

PDHonline Course M184 (3 PDH)

Material Data Sheets for the Construction of Piping Systems

Instructor: Peter Smith, HNC (Mech)

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5272 Meadow Estates Drive Fairfax, VA 22030-6658 Phone: 703-988-0088 www.PDHonline.com

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Material data sheets for piping

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Norwegian Technology Centre Oscarsgt. 20, Postbox 7072 Majorstuen N-0306 Oslo NORWAY Telephone: + 47 22 59 01 00 Fax: + 47 22 59 01 29 Email: norsok@nts.no Website: www.nts.no/norsok

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Foreword

The NORSOK standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness -for petroleum industry developments and operations. Furthermore, NORSOK standards are as far as possible intended to replace oil company specifications and serve as references in the authorities regulations.

The NORSOK standards are normally based on recognised international standards, adding the provisions deemed necessary to fill the broad needs of the Norwegian petroleum industry. Where relevant NORSOK standards will be used to provide the Norwegian industry input to the international standardisation process. Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

The NORSOK standards are developed according to the consensus principle generally applicable standards work and according to established procedures defined in NORSOK A-001.

The NORSOK standards are prepared and published with supported by OLF (The Norwegian Oil Industry Association) and TBL (Federation of Norwegian Manufacturing Industries). NORSOK standards are administered and published by NTS (Norwegian Technology Centre).

Introduction

This revision replace NORSOK standard M-630 rev 2, and the changes from rev. 2 to rev. 3 are only inclusion of 7 new MDS under material type P, Polymers including fibre reinforced.

MINOR DEVIATIONS FROM ASME B31.1 CODE REQUIREMENTS

The use of the piping materials according to NORSOK Standards (L-CR-001, M-630 and M-601) will result in some minor deviations from the ASME B31.3 code. All deviations have been carefully considered, and they are in line with Norwegian and European practice. The deviations are:

- NORSOK have of practical reasons limited the thickness for requiring impact testing to 6 mm
- If subsize Charpy V-notch impact test specimens are used, the energy requirement is increased instead of lowering the test temperature.
- Impact testing is not required in the qualification of the welding procedures for weldments in austenitic stainless steel when used in the temperature range from – 29 °C to – 105 °C.
- Eddy current examination is accepted as replacement for spot radiography of stainless steel welds for wall thicknesses less than 4.0 mm.
- Thin walled (thickness up to 7 mm) longitudinal welded pipes in 6 Mo austenitic stainless is accepted in as welded condition provided the plate material used is solution annealed.

In general, the MDS have supplementary requirement beyond the ASTM standard to ensure a proper safety level.

1 Scope

This standard includes material requirement in a collection of Piping Material Data Sheets (MDS) for use in piping systems, selected according to NORSOK L-001, Piping and Valves.

2 Normative references

The following standards include provisions and guidelines which, through reference in this text, constitute provisions and guidelines of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet or exceed the requirements and guidelines of the standards referenced below.

3 Definitions

3.1.1

can

verbal form used for statements of possibility and capability, whether material, physical or casual.

3.1.2

carbon steel type 235

carbon steel with SMYS \geq 220MPa and not impact tested

3.1.3

carbon steel type 235LT

carbon steel with SMYS \ge 220 MPa and impact tested at - 46 °C

3.1.4

carbon steel type 360LT

carbon steel with SMYS \geq 350 MPa and impact tested at - 46 °C

3.1.5

may

verbal form used to indicate a course of action permissible within the limits of the standard

3.1.6

MDS

material data sheet

3.1.7

shall

verbal form used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted, unless accepted by all involved parties

3.1.8

should

verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required

3.1.9

SMYS specified minimum yield strength

3.1.10

stainless steel type 316 alloys with approx. 2.5 % Mo of type AISI 316

3.1.11 stainless steel type 6Mo

alloys with 6 % Mo and PRE > 40

3.1.12

stainless steel type 22Cr duplex

alloys with 22 % Cr according to UNS S31803

3.1.13

stainless steel type 25Cr duplex

alloys with 25 % Cr and PRE > 40, often also referred to as "super duplex".

4 Collection of material data sheets

4.1 General

Materials/components manufactured in accordance with M-CR-630 rev. 1 may be accepted. This shall be agreed with the actual project/company.

The material selection menu for material standards and grades relevant for the piping systems is shown in Table 1. The actual grades to be used with respect to piping design shall be stated on the piping class sheet.

The materials shall be delivered in accordance with the standard referred to. In addition the MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.

The actual types of materials covered are as follow:

- C Carbon steels; Type 235, Type 235LT, Type 360LT
- D Ferritic/Austenitic Stainless Steels; Type 22Cr, Type 25Cr
- K Copper/Nickel 90/10 and other copper alloys
- N Nickel base alloys; Type 625
- P Polymers including fibre reinforced
- R Austenitic Stainless Steels; Type 6Mo
- S Austenitic Stainless Steels; Type 316
- T Titanium
- X High strength low alloyed steels.

Note: Welded products according to MDS D42, D43, D52, D53, R12, R13, S01 and T01 have acceptance classes which give welding factors 0.8 and 1.0. The correct class is specified on the piping class sheet. The order shall include acceptable classes

NORSOK standard M-630

Rev. 3, June. 2003

Table 1 – Material Selection Menu for Piping Systems

Product	Carbon steel Type 235 ¹⁾	Carbon steel Type 235LT impact tested	Carbon steel Type 360LT impact tested	Stainless steel Type 316	Stainless steel Type 22Cr Duplex	Stainless steel Type 25Cr Duplex	Stainless steel Type 6Mo ²⁾	Cu/Ni 90/10 and other copper alloys	Nickel alloy	Titanium Grade 2 ³⁾	High strength low alloyed steel
Pipes Seamless	A106 Grade B	A333 Grade 6	API 5L Grade X52	A312 Grade TP 316	A790 UNS S31803	A790 UNS S32550, UNS S32750, UNS S32760	A312 UNS S31354, UNS N08367, UNS N08925, UNS N08926	B466 UNS C 70600	B705 UNS UNS N06625	B861 Gr 2	A519 AISI 4130
Pipes Welded	API 5L Grade B ASTM A672 CC60, CC70 Class 12, 22	A671 Grade CC60, CC70 Class 12, 22	A671 Grade CC70 Class 12, 22	A312 Grade TP316 A358 Grade 316 Class 1, 3, 4	A928 UNS S31803 Class 1, 3, 5	A928 UNS S32550, UNS S32750, UNS S32760, Class 1, 3 and 5	A358 UNS S31254, UNS N08367, UNS N08925,	B467 UNS C 70600	B705 UNS UNS N06625	B862 Gr 2	
Fittings	A234 Grade WPB	A420 Grade WPL 6	A860 Grade WPHY 52	A403 Grade WP 316 Class S, W, WX	A815 UNS S31803 Class S, W, WX	A815 UNS S32550, UNS S32750, UNS S32760, Class S, W, WX	A403 WP S31254, UNS N08367, UNS N08925, UNS N08926 Class S, W, WX	- UNS C 70600	B366 UNS UNS N06625	B363 Grade WPT2 / WPT2W	A234 AISI 4130
Forgings	A105	A350 Grade LF2	A694 Grade F52	A182 Grade F316	A182 Grade F51	A182 UNS S32550, F53 (UNS S32750), F55 (UNS S32760)	A182 Grade F44, UNS N08367, UNS N08925, UNS N08926	- UNS C 70600	B564 UNS UNS N06625	B381 Grade F2	ASTM A 788 AISI 4140 API 6A 60K (AISI 4130) A182 F22
Plate	A516 Grade 60, 70	A516 Grade 70	A516 Grade 70,	A240 Grade 316	A240 UNS S31803	A240 UNS S32550, UNS S32750, UNS S 32760	A 240 UNS S31254, UNS N08367, UNS N08925, UNS N08926	B171 UNS C 70600	B443 UNS UNS N06625	B265 Grade 2	

Castings	A216 Grade	A352 Grade LCC	A352 Grade	A351 Grade CF8M	A890 UNS	A890	A 351	B148 UNS	B494	B367 Grade	ASTM A
	WCB		LCC	or CF3M	Grade 4	UNS J93404,	CK-3MCuN,	C 95800	Grade CW-	C2	487 Gr 2B
					(J92205)	UNS J93380	CN-3MN		6MC (UNS		ASTM A
									N06625)		487
									Grade		Gr 2B
									CX2MW		(÷46°C)
									(UNS		
									N26022)		
Bars					A276	A276	A276		B446	B348	
					UNS S 31803	UNS S 32550	UNS S 31259		UNS N06625	Gr 2	
						UNS S 32750	UNS N08367				
						UNS S 32960	UNS N08925				
							UNS N08926				
Tubes				A269	A789	A789	A269		B444	B338	
				316	UNS S 31803	UNS S32550	UNS S 31259		UNS N06625	Gr 2	
						UNS S 32750	UNS N08367				
						UNS S 32760	UNS N08925				
							UNS N08926				

NOTE 1)

Type 235 should be used in piping systems with minimum design temperature above or equal to -15 °C and thicknesses less than approx.15 mm. The grades UNS N08367, N08925 and N08926 are considered equivalent to UNS S31254. The grade CN-3 MN is considered equivalent to CK-3MCuN. GOST VT-1-0 is considered equivalent.

NOTE 2) NOTE 3)

		andards and Corresponding MDS	
MDS No.	Rev. No.	Standard and Grade (Note 1)	Products
		Carbon Steel Type 235	
C01	2	A 106 Grade B (1995)	Seamless pipes
C01	2	API 5L Grade B (1995)	Welded pipes
C01	2	A 672 Grade CC60,CC70 (1994)	Welded pipes
C01	2	A 234 Grade WPB (1996)	Wrought fittings
C01	2	A 105 (1995)	Forgings
C01	2 2	A 516 Grade 60 (1990)	Plates
C02	2	A 216 Grade WCB (1993)	Castings
		Carbon Steel Type 235LT	
C11	2	A 333 Grade 6 (1994)	Seamless pipes
C11	2	A 671 Grade CC60, CC70 (1994)	Welded pipes
C11	2	A 420 Grade WPL 6 (1996)	Wrought fittings
C11	2	A 350 Grade LF 2 (1996)	Forgings
C11	2	A 516 Grade 70 (1990)	Plates
C12	2	A 352 Grade LCC (1993)	Castings
		Carbon Steel Type 360LT	
C21	2	A 694 Grade 52 (1995)	Forgings
C21	2	A 860 WPHY 52 (1996)	Wrought fittings
C22	2	API 5L Grade X52 (1995)	Seamless pipes
		Ferritic/Austenitic Stainless Steel Type 22Cr D	Juplex
D41	2	A 790 UNS S31803 (1995)	Seamless pipes
D42	2	A 928 UNS S31803 (1994)	Welded pipes
D43	2	A 815 UNS S31803 (1996)	Wrought fittings
D44	2	A 182 Grade F51 (1996)	Forgings
D45	2	A 240 UNS S31803 (1996)	Plates
D46	2	A 890 Grade 4 (UNS J92205) (1994)	Castings
D47	2	A 276 UNS S31803 (1996)	Bars
D48	2	A 789 UNS S31803 (1994)	Tubes
		Ferritic/Austenitic Stainless Steel Type 25Cr D	Juplex
D51	2	A 790 UNS S32550 (1995)	Seamless pipes
		A 790 UNS S32750 (1995)	
		A 790 UNS S32760 (1995)	
D52	2	A 928 UNS S32550 (1994)	Welded pipes

MDS No.	Rev. No.	Standard and Grade	Products
		A 928 UNS S32750 (1994)	
D53	2	A 928 UNS S32760 (1994)	Wrought fittings
		A 815 UNS S32550 (1996)	
		A 815 UNS S32750 (1996)	
	-	A 815 UNS S32760 (1996)	
D54	2	A 182 UNS S32550 (1996)	Forgings
		A 182 Grade F53 (UNS S32750) (1996)	
DEE	0	A 182 Grade F55 (UNS S32760) (1996)	Distas
D55	2	A 240 UNS S32550 (1996) A 240 UNS S32750 (1996)	Plates
		A 240 UNS S32750 (1996)	
D56	2	A 890 UNS J93380 (1994)	Castings
000	2	A 890 UNS J93404 (1994)	Castings
D57	2	A 276 UNS S32550 (1996)	Bars
201	-	A 276 UNS S32750 (1996)	Baro
		A 276 UNS S32760 (1996)	
D58	1	A 789 UNS S32550 (1995)	Tubes
		A 789 UNS S32750 (1995)	
		A 789 UNS S32760 (1995)	
		Copper/Nickel 90/10	
K01	1	B 466 UNS C 70600 (1992)	Seaml. pipes & tubes
	·	B 467 UNS C 70600 (1988)	Welded pipes
		B 151 UNS C 70600 (1994)	Rod & bar
		B 171 UNS C 70600 (1995)	Plates & sheets
		- UNS C 70600 (1995)	Fittings
		- UNS C 70600 (1995)	Flanges
		Aluminium - Bronze Sand Castings	
K02	1	B 148 UNS C 9580 (1993)	Castings
		Nickel Alloy Type 625	
N01	2	B 366 UNS N06625 (1996)	Wrought fittings
N01	2	B 705 UNS N06625 (1995)	Pipes
N01	2	B 564 UNS N06625 (1996)	Forgings
N01	2	B 443 UNS N06625 (1993)	Plates
N01	2	B 446 UNS N06625 (1993)	Bars
N01	2	B 444 UNS N06625 (1995)	Pipes and tubes
N02	2	A 494 Grade CW-6MC (1993)	Castings
N02	2	A 494 Grade CX 2MW (1993)	
		Polymers including fibre reinforced	
D04	4		
P01	1		GRP pipes and fittings
P11	1	Hudrogenated Nitrile (HNBR)	O-ring
P12 P13	1 1	Fluorocarbon terpolymer (FKM) Fluorocarbon low T terpolymer (FKM GLT)	O-ring O ring
P13 P14	1	Nitrile	O-ring O-ring
P14 P21	1	PEEK (Poly-ether-ether-ketone)	Back-up rings and seal
	-		inserts
P22	1	PTFE (Poly-tetra-fluoro-ethylene)	Lipseals,back-up rings and seal inserts
P23	1	PEEK (Poly-ether-ether-ketone) with PTFE added	Seal inserts

Austenitic Stainless Steel Type 6Mo

R11 R12 R13 R14 R15 R16 R17 R18	2 2 2 2 2 2 2 2 2 2 2	A 312 UNS S31254 (1995) A 358 UNS S31254 (1995) A 403 UNS S31254 (1996) A 182 Grade F44 (1996) A 240 UNS S31254 (1996) A 351 Grade CK-3McuN (1994) A 276 UNS S31254 (1996) A 269 UNS S 31254 (1996)	Seamless pipes Welded pipes Wrought fittings Forgings Plates Castings Bars Tubes
		Austenitic Stainless Steel Type 316	
S01 S01 S01 S01 S01 S02 S02	2 2 2 2 2 2 2 2 2	A 312 Grade TP 316 (1995) A 358 Grade 316 (1995) A 403 Grade WP 316 (1996) A 182 Grade F 316 (1996) A 240 Grade 316 (1996) A 351 Grade CF8M (1994) A 351 Grade CF3M (1994)	Seamless & welded pipes Welded pipes Wrought fittings Forgings Plates Castings Castings
		Titanium Grade 2	
T01 T01 T01 T01 T01 T01 T01 T02	2 2 2 2 2 2 2 2 2 2 2	B 861 Grade 2 (1995) B 862 Grade 2 (1995) B 363 Grade WPT2/WPT2W (1995) B 381 Grade F2 (1995) B 265 Grade 2 (1995) B 348 Grade 2 (1995) B 338 Grade 2 (1995) B 367 Grade C2 (1993)	Seamless pipes Welded pipes Wrought fittings Forgings Plates Bars Tubes Castings
		High Strength Low Alloy Steel	
X01	1	A 519 AISI 4130 (1994) A 234 AISI 4130 (1996)	Seamless pipes Wrought fittings (seamless)
X02 X03 X04 X05 X06	2 2 1 1	A 788 AISI 4140 (1994) A 487 Grade 2B (1993) API 6A 60K (AISI 4130) (1996) A 182 F22 (1996) A 487 Grade 2B (-46 °C) (1993)	Forgings Castings Forgings Castings Castings

Note 1: The current year of issue of standards referenced is shown for guidance only. The latest year of issue shall be used unless otherwise specifically agreed.

MATERIAL DA'	FA SHEET	M	DS - C01	Rev. 2		
TYPE OF MATERIAL: Ca	Page 1 of 1					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Wrought fittings Welded pipes	ASTM A 234 API 5L ASTM A 672	WPB B CC60, CC70	- - t ≤ 19 mm: Class 12 t > 19 mm: Class 22	- - -		
Seamless pipes Forgings Plates	ASTM A 106 ASTM A 105 ASTM A 516	B - 60, 70	- - -	- -		
1. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. MANUFACTURING PROCESS	Welded pipes to AP	PI 5L: Electric resis	tance welded pipes are not	acceptable.		
2. HEAT TREATMENT	Welded pipes to AP	PI 5L: Stress relievi	ing when the nominal thick	mess t ≥ 19 mm.		
3. CHEMICAL COMPOSITION	$C \le 0.22$ %; $Si \ge 0$. CE = C + Mn/6 + 0		1.35%; $S \le 0.025$ %; $P \le 0$.030 %;		
4. TEST SAMPLING	Samples for produc component.	tion testing shall re	ealistically reflect the prope	erties in the actual		
5.DIMENSIONAL TOLERANCES	Fittings to A 234:		erence to MSS-SP-75 shall indertolerance of 0.3 mm.	have maximum		
	Flanges to A 105:	U	-SP-44 shall have a maxim of 0.3 mm for the hub at th			
6. NON DESTRUCTIVE TESTING	Pipes to API 5L:	RT of weld sear remaining weld.	n or RT at ends and US/Ed	dy Current of the		
	Fittings to A 234:	UT is not accepta	able as replacement of RT.			
7. CERTIFICATION	EN 10 204 Type 3.	1B				

MATERIAL DA	TA SHEET	MDS	5 - C02	Rev. 2			
TYPE OF MATERIAL: (Carbon Steel Type 23	5		Page 1 of 1			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Castings	ASTM A 216	WCB	-	S4, S5			
1. SCOPE	-	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. CHEMICAL COMPOSITION	$C \le 0.22$ % and $CE =$	$C + Mn/6 + 0.04 \le 0$).43 for castings with b	utt weld ends.			
3. EXTENT OF TESTING	One set of tensile test	is required for each	melt and heat treatment	t load.			
4. TEST SAMPLING	components. For castings with wei	ght 250 kg and above	stically reflect the prope e the test blocks shall be leat treated together wit	e integrally cast			
5. NON DESTRUCTIVE TESTING	 <i>Magnetic particle testing:</i> Supplementary requirement S4 shall apply to all accessible surfaces of all castings. The examination shall be carried out after fi machining. The acceptance criterias shall be ASME VIII, Div.1, Appendix 7. <i>Radiographic testing:</i> Supplementary requirement S5 shall apply to: Critical areas as per ANSI B16.34 of the pilot cast of each pattern All butt weld ends of each casting. Class 1500 psi and above; all critical areas according to ANSI B16.34 of eac casting. 						
	Ū.	ia shall be to ASME	VIII, Div. 1, Appendix	7.			
6. CERTIFICATION	EN 10 204 Type 3.1B	8.					

