAL

4.1.1 Oil and Natural Gas Corporation Ltd. (ONGC) is planning for installation of a number of submarine pipelines.

Details/data of pipeline and riser system to be installed and platforms to be connected by these pipelines are given in field layout, Table 4.2 A (placed at Annexure to Section 4A) & other drawings including specifications.

This section includes the minimum requirements for the survey, design, engineering, material procurement, fabrication, transportation, installation, hook-up and testing/pre-commissioning of the submarine pipeline & risers covered within this Bid Package.

The final design of the pipeline & riser system shall be the sole responsibility of the CONTRACTOR. The CONTRACTOR shall ensure that the final design of the pipeline system complies fully with the design criteria and operating philosophy as presented in this Bid Package.

The CONTRACTOR shall also be responsible for the supply of material, fabrication, transportation, installation, hook-up, testing/pre-commissioning and making the entire pipeline system as described herein operational to the extent that they fulfill the intent of the system.

Company shall accept either of or a combination of S-lay or Reel-lay methods for laying of pipelines on overall cost economics.

4.1.2 As used in this specification, the following definitions shall apply:

COMPANY : Oil and Natural Gas Corporation Ltd

CONTRACTOR : Turnkey Contractor for the Project

4.1.3 CONTRACTOR shall obtain COMPANY's written approval for any deviations from the requirement of the bid specifications. This document is not intended to be all-inclusive and the use of the guidelines set forth does not relieve the CONTRACTOR of his responsibility in performing the work for its intended service.

Design/installation requirements shall be in accordance with Table 4.1A and 4.2A, drawings and specifications listed at Appendix A & B (placed at Annexure to Section 4A).

4.2 **SCOPE**

4.2.1 **Requirements**

This section includes the minimum indicative requirements for the design, detailed engineering, material supply, inspection, coating & wrapping, expediting & transportation to site, fabrication, installation as per approved drawings/procedures and testing/pre-commissioning of the submarine pipeline & riser system covered within this bid package.

4.2.2 **Scope of Work**

The scope of work to be performed by the CONTRACTOR shall be but not limited to the following:-

a) Pre-engineering and pre-construction surveys:

Carrying out seabed survey along the proposed routes, collection/ interpretation of survey results/data, selection and recommendation of final route (keeping the pipeline length and crossings as minimum and clearance with respect to jacket legs of existing well platforms as shown in relevant drawing) after finalizing departure and approach angles of pipelines at various platforms based on the survey carried out within the corridor or within additional corridor / area duly surveyed / investigated by CONTRACTOR and approved by the COMPANY. Pre-installation survey shall be carried out to ensure the installation in the designated slot/route with control during installation supervision.

The scope of work shall also include survey and inspection of jacket face to check the dimensions of existing members and to check the adequacy of space available for installation of risers and clamps. Interference or obstruction, if any, shall be identified by the CONTRACTOR.
The survey shall be carried out as per Spec. 2011.

b) Finalization of design data/basis for COMPANY's approval for carrying out design, detailed engineering, procurement, preparation of construction drawings and documents, installation and testing of pipelines/risers and other associated works. Finalization of design basis shall be done in accordance with Table 4.1A, & 4.2A (placed at Annexure to Section 4A) and design criteria, codes, standards and specifications contained in the bid package.

c) Design, detailed engineering of all submarine pipeline and riser system, including clamps, CP system, fittings, all tie-ins, pipeline crossings and free span corrections and anchoring etc., all complete in

accordance with approved design basis and requirements of this bid package. CONTRACTOR's scope shall also include furnishing of design reports, calculations and drawings etc. as per the requirement of bid package.

d) Preparation of material requisition, purchase and supply, expediting, inspection, fabrication, testing and transportation of all materials to intermediate storage/plant locations and job site(s) including sea fastening , for successful execution of works at site.

e) Supply and application of external corrosion protection coating as per Spec. no.2012A.

f) Supply and application of internal corrosion protection coating for Water Injection Pipelines for 200mmm ND and above sizes. Bidder to submit the specifications for the same including the procedure for internal coating of field girth joint for Company's review and approval.

g) Supply and application of concrete weight coating as per Spec. no. 2013 Rev.1 for S-Lay method only. In case of Reel Lay Method, only corrosion coating shall be provided and no concrete coating is required. For Reel Lay Method, additional wall thickness, if required, shall be worked out and provided for on-bottom stability and reeling/unreeling requirements of the pipeline in addition to the requirement covered for S-Lay Method given in table 4.2 A (placed at Annexure to Section 4A).

h) Design, engineering, supply, installation and testing of sacrificial anode type cathodic protection system for all pipelines and risers. The cathodic protection system shall be as per scope of work, design criteria and specification No. FS 4002 enclosed in the bid package.

i) Removal and cleaning of marine growth/fouling from jacket braces/members to facilitate installation and proper fit up of new riser clamps/brace clamps of additional member.

j) Riser clamps and new structural members wherever required shall be designed, supplied, fabricated and installed by the CONTRACTOR. Riser clamps, wherever existing in the same location where the new riser clamps are to be installed, shall be replaced by new clamps by the CONTRACTOR after cutting existing clamps. Procedure for the same shall be approved by the COMPANY.

The location of risers shall be finalized during survey/detailed engineering.

All works incidental to installation of risers such as design and provision of additional/new members/braces wherever necessitated by detailed engineering, removal of interfering structures/members, boat landing, riser protector, barge bumper, anodes etc., and modifications thereof, if any, and reinstallation of the same as per original design conditions shall form part of CONTRACTOR's scope of work and cost of such works shall be deemed to be included in the price quoted by the CONTRACTOR. The removal/re-installation procedures of riser protector, boat landing, jacket anodes etc. to facilitate installation of risers shall be approved by the COMPANY.

k) Providing & installing Monel sheathing on splash zone part of the riser as per Spec no.2015 Rev.1.

l) Finalization and submission of installation procedures including analysis/calculations for safe installation of pipeline & risers, for Company's approval, as per the bid package requirement. Installation of all pipelines & risers as per Company's approved procedure including rectification of all unsupported spans to design permissible limit, pipeline crossings etc.

Both S-lay and Reel-lay methods are kept as alternative pipeline laying methods. Bidders are allowed to propose any of or a combination of the two methods. Company shall accept the above based on economic considerations.

m) Testing of pipelines for possible buckling during installation by passing a 'gauging pig' through the entire pipeline and riser system. This must be done for each pipeline segment as per the requirement of the bid package in addition to the use of buckle detector during pipe laying.

n) Cleaning and hydrostatic pressure testing of all installed submarine pipeline and riser system in accordance with the specification enclosed with the bid package.

n) All pipelines including associated risers after hydrostatic testing, shall be left with treated seawater and hooked-up with the existing deck piping. Contractor shall supply minimum 4 Nos. of Dewatering/poly pigs of appropriate sizes for each segment, after hydrostatic testing. Commissioning shall be done by the Company for which necessary assistance required shall be provided by the Contractor.

o) Carrying out post installation survey including C.P survey, all clean-up operations and preparation of as built drawings and documents as per bid package requirement.

p) Each valve of 200 mm NB and above on pipeline laterals shall be provided with a hydraulic actuator. Further, for valves up to 150mm NB, valve vendor shall provide the valve operating torque values corresponding to valve pressure rating. In case, maximum hand wheel force required to operate the valve is within 35kgf, valve shall be operated manually. Further, in case for valves up to 150mm NB, maximum hand wheel force exceeds 35kgf, valve shall be provided with hydraulic actuator.

q) All valves provided on idle laterals shall be kept in closed condition after completion of pigging and hydrotesting of pipeline with laterals.

4.2.3 CONTRACTOR's Responsibility

a) Entire work(s) defined above shall be carried out by CONTRACTOR in accordance with the specifications, drawings and other requirements of the bid package, and instructions/directions of the COMPANY. Quality control shall be carried out as per the governing code(s) and Company's specification.

b) Review and approval of CONTRACTOR's entire work(s) by COMPANY shall in no way relieve the CONTRACTOR of his sole responsibility for safe and efficient design, engineering, supply, installation and subsequent operation of all the pipeline(s)/riser(s) by COMPANY in accordance with applicable codes and standards for intended use of the pipeline(s) system.

c) The CONTRACTOR is deemed to have recognized any restrictive features of the site(s) and/or specific requirements of the work and made due allowances for it in the work to be performed by him.

d) The CONTRACTOR is cautioned to exercise extreme care and take necessary precautions to prevent damage to the existing offshore pipeline(s), riser(s), electrical and other cables, marine structures and/or jackets during execution of the entire works. It is CONTRACTOR's sole responsibility to obtain sufficient information on these existing facilities for safe and sound execution of the work. Entire cost of repair or replacement of these facilities damaged due to CONTRACTOR's negligence shall be to CONTRACTOR's account including any production loss to the owner/COMPANY thereof. COMPANY shall be the sole judge for deciding the same.

4.2.4 **COMPANY's Responsibilities**

COMPANY has provided available information on the existing pipelines and other facilities. It is the CONTRACTOR's responsibility to obtain relevant additional information on these existing facilities to allow safe and sound design and installation of the new pipelines and risers.

4.3 **DESIGN CRITERIA**

4.3.1 **Design Parameters**

The design of pipelines, risers, tie-ins, pipeline crossings and free span corrections shall follow the guidelines of Det Norske Veritas Rules for submarine pipeline system 1981 (DNV). The design and loading conditions and design criteria shall be as defined in Section 3 & 4 of the above rules. Constants and coefficients to be used for the design calculations can also be taken from these rules except as specified below:

i) Maximum allowable steel stresses during installation. loading condition "b" (SMYS- Specified Minimum Yield Strength). : 85% SMYS

During Hydrotest: : 90% SMYS

ii) Zone-1
Maximum allowable steel stress during operation

Pipeline, load condition 'a' : 72% SMYS

Pipeline, load condition 'b' : 85% SMYS

iii) Zone-2 (upto a distance of 12.2M from bottom end of the riser bend)

Load Condition 'a' : 50% SMYS

Load Condition 'b' : 67% SMYS

Von Mises Stress Hypothesis shall be used for determination of combined stresses in the riser/pipeline

iv) Environmental Parameters

Table 4.1A (placed at Annexure to Section 4A) represents minimum environmental requirements.

v) Pipeline sizes, design temperature/pressure etc. are presented in Table 4.2A (placed at Annexure to Section 4A).

vi) The geo-technical data shall be collected by CONTRACTOR during surveys as per Spec. 2011 Rev.2. The soil data collected should be enough to determine strength and index properties required for engineering, areas prone to scour & instability.

vii) Internal/External corrosion allowance as indicated in Table 4.2A (placed at Annexure to Section 4A) shall be used in pipeline & riser design.

4.3.2 Codes and Standards

The design, fabrication and installation of all pipe-lines and risers shall meet the requirements of Det Norske Veritas, "Rules for Submarine Pipeline System" 1981 (DNV). Additionally, latest edition of the following codes and standards shall be followed wherever applicable:

ANSI B31.4	-	Liquid Petroleum Transportation Piping Systems.
IP Part 6	-	Institute of Petroleum, Model code of safe Practice.
ANSI B31.8	-	Gas Transmission and Distribution Piping Systems.
API Std.1104	-	Standard for Welding Pipelines and Related Facilities.
API RP 1110	-	Recommended Practice for the Pressure Testing of Liquid Petroleum Lines.
API RP 1111	-	Recommended practice for design construction, operation and maintenance of offshore hydrocarbon pipeline.
United States	-	Minimum Federal Safety Standards for Gas Lines. Part 191,192
	-	Minimum Federal Safety Standards for Liquid Pipelines. Part 195

SIS 05-5900	-	Swedish Standards Institution for Surface Preparation.
DNV RPB-401	-	Cathodic Protection System
NACE Std. RP-06-75	-	Recommended Practices : Control of Corrosion on Offshore Steel Pipelines.
API RP 5L1	-	Recommended practice for Rail – Road Transportation of Line pipe.
API RP 2A	-	Recommended practice for planning, designing, construction of fixed offshore platforms.
API RP 5L5	-	Recommended practice for marine transportation of line pipe.
DNV OS-F101	-	Submarine pipeline systems.

ASTM Standards where applicable and all relevant specifications contained in the Bid Package.

Where conflicting statements exist between the different codes and standards, the most stringent regulations shall apply unless directed or agreed otherwise by the COMPANY.

4.3.3. Pipe diameters as indicated in Table 4.2A (placed at Annexure to Section 4A) are already decided and shall not be revised by the CONTRACTOR. The grade of pipe, wall thickness, thickness of corrosion protection coating & weight coating as given in Table 4.2A are the minimum requirement to be provided by the CONTRACTOR for S-Lay method only.

4.3.4 All calculation methods which bidder proposes to use in detail design, the installation procedures, testing procedure and marine equipment etc. proposed to be used shall be in sufficient details to allow the COMPANY to verify the design basis and technical suitability of bidder's proposal. If computer output is proposed, bidder shall furnish a brief description of the analytical methods employed in the programme and identify the basis and theory used. CONTRACTOR shall also perform detailed flexibility analysis for pipeline including checking spans for vortex shedding criteria.

4.3.5 **PIPELINE DESIGN METHODS**

4.3.5.1 Pipeline and related facilities shall be designed as per the requirements stated herein and complying with the requirements indicated in Table 4.1A & 4.2A (Annexure to Section 4A), drawings (enclosed elsewhere in the bid document) and specifications listed in Appendix A & B (placed at Annexure to Section 4A).The Contractor shall design the entire pipeline system in such way to ensure the piggability of pipelines from pig barrel to pig barrel.

4.3.5.2 **Wall Thickness Design**

Wall Thickness Analysis shall be carried out for installation, testing & operating conditions for selection of pipeline wall thickness. The pipeline wall thickness shall be checked for pressure containment (hoop stress) and against collapse due to external over-pressure.

In addition, local buckling (due to external over-pressure and combined effect of axial tension and bending), propagation buckling due to external over-pressure bar buckling and upheaval buckling shall be analyzed. Allowable out-of-of roundness of the pipe to be used for the analysis, where applicable shall be 2%. The selected wall thickness shall comply the equivalent stress criteria considering thermal & curvature stresses etc. For thickness verification under operating condition, corroded thickness shall be used.

4.3.5.3 **Stability Analysis**

The stability requirements shall be evaluated by lateral and vertical stability analysis of the pipeline during installation, testing and operation. The lateral stability analysis shall include all environmental forces such as drag, inertia and lift as well as frictional resistance. The vertical stability analysis shall include pipe buoyancy, an assessment of soil liquefaction potential, trenching depth and backfill material requirements. The following design cases shall be considered:

- Pipe resting on the seabed
- Pipe in a Trench (if applicable)
- Pipe resting on seabed and stabilized by other means such as placing additional restraints e.g. grout bags etc.
- Pipe crossing with pipe resting on supports.

Unless otherwise specified by the COMPANY, the stability requirements shall primarily be met by increasing the submerged weight of the pipe. The required submerged weight shall as far as practicable be achieved by applying concrete weight coating to the pipe in case of conventional lay method or by providing additional wall thickness to the pipe in case of Reel Lay method.

The required submerged weight of the pipe for the stability analysis shall be determined for the following design conditions:

- Pipe empty during installation
- Pipe filled with product during operation.

On-bottom stability analysis shall be carried out considering the passive resistance of soil due to settlement of pipeline using Veritec RP E305/DNV RP F109/AGA level 2 such that the pipeline will not move from as installed position, apart from movements corresponding to permissible deformation, thermal expansion and limited amount of settlement after installation in line with the requirement of DNV 1981.

4.3.5.4 Expansion & Stress Analysis and Unsupported Span

Expansion analysis of pipeline shall be carried out in accordance with Design and Operating conditions, Temperature decay along the pipeline shall be calculated based on process design parameters.

