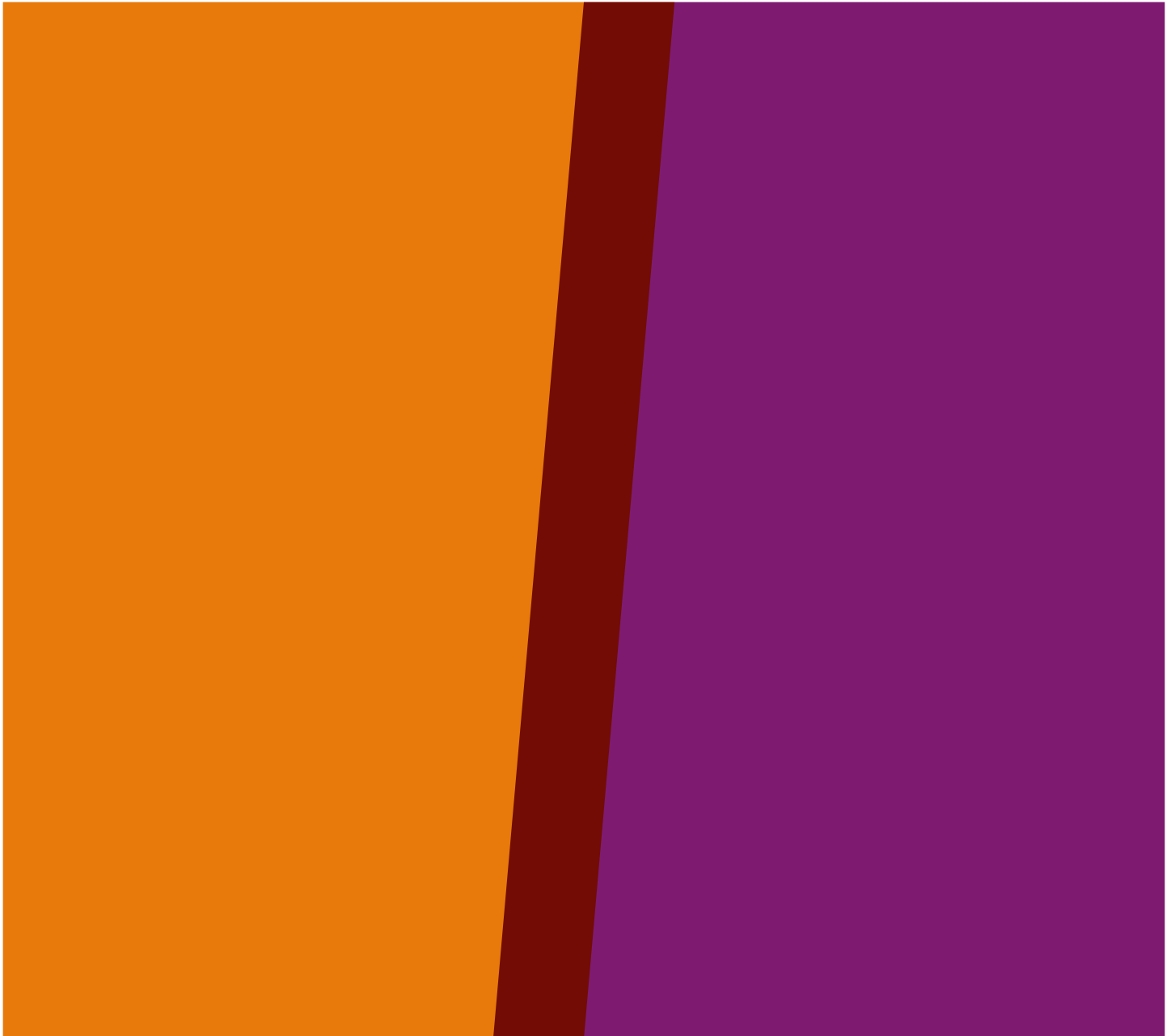


# Piping material specification



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## Acknowledgements

This Specification was prepared by a Joint Industry Project 33 *Standardization of Equipment Specifications for Procurement* organized by IOGP with support by the World Economic Forum (WEF)

### Feedback

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# Piping material specification

## Revision history

VERSION	DATE	AMENDMENTS
1.0	December 2016	First release
1.1	January 2017	Correction to report reference on page 6 - S-572 corrected to S-562.

# Piping material specification

This document compiles  
Material Data Sheets for  
piping components for use  
in piping system designed  
in compliance with ASME  
B31.3.

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## Foreword

This IOGP Specification was prepared by a Joint Industry Project 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF). Seventeen key members from WEF and IOGP membership participated in JIP33 with an effort to leverage and improve industry level standardization. The scope of work has been to harmonize procurement specifications from the seventeen participating Members and develop one agreed and jointly approved Specification building on recognized industry and/or international standards. This is one of the initial Specifications to prove this concept.

Following agreement of the relevant IOGP sub-team and approval by the JIP33 Steering Committee, the IOGP Management Committee has agreed to the publication of this Specification by IOGP. The next step is for the individual operating companies to evaluate this Specification and consider whether to replace their own Specification with this joint Specification and thereby achieve real standardization across the oil and gas industry for the subject at hand. This applies to the participating companies and hopefully many more WEF and IOGP Members.

# Introduction

Most oil and gas companies design the process and utility piping systems for upstream development facilities in accordance with ASME B31.3 and specify bulk, piping components to ASTM standard specification. However, companies have, over the years, developed different additional requirements to the basic ASTM requirements as a response to lessons learnt. This has resulted in specialized requirements that are often changed from project to project within the same company without considering the consequences of cost, availability and impact on the market. This has contributed to the need for production of dedicated products, which increase cost and lead-time, which again increase the construction time and the overall project schedule. The overall consequence is increased project development cost.

The aim with this IOGP specification is to standardize the minimum technical requirements for the procurement of the most commonly used bulk piping materials and to facilitate the manufacture of “stock products” to reduce cost and increase availability.

---

## 1. Scope

This IOGP specification is a collection of material data sheets for the most commonly used bulk piping components for use in piping systems designed in accordance with ASME B31.3 Normal or Category D fluid service <sup>(1)</sup> for oil and gas production and processing facilities <sup>(2)</sup>.

The material data sheets define applicable options and/or requirements that supplement or amend the referenced ASTM standard specification for the following material types:

- Non-impact tested carbon steel
- Impact tested carbon steel
- Ferritic/austenitic stainless steel: types 22Cr duplex and 25Cr duplex
- High alloy austenitic stainless steel: type 6Mo
- Austenitic stainless steel: type 316/316L, type 304/304L
- Copper/Nickel: type 90/10, aluminium bronze
- Nickel base alloys: type 625
- Nickel base bolting; type 625, 660
- Titanium grade 2
- High strength, low alloy steel bolting

The above scope is not intended to preclude the use of alternative generic materials or grades within a referenced ASTM standard specification; where the use of alternative materials/grades are considered appropriate, the end user is responsible for specifying any additional requirements.

This IOGP specification does not aim to address specific requirements for bulk piping materials exposed to sour environments as defined in NACE MR0175/ISO 15156 as the selection of suitable materials is the responsibility of the end (equipment) user. However, Section 4.4 defines a minimum set of additional requirements that have been specified to provide some flexibility in the event of ‘souring’ during operation.

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## 2. Normative references

The following referenced documents are indispensable for the application of this document. For undated references, the latest edition of the referenced document (including any amendments) applies.

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<sup>1</sup> For other types of fluid service in ASME B31.3, the end user is responsible for specifying any appropriate additional requirements necessary to meet the design

<sup>2</sup> The scope is intended to cover upstream offshore fixed and floating production and processing facilities, onshore production and processing facilities, and liquefied gas import and export terminals. Downstream refining and chemical manufacturing facilities are excluded

ASME B31.3	Process Piping
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
EN 10204	Metallic products – Types of inspection documents
IOGP S-562	Supplementary Requirements to API Spec 6D Ball Valves
ISO 6892-1	Metallic materials -- Tensile testing -- Part 1: Method of test at room temperature
ISO 10474	Metallic products – Inspection documents
ISO 15156-2	Petroleum and natural gas industries - Materials for use in H <sub>2</sub> S-containing environments in oil and gas production - Part 2: Cracking-resistant carbon and low-alloy steels, and the use of cast irons (See Note below)
ISO 15156-3	Petroleum and natural gas industries - Materials for use in H <sub>2</sub> S-containing environments in oil and gas production - Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys (See Note below)
ISO 17781	Petroleum, petrochemical and natural gas industries - Test methods for quality control of microstructure of austenitic/ferritic (duplex) stainless steels
ISO 17782	Petroleum, petrochemical and natural gas industries – Qualification of Manufactures of Special Materials
NORSOK M-650	Qualification of Manufactures of Special Materials

There are a large number of API, ASME, ASTM, ISO and other material related standards listed in Table 1 and Annex A which are applicable to the individual data sheet and not listed here

Note: ISO 17781 and 17782 are referenced within this specification and the material datasheets for duplex stainless steels. These ISO standards are in final stages of development/balloting and have not been finally published, therefore when this IOGP specification is issued, the requirements related to these two standards shall, until published, be taken to mean those specified in the ISO DIS.2 version of both standards

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## 3. Terms, definitions and abbreviations

For the purposes of this IOGP specification the following terms, definitions and abbreviations shall apply.

---

### 3.1 Terms and definitions

#### 3.1.1

##### **shall**

verbal form used to indicate requirements strictly to be followed in order to conform to this IOGP specification and from which no deviation is permitted, unless accepted by the end (equipment) user

#### 3.1.2

##### **may**

verbal form used to indicate a course of action permissible within the limits of this IOGP specification

### 3.1.2

#### **stainless steel types 304 and 316**

austenitic stainless steel certified to meet both 304/304L or 316/316L properties

### 3.1.3

#### **stainless steel type 6Mo**

austenitic stainless steel alloys with 6% Mo and PRE  $\geq$  40

### 3.1.4

#### **stainless steel type 22Cr duplex**

ferritic/austenitic stainless steel alloys with  $30 < \text{PREN} < 40$  and Cr  $\geq$  19% (mass fraction)

### 3.1.5

#### **stainless steel type 25Cr duplex**

ferritic/austenitic stainless steel alloys with  $40 \leq \text{PREN} < 48$  and 25 %Cr nominal content

NOTE: Often referred to as "super duplex".

---

## 3.2 Abbreviations

API	The American Petroleum Institute
ASTM	The American Society of Testing and Materials
ASME	The American Society of Mechanical Engineers
ISO	International Organization for Standardization
MDS	material data sheet
NDT	non-destructive testing
PREN	pitting resistance equivalent number ( $\%Cr + (3.3\% Mo + 0.5\%W) + 16\%N$ )
SMYS	specified minimum yield strength
UNS	unified numbering system

---

## 4. Material data sheets

### 4.1 General

The component shall be delivered in accordance with the ASTM standard specification referenced in the MDSs including any additional requirements specified therein. Unless otherwise specified in the MDSs, all the requirements of the referenced ASTM/API standard specification apply.

The latest issue of the referenced ASTM/API standard specification at the time of use shall apply.

Welded pipes according to MDS IC01, IC11, MDS ID42, MDS ID43, MDS ID52, MDS ID53, MDS IN01, MDS IR12, MDS IR13, MDS IS01 and MDS IS21 specify acceptance classes, which give welding factors ranging from 0.8 to 1.0. The correct class shall be specified on the piping class sheet and the purchase order shall specify acceptable class for each relevant item.

## 4.2 MDS numbering system

The numbering system of the MDSs consists of four characters and follow similar logic as applied in Norsok M-630. The letter "I" is added as the 1<sup>st</sup> character to the IOGP MDSs to differentiate them from the Norsok MDSs.

The 2<sup>nd</sup> character is identifying the type of material with the following interpretation:

- C - carbon steels;
- D - ferritic/austenitic stainless steels, type 22Cr duplex, type 25Cr duplex;
- K - copper/nickel 90/10 and other copper alloys;
- N - nickel base alloys;
- R - austenitic stainless steels: type 6Mo;
- S - austenitic stainless steels: type 304/304L, type 316/316L;
- T - titanium;
- X - low alloyed steels.

For carbon steel the third character is indicating if impact toughness testing is applicable or not, respectively with the following interpretation:

The third character:

- 0 Impact testing is not applicable;
- 1 Impact testing at -46 °C is applicable.

The fourth character:

- 1 MDS contains several products;
- 2 The product is a casting;

For duplex stainless steels the third character is defining the type of duplex stainless steel with the following interpretation:

- 4 nominal composition 22 % chromium for type 22Cr duplex;
- 5 nominal composition 25 % chromium for type 25Cr duplex.

For type 6Mo stainless steel the third character is not given any logic.

The fourth character for duplex and type 6Mo stainless steel is a product code with the following logic:

- 1 seamless pipe;
- 2 welded pipe solution annealed;
- 3 wrought fitting/HIP product;
- 4 forging/HIP product;
- 5 plate;
- 6 casting;
- 7 bar;
- 8 tube.

For austenitic stainless steel types 304 or 316, nickel alloy and titanium alloy the third character has no logic.

The fourth character:

- 1 MDS contains several products;
- 2 The product is a casting;
- 3 or greater No logic, only a sequential number.

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### 4.3 Implementation of statutory regulations

This IOGP specification is not intended to address any statutory regulations. The responsibility for complying with any such statutory regulations and the specification of any further additional requirements is the responsibility of the end (equipment) user.

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### 4.4 H<sub>2</sub>S-containing (sour) environments

This specification is not intended to address all the metallurgical and manufacturing requirements within the relevant parts of ISO 15156/NACE MR0175. It is the end (equipment) user's responsibility to ensure that any material specified for use in their facilities is satisfactory in the specific sour service environment.

However, in order to provide an additional level of integrity in the event that initially sweet service environments experience souring during operation, the following requirements specified by ISO 15156-2 and ISO 15156-3 are included in the attached MDS:

#### *Carbon steel (MDS ICXX series)*

- All the carbon steel grades and weld metal have nickel content less than 1%;
- No free-machining steels are specified;
- Where appropriate, the MDS specifies components to be delivered in the heat-treated condition;
- Sulphur is specified to a maximum 0.020% for all products;

#### *Austenitic stainless steels and nickel base alloys (MDS INXX, IRXX and ISXX series)*

- Components to be manufactured and certified in solution heat treated condition except for welded pipes in Type 6Mo with wall thickness less than 7.11 mm, which are to be made from solution annealed plates and delivered in welded condition.

#### *Ferritic/austenitic stainless steels (MDS IDXX series)*

- Components to be manufactured and certified in solution heat treated condition except for bolts to MDS ID59, which are specified in solution annealed and strain hardened condition.
- The ferrite content is specified in accordance with ISO 17781; this is more stringent than the requirements in ISO 15156-3/NACE MR0175-3.
- The microstructure of welds is specified in accordance with ISO 17781; this is more stringent than the requirements in ISO 15156-3/NACE MR0175-3.

---

### 4.5 Mechanical testing

Tensile testing shall in general be carried out in accordance with ASTM A370 as specified in the referenced standard specifications in the respective MDS. However, testing in accordance with ISO 6892-1 is considered equivalent and thereby also acceptable. The elongation shall be measured and reported in accordance with the selected tensile test standard ASTM A370 or ISO 6892-1. For specimens to ASTM A370 the gauge length shall be 50mm as far as is practically possible.

Impact testing shall, in general, be carried out in accordance with ASTM A370 as specified by the referenced standard specifications in the respective MDS. However, testing in accordance with ISO 148 using a striker radius of 8mm is also acceptable.

The test temperature for carbon and duplex stainless steels is in general specified to be minus 46°C since this is the lowest standardized test temperature within ASME B31.3 for these materials. The use of a lower test temperature is acceptable, but the specified minimum absorbed energy shall apply unless otherwise agreed with the end (equipment) user.

---

## 4.6 Machining of valve components and pipe fittings from bar

When allowed by the ASTM standard specifications, hollow cylindrically shaped pressure-containing parts, including valve bodies for weld-end and integral flanged valves, and pressure-controlling parts of valves, may be machined from cylindrically shaped bars, provided the requirements in the relevant MDS are met in full.

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## 4.7 Radiography of castings for valve components

Castings for ball valves specified to the requirements of IOGP S-562 shall be subject to the radiographic requirements specified therein. For other valves, castings shall meet the requirements of the applicable MDS.

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## 4.8 Lists of established material sheets

The established IOGP piping material data sheets are listed in Table 1 and compiled in Annex A.