MATERIAL DAT	FA SHEET	M	DS - C11	Rev. 2		
<i>TYPE OF MATERIAL:</i> Ca	Page 1 of 2					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Wrought fittings Welded pipes	ASTM A 420 ASTM A 671	WPL 6 CC60, CC70	$t \le 19 \text{ mm: Class } 12$	<i>S2</i> ,S4 <i>S2</i> , <i>S7</i>		
Seamless pipes Forgings Plates	ASTM A 333 ASTM A 350 ASTM A 516	6 LF2 70	t > 19 mm: Class 22 - Class 1	S2, S7 - S7 S5		
1. SCOPE	-	n shall be added of	ons in the referred standar supersede the correspond			
2. CHEMICAL COMPOSITION	$C \le 0.22 \%; Mn = 0$ CE = C + Mn/6 + 0		0.025 %; $P \le 0.030$ %;			
3. IMPACT TESTING	Charpy V-notch testing at - 46°C is required for the thicknesses ≥ 6 mm. For flanges apply the thickness at the weld neck. The minimum absorbed energy for full size specimens shall be 27 J average and 20 J single. Reduction factors for subsize specimens shall be: 7.5mm - 5/6 and 5 mm - 2/3.					
4. EXTENT OF TESTING	<i>Fittings to A 420:</i> Supplementary requirement S2 shall apply. Impact testing shall be carried out to the same extent as tensile testing (S2).					
	<i>Pipes to A 671:</i> Supplementary requirement S2 shall apply to the same extent as tensile testing.					
	<i>Forgings to A 350:</i> One set of tensile and impact testing shall be carried out for each heat and heat treatment load. A test lot shall not exceed 2000 kg for forgings with as forged weight \leq 50 kg, and 5000 kg for forgings with as forged weight $>$ 50 kg.					
5. TEST SAMPLING	All products: Samples for production testing shall realistically reflect the properties in the actual component.					
	<i>Fittings to A 420:</i> Supplementary requirement S2 shall apply.<i>Forgings to A350:</i> Sketches shall be established showing type, size and test samples and extraction of test specimens.					
6. DIMENSIONAL TOLERANCES	<i>Fittings to A 420:</i> Fittings with reference to MSS SP-75 shall have maximum wall thickness under tolerance of 0.3 mm in accordance with standard. <i>Flanges to A 350:</i> Flanges to MSS SP-44 shall have a maximum wall thickness					

MATERIAL DA	AT'A SHEET	M	DS - C11	Rev. 2		
TYPE OF MATERIAL:	Page 2 of 2					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Wrought fittings	ASTM A 420	WPL 6	-	<i>S2</i> , <i>S</i> 4		
Welded pipes	ASTM A 671	CC60, CC70	t ≤ 19 mm: Class 12	S2, S7		
			t > 19 mm: Class 22	S2, S7		
Seamless pipes	ASTM A 333	6	-	-		
Forgings	ASTM A 350	LF2	Class 1	S7		
Plates	ASTM A 516	70		S5		
TESTING		 <i>Fittings to A 420:</i> Ultrasonic testing is not acceptable as replacement of radiographic testing. Supplementary requirement S4, magnetic particle testing, shall apply to 10 % of all fittings (same test lot as defined for mechanical testing) for nominal thicknesses < 12.7mm and 100 % of all fittings for nominal thicknesses ≥ 12.7 mm. The testing shall be carried out after calibration. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 6. <i>Forgings to A 350:</i>Supplementary Requirement S7.1, magnetic particle testing shall apply to 10 % of all forgings (same test lot as defined for mechanical testing) with NPS > 2. The testing shall be carried out after final machining. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 6. 				
8. REPAIR OF DEFECTS	<u>^</u>	se material is not a	•			
9. MARKING		Heat treatment load number shall be permanently marked on the component where testing is required per. heat treatment load.				
10. CERTIFICATION	EN 10 204 Type should be stated i		nt temperature, soaking tim	e and cooling medium		

MATERIAL DA	IA SHEET	MD	S - C12	Rev. 2		
<i>TYPE OF MATERIAL:</i> C	arbon Steel Type 23	5LT		Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Castings	ASTM A 352	LCC	-	S4, S5		
1. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. CHEMICAL COMPOSITION	$C \le 0.22 \%$; $S \le 0.02$	25 %; $P \le 0.030$ %;	;			
	CE = C + Mn/6 + (CI)	x+Mo+V)/5 + (Cu+	$-Ni)/15 \le 0.43$			
3. IMPACT TESTING	The minimum absorb single.	ed energy for full	size specimens shall be 27	7 J average and 20 J		
4. EXTENT OF TESTING	One set of tensile and	l impact test is requ	uired for each melt and he	at treatment load.		
	A test lot shall not ex	ceed 5 000 kg.				
	components as heat the components the large	amples for mechanical testing shall realistically reflect the properties in the actual omponents. Thickness of the test block shall be equal to the thickness of the actual omponents as heat treated up to a maximum thickness of 100 mm. For flanged omponents the largest flange thickness apply. est specimens shall be cut from the 1/4 T location from the surface where T is the islange of the test block.				
	Test block shall be integrally cast or gated onto the castings and shall not be removed from the castings until after the final quality heat treatment.					
6. NON DESTRUCTIVE TESTING	<i>Magnetic Particle testing:</i> Supplementary requirement S4 shall apply to all accessible surfaces of all castings. The testing shall be carried out after final machining. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 7.					
	 Critical areas as per All butt weld ends c Class 1500 psi and a 	ANSI B16.34 of t of each casting. above; all critical a	equirement S5 shall apply he pilot cast of each patte reas to ANSI B16.34 of e IE VIII, Div. 1, Appendix	rn ach casting.		
7. REPAIR OF DEFECTS.	A cast plate shall be	used in the qualific	ation of the repair weldin	g procedure.		
8. MARKING	The component shall lot.	be marked to ensu	re full traceability to melt	and heat treatment		
9. CERTIFICATION	EN 10 204 Type 3.1E shall be stated in the		emperature, soaking time	and cooling medium		

MATERIAL DA	TA SHEET	C M	IDS - C21	Rev. 2		
TYPE OF MATERIAL: C	arbon Steel Type	360LT		Page 1 of 2		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Wrought fittings Forgings	ASTM A 860 ASTM A 694	WPHY 52 F52	Seamless and welded			
1. SCOPE	▲ ▲	•	ons in the referred standard a supersede the corresponding			
2. CHEMICAL COMPOSITION	Ti ≤0.05 %; Nb ≤ 0	0.04% ; Al $\le 0.06 \%$	$0.10-0.50$ %; S ≤ 0.025 %; P %; N ≤ 0.015 %; V+Nb+Ti \leq +Mo+V)/5 + (Cu+Ni)/15 ≤ 0.000	0.10 %;		
3. IMPACT TESTING	thicknesses $\geq 6 \text{ mm}$	n. The minimum at	ASTM A 370 at - 46 °C is re- psorbed energy for full size spectrons for subsize specimens s	pecimen shall be 40 J		
4. EXTENT OF TESTING	Forgings to A 694: One set of tensile and impact testing shall be carried ou for each heat and heat treatment load. A test lot shall not exceed 2000 kg for forgings with as forged weigth \leq 50 kg, and 5000 kg for forgings with as forged weigth > 50 kg.					
5. TEST SAMPLING						
6. WELDING		The WPQ shall be 288-3.	qualified in accordance with	ASME IX or EN		
7. DIMENSIONAL TOLERANCES	Flanges to A 694:	 860: Fittings with reference to MSS-SP-75 shall have maximum wall thickness under tolerance of 0.3 mm. 694: Flanges to MSS-SP-44 shall have a maximum wall thickness under tolerance of 0.3 mm for the hub at the welding end. 				
8. NON DESTRUCTIVE TESTING	Fittings to A 860: Forgings to A 694:	Supplementary rec to 10 % of all fittin testing) for nomina for nominal thickn after calibration. 10 % of all forging mechanical testing ASME V Article 7	quirement S4, magnetic particle ngs (same test lot as defined a al thicknesses < 12.7 mm and lesses \geq 12.7 mm. The testing gs with NPS > 2 (same test lot g) shall be magnetic particle t 7. The testing shall be carried	cle testing, shall appl for mechanical 1 100 % of all fittings g shall be carried out ot as defiend for esting according to		
		machining. The acceptance cr	iteria shall be to ASME VIII	Div 1 Appendix 6		

MATERIAL DA	TA SHEET	MD	S - C21	Rev. 2
TYPE OF MATERIAL: C	arbon Steel Type 36	OLT		Page 2 of 2
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.
Wrought fittings Forgings		WPHY 52 F52	Seamless and welded -	
9. REPAIR OF DEFECTS	Weld repair of base m	aterial is not accept	able.	
10. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.			
	EN 10 204 Type 3.1B should be stated in the		nperature, soaking time ar	d cooling medium

MATERIAL DA	Rev. 2					
TYPE OF MATERIAL: C	Page 1 of 1					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Seamless pipes	API 5L	X52	-	SR 4.3		
1. SCOPE	-		ions in the referred stand r supersede the correspo	dard and additional onding requirements in the		
2. STEEL MAKING	Fine grain treatment	t shall be carried	out.			
3. HEAT TREATMENT/ DELIVERY CONDITION	Normalised or Quer	nched and Tempe	ered.			
4. CHEMICAL COMPOSITION	$ \begin{array}{l} C \leq 0.16 \ \%; \ Mn = 0.90 - 1.60 \ \%; \ Si = 0.10 - 0.50 \ \%; \ S \leq 0.025 \ \%; \ P \leq 0.035 \ \%; \ Ti \leq 0.05 \ \%; \ Nb \leq 0.04 \ \%; \ Al \leq 0.06 \ \%; \ N \leq 0.015 \ \%; \ V + Nb + Ti \leq 0.10 \ \%; \ V + Nb \leq 0.07 \ \%; \ CE \\ = C + Mn/6 + (Cr + Mo + V)/5 + (Cu + Ni)/15 \leq 0.43 \end{array} $					
5. IMPACT TESTING	Charpy V-notch testing according to ASTM A 370 at - 46 °C is required for the thicknesses ≥ 6 mm. The minimum absorbed energy for full size specimens shall be 40 J average and 30 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.					
6. TEST SAMPLING	Samples for production testing shall realistically reflect the properties in the actual component.					
7. NON DESTRUCTIVE TESTING	Supplementary requirement SR 4.3 with notch calibration of 5 % of the nominal wall thickness shall apply for all thicknesses.					
8. SURFACE FINISH	The surface finish shall comply with ASTM A 106 para. 18.3.2.					
9. REPAIR OF DEFECTS	Weld repair is not a	cceptable.				
10. CERTIFICATION	EN 10 204 Type 3.1	В				

MATERIAL DA	TA SHEET	' N	IDS - D41	Rev. 2		
<i>TYPE OF MATERIAL:</i> F	erritic / Austenitic	Stainless Steel,	Type 22Cr duplex	Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Seamless pipes	ASTM A 790	UNS S 31803	-	-		
1. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. QUALIFICATION	Manufacturers of p. Standard M-650.	roduct to this MD	OS shall comply with the	e requirement of NORSOK		
3. STEEL MAKING	The steel melt shall	be refined with A	AOD or equivalent.			
4. CHEMICAL COMPOSITION	N = 0.14 - 0.20 %					
5. HARDNESS	The hardness shall	be maximum 28 I	HRC or alternatively 27	1 HB or 290 HV10.		
6. IMPACT TESTING	Charpy V-notch testing (3 specimens) according to ASTM A 370 at - 46 °C is required for the thicknesses \geq 6 mm. The minimum absorbed energy shall be 45 J average / 35 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.					
7. MICROGRAPHIC EXAMINATION	The micrographic examination shall cover the near surfaces and mid-thickness region of the pipe. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35-55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.					
8. EXTENT OF TESTING		ned in the referred	l standard. For batch fui	e testing shall be carried out mace charges the specified		
9. TEST SAMPLING	Samples for produc components.	ction testing shall	realistically reflect the	properties in the actual		
10. SURFACE FINISH	White pickled.					
11. REPAIR OF DEFECTS	Weld repair is not acceptable.					
12. MARKING	The component sha lot.	Ill be marked to en	nsure full traceability to	melt and heat treatment		
13. CERTIFICATION	EN 10 204 Type 3. should be stated in		nt temperature, soaking	time and cooling medium		

MATERIAL DA	TA SHEET	Ν	IDS - D42	Rev. 2			
<i>TYPE OF MATERIAL:</i> F	erritic/Austenitic S	tainless Steel, T	ype 22Cr duplex	Page 1 of 2			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Welded pipes	ASTM A 928	UNS S31803	Class 1, 3 and 5	S3			
1. SCOPE	-	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. QUALIFICATION	Manufacturers of pr standard M-650.	oduct to this MD	S shall comply with the	e requirement of NORSOK			
3. STEEL MAKING	The steel melt shall	be refined with A	AOD or equivalent.				
4. HEAT TREATMENT	The pipes shall be s	olution annealed	followed by water quer	iching.			
5. CHEMICAL COMPOSITION	N = 0.14 - 0.20 %						
6. TENSILE TESTING	Base material prope	erties: $R_{p0.2} \ge 450$	MPa; $R_m \ge 620$ MPa; A	$A \ge 25 \%$.			
7. HARDNESS	The hardness shall b material, HAZ and		HRC or alternatively 27	1 HB or 290 HV10 for base			
8. IMPACT TESTING	Charpy V-notch testing according to ASTM A 370 at - 46 °C is required for the thicknesses ≥ 6 mm. The minimum absorbed energy shall be 45 J average and 35 J single. Two sets, each 3 specimen, shall be carried out with notch located in weld metal and fusion line, respectively. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.						
9. MICROGRAPHIC EXAMINATION	The micrographic examination shall cover the near surfaces and mid-thickness region of the pipe including the weld zone. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35-55 % for base material and 25-60 % for weld metal. The microstructure, as examined at 400 X magnification on a						
10. EXTENT OF TESTING	 suitably etched specimen, shall be free from intermetallic phases and precipitates. Tensile test, impact test, hardness test and microstructure examination shall be carried out for each lot. The lot is defined as follows: For batch furnace a lot is defined as maximum 60 m of pipe of the same heat, size and heat treatment charge. For continuous heat treatment furnace the lot definition in para 8.1 of the ASTM 						
11. TEST SAMPLING	standard apply Samples for product components.	tion testing shall	realistically reflect the p	properties in the actual			
12. WELDING	The PQR/WPAR shall be qualified in accordance with ASME IX or EN 288-3 and shall include the same examinations as for the production testing. The qualification shall be carried out on the same material grade (UNS number) as used in production. Change of specific make (brand name) of welding consumables requires requalification.						
13. TOLERANCES	The pipes shall have	e a max. undertol	erance of 0.3 mm.				
14. NON DESTRUCTIVE TESTING	Eddy current testing radiography for wal	· •	-	e as replacement for spot			
	apply to the weld ar testing) delivered. T	rea of 10 % of the The testing shall b	etrant testing, according e pipes (same test lot as be carried out after calib E VIII, Div. 1 Appendix	ration and pickling.			

MATERIAL DA	ATA SHEET	ΓN	IDS - D42	Rev. 2		
TYPE OF MATERIAL:	Page 2 of 2					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Welded pipes	ASTM A 928	UNS S31803	Class 1, 3 and 5	S3		
15. SURFACE FINISH	White pickled.					
16. REPAIR OF DEFECTS	•	Weld repair of base material is not acceptable. For repair of welds the same requirements to PQR/WPAR shall apply as for production welding.				
17. MARKING	The componenet shall be marked to ensure full traceability to melt and heat treatment lot.					
18. CERTIFICATION	• -	EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.				

MATERIAL DA	TA SHEET	N	DS - D43	Rev. 2			
<i>TYPE OF MATERIAL:</i> F	erritic / Austenitic	Stainless Steel, '	Type 22Cr duplex	Page 1 of 2			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Wrought fittings	ASTM A 815	UNS S 31803	WP-W, WP-S or WP-WX	S7			
1. SCOPE	·	•	ons in the referred standard an supersede the corresponding				
2. QUALIFICATION	Manufacturers of pr Standard M-650.	Anufacturers of product to this MDS shall comply with the requirement of NORSOK tandard M-650.					
3. STEEL MAKING	The steel melt shall	be refined with A	OD or equivalent.				
4. HEAT TREATMENT	The fittings shall be	solution anneale	d followed by water quenching				
5. CHEMICAL COMPOSITION	N = 0.14 - 0.20 %						
6. HARDNESS	The hardness shall b material, HAZ and y		IRC or alternatively 271 HB o	r 290 HV10 for base			
7. IMPACT TESTING	Charpy V-notch testing according to ASTM A 370 at - 46 °C is required for the thicknesses ≥ 6 mm. The minimum absorbed energy shall be 45 J average and 35 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3 The notch location and number of specimen shall be:						
	Seamless fittings: C	One set, 3 specime	en.				
	Welded fittings:	Two sets, each 3	specimen, located in weld meta	al and fusion line.			
8. MICROGRAPHIC EXAMINATION	The micrographic examination shall cover the near surfaces and mid-thickness region of the fittings including the weld zone. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 - 55 % for base materia and 25 - 60 % for weld metal. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.						
9. EXTENT OF TESTING		eat treatment load	and microstructure examinati within a wall thickness range				
10. TEST SAMPLING	Samples for product components.	tion testing shall	realistically reflect the propert	ies in the actual			
11. WELDING	The PQR/WPAR shall be qualified in accordance with ASME IX or EN 288-3 and shall include the same examinations as for the production testing. The qualification shall be carried out on the same material grade (UNS number) as used in production. Change of specific make of welding consumables requires requalification.						
12. DIMENSIONAL TOLERANCES	_	Fitting with reference to MSS-SP-75 shall have maximum wall thickness under tolerance of 0.3 mm.					
13. NON DESTRUCTIVE TESTING	seamless (from the t 2. The testing shall	test lot as defined be carried out aft	d penetrant testing, shall apply above) and 100 % of welded er calibration and pickling. For e acceptance criteria shall be A	fittings above NPS r welded fittings the			

MATERIAL DA	TA SHEET	' N	1DS - D43	Rev. 2	
<i>TYPE OF MATERIAL:</i> F	Page 2 of 2				
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Wrought fittings	ASTM A 815	UNS S31803	WP-W, WP-S or WP-WX	S7	
14. SURFACE FINISH	White pickled. Mac	chined surfaces do	o not require pickling.		
15. REPAIR OF DEFECTS	Weld repair of base material is not acceptable. For repair of welds the same requirements to PQR/WPAR shall apply as for production welding.				
16. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.				
17. CERTIFICATION	EN 10 204 Type 3. should be stated in		nt temperature, soaking time an	nd cooling medium	