The criteria for pipe stress analysis shall be to maintain all stresses during installation, testing and operation within the allowable limits set by Section 4.3.1 of this specification.
Operational stress limits specified for risers shall also be applied to Zone-II pipe upto a distance of 12.2 meter from the end of the riser bottom bend. The riser is defined as the portion extending from top of transition bend to the end of Zone-II pipe / end of expansion spool/ Tie-in spool (if any).

To keep pipeline stresses within the allowable limits, the unsupported spans shall not exceed certain maximum values. The static allowable spans shall be calculated for the following three pipeline conditions:

- Pipe empty after installation
- Pipe flooded during hydrostatic testing
- Pipe filled with product during operation.

In addition, the pipeline shall be designed to avoid excessive vibrations due to vortex shedding by limiting span lengths so that resonance does not occur. If this is not feasible, safety against fatigue failure shall be analyzed.

For each of the three pipeline conditions mentioned above, the shortest calculated span length shall be used as the maximum allowable span length.

In the event, the touch down length of proposed pipeline is less than one pipe length (12.2 mtrs.) between two consecutive free span corrections, then the entire configuration shall be treated as ONE free span correction.

4.3.5.5 **Collapse and Buckling Analysis**

Wall thickness shall be checked against collapse in addition to hoop stress.

Local buckling due to external over pressure, bending and propagation buckling due to external over-pressure shall also be analyzed. Allowable out-of-roundness of the pipe to be used for the analysis shall be 2 %.

4.3.5.6 **Corrosion Protection**

Pipeline external and internal corrosion protection shall be provided by corrosion protection coating. This external coating shall be as per the specification attached in Appendix B. Specification for internal coating (for Water Injection Pipelines) including coating of the field girth weld joint is to be submitted for Company's review and approval. The CONTRACTOR shall check the serviceability of such coating for the operating temperature and fluid characteristics of the pipeline.

4.3.5.7 **Cathodic Protection**

The cathodic protection of all pipelines shall be provided by Contractor in accordance with the attached specification No. FS 4002. As the Contractor is responsible for post-installation C.P. surveys and results of survey ensuring proper response of the system provided, Contractor shall inspect the installed anodes for appropriate mounting and electric connection.

4.3.5.8 **Route and Profile**

Utilizing the survey information, the CONTRACTOR shall finalize the pipeline alignment. The pipeline route shall be selected such that the pipeline follows a smooth seabed profile, and avoid, wherever possible, coral reefs, and soft or liquefied soils. Where it is not practical to avoid seabed irregularities, capable of causing significant stresses in the pipeline, stress levels shall be checked against the allowable stresses. In the event that the stress levels exceed the allowable limit, the pipeline profile shall be modified such that the stress levels are within the allowable limits. Unsupported pipeline spans shall not exceed the allowable limits calculated.

4.3.5.9 **Offshore Pipeline Crossings**

The crossings shall be designed, such that the existing or proposed pipeline shall not be over-stressed, either during installation, hydrotest or operation,

according to criteria mentioned in Section 4.3.1 and the resulting spans shall not exceed their allowable limits. The minimum clearance shall be subject to the COMPANY's approval and shall be based upon the predicted settlement of pipes and supports, size and type of supports and allowable span length.

The stability analysis of the pipeline and supports at the crossing shall be based on maximum wave heights/significant wave height at operating conditions.

On-bottom stability of the pipeline and supports including check for settlement of pipeline & supports based on soil bearing capacity, sliding and overturning of support.

The minimum factor of safety to be considered for support design shall be as follows :

- Factor of safety against settlement shall be considered as 2.0
- Factor of safety against sliding shall be considered as 1.5
- The eccentricity of the resultant force (against overturning) shall lie within middle third of the base of the support.

The newly installed pipeline should normally cross the existing line at an angle not less than 30 Degree. In case of any specific case involving restriction in maintenance of crossing angle as stipulated above, the same shall be reviewed by the COMPANTY during detailed engineering review. CONTRACTOR shall design the supports for crossings considering the parameters given in Table 4.1A (placed at Annexure to Section 4A) and submit to the COMPANY for review and approval. Grout bag supports shall be provided to maintain physical separation of 350mm or more between the existing pipeline and the proposed pipeline for the life span of the proposed pipeline.

4.3.5.10 **Pipelay analysis**

The laying analysis shall be performed using the details of the proposed barge/laying method to confirm that pipelines can be laid with proposed barge and the design thickness without exceeding allowable stresses.

4.3.6 **RISER DESIGN METHOD**

The design of all pipeline & risers including the 12.2 meters horizontal length of Zone-II pipe shall be done in compliance with the code and standards specified in Section 4.3.2 and design parameters defined in Section 4.3.1.

4.3.6.1 **Riser Location**

The indicative location of risers for each submarine pipeline connecting the existing platforms are shown in the various drawings enclosed in the bid

package. These shall be finalized during pre-engineering survey / detailed engineering. For new platforms to be installed, the location of risers shall be finalized during detailed engineering. The risers shall be pre-installed within the confinement of the jacket at the new platforms. These risers shall have flanged connection at riser base.

4.3.6.2 **Stress Control**

The criteria for the riser stress analysis shall be to provide a safe and functional riser design. Stresses during installation, operation and testing shall not exceed the allowable limits as per Section 4.3.1. Expansion of pipelines and movement of jacket due to operational and environmental load shall be considered in the riser design.

For stress analysis of riser, the temperature decay along the pipeline shall be considered for thermal expansion of the pipeline based on process design parameters.

The Contractor shall endeavor to absorb in the riser any expansion/contraction in the pipeline or deflection of the platform caused by environmental and functional forces without the use of expansion loop by locating the first riser clamp as high as possible from the seabed or increasing the submerged weight of the pipe-line near the riser end, thus ensuring that the stresses in the riser are below the allowable limits and the loads transferred from the risers to the jacket are minimized. CONTRACTOR shall also perform a flexibility analysis.

4.3.6.3 **Clamps and Location**

Riser shall be supported by hanger flange and guided by non-frictional riser clamps attached to the platform. All new riser clamps shall be designed in accordance with the API RP 2A-WSD and provided as per approved Riser design reports.

The clamp spacing shall be such that the risers are safely supported and that calculated allowable spans are not exceeded. Number of clamps and their location shall be selected by the CONTRACTOR to prevent the riser from becoming over-stressed during design storm conditions while the pipeline remains in full operation. Spacing of riser clamps shall be based on risers withstanding storm conditions, temperature stresses and vortex shedding criteria given in Appendix-A to DNV rules for submarine pipeline system. Clamps shall be internally padded with 12mm thick neoprene bonded to the clamps steel surface by adhesion. However, contractor shall submit detailed procedure for company's approval. Where adjustable clamps are provided, electrical continuity for cathodic protection of clamps shall be provided between jacket and clamps. All bolting on the riser clamps shall utilize fully

tightened double nuts on each end of the struts. All nuts and bolts used for clamping the risers shall be XYLAN coated.

4.3.6.4 The internal and external corrosion allowance for the risers shall be considered in Design as per Table 4.2A (placed at Annexure to Section 4A).

4.3.6.5 **Coating of Risers and Bends**

i) All risers, including bends, shall be coated and wrapped with the corrosion protective coating as described in the specification attached with the bid package, from the sea bed upto the splash zone.

ii) All risers shall be coated with a concrete weight coating upto splash zone. The minimum thickness of concrete coating on risers shall be 30 mm. The field joint coating at the riser to pipeline connection and on risers shall follow the guidelines set for pipeline field joints.

iii) Riser extending above the splash zone shall be painted in accordance with general specification 2005 "Protective Coating".

iv) For splash zone (Portion extending from (-)2.0m w.r.t. Chart Datum upto (+) 5.5m or bottom of hanger flange "Monel Jacket" shall be applied. A 5mm thick monel sheet shall be welded to the riser pipe at top and bottom to form a tight jacket which should have facilities for future testing for tightness. At onshore yard, the monel jacket shall be checked for tightness by an air pressure test to 1.5 kg/cm^2. Installation tolerances and tolerances in surveyed water depth shall be considered for meeting the above requirements. Monel Sheathing shall meet the requirements of Clause 8.13 of Spec. No. 2015 Rev.1. All the welds shall be coated with epoxy/resin to prevent corrosion.

Specification and application procedure for splash zone protection shall be submitted by CONTRACTOR for approval by COMPANY.

4.3.6.6. **Riser Bend**

i) Prefabricated shop pipe bends as described in the specification attached with the Bid package shall be used at the bottom and at the top of risers. Bends radius shall be at least 5 times the outside diameter of pipe and should be suitable for pigging with fault detection/intelligent pig.

ii) Transition from one pipe wall thickness to another shall be by internal bevel not exceeding 1 to 4 taper.

iii) Diagonal bracing shall be attached to the bottom riser bends by clamps during fabrication. These bracing shall be removed or a 600 mm

section cut out of the brace after riser installation is completed and clamps are tightened. The brace shall not be welded to the pipeline. The clamps shall be padded with 12 mm thick neoprene padding as per Clause 8.10 of specification No. 2015 Rev.1.

4.3.6.7 **Cathodic Protection of Risers**

Cathodic protection of risers shall be provided by Contractor to conform to enclosed Spec. No. FS 4002 and Electrical design criteria.
No insulating joints are envisaged on pipeline- riser system.

4.3.6.8 **Hanger Flanges**

All pipelines shall be provided with suitable hanger flanges for supporting the risers. The riser hanger flanges shall be designed, manufactured and installed by the CONTRACTOR as per relevant Codes and Standards. The material for hanger flanges shall meet the provisions of clause 5.7 of DNV, 1981 Rules for Submarine pipeline System.

CONTRACTOR shall perform detailed piping flexibility analysis for all risers and connected deck piping to determine the design loads.

The complete details, design, fabrication and installation of riser hanger flange shall be approved by the COMPANY.

4.3.7 In addition to the technical requirements and conditions stated herein above, specifications and drawings enclosed as Appendix - A & B shall be complied with for various works to be performed by the CONTRACTOR.

4.4 **DESIGN REVIEW**

4.4.1 **Requirements**

CONTRACTOR shall be required to present written substantiation of all proposed designs, installation, and testing procedures for approval by COMPANY. This shall be done thirty (30) days prior to the commencement of any phase of fabrication or installation. The work shall begin only after COMPANY approval has been obtained. The presentation may be in the form of one or more reports and shall contain the design calculations to substantiate CONTRACTOR's proposed materials and construction techniques. The report shall contain the design assumptions, design calculations, material specifications, and details of construction. Data included in the report shall be sufficient to show that all factors listed in section 4.3 have been considered. Calculations shall also be submitted for any other factor not listed in Section 4.3 but which are necessary to prove the validity of CONTRACTOR's design or proposed construction methods. CONTRACTOR shall furnish his document

schedule, indicating clearly sequencing of the documents. The following paragraphs cover the minimum requirements for the design document which includes:

i) Reports

ii) Drawings

iii) Calculation Books.

The above mentioned items shall be a part of design documentation by the CONTRACTOR and shall be the property of the COMPANY.

4.4.1.1 **REPORTS**

The CONTRACTOR shall prepare the following reports as applicable:

a) Pipeline Design Criteria Report

b) Pipeline Design Report

c) Riser Design Report

d) Installation/Testing Method Report

e) Specifications

f) Cathodic Protection System design report.

a) **Pipeline Design Criteria Report**

Pipeline Design Criteria Report shall include the following items:

- Appraisal of Data (environmental, bathymetry, soils, etc.) submitted by the COMPANY and collected by CONTRACTOR after survey.
- Selection of the Pipeline Route and pipeline length.
- Pre-engineering, pre-construction and post-installation survey reports.

b) **The Pipeline Design Report shall include:**

- Pipeline wall thickness analysis
- Pipeline Lateral & Vertical Stability Analysis

- Pipeline Construction, Testing and Operating Stress Analysis.
- Pipe lay analysis
- Pipeline Buckle & Collapse Analysis
- Pipeline Unsupported Span Analysis
- Pipeline Crossing Stability and Stress Analysis
- Pipeline expansion analysis.
- Pipe Cathodic Protection Analysis
- Pipeline Fracture Analysis, if required

c) **The riser design reports shall include**:

- Riser Flexibility Analysis
- Riser Construction, Testing & Operating Stress Analysis.
- Clamp Loads
- Vortex shedding analysis
- Clamps and clamps spacing/allowable spans

d) **The Installation Methods Report shall include:**

- Offshore Pipeline Section
- Risers
- Hydrotest
- Spacing between existing & installed pipelines & method Contractor proposes to use ensure that related spacing is maintained.

e) **Specification for:**

i) Pipe

ii) Pipe Bends

iii) Pipe Fittings & Flanges, if any

iv)Riser Hanger Flange/Riser Clamps

v) Knee Brace

vi)Corrosion Protection Coating (internal & external)

vii) Concrete weight coating

viii) Field Joint Coating (internal & external)

ix)Splash Zone Materials

x) Pipeline Crossings

xi)Tie-ins fittings

xii) Cathodic Protection System

xiii) Trenching and burial, if required

4.4.1.2 **DRAWINGS**

The CONTRACTOR shall prepare all the design drawings required to complete the design. The drawings shall include pipeline alignment drawings, schematics, lay-outs and isometrics, riser location and make up, riser clamps, tie-ins etc.

The drawings index shall be divided into the following major categories:

- Area Maps
- Pipeline Alignment Drawings
- Anode Installation drawings
- Pipeline Approach to and Departure from platforms
- Pipeline Crossings.
- Riser Elevation and Clamps spacing, riser makeup
- Clamps details

- Sketches and Illustrations.

A scale 1:5000 for the pipeline alignment sheets and a scale of 1:250 for the platform approach covering a distance of minimum 200 m shall be used unless otherwise specified by the COMPANY.

4.4.1.3 CALCULATION BOOKS

The calculation books shall include all calculations and computer analysis. The books shall have separate sections for pipelines and risers.

4.5 PIPELINE INSTALLATION

All works related to pipeline installation by S lay or Reel Lay method shall be performed in accordance with the specifications listed at Appendix B.

Rigid pipelines may be installed by "REEL LAY" method. In this method the pipes shall be welded together at the shore based yard. Also, corrosion coating has to be applied at the onshore yard. Next, welded pipes shall be spooled on to the pipe laying vessel's reel (normally a D.P. vessel).

To initiate pipe lay, the end of pipe stalk shall be anchored, and the pipe-laying vessel then shall move along the pipeline route, unreeling pipes, as it shall advance.

Also, in this method, concrete weight coating cannot be applied, and hence on bottom stability may be achieved by increasing the wall thickness of the pipe, if required.

However, based on the brief methodology, mentioned above the Contractor shall furnish detailed methods/procedures at the time of bidding for Company's evaluation.

For submarine pipeline to be laid by Reel Lay Method, pipe material & procedures, etc. shall comply to the requirements of Section 7H of DNV OS-F101 Offshore Standard for Submarine Pipeline Systems 2000 edition.

4.6 TIE-IN-OPERATIONS

4.6.1 Procedure

CONTRACTOR shall submit tie-in procedures for riser installation, connections to stub lines & laterals mechanical connections as applicable, to the COMPANY for approval.

4.6.2 The tie-in between pipeline and riser at the existing platforms shall be of welded connection, performed at the lay vessel and subsequently lowered. However, in case of new platforms the riser shall be pre-installed within the confinement of jacket. These risers shall have flanged connection (set of WN flange and Swivel flange) at riser base.

4.6.3 CONTRACTOR shall furnish the tie-in details to the COMPANY for approval. The following information shall be furnished as a minimum:

i) Description and specification of components which will be introduced as permanent parts of the pipelines.

ii) Calculation of stresses occurring during installation and operation.

iii) Procedure specification covering all tie-in operations.

iv) Description and specification of equipment and instruments to be used for the installation.

v) Description and specification of methods of inspection and testing.

4.6.4 **Other Tie-Ins**

The tie-in between riser and deck piping shall be provided by welding.

