

6 DATA SHEETS, DATA OF THE STRUCTURES, GENERAL ARRANGEMENTS AND ANCILLARY EQUIPMENT DRAWINGS

6.1 DATA SHEET

The design pressure of 621 bar is the maximum differential design pressure along the flexible pipe

6.1.1 Riser top section – Structure 152.53416

INTERNAL DIAMETER	6.00"	SOUR SERVICE
DESIGN PRESSURE	9000 psi	621 bar
DESIGN TEMPERATURE	90 °C	
FACTORY TEST PRESSURE	13500 psi	932 bar
FTP/DP 1.50		

N°	LAYER DESCRIPTION	UTS (MPa)	MYS (MPa)	Mass (Kg/m)	I.D. (mm)	Th. (mm)	SDP (MPa)
1	INTERLOCKED CARCASS 48.0 x 1.2 x 6.0 DUPLEX (FE 04)	660	-	14.47	152.40	6.00	
2	PRESSURE SHEATH RILSAN P40TL TP01			7.01	164.40	11.30	
3	TETA-CLIP FI 18	780	700	57.96	187.00	14.00	357
4	SPIRAL FI 09 2 Flat wires: 15 x 7.5	850	700	35.54	215.00	7.50	324
5	ANTI-WEAR TAPE 75.0 x 1.5 (BF 01)			1.01	230.00	1.50	
6	FIRST ARMOUR LAY. FI 09 46 Flat wires: 14 x 6 at 25 deg.	850	750	31.35	233.00	6.00	139
7	ANTI-WEAR TAPE 75.0 x 1.5 (BF 01)			1.08	245.00	1.50	
8	SECOND ARMOUR LAY FI 09 49 Flat wires: 14 x 6 at -25 deg.	850	750	33.40	248.00	6.00	104
9	FABRIC TAPE			0.52	260.00	1.30	
10	ANTI-WEAR TAPE 75.0 x 1.5 (BF 01)			1.15	262.60	1.50	
11	FIRST ARMOUR LAY. FI 09 52 Flat wires: 14 x 6 at 25 deg.	850	750	35.44	265.60	6.00	130
12	ANTI-WEAR TAPE 75.0 x 1.5 (BF 01)			1.22	277.60	1.50	
13	SECOND ARMOUR LAY FI 09 55 Flat wires: 14 x 6 at -25 deg.	850	750	37.49	280.60	6.00	94
14	HIGH STRENGTH TAPE TECH/TECH			2.12	292.60	3.27	
15	LEAKPROOF SHEATH HD-FLEX (TP26+TP28) Yellow			8.10	299.14	8.80	
16	INSULATION MO03 2 Strips: 50 x 5.5			7.20	316.74	11.00	
17	FABRIC TAPE			0.89	338.74	1.20	
18	EXTERNAL SHEATH HD-FLEX (TP26+TP28) Yellow			10.92	341.14	10.40	

THEORETICAL CHARACTERISTICS	IMPERIAL	METRIC
DIAMETER inside	6.00 in	152.40 mm
DIAMETER outside	14.25 in	361.94 mm
VOLUME internal	0.209 cf/ft	19.38 l/m
VOLUME external	1.107 cf/ft	102.89 l/m
WEIGHT in air empty	192.76 lbf/ft	286.86 kgf/m
WEIGHT in air full of seawater	206.11 lbf/ft	306.73 kgf/m
WEIGHT in seawater empty	121.89 lbf/ft	181.40 kgf/m
WEIGHT in seawater full of seawater	135.25 lbf/ft	201.27 kgf/m
SPECIFIC GRAVITY in sea water empty	2.72	2.72
PRESSURE Nominal bursting	18289 psi	1261 bar
HYDROSTATIC collapse pressure lay 2	3553 psi	245 bar
HYDROSTATIC collapse pressure lay 15	8876 psi	612 bar
DAMAGING PULL in straight line	2288119 lbf	10178.06 kN
MINIMUM BENDING RADIUS for STORAGE	7.71 ft	2.35 m
BENDING STIFFNESS at 20°C	282021 lbf.ft ²	116.55 kN.m ²
RELATIVE ELONGATION at design pressure	0.047 %	0.047 %
RELATIVE ELONGATION for 100 kN	0.004668 %	0.004668 %
THERMAL EXCHANGE COEFFICIENT at 20°C	1.66 Btu/hftF	2.87 W/m.K

6.1.2 Riser intermediate section– Structure 152.53417

INTERNAL DIAMETER	6.00"	SOUR SERVICE
DESIGN PRESSURE	9000 psi	621 bar
DESIGN TEMPERATURE	90 °C	
FACTORY TEST PRESSURE	13500 psi	932 bar
FTP/DP 1.50		