MATERIAL DA	TA SHEET	N	DS - D44	Rev. 2		
<i>TYPE OF MATERIAL:</i> F	erritic / Austenitic	Stainless Steel, '	Type 22Cr duplex	Page 1 of 2		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Forgings	ASTM A 182	F51	-	S5		
1. SCOPE			ons in the referred standar supersede the correspond			
2. QUALIFICATION	Manufacturers of pr Standard M-650.	roduct to this MD	S shall comply with the re	equirement of NORSOK		
3. STEEL MAKING	The steel melt shall	be refined with A	OD or equivalent.			
4. MANUFACTURING PROCESS	The Hot Isostatic Pr	ressed (HIP) proc	ess is an acceptable altern	ative to forging.		
5. HEAT TREATMENT	The forgings shall b	e solution anneal	ed followed by water que	nching.		
6. CHEMICAL COMPOSITION	N = 0.14 - 0.20 %					
7. HARDNESS	The hardness shall b	be less than 28 Hl	RC (or alternatively 271 H	IB or 290 HV10).		
8. IMPACT TESTING	Charpy V-notch testing according to ASTM A 370 at - 46 °C is required for the thicknesses ≥ 6 mm (thickness at the weld neck). The minimum absorbed energy shall satisfy 45 J average and 35 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.					
9. MICROGRAPHIC EXAMINATION	The micrographic examination shall be carried out at the same area as location of specimens for mechanical. The area shall be minimum 10 x 10 mm. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 - 55%. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.					
10. EXTENT OF TESTING	One set of impact test, tensile test, hardness test and microstructure examination shall be carried out for each heat and heat treatment load. A test lot shall not exceed 2000 kg for forgings with as forged weight \leq 50 kg, and 5000 kg for forgings with as forged weight $>$ 50 kg.					
11. TEST SAMPLING	Samples for product components.	tion testing shall	realistically reflect the pro	operties in the actual		
Test samples shall be from prolongations on actual component. Sacrificial forgi shall be used for die forged components. However, special agreements may be r die forged components with as forged weight exceeding 50 kg. Integrated test be shall be used for HIP.						
	Test specimens shall be cut at the 1/4 T location from the surface where T is the thickness of the test samples as heat treated. Sketches shall be established showing type, size and location of test samples and extraction of test specimens.					
12. DIMENSIONAL TOLERANCES	Flanges to MSS SP- for the hub at the we		ximum wall thickness und	ler tolerance of 0.3 mm		

MATERIAL D	ATA SHEET	ΓΝ	IDS - D44	Rev. 2			
TYPE OF MATERIAL:	Ferritic / Austenitic	stainless Steel,	Type 22Cr duplex	Page 2 of 2			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Forgings	ASTM A 182	F51	-	S5			
13. NON DESTRUCTIVE TESTING	(from the lot as def carried out after fin	Supplementary requirement S5, liquid penetrant testing, shall apply to 10 % of forgings (from the lot as defined for mechinical testing) above NPS 2. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 8.					
14. SURFACE FINISH	White pickled. Ma	White pickled. Machined surfaces do not require pickling.					
15. REPAIR OF DEFECTS	Weld repair is not	acceptable.					
16. MARKING	The component shalot.	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
17. CERTIFICATION	EN 10 204 Type 3 should be stated in		nt temperature, soaking tin	ne and cooling medium			

MATERIAL DA	TA SHEET	Ν	IDS - D45	Rev. 2		
<i>TYPE OF MATERIAL:</i> F	erritic / Austenitic	Stainless Steel,	Type 22Cr duplex	Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Plates	ASTM A 240	UNS S 31803	-	-		
1. SCOPE		•	ons in the referred standard and and supersede the corresponding			
2. QUALIFICATION	Manufacturers of pr Standard M-650.	oduct to this MD	S shall comply with the requi	rement of NORSOK		
3. STEEL MAKING	The steel melt shall	be refined with A	AOD or equivalent.			
4. HEAT TREATMENT	The plates shall be s	solution annealed	followed by water quenching	ŗ.		
5. CHEMICAL COMPOSITION	N = 0.14 - 0.20 %					
6. HARDNESS	The hardness shall b	oe maximum 28 H	HRC or alternatively 271 HB	or 290 HV10.		
7. IMPACT TESTING	Charpy V-notch testing according to ASTM A 370 at - 46 °C is required for the thicknesses ≥ 6 mm. The minimum absorbed energy shall satisfy 45 J average and 35 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.					
8. MICROGRAPHIC EXAMINATION	The micrographic examination shall cover the near surface and mid-thickness region. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 -55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.					
9. EXTENT OF TESTING	Impact test, tensile test, hardness test and micrographic examination shall be carried out for each heat, size and heat treatment load.					
10. TEST SAMPLING	Samples for production testing shall realistically reflect the properties in the actual components.					
11. SURFACE FINISH	White pickled.					
13. REPAIR OF DEFECTS	Weld repair is not acceptable.					
14. MARKING	The component shall lot.	The component shall be marked to ensure full traceability to melt and heat treatment				
15. CERTIFICATION	EN 10 204 Type 3.1 should be stated in t		nt temperature, soaking time a	nd cooling medium		

MATERIAL D	ATA SHEET	Ν	IDS - D46	Rev. 2			
TYPE OF MATERIAL:	Ferritic / Austenitic	Stainless Steel,	Type 22Cr duplex	Page 1 of 2			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Castings	ASTM A 890	4 (UNS J9225)) -	S2, S3, S33			
1. SCOPE	-	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. QUALIFICATION	Manufacturers of pr standard M-650.	roduct to this MD	DS shall comply with the re	equirement of NORSOK			
3. STEEL MAKING	The steel melt shall	be with AOD or	equivalent refining.				
4. HEAT TREATMENT	The castings shall b	e solution anneal	led followed by water que	nching.			
5. CHEMICAL COMPOSITIC	PN = 0.14 - 0.20 %						
6. HARDNESS	The hardness shall l	be maximum 28 l	HRC or alternatively 271 I	HB or 290 HV10.			
7. IMPACT TESTING	A •	v	ccording to ASTM A 370 rerage and 35 J single.	at - 46 °C. The minimum			
8. MICROGRAPHIC EXAMINATION	The micrographic examination shall be carried out at the same area as location of specimens for mechanical testing. The area shall be minimum 10 x 10 mm. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 -55 %. The microstructure, as examined at 200 X and 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.						
9. EXTENT OF TESTING			crostructure examinations lot shall not exceed 5 000				
10. TEST SAMPLING	components. Thickn components up to a	heat and heat treatment load. A test lot shall not exceed 5 000 kg. Samples for mechanical testing shall realistically reflect the properties in the actual components. Thickness of the test block shall be equal to the thickness of the actual components up to a maximum thickness of 100 mm. For flanged components the largest flange thickness shall apply.					
	thickness of the test		1/+ 1 location from the su	frace where T is the			
			gated onto the castings an quality heat treatment.	d shall not be removed			
12. NON DESTRUCTIVE TESTING	<i>Liquid penetrant testing:</i> Supplementary requirement S3 shall apply to all accessible surfaces of all castings. The examination shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 7.						
	- Critical areas as pe - All butt weld ends	 <i>Radiographic testing:</i> Supplementary requirement S2 shall apply to: Critical areas as per ANSI B16.34 of the pilot cast of each pattern. All butt weld ends of each casting Class 1500 psi and above; all critical areas to ANSI B16.34 of each casting 					
	The acceptance crit	eria shall be to A	SME VIII, Div. 1 Append	ix 7.			

MATERIAL D	ATA SHEET	r M	[DS - D46	Rev. 2	
TYPE OF MATERIAL:	Page 2 of 2				
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Castings	ASTM A 890	4 (UNS J9225)	-	S2, S3, S33	
13. SURFACE FINISH	White pickled. Mad	chined surfaces do	not require pickling.		
<i>14. REPAIR OF DEFECTS</i>	 Supplementary requirement S33 shall apply. The repair welding procedure qualification shall include the following: qualified on a cast plate of the same grade (UNS-number) which shall be welded change of specific make of filler metal (brand name) requires re-qualification examination of microstructure of base material and weld zone. The ferrite content shall be 35-55 % for the base material and 25-60 % for the weld metal. Charpy V-notch testing as specified above, with two sets each 3 specimens, with notch located in weld metal and fusion line, respectively. 				
15. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.				
16. CERTIFICATION	EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.				

MATERIAL DA	TA SHEET	\mathbf{N}	DS - D47	Rev. 2	
TYPE OF MATERIAL: H	Ferritic / Austenitic	Stainless Steel,	Type 22Cr duplex	Page 1 of 1	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Bars	ASTM A 276	UNS S 31803	-	-	
I. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.				
2. QUALIFICATION	Manufacturers of pr Standard M-650.	oduct to this MD	S shall comply with the req	uirement of NORSOK	
3. STEEL MAKING	The steel melt shall	be refined with A	AOD or equivalent.		
4. HEAT TREATMENT	The bars shall be so	lution annealed f	ollowed by water quenchin	g.	
5. CHEMICAL COMPOSITION	N = 0.14 - 0.20 %				
6. HARDNESS	The hardness shall be maximum 28 HRC or alternatively 271 HB or 290 HV10.				
7. IMPACT TESTING	Charpy V-notch testing is required according to ASTM A 370 at - 46 °C. The minimum absorbed energy shall satisfy 45 J average and 35 J single.				
8. MICROGRAPHIC EXAMINATION	The micrographic examination shall be carried out at the same area as location of speciemns for mechanical testing. The area shall be minimum 10 x 10 mm. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 - 55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.				
9. EXTENT OF TESTING	Impact test, hardness test and micrographic examination shall be carried out to the same extent as tensile test.				
10. TEST SAMPLING	Samples for production testing shall realistically reflect the properties in the actual components.				
11. SURFACE FINISH	White pickled. Machined surfaces do not require pickling.				
12. REPAIR OF DEFECTS	Weld repair is not acceptable.				
13. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.				
14. CERTIFICATION	EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.				

MATERIAL D	ATA SHEET	MI	S - D48	Rev. 2		
TYPE OF MATERIAL:	Ferritic / Austenitic	Stainless Steel, Typ	e 22Cr duplex	Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Tubes	ASTM A 789	UNS S 31803	-	-		
1. SCOPE	requirements which	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.				
2. QUALIFICATION		Manufacturers of product to this MDS shall comply with the requirement of NORSOK Standard M-650.				
3. STEEL MAKING	The steel melt shall	be refined with AOD	or equivalent.			
4. HEAT TREATMENT	The tubes shall be so	olution annealed follo	owed by water quenching	y.		
5. CHEMICAL COMPOSITIO	$p_N N = 0.14 - 0.20 \%$					
6. HARDNESS	The hardness shall b	The hardness shall be maximum 28 HRC or alternatively 271 HB or 290 HV10.				
7. IMPACT TESTING	Charpy V-notch testing (3 specimens) according to ASTM A 370 at - 46 °C is required for the thicknesses \geq 6 mm. The minimum absorbed energy shall be 45 J average / 35 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.					
8. MICROGRAPHIC EXAMINATION	The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35-55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.					
9. EXTENT OF TESTING	Microstructure, hardness and tensile testing shall be carried out for each lot as defined in the referred standard.					
10. TEST SAMPLING	Samples for production testing shall realistically reflect the properties in the actual components.					
11. SURFACE FINISH	White pickled.					
12. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
13. CERTIFICATION	EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.					

MATERIAL DA	TA SHEET	MD	S - D51	Rev. 2	
TYPE OF MATERIAL: Ferritic / Austenitic Stainless Steel, Type 25Cr duplexPage 1 of 2					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Seamless pipes	ASTM A 790	UNS S 32550 UNS S 32750 UNS S 32760	-	-	
I. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard. This MDS is based on the mechanical properties of UNS S 32750 which is the only Type 25 Cr duplex listed in ASME B31.3.				
2. QUALIFICATION	Manufacturers of proc NORSOK Standard M		all comply with the requ	irement of	
3. STEEL MAKING	The steel melt shall be	e refined with AOD	or equivalent.		
4. HEAT TREATMENT	The pipes shall be sol	ution annealed follo	wed by water quenching	g.	
5. CHEMICAL COMPOSITION	$\frac{1}{PRE} (\% Cr + 3.3 \% Mo + 16 \% N) \ge 40.0$				
6. TENSILE TESTING	$R_{p0.2} \ge 550 \text{ MPa}; R_m$	≥ 800 MPa;			
7. HARDNESS	The harness shall be max. 32 HRC (or alternatively 301 HB or 330 HV 10).				
8. IMPACT TESTING	Charpy V-notch testing (3 specimen) according to ASTM A 370 at - 46 °C is required for thicknesses \geq 6 mm. The minimum absorbed energy shall be 45 J average / 35 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.				
9. CORROSION TEST	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The specimen shall have the internal and external surfaces in the as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G 48, and the whole specimen shall be pickled (20 % $HNO_3 + 5$ % HF, 60 °C, 5 minute). The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. The acceptance criteria are: - No pitting 20 X magnification.				
	- The weight loss shall be less than 4.0 g/m^2 .				
10. MICROGRAPHIC EXAMINATION	The micrographic examination shall cover the near surfaces and mid-thickness region of the pipe. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35-55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.				
11. EXTENT OF TESTING	Charpy V-notch impact, microstructure, hardness, corrosion and tensile testing shall be carried out for each lot as defined in the referred standard. For batch furnace charges the specified tests shall be carried out for each heat treatment charge.				

MATERIAL D	ATA SHEET	Г MD	DS - D51	Rev. 2	
TYPE OF MATERIAL:	Page 2 of 2				
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Seamless pipes	ASTM A 790	UNS S 32550 UNS S 32750 UNS S 32760	-	-	
12. TEST SAMPLING	Samples for production testing shall realistically reflect the properties in the actual components.				
13. SURFACE FINISH	White pickled.				
14. REPAIR OF DEFECTS	Weld repair is not acceptable.				
15. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.				
15. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.				
16. CERTIFICATION	EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.				

MATERIAL DA	TA SHEET	ME	DS - D52	Rev. 2	
TYPE OF MATERIAL: Ferritic / Austenitic Stainless Steel, Type 25Cr duplex Page 1 of 2					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Welded pipes	ASTM A 928	UNS S 32550 UNS S 32750 UNS S 32760	Class 1, 3 and 5	-	
1. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard. This MDS is based on the mechanical properties of UNS S 32750 which is the only Type 25 Cr dupøex listed in ASME B31.3.				
2. QUALIFICATION	Manufacturers of pro NORSOK Standard M		hall comply with the re	equirement of	
3. STEEL MAKING	The steel melt shall b	e refined with AOI	D or equivalent.		
4. HEAT TREATMENT	The pipes shall be so	lution annealed foll	lowed by water quench	ing.	
5. CHEMICAL COMPOSITION	^V PRE (% Cr + 3.3 % N	$(40 + 16 \% N) \ge 40$.0		
6. TENSILE TESTING	$R_{p0.2} \ge 550 \text{ MPa}; R_m$	≥ 795 MPa; A ≥ 15	5 %		
7. HARDNESS		The hardness shall be maximum 32 HRC (or alternatively 301 HB or 330 HV10) for base material, HAZ and weld metal.			
8. IMPACT TESTING	Charpy V-notch testing according to ASTM A 370 at - 46 °C is required for thicknesses ≥ 6 mm. The minimum absorbed energy shall be 45 J average / 35 J single. Two sets, each 3 specimens, shall be carried out with notch located in weld meal and fusion line, respectively. Reduction factors for subsize specimens shall be 7.5 mm - 5/6 and 5 mm - 2/3.				
9. CORROSION TEST	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The specimen shall have the interna and external surfaces in the as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G48, and the whole specimen shall be picklet (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The test shall expose the external and internal surfaces and a cross section surface including weld zone in full wall thickness. The acceptance criteria are: - No pitting at 20 X magnification				
	- The weight loss shall be less than 4.0 g/m^2				
10. MICROGRAPHIC EXAMINATION	 The weight loss shall be less than 4.0 g/m The micrographic examination shall cover the near surfaces and mid-thickness region of the pipe including the weld and heat affected zone. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35-55 % for base material and 25-60 % for weld metal. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates. 				
11. EXTENT OF TESTING	 out for each lot. The for batch furnace and heat treatment 	lot is defined as fol a lot is defined as 1 t charge.	l microstructure examir lows: maximum 60 m of pipe ce the lot definition in	of the same heat, size	
	standard apply.			para 0.1 of the ASTM	

MATERIAL D	ATA SHEE	Г МІ	DS - D52	Rev. 2		
<i>TYPE OF MATERIAL:</i> F	Page 2 of 2					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Welded pipes	ASTM A 928	UNS S 32550 UNS S 32750 UNS S 32760	Class 1, 3 and 5	-		
12. TEST SAMPLING	Samples for produce components.	Samples for production testing shall realistically reflect the properties in the actual components.				
13. WELDING	The PQR/WPAR shall be qualified in accordance with ASME IX or EN 288-3 and shall include the same examinations as for the production testing. The qualification shall be carried out on the same material grade (UNS number) as used in production. Change of specific make (brand name) of welding consumables requires requalification.					
14. TOLERANCES	The pipes shall have a max. undertolerance of 0.3 mm.					
15. NON DESTRUCTIVE TESTING	Eddy current testing according to ASTM A 450 is acceptable as replacement for spot radiography for wall thicknesses less than 4.0 mm.					
	Supplementary requirement S3, penetrant testing, according to ASME V A shall apply to the weld of 10 % of the pipes (same test lot as defined for me testing) delivered. The testing shall be carried out after calibration and pick Acceptance criteria shall be to ASME VIII, Div 1, Appendix 8.					
16. SURFACE FINISH	White pickled.					
17. REPAIR OF DEFECTS	Weld repair of base material is not acceptable. For repair of welds the same requirements to PQR/WPAR shall apply as for production welding.					
18. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
19. CERTIFICATION	EN 10 204 Type 31.B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.					