4.7 HYDROSTATIC TESTING OF PIPELINE SYSTEM

Testing of pipeline & riser system shall be done as per the specification attached with bid package after completion of all installation works of pipelines, risers, crossing, operations and remedial works, if any. Before hydrostatic testing, the pipeline & riser shall be cleaned with a mechanical pig. Testing procedure and equipment shall be subject to Company's approval and shall include cleaning, gauging and hydrotesting of the pipeline & riser system. COMPANY's Representative must be present to witness all pipeline tests conducted by the CONTRACTOR. CONTRACTOR shall carry out hydrostatic test for a minimum continuous period of 24 hrs. after stabilization, all lines and risers to a test pressure of 1.25 times the design pressure given in Table 4.2A (placed at Annexure to Section 4A).

4.8 POST-TEST PROCEDURE

4.8.1 Following completion of the hydrostatic tests, all completed pipelines shall be left full of inhibited test water by CONTRACTOR, unless cleaning & purging is required by the COMPANY. CONTRACTOR will then make all above water tie-in-connections.

4.8.2 CONTRACTOR shall also remove all appurtenances that were installed to facilitate pigging & hydrotesting.

4.9 POST-CONSTRUCTION SURVEY

4.9.1 The CONTRACTOR shall carryout a survey of the installed pipeline system, with all necessary equipment, such as sub-bottom profiler, side scan sonar, echo sounder etc. for determining the extent of unsupported spans, damage etc.

4.9.2 Testing of Cathodic Protection System - Refer Section 3.5, Part-IV of the bid package.

4.9.3 Details of all subsea works, such as crossings, repair to pipeline system, supports to free spans. etc., shall also be Video recorded after carrying out the works and submitted to COMPANY for record.

4.10 CLEAN-UP

Any stakes, buoys, or temporary obstructions placed along the pipeline right of way in the water or on land, shall be removed by CONTRACTOR or COMPANY shall remove at CONTRACTOR's expense unless COMPANY specifically requests that they be left in place. Work spaces furnished to the CONTRACTOR by COMPANY shall be cleaned of all scrap and debris and restored to their original conditions.

CONTRACTOR shall remove all surplus materials from the work site and shall deliver such material belonging to COMPANY to the points designated by the COMPANY.

4.11 AS BUILT PIPELINE SYSTEM REPORT

4.11.1 On completion of hydrostatic testing, the CONTRACTOR shall prepare As built Drawings/Reports for all pipeline system. The COMPANY will specify the Coordinate system and scale to be used. Alignment details shall be obtained from plotted data taken during construction and post-construction surveys. All pertinent data such as pipeline appurtenances, fittings, crossings, unsupported spans, burial details, location of anodes, elevation of riser clamps, monel sheath, hanger flange etc. shall be accurately located on the "As Built Drawings".

4.11.2 The CONTRACTOR shall also prepare As Built Report which will include the following as a minimum:

a) Pipeline installation record showing pipeline material, diameter, wall thickness, reference to pipe tally sheet numbers, length of such pipe, cumulative length, weld joint number, NDT results.

b) Pipeline route/alignment maps at a scale of 1:5000 and Approaches to platform to a scale of 1:250 for 200 mtrs portion in vicinity of platform.

c) Hydrostatic testing and pigging details.

d) Riser Details showing riser makeup, pipe material, diameter, wall thickness, weld joint number, details of coating, riser bend diameter, wall thickness and radius, approach angle of pipe-line, locations/elevations of riser clamps, field joints, anodes, monel sheathing etc. exact placing, location and orientation of all risers installed shall be furnished on the "AS BUILT DRAWINGS".

e) Location of Anodes, and post-installation potential measurement survey report.

f) Spanning of pipelines, if any and remedial measures.

g) Corrosion coating and concrete coating details for pipelines and risers.

h) Details of field joints.

i) Pipeline crossing details

j) Pop-up Buoy details and locations.

k) Other miscellaneous details, such as diary of events, list of video recordings, photo-graphic records etc.

l) Table 4.2A (placed at Annexure to Section 4A) which shall be updated based on as build data and coordinates of originating/terminating platforms/stub end shall also be mentioned.

4.11.3 Six copies of the As Built Drawings and "As Built" Report and three copies of all photographic records and video recordings for each pipeline system shall be submitted to the COMPANY. Contractor shall also provide two copies on Compact Disc (CD) of all reports (in MS Office) and drawings in AUTOCAD 2000 or latest Version.

Section 5.0

Pre-Commissioning, Commissioning Procedure & Performance Tests (Well Platform)

PN/RS	AKG	SVB	25	28.06.2021	2A
MSA	BS	RKS	34	31.03.2017	2
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Prepared / Revised By	**Reviewed By**	**Approved By**	**No. of Pages**	**Date**	**Rev. No.**

CONTENT

7.2. Pre-commissioning documents:
7.3. Modification/hook up procedure
7.4. Commissioning procedure
7.5. Other requirements
7.6. Yard checkout before load out
7.7. Manpower for Assistance during Commissioning & start of Production

Pre-Commissioning checklist (Attachment A)

1.1. General Procedures
1.2. Packing and Seals
1.3. Removal of Temporary Supports
1.4. Alignment of Rotating Equipment
1.5. Tie-ins at Unit Limits
1.6. System Check/Inspection
1.7. Site Modifications
1.8. Flushing
1.9. Temporary Screens, Strainers and Blinds
1.10. Leak Tests
1.11. Safety Devices
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1.13. Drying out
1.14. Lubricants and chemicals
1.15. House keeping
1.16. Equipment Protection and Spare Parts
1.17. Chemical Cleaning
1.18. Fire Fighting & Life Saving Equipment
1.19. Miscellaneous
1.20. Operability test for a system/equipment

1. INTRODUCTION

Contractor shall pre-commission, commission (such as crane etc.) and carry out the Performance Tests on the Works including all the facilities of the Well Platform, listed in Description of work in the bid package and make them ready for Platform commissioning Prior to performing said activities Contractor shall submit a procedure for the same well in advance as per guidelines stated herein for Company's review and approval.

This procedure defines the following stages of the Works:

- Mechanical Completion
- Pre Commissioning activities
- Commissioning activities
- Performance Tests

For other requirements of testing refer Basic Bid Work, respective Design Criteria and respective Functional Specification given elsewhere in Bid Package.

A Pre-commissioning activity shall be considered to be complete only when it has been witnessed and the procedure and the results of successfully carrying out that procedure have been signed off by both Contractor and Company. Company may also require Vendor's representative to witness and sign that document.

During the pre-commissioning & commissioning activities, the Contractor shall involve Company's operating staff (nominated by the Company) and impart necessary techniques and know-how required for operation and maintenance of the facilities.

2. MECHANICAL COMPLETION

2.1 Definition

Mechanical Completion of the Well Platform and modification work is defined as the state when all systems including utility and auxiliary facilities have installed in accordance with the drawing and specifications and ready for pre-commissioning in safe manner and in compliance with project requirements and accordingly certified by the Company or company authorized representative.

Mechanical completion of a system includes following but not limited to:

- All design and engineering has been completed
- All installation work for that system including all equipment has been completed in accordance with "Approved for Construction" drawings, specifications, applicable codes and regulations and good engineering practices, all tie-in connections have been made,

all testing and inspection completed and system/ facilities are ready for pre-commissioning.

- All instruments have been installed as per Installation Standards.
- All tie-in connections have been made.
- All Factory Acceptance Tests and all other testing and inspection activities have been completed.
- Contractor has obtained all relevant approvals from the company.
- Safety Studies have been completed and satisfaction of all the Safety Studies' requirements has been met and all documentation put in place.
- All required documentation and certification documents required by the Contract have been supplied.
- All operating procedures and maintenance procedures have been forwarded to the
- Company well in advance for review.
- All items for which Contractor is responsible for obtaining third party, regulatory or Company approval have been obtained and confirmation documentation has been provided to Company.
- All software systems have been loaded and proved
- Construction-related equipment has been removed from the platform, leaving only that is necessary to pre-commission and commission the works.

2.2 Ready for pre-commissioning

The work is Ready for pre-commissioning when the Company has issued a certificate for Mechanical Completion and notification in writing that the Works is Ready for Pre – commissioning.

2.3 Pre – commissioning activities

Pre-commissioning activities are activities to be performed after Mechanical Completion of a piece of equipment or system or sub-system to make it safe and ready to receive hydrocarbons and Ready for Commissioning. This includes:

- Performance of all remaining works other than commissioning and Performance Tests.
- Making operational and commissioning all systems that can be made operational before process fluids are introduced.
- The completion and testing of the platform, equipment & systems
- Testing of all parts and systems of the Works including the communications systems (if required).

- Provision of initial fill of packing, chemicals, inhibitors, lubricants, glycol, water and other stocks has been made.
- Provision of temporary launcher/ receiver, if required, to carry out pre - commissioning activities for the pipelines, Checking site modifications.
- Internal inspection of the vessels
- Flushing/cleaning of vessels & piping
- Hydro testing and pneumatic testing of vessels (at vendor place ⚠2), piping and pipelines.
- Calibration of Pressure safety valves (PSVs) etc.
- Calibration of all the instruments & documentation /report.
- Loop checking including HIPPS & Corrosion system.
- Complete checking of the safety system.
- Checks on electrical system and other vendor packages.
- The delivery, storage and cataloguing of all spare.
- Items for which a defect Notices are issued by company at any earlier stage are to be rectified and all defect Notices shall have been closed out prior to this activity.
- The Completion Documents along with all Design Documents to As-Built.
- The preparation of the commissioning plan and submission to Company for review.
- Removal of all debris and construction equipment from Site. Further details are given in Attachment A.

2.4 Ready for Commissioning

Ready for Commissioning means the point at which the Company issues a certificate to the Contractor saying that the system is ready for commissioning. Ready for commissioning status shall be jointly reviewed by the company/ contractor. At this point all systems and equipment shall be at a stage where process fluids can be safely introduced and all equipment can be safely operated with all controls and safety devices in service to meet the requirement as per design specification

2.5 Design Capacities

The maximum design capacity and minimum design capacity are defined elsewhere in bid package.

3. EXECUTION OF PRE-COMMISSIONING ACTIVITIES

Contractor shall complete all the pre-commissioning activities in accordance with conditions stipulated under Attachment A and as per instructions from vendor's of individual equipment. Contractor shall write necessary procedures and obtain approval from Company prior to commencing work and shall carry out the work in accordance with approved procedures.

The Contractor shall complete as many of the pre-commissioning activities as possible at the fabrication yard to minimize the working time in offshore. A guideline for carrying out the pre-commissioning activities at yard/offshore is given below. These are minimum requirements only.

Contractor shall repeat these yard tests offshore in so far as is necessary to demonstrate that the equipment has not been damaged during transit from yard to offshore site and during erection/installation ⚠2 at offshore and that it is in the same condition as it was when first tested.

The Contractor shall submit a detailed schedule and procedure for carrying out these activities for approval by the Company before starting work.

3.1 Factory Acceptance Test Requirements (FAT)

As a minimum Factory Acceptance Test shall be required on the following packages:

- HIPPS System
- HPU System
- DCP skid with hose reel
- Well/ Fire shutdown system (SDP)
- Nav-Aid system along with battery,
- F& G Detector
- Fire & Gas detection system
- Multi-phase flow meter
- Coriolis Flow meter, Ultra sonic meter, Magnetic flow meter
- Multi-port valve
- Testing of PSV
- Communications system.
- Emergency Shutdown System (ESD)
- Deck Crane (pedestal), All Pumps ⚠2
- Instrument & Utility gas system

- Sacrificial anode, Solar Electric power system, submarine cable,
- SSIV actuator △2
- Solar Panel and solar power controller △2
- Subsea umbilical, TUTA △2
- PLC-based safety and control systems △2
- Control valves, Shutdown valves, transmitters, gauges, etc. △2

The above list shall be considered as a minimum and shall be supplemented with other items based upon requirement indicated in respective functional specifications. The Contractor shall define factory Acceptance Testing Requirements as a part of all Purchase Requisitions. This requirement shall be submitted to the Company for approval prior to the award of a purchase order. The packages shall be tested with the ancillary equipment that is to be supplied with them.

Factory acceptance testing of instrumentation related equipment shall be as per functional specifications of the respective instrument items.

A Factory Acceptance Testing shall be conducted prior to dispatch from the Vendors works to determine that the assembled equipment meets the design requirements.

The Contractor shall submit a full Factory Acceptance Test procedure 6 weeks prior to the Factory Acceptance Test to detail the full extent of testing of the equipment. The testing procedure shall be approved by the Company prior to the commencement of testing and shall be complete with all equipment procedures, checklists and safety requirements to be taken. The Contractor shall be responsible for providing all necessary equipment and utility services to conduct the tests. The Contractor shall ensure that an opportunity is given to all relevant parties to attend all hold and witness points during Factory Acceptance Testing.

3.2 Minimum pre-commissioning activities to be carried out at yard

- Check systems conforming to the requirements of the P&IDs, drawings and datasheets.
- Leak Testing
- Internal Inspection of Vessels
- Inspection of strainers/filters, orifice plates and other piping specialties.
- Operability test of utility systems (except those which cannot be operated at the yard) Equipment shall be operated for a minimum of 4 hrs.
- System Flushing and Cleaning
- Operability test of pump and rotating equipment.

- Load test and operability test for crane.

Pre-commissioning activities related to instrumentation at yard shall be as follows:

1. Off line testing and calibration of instruments as reflected in P&IDs, safe charts and other project documents.
2. Installation and hook-up as per installation & hook-up drawing.
3. Hydro testing of impulse tubing and other associated tubing. Leak test of instrument isolation valves / manifolds.
4. On line testing and calibration checks of all instruments and loop checking of all such instruments.
5. Installation and hook-up of gas detector fusible plug, ESD/FSD stations etc.
6. ESD/FSD loop testing.
7. Functional test of well /fire shutdown panel inclusive of all related field devices, controls signals.
8. Functional test of gas detection system inclusive of all related field devices, controls signals.
9. Functional test of Telemetry Interface cabinet inclusive of all related field devices, controls signals.
10. Any other instrument related activity not listed above but mentioned in the relevant functional specifications elsewhere in the bid package.

3.3 Minimum activities to be carried out at offshore after installation and hook-up

- Calibration checks of instruments and loop checking. All the system/equipment including Vendor's packages and Company supplied equipment (if any) shall be included. Operability test of Fire water pump for 8 hours Operability test of other pumps for 4 hours
- Load test and operability test for Crane
- Charging of filter media, packing, lubes, chemicals etc.
- Repeat testing of PSVs
- System flushing
- System drying (Where applicable).
- System leak test. Water lines are also included.
- Emergency Shut down and Fire and Gas system. All such tests to be carried out at offshore after installation.
- Pre-Commissioning checks for Switch gear, MCC etc. as recommended by the manufacturer.
- Testing and checking of electrical equipment for proper earthing, continuity, insulation resistance. ⚠
- Post Installation CP Survey as per FS 4001. ⚠

3.4 Site Acceptance test (SAT) ⚠2

As a minimum Site Acceptance test shall be required on the following packages which has to be inspected by ONGC/ Certification Agency.

- HIPPS
- Process Control System
- F&G Detection system
- Subsea umbilical
- Well head shutdown panel & standalone shutdown panel
- SSIV Actuator & HPU
- PLC based system
- Deck crane (pedestral)
- Instrument & utility gas system

The above list shall be considered as a minimum and shall be supplemented with other items based upon requirement indicated in respective functional specifications.

3.5 Pre-commissioning of modification works

Contractor shall carry out modification works, interconnection and hook-up operation as given in Description of work in bid package. It shall be contractor's responsibility to carry out all necessary preparatory work like draining, venting, gas freeing, purging etc., for all the existing facilities required for modification and safe tie-in. It shall be contractor's responsibility to arrange and provide steam, chemicals, nitrogen etc. required for gas freeing operation. It shall be contractor's responsibility to ensure proper safety during tie-in / modification operation.