**Table 1 – List of IOGP material data sheets per type of material**

IOGP No.	Rev. No.	Standard and grade	Products
<b>Non-impact tested carbon steel</b>			
IC01	0	A106 Grade B	Seamless pipes
		A672 Grade CC60, CC65, CC70	Welded pipes
		A234 Grade WPB	Wrought fittings
		A105	Forgings
		A516 Grade 60, 65, 70	Plates
		A696 Grade B or C	Bars
IC02	0	A216 Grade WCB	Castings
<b>Impact tested carbon steel</b>			
IC11	0	A333 Grade 6	Seamless pipes
		A671 Grade CC60, CC65, CC70	Welded pipes
		A420 Grade WPL 6	Wrought fittings
		A350 Grade LF2	Forgings
		A 516 Grade 60, 65, 70	Plates
		A696 Grade B or C	Bars
IC12	0	A352 Grade LCC	Castings
<b>Ferritic/austenitic stainless steel type 22Cr Duplex</b>			
ID41	0	A790 UNS S31803, UNS S32205	Seamless pipes
ID42	0	A928 UNS S31803, UNS S32205	Welded pipes
ID43	0	A815 UNS S31803, UNS S32205	Wrought fittings and HIP fittings
ID44	0	A182 Grade F51, F60	Forgings and HIP fittings
ID45	0	A240 UNS S31803, UNS S32205	Plates
ID46	0	A995 Grade 4A (UNS J92205)	Castings
ID47	0	A276/A479 UNS S31803, UNS S32205	Bars
ID48	0	A789 UNS S31803, UNS S32205	Tubes
<b>Ferritic/austenitic stainless steel type 25Cr Duplex</b>			
ID51	0	A790 UNS S32550, S32750, S32760 and UNS S39274	Seamless pipes
ID52	0	A928 UNS S32550, S32750 and S32760	Welded pipes
ID53	0	A815 UNS S32550, S32750 and S32760	Wrought fittings and HIP fittings
ID54	0	A182 Grade F53 (UNS S32750), Grade F55 (UNS S32760, Grade F61 (UNS S32550)	Forgings and HIP fittings
ID55	0	A240 UNS S32550, S32750 and S32760	Plates
ID56	0	A995 Grade 6A (UNS J93380), Grade 5A (UNS J93404)	Castings
ID57	0	A276/A479 UNS S32550, S32750 and S32760	Bars
ID58	0	A789 UNS S32550, S32750, S32760 and UNS S39274	Tubes
ID59	0	A1082 (modified) UNS S32750, S32760 (strain hardened)	Studs, bolts, nuts
ID60	0	A1082 UNS S32750, S32760 (solution annealed)	Studs, bolts, nuts
<b>Copper/nickel 90/10</b>			
IK01	0	B466 UNS C70600	Seamless pipes and tubes

IOGP No.	Rev. No.	Standard and grade	Products
		B467 UNS C70600	Welded pipes
		B151 UNS C70600	Rod and bar
		B171 UNS C70600	Plates and sheets
		UNS C70600	Fittings
		UNS C70600	Flanges
<b>Aluminium - bronze castings</b>			
IK02	0	B148 UNS C09580	Castings
<b>Nickel alloys</b>			
IN01	0	B366 UNS N06625	Wrought fittings
		B705 UNS N06625	Pipes
		B564 UNS N06625	Forgings
		B443 UNS N06625	Plates
		B446 UNS N06625	Bars
		B444 UNS N06625	Pipes and tubes
IN02	0	A494 Grade CW-6MC, CX 2MW	Castings
IN03	0	F468 Grade Ni625	Studs, bolts, screws
		F467 Grade Ni625	Nuts
IN04	0	A453 Grade 660	Studs, bolts, screws and nuts
<b>Austenitic stainless steel type 6Mo</b>			
IR11	0	A312 UNS S31254, UNS N08367, N08926	Seamless pipes
IR12	0	A358 UNS S31254, UNS N08367, N08926	Welded pipes
IR13	0	A403 UNS S31254, N08367, N08926	Wrought fittings
IR14	0	A182 Grade F44, UNS N08367, N08926	Forgings
IR15	0	A240 UNS S31254, N08367, N08926	Plates
IR16	0	A351 Grade CK-3MCuN, CN-3MN	Castings
IR17	0	A276/A479 UNS S31254, N08367, N08926	Bars
IR18	0	A269 UNS S31254, N08367, N08926	Tubes
<b>Austenitic stainless steel type 316</b>			
IS01	0	A312 Grade TP316	Seamless and welded pipes
		A358 Grade 316	Welded pipes
		A403 Grade WP316	Wrought fittings
		A182 Grade F316	Forgings
		A240 Grade 316	Plates
		A269 Grade 316	Tubes
		A276/A479 Grade 316	Bars
IS02	0	A351 Grade CF3M, CF8M	Castings
<b>Austenitic stainless steel type 304</b>			
IS21	0	A312 Grade TP304	Seamless and welded pipes
		A358 Grade 304	Welded pipes
		A403 Grade WP304	Wrought fittings
		A182 Grade F304	Forgings

IOGP No.	Rev. No.	Standard and grade	Products
		A240 Grade 304	Plates
		A269 Grade 304	Tubes
		A276/A479 Grade 304	Bars
IS22	0	A351 Grade CF3, CF8	Castings
<b>Titanium Grade 2</b>			
IT01	0	B861 Grade 2	Seamless pipes
		B862 Grade 2	Welded pipes
		B363 Grade WPT2/WPT2W	Wrought fittings
		B381 Grade F2	Forgings
		B265 Grade 2	Plates
		B348 Grade 2	Bars
		B338 Grade 2	Tubes
IT02	0	B367 Grade C2	Castings
<b>High strength low alloy steel fasteners</b>			
IX07	0	A320 Grade L7, L7M (HDG)	Studs, bolts, screws
		A194 Grade 7, 7M (HDG)	Nuts
IX08	0	A193 Grade B7, B7M (HDG)	Studs, bolts, screws
		A194 Grade 2H, 2HM (HDG)	Nuts
IX09	0	A320 Grade L7, L7M (Black or uncoated)	Studs, bolts, screws
		A194 Grade 7, 7M (Black or uncoated)	Nuts
IX10	0	A193 Grade B7, B7M (Black or uncoated)	Studs, bolts, screws
		A194 Grade 2H, 2HM (Black or uncoated)	Nuts

## Annex A - IOGP Piping Material Data Sheets

*(normative)*

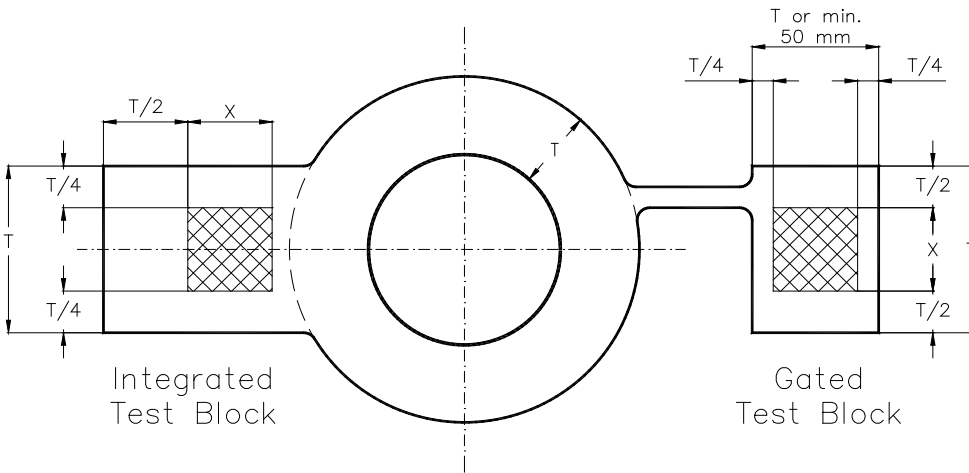
MATERIAL DATA SHEET		IC01	Rev. 0	
<b>TYPE OF MATERIAL:</b> Non-impact tested carbon steel				
PRODUCT	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPL. REQ.
Welded pipes	ASTM A672	C60, C65, C70	t ≤ 19mm: Cl. 12 t > 19mm: Cl. 22 or Cl.32 or Cl.42	-
Seamless pipes	API 5L	B	PSL 1	-
	ASTM A106	B	-	S6
Wrought fittings	API 5L	B	PSL 1	-
	ASTM A234	WPB, WPBW	-	S3
Forgings	ASTM A105	-	-	S4
Plates	ASTM A516	60, 65, 70	-	-
Bars	ASTM A696	B or C	-	-
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. CHEMICAL COMPOSITION	All products: C ≤ 0.23%; S ≤ 0.020%; P ≤ 0.025%, CE ≤ 0.43%			
3. MANUFACTURING METHOD	<p><i>Seamless pipe:</i> A106 shall be furnished in the hot finished condition; cold-drawn pipe is not permitted</p> <p><i>Welded pipes to A672/API 5L:</i></p> <ul style="list-style-type: none"> <li>- The longitudinal weld shall be straight and made using the SAW process</li> <li>- The weld metal shall be mild steel analysis A-No.1 per ASME Section IX, Table QW-442</li> <li>- API 5L pipe shall be full body stress relieved when wall thickness is above 19mm</li> </ul> <p><i>Machining components from bar:</i> When permitted by ASTM A960/A961, pipe fittings and valve pressure containing/controlling parts may be machined from bar provided the following requirements are met:</p> <ul style="list-style-type: none"> <li>- Forged bar as defined in ASTM A788, supplied in heat treated condition as specified below and certified to ASTM A105 or:</li> <li>- Hot rolled/wrought bar with a maximum outside diameter ≤ 250 mm supplied in heat treated condition as specified below and certified to ASTM A696 Grade B or C or;</li> <li>- Hot rolled/wrought and cold finished bar with a maximum outside diameter ≤ 225 mm supplied in heat treated condition as specified below and certified to ASTM A696 Grade B or C.</li> </ul> <p>NOTE 1 Cold finishing shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold forming is not permitted.</p> <p>NOTE 2 For integral flanged valves, the minimum valve body to integral flange transition radius shall be 10mm</p>			
4. SAMPLING OF TEST SPECIMENS FOR BARS INTENDED FOR MACHINING OF COMPONENTS	<p>Sampling shall apply dependent on outside diameter:</p> <ul style="list-style-type: none"> <li>- The mid-length of the axial tensile test specimen shall be located at a distance equal to the bar outside diameter or minimum of 100 mm, whichever is the greater, from the end of the bar, and the centreline of the specimen shall be located at a minimum distance of OD/4 from the surface</li> <li>- The centreline of the tangential tensile test specimen shall be located at a minimum distance of OD/4 from the surface and the mid-point of the specimens at a minimum of 100mm from the end of the bar</li> <li>- For bar with outside diameter &lt; 100mm: <ul style="list-style-type: none"> <li>o One tensile test specimens shall be taken in axial direction of the bar.</li> </ul> </li> <li>- For bar with outside diameter ≥ 100 mm: <ul style="list-style-type: none"> <li>o One tensile test specimen shall be taken in axial direction of the bar.</li> <li>o In addition, one tensile test specimen shall be taken in tangential direction of the bar; the centreline of the tensile test specimen shall be located a minimum of 100mm from the end of the bar</li> </ul> </li> <li>- The specified minimum tensile strength properties of the referenced standard specification shall be met in both directions.</li> </ul>			
5. HEAT TREATMENT	<i>Forgings to A105 and bars to A696:</i> Normalised or normalised and tempered			
6. NON DESTRUCTIVE TESTING	<i>Fittings to A234:</i> UT is not acceptable as replacement for RT <i>Welded pipe to API 5L:</i> 100% RT of weld seam			
7. REPAIR OF DEFECTS	Weld repair of base material is not acceptable. Repairs to weld metal are acceptable in accordance with the standard specification and shall meet the chemistry requirements of the original manufacturing weld			

<b>MATERIAL DATA SHEET</b>		<b>IC01</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Non-impact tested carbon steel					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPTANCE CLASS</b>	<b>SUPPL. REQ.</b>	
Welded pipes	ASTM A672	C60, C65, C70	t ≤ 19mm: Cl. 12 t > 19mm: Cl. 22 or Cl.32 or Cl.42	-	
Seamless pipes	API 5L	B	PSL 1	-	
	ASTM A106	B	-	S6	
Wrought fittings	API 5L	B	PSL 1	-	
	ASTM A234	WPB, WPBW	-	S3	
Forgings	ASTM A105	-	-	S4	
Plates	ASTM A516	60, 65, 70	-	-	
Bars	ASTM A696	B or C	-	-	
<b>8. MARKING</b>	The components shall be marked to ensure full traceability to heat and heat treatment lot				
<b>9. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Heat treatment condition; for tempered condition, austenitising and tempering temperature shall be stated</li> </ul>				

MATERIAL DATA SHEET		IC02		Rev. 0																								
<b>TYPE OF MATERIAL:</b> Non-impact tested carbon steel																												
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.																								
Castings	ASTM A216	WCB	-	S4, S5, S11 A703 S14, S20																								
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification																											
2. CHEMICAL COMPOSITION	C ≤ 0.23% ; S ≤ 0.020% ; P ≤ 0.025% ; S11 shall apply, with CE ≤ 0.43%																											
3. EXTENT OF MECHANICAL TESTING	A704 S14 shall apply																											
4. TEST SAMPLING	For castings with weight 250 kg or more the test blocks shall be integrally cast or gated onto the casting and shall accompany the castings through all heat treatment operations including any post weld stress relieving.																											
5. NON DESTRUCTIVE TESTING	<p><i>Magnetic particle testing:</i> S4 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be cleaned prior to the testing</p> <p><i>Radiographic testing:</i> S5 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- The method of radiography and acceptance criteria for all castings shall be in accordance with ASME VIII Div. 1 Appendix 7.</li> <li>- <i>For valve castings:</i> <ul style="list-style-type: none"> <li>- Sampling shall be in accordance with the following table based on pressure class and nominal outside diameter:</li> </ul> </li> </ul> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 20%;">Pressure Class:</th> <th style="width: 10%;"></th> <th style="width: 10%;">≤ 150</th> <th style="width: 10%;">300</th> <th style="width: 10%;">600</th> <th style="width: 10%;">900</th> <th style="width: 10%;">1500</th> <th style="width: 10%;">2500</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Sampling for RT</td> <td>10 %</td> <td>≥ 10"</td> <td>≥ 10"</td> <td>≥ 2"</td> <td>≥ 2"</td> <td>≥ 2"</td> <td>≥ 2"</td> </tr> <tr> <td>100 %</td> <td>N/A</td> <td>N/A</td> <td>≥ 20"</td> <td>≥ 16"</td> <td>≥ 6"</td> <td>≥ 6"</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>- Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10 %) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be tested</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined in the purchase order. Sketches of the areas to be tested shall be established and agreed</li> </ul>					Pressure Class:		≤ 150	300	600	900	1500	2500	Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"	100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"
	Pressure Class:		≤ 150	300	600	900	1500	2500																				
	Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"																				
		100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"																				
6. REPAIR OF DEFECTS	<p>A703 S20 shall apply</p> <p>Weld repairs are not acceptable for castings that leak during final pressure testing</p> <p>The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this datasheet</p>																											
7. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot																											
8. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Heat treatment condition; for tempered condition, austenitising and tempering temperature shall be stated</li> </ul>																											

MATERIAL DATA SHEET		IC11	Rev. 0	
<b>TYPE OF MATERIAL:</b> Impact tested carbon steel				
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.
Welded pipes	ASTM A671	CC60, CC65, CC70	t ≤ 19mm: Cl. 12 t > 19mm: Cl. 22 or Cl.32 or Cl.42	S2, S7, S14
Seamless pipes	ASTM A333	6	-	-
Wrought fittings	ASTM A420	WPL6	-	A960 S51, S53, S57, S69
Forgings	ASTM A350	LF2	Class 1	S6, A961 S55
Plates	ASTM A516	60, 65, 70	-	S5
Bars	ASTM A696	B or C	-	-
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. MANUFACTURING METHOD	<p><i>Welded pipe to A671:</i></p> <ul style="list-style-type: none"> <li>- The longitudinal weld shall be straight and made using the SAW process</li> <li>- The weld metal shall be mild steel analysis A-No.1 per ASME Section IX, Table QW-442</li> </ul> <p><i>Fittings to A420:</i> The weld metal shall be mild steel analysis A-No.1 per ASME Section IX, Table QW-442</p> <p><i>Machining components from bar:</i> When permitted by ASTM A960/A961, pipe fittings and valve pressure containing/controlling components may be machined from bar provided the following requirements are met:</p> <ul style="list-style-type: none"> <li>- Forged bar as defined in ASTM A788, supplied in heat treated condition as specified below and certified to ASTM A350 LF2 or;</li> <li>- Hot rolled/wrought bar with a maximum outside diameter ≤ 250 mm supplied in heat treated condition as specified below and certified to ASTM A696 Grade B or C or;</li> <li>- Hot rolled/wrought and cold finished bar with a maximum outside diameter ≤ 225 mm supplied in heat treated condition as specified below and certified to ASTM A696 Grade B or C.</li> </ul> <p>NOTE 1 Cold finishing shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold forming is not permitted.</p> <p>NOTE 2 For integral flanged valves, the minimum valve body to integral flange transition radius shall be 10mm.</p>			
3. HEAT TREATMENT	<p><i>All components:</i> During the heat treatment process, components shall be placed in such a way as to ensure free circulation around each component including any quenching operation</p> <p><i>Bars to A696:</i> Shall be supplied in the normalised or normalised and tempered condition</p>			
4. CHEMICAL COMPOSITION	<p><i>All products:</i> C ≤ 0.23%; S ≤ 0.020%; P ≤ 0.025%, CE ≤ 0.43</p>			
5. SAMPLING OF TEST SPECIMENS FROM BARS INTENDED FOR MACHINING OF COMPONENTS	<p>Sampling shall apply dependent on outside diameter:</p> <ul style="list-style-type: none"> <li>- The mid-length of the axial tensile and impact test specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm, whichever is the greater, from the end of the bar, and the centreline of the specimens shall be located at a minimum distance of OD/4 from the surface</li> <li>- The centreline of the tangential tensile and impact test specimens shall be located at a minimum distance of OD/4 from the surface and the mid-point of the specimens at a minimum of 100mm from the end of the bar</li> <li>- The notch of the impact test specimen shall be located perpendicular to the bar surface.</li> <li>- For bar with outside diameter &lt; 60mm: <ul style="list-style-type: none"> <li>o One tensile and one set impact test specimens shall be taken.</li> </ul> </li> <li>- For bar with outside diameter 60 ≤ OD &lt; 100 mm: <ul style="list-style-type: none"> <li>o One tensile and set impact test specimens shall be taken in axial direction of the bar.</li> <li>o In addition, one set impact test shall be taken in tangential direction.</li> </ul> </li> <li>- For bar with outside diameter ≥ 100 mm: <ul style="list-style-type: none"> <li>o One tensile and set impact test specimens shall be taken in axial direction of the bar.</li> <li>o In addition, one tensile test specimen and one set impact test specimens shall be taken in tangential direction of the bar; the centreline of the tensile test specimen shall be located a minimum of 100mm from the end of the bar</li> </ul> </li> <li>- The specified minimum tensile strength of the referenced standard specification and impact energies specified in this datasheet shall be met in both directions</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IC11</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Impact tested carbon steel				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Welded pipes	ASTM A671	CC60, CC65, CC70	t ≤ 19mm: Cl. 12 t > 19mm: Cl. 22 or Cl.32 or Cl.42	S2, S7, S14
Seamless pipes	ASTM A333	6	-	-
Wrought fittings	ASTM A420	WPL6	-	A960 S51, S53, S57, S69
Forgings	ASTM A350	LF2	Class 1	S6, A961 S55
Plates	ASTM A516	60, 65, 70	-	S5
Bars	ASTM A696	B or C	-	-
6. <b>EXTENT OF MECHANICAL TESTING</b>	<i>Pipes to A671:</i> S14 shall apply. Impact testing per S2 shall also be carried out per lot <i>Fittings to A420:</i> ASTM A960 S51 shall apply. Impact testing shall also be carried out for each heat and heat treatment load <i>Forgings to A350:</i> One set of tensile, impact and hardness 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 ≤ 50 kg, and 5000 kg for forgings with as forged weight > 50 kg.			
7. <b>HARDNESS TESTING</b>	<i>Fittings to A420:</i> A960 S57 shall apply. Hardness testing shall be carried out on a minimum two components, including welds, for each test lot and shall not exceed 197 HB			
8. <b>IMPACT TESTING</b>	Impact testing is required for thickness ≥ 6 mm; for components with a weld end, the weld end thickness shall govern. The test temperature shall be minus 46 °C unless the ASTM standard specification requires a lower test temperature The minimum absorbed energy for full size specimens shall be 27J average and 20J single For plates, the test specimen shall be taken in the longitudinal orientation to the final direction of rolling			
9. <b>NON DESTRUCTIVE TESTING</b>	<i>Fittings to A420:</i> <ul style="list-style-type: none"> <li>- Ultrasonic testing is not acceptable as replacement of radiographic testing.</li> <li>- ASTM A960 S53 and S69 shall apply to 10% of all fittings (same test lot as defined for mechanical testing) for nominal thickness &lt; 12,7 mm and 100% of all fittings for nominal thickness ≥ 12,7 mm. The testing shall be carried out after any expansion.</li> <li>- The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 6.</li> </ul> <i>Forgings to A350:</i> <ul style="list-style-type: none"> <li>- A961 S55 shall apply to 10% of each test lot</li> <li>- The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 6.</li> </ul>			
10. <b>REPAIR OF DEFECTS</b>	Weld repair of base material is not acceptable. Repairs to weld metal are acceptable in accordance with the standard specification and shall meet the chemistry requirements of the original manufacturing weld			
11. <b>MARKING</b>	The components shall be marked to ensure full traceability to heat and heat treatment lot.			
12. <b>CERTIFICATION</b>	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information: <ul style="list-style-type: none"> <li>- Heat treatment condition; for tempered condition, austenitising and tempering temperature shall be stated.</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IC12</b>		<b>Rev. 0</b>
<b>TYPE OF MATERIAL:</b> Impact tested carbon steel				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Castings	ASTM A352	LCC		S4, S5, S23 A703 S8, S20
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. CHEMICAL COMPOSITION	C ≤ 0.23% ; S ≤ 0.020% ; P ≤ 0.025% ; S23 shall apply, with CE ≤ 0.43%			
3. HEAT TREATMENT	During the heat treatment process, components shall be placed in such a way as to ensure free circulation around each component including possible quenching operation.			
4. IMPACT TESTING	A703 S8 shall apply. The minimum absorbed energy for full size specimens shall be 27J average and 20J single.			
5. EXTENT OF TESTING	One set of tensile tests is required for each heat and heat treatment load			
6. TEST SAMPLING	<p>Test blocks shall be integrally cast or gated onto the casting and shall accompany the castings through all heat treatment operations including any post weld stress relieving</p> <p>Thickness of the test block shall be equal to the thickest part of the casting represented up to a maximum thickness of 100 mm. For flanged components, the largest flange thickness is the ruling section.</p> <p>Dimensions of test blocks and location of test specimens within the test blocks are shown in figure below for integral and gated test block. The test specimens shall be taken within the cross hatched area. Distance from end of test specimen to end of test block shall minimum be T/4.</p> <div style="text-align: center;">  <p>Integrated Test Block</p> <p>Gated Test Block</p> </div>			

