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SUBMARINE PIPELINES AND  
RISERS (RIGID PIPELINES)

PIPELINE REPLACEMENT  
PROJECT-X (PRP-X)

Vol.

II

Sec.

4

Rev

0

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## ANNEXURE TO SECTION-4A

### SUBMARINE PIPELINES AND RISERS (RIGID PIPELINES)

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**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 Mumbai High North Field**

**A.1.1 Submarine Pipeline (Mumbai High North)**

	Parameters	During Installation	During Operation
a)	Pipeline Condition	Empty	Full of product
b)	Significant Wave Height	6.30 m	9.80 m
c)	Significant Wave Period	10.0 Sec.	12.0 Sec.
d)	Wave direction	Perpendicular to Pipeline	Perpendicular to Pipeline
e)	Current Velocity at Mud line (Tidal + Wind drift)	0.40 m/sec	0.62 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	2.6 m	3.8 m
j)	Storm Surge	0.3 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 <sup>3</sup> )	1030	1030

## A.1.2 Riser (Mumbai High North)

<b>A.</b>	<b>Environmental Parameters:</b>		
		<b>During Installation</b>	<b>During Operation</b>
a)	Max. wave height	11.58 m	18.0 m
b)	Max. wave period	11.0 sec	14.4 sec.
c)	Astronomical tide	2.6 m	3.8 m
d)	Storm tide/total tide	0.3 m/2.9 m	1.3 m/5.1 m
e)	Current velocity		
	i) Bottom (mud line)	0.4 m/sec	0.62 m/sec
	ii) 1/4 depth	0.7 m/sec	1.1 m/sec
	iii) 1/2 depth	0.85 m/sec	1.3 m/sec
	iv) 3/4 depth	1.0 m/sec	1.5 m/sec
	v) Surface	1.2 m/sec	1.8 m/sec
<b>B.</b>	The risers shall be designed for operational condition considering the following marine growth:		
-	from mud line to 30m 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		
<b>C.</b>	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.		
<b>D.</b>	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.		
<b>E.</b>	Internal corrosion allowance in wall thickness for steel pipeline and risers shall be as per Table 4.2A enclosed.		
<b>F.</b>	<b>Other Parameters</b>		
	Force Coefficients	During Installation	During Operation
	Drag Coefficient, CD	0.6	0.6
	Inertia Coefficient, CM	2.0	2.0
<b>G.</b>	<b>Sea Water Temperature</b>		
	Minimum	22.8 °C	
	Maximum	30.0 °C	
<b>H.</b>	<b>Air Temperature</b>		
	Minimum	16 °C	
	Maximum	40 °C	



## A.2 Mumbai High South Field

### A.2.1 Submarine Pipeline (Mumbai High South)

	Parameters	During Installation	During Operation
a)	Pipeline Condition	Empty	Full of product
b)	Significant Wave Height	6.40 m	10.20 m
c)	Significant Wave Period	11.0 Sec.	14.4 Sec.
d)	Wave direction	Perpendicular to Pipeline	Perpendicular to Pipeline
e)	Current Velocity at Mud line (Tidal + Wind drift)	0.40 m/sec	0.51 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	2.6 m	3.7 m
j)	Storm Surge	0.3 m	1.2 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 <sup>3</sup> )	1030	1030

## A.2.2 Riser (Mumbai High South)

A.	Environmental Parameters:		
		During Installation	During Operation
a)	Max. wave height	11.58 m	18.3 m
b)	Max. wave period	11.0 sec	14.4 sec.
c)	Astronomical tide	2.6 m	3.7 m
d)	Storm tide/total tide	0.3 m/2.9 m	1.2 m/4.9 m
e)	Current velocity		
	i) Bottom (mud line)	0.4 m/sec	0.51 m/sec
	ii) 1/4 depth	0.7 m/sec	1.0 m/sec
	iii) 1/2 depth	0.85 m/sec	1.2 m/sec
	iv) 3/4 depth	1.0 m/sec	1.4 m/sec
	v) Surface	1.2 m/sec	1.65 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.3 Bassein and Panna Fields

#### A.3.1 Submarine Pipeline (Bassein and Panna)

	Parameters	During Installation	During Operation
a)	Pipeline Condition	Empty	Full of product
b)	Significant Wave Height	5.60 m	8.70 m
c)	Significant Wave Period	10.0 Sec.	13.3 Sec.
d)	Wave direction	Perpendicular to Pipeline	Perpendicular to Pipeline
e)	Current Velocity at Mud line (Tidal + Wind drift)	0.52 m/sec	0.67 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
i)	Astronomical Tide	3.1 m	4.4 m
j)	Storm Surge	0.61 m	1.2 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 <sup>3</sup> )	1030	1030

### A.3.2 Riser (Bassein and Panna)

A.	Environmental Parameters:		
		During Installation	During Operation
a)	Max. wave height	10.4 m	18.0 m
b)	Max. wave period	11.9 sec	14.4 sec.
c)	Astronomical tide	3.1 m	4.4 m
d)	Storm tide/total tide	0.6 m/3.7 m	1.2 m/5.6 m
e)	Current velocity		
	i) Bottom (mud line)	0.52 m/sec	0.67 m/sec
	ii) 1/4 depth	0.753 m/sec	1.05 m/sec
	iii) 1/2 depth	0.832 m/sec	1.26 m/sec
	iv) 3/4 depth	0.881 m/sec	1.48 m/sec
	v) Surface	0.918 m/sec	1.73 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.4 Heera and Ratna Fields

##### A.4.1 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 <sup>3</sup> )	1030	1030



#### A.4.2 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.5 Daman Field

### A.5.1 Submarine Pipeline (Daman)

		During Installation	During Operation
a)	Pipeline Condition	Empty	Full of product
b)	Significant Wave Height	5.243 m	9.418 m
c)	Significant Wave Period	9.2 sec	13 sec
d)	Wave direction	Perpendicular to Pipeline	Perpendicular to Pipeline
e)	Current Velocity at Mud line (Tidal + Wind drift)	0.579 m/sec	0.762 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 maximum.
	*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	4.267 m	4.267 m
j)	Storm Surge	0.884 m	1.494 m
k)	Water depth (Chart datum)		
	i) For stress calculation & stability	Min. along route	Min. along route + storm surge
	ii) 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 <sup>3</sup> )	1030	1030

## A.5.2 Riser (Daman)

A.	Environmental Parameters:		
		During Installation	During Operation
a)	Max. wave height	9.754 m	17.496 m
b)	Max. wave period	10.2 sec	14.4 sec
c)	Astronomical tide	4.267 m	4.267 m
d)	Storm tide/total tide	0.884 m/5.151 m	1.494 m/5.761 m
e)	Current velocity		
	i) Bottom (mud line)	0.579 m/sec	0.762 m/sec
	ii) 3/4 depth	0.914 m/sec	1.173 m/sec
	iii) 1/2 depth	1.067 m/sec	1.402 m/sec
	iv) 1/4 depth	1.250 m/sec	1.631 m/sec
	v) Surface	1.402 m/sec	1.859 m/sec
B.	Risers shall be designed for operational condition considering the following marine growth:		
-	from mud line to 30m below chart datum	50 mm (on radius)	
-	from 30 m below chart datum to EL. (-) 2.0 M CD	100 mm (on radius)	
-	from - 2 m below chart datum 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	



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## **TABLE 4.2A**

### **SUBMARINE PIPELINE DESIGNATION TABLE**

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### SEASON-1

#### 1A) NEW PIPELINES

Sl. No.	Segment No.	1	2	3
1	Originating Platform	MNP	B-12-17	N-14
2	Terminating Platform	WIN	B-12-11	NHA
3	New/Replacement Pipeline	New	New	New
4	Approximate Pipeline Length (km)	7.1	19.8	2.9
5	Pipeline OD (mm)	168.3	406.4	168.3
6	Pipeline OD (inch)	6 5⁄8	16.0	6 5⁄8
7	Riser OD (mm)	182.9	422.2	182.9
8	Material Specification			
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. NACE	C.S. NACE	C.S. NACE
b	Pipeline/Riser Grade	API 5L X-60 PSL2	API 5L X-60 PSL2	API 5L X-60 PSL2
9	Wall thickness (mm), including corrosion allowance			
a	Pipeline	11.0	19.1	11.0
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	18.3	27.0	18.3
10	Corrosion Allowance (mm)			
a	Pipeline /Riser /Zone-2 pipe (Internal)	6	6	6
b	Riser splash zone (external)	12	12	12
11	Service	WF (Free Gas)	WF	GL
12	Design Pressure (kg/cm²)	Refer Process Design Criteria		
13	Design Temperature (°C)	Refer Process Design Criteria		
14	Offshore hydro test pressure (kg/cm²)	1.25 times the Design Pressure		
15	Design Life	25 Years		
16	External Anti-Corrosion Coating			
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m³		
b	Thickness (mm)	2.5	3.5	2.5
17	Internal Anti-Corrosion Coating	No	No	No
18	Concrete Coating			
a	Material	As per Specification No. 2013 Rev. 2		
b	Density	3044 kg/ m3		
c	Minimum Thickness (mm) - Pipeline	40	70	60
d	Thickness (mm) - Riser	30	30	30