4. COMMISSIONING

Commissioning of the Well Platform by introducing well fluid shall not be in the scope of this present contract. However commissioning of equipment such as Crane(s), Portable DG set and DCP Skid shall be carried out along-with pre-commissioning of platform. Also contractor shall pre-commission all the instrumentation and control system by nitrogen gas. Further contractor shall be required to provide man-power assistance during commissioning and start of production by Company after completion of drilling of wells.

4.1 Shut down Requirements

During part of the Modifications Work and subsequent Pre-commissioning and Commissioning activities, some equipment in the existing process/ well platforms shall remain operational. The Contractor shall schedule all activities to minimize disruption to the production of existing platform and shall recognize that limitations will be placed on his access. The Contractor shall comply with all the permit and safety procedures of the existing platform.

The platform Operations Group will control the scheduling and duration of any shutdown of the platform. The contractor shall submit Shutdown Schedule to the Company for approval as part of the Pre-commissioning and Commissioning Procedure.

The shutdown schedule shall include the following as a minimum:

- A detailed list of all activities
- Estimated duration of each activity
- Float calculations for each activity
- Manpower Histogram for each shifts of the shutdown.

Contractor shall also provide any requests for services and access required e.g. requests for accommodation, access to utilities, crane usage requirements, deck area access requirements, permit requirements etc.
Contractor shall note that its use of Company's facilities is limited and the availability of these facilities cannot be assumed or assured (as is described elsewhere in the contract documents).

4.2 Purging and Cleaning Requirements

Contractor shall prepare procedures for all work on existing systems and submit them for approval before starting work. Before modifications work is carried out on any system, pipe work and equipment shall be prepared in accordance with approved procedures, gas freed and purged as appropriate and as required by Company.

Contractor shall arrange and supply nitrogen required for purging. The final oxygen content in process system shall be brought down to less than 2% (V/V).

The contractor shall develop procedures for the purging of systems prior to the introduction of hydrocarbons. Included in this procedure shall be the purging and gas freeing of existing lines of the platform requiring modification. This procedure shall include the proposed method of purging to be used, the duration of the purge, the purge medium and the

acceptance criteria used to determine a successful purge. This procedure shall be approved by the Company prior to the commencement of any works at the platform.

4.3 Preservation of Systems:

After completion of pre-commissioning and before handover of platforms, Contractor shall ensure the preservation of Equipment, systems, facilities etc., for 6 (six) months so as to the platform shall be ready for Commissioning / Start of Production soon after drilling of wells is completed. Piping shall be preserved by filling Nitrogen or Water as required. Preservation of equipment etc. shall be done as recommended by respective vendors.

5. HSE / RISK MANAGEMENT ⚠

Work onsite shall comply with ONGC's Health and Safety Manuals, Work Permit System and other relevant documents.

The HSE program during Project Hook-up & Commissioning shall focus on the following six (6) main areas:

1) Site Supervision
2) Personnel Awareness
3) Personnel Capability
4) Accident Prevention
5) Management involvement and visibility
6) Pre-Startup Assessment

5.1 Personnel Awareness

Briefing on safety expectations for Project Hook-up & Commissioning supervisory team and Contractor's personnel will be conducted prior to mobilization.

The briefs shall be immediately prior to mobilization. All personnel will again undergo briefing once they arrive at the work site for specific health, safety and security procedures.

The Contractor shall publish and disseminate his HSE manuals and programs to his supervisory and all other personnel prior to mobilization.

Daily tool-box meetings and Job Safety Analysis (JSA) shall be carried out to ensure personnel are aware of work to be performed and the risk, if any, associated with the days work and mitigate steps to take. The work group foreman shall lead the daily morning discussion prior to commencing with work. The Project Hook-up & Commissioning supervisors or discipline engineer or operations personnel shall periodically monitor and participate in the toolbox meeting.

5.2 Personnel Capability

All personnel involved in the Project Hook-up & Commissioning are required to attend mandatory safety training as required by ONGC as a minimum. Contractor's personnel, e.g. rigger / scaffolder, welder, crane operator, grinder, etc. shall undergo trade competence training as required.

Safety investigation training shall be provided for supervisory, inspection personnel for both Project Hook-up & Commissioning and Contractor to provide them knowledge in recognizing root causes of safety incidence and encourage them to be pro-active in safety matters.

5.3 Accident Prevention

Project Hook-up & Commissioning shall carry out inspection on construction tools and equipment prior to issuance to the Project Hook-up & Commissioning personnel to ensure they are fit for service. The inspection shall be done periodically.

Once the tools and equipment have been issued, inspection will be by the user, supervisor, safety officer and discipline inspectors, as appropriate.

All lifting equipment shall be tested, certified and assigned a color code signifying its certification period.

The Project Hook-up & Commissioning contractor shall screen its personnel prior to their employment to confirm that they are qualified for their assignment and are free from Drug & Alcohol (D&A) abuse. This shall be supplemented by random testing and testing for cause after mobilization.

Contractor Management will carry out safety audits on a regular basis.

Contractor shall implement a hazard identification program as part of daily routine.

ONGC Operation shall administer the work permitting procedure for simultaneous operations (SIMOPS) and simultaneous production & drilling (SIPROD) of Project Hook- up & Commissioning.

ONGC Operation shall administer the Emergency Response Plan (ERP). Project Hook-up

& commissioning group and its contractor shall formulate an ERP in-line with Operations established ERP procedures.

Contractor shall implement Job Safety Analysis (JSA) or Critical Work Analysis for engineered control of hazards on non-routine or critical activities with high hazard potential.

5.4 ONGC Supervisor's Responsibility

Publish the Project Hook-up & Commissioning Execution Plan after management endorsement and ensure its availability at work site.

Ensure that the Emergency Response Procedure (ERP) and Simultaneous Operations (SIMOPS), Health Safety Environment Management System and other safety documents are available at the Worksite.

Ensure that the Project Hook-up & Commissioning contractor assigns a safety engineer / officer full-time onsite to provide the supervisors with HSE advice.

Daily supervisory planning meeting shall be held between different groups, i.e. Operations, Drilling, Project Hook-up & Commissioning and their contractors. This meeting shall serve as a forum to provide the different groups the guidance to plan / modify each group's activity as necessary to avert any conflict or interference.

5.5 Management Involvement and Visibility

Onsite visits by ONGC management and contractor's management shall be conducted on a regular basis at least once a month. The timing of such visits can be planned that they coincide so that any pertinent HSE issues can be discussed together first hand.

5.6 Pre-Startup Assessment

A pre-startup assessment of the Facilities shall be performed prior to introduction of hydrocarbon into the system. The assessment is performed and documented to confirm that:

- Construction is in accordance with design specifications.
- Safety, environment, emergency, operations and maintenance procedures are in place and adequate.
- Risk management recommendations have been addressed and the required actions taken.
- Training of personnel has been accomplished.

6. GENERAL

6.1 Vendor's representatives

The Contractor shall arrange manufacturer's representative(s) (at fabrication yard and offshore) of at least the following major equipment/systems (as applicable as per Scope of Works) during operability tests, pre- commissioning and until the satisfactory completion of the Performance Tests. The period required to be on the platform shall be that needed by contractor and that required and approved by company.

- HIPPS system

- HPU System
- Instrument Air Compressor
- Crane(s)
- Shut down system
- Fire & Gas detection system
- Test separator
- MPFM system (MPFM, MPV, PLC, FCV etc.).
- Hybrid Solar Power System
- Chemical dosing system
- DCP Skid
- Portable DG Set
- IUG System
- SCADA System
- Hinge closure

The contractor shall reconfirm the schedule and duration (of vendor representative) three weeks prior to pre-commissioning, which shall be strictly complied. It is contractor's responsibility to retain vendor's representatives at site if job is not completed within the period indicated in the offer. Contractor shall inform the company about completion of job and shall take approval from the company before sending vendor's representative back from yard/ offshore.

6.2 Spares, Utilities etc.

The contractor shall be responsible for submission of list of one year operational spares. The contractor shall provide list of spares and responsible for initial fill up and six month supply of consumables (like lube oil, lubricants, etc.) for the platform operations after modification works are mechanically completed, pre- commissioned/ commissioned and handed over to the company. Contractor shall refer section 5.16 of 3.0 part II general condition of contract. ⚠

All utilities required during pre-commissioning of the facilities including power, water, air, cranes, etc. shall be provided by the contractor. In no case the facilities provided on the platform shall be used for this purpose unless authorized by the company.

It shall be contractor's responsibility to supply lubes, chemicals, purging materials and other pre-commissioning aids required till the platform is handed over to the company.

It shall be contractor's responsibility to repair any damage to the system occurred during load out, transportation and installation and pre- commissioning of the facilities.

The contractor shall maintain a record of the start-up spares consumed during pre-commissioning and hand over the balance items to the company.

6.3 Handing over of Materials

After the mechanical completion and completion of pre-commissioning activities for all the systems installed on the platform by the contractor, the contractor shall hand over to the company all the materials which shall include but not limited to the following:

- All loose supply material
- Special tools and tackles
- Commissioning spares
- Spares as specified in relevant functional specifications

6.4 Special requirements

It shall be Contractor's responsibility to install, calibrate and make all laboratory and workshops equipment operable. Contractor shall involve Company's chemist and maintenance engineers and impart necessary techniques and know-how required for operation and maintenance of this equipment.

7. DOCUMENTS TO BE SUBMITTED

7.1 Operating manual

The Contractor shall prepare a draft start-up and Operating Manual for all of the facilities that are included in the Works and submit to Company at least 150 days prior to start of pre-commissioning activities for approval. Quantity of operating manuals requirement for all equipment shall be provided as per respective specification given elsewhere in bid package. The related attachments will go with each manual. The following information shall be included:

- Design basis
- Description of facilities
- Pre-commissioning check
- Start-up, normal operation & shut down procedures for each equipment.
- Platform start-up procedure.
- Platform normal operation procedure

- Platform shut down procedure (normal/emergency)
- Vendor instructions for all equipment for normal operation and trouble shooting.
- Emergency procedures.
- Operating parameters and set points of different alarms and trip devices
- Summary of chemical consumption including list of recommended Indian equivalent.
- Summary of utilities consumption for each equipment.
- Lubrication Schedule (include Indian equivalent, initial fill, frequency of change of lubricant and 6 months requirement).
- Gas detection and associated safety system operation, calibration and maintenance procedure.
- Life saving devices operation and maintenance procedure.
- Routine structural maintenance check.
- List of equipment (showing skid size, weight, purchase order no., vendor data book reference tag no.)
- Effluent disposal.

The manual shall have the following attachments as a minimum:

- Reduced size copies (275 mm x 425 mm) of line lists
- Equipment and instrument data sheets in accordance with purchase order
- Electrical Single line diagrams, area classification drawings and control schemes
- Pump characteristic curves
- Process Flow Diagrams (PFDs) & Piping and Instrumentation Drawings (P & IDs)
- Recommended proforma for recording routine parameters during normal operation for all equipment.
- Equipment layout.
- Safety escape routes
- Field location maps.
- Layout and location Maps for fire and safety equipments.
- All hardware and schematic drawings of system packages like PCS, PLC-based ESD etc. shall be as-built. ⚠2

The contractor shall submit the draft Operating Manual to the Company for approval. The Contractor shall discuss the comments with Company & incorporate the comments in the final document. The Contractor shall submit the final document for approval to the Company. After the document is approved by the company/ engineer's representative, contractor shall make the required number of copies, specified elsewhere and submit to the company/ engineer's representative. This manual shall be followed during start-up and commissioning of the facilities. Vendor operating and maintenance manuals shall be submitted along with the final operating manual.

The operation manual can be divided into two or three parts if the thickness of manual exceeds 80 mm. It shall describe, pre-start up checks, start-up procedures, shut down

procedure and normal operation for an equipment vendor recommended procedure and integration of that equipment with other facilities. Contractor shall also submit 150 days before the commissioning the system operating Manual for the distributed control system (DCS), which shall contain system description, operating instructions and necessary information for the familiarization of the operator.

7.2 Pre-commissioning documents:

Contractor shall prepare detailed format of checklists of pre-commissioning and commissioning activities for each equipment/system. The Contractor shall submit the said format for approval of the Company. These check lists shall describe the checks/test to be carried out on each equipment/system, shall also indicate if a particular check/test is to be carried out at the yard or offshore.

All the check list points shall be dealt by the Contractor. Determination of the system readiness for commissioning shall be determined based on the relevant portion of check lists have been completed by the Contractor.

For the purpose of execution of these pre-commissioning activities, the entire platform shall be divided into system and sub-systems. The pre-commissioning document shall contain the following:

- System / sub-system identification.
- Detail procedures for the various pre-commissioning activities, such as system check, flushing, de-watering, drying, leak test, purging etc. with format to record the observations of the activities carried out.
- Procedures and formats for recording the operability test/performance test for different equipment/system.
- Lube schedule, indicating the nomenclature (Indian equivalent) of lubes, quantity of initial fills.
- Listing of commissioning and start up spares.
- List of pre-commissioning activities to be carried out at fabrication yard, or offshore, or at both places.
- High-pressure leak check procedure of gas system.
- A detailed procedure for management of any special bypass or defaults required for commissioning.

The Contractor shall submit a draft pre-commissioning documents 180 days before the activities are to be carried out. This should include the schedule for Yard Pre- commissioning and commissioning also to suit ONGC's key milestone target dates and scheduled mechanical completion dates. The document shall be reviewed by the Company. The Contractor shall submit a revised document after incorporating Company's comment for approval to the Company. The approved document shall be submitted 120 days prior to starting of the pre-commissioning activities.

At the end of pre-commissioning activities, all the pre-commissioning test records (duly signed) shall be compiled by the Contractor. Three copies of documents for each system shall be delivered to the Company.

7.3 Modification/hook up procedure

During part of the Modifications Work and subsequent Pre-commissioning and Commissioning activities, some equipments of the existing platform shall remain operating. The Contractor shall schedule all activities to minimize disruption to the Production of the existing platform and shall recognize that limitations will be placed on his access. The Contractor shall comply with all the permit and safety procedures of the platform.

Contractor shall produce a procedure with his detailed shut down requirements for the various hook-ups required to be carried out on the platform. This shall be presented to company for approval within 120 days of Notification of Award.

Contractor shall submit, along with Pre-commissioning procedure, a detailed procedure for carrying out modification works, interconnections and hook-up operations for the facilities. An Isolation scheme to be prior to carrying out modification works shall be worked out in advance and detailed in this document.

7.4 Commissioning procedure

Contractor shall prepare this document to detail out the procedures and sequence of commissioning of the project facilities including the log sheets for logging of parameters of different equipment / system during commissioning. The contractor shall have required inputs from the company and the vendor's representatives. The document shall include the shift rosters for the contractor/vendor's representative to be deployed during commissioning operation. This document shall be submitted to the company for approval, 120 days prior to the commencement of commissioning operation.

The Pre-commissioning and Commissioning Procedure shall be submitted to ONGC for approval.

For any system that is not possible to Pre-commission or Commission as full system, then partial Pre-commissioning shall be conducted (e.g. multi Module systems, Onsite systems that are connected to the Modules).

Once the system is reasonably complete and ready for Pre-commissioning or Commissioning, Contractor shall advise ONGC to proceed with the Pre-commissioning or Commissioning. A final joint line check with all parties shall be conducted and shall be collectively agreed that the system is ready for Pre-commissioning or Commissioning.

During the Pre-commissioning or Commissioning, all parties required to witness shall be available including Vendor Representatives and Operations Representatives.
The Commissioning Team will do full system Commissioning after Hook-up of all the Piping, Electrical, Instruments, etc. is completed.

After the Module are installed Onsite, partially Pre-commissioned systems will then be integrated and commissioned. The handing-over Document will then be signed-off by all parties to check the completeness of the whole system.

7.5 Other requirements

The Contractor shall provide safety equipment locations, H2S safety information chart, warning signs and escape route drawings (framed). These drawings must be placed in locations approved by the Company before the platform is commissioned. The Contractor shall also provide adequate numbers of NO SMOKING boards, which will be installed where required by the Company.