MATERIAL DATA SHEET		IC12		Rev. 0																								
<b>TYPE OF MATERIAL:</b> Impact tested carbon steel																												
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.																								
Castings	ASTM A352	LCC		S4, S5, S23 A703 S8, S20																								
7. NON DESTRUCTIVE TESTING	<p><i>Magnetic particle testing:</i> S4 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be cleaned prior to the testing.</p> <p><i>Radiographic testing:</i> S5 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- The method of radiography and acceptance criteria for all castings shall be in accordance with ASME VIII Div. 1 Appendix 7.</li> <li>- <i>For valve castings:</i> <ul style="list-style-type: none"> <li>o Sampling shall be in accordance with the following table based on pressure class and nominal outside diameter:</li> </ul> </li> </ul> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px;">Pressure Class:</td> <td></td> <td><math>\leq 150</math></td> <td>300</td> <td>600</td> <td>900</td> <td>1500</td> <td>2500</td> </tr> <tr> <td rowspan="2" style="padding: 2px;">Sampling for RT</td> <td style="padding: 2px;">10 %</td> <td><math>\geq 10''</math></td> <td><math>\geq 10''</math></td> <td><math>\geq 2''</math></td> <td><math>\geq 2''</math></td> <td><math>\geq 2''</math></td> <td><math>\geq 2''</math></td> </tr> <tr> <td style="padding: 2px;">100 %</td> <td>N/A</td> <td>N/A</td> <td><math>\geq 20''</math></td> <td><math>\geq 16''</math></td> <td><math>\geq 6''</math></td> <td><math>\geq 6''</math></td> </tr> </table> <ul style="list-style-type: none"> <li>o Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10 %) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be tested</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined in the purchase order. Sketches of the areas to be tested shall be established and agreed</li> </ul>					Pressure Class:		$\leq 150$	300	600	900	1500	2500	Sampling for RT	10 %	$\geq 10''$	$\geq 10''$	$\geq 2''$	$\geq 2''$	$\geq 2''$	$\geq 2''$	100 %	N/A	N/A	$\geq 20''$	$\geq 16''$	$\geq 6''$	$\geq 6''$
Pressure Class:		$\leq 150$	300	600	900	1500	2500																					
Sampling for RT	10 %	$\geq 10''$	$\geq 10''$	$\geq 2''$	$\geq 2''$	$\geq 2''$	$\geq 2''$																					
	100 %	N/A	N/A	$\geq 20''$	$\geq 16''$	$\geq 6''$	$\geq 6''$																					
8. REPAIR OF DEFECTS	<p>A703 S20 shall apply using a cast plate for the qualification of the repair welding procedure Weld repairs are not acceptable for castings that leak during final pressure testing The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this MDS.</p>																											
9. MARKING	<p>The components shall be marked to ensure full traceability to heat and heat treatment lot.</p>																											
10. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001. The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Heat treatment condition; for tempered condition austenitising and tempering temperature shall be stated.</li> </ul>																											

<b>MATERIAL DATA SHEET</b>		<b>ID41</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic/Austenitic stainless steel type 22Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Seamless pipes	ASTM A790	UNS S31803 UNS S32205	-	-	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650				
3. <i>HEAT TREATMENT</i>	The pipes shall be solution annealed followed by rapid cooling in air or water/liquid Pipes shall be placed in such a way as to ensure free circulation of heating and cooling media around each pipe during the heat treatment process including quenching.				
4. <i>CHEMICAL COMPOSITION</i>	S ≤ 0.010%; P ≤ 0.025% UNS S31803: N = 0.14 – 0.20%				
5. <i>TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION</i>	<p><i>Extent of testing:</i> One tensile, impact and corrosion test, and one microstructure examination shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing:</i> All tensile tests shall meet the specified properties of ASTM A790</p> <p><i>Micrographic examination, impact and corrosion testing:</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. <i>HARDNESS TESTING</i>	Hardness testing shall be performed by the Rockwell C method on a cross sectional traverse				
7. <i>SURFACE FINISH</i>	Finished components shall be pickled or bright annealed				
8. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable				
9. <i>MARKING</i>	The components shall be marked to ensure full traceability to heat and heat treatment lot				
10. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated. (Holding time is not applicable for pipes produced hot finished/direct quenched)</li> </ul>				

MATERIAL DATA SHEET		ID42		Rev. 0	
<b>TYPE OF MATERIAL:</b> Ferritic/Austenitic stainless steel type 22Cr duplex					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Welded pipes	ASTM A928	UNS S31803, UNS S32205	Class 1, 3, 4 and 5	S3	
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650				
3. HEAT TREATMENT	The pipes shall be solution annealed followed by rapid cooling in air or water/liquid. Pipes shall be placed in such a way as to ensure free circulation of heating and cooling media around each pipe during the heat treatment process including quenching.				
4. CHEMICAL COMPOSITION	S ≤ 0.010%; P ≤ 0.025% UNS S31803: N = 0.14 – 0.20 %				
5. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Extent of testing:</i> One tensile, impact and corrosion test, and one microstructure examination shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing:</i> All tensile tests shall meet the specified properties of ASTM A928</p> <p><i>Micrographic examination, impact and corrosion testing:</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781</p> <p>For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. WELDING	The WPS shall be qualified in accordance with ASME IX or ISO 15614-1 and shall include the same examinations as for the production testing and shall fulfil the acceptance criteria of ISO 17781. 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.				
7. NON DESTRUCTIVE TESTING	S3 shall apply to the complete weld of 10 % of the pipes for each heat and heat treatment lot. The testing shall be carried out after any calibration and pickling. Acceptance criteria shall be to ASME VIII, Div. 1 Appendix 8.				
8. SURFACE FINISH	Finished components shall be pickled or bright annealed				
9. REPAIR OF DEFECTS	Weld repair of base material is not acceptable. For repair of welds, the requirements for production welding above shall apply to the repair WPS. Repair welds shall be heat treated as per the original production weld				
10. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
11. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Manufacturer of the starting material;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>ID43</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic stainless steel type 22Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Wrought fittings	ASTM A815	UNS S31803 UNS S32205	WP-W, WP-S or WP-WX	S2, S7	
HIP fittings	ASTM A988	UNS S31803 UNS S32205	-	S5	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or Norsok M-650 When permitted by ASTM A960, pipe fittings may be machined from bar provided the requirements of MDS ID47 are met in full				
3. <i>HEAT TREATMENT</i>	The fittings shall be solution annealed followed by water/liquid quenching. Fittings shall be placed in such a way as to ensure free circulation of heating and cooling media around each fitting during the heat treatment process including quenching.				
4. <i>CHEMICAL COMPOSITION</i>	S ≤ 0.010%; P ≤ 0,025% UNS S31803: N = 0.14 – 0.20%				
5. <i>TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION</i>	<p><i>Extent of testing</i> One tensile, impact and corrosion test, and one microstructure examination shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing</i> For fittings, A420 S2 shall apply. All tensile tests shall meet the specified properties of the relevant standard specification</p> <p><i>Micrographic examination, impact and corrosion testing</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. <i>WELDING</i>	The WPS shall be qualified in accordance with ASME IX or ISO 15614-1 and shall include the same examinations as for the production testing and shall fulfil the acceptance criteria of ISO 17781. 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.				
7. <i>NON DESTRUCTIVE TESTING</i>	Ultrasonic testing is not acceptable as replacement for RT of fittings. A815 S7 or A988 S5 (as applicable) shall apply to 10 % of seamless/HIP fittings from each heat and heat treatment lot, and 100 % of welded fittings above NPS2. The testing shall be carried out after any expansion and pickling. For welded fittings, the testing shall cover the weld only. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 8.				
8. <i>SURFACE FINISH</i>	Finished components shall be pickled. Machined surfaces do not require pickling.				
9. <i>REPAIR OF DEFECTS</i>	Weld repair of base material is not acceptable. For repair of welds, the requirements for production welding shall apply to the repair WPS. Repair welds shall be heat treated as per the original production weld				
10. <i>MARKING</i>	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
11. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or Norsok M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer of the starting material for the finished product;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated</li> </ul>				

MATERIAL DATA SHEET		ID44		Rev. 0	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel type 22Cr duplex					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Forgings	ASTM A182	F51 (UNS S31803) F60 (UNS S32205)	-	A961 S56	
HIP Fittings	ASTM A988	UNS S31803 UNS S32205	-	S5	
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or NORSOK M-650 When permitted by ASTM A961, pipe fittings and valve pressure containing/controlling components may be machined from bar provided the requirements of MDS ID47 are met in full Note 1: For integral flanged valves, the minimum valve body to integral flange transition radius shall be 10mm				
3. HEAT TREATMENT	The components shall be solution annealed followed by water/liquid quenching. Components shall be placed in such a way as to ensure free circulation of heating and cooling media around each component during the heat treatment process including quenching.				
4. CHEMICAL COMPOSITION	S ≤ 0.010%; P ≤ 0.025% UNS S31803: N = 0.14 – 0.20%				
5. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Extent of testing</i></p> <p>One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each heat and heat treatment lot.</p> <p>The testing shall be carried out on the component with heaviest wall thickness within the heat treatment load.</p> <p>A test lot shall not exceed 2000kg for forgings with as forged weight ≤ 50kg, and 5000kg for forgings with as forged weight &gt; 50kg.</p> <p><i>Tensile testing</i></p> <p>All tensile tests shall meet the specified properties of the relevant standard specification</p> <p><i>Micrographic examination, impact and corrosion testing</i></p> <p>The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781</p> <p>For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. NON DESTRUCTIVE TESTING	ASTM A961 S56 or A988 S5 (as applicable) shall apply to 10 % of forgings/HIP fittings from each heat and heat treatment lot above NPS2. The testing shall be carried out after final machining. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 8.				
7. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling.				
8. REPAIR OF DEFECTS	Weld repair is not acceptable.				
9. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
10. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer of the starting material;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>ID45</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic stainless steel type 22Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Plates	ASTM A240	UNS S31803 UNS S32205	-	S1	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or Norsok M-650				
3. <i>HEAT TREATMENT</i>	The plates shall be solution annealed followed by water/liquid quenching. Plates shall be placed in such a way as to ensure free circulation of heating and cooling media around each plate during the heat treatment process including quenching				
4. <i>CHEMICAL COMPOSITION</i>	S ≤ 0.010%; P ≤ 0.025% UNS S31803: N = 0.14 – 0.20%				
5. <i>TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION</i>	<p><i>Extent of testing</i> One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each heat of steel and heat treatment lot.</p> <p><i>Tensile testing</i> All tensile tests shall meet the specified properties of ASTM A240</p> <p><i>Micrographic examination, impact and corrosion testing</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. <i>SURFACE FINISH</i>	Finished components shall be pickled.				
7. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable.				
8. <i>MARKING</i>	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
9. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or Norsok M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

MATERIAL DATA SHEET		ID46		Rev. 0																								
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic stainless steel type 22Cr duplex																												
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.																								
Castings	ASTM A995	4A (UNS J92205)	-	S5, S6																								
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification																											
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or Norsok M-650.																											
3. HEAT TREATMENT	The castings shall be solution annealed followed by water/liquid quenching. Components shall be placed in such a way as to ensure free circulation of heating and cooling media around each component during the heat treatment process including quenching.																											
4. CHEMICAL COMPOSITION	S ≤ 0.010%; P ≤ 0.025% N = 0.14 – 0.30%																											
5. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Test sampling</i> The test blocks shall be in compliance with ISO 17781.</p> <p><i>Extent of testing</i> One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each heat of steel and heat treatment lot. A test lot shall not exceed 5000kg in weight.</p> <p><i>Tensile testing</i> All tensile tests shall meet the specified properties of ASTM A995</p> <p><i>Micrographic examination, impact and corrosion testing</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>																											
6. NON DESTRUCTIVE TESTING	<p><i>Liquid penetrant testing:</i> S6 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing.</p> <p><i>Radiographic testing:</i> S5 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- The method of radiography and acceptance criteria for all castings shall be in accordance with ASME VIII Div. 1 Appendix 7</li> <li>- <i>Valve castings:</i> <ul style="list-style-type: none"> <li>- Sampling shall in accordance with the following table based on pressure class and nominal outside diameter:</li> </ul> </li> </ul> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="text-align: left;">Pressure Class:</th> <th></th> <th>≤ 150</th> <th>300</th> <th>600</th> <th>900</th> <th>1500</th> <th>2500</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: left;">Sampling for RT</td> <td>10 %</td> <td>≥ 10"</td> <td>≥ 10"</td> <td>≥ 2"</td> <td>≥ 2"</td> <td>≥ 2"</td> <td>≥ 2"</td> </tr> <tr> <td>100 %</td> <td>N/A</td> <td>N/A</td> <td>≥ 20"</td> <td>≥ 16"</td> <td>≥ 6"</td> <td>≥ 6"</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>- Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10 %) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be tested</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined by designer. Sketches of the areas to be tested shall be established and agreed</li> </ul>					Pressure Class:		≤ 150	300	600	900	1500	2500	Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"	100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"
Pressure Class:		≤ 150	300	600	900	1500	2500																					
Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"																					
	100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"																					
7. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling.																											