N°	LAYER DESCRIPTION	UTS (MPa)	MYS (MPa)	Mass (Kg/m)	I.D. (mm)	Th. (mm)	SDP (MPa)
1	INTERLOCKED CARCASS 60.0 x 1.5 x 7.5 DUPLEX 2205 (FE 04)	660	-	18.27	152.40	7.50	
2	PRESSURE SHEATH RILSAN P40TL TP01			5.80	167.40	9.30	
3	ZETA WIRE 10.0 FI 09	850	700	41.21	186.00	10.00	374
4	SPIRAL FI 09 2 Flat wires: 15 x 7.5	850	700	34.10	206.00	7.50	344
5	ANTI-WEAR TAPE 75.0 x 1.5 (BF 01)			1.00	221.00	1.50	
6	FIRST ARMOUR LAY. FI42 42 Flat wires: 14 x 6 at 31 deg.	1200	1080	30.27	224.00	6.00	305
7	ANTI-WEAR TAPE 75.0 x 1.5 (BF 01)			1.07	236.00	1.50	
8	SECOND ARMOUR LAY FI42 45 Flat wires: 14 x 6 at -31 deg.	1200	1080	32.43	239.00	6.00	260
9	HIGH STRENGTH TAPE TECH/TECH			1.82	251.00	3.27	
10	LEAKPROOF SHEATH HD-FLEX (TP26+TP28) Yellow			5.53	257.54	7.00	
11	INSULATION MO03 2 Strips: 50 x 5.5			6.21	271.54	11.00	
12	FABRIC TAPE			0.60	293.54	1.05	
13	EXTERNAL SHEATH HD-FLEX (TP26+TP28) Yellow			8.19	295.64	9.00	

THEORETICAL CHARACTERISTICS	IMPERIAL	METRIC
DIAMETER inside	6.00 in	152.40 mm
DIAMETER outside	12.35 in	313.64 mm
VOLUME internal	0.212 cf/ft	19.68 l/m
VOLUME external	0.832 cf/ft	77.26 l/m
WEIGHT in air empty	125.32 lbf/ft	186.49 kgf/m
WEIGHT in air full of seawater	138.87 lbf/ft	206.67 kgf/m
WEIGHT in seawater empty	72.10 lbf/ft	107.30 kgf/m
WEIGHT in seawater full of seawater	85.66 lbf/ft	127.47 kgf/m
SPECIFIC GRAVITY in sea water empty	2.35	2.35
PRESSURE Nominal bursting	17419 psi	1201 bar
HYDROSTATIC collapse pressure lay 2	4351 psi	300 bar
HYDROSTATIC collapse pressure lay 10	9137 psi	630 bar
DAMAGING PULL in straight line	1350313 lbf	6006.49 kN
MINIMUM BENDING RADIUS for STORAGE	6.68 ft	2.04 m
BENDING STIFFNESS at 20°C	158824 lbf.ft2	65.63 kN.m2
RELATIVE ELONGATION at design pressure	0.145 %	0.145 %
RELATIVE ELONGATION for 100 kN	0.012477 %	0.012477 %
THERMAL EXCHANGE COEFFICIENT at 20°C	1.86 Btu/hftF	3.22 W/m.K

6.1.3 Riser bottom section - Structure 152.53755

INTERNAL DIAMETER	6.00"	SOUR SERVICE
DESIGN PRESSURE	9000 psi	621 bar
DESIGN TEMPERATURE	90 °C	
FACTORY TEST PRESSURE	13500 psi	932 bar
FTP/DP 1.50		

N°	LAYER DESCRIPTION	UTS (MPa)	MYS (MPa)	Mass (Kg/m)	I.D. (mm)	Th. (mm)	SDP (MPa)
1	INTERLOCKED CARCASS 60.0 x 1.5 x 7.5 DUPLEX 2205 (FE 04)	660	-	18.27	152.40	7.50	
2	PRESSURE SHEATH RILSAN P40TL TP01			5.80	167.40	9.30	
3	ZETA WIRE 10.0 FI 09	850	700	41.21	186.00	10.00	372
4	SPIRAL FI 09 2 Flat wires: 14 x 6	850	750	26.38	206.00	6.00	344
5	ANTI-WEAR TAPE 75.0 x 1.5 (BF 01)			0.98	218.00	1.50	
6	FIRST ARMOUR LAY. FI42 39 Flat wires: 14 x 6 at 37 deg.	1200	1080	30.17	221.00	6.00	357
7	ANTI-WEAR TAPE 75.0 x 1.5 (BF 01)			1.05	233.00	1.50	
8	SECOND ARMOUR LAY FI42 41 Flat wires: 14 x 6 at -37 deg.	1200	1080	31.71	236.00	6.00	303
9	HIGH STRENGTH TAPE TECH/TECH			1.80	248.00	3.27	
10	LEAKPROOF SHEATH HD-FLEX (TP26+TP28) Yellow			5.47	254.54	7.00	
11	INSULATION MO03 2 Strips: 50 x 5.5			6.14	268.54	11.00	
12	FABRIC TAPE			0.59	290.54	1.05	
13	EXTERNAL SHEATH HD-FLEX (TP26+TP28) Yellow			6.27	292.64	7.00	