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Sl. No.	Segment No.	1	2	3
<b>19</b>	<b>Number of risers to be installed</b>			
a	Originating platform	1	1	1
b	Terminating Platform	1	1	1
<b>20</b>	Originating platform riser location (platform face)	North	East	West
	Whether new Riser protector/Guard is to be installed	Yes	No	Yes
<b>21</b>	Terminating Platform riser location (platform face)	South	West	South-East
	Whether new Riser protector/Guard is to be installed	Yes	No	No
<b>22</b>	No. of existing risers/I/J tubes to be removed along with clamps	-	-	-
<b>23</b>	P/L crossings (Nos.)	24	3	6
<b>24</b>	Pipeline Free Span (Nos.)	7	20	3
<b>25</b>	Burial of pipelines	Not Required	<b>Flush Burial</b>	Not Required
<b>26</b>	<b>Approximate water depth w.r.t Chart Datum C.D (m)</b>			
a	Originating Platform	70-75	28-33	53-58
b	Terminating Platform	63-68	24-29	52-57
<b>27</b>	<b>Platform Co-ordinates</b>			
a	Originating Platform	<b>MNP</b>	<b>B-12-17</b>	<b>N14</b>
	i. Type of Centre	COJ	WAC	WAC
	ii. Easting	741 624.60	787 533.437	747 880.642
	iii. Northing	2 160 873.89	2 229 624.995	2 172 384.572
	iv. Orientation	28.5° (TN)	0.47° (TN)	0° (TN)
b	Terminating Platform	<b>WIN</b>	<b>B-12-11</b>	<b>NHA</b>
	i. Type of Centre	COJ	WAC	
	ii. Easting	743 914.97	804 568.630	746 483.614
	iii. Northing	2 167 168.48	2 238 468.359	2 174 023.47
	iv. Orientation	36.30° (TN)	0.12° (TN)	125° (TN)
<b>28</b>	Whether SPRU/Subsea Flange is NACE Compliant	Yes	Yes	Yes
<b>29</b>	SPRU/Flange ANSI Rating	#900	#900	#900
<b>30</b>	Field	MHN	Daman	MHN

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work



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Sl. No.	Segment No.	4
1	Originating Platform	WO-16
2	Terminating Platform	SS Tie-in <b>30" ICP-HRG</b> Line
3	New/Replacement Pipeline	<b>New</b> (Thermally Insulated, Riser bottom to Subsea Tie in)
4	Approximate Pipeline Length (km)	5.4
5	Pipeline OD (mm)	219.1
6	Pipeline OD (inch)	8 5/8
7	Riser OD (mm)	231.7
8	<b>Material Specification</b>	
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. NACE
b	Pipeline/Riser Grade	API 5L X-60 PSL2
9	<b>Wall thickness (mm), including corrosion allowance</b>	
a	Pipeline	14.3
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	20.6
10	<b>Corrosion Allowance (mm)</b>	
a	Pipeline /Riser /Zone-2 pipe (Internal)	6
b	Riser splash zone (external)	12
11	Service	Oil
12	Design Pressure (kg/cm <sup>2</sup> )	Refer Process Design Criteria
13	Design Temperature (°C)	Refer Process Design Criteria
14	Offshore hydro test pressure (kg/cm <sup>2</sup> )	1.25 times the Design Pressure
15	Design Life	25 Years
16	<b>External Anti-Corrosion Coating</b>	
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m <sup>3</sup>
b	Thickness (mm)	3.0
17	<b>Internal Anti-Corrosion Coating</b>	
18	<b>Concrete Coating</b>	
a	Material	As per Specification No. 2013 Rev. 2
b	Density	3044 kg/ m3
c	Minimum Thickness (mm) - Pipeline	40
d	Thickness (mm) - Riser	30

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Sl. No.	Segment No.	4
19	Number of risers to be installed	
a	Originating platform	-
b	Terminating Platform	-
20	Originating platform riser location (platform face)	East
	Whether new Riser protector/Guard is to be installed	-
21	Terminating Platform riser location (platform face)	NA
	Whether new Riser protector/Guard is to be installed	-
22	No. of existing risers/I/J tubes to be removed along with clamps	-
23	P/L crossings (Nos.)	4
24	Pipeline Free Span (Nos.)	5
25	Burial of pipelines	Not Required
26	Approximate water depth w.r.t Chart Datum C.D (m)	
a	Originating Platform	73-78
b	Terminating Platform	-
27	Platform Co-ordinates	
a	Originating Platform	WO-16
	i. Type of Centre	WAC
	ii. Easting	776 282.333
	iii. Northing	2 099 750.070
	iv. Orientation	0° (TN)
b	Terminating Platform	NA
	i. Type of Centre	-
	ii. Easting	-
	iii. Northing	-
	iv. Orientation	-
28	Whether SPRU/Subsea Flange is NACE Compliant	YES
29	SPRU/Flange ANSI Rating	#1500
30	Field	MHS

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work



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## 1B) FULL REPLACEMENT PIPELINES

Sl. No.	Segment No.	5	6	7	8
1	Originating Platform	WIN	WIN	NI	MNW
2	Terminating Platform	ND	N-3	N-10	N-9
3	New/Replacement Pipeline	Full Replacement	Full Replacement	Full Replacement	Full Replacement
4	Approximate Pipeline Length (km)	3.1	2.9	4.6	2.0
5	Pipeline OD (mm)	168.3	168.3	168.3	168.3
6	Pipeline OD (inch)	6 5⁄8	6 5⁄8	6 5⁄8	6 5⁄8
7	Riser OD (mm)	184.1	184.1	184.1	184.1
8	Material Specification				
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. Non-NACE	C.S. Non-NACE	C.S. Non-NACE	C.S. Non-NACE
b	Pipeline/Riser Grade	API 5L X-52 PSL2	API 5L X-52 PSL2	API 5L X-52 PSL2	API 5L X-52 PSL2
9	Wall thickness (mm), including corrosion allowance				
a	Pipeline	14.3	14.3	14.3	14.3
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	22.2	22.2	22.2	22.2
10	Corrosion Allowance (mm)				
a	Pipeline /Riser /Zone-2 pipe (Internal)	6	6	6	6
b	Riser splash zone (external)	12	12	12	12
11	Service	WI	WI	WI	WI
12	Design Pressure (kg/cm²)	Refer Process Design Criteria			
13	Design Temperature (°C)	Refer Process Design Criteria			
14	Offshore hydro test pressure (kg/cm²)	1.25 times the Design Pressure			
15	Design Life	25 Years			
16	External Anti-Corrosion Coating				
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m³			
b	Thickness (mm)	2.5	2.5	2.5	2.5
17	Internal Anti-Corrosion Coating	Yes, Liq. Epoxy	Yes, Liq. Epoxy	Yes, Liq. Epoxy	Yes, Liq. Epoxy
18	Concrete Coating				
a	Material	As per Specification No. 2013 Rev. 2			
b	Density	3044 kg/ m3			
c	Minimum Thickness (mm) - Pipeline	40	40	40	40
d	Thickness (mm) - Riser	30	30	30	30

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Sl. No.	Segment No.	5	6	7	8
<b>19</b>	<b>Number of risers to be installed</b>				
a	Originating platform	1	1	1	1
b	Terminating Platform	1	1	1	1
<b>20</b>	Originating platform riser location (platform face)	North	North	East	North
	Whether new Riser protector/Guard is to be installed	No	No	No	No
<b>21</b>	Terminating Platform riser location (platform face)	South	South	East	West
	Whether new Riser protector/Guard is to be installed	No	No	No	No
<b>22</b>	No. of existing risers/I/J tubes to be removed along with clamps	2	2	2	2
<b>23</b>	P/L crossings (Nos.)	6	2	24	20
<b>24</b>	Pipeline Free Span (Nos.)	3	3	4	2
<b>25</b>	Burial of pipelines	Not Required	Not Required	Not Required	Not Required
<b>26</b>	<b>Approximate water depth w.r.t Chart Datum C.D (m)</b>				
a	Originating Platform	63-68	63-68	68-73	68-73
b	Terminating Platform	59-64	60-65	64-69	68-73
<b>27</b>	<b>Platform Co-ordinates</b>				
a	Originating Platform	<b>WIN</b>	<b>WIN</b>	<b>NI</b>	<b>MNW</b>
	i. Type of Centre	COJ	COJ	COH	COJ
	ii. Easting	743 914.97	743 914.97	746 736.80	741 765.00
	iii. Northing	2 167 168.48	2 167 168.48	2 162 429.50	2 160 821.00
	iv. Orientation	36.30° (TN)	36.30° (TN)	10.0° (TN)	27.85° (TN)
b	Terminating Platform	<b>ND</b>	<b>N-3</b>	<b>N-10</b>	<b>N-9</b>
	i. Type of Centre	COP	COJ	COJ	COJ
	ii. Easting	744 870.00	742 885.50	747 200.00	743 526.71
	iii. Northing	2 169 885.00	2 169 557.20	2 163 293.40	2 161 329.21
	iv. Orientation	17° (TN)	9.98° (TN)	0° (TN)	0° (TN)
<b>28</b>	Whether SPRU/Subsea Flange is NACE Compliant	No	No	No	No
<b>29</b>	SPRU/Flange ANSI Rating	#1500	#1500	#1500	#1500
<b>30</b>	Field	MHN	MHN	MHN	MHN