<b>MATERIAL DATA SHEET</b>		<b>ID46</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic stainless steel type 22Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPL. REQ.</b>	
Castings	ASTM A995	4A (UNS J92205)	-	S5, S6	
<b>8. REPAIR OF DEFECTS</b>	<p>All major repairs as defined by A995 shall be documented</p> <p>The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this datasheet, and shall be carried out on the same material grade (UNS number) as used in production. A change of specific make (brand name) of welding consumables requires requalification.</p> <p>Weld repairs are not acceptable for castings that leak during final pressure testing</p> <p>Post weld heat treatment is required after all weld repairs. If a minor cosmetic repair is required to a semi-finished or finished cast component, heat treatment may be omitted provided the welding procedure meets the test requirements of this datasheet in the as-welded condition</p>				
<b>9. MARKING</b>	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
<b>10. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel heat and refining practice;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

MATERIAL DATA SHEET		ID47		Rev. 0	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic stainless steel type 22Cr duplex					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Bars	ASTM A276 or ASTM A479	UNS S31803 UNS S32205	-	-	
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or NORSOK M-650. Bars shall be cylindrical shaped with a maximum outside diameter $\leq$ 300mm. Note 1: Cold finishing after heat treatment shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold forming is not permitted				
3. HEAT TREATMENT	The bars shall be solution annealed followed by water/liquid quenching Bars shall be placed in such a way as to ensure free circulation of heating and cooling media around each bar during the heat treatment process including quenching.				
4. CHEMICAL COMPOSITION	S $\leq$ 0,010%; P $\leq$ 0.025% UNS S31803: N = 0.14 – 0.20%				
5. SAMPLING OF TEST SPECIMENS FROM BARS INTENDED FOR MACHINING OF COMPONENTS	Sampling of test specimens shall apply dependent on the outside diameter: <ul style="list-style-type: none"> <li>- The mid-length of the axial tensile and impact test specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm, whichever is the greater, from the end of the bar, and the centreline of the test specimens shall be located a minimum distance of OD/4 from the surface</li> <li>- The centreline of the tangential tensile and impact test specimens shall be located at a minimum distance of OD/4 from the surface and the mid-point of the specimens at a minimum of 100mm from the end of the bar</li> <li>- The notch of the impact test specimens shall be located perpendicular to the bar surface.</li> <li>- For bar with outside diameter <math>&lt;</math> 60mm: <ul style="list-style-type: none"> <li>o One tensile and one set of impact test specimens shall be taken.</li> </ul> </li> <li>- For bar with outside diameter <math>60 \leq</math> OD <math>&lt;</math> 100 mm: <ul style="list-style-type: none"> <li>o One tensile and set of impact test specimens shall be taken in the axial direction</li> <li>o In addition, one set of impact test specimens shall be taken in the tangential direction</li> </ul> </li> <li>- For bar with outside diameter <math>\geq</math> 100 mm: <ul style="list-style-type: none"> <li>o One tensile and set of impact test specimens shall be taken in the axial direction</li> <li>o In addition, one tensile test specimen and one set of impact test specimens shall be taken in the tangential direction</li> </ul> </li> </ul>				
6. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Extent of testing</i> Tensile, impact and corrosion tests, and one microstructural examination, shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing</i> All tensile tests shall meet the specified properties of the referenced standard specification in both directions</p> <p><i>Micrographic examination, impact and corrosion testing</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781</p> <p>For impact testing, the acceptance criteria shall comply with ISO 17781 QLII for specimens taken in the axial direction and 45J average, 35J minimum for specimens taken in the tangential direction.</p>				
7. REPAIR OF DEFECTS	Weld repair is not acceptable.				
8. MARKING	The component shall be marked to ensure full traceability to heat and heat treatment lot.				
9. CERTIFICATION	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information: <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer of the starting material;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>ID47</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic stainless steel type 22Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Bars	ASTM A276 or ASTM A479	UNS S31803 UNS S32205	-	-	
<b>MATERIAL DATA SHEET</b>		<b>ID48</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic stainless steel type 22Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Tubes	ASTM A789	UNS S31803 UNS S32205	-	-	
<b>1. SCOPE</b>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
<b>2. QUALIFICATION AND MANUFACTURING</b>	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or NORSOK M-650.				
<b>3. HEAT TREATMENT</b>	The tubes shall be solution annealed followed by rapid cooling in air or water. Tubes shall be placed in such a way as to ensure free circulation of heating and cooling media around each tube during the heat treatment process including rapid cooling.				
<b>4. CHEMICAL COMPOSITION</b>	S ≤ 0.010%; P ≤ 0.025% UNS S31803: N = 0.14 – 0.20%				
<b>5. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION</b>	<p><i>Extent of testing</i></p> <p>One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing</i></p> <p>All tensile tests shall meet the specified properties of ASTM A789</p> <p><i>Micrographic examination, impact and corrosion testing</i></p> <p>The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781</p> <p>For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
<b>6. SURFACE FINISH</b>	Finished components shall be pickled or bright annealed.				
<b>7. REPAIR OF DEFECTS</b>	Weld repair is not acceptable.				
<b>8. MARKING</b>	The component shall be marked to ensure full traceability to heat and heat treatment lot.				
<b>9. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer of the starting material;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>ID51</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic/Austenitic stainless steel type 25Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Seamless pipes	ASTM A790	UNS S32550 UNS S32750 UNS S32760	-	-	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process used for manufacturing of products to this specification shall be qualified in accordance with ISO 17782 or NORSOK M-650.				
3. <i>HEAT TREATMENT</i>	The pipes shall be solution annealed followed by rapid cooling in air or water/liquid Pipes shall be placed in such a way as to ensure free circulation of heating and cooling media around each pipe during the heat treatment process including quenching.				
4. <i>CHEMICAL COMPOSITION</i>	S ≤ 0.010%; P ≤ 0.025% PREN ≥ 40				
5. <i>TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION</i>	<p><i>Extent of testing:</i> One tensile, impact and corrosion test, and one microstructure examination shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing:</i> Tensile tests shall meet the specified properties of ASTM A790</p> <p><i>Micrographic examination, impact and corrosion testing:</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. <i>HARDNESS TESTING</i>	Hardness testing shall be performed by the Rockwell C method on cross sectional traverse				
7. <i>SURFACE FINISH</i>	Finished components shall be pickled or bright annealed.				
8. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable.				
9. <i>MARKING</i>	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
10. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001. The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated. (Holding time is not applicable for pipes produced hot finished/direct quenched.)</li> </ul>				

MATERIAL DATA SHEET		ID52		Rev. 0	
<b>TYPE OF MATERIAL:</b> Ferritic/Austenitic stainless steel type 25Cr duplex					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Welded pipes	ASTM A928	UNS S32550, UNS S32750, UNS S32760	Class 1, 3, 4 and 5	S3	
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650				
3. HEAT TREATMENT	The pipes shall be solution annealed followed by rapid cooling in air or water/liquid. Pipes shall be placed in such a way as to ensure free circulation of heating and cooling media around each pipe during the heat treatment process including quenching.				
4. CHEMICAL COMPOSITION	S ≤ 0.010%; P ≤ 0.025% PREN ≥ 40.				
5. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Extent of testing:</i> One tensile, impact and corrosion test, and one microstructure examination shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing:</i> Tensile tests shall meet the specified properties of ASTM A928</p> <p><i>Micrographic examination, impact and corrosion testing:</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781</p> <p>For impact testing the acceptance criteria shall comply with ISO 17781 Q11</p>				
6. WELDING	The WPS shall be qualified in accordance with ASME IX or ISO 15614-1 and shall include the same examinations as for the production testing and shall fulfil the acceptance criteria of ISO 17781. 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.				
7. NON DESTRUCTIVE TESTING	S3 shall apply to the complete weld area of 10 % of the pipes from each heat and heat treatment lot. The testing shall be carried out after any calibration and pickling. Acceptance criteria shall be to ASME VIII, Div. 1 Appendix 8.				
8. SURFACE FINISH	Finished components shall be pickled or bright annealed.				
9. REPAIR OF DEFECTS	Weld repair of base material is not acceptable. For repair of welds, the requirements for production welding above shall apply to the repair WPS. Repair welds shall be heat treated as per original production weld				
10. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
11. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001. The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Manufacturer of the starting material;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>ID53</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Wrought fittings	ASTM A815	UNS S32550 UNS S32750 UNS S32760	WP-W, WP-S or WP-WX	S2, S7	
HIP fittings	ASTM A988	UNS S32750 UNS S32760 UNS S32505	-	S5	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650 When permitted by ASTM A960, pipe fittings may be machined from bar provided the requirements of MDS ID47 are met in full				
3. <i>HEAT TREATMENT</i>	The fittings shall be solution annealed followed by water/liquid quenching. Fittings shall be placed in such a way as to ensure free circulation of heating and cooling media around each fitting during the heat treatment process including quenching.				
4. <i>CHEMICAL COMPOSITION</i>	S ≤ 0.010 %; P ≤ 0.025 % PREN ≥ 40				
5. <i>TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION</i>	<p><i>Extent of testing</i> One tensile, impact and corrosion test, and one microstructure examination shall be carried out for each heat and heat treatment lot.</p> <p><i>Tensile testing</i> For fittings, A420 S2 shall apply. All tensile tests shall meet the specified properties of the relevant standard specification</p> <p><i>Micrographic examination, impact and corrosion testing</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. <i>WELDING</i>	The WPS shall be qualified in accordance with ASME IX or ISO 15614-1 and shall include the same examinations as for the production testing and shall fulfil the acceptance criteria of ISO 17781. 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.				
7. <i>NON DESTRUCTIVE TESTING</i>	Ultrasonic testing is not acceptable as replacement for RT of fittings. A815 S7 or A988 S5 (as applicable) shall apply to 10 % of seamless/HIP fittings from each heat and heat treatment lot and 100 % of welded fittings above NPS2. The testing shall be carried out after any expansion and pickling. For welded fittings, the testing shall cover the weld only. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 8.				
8. <i>SURFACE FINISH</i>	Finished components shall be pickled. Machined surfaces do not require pickling.				
9. <i>REPAIR OF DEFECTS</i>	Weld repair of base material is not acceptable. For repair of welds, the requirements for production welding shall apply to the repair WPS. Repair welds shall be heat treated as per the original production weld				
10. <i>MARKING</i>	The component shall be marked to ensure full traceability to heat and heat treatment lot.				
11. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer of the starting material for the finished product;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated</li> </ul>				

MATERIAL DATA SHEET		ID54		Rev. 0	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Forgings	ASTM A182	F53 (UNS S32750) F55 (UNS S32760) F61 (UNS S32550)	-	A961 S56	
HIP fittings	ASTM A988	UNS S32750 UNS S32760 UNS S32505	-	S5	
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or NORSOK M-650 When permitted by ASTM A961, pipe fittings and valve pressure containing/controlling components may be machined from bar provided the requirements of MDS ID47 are met in full For integral flanged valves, the minimum valve body to integral flange transition radius shall be 10mm				
3. HEAT TREATMENT	The components shall be solution annealed followed by water/liquid quenching. Components shall be placed in such a way as to ensure free circulation of heating and cooling media around each component during the heat treatment process including quenching.				
4. CHEMICAL COMPOSITION	S ≤ 0.010%; P ≤ 0.025% PREN ≥ 40				
5. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Extent of testing</i></p> <p>One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each heat and heat treatment lot.</p> <p>The testing shall be carried out on the component with heaviest wall thickness within the heat treatment load.</p> <p>A test lot shall not exceed 2000kg for forgings with as forged weight ≤ 50kg, and 5000kg for forgings with as forged weight &gt; 50kg.</p> <p><i>Tensile testing</i></p> <p>All tensile tests shall meet the specified properties of the relevant standard specification</p> <p><i>Micrographic examination, impact and corrosion testing</i></p> <p>The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781</p> <p>For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. NON DESTRUCTIVE TESTING	ASTM A961 S56 or A988 S5 (as applicable) shall apply to 10 % of forgings/HIP fittings as applicable from each heat and heat treatment lot above NPS2. The testing shall be carried out after final machining. The acceptance criteria shall be ASME VIII, Div. 1, Appendix 8.				
7. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling.				
8. REPAIR OF DEFECTS	Weld repair is not acceptable.				
9. MARKING	The component shall be marked to ensure full traceability to heat and heat treatment lot.				
10. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer of the starting material for the finished product;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated</li> </ul>				

MATERIAL DATA SHEET		ID55		Rev. 0	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Plates	ASTM A240	UNS S32550, UNS S32750, UNS S32760	-	S1	
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or NORSOK M-650.				
3. HEAT TREATMENT	The plates shall be solution annealed followed by water/liquid quenching. Plates shall be placed in such a way as to ensure free circulation of heating and cooling media around each plate during the heat treatment process including quenching				
4. CHEMICAL COMPOSITION	S ≤ 0.010%; P ≤ 0.025% PREN ≥ 40				
5. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Extent of testing</i></p> <p>One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each heat and heat treatment lot.</p> <p><i>Tensile testing</i></p> <p>All tensile tests shall meet the specified properties of ASTM A240</p> <p><i>Micrographic examination, impact and corrosion testing</i></p> <p>The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781</p> <p>For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. SURFACE FINISH	Finished components shall be pickled.				
7. REPAIR OF DEFECTS	Weld repair is not acceptable.				
8. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
9. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel manufacturer of the starting material for the finished product;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated</li> </ul>				

MATERIAL DATA SHEET		ID56		Rev. 0																									
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex																													
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.																									
Castings	ASTM A995	5A (UNS J93404) 6A (UNS J93380)	-	S5, S6																									
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification																												
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or Norsok M-650.																												
3. HEAT TREATMENT	The castings shall be solution annealed followed by water/liquid quenching Components shall be placed in such a way as to ensure free circulation of heating and cooling media around each component during the heat treatment process including quenching.																												
4. CHEMICAL COMPOSITION	S ≤ 0.010%; P ≤ 0.025% PREN ≥ 40																												
5. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Test sampling</i> The test blocks shall be in compliance with ISO 17781.</p> <p><i>Extent of testing</i> One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each heat and heat treatment lot. A test lot shall not exceed 5000kg in weight.</p> <p><i>Tensile testing</i> All tensile tests shall meet the specified properties of ASTM A995</p> <p><i>Micrographic examination, impact and corrosion testing</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>																												
6. NON DESTRUCTIVE TESTING	<p><i>Liquid penetrant testing:</i> S6 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing.</p> <p><i>Radiographic testing:</i> S5 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- The method of radiography and acceptance criteria for all castings shall be in accordance with ASME VIII Div. 1 Appendix 7</li> <li>- <i>Valve castings:</i> <ul style="list-style-type: none"> <li>- Sampling shall in accordance with the following table based on pressure class and nominal outside diameter:</li> </ul> </li> </ul> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="border: none;">Pressure Class:</th> <th style="border: none;"></th> <th style="border: none;">≤ 150</th> <th style="border: none;">300</th> <th style="border: none;">600</th> <th style="border: none;">900</th> <th style="border: none;">1500</th> <th style="border: none;">2500</th> </tr> </thead> <tbody> <tr> <td style="border: none;">Sampling for RT</td> <td style="border: none;">10 %</td> <td style="border: none;">≥ 10"</td> <td style="border: none;">≥ 10"</td> <td style="border: none;">≥ 2"</td> <td style="border: none;">≥ 2"</td> <td style="border: none;">≥ 2"</td> <td style="border: none;">≥ 2"</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">100 %</td> <td style="border: none;">N/A</td> <td style="border: none;">N/A</td> <td style="border: none;">≥ 20"</td> <td style="border: none;">≥ 16"</td> <td style="border: none;">≥ 6"</td> <td style="border: none;">≥ 6"</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>- Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10 %) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be tested</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined by designer. Sketches of the areas to be tested shall be established and agreed</li> </ul>					Pressure Class:		≤ 150	300	600	900	1500	2500	Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"		100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"
Pressure Class:		≤ 150	300	600	900	1500	2500																						
Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"																						
	100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"																						
7. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling.																												

<b>MATERIAL DATA SHEET</b>		<b>ID56</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPL. REQ.</b>	
Castings	ASTM A995	5A (UNS J93404) 6A (UNS J93380)	-	S5, S6	
<b>8. REPAIR OF DEFECTS</b>	<p>All major repairs as defined by A995 shall be documented</p> <p>The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this datasheet, and shall be carried out on the same material grade (UNS number) as used in production. A change of specific make (brand name) of welding consumables requires requalification.</p> <p>Weld repairs are not acceptable for castings that leak during final pressure testing</p> <p>Post weld heat treatment is required after all weld repairs. If a minor cosmetic repair is required to a semi-finished or finished cast component, heat treatment may be omitted provided the welding procedure meets the test requirements of this datasheet in the as-welded condition</p>				
<b>9. MARKING</b>	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
<b>10. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel heat and refining practice;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

MATERIAL DATA SHEET		ID57		Rev. 0	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex					
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.	
Bars	ASTM A276 or ASTM A479	UNS S32550 UNS S32750 UNS S32760	-	-	
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or NORSOK M-650 Bars shall be cylindrical shaped with a maximum outside diameter $\leq 200$ mm. Note 1: Cold finishing after heat treatment shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold forming is not permitted				
3. HEAT TREATMENT	The bars shall be solution annealed followed by water/liquid quenching Bars shall be placed in such a way as to ensure free circulation of heating and cooling media around each bar during the heat treatment process including quenching.				
4. CHEMICAL COMPOSITION	S $\leq 0.010\%$ ; P $\leq 0.025\%$ PREN $\geq 40$				
5. SAMPLING OF TEST SPECIMENS FROM BARS INTENDED FOR MACHINING OF COMPONENTS	Sampling of test specimens shall apply dependent on the outside diameter: <ul style="list-style-type: none"> <li>- The mid-length of the axial tensile and impact test specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm, whichever is the greater, from the end of the bar, and the centreline of the test specimens shall be located a minimum distance of OD/4 from the surface</li> <li>- The centreline of the tangential tensile and impact test specimens shall be located at a minimum distance of OD/4 from the surface and the mid-point of the specimens at a minimum of 100mm from the end of the bar</li> <li>- The notch of the impact test specimens shall be located perpendicular to the bar surface.</li> <li>- For bar with outside diameter <math>&lt; 60</math>mm: <ul style="list-style-type: none"> <li>o One tensile and one set of impact test specimens shall be taken.</li> </ul> </li> <li>- For bar with outside diameter <math>60 \leq OD &lt; 100</math> mm: <ul style="list-style-type: none"> <li>o One tensile and set of impact test specimens shall be taken in the axial direction</li> <li>o In addition, one set of impact test specimens shall be taken in the tangential direction</li> </ul> </li> <li>- For bar with outside diameter <math>\geq 100</math> mm: <ul style="list-style-type: none"> <li>o One tensile and set of impact test specimens shall be taken in the axial direction</li> <li>o In addition, one tensile test specimen and one set of impact test specimens shall be taken in the tangential direction</li> </ul> </li> </ul>				
6. TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION	<p><i>Extent of testing</i></p> <p>Tensile, impact and corrosion tests, and one microstructural examination, shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing</i></p> <p>The minimum tensile strength properties of the referenced standard specification shall be met in both directions</p> <p><i>Micrographic examination, impact and corrosion testing</i></p> <p>The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781</p> <p>For impact testing the acceptance criteria shall comply with ISO 17781 QLI for specimens taken in the axial direction and 45J average, 35J minimum for specimens taken in the tangential direction.</p>				
7. REPAIR OF DEFECTS	Weld repair is not acceptable.				
8. MARKING	The products shall be marked to ensure full traceability to heat and heat treatment lot.				