MATERIAL D	ATA SHEF	ET. I	MDS - D53	Rev. 2	
TYPE OF MATERIAL: F	Ferritic / Austenitic	Stainless Steel, Typ	e 25Cr duplex	Page 1 of 2	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Wrought fittings	ASTM A 815	UNS S 32550 UNS S 32750 UNS S 32760	WP-S, WP-WX and W	'P-W S7	
I. SCOPE	•	ich shall be added o	ions in the referred stands or supersede the correspon		
2. QUALIFICATION	Manufacturers of NORSOK Stand		DS shall comply with the	requirement of	
3. STEEL MAKING	The steel melt sh	all be refined with	AOD or equivalent.		
4. HEAT TREATMENT	Solution annealing	ng followed by wate	er quenching.		
5. CHEMICAL COMPOSITION	PRE (% Cr + 3.3	% Mo + 16 % N)≥	≥ 40.0		
6. TENSILE TESTING	Base material pro	operties: $R_{p0.2} \ge 55$	0 MPa; R _m ≥ 800 MPa;		
7. HARDNESS	The hardness shall be maximum 32 HRC (or alternatively 301 HB or 330 HV10) for base material, HAZ and weld metal.				
8. IMPACT TESTING	thicknesses ≥ 6 r single. Reduction The notch location	nm. The minimum a		45 J average / 35 J	
	Welded fittings:	-	3 specimen) located in w	eld metal and fusion	
9. CORROSION TEST	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The specimen shall have the internal and external surfaces in the as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G 48, and the whole specimen shall be pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The test shall expose the external and internal surfaces and a cross section including weld zone (if relevant) in full wall thickness. The acceptance criteria are:				
	- No pitting at 2	20 X magnification.			
	- The weight lo	ss shall be less than	$a 4.0 \text{ g/m}^2$.		
10. MICROGRAPHIC EXAMINATION	The micrographic examination shall cover the near surfaces and mid-thickness region. For welded fittings both the weld and the base material is required examined. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35-55 % for base material and 25-60 % for weld metal. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.				
11. EXTENT OF TESTING	examination shall	l be carried out for	ness testing, corrosion tes each heat and heat treatm with the same WPS.	-	

MATERIAL D	ATA SHE	ET N	IDS - D53	Rev. 2		
TYPE OF MATERIAL: I	Ferritic / Austenitic	Stainless Steel, Type	25Cr duplex	Page 2 of 2		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Wrought fittings	ASTM A 815	UNS S 32550 UNS S 32750 UNS S 32760	WP-S, WP-WX and WP-W	S7		
12. TEST SAMPLING	Samples for proc	luction testing shall	realistically reflect the proper	ties in the actual		
13. WELDING	shall include the shall be carried of	The PQR/WPAR shall be qualified in accordance with ASME IX or EN 288-3 and shall include the same examinations as for the production testing. The qualification shall be carried out on the same material grade (UNS number) as used in production. Change of specific make (brand name) of welding consumables requires requires				
14. DIMENSIONAL TOLERANCES	Fittings with refe tolerance of 0.3	Fittings with reference to MSS-SP-75 shall have maximum wall thickness under tolerance of 0.3 mm.				
15. NON DESTRUCTIVE TESTING	seamless (from t 2. The examination fittings the examination	Supplementary requirements S7, liquid penetrant examination, shall apply to 10 % of seamless (from the test lot as defined above) and 100 % of welded fittings above NPS 2. The examination shall be carried out after calibration and pickling. For welded fittings the examination shall cover the weld only. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 8.				
16. SURFACE FINISH	White pickled.					
17. REPAIR OF DEFECTS	-	Weld repair of base material is not acceptable. For repair of welds the same requirements to PQR/WPAR shall apply as for production welding.				
18. MARKING	The component s lot.	The component shall be marked to ensure full traceability to melt and heat treatment				
19. CERTIFICATION		3.1B. Heat treatmen in the certificate.	t temperature, soaking time a	nd cooling medium		

MATERIAL D	ATA SHEE	T MD	S - D54	Rev. 2
TYPE OF MATERIAL	Ferritic/Austenitio	c Stainless Steel, Type	25Cr duplex	Page 1 of 2
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.
Forgings	ASTM A 182	- UNS S 32550 F53 - UNS S 32750 F55 - UNS S 32760	-	S5
1. SCOPE	requirements which the referred standa	es the selected options in ch shall be added or supe ard. This MDS is based o e only Type 25 Cr duple	ersede the correspondin on the mechanical prop	g requirements in erties of UNS S
2. QUALIFICATION	Manufacturers of NORSOK Standar	product to this MDS sha rd M-650.	ll comply with the requ	irement of
3. STEEL MAKING	The steel melt sha	Ill be refined with AOD	or equivalent.	
4. MANUFACTURING PROCESS	The Hot Isostatic	Pressed (HIP) process is	an acceptable alternati	ve to forging.
5. HEAT TREATMENT	Solution annealing	g followed by water quer	nching.	
6. CHEMICAL COMPOSITION	PRE (% Cr + 3.3	% Mo + 16 % N) \ge 40.0.		
7. TENSILE TESTING	$R_{p0.2} \ge 550 \text{ MPa};$	$R_{\rm m} \ge 800 \text{ MPa}; \text{ A} \ge 15 \text{ 9}$	%.	
8. HARDNESS	The hardness shal	l be less than 32 HRC (o	or alternatively 301 HB	or 330 HV10).
9. IMPACT TESTING	thicknesses $\geq 6 \text{ m}$	esting according to AST m (thickness at the weld average / 35 J single. Rec and 5 mm - 2/3.	neck). The minimum a	bsorbed energy
10. MICROGRAPHIC EXAMINATION	The micrographic examination shall be carried out at the same area as location of specimens for mechanical testing. The area shall be minimum 10 x 10 mm. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 -55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.			
11. CORROSION TEST	shall be 50 °C and at the same location according to AST acceptance criteria - No pitting at 20	Fording to ASTM G 48, N I the exposure time 24 ho on as those for mechanic M G 48 and pickled (20 a are: 0 X magnification.	ours. The corrosion test al testing. Cut edges sh % HNO3 + 5 % HF, 60	all be prepared
<i>12. EXTENT OF TESTING</i>	One set of impact examination shall not exceed 2000 k	, tensile, hardness, corros be carried out for each h ag for forgings with as fo orged weight > 50 kg.	sion testing and micros neat and heat treatment	load. A test lot shall

MATERIAL I	DATA SHEE	T MD	S - D54	Rev. 2		
TYPE OF MATERIAL	L: Ferritic/Austenitie	c Stainless Steel, Type	25Cr duplex	Page 2 of 2		
PRODUCT	STANDARD	STANDARD GRADE ACCEPT. CLASS				
Forgings	ASTM A 182	- UNS S 32550 F53 - UNS S 32750 F55 - UNS S 32760	-	\$5		
13. TEST SAMPLING	Samples for produced components.	uction testing shall realis	tically reflect the prope	erties in the actual		
	shall be used for of for die forged con	Test samples shall be from prolongations on actual component. Sacrificial forgings shall be used for die forged components. However, special agreements may be made for die forged components with as forged weight exceeding 50 kg. Integrated test blocks shall be used for HIP.				
	thickness of the te	Test specimens shall be cut at the ¹ / ₄ T location from the surface where T is the thickness of the test samples as heat treated. Sketches shall be established showing type, size and location of test samples and extraction of test specimens.				
14. DIMENSIONAL TOLERANCES		Flanges to MSS SP-44 shall have maximum wall thickness under tolerance of 0.3 mm for the hub at the welding end.				
15. NON DESTRUCTIVE TESTING	forgings (from the shall be carried ou	Supplementary requirement S5, liquid penetrant testing, shall apply to 10 % of forgings (from the lot as defined for mechanical testing) above NPS 2. The testing shall be carried out after final machining and pickling. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 8.				
16. SURFACE FINISH	White pickled inc	luding machined surface	s.			
17. REPAIR OF DEFECTS	Weld repair is not	Weld repair is not acceptable.				
18. MARKING	The component sl lot.	The component shall be marked to ensure full traceability to melt and heat treatment				
19. CERTIFICATION	EN 10 204 Type 3 should be stated it	3.1B. Heat treatment tem n the certificate.	perature, soaking time	and cooling medium		

MATERIAL DA'	TA SHEET	MI	S - D55	Rev. 2
TYPE OF MATERIAL: Fe	erritic/Austenitic St	ainless Steel, Type	25Cr duplex	Page 1 of 1
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.
Plates	ASTM A 240	UNS S 32550 UNS S 32750 UNS S 32760	-	-
I. SCOPE	requirements which the referred standard	shall be added or su d. This MDS is based	in the referred standard persede the correspondin d on the mechanical prop lex listed in ASME B 31	ng requirements in perties of UNS S
2. QUALIFICATION	Manufacturers of pr NORSOK Standard		hall comply with the req	uirement of
3. STEEL MAKING	The steel melt shall	be refined with AOI	O or equivalent.	
4. HEAT TREATMENT	Solution annealing f	followed by water qu	ienching.	
5. CHEMICAL COMPOSITION	PRE (%Cr + 3.3 %)	$Mo + 16 \% N) \ge 40.0$	0.	
6. TENSILE TESTING	$R_{p0.2} \ge 550 \text{ MPa}; R_r$	$_{\rm m} \ge 750 \text{ MPa}; \text{ A} \ge 150 \text{ MPa}$	5%.	
7. HARDNESS	The hardness shall b	e maximum 32 HRC	C or alternatively 301 H	3 or 330 HV10.
8. IMPACT TESTING	Charpy V-notch testing is required according to ASTM A 370 at - 46 °C. The minimum absorbed energy shall satisfy 45 J average / 35 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.			
9. MICROGRAPHIC EXAMINATION	The micrographic examination shall cover the near surface and mid-thickness region. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 -55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.			
10 CORROSION TEST	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The specimen shall have surfaces in the as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G 48, and the whole specimen shall be pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The test shall expose both surfaces and a cross section in full wall thickness. The acceptance criteria are: - No pitting at 20 X magnification.			
	- The weight loss sl	hall be less than 4.0	g/m^2 .	
11. EXTENT OF TESTING			ructure, hardness, corros and heat treatment lot.	ion and tensile
12. TEST SAMPLING	Samples for product components.	tion testing shall real	listically reflect the prop	erties in the actual
13. SURFACE FINISH	White pickled.			
14. REPAIR OF DEFECTS	Repair welding is no	ot acceptable.		
15. MARKING	The component shallot.	ll be marked to ensur	re full traceability to mel	t and heat treatment
16. CERTIFICATION	EN 10 204 Type 3.1 should be stated in t		emperature, soaking time	and cooling medium

MATERIAL DA	TA SHEET	M	DS - D56	Rev. 2	
TYPE OF MATERIAL: Fe	erritic/Austenitic S	tainless Steel, Typ	e 25Cr duplex	Page 1 of 2	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Castings	ASTM A 890	UNS J93404 UNS J93380	-	S2, S3, S33	
1. SCOPE	-	shall be added or s	is in the referred standar upersede the correspond		
2. QUALIFICATION	Manufacturers of particular of particular of particular of the second standard stand		shall be qualified in acc	ordance with	
3. STEEL MAKING	The steel melt shall	be refined with AC	DD or equivalent process	5.	
4. HEAT TREATMENT	According to Grade	e 5A (UNS J93404).			
5. CHEMICAL COMPOSITION	PRE (% Cr + 3.3 %	$Mo + 16 \% N \ge 4$	0.0.		
6. TENSILE TESTING	$R_{p0.2} \ge 450 \text{ MPa}; \text{ R}$	$m \ge 700 \text{ MPa}; \text{ A} \ge 3$	15 %.		
7. HARDNESS	The hardness shall	be less than 32 HRC	C (or alternatively 301 H	B or 330 HV10).	
8. IMPACT TESTING		• •	ording to ASTM A 370 45 J average / 35 J sing		
9. MICROGRAPHIC EXAMINATION	The micrographic examination shall be carried out at the same area as location of specimens for mechanical tests. The area shall be minimum 10 x 10 mm. On WPQ's both the weld, HAZ and base material shall be examined. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 - 55 %. The microstructure, as examined at 200 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.				
10. CORROSION TEST	 Suitably etched specifield, shall be nee from intermetance phases and precipitates. Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The corrosion test specimen shall be at the same location as those for mechanical testing. Cut edges shall be prepared according to ASTM G 48 and pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The acceptance criteria are: No pitting at 20X magnification. 				
	- The weight loss s	hall be less than 4.0	g/m^2 .		
11. EXTENT OF TESTING	A full set of mechanical and corrosion tests and microstructure examinations shall be made for each heat and heat treatment charge. A test lot shall not exceed 5 000 kg.				
12. TEST SAMPLING	actual components. the actual compone components the larg	Thickness of the te nts up to a maximum gest flange thicknes		o the thickness of For flanged	
	Test specimens shall be cut from the 1/4 T location from the surface where T is the thickness of the test block. Test block shall be integrally cast or gated onto the castings and shall not be removed from the castings until after the final quality heat treatment.				

MATERIAL D	ATA SHEET	MI)S - D56	Rev. 2		
TYPE OF MATERIAL:	· Ferritic/Austenitic S	tainless Steel, Type	e 25Cr duplex	Page 2 of 2		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Castings	ASTM A 890	UNS J93404 UNS J93380	-	S2, S3, S33		
13. NON DESTRUCTIVE TESTING	<i>Liquid penetrant testing:</i> Supplementary requirement S3 shall apply to all accessible surfaces of all castings. The testing shall be carried out after final machining and pickling. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 7.					
	Radiographic testir	<i>ig:</i> Supplementary re	equirement S2 shall app	bly to:		
	- All butt weld ends	 Critical areas as per ANSI B16.34 of the pilot cast of each pattern. All butt weld ends of each casting Class 1500 psi and above; all critical areas to ANSI B16.34 of each casting. 				
	The acceptance crit	The acceptance criteria shall be to ASME VIII, Div. 1 Appendix 7.				
14. SURFACE FINISH	-	White pickled shall be carried out after any blasting and shall include finished machined surfaces.				
15. REPAIR OF DEFECTS	be qualified in acco	-	oply. The repair weldin IX or EN 288-3 and thi clude the following:			
	- qualified on a cast	t plate of the same gr	ade (UNS number) wh	ich shall be welded		
	- change of specific	make of filler metal	(brand names) require	s requalification		
			material and weld zone naterial and 25 - 60 %			
		- Charpy V-notch testing as specified above, with two sets (each 3 specimens), with notch located in weld metal and fusion line, respectively				
	- corrosion test as s	pecified above. The	specimen shall include	weld zone.		
16. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
17. CERTIFICATION	÷ 1	1B. Heat treatment to stated in the certification	emperature, soaking tin te.	ne and cooling		

MATERIAL DA	TA SHEET	C ME	DS - D57	Rev. 2	
TYPE OF MATERIAL: Fe	erritic/Austenitic S	Stainless Steel, Type	25Cr duplex	Page 1 of 1	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Bars	ASTM A 276	UNS S 32550 UNS S 32750 UNS S 32760	-	-	
1. SCOPE	requirements which in the referred star	ch shall be added or sundard. This MDS is ba	in the referred standar persede the correspond sed on the mechanical uplex listed in ASME I	ling requirements properties of UNS	
2. QUALIFICATION	Manufacturers of J NORSOK Standar		hall comply with the re	equirement in	
3. STEEL MAKING	The steel melt sha	ll be refined with AOI	O or equivalent.		
4. HEAT TREATMENT	Solution annealing	g followed by water qu	enching.		
5. CHEMICAL COMPOSITION	PRE (% Cr + 3.3 %	$% \text{Mo} + 16 \% \text{N} \ge 40$.0.		
6. TENSILE TESTING	$R_{p0.2} \ge 550 \text{ MPa};$	$R_m \ge 800 \text{ MPa}; A \ge 13$	5%.		
7. HARDNESS	The hardness shall	l be less than 32 HRC	(or alternatively 301 H	B or 330 HV10).	
8. IMPACT TESTING	Charpy V-notch testing is required according to ASTM A 370 at - 46 °C. The minimum absorbed energy shall satisfy 45 J average / 35 J single.				
9. MICROGRAPHIC EXAMINATION	The micrographic examination shall be carried out at the same area as location of specimens for mechanical testing. The area shall be minimum 10 x 10 mm. The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 - 55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.				
10. CORROSION TEST	 Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The corrosion test specimen shall be at the same location as those for mechanical testing. Cut edges shall be prepared according to ASTM G 48 and pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The acceptance criteria are: No pitting at 20 X magnification. 				
		shall be less than 4.0			
11. EXTENT OF TESTING	-	· ·	ructure, hardness, correated and heat treatment lot.		
12. TEST SAMPLING	Samples for produ actual components	-	listically reflect the pro	perties in the	
15. SURFACE FINISH	White pickled				
16. REPAIR OF DEFECTS	Weld repair is not acceptable.				
17. MARKING	The component sh treatment lot.	all be marked to ensur	re full traceability to m	elt and heat	
18. CERTIFICATION	• •	.1B. Heat treatment te stated in the certification	emperature, soaking tin te.	ne and cooling	

MATERIAL DA			DS - D58	Rev. 1		
TYPE OF MATERIAL: Fe		Stainless Steel, Type	-	Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Tubes	ASTM A 789	UNS S 32550 UNS S 32750 UNS S 32760	-	S5		
1. SCOPE	requirements whic the referred standa	h shall be added or so rd. This MDS is base	s in the referred standard upersede the correspondi ed on the mechanical pro- plex listed in ASME B31	ng requirements in perties of UNS S		
2. QUALIFICATION	Manufacturers of p NORSOK Standar		shall comply with the req	uirement of		
3. STEEL MAKING	The steel melt shall	ll be refined with AO	D or equivalent.			
4. HEAT TREATMENT	The tubes shall be	solution annealed for	llowed by water quenching	ng.		
5. CHEMICAL COMPOSITION	PRE (% Cr + 3.3 %	% Mo + 16 % N) \ge 40	0.0.			
6. TENSILE TESTING	$R_{p0.2} \ge 550 \text{ MPa}; 1$	$R_m \ge 750 \text{ MPa}; A \ge 1$	15 %.			
7. HARDNESS	The hardness shall	be max. 32 HRC (or	alternatively 301 HB or	330 HV10).		
8. IMPACT TESTING	required for the thi	icknesses ≥ 6 mm T le. Reduction factors	according to ASTM A 37 The minimum absorbed en a for subsize specimens sh	nergy shall be 45 J		
9. CORROSION TEST	shall be 50 °C and and external surface shall be prepared a pickled (20 % HN	the exposure time 2^{4} ces in the as-delivered according to ASTM C O3 + 5 % HF, 60 °C, res and a cross section	8 Method A is required. 7 4 hours. The specimen sh d condition (including pio 6 48, and the whole speci 5 minute). The test shall n surface in full wall thic	all have the internal ckling). Cut edges men shall be expose the external		
	- No pitting at 20 X magnification.					
	- The weight loss	shall be less than 4.0	g/m^2 .			
10 MICROGRAPHIC EXAMINATION	The ferrite content shall be determined according to ASTM E 562 or equivalent and shall be within 35 - 55 %. The microstructure, as examined at 400 X magnification on a suitably etched specimen, shall be free from intermetallic phases and precipitates.					
11. EXTENT OF TESTING	Microstructure, ha defined in the refe		sting shall be carried out	for each lot as		
12. TEST SAMPLING	Samples for production testing shall realistically reflect the properties in the actual components.					
13. SURFACE FINISH	White pickled.					
14. MARKING	The component sh treatment lot.	The component shall be marked to ensure full traceability to melt and heat				
15. CERTIFICATION	• •	.1B. Heat treatment t stated in the certification of the states of the s	emperature, soaking time	e and cooling		