THEORETICAL CHARACTERISTICS	IMPERIAL	METRIC
DIAMETER inside	6.00 in	152.40 mm
DIAMETER outside	12.07 in	306.64 mm
VOLUME internal	0.212 cf/ft	19.68 l/m
VOLUME external	0.795 cf/ft	73.85 l/m
WEIGHT in air empty	118.16 lbf/ft	175.84 kgf/m
WEIGHT in air full of seawater	131.72 lbf/ft	196.02 kgf/m
WEIGHT in seawater empty	67.30 lbf/ft	100.15 kgf/m
WEIGHT in seawater full of seawater	80.85 lbf/ft	120.32 kgf/m
SPECIFIC GRAVITY in sea water empty	2.32	2.32
PRESSURE Nominal bursting	17883 psi	1233 bars
HYDROSTATIC collapse pressure lay 2	4220 psi	291 bars
HYDROSTATIC collapse pressure lay 10	8455 psi	583 bars
DAMAGING PULL in straight line	1171534 lbf	5211.24 kN
MINIMUM BENDING RADIUS for STORAGE	6.53 ft	1.99 m
BENDING STIFFNESS at 20°C	132790 lbf.ft2	54.88 kN.m2
RELATIVE ELONGATION at design pressure	0.190 %	0.190 %
RELATIVE ELONGATION for 100 kN	0.017855 %	0.017855 %
THERMAL EXCHANGE COEFFICIENT at 20°C	1.92 Btu/hftF	3.33 W/m.K

6.1.4 Flowline – Estrutura 152.52656 rev. 0

INTERNAL DIAMETER	6.00"	SOUR SERVICE
DESIGN PRESSURE	9645 psi	664 bar
DESIGN TEMPERATURE	90 °C	
FACTORY TEST PRESSURE	12539 psi	864 bar
FTP/DP 1.30		

N°	LAYER DESCRIPTION	UTS (MPa)	MYS (MPa)	Mass (Kg/m)	I.D. (mm)	Th. (mm)	SDP (MPa)
1	INTERLOCKED CARCASS 72.0 x 1.8 x 9.0 DUPLEX (FE 04)	660	-	22.08	152.40	9.00	
2	PRESSURE SHEATH RILSAN P40TL TP01			4.84	170.40	7.70	
3	ZETA WIRE 8.0 FI 09	850	750	32.31	185.80	8.00	468
4	SPIRAL FI 09	850	750	25.86	201.80	6.00	436
	2 Flat wires: 14 x 6						
5	FABRIC TAPE			0.20	213.80	0.80	
6	FIRST ARMOUR LAY. FI42 39 Flat wires: 14 x 6 at 35 deg.	1200	1080	29.48	215.40	6.00	367
7	FABRIC TAPE			0.21	227.40	0.80	
8	SECOND ARMOUR LAY FI42 41 Flat wires: 14 x 6 at -35 deg.	1200	1080	30.99	229.00	6.00	326
9	HIGH STRENGTH TAPE TECH/TECH			1.11	241.00	2.47	
10	EXTERNAL SHEATH TP-FLEX TP26 Yellow			4.88	245.94	6.50	

THEORETICAL CHARACTERISTICS	IMPERIAL	METRIC
DIAMETER inside	6.00 in	152.40 mm
DIAMETER outside	10.19 in	258.94 mm
VOLUME internal	0.215 cf/ft	19.99 l/m
VOLUME external	0.567 cf/ft	52.66 l/m
WEIGHT in air empty	102.13 lbf/ft	151.98 kgf/m
WEIGHT in air full of seawater	115.90 lbf/ft	172.47 kgf/m
WEIGHT in seawater empty	65.86 lbf/ft	98.00 kgf/m
WEIGHT in seawater full of seawater	79.63 lbf/ft	118.50 kgf/m
SPECIFIC GRAVITY in sea water empty	2.82	2.82
PRESSURE Nominal bursting	15910 psi	1097 bars
HYDROSTATIC collapse pressure lay 2	4699 psi	324 bars
DAMAGING PULL in straight line	1185587 lbf	5273.76 kN
MINIMUM BENDING RADIUS for STORAGE	5.52 ft	1.68 m
BENDING STIFFNESS at 20°C	50290 lbf.ft2	20.78 kN.m2
RELATIVE ELONGATION at design pressure	0.164 %	0.164 %
RELATIVE ELONGATION for 100 kN	0.015812 %	0.015812 %
THERMAL EXCHANGE COEFFICIENT at 20°C	3.99 Btu/hftF	6.91 W/m.K