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work

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Sl. No.	Segment No.	9	10	11	12
1	Originating Platform	IM	SB	SP	IG
2	Terminating Platform	S-1-6	SA	BHS	BHS
3	New/Replacement Pipeline	Full Replacement	Full Replacement	Full Replacement	Full Replacement
4	Approximate Pipeline Length (km)	3.8	5.8	4.1	2.3
5	Pipeline OD (mm)	168.3	273.1	273.1	323.9
6	Pipeline OD (inch)	6 5⁄8	10 3⁄4	10 3⁄4	12 3⁄4
7	Riser OD (mm)	184.1	284.3	284.3	336.5
8	Material Specification				
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. Non-NACE	C.S. NACE	C.S. NACE	C.S. NACE
b	Pipeline/Riser Grade	API 5L X-52 PSL2	API 5L X-60 PSL2	API 5L X-60 PSL2	API 5L X-60 PSL2
9	Wall thickness (mm), including corrosion allowance				
a	Pipeline	14.3	12.7	12.7	14.3
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	22.2	18.3	18.3	20.6
10	Corrosion Allowance (mm)				
a	Pipeline /Riser /Zone-2 pipe (Internal)	6	6	6	6
b	Riser splash zone (external)	12	12	12	12
11	Service	WI	WF	WF	WF
12	Design Pressure (kg/cm²)	Refer Process Design Criteria			
13	Design Temperature (°C)	Refer Process Design Criteria			
14	Offshore hydro test pressure (kg/cm²)	1.25 times the Design Pressure			
15	Design Life	25 Years			
16	External Anti-Corrosion Coating				
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m³			
b	Thickness (mm)	2.5	3.0	3.0	3.0
17	Internal Anti-Corrosion Coating	Yes, Liq. Epoxy	Yes, FBE	Yes, FBE	Yes, FBE
18	Concrete Coating				
a	Material	As per Specification No. 2013 Rev. 2			
b	Density	3044 kg/ m3			
c	Minimum Thickness (mm) - Pipeline	40	40	40	40
d	Thickness (mm) - Riser	30	30	30	30



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Sl. No.	Segment No.	9	10	11	12
<b>19</b>	<b>Number of risers to be installed</b>				
a	Originating platform	1	1	1	1
b	Terminating Platform	1	1	1	1
<b>20</b>	Originating platform riser location (platform face)	East	East	East	South
	Whether new Riser protector/Guard is to be installed	No	No	No	No
<b>21</b>	Terminating Platform riser location (platform face)	East	West	South	North
	Whether new Riser protector/Guard is to be installed	No	No	No	No
<b>22</b>	No. of existing risers/I/J tubes to be removed along with clamps	2	2	2	2
<b>23</b>	P/L crossings (Nos.)	8	19	9	15
<b>24</b>	Pipeline Free Span (Nos.)	4	6	4	2
<b>25</b>	Burial of pipelines	Not Required	Not Required	Not Required	Not Required
<b>26</b>	<b>Approximate water depth w.r.t Chart Datum C.D (m)</b>				
a	Originating Platform	66-71	79-84	76-81	77-82
b	Terminating Platform	67-72	75-80	75-80	75-80
<b>27</b>	<b>Platform Co-ordinates</b>				
a	Originating Platform	<b>IM</b>	<b>SB</b>	<b>SP</b>	<b>IG</b>
	i. Type of Centre	WAC	WAC	WAC	COJ
	ii. Easting	760 001.20	743 275.15	744 317.508	747 873.00
	iii. Northing	2 130 155.80	2 146 590.932	2 142 834.428	2 145 728.00
	iv. Orientation	359° (TN)	7° (TN)	6.75° (TN)	0° (TN)
b	Terminating Platform	<b>S-1-6</b>	<b>SA</b>	<b>BHS</b>	<b>BHS</b>
	i. Type of Centre	WAC	COJ	COJ	COJ
	ii. Easting	761 090.40	748 033.58	747 958.00	747 958.00
	iii. Northing	2 132 516.90	2 143 739.38	2 143 696.00	2 143 696.00
	iv. Orientation	359.82° (TN)	10.55° (TN)	2.75° (TN)	2.75° (TN)
<b>28</b>	Whether SPRU/Subsea Flange is NACE Compliant	No	Yes	Yes	Yes
<b>29</b>	SPRU/Flange ANSI Rating	#1500	#900	#900	#900
<b>30</b>	Field	MHS	MHS	MHS	MHS

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work

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Sl. No.	Segment No.	13	14	15	16
1	Originating Platform	N-12	SJ	NQP	SHG
2	Terminating Platform	NQP	SA	LB	RS7
3	New/Replacement Pipeline	Full Replacement	Full Replacement	Full Replacement	Full Replacement
4	Approximate Pipeline Length (km)	6.2	9.0	3.7	4.9
5	Pipeline OD (mm)	323.9	323.9	168.3	168.3
6	Pipeline OD (inch)	12 ¾	12 ¾	6 ⅝	6 ⅝
7	Riser OD (mm)	336.5	336.5	182.9	182.9
8	Material Specification				
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. NACE	C.S. NACE	C.S. NACE	C.S. NACE
b	Pipeline/Riser Grade	API 5L X-60 PSL2	API 5L X-60 PSL2	API 5L X-60 PSL2	API 5L X-60 PSL2
9	Wall thickness (mm), including Corrosion Allowance				
a	Pipeline	14.3	14.3	11.0	11.0
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	20.6	20.6	18.3	18.3
10	Corrosion Allowance (mm)				
a	Pipeline /Riser /Zone-2 pipe (Internal)	6	6	6	6
b	Riser splash zone (external)	12	12	12	12
11	Service	WF	WF	GL	GL
12	Design Pressure (kg/cm <sup>2</sup> )	Refer Process Design Criteria			
13	Design Temperature (°C)	Refer Process Design Criteria			
14	Offshore hydro test pressure (kg/cm <sup>2</sup> )	1.25 times the Design Pressure			
15	Design Life	25 Years			
16	External Anti-Corrosion Coating				
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m <sup>3</sup>			
b	Thickness (mm)	3.0	3.0	2.5	2.5
17	Internal Anti-Corrosion Coating	Yes, FBE	Yes, FBE	No	No
18	Concrete Coating				
a	Material	As per Specification No. 2013 Rev. 2			
b	Density	3044 kg/ m3			
c	Minimum Thickness (mm) - Pipeline	40	40	40	40
d	Thickness (mm) - Riser	30	30	30	30



Sl. No.	Segment No.	13	14	15	16
<b>19</b>	<b>Number of risers to be installed</b>				
a	Originating platform	1	1	1	1
b	Terminating Platform	1	1	1	1
<b>20</b>	Originating platform riser location (platform face)	West	East	South	North
	Whether new Riser protector/Guard is to be installed	Yes	No	No	No
<b>21</b>	Terminating Platform riser location (platform face)	South	West	West	West
	Whether new Riser protector/Guard is to be installed	No	No	Yes	No
<b>22</b>	No. of existing risers/I/J tubes to be removed along with clamps	2	2	2	2
<b>23</b>	P/L crossings (Nos.)	30	18	22	8
<b>24</b>	Pipeline Free Span (Nos.)	6	9	4	5
<b>25</b>	Burial of pipelines	Not Required	Not Required	Not Required	Not Required
<b>26</b>	<b>Approximate water depth w.r.t Chart Datum C.D (m)</b>				
a	Originating Platform	68-73	76-81	61-66	69-74
b	Terminating Platform	61-66	76-81	63-68	69-74
<b>27</b>	<b>Platform Co-ordinates</b>				
a	Originating Platform	<b>N-12</b>	<b>SJ</b>	<b>NQP</b>	<b>SHG</b>
	i. Type of Centre	COJ	WAC	COJ	COJ
	ii. Easting	748 995.84	742 543.115	747 805.20	755 256.50
	iii. Northing	2 161 124.38	2 150 517.085	2 165 788.30	2 133 264.60
	iv. Orientation	359.75° (TN)	0° (TN)	359.41° (TN)	27.87° (TN)
b	Terminating Platform	<b>NQP</b>	<b>SA</b>	<b>LB</b>	<b>RS7</b>
	i. Type of Centre	COJ	COJ	WAC	WAC
	ii. Easting	747 805.20	748 033.58	750 592.81	758 529.484
	iii. Northing	2 165 788.30	2 143 739.38	2 164 191.93	2 136629.904
	iv. Orientation	359.41° (TN)	10.55° (TN)	0.43° (TN)	0° (TN)
<b>28</b>	Whether SPRU/Subsea Flange is NACE Compliant	Yes	Yes	Yes	Yes
<b>29</b>	SPRU/Flange ANSI Rating	#900	#900	#900	#900
<b>30</b>	Field	MHN	MHS	MHN	MHS