An emergency plan shall be prepared and shall be in place prior to commencement of Pre-commissioning and commissioning activities. The plan shall define the actions, personnel and facilities required in case of an emergency.

In addition to the other requirements of the Contract, Contractor shall supply adequate sets (A3 size) of Process & Instrument Drawings, electrical single line diagrams to the company to facilitate system check before start of hook-up work. The Contractor shall also provide two sets of PFDs on acrylic sheets which will be installed at locations specified by the Company.

7.6 Yard checkout before load out

Prior to load out, the Contractor shall carry out, at the yard, a check of the facilities for correct erection and installation, operability, maintenance requirement and safety of plant and personnel during operation in accordance with accepted international good engineering practices; this will be witnessed by the Company. The Contractor shall carry out all modifications and corrections in accordance with the final punch list prepared jointly by the Contractor and the Company.

7.7 Manpower for assistance during commissioning and start of production

The Contractor shall arrange & provide all categories of personnel i.e. shift engineers, operators, technician, chemist; safety engineer etc. required for manning the platform during commissioning and starts of production. For assistance during commissioning by Company and start of production of platforms, Contractor shall deploy vendor representatives for the following equipment's (as applicable as per scope of work). Vendor representatives shall be deployed for maximum 4 (four) days for each well platform as

required. Company shall provide one week advance notice for deployment of the vendor representatives.

ATTACHMENT - A

Pre-Commissioning Check List

1. PRE-COMMISSIONING CHECKLIST

This checklist represents the absolute minimum of work which has to be performed by the Contractor prior to commissioning of the facilities. It is not intended to be a complete list of activities required. Manufacturer's instructions for pre-commissioning checks/ testing shall be followed for all equipment.

1.1. General procedures

The general work procedures listed below outline the work to be performed by the Contractor. Other procedures applicable to specific system or items of equipment may be covered elsewhere in the contract.

1.2. Packing and seals

- Install mechanical seals, permanent packing and accessories wherever required.
- Adjust and replace mechanical seals, packing and accessories, as necessary, during pre - commissioning period.

1.3. Removal of temporary supports

Removal all temporary supports, bracing or other foreign objects that were installed in vessels, transformers, piping, rotating machinery or other equipment to prevent damage during shipping, storage and erection/ installation.

1.4. Alignment of rotating equipment

- Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
- Make cold alignment to the manufacturer's tolerances along with Company. Provide all the alignment readings records to Company. Contractor shall prepare the formats (unfilled) and submit to Company for approval.
- Check all lubricants and their quality, fill etc. before operating the equipment. Carry out uncoupled run of motors, check bearing temperatures, vibration, no load currents, over current trips, function of different safety devices and carry out adjustments as required.
- Make hot alignment and any dowelling required after equipment has been put in operation.
- Obtain manufacturer representative for equipments as required during installation and/or pre-commissioning and commissioning.

1.5. Tie-ins at unit limits

Prepare all systems for safe tie-ins with bridge connected platform or with existing operating systems. Contractor shall prepare the systems for Tie-ins in consultation with Company and will

be responsible for safety during tie-ins being made. Contractor shall gain approval of Company for the safety measures to be taken by them before any tie-in work is taken up.

1.6. System check / inspection

- Provide inspection facilities to the Company to check that erected facilities conform to Process & Instrumentation Diagrams, construction drawings, vendor drawings and specifications approved for construction.
- Verify and approve the facility check. Note exceptions, if any, on a separate work order list (punch list).

1.7. Site modifications

Carry out site modifications as found necessary during system checks and inspection from the viewpoint of routine operations, maintenance and safety of the platform. A list of such jobs shall be prepared by the Company and shall be handed over to the Contractor for execution.

1.8. Flushing

Perform flushing and blowing of all piping to remove dirt, welding slag, etc. Arrange for cleaning media (potable water or compressed dry air, as applicable) for carrying out flushing/blowing and disposal of the cleaning media in accordance with minimum procedures to be developed by the Contractor and approved by the Company.
Following is the minimum velocity of cleaning media to be maintained for flushing/blowing of piping:

AIR: 2.4 – 2.7 m/sec
WATER: 1 – 1.2 m/sec.

1.9. Temporary screens, strainers and blinds

- Provide and install temporary strainers where required. Install permanent strainers after initial operation.
- Clean strainers as required during pre-commissioning and commissioning.
- Provide, install and remove all blinds required for flushing or operation.
- Change gasket if necessary.

1.10. Leak tests

- Leak test of complete process facilities including piping, equipment, instrument connections etc. to be carried out in accordance with ASME 31.3 latest addition after completion of pre-commissioning activities, safety checks and hydro test. ⚠
- Notify the Company of test schedule at least two weeks in advance. All the tests are to be witnessed and the test record on satisfactory completion of the test be signed by Company.
- Provide 4 copies of all the test records to the Company.

- Provide any special media, if required for test purpose and provide facilities for disposal.
- Conduct all operational tightness testing.
- Carry out vacuum test to rectify any leakage

1.11. Safety devices

- Provide the Company with a list of proper settings for safety devices.
- Install all safety devices on the equipment.
- Test and adjust all safety devices such as PSVs, TSVs at offshore and seal wherever necessary. Other safety instruments/ instruments systems inclusive of field devices, Well / fire shutdown panel, gas detection system shall also be tested.

1.12. Purging

Install necessary purge connections and carry out system purging including that of flare and vent with Nitrogen in accordance with Company approved procedure. The final Oxygen content in purged systems shall be reduced to an approved safe limit. Contractor shall arrange & supply the Nitrogen required for purging.

1.13. Drying out

Dry out necessary facilities wherever required by Company.

1.14. Lubricants and chemicals

- Procure and supply initial fill of all lubricants, chemicals, resins, desiccants and other similar materials, replenish the chemicals consumed during pre- commissioning and commissioning.
- Inspect vessel interior along with Company representative/ certifying authority before filling of chemicals for proper cleanliness.

1.15. House keeping

Provide continuous clean-up of the construction and operational area. Remove excess materials, temporary facilities and scaffolding and pick up trash. Perform washing for further clean-up as required.

1.16. Equipment protection and spare parts

- Protect equipment from normal weather conditions, corrosion or damage before commissioning.
- Provide all installation and commissioning spares.
- Chemical Cleaning.

- Perform special chemical cleaning or pickling of the critical piping and compressor suction piping, etc. in accordance with vendors approved procedures.

1.17. Firefighting & lifesaving equipment

- Ensure correct installation of all firefighting and lifesaving equipment.
- Carry out function test of fire detection devices, foam and fire water spray system.
- Carry out Visual inspection of portable apparatus and ensure that these are installed at critical locations.
- Ensure that the escape drawings duly framed are installed at critical locations.

1.18. Miscellaneous

To carry out any other check/test as required by Company and provide all test certificate as required by the Company.

1.19. Operability test for a system/equipment

- The Contractor shall provide a procedure for carrying out the operability test of each equipment/system to prove that the equipment/system installed meet the design specification. This procedure shall include log sheets wherein the operating parameters shall be recorded hourly.
- Each system / equipment shall be subjected to an operability test to determine that it operates in accordance with its specifications and the design intent over the full range required by the Design Criteria. The operability test shall be conducted, using all ancillary equipment, auxiliaries and controls, continuously for the duration specified in these documents after stability conditions have been attained. If no duration is specified the test shall be conducted for 4 hours after stability has been attained. If the test is interrupted due to any reason, the test shall be started afresh.
- The operability test shall be carried out by the Contractor and the vendor's representatives, wherever applicable and witnessed by Company.
- The Contractor shall make necessary checks, adjustment, repairs required for normal operation of the system/equipment. All the safety devices shall be tested for their proper operation.
- Upon completion of the Operability test, the log sheet with all observation shall be signed by the Contractor, Vendor, Company representatives. The Performance shall be evaluated based on the data and observations made during the operability test. In case of any dispute, the decision of Company shall be final.

Section 5.0

Pre-Commissioning, Commissioning Procedure & Performance Tests (Process Platform)

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CONTENT

9.1. Operating manual
9.2. Pre-commissioning documents:
9.3. Modification/hook up procedure
9.4. Commissioning procedure
9.5. Other requirements
9.6. Yard check out before Load out
9.7. Modification and Hook-up
9.8. Manpower for Commissioning

Attachment A

1. Commissioning Checklist
   1.1. General Procedure
   1.2. Packing and seals
   1.3. Removal of temporary supports
   1.4. Alignment of rotating Equipment
   1.5. Tie-ins at unit limits
   1.6. System check/ inspection
   1.7. Site modifications
   1.8. Flushing
   1.9. Temporary screens, Strainers and Blinds
      1.9.1. Leak Test
      1.9.2. Vacuum Test
   1.10. Safety Devices
   1.11. Purging
   1.12. Drying out
   1.13. Lubricants and chemicals
   1.14. House keeping
   1.15. Equipment protection and spare parts
   1.16. Chemical Cleaning
   1.17. Firefighting & lifesaving equipment
   1.18. Miscellaneous
   1.19. Operability test for a system/equipment

2. SPECIFIC PROCEDURE
   2.1. Vessels
   2.2. Shell and tube exchanger

2.3. Air-cooled exchanger
2.4. Pumps, compressors and drivers
2.5. Piping system
2.6. Electrical power and lighting system
2.7. Instrument system
2.8. Portable water system
2.9. Water system (fire water system and sea water systems)
2.10. Sewage treatment and disposal
2.11. Building and Accessories
2.12. Cranes and hoists
2.13. Fire and Gas detection & Fire Fighting system
2.14. Shutdown system
2.15. Control Panels
2.16. Generals

1. INTRODUCTION

Contractor shall pre-commission, commission and carry out the Performance Tests on the Works including all the facilities of the Platform and associated Modifications of the facilities as listed in Description of work in the bid package. Prior to performing said activities Contractor shall submit a procedure for the same well in advance as per guidelines stated herein for Company's review and approval.

This procedure defines the following stages of the Works:

- Mechanical Completion
- Pre Commissioning activities
- Commissioning activities
- Performance Tests

For other requirements of testing refer Basic Bid Work, respective Design Criteria and respective Functional Specification given elsewhere in Bid Package.

A Pre-commissioning activity shall be considered to be complete only when it has been witnessed and the procedure and the results of successfully carrying out that procedure have been signed off by both Contractor and Company. Company may also require Vendor's representative to witness and sign that document.

During the pre-commissioning & commissioning activities, the Contractor shall involve Company's operating staff (nominated by the Company) and impart necessary techniques and know-how required for operation and maintenance of the facilities.

2. DEFINITIONS

2.1. Mechanical Completion

Mechanical Completion of the process Platform and modification work is defined as the state when all systems including utility and auxiliary facilities have been installed in accordance with the drawing and specifications and ready for pre-commissioning in safe manner and in compliance with project requirements and accordingly certified by Company or Company authorized representative.

Mechanical completion of a system includes following but not limited to:

- All design and engineering has been completed
- All installation work for that system including all equipment, piping, cables, etc., has been completed in accordance with "Approved for Construction" drawings, specifications, applicable codes and regulations and good engineering practices.
- All instruments have been installed as per installation Standards.
- All tie-in connections have been made.
- All factory acceptance tests and all other testing and inspection activities have been completed
- Contractor has obtained necessary approvals, which are the responsibility of the Contractor to obtain.
- Safety Studies have been completed and recommendation/observation of the Safety Studies reports has been met and all documentation put in place.
- All required documentation and certification documents required by the Contract have been supplied.
- All operating procedures and maintenance procedures have been forwarded to the Company well in advance for review.
- All items for which Contractor is responsible for obtaining third party, regulatory or Company approval have been obtained and confirmation documentation has been provided to Company.
- All software systems have been loaded and proved.
- Most construction-related equipment has been removed from the Platform, leaving only that necessary to pre-commission and commission the Works.

2.2. Ready for Pre-Commissioning

The works is Ready for pre-commissioning when the Company/company's authorized representative has issued a certificate for Mechanical Completion and notification in writing that the Works is Ready for Pre – commissioning.

2.3. Pre – commissioning Activities

Pre-commissioning activities are activities to be performed after Mechanical Completion of a piece of equipment, sub-system or system to make it safe and ready to receive hydrocarbons and Ready for Commissioning. This includes:

- Performance of all remaining works other than commissioning and Performance Tests.
- Making operational and commissioning all systems that can be made operational before well fluids are introduced.

- The completion and testing of connections between different Platforms and the platform equipment & systems
- Testing of all parts and systems of the Works including the communications systems (if requires).
- Provision of initial fill of packing, chemicals, inhibitors, lubricants, glycol, water and other stocks has been made.
- Checking site modifications.
- Internal inspection of the vessels
- Flushing/cleaning of vessels, piping, pipelines etc.
- Calibration of Pressure safety valves (PSVs) and Temperature safety valves (TSVs) etc.
- Calibration of all the instruments with documentation of results.
- Loop checking.
- Complete checking of the safety system
- Checks on electrical system and other vendor packages including Distributed control system (DCS) etc.
- The delivery, storage and cataloguing of all spares
- Items for which a Defect Notice are issued to be rectified and all Defect Notices shall have been closed out.
- The Completion Documents along with all Design Documents to As-Built
- The preparation of the commissioning plan and submission to Company for review.
- The hydro testing and pneumatic testing of vessels, piping, pipeline etc.
- Training and briefing of the Company's and Contractor's personnel involved in commissioning
- Removal of all debris and construction equipment from Site.

Further details are given in Attachment A.

2.4. Ready for Commissioning

Ready for Commissioning means the point at which the Company issues a certificate to the Contractor to say that the system is ready for commissioning. Ready for commissioning status shall be jointly reviewed by the company/ contractor.

At this point all systems and equipment shall be at a stage where process fluids can be safely introduced and all equipment can be safely operated with all controls and safety devices in service to meet the requirement as per design specification.

2.5. Design Capacities

The Maximum Design Capacity and Minimum Design Capacity are defined elsewhere in bid package

3. Execution of Pre-Commissioning Activities

Contractor shall complete all the pre-commissioning activities in accordance with conditions stipulated under Attachment A and as per instructions from vendor's of individual equipment. Contractor shall write necessary procedures and obtain approval from Company prior to commencing work and shall carry out the work in accordance with approved procedures.

The Contractor shall complete as many of the pre-commissioning activities as possible at the fabrication yard to minimize the working time in offshore. A guideline for carrying out the pre-commissioning activities at yard/offshore is given below. These are minimum requirements only.

Contractor shall repeat these yard tests at offshore in so far as is necessary to demonstrate that the equipment has not been damaged during transit from yard to offshore site and during erection/installation at offshore and that it is in the same condition as it was when first tested.

The Contractor shall submit a detailed schedule and procedure for carrying out these activities for approval by the Company before starting work.

3.1. Factory Acceptance Test Requirements (FAT)

As a minimum Factory Acceptance Test shall be required on the following packages:

- HIPPS System
- HPU System
- DCP skid with hose reel
- Navigational -Aid system along with battery ⚠
- F& G Detector ⚠
- Hypo chlorinator ⚠
- Fire & Gas system
- Multi-phase flow meters
- Multi-port flow selection valves (MPV)
- Pumps
- Compressors
- Turbine
- Well Fluid Heater, air coolers, any other exchangers
- Generator
- Water Maker
- Nitrogen Generator Package
- Pressure Vessel
- Inline separators ⚠

- Hydro-cyclone ⚠
- PSV & TSV
- Communications system.
- Distributed Control System (DCS)
- Fire/Emergency Shutdown System (FSD/ESD)
- Deck Crane (pedestal), All Pumps ⚠
- Chemical Dosing/ Injection Pumps
- Oil/ Gas Metering system
- Analyzers ⚠
- Instrument & Utility gas system
- Sacrificial anode, Solar Electric power system, submarine cable, ⚠
- Solar Panel and solar power controller ⚠
- Sub-sea umbilical ⚠
- PLC-based safety and control systems ⚠
- Control valves & Shutdown valves ⚠
- Transmitters & gauges ⚠

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The above list shall be considered as a minimum and shall be supplemented with other items based upon requirement indicated in respective functional specifications. The Contractor shall define factory Acceptance Testing Requirements as a part of all Purchase Requisitions. This requirement shall be submitted to the Company for approval prior to the award of a purchase order.