Baker Hughes Proprietary

STATIC 152.4 mm 62.053 MPa 2500 m 6 Inch Gas Injection Flowline

Structure Number: WSI 152.2553-RD-4042-6 R1

S.I. Units Pipe Data Sheet, 152.2553-RD-4042-6 R1

Prepared by: Gustavo Dionisio

Checked by: Victor Caraubá

Approved by: Igor Pereira

Inside Diameter	152.4 mm	Service	Static	Max. Fluid Temp.	90 °C
Design Pressure	62.053 MPa	Conveyed Fluid	Gas	Water Depth	2500 m

Layer	Material	I.D. [mm]	Thick [mm]	O.D. [mm]	Weight [kg/m]
Flexbody	Duplex 2205	152.40	8.40	169.20	18.855
Flexbarrier	PA 12 Natural	169.20	10.00	189.20	5.742
Flexlok	Steel 100ksi YS 125ksi UTS	189.20	11.99	213.18	52.109
Flextape	Tape PA 11 P20 30mil	213.18	1.52	216.22	1.076
Flextensile 1	0.7% C Steel 135ksi MYS 150 UTS	216.22	7.00	230.22	33.244
Flextape	Polypropylene	230.22	0.30	230.81	0.199
Flextape	High Strength Glass Filament	230.81	2.03	234.87	1.932
Flextape	Polypropylene	234.87	0.30	235.47	0.203
Flextensile 2	0.7% C Steel 135ksi MYS 150 UTS	235.47	7.00	249.47	36.063
Flextape	Polypropylene	249.47	0.30	250.06	0.215
Flextape	High Strength Glass Filament	250.06	2.03	254.12	2.092
Flextape	Polypropylene	254.12	0.30	254.71	0.219
Flextape	Tape Polyester Fabric	254.71	0.41	255.53	0.217
Flexshield	PE100 Grade GP100BK	255.53	7.00	269.53	5.642
Flexinsul	PT7000 Insulation (Reinforcing Layer)	269.53	3.50	276.53	2.048
Flextape	Tape Polyester Fabric	276.53	0.41	277.34	0.236
Abrasion	PE100 Grade GP100BK	277.34	7.00	291.34	6.111

Layer	Raw Material	Dimensions	Mfg Pitch	Wires	Angle	Filled
Flexbody	55.0mm x 1.6mm	2.165in x 0.063in			87.9	85.48%
Flexlok (Profile H)	27.3mm x 12.0mm	1.076in x 0.472in			88.2	91.96%
Flextensile 1	12.0mm x 7.0mm	0.472in x 0.276in	1079.8mm	46	33.0	96.90%
Flextensile 2	12.0mm x 7.0mm	0.472in x 0.276in	1267.7mm	51	31.0	96.52%
Flexinsul	50.8mm x 3.5mm	2.000in x 0.138in				90.60%

Outside Diameter	291.34 mm	Volume (at OD)	66.381 l/m
Storage Radius, SBR	1.89 m	Volume (at ID)	20.095 l/m
Operating Radius, OBR (Dry Bore) ¹	4.60 m	Wt, Empty in Air	166.20 kg/m
Operating Radius, OBR (Flooded Bore) ²	2.40 m	S/W filled in Air	186.81 kg/m
Pipe bending stiffness at 23 °C, EI	40.412 kNm ²	Air filled in S/W	98.14 kg/m
Spooling Tension	11292 N	S/W filled in S/W	118.74 kg/m
Therm. Cond./Length, C/L	5.26 w/m°C	Burst Pressure	120.75 MPa
Effective Thermal Cond, ke	0.54 w/m°C	Burst/Design	1.95
OHTC, Uo {based on ID}	10.99 w/m ² °C	Collapse Pressure (Wet Flexlok)	30.32 MPa
SWDR with bore empty	3.30 N/m mm	Collapse Depth (Wet Flexlok)	3015 m
SWDR with bore filled by SW	4.00 N/m mm	Collapse/Design (Wet Flexlok)	1.21
Pipe torsional stiffness (GJ) at 23 °C:		Failure Tension	5913.1 kN
Limp direction	1685 kNm ²		
Stiff direction	3559 kNm ²		
Axial Stiffness	563380 kN		

Notes¹OBR (MBR) increased to comply with internal carcass design criteria (0.85) for bent collapse failure mode.²OBR (MBR) for pipe flooded condition in order to comply with Petrobras tensile armour design criteria (0.67) for tensile buckling failure mode.

Pipe Data Sheet revised to adjust correct Spooling Tension value. No structural/layer change.