MATERIAL DA	TA SHEET	Γ Μ	IDS - K01	Rev. 1	
TYPE OF MATERIAL: Co	opper/Nickel 90/10			Page 1 of 2	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Sml pipes & tubes Welded pipes Rod & bar Plates & sheets Fittings Flanges	ASTM B 466 ASTM B 467 ASTM B 151 ASTM B 171 - -	UNS C 70600 UNS C 70600 UNS C 70600 UNS C 70600 UNS C 70600 UNS C 76000	-	- - - - -	
1. SCOPE 2. DESIGN AND	requirements white referred standard.	ch shall be added or s		ling requirements in the	
2. DESIGN AND DIMENSIONAL STANDARDS	Applications "sh - EEMUA Publica - EEMUA Publica	 The following EEMUA standards for: "90/10 Copper/Nickel Piping for Offshore Applications "shall be used: EEMUA Publication No. 144: "Tubes, Seamless and Welded". EEMUA Publication No. 145: "Flanges, Composite and Solid ". EEMUA Publication No. 146: "Fittings ". 			
3. MATERIALS	Materials for fittin MDS.	Materials for fittings and flanges shall comply with the above listed standards and this MDS.			
4. MANUFACTURING PROCESS	in cooperation wi <i>Welding:</i>	<i>Forming:</i> Cold forming or hot forming may be used according to written procedures established in cooperation with the material manufacturers.			
5. HEAT TREATMENT/ DELIVERY CONDITION	 Hot formed components: Parts hot formed in the temperature range of 760 - 800 °C do not need annealing after forming. Cold formed components: Annealed. Welded components: Annealed, but acceptable as welded from annealed materials. 				
6. CHEMICAL COMPOSITION	-	elding the chemical c ≤ 0.02 % and C ≤ 0.05	omposition shall be mod 5 %.	dified as stated:	
7. EXTENT OF TESTING	Tensile test specimens shall be taken from each lot. A lot is defined as all products of the same type, nominal size which are produced from the same heat of material and subject to the same finishing operation.				
8. TEST SAMPLING	components. Test samples shal overlength on the	l be cut from the prod components may be u	alistically reflect the pro- lucts themselves. Sacrifi used. Sketches shall be e and extraction of test spe	icial components or established showing	
9. WELDING			d and qualified in accor		

12. CERTIFICATION

MATERIAL DATA SHEET **MDS - K01 Rev. 1** TYPE OF MATERIAL: Copper/Nickel 90/10 Page 2 of 2 GRADE SUPPL. REQ. PRODUCT STANDARD ACCEPT. CLASS Sml pipes & tubes **ASTM B 466** UNS C 70600 Welded pipes ASTM B 467 UNS C 70600 Rod & bar ASTM B 151 UNS C 70600 Plates & sheets **ASTM B 171** UNS C 70600 Fittings UNS C 70600 Flanges UNS C 76000 10. NON DESTRUCTIVE Welded Pipes to B 467: **TESTING** Sch. 10S: Welded pipes shall be spot radigraphed to the extent of not less than 12 in. (300 mm) of radiograph per 50 ft (15 m) of weld. Otherwise: All welds shall be completly radiographed. The radiographic testing shall be in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Div. 1, Paragraph UW-51 and UW-52 for 100 % and spot check tested respectively. 11. HYDROSTATIC TESTS Sml. pipes & tubes to B 466 and Welded pipes to B 467: Each length of finished pipe shall be subjected to the hydrostatictest in accordance with ASTM A 530.

EN 10 204 Type 3.1B.

MATERIAL DA'	TA SHEET		MDS - K02	Rev. 1
TYPE OF MATERIAL: Alur	minium - Bronze Sa	nd Castings		Page 1 of 1
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.
Castings	ASTM B 148	UNS C95800	-	-
1. SCOPE			tions in the referred stand or supersede the correspo	lard and additional onding requirements in the
2 CHEMICAL COMPOSITION	$Pb \le 0.02 \%$.			
3. HEAT TREATMENT	Heat treatment sha 700 °C for 6 hours		at the discretion of the ma	anufacturer, e.g. approx.
4. EXTENT OF TESTING	One tensile test sh treatment load.	all be carried out	for each lot, as defined b	y the in B148, and heat
5. TEST SAMPLING	components. Thic components up to largest flange thic	kness of the test b a maximum thick kness shall apply.	Il realistically reflect the p plock shall be equal to the cness of 100 mm. For flan e 1/4 T location from the	thickness of the actual ged components the
		e integrally cast o	r gated onto the castings a al quality heat treatment.	and shall not be removed
6. WELDING	Welding procedur	es shall be establi	ished and qualified in acc	ordance with ASME IX
	for all repair weld	ing.		
7. NON DESTRUCTIVE TESTING		ssible surfaces of	all castings. The testing s iteria shall be to ASME V	
	All butt weld endClass 1500 psi and	per ANSI B 16.34 ds of each casting nd above, all criti	4 of the pilot cast of each cal areas to ANSI B16.34 ASME VIII, Div. 1, Appe	of each casting.
8. WELD REPAIR	The repair welding MDS.	g procedure shall	be qualified in accordance	e with ASME IX and this
	A macro test shaRepairs by peeni	ll be carried out. ng and impregnat	grade shall be used. tion are prohibited. the requires requalification	
9. CERTIFICATION	EN 10 204 Type 3		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	

MATERIAL D	ATA SHEE	Т	MDS - N01	Rev. 2		
TYPE OF MATERIAL:	Nickel alloy Type	625		Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Wrought fittings	ASTM B 366	UNS N06625	-	S3		
Pipes	ASTM B 705	UNS N06625	Class 1	-		
Forgings	ASTM B 564	UNS N06625	-	-		
Plates	ASTM B 443	UNS N06625	-	-		
Bars	ASTM B 446	UNS N06625	-	-		
Pipes and tubes	ASTM B 444	UNS N06625	-	-		
1. SCOPE	requirements which the referred standa	sh shall be added or s ard.	shall comply with the reg	ng requirements in		
2. QUALIFICATION	Manufacturers of product to this MDS shall comply with the requirement of NORSOK Standard M-650.					
3. HEAT TREATMENT/ DELIVERY CONDITION	Annealed.	Annealed.				
4. TEST SAMPLING	Samples for produ component.	ction testing shall re	alistically reflect the prop	erties in the actual		
5. DIMENSIONAL TOLERANCES	Flanges to B 381:	Flanges to MSS SP tolerance of 0.3 mi	-44 shall have a maximum n at weld end.	wall thickness unde		
6. NON DESTRUCTIVE TESTING	Fittings to B 366:	apply to the weld an defined for mechan	nirement S3, liquid penetra rea at 10 % of seamless (fr ical testing) and 100 % of elded fittings the testing st	rom the same lot as welded fittings		
	Forgings to B 564	· ·	sting shall be performed at me lot as defined for mech			
7. SURFACE FINISH	White pickled. Shall be carried out after any blasting and shall include finished machined surfaces.					
8. REPAIR OF DEFECTS	Weld repair of base material is not acceptable.					
9. MARKING	The component sh lot.	all be marked to ens	ure full traceability to mel	t and heat treatment		
10. CERTIFICATION	EN 10 204 Type 3 should be stated in		temperature, soaking time	and cooling medium		

MATERIAL D	DATA SHE	ET N	IDS - N02	Rev. 2		
TYPE OF MATERIAL	.: Cast Nickel allo	у		Page 1 of 2		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Castings	ASTM A 494	Grade CW-6MC (UNS N06625) Grade CX2MW (UNS N26022)	Class 1 Class 1	S2, S3 S2, S3		
1. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. QUALIFICATION	Manufacturers of NORSOK Standar	product to this MDS sha rd M-650.	ll comply with the requ	irement of		
3. STEEL MAKING		ll be refined with AOD of in an electric furnace is				
4. HARDNESS	The hardness shal	l be maximum 35 HRC (or alternatively 301HB	or 330HV).		
5. CORROSION TESTING	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The corrosion test specimen shall be at the same location as those for mechanical testing. Cut edges shall be prepared according to ASTM G 48 and pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The acceptance criteria are: - No pitting at 20 X magnification.					
6. EXTENT OF TESTING		shall be less than 4.0 g/n prosion test shall be mad sceed 5 000 kg.		at treatment load. A		
7. TEST SAMPLING	Samples for mech components. Thic	anical testing shall realis kness of the test block sh a maximum thickness of	nall be equal to the thicl	cness of the actual		
	Test specimens sh thickness of the te	all be cut from the 1/4 T st block.	location from the surfa	ce where T is the		
		e integrally cast or gated until after the final quali		hall not be removed		
8. NON DESTRUCTIVE TESTING	 <i>Liquid penetrant testing:</i> Supplementary requirement S3 shall apply to all access surfaces of all castings. The testing shall be carried out after final machining and pickling. The acceptance criteria shall be ASME VIII, Div.1, Appendix 7. <i>Radiographic testing:</i> Supplementary requirement S2 shall apply to: - Critical areas as per ANSI B 16.34 of the pilot cast of each pattern. 					
	- All butt weld end	ds of each casting. nd above; all critical area				
	^	iteria shall be ASME VI	**			
9. SURFACE FINISH	White pickled. Sh machined surfaces	all be carried out after an s.	ny blasting and shall inc	clude finished		

MATERIAL D	OATA SHEF	ET N	IDS - N02	Rev. 2			
TYPE OF MATERIAL	.: Cast Nickel allo	у		Page 2 of 2			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Castings	ASTM A 494	Grade CW-6MC (UNS N06625) Grade CX2MW	Class 1 Class 1	\$2, \$3 \$2, \$3			
		(UNS N26022)	Class 1	82,83			
<i>10. REPAIR OF DEFECTS</i>	The repair welding 288-3 and this ME - A cast plate of - A macro and co - Change of spec	 Repair welding shall be carried out in accordance with ASTM A 488. The repair welding procedure shall be qualified in accordance with ASME IX or EN 288-3 and this MDS. A cast plate of the same material grade (UNS number) which shall be used. A macro and corrosion test as specified above shall be carried out. Change of specific make of filler metal (brand name) requires requalification. All casting with major repairs shall be given a solution heat treatment after welding. 					
11. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.						
12. CERTIFICATION	EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.						

MATERIAL DATA SHEET MDS - P01

<i>TYPE OF MATERIAL:</i> G	lassfibre Reinforced Plastics (GRP)	Page 1 of 4				
PRODUCT	STANDARD					
Pipes, Fittings, Flanges, Adhesive and pre-fabricated spools	UKOOA: Specification and Recommended Practice for the Use of GRP Piping Offshore. (UKOOA: United Kingdom Offshore Operators Association)					
I. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. MANUFACTURING PROCESS	Pipes and fittings shall be made by filament winding or equiva	alent methods.				
3. RESIN/HARDENER TYPE	Preferred resins are bisphenol A epoxies with aromatic or cyc agents or vinylester.	loaliphatic curing				
4. INNER LINER	The internal lining when transporting non-aggressive fluids such as water, shall be a resin rich layer of min. 0,5 mm with C-glass or synthetic veil reinforcement.					
	For transporting concentrated sulphuric acid and hypochlorite, an internal liner of PVC of min. 3 mm should be used. Application of PVC liner shall be according to the German standard KRV A984/82-02. C-glass or ECR-glass reinforcement should be used in the structural part of the pipe wall. (KRV: Kunststoff Rohrverband).					
	For other agressive fluids such as acids, the internal lining shall be a resin of min. 3,0 mm with C-glass or syntetic veil reinforcement. C-glass or ECI reinforcement should be used in the structural part of the pipe wall.					
5. QUALIFICATION TESTING	Qualification testing shall be performed according to UKOOA document, Part 2, chapter 2 with the following additional requirements:					
	<u><i>Pressure rating.</i></u> (Section 2.1.2 or 2.1.3): Minimum requirements are that one representative diameter of pipe, fittings and joints shall be qualified according to option 1. For qualification option 3 the factor $f_1 = 0.85$ shall be moved to the numerator.					
	<i>The qualification of flanges</i> shall in addition to the UKOOA document comply with ASTM D 4024, clauses 6, 7, 8 and 11 with the additional requirements below.					
	The pressure rating of the flanges multiplied by 4 shall be above the 97.5 % confidence limit obtained from the <i>Short-Term Rupture Strength</i> test.					
	The test assembly for the maximum bolt torque test shall be fitted together using gasket and steel flange intended to be used during fabrication and installation.					
	No visual damage is allowed for the sealing test and the bolt torque test according to table 4.3.5 in UKOOA document.					
	to table 4.3.5 in UKOOA document. <u>Service Conditions Exceeding "Standard Conditions",(A new section 2.1.1.5 after</u> section 2.1.1.4, Standard Service Conditions): For design life exceeding 20 years, the following shall apply:					

MATERIAL DA	TA SHEETMDS - P01	Rev.				
TYPE OF MATERIAL: C	lassfibre Reinforced Plastics (GRP)	Page 2 of 4				
PRODUCT	STANDARD					
Pipes, Fittings, Flanges, Adhesive and pre-fabricated spools	UKOOA: Specification and Recommended Practice for the Use of GRP Pi Offshore. (UKOOA: United Kingdom Offshore Operators Association)					
5. QUALIFICATION TESTING (Cont.)	 a) Assessment of previous well documented in-service ex b) Qualification results from tests done according to Qua section 2.1.2. or 2.1.3. Alternatively use a pipe with a minimum one class higher than for 20 years design. 	lification Option 1 in				
	 c) Design calculations shall be re-evaluated and extrapolative increased service life. <u>Adhesive/resin for bonded/laminated joints</u>, (A new section 2. The adhesive used for bonded joints or resin used for lamir qualified according to section 2.1.2 or 2.1.3. The adhesive/properties for field assembly and fulfilling the following references for field assembly and fulfilling the following reference of 10 rotations per second (absolute viscosity data - The fracture elongation of the cured adhesive/resin in than that of the resin used in the piping. The glass transition temperature (T_G) or the residual he cured adhesive/resin shall be determined by DSC accommensurement of samples taken from joints of component testing. Alternatively, for polyester and vinylester based produmonomer content for joints in components used in quadidetermined. The measurement shall be performed accommenses for <i>Fabrication, Prefabrication and Instal Baselines.</i> (A new section 2.1.10): The manufacturer shall gualification programme baseline values including accepta fabrication and installation quality control programme. This includes measurement of degree of cure and glass con - The degree of cure shall be determined by DSC in accomby residu	2.1.9): nated joints shall be resin shall have suitable equirements: pplication at room at 23°C with a shear). joints shall not be less eat of reaction of the rding to Annex C, by ents used in qualification acts, the residual styrene lification testing may be ording to ISO 4901. <u>Allation Quality Control</u> enerate from the nce criteria for the tent: ordance with Annex C of e with ISO 4901 for the minated joints.				

MATERIAL DA	TA SHEET M	IDS - P01	Rev.		
<i>TYPE OF MATERIAL:</i> G	lassfibre Reinforced Plastics (GRP)		Page 3 of 4		
PRODUCT	STANDARD				
Pipes, Fittings, Flanges, Adhesive and pre-fabricated spools	UKOOA: Specification and Recomme Offshore. (UKOOA: United Kingdom Offshore Oper		Jse of GRP Piping		
5. QUALIFICATION TESTING (Cont.)	<u>Chemical Resistance</u> , (Delete section 2.2 other than the water used in the testing resistance of the material shall be deter	according to section 2	2.1, the chemical		
	ASTM D 3681. The test duration and conditions shall be relevant for the service conditions, life time requirements and the criticality of the system and the safety risks of the conveyed fluid. Alternatively, well documented in-service experience under similar conditions can be used. Examples of typical fluids that can require specific documentation of compatibility if transported in GRP pipes are:				
	hydraulic fluids, scale inhibitors, corrosion inhibitors (also diluted), injection chemicals (i.e. acid stimulation, etc.), completion fluids, packer fluids and methanol				
	<u>Component Properties for System Design</u> (section 2.4) All listed properties shall be determined by the Manufacturer (Delete "Where applicable in UKOOA document)				
	<u>Test Method for Determination of Deg</u> <u>Scanning Calorimetry (DSC)</u> (Annex C C.5.3 (<i>Delete sentence and replace with:</i>) Obtain the T _{G1} (midpoint of the inflect				
	heat of reaction from the first scan and second scan. (Sample not powdered).				
	C.6.5 (<i>Delete sentence and replace with:</i>) Record of glass transition temperature of reaction for both the first and second	(inflection value) as T	G1 and /or residual hea		
6. ELECTRIC CONDUCTIVITY	If conductive components are specified shall not be accomplished by adding ca		-		
7. PRODUCTION TESTING	Production testing shall be performed according to UKOOA document, Part 2, Chapter 4 with the following additional requirements.				
	<u><i>Hydrostatic Mill Test</i></u> (Section 4.3.1): 10 % of produced pipes and 100 % of all prefabricated spools shall be pressure tested to 1.5 times their nominal static pressure rating and pressure shall be maintained for a minimum of 15 minutes in order to ascertain there is no leakage.				
	<u>Degree of Cure</u> (Section 4.3.2, Add follow If the residual heat of reaction exceeds component variant in the qualification rejected, subject to the retest option of	10% of the measured tests, then the product	value on the qualified		
	Alternatively, vinylester or polyester based products may be tested in accordance with ISO 4901. The residual styrene content shall be maximum 10 % above the level measured during component qualification but not above 2 % total content.				

MATERIAL DA	TA SHEET MDS - P01	Rev.				
TYPE OF MATERIAL: G	TYPE OF MATERIAL: Glassfibre Reinforced Plastics (GRP)					
PRODUCT	STANDARD					
Pipes, Fittings, Flanges, Adhesive and pre-fabricated spools	UKOOA: Specification and Recommended Practice for the Use of GRP Piping Offshore. (UKOOA: United Kingdom Offshore Operators Association)					
8. FLANGES	Allowable bolt torque and flange mis-alignment shall be defined by manufacturer.					
9. NDT/VISUAL TESTING	According to UKOOA, Part 4 or BS 7159.					
10. CERTIFICATION	EN 10 204 Type 3.1B containing: - Hydrostatic mill test Degree og cure Short time failure pressure Glass content Visual inspection Wall thickness Resistivity (If conductive pipe is specified)	- - - - - -				

MATERIA	LDA	TA SHEET	MDS - P11	Rev. 1			
TYPE OF M	ATERIA	L: Hydrogenated	l Nitrile (HNBR)				
PRODUCT	O-ring TEMPERATURE - 46°C to + 150°C. Only short time exposure below - 20°C acceptable.						
1. SCOPE	This MD	S specifies the technic		HNBR O-ring material.			
2. PURCHASE							
INFORMATION	dimensio	The purchase order shall contain the following information: Product form, dimensions, tolerances and / or referenced drawing(s) and grade designation.					
3. CHEMICAL COMPOSITION		6 acrylonitrile content					
4. QUALIFICATION TEST REQUIREMENTS	the follow are chang composit qualificat ED-test Qualifica compress Methane, by 10 cyc • 20 • D • 1 • Ro • Lo No leakag pressure t	Qualification test requirements: O-ring cross section diameter 5.33 mm, 20% compression, text fixture, 70 – 85% groove fill, test medium 10% CO ₂ in Methane, test temperature 100°C. 72 hours initial soak at full pressure, followed by 10 cycles of: • 200 bar (24h),					
	Hardness Tensile st Elongatic Compress (% max. 2 Physical	24 hr. 150°C) properties	ASTM D 2240 ASTM D 412/ 1414 ASTM D 412/ 1414 ASTM D 395	90 +/- 5 20 MPa 100% 25%			
5 DIMENSIONS	Specific g	gravity	ASTM D 792	$1.24 - 1.27 \text{ g/cm}^3$			
5. DIMENSIONS 6. PRODUCTION	BS 4518	warmonartian at -11 1 1	commonted by testing C	r analy production 1 - t-1			
6. PRODUCTION TEST				or each production batch			
REQUIREMENTS	and sat Specific g	isfy the requirements l		ГМ D 792)			
	Hardness		· · · · · · · · · · · · · · · · · · ·	2			
	Hardness(ASTM D 2240)Tensile and elongation properties(ASTM D 412/ 1414)						
7. MARKING &		* * *	· · · · · · · · · · · · · · · · · · ·	is on the bags shall clearly			
PACKAGING	indicate b producers addition, at room to	batch number, and such s QC system to raw may the bags shall be mark emperature and withou	n markings shall ensure aterials, formulation and red with an expected sho at direct exposure to sur	traceability through the I manufacturing details. In elf life assuming storage ilight.			
8. CERTIFICATION	Inspection	n certificate to EN 102	204 3.1 B shall contain I	D no. and all test results.			