The packages shall be tested with the ancillary equipment that is to be supplied with them. Factory acceptance testing of instrumentation related equipment shall be as per functional specifications of the respective instrument items.

A Factory Acceptance Testing shall be conducted prior to dispatch from the Vendors works to determine that the assembled equipment meets the design requirements.

The Contractor shall submit a full Factory Acceptance Test procedure 6 weeks prior to the Factory Acceptance Test to detail the full extent of testing of the equipment. The testing procedure shall be approved by the Company prior to the commencement of testing and shall be complete with all equipment procedures, checklists and safety requirements to be taken. The Contractor shall be responsible for providing all necessary equipment and utility services to conduct the tests. The Contractor shall ensure that an opportunity is given to all relevant parties to attend all hold and witness points during Factory Acceptance Testing

3.2. Minimum Pre-Commissioning Activities to be carried out at yard

Factory acceptance test as brought out above shall be completed prior to pre commissioning activities at yard can be commenced. At least the following pre-commissioning activities shall be carried out at the fabrication yard.

- Check systems conforming to the requirements of the P&IDs, drawings and datasheets
- Leak Testing
- Internal Inspection of Vessel
- Inspection of strainers/filters, orifice plates and other piping specialties.
- Operability test of utility systems (except those which cannot be operated at the yard). Equipment shall be operated for a minimum of 4 hrs.
- System Flushing and Cleaning
- Operability test of pump and rotating equipment.
- Testing of PSV and TSV
- Complete unit test (Full load string test) of Turbine generator (TG) and Process gas compressor (PGC)

Pre-commissioning activities related to instrumentation at yard shall be as follows: ⚠

1. Off line testing and calibration of instruments as reflected in P&IDs, safe charts and other project documents.
2. Installation and hook-up as per installation & hook-up drawing.
3. Hydro testing of impulse tubing and other associated tubing. Leak test of instrument isolation valves / manifolds.
4. On line testing and calibration checks of all instruments and loop checking of all such instruments.
5. Installation and hook-up of gas detector fusible plug, ESD/FSD stations etc.
6. ESD/FSD loop testing.
7. Functional test of gas detection system inclusive of all related field devices, controls signals.
8. Any other instrument related activity not listed above but mentioned in the relevant functional specifications elsewhere in the bid package.
9. Additional test requirements are detailed in FAT Procedure.
10. All above tests are to be performed on the assembled systems to check their integrity, completeness and correctness before dispatch from vendor's works
11. All the tests will be witnessed by the Company.

3.3. Minimum operation checks for Distributed Control System (DCS) at vendor works.

Once the system is made ready at Vendor's works the Contractor shall carry out Operation and functional checks necessary to confirm that the system meets the Contract requirements of hardware, software & integration including the following:

- Debugging and graphics to ensure the correct display.
- Debugging alarms with respect to correct color codes, descriptions, priority and correct tag numbers.
- Checking and correction of the various control loops for conformance with the Platform systems safety philosophy.
- Functional test for the special assigned soft keys with respects to correct display.
- Debugging of guided messages display.
- Checking of all I/O through to field terminals
- Trip point simulation ⚠
- Logic function simulation ⚠
- Alarm generation and resetting ⚠
- Operator functions testing like normal functions, bypass operation, manual shutdown etc. ⚠
- System and process alarm diagnostic functions ⚠

Additional test requirements are detailed in FAT Procedure.
All above tests are to be performed on the assembled systems to check their integrity, completeness and correctness before dispatch from vendor's works.
All the tests will be witnessed by the Company.

3.4. Minimum Activities to be carried out at Offshore after Installation and Hook – up

The Contractor shall carry out the following activities after installation and Hook Up.

- Calibration checks of instruments and loop checking. All the system/equipment including Vendor's packages and Company supplied equipment (if any) shall be included.
- Charging of filter media, packing, lubes, chemicals, etc.
- Repeat testing of PSVs and TSVs.
- System flushing
- System drying (Where applicable).
- System leak test. Water lines are also included.

- Inert gas purging (wherever applicable) for hydrocarbon system. ⚠
- The acceptance criteria for purging will be safe tie-in site condition accepted by both company and contractor. ⚠
- Complete functional checks of DCS, Emergency Shut down and Fire and Gas Programmable Logic Controllers. All such tests to be carried out at offshore after installation and shall be followed as per functional specification of DCS and respective control system given in S.A.T
- Pre-Commissioning checks for UPS, Switch gear, MCC etc.
- Testing and checking of electrical equipment for proper earthing, continuity, insulation resistance and relay testing as per OEM recommendation, illumination level checking. ⚠
- Testing and checking of all lifesaving equipment and operability test (including load test) for survival craft (load testing of survival craft davit either at yard or offshore).
- Operability test of all utilities and fire water pumps for 8 hours.
- Repeat operability test of IA/UA air compressors & dryers, emergency (starting) Air compressor, utility/potable water pumps, chlorinators etc. for 8 hours.
- Calibration of gas/fire/smoke and H2S detectors. Testing and calibration of F&G System including various type of detector shall be followed as per Functional Specification of F&G System given elsewhere in Bid Package & SAFE Charts.
- Functional test and check of Central Control Panel, local Shutdown Panels and startup & shut down logics for injection pumps and booster compressors as per respective
- Functional Specification given elsewhere in Bid Package.
- Operability test of TG sets (8 hours each unit).
- Operability test for utility water lift pumps, injection pumps, chemical dosing pumps and operability test of deck cranes. (Load test of deck cranes will be required if the deck crane is installed at offshore or if it cannot be tested adequately at onshore).
- Operability and load test of material handling system.
- Operability test of firefighting equipment including hose reels, clean agent system and sprinklers system etc.
- Operability test of HVAC, radio, paging, intercom, CCTV, telephone system, EPABX and all living quarters equipment ⚠

- Run test of gas turbines, process gas compressor, booster compressors and generators for 24 hours at no load. All control logic, start-up & shutdown features shall be tried.
- Run test of Fuel Gas Compressors for minimum 4 hours at rated condition in conjunction with FG conditioning skid to demonstrate fulfillment of their purpose as per Process Design Criteria. All control logic, start-up & shut down features shall be tested.
- Installation & calibration of all laboratory equipment/instruments and put them on operation. Detail requirement to be firmed up in detailed design phase.
- Installation and placing in service of the machines provided in workshop.
- Checking of electrical power system, CP monitoring system, Battery capacity, etc. ⚠
- Functional test of ESD and Fire and Gas systems and associated start-up and maintenance by-passes
- Operability Test for Flare System ⚠
- Operability Test for Clean agent system

3.5 Site Acceptance Test (SAT) ⚠

As a minimum Site Acceptance test shall be required on the following packages which has to be inspected by ONGC/ Certification Agency.

- HIPPS
- DCS
- F&G Detection system
- Subsea umbilical
- Well head shutdown panel & standalone shutdown panel
- SSIV Actuator & HPU
- PLC
- Produce water Conditioning
- Fuel gas system
- Deck crane (pedestal)
- Instrument & utility gas system
- HVAC System

The above list shall be considered as a minimum and shall be supplemented with other items based upon requirement indicated in respective functional specifications.

3.6. Preservation of systems:

After completion of pre-commissioning and before handover of platforms, Contractor shall ensure the preservation of Equipment, systems, facilities etc., for 6 (six) months so as to the platform shall be ready for Commissioning / Start of Production Piping shall be preserved by filling Nitrogen or Water as required. Preservation of equipment etc. shall be done as recommended by respective vendors.

4. COMMISSIONING

Commissioning of the Platform and the Modifications involves the programmed introduction of hydrocarbons and the operation of all systems in the manner intended.

At least three months in advance of the planned date for the issue of Ready for Commissioning, Contractor shall submit for approval a procedure to the Company giving complete details of the programme and procedures to be followed for commissioning. The procedure shall describe all activities and methods for executing these activities safely. It shall provide details of the rates, ramp up rates, configurations of equipment, throughput, train combination, operation of standby equipment and all other matters required to introduce hydrocarbons to the Works, ramp up flows, test and prove the Works on hydrocarbons and do all other things required by Company to commission the Works.

After Company has given approval to commission the Works, well fluids will be introduced to into the Works. The flow of well fluids will be modulated as Company judges appropriate. At a time to be determined by the Company, the Company will determine that the Works is ready for Performance Tests and these tests will be conducted in accordance with the requirements of the Company.

4.1. Shut down Requirements

During part of the Modifications Work and subsequent Pre-commissioning and Commissioning activities, some equipment in the existing process/ well platforms shall remain operational. The Contractor shall schedule all activities to minimize disruption to the production of existing platform and shall recognize that limitations will be placed on his access. The Contractor shall comply with all the permit and safety procedures of the existing platform.

The platform Operations Group will control the scheduling and duration of any shutdown of the platform. The contractor shall submit Shutdown Schedule to the

Company for approval as part of the Pre-commissioning and Commissioning Procedure. The shutdown schedule shall include the following as a minimum:

A detailed list of all activities
Estimated duration of each activity
Float calculations for each activity
Manpower Histogram for each shifts of the shutdown.

Contractor shall also provide any requests for services and access required e.g. requests for accommodation, access to utilities, crane usage requirements, deck area access requirements, permit requirements etc.

Contractor shall note that its use of Company's facilities is limited and the availability of these facilities cannot be assumed or assured (as is described elsewhere in the contract documents).

4.2. Purging and Cleaning Requirements

Contractor shall prepare procedures for all work on existing systems and submit them for approval before starting work. Before modifications work is carried out on any system, pipe work and equipment shall be prepared in accordance with approved procedures, gas freed and purged as appropriate and as required by Company. Contractor shall arrange and supply nitrogen required for purging. The final oxygen content in process system shall be brought down to less than 2% (V/V). ⚠

The contractor shall develop procedures for the purging of systems prior to the introduction of hydrocarbons. Included in this procedure shall be the purging and gas freeing of existing lines of the platform requiring modification. This procedure shall include the proposed method of purging to be used, the duration of the purge, the purge medium and the acceptance criteria used to determine a successful purge. This procedure shall be approved by the Company prior to the commencement of any works at the platform

5. HSE / RISK MANAGEMENT ⚠

Work onsite shall comply with ONGC's Health and Safety Manuals, Work Permit System and other relevant documents.

The HSE program during Project Hook-up & Commissioning shall focus on the following six (6) main areas:

1) Site Supervision
2) Personnel Awareness
3) Personnel Capability
4) Accident Prevention
5) Management involvement and visibility
6) Pre-Startup Assessment

5.1 Personnel Awareness

Briefing on safety expectations for Project Hook-up & Commissioning supervisory team and Contractor's personnel will be conducted prior to mobilization.

The briefs shall be immediately prior to mobilization

All personnel will again undergo briefing once they arrive at the work site for specific health, safety and security procedures.

The Contractor shall publish and disseminate his HSE manuals and programs to his supervisory and all other personnel prior to mobilization.

Daily tool-box meetings and Job Safety Analysis (JSA) shall be carried out to ensure personnel are aware of work to be performed and the risk, if any, associated with the days work and mitigate steps to take. The work group foreman shall lead the daily morning discussion prior to commencing with work. The Project Hook-up & Commissioning supervisors or discipline engineer or operations personnel shall periodically monitor and participate in the toolbox meeting.

5.2 Personnel Capability

All personnel involved in the Project Hook-up & Commissioning are required to attend mandatory safety training as required by ONGC as a minimum. Contractor's personnel, e.g. rigger / scaffolder, welder, crane operator, grinder, etc. shall undergo trade competence training as required.

Safety investigation training shall be provided for supervisory, inspection personnel for both Project Hook-up & Commissioning and Contractor to provide them knowledge in recognizing root causes of safety incidence and encourage them to be pro-active in safety matters.

5.3 Accident Prevention

Project Hook-up & Commissioning shall carry out inspection on construction tools and equipment prior to issuance to the Project Hook-up & Commissioning personnel to ensure they are fit for service. The inspection shall be done periodically.

Once the tools and equipment have been issued, inspection will be by the user, supervisor, safety officer and discipline inspectors, as appropriate.

All lifting equipment shall be tested, certified and assigned a colour code signifying its certification period.

The Project Hook-up & Commissioning contractor shall screen its personnel prior to their employment to confirm that they are qualified for their assignment and are free from Drug & Alcohol (D&A) abuse. This shall be supplemented by random testing and testing for cause after mobilization.

Contractor Management will carry out safety audits on a regular basis.

Contractor shall implement a hazard identification program as part of daily routine.

ONGC operation shall administer the work permitting procedure for simultaneous operations (SIMOPS) and simultaneous production & drilling (SIPROD) of Project Hook-up & Commissioning.

ONGC Operation shall administer the Emergency Response Plan (ERP). Project Hook-up & commissioning group and its contractor shall formulate an ERP in-line with Operations established ERP procedures.

Contractor shall implement Job Safety Analysis (JSA) or Critical Work Analysis for engineered control of hazards on non-routine or critical activities with high hazard potential.

5.4 ONGC Supervisor's Responsibility

Publish the Project Hook-up & Commissioning Execution Plan after management endorsement and ensure its availability at work site.

Ensure that the Emergency Response Procedure (ERP) and Simultaneous Operations (SIMOPS), Health Safety Environment Management System and other safety documents are available at the Worksite.

Ensure that the Project Hook-up & Commissioning contractor assigns a safety engineer / officer full-time onsite to provide the supervisors with HSE advice.

Daily supervisory planning meeting shall be held between different groups, i.e. Operations, Drilling, project hook-up & commissioning and their contractors. This meeting shall serve as a forum to provide the different groups the guidance to plan / modify each group's activity as necessary to avert any conflict or interference.

5.5 Management Involvement and Visibility

Onsite visits by ONGC management and contractor's management shall be conducted on a regular basis at least once a month. The timing of such visits can be planned that they coincide so that any pertinent HSE issues can be discussed together first hand.

5.6 Pre-Startup Assessment

A pre-startup assessment of the Facilities shall be performed prior to introduction of hydrocarbon into the system. The assessment is performed and documented to confirm that:

- Construction is in accordance with design specifications.
- Safety, environment, emergency, operations and maintenance procedures are in place and adequate.
- Risk management recommendations have been addressed and the required actions taken.
- Training of personnel has been accomplished.

6. MODIFICATION WORKS

Contractor shall carry out modification works, interconnection and hook-up operation as given in Description of work in bid package. It shall be contractor's responsibility to carry out all necessary preparatory work like draining, venting, gas freeing, purging etc., for all the existing facilities required for modification and safe tie-in. It shall be contractor's responsibility to arrange and provide steam, chemicals, nitrogen etc. required for gas freeing operation. It shall be contractor's responsibility to ensure proper safety during tie-in / modification operation.

7. PERFORMANCE TESTS FOR WORKS

The Contractor shall carry out Performance Tests. The Contractor shall develop a detailed procedure for the performance tests in accordance with the requirements of the Contract and submit them to Company for Approval.

If sufficient well fluid is not available to test all streams and compressors simultaneously, the streams and compressors shall be tested individually in a manner approved by the Company and the Contract requirement shall be met at the approved rate used for the test.

7.1 Maximum Rate Performance Test of Platform

A performance test of the platform shall be carried out to demonstrate that everything (including process facilities and utilities) meets its Contract requirement.

The test shall be arranged such that the inlet flow rate to the facilities is ramped up in suitable steps until the Maximum Design Capacity is reached. A 72 hour test period will commence once the process is in a stable operating mode at the Maximum Design Capacity. Any reduction/change to the throughout (outside a band of ± 3%) during the 72 hours will negate the test and it will be recommended for another 72 hours once the flow rate has again stabilized at the design throughput.