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work



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Sl. No.	Segment No.	17	18	19
1	Originating Platform	IL	EE	HE
2	Terminating Platform	SHP	SHP	HRG
3	New/Replacement Pipeline	Full Replacement	Full Replacement	Full Replacement
4	Approximate Pipeline Length (km)	9.6	2.5	7.2
5	Pipeline OD (mm)	355.6	273.1	355.6
6	Pipeline OD (inch)	14.0	10 ¾	14.0
7	Riser OD (mm)	371.4	288.9	371.4
8	Material Specification			
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. NACE	C.S. NACE	C.S. NACE
b	Pipeline/Riser Grade	API 5L X-60 PSL2	API 5L X-60 PSL2	API 5L X-60 PSL2
9	Wall thickness (mm), including Corrosion Allowance			
a	Pipeline	17.5	14.3	15.9
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	25.4	22.2	20.6
10	Corrosion Allowance (mm)			
a	Pipeline /Riser /Zone-2 pipe (Internal)	6	6	6
b	Riser splash zone (external)	12	12	12
11	Service	WF	WF	WF
12	Design Pressure (kg/cm²)	Refer Process Design Criteria		
13	Design Temperature (°C)	Refer Process Design Criteria		
14	Offshore hydro test pressure (kg/cm²)	1.25 times the Design Pressure		
15	Design Life	25 Years		
16	External Anti-Corrosion Coating			
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m³		
b	Thickness (mm)	3.5	3.0	3.5
17	Internal Anti-Corrosion Coating	Yes, FBE	Yes, FBE	Yes, FBE
18	Concrete Coating			
a	Material	As per Specification No. 2013 Rev. 2		
b	Density	3044 kg/ m3		
c	Minimum Thickness (mm) - Pipeline	40	40	40
d	Thickness (mm) - Riser	30	30	30

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Sl. No.	Segment No.	17	18	19
<b>19</b>	<b>Number of risers to be installed</b>			
a	Originating platform	1	1	1
b	Terminating Platform	1	1	1
<b>20</b>	Originating platform riser location (platform face)	East	West	West
	Whether new Riser protector/Guard is to be installed	No	Yes	Yes
<b>21</b>	Terminating Platform riser location (platform face)	South	South	West
	Whether new Riser protector/Guard is to be installed	No	No	No
<b>22</b>	No. of existing risers/I/J tubes to be removed along with clamps	2	2	2
<b>23</b>	P/L crossings (Nos.)	17	13	25
<b>24</b>	Pipeline Free Span (Nos.)	9	2	7
<b>25</b>	Burial of pipelines	Not Required	Not Required	Not Required
<b>26</b>	<b>Approximate water depth w.r.t Chart Datum C.D (m)</b>			
a	Originating Platform	75-80	70-75	49-54
b	Terminating Platform	68-73	68-73	51-56
<b>27</b>	<b>Platform Co-ordinates</b>			
a	Originating Platform	<b>IL</b>	<b>EE</b>	<b>HE</b>
	i. Type of Centre		COJ	COJ
	ii. Easting	757 554.9	757 253.0	842 965.31
	iii. Northing	2 127 625.	2132747.0	2 055 134.90
	iv. Orientation	0° (TN)	0° (TN)	0° (TN)
b	Terminating Platform	<b>SHP</b>	<b>SHP</b>	<b>HRG</b>
	i. Type of Centre	COJ	COJ	COJ
	ii. Easting	755 156.50	755 156.50	841 999.03
	iii. Northing	2 133 180.8	2 133 180.8	2 057 528.27
	iv. Orientation	17.28° (TN)	17.28° (TN)	353.5° (TN)
<b>28</b>	Whether SPRU/Subsea Flange is NACE Compliant	Yes	Yes	Yes
<b>29</b>	SPRU/Flange ANSI Rating	#900	#900	#900
<b>30</b>	Field	MHS	MHS	NH

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work





### 1C) PART REPLACEMENT PIPELINES

Sl. No.	Segment No.	20
1	Originating Platform	B-172-A
2	Terminating Platform	B-178-A
3	New/Replacement Pipeline	Part Replacement
4	Approximate Pipeline Length (km)	1.0 (From 0.0 KP to 1.0 KP from B-172A)
5	Pipeline OD (mm)	323.9
6	Pipeline OD (inch)	12 ¾
7	Riser OD (mm)	339.7
8	<b>Material Specification</b>	
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. NACE
b	Pipeline/Riser Grade	API 5L X-60 PSL2
9	<b>Wall thickness (mm), including corrosion allowance</b>	
a	Pipeline	14.3
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	22.2
10	<b>Corrosion Allowance (mm)</b>	
a	Pipeline /Riser /Zone-2 pipe (Internal)	6
b	Riser splash zone (external)	12
11	Service	WF
12	Design Pressure (kg/cm <sup>2</sup> )	Refer Process Design Criteria
13	Design Temperature (°C)	Refer Process Design Criteria
14	Offshore hydro test pressure (kg/cm <sup>2</sup> )	1.25 times the Design Pressure
15	Design Life	25 Years
16	<b>External Anti-Corrosion Coating</b>	
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m <sup>3</sup>
b	Thickness (mm)	3.0
17	<b>Internal Anti-Corrosion Coating</b>	
18	<b>Concrete Coating</b>	
a	Material	As per Specification No. 2013 Rev. 2
b	Density	3044 kg/ m3
c	Minimum Thickness (mm) - Pipeline	40
d	Thickness (mm) - Riser	30



Sl. No.	Segment No.	20
19	Number of risers to be installed	
a	Originating platform	-
b	Terminating Platform	-
20	Originating platform riser location (platform face)	-
	Whether new Riser protector/Guard is to be installed	-
21	Terminating Platform riser location (platform face)	-
	Whether new Riser protector/Guard is to be installed	-
22	No. of existing risers/I/J tubes to be removed along with clamps	-
23	P/L crossings (Nos.)	1
24	Pipeline Free Span (Nos.)	1
25	Burial of pipelines	Not Required
26	Approximate water depth w.r.t Chart Datum C.D (m)	
a	Originating Platform	60-65
b	Terminating Platform	-
27	Platform Co-ordinates	
a	Originating Platform	<b>B-172-A</b>
	i. Type of Centre	WAC
	ii. Easting	836 809.22
	iii. Northing	2 104 809.81
	iv. Orientation	150° (TN)
b	Terminating Platform	-
	i. Type of Centre	-
	ii. Easting	-
	iii. Northing	-
	iv. Orientation	-
28	Whether SPRU/Subsea Flange is NACE Compliant	Yes
29	SPRU/Flange ANSI Rating	#900
30	Field	B&S

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work




## 1D) RISER ONLY REPLACEMENT SEGMENTS

Sl. No.	Segment No.	21	22
1	Originating Platform	N-8	PPA
2	Terminating Platform	NQO	PB
3	New/Replacement Pipeline	Riser Replacement	Riser Replacement
4	Approximate Pipeline Length (km)	(Golden Joint to riser bottom at N-8 end)	(Golden Joint to riser bottom at PB end)
5	Pipeline OD (mm)	323.9	114.3
6	Pipeline OD (inch)	12 ¾	4 ½
7	Riser OD (mm)	336.5	126.3
8	Material Specification		
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. NACE	C.S. NACE
b	Pipeline/Riser Grade	API 5L X-60 PSL2	API 5L X-60 PSL2
9	Wall thickness (mm), including corrosion allowance		
a	Pipeline	14.3	11.1
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	20.6	17.1
10	Corrosion Allowance (mm)		
a	Pipeline /Riser /Zone-2 pipe (Internal)	6	6
b	Riser splash zone (external)	12	12
11	Service	WF	GL
12	Design Pressure (kg/cm²)	Refer Process Design Criteria	
13	Design Temperature (°C)	Refer Process Design Criteria	
14	Offshore hydro test pressure (kg/cm²)	1.25 times the Design Pressure	
15	Design Life	25 Years	
16	External Anti-Corrosion Coating		
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m³	
b	Thickness (mm)	3.0	2.5
17	Internal Anti-Corrosion Coating	Yes, FBE	No
18	Concrete Coating		
a	Material	As per Specification No. 2013 Rev. 2	
b	Density	3044 kg/ m3	
c	Minimum Thickness (mm) - Pipeline	-	-
d	Thickness (mm) - Riser	30	30