<b>MATERIAL DATA SHEET</b>		<b>ID57</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Bars	ASTM A276 or ASTM A479	UNS S32550 UNS S32750 UNS S32760	-	-	
<b>9. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel heat and refining practice;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>ID57</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPL. REQ.</b>	
Bars	ASTM A276 or ASTM A479	UNS S32550 UNS S32750 UNS S32760	-	-	
<b>MATERIAL DATA SHEET</b>		<b>ID58</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPL. REQ.</b>	
Tubes	ASTM A789	UNS S32550 UNS S32750 UNS S32760	-	-	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or NORSOK M-650.				
3. <i>HEAT TREATMENT</i>	The tubes shall be solution annealed followed by rapid cooling in air or water/liquid. Tubes shall be placed in such a way as to ensure free circulation of heating and cooling media around each tube during the heat treatment process including rapid cooling.				
4. <i>CHEMICAL COMPOSITION</i>	S ≤ 0.010%; P ≤ 0.025% PREN ≥ 40				
5. <i>TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION</i>	<p><i>Extent of testing</i> One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each heat and heat treatment lot.</p> <p><i>Tensile testing</i> All tensile tests shall meet the specified properties of ASTM A789</p> <p><i>Micrographic examination, impact and corrosion testing</i> The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 For impact testing the acceptance criteria shall comply with ISO 17781 QLII</p>				
6. <i>SURFACE FINISH</i>	Finished components shall be pickled or bright annealed.				
7. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable.				
8. <i>MARKING</i>	The components shall be marked to ensure full traceability to heat and heat treatment lot.				
9. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Steel heat and refining practice;</li> <li>- Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>				

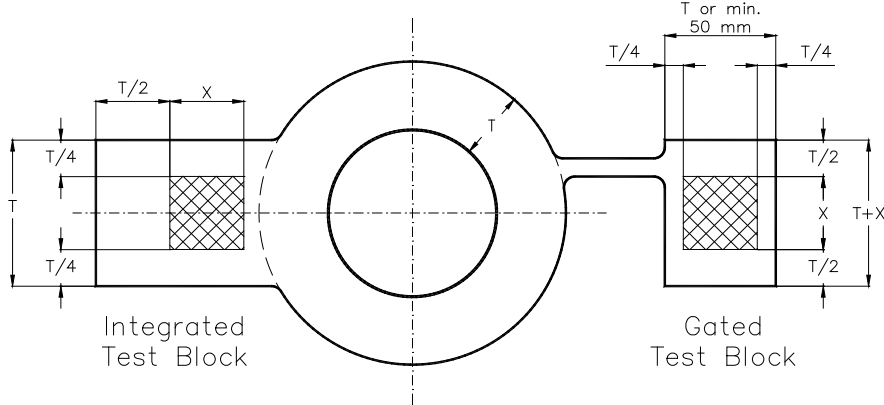
<b>MATERIAL DATA SHEET</b>		<b>ID59</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex (strain hardened)					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Studs, bolts, nuts	ASTM A1082 (modified)	UNS S32550 UNS S32760	-	S5 or S6 (nuts only) A962 S66	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. <i>QUALIFICATION AND MANUFACTURING</i>	<p>Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or Norsok M-650.</p> <p>Studs and bolts shall be manufactured from bars certified to A276 Condition S. The cold work shall be performed in accordance with a qualified procedure to ensure the correct level of strain hardening. Headed bolts shall be manufactured by machining from strain hardened bar; no forging or heat treatment of the strain hardened bar is permitted.</p> <p>Nuts shall be machined from solution annealed and water quenched bar or forgings.</p> <p>Threads on studs and bolts may be made by cold rolling or machining. Threads in nuts shall be machined.</p> <p>The maximum size of studs/bolts shall be M50 (2")</p>				
3. <i>CHEMICAL COMPOSITION</i>	<p>S ≤ 0.010%; P ≤ 0.025%</p> <p>PREN ≥ 40</p>				
4. <i>TENSILE, IMPACT, CORROSION TESTING AND MICROSTRUCTURAL EXAMINATION</i>	<p><i>Extent of testing</i></p> <p>One tensile, impact and corrosion test, and one microstructural examination shall be carried out for each test lot where a test lot is as-defined in ASTM A962 for non-heat treated, strain hardened components including the same heat treatment lot for the bar material.</p> <p><i>Tensile testing</i></p> <p>Tensile testing of studs and headed bolt shall be carried out on a sample representing the finished component in accordance with ASTM F606 Method 2 or 2A.</p> <p>All tensile tests shall meet the specified properties of ASTM A276 Condition S.</p> <p><i>Impact testing</i></p> <p>Testing shall be carried out on a sample representing the finished component. The test samples shall be taken in the axial direction and test temperature shall be minus 46°C with a minimum absorbed energy shall be 45J average and 35J single.</p> <p><i>Microstructural examination and corrosion testing</i></p> <p>Testing shall be carried out on a sample representing the finished component using the testing methodology and acceptance criteria in accordance with the principles in ISO 17781.</p>				
5. <i>HARDNESS TEST</i>	Maximum hardness of the strain hardened bar shall not exceed the values in ASTM A276 for the specified grades supplied in Condition S. Hardness may be measured at bar outer surface before threading or in area not affected by the thread rolling operation.				
6. <i>PROOF LOAD TESTING OF NUTS</i>	A1082 S5 shall apply to at least one nut per test lot - the load shall comply with A194 Grade 7. Alternatively, A1082 S6 may be applied as alternative to proof load testing for nuts with size M36 (1½ inch) or above - the hardness shall not exceed the values in A276 for the specified grades.				
7. <i>SURFACE FINISH</i>	All products shall be 100 % visually examined in all areas of threads, shanks, and heads. Discontinuities shall comply with requirements specified in ASTM F788 for bolts/studs and ASTM F812 for nuts.				
8. <i>REPAIR OF DEFECTS</i>	Weld repair of the starting bar is not acceptable.				
9. <i>TRACEABILITY</i>	ASTM A962 S66 shall apply.				
10. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or Norsok M-650 Manufacturing Summary identification or Qualification Test Report number used (for bar and/or fasteners as appropriate);</li> <li>- Bar manufacturer;</li> <li>- Heat treatment condition (solution annealing temperature and holding time shall be stated)</li> <li>- Finished condition</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>ID60</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Ferritic / Austenitic Stainless Steel, Type 25Cr duplex (solution annealed)					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Studs, bolts, nuts	ASTM A1082	UNS S32550, UNS S32750 UNS S32760	-	S5 or S6 (nuts only) A962 S66	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. <i>QUALIFICATION AND MANUFACTURING</i>	<p>Manufacturers and the manufacturing process used for manufacturing of bars as pre-material for fasteners to this MDS shall be qualified in accordance with the requirements in MDS ID57</p> <p>Note 1: If the product manufacturer applies any process that changes the heat treatment condition from the bar to final product, they shall be considered a material manufacturer and shall be qualified in accordance with ISO 17782 or NORSOK M-650 and the product shall be subject to the same requirements as defined for the bar in MDS ID57</p> <p>The studs, bolts and nuts shall be made from bars manufactured and certified to MDS ID57</p> <p>Threads on studs and bolts may be made by cold rolling or machining. Threads in nuts shall be machined</p>				
3. <i>CHEMICAL COMPOSITION</i>	<p><math>S \leq 0.010\%</math>; <math>P \leq 0.025\%</math></p> <p>PREN <math>\geq 40</math></p>				
4. <i>PROOF LOAD TESTING OF NUTS</i>	<p>A1082 S5 shall apply to at least one nut per test lot - the load shall comply with A194 Grade 7M. Alternatively, A1082 S6 may be applied as alternative to proof load testing for nuts with size M36 (1½ inch) or above - the hardness shall not exceed the values specified in ASTM A1082 for the specified grades</p>				
5. <i>SURFACE FINISH</i>	<p>All products shall be 100% visually examined in all areas of threads, shanks, and heads. Discontinuities shall comply with requirements specified in ASTM F788 for bolts/studs and ASTM F812 for nuts.</p>				
6. <i>TRACEABILITY</i>	<p>ASTM A962 S66 shall apply</p>				
7. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used (for bar and/or fasteners as appropriate)</li> <li>- Bar manufacturer;</li> <li>- Heat treatment condition (solution annealing temperature and holding time shall be stated).</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>IK01</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Copper/Nickel 90/10				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPL. REQ.</b>
Seamless pipes and tubes	ASTM B466 ASTM B467	UNS C70600 UNS C70600	- -	- -
Welded pipes	ASTM B151	UNS C70600	-	-
Rod and bar	ASTM B171	UNS C70600	-	-
Plates and sheets	-	UNS C70600	-	-
Fittings	-	UNS C76000	-	-
Flanges	-	UNS C76000	-	-
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. <i>DESIGN AND DIMENSIONAL STANDARDS</i>	The EEMUA standard No. 234: "Copper Nickel alloy piping for offshore applications specification" shall apply.			
3. <i>MATERIALS</i>	Materials for fittings and flanges shall comply with the above listed standards and this MDS.			
4. <i>MANUFACTURING PROCESS</i>	<i>Forming:</i> Cold forming or hot forming may be used according to written procedures established in cooperation with the material manufacturers. <i>Welding:</i> An electric fusion welding process shall be used.			
5. <i>HEAT TREATMENT/ DELIVERY CONDITION</i>	<i>Hot formed components:</i> Components hot formed in the temperature range of 760 – 800 °C do not need annealing after forming. <i>Cold formed components:</i> Annealed. <i>Welded components:</i> Annealed or as-welded from annealed materials			
6. <i>CHEMICAL COMPOSITION</i>	For components subject to welding, the chemical composition shall be modified as follows: Zn ≤ 0.50%, Pb ≤ 0.02%; C ≤ 0.05%			
7. <i>EXTENT OF TESTING</i>	Tensile test specimens shall be taken from each lot where a lot is defined as all products of the same type and nominal size, which are produced from the same heat of material and subject to the same finishing operation.			
8. <i>TEST SAMPLING</i>	Test samples may be cut from the products themselves, from prolongations or from sacrificial components.			
9. <i>WELDING</i>	Welding procedures shall be established and qualified in accordance with ASME IX.			
10. <i>NON DESTRUCTIVE TESTING</i>	<i>Welded Pipes to B467:</i> - Sch. 10S: Welded pipes shall be spot radiographed to the extent of not less than 300 mm per 15m of weld - Other schedules: All welds shall be 100 % radiographed The radiographic testing shall be in accordance with the requirements of the ASME VIII, Div. 1, Paragraph UW-51 and UW-52 for 100 % and spot radiography respectively.			
11. <i>REPAIR OF DEFECTS</i>	Weld repair of base material is not acceptable. For repair of welds, the requirements for production welding shall apply to the repair WPS			
12. <i>HYDROSTATIC TESTS</i>	<i>Seamless pipes and tubes to B466 and welded pipes to B467:</i> Each length of finished pipe shall be subjected to a hydrostatic test			
13. <i>CERTIFICATION</i>	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1 and shall confirm compliance with this specification.			

<b>MATERIAL DATA SHEET</b>		<b>IK02</b>		<b>Rev. 0</b>									
<b>TYPE OF MATERIAL: ALUMINIUM - BRONZE SAND CASTINGS</b>													
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>									
Castings	ASTM B148	UNS C95800	-	-									
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification												
2. <i>HEAT TREATMENT</i>	Heat treatment may be carried out at the discretion of the manufacturer												
3. <i>EXTENT OF TESTING</i>	One tensile test shall be carried out for each lot as defined by the in ASTM B148												
4. <i>NON DESTRUCTIVE TESTING</i>	<p><i>Liquid penetrant testing:</i> All accessible internal and external surfaces of each pilot casting and all production castings shall be examined by liquid penetrant. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing.</p> <p><i>Radiographic testing:</i> Radiographic testing shall be performed for each pilot casting and each production casting as follows:</p> <ul style="list-style-type: none"> <li>- Method of radiography and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7.</li> <li>- <i>Valve castings:</i> <ul style="list-style-type: none"> <li>- Sampling shall in accordance with the following table based on pressure class and nominal size:</li> </ul> </li> </ul> <table border="1" style="margin-left: 40px;"> <tr> <td style="text-align: center;"><i>Pressure Class:</i></td> <td></td> <td style="text-align: center;"><i>≤ 150</i></td> <td style="text-align: center;"><i>300</i></td> </tr> <tr> <td style="text-align: center;">Extent of RT</td> <td style="text-align: center;">10 %</td> <td style="text-align: center;">≥ 10"</td> <td style="text-align: center;">≥ 10"</td> </tr> </table> <ul style="list-style-type: none"> <li>- Extent of examination shall include the areas defined by ASME B16.34 for special class valves and at abrupt changes in sections or other critical areas defined in the purchase order. When random examination (10 %) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be tested</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined by designer. Sketches of the areas to be tested shall be established and agreed</li> </ul>					<i>Pressure Class:</i>		<i>≤ 150</i>	<i>300</i>	Extent of RT	10 %	≥ 10"	≥ 10"
<i>Pressure Class:</i>		<i>≤ 150</i>	<i>300</i>										
Extent of RT	10 %	≥ 10"	≥ 10"										
5. <i>REPAIR OF DEFECTS</i>	<p>All major repairs shall be documented with a sketch showing location and size of excavations Weld repairs are not acceptable for castings that leak during the final pressure testing Repairs by peening and impregnation are prohibited The repair welding procedure shall be qualified in accordance with ASME IX; a change of filler metal brand names requires requalification</p>												
6. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be in accordance with ISO 10474/EN 10204 Type 3.1 and shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Heat treatment condition (annealing temperature).</li> </ul>												

<b>MATERIAL DATA SHEET</b>		<b>IN01</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Nickel alloy type 625				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Wrought fittings	ASTM B366	UNS N06625 Grade 1	WP Cl. S, WP Cl. W, WP Cl. WX	S3
Welded pipes	ASTM B705	UNS N06625 Grade 1	Class 2	-
Forgings	ASTM B564	UNS N06625	-	S5.3
Plates	ASTM B443	UNS N06625 Grade 1	-	-
Bars	ASTM B446	UNS N06625 Grade 1	-	-
Seamless pipes and tubes	ASTM B444	UNS N06625 Grade 1	-	-
HIP fittings	ASTM B834	UNS N06625 Grade 1	-	-
<b>1. SCOPE</b>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
<b>2. MANUFACTURING</b>	Welding procedures shall be qualified in accordance with ASME IX or ISO 15614-1 using the same material grade (UNS number) as used in production A change of filler metal classification requires requalification			
<b>3. HEAT TREATMENT</b>	Annealed Components shall be placed in such a way as to ensure free circulation of heating and cooling media around each component during the heat treatment process including any rapid cooling/quenching			
<b>4. EXTENT OF TESTING</b>	A lot shall consist of all components of the same type, size, and wall thickness, manufactured from one heat of material, and, if welding is performed, using the same classification of welding product			
<b>5. NON DESTRUCTIVE TESTING</b>	<p><i>Fittings to B366:</i> S3 shall apply to the weld end area of 10% of seamless components from each lot and 100 % of welded fittings above NPS2. For welded fittings, the testing shall cover the weld only</p> <p><i>Forgings to B564:</i> S5.3 shall be performed on 10% of forgings above NPS2 from each lot</p>			
<b>6. SURFACE FINISH</b>	Finished components shall be pickled. Machined surfaces do not require pickling			
<b>7. REPAIR OF DEFECTS</b>	Weld repair of base material is not acceptable For repair of welds, the requirements for production welding shall apply to the repair WPS.			
<b>8. MARKING</b>	The component shall be marked to ensure full traceability to heat and heat treatment lot.			
<b>9. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and include the following information:</p> <ul style="list-style-type: none"> <li>- Heat treatment condition. (Solution annealing and annealing temperature shall be stated.)</li> </ul>			

MATERIAL DATA SHEET		IN02		Rev. 0
<b>TYPE OF MATERIAL:</b> Cast Nickel alloy				
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.
Castings	ASTM A494	Grade CW6MC (UNS N26625) Grade CX2MW (UNS N26022)	-	S2, S3 A781 S16
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of products to this MDS shall comply with the requirement of ISO 17782 or NORSOK Standard M-650.			
3. HEAT TREATMENT	Components shall be placed in such a way as to ensure free circulation of heating and cooling media around each component during the heat treatment process including quenching			
4. HARDNESS	The hardness shall be maximum 35 HRC.			
5. CORROSION TESTING	<p>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 G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60 °C in a solution of 20 % HNO<sub>3</sub> + 5 % HF.</p> <p>The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification.</li> <li>- The weight loss shall be less than 40g/m<sup>2</sup></li> </ul>			
6. EXTENT OF TESTING	Tensile test and corrosion test shall be made for each heat and heat treatment load. A test lot shall not exceed 5000kg.			
7. TEST SAMPLING	<p>Test blocks shall be integral or gated with the casting(s) they represent and shall accompany the castings through all heat treatment operations.</p> <p>Thickness of the test block shall be equal to the thickest part of the casting represented. For flanged components, the largest flange thickness is the ruling section.</p> <p>Dimensions of test blocks and location of test specimens within the test blocks are shown in the figure below. The test specimens shall be taken within the cross hatched area and in a distance of T/4 from the ends.</p> <p>During any PWHT the test block shall be tack welded onto the casting.</p> <div style="text-align: center;">  </div>			