During the ramp up period process controls can be tuned. The appropriate process measurements shall be recorded from the beginning of the test, throughout the 72 hours period and during the ramp down.

The performance test shall demonstrate that the works meet the requirements of the Contract. All equipment shall be tested to see that it meets the requirements specified (including capacities). These tests shall include demonstrations of the following (note that this list below is not an exhaustive list of the tests and demonstrations that shall be carried out on these systems);

Well stream heaters - these must also be shown to achieve the desired outlet temperature of the well stream fluids at the design throughput. Critical variables are the inlet and outlet temperature from the exchanger and the shell and tube side pressure drops.

Inlet separators - the ability of the separators to perform the gas/oil/water separation shall be tested. The test must be carried out with the addition of demulsifier to the feed to the well stream heaters. Testing will be required to determine the water-in-oil content of the outlet oil stream, the oil-in-water content of the separated water, and the liquid carryover in the gas stream.

Water treatment – the hydrocyclone system must be tested to ensure the water being discharged to the sea meets the specifications for discharged water. This shall be tested at lower rates during the ramp as well as at the maximum design capacity.

Process gas compression – the compressor train must be run and achieve the required pressure at the connection point to the main compressor outlet whilst achieving the inter- stage and discharge temperature requirements.

Gas dehydration – the gas dehydration package unit must operate in a stable condition and achieve the water dew point specification and glycol carryover specification for the gas. The glycol regeneration unit must operate and produce on specification glycol for return to the TEG column.

Booster gas compression – the booster gas compressors must achieve the desired outlet pressure at the design suction pressure and throughput. The pressure at the inlet to the PGC must be achieved at the maximum design capacity.

Hot oil system – the hot oil system must achieve the required hot oil supply temperature under all operating scenarios during the test. This will require that the well-stream heaters be on line so that the supply to these units can be confirmed.

The Instrument air package – the instrument air system shall be capable of providing the required air quality at the required flow rate. The air drier must operate for the design period before regeneration commences.

Fuel gas – the fuel gas system shall be shown to be capable of providing sufficient dry, superheated gas to the users.

Potable water – the potable water maker must produce the specified water quality and be shown to meet its design capacity requirements.

The test must successfully demonstrate that all equipment operates to specification and the shutdown systems for each system and the overall facility, work as required. As part of the test, the process simulation model of the process must be updated and validated against operating data. This will require some sampling and analysis of the Process streams in the facility.
At the end of the 72 hour test period the flow rates shall be ramped down and process recordings continued unit flow is stopped. The shutdown systems can be tested during the ramp up and ramp down period, but should not be tested during the 72 hour stable operation period.

The Contractor shall develop an extensive test procedure for the above, including details of all process measurements and analyses to be carried out.

7.2 Minimum Rate Performance test of Platform

The test procedure described above shall be repeated at the Design Minimum Capacities but for a period of 12 hours.
The Performance test shall demonstrate the works meets the Design requirements and demonstrate those things described in Section 6.1.

7.3 Performance Test of the Modifications

Performance test of the Modifications shall be carried out in a similar manner and scope to these nominated in Section 6.1 and 6.2.

They shall demonstrate that the Modifications meet the requirements of the Contract over the range of rates between Maximum Design Capacity and Minimum Design Capacity.

8. GENERAL

8.1. Vendor's representatives

The Contractor shall arrange manufacturer's representative(s) (at fabrication yard and offshore) of at least the following major equipment/systems (as applicable as per Scope of Works) during operability tests, pre- commissioning and until the satisfactory completion of the Performance Tests. The period required to be on the platform shall be that needed by contractor and that required and approved by company.

- ✓ Process Gas compressors
- ✓ Booster compressors
- ✓ Turbine generator package
- ✓ Emergency Generator
- ✓ Well fluid heater
- ✓ Separator
- ✓ HIPPS
- ✓ Multiport Valve
- ✓ HPU
- ✓ Gas dehydration packages
- ✓ Hot oil package/ WHRU
- ✓ Air compressor package
- ✓ HVAC
- ✓ Water maker
- ✓ Nitrogen Generator Package
- ✓ Fuel Gas conditioning skid
- ✓ Main injection pump package
- ✓ Sea water lift pump package/Utility Water pump package.
- ✓ Chlorinator package
- ✓ Sewage treatment plant package
- ✓ Main oil transfer pump package
- ✓ Produced water treatment system

- ✓ Communications systems
- ✓ Distributed Control System (DCS)
- ✓ Emergency Shutdown System (ESD)
- ✓ Fire and Gas System
- ✓ Battery and Battery charger
- ✓ HT/LT transformers.
- ✓ CP system
- ✓ Pedestal deck crane
- ✓ UPS
- ✓ Fire water pump
- ✓ Survival craft
- ✓ MPFM & MPV
- ✓ Chemical dosing / Injection Pumps.
- ✓ Oil Metering Systems.
- ✓ Gas Metering System.
- ✓ Online corrosion Monitoring
- ✓ Flare system
- ✓ SSIVs

In addition to above the contractor shall retain manufacturer's representatives for at least the following equipment on the platform during commissioning and at least two (2) weeks after successful commissioning of the platform facilities.

- ✓ Booster compressors
- ✓ Gas compressors
- ✓ Gas dehydration packages
- ✓ Turbine generator package
- ✓ Emergency Generator package
- ✓ HVAC
- ✓ Water Maker
- ✓ Sewage treatment plant package
- ✓ Hot oil package
- ✓ Main Oil transfer pump
- ✓ Separator
- ✓ Communications systems
- ✓ Distributed Control System (DCS)
- ✓ Emergency Shutdown System (ESD)
- ✓ Fire and Gas System
- ✓ Oil Metering System

- ✓ Gas Metering System.

The contractor's key commissioning personnel (at least one for each discipline, i.e. mechanical, electrical, instrumentation, electronics & process) shall be retained on platform for 30 days after successful commissioning of the complex.

8.2. Spares, Utilities ⚠

The contractor shall be responsible for submission of list of one year operational spares. The contractor shall provide list of spares and responsible for initial fill up and six month supply of consumables (like lube oil, lubricants, etc.) for the platform operations after modification works are mechanically completed, pre-commissioned/ commissioned and handed over to the company. Contractor shall refer section 5.16 of 3.0 part II general condition of contract.

All utilities required during pre-commissioning of the facilities including power, water, air, cranes, etc. shall be provided by the contractor. In no case the facilities provided on the platform shall be used for this purpose unless authorized by the company.

It shall be contractor's responsibility to supply lubes, chemicals, purging materials and other pre-commissioning aids required till the platform is handed over to the company. It shall be contractor's responsibility to repair any damage to the system occurred during load out, transportation and installation and pre- commissioning of the facilities.

The contractor shall maintain a record of the start-up spares consumed during pre-commissioning and hand over the balance items to the company.

8.3. Handing over of Materials ⚠

After the mechanical completion and completion of pre-commissioning activities for all the systems installed on the platform by the contractor, the contractor shall hand over to the company all the materials which shall include but not limited to the following:

- ✓ All loose supply material
- ✓ Special tools and tackles
- ✓ Commissioning spares
- ✓ Spares as specified in relevant functional specifications

8.4. Special requirements

It shall be Contractor's responsibility to install, calibrate and make all laboratory and workshops equipment operable. Contractor shall involve Company's chemist and maintenance engineers and impart necessary techniques and know-how required for operation and maintenance of this equipment.

9. DOCUMENTS TO BE SUBMITTED

9.1. Operating Manual

The Contractor shall prepare a draft start-up and Operating Manual for all of the facilities that are included in the Works and submit to Company at least 150 ⚠days prior to start of pre-commissioning activities for approval. Quantity of operating manuals requirement for all equipment shall be provided as per respective specification given elsewhere in bid package. The related attachments will go with each manual. The following information shall be included and hyperlinked in one single soft manual for easy maneuvering:

- ✓ Design basis of facilities
- ✓ Detailed process/ facilities description.
- ✓ Pre-commissioning check
- ✓ Start-up, normal operation & shut down procedures for each equipment.
- ✓ Platform start-up procedure.
- ✓ Platform normal operation procedure
- ✓ Platform shut down procedure (normal/emergency)
- ✓ Vendor instructions for all equipment for normal operation and trouble shooting.
- ✓ Emergency procedures.
- ✓ Operating parameters and set points of different alarms and trip devices
- ✓ Summary of chemical consumption including list of recommended Indian equivalent.
- ✓ Summary of utilities consumption for each equipment.
- ✓ Lubrication Schedule (include Indian equivalent, initial fill, frequency of change of lubricant and 6 months requirement).
- ✓ Gas detection and associated safety system operation, calibration and maintenance procedure.
- ✓ Life saving devices operation and maintenance procedure.
- ✓ Routine structural maintenance check.

- ✓ List of equipment (showing skid size, weight, purchase order no., vendor data book reference tag no.)
- ✓ Effluent disposal.

The manual shall have the following attachments as a minimum:

- Reduced size copies (275 mm x 425 mm) of line lists
- Equipment and instrument data sheets in accordance with purchase order
- Electrical Single line diagrams, area classification drawings and control schemes
- Pump characteristic curves
- Process Flow Diagrams (PFDs) & Piping and Instrumentation Drawings (P & IDs)
- Booster compressor start & shutdown procedure, logics and protection system. ⚠
- Process gas compressor start-up & shutdown procedure, logics and protection systems ⚠
- Gas turbine generator start-up & shutdown procedure, logics and protection system ⚠
- Safety Logic Diagrams and Safe charts.
- Recommended proforma for recording routine parameters during normal operation for PGC, booster compressor, TG, DG set, IA/UA compressor and fire water pump and cathodic protection system and all process equipment.
- Equipment layout.
- Safety escape routes
- Field location maps.
- Layout and location Maps for fire and safety equipment's.
- All hardware and schematic drawings of system packages like PCS, PLC-based ESD etc. shall be as-built ⚠

The contractor shall submit the draft Operating Manual to the Company for approval. The Contractor shall discuss the comments with Company & incorporate the comments in the final document. The Contractor shall submit the final document for approval to the Company. After the document is approved by the company/ engineer's representative, contractor shall make the required number of copies, specified elsewhere and submit to the company/ engine r's representative. This manual l shall be followed during start-up and commissioning of the facilities.

Vendor operating and maintenance manuals shall be submitted along with the final operating manual. ⚠

The operation manual can be divided into two or three parts if the thickness of manual exceeds 80 mm. It shall describe, pre-start up checks, start-up procedures, shut down procedure and normal operation for an equipment vendor recommended procedure and integration of that equipment with other facilities. Contractor shall also submit 150 days before the commissioning the system operating Manual for the distributed control system (DCS), which shall contain system description, operating instructions and necessary information for the familiarization of the operator.

9.2. Pre-commissioning documents:

The Contractor shall submit a detailed schedule for carrying out the pre-commissioning activities in a network form.
Contractor shall prepare detailed format of checklists of pre-commissioning and commissioning activities for each equipment/system. The Contractor shall submit the said format for approval of the Company. These check lists shall describe the checks/test to be carried out on each equipment/system, shall also indicate if a particular check/test is to be carried out at the yard or offshore.

All the check list points shall be dealt by the Contractor. Determination of the system readiness for commissioning shall be determined based on the relevant portion of check lists have been completed by the Contractor.

For the purpose of execution of these pre-commissioning activities, the entire platform shall be divided into system and sub-systems. The pre-commissioning document shall contain the following:

- System / sub-system identification.
- Detail procedures for the various pre-commissioning activities, such as system check, flushing, de-watering, drying, leak test, purging etc. with format to record the observations of the activities carried out.
- Procedures and formats for recording the operability test/performance test for different equipment/system.
- Lube schedule, indicating the nomenclature (Indian equivalent) of lubes, quantity of initial fills.
- Listing of commissioning and start up spares.

- List of pre-commissioning activities to be carried out at fabrication yard, or offshore, or at both places.
- High-pressure leak check procedure of gas system.
- A detailed procedure for management of any special bypass or defaults required for commissioning.

The Contractor shall submit a draft pre-commissioning documents 180 days before the activities are to be carried out. The document shall be reviewed by the Company. The Contractor shall submit a revised document after incorporating Company's comment for approval to the Company. The approved document shall be submitted 120 days prior to starting of the pre-commissioning activities.

At the end of pre-commissioning activities, all the pre-commissioning test records (duly signed) shall be compiled by the Contractor. Three copies of documents for each system shall be delivered to the Company.

9.3. Modification/hook up procedure

During part of the Modifications Work and subsequent Pre-commissioning and Commissioning activities, some equipment of the existing platform shall remain operating. The Contractor shall schedule all activities to minimize disruption to the production of the existing platform and shall recognize that limitations will be placed on his access. The Contractor shall comply with all the permit and safety procedures of the platform.

Contractor shall produce a procedure with his detailed shut down requirements for the various hook-ups required to be carried out on the platform. This shall be presented to company for approval within 120 days ⚠ of Notification of Award. Contractor shall submit, along with Pre- commissioning procedure, a detailed procedure for carrying out modification works, interconnections and hook-up operations for the facilities. An Isolation scheme to be prior to carrying out modification works shall be worked out in advance and detailed in this document.

A Separate Hook-up Procedure for modification at platform along with pre-engineering survey document shall also be submitted to Company for review as part of the Commissioning Procedure.

9.4. Commissioning procedure

Contractor shall prepare this document to detail out the procedures and sequence of commissioning of the project facilities including the log sheets for logging of parameters of different equipment/ system during commissioning. The contractor shall have required inputs from the company and the vendor's representatives. The document shall include the shift rosters for the contractor/vendor's representative to be deployed during commissioning operation. This document shall be submitted to the company for approval, 120 days prior to the commencement of commissioning operation.The document shall also include log sheets for the Performance Test. The document shall be submitted to the company for approval as described in Section 4.

9.5. Other requirements

The Contractor shall provide safety equipment locations, H2S safety information chart, warning signs and escape route drawings (framed). These drawings must be placed in locations approved by the Company before the platform is commissioned. The Contractor shall also provide adequate numbers of NO SMOKING boards, which will be installed where required by the Company.

An emergency plan shall be prepared and shall be in place prior to commencement of Pre-commissioning and commissioning activities. The plan shall define the actions, personnel and facilities required in case of an emergency.

In addition to the other requirements of the Contract, Contractor shall supply adequate sets (A3 size) of Process & Instrument Drawings, electrical single line diagrams and wiring diagram to the company to facilitate system check before start of hook-up work. The Contractor shall also provide two sets of PFDs on acrylic sheets which will be installed at locations specified by the Company.

9.6. Yard checkout before Load out

Prior to load out, the Contractor shall carry out, at the yard, a check of the facilities for correct erection and installation, operability, maintenance requirement and safety of plant and personnel during operation in accordance with accepted international good engineering practices, this will be witnessed by the Company. The Contractor shall carry out all modifications and corrections in accordance with the final punch list prepared jointly by the Contractor and the Company.

9.7. Modification and Hook up with platform

Contractor shall carry out hook-up operation of modification works at Platform. Contractor shall obtain and produce details of all existing platforms for this purpose during a pre-engineering survey of existing platforms.

The Contractor shall carry out the required pre-commissioning activities for the existing system which are either modified or hooked up to the new facilities. Contractor shall carry out all preparatory work necessary including: draining, venting, gas freeing, purging etc. for facilities at platform required for safe tie-ins. It shall be the Contractor's responsibility to arrange everything required to safely complete these operations. Contractor shall also ensure safety of personnel during tie-in operations.