Sl. No.	Segment No.	21	22
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<b>19</b>	<b>Number of risers to be installed</b>		
a	Originating platform	1	-
b	Terminating Platform	-	1
<b>20</b>	Originating platform riser location (platform face)	East	-
	Whether new Riser protector/Guard is to be installed	No	-
<b>21</b>	Terminating Platform riser location (platform face)	-	East
	Whether new Riser protector/Guard is to be installed	-	No
<b>22</b>	No. of existing risers/I/J tubes to be removed along with clamps	1	1
<b>23</b>	P/L crossings (Nos.)	-	-
<b>24</b>	Pipeline Free Span (Nos.)	-	-
<b>25</b>	Burial of pipelines	-	-
<b>26</b>	<b>Approximate water depth w.r.t Chart Datum C.D (m)</b>		
a	Originating Platform	54-59	-
b	Terminating Platform	-	44-49
<b>27</b>	<b>Platform Co-ordinates</b>		
a	Originating Platform	<b>N-8</b>	-
	i. Type of Centre	WAC	-
	ii. Easting	747 590.105	-
	iii. Northing	2 171 252.853	-
	iv. Orientation	8.3° (TN)	-
b	Terminating Platform	-	<b>PB</b>
	i. Type of Centre	-	COJ
	ii. Easting	-	816 105.00
	iii. Northing	-	2 139 160.00
	iv. Orientation	-	20° (TN)
<b>28</b>	Whether SPRU/Subsea Flange is NACE Compliant	Yes	Yes
<b>29</b>	SPRU/Flange ANSI Rating	#900	#900
<b>30</b>	Field	MHN	B&S (Panna)

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work

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## 1E) SUBSEA TIE-IN PIPELINES

Sl. No.	Segment No.	23
1	Originating Platform	Existing Tie-in Spool (on 10" WI BCPA2-VSEA Line) at VSEA end
2	Terminating Platform	Tie in on 6" WI SS Lateral to VSEC **
3	New/Replacement Pipeline/Riser	SS Tie in with Piggable Flow Tee
4	Approximate Pipeline Length (km)	0.100
5	Pipeline OD (mm)	168.3
6	Pipeline OD (inch)	6 5/8
7	Riser OD (mm)	-
8	<b>Material Specification</b>	
a	Pipeline/Riser/Riser Bend /Zone-2 pipe/ Riser Splash Zone	C.S. Non-NACE
b	Pipeline/Riser Grade	API 5L X-52 PSL2
9	<b>Wall thickness (mm), including corrosion allowance</b>	
a	Pipeline	14.3
b	Riser (including Riser bend, Splash Zone and Zone-2 pipe)	22.2
10	<b>Corrosion Allowance (mm)</b>	
a	Pipeline /Riser /Zone-2 pipe (Internal)	6
b	Riser splash zone (external)	12
11	Service	WI
12	Design Pressure (kg/cm <sup>2</sup> )	Refer Process Design Criteria
13	Design Temperature (°C)	Refer Process Design Criteria
14	Offshore hydro test pressure (kg/cm <sup>2</sup> )	1.25 times the Design Pressure
15	Design Life	25 Years
16	<b>External Anti-Corrosion Coating</b>	
a	Material/ Density	As per Specification No. 2012 A/ 900 kg/m <sup>3</sup>
b	Thickness (mm)	2.5
17	<b>Internal Anti-Corrosion Coating</b>	Yes, Liq. Epoxy
18	<b>Concrete Coating</b>	
a	Material	As per Specification No. 2013 Rev. 2
b	Density	3044 kg/ m3
c	Minimum Thickness (mm) - Pipeline	40
d	Thickness (mm) - Riser	-

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Sl. No.	Segment No.	23
<b>19</b>	<b>Number of risers to be installed</b>	
a	Originating platform	-
b	Terminating Platform	-
<b>20</b>	Originating platform riser location (platform face)	-
	Whether new Riser protector/Guard is to be installed	-
<b>21</b>	Terminating Platform riser location (platform face)	-
	Whether new Riser protector/Guard is to be installed	-
<b>22</b>	No. of existing risers/I/J tubes to be removed along with clamps	01 (old 10"-BCPA-2 to VSEA WI line riser at VSEA)
<b>23</b>	P/L crossings (Nos.)	-
<b>24</b>	Pipeline Free Span (Nos.)	-
<b>25</b>	Burial of pipelines	Not Required
<b>26</b>	<b>Approximate water depth w.r.t Chart Datum C.D (m)</b>	
a	Originating Platform	43-48
b	Terminating Platform	-
<b>27</b>	<b>Platform Co-ordinates</b>	
a	Originating Platform	-
	i. Type of Centre	-
	ii. Easting	*
	iii. Northing	*
	iv. Orientation	-
b	Terminating Platform	-
	i. Type of Centre	-
	ii. Easting	*
	iii. Northing	*
	iv. Orientation	-
<b>28</b>	Whether SPRU/Subsea Flange is NACE Compliant	No
<b>29</b>	SPRU/Flange ANSI Rating	#1500
<b>30</b>	Field	B&S

\* - To be obtained during Pre-Engineering Survey / From Structure Scope of Work

\*\* - Refer attached schematic diagram

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### Special Note:


- Pipeline Route corridor survey (as a part of pre-engineering survey) for all 21 pipeline segments shall be carried out by ONGC and survey report of these pipeline segments shall be provided to successful bidder.

### **Notes to Tables 4.2A**

1. The Pipeline lengths indicated in table are indicative only. These shall be firmed up during detailed engineering to be carried out by the EPCI CONTRACTOR based on pipeline route survey and geo-technical survey carried out by EPCI CONTRACTOR. EPCI CONTRACTOR's scope for survey for all pipeline route corridors includes all route surveys (pre-engineering survey except pre-engineering survey for pipeline segments as indicated in Special Note, pre-construction and post-installation survey including CP Survey and As-built Survey) for all pipeline route corridors. EPCI CONTRACTOR's scope also includes geo-technical survey along the pipeline route - corridor. EPCI CONTRACTOR's scope for Jacket face Survey shall include Pre-engineering, Pre-construction and Post Installation Survey. While finalizing the pipeline route alignment, EPCI CONTRACTOR shall ensure that very high levels of seabed undulations shall be avoided while keeping the pipeline alignment within the survey corridor.
2. EPCI CONTRACTOR's scope includes survey, design, engineering, procurement (except free issue material i.e. bare line pipes), transportation, fabrication, installation, free span correction, crossing installation, sub-sea tie-ins / hook-ups, pigging, hydro-testing, pre-commissioning and commissioning assistance. **Procurement of line pipes (for subsea pipeline, risers, tie-in/expansion spools and bends) shall be the responsibility of COMPANY.** However, in addition to COMPANY or COMPANY appointed inspection agency, the CONTRACTOR has to carry out the inspection of (rigid) line pipe at pipe factory/mill through third part inspection agency duly approved by the COMPANY. The same line pipe will be free issued to CONTRACTOR. Transportation of material from Ex-Factory (mill) or ONGC storage yard, as applicable to coating yard /workshop, worksite/field for fabrication/installation including handling, loading/unloading, storage etc. is included in CONTRACTOR's scope.
3. Minimum thickness of concrete weight required for line pipes are indicated in in Table 4.2A. However, CONTRACTOR shall be responsible for calculating the precise concrete thickness based on the detailed design specifications. The CONTRACTOR shall also be required to ascertain the anode requirements in accordance with the detailed design. Upon completion of the above tasks, CONTRACTOR's scope shall include external/internal coatings, fabrication of tie-in/expansion spools/LR bends & Anode installation on the line pipes.
4. Riser locations at existing platforms shall be finalized during detail engineering based on pre-engineering jacket face survey of platform. CONTRACTOR shall carry out Spider Deck survey of each platform for existing riser locations and then finalize new riser location and respective pipeline route given in the survey report by COMPANY. Pipeline end co-ordinates and departure angles shall be finalized during detailed engineering after pre-engineering.
5. Bidder shall make his all-out effort to place the riser of replacement pipeline segment on the same jacket face on which existing riser is located. In case it is not feasible to locate the replacement riser on same face due to space constraint, bidder can suggest during engineering alternate jacket face to locate risers. This shall not constitute any change in scope.
6. 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.