MATERIAL DATA SHEET		IN02		Rev. 0																						
<b>TYPE OF MATERIAL:</b> Cast Nickel alloy																										
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.																						
Castings	ASTM A494	Grade CW6MC (UNS N26625) Grade CX2MW (UNS N26022)	-	S2, S3 A781 S16																						
8. NON DESTRUCTIVE TESTING	<p><i>Liquid penetrant testing:</i> S3 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing.</p> <p><i>Radiographic testing:</i> S2 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- Method of radiography and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7.</li> <li>- Valve castings: <ul style="list-style-type: none"> <li>o Sampling shall in accordance with the following table based on pressure class and valve size:</li> </ul> </li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: left;">Pressure Class:</th> <th><math>\leq 150</math></th> <th>300</th> <th>600</th> <th>900</th> <th>1500</th> <th>2500</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Sampling for RT</td> <td style="text-align: center;">10 %</td> <td style="text-align: center;"><math>\geq 10''</math></td> <td style="text-align: center;"><math>\geq 10''</math></td> <td style="text-align: center;"><math>\geq 2''</math></td> <td style="text-align: center;"><math>\geq 2''</math></td> <td style="text-align: center;"><math>\geq 2''</math></td> </tr> <tr> <td></td> <td style="text-align: center;">100 %</td> <td style="text-align: center;">N/A</td> <td style="text-align: center;">N/A</td> <td style="text-align: center;"><math>\geq 20''</math></td> <td style="text-align: center;"><math>\geq 16''</math></td> <td style="text-align: center;"><math>\geq 6''</math></td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>o Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10 %) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be test</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined by designer. Sketches of the areas to be tested shall be established and agreed.</li> </ul>					Pressure Class:	$\leq 150$	300	600	900	1500	2500	Sampling for RT	10 %	$\geq 10''$	$\geq 10''$	$\geq 2''$	$\geq 2''$	$\geq 2''$		100 %	N/A	N/A	$\geq 20''$	$\geq 16''$	$\geq 6''$
Pressure Class:	$\leq 150$	300	600	900	1500	2500																				
Sampling for RT	10 %	$\geq 10''$	$\geq 10''$	$\geq 2''$	$\geq 2''$	$\geq 2''$																				
	100 %	N/A	N/A	$\geq 20''$	$\geq 16''$	$\geq 6''$																				
9. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling																									
10. REPAIR OF DEFECTS	<p>All major repairs shall be documented according to ASTM A781 S16 Weld repairs are not acceptable for castings that leak during final pressure testing All major weld repairs shall be heat treated after welding. The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this MDS and shall include the following:</p> <ul style="list-style-type: none"> <li>- A macro and corrosion test as specified above shall be carried out</li> <li>- A change of specific make of filler metal (brand name) requires requalification.</li> </ul>																									
11. MARKING	The component shall be marked to ensure full traceability to heat and heat treatment lot.																									
12. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Report number used;</li> <li>- Heating and refining process to be stated;</li> <li>- Heat treatment condition (solution annealing temperature and holding times shall be stated.).</li> </ul>																									

<b>MATERIAL DATA SHEET</b>		<b>IN03</b>		<b>Rev. 0</b>
<b>TYPE OF MATERIAL:</b> Nickel alloy type 625				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Studs, bolts, screws	ASTM F468	UNS N06625	-	-
Nuts	ASTM F467	UNS N06625	Grade 2	-
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. <i>MANUFACTURE</i>	Threading of studs, bolts and screws may be done by machining or rolling. Thread rolling shall be done after heat treatment. Threads in nuts shall be machined			
3. <i>SURFACE FINISH</i>	All components shall be 100% visually examined all areas of threads, shanks and heads. Discontinuities shall comply with requirements specified in F788 for bolts/studs and F812 for nuts			
4. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable			
5. <i>MARKING</i>	Each bolt and nut shall be marked on the end/head to ensure full traceability to heat and heat treatment lot.			
6. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificates shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Heat treatment conditions (annealing temperature and time shall be stated).</li> <li>- Original material certificate of the bar material shall be included in the documentation.</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IN04</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Grade 660				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPL. REQ.</b>
Studs, bolts, screws and Nuts	ASTM A453	Grade 660 (UNS N66286)	Class D	
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. <i>MANUFACTURE</i>	Threading of studs, bolts and screws may be done by machining or rolling. Thread rolling shall be done after precipitation heat treatment. Threads in nuts shall be machined			
3. <i>HEAT TREATMENT</i>	Heat treatment shall be carried out after the final hot forming operation.			
4. <i>IMPACT TESTING</i>	Impact testing shall be carried out at -101 °C. The minimum absorbed energy shall be 27J average and 20J single, the lateral expansion shall be 0.38 mm			
5. <i>PROOF LOAD TESTING</i>	<i>Nuts:</i> Proof load testing to A962; the load shall comply with A194 Grade 7.			
6. <i>MARKING</i>	Each bolt and nut shall be marked on the end/head to ensure full traceability to cast and heat treatment lot.			
7. <i>SURFACE FINISH</i>	All components shall be 100% visually examined all areas of threads, shanks and heads. Discontinuities shall comply with requirements specified in F788 for fbolts/studs and F812 for nuts			
8. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable			
9. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificates shall be in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Heat treatment conditions (annealing temperature and time shall be stated).</li> <li>- Original material certificate of the bar material shall be included in the documentation.</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IR11</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Austenitic stainless steel, Type 6Mo				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPL. REQ.</b>
Seamless pipes	ASTM A312	UNS S31254 UNS N08367 UNS N08926	-	-
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process used for manufacturing of products to this MDS shall comply with the requirement of ISO 17782 or Norsok Standard M-650.			
3. <i>HEAT TREATMENT</i>	The pipes shall be solution annealed followed by rapid cooling in air or water/liquid. Pipes shall be placed in such a way as to ensure free circulation of heating and cooling media around each pipe during the heat treatment process including quenching			
4. <i>TENSILE AND CORROSION TESTING</i>	<p><i>Extent of testing:</i> One tensile and corrosion test shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing:</i> All tensile tests shall meet the specified properties of ASTM A312</p> <p><i>Corrosion testing:</i> Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50°C and the exposure time 24 hours. The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. Cut edges shall be prepared according to ASTM G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60°C in a solution of 20% HNO<sub>3</sub> + 5 % HF.</p> <p>The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification.</li> <li>- The weight loss shall be less than 4.0 g/m<sup>2</sup></li> </ul>			
5. <i>SURFACE FINISH</i>	Finished components shall be pickled or bright annealed			
6. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable.			
7. <i>MARKING</i>	The component shall be marked to ensure full traceability to heat and heat treatment lot.			
8. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or Norsok M-650 Manufacturing Summary identification or Qualification Test Record number used;</li> <li>- Steel manufacturer</li> <li>- Heat treatment condition. (Solution annealing temperature and holding time shall be stated)</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IR12</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Welded Pipes	ASTM A358	UNS S31254 UNS N08367 UNS N08926	Class 1, 3 or 5	S3
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process used for manufacturing of products to this MDS shall comply with the requirement of ISO 17782 or NORSOK Standard M-650.			
3. <i>HEAT TREATMENT</i>	<p>The pipes shall be solution annealed followed by rapid cooling in air or water/liquid Pipes shall be placed in such a way as to ensure free circulation of heating and cooling media around each pipe during the heat treatment process including quenching.</p> <p>Post weld solution annealing is not required for pipes with nominal wall thickness up to 7.11 mm manufactured from of solution annealed strip/plate material; such pipe shall be marked as stated in A358.</p>			
4. <i>TENSILE AND CORROSION TESTING</i>	<p><i>Extent of testing:</i> One tensile and corrosion test shall be carried out for each lot as defined below:</p> <ul style="list-style-type: none"> <li>- For batch heat treatment, a lot is defined as maximum 60m pipe of the same heat, size and heat treatment charge.</li> <li>- For continuous heat treatment, a lot is defined as maximum 60m of pipe of the same heat and size and which is heat treated the same day</li> </ul> <p><i>Tensile testing:</i> All tensile tests shall meet the specified properties of ASTM A358</p> <p><i>Corrosion testing:</i> Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50°C and the exposure time 24 hours. The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. Cut edges shall be prepared according to ASTM G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60°C in a solution of 20% HNO<sub>3</sub> + 5 % HF.</p> <p>The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification.</li> <li>- The weight loss shall be less than 4.0 g/m<sup>2</sup></li> </ul>			
5. <i>WELDING</i>	<p>The WPS shall be qualified in accordance with ASME IX or ISO 15614-1 and this MDS:</p> <ul style="list-style-type: none"> <li>- A matching consumable with enhanced Mo or Cr content compared to the base material shall be used; the S content shall not exceed 0.015%</li> <li>- The welding procedure qualification shall be corrosion tested as specified above.</li> <li>- The qualification shall be carried out on the same material grade (UNS number) as used in production.</li> <li>- A change of specific make (brand name) of welding consumables requires requalification.</li> </ul>			
6. <i>NON DESTRUCTIVE TESTING</i>	<p>Eddy current testing according to ASTM A450 is acceptable as replacement for radiography for wall thickness less than 4.0 mm.</p> <p>S3 shall apply to the longitudinal weld ends of 10% of pipes per lot. The weld of each examined pipe shall be ground flush for a length of 100mm prior to penetrant testing. Method of testing shall be according to ASME V Article 6 and acceptance criteria shall be to ASME VIII, Div. 1, Appendix 8. The testing shall be carried out after any calibration.</p>			
7. <i>SURFACE FINISH</i>	Finished components shall be pickled or bright annealed			
8. <i>REPAIR OF DEFECTS</i>	<p>Weld repair of base material is not acceptable.</p> <p>For repair of welds, the requirements for production welding above shall apply to the repair WPS. Repair welds shall be heat treated as per original production weld</p>			
9. <i>MARKING</i>	The component shall be marked to ensure full traceability to heat and heat treatment lot.			

<b>MATERIAL DATA SHEET</b>		<b>IR12</b>		<b>Rev. 0</b>
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Welded Pipes	ASTM A358	UNS S31254 UNS N08367 UNS N08926	Class 1, 3 or 5	S3
<b>10. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or Norsok M-650 Manufacturing Summary identification or Qualification Test Record number used;</li> <li>- Steel manufacturer;</li> <li>- Heat treatment condition. (Solution annealing temperature and holding time shall be stated)</li> </ul>			

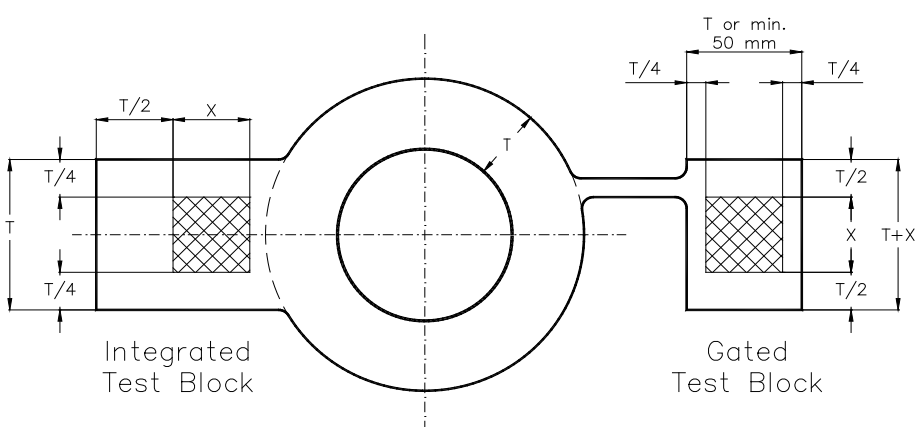
<b>MATERIAL DATA SHEET</b>		<b>IR13</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Wrought fittings	ASTM A403	UNS S31254 UNS N08367 UNS N08926	WP-S, WP-WX and WP-W	A960 S52	
HIP fittings	ASTM A988	UNS S31254 UNS N08367	-	S5	
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification				
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of products to this MDS shall comply with the requirement of ISO 17782 or Norsok Standard M-650. When permitted by ASTM A960, pipe fittings may be machined from bar provided the requirements of MDS IR17 are met in full				
3. HEAT TREATMENT	The fittings shall be solution annealed followed by water/liquid quenching Fittings shall be placed in such a way as to ensure free circulation of heating and cooling media around each fitting during the heat treatment process including quenching.				
4. TENSILE AND CORROSION TESTING	<p><i>Extent of testing:</i> One tensile and corrosion test shall be carried out for each lot as defined below:</p> <ul style="list-style-type: none"> <li>- A test lot shall include all components from the same heat, heat treatment load with a wall thickness range of <math>\pm 5</math>mm and, where applicable, welded with the same WPS</li> </ul> <p><i>Tensile testing:</i> All tensile tests shall meet the specified properties of the referenced standard specifications</p> <p><i>Corrosion testing:</i> Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50°C and the exposure time 24 hours. The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. Cut edges shall be prepared according to ASTM G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60°C in a solution of 20% HNO<sub>3</sub> + 5 % HF.</p> <p>The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification.</li> <li>- The weight loss shall be less than 4.0 g/m<sup>2</sup></li> </ul>				
5. WELDING	<p>The welding procedure shall be qualified in accordance with ASME IX or ISO 15614-1 and this MDS:</p> <ul style="list-style-type: none"> <li>- A matching consumable with enhanced Mo or Cr content compared to the base material shall be used; the S content shall not exceed 0.015%.</li> <li>- The welding procedure qualification shall be corrosion tested as specified above</li> <li>- The qualification shall be carried out on the same material grade (UNS number) as used in production.</li> <li>- A change of specific make (brand name) of welding consumables requires requalification.</li> </ul>				
6. NON DESTRUCTIVE TESTING	A960 S2 or A988 S5 (as applicable) shall apply to 10% of seamless/HIP fittings from each lot and 100 % of welded fittings above NPS2. For welded fittings, the testing shall cover the weld ends only. The weld of each examined fitting shall be ground flush in a length of 100 mm prior to penetrant testing The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 8.				
7. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling				
8. REPAIR OF DEFECTS	Weld repair of base material is not acceptable. For repair of welds, the requirements for production welding above shall apply to the repair WPS. Repair welds shall be heat treated as per the original production weld				
9. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.				

<b>MATERIAL DATA SHEET</b>		<b>IR13</b>		<b>Rev. 0</b>
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPL. REQ.</b>
Wrought fittings	ASTM A403	UNS S31254 UNS N08367 UNS N08926	WP-S, WP-WX and WP-W	A960 S52
HIP fittings	ASTM A988	UNS S31254 UNS N08367	-	S5
<b>10. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Record number used;</li> <li>- Steel manufacturer;</li> <li>- Heat treatment condition. (Solution annealing temperature and holding time shall be stated)</li> </ul>			

MATERIAL DATA SHEET		IR14	Rev. 0
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS
Forgings	ASTM A182	F44 (UNS S31254) F62 (UNS N08367) UNS N08926	-
HIP fittings	ASTM A988	UNS S31254 UNS N08367	-
SUPPL. REQ.			
			S56
			S5
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification		
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this MDS shall be qualified in accordance with ISO 17782 or NORSOK Standard M-650. When permitted by ASTM A961, pipe fittings and valve pressure retaining/controlling parts may be machined from bar provided the requirements of MDS IR17 are met in full		
3. HEAT TREATMENT	The components shall be solution annealed followed by water/liquid quenching. Components shall be placed in such a way as to ensure free circulation of heating and cooling media around each component during the heat treatment process including quenching.		
4. TENSILE AND CORROSION TESTING	<p><i>Extent of testing:</i> One tensile and corrosion test shall be carried out for each lot as defined below:</p> <ul style="list-style-type: none"> <li>- A test lot shall include all components from the same heat, heat treatment load and shall not exceed 2000kg for forgings with as forged weight <math>\leq 50</math>kg, and 5000kg for forgings with as forged weight <math>&gt; 50</math>kg;</li> <li>- For forgings/HIP fittings having maximum section thickness, <math>T \leq 50</math>mm, the test specimen shall be taken at mid thickness and its mid length shall be at least 50mm from any second surface or at equal distance from the second surfaces;</li> <li>- For forgings/HIP fittings having maximum section thickness, <math>T &gt; 50</math>mm, the test specimens shall be taken at least <math>\frac{1}{4} T</math> from the nearest surface and mid-length of test specimens at least T or 100mm, whichever is less, from any second surface.</li> <li>- Sketches shall be established showing type, and size of test samples and location for extraction of test specimens</li> </ul> <p><i>Tensile testing:</i> All tensile tests shall meet the specified properties of the referenced standard specifications</p> <p><i>Corrosion testing:</i> Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50°C and the exposure time 24 hours. The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. For forgings with wall thickness less than 100mm the test specimen shall expose a cross section from surface to mid-thickness. For greater wall thickness the specimen shall expose a cross section from surface to a depth of 50mm. Cut edges shall be prepared according to ASTM G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60°C in a solution of 20% HNO<sub>3</sub> + 5 % HF. The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification</li> <li>- The weight loss shall be less than 4.0 g/m<sup>2</sup></li> </ul>		
5. NON DESTRUCTIVE TESTING	ASTM A961 S56 or A988 S5 (as applicable) shall apply to 10 % of forgings/HIP fittings from each lot above NPS2. The testing shall be carried out after final machining and pickling. The acceptance criteria shall be to ASME VIII, Div. 1, Appendix 8.		
6. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling		
7. REPAIR OF DEFECTS	Weld repair is not acceptable.		
8. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.		