9.8. Manpower for Commissioning

For commissioning of the platform, Contractor shall deploy personnel with experience in operation of similar facilities, commissioning shall be round the clock uninterrupted operation. The Contractor shall arrange & provide all categories of personnel i.e. shift engineers, operators, technician, chemist, safety engineer etc. required for manning the platform during commissioning operations. The Contractor shall submit the commissioning organization chart with details of the experience and qualifications of key commissioning personnel for approval to the Company. Contractor shall modify the charts to incorporate Company requirements. Contractor shall submit this chart along with pre-commissioning documents.

ATTACHMENT A

Pre-Commissioning Check List

1. PRE-COMMISSIONING CHECKLIST

This checklist represents the absolute minimum of work which has to be performed by the Contractor prior to commissioning of the facilities. It is not intended to be a complete list of activities required. Manufacturer's instructions for pre-commissioning checks/ testing shall be followed for all equipment.

1.1. General procedure

The general work procedures listed below outline the work to be performed by the Contractor. Other procedures applicable to specific system or items of equipment may be covered elsewhere in the contract.

1.2. Packing and seals

- Install mechanical seals, permanent packing and accessories wherever required.
- Adjust and replace mechanical seals, packing and accessories, as necessary, during pre-commissioning period.

1.3. Removal of temporary supports

Removal all temporary supports, bracing or other foreign objects that were installed in vessels, transformers, piping, rotating machinery or other equipment to prevent damage during shipping, storage and erection/ installation.

1.4. Alignment of rotating equipment

- Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
- Make cold alignment to the manufacturer's tolerances along with Company. Provide all the alignment readings records to Company. Contractor shall prepare the formats (unfilled) and submit to Company for approval.

- Check all lubricants and their quality, fill etc. before operating the equipment.
- Carry out uncoupled run of motors, check bearing temperatures, vibration, no load currents, over current trips, function of different safety devices and carry out adjustments as required.
- Make hot alignment and any dowelling required after equipment has been put in operation.
- Obtain manufacturer representative for equipment as required during installation and/or pre-commissioning and commissioning.

1.5. Tie-ins at unit limits

Prepare all systems for safe tie-ins with bridge connected platform or with existing operating systems. Contractor shall prepare the systems for Tie-ins in consultation with Company and will be responsible for safety during tie-ins being made. Contractor shall gain approval of Company for the safety measures to be taken by them before any tie-in work is taken up.

1.6. System check / inspection

Provide inspection facilities to the Company to check that erected facilities conform to Process & Instrumentation Diagrams, construction drawings, vendor drawings and specifications approved for construction.

Verify and approve the facility check. Note exceptions, if any, on a separate work order list (punch list).

1.7. Site modifications

Carry out site modifications as found necessary during system checks and inspection from the viewpoint of routine operations, maintenance and safety of the platform. A list of such jobs shall be prepared by the Company and shall be handed over to the Contractor for execution.

1.8. Flushing

Perform flushing and blowing of all piping to remove dirt, welding slag, etc. Arrange for cleaning media (potable water or compressed dry air, as applicable) for carrying out flushing/blowing and disposal of the cleaning media in accordance with minimum procedures to be developed by the Contractor and approved by the Company. Following is the minimum velocity of cleaning media to be maintained for flushing/blowing of piping:

AIR: - 2.4 – 2.7 m/sec
WATER: - 1 – 1.2 m/sec.

1.9. Temporary screens, strainers and blinds

- Provide and install temporary strainers where required. Install permanent strainers after initial operation.
- Clean strainers as required during pre-commissioning and commissioning.
- Provide, install and remove all blinds required for flushing or operation.
- Change gasket if necessary.

1.9.1. Leak Test ⚠

- Leak test of complete process facilities including piping, equipment, instrument connections etc. to be carried out in accordance with ASME 31.3 latest addition after completion of pre-commissioning activities, safety checks and hydro test.

- Notify the Company of test schedule at least two weeks in advance. All the tests are to be witnessed and the test record on satisfactory completion of the test be signed by Company.
- Provide 4 copies of all the test records to the Company.

- Provide any special media, if required for test purpose and provide facilities for disposal.

- Conduct all operational tightness testing

1.9.2. Vacuum tests

Carry out vacuum test to rectify any leakage

1.10. S a f e t y devices

- Provide the Company with a list of proper settings for safety devices.

- Install all safety devices on the equipment.
- Test and adjust all safety devices such as PSVs, TSVs at offshore and seal wherever necessary. Other safety instruments/ instruments systems inclusive of field devices, Well / fire shutdown panel, gas detection system shall also be tested.

1.11. Purging

Install necessary purge connections and carry out system purging including that of flare and vent with Nitrogen in accordance with Company approved procedure. The final Oxygen content in purged systems shall be reduced to an approved safe limit. Contractor shall arrange & supply the Nitrogen required for purging.

1.12. Drying out

Dry out necessary facilities wherever required by Company.

1.13. Lubricants and chemicals

Procure and supply initial fill of all lubricants, chemicals, resins, desiccants and other similar materials, replenish the chemicals consumed during pre- commissioning and commissioning.

Inspect vessel interior along with Company representative/ certifying authority before filling of chemicals for proper cleanliness.

1.14. House keeping

Provide continuous clean-up of the construction and operational area. Remove excess materials, temporary facilities and scaffolding and pick up trash. Perform washing for further clean-up as required.

1.15. Equipment protection and spare parts

Protect equipment from normal weather conditions, corrosion or damage before commissioning.

Provide all installation and commissioning spares.

1.16. Chemical Cleaning.

Perform special chemical cleaning or pickling of the critical piping and compressor suction piping, etc. in accordance with vendors approved procedures

1.17. Firefighting & lifesaving equipment

- Ensure correct installation of all firefighting and lifesaving equipment.
- Carry out function test of fire detection devices, foam and fire water spray system.
- Carry out load test of survival crafts in accordance with company approved procedure.
- Carry out Visual inspection of portable apparatus and ensure that these are installed at critical locations.
- Visual inspection of survival crafts, checking the inventory of items, starting of engine by battery and manual cranking.
- Mock demonstration of complete operation of survival craft including a run of 10-15 kms.

1.18. Miscellaneous

To carry out any other check/test as required by Company and provide all test certificate as required by the Company.

1.19. Operability test for a system/equipment

The Contractor shall provide a procedure for carrying out the operability test of each equipment/system to prove that the equipment/system installed meet the design specification. This procedure shall include log sheets wherein the operating parameters shall be recorded hourly.

Each system / equipment shall be subjected to an operability test to determine that it operates in accordance with its specifications and the design intent over the full range required by the Design Criteria. The operability test shall be conducted, using all ancillary equipment, auxiliaries and controls, continuously for the duration specified in these documents after stability conditions have been attained. If no duration is specified the test shall be conducted for 4 hours after stability has been attained. If the test is interrupted due to any reason, the test shall be started afresh.

The operability test shall be carried out by the Contractor and the vendor's representatives, wherever applicable and witnessed by Company.

The Contractor shall make necessary checks, adjustment, repairs required for normal operation of the system/equipment. All the safety devices shall be tested for their proper operation.

Upon completion of the Operability test, the log sheet with all observation shall be signed by the Contractor, Vendor, Company representatives. The Performance shall be evaluated based on the data and observations made during the operability test. In case of any dispute, the decision of Company shall be final.

2. SPECIFIC PROCEDURES

In addition to the work to be performed in accordance with the above, the detailed procedures outlined below further define the work responsibilities of the contractor for specific systems and items of equipment.

2.1. Vessels

- Open vessel after erection and put in place any internals requiring field installation.
- These internals shall be inspected before and after installation. Open both internal and external man ways for inspection of vessels by the company.

Check filter media/packing for correct level (if applicable)

Note: Vessels that have been pressure tested in the shop may require retesting offshore if required by the company. They shall, however, be included in the testing of attendant piping systems whenever practical and approved by the company.

2.2. Shell and Tube Exchangers

- Perform internal inspection/testing as required by specifications or drawings
- Perform separate field testing, if desired by the company of Exchangers that have been shop tested.
- Cross leakage for exchangers may be tested at company's discretion
- Check electrical earthing of vessel.
- Check piping connections flange face alignments and remove any blinds installed while construction/testing
- Check mounting of instruments & safety valve
- Check for correct insulation/paint/name plate

NOTE: Shell and tube exchangers that have been pressure tested in the shop may require testing offshore if required by the company. They shall, however, be included in the testing of attendant piping system whenever practical and approved by the company. If shell and tube exchanger is taken in piping system test and the exchanger is designed for differential pressure, proper care shall be taken to ensure that differential pressure between shell and tube side is not exceeded beyond the maximum recommended differential pressure during the testing.

2.3. Air Cooled Exchangers

- Inspect exchangers to ensure that temporary shipping supports and erection material have been removed.
- Check fins and fan for shipping damage.
- Perform separate field testing, if desired, of exchangers that previously have been shop tested

Note: - Air cooled exchangers that have been pressure tested in the shop may require retesting offshore if required by the Company. They shall, however, be included in the testing of attendant piping systems whenever practical and approved by the Company.

2.4. Pumps, Compressors, and Drivers

- Level base plates and sole plates.
- Alleviate any excess piping stresses that may be imposed on pumps, compressors, and drivers.
- Chemically clean lube oil, seal oil system, when specified. Dispose of wastes and cleaning media in accordance with Company's instructions.
- Change the lube oil, seal oil, and cooling systems with flushing oil and circulate for cleaning purpose. Dispose of any flushing oil in accordance with the Company's approved procedure.
- Change the lube oil, seal oil and oil cooling systems with the operating oil after removal of flushing oil recommended by the manufacturer
- Provide service engineer for technical assistance during installation and/or pre-commissioning and commissioning as specified

2.5. Piping Systems

- Notify the Company of hydro test schedule at least two weeks in advance.
- Orifice plates, control valves and any other on -line instruments should not be installed before testing and flushing. If installed, they shall be removed and necessary spool pieces shall be provided in their place wherever required.
- Piping system shall be thoroughly flushed and cleaned to the satisfaction of the Company.
- Hydrostatically or pneumatically test all piping as required by the Drawings or specifications.
- After testing, drain and dispose of the test media in accordance with the Company's instructions. All the piping will be dried using air and sealed.
- Check pipe hangers, supports, guides, and pipe specialty items for the removal of all shipping and erection stops and for the correctness of cold settings for the design service.
- Check pipe hangers, supports, guides, and pipe specialty items for hot settings and make minor adjustments as necessary.
- Install seals on valves where necessary.
- Correct support, vibration, and thermal expansion problems detected during commissioning.
- Ensure appropriate permanent gaskets are installed and all flanges are tightened properly.

Refer Functional Specification Piping Fabrication & Installation (2004B).

2.6. Electrical Power and Lighting systems

- Notify the Company of the test schedule prior to commencement of work.
- Using a megger, make insulation tests on all wiring.
- Insulation tests are to be carried out on all HT/LT cables, HT/LT panels & lighting boards etc.
- Using a megger, make insulation tests on generators, motors, and transformer windings from phase to phase and phase to ground.
- Make grounding system test to determine the continuity of ground connections and the value of resistance to ground.
- Carry out insulation tests on all dry transformers
- Make trials and adjustments and functional tests on all switchgear, control panels, and motor control equipment.
- Test-set switchgear relays for proper coordination.
- Check phase sequence and polarity.
- Energize the complete power system with approval of the Company after completion of all tests.
- Check installation and operation of emergency power systems.
- Check that all electrical equipment is certified for the environment in which they are located.
- All relays are to be tested as per OEM recommendation.
- No load current of all the equipment is to be recorded. Three copies of all the test results to be provided to Company representative
- Make function test at LT / HT switch gear.
- Illumination level checks are to be done for entire lighting system.
- Check phase sequence & polarity.
- All UPS Powered systems shall be operated for 8hrs on UPS power.
- All HMI Functionalities shall be checked in HT/LT switchgears

2.7. Instrument Systems

- The Contractor will make all non-operating checks that will ensure instrument operability, i.e. remove all shipping stops; check pointer travels' and verify instrument capability to measure, operate and stroke in the direction and manner required by the process application.
- Clean all transmission and control tubing by blowing with cooled and filtered clean air before connecting to instrument components.
- Clean all air-supply headers by blowing with clean air and check them for tightness.
- Leak test pneumatic control circuits in accordance with ISA Recommended
- Practice RP 7.1. Pneumatic Control Circuit Pressure Test, 1956.
- Check piping from instruments to process piping for tightness.
- Install and connect all system components and verify their conformance to specifications and design criteria for function and range using dummy transmission signals as needed.

- Check all electrical signals and alarm wiring for continuity, correct source of power, and polarity.
- Check thermocouples f o r proper joining of wires, position of elements in wells, proper polarity & continuity of receiving instruments.
- Identify orifice plates by tagging and check for proper installation of upstream side of plate.
- Isolate, or remove if necessary, online components such as control valves, positive displacement meters, and turbine meters for pressure testing. Reinstall these items after testing the system.
- Check bores of orifice plates and install these plates after completion of flushing operations.
- As dictated by the Company's specification, calibrate instruments with standard test equipment and make all required adjustments and control point settings.
- Fully pressurize and energize the transmitting and control signal system(s) by opening process connections at primary sensors and final regulators, and by making control mode settings for automatic operation of equipment as the process unit is charged and brought on stream.
- Check settings of all alarm and shutdown switches.
- Check all shutdown systems before commissioning.
- Check all safety valves and settings. Ensure that safety valve isolation valves are locked open in accordance with drawings.

2.8. Potable Water System

- Inspect for completeness and correctness of installations and make any non- operating checks that may be required.
- Make the necessary operating tests and adjustments to water maker systems.
- Provide all water treatment chemicals.
- Carry out quality checks on potable water.

2.9. Water System (Fire Water System and Sea Water Systems)

- **I**nspect for completeness and correctness of installation and make any non-operating checks that may be required.
- Clean and install screens in the suction line before water circulation.
- Operate pumps to check correct operation and output of system.
- Obtain and install all required firefighting chemicals and portable equipment such as houses, fire extinguishers, and related equipment.

2.10. Sewage Treatment and Disposal

- Inspect facilities for completeness and correctness of installation and make any non-operating checks to ensure their conformance to specifications.

- Operate all equipment and supply all chemicals and agents dedicated to waste treatment.

2.11. Building and Accessories

- Check installation of buildings and accessories, including all heating, ventilation and air conditioning equipment, to ensure their completeness and conformance to specifications.
- Operate heating, ventilation and air conditioning systems and make all performance tests.
- Check for correct pressurization achieved where ever provided, with reference to the start-up purging and alarm system.

2.12. Cranes and Hoists

Check all materials and equipment handling systems to assure freedom, direction of movement, and proper operation

Load test of deck cranes will be required if the deck crane is installed offshore or if it cannot be tested adequately onshore or if required by the company.

2.13. Fire and gas detection and firefighting system

After installation work of detector heads is complete, all the fire detection systems and the fire safety panels such as UV detectors, thermal detector, and smoke detector shall be tested to demonstrate that the system and its components work in accordance with the contract and the design. This shall include annunciation at fire & safety panel, shutdown of the facilities, starting of the fire suppression system etc. procedures for testing the clean agent system shall be produced and carried out after approval of company.

The dry chemical system shall be checked for proper Nitrogen cylinder, quality & quantity of powder, and actuation system. Each hose station shall be tried for its intended application. A separate Nitrogen cylinder shall be used for the trial run. All the foam and fire hose stations, monitors shall be tried.

All the portable fire extinguishers & other safety equipment shall be installed at company's approved locations. Deluge valve testing shall be carried out

2.14. Shutdown system

The ESD system shall be checked for closure of all valves, shutdown of generator & other rotating equipment, etc. the ESD and FSD systems shall be checked by manual pull switches and by removal of fusible plug from fusible plug loop.

2.15. Control panels

The control panel and shutdown panels, annunciators shall be checked for all process, fire, gas and ESD/FSD signals. The panels shall be checked for visual as well as audible alarms.

2.16. General

All utilities, namely running of utility pumps, firewater pumps, air compressor, air conditioning, pressurization system, crane and essential lighting system shall be operational before fuel gas is fed to the platform.