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7. 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) for the pipelines and risers, same shall be done without additional time and cost to the COMPANY.
8. ID of Riser, riser splash zone and zone-2 pipe is to be kept same as ID for pipeline systems. Uniform ID of pipeline system is the requirement for effective pigging. This is not applicable for riser-only replacements. Further ID of topside piping from minor barrel up to riser transition bend is to be kept as same as ID of pipeline-riser system for effective pigging.
9. Risers shall be provided with Monel sheathing in splash zone in accordance with bid specifications.
10. 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.
11. Riser protector as per the structural design criteria shall be provided in case the riser protector does not exist 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.
12. 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. Also, there is no unit adjustment price for riser and riser clamps.
13. The Existing riser removal shall be from top of transition bend and will include two pipe lengths of Zone-1 pipeline (Zone-1 length to be demolished will be finalized based on survey) to facilitate the installation of riser for proposed pipeline(s) or riser installation of any future riser. For scope of work of demolition of topside piping above transition bend, Basic bid work/Piping section is to be referred.
14. 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 by the CONTRACTOR.
15. 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.
16. Supply and application of internal sleeves at girth weld joints of free issued carbon steel water injection pipelines and risers including long radius bends for 4 1/2" and above to be installed offshore. Detailed specification and procedure for internal corrosion protection coating including the procedure for internal coating of field girth weld joint with QA / QC plans for this activity at the onshore yard as well as on the barge at offshore shall be developed by the successful bidder and shall be submitted to ONGC for review and approval.

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17. 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.

18. **Thermal insulation of 8" dia. WF (oil) (WO-16 to Subsea hook up on 30" ICP-Heera trunk line) pipeline is as follows :**

- Thermal insulation is to be designed, provided & installed on 8" dia pipeline in order to achieve minimum arrival temperature of well fluid (oil) at subsea hook up point on 30" ICP-Heera trunk line end.
- Subsea thermal insulation is to be provided on 8" dia.- WO-16 to subsea hook up well fluid (oil) pipeline, as per the requirement specified in Process Design Criteria, Section 3.2 of the Tender document. Specifications, Installation scheme including field joint, Procedures and QA/QC plan for thermal insulation shall be finalized during detail engineering based on the recommendation of the applicator, manufacturer and international practice in this regard.
- Contractor shall refer process design criteria for departure & required Arrival temperature condition of Well fluid.
- Thickness of hot insulation shall be designed by the vendor of thermal insulation and shall be vetted by detailed engineering sub-contractor of LSTK contractor.
- LSTK contractor / vendor shall provide guarantee for minimum arrival temperature of well fluid at receiving platform.
- Specification of material for subsea thermal insulation and its application procedures shall be prepared by vendor / LSTK contractor and shall be submitted to company for review.

19. **Subsea Hot Tapping:**

Segment no. 4 i.e. 8" dia.WF pipeline from WO-16 platform shall be hooked up to the Tie-in point on existing 30" ICP-Heera Trunk line by carrying out a subsea hot tapping to avoid shut down of the existing 30" dia. pipeline during the installation in such a way that the existing 30" dia. pipeline remains piggable.

- Scope of hot tapping includes but not limited to preparation of complete drawings, generation of MTO for complete job including specialities for subsea hot tapping, procurement and supply, anti-corrosion coating and concrete coating, cathodic protection, preparation and submission of subsea hot tapping procedure and safety procedures, installation of subsea hot tapping etc. complete to the satisfaction of the Company.
- Supply of hot tapping fittings and subsea hot tapping operation shall be carried out by an expert subsea hot tapping agency with proven track record.
- De-burial / Dredging (if required) of stopple/hot tapping location points of existing 30" pipeline at tie-in point with utmost safety and wall thickness measurement of existing pipeline by UT.
- Removal of concrete and anti-corrosion/coal tar coating of the pipeline at the tie-in points to find out the wall thickness by UT readings at around the 8 cardinal positions of the pipeline cross section at the tie-in points.
- Suitable location for tie-in shall be based on UT readings for pipe wall thickness and shall be identified during pre-engineering/construction survey by dive survey. Based on UT measurement, location of hook up points shall be firmed up and get it confirmed from the Asset team of Company prior to taking up the hot tapping job.
- Scope also include providing suitable supports / arrangements below the existing pipelines near the locations where subsea hot tapping and valves are to be installed and also at locations of valves/ lateral on the new pipelines.

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- g. Surface preparation of the pipe body at the tie-in locations by performing activities like concrete and anti-corrosion coating removal to the required extent, for facilitating joint of the new replacement pipeline to the existing pipeline by mechanical connector.
- h. Removal and recovery to surface and disposal of any other material used as an installation aid for achieving stability of the existing pipeline after completion of the above.

## 20. Configuration of Subsea Tie-In:


- a. **8" dia. Subsea Tie-in of segment no.4 (WO-16 to tie-in on 30" ICP-Heera trunk Line):** Tie-in shall be completed with 02 nos 14" ANSI class #1500 Subsea Ball valve (**to be Free issued by Company**) along with an ANSI class #1500 PLEM (consisting of with 02 nos 8" ANSI class #1500 Subsea Ball valve, 02 nos 2" ANSI class #1500 Subsea Ball valve for venting and one 8" Subsea Pig Launcher) and associated flanges/blind flanges including necessary supports as per detail engineering.
- b. **6" dia. Subsea Tie-in of segment no.23 (6" WI SS Lateral to VSEC to 10" WI BCPA2-VSEA Line):** Tie-in shall be completed with Supply and Installation of one piggable #1500, 10"x6"x10" Subsea Flow Tee, spool arrangement and associated fittings on the existing 10" WI BCPA-2 to VSEA pipeline at VSEA riser bottom in order to tie-in to the existing 6" WI pipeline lateral to VSEC. The existing riser tie-in spool of 10" WI BCPA-2 to VSEA at VSEA riser bottom shall be replaced along with proposed arrangement and necessary shutdown shall be provided to the 10" pipeline for removal of existing riser spool at VSEA. The proposed tie-in line will originate from the 6" arm of the flow tee and terminate at the upstream of existing 6" Ball valve of lateral (on old 10" BCPA-2 to VSEA line) to VSEC.

The scope of work for the CONTRACTOR shall include, but not be limited to, the following:

- I. Assessment of burial status of the existing 6" WI pipeline to VSEC at the proposed tie-in locations during pre-engineering and pre-construction surveys. The pipeline is unburied by design; however, present burial status shall be confirmed by dive survey. If found buried due to natural sediment accumulation, de-burial and exposure of the pipeline at the tie-in point shall be carried out by CONTRACTOR.
- II. Removal of 10" riser spool of existing 10" WI BCPA2-VSEA Line at riser bottom of VSEA and installation of new 10" riser spool with a 10" x 6" x 10" Piggable Subsea Flow Tee at Pipeline end.
- III. Fabrication and installation of the interconnecting 6" spool between the flow tee assembly and the existing 6" WI pipeline to VSEC, with anti-corrosion coating at field joints and tie-in locations. Minimum number of bends shall be used. The completed pipeline system on the 10" main run shall remain piggable post installation.
- IV. Cathodic protection of the new spool assembly by sacrificial anode method, as per the Electrical Scope of Work. CP requirements shall be firmed up during detail engineering.
- V. Cutting, removal and recovery to surface of redundant pipe sections within one metre of the new assembly post tie-in, and disposal of all removed pipe sections, coatings and fittings.

Lateral assembly shall be provided with protection cage (with provision of removal of its parts) along with CP protection for the cage. Scope also includes providing mattress based on detailed engineering for Lateral Assembly and its protection cage for pipeline system.


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The scope described above is indicative and not exhaustive. All activities necessary for successful completion of the above tie-in are within the scope of CONTRACTOR.