<b>MATERIAL DATA SHEET</b>		<b>IR14</b>		<b>Rev. 0</b>
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo				
<i>PRODUCT</i>	<i>STANDARD</i>	<i>GRADE</i>	<i>ACCEPT. CLASS</i>	<i>SUPL. REQ.</i>
Forgings	ASTM A182	F44 (UNS S31254) F62 (UNS N08367) UNS N08926	-	S56
HIP fittings	ASTM A988	UNS S31254 UNS N08367	-	S5
<b>9. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or Norsok M-650 Manufacturing Summary identification or Qualification Test Record number used;</li> <li>- Steel manufacturer of the starting material;</li> <li>- Heat treatment condition (Solution annealing temperature and holding time shall be stated).</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IR15</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Plates	ASTM A240	UNS S31254 UNS N08367 UNS N08926	-	-
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process used for manufacturing of product to this MDS shall be qualified in accordance with ISO 17782 or Norsok Standard M-650.			
3. <i>HEAT TREATMENT</i>	The plates shall be solution annealed followed by water/liquid quenching. Plates shall be placed in such a way as to ensure free circulation of heating and cooling media around each plate during the heat treatment process including quenching.			
4. <i>TENSILE AND CORROSION TESTING</i>	<p><i>Extent of testing:</i> One tensile and corrosion test shall be carried out for each lot as defined below:</p> <ul style="list-style-type: none"> <li>- A test lot shall include all plate from the same heat, heat treatment load and with the same nominal thickness. For heat treatment in a continuous furnace, a heat treatment load is defined as all plates heat treated continuously in the same furnace, of the same heat and same nominal thickness</li> </ul> <p><i>Tensile testing:</i> Tensile test specimens shall be sampled in the transverse orientation to the direction of final rolling and shall be located in mid-thickness for thickness (T) ≤ 40 mm and at location T/4 for thicknesses &gt; 40 mm All tensile tests shall meet the specified properties of ASTM A240</p> <p><i>Corrosion testing:</i> Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50°C and the exposure time 24 hours. The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. Cut edges shall be prepared according to ASTM G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60°C in a solution of 20% HNO<sub>3</sub> + 5 % HF. The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification.</li> <li>- The weight loss shall be less than 4.0 g/m<sup>2</sup></li> </ul>			
5. <i>SURFACE FINISH</i>	Finished components shall be pickled			
6. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable.			
7. <i>MARKING</i>	The components shall be marked to ensure full traceability to heat and heat treatment lot.			
8. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or Norsok M-650 Manufacturing Summary identification or Qualification Test Record number used;</li> <li>- Steel manufacturer;</li> <li>- Heat treatment condition (Solution annealing temperature and holding time shall be stated).</li> </ul>			

MATERIAL DATA SHEET		IR16	Rev. 0
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo			
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS
Castings	ASTM A351	CK3MCuN (J93254) CN3MN (J94651)	-
S5, S6, A703 S20			
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification		
2. QUALIFICATION AND MANUFACTURE	Manufacturers and the manufacturing process used for manufacturing of product to this MDS shall be qualified in accordance with ISO 17782 or NORSOK Standard M-650.		
3. HEAT TREATMENT	Solution annealed at temperature $\geq 1225^{\circ}\text{C}$ followed by water/liquid quenching Components shall be placed in such a way as to ensure free circulation of heating and cooling media around each component during the heat treatment process including quenching.		
4. CHEMICAL COMPOSITION	P $\leq 0,030\%$		
5. TENSILE AND CORROSION TESTING	<p><i>Extent of testing:</i> One tensile and corrosion test shall be carried out for each lot as defined below:</p> <ul style="list-style-type: none"> <li>- A test lot shall include all castings from the same heat, heat treatment lot, including any PWHT, and shall not exceed 5000kg</li> </ul> <p><i>Tensile testing:</i> All tensile tests shall meet the specified properties of ASTM A351</p> <p><i>Corrosion testing:</i> Corrosion test according to ASTM G48 Method A is required. Test temperature shall be <math>50^{\circ}\text{C}</math> and the exposure time 24 hours. The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. Cut edges shall be prepared according to ASTM G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at <math>60^{\circ}\text{C}</math> in a solution of 20% <math>\text{HNO}_3</math> + 5 % HF.</p> <p>The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification.</li> <li>- The weight loss shall be less than <math>4.0\text{g}/\text{m}^2</math></li> </ul>		
6. TEST SAMPLING	<p>Test blocks shall be integral or gated with the casting(s) they represent and shall accompany the castings through all heat treatment operations.</p> <p>Thickness of the test block shall be equal to the thickest part of the casting represented. For flanged components, the largest flange thickness is the ruling section.</p> <p>Dimensions of test blocks and location of test specimens within the test blocks are shown in the figure below. The test specimens shall be taken within the cross hatched area and in a distance of <math>T/4</math> from the ends.</p> <p>During any PWHT the test block shall be tack welded onto the casting.</p> <div style="text-align: center;">  <p>Integrated Test Block</p> <p>Gated Test Block</p> </div>		

MATERIAL DATA SHEET		IR16	Rev. 0																									
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo																												
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.																								
Castings	ASTM A351	CK3MCuN (J93254) CN3MN (J94651)	-	S5, S6, A703 S20																								
<b>7. NON DESTRUCTIVE TESTING</b>	<p><i>Liquid penetrant testing:</i> S6 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing.</p> <p><i>Radiographic testing:</i> S5 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- Method of radiography and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7.</li> <li>- Valve castings: <ul style="list-style-type: none"> <li>o Sampling shall in accordance with the following table based on pressure class and valve size:</li> </ul> </li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="border: none;">Pressure Class:</th> <th style="border: none;"></th> <th style="border: none;">≤150</th> <th style="border: none;">300</th> <th style="border: none;">600</th> <th style="border: none;">900</th> <th style="border: none;">1500</th> <th style="border: none;">2500</th> </tr> </thead> <tbody> <tr> <td style="border: none;">Sampling for RT</td> <td style="border: none;">10 %</td> <td style="border: none;">≥ 10"</td> <td style="border: none;">≥ 10"</td> <td style="border: none;">≥ 2"</td> <td style="border: none;">≥ 2"</td> <td style="border: none;">≥ 2"</td> <td style="border: none;">≥ 2"</td> </tr> <tr> <td style="border: none;"></td> <td style="border: none;">100 %</td> <td style="border: none;">N/A</td> <td style="border: none;">N/A</td> <td style="border: none;">≥ 20"</td> <td style="border: none;">≥ 16"</td> <td style="border: none;">≥ 6"</td> <td style="border: none;">≥ 6"</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>o Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10%) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be test</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined by designer. Sketches of the areas to be tested shall be established and agreed.</li> </ul>				Pressure Class:		≤150	300	600	900	1500	2500	Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"		100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"
Pressure Class:		≤150	300	600	900	1500	2500																					
Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"																					
	100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"																					
<b>8. SURFACE FINISH</b>	Finished components shall be pickled. Machined surfaces do not require pickling																											
<b>9. REPAIR OF DEFECTS</b>	<p>All major repairs shall be documented in accordance with A703 S20. Weld repairs are not acceptable for castings that leak during final pressure testing The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this MDS. A change in the specific make of filler metal (brand name) requires requalification Post weld heat treatment is required after all weld repairs. If a minor cosmetic repair is required to a semi-finished or finished cast component, heat treatment may be omitted provided the welding procedure meets the test requirements of this datasheet in the as-welded condition and as follows:</p> <ul style="list-style-type: none"> <li>- Welding shall be carried out with Ni-based consumable with enhanced Mo or Cr content compared to the base material; the S content shall not exceed 0.015 %</li> </ul>																											
<b>10. MARKING</b>	The components shall be marked to ensure full traceability to heat and heat treatment load.																											
<b>11. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be issued in accordance with EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Record number used;</li> <li>- Steel manufacturer;</li> <li>- Heat treatment condition (Solution annealing temperature and holding time shall be stated).</li> </ul>																											

<b>MATERIAL DATA SHEET</b>		<b>IR17</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 6Mo				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Bars	ASTM A276, ASTM A479	UNS S31254 UNS N08367 UNS N08926	-	-
<b>1. SCOPE</b>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
<b>2. QUALIFICATION AND MANUFACTURING</b>	Manufacturers and the manufacturing process used for manufacturing of product to this specification shall be qualified in accordance with ISO 17782 or Norsok M-650 Bars shall be cylindrical shaped with a maximum outside diameter $\leq$ 200mm Note 1: Cold finishing after heat treatment shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold forming is not permitted			
<b>3. HEAT TREATMENT</b>	The bars shall be solution annealed followed by water/liquid quenching Bars shall be placed in such a way as to ensure free circulation of heating and cooling media around each bar during the heat treatment process including quenching.			
<b>4. SAMPLING OF TEST SPECIMENS FROM BARS INTENDED FOR MACHINING OF COMPONENTS</b>	Sampling of test specimens shall apply dependent on the outside diameter: <ul style="list-style-type: none"> <li>- The mid-length of the axial tensile test specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm, whichever is the greater, from the end of the bar, and the centreline of the test specimens shall be located a minimum distance of OD/4 from the surface</li> <li>- The centreline of the tangential tensile test specimens shall be located at a minimum distance of OD/4 from the surface and the mid-point of the specimens at a minimum of 100mm from the end of the bar</li> <li>- For bar with outside diameter &lt; 100mm: <ul style="list-style-type: none"> <li>o One tensile test specimen shall be taken in the axial direction</li> </ul> </li> <li>- For bar with outside diameter <math>\geq</math> 100 mm: <ul style="list-style-type: none"> <li>o One tensile test specimen shall be taken in the axial direction</li> <li>o In addition, one tensile test specimen shall be taken in the tangential direction</li> </ul> </li> </ul>			
<b>5. TENSILE AND CORROSION TESTING</b>	<p><i>Extent of testing:</i> Tensile and corrosion tests shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing:</i> The minimum tensile strength properties of the referenced standard specification shall be met in both directions</p> <p><i>Corrosion testing:</i> Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50°C and the exposure time 24 hours. The test shall expose the external and internal surfaces and a cross section surface in full wall thickness. Cut edges shall be prepared according to ASTM G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60°C in a solution of 20% HNO<sub>3</sub> + 5 % HF.</p> <p>The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification</li> <li>- The weight loss shall be less than 4.0g/m<sup>2</sup></li> </ul>			
<b>6. SURFACE FINISH</b>	Finished product shall be white pickled.			
<b>7. REPAIR OF DEFECTS</b>	Weld repair is not acceptable			
<b>8. MARKING</b>	The components shall be marked to ensure full traceability to heat and heat treatment lot			
<b>9. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or Norsok M-650 Manufacturing Summary identification or Qualification Test Record number used;</li> <li>- Steel manufacturer;</li> <li>- Heat treatment condition (Solution annealing temperature and holding time shall be stated).</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IR18</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Austenitic stainless steel, Type 6Mo				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Tubes	ASTM A269	UNS S31254 UNS N08367 UNS N08926	-	-
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. <i>QUALIFICATION AND MANUFACTURING</i>	Manufacturers and the manufacturing process used for manufacturing of product to this MDS shall be qualified in accordance with ISO 17782 or NORSOK Standard M-650.			
3. <i>HEAT TREATMENT</i>	The tubes shall be solution annealed followed by rapid cooling in air or water/liquid Tubes shall be placed in such a way as to ensure free circulation of air and quenching medium around each tube during the heat treatment process including cooling.			
4. <i>TENSILE AND CORROSION TESTING</i>	<p><i>Extent of testing:</i> One tensile and corrosion test shall be carried out for each heat and heat treatment lot</p> <p><i>Tensile testing:</i> All tensile tests shall meet the specified properties of ASTM A269</p> <p><i>Corrosion testing:</i> Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50°C and the exposure time 24 hours. The test shall expose the external and internal surfaces and a cross section surface including weld zone in full wall thickness. Cut edges shall be prepared according to ASTM G48. The complete specimen shall be pickled before being weighed and tested. Pickling may be performed for 5 minutes at 60°C in a solution of 20% HNO<sub>3</sub> + 5% HF.</p> <p>The acceptance criteria are:</p> <ul style="list-style-type: none"> <li>- No pitting at 20x magnification.</li> <li>- The weight loss shall be less than 4.0g/m<sup>2</sup></li> </ul>			
5. <i>SURFACE FINISH</i>	Finished product shall be white pickled or bright annealed			
6. <i>REPAIR OF DEFECTS</i>	Weld repair is not acceptable			
7. <i>MARKING</i>	The components shall be marked to ensure full traceability to heat and heat treatment lot.			
8. <i>CERTIFICATION</i>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Record number used;</li> <li>- Steel manufacturer;</li> <li>- Heat treatment condition (Solution annealing temperature and holding time shall be stated)</li> </ul>			

MATERIAL DATA SHEET		IS01	Rev. 0	
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 316				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Wrought fittings	ASTM A403	WP316	W or S or WX	-
Welded pipes	ASTM A358	316	Class 1, 3, 4 or 5	-
Seamless and welded pipes	ASTM A312	TP316	-	-
Forgings	ASTM A182	F316	-	-
Plates	ASTM A240	316	-	-
Tubes	ASTM A269	316	-	-
Bars	ASTM A276, ASTM A479	316	-	-
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. MANUFACTURING METHOD	<p><i>Machining components from bar:</i> When permitted by ASTM A960/A961, pipe fittings and valve pressure containing/controlling parts may be machined from bar provided the following requirements are met:</p> <ul style="list-style-type: none"> <li>- Forged bar as defined in ASTM A788, supplied in solution annealed condition and certified to this MDS;</li> <li>- Hot rolled/wrought bar with a maximum outside diameter <math>\leq</math> 300 mm supplied in the solution annealed condition and certified to this MDS</li> </ul> <p>NOTE 1 For integral flanged valves, the minimum valve body to integral flange transition radius shall be 10mm</p>			
3. CHEMICAL COMPOSITION	<i>All products:</i> The chemical composition shall comply with UNS S31603/Grade 316L for all products forms			
4. HEAT TREATMENT	<i>Fittings and forgings:</i> During heat treatment components shall be placed in such a way as to ensure free circulation around each component during the heat treatment process including possible quenching operation			
5. SAMPLING OF TEST SPECIMENS FROM BARS INTENDED FOR MACHINING OF COMPONENTS	<p>Sampling of test specimens shall apply dependent on the outside diameter:</p> <ul style="list-style-type: none"> <li>- The mid-length of the axial tensile test specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm, whichever is the greater, from the end of the bar, and the centreline of the test specimens shall be located a minimum distance of OD/4 from the surface</li> <li>- The centreline of the tangential tensile test specimens shall be located at a minimum distance of OD/4 from the surface and the mid-point of the specimens at a minimum of 100mm from the end of the bar</li> <li>- For bar with outside diameter &lt; 100mm: <ul style="list-style-type: none"> <li>o One tensile test specimen shall be taken in the axial direction</li> </ul> </li> <li>- For bar with outside diameter <math>\geq</math> 100 mm: <ul style="list-style-type: none"> <li>o One tensile test specimen shall be taken in the axial direction</li> <li>o In addition, one tensile test specimen shall be taken in the tangential direction</li> </ul> </li> </ul>			
6. NON DESTRUCTIVE TESTING	<p><i>Welded tubes to A269:</i> Non-destructive electric testing is required</p> <p><i>Fittings to A403:</i> Ultrasonic testing is not acceptable as replacement for radiography</p>			
7. SURFACE FINISH	<p><i>All products except plate:</i> Finished components shall be pickled or bright annealed. Machined surfaces do not require pickling.</p> <p><i>Plates:</i> According to the requirements in ASTM A480</p>			
8. REPAIR OF DEFECTS	<p>Weld repair of base material is not acceptable.</p> <p>For repair of welds, the requirements for production welding above shall apply to the repair WPS. Repair welds shall be heat treated as per original production weld</p>			
9. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.			
10. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the heat treatment condition.</p> <p>The certificate shall confirm compliance to both UNS S31603 and S31600</p>			

MATERIAL DATA SHEET		IS02		Rev. 0																								
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel Castings Type 316																												
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>																								
Castings	ASTM A351	CF8M CF3M	-	S5, S6																								
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification																											
2. EXTENT OF TESTING	Tensile testing is required for each heat and heat treatment lot including any PWHT.																											
3. TEST SAMPLING	For castings with a weight of 250 kg or more, the test blocks shall be integrally cast or gated onto the casting and shall accompany the castings through all heat treatment operations. During any PWHT the test block shall be tack welded onto the casting.																											
4. NON DESTRUCTIVE TESTING	<p><i>Liquid penetrant testing:</i> S6 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing.</p> <p><i>Radiographic testing:</i> S5 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- Method of radiography and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7.</li> <li>- Valve castings: <ul style="list-style-type: none"> <li>o Sampling shall in accordance with the following table based on pressure class and valve size:</li> </ul> </li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="2"><i>Pressure Class:</i></th> <th><i>≤150</i></th> <th><i>300</i></th> <th><i>600</i></th> <th><i>900</i></th> <th><i>1500</i></th> <th><i>2500</i></th> </tr> </thead> <tbody> <tr> <td rowspan="2">Sampling for RT</td> <td>10 %</td> <td>≥ 10"</td> <td>≥ 10"</td> <td>≥ 2"</td> <td>≥ 2"</td> <td>≥ 2"</td> <td>≥ 2"</td> </tr> <tr> <td>100 %</td> <td>N/A</td> <td>N/A</td> <td>≥ 20"</td> <td>≥ 16"</td> <td>≥ 6"</td> <td>≥ 6"</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>o Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10 %) is specified a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be test</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined by designer. Sketches of the areas to be tested shall be established and agreed.</li> </ul>					<i>Pressure Class:</i>		<i>≤150</i>	<i>300</i>	<i>600</i>	<i>900</i>	<i>1500</i>	<i>2500</i>	Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"	100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"
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5. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling																											
6. REPAIR OF DEFECTS	All major repairs as defined by ASTM A351 shall be documented Weld repairs are not acceptable for castings that leak during final pressure testing The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this MDS																											
7. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.																											
8. CERTIFICATION	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the heat treatment condition.																											