MATERIA	LDA	TA SHEET	MDS – P12	Rev. 1			
TYPE OF MA	ATERIA	L: Fluorocarbor	terpolymer (FKM	()			
PRODUCT	O-ring	TEMPERATURE	$\begin{array}{c} -46^{\circ}\text{C to} + 210^{\circ}\text{C}^{-}\text{O} \\ \text{below} - 20^{\circ}\text{C} \text{ accepta} \end{array}$	only short time exposure able.			
1. SCOPE	This MD	S specifies the technic	al requirements for the	FKM O-ring material.			
2. PURCHASE INFORMATION			in the following informative referenced drawing(s)				
3. CHEMICAL COMPOSITION	Vinylidene fluoride (VF2), hexafluoropropylene (HFP), and tetrafluoroethylene (TFE) with necessary fillers, stabilisers, cross-link agents.						
4. QUALIFICATION TEST REQUIREMENTS	The material shall be rapid pressure reduction resistant (ED resistant) and satisfy the following minimum requirements. The qualification shall be repeated if there are changes in the production route, manufacturing procedures, specified composition or properties of the product which exceeds the limits defined from qualification testing (each manufacturer and seal type shall be qualified): ED - test Qualification test requirements: O-ring cross section diameter 5.33 mm, 20% compression, text fixture, 70 – 85% groove fill, test medium 10% CO ₂ in Methane, test temperature 100°C. 72 hours initial soak at full pressure, followed by 10 Cycles of: • 200 bar (24h), • Depressurisation: 70 bar/min. • 1 hour rest time • Re-pressurisation • Leakage test No leakage shall occur in a leakage test at room temperature and service pressure following the 10 decompression cycles. Further, no cracks shall be longer then 50 % of the sample thickness, based on dissection, after the leakage test.						
	Hardness Tensile st Elongatio Compress (% max.2	24 hr. 200°C) properties	ASTM D 2240 ASTM D 412/ 1414 ASTM D 412/ 1414 ASTM D 395 ASTM D 792	90 +/- 5 11 MPa. 90% 40% 1.65 - 1.72 g/cm ³			
5. DIMENSIONS	BS 4518						
6. PRODUCTION TEST REQUIREMENTS	The below properties shall be documented by testing for each production batch and satisfy the requirements listed above.Specific gravity(ASTM D 792) (ASTM D 2240)						
7. MARKING & PACKAGING 8. CERTIFICATION	Tensile and elongation properties(ASTM D 412/1414)Seals shall be supplied in sealed airtight bags. Markings on the bags shall clearlyindicate batch number, and such markings shall ensure traceability through theproducers QC system to raw materials, formulation and manufacturing details. Inaddition, the bags shall be marked with an expected shelf life assuming storage atroom temperature and without direct exposure to sunlight.Inspection certificate to EN 10204 3.1 B shall contain ID no. and all test results.						

MATERIA	L DA'	TA SHEET	MDS – P13	Rev. 1			
TYPE OF M	ATERIA	L: Fluorocarbon	low T terpolymer	(FKM GLT)			
PRODUCT	O-ring	O-ring TEMPERATURE - 46°C to + 200°C. Only short time exposure					
			below - 20°C acceptal	ble.			
1. SCOPE		S specifies the technic	al requirements for the	FKM-GLT O-ring			
	material.						
2. PURCHASE INFORMATION			n the following informa				
			referenced drawing(s) a	and grade designation.			
3. CHEMICAL COMPOSITION	36 - 40%	6 acrylonitrile conten	t (ACN)				
4. QUALIFICATION TEST REQUIREMENTS	the follow are chang composit qualificat ED-test Qualifica compress Methane, by 10 Cy • 20 • Do • 1 • Ro • Lo No leakag pressure t	ving minimum require ges in the production re- tion or properties of the tion testing (each many tion test requirements: ion, text fixture, 70 – test temperature 100° cles of: 00 bar (24h), epressurisation: 70 bar hour rest time e-pressurisation eakage test ge shall occur in a leak following the 10 decor	ments. The qualification oute, manufacturing pro- ble product which exceed afacturer and seal type s O-ring cross section di 85% groove fill, test me C. 72 hours initial soak c/min.	Is the limits defined from shall be qualified): ameter 5.33 mm, 20% edium 10% CO ₂ in at full pressure, followed			
	Hardness Tensile st Elongatic Compress (% max.2 Physical	24 hr. 200°C) properties	ASTM D 2240 ASTM D 412/ 1414 ASTM D 412/ 1414 ASTM D 395	11 +/- 5 90% MPa 90% 40%			
5. DIMENSIONS	Specific g	gravity	ASTM D 792	$1.65 - 1.72 \text{ g/cm}^3$			
6. PRODUCTION	BS 4518 The below	w properties shall be d	ocumented by testing fo	or each production batch			
TEST				or each production batch			
REQUIREMENTS		and satisfy the requirements listed above. Specific gravity (ASTM D 792)					
	Hardness			TM D 2240)			
		nd elongation properti		TM D 412/ 1414)			
7. MARKING & PACKAGING	indicate b producers addition, at room to	Seals shall be supplied in sealed airtight bags. Markings on the bags shall clearly indicate batch number, and such markings shall ensure traceability through the producers QC system to raw materials, formulation and manufacturing details. In addition, the bags shall be marked with an expected shelf life assuming storage at room temperature and without direct exposure to sunlight.					
8. CERTIFICATION	Inspectio	n certificate to EN 102	204 3.1 B shall contain I	ID no. and all test results.			

MATERIA	LDA	FA SHEET	MDS – P14	Rev. 1			
		L: Nitrile (NBR					
PRODUCT	O-ring	TEMPERATURE		nly short time exposure ble.			
1. SCOPE	This MD	S specifies the technic	al requirements for the	NBR O-ring material.			
2. PURCHASE			n the following informa				
INFORMATION	dimension	ns, tolerances and / or	referenced drawing(s) a	and grade designation.			
3. CHEMICAL COMPOSITION	36 - 40%	acrylonitrile conten	t (ACN)				
4. QUALIFICATION	The mate	rial shall not be used f	for gas service or gas co	ntaining fluids and hence,			
TEST			ressure reduction testing				
REQUIREMENTS	materials	shall satisfy the follow	wing minimum requiren	nents. The qualification			
			anges in the production				
			ion or properties of the				
			ation testing (each manu	ufacturer and seal type			
	shall be q	,					
	Oil resist		O mina anaga gaatian di	amatar 5 22 mm 200/			
			O-ring cross section di	edium 10% toluene/ 90%			
				hours soak time. The test			
		all be pressurised with	1 /	nouis sour time. The test			
	No leakas	ge shall occur in a leal	kage test at room temper	rature and service			
	pressure f + 20%/ -5		e time. Further, the volu	me change shall be within			
	Mechani	cal properties					
		(Shore A)	ASTM D 2240	70 +/- 5			
		rength (min.)	ASTM D 412/ 1414	15 MPa			
		n at break (min.)	ASTM D 412/ 1414	350%			
	Compress		ASTM D 395	25%			
	(% max. 2	24 hr. 100°C)					
	Physical	properties		_			
	Specific g	gravity	ASTM D 792	$1.24 - 1.27 \text{ g/cm}^3$			
5. DIMENSIONS	BS 4518						
6. PRODUCTION				or each production batch			
TEST REQUIREMENTS		and satisfy the requirements listed above.					
2		Specific gravity (ASTM D 792)					
		Hardness (ASTM D 2240)					
7. MARKING &		nd elongation properti		TM D 412/1414)			
PACKAGING &				s on the bags shall clearly traceability through the			
				d manufacturing details. In			
	1			elf life assuming storage			
			at direct exposure to sur				
8. CERTIFICATION		-	*	ID no. and all test results.			

	L DATA SHEE	T MDS	S - P21 I	Rev. 1		
TYPE OF MA	ATERIAL: PEEK (P	olv-ether-ethe				
PRODUCT	Back-up rings and seat inserts	TEMPERATU	/	+250°C		
1. SCOPE	This MDS specifies the te	chnical requirement	ents for the PEEK	material.		
2. PURCHASE INFORMATION	The purchase order shall of Product form, dimensions and grade designation.	, tolerances and /	or referenced dra			
3. CHEMICAL COMPOSITION	Poly-ether-ether-ketone p	olymer with nece	ssary stabilisers a	nd processing aids.		
4. QUALIFICATION TEST REQUIREMENTS	The material shall satisfy qualification shall be repe manufacturing procedures which exceeds the limits of	ated if there are c s, specified compo	hanges in the pro-	duction route,		
	Mechanical properties		Virgin	Glass filled		
	Tensile strength	ASTM D 638	95 MPa	>150 MPa		
	Tensile Modulus	ASTM D 638	>3000MPa	>3500MPa		
	Compressive strength	ASTM D 695	110 MPa	150 MPa		
	HDT @ 1.81 MPa	ASTM D 648	160°C	>300°C		
	Impact strength (notched)	ASTM D 256	>70 J/m	>70 J/m		
	Ultimate elongation (%)	ASTM D 638	> 60 %	> 5 %		
	Physical properties					
	Density (g/cm ³⁾ ASTM D 792 1.3 - 1.33 1.46 - 1.55 Melting point ASTM 3418 340°C 340°C 340°C Water absorbtion ASTM D 570 0.15 % 0.15% 0.15%					
5. DIMENSIONS	BS 4518					
6. PRODUCTION TEST REQUIREMENTS	The below properties shall be documented by testing for each production batchand satisfy the requirements listed above.DensityASTM D 792Tensile strengthASTM D 638Ultimate elongation (%)ASTM D 638					
7. MARKING & PACKAGING 8. CERTIFICATION	Components shall be supplied in suitable packaging as to protect the items from physical damage prior to installation. Markings on the packaging shall clearly indicate material batch number, and such markings shall ensure traceability through the producers QC system to raw materials, formulation and manufacturing details. Inspection certificate to EN 10204 3.1 B shall contain ID no. and all test results.					

MATERIA	L DATA SHEE	T MDS	S - P22	2 Rev.	1
TYPE OF M	ATERIAL: PTFE (P	oly-tetra-fluor	o-ethyl	ene)	
PRODUCT	Lip-seals, back-up rings and seat inserts	TEMPERATU.		0°C to +200°C	
1. SCOPE	This MDS specifies the te				ial.
2. PURCHASE INFORMATION	The purchase order shall of Product form, dimensions and grade designation.)
3. CHEMICAL COMPOSITION	Carbon and fluorine, poly stabilisers and process aid lip-seal must be energised similar.	ls. Also with grap	hite, glass	or carbon fibr	e fillers. The
4. QUALIFICATION TEST REQUIREMENTS	The material shall satisfy shall be repeated if there a procedures, specified com the limits defined from qu	are changes in the position or prope	production production production	n route, manu	facturing
	Mechanical properties		Virgin	25%Glass	25%Graph
	Tensile strength (MPa)	ASTM D 638	>25	> 15	> 15
	Hardness (Shore D)	ASTM D 785	50 - 60	50 - 60	60-70
	Compressive strength (1%) (MPa) Compressive modulus	ASTM D 695	4	6	6
	(MPa) HDT @ 1.81 MPa Impact strength	ASTM D 695 ASTM D 648	> 400 54°C	> 600 110°C	>600 95°C
	(notched) (J/m)	ASTM D 256	>145	>130	140
	Ultimate elongation (%)	ASTM D 638	>180	>180	>65
	NI 1 (1				
	Physical properties Density (g/cm ³)	ASTM D 792	2 - 2.2	2-2.24	1.9-2.1
	Melting point (°C)	ASTM D 792 ASTM 3418	325	325	325
	Water absorbtion (24 hrs.)	ASTM D 570	0.01 %	0.02%	0.01%
5. PRODUCTION	The below properties shal	l be documented l	by testing	for each produ	uction batch
TEST REQUIREMENTS	and satisfy the requirement				
REQUIREMENTS	Hardness (Shore D)	ASTM D7	85		
	Density	ASTM D7	92		
	Tensile strength	ASTM D638			
6. MARKING &	Ultimate elongation (%)	ASTM D638	alvasius	a to marta at 1	a itama forma
6. MARKING & PACKAGING	Components shall be supp physical damage prior to i				
	indicate material batch nu				
	through the producers QC				
	manufacturing details.	2,500 to 140, 11		und	-
7. CERTIFICATION	Inspection certificate to E	N 10204 3.1 B sh	all contain	n ID no. and al	l test results.

MATERIA	L DATA SHEE	T MDS - I	P23 Rev. 1		
TYPE OF M	ATERIAL: PEEK (P	oly-ether-ether-ke	etone) with PTFE added		
PRODUCT	Seat inserts	TEMPERATURE	-100°C to +200°C		
1. SCOPE			for the PEEK/ PTFE material.		
2. PURCHASE INFORMATION	The purchase order shall of Product form, dimensions and grade designation.				
3. CHEMICAL COMPOSITION	Poly-ether-ether-ketone p and 10 to 20 % PTFE (Po		y stabilisers and processing aids ne) added.		
4. QUALIFICATION TEST REQUIREMENTS	The material shall satisfy qualification shall be repe	the following minimum ated if there are chang s, specified compositio	m requirements. The ges in the production route, on or properties of the product		
	Mechanical properties		Virgin		
	Tensile strength	ASTM D 638	> 80 MPa		
	Hardness (Shore D)	ASTM D 785	82-88		
	Tensile Modulus	ASTM D 638	>3000MPa		
	Compressive strength	ASTM D 695	100 MPa		
	HDT @ 1.81 MPa	ASTM D 648	150°C		
	Impact strength (notched)	ASTM D 256	HOLD J/m		
	Ultimate elongation (%) Physical properties	ASTM D 638	> 20 %		
	Density (g/cm^{3})	ASTM D 792	1.36 - 1.40		
	Melting point	ASTM 3418	1.50 - 1.40 340 °C		
	Water absorbtion (24 hrs.)	ASTM D 570	0.10 %		
5. DIMENSIONS	BS 4518				
6. PRODUCTION TEST REQUIREMENTS	IS 4518The below properties shall be documented by testing for each production batchand satisfy the requirements listed above.HardnessASTM D 785DensityASTM D 792Tensile strengthASTM D 638				
	Ultimate elongation (%)	ASTM D 638			
7. MARKING & PACKAGING	Components shall be supplied in suitable packaging as to protect the items from physical damage prior to installation. Markings on the packaging shall clearly indicate material batch number, and such markings shall ensure traceability through the producers QC system to raw materials, formulation and manufacturing details.				
8. CERTIFICATION	Inspection certificate to E	N 10204 3.1 B shall co	ontain ID no. and all test results.		

TYPE OF MATERIAL	Austenitic stainle	: Austenitic stainless steel, Type 6Mo					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Seamless pipes	ASTM A 312	UNS S31254 UNS N08367 UNS N08925 UNS N08926	-	-			
1. SCOPE	requirements which the referred standa	ch shall be added or su	in the referred standard persede the correspondir of included in A 312 shal de UNS S31254.	ng requirements in			
2. QUALIFICATION	Manufacturers of NORSOK Standar		hall comply with the requ	uirement of			
3. STEEL MAKING	The steel melt sha	ll be refined by AOD	or equivalent.				
4. HEAT TREATMENT	The pipes shall be	solution annealed foll	lowed by water quenchin	.g.			
5. CORROSION TESTING	 CORROSION TESTING Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. Test specimens shall have the internal external surfaces in the as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G48, and the whole specimen shall be pick (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. The acceptance criteria are: No pitting at 20 X magnification. 						
	- The weight loss shall be less than 4.0 g/m.						
6. EXTENT OF TESTING	Corrosion test sha the referred standa		same extent as stated for	r mechanical tests in			
7. TEST SAMPLING	Samples for produce components.	Samples for production testing shall realistically reflect the properties in the actual components.					
8. SURFACE FINISH	White pickled.						
9. REPAIR OF DEFECTS	Weld repair is not	acceptable.					
10. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.						
11. CERTIFICATION	EN 10 204 Type 3 should be stated ir		emperature, soaking time	and cooling medium			

MATERIAL I	DATA SHEE'	T' MI	DS - R12	Rev. 2		
TYPE OF MATERIA	L: Austenitic Stainle	ss Steel, Type 6Mo		Page 1 of 2		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Welded Pipes	ASTM A 358	UNS S31254 UNS N08367 UNS N08925 UNS N08926	Class 1, 3 and 5.	S3		
1. SCOPE	requirements whic the referred standa	h shall be added or su	in the referred standard as persede the corresponding t included in A 240 shall Grade UNS S31254.	requirements in		
2. QUALIFICATION	Manufacturers of J NORSOK Standar		nall comply with the requi	rement of		
3. STEEL MAKING	Steel melt shall be	refined with AOD or	equivalent refining.			
4. HEAT TREATMENT	annealing is not re	The pipes shall be solution annealed followed by water quenching. Post weld solution annealing is not required of pipes with nominal wall thickness up to 7.11 mm manufactured out of solution annealed plate material as stated in chapter 5.3.2.2 of A				
5. CHEMICAL COMPOSITION	UNS N08925 and	N08926: N = 0.18 - 0.1	22 %.			
6. CORROSION TESTING	be 50 °C and the e external surfaces i be prepared accord % HNO3 + 5 % H surfaces and a cross acceptance criteria - No pitting at 20	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. Test specimens shall have the internal and external surfaces in the as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G 48, and the whole specimen shall be pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The test shall expose the external and internal surfaces and a cross section surface including weld zone in full wall thickness. The acceptance criteria are: - No pitting at 20 X magnification.				
		shall be less than 4.0	-			
7. EXTENT OF TESTING	 For batch furnae and heat treatm For continuous 	 Tensile and corrosion testing shall be carried out for each lot defined as follows: For batch furnace a lot is defined as maximum 60 m pipe of the same heat, size and heat treatment charge. For continuous heat treatment furnace a lot is defined as maximum 60 m of pipe of the same heat and size and which are heat treated the same day. 				
8. TEST SAMPLING			istically reflect the proper			
9. WELDING	 this MDS: The weld constant %; Cr ≥ 15.0 % The PQR/WPA The qualification s 	amable shall be Ni-bas ; (Mo + Cr) ≥ 28 %; C R shall be corrosion to shall be carried out on the carried out on	cordance with ASME IX of e and the alloying content $C \le 0.030 \%$; S $\le 0.015 \%$ ested as specified above. the same material grade () hake (brand name) of welc	a shall be: Mo ≥ 8.0 and Nb < 0.5 %. UNS number) as		

MATERIAL D	ATA SHEE	T' M	DS - R12	Rev. 2			
TYPE OF MATERIAL	Page 2 of 2						
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Welded Pipes	ASTM A 358	UNS S31254 UNS N08367 UNS N08925 UNS N08926	Class 1, 3 and 5.	\$3			
10. NON DESTRUCTIVE TESTING	radiography for w Supplementary re Article 6, to the w mechanical testin	 Eddy current testing according to ASTM A 450 is acceptable as replacement for radiography for wall thicknesses less than 4,0 mm. Supplementary requirement S3, penetrant testing, shall apply according to ASME V Article 6, to the weld area of 10 % of the pipes (same test lot as defined for mechanical testing) delivered. The testing shall be carried out after calibration and pickling. Acceptance criteria shall be to ASME VIII Div. 1 Appendix 8. 					
11. SURFACE FINISH	White pickled.						
12. REPAIR OF DEFECTS	-	Weld repair of base material is not acceptable. For repair of welds same requirements to PQR/WPAR as for production welding.					
13. MARKING	The component sl lot.	The component shall be marked to ensure full traceability to melt and heat treatment					
14. CERTIFICATION		EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.					