21. Pipeline Segment Nos. 21 (N8-NQO) and 22 (PPA-PB) is involved with Riser replacement work only.
  - a. Riser installation at N-8 and PB may be done by either stalk-on method or flanged connection both at east face.
  - b. During Installation, removal of existing Riser Guard and Boat Landing Stairs and reinstallation of the same shall be in Contractor's scope.
22. For Full replacement pipelines of hydrocarbon pipeline segments, flushing of the existing pipeline will be done by COMPANY prior to taking up the tie in of the replacement pipeline with topside piping by the CONTRACTOR.
23. For part/sectional replacement of hydrocarbon pipeline segments flushing of the existing pipeline will be done by COMPANY prior to taking up the tie in of the replacement pipeline by the CONTRACTOR. The following is scope of work of the CONTRACTOR for segments of sectional/Part replacement of pipelines, but not limited to the following:
  - a. Supply of mechanically actuated subsea pipeline repair unit (SPRU) / Connectors (for each pipeline segment requiring sectional/Part replacement) consisting of coupling and MAF for the pipeline nominal diameter complete with stud tensioners equal to number of studs and their sizes, adopters, interconnectors etc. required for 100% actuation of coupling. Number of SPRUs, their ASME class pressure rating and NACE compliance (wherever required) for sub-sea tie-in with the existing pipeline is given in Table 4.2A of Annexure to Section-4A. COMPANY's Specification and suggested vendors list for SPRU is enclosed elsewhere in the bid. After installation of connector, seal test shall be carried out by the CONTRACTOR for connector / Gripper and the MAF as per manufacturer's installation brochure. The subsea tie-in with the existing pipeline is included in the scope of the CONTRACTOR. The requirement of pipeline spool including supply of flanges included in the scope of the CONTRACTOR for subsea connection with the existing pipeline using SPRU/connectors shall be finalised during detail engineering. OEM support for the connectors/grippers, if so required, including mobilisation at site during subsea tie-in, shall be arranged by the CONTRACTOR at his cost. List of names of Suggested Vendor List for SPRU is attached with the SPRU Specification.
  - b. CONTRACTOR to propose, design, engineer and install suitable method of successful anchoring/ stabilization of the existing pipeline at the tie-in points, if required in a safe manner, so that it will not deviate from the alignment after cutting of the pipeline at the proposed tie-in point.
  - c. Exposing / de-burial of the pipeline at the proposed tie in points. The pipeline is unburied by design, but present burial status to be assessed during pre-engineering & pre-construction surveys.
  - d. Removal of concrete and coal tar/3LPP/3LPE coating of the pipeline at the tie-in points to find out the wall thickness by UT readings at around the 8 cardinal positions of the pipeline cross section at the tie-in points. Suitable location for tie-in shall be the one with wall thickness UT readings shall be identified during pre-construction survey by dive survey. Wall thickness of existing pipeline at tie-in location shall not be less than 3mm from its nominal wall thickness as measured by UT. If the UT readings found are not satisfying as per criterion given above, finding out suitable alternate Tie-in locations.
  - e. Measurement of wall thickness of existing sectional replacement pipeline by UT needs to be done for three pipe lengths in downstream direction from the nearest location of subsea tie-in to find the suitable thickness as per tender requirement.

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- f. Surface preparation of the pipe body at the tie-in locations by performing activities like concrete and anti-corrosion coating removal to the required extent, for facilitating joint of the new replacement pipeline to the existing pipeline by mechanical connector.
  - g. Cold cutting of the pipeline section for tie-ins. CONTRACTOR shall cut the requisite length of existing pipeline at both the ends to facilitate tie-in connection of newly laid replaced section with existing pipeline. Existing pipeline to be secured after cutting.
  - h. Laying of the Replacement pipeline section (refer table 4.2A). Scope also includes providing of anti-corrosion coatings at the location of sub-sea tie in.
  - i. For facilitating the tie-in of the new pipeline with the existing pipeline, minimum nos. of bends shall be used. The completed pipeline system shall be piggable.
  - j. Replacement pipeline section shall be pigged, and hydro tested before tie-in with the existing pipeline as part of the testing that are to be carried out.
  - k. Removal and recovery to surface and disposal of any other material used as an installation aid for achieving stability of the existing pipeline after completion of the above.
  - l. Cutting, removal and recovery to surface the redundant pipe sections which are within one metre from the new pipeline.
  - m. Disposal of the demolished and removed pipe, clamps and other material.
  - n. Crossing and Free span corrections of the replacement pipeline.
  - o. Scope of work given above is a brief account of main activities to be performed by CONTRACTOR. Same is not exhaustive. All activities of work for successfully completing the part replacement of the above pipeline are within the scope of the CONTRACTOR.
24. The Scope comprises of demolition of risers along with its riser clamps and demolition of two pipeline lengths beyond horizontal section of riser at platforms as in Table 4.2A. The scope may involve demolition of small length of existing topside piping above transition bend at platforms. For scope of work of demolition of topside piping above transition bend, Basic bid work/Piping section is to be referred. COMPANY will provide necessary shut down and de-oiling/flushing before taking up of demolition job by the EPCI CONTRACTOR. Water jetting or any other safe method for exposing the buried section of zone-2 pipe for dismantling is included in the scope.
  25. Where pipelines are to be flush buried, at platform approaches and near pipeline crossings where burial of pipeline is technically not feasible, EPCI CONTRACTOR shall provide alternate measures for establishing on-bottom stability of pipelines required.
  26. Pigging and Hydro-testing of submarine pipeline shall be carried out by the CONTRACTOR as per COMPANY specification attached with the bid package. CONTRACTOR shall make arrangement of temporary pig barrels, if required, for pigging of the pipeline. Pigging and hydrotesting of pipeline segments shall be done from pig barrel to pig barrel and for segments requiring sectional replacement shall be done from end to end for the section of the subsea pipeline laid.
  27. All the pipeline segments shall be filled up with sea water dozed with corrosion inhibitor, bactericide and oxygen scavenger as per ONGC FS 2022.
  28. CONTRACTOR's scope includes pre-commissioning of pipeline making pipeline ready for safe commissioning and providing commissioning assistance.

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29. CONTRACTOR shall submit all drawings/layouts/as-built/Survey Report in Spheroid WGS-84 System.
30. Coordinates of all Platforms except (N-12 and PB) are given in UTM System on EVEREST 1830 Spheroid, Mumbai High datum and Platform coordinates of N-12 and PB are given are in WGS-84, Zone 42N, CM 69 Coordinate System.
31. CONTRACTOR shall firm up the table 4.2A during detail engineering and shall get the same approved by the COMPANY.
32. CONTRACTOR shall provide 04 Nos. of poly pigs as loose supply material to COMPANY for each pipeline segment.
33. N.A. shall be read as 'Not Applicable.'

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## APPENDIX-A

### LIST OF DRAWINGS (REFER VOL-IV OF BID DOCUMENT)

Sl. No.	Document/Drawing Title	Doc. /Dwg. No	Rev No
1	Mumbai High Field Layout	71XX-EPEC-PL-4001A/B	Rev 0
2	Bassein and Panna Field Layout	71XX-EPEC-PL-4002	Rev 0
3	Daman Field Layout	71XX-EPEC-PL-4003	Rev 0
4	Heera Field Layout	71XX-EPEC-PL-4004	Rev 0
5	Pipeline Approach & Departure Drawing- MNP Platform	I1154-S1-MNP-INT-PLE-DWG-3440	Rev 1
6	Pipeline Approach & Departure Drawing- WIN Platform	I0182-S3-PL-ENG-DWG-30316	Rev 0
7	Pipeline Approach & Departure Drawing- B12-17 Platform	C17022-54-1-B1217-4101	Rev X
8	Pipeline Approach & Departure Drawing- B12-11 Platform	C17022-54-1-B1211-4102	Rev X
9	Pipeline Approach & Departure Drawing- N-14 Platform	COMGD993-54-1-4112	Rev X
10	Pipeline Approach & Departure Drawing- NH Platform	I0182-S2-PL-ENG-DWG-21049	Rev 1
11	Pipeline Approach & Departure Drawing- ND Platform	I0182-PL-ENG-DWG-0120	Rev 0
12	Pipeline Approach & Departure Drawing- N-3 Platform	I1154-S1-N3-INT-PLE-DWG-3431	Rev 1
13	Pipeline Approach & Departure Drawing- NI Platform	9302-54-1-4024	Rev 1
14	Pipeline Approach & Departure Drawing- N-10 Platform	9302-54-1-4020	Rev 1
15	Pipeline Approach & Departure Drawing- MNW Platform	SSPRP5-PRT-MNW-PL-DWG-3529	Rev Z
16	Pipeline Approach & Departure Drawing- N-9 Platform	I0182-S2-PL-ENG-DWG-21414	Rev 1
17	Pipeline Approach & Departure Drawing- IM Platform	IM-DRG-PLE-0011	Rev 1
18	Pipeline Approach & Departure Drawing- SB Platform	PBD501-54-1-4142	Rev X
19	Pipeline Approach & Departure Drawing- SA Platform	SA-DRG-PLE-0006	Rev 1
20	Pipeline Approach & Departure Drawing- SP Platform	PBD501-54-1-4141	Rev X
21	Pipeline Approach & Departure Drawing- BHS Platform	BHS-DRG-PLE-0006	Rev 1
22	Pipeline Approach & Departure Drawing- IG Platform	PBD501-54-1-4152	Rev X
23	Pipeline Approach & Departure Drawing- N-12 Platform	I1154-S1-N12-INT-PLE-DWG-3454	Rev 1
24	Pipeline Approach & Departure Drawing- NQP Platform	COMGD993-54-1-4106	Rev X
25	Pipeline Approach & Departure Drawing- SJ Platform	I0182-S2-PL-ENG-DWG-21401	Rev 1
26	Pipeline Approach & Departure Drawing- LB Platform	I0182-S2-PL-ENG-DWG-21420	Rev 1
27	Pipeline Approach & Departure Drawing- SHG Platform	I0182-S2-PL-ENG-DWG-0154	Rev 0
28	Pipeline Approach & Departure Drawing- RS-7 Platform	SSPRP5-PRT-RS7-PL-DWG-3521	Rev Z
29	Pipeline Approach & Departure Drawing- SHP Platform	C11800-11-J-DW-0607	Rev Z
30	Pipeline Approach & Departure Drawing- HE Platform	C17029-54-1-HE-4105	Rev 0
31	Pipeline Approach & Departure Drawing- HRG Platform	SSPRP5-PRT-HRG-PL-DWG-3817	Rev Z
32	Pipeline Approach & Departure Drawing- B-172A Platform	C11300-SOC-PL-DO-014	Rev X
33	Pipeline Approach & Departure Drawing- N-8 Platform	PBD501-54-1-4055	Rev X
34	Pipeline Approach & Departure Drawing- PB Platform	C19032-PL-PB-DWG-4116	Rev 0
35	Riser Assembly Drawing – 14” WF at MNP	COPGD835-54-1-3202	Rev X
36	Riser Assembly Drawing – 6” WI at WIN	9170-54-1-3003	Rev A
37	Riser Assembly Drawing – 8” WF at B12-11	C17022-54-1-B1211-3202	Rev X
38	Riser Assembly Drawing – 8” WF at B12-17	C17022-54-1-B1211-3201	Rev X
39	Riser Assembly Drawing – 6” GL at N-14	COWGD992-54-1-N14-3204	Rev 1
40	Riser Assembly Drawing – 16” WF at NH	I0182-S2-PL-ENG-DWG-21709	Rev 1
41	Riser GA & Details at WO-16	1229-N-1001	Rev 2X
42	Riser Assembly Drawing – 6” WI at ND	9170-54-1-3004	Rev A
43	Riser Assembly Drawing – 6” GL at N3	I1154-S1-N3-INT-PLE-DWG-3341	Rev 1