MATERIAL DATA SHEET		IS21	Rev. 0	
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel, Type 304				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Wrought fittings	ASTM A403	WP304	W or S or WX	-
Welded pipes	ASTM A358	304	Class 1, 3, 4 or 5	-
Seamless and welded pipes	ASTM A312	TP304	-	-
Forgings	ASTM A182	F304	-	-
Plates	ASTM A240	304	-	-
Tubes	ASTM A269	304	-	-
Bars	ASTM A276, ASTM A479	304	-	-
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. MANUFACTURING METHOD	<p><i>Machining components from bar:</i> When permitted by ASTM A960/A961, pipe fittings and valve pressure containing/controlling parts may be machined from bar provided the following requirements are met:</p> <ul style="list-style-type: none"> <li>- Forged bar as defined in ASTM A788, supplied in solution annealed condition and certified to this MDS;</li> <li>- Hot rolled/wrought bar with a maximum outside diameter <math>\leq</math> 300 mm supplied in the solution annealed condition and certified to this MDS</li> </ul> <p>NOTE 1 For integral flanged valves, the minimum valve body to integral flange transition radius shall be 10mm</p>			
3. CHEMICAL COMPOSITION	<i>All products:</i> The chemical composition shall comply with UNS S30403/Grade 304L for all products forms			
4. HEAT TREATMENT	<i>Fittings and forgings:</i> During heat treatment components shall be placed in such a way as to ensure free circulation around each component during the heat treatment process including possible quenching operation			
5. SAMPLING OF TEST SPECIMENS FROM BARS INTENDED FOR MACHINING OF COMPONENTS	<p>Sampling of test specimens shall apply dependent on the outside diameter:</p> <ul style="list-style-type: none"> <li>- The mid-length of the axial tensile test specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm, whichever is the greater, from the end of the bar, and the centreline of the test specimens shall be located a minimum distance of OD/4 from the surface</li> <li>- The centreline of the tangential tensile test specimens shall be located at a minimum distance of OD/4 from the surface and the mid-point of the specimens at a minimum of 100mm from the end of the bar</li> <li>- For bar with outside diameter &lt; 100mm: <ul style="list-style-type: none"> <li>o One tensile test specimen shall be taken in the axial direction</li> </ul> </li> <li>- For bar with outside diameter <math>\geq</math> 100 mm: <ul style="list-style-type: none"> <li>o One tensile test specimen shall be taken in the axial direction</li> <li>o In addition, one tensile test specimen shall be taken in the tangential direction</li> </ul> </li> </ul>			
6. NON DESTRUCTIVE TESTING	<p><i>Welded tubes to A269:</i> Non-destructive electric testing is required</p> <p><i>Fittings to A403:</i> Ultrasonic testing is not acceptable as replacement for RT</p>			
7. SURFACE FINISH	<p><i>All products except plate:</i> Finished components shall be pickled or bright annealed. Machined surfaces do not require pickling.</p> <p><i>Plates:</i> According to the requirements in A480</p>			
8. REPAIR OF DEFECTS	<p>Weld repair of base material is not acceptable.</p> <p>For repair of welds, the requirements for production welding above shall apply to the repair WPS. Repair welds shall be heat treated as per original production weld</p>			
9. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.			
10. CERTIFICATION	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the heat treatment condition.</p> <p>The certificate shall confirm compliance to both UNS S30403 and S30400</p>			

MATERIAL DATA SHEET		IS22		Rev. 0																								
<b>TYPE OF MATERIAL:</b> Austenitic Stainless Steel Castings Type 304																												
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.																								
Castings	ASTM A351	CF8 CF3	-	S5, S6																								
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification																											
2. EXTENT OF TESTING	Tensile testing is required for each heat and heat treatment lot including any PWHT.																											
3. TEST SAMPLING	For castings with a weight of 250 kg or more, the test blocks shall be integrally cast or gated onto the casting and shall accompany the castings through all heat treatment operations. During any PWHT the test block shall be tack welded onto the casting.																											
4. NON DESTRUCTIVE TESTING	<p><i>Liquid penetrant testing:</i> S6 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing.</p> <p><i>Radiographic testing):</i> S5 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- Method of radiography and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7.</li> <li>- Valve castings: <ul style="list-style-type: none"> <li>o Sampling shall in accordance with the following table based on pressure class and valve size:</li> </ul> </li> </ul> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="text-align: left;">Pressure Class:</th> <th></th> <th>≤150</th> <th>300</th> <th>600</th> <th>900</th> <th>1500</th> <th>2500</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Sampling for RT</td> <td>10 %</td> <td>≥ 10"</td> <td>≥ 10"</td> <td>≥ 2"</td> <td>≥ 2"</td> <td>≥ 2"</td> <td>≥ 2"</td> </tr> <tr> <td>100 %</td> <td>N/A</td> <td>N/A</td> <td>≥ 20"</td> <td>≥ 16"</td> <td>≥ 6"</td> <td>≥ 6"</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>o Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10 %) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be test</li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined by designer. Sketches of the areas to be tested shall be established and agreed.</li> </ul>					Pressure Class:		≤150	300	600	900	1500	2500	Sampling for RT	10 %	≥ 10"	≥ 10"	≥ 2"	≥ 2"	≥ 2"	≥ 2"	100 %	N/A	N/A	≥ 20"	≥ 16"	≥ 6"	≥ 6"
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5. SURFACE FINISH	Finished components shall be pickled. Machined surfaces do not require pickling																											
6. REPAIR OF DEFECTS	All major repairs as defined by ASTM A351 shall be documented Weld repairs are not acceptable for castings that leak during final pressure testing The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this MDS																											
7. MARKING	The components shall be marked to ensure full traceability to heat and heat treatment lot.																											
8. CERTIFICATION	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the heat treatment condition.																											

<b>MATERIAL DATA SHEET</b>		<b>IT01</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Titanium Grade 2				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Seamless pipes	ASTM B861	2	-	-
Welded pipes	ASTM B862	2	-	S1.1
Wrought fittings	ASTM B363	WPT2/WPT2W	-	S1
Forgings	ASTM B381	F2	-	-
Plates	ASTM B265	2	-	-
Bars	ASTM B348	2	-	-
Tubes	ASTM B338	2	-	-
<b>1. SCOPE</b>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
<b>2. QUALIFICATION AND MANUFACTURING</b>	Manufacturers and the manufacturing process used for manufacturing of product to this MDS shall be qualified in accordance with ISO 17782 or NORSOK Standard M-650.			
<b>3. HEAT TREATMENT</b>	<i>Wrought fittings to B363, Forgings to B381, Plates to B265 and Bars to B348:</i> - Annealed condition unless the tensile properties in the referred standard can be achieved in the as formed condition.			
<b>4. EXTENT OF TESTING</b>	<i>Fittings to B363:</i> Tensile test specimens shall be taken from each heat and heat treatment lot, for each type and size <i>Forgings to B381 and bars to B348:</i> Tensile test specimens shall be taken from each heat and heat treatment lot, with a maximum deviation from the test block thickness of $\pm 10$ mm			
<b>5. WELDING</b>	<i>Welded pipes to B862:</i> Welding procedures shall be qualified in accordance with ASME IX or ISO 15614-5			
<b>6. NON DESTRUCTIVE TESTING</b>	<i>General:</i> Method and acceptance criteria for penetrant testing shall be to ASME VIII, Div. 1, Appendix 8 <i>Welded pipes to B862:</i> S1.1 shall apply <i>Fittings to B363:</i> S1 shall apply to 10 % of seamless fittings per lot (as defined for mechanical testing) and 100 % of welded fittings above NPS 2 <i>Forgings to B381:</i> Penetrant testing shall apply to 10 % of all forgings per lot above NPS2. The testing shall be carried out after final machining			
<b>7. REPAIR</b>	Repair welding of base material is not acceptable For repair of welds, the requirements for production welding shall apply to the repair WPS. Repair welds shall be heat treated as per original production weld (if applicable)			
<b>8. CERTIFICATION</b>	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent. The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information: - ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Record number used			

MATERIAL DATA SHEET		IT02		Rev. 0									
<b>TYPE OF MATERIAL:</b> Titanium Grade 2													
PRODUCT	STANDARD	GRADE	ACCEPT. CLASS	SUPPL. REQ.									
Castings	ASTM B367	C2	-	S1, S2, S5, S7									
1. SCOPE	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification												
2. QUALIFICATION AND MANUFACTURING	Manufacturers and the manufacturing process used for manufacturing of product to this MDS shall be qualified in accordance with ISO 17782 or Norsok Standard M-650.												
3. HOT ISOSTATIC PRESSING	All castings shall be subject to Hot Isostatic Pressing (HIP). All castings, which due to size limitations cannot be HIP, shall be heat treated and radiographed. When the HIP operation is applied, this shall be in accordance with ASTM A1080.												
4. EXTENT OF TESTING	Tensile testing is required for each heat and HIP batch or heat treatment lot												
5. TEST SAMPLING	<p>Samples for production testing shall be cut from the gating system of the casting. For castings with weight 150kg and above, the test blocks shall be integrally cast with the casting.</p> <p>Size of the test block shall be 140mm in length and 80 mm in height with thickness (T):</p> <ul style="list-style-type: none"> <li>- T = 22mm for t ≤ 30mm.</li> <li>- T = 50mm for 30mm &lt; t ≤ 60mm</li> <li>- T = 75mm for t &gt; 60mm</li> </ul> <p><i>NOTE: T = section (shell) thickness of castings; for flanged components, the largest flange thickness is the ruling thickness.</i></p> <p>Test samples shall accompany the castings through HIP and any heat treatment, chemical cleaning process or any other operation that may alter metallurgical or mechanical properties</p>												
6. NON DESTRUCTIVE TESTING	<p><i>Liquid penetrant testing:</i></p> <p>S2 shall apply for each pilot casting and all production castings, on all accessible internal and external surfaces. The method and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7. The testing shall be carried out after final machining. Non-machined surfaces shall be pickled prior to the testing.</p> <p><i>Radiographic testing:</i></p> <p>S1 shall apply for each pilot casting and for production castings as follows:</p> <ul style="list-style-type: none"> <li>- Method of radiography and acceptance criteria shall be in accordance with ASME VIII Div. 1 Appendix 7</li> <li>- Valve castings: <ul style="list-style-type: none"> <li>o All valve castings that are not subject to HIP shall be radiographed to the extent defined below</li> <li>o Sampling for valves that have been subject to HIP shall be in accordance with the following table based on pressure class and valve size:</li> </ul> <table border="1" style="margin-left: 20px;"> <tr> <td colspan="2"><i>Pressure Class:</i></td> <td>≤ 150</td> <td>300</td> </tr> <tr> <td><i>Sampling for RT</i></td> <td>10 %</td> <td>≥ 10"</td> <td>≥ 10"</td> </tr> </table> <ul style="list-style-type: none"> <li>o Extent of examination shall include the areas defined by ASME B16.34 for special class valves, at abrupt changes in sections and at the junctions of risers, gates or feeders to the casting. When random examination (10 %) is specified, a minimum of one casting of each pattern in any purchase order with the foundry shall be examined. If defects outside of the acceptance criteria are detected, two more castings shall be tested, and if any of these two fail, all items represented shall be test</li> </ul> </li> <li>- <i>Other type of castings:</i> Each casting shall be examined unless agreed otherwise. Testing shall be at abrupt changes in sections and at the junctions of risers, gates or feeders to the castings and other critical areas as defined by designer. Sketches of the areas to be tested shall be established and agreed.</li> </ul>					<i>Pressure Class:</i>		≤ 150	300	<i>Sampling for RT</i>	10 %	≥ 10"	≥ 10"
<i>Pressure Class:</i>		≤ 150	300										
<i>Sampling for RT</i>	10 %	≥ 10"	≥ 10"										
7. SURFACE FINISH	<p>For castings manufactured to this MDS α-case in the casting surface shall be completely removed at the foundry from following locations:</p> <ul style="list-style-type: none"> <li>- All surfaces, which shall be machined.</li> <li>- All weld bevels including an area of 20mm on each side of the bevel.</li> <li>- All highly stressed areas including areas prone to fatigue.</li> </ul> <p><i>NOTE: Alpha-case (TiO) is a very hard and brittle surface layer, which is formed as a result of reaction between the molten titanium and some types of mould binders, e.g. periclase. The thickness of the alpha-case is dependent on the cooling rate during solidification. The heavier the casting wall, the thicker the alpha-case layer. The alpha case makes machining difficult, may cause cracking during welding and shallow micro cracks may appear during liquid penetrant examination.</i></p>												

<b>MATERIAL DATA SHEET</b>		<b>IT02</b>		<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Titanium Grade 2					
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>	
Castings	ASTM B367	C2	-	S1, S2, S5, S7	
<b>8. REPAIR OF DEFECTS</b>	<p>All major repairs shall be documented, where a major repair is defined as excavations exceeding 20% of the casting section or wall thickness, and/or 4% of the casting surface area</p> <p>Weld repairs are not acceptable for castings that leak during final pressure testing</p> <p>The repair welding procedure shall be qualified in accordance with ASME IX or ISO 15614-5 and this MDS.</p>				
<b>9. MARKING</b>	The component shall be marked to ensure full traceability to heat and heat treatment lot.				
<b>10. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent.</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- ISO 17782 or NORSOK M-650 Manufacturing Summary identification or Qualification Test Record number used</li> <li>- Name of HIP manufacturer</li> <li>- HIP parameters (e.g. temperature, time at temperature and pressure)</li> <li>- If HIP is replaced by radiography</li> <li>- If heat treated in-lieu of HIP or after weld repairs, the heat treatment conditions shall be stated</li> </ul>				

<b>MATERIAL DATA SHEET</b>		<b>IX07</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Low alloyed steel fasteners (HDG)				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Studs and bolts	ASTM A320	L7, L7M, L43	-	-
Nuts	ASTM A194	7 or 7M	-	S3, S4, S5
<b>1. SCOPE</b>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
<b>2. MANUFACTURE</b>	Threading of studs and bolts may be done by machining or rolling. Thread rolling shall be done after heat treatment Threads in nuts shall be machined			
<b>3. IMPACT TESTING</b>	<i>Nuts to A194:</i> S3 shall apply			
<b>4. PROOF LOAD TESTING</b>	<i>Nuts to A194:</i> S4 shall apply			
<b>5. DIMENSIONS</b>	<p><i>Studs and bolts:</i></p> <ul style="list-style-type: none"> <li>- Threading shall be in accordance with ASME B1.1, class 2A fit for diameters 1" and smaller (UNC series) and 8 pitch thread series for 1½" and larger</li> </ul> <p><i>Nuts:</i></p> <ul style="list-style-type: none"> <li>- Nuts shall be ASME heavy HEX-series, double chamfered.</li> <li>- Nut threads shall be oversized to fit studs/bolts dependent of specified coating.</li> </ul>			
<b>6. SURFACE PROTECTION</b>	All studs, bolts, nuts and washers shall be hot dipped galvanized according to ASTM A153 The zinc coating on threads shall not be subject to cutting, rolling or finishing tool operation. Nuts may be tapped after galvanizing.			
<b>7. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent</p> <p>S5 shall apply for nuts to A194</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Steel manufacturer of starting material;</li> <li>- Heat treatment condition.</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IX08</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Low alloyed steel fasteners (HDG)				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Studs and bolts	ASTM A193	B7, B7M	-	-
Nuts	ASTM A194	2H, 2HM	-	-
1. <i>SCOPE</i>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
2. <i>MANUFACTURE</i>	Threading of studs and bolts may be done by machining or rolling. Thread rolling shall be done after heat treatment Threads in nuts shall be machined			
3. <i>DIMENSIONS</i>	<i>Studs and bolts:</i> <ul style="list-style-type: none"> <li>- Threading shall be in accordance with ASME B1.1, class 2A fit for diameters 1" and smaller (UNC series) and 8 pitch thread series for 1½" and larger</li> </ul> <i>Nuts:</i> <ul style="list-style-type: none"> <li>- Nuts shall be ASME heavy HEX-series, double chamfered.</li> <li>- Nut threads shall be oversized to fit studs/bolts dependent of specified coating.</li> </ul>			
4. <i>SURFACE PROTECTION</i>	All studs, bolts, nuts and washers shall be hot dipped galvanized according to ASTM A153 The zinc coating on threads shall not be subjected to cutting, rolling or finishing tool operation. Nuts may be tapped after galvanizing.			
5. <i>CERTIFICATION</i>	The material manufacturer shall have a quality system certified in accordance with ISO 9001. The material certificate shall be issued in accordance with EN 10204 Type 2.2 as minimum.			

<b>MATERIAL DATA SHEET</b> <span style="float: right; margin-right: 50px;"><b>IX09</b></span> <span style="float: right;"><b>Rev. 0</b></span>				
<b>TYPE OF MATERIAL:</b> Low alloyed steel fasteners (black/uncoated)				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Studs and bolts	ASTM A320	L7, L7M, L43	-	-
Nuts	ASTM A194	7 or 7M	-	S3, S4, S5
<b>1. SCOPE</b>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
<b>2. MANUFACTURE</b>	Threading of studs and bolts may be done by machining or rolling. Thread rolling shall be done after heat treatment			
<b>3. IMPACT TESTING</b>	<i>Nuts to A194:</i> S3 shall apply.			
<b>4. PROOF LOAD TESTING</b>	<i>Nuts to A194:</i> S4 shall apply			
<b>5. DIMENSIONS</b>	<p><i>Studs and bolts:</i></p> <ul style="list-style-type: none"> <li>- Threading shall be in accordance with ASME B1.1, class 2A fit for diameters 1" and smaller (UNC series) and 8 pitch thread series for 1½" and larger</li> </ul> <p><i>Nuts:</i></p> <p>Nuts shall be ASME heavy HEX-series, double chamfered.</p>			
<b>6. CERTIFICATION</b>	<p>The material manufacturer shall have a quality system certified in accordance with ISO 9001 or equivalent</p> <p>S5 shall apply for nuts to A194</p> <p>The material certificate shall be issued in accordance with ISO 10474/EN 10204 Type 3.1, shall confirm compliance with this specification and shall include the following information:</p> <ul style="list-style-type: none"> <li>- Steel manufacturer of starting material;</li> <li>- Heat treatment condition</li> </ul>			

<b>MATERIAL DATA SHEET</b>		<b>IX10</b>	<b>Rev. 0</b>	
<b>TYPE OF MATERIAL:</b> Low alloyed steel fasteners (black/uncoated))				
<b>PRODUCT</b>	<b>STANDARD</b>	<b>GRADE</b>	<b>ACCEPT. CLASS</b>	<b>SUPPL. REQ.</b>
Studs and bolts	ASTM A193	B7, B7M	-	-
Nuts	ASTM A194	2H, 2HM	-	-
<b>1. SCOPE</b>	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification			
<b>2. MANUFACTURE</b>	Threading of studs and bolts may be done by machining or rolling. Thread rolling shall be done after heat treatment Threads in nuts shall be machined			
<b>3. DIMENSIONS</b>	<i>Studs and bolts:</i> <ul style="list-style-type: none"> <li>- Threading shall be in accordance with ASME B1.1, class 2A fit for diameters 1" and smaller (UNC series) and 8 pitch thread series for 1½" and larger</li> </ul> <i>Nuts:</i> <ul style="list-style-type: none"> <li>- Nuts shall be ASME heavy HEX-series, double chamfered.</li> </ul>			
<b>4. CERTIFICATION</b>	The material manufacturer shall have a quality system certified in accordance with ISO 9001. The material certificate shall be issued in accordance with EN 10204 Type 2.2 as minimum.			



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**This document compiles Material Data Sheets for piping components for use in piping systems designed in compliance with ASME B31.3.**