MATERIAL D	ATA SHEE	ET	MDS - R13	Rev. 2	
TYPE OF MATERIAL:	Austenitic Stainl	ess Steel, Type 6	5Мо	Page 1 of 2	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Wrought fittings	ASTM A 403	WP S31254 UNS N08367 UNS N08925 UNS N08926	WP-S, WP-WX and WP-W	S2, S7	
1. SCOPE	requirements wh referred standard	nich shall be addeo d. Material grades	ptions in the referred standard and or supersede the corresponding not included in A 403 shall com to Grade UNS S31254.	requirements in the	
2. QUALIFICATION	Manufacturers o NORSOK Stand	-	ADS shall comply with the requi	rement of	
3. STEEL MAKING	Steel melt shall	be refined with A	OD or equivalent.		
4. HEAT TREATMENT	The fittings shal	l be solution anne	aled followed by water quenchir	lg.	
	be 50 °C and the external surfaces prepared accord HNO3 + 5 % HI surfaces and a cr The acceptance	e exposure time 24 s in the as-delivered ing to ASTM G 44 F, 60 °C, 5 minute ross section includ	I G 48 Method A is required. Te hours. The specimen shall have ed condition (including pickling) 8, and the whole specimen shall). The test shall expose the exter ling weld zone (if relevant) in fu	the internal and Cut edges shall be be pickled (20 % nal and internal	
	- The weight los	ss shall be less tha	$an 4.0 \text{ g/m}^2$.		
6. EXTENT OF TESTING		-	be performed for each heat, hea m and welded with the same WI		
7. TEST SAMPLING	Samples for proc components.	duction testing sha	all realistically reflect the proper	ties in the actual	
8. WELDING	 The welding procedure shall be qualified in accordance with ASME IX or EN 288-3 and this MDS: The weld consumable alloying content shall be: Mo ≥ 8.0 %; Cr ≥ 15.0 %; (Mo + Cr) ≥ 28 %; C ≤ 0.030 %; S ≤ 0.015 %; Nb < 0.5 %. The PQR/WPAR shall be corrosion tested as specified above. The qualification shall be carried out on the same material grade (UNS number) as used in production. Change of specific make (brand name) of welding consumables requires requalification. 				
9. DIMENSIONAL TOLERANCES	Fittings with refetee tolerance of 0.3		P-75 shall have maximum wall th	ickness under	
10. NON DESTRUCTIVE TESTING	Supplementary requirement S7, liquid penetrant testing, shall apply to 10 % of seamless fittings (from the test lot as defined above) and 100 % of welded fittings above NPS 2. For welded fittings the testing shall cover the weld only. The resting shall be carried out after calibration and pickling. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 8.				

MATERIAL DA	ATA SHEE	T	MDS - R13	Rev. 2		
TYPE OF MATERIAL: Austenitic Stainless Steel, Type 6Mo				Page 2 of 2		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Wrought fittings	ASTM A 403	WP S31254 UNS N08367 UNS N08925 UNS N08926	WP-S, WP-WX and WP-W	S2, S7		
11. SURFACE FINISH	White pickled.					
12. REPAIR OF DEFECTS	Weld repair of base material is not acceptable. For repair of welds the same requirement to PQR/WPAR shall apply as for production testing.					
13. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
14. CERTIFICATION	• •	3.1B. Heat treatm in the certificate.	ent temperature, soaking time ar	nd cooling medium		

MATERIAL DA'	TA SHEE	T	MDS - R14	Rev. 2	
TYPE OF MATERIAL: Aust	enitic Stainless Steel, Type 6Mo			Page 1 of 2	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Forgings	ASTM A 182	F44 UNS N08367 UNS N08925 UNS N08926	-	S5	
1. SCOPE	requirements wind the referred s	hich shall be added standard. Material g	ptions in the referred stand or supersede the correspondence and a standard of the correspondence of the standard of the standard of the standard of the standard of the standard of the standard of the standard of the stand	onding requirements	
2. QUALIFICATION	Manufacturers of NORSOK Stand	•	IDS shall comply with the	requirement of	
3. STEEL MAKING	The steel melt s	shall be refined with	n AOD or equivalent.		
4. MANUFACTURING PROCESS	The Hot Isostat	ic Pressed (HIP) pr	ocess is an acceptable alte	ernative to forging.	
5. HEAT TREATMENT	The forgings sh	all be solution anne	ealed followed by water qu	uenching.	
6. CHEMICAL COMPOSITION	UNS N08925 ar	nd N08926: N = 0.1	.8 - 0.22 %		
7. CORROSION TESTING	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The corrosion test specimens shall be at the same location as those for mechanical testing. Cut edges shall be prepared according to ASTM G 48 and pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The acceptance criteria are: - No pitting at 20 X magnification.				
8. EXTENT OF TESTING	 The weight loss shall be less than 4.0 g/m². One set of tensile test and corrosion test shall be carried out for each heat and heat treatment load. A test lot shall not exceed 2000 kg for forgings with as forged weight ≤ 50 kg, and 5000 kg for forgings with as forged weight > 50 kg. 				
9. TEST SAMPLING	actual compone	ents.	ll realistically reflect the prations on actual component	-	
	Test samples shall be from prolongations on actual component. Sacrificial forgings shall be used for die forged components. However, special agreements may be made for die forged components with as forged weight exceeding 50 kg. Integrated blocks shall be used for HIP.				
	thickness of the	test samples as hea	1/4 T location from the sum at treated. Sketches shall b test samples and extraction	e established	
10. DIMENSIONAL TOLERANCES	Flanges to MSS mm at the weld		naximum wall thickness u	nder tolerance of 0.3	

MATERIAL D	ATA SHEE	ET	MDS - R14	Rev. 2			
TYPE OF MATERIAL: A	ustenitic Stainless	Steel, Type 6Mo		Page 2 of 2			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Forgings	ASTM A 182	F44 UNS N08367 UNS N08925 UNS N08926	-	85			
11. NON DESTRUCTIVE TESTING	forgings (from t shall be carried	Supplementary requirement S5, liquid penetrant testing, shall apply to 10 % of all forgings (from the lot as defined for mechanical testing) above NPS 2. The testing shall be carried out after final machining and pickling. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 8.					
12. SURFACE FINISH	White pickled including machined surfaces.						
13. REPAIR OF DEFECTS	Weld repair is not acceptable.						
14. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.						
15. CERTIFICATION	EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.						

MATERIAL DA	TA SHEE	T	MDS - R15	Rev. 2	
TYPE OF MATERIAL: Aust	tenitic Stainless S	Steel, Type 6Mo		Page 1 of 1	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Plates	ASTM A 240	UNS S31254 UNS N08367 UNS N08925 UNS N08926	-	-	
1. SCOPE	requirements while the referred s	hich shall be addec tandard. Material g	ptions in the referred star l or supersede the corresp grades not included in A s given to Grade UNS S3	oonding requirements 240 shall comply with	
2. QUALIFICATION	Manufacturers of NORSOK Stand	-	IDS shall comply with th	ne requirement of	
3. STEEL MAKING	The steel melt s	hall be refined wit	h AOD or equivalent.		
4. HEAT TREATMENT	The plates shall	be solution anneal	led followed by water qu	enching.	
5. CHEMICAL COMPOSITION	UNS N08925 ar	ad N08926: $N = 0.2$	18 - 0.22 %		
6. CORROSION TESTING	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. Test specimens shall have the surfaces in the as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G 48, and the whole specimen shall be pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. The acceptance criteria are:				
		20 X magnification			
7. EXTENT OF TESTING	Corrosion testin	-	n 4.0 g/m ² .	stated for mechanical	
8. TEST SAMPLING	tests in the referred standard. Samples for production testing shall realistically reflect the properties in the actual components.				
9. SURFACE FINISH	White pickled.				
<i>10. REPAIR OF DEFECTS</i>	Weld repair is n	ot acceptable.			
11. MARKING	The component treatment lot.	shall be marked to	ensure full traceability t	o melt and heat	
CERTIFICATION	• •	e 3.1B. Heat treatm be stated in the cer	nent temperature, soaking rtificate.	g time and cooling	

MATERIAL D	ATA SHE	ET MDS	- R16	Rev. 2			
TYPE OF MATERIAL	: Austenitic Stain	less Steel, Type 6M	0	Page 1 of 2			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Castings	ASTM A 351	CK-3MCuN CN-3MN	-	\$5, \$6			
1. SCOPE	requirements which	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. QUALIFICATION	Manufacturers of NORSOK Standar		shall comply with the requin	rement of			
3. STEEL MAKING			D or equivalent process. Re e is acceptable. Use of inter				
4. HEAT TREATMENT	Solution annealed	at temperature ≥ 122	5 °C.				
5. CHEMICAL	P ≤ 0.030 %						
6. CORROSION TESTING	shall be 50 °C and at the same locatic according to AST acceptance criteria	the exposure time 24 on as those for mecha M G 48 and pickled (8 Method A is required. Tes 4 hours. The corrosion test s nical testing. Cut edges shal 20 % HNO3 + 5 % HF, 60 %	specimen shall be ll be prepared			
	· ·	shall be less than 4.0	g/m^2 .				
7. EXTENT OF TESTING		prrosion test shall be	made for each melt and heat	t treatment load. A			
8. TEST SAMPLING	components. Thic	kness of the test block a maximum thickness	alistically reflect the proper k shall be equal to the thick s of 100 mm. For flanged co	ness of the actual			
	Test specimens sh thickness of the te		4 T location from the surfac	e where T is the			
		e integrally cast or ga until after the final qu	ted onto the castings and sh ality heat treatment.	all not be removed			
9. NON DESTRUCTIVE TESTING	<i>Liquid penetrant testing:</i> Supplementary requirement S6 shall apply to all accessible surfaces of all castings. The testing shall be carried out after final machining and pickling. The acceptance criteria shall be ASME VIII, Div.1, Appendix 7. <i>Radiographic testing:</i> Supplementary requirement S5 shall apply to:						
			the pilot cast of each patter				
		ds of each casting					
		e	areas to ANSI B16.34 of ea	ich casting.			
	The acceptance cr	iteria shall be to ASM	IE VIII, Div. 1, Appendix 7				
10. SURFACE FINISH	White pickled. Sh machined surfaces		r any blasting and shall incl	ude finished			

MATERIAL D	OATA SHEE	ET MDS - F	R16	Rev. 2		
TYPE OF MATERIAL	Page 2 of 2					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Castings	ASTM A 351	CK-3MCuN CN-3MN	-	\$5, \$6		
11. REPAIR OF DEFECTS	 Repair welding shall be carried out with Ni-based consumables with alloying content: Mo ≥ 8.0 %; Cr ≥ 15.0 %; (Mo + Cr) ≥ 28 %; C ≤ 0.030 %; S ≤ 0.015 %; Nb < 0.5 %. Welding consumables with matching chemical composition is acceptable provided solution annealing heat treatment after welding. The repair welding procedure shall be qualified in accordance with ASME IX or EN 288-3 and this MDS. A cast plate shall be used for the test welding. A macro and corrosion test as specified above shall be carried out. Change specific make of filler metal (brand name) requires requalification. All casting with major repairs shall be given a solution heat treatment after welding. 					
12. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
13. CERTIFICATION	EN 10 204 Type 3 should be stated in	B.1B. Heat treatment temport the certificate.	erature, soaking time ar	nd cooling medium		

MATERIAL D	OATA SHEI	ET M	IDS - R17	Rev. 2		
TYPE OF MATERIAL:	Austenitic Stainless	s Steel, Type 6Mo		Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Bars	ASTM A 276	UNS S31254 UNS N08367 UNS N08925 UNS N08926	-	-		
1. SCOPE	requirements which the referred stand	ch shall be added or su	in the referred standard persede the correspondin t included in A 276 shall UNS S31254.	g requirements in		
2. QUALIFICATION	Manufacturers of NORSOK Standa		nall comply with the requ	airement of		
3. STEEL MAKING	The steel melt sha	The steel melt shall be refined with AOD or equivalent.				
4. HEAT TREATMENT	Solution annealin	Solution annealing followed by water quenching.				
5. CHEMICAL COMPOSITION	<i>UNS N08925 and N08926:</i> N = 0.18 - 0.22 %					
6. CORROSION TESTING	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. The corrosion test specimens shall be at the same location as those for mechanical testing. Cut edges shall be prepared according to ASTM and pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The acceptance criteria are:					
	- No pitting at 20	X magnification.				
	- The weight loss	shall be less than 4.0 g	g/m^2 .			
7. EXTENT OF TESTING	One tensile test ar treatment load.	nd corrosion test shall b	be carried out for each he	eat and heat		
8. TEST SAMPLING	Samples for produced components.	uction testing shall real	istically reflect the prope	erties in the actual		
9. SURFACE FINISH	Finished product	Finished product shall be white pickled.				
10. REPAIR OF DEFECTS	Weld repair is not	t acceptable				
11. MARKING	The component sl lot.	The component shall be marked to ensure full traceability to melt and heat treatment				
12. CERTIFICATION	EN 10 204 Type 3 should be stated in		mperature, soaking time	and cooling medium		

MATERIAL D	ATA SHE	ET N	/IDS - R18	Rev. 2		
TYPE OF MATERIAL	: Austenitic stainle	ess steel, Type 6Mo		Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Tubes	ASTM A 269	UNS S31254 UNS N08367 UNS N08925 UNS N08926	-	-		
I. SCOPE	requirements which referred standard.	h shall be added or su	in the referred standard persede the correspondir cluded in A 269 shall co JNS S31254.	ng requirements in the		
2. QUALIFICATION	Manufacturers of J Standard M-650.	product to this MDS s	hall comply with the requ	irement of NORSOK		
3. STEEL MAKING	The steel melt sha	The steel melt shall be refined by AOD or equivalent.				
4. HEAT TREATMENT	The tubes shall be solution annealed followed by water quenching.					
5. CORROSION TESTING	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. Test specimens shall have internal and external surfaces in an as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G 48 and the whole specimen shall be pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The acceptance criteria are: - No pitting at 20 X magnification.					
	- The weight loss	shall be less than 4.0	g/m^2 .			
6. EXTENT OF TESTING	-	Corrosion testing shall be carried out to the same extent as stated for mechanical tests in the referred standard.				
7. TEST SAMPLING	Samples for production testing shall realistically reflect the properties in the actual components.					
8. SURFACE FINISH	White pickled.					
9. REPAIR OF DEFECTS	Weld repair is not	Weld repair is not acceptable.				
10. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
11. CERTIFICATION	EN 10 204 Type 3 should be stated in		emperature, soaking time	and cooling medium		

MATERIAL D	ATA SHE	ET N	/IDS - R18	Rev. 2		
TYPE OF MATERIAL	: Austenitic stainle	ess steel, Type 6Mo		Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Tubes	ASTM A 269	UNS S31254 UNS N08367 UNS N08925 UNS N08926	-	-		
I. SCOPE	requirements which referred standard.	h shall be added or su	in the referred standard persede the correspondir cluded in A 269 shall co JNS S31254.	ng requirements in the		
2. QUALIFICATION	Manufacturers of J Standard M-650.	product to this MDS s	hall comply with the requ	irement of NORSOK		
3. STEEL MAKING	The steel melt sha	The steel melt shall be refined by AOD or equivalent.				
4. HEAT TREATMENT	The tubes shall be solution annealed followed by water quenching.					
5. CORROSION TESTING	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C and the exposure time 24 hours. Test specimens shall have internal and external surfaces in an as-delivered condition (including pickling). Cut edges shall be prepared according to ASTM G 48 and the whole specimen shall be pickled (20 % HNO3 + 5 % HF, 60 °C, 5 minute). The acceptance criteria are: - No pitting at 20 X magnification.					
	- The weight loss	shall be less than 4.0	g/m^2 .			
6. EXTENT OF TESTING	-	Corrosion testing shall be carried out to the same extent as stated for mechanical tests in the referred standard.				
7. TEST SAMPLING	Samples for production testing shall realistically reflect the properties in the actual components.					
8. SURFACE FINISH	White pickled.					
9. REPAIR OF DEFECTS	Weld repair is not	Weld repair is not acceptable.				
10. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
11. CERTIFICATION	EN 10 204 Type 3 should be stated in		emperature, soaking time	and cooling medium		

MATERIAL DA'	T'A SHEET		MDS - S01	Rev. 2		
TYPE OF MATERIAL: A	Page 1 of 1					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Wrought fittings	ASTM A 403	WP 316	W/S/WX	-		
Welded pipes	ASTM A 358	316	Class 1, 3, 4 or 5	-		
Seamless & welded pipes	ASTM A 312	TP 316	-	-		
Forgings	ASTM A 182	F 316	-	-		
Plates	ASTM A 240	316	-	-		
Tubes	ASTM A 269	316	-	-		
1. SCOPE	L .	h shall be add	options in the referred stand ed or supersede the correspo			
2. CHEMICAL COMPOSITION	•	All products: $C \le 0.035 \%$ Plates to A 240: $S \le 0.015 \%$				
3. TENSILE TESTING	Grade 316 L with 1	$R_{p0.2} \ge 205 M$	Pa and $R_m \ge 515$ MPa is acc	eptable.		
4. TEST SAMPLING	Samples for produce component.	Samples for production testing shall realistically reflect the properties in the actual component.				
5. DIMENSIONAL TOLERANCES	Flanges to A 182:	U	SS SP-44 shall have a maxin ce of 0.3 mm at weld end.	num wall thickness		
6. NON DESTRUCTIVE TESTING	Welded pipes to A 358:Eddy current testing according to ASTM A450 is acceptable as replacement for spot radiography for wall thicknesses less than 4.0 mm.Welded tubes to A269:Eddy current testing according to ASTM A 450, section 23 is required.					
7. SURFACE FINISH	White pickled. Ma		es do not require pickling.			
8. REPAIR OF DEFECTS	Weld repair of base	Weld repair of base material is not acceptable.				
9. CERTIFICATION	EN 10 204 Type 3.	.1B				

MATERIAL D	ATA SHEET	Г М	1DS - S02	Rev. 2	
TYPE OF MATERIAL:	· Austenitic Stainles	s Steel Castings		Page 1 of 1	
PRODUCT	STANDARD	GRADE	ACCEPT. CLAS	SS SUPPL. REQ.	
Castings	ASTM A 351	CF8M CF3M	-	\$5, \$6 \$5, \$6	
1. SCOPE	.	h shall be added o	ons in the referred stand r supersede the correspo		
2. EXTENT OF TESTING	Tensile testing is r	equired for each h	eat and heat treatment lo	oad .	
3. TEST SAMPLING	For castings with weight 250 kg and above the test blocks shall be integrally cast with the casting. The test blocks shall be heat treated together with the castings they represents. Samples for mechanical testing shall realistically reflect the properties in the actual				
4. NON DESTRUCTIVE TESTING	 components. Liquid penetrant testing: Supplementary requirement S6 shall apply to all accessible surfaces of all castings. The testing shall be carried out after final maching and pickling. The acceptance criteria shall be ASME VIII, Div.1, Appendix 7. <i>Radiographic testing:</i> Supplementary requirement S5 shall apply to: Critical areas as per ANSI B16.34 of the pilot cast of each pattern All butt weld ends of each casting. Class 1500 psi and above; all critical areas according to ANSI B16.34 of each casting. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 7. 				
5. SURFACE FINISH	White pickled. Machined surfaces do not require pickling.				
6. CERTIFICATION	EN 10 204 Type 3	.1B			

MATERIAL DAT	A SHEET	MD	S - T01	Rev. 2	
TYPE OF MATERIAL: Tit	anium Grade 2			Page 1 of 1	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Seamless pipes	ASTM B 861	2	-	-	
Welded pipes	ASTM B 862	2	-	-	
Wrought fittings	ASTM B 363	WPT2/WPT2W	-	-	
Forgings	ASTM B 381	F2	-	-	
Plates	ASTM B 265	2	-	-	
Bars	ASTM B 348	2	-	-	
Tubes	ASTM B 338	2	-	-	
1. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard. Equivalent Titanium grade (GOST VT 1-0) is acceptable provided the requirements in the referred standard and this MDS is fulfilled.				
2. CHEMICAL COMPOSITION	Chemical composit	ion other than Grad	e 2 (GOST VT 1-0) is a	cceptable.	
3. HEAT TREATMENT	Wrought fittings to B 363, Forgings to B 381, Plates to B 265 and Bars to B 348: Annealed condition if not the tensile properties in the referred standard can be acheived in as formed condition.				
4. EXTENT OF TESTING	Wrought fittings to		st shall be carried out fo load, type and size.	r each heat, heat	
	Forgings to B 381:	is defined treatment	st specimen shall be take as all products of the sa load with a maximum de kness of 10 mm	me heat and heat	
	Bars to B 348:	is defined treatment	st specimen shall be take as all products of the sa load with a maximum d kness of 10 mm.	me heat and heat	
5. TEST SAMPLING	All products:		or production testing sh	all realistically reflect	
		•	ties in the actual compo	•	
6. WELDING	Welded pipes to B &	862: Welding p with ASM	procedures shall be qualities IX.	ified in accordance	
7. DIMENSIONAL TOLERANCES	Flanges to B 381:		MSS SP-44 shall have under tolerance of 0.3 m		
8. CERTIFICATION	EN 10 204 Type 3.	1B.			

MATERIAL DA	TA SHEET	MDS	5 - T02	Rev. 2			
TYPE OF MATERIAL: T	itanium Grade 2			Page 1 of 1			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Castings	ASTM B 367	C2	-	S1, S2			
1. SCOPE	requirements which shows the referred standard.	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard. Equivalent Titanium grades (GOST VT 1-0) are acceptable provided the					
	requirements in this N	IDS is fulfilled.					
2. QUALIFICATION	Manufacturers of proc NORSOK Standard M		Il be qualified in accord	dance with			
3. CHEMICAL COMPOSTION	Chemical composition	n other than Grade 2	(GOST VT 1-0) is acce	eptable.			
4. EXTENT OF TESTING	Tensile testing is requ	Tensile testing is required for each heat and heat treatment load.					
5. TEST SAMPLING	Samples for mechanical testing shall realistically reflect the properties in the actual components. For castings with weight 250 kg and above the test blocks shall be integrally cast with the casting. The test blocks shall be heat treated together with the castings they represents.						
6. NON DESTRUCTIVE TESTING	<i>Liquid penetrant testing:</i> Supplementary requirement S2 shall apply to all accessible surfaces of all castings. The testing shall be carried out after final machining. The acceptance criteria shall be ASME VIII, Div.1, Appendix 7.						
	 <i>Radiographic testing:</i> Supplementary requirement S1 shall apply to: Critical areas as per ANSI B16.34 of the pilot cast of each pattern All butt weld ends of each casting. Class 1500 psi and above; all critical areas according to ANSI B16.34 of each casting. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 7. 						
7. MARKING	The component shall lot.	be marked to ensure	full traceability to melt	and heat treatment			
8. CERTIFICATION	EN 10 204 Type 3.1B						

MATERIAL DAT	A SHEET	Μ	IDS - X01	Rev. 1		
TYPE OF MATERIAL: Lo	w Alloyed Steel T	ype AISI 4130		Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	S SUPPL. REQ.		
Seamless pipes Wrought fittings (seamless)	ASTM A 519 ASTM A 234	AISI 4130 AISI 4130		S2		
1. SCOPE	·	h shall be added	otions in the referred stan or supersede the corresp			
2. HEAT TREATMENT			d in the liquid quenched e minimum 650 °C.	and tempered condition.		
3. MANUFACTURING PROCESS		ufactured by me	ans of the hot finished (H	HF) sizing method.		
4. CHEMICAL COMPOSITION	Max. sulphur conte	_				
5. TENSILE TESTING	Max. phosphorous content: $P \le 0.025 \%$ Minimum yield strength: Reh ≥ 415 MPaMinimum tensile strength: Rm ≥ 620 MPaMinimum elongation: A5 $\ge 18 \%$ Minimum red. of area: $Z \ge 35 \%$					
6. IMPACT TESTING	Charpy V-notch impact testing shall be carried out according to ASTM A 370 for thicknesses $t \ge 6$ mm. Full sized Charpy V-notch specimens shall be used wherever possible. The notch shall be perpendicular to the surface. The test temperature shall be - 30 °C. The minimum absorbed energy for full size specimens shall be 42 J average and 30 J single. Reduction factors for subsize specimens shall be: 7.5 mm - 5/6 and 5 mm - 2/3.					
7. EXTENT OF TESTING	One set of tensile and impact test shall be carried out for each lot. A lot is defiened as all products of the same type, nominal size and wall thickness, produced from the same heat and heat treatment load. For pipes heat treated in continous furnace the maximum lot size shall be 60 m.					
8. TEST SAMPLING	component.	-	ll realistically reflect the	properties in the actual		
9. NON DESTRUCTIVE TESTING	Fittings: According to supplementary requirement S2. Pipes: All pipes shall be 100 % tested in accordance with API 5L supplementary requirement 4 (SR4). Alternatively, ultrasonic testing according to SEL 1915 may be carried out. Fittings: Fittings shall be 100 % magnetic particle tested in accordance with ASME VIII, div. 1, Appendix 6.					
10. REPAIR OF DEFECTS	Weld repair is not acceptable.					
11. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
12. CERTIFICATION	EN 10 204 Type 3. should be stated in		ent temperature, soaking	time and cooling medium		

MATERIAL DAT	A SHEET	M	DS - X02	Rev. 2		
TYPE OF MATERIAL: Hig	h Strength Low A	lloyed Steel Typ	e AISI 4140	Page 1 of 1		
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.		
Forgings	ASTM A 788	AISI 4140	-	S18		
1. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. MANUFACTURING PROCESS	The forgings shall	be finished hot-w	orked.			
3. HEAT TREATMENT	The forgings shall	be austenitised, li	quid quenched and tempe	ored.		
4. CHEMICAL COMPOSITION	According to AST	M A 29, AISI 414	.0			
5. TENSILE TESTING	Minimum yield stro Minimum tensile st Minimum elongatio	trength: $\text{Rm} \ge 85$				
6. IMPACT TESTING	Charpy V-notch testing is required according to ASTM A 370 at - 30 °C. The nocth shall be perpendicular to the surface. The minimum absorbed energy for full size specimens shall be 42 J average and 30 J single.					
7. EXTENT OF TESTING	One set of tensile and impact test shall be carried out for each melt, section thickness $+/-25$ % and heat treatment load.					
8. TEST SAMPLING	Samples for product component.	ction testing shall	realistically reflect the pr	operties in the actual		
	Test samples shall be from prolongations on actual components. Sacrificial forging shall be used for die forged components. However, special agreements may be made for die forged components with as forged weight exceeding 50 kg.					
	thickness of the tes	t samples as heat	4 T location from the surf treated. Sketches shall be es and extraction of test sp	established showing		
9. NON DESTRUCTIVE TESTING	type, size and location of test samples and extraction of test specimens.Supplementary Requirement, S18, magnetic particle tested, shall apply to 10 % of all forgings (from the lot as defined for mechanical testing). The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 6.					
10. REPAIR OF DEFECTS	Weld repair is not a	acceptable.				
11. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.					
12. CERTIFICATION	EN 10 204 Type 3.	1B				
	Heat treatment tem certificate.	perature, soaking	time and cooling medium	n should be stated in the		

MATERIAL D	ATA SHEET	n MI	DS - X03	Rev. 2			
TYPE OF MATERIAL	: High Strength Low	Alloy Steel		Page 1 of 1			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.			
Castings	ASTM A 487	Grade 2B, 2C	-	S4, S5			
1. SCOPE	-	-	in the referred standard an ersede the corresponding				
2. IMPACT TESTING		he surface. The mini	ling to ASTM A 370 at - 3 mum absorbed energy sha				
3. EXTENT OF TESTING	One set of tensile an lot shall not exceed :		red for each melt and heat	treatment load. A test			
4. TEST SAMPLING	Samples for mechanical testing shall realistically reflect the properties in the actual components. Thickness of the test block shall be equal to the thickness of the actual components up to a maximum thickness of 100 mm. For flanged components the largest flange thickness shall apply.						
	-	Test specimens shall be cut from the 1/4 T location from the surface where T is the thickness of the test block.					
		ntegrally cast or gate til after the final qual	d onto the castings and sha ity heat treatment.	all not be removed			
5. NON DESTRUCTIVE TESTING	surfaces of all castin	gs. The examination	v requirement S4 shall app shall be carried out after 1 I, Div. 1, Appendix 7.	-			
	 <i>Radiographic testing:</i> Supplementary requirement S5 shall apply to: - Critical areas as per ANSI B16.34 of the pilot cast of each pattern. - All butt weld ends of each casting. - Class 1500 psi and above; all critical areas to ANSI B16.34 of each casting. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 7. 						
6. REPAIR OF DEFECTS		All weld repairs shall be post weld heat treated. The repair welding procedure qualification shall include the following:					
	- qualification on a c	- qualification on a cast plate of the same grade					
	- one set of impact test (3 specimens), shall be taken from weld metal and fusion line.						
7. MARKING	The component shal	l be marked to ensure	e full traceability to melt a	nd heat treatment lot.			
8. CERTIFICATION	EN 10 204 Type 3.1 should be stated in the		nperature, soaking time ar	nd cooling medium			

MATERIAL DAT	A SHEET	MD	S - X04	Rev. 1	
TYPE OF MATERIAL: Hig	h Strength Low A	lloyed Steel Type	AISI 4130	Page 1 of 1	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Forgings	API 6A	60K (AISI 4130)	Product Specification Level (PSL) 3	-	
1. SCOPE		n shall be added or s	is in the referred standard upersede the correspondir		
2. MANUFACTURING PROCESS	The flanges shall be accepted.	e forged to shape. Fl	langes machined out of ba	ar and or plate are not	
3. HEAT TREATMENT/ DELIVERY CONDITION	The flanges shall be	e austenitised, liquid	l quenched and tempered.		
4. CHEMICAL COMPOSITION	modified in accorda		the requirements of AISI 4 ements PSL 3 given in tab eed.		
5. IMPACT TESTING	Charpy V-notch testing at - 30 °C is required. The minimum absorbed energy for full size specimens shall be 42 J average and 30 J single.				
6. EXTENT OF TESTING	One set of tensile and impact test shall be carried out for each melt, section thickness according to API 6A, PSL 3, and heat treatment load. A test lot shall not exceed 2000 kg.				
7. TEST SAMPLING	Samples for produc component.	ction testing shall rea	alistically reflect the prop	erties in the actual	
	shall be used for di	e forged component	ns on actual components. s. However, special agree ed weight exceeding 50 k	ments may be made	
	Test specimens shall be cut at the 1/4 T location from the surface where T is the thickness of the test samples as heat treated. Sketches shall be established showing type, size and location of test samples and extraction of test.				
8. DIMENSIONAL TOLERANCES	Flanges to MSS SP mm for the hub at t		ximum wall thickness und	ler tolerance of 0.3	
9. NON DESTRUCTIVE TESTING	 NDT shall be carried out after final heat treatment: 100 % MT according to ASME VIII, Div.1, App.6, shall be carried out. 100 % UT according to ASTM A 388, shall be carried out. The acceptance criterias shall be according to ASTM A 388 para 8. 				
10. REPAIR OF DEFECTS	Weld repair is not a	acceptable.			
11. MARKING	The component sha lot.	Ill be marked to ensu	ure full traceability to mel	t and heat treatment	
12. CERTIFICATION	EN 10 204 Type 3. should be stated in		emperature, soaking time	and cooling medium	

MATERIAL D	AIA SHEEI	I	/ID/S - X05	Rev. 1			
TYPE OF MATERIAL	: High Strength Low A	Alloyed Steel T	ype F22	Page 1 of 1			
PRODUCT	STANDARD	GRADE	ACCEPT. CLAS	S SUPPL. REQ.			
Forgings	ASTM A 182	F22	3	S4			
1. SCOPE	requirements which	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.					
2. HEAT TREATMENT	Normalized and te	empered.					
3. IMPACT TESTING	size specimens sh	Charpy V-notch testing at - 46 °C is required. The minimum absorbed energy for full size specimens shall be 27 J average and 20 J single. Reduction factors for subsize specimens shall be: 7,5 mm - 5/6 and 5 mm - 2/3.					
4. EXTENT OF TESTING		One set of tensile and impact test shall be carried out for each heat and heat treatment load. A test lot shall not exceed 2000 kg.					
5. TEST SAMPLING	Samples for produced component	Samples for production testing shall realistically reflect the properties in the actual component					
	shall be used for a	Test samples shall be from prolongations on actual components. Sacrificial forgings shall be used for die forged components. However, special agreements may be made for die forged components with as forged weight exceeding 50 kg.					
	thickness of the te	Test specimens shall be cut at the 1/4 T location from the surface where T is the thickness of the test samples as heat treated. Sketches shall be established showing type, size and location of test samples and extraction of test specimens.					
6. DIMENSIONAL TOLERANCES	Flanges to MSS S mm for the hub at			ess under tolerance of 0.3			
7. NON DESTRUCTIVE TESTING	of all forgings (fro	Supplementary Requirement, S4, Magnetic Particle testing, shall apply to 10 % of all forgings (from the lot as defined for mechanical testing). The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 6.					
8. REPAIR OF DEFECTS	Weld repair of ba	se material is no	t acceptable.				
9. MARKING	The component sl lot.	The component shall be marked to ensure full traceability to melt and heat treatment					
10. CERTIFICATION	EN 10 204 Type 3 should be stated it		nent temperature, soakin	g time and cooling medium			

MATERIAL D	DATA SHEET	MD	S - X06	Rev. 1
<i>TYPE OF MATERIAL:</i> High Strength Low Alloy Steel for application down to -46 °C			Page 1 of 1	
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.
Castings	ASTM A 487	Grade 2B, 2C	-	S4, S5
I. SCOPE	This MDS specifies the selected options in the referred standard and additional requirements which shall be added or supersede the corresponding requirements in the referred standard.			
2. CHEMICAL COMPOSITION	$C \leq 0.14$ %; Si ≤ 0.50 %; Mn = 1.30-1.60 %; Cr ≤ 0.20 %; Ni = 0.90-1.10 % and Mo = 0.15-0.25 %			
3. IMPACT TESTING	Charpy V-notch testing is required according to ASTM A 370 at -46 °C. The notch shall be perpendicular to the surface. The minimum absorbed energy shall be 42 J average (of (3 specimens) and 30 J single value.			
4. EXTENT OF TESTING	One set of tensile and impact test is required for each melt and heat treatment load. A test lot shall not exceed 5000 kg.			
5. TEST SAMPLING	Samples for mechanical testing shall realistically reflect the properties in the actual components. Thickness of the test block shall be equal to the thickness of the actual components as heat treated up to a maximum thickness of 100 mm. For flanged components the largest flange thickness apply.			
	Test specimens shall be cut from the 1/4 T location from the surface where T is the thickness of the test block.			
	Test block shall be integrally cast or gated onto the castings and shall not be removed from the castings before after the final quality heat treatment.			
6. NON DESTRUCTIVE TESTING	<i>Magnetic particle testing:</i> Supplementary requirement S4 shall apply to all accessible surfaces of all castings. The examination shall be carried out after machining. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 7.			
	 <i>Radiographic testing:</i> Supplementary requirement S5 shall apply to: - critical areas as per ANSI B16.34 of the pilot cast of each pattern - all butt weld ends of each casting - Class 1500 psi and above; all critical areas to ANSI B16.34 of each casting. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 7. 			
7. REPAIR OF DEFECTS	All weld repairs shall be post weld heat treated. The repair welding procedure qualification shall include the following:			
	- qualification on a cast plate of the same grade- one set of impact test (3 specimens) shall be taken from weld metal and fusion line.			
8. MARKING	The component shall be marked to ensure full traceability to melt and heat treatment lot.			
9. CERTIFICATION	EN 10 204 Type 3.1B. Heat treatment temperature, soaking time and cooling medium should be stated in the certificate.			