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44	Riser Assembly Drawing – 6” WI at NI	9302-54-1-3009	Rev 1
45	Riser Assembly Drawing – 6” WI at N10	9302-54-1-3010	Rev 1
46	Riser Assembly Drawing – 6” WI at MNW	SSPRP5-PRT-MNW-PL-DWG-3429	Rev Z
47	Riser Assembly Drawing – 6” GL at N9	I0182-S2-PL-ENG-DWG-21714	Rev 1
48	Riser Assembly Drawing – 6” GL at IM	IM-DRG-PL-0008	Rev 1
49	Pipeline Alignment Drawing, 140 mm Flex. IM to S1-6	CM-06-08-15-0001-DD-25	Rev 2
50	Riser Clamp Location Drawing-S1-6	9023-73-1-1417	Rev 0
51	Riser Assembly Drawing – 12” WF at SB	PBD601-54-1-2013	Rev 0
52	Riser Assembly Drawing – 10” WF at SA	I0182-S2-PL-ENG-DWG-21706	Rev 1
53	Riser Assembly Drawing – 12” WF at SP	PBD501-54-1-3050	Rev X
54	Riser Assembly Drawing – 12” WF at BHS	I0182-S2-PL-ENG-DWG-21704	Rev 1
55	Riser Assembly Drawing – 6” GL at IG	PBD501-54-1-3068	Rev X
56	Riser Assembly Drawing – 203mm WI at N-12	I1154-S1-N12-INT-STR-DWG-3624-1	Rev 1
57	Riser Assembly Drawing – 12” WF at NQP	PBD501-54-1-3063	Rev X
58	Riser Assembly Drawing – 8” GL at SJ	I0182-S2-PL-ENG-DWG-21701	Rev 1
59	Riser Assembly Drawing – 18” WF at SHG	COWGD725-54-1-3012	Rev X
60	Riser Assembly Drawing – 8” WF at RS-7	SSPRP5-PRT-RS7-PL-DWG-3425	Rev Z
61	Jacket Vertical Framing- at IL Platform	2487-48-IL-A1-721	Rev 1
62	Riser Assembly Drawing – 12” WF at SHP	C11800-11-J-DW-0705	Rev Z
63	Riser GAD & Location Drawing- 406.4 mm at EE	4586-00-16-71-1014	Rev 3
64	Pipeline Alignment Drawing, 6” EE to SHP	CM-06-08-15-0001-DD-23	Rev 2
65	Riser Assembly Drawing – 10” WF at HE	PBD501-54-1-3012	Rev X
66	Riser Assembly Drawing – 10” WF at HRG	SSPRP5-PRT-HRG-PL-DWG-3810	Rev 1
67	Riser Assembly Drawing – 12” WF at B-172A	0566-B172A-B-DW-8130	Rev Z
68	Riser Assembly Drawing – 22” WF at N-8	PBD501-54-1-3021	Rev X
69	Riser Assembly Drawing – 4” GL at PB	C19032-PL-PB-DWG-3216	Rev 0
70	Clearance for Drilling Rig (Sheet 2 of 2)	PL-EP-DRC-008-2	Rev 0
71	As-built P&ID of Subsea PLEM	72007-I-D1104-PS003-00001	Rev 3
72	As-built Piping Arrangement Drawing of Subsea PLEM	72007-I-D1104-PP003-00001	Rev 2
73	As-built GAD of Subsea PLEM	72007-I-D1104-ST0xx-000xx	Rev 2
74	Schematic Drawing of Proposed Tie in for tie in 10” WI-BCPA-2 to VSEA line to VSEC	71XX-EPEC-PL-3035	Rev.0

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## **APPENDIX-B**

### **LIST OF SPECIFICATIONS**

<b>Sl. No</b>	<b>Description</b>	<b>Spec. No.</b>
1	Route Survey	2011 Rev 2
2	Corrosion Protection Coating (3LPP)	2012A Rev 1
3	Concrete Weight Coating	2013 Rev 2
4	Field Joint Coating with Addendum to Specification	2014 Rev 1
5	Installation of Submarine Pipelines & Related Facilities	2015 Rev 2
6	Long Radius Bends	2018 Rev 0
7	C.S. Seamless Line pipe for Submarine Pipeline with Addendum	2020A Rev 5
8	C.S. Seamless Line pipe for Submarine Pipeline (Sour Service) with Addendum and Addendum-2 to Specification	2020B Rev 5
9	Longitudinal Seam Submerged Arc Welded Submarine Pipelines (Sour Service) with Addendum and Addendum-2	2020D Rev 2
10	Hydrostatic Testing of Submarine Pipeline	2022 Rev 1
11	Fittings and Flanges for Submarine Pipeline	2024A Rev 0
12	Fittings and Flanges for Submarine Pipeline (Sour Service)	2024B Rev 0
13	Subsea Ball Valves (Sour Service)	2025B Rev 2
14	Data Sheet of Subsea Ball Valves (Sour Service)	2025B-DS-BV-PRP-X
15	Subsea Flow Tees	2028A Rev 0
16	Data Sheet of Subsea Flow Tees	2028B-DS-SSTEE-PRP-X
17	Subsea Flow Tees (Sour Service)	2028B Rev 0
18	Data Sheet of Subsea Flow Tees (Sour Service)	2028B-DS-SSTEE-S-PRP-X
19	Spec for Pipeline Repair connectors/SPRU (Sour Service) along with suggested vendor list	DS-SPRU-PRP-VII-RTR

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## APPENDIX-C

### JACKET DEFLECTIONS

**C.0** Following jacket movements for well and process platforms from mud line to hanger clamps are to be considered:

**C.1** Mumbai High North Field

100-year storm : 200 mm  
1 year storm : 100 mm

**C.2** Mumbai High South Field

100-year storm : 150 mm  
1 year storm : 100 mm

**C.3** Bassein & Panna Fields

100-year storm : 200 mm  
1 year storm : 200 mm

**C.4** Heera Field

100 year storm : 400 mm  
1 year storm : 300 mm

## APPENDIX-D

### WAVE EXCEEDANCE TABLE

#### D.0 Number of Waves Exceeding Specified Height in 1 Year for Offshore Mumbai 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	-

#### D.1 Number of Waves Exceeding Specified Height in 1 Year for Daman Area

WAVE HEIGHT (m)	NUMBER OF WAVE EXCEEDANCES				
	S DIR	SW DIR	W DIR	NW DIR	ALL DIR
0	1,77,348	10,84,956	15,64,841	9,96,281	38,23,426
0.61	69,102	4,22,740	6,09,722	3,88,189	14,89,753
1.22	26,282	1,60,783	2,31,898	1,47,642	5,66,605
1.83	9,996	61,151	88,198	56,153	2,15,498
2.44	3,802	23,258	33,545	21,357	81,962
3.05	1,446	8,846	12,758	8,123	31,173
3.66	550	3,365	4,853	3,089	11,857
4.27	225	1,380	1,989	1,175	4,769
4.88	137	836	1,206	47	2,226
5.49	56	342	492	-	890
6.1	21	130	187	-	338
7.62	1	16	13	-	30
9.14	-	2	1	-	3
10.67	-	-	-	